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No. 7

STUDY
ON
SOLID WASTE MANAGEMENT SYSTEM
IMPROVEMENT PROJECT
IN
THE CITY OF JAKARTA IN INDONESIA

FINAL REPORT

SUMMARY

NOVEMBER 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of the Republic of Indonesia, the Japanese Government has decided to conduct a study on the Solid Waste Management System Improvement Project in the city of Jakarta and entrusted the study to the Japan International Cooperation Agency (JICA).

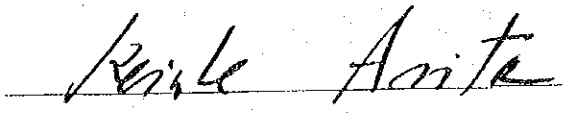
JICA sent to Indonesia a study team headed by Mr. Koomi NODA and consisted of Yachiyo Engineering Co., Ltd., associated with EX Urban & Environmental Research Institute Co., Ltd., from January to March 1986, July to September 1986 and January to March 1987.

The team had discussions on the Project with the officials concerned of the Government of Indonesia and conducted a field survey in the whole area of DKI Jakarta. After the team returned to Japan, further studies were made and the present report has been prepared.

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

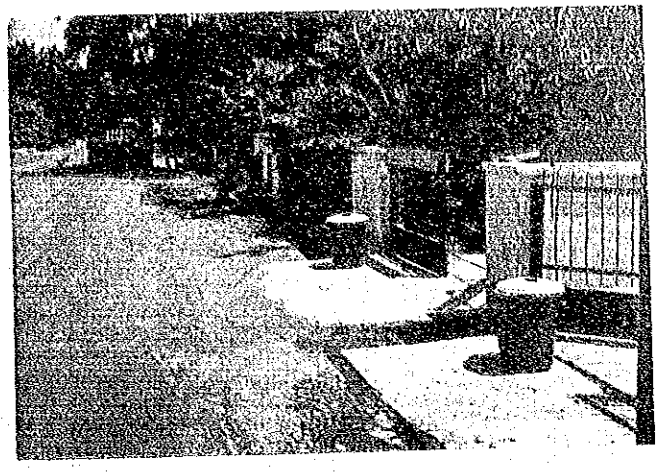
I wish to express my deep appreciation to the officials concerned of the Government of Indonesia and DKI Jakarta for their close cooperation extended to the team.

November, 1987



Keisuke ARITA
President
Japan International Cooperation Agency

CAMPAIGN CAR



PILOT STUDY
DOOR TO DOOR COLLECTION - PLASTIC CANTAINER

PILOT STUDY
COMMUNAL CONTAINER - CRANE TRUCK

PILOT STUDY
MOVABLE CONTAINER - COMPACTOR CAR

BASIC FIELD SURVEY

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SEMINAR ON GENERAL SOLID WASTE
MANAGEMENT ISSUES AT D.P.U.

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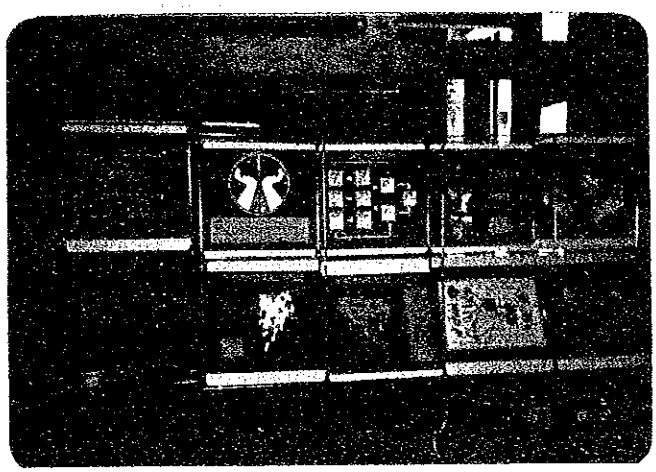
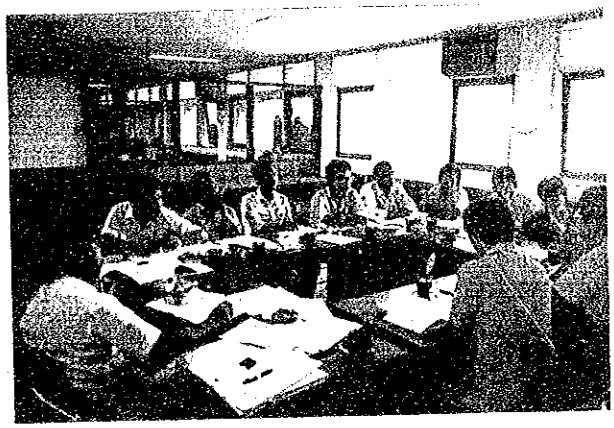


SEMINAR ON GENERAL SOLID WASTE
MANAGEMENT ISSUES AT D.P.U.

STEERING COMMITTEE MEETING
AT CIPTA KARYA



TECHNICAL MEETING
AT DINAS KEBERSIHAN

CONTENTS

GLOSSARY

WORD	DESCRIPTION
DKI JAKARTA	JAKARTA local government which is equal to state level.
Wilayah	District. DKI Jakarta consists of 5 Wilayah, Pusat, Utara, Barat, Timur, Selatan.
Kecamatan	Smaller district. About 6 Kecamatan compose 1 Wilayah.
Kelurahan	Ward. About 8 Kelurahan compose 1 Kecamatan. Population is about 30,000 people.
RT/RW	Local community organization. RW is composed of about RTs. RT/RW is not official governmental organization but community which is important for urban life. Activities for RT/RW includes security, cleaning, culture, religion, etc.
Squatter	Illegal occupants who mainly live along canals or railways.
Kampung	Area in the city where characteristics of village is kept. Generally population density is high (400 - 500 persons/ha) and income level is low. Roads inside Kampung are narrow (1.5 - 3 m) for pedestrian only. Houses are small.
P.D.Pasar Jaya	Public market company managing public markets. It transports waste from the public markets to the final disposal sites by itself.
Domestic waste	Solid waste generated by households.
Market waste	Solid waste generated by markets.
Commercial waste	Solid waste generated by shops, hotel's, offices, etc.
Industrial waste	Solid waste generated factories, manufactures etc.
Canal waste	Solid waste in rivers and canals.
Door to door	Direct collection to each household by collection vehicle.
Jali-Jali	Collection that residents bring waste to collection vehicle by themselves.

WORD	DESCRIPTION
LPS	Space for transferring of waste from handcarts for primary collection to vehicle for secondary collection. LPS includes the following; - Handcart pool ... Road side - Concrete bin/Open space .. Special collection space - Container ... 6 or 10 m^3 container - Depot ... Exclusive area for transferring
LPA	Final disposal site
Depot	Exclusive area for transferring of Dinas Kebersihan.
Dinas Kebersihan (S.D.K.)	Cleansing Department of DKI Jakarta.
Suku Dinas Kebersihan (S.D.K.)	District cleansing division (Wilayah unit)
Seksi Kecamatan (S.K.)	Local cleansing office (Kecamatan unit)
Dinas PU	Department of Public Works of DKI Jakarta.
Dinas Pertamanan	Department of garden
Walikata	Mayor of Wilayah
Camat	Head of Kecamatan
Lura	Chief of Kelurahan

INTRODUCTION

1. Background of the Study

Jakarta, the capital of the Republic of Indonesia, has a population of some 7.3 million, daily producing almost 4,900 tons of urban solid waste.

With rapid urbanization, Jakarta is becoming a most important city in the ASEAN region in terms of social, economic and political activities. It is estimated that the population will rapidly swell to some 10 million by 1995 and 12 million by 2005.

In addition to this population pressure, due to wide distribution of densely populated residential areas with narrow paths, known as "Kampung", it will create more serious problems in maintaining the city's requirements for a satisfactory living environment and beautiful scenery if conventional solid waste management is relied upon in future.

The importance of proper management of urban solid waste in conserving an acceptable living environment and in securing urban space for economic activities is increasing each year.

These problems have already been pointed out in REPELITA-IV (1984/85 - 1988/89), the Jabotabek Metropolitan Development Plan and the Jakarta Master Plan 2005, including targets and measures to be completed by the respective years, and calls for their urgent implementation.

Although the IBRD, ADB and other organizations have so far extended technical cooperation to improve urban solid waste management, the subject areas of the studies are limited and so far a study covering all of Jakarta has not yet been conducted.

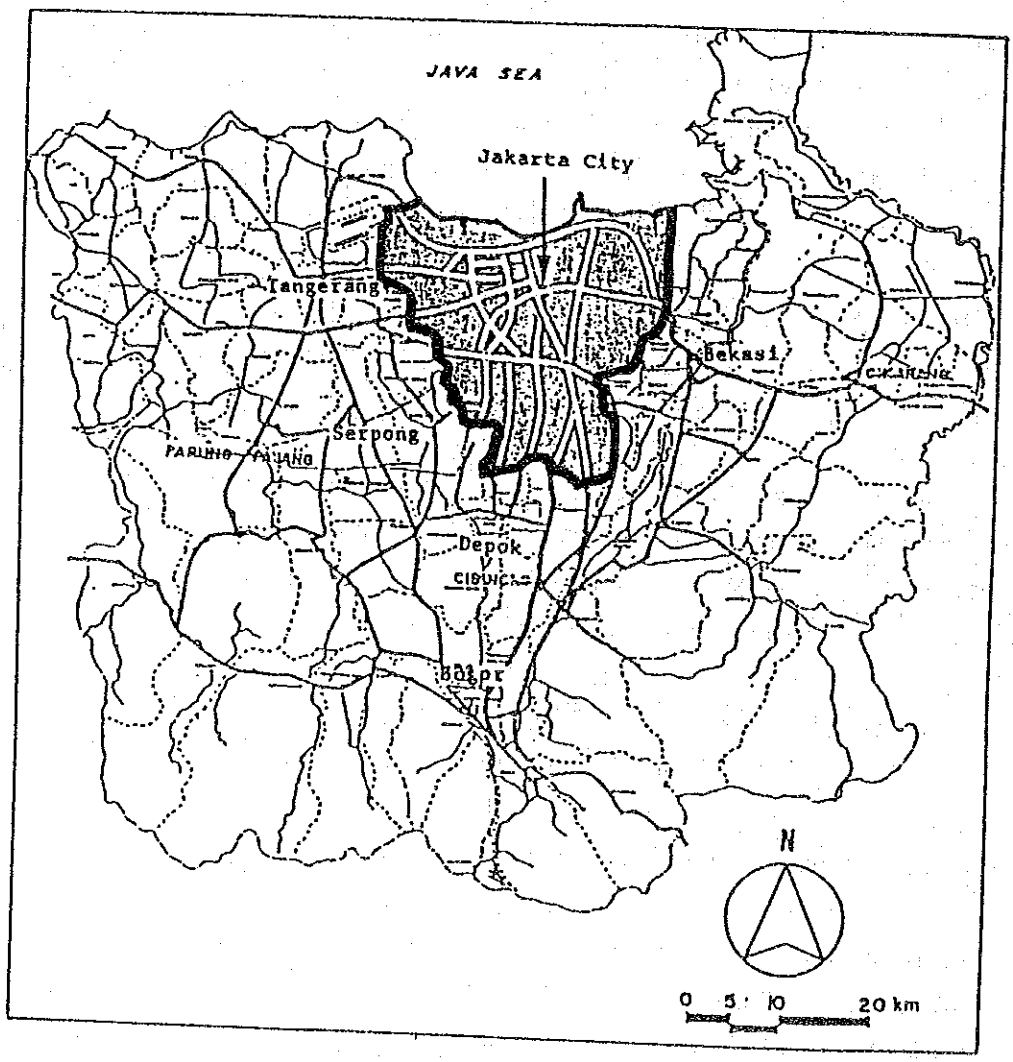
Against this background, the Ministry of Public Works, in cooperation with the Jakarta Municipal Government, requested that the Japanese Government conducts the "Study on Solid Waste Management System Improvement Project for Jakarta".

2. Objectives of the Study

The present study has the following objectives in order to bring about the improvement of the solid waste management system in Jakarta.

i) Clear presentation of a desirable solid waste management system for the future and preparation of a conceptual master plan which is technically, financially and socially feasible.

ii) Selection of first priority projects based on the conceptual master plan, and implementation of a feasibility study concerning the selected projects.



Study Area

PART I PRESENT CONDITIONS

1.1 Present Condition of the Study Area

1) General description of the area

Jakarta, the capital city of the Republic of Indonesia, is the central city of the Jabotabek Metropolitan Region consisting of Bogor, Bekasi and Tangerang, and its area covers 650 km^2.

The city of Jakarta is located in a tropical zone which has a rainy season from November to April and a dry season from May to October, with the mean temperature ranging from 26°C to 28°C through all seasons.

Jakarta is situated on a seaside plain with an elevation ranging from 0 m to 50 m above the mean sea level.

The yearly rainfall is 1,900 mm, 70% of which is in the rainy season. In January and February, monthly rainfall exceeds 300 mm.

Jakarta is divided into five "Wilayah". A Wilayah is divided into "Kecamatan" (30 Kecamatan in total) and a Kecamatan consists of "Kelurahan" (260 Kelurahan in total).

2) Social and Economic Aspects

The population of Jakarta is 7.3 million with a population density of 111 persons/ha in 1984, and its growth rate has been 2.7% since 1981. The population growth is conspicuous on the outskirts of the city.

The main economic activities in Jakarta are in tertiary industries like trade and service sectors, including financial services.

The mean economic growth rate has been 10% per year during past three years, which exceeds the national growth rate.

Special attention has to be given to the informal community activities of the RW/RT in Jakarta, as their activities, including waste collection, are likely to be limited in their financial scale.

3) Infrastructure

The total area of Jakarta is around 60% urbanized. The main roads, radiating in all directions and including circular one, are remarkably congestion recently.

44% of the area and 26% of the population in the city is covered by water service. At the same time, 80% of the population has electrial service, while the sewerage system is to be the subject in the future.

1.2 Present Condition and Problems of Solid Waste Management in Jakarta City

1) General

Jakarta is one of the most beautiful cities in Southeast Asia as long as it is seen from Protocol streets. But once one walks inside the city, one will find a fairly large number of unsanitary places, such as concrete bins leaving waste, and small disposal sites found around residential areas and rivers covered with floating waste.

It is estimated that the waste collection service by Dinas Kebersihan and RT/RW covered about 86% of the total population in the city. In principle, collection frequency is twice a week but it is insufficient for the citizens due to its irregularity.

Dinas Kebersihan collects and hauls 2,950 t/d of waste and disposes of 2,160 t/d at formal disposal sites only.

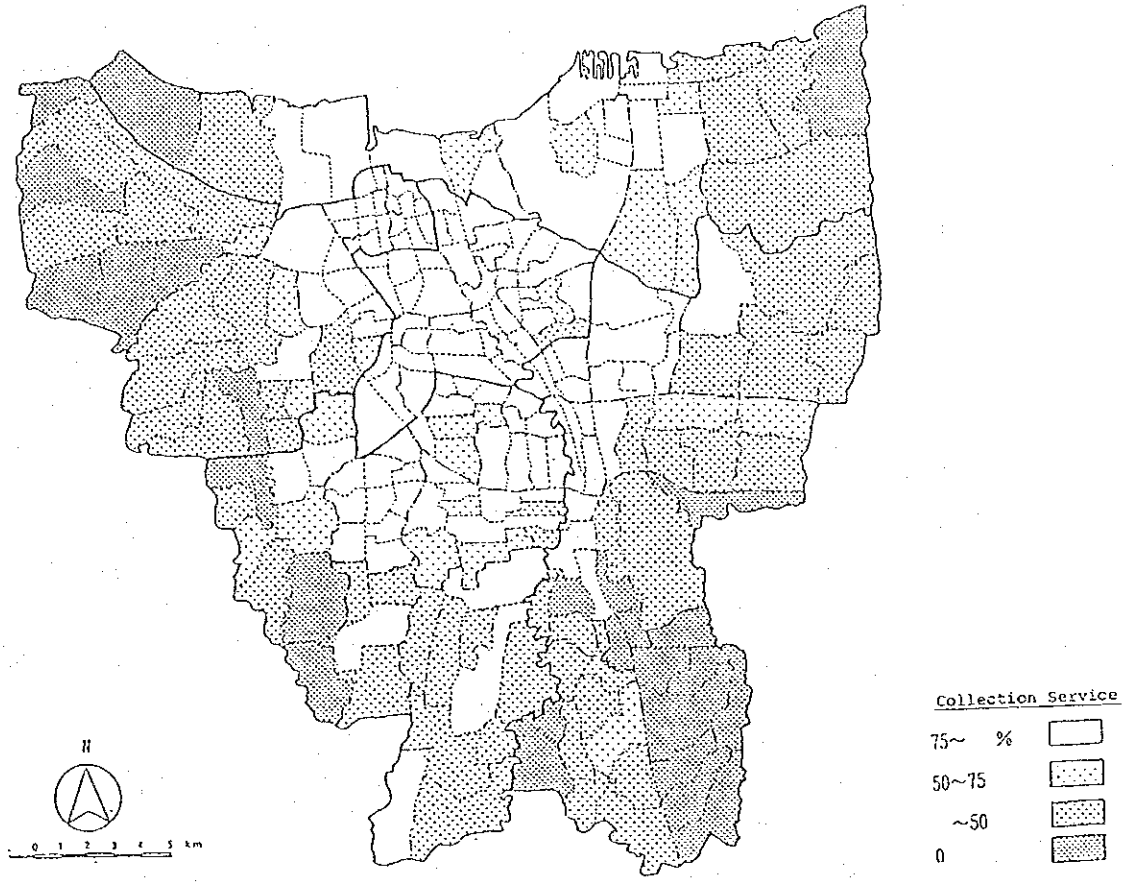


Fig. 1.2-1 Present Situation of Collection Service

2) Collection and haulage

Collection methods are classified as shown in Fig. 1.2-2. 85% of collected waste is collected by handcart system and 15% by Jali-Jali and Door-to-door systems.

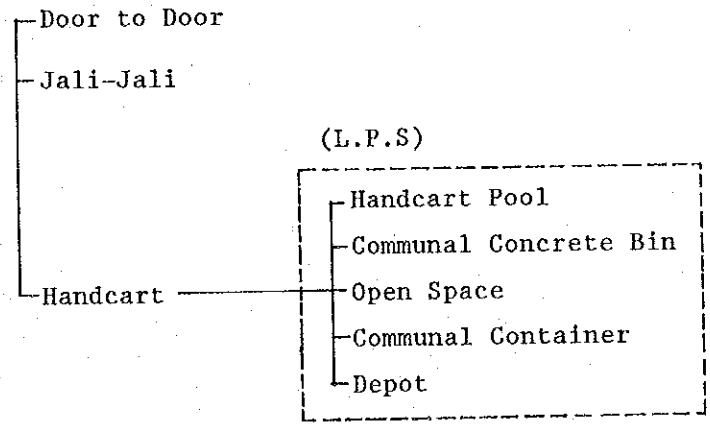


Fig. 1.2-2 Present Collection Systems

Dinas Kebersihan has 752 collection vehicles. Open cargo with poor efficiency accounts for some 30%.

3) Street sweeping

Street sweeping consists mainly of manual sweeping, which is partially supplemented by mechanical sweeping using seven units. Total length of the swept street is 751 km.

4) Treatment and disposal

Dinas Kebersihan has three disposal sites; Cakung, Srenseng and Kapuk Kamal. 45% of the waste is disposed of at these sites mostly with the open dumping method. Other waste is disposed of at informal small disposal sites littered in the urban area.

5) Operation and organization

85% of collection vehicles are always serviceable, and some 70% of the total number are in operation everyday. The average number of trips done by collection vehicles is 1.5 to 1.7 per day in every Wilayah.

Although the trip of each collection vehicle is recorded daily, there is insufficient control of the collected waste's weight, collection time and vehicle maintenance.

The administrative structure relating to solid waste management is as shown in Fig. 1.2-3. Suku Dinas Kebersihans are controlled under both Dinas Kebersihan and Wilayah.

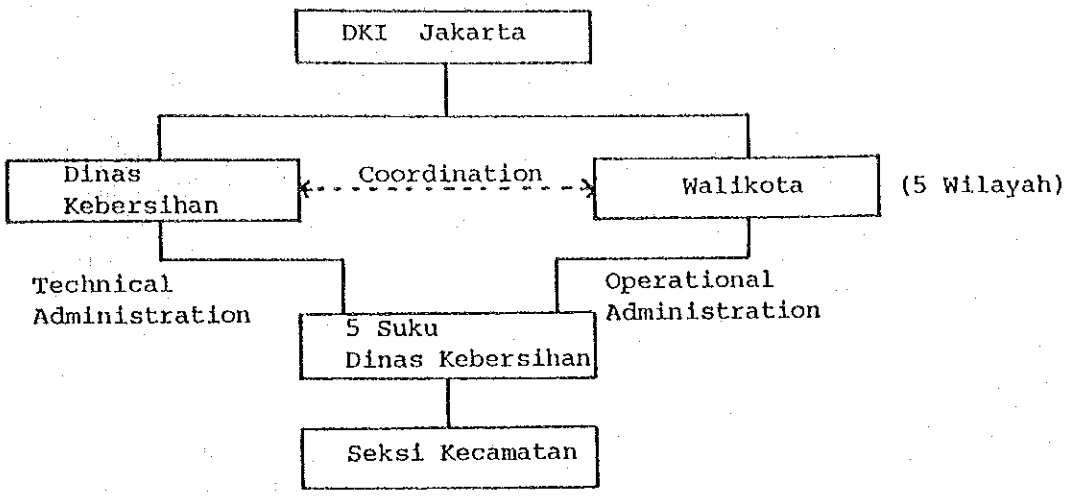


Fig. 1.2-3 Administrative Structure

The Dinas Kebersihan deals mostly with domestic and commercial waste. The collection of waste generated at public markets is executed by P.D. Pasar Jaya, and that at canals and public gardens is conducted by the relevant authorities.

6) Budget and fee collection

The fee collection system has been formally established and a target figure is set for each year, but the actual ratio of fees collected is currently as low as 3% in the total budget.

The total budget on solid waste management is Rp. 17.5 billion and per capita expenditure is Rp. 2,500/year. As other projects are given policy priority, it is difficult to expect increasing the budget from the general account for solid waste management.

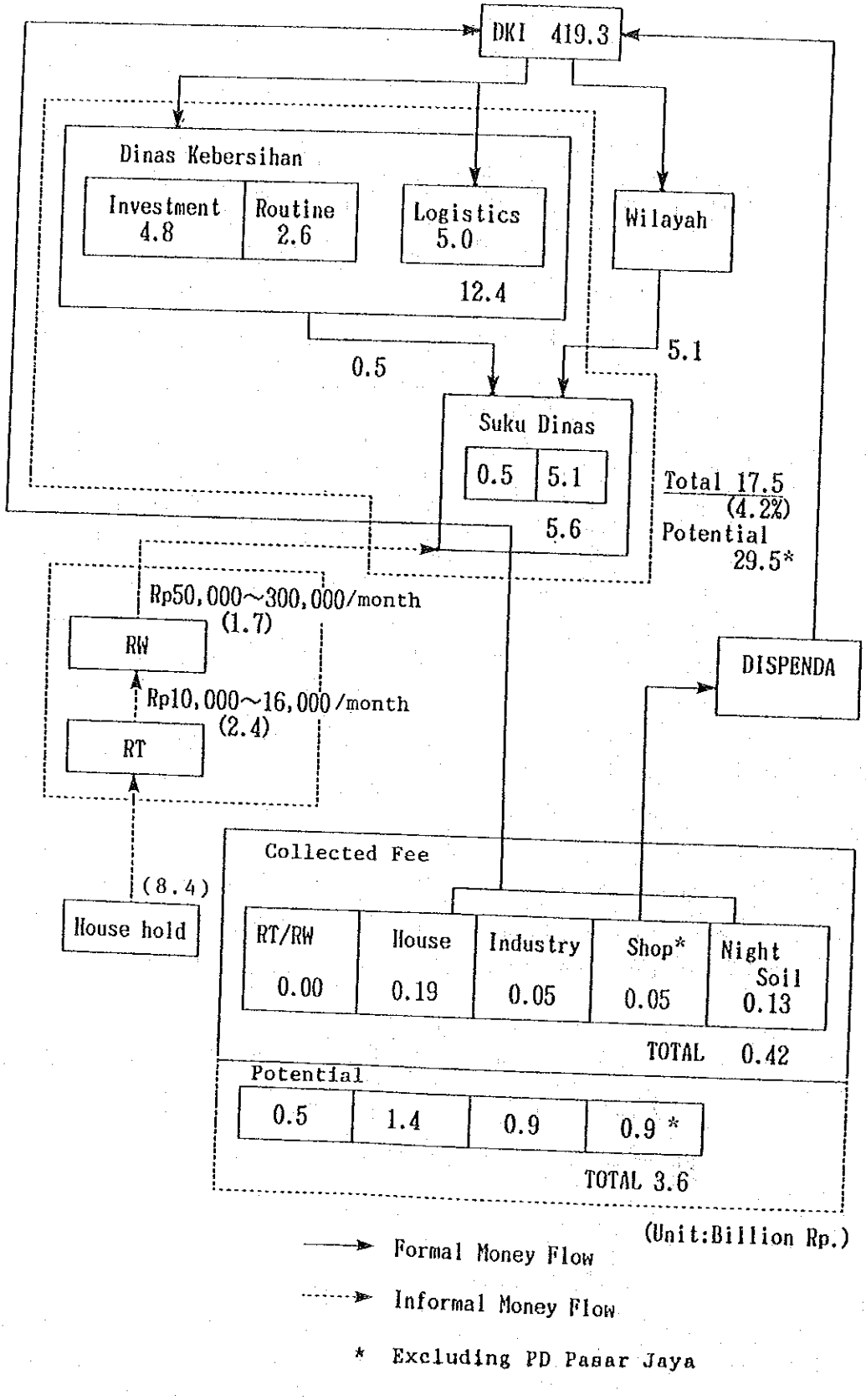


Fig. 1.2-4 Present Money Flow

PART II CONCEPTUAL MASTER PLAN

2.1 Future Goal

1) Goal

High environmental sanitation at an affordable level is secured for Jakarta as an international central city in Southeast Asia.

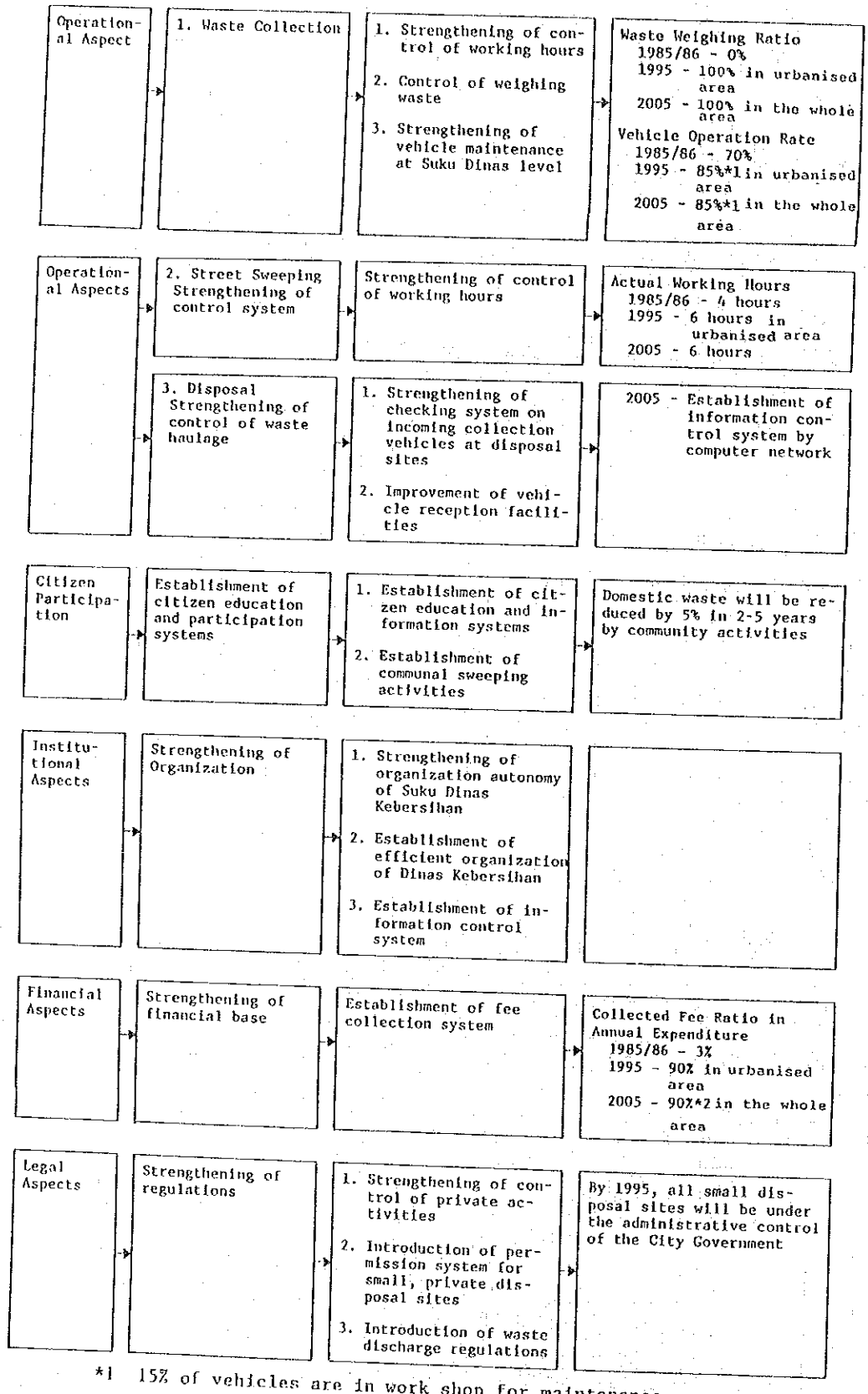
The fast removal of waste from residential areas and sanitary disposal are prerequisites to an adequate environmental sanitation in Jakarta.

2) Objectives and targets

The objectives and targets to be achieved by the year 2005 are shown in Table 2.1-1.

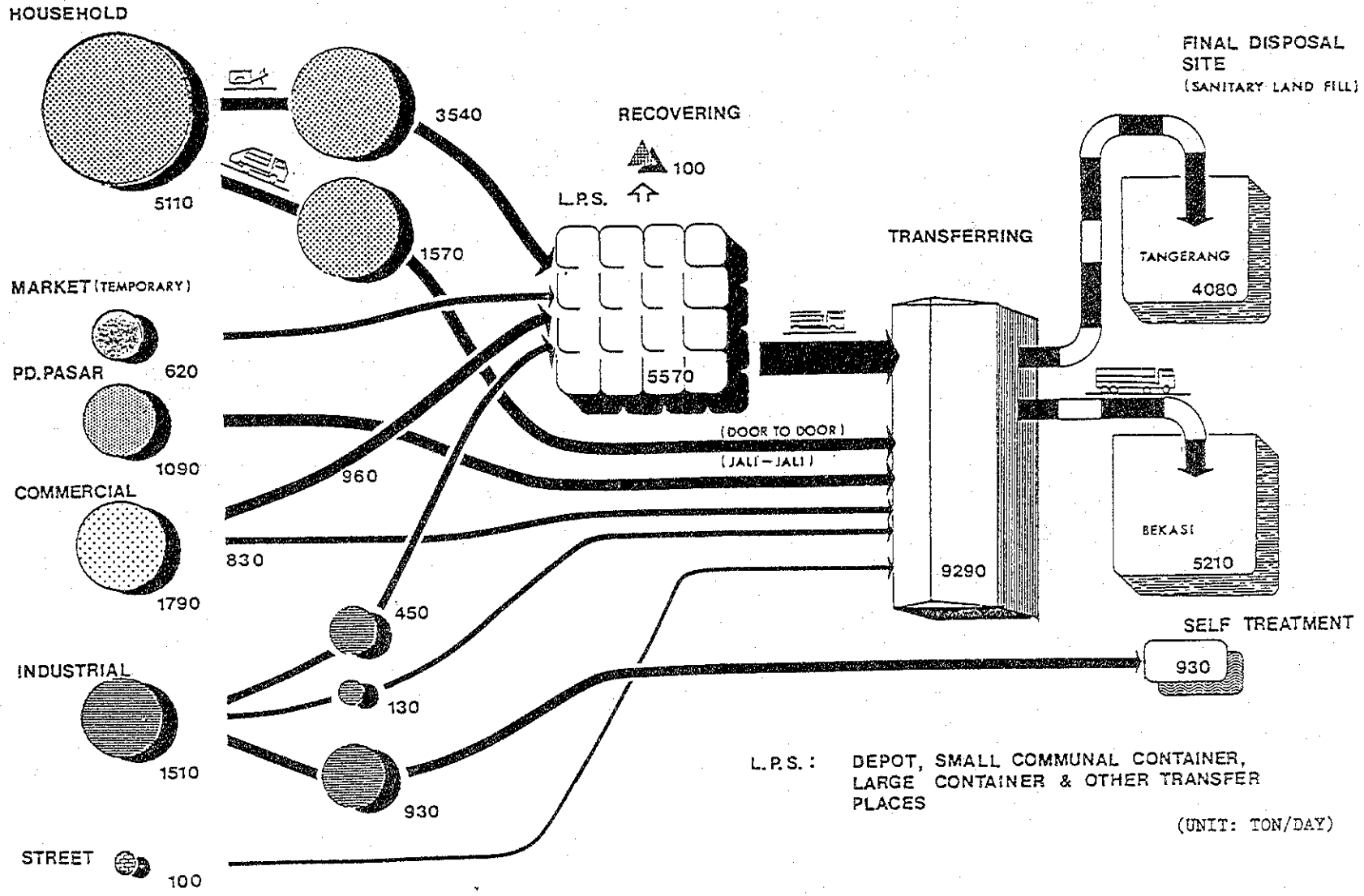
Table 2.1-1 Objectives and Targets

Item	Strategical Requirements	Objectives	Targets
Technical Aspect	1. Waste Collection o Establishment of efficient waste collection system o Establishment of efficient haulage system	1. Vehicle mechanisation 2. Substitution of inefficient transfer system by efficient system 3. Simplified collection system 4. Provision and improvement of transfer stations	Vehicle Mechanisation Ratio 1985/86 - 40% 1995 - 100% in urbanised area 2005 - 100% in the whole area Provision Ratio of LPS Transfer Facilities 1985/86 - 30% 1995 - 100% in urbanised area 2005 - 100% in the whole area
	2. Street Sweeping Establishment of efficient street sweeping system	1. Introduction of adequate sweeping frequency 2. Establishment of efficient sweeping method	Basic Frequency 1985/86 - daily 1995 - twice a week in urbanised area 2005 - twice a week in the whole area
	3. Disposal Establishment of adequate disposal system	1. Provision of sanitary landfilling 2. Introduction of facility standards	Sanitary Landfilling Ratio 1985/86 - 5% 1995 - 100% in urbanised area 2005 - 100% in the whole area



*1 15% of vehicles are in work shop for maintenance.

*2 10% of expenditure is used for street sweeping and other public cleansing, the costs of which are not covered by beneficiaries.



DESIRABLE SOLID WASTE FLOW IN 2005

Fig. 2.1-1 Target Waste Stream in 2005

2.2 Preconditions for the Conceptual Master Plan

1) Population

In the year 2005, the estimated population is projected to be 12 millions taking into consideration of the Master Plan 2005 DKI Jakarta.

2) Future perspective of RT and RW

The community organization of RT and RW is expected to carry on waste collection in future as well.

3) Financial precondition

It is projected that Jakarta's regional revenue in 2005 will increase from the present level in accord with a growth rate of 5%.

4) Solid waste amount and composition

The estimated overall amount of waste generation is 7,360 t/d in 1995 and 10,220 t/d in 2005, as shown in Table 2.2-1. The waste composition is estimated as shown in Table 2.2-2.

Table 2.2-1 The Estimated Amount of Waste

(Unit: t/day)

Year	Wilayah	Domestic	Market	Commercial	Industrial	Street	Total
1984	Pusat	470	190	300	90	-	1,050
	Utara	340	120	100	210	-	770
	Barat	440	170	130	190	-	930
	Selatan	620	160	160	170	-	1,110
	Timur	560	170	170	120	-	1,020
	Total	2,430	810	860	780	50	4,930
1995	Pusat	520	280	430	130	-	1,360
	Utara	510	170	140	300	-	1,120
	Barat	720	240	190	270	-	1,420
	Selatan	1,070	240	220	240	-	1,770
	Timur	950	240	250	180	-	1,620
	Total	3,770	1,170	1,230	1,120	70	7,360
2005	Pusat	620	410	620	180	-	1,830
	Utara	670	250	210	400	-	1,530
	Barat	1,080	360	270	360	-	2,070
	Selatan	1,410	340	330	330	-	2,410
	Timur	1,330	350	360	240	-	2,280
	Total	5,110	1,710	1,790	1,510	100	10,220

Table 2.2-2 Projected Composition of Domestic Waste

	1986	1995	2005	% growth/annum
Plastic	10%	12%	14%	2%
Paper	17	19	21	1
Textile	5	5	5	0
Wood/Leaf	12	11	10	-1
Garbage	23	21	19	-1
Others	15	14	12	-
Sub Total	82	82	81	-
Metal	4	5	7	5
Glass	4	5	6	3
Stone	10	8	6	3
Sub Total	18	18	19	-
Total	100	100	100	
Moisture Content	54%	51%	48%	-3%
Volatile	28	30	32	-
Ash Content	18	19	20	-
C/N ratio	32	33	35	-
Low cal. value (kcal/kg)	1,100	1,300	1,500	

2.3 Examination and Evaluation of Alternatives

1) Collection

As vehicle trips are very inefficient, most systems shall be largely improved by introducing strong operation control.

Considering conditions in the area, collection systems in Jakarta shall consist of a combination of the four systems shown in Fig. 2.3-1. In the handcart collection system, it is better to employ the depot-container system.

Fig. 2.3-2 shows the results of cost estimations for comparison between present collection systems and improved collection systems. The improved systems result saving of Rp. 8.2 billion in an annual operation cost.

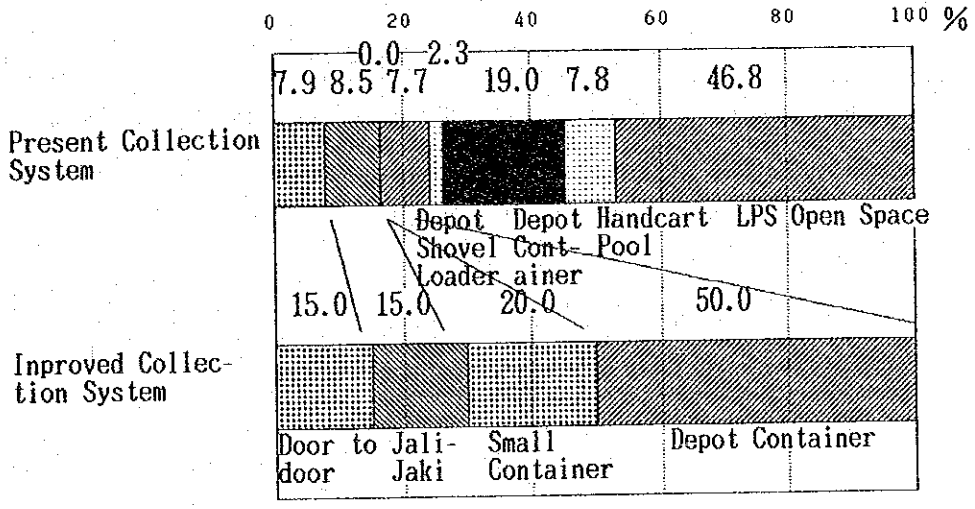


Fig. 2.3-1 Future Collection System

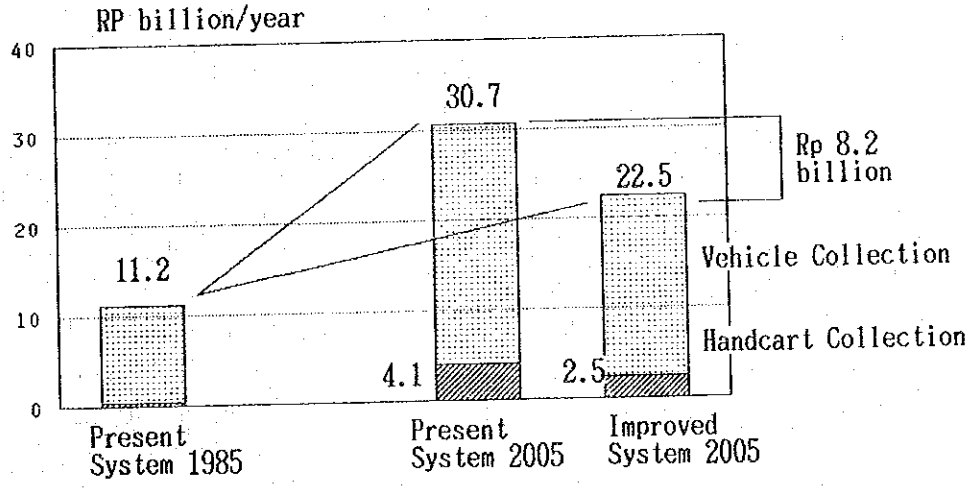


Fig. 2.3-2 Cost Saving with Improved Collection

2) Haulage

Since the distance from collection areas to disposal sites will be more than doubled in 2005, an efficient haulage system shall be established by the provision of transfer stations.

As each Wilayah has its own characteristics with regards to available land, the introduction of large transfer stations in Pusat and Selatan, and a combination of small and medium size transfer stations in Utara, Barat and Timur should be examined.

Fig. 2.3-3 shows comparison of the costs between transfer haulage and direct haulage based on the current collection system. An annual saving of Rp. 7.6 billion can be expected in the year 2005 by the introduction of transfer haulage.

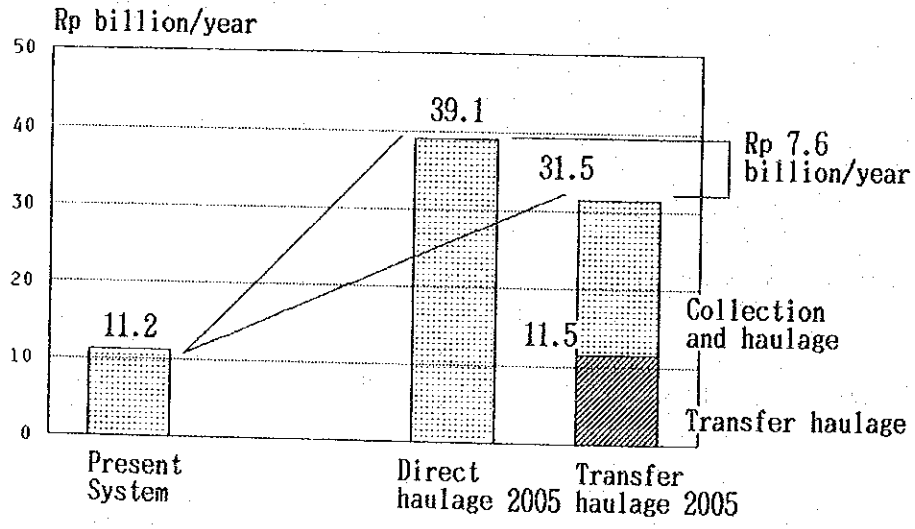


Fig. 2.3-3 Cost Saving with Transfer Station

3) Treatment and disposal

Sanitary landfill is the most economical treatment method and should be employed as the basic method for solid waste management in Jakarta. At least two disposal sites on the east and west sides should be secured.

Sanitary landfills should be covered with soil and leachate should be treated. The cost of it will be Rp.3,600/t.

The result of cost estimation for open dumping, sea reclamation, incineration and composting is shown in Fig. 2.3-4.

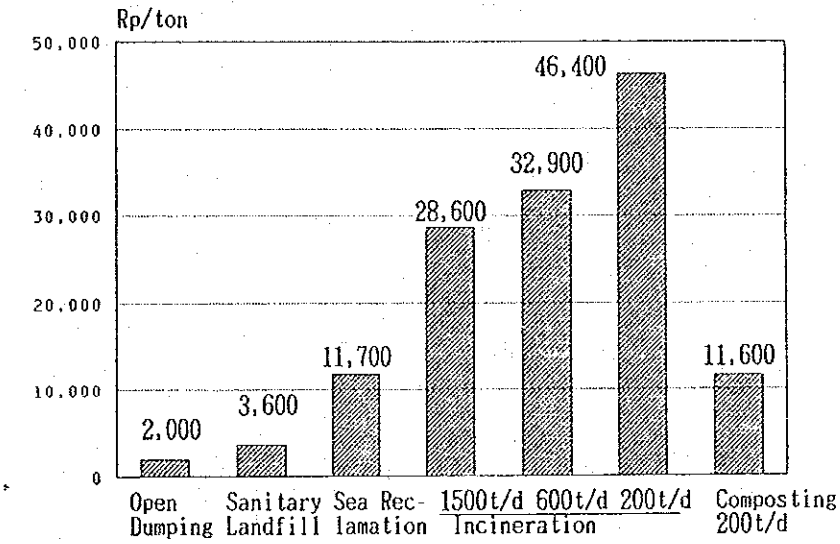


Fig. 2.3-4 Cost Comparison in Treatment and Disposal

4) Other systems

In the three possible maintenance systems such as centralized system, decentralized one and branch system with main workshop, third one is recommended as the most realistic system for vehicle maintenance. Therefore, existing sub-workshops of Suku Dinas Kebershihan will be reinforced for carrying out preventing maintenance and easy maintenance.

Handcart collection by RT/RW will be continued, and cleaning days for community and recovering reusable materials will be promoted with the residents' participation.

Efforts to improve the productivity of the waste collection service and to secure sources of self-financing will presently be made based on the current organization. New organization like Public Enterprise shall be introduced in future in order to secure the more autonomy in its operation. The improvement of the relative status of the Suku Dinas Kebersihans vis-a-vis the Dinas Kebersihan is proposed for the managerial and technical independence.

Possible methods of fee collection can be classified into direct and indirect collection, including collection through RT/RW.

Introducing indirect collection linked to the electricity is recommended in order to secure the financial resources in early stage, although there are advantages and disadvantages in these methods.

It is, however, indispensable that the new fee collection system shall be introduced providing stable waste collection service and fair fee rates.

5) Evaluation of alternatives

The possible combinations of the technical systems are shown in Fig. 2.3-5.

The treatment cost of alternative Z is the lowest, followed by W, Y and X, as shown in Fig. 2.3-6.

Alternative Z proves to be the most economical system and the results of the evaluation of the alternatives show no positive reasons why another system with a higher cost should be adopted.

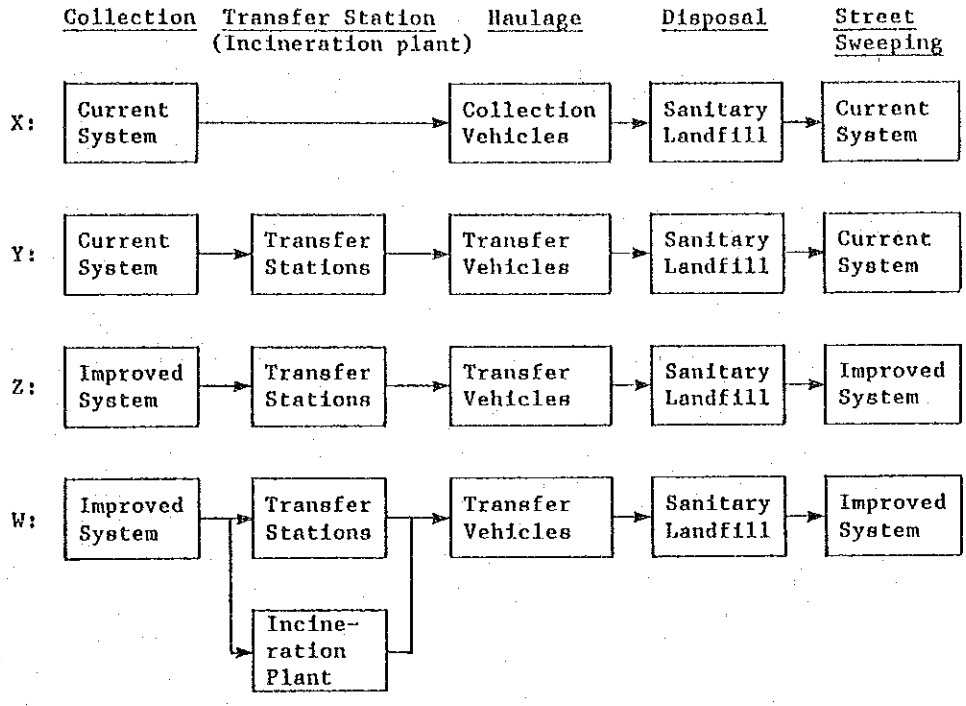


Fig. 2.3-5 Proposed Alternatives

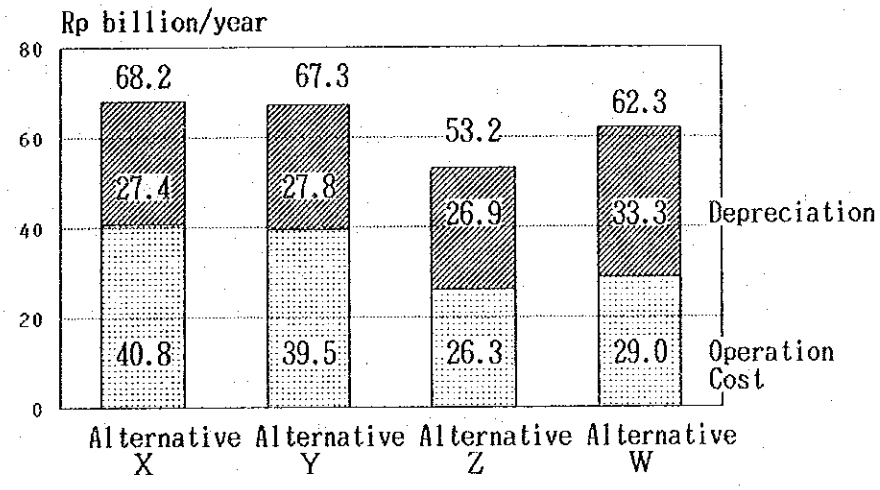


Fig. 2.3-6 Cost Comparison of Alternatives

2.4 Contents of Conceptual Master Plan

1) Precondition and Targets

The conceptual master plan covers whole city of Jakarta aiming at year 2005.

Wastes to be subject are domestic, market, commercial, street and some industrial one.

The waste amount to be generated within the city in 2005 is estimated to be 10,220 t/d.

The waste to be collected by the Dinas Kebersihan amounts to 7,970 t/d and transferring waste amounts to 9,290 t/d including waste to be collected by the other sectors.

In the meantime, the waste to be disposed of at sanitary landfill sites amounts to 11,430 t/d including the waste of Bekasi and Tangerang.

Responsibility of the relevant organization is as shown in Table 2.4-1.

Table 2.4-1 Responsibility

Waste	Collection	Transfer, haulage & disposal
Domestic waste	Dinas Kebersihan. RT/RW	Dinas Kebersihan
Market waste	P.D. Pasar Jaya	Dinas Kebersihan
Commercial waste	Dinas Kebersihan	Dinas Kebersihan
Industrial & other	Factories themselves or other	

2) Collection and Haulage Plan

Collection of waste shall be divided into three categories: ordinary, special and bulk waste, according to the discharge characteristics.

The basic collection systems to be applied shall be the Handcart-depot-container and Small-container system.

Equipment and facilities are as shown in Table 2.4-2. The personnel necessary for collection will be 2,852 persons.

Table 2.4-2 Equipment for Collection

	(2005)
10 m^3 Communal Container	1,138 units
Large-Arm roll	574 units
1 m^3 Communal Container	6,582 units
10 m^3 Compactor Vehicle	176 units
4 m^3 Compactor Vehicle	648 units
6 m^3 Tipper	36 units
Handcart	2,491 units
Depot	162 units

Transfer station shall be developed as shown in Fig. 2.4-1. Two large transfer stations shall be set up in Jakarta Pusat and Jakarta Selatan. 13 medium-size transfer stations shall be set up in Jakarta Utara, Jakarta Barat and Jakarta Timur.

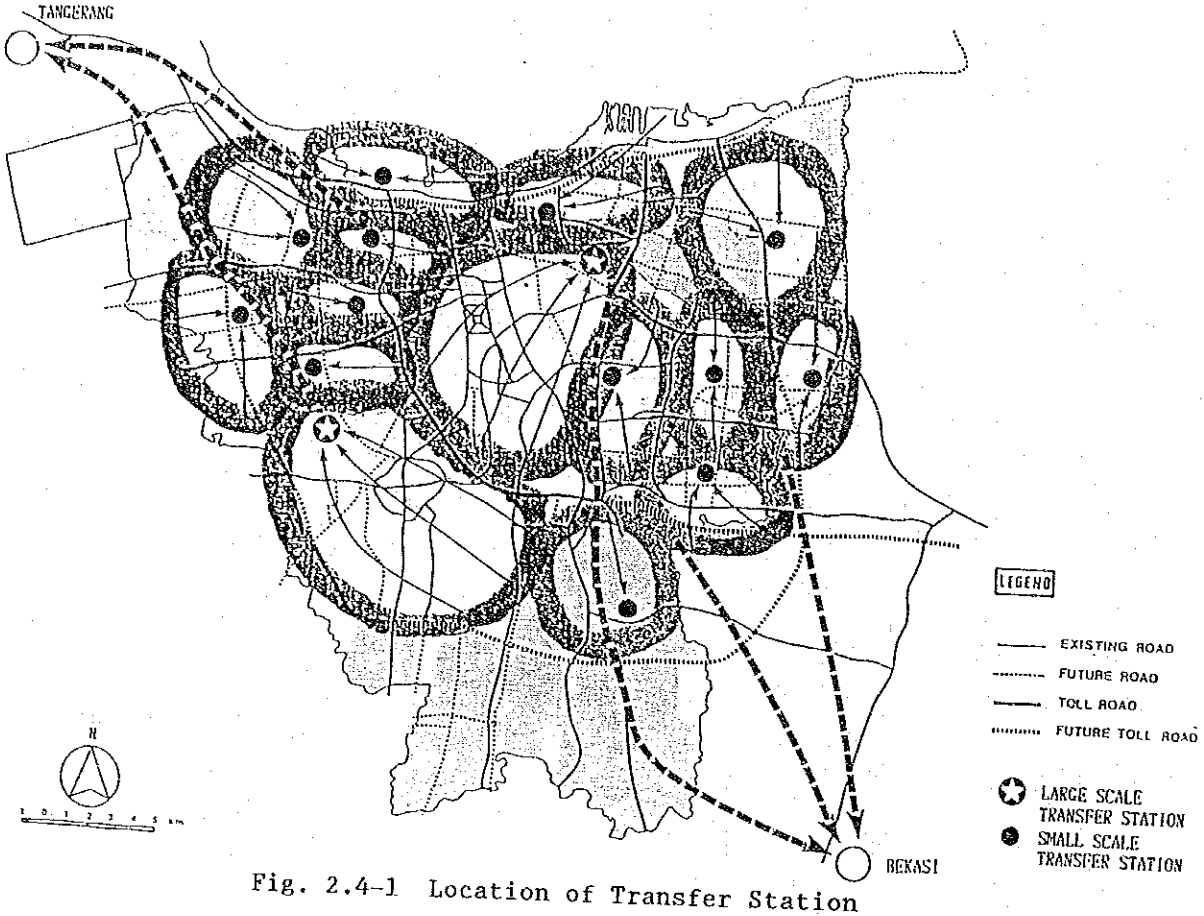


Fig. 2.4-1 Location of Transfer Station

3) Street sweeping plan

A total length of 1,693 km, mostly main streets, should be swept in 2005.

23 mechanical sweeper units shall be introduced and 2,753 personnel shall be secured for street sweeping.

4) Treatment and disposal plan

The Bekasi and Tangerang disposal sites shall be developed as sanitary landfill sites, as shown in Fig. 2.4-2. Disposal amounts at both Bekasi and Tangerang will be 6,050 t/d and 5,380 t/d respectively.

The total amount of waste which must be disposed of from 1992 to 2005 will be approximately 50 million tons.

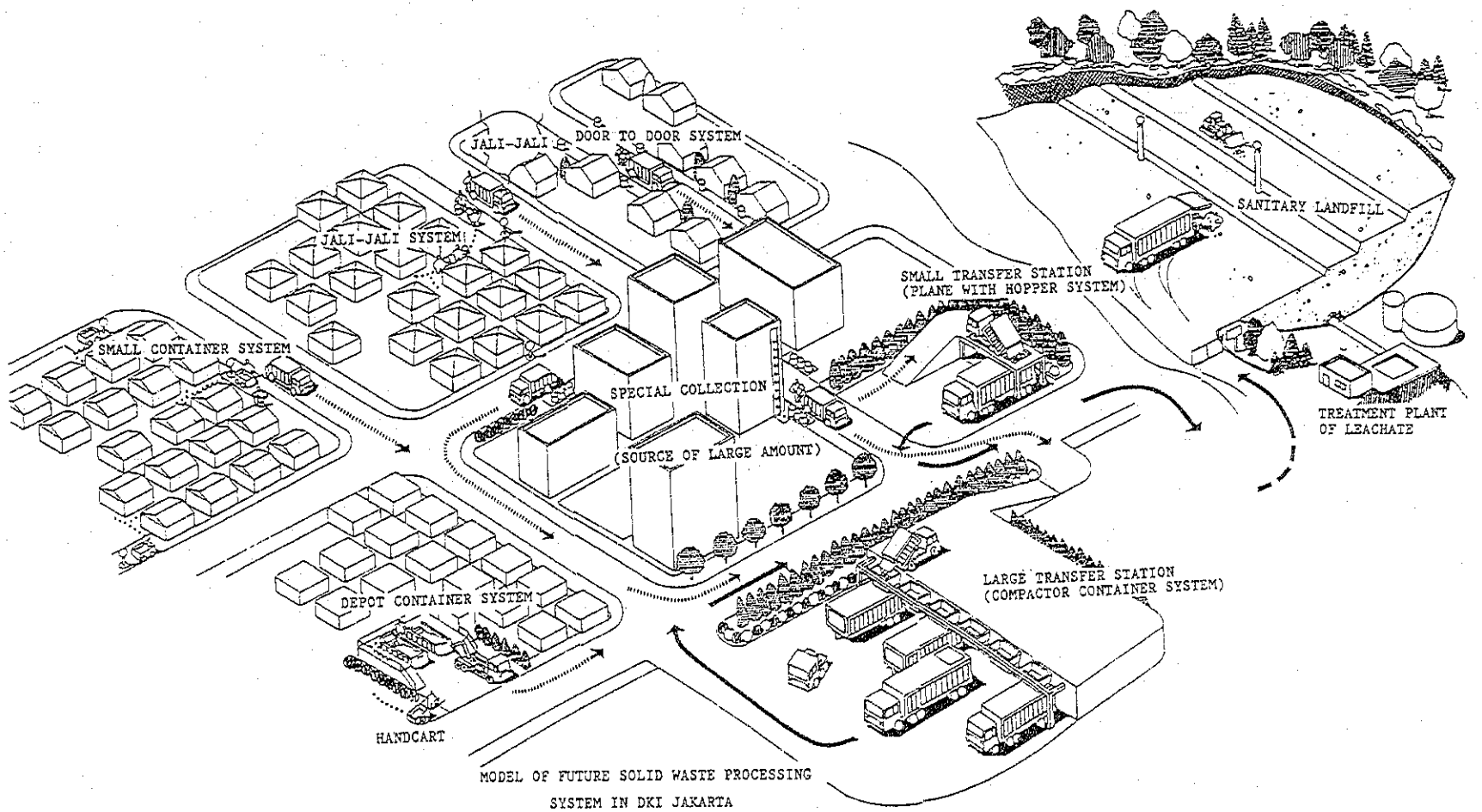


Fig. 2.4-2 Model of Future Solid Waste Processing System in Jakarta

5) Maintenance plan

A main workshop and five sub-workshops shall be established for vehicle maintenance.

2.5 Organization

The proposed organizational structure is as shown in Fig. 2.5-1. The main difference from the present organization lies in the separation of the Suku Dinas Kebersihan from the Wilayah, two departments of headquarter staff, and provision of the Transfer & Disposal Department.

Total manpower will be 10,278 persons -- as much as 1.5 times with present.

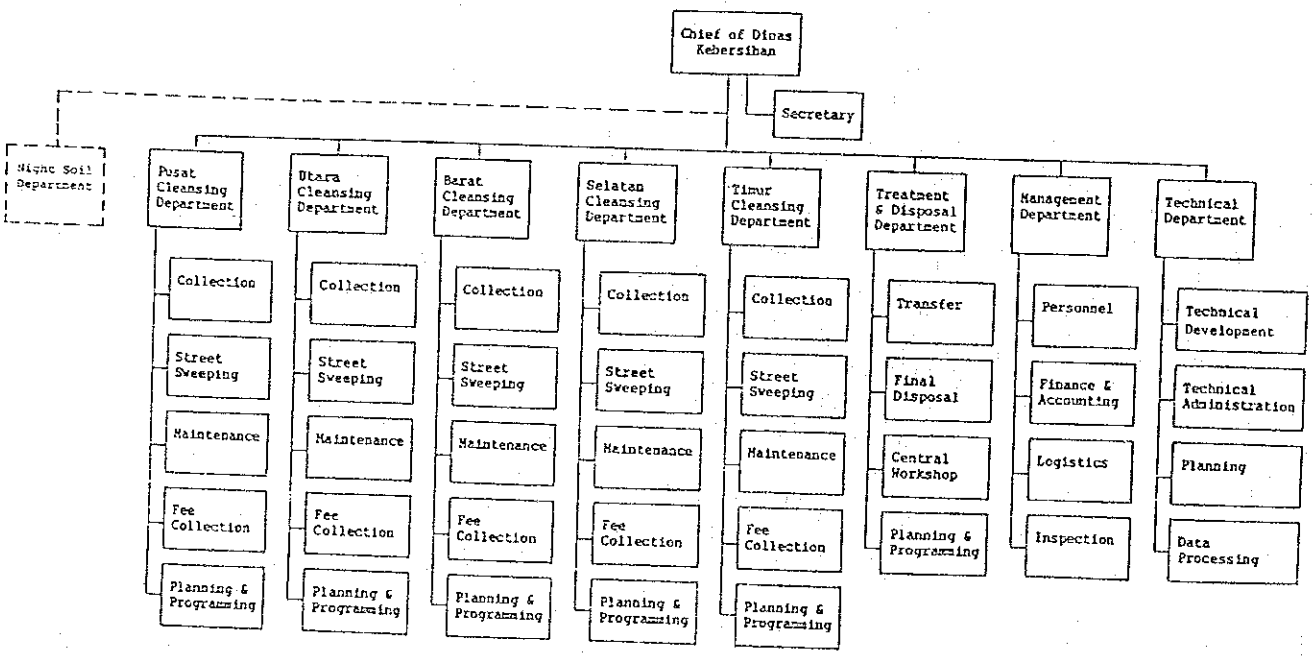


Fig. 2.5-1 Proposed Organization

2.6 Investment Cost

Approximately Rp. 456 billion is required by 2005 for investment, among which Rp. 263 billion is for constructing transfer station, sanitary landfill and sub-workshop including collection improvement, and other Rp. 193 billion is for renewing equipments.

Investment schedule by phase as shown in Table 2.6-1, Rp. 81.8 billion is required for phase I-A.
The operation costs are comprised of depreciation, maintenance costs, utility costs, personnel expenses and interests.

This operation costs will increase to Rp. 63 billion at year 2005.

Table 2.6-1 Investment Plan

(Rp. billion)

	Phase I-A	Phase I-B	Phase II	Phase III	Total
Development					
Collection improvement	11.3	29.9	28.2	-	69.4
Transfer Station	21.8	27.7	25.9	6.2	81.6
Final Disposal Site	18.4	18.1	21.4	28.3	86.2
Street Sweeping	1.6	2.9	2.7	-	7.2
Workshop	3.4	4.8	4.8	5.4	18.4
Sub Total	56.5	83.4	83.0	39.9	262.8
Replacement	25.3	1.8	34.8	130.9	192.8
Total	81.8	85.2	117.8	170.8	455.6

Table 2.6-2 Annual Cost

(Rp. billion)

	1990	1995	2000	2005
Depreciation	6.1	17.9	21.9	23.8
Operation Cost	13.9	22.1	23.6	25.9
Sub Total	20.0	40.0	45.5	49.7
Interest*	0	6.3	10.3	13.3

* Annual interest rate foreign loan 4%,
local loan 5%

2.7 Financial Plan

1) Securing independent revenue

Solid waste management is expected to have an independent source of revenue through introducing fee collection system from a view point of "Beneficiaries Pay Principle". Securing independent revenue will be attained in steps, as service improves and the fee collection system is prepared.

An attainable target is as follows:

Table 2.7-1 Planning target

	Self-financing rate	Fee collection rate
1990	24%	30%
1995	30%	45%
2000	96%	90%
2005	100%	90%

Fee collection rate will be set according to the income level. Large amount dischargers and receiver of special service are charged extra fee in addition to the basic fee. Amount of the fee to be collected is expected Rp. 15 billion in 1995 and Rp. 73 billion in 2005.

2) Financial Plan

Assuming that the fee collection target will be attained, the financial plan of the project will be in surplus operation from year 2000 in the event that the repayment of foreign loan is over 25 years with a seven-year grace period and 4% annual interest, and that domestic loans are paid over 20 years with a five-year grace period and 5% annual interest.

Table 2.7-2 Money Flow of the Project (Dinas Kebersihan)

1¥=10Rp. Unit: Rp. billion

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Revenue																											
Basic Fee	0.9	1.9	3.0	4.0	5.0	5.9	7.0	11.8	15.1	18.5	21.8	28.3	29.3	30.4	31.4	32.5	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	582.8
Spcial Fee	0.0	0.0	0.0	4.1	5.4	6.7	8.0	13.3	17.0	20.6	24.3	31.9	33.5	34.4	36.6	38.3	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	672.1
Budget from DKI	15.0	15.0	15.0	15.0	15.0	15.0	15.0	10.0	10.0	10.0	10.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	225.0
Subtotal (A)	15.9	16.9	18.0	23.1	25.4	27.6	30.0	35.1	42.1	49.1	56.1	70.2	67.8	69.8	73.0	75.8	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4	1,479.9
Expense																											
Depreciation (B1)	6.1	6.1	6.8	12.2	12.2	12.2	17.9	17.9	17.9	20.3	21.8	21.9	22.6	23.5	23.8	23.8	23.8	23.8	23.3	23.3	23.2	23.2	23.2	23.2	23.2	23.2	500.4
Personnel	9.8	10.1	10.4	11.7	12.1	12.4	12.2	12.1	12.0	11.6	11.5	11.4	11.6	11.8	12.1	12.3	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	309.1
Maintenance	2.6	2.6	2.9	4.9	4.9	4.9	6.6	6.6	6.6	7.4	7.8	7.8	8.0	8.3	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	182.7
Fuel & Others	1.2	1.2	1.2	2.1	2.2	2.3	3.3	3.5	3.6	4.1	4.2	4.4	4.5	4.7	4.9	5.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	103.4
Interests	0.0	0.0	1.2	3.1	3.1	3.3	6.3	6.3	6.2	8.9	10.4	10.3	10.0	12.9	12.6	12.0	13.3	14.4	14.2	13.6	15.2	14.5	13.4	14.4	14.5	13.2	247.3
Subtotal (B)	19.7	20.0	22.5	34.0	34.5	35.1	46.3	46.4	46.3	52.3	55.7	55.8	56.7	61.2	61.8	61.5	63.0	64.1	63.4	62.8	64.3	63.6	62.5	63.5	63.6	62.3	1,342.9
Balance (A-B)	-3.8	-3.1	-4.5	-10.9	-9.1	-7.5	-16.3	-11.3	-4.2	-3.2	0.4	14.4	11.1	8.6	11.2	14.3	15.4	14.3	15.0	15.6	14.1	14.8	15.9	14.9	14.8	16.1	137.0
Resource of Investment																											
Budget from DKI (C1)	1.0	5.0	5.0	0.0	5.0	5.0	0.7	4.1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.5	5.0	5.0	4.0	5.0	113.3
Long Term Loan																											
Local (C2)	0.0	8.0	14.4	0.0	5.4	24.6	0.0	0.0	55.6	33.0	4.1	1.0	61.9	6.3	2.3	40.1	35.2	13.7	6.9	50.4	7.3	0.0	44.0	25.1	0.0	7.2	446.5
Foreign (C3)	0.0	19.4	29.0	0.0	0.0	44.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	92.9
Subtotal (C)	1.0	32.4	48.4	0.0	10.4	74.1	0.7	4.1	60.6	38.0	9.1	6.0	66.9	11.3	7.3	45.1	40.2	18.7	11.9	55.4	12.3	3.5	49.0	30.1	4.0	12.2	652.7
Repayment (D)	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	2.6	4.6	6.2	6.2	6.2	12.4	14.6	14.9	14.9	19.1	19.5	19.6	22.3	24.1	24.1	24.5	27.5	26.4	291.7
Remain of Loan	0.0	27.4	70.8	70.8	76.2	145.3	144.8	143.3	196.3	224.7	222.6	217.4	273.1	267.0	254.7	279.9	300.2	294.8	282.2	313.0	298.0	273.9	293.8	294.4	266.9	247.7	
Money Demand (E)	14.6	46.3	64.1	21.8	32.7	97.0	29.6	34.1	91.6	74.6	49.2	46.1	107.2	61.4	59.9	97.7	94.3	78.1	71.5	114.5	75.7	68.0	112.4	94.9	71.9	77.7	
Short Term Loan (F)	-2.3	-3.0	-2.3	-1.3	-3.1	-4.7	-1.1	-5.1	-11.1	-12.5	-16.0	-30.1	-27.5	-19.7	-20.4	-23.2	-24.3	-19.0	-18.8	-19.3	-15.0	-13.9	-15.0	-13.6	-10.5	-12.9	-345.7
Total of Debt (G1)		22.1	63.2	61.9	64.2	128.6	127.0	120.4	162.3	178.2	160.1	124.8	153.0	127.2	94.5	96.5	92.5	68.1	36.7	48.2	18.2						
Reserve Fund (G2)	2.3																					19.8	14.9	27.9	65.9	98.0	

Comment

E=(B-B1)+C+D Foreign loan Interest = 4% Repayment Period = 25 years Grace Period = 7 years

F=E-C-A Local loan Interest = 5% Repayment Period = 20 years Grace Period = 5 years

2.8 Stage Plan

1) Constraints and development policy

The main tasks are to establish regular collection service, sanitary landfill sites, transfer system and fee collection system.

Improvement of solid waste management will first be introduced in Jakarta Pusat, for the following reasons.

(1) The solid waste management organizational unit shall be based on the Wilayah
(2) Pusat has the best possibility for successful improvement with a minimum of additional effort
(3) The necessity of a disposal site and a transfer station is the highest in Jakarta Pusat due to the poor availability of disposal sites.
(4) Jakarta Pusat is central in terms of its business and commercial activities.

2) Stage plan

The developing plan of solid waste management will consist of 3 phases.

Phase I: 1989 - 1995

A: Improvement in Jakarta Pusat
   a. Collection improvement in Jakarta Pusat
   b. Development of the transfer station at Suntar
   c. First development of the final disposal site at Bekasi
   d. Promotion of fee collection in Jakarta Pusat

B: Improvement in urbanized area
   a. To improve collection in urbanized area
   b. Development of the transfer station at Srenseng
   c. First development of the final disposal site at Tangerang
   d. Promotion of fee collection in this area

Phase II: 1996 - 2000

(1) Improvement in suburban area

a. To improved collection in suburban area

b. Development of the transfer stations

c. Promotion of fee collection in this area

(2) Development of disposal sites

a. Second development of the Bekasi final disposal site

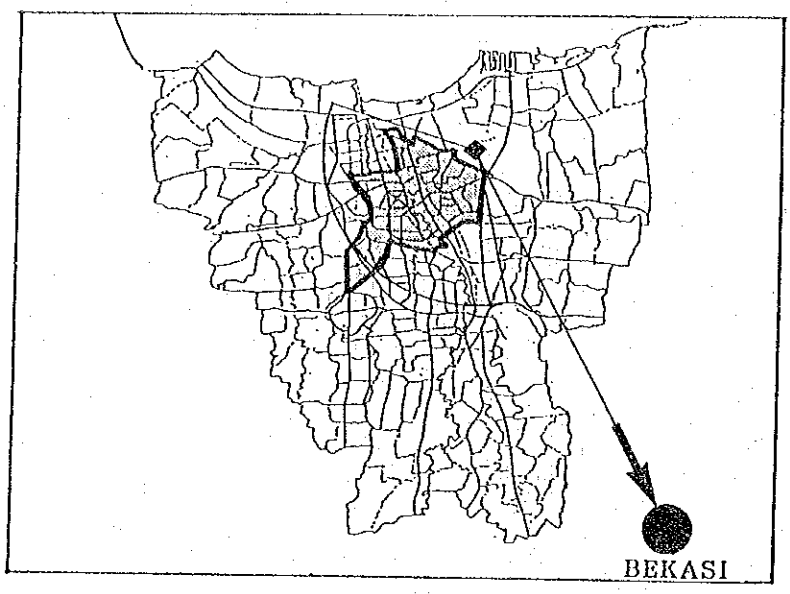
b. Second development of the Tangerang final disposal site

Phase III: 2001 - 2005

a. Expansion of collection capacities in Jakarta Pusat, Selatan and Utara

b. Expansion of the Suntar and Srenseng transfer stations

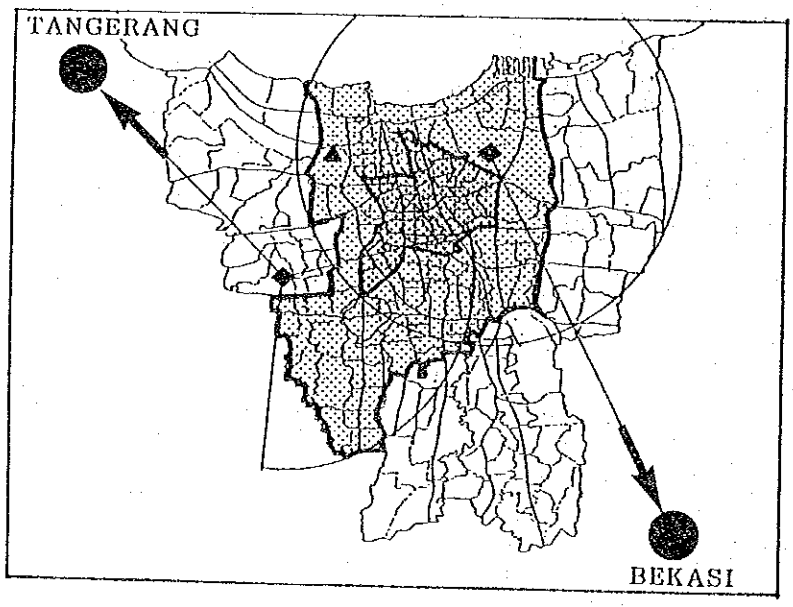
c. Third development of the Bekasi and Tangerang disposal sites



PART II

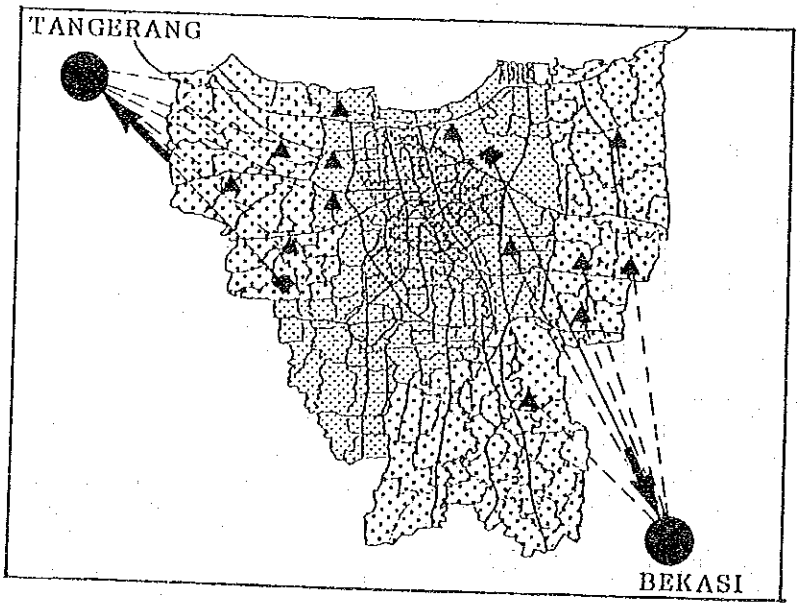
PHASE I - A

(1989-1992)



PHASE I - B

(1993-1995)



PHASE II

(1996-2000)

TRANSFER STATION

Fig. 2.8-1 Stage Plan

PART III PROJECT PLAN

3.1 Selection of the Project Plan

Staged improvements will be required to achieve the objectives specified in the Conceptual Master Plan by the year 2005, and it is anticipated in the Master Plan that these objectives will be achieved through the following 3 phases.

Phase	I :	A. 1989 - 1992 B. 1993 - 1995
Phase	II :	1996 - 2000
Phase	III :	2001 - 2005

Priority projects will be selected in Phase I-A which act as strategic projects and collectively act as catalysts to achieve the highly important objectives by 2005.

Jakarta Pusat has subsequently been selected as the subject area for the implementation of these top priority projects and the success of these projects in Jakarta Pusat will be the key to successfully managing solid waste throughout the whole city of Jakarta.

The projects required for Phase I-A were determined to be as follows through detailed discussion.

1) Construction of a sanitary landfill site at Bekasi
2) Construction of a transfer station at Sunter
3) Improvement of collection system
4) Improvement of street sweeping
5) Construction of a sub-workshop

3.2 Preconditions for the Project Plan

1) Project Area

The population of Jakarta Pusat was approximately 1,390,000 in 1985, and the population density is as high as 283 persons/ha. The future population of Jakarta Pusat is projected as 1,400,000 in 1995 and 1,410,000 in 2005. The population increase is projected conservatively. The land use of Jakarta Pusat will not change basically even in future.

2) Amount of Waste Subject to Collection Service

Waste which is subject to collection service includes all the waste generated in Jakarta Pusat except the waste of P.D. Pasar and other wastes hauled by each body. This will amount to 1,120 t/day in 1995 and 1,470 t/day in 2005 in Jakarta Pusat.

The amount of waste handled at transfer station is 1,730 t/day, which includes the amount of waste to be hauled by other sectors.

The final disposal site in Bekasi will be constructed in three stages. At the first stage (1992 - 1997), total amount of waste to be disposed of will be approximately 5,300,000 tons, which includes Bekasi waste and part of the waste of Jakarta Utara.

3) Site Conditions of Facilities

For the transfer station site, a two-hectare land is to be prepared in Sunter. In order to construct this transfer station, topographical and geological conditions, transportation and accessibility, and other environmental circumstances should be considered.

The final disposal site in Bekasi is in Kecamatan Bantar Gebang, about 35 km a way from the centre of Jakarta.

Detailed surveys have been made on the topographical and soil conditions. Underground water is used for drinking around the site. Transportation conditions and accessibility to the site have been investigated for project planning.

3.3 Project Plan

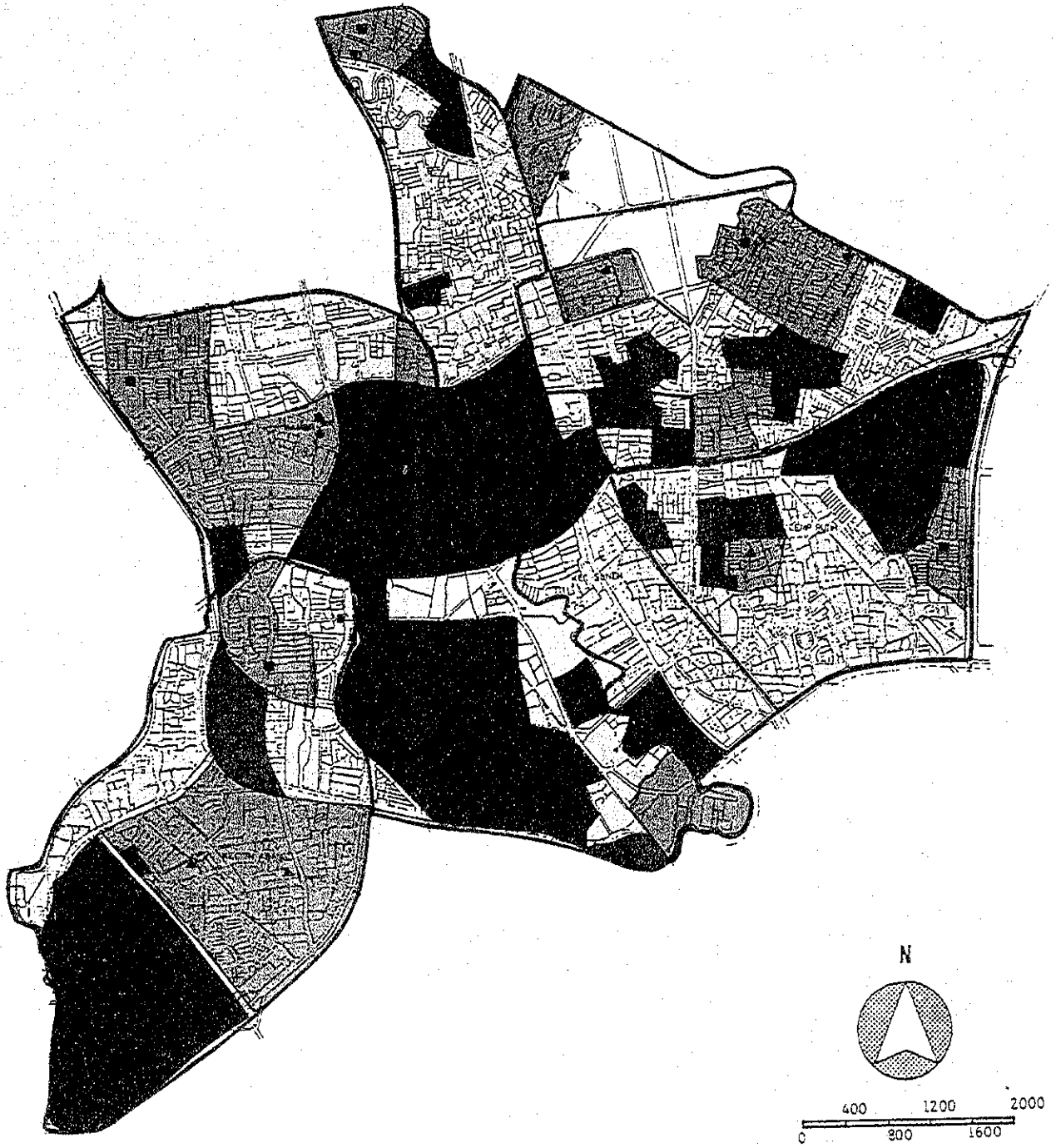
1) Improvement Plan for waste collection in Jakarta Pusat

According to the Conceptual Master Plan the improved system of waste collection is classified into two categories of general waste and bulky waste. Further, collection of general waste is divided into two systems of large amounts dischargers and ordinary ones.

Ordinary collection is as shown in Fig. 3.3-1. 9 existing depots will be improved and 9 depots will be newly constructed for the Depot-Container System. A small container system will be provided in the other area with Jali-Jali and Door-to-Door systems. The proposed new system consolidates the current seven collection systems into four in addition to employing full mechanization in the collection system.

2) Street sweeping plan in Jakarta Pusat

For the improvement of street sweeping, first it is recommended to make use of mechanical sweepers where manual sweeping is dangerous for workers. Second, have an appropriate distribution of manpower according to the amount of work in accordance with verified the length of streets to be swept.



LEGEND

COLLECTION SYSTEM

- Depot-Container
- Small Container
- Jali-jali
- New Door-to-door
- ▲ Existing Depot
- ■ New Depot
- ● Office

Fig. 3.3-1

Location Map of Collection Systems in Ordinary Collection

STUDY ON
SOLID WASTE MANAGEMENT SYSTEM
IMPROVEMENT PROJECT
IN JAKARTA

3) Sunter transfer station

The Sunter transfer station is planned with 1,730 t/day of treatment. This transfer station is equipped with six large compactors, 64 containers (40 m^3 capacity), and 32 tractors. A tractor will carry a container to Bekasi three times a day.

In this transfer station careful considerations will be made for sanitation, obnoxious odors and dust in and around the site.

4) Final disposal site in Bekasi

34.4 ha of land has been prepared for the final disposal site in Bekasi. This site is divided into two blocks, consisting of east side (A) and west side (B). The total amount of disposal is 5.3 million tons, over 7 years

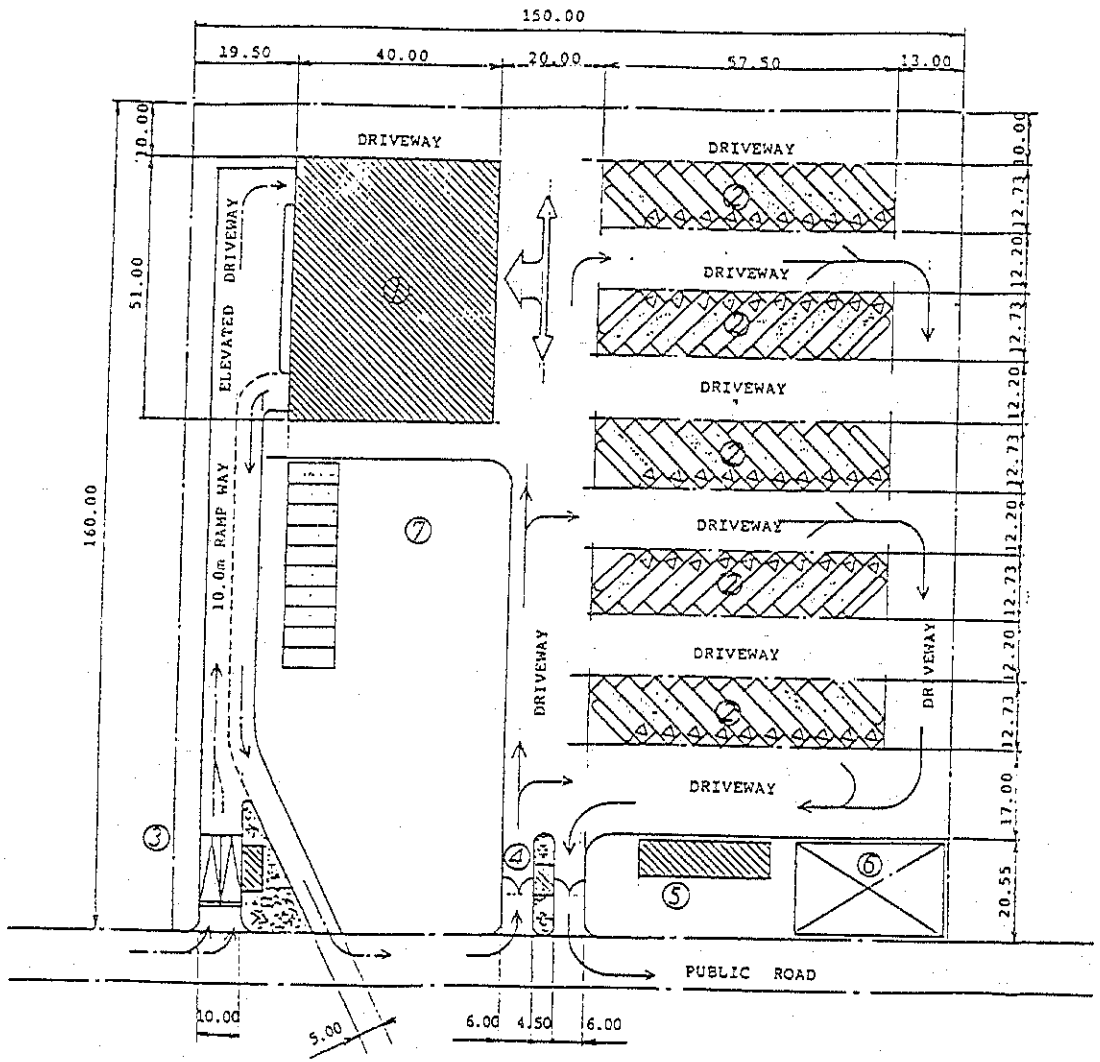
1,450,000 m^3 of covering soil will be required. In order to prevent the pollution of underground water, the site will be well planned with provision of unpermeable soil liner. Leachate should be collected and treated before being discharged.

5) Sub-workshop

A sub-workshop primarily for preventive maintenance will be constructed in order to maintain the effective operation of collection vehicles in Jakarta Pusat. This sub-workshop will be large enough to make periodical inspection and equipped with inspections and repairing equipments and tools.

3.4 Project Organization and Institution

It is required to have proper management and technical staff to implement the project. Accordingly, it is necessary to have a new department for planning and programming the execution of construction of the Sunter transfer station and Bekasi final disposal site, and also to have a new



LEGEND :

① TRANSFER STATION BUILDING
② CONTAINER YARD
③ VEHICLE REGISTRATION HOUSE
④ GUARD HOUSE
⑤ TRANSPORT OFFICE/DRIVERS' AMENITIES
⑥ VEHICLES WASHING AREA
⑦ TRACTOR PARKING AREA, ETC.

TRAIL OF VEHICLES :

→ TRACTOR
→ COLLECTION VEHICLE
⇒ PRIME MOVER

Fig. 3.3-2 Layout Plan of Sunter Transfer Station

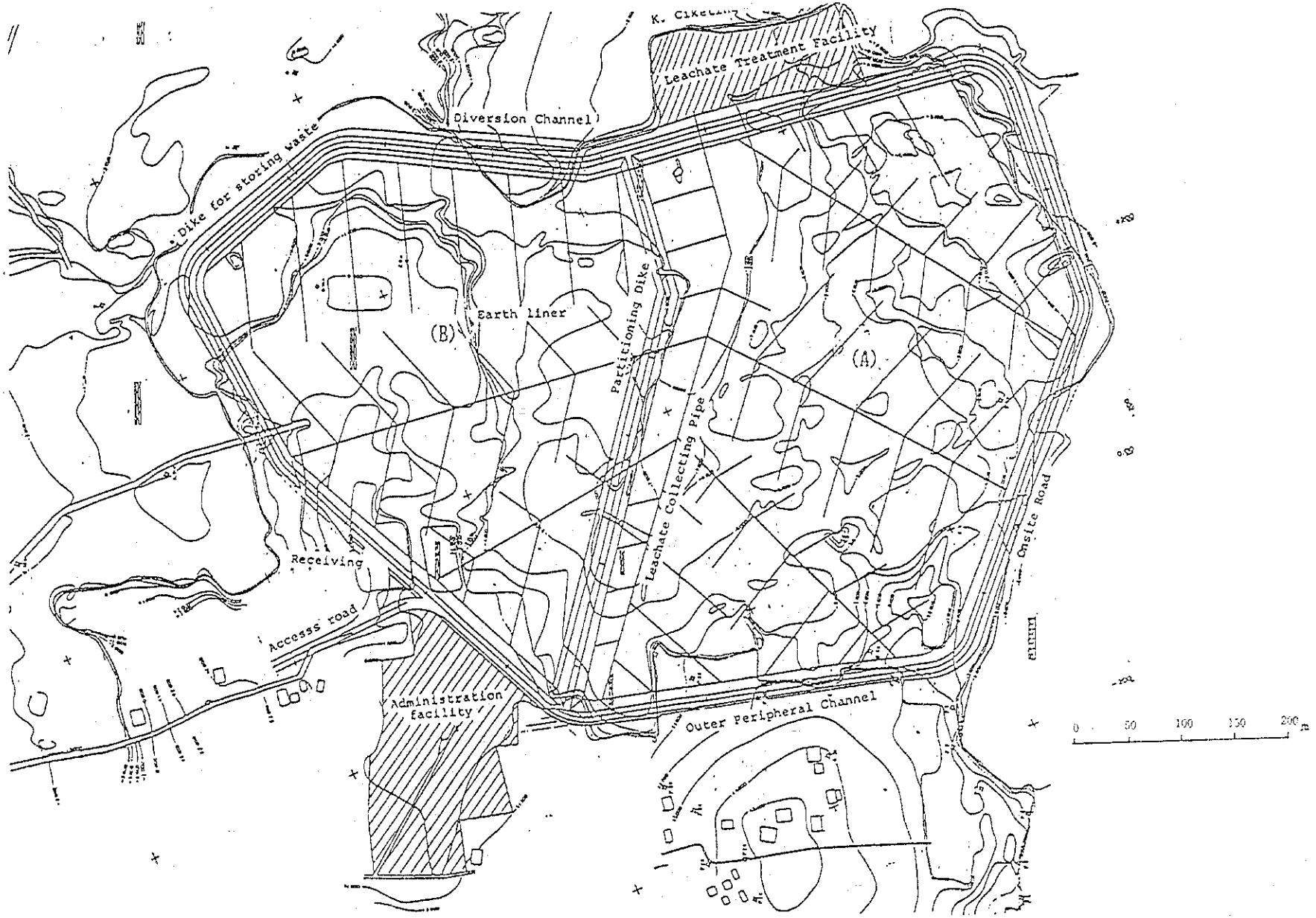


Fig. 3.3-3 Layout Plan of Bekasi Final Disposal Site

section in Suku Dinas Kebersihanfor the execution of collection and street sweeping improvement. A new fee collection system linked with electric charges should be prepared and introduced during the project execution period.

In the institutional aspect, service charge regulation, control of private activity for waste treatment and penalty regulations for illegal discharge of waste should be studied and realized.

3.5 Project Cost

The project cost, including engineering fee and physical contingency, is estimated at Rp. 75.0 billion.

It is estimated that Rp. 30 billion for the Sunter transfer station, Rp. 19.4 billion for the Bekasi sanitary landfill site, Rp. 11.9 billion for collection system improvement and Rp. 0.6 billion for the improvement of street sweeping are required. The breakdown of this project cost is as shown in Table 3.5-1.

Table 3.5-1 Investment Cost

(Rp. million)

	Project Cost		
	Foreign	Local	Total
Collection improvement	7,131	4,815	11,946
Street Sweeping	480	114	594
Transfer Station	23,274	6,787	30,061
Final Disposal	10,712	8,706	19,418
Sub Workshop	1,407	1,052	2,459
Sub Total	43,004	21,474	64,478
Engineering Fee	3,010	1,503	4,513
Physical Contingency	2,341	1,715	4,056
Price Contingency	939	1,056	1,995
Total	49,294	25,748	75,042

Investment fund resources are also shown in the above table. The portion of foreign fund is Rp. 49.3 billion, which is 65% of the total amount.

The operation cost is as shown in the following table.

Table 3.5-2 Operation Cost

(Rp. million)

	Depreciation	Maintenance	Fuel and Others	Personnel
Collection improvement	1,619.0	293.1	320.0	916.8
Street Sweeping	103.1	20.6	47.3	397.0
Transfer Station	2,351.6	838.8	766.0	113.3
Final Disposal	2,134.0	331.7	595.5	77.3
Sub Workshop	122.3	28.9	271.0	103.0
Fee Collection etc.				67.2
Total	6,330.0	1,513.1	1,999.8	1,674.6

3.6 Project Evaluation

Projects will be evaluated in terms of economic, financial and environmental aspects.

The economic evaluation shall be based on the cost minimization method because of the difficulty of immediately measuring the benefits of solid waste management. However, only the costs and benefits of introducing the transfer stations which are quantifiable will be calculated.

Financial evaluation shall be discussed on budgetary impact through implementation of the projects.

On the other hand, environmental evaluation shall be based on qualitative analysis.

1) Economic Evaluation

The economic benefits of the improved collection system is to reduce costs up to Rp. 8,690 per ton of waste, compared with Rp. 10,570 per ton of waste in the case of a conventional collection system, in addition to the improvement of public sanitation and the living environment in Jakarta Pusat.

With regard to the introduction of sanitary landfill at the Bekasi site, it is not possible to estimate the economic benefits.

But sanitary landfill at Bekasi will make it possible to limit small disposal sites scattered in Jakarta Pusat so as to improve environmental conditions. The site will also assist in the establishment of an appropriate final disposal technique for Jakarta's solid waste management, and the transfer of the relevant technology to other cities will be possible.

The construction of the transfer station is considered to be a highly profitable project, with an EIRR of 6.3% compared to other BHN-type projects. This profitability is mainly the result of a reduction in the transport cost. The station will also contribute to the maintenance of regular and stable waste collections, etc.

2) Financial Evaluation

The results of the financial evaluation suggest that the total debt in 2005 will be reduced to Rp. 39 billion and an operation surplus will be generated from 2003 onwards, with additional investment for equipment renewal and the expansion of the final disposal site being implemented throughout the project period, up to 2005. Therefore, the Project is also considered to be feasible on financial grounds.

3) Environmental and Social Impact

With regard to the social and environmental aspects, the areas around the transfer station and the final disposal site will be affected. However, the Project envisages the introduction of environmental measures to mitigate the possible adverse impact. The Project's contribution to environmental conservation in Jakarta Pusat should be duly evaluated. Although the scope of activity of scavengers and handcart workers will be narrowed with the implementation of the Project, the anticipated changes will not be large or rapid enough to cause serious friction.

In conclusion, the Project is considered to be feasible on economic, financial, environmental and social grounds.

3.7 Implementation Programme

1) Basic Policy

The basic policy for the preparation of the implementation programme is as follows.

(1)	Target Year	: 1995
(2)	Commencement of Operation	: 1992
(3)	Subject Area	: Jakarta Pusat
(4)	Main Facilities and Equipment	: Sunter Transfer Station
		: Bekasi Final Disposal Site
		: Sub-Workshop (Sunter)
		: Depots
		: Collection Vehicles

2) Preparation Period

The preparation period between the completion of the feasibility study and the commencement of the construction work will be 2 years, during which the following must be completed.

- Budgetary authorization of the local portion of the project cost.
- Fund raising of the foreign portion of the project cost and preparation of the repayment programme.
- Acquisition of the necessary sites (depots, transfer station, sub-workshop and final disposal site).
- Selection of contractor(s) (tender, evaluation and contract).

3) Work Schedule

The necessary work related to the Project is largely divided into the procurement of materials and equipments and the construction of the facilities. The period required for each work is as follows.

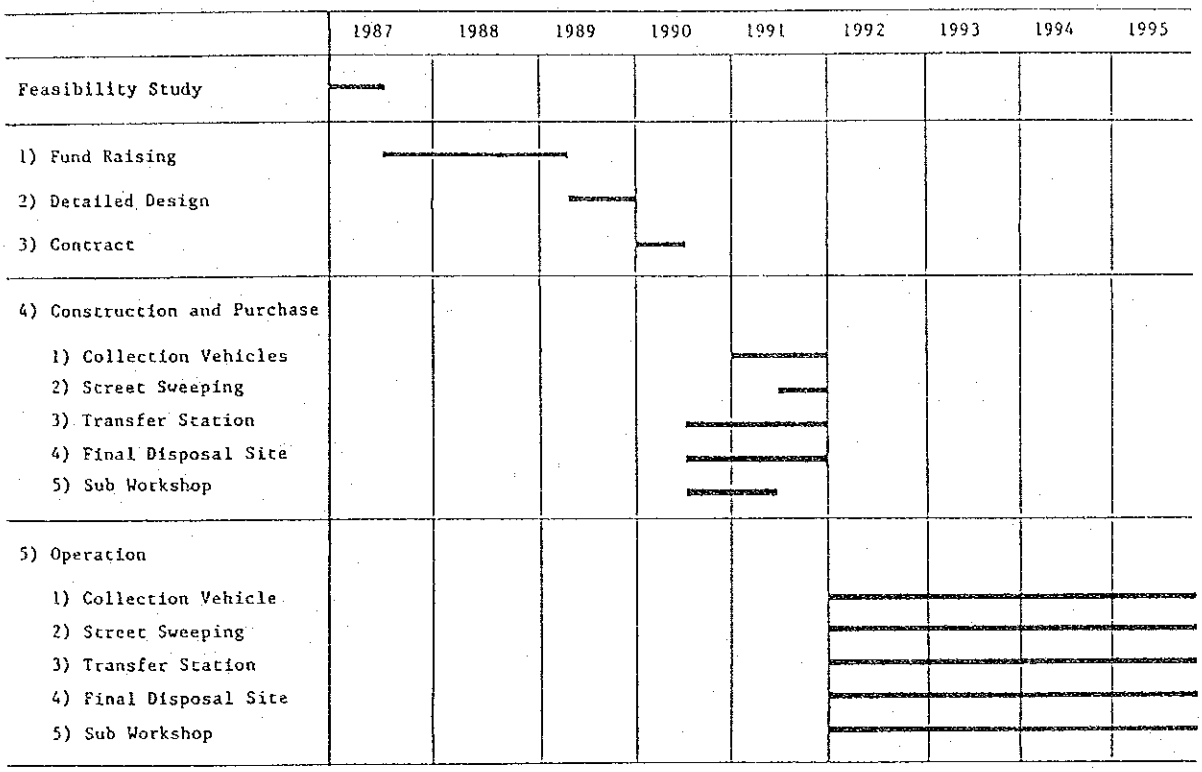
- Procurement of materials and equipments: 6 months
- Transfer Station : 18 months
- Final Disposal Site : 18 months
- Sub-Workshop : 12 months

The improvement of the collection system will only be possible when the transfer station becomes operational. Approximately 1 year will be required after the transfer station becomes operational for the new system to take root.

4) Execution Body for the Project

Solid waste management in Jakarta is currently under the direct control of the municipal government and, therefore, the municipal government will be the main body responsible for the Project. The Ministry of Public Works will be responsible for raising foreign funds relating to the Project.

Table 3.7-1 Work Implementation Schedule



3.8 Financial Plan

The financial plan for implementation of the Project will be as follows.

1) Sources

Investment fund sources are the DKI development budget and foreign and local loans as shown in Table 3.8-1 (1987 figures).

Table 3.8-1 Sources of Investment Funds

(Unit: Rp. billion)

	1989	1990	1991	Total*
DKI Development Budget	1.5	-	4.9	6.4
Foreign Loans	3.0	12.9	33.4	49.3
Local Loans	-	9.1	10.2	19.3
Total	4.5	22.0	48.5	75.0

* Physical contingency & price contingency are not included.

The loan conditions shown on Table 3.8-2 will be followed as far as possible, presuming the transfer of the Project to a public corporation around 1995.

Table 3.8-2 Loan Condition

		Nominal Interest Rate	Real Interest Rate
Foreign Loans	Repayment over 25 years at a seven-year grace period	8%	4%
Local Loans			
RDI	Repayment over 20 years at a five-year grace period	9%	5%
BFD	Short-term loan (To be repaid the following year)	18%	12%

The sources of revenue for the operation will be the DKI budget and collection fees. The new fee collection system of a surcharge on the electricity bill will commence in 1993, in view of the necessary preparation period. The tipping fee on solid waste from Bekasi will be collected from 1992.

The composition of the revenue for the project's operation is as shown in Table 3.8-3 (1987 figures).

Table 3.8-3 Composition of Revenue

(Unit: Rp. billion)

General	1992	1993	1994	1995	Total
DKI Budget	2.2	2.2	2.2	2.2	8.8
Fee Collection					
Basic Fee	-	2.9	3.0	3.1	9.0
Special Fee	2.7	2.8	2.8	2.9	11.2
Tipping Fee	2.9	2.9	2.9	2.9	11.6
Sub-Total	5.6	8.6	8.7	8.9	31.8
Total	7.8	10.8	10.9	11.1	40.6

2) Cash

Assuming the above revenue and expenditures, the cash flow based on 1987 figures is as shown in Table 3.8-4.

As can be clearly seen in the Table, the revenue and expenditure balance will start to show a surplus from the year 2005, reducing the total debt in 2005 to Rp. 53 billion, of which Rp. 26.3 billion is the balance of the initial foreign loan and Rp. 11.9 billion is the initial local loan. There will be an internal reserve of Rp. 10.6 billion in 2005 which could cover the renewal cost of the transfer station to a large extent, if not entirely.

Table 3.8-4 Money Flow of the Project (1987 Constant Price)

1¥=10Rp.

Unit: Rp. million

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
Revenue																		
Base fee	0	0	0	0	2,888	3,007	3,124	3,921	4,104	4,289	4,471	5,794	6,025	6,256	6,485	6,717	6,947	64,029
Special fee	0	0	0	2,678	2,753	2,828	2,903	3,607	3,730	3,854	3,977	5,126	5,277	5,426	5,577	5,726	5,877	59,339
Tipping fee	0	0	0	2,905	2,897	2,892	2,884	3,434	3,408	3,381	3,356	4,161	4,128	4,096	4,062	4,030	3,997	49,631
Budget from DKI	0	0	0	2,200	2,200	2,200	2,200	1,100	1,100	1,100	1,100	1,100	600	600	600	600	600	17,300
Subtotal (A)	0	0	0	7,783	10,738	10,927	11,111	12,062	12,342	12,624	12,904	16,181	16,030	16,378	16,724	17,073	17,421	190,299
Expense																		
Depreciation (B1)	0	0	0	6,330	6,330	6,330	6,330	6,330	6,330	6,330	7,052	7,052	7,052	7,052	7,052	7,052	7,052	93,674
Personnel	0	0	0	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,945	1,945	1,945	1,945	1,945	1,945	1,945	25,326
Maintenance	0	0	0	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,634	1,634	1,634	1,634	1,634	1,634	1,634	22,036
Fuel & Others	0	0	0	1,954	1,969	1,985	1,999	2,025	2,050	2,075	2,100	2,125	2,150	2,175	2,200	2,225	2,250	29,282
Interest	0	120	1,111	3,159	3,303	2,969	2,938	2,971	2,902	3,054	4,397	4,303	4,125	3,949	3,754	3,537	3,236	49,828
Fee Collect	0	0	0	279	427	436	446	548	562	576	590	754	771	789	806	824	841	8,650
Subtotal (B)	0	120	1,111	14,910	15,216	14,908	14,899	15,061	15,031	15,222	17,718	17,814	17,677	17,544	17,391	17,217	16,958	228,796
Balance (A-B)	0	-120	-1,111	-7,127	-4,478	-3,981	-3,788	-2,999	-2,689	-2,597	-4,814	-1,632	-1,648	-1,166	-667	-144	463	-38,497
Resource of Investment																		
Budget from DKI (C1)	1,503	0	4,929	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,432
Long Term Loan																		
Local (C2)	0	9,087	10,229	0	0	0	1,266	48	5,024	30,356	1,595	0	48	0	1,595	0	0	59,248
Foreign (C3)	3,010	12,875	33,409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49,294
Subtotal (C)	4,513	21,962	48,567	0	0	0	1,266	48	5,024	30,356	1,595	0	48	0	1,595	0	0	114,974
Repayment (D)	0	0	0	0	0	0	606	1,455	2,171	4,027	4,027	4,111	4,114	4,449	6,473	6,579	6,579	44,591
Remain of Loan	3,010	24,972	68,610	68,610	68,610	68,610	69,270	67,864	70,717	97,046	94,614	90,503	86,437	81,988	77,110	70,530	63,951	
Money Demand (E)	4,513	22,082	49,678	8,580	8,886	8,578	10,441	10,234	15,896	43,275	16,288	14,873	14,788	14,942	18,407	16,744	16,485	
Short Term Loan (F)	0	120	1,111	797	-1,852	-2,349	-1,936	-1,877	-1,470	294	1,789	-1,309	-1,290	-1,436	88	-329	-936	-10,586
Total of Debt (G1)	3,010	25,092	69,841	70,638	68,785	66,436	65,160	61,877	63,260	89,883	89,240	83,821	78,464	72,579	67,788	60,880	53,365	
Reserve Fund (G2)																		

PART IV RECOMMENDATION

4.1 Recommendation for Implementation of the Project

1) Establishment of the Project Team

Establishment of the Project Team, consisting of Cipta Karya and DKI Jakarta is indispensable in order for the project plan to proceed smoothly.

The Project Team has to be allowed to conduct and order in line with the project is proceeding, and its staff should be proficient in managerial and technical aspects because they will be responsible for the administration in relation to the future sanitation and environment in Indonesia.

(1) Preparation of regulations for solid waste management

- to introduce a licensing system for private collection and disposal operators
- to regulate the responsibility of solid waste disposal by its character in accordance with the Conceptual Master Plan
- to revise the regulations and laws in relation to waste discharge and fee system and put them into full scale effect

Those regulations are to be executed first in Jakarta Pusat and then extended to other Wilayahs step by step.

(2) Arrangement of fee collection system

- to arrange the regulation and data for door-to-door service and large volume dischargers in order to introduce new fee collection system.
- to reinforce the present fee collection system, while the new system of collecting fees is being implemented.

(3) Reinforcement of management and planning capability

It is recommended to prepare a management system capable of processing and analyzing the basic data necessary for solid waste management by reinforcing the existing management and planning capacity of Dinas Kebersihan and Suku Dinas Kebersihan of Jakarta Pusat.

The following data and information are necessary for management and planning.

- Amount of solid waste of entire treatment and disposal, and its composition
- Amount of solid waste by area and by large-volume discharger
- Population and number of households by RW which receive solid waste collection service
- Number and location of large-volume dischargers
- Operation record of vehicles
- Amount of fees collected for solid waste services
- Total length of street sweeping

(4) Arrangement of equipment before commencement of the project

In Jakarta Pusat, even before starting the project, some new equipments will be required, e.g. increasing and renewing the collection vehicles.

The arrangement of this new equipments should be done in accordance with the project's requirements.

(5) Public campaign for project execution

It is recommended to campaign publicly in order to obtain the understanding and cooperation of the citizenry and business establishments in implementing the project.

2) Securing of the Project sites

It is recommended that the following sites for the project be secured in the earlier period of the project schedule.

- Sunter transfer station site: in order to prepare this site, sanitary landfill should be completed at the site of Sunter as soon as possible.
- Sites for Depots and Sub-workshop
- Entire site of Bekasi final disposal site including access road

3) Securing funds

It is necessary to prepare funds for implementing of the project.

- Introduction of the foreign fund(s)
  By raising the priority of this project among other projects in Indonesia, start preparing the introduction of foreign aid loans to this project.

- Securing domestic funds
  Considering the optimum combination of the various domestic loans available to this project and the development budget of D.K.I. Jakarta, prepare domestic funds for the project.

4) Arrangement of staff and workers

It is necessary to arrange sufficient staff and workers for the new transfer station, disposal site and sub-workshop. Also it is required to arrange the planning and supervising staff in the office of Suku Dinas Kebersihan. In particular, technical staff and upper and middle management staff are essential. It is recommended to make efforts to educate necessary staff through training and other proper means.

As technology advances in future, it is recommended to introduce technical aid from abroad.

4.2 Other Recommendations

1) Preparation for reinforcing the fee collection system

In order to collect waste management fees through the fee collection system of P.L.N., it is necessary to prepare for managing large quantities of data and information. Accordingly, it is recommended to prepare another project dealing with these matters.

2) Securing sites in th other Wilayahs

Considering the future development of Phase I-B, II and III, necessary lands (e.g. sanitary landfill sites) should be secured beforehand.

3) Reinforcement of the organization

Through the reallocation of staff experienced with the project in Jakarta Pusat to the other Wilayahs, where similar projects are to be executed, effective reinforcement of the organization in Suku Dinas Kebersihan is recommended.

4) Reinforcement of cleansing service management in the other Wilayahs

While this project in Jakarta Pusat is going on, cleansing service requirements in the other Wilayahs will be increased as they physically develop. In order to cope with the situation, cleansing service management in the other four Wilayahs should be reinforced.

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