

2. Solid Waste Characteristics in Jakarta

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2.1 General

The following basic data were studied for estimation of amount and quality of waste:

- 1) Results of Basic Field Survey conducted in August-September 1986, February 1987.
- 2) Data of Dinas Kebersihan, Dinas Pertamanan etc.
- 3) Data of BPPT etc.
- 4) Data of P.D. Pasar Jaya

Amount of domestic waste, commercial waste, street waste and canal waste was estimated. Amount of waste of Bekasi and Tangerang where there are the planned final disposal sites, was also considered.

Quality of domestic waste, commercial and industrial waste was investigated, because it forms most of whole generated waste.

2.2 Estimation of the Waste Amount

2.2.1 Method of Estimation

1) Domestic waste

The domestic waste was estimated by using the waste generation rate for each income class in 1985 obtained during the basic survey on the basis of population and income distribution. For population and income distribution, the figures in the DKI Jakarta Master Plan was used.

2) Market waste

The market waste was estimated on the basis of the data provided by P.D. Pasar Jaya and the findings from the questionnaire survey conducted by the Dinas Kebersihan. The future growth was projected by using the growth rate of the commercial employment size.

3) Commercial waste

The commercial waste was estimated for each category of shops, hotels and offices. The waste generation rates were estimated to be 1.0 kg/employee for offices based on the findings of the basic survey.

4) Industrial waste

Industrial waste include waste discharged from manufacturing processes and other waste. Waste discharged from manufacturing processes ought to be captively disposed of, in principle, but it is not clear how much of such wastes are discharged. Here, the generation rate of industrial waste was estimated to be 1.8 kgs./employee on the condition that such process waste are discharged in the industrial waste.

5) Street sweeping waste

Street sweeping waste was estimated on the basis of a generation rate of 75 kgs/km according to the data obtained from the basic field survey. The future extension of streets subject to sweeping was based on the DKI Jakarta Master Plan. Since the waste on local road in front of each home are collected by each home even now, these waste shall be considered to be a part of domestic waste.

6) Canal waste

Canal waste, with the exception of those from small drainage ditches, shall be cleaned and hauled by DPU. The amount of such waste was estimated on the basis of the amount currently hauled. The waste from small drainage ditches on the other hand shall not be estimated since they are considered to be principally part of domestic waste and incidentally left scattered now.

7) Amounts of Bekasi and Tangerang waste

The amounts of Bekasi and Tangerang waste have been established in the West Java Urban Development Project. The amounts in 1990 are 700 m³ for Tangerang and 575 m³ for Bekasi. Although the density had been estimated to be 0.25 t/m³, it shall be changed to 0.3 t/m³ according to the measurement results in Jakarta, so that the respective amount shall be 210 t and 170 t.

8) Hospital waste

Sufficient care should be exercised in handling hospital waste since they contain pathogenic bacteria and other harmful matters although the amount generated is no very large.

2.2.2 Projection Method

1) General

Projections of the future solid waste amount will be needed for elaborating the Master Plan for Solid Waste Management which involves the construction plan for landfill, the intermediate treatment facility, a purchase plan for equipment, and also a financial plan.

2) Projection method

In general, there are two representative projection methods as follows:

- (a) By correlations between generation rate (g/capita), including all sources, and GNP.
- (b) By generation rate of each source multiplied by each future variable.

Method (a) is quite a common method in industrialized countries. It is well-known that there is a close correlation between generation rate and GNP. However, in Jakarta, former data concerning generation rate is not available and therefore the application of this method would be difficult. The only method that can be suggested is the use of the coefficient of elasticity which indicates increases in the generation rate, for instance, with a double increase in national income per capita based on the experience of developed countries. Using the measure, a rather rough estimation will be obtained.

On the other hand, method (b) is usually applied when it is necessary to estimate the future generation rate by each source. This method has a lot of difficulties and great efforts are needed to set up the generation rate and to obtain the data on parameters.

In spite of the above, method (b) is applied in this study because an estimation of the generation amount by source must be calculated in order to design a future solid waste management and collection system. In addition, method (a) will be used as a supplementary means only of checking outcomes.

An examination of the procedures for the future estimation of waste amount by generation source is given by below.

a) Domestic waste

-- Preconditions

- Generation rate by each income level is fixed at the rate which was obtained in the Basic Field Survey.
- Projected population by each income level is based on the Master Plan of DKI Jakarta.

-- Calculation formula

$$Q = (q_{1i} \cdot A_i)$$

Q₁ : Projected amount (ton/day)

Q_{1i} : Generation rate by each income level (g/capita)

A_i : Population at each income level (person)

b) Market waste

- Preconditions

- Generation rate per market is fixed at the present rate.
- Number of markets increases in proportion to increases in population

- Calculation formula

$$Q_2 = q_2 * B * k$$

Q_2 : Projected amount of market waste (ton/day)

q_2 : Generation rate per market (ton/pasar/day)

B : Number of markets in 1985

k : rate of population increase

c) Other market waste

- Preconditions

- Generation rate per other market is fixed at the present rate.
- Number of other markets increases in proportion to increases in population.

- Calculation formula

$$Q_3 = q_3 * C * k$$

Q_3 : Projected amount of other market (ton/day)

q_3 : Generation rate per other market (ton/other market/day)

C : Number of other markets in 1985

k : Rate of population increase

d) Hotel waste

- Preconditions

- Generation rate per employee is fixed at the present rate.
- Projected number of hotel employees is determined by the rate of increase in number of employees in tertiary industry.

- Calculation formula

$$Q_4 = q_4 * D * l$$

Q_4 : Projected amount of hotel waste (ton/day)

q_4 : Generation rate per employee (kg/person/day)

D : Present number of hotel employees

l : Rate of increase in number of employees in tertiary industry

e) Shop waste

- Preconditions

- Generation rate per employee is fixed at the rate which was obtained in the Basic Field Survey.

- Projected number of shop employees is determined by the rate of increase in number of employee in tertiary industry.

- Calculation formula

$$Q_5 = q_5 * E * l$$

Q_5 : Projected amount of hotel waste (ton/day)

q_5 : Generation rate per shop employee is fixed at the present rate which was obtained through the interview. (g/person/day)

l : Rate of increase in employees in tertiary industry

f) Office waste

- Precondition

- Generation rate per office employee is also fixed at the present rate.

- Projected number of employees depends on the rate of increase in number of employees in tertiary industry.

- Calculation formula

$$Q_6 = q_6 * F * l$$

Q_6 : Projected amount of office waste (ton/day)

q_6 : Generation rate per office employee (g/person/day)

F : Present number of office employees

l : Rate of increase in number of employees in tertiary industry

g) Industrial waste

- Preconditions

- Generation rate per employee in secondary industry is also fixed at the present rate.
- Projected number of employees in secondary industry is based on the Master Plan of DKI Jakarta.

- Calculation formula

$$Q_7 = q_7 * J$$

Q_7 : Projected amount of industrial waste (ton/day)

q_7 : Generation rate per industrial employee
(kg/person/day)

J : Projected number of employees in secondary industry

h) Street rubbish

- Preconditions

- Generation rate per street length which was obtained through the Street sweeping survey is fixed.
- Projected street length for which a street sweeping service is provided depends on the future road network plan, including existing major roads.

2.2.3 Estimation of the Amount of Domestic Waste

The amount of domestic waste was estimated as follows:

1) Population

The population by Kecamatan projected for 1980, 1995 and 2005 as used in DKI Jakarta Master Plan was used. The 1984 population was determined based on the 1980 data and its growth are projected up to 1995. The population estimated for the respective years would be as follows:

Year	Population
1984	7,300,000
1995	9,950,000
2005	12,000,000

2) Income classes and income distribution

The data on income classes as used in the DKI Jakarta Master Plan for 1980, 1995 and 2005 were used. The income classes may be divided by the family income and also by the income per employed person, but here, the division by the family income was adopted. Income classes are defined as shown in Table 2.2-1 in terms of the 1980 prices.

Table 2.2-1 Income classes

	Income division	Mean income
High income	200,000 Rp/month or more	400,000 Rp/month
Medium income	55,000 to 200,000 Rp/month	109,000 Rp/month
Low income	0 to 55,000 Rp/month	33,000 Rp/month

Income distribution by area is shown for 1980 and 2005 in terms of the division by income per employed person. Said income distribution by area was modified by the foregoing income division by household.

3) Waste generation rates by income class

Waste discharge rates by income class obtained from the basic survey was used. However as the income in this survey is shown in the 1985 prices and the income division is also different, the above waste discharge rates was modified to commensurate to the mean income of each income class. The inflation rate between 1980 and 1985, therefore, was estimated to have been 1.6 times, from which the following waste discharge rates were obtained.

Table 2.2-2 Generation Rate of Domestic Waste

	Mean income in 1985 prices	Waste discharge rate
High income	640,000 Rp/month	680 g/capita
Medium income	175,000 Rp/month	390 g/capita
Low income	53,000 Rp/month	210 g/capita

In 2005, the mean income values will become somewhat higher due to the change in income class distribution, but the above waste discharge rates are employed because the results of the trial estimates do not indicate any significant difference.

4) Amount of domestic waste

The amounts of domestic waste estimated on the foregoing conditions are 2,430 t/d for 1985, 3,770 t/d for 1995 and 5,110 t/d for 2005. The amount of domestic waste by Wilayah is summarized in Tables 2.2-8,-9,-10.

2.2.4 Market Waste

The amount of waste generated from markets under the control of P.D. Pasar Jaya and that generated from other markets were estimated separately as follows.

1) Number of markets

There are 296 markets in Jakarta, of which 149 are under the control of P.D. Pasar Jaya. The balance, 147, are other markets.

On the assumption that the number of markets in the future will increase proportionate to the number of persons engaged in commerce, it will reach 425 in 1995 and 622 in 2005.

The amount of waste generated varies depending on the size of each market, but as there are not enough data to show the relationship among area, number of persons engaged and amount of waste, the waste generation rate per market was used for estimation. The geographical distribution of markets was projected on the basis of the 1984 statistical data of DKI Jakarta.

2) Waste generation rate per market

According to the data of P.D. Pasar Jaya, 1,754 m³/d of wastes were generated from 149 markets. If the density of waste was estimated to be 0.3 t/m³ based on the results of the basic survey, the amount generated was 526 t/d, resulting in a waste generation rate of 3.5 t/market.

As for other markets, the result of the questionnaire survey conducted by the Dinas Kebersihan was 912 m³/d for a total of 140 markets. Using the waste density of 0.3 t/m³, the generation rate was 2.0 t/market.

3) Amount of waste

From the foregoing data, the amount of market waste is estimated as follows.

Table 2.2-3 Amount of Market Waste

	1985	1995	2005
P.D. Pasar	520 t/d	750 t/d	1,090 t/d
Others	290	420	1,710
Total	810	1,170	1,710

The amount of market wastes by Wilayah is summarized on Tables 2.2-8,-9,-10.

2.2.5 Commercial Waste (Excluding Market Waste)

The amount of commercial waste excluding market waste was separately estimated for each category of shops, hotels, and offices.

- 1) The numbers of shops, hotels and offices and their respective employment size

According to the statistical data of DKI Jakarta, the number of buildings for shops, hotels and offices (and their geographical distributions) in 1985 were 27,179 and 105 and 4,396 respectively. The number of employees for each category based on the DKI Jakarta Master plan is as follows.

Table 2.2-4 Number of Employee

	1985	1995	2005
Shops & markets	555,000	794,000	1,162,000
Hotels	16,000	23,000	33,000
Offices	1,056,000	1,511,000	2,210,000

Since the division in the number of employees by shops and markets unavailable, it was estimated here that 70% of the number of employees work in the shops and that the balance work in markets.

- 2) Waste generation rate

According to the results of the basic survey, the waste generation rate is 0.4 kg/employee/d for small shops and 1.2 kg/employee/d for large shops. The waste generation rate of 1.0 kg/employee/d was therefore used by emphasizing the large shops.

The waste generation rate for large hotels is 3.0 kgs to 3.6 kgs/employee/d, so that the common waste generation rate of 3.0 kgs/employee/d was used here.

Office waste, according to the survey, was 0.6 - 1.0 kg/employee/d for large buildings, which seems somewhat too large when compared to the domestic waste generation rate. It is therefore estimated to be 0.4 kg/employee/d considering small to medium size offices and data of the other countries.

3) Amount of waste

As a consequence, the respective amount of wastes was estimated as follows.

Table 2.2-5 Amount of Commercial Waste

Source	1985	1995	2005
Shops	390 t/d	560 t/d	810 t/d
Hotels	50	70	100
Offices	420	600	880
Total	860	1,230	1,790

2.2.6 Industrial Waste

Industrial waste include waste which are discharged from manufacturing processes and those which are not. The former may possibly contain harmful substances so that it is preferable to captively dispose of them after having them properly treated according to their respective properties. The prevalent state in Jakarta suggests that waste discharged from manufacturing processes, except those which are recycled, are mixed in other waste. The extent to which these waste are mixed, however, is unknown.

1) Number of factories and number of factory employees

According to the statistical data of DKI Jakarta, the number of factories in 1985 was 4,309. This number, however, represents the number of factory buildings or the approximate number of factories with five or more employees. The number of employees working in factories, each with five or more employees is estimated to account for about 95% of the total.

The number of employees is estimated to be 338,000 in 1984, 489,000 in 1985 and 663,000 in 2005 based on the DKI Jakarta Master Plan.

2) Waste discharge rate

According to the results of a questionnaire survey conducted on 487 factories in Utara, the total amount of waste generated is 950 m^3 and using the density of 0.3 t/m^3 as in the case of commercial waste, the waste generation rate per factory would become 0.59 t/factory. As the mean employment size of factories with five or more employees is 57 employees in Utara, the waste generation rate per capita would be 10.3 kgs/employee/d. This figure is quite large compared to the data for Japan, and is considered not only to include wastes discharged from production processes but to be substantially overstated. For this reason, the data for Japan was used as a reference, as result of which the waste generation rate was determined to be 1.8 kgs/employee/d. According to the same data, about 1/4 of this figure represents general wastes, and the balance, waste discharged from manufacturing processes.

3) Amount wastes

The amount of industrial wastes was estimated from the foregoing to be 610 t/d in 1985, 880 t/d in 1995 and 1,190 t/d in 2005.

4) Other waste

There were 59 hospitals in the city of Jakarta as of 1985. As a result of investigating 17 hospitals in Utara, the waste generation rate was found to be 0.7 t per hospital. When this waste generation rate is used, the amount of wastes generated in 1984 would have been 40 tons. Projecting that the amount of wastes will increase proportionate to the population increase in the future, the estimated amount of waste will become 60 tons in 1995 and 70 tons in 2005.

Now, the amount of waste generated from industrial activities has been estimated mainly by the number of employees, but there are also employees who are not included in the aforementioned categories, such as construction workers who nevertheless generate waste. The estimated number of such employees is 321,000 for 1985, 454,000 for 1995 and 617,000 for 2005. No appropriate data are available on waste generation rate but it is not considered to be very large. Using the same 0.4 kg/employee/d as applied to offices, the amount of waste generated is estimated to be 130 t/d in 1985, 180 t/d in 1995 and 250 t/d in 2005. The geographical distribution of these waste is assumed to be the same as for industrial wastes.

2.2.7 Street Waste, Canal Waste

The extended length of streets swept was 713 kms. in 1985. Since the waste generation rate is 75 kgs/km, the amount of street wastes generated is estimated to have been 50 tons in 1985. With the improvement development of streets, the amount of street waste will increase, and projecting the growth rate of street wastes to be the same 3.0% per annum as the rate of development/improvement of streets, the amount of waste was estimated for each Wilayah as follows.

Table 2.2-6 Amount of Street Waste

Wilayah		1985	1995	2005
Pusat	296 kms	20 t/d	30 t/d	40 t/d
Utara	83	10	10	10
Jakarta Barat	60	0	10	10
Selatan	160	10	10	20
Timur	114	10	10	20
Total	713 kms	50 t/d	70 t/d	100 t/d

Wastes on local roads are swept by the residents even now and become a part of domestic wastes.

As for canal waste, DPU undertakes recovery and haulage of wastes mainly in the river mouth sections which amount to about 415 m³/d. Using the density of 0.3 t/m³, the amount of canal waste is about 130 tons per day.

No data are available on waste in small drainage ditches. But, since the canal waste as well as waste in small drainage ditches are presumed to consist mostly of domestic waste littered or illegally thrown away, the latter are considered to be a part of domestic waste.

2.2.8 Amount of Waste from Tangerang and Bekasi

The amount of waste from Tangerang and Bekasi was estimated to be 280 tons/d and 170 tons/d respectively in 1990. The amount of wastes after 1990 was projected as follows with due consideration to population increase.

Table 2.2-7 Amount of Waste from Tangerang and Bekasi

Source	1985	1990	1995	2005
Tangerang	140 t/d	280 t/d	530 t/d	1,260 t/d
Bekasi	80	170	340	880

2.2.9 Waste Amount of DKI Jakarta

Resulting, the estimated amount of waste of DKI Jakarta is shown as follows:

Table 2.2-8 Estimated Amount of Waste in Jakarta in 1985

Unit: ton/day

Wilayah	Generation House- hold	Market		Commercial	Industry	Street	Total
		Temporary	P.D. Pasar				
1. Jakarta Selatan	620	50	110	160	170	-	1,110
2. Jakarta Timur	560	60	110	170	120	-	1,020
3. Jakarta Pusat	470	60	130	300	90	-	1,050
4. Jakarta Barat	440	80	90	130	190	-	930
5. Jakarta Utara	340	40	80	100	210	-	770
DKI Jakarta	2,430	290	520	860	780	50	4,930

Table 2.2-9 Estimated Amount of Waste in Jakarta in 1995

Unit: ton/day

Wilayah	Generation House- hold	Market		Commercial	Industry	Street	Total
		Temporary	P.D. Pasar				
1. Jakarta Selatan	1,070	80	160	220	240	-	1,770
2. Jakarta Timur	950	80	160	250	180	-	1,620
3. Jakarta Pusat	520	100	180	430	130	-	1,360
4. Jakarta Barat	720	110	130	190	270	-	1,420
5. Jakarta Utara	510	50	120	140	300	-	1,120
DKI Jakarta	3,770	420	750	1,230	1,120	70	7,360

Table 2.2-10 Estimated Amount of Waste in Jakarta in 2005

Unit: ton/day

Wilayah	Generation House- hold	Market		Commercial	Industry	Street	Total
		Temporary	P.D. Pasar				
1. Jakarta Selatan	1,410	120	220	330	330	-	2,410
2. Jakarta Timur	1,330	120	230	360	240	-	2,280
3. Jakarta Pusat	620	140	270	620	180	-	1,830
4. Jakarta Barat	1,080	160	200	270	360	-	2,070
5. Jakarta Utara	670	80	170	210	400	-	1,530
DKI Jakarta	5,110	620	1,090	1,790	1,510	100	10,220

2.2.10 Amount of Waste of Jakarta Pusat

The present amount of waste of Jakarta Pusat is as follows:

Table 2.2-11 Estimated Amount of Waste in Jakarta Pusat in 2005

Unit: ton/day

Wilayah	Generation House- hold	Market		Commercial	Industry	Street	Total
		Temporary	P.D. Pasar				
1. Tanah Abang	90	20	25	30	35	-	200
2. Menteng	50	-	20	50	5	-	125
3. Senen	50	5	25	40	-	-	120
4. Cempaka Putih	80	10	15	20	-	-	125
5. Sawah Besar	60	10	10	100	20	-	200
6. Gambir	60	10	10	100	20	-	200
7. Kemayoran	80	5	20	10	5	-	120
Jakarta Pusat	470	60	130	300	90	-	1,050

2.2.11 Estimated Amount of Waste

In the Conceptual Master Plan for the solid waste management improvement project formulated in this study, collection is classified into the following four systems, that is, ordinary and special collection by Dinas Kebersihan, collection by P.D. Pasar Jaya, and self-treatment/collection by private sectors. The estimated amount of waste by each collection system in Jakarta Pusat in 1995 is as follows:

Table 2.2-12 Estimated Amount of Waste by Each Collection Type in Jakarta Pusat in 1995

Collection Type		By Dinas Kebersihan					By Others	
		Ordinary Collection			Special Collection			
Kecamatan	Generation	H	C	I	C	TM	PD.PSR	I
1.	Tanah Abang	100	20	30	20	20	35	30
2.	Menteng	50	40	5	40	5	25	5
3.	Senen	60	30	0	30	10	30	7
4.	Gempaka Putih	90	10	0	10	15	25	2
5.	Sawah Besar	70	40	10	40	20	20	2
6.	Gambir	60	70	15	70	20	15	20
7.	Kemayoran	90	10	0	10	10	30	4
Jakarta Pusat		520	220	60	220	100	180	70

KEY

H: Household, C: Commercial, I: Industry, TM: Temporary Market,
PD. PSR: P.D. Pasar Jaya

2.2.12 Unit Generation Rates

Unit generation rates of waste used in the calculation rates shown below.

Table 2.2-13 Unit Generation Rates of Waste per Day (1985)

		Unit Generation Rate	Results of the survey
Domestic	High income	680 g/capita	580 g/capita
	Medium income	390 g/capita	470 g/capita
	Low income	210 g/capita	310 g/capita
	Average	427 g/capita	414 g/capita
	P.D.Pasar Jaya	3.5 ton/market	-
	Temporary Market	2.0 ton/market	-
Commercial	Hotel	3.0 kg/employee	2.1 kg/employee
	Shop	1.0 kg/employee	390 g/employee
	Office	400 g/employee	330 g/employee
	Industry	1.8 kg/employee	-
	Street	75 kg/km	-

2.3 Waste Composition

The waste quality was estimated for domestic waste, market waste, commercial waste and industrial waste which are generated in large amounts.

2.3.1 Survey for Domestic Waste

The results of the survey on quality of domestic wastes by income class are as shown in Table 2.2.-14 and -15. Sampling spaces could not be found in the shade of medium and low income class area so that moisture evaporation during their sampling was substantial. The moisture contents in wastes of medium and low income households were therefore considered to be 5% higher than the measured values. Since this survey was carried out by directly collecting waste in bags or plastic containers from homes and sampling from these, the moisture content and other characteristics are considered to be different from the quality of waste that have been left for a few days in a concrete box accumulated at a depot.

Under the present mode of collection, the moisture content increases by rainfall during the rainy season, so that adequate care must be given to waste quality during the rainy season.

According to the analytical results of these samples,

- * Plastic contents and low calorific values are low in the waste generated from the high income class.
- * Garbage and moisture contents are high in the waste generated from the high income class.
- * Paper, metal, and glass contents are not significantly different among income classes.

The above are presumed to be attributable to the following two causes.

- * Waste generated from high income households include garden wastes.
- * Employees in high income households remove the reusable materials from wastes before taking them out to be collected.

Table 2.2-14 Composition of Domestic and Commercial Wastes

Unit: %

	Domestic								Commercial	
	High		Middle		Low		Average		Dry	Wet
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet		
Plastic	7.30	6.20	8.70	11.50	12.90	10.10	9.63	9.27	13.00	9.30
Paper	17.80	12.40	15.30	24.30	17.30	17.90	16.80	18.20	25.00	18.90
Textile	2.60	3.60	8.80	10.50	5.10	2.30	5.50	5.47	2.30	5.30
Wood/Leaf	13.30	32.30	9.60	10.60	11.90	15.20	11.60	19.37	7.50	20.70
Garbage	15.10	11.60	10.90	12.50	11.10	13.40	12.37	12.50	17.50	16.90
Other 5 mm	15.60	10.80	7.70	10.40	10.40	14.90	11.23	12.03	10.70	14.10
Other 5 mm	14.00	11.10	18.50	5.70	12.70	9.70	15.07	8.83	14.00	5.10
Sub-total	85.70	88.00	79.50	85.50	81.40	83.50	82.20	85.67	90.00	90.30
Metal	4.20	2.80	2.40	4.50	4.10	2.50	3.57	3.27	4.30	0.60
Glass	3.00	4.50	3.80	5.00	3.90	4.30	3.57	4.60	4.80	1.30
Stone	7.10	4.70	14.30	5.00	10.60	9.70	10.67	6.46	0.90	7.80
Sub-total	14.30	12.00	20.50	14.50	18.60	16.50	17.80	14.33	10.00	9.70
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Remarkable difference of waste composition between dry season and wet season is increase of wood/leaf in wet season. It is 2.5 times more in high income households and 3 times more in commercial waste. Besides increase of paper of low and medium income household in wet season is observed. Decrease of others in wet season is considered due to improvement of skills of sorting in sampling.

Table 2.2-15 Estimated Physical and Chemical Compositions of Domestic and Commercial Wastes

		Domestic								Commercial	
		High		Middle		Low		Average		Dry	Wet
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet		
Moisture content	%	56.88	64.07	52.40	62.59	52.83	63.61	54.03	63.42	47.95	54.40
Volatile	%	26.83	28.54	26.52	28.85	29.82	26.90	27.72	28.10	35.50	36.97
Ash content	%	16.29	7.39	21.07	8.56	17.35	9.49	18.23	8.48	16.50	8.63
C/N ratio		30.83	33.70	29.92	31.40	33.85	31.20	31.5	32.10	34.78	31.90
Low cal. value	Kcal/kg	987	999	1,085	1,095	1,309	983	1,127	1,025	1,620	1,514

The characteristics is found that moisture content of both domestic and commercial waste in wet season increases 7 - 10% more than in dry season. Ash content in wet season decreases half comparing to that in dry season. Lower calorific value in wet season is about 100 kcal lower than in dry season, that in low income household is about 300 kcal lower. The difference in whole DKI Jakarta should be taken into consideration.

2.3.2 Quality of Domestic Waste

Even though many more analyses are necessary in the future, the results of analysis conducted during this survey suggest that the quality of domestic waste generated from every income class is approximately the same. The quality of domestic wastes was therefore determined based on the mean values shown in Table 2.2.-16.

Table 2.2-16 Estimated Composition of Domestic Waste in Future

	1985	1995	2005	% growth p.a.
Plastic	10%	12%	14%	2%
Paper	17	19	21	1
Textile	5	5	5	0
Wood/eat	12	11	10	-1
Garbage	23	21	19	-1
Others	15	14	12	(-1)
Sub total	82	82	81	
Metal	4	5	7	5
Glass	4	5	6	3
Store	10	8	6	(-2)
Sub total	18	18	19	
Total	100	100	100	
Moisture content	54			
Volatile	28			
Ash	18			
C/N	31			
Lower Cal. V.	1100 kcal/kg			

2.3.3 Quality of Market Waste and Commercial Waste

The quality of market waste and commercial waste is estimated to be as follows based on the results of the survey.

Table 2.2-17 Estimated Composition of Commercial Waste in Future

	1984	1995	2000
Plastic	13%	15%	17%
Paper	25	27	30
Textile	3%	3	3
Wood/eat	7	6	5
Garbage	28	25	21
Others	14	12	9
Sub total	90	88	85
Metal	4	5	7
Glass	5	6	7
Store	1	1	1
Sub total	10%	12	15
Total	100	100	100
Moisture content	48	46	43
Volatile	36		
Ash	17		
C/N	35		
Lower Cal. V.	1600 kcal/kg		

2.3.4 Quality of industrial waste

Quality of industrial waste is considered to be the same as the commercial wastes.

2.4 Basic Field Survey

2.4.1 General

The basic field survey was carried out in part of Kecamatan Cempaka Putih as selected survey areas in dry season (August-September 1986) and wet season (February 1987). In the dry season, collection, measurement and sampling was conducted to obtain data for amount and quality of waste. A traffic survey of collection vehicles was done by counting the numbers of vehicles visiting each disposal site. Interview and observation to scavengers at disposal site and interview to large buildings (hotel, office, etc.) and Soekarno Hatta Airport was carried out.

In the wet season, collection and sampling was carried out to obtain data for quality of waste. Interview to large amount discharges was done to grasp the present condition in Jakarta Pusat.

2.4.2 Objectives

- 1) To collect reliable data on the waste generation rate, and the composition and density of waste as a basis for the elaboration of an improvement plan for the system of waste management.
- 2) To determine the total waste amount of the city of Jakarta, it is necessary to measure the waste generation rate.
- 3) For the purposes of making an appropriate selection of processing and disposal systems, the salvaging of reusable materials and for estimating future waste composition, and break down of current waste composition is needed.

Main subjects of this survey are as follows:

- Determination of the generation rate for household waste based on data from high, middle, and low income households.

- Determination of solid waste density.
 - Determination of solid waste composition.
 - Loading weight of vehicles and density of waste in vehicles.
 - To obtain supplementary data for the estimation of commercial waste.
(Reference)
- Estimation of future amounts of solid waste (household-waste).

Density, generation
rate, composition

Population
classified by
income level

Living
conditions

Future population
classified by
income level

Household waste
- amount
- density
- composition

Estimate of
future density,
generation rate,
composition

(based on Master Plan)

Future solid
waste amount

Fig. 2.4-1 Outline of the Basic Field Survey

2.4.3 Selection of the Survey Area

1) Type of area

- The survey was executed in 2 types of areas, i.e residential and commercial.
- The residential area was divided into 3 categories according to income strata, classified by the average household income per month shown as follows:

Table 2.4-18 Income Strata

Strata	Income (Rp)
High income	over 500,000
Medium income	100,000 - 500,000
Low income	under 100,000

- The commercial area was divided into 2 categories as follows:

. Shopping complex

. A block of streets consisting of shops, offices and restaurant with a few residence (hereinafter referred to as Road Side Commercial: R.S.C.)

2) Size and number of area

The size and number of the survey areas by each category are shown in the following table.

Table 2.4-19 Size and Number of the Survey Areas

Type	Category	Size	Number
1. Residential	. High income area	Same extent as that covered by 1 handcart	4 areas
	. Medium income area	ditto	4 areas
	. Low income area	ditto	4 areas
2. Commercial	. Shopping complex	Around 50 shops	1 area
	. R.S.C.	Around 50 shops	1 area

3) Selection of areas

All 12 residential areas were selected from Kecamatan Cempaka Putih, Jakarta Pusat. Final selection was carried out based on information and data with respect to the average household income by RT which was obtained through reconnaissance in Kecamatan Cempaka Putih and from information of the officers of Seksi Kebersihan Cempaka Putih (Cleansing Section of Cempaka Putih District).

Two commercial areas were also selected from Kecamatan Cempaka Putih. One is the shopping complex named Gedung P.D WISATA NIAGA JAYA facing JL. Suprpto. And the other is R.S.C. also facing the above street.

2.4.4 Situation of the Survey Area

1) Location

All survey areas are located in Kecamatan Cempaka Putih and are shown in the following map.

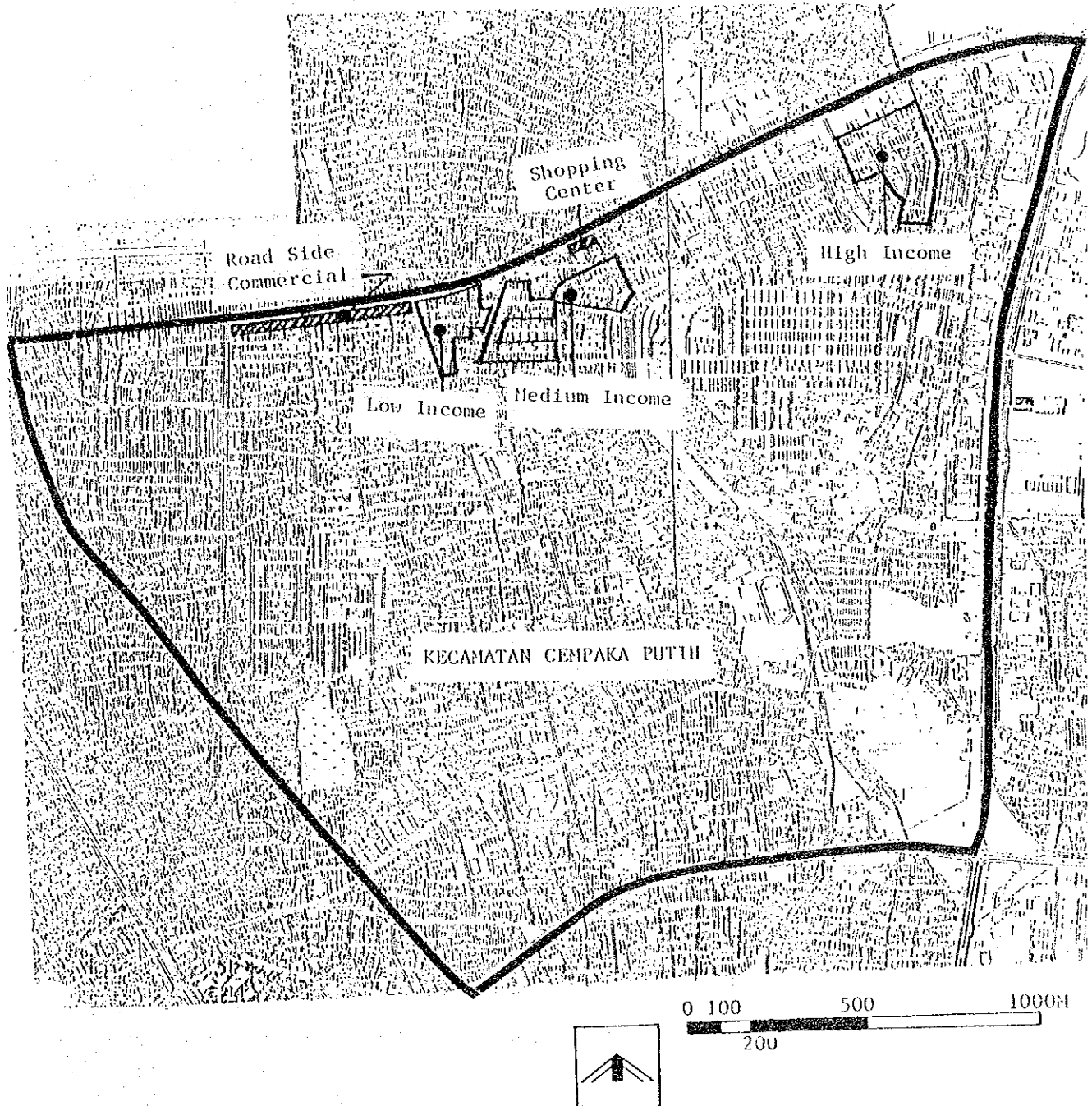


Fig. 2.4-2 Location of the Survey Areas

2) Classification of Survey Area

Each survey area is classified in the following tables.

- Residential Area

Table 2.4-20 Classification of Residential Area

Category	RW	RT	No. of House-holds	Ave. No. of Persons in a house	Population	Income Strata (%)			
						Low	Medium	High	
. High Income		08	30	6.13	184	6.9	51.7	41.4	
		09N	34	6.64	226	9.7	35.5	54.8	
- Cempaka Putih Timur	07	09S	24	7.42	178	8.3	54.2	37.5	
		11	28	7.33	205	7.4	63.0	29.6	
			116	6.84	793	8.1	51.1	40.8	
. Medium Income		01	24	7.55	181	5.5	88.9	5.5	
		04	33	6.31	208	18.2	72.7	9.1	
- Cempaka Putih Barat	03	07	48	7.17	344	4.8	66.7	28.5	
		02	22	7.27	160	4.5	95.5	0	
		10	33	6.27	207	3.0	78.8	18.2	
			160	6.88	1,100	7.2	80.5	12.3	
. Low Income		01	37	7.15	265	14.8	85.2	0	
		02	28	5.92	166	57.7	38.5	3.8	
- Cempaka Putih Barat	01	03	32	6.40	205	65.6	34.4	0	
		06	48	5.94	285	66.0	34.0	0	
		04	21	9.25	194	35.0	65.0	0	
		05	34	7.05	240	45.2	54.8	0	
		06	32	5.63	180	42.4	57.6	0	
		08	33	6.41	212	53.6	46.4	0	
				265	6.60	1,747	47.2	52.0	0.8
				541	6.73	3,640	20.8	61.2	18.0

Source: Field Survey (Interviews throughout the survey area) in 1986 by JICA Study Team.

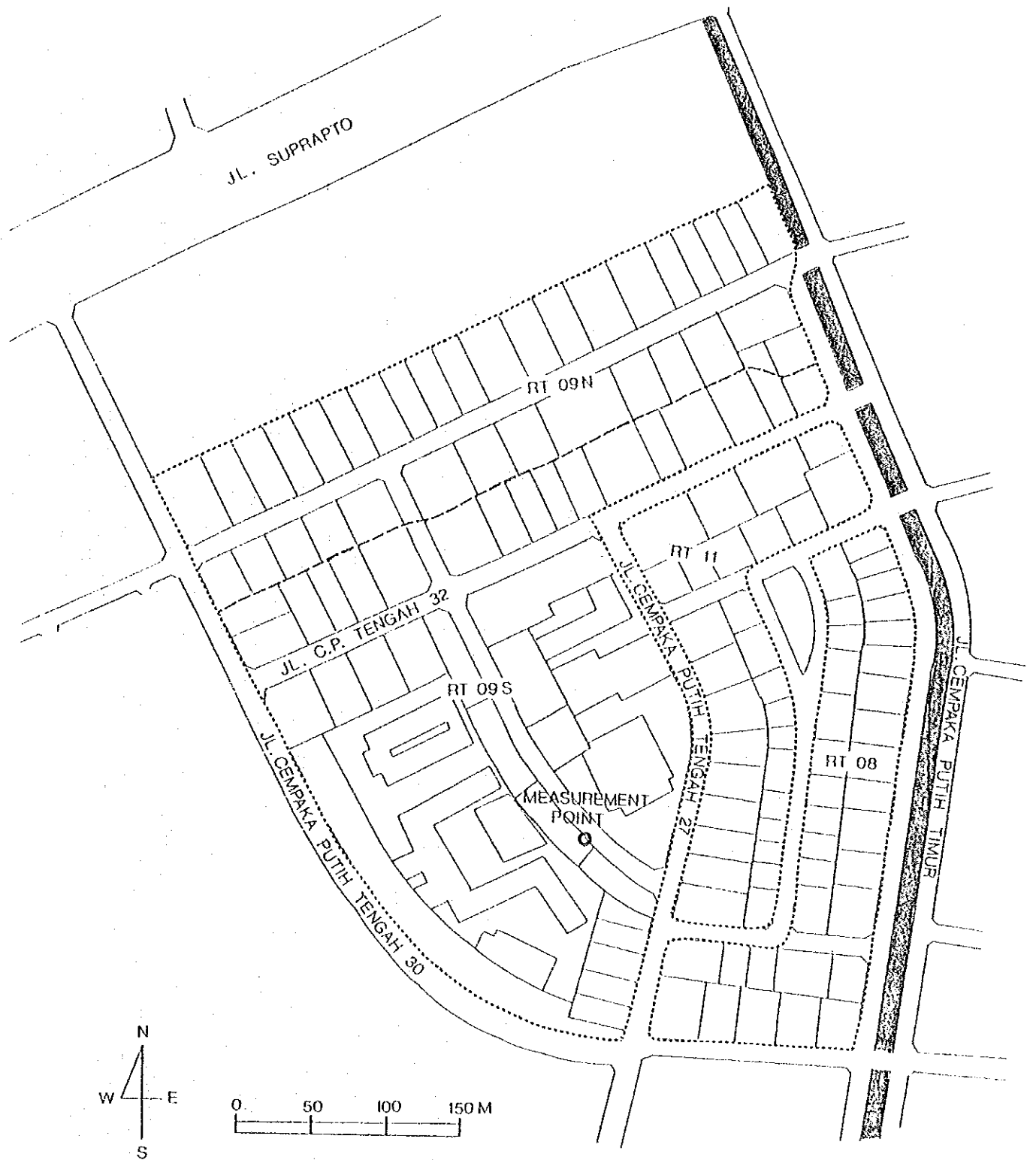


Fig. 2.4-3 Kelurahan Cempaka Putih Timur RW 07 (High Income Area)

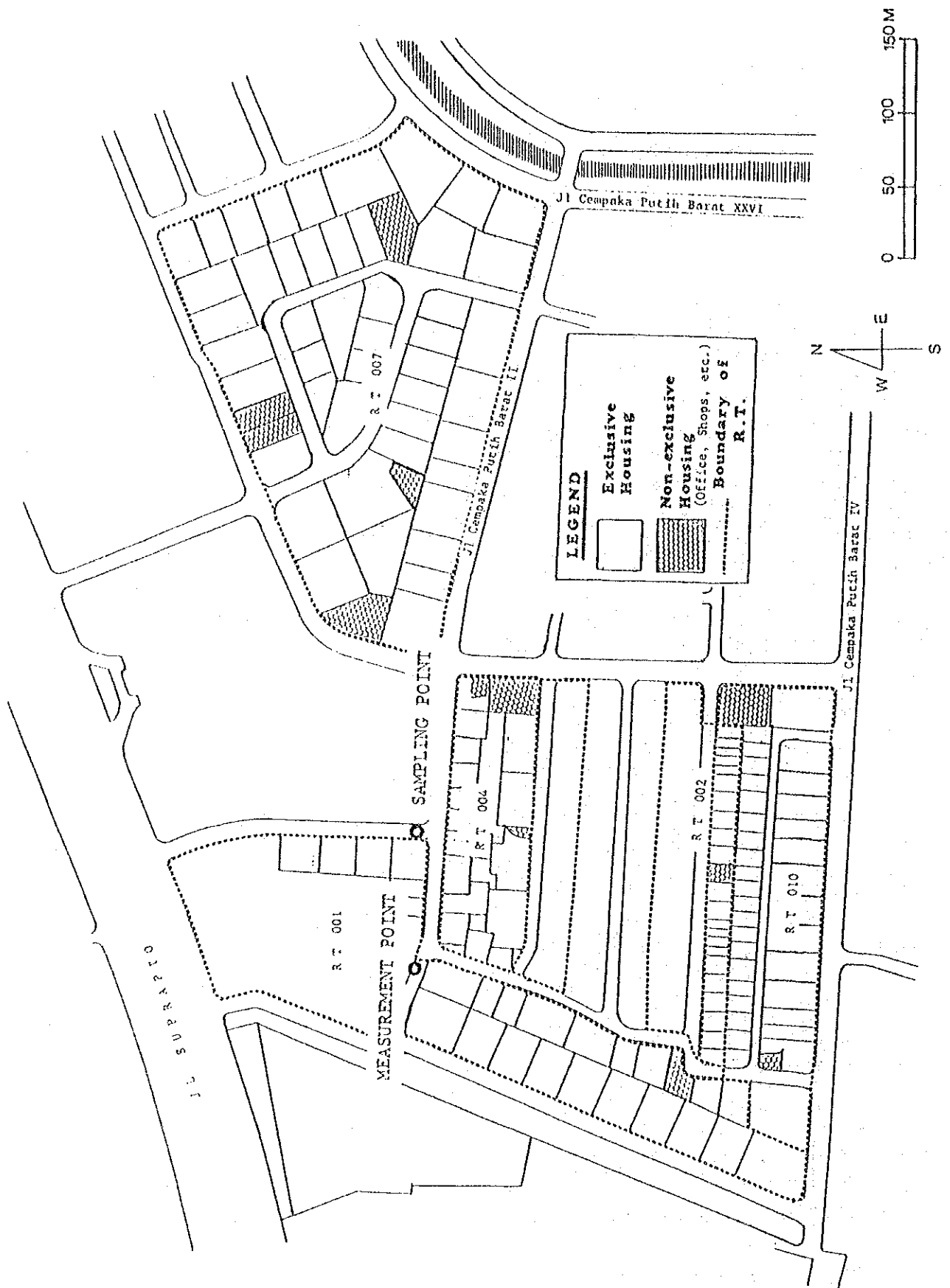


Fig. 2.4-4 Kelurahan Cempaka Putih Barat R.W. 03 (Medium Income Area)



Fig. 2.4-5 Kelurahan Cempaka Putih Barat R.W. 01 (Low Income Area)

- Commercial area

Table 2.4-34 Classification of Commercial Area

Type of Area	Area Code	Building Use	Number	Number of Employees	Size of the Area
Shopping Complex	SC	Shops	29	99	1,530 m ²
		Offices	8	31	400 m ²
		Restaurant	4	13	70 m ²
		Theater	1	20	660 m ²
		Others	2	16	160 m ²
		Total	46	179	2,820 m ²
Road side Commercial	RSC	Shops	42	137	Length 550 m
		Offices	9	46	
		Restaurant	3	11	
		Theater	-	-	
		Others	14	89	
		Total	68	283	

Source: Basic Field Survey (Interviews throughout the survey area) in 1986 by JICA Study Team.

Road side Commercial Area ~~~ Jl. Soeprapto



Fig. 2.4-6 Road Side Commercial Area Facing JL. Soeprapto

2.4.5 Survey Scheme

1) Preparation Survey

For the purpose of selection of the survey area, two surveys were done prior to the main survey.

The purpose of the Basic Field Survey (hereinafter referred to as B.F.S) is not concerned with the efficiency of collection but the measurement of weight and sampling of waste composition. Therefore the selection of the survey area was based on the following principles:

- Existing collection system should be unchanged.
- Handcarts should be available at each residential area for the survey.
- As few residence as possible should be included in the commercial area of the survey.

During the period of the preparatory survey officials of the Cleansing Section of Kelurahan Cempaka Putih gave information on the actual conditions in the areas where they are in charge, and collected data concerning commercial facilities in the Kelurahan.

The final selection of the survey area was based on the above mentioned information and data.

2) Collection, Measurement and Sampling

In each study area, collection, measurement and sampling were carried out as follows.

- High income area

. Preparation	Instructions and distribution of plastic bags (8 pieces) to each residence on 10/8 and 11/8.
---------------	--

. Collection

For 8 days from 12/8 to 19/8 except 17/8, by 4 crews on average and 3 handcarts collected waste in plastic bags from each household every morning, 9:00 - 10:00.

. Measurement

Collected waste in plastic bags was measured for every RT with a platform scale at the measurement point.

. Sampling

Sampling was done 2 times, first on 13/8 for RT 09 N and RT 09 S, second on 18/8 for RT 08 and RT 11.

Data on wet base composition and density, measured on site, was obtained.

- Medium income area

. Preparation

Instruction and distribution of plastic bags (8 pieces) to each residence on 18/8.

. Collection

For 8 days from 20/8 to 27/8 except 24/8, by 4 crews on average and 3 handcarts collected waste in plastic bags from each household every morning 9:00 - 10:00

. Measurement

Collected waste in plastic bags was measured for every RT with a platform scale at the measurement point.

. Sampling

Sampling was done 2 times, first on 21/8 for RT 01 and RT 04, second on 22/8 for RT 07 and RT 10 (including a part of RT 02)

Data on wet base composition and density, measured on site was obtained.

- Low income area

- . Preparation Instructions and distribution of plastic buckets to each residence on 26/8 and 27/8.
- . Collection For 8 days from 28/8 to 4/9 except 31/8, by 6 crews on average and 3 handcarts collected waste in plastic buckets by putting them into plastic bags from each household every morning 9:00 - 11:00.
- . Measurement Collected waste in plastic bags was measured for every coupled RT with a platform scale at the measurement point.
- . Sampling Sampling was done 2 times, first on 29/8 for RT -02 and RT 03-06, second on 30/8 for RT 04-05 and RT 07-08. Data on wet base composition and density, measured there, was obtained.

- Shopping center and Road Side Commercial

- . Preparation Instructions and distribution of plastic buckets to each shop, office and other buildings on 19/8.
- . Collection For 8 days from 20/8 to 27/8 except 24/8, by 3 crews on average collected waste in plastic buckets by hand from each shop, office and other building every morning 9:00 - 11:00.
- . Measurement Collected waste in plastic buckets was measured for each with a platform scale at the measurement point.

. Sampling

Sampling was done once on 25/8 for both shopping center and road side commercial. Data on wet base composition and density measured there, was obtained.

3) Composition

Collected samples were dried in a drier for 7 days, and moisture content was measured. Other samples were separated into 7 items and, taken to PPPPL. of DKI Jakarta, mainly for analysis of ash content.

4) Other relative surveys

- A loading weight survey was done with the truck scale under the control of Dinas L.L.A.J.R (Road Transportation Service) for 4 days (from 28/8 - 1/9).

Both empty and loaded weight were measured for 7 types of truck.

- A traffic survey was done at Cakung Cilincing dump site on 9/9, and the other sites.

The purpose of this survey was to count the number of trucks which come to the site with laden waste from 7:00 to 19:00.

- Interviews in residential and commercial areas by households, shops, offices and other buildings were done for a total of 12 days. The main purpose of these interviews was to determine the exact population, composition of household and income levels.

- Interviews in multi-storey commercial buildings, offices, restaurants and hospitals was carried out in mid-September. The main purpose of these interviews is to determine the waste generation rate per person in multi-storey buildings.

- Interviews with scavenger at the final disposal site was carried out in the middle of September. The main purpose of these interviews is to be obtain information on the recovery rate per scavenger.

2.4.6 Solid Waste Amount in Residential Areas

The results of a 24 day survey are as shown in the following table.

Table 2.4-22 Solid Waste Generation Amount and Rate per Household and per Capita

Area	RT	No. of House- hold	Population	Average Generation Amount	Generation/ Household	Rate/ Capita
High Income RW 07	08	30	184	119.5 kg/day	3.98 kg	0.65 kg
	09N	34	226	140.4	4.13	0.62
C.P.Timur	09S	24	178	119.8	4.99	0.67
	11	28	205	83.3	2.98	0.41
Total/Ave.		116	793	463.0	3.99	0.58
Medium Income	01	24	181	94.8	3.95	0.52
	04	33	208	96.3	2.92	0.46
RW 03	07	48	344	183.3	3.82	0.53
C.P.Barat	02, 10	55	367	138.2	2.51	0.38
Total/Ave.		160	1,100	512.6	3.20	0.47
Low	01, 02	65	431	175.9	2.71	0.41
	03, 06	80	490	135.7	1.70	0.28
RW 01	04, 05	55	434	100.2	1.82	0.23
C.P.Barat	07, 08	65	392	134.9	2.08	0.34
Total/Ave.		265	1,747	546.7	2.06	0.31
Survey Area Total/Ave.		541	3,640	1,522.3	2.81	0.42

Source: All data obtained through B.F.S. by JICA Study Team in 1986.

The amount of generated waste of each day in the survey area is shown Fig. 2.4-5.

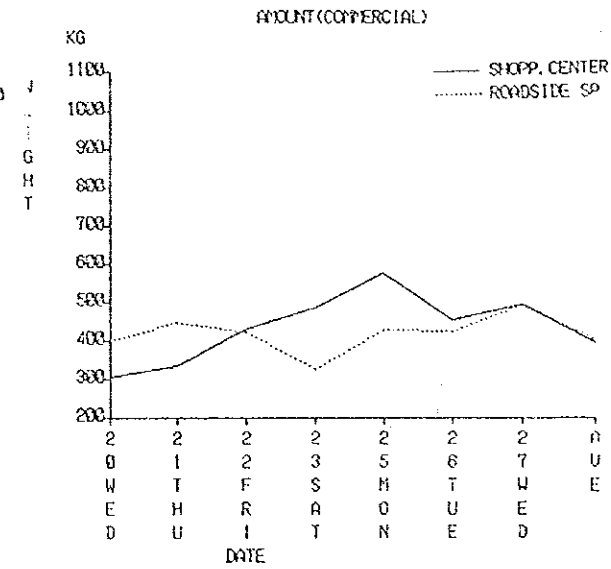
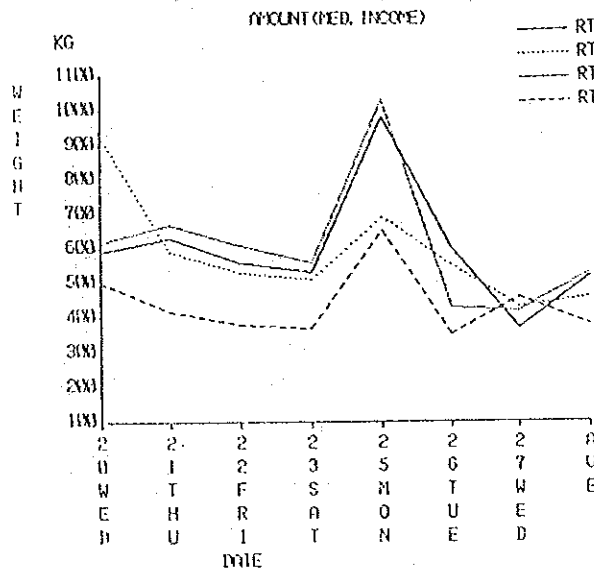
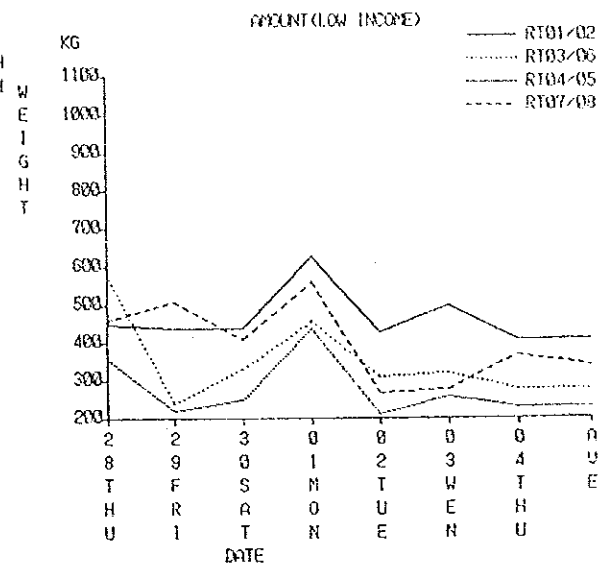
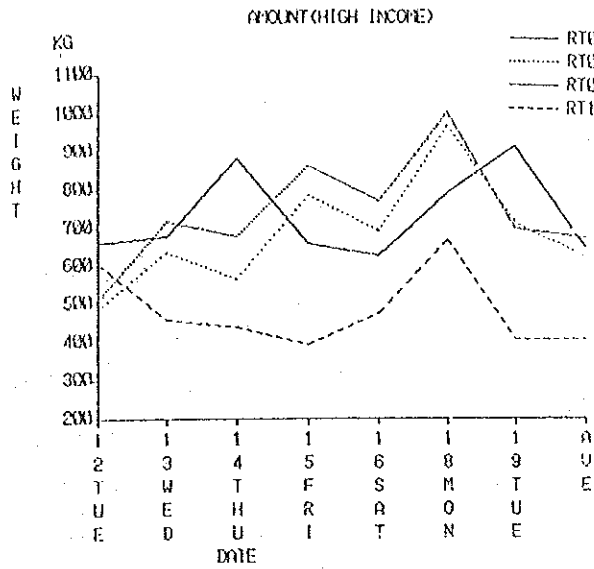


Fig. 2.4-7 Discharge Amount Per Capita Per Day (Result of Basic Field Survey)

2.4.7 Composition in Residential Areas

Result of analysis are as follows:

1) Moisture Content

Table 2.4-23 Moisture Content of Residential Waste

Sample from:	RT	Net Weight before drying	Net weight after being dried	Weight of Moisture	Moisture Content
High Income Area					
	08	15.25 kg	7.35 kg	7.9 kg	51.8
	09N	12.8	5.4	7.4	57.8
	09S	18.5	7.1	11.4	61.6
	11	12.0	5.25	6.75	56.3
	Ave.	14.6	6.3	8.4	56.9
Medium Income Area					
	01	13.25	8.25	5.00	37.7
	04	13.85	7.45	6.40	46.2
	07	14.80	7.55	7.25	49.0
	02, 10	14.20	6.15	8.05	56.7
	Ave.	14.03	7.35	6.68	47.4
Low Income Area					
	01, 02	13.75	6.8	6.95	50.5
	03, 06	16.40	7.9	8.5	51.8
	04, 05	13.90	7.5	6.4	46.0
	07, 08	13.90	7.9	6.0	43.0
	Ave.	14.5	7.5	7.0	47.8

Moisture of solid waste in high income household is higher than others. This is due to the condition of the sampling places where there was no shade.

2) Physical Composition in Residential Areas

Table 2.4-24 Physical Composition (Ratio in Weight: %)

Sample Items	High Income				Medium Income				Low Income			
	08	09N	09S	11	01	04	07	02,10	01,02	03,06	04,05	07,08
(Dry base)												
Plastic	8.0	5.7	6.8	8.6	3.8	6.2	7.6	17.3	15.7	10.4	13.5	12.0
Paper	22.0	14.3	13.5	21.5	10.1	11.0	18.15	21.8	17.2	15.2	18.2	18.4
Textile	3.0	2.1	4.0	1.1	28.3	2.0	3.2	1.8	6.7	4.4	3.4	5.7
Wood/leaf/ bamboo	21.0	15.7	8.8	7.5	1.3	7.5	18.5	10.9	14.2	8.0	11.5	13.9
Garbage Others	9.0	25.0	11.5	15.1	5.7	11.6	7.0	19.1	9.7	16.6	8.8	9.5
Over 5 mm	15.0	14.3	18.2	15.0	6.3	10.3	7.0	7.3	15.7	11.0	6.1	8.7
Under 5 mm	8.0	12.1	15.5	20.4	16.3	25.3	22.3	10.0	8.2	14.7	12.8	15.2
Sub-total	86.0	89.3	78.4	89.3	71.8	74.0	84.1	88.2	87.4	80.3	74.3	83.4
Metal	5.0	4.3	5.4	2.1	0.6	4.8	3.2	0.9	2.2	4.3	7.4	2.6
Glass	7.0	1.4	1.4	2.2	3.1	0.7	7.0	4.5	3.7	3.7	2.7	5.7
Stone	2.0	5.0	14.9	6.4	24.5	20.5	5.7	6.4	6.7	11.7	15.6	8.5
Sub-total	14.0	10.7	21.6	10.8	28.2	26.0	15.9	11.8	12.6	19.7	25.7	16.0
Total	100	100	100	100	100	100	100	100	100	100	100	100

3) Density

Density by samples are shown in the following table:

Table 2.4-25 Density of the Residential Waste (Kg/m³)

- High income area

Sample	RT08	09N	09S	11	Ave.
Density	289.6	287.5	408.3	358.3	335.9

- Medium income area

Sample	RT01	04	07	02,10	Ave.
Density	318.8	331.3	350.3	335.4	333.9

- Low income area

Sample	RT01,02	03,06	04,05	07,08	Ave.
Density	300.0	358.3	302.1	302.1	315.6

2.4.8 Solid Waste Amount in Commercial Area

The result of the measurement is as follows.

Table 2.4-26 The Solid Waste Generation Amount and Rate per Shop, Employee, Unit Floor Size and Unit Length

Area	Code	Nos. of Shops	Nos. of Employee	Averaged Generation Amount per day	Generation			
					per Shop	per Employee	per m ²	per Km
Shopping Centre	SC	46	179	71.3 kg	1.55 kg	0.39 kg	25.3 g	-
Road Side Commercial	RSC	68	283	103.0 kg	1.69* kg	0.41* kg	20.3 g	187.3 kg

* This value was obtained excluding 7 bins from which the waste was never collected during the survey period.

2.4.9 Composition of Commercial Waste

The results of this analysis are as follows:

1) Moisture Content

Table 2.4-27 Moisture Content of Commercial Waste

Sample from:	Moisture Content
Shopping Center	41.9%
Road Side Commercial	36.8%

2) Physical Composition of Commercial Waste

Table 2.4-28 Physical Composition of Commercial Waste
(dry base, percent in weight)

Items	Sample	Shopping Center	Road Side Commercial
Plastic		10.2	15.8
Paper		27.1	22.8
Textile		3.4	1.2
Wood/Bamboo/Leaf		5.1	9.9
Garbage		28.0	7.0
Other Over 5 mm		12.7	8.8
Under 5 mm		3.4	24.6
Sub Total		89.9	90.1
Metal		3.4	5.3
Glass		6.7	2.9
Stone		-	-
Sub Total		10.1	9.9
Total		100.0	100.0

3) Density of Commercial Waste

The density of commercial waste is as follows:

Table 2.4-29 Density of Commercial Waste (kg/m³)

Area	Density
Shopping Center	281.3
Road Side Commercial	314.6

2.4.10 Payload Survey of Collection Vehicles

1) Survey method

- Each type of vehicle belonging to Suku Dinas Kebersihan in Jakarta Timur was selected.
- Loaded waste was weighed by truck scale which was located at a distance of 10 km from Dinas Kebersihan office and was controlled by the Traffic Department of DKI Jakarta.
- The survey was done for three days.
- Each collection vehicle loaded waste was weighed after the first trip.
- Survey period:

1st September, Monday

2nd September, Tuesday

3rd September, Wednesday

2) Result

Record of payload are shown in the following table.

Table 2.4-30 Payload

Type of vehicle	Vehicle No.	Capacity m ³ (Actual)	Empty ton	Pay Load			Ave. ton	Dens. t/m ³
				1st ton	2nd ton	3rd ton		
Big Cargo	10T	10 (8)	4.57	3.16	3.01	2.08	2.75	0.34
Small Cargo	-	-	2.05	-	-	-		
Big Tipper	043T	10 (12)	5.68	5.38	5.89	5.83	5.73	0.44
Small Tipper	43T	6 (7.2)	3.08	3.19	3.45	2.93	3.19	0.44
Big Compactor	18T	10	7.6	6.2	5.85	6.11	6.05	0.61
Small Compactor	3T	4	3.7	3.18	3.01	2.93	3.04	0.76
Big Arm Roll	19T	10 (8)	5.97	2.45	3.19	2.81	2.82	0.35
Small Arm Roll	69T	6 (4.8)	3.16	1.74	1.63	1.23	1.53	0.32

4) Comments

First, it must be taken into consideration that generally the payload on the 1st trip is usually higher than that of the 2nd trip.

It is estimated that the payload on the 2nd trip is 20% less than that of the first trip.

The payload of big cargo was smaller than expected. It was likely that waste was not packed tightly when loading. This type of vehicle does not have a dump function, so it takes longer to unload at the final disposal site. Therefore, workers preferred to load waste without compacting. On the other hand, the density of waste was quite reasonable, because this record can be compared to the density at discharge point.

In the case of tipper trucks, waste was piled higher than the capacity and also packed. Consequently, the solid waste in tipper trucks was heavier than that in open cargo trucks. And also density of waste was higher. It was estimated that the compaction ratio was about 1.4.

In the case of compactor vehicles, it was clear that actual load was too heavy in comparison with standard payload. Each compaction ratio of big compactor vehicles to small ones was 1.8 to 2.2. The difference in these ratios comes from the difference between compaction instruments attached.

In the case of arm roll vehicles, it was observed that the actual capacity of waste loaded was smaller than the capacity of communal containers which were bedded on chassis. The waste inside the containers was not packed. Consequently, the record of density was compared to the one at discharge.

2.4.11 Number of Visiting Collection Vehicles

The number of collection vehicles of the cleansing department was counted at the final disposal sites of Cakung-Cilincing, Srengseng and Kapuk Kamal. Survey time was from 8:00 to 17:00 weekdays.

The results are shown in Tables 2.4-31 to -34.

Key for Tables 2.4-31 to -34

BK : Small Open Truck
BB : Large Open Truck
TK : Small Tipper
TB : Large Tipper
KK : Small Compactor
KB : Large Compactor
KB² : Extra-large Compactor
AK : Small Detachable Container Truck
AB : Large Detachable Container Truck
MK : Others (Small)
MB : Others (Large)

Table 2.4-31 Number of Visiting Collection Vehicles at Final Disposal Sites (September 1986)
 [Cakung - Cilincing Site]

Vehicle	Dinas	Pusat	Barat	Utara	Selatan	Timur	P.D. Pasar	Other	Total
1.53	3	8		2		2	14		29
BK	4.59 (t)	12.24		3.06		3.06	21.42		44.37
2.75	4	27		1		3	10	2	47
BB	11.00	74.25		2.75		8.25	27.50	5.50	129.25
3.19	3	37		18		10	4		72
TK	9.57	118.03		57.42		31.90	12.76		229.68
5.73		13	2	4		2	24		45
TB		74.49	11.46	22.92		11.46	137.52		257.85
3.04	1	19	1	13		5			39
KK	3.04	57.76	3.04	39.52		15.20			118.56
6.05	3	12		1		6			22
KB	18.15	72.60		6.05		36.30			133.10
7.26		7		9					16
KB2		50.82		65.34					116.16
1.53		5		7					12
AK		7.65		10.71					18.36
2.82	1	10		4		7		1	23
AB	2.82	28.20		11.28		19.74		2.82	64.86
1.77	2								2
MK	3.54								3.54
2.85	1								1
MB	2.85								2.85
Total	18	138	3	59	0	35	52	3	308
%	55.56 (5.0)	496.04 (44.3)	14.50 (1.3)	219.05 (19.6)	0	125.91 (11.3)	199.20 (17.8)	8.32 (0.7)	1,118.58

Table 2.4-32 Number of Visiting Collection Vehicles at Final Disposal Sites (September 1986)
[Srengseng Site]

Vehicle	Dinas	Pusat	Barat	Utara	Selatan	Timur	P.D. Pasar	Other	Total
1.53 BK		1 1.53			1 1.53		2 3.06	3 4.59	7 10.71
2.75 BB		2 5.50	1 2.75		13 35.75		3 8.25		19 52.25
3.19 TK		5 15.95	6 19.14		12 38.28		3 9.57		26 82.94
5.73 TB		2 11.46			4 22.92		11 63.03		17 97.41
3.04 KK	1 3.04		11 33.44		5 15.20				17 51.68
6.05 KB			1 6.05		10 60.50				11 66.55
7.26 KB2									
1.53 AK		1 1.53	1 1.53		4 6.12				6 9.18
2.82 AB		1 2.82	2 5.64		3 8.46				6 16.92
1.77 MX									
Total	1 3.04 (0.8)	12 38.79 (10.0)	22 68.55 (17.7)		52 188.76 (48.7)		19 83.91 (21.6)	3 4.59 (1.2)	109 387.64 (100.0)

Table 2.4-33 Number of Visiting Collection Vehicles at Final Disposal Sites (September 1986)
 [Kapuk Kamal Site]

Vehicle	Dinas	Pusat	Barat	Utara	Selatan	Timur	P.D. Pasar	Other	Total
1.53 BK							1 1.53		1 1.53
2.75 BB		1 2.75	7 19.25					1 2.75	9 24.75
3.19 TK			32 102.08	4 12.76					36 114.84
5.73 TB	1 5.73	2 11.46	10 57.30	1 5.73			1 5.73		15 85.95
3.04 KK			31 94.24	1 3.04					32 97.28
6.05 KB	1 6.05		23 139.15						24 145.20
7.26 KB ²									
1.53 AK			1 1.53						1 1.53
2.82 AB			5 14.10						5 14.10
1.77 MK									
2.85 MB									
Total	2 11.78 (2.4)	3 14.21 (2.9)	109 427.65 (88.1)	6 21.53 (4.4)			2 7.26 (1.5)	1 2.75 (0.6)	123 485.18 (100.0)

Table 2.4-34 Number of Visiting Collection Vehicles at Final Disposal Sites (September 1986)

[Total of Three Sites]

Vehicle	Dinas	Pusat	Barat	Utara	Selatan	Timur	P.D. Pasar	Other	Total
1.53	3	9		2	1	2	17	3	37
BK	4.59	13.77							
2.75	4	30	8	1	13	3	13	3	75
BB	11.00	82.50							
3.19	3	42	38	22	12	10	7		134
TX	9.57	133.98							
5.73	1	17	12	5	4	2	36		77
TB	5.73	97.41							
3.04	2	19	43	14	5	5			88
XK	6.08	57.76							
6.05	4	12	24	1	10	6			57
KB	24.20	72.60							
7.26		7		9					16
KB2		50.82							
1.53		6	2	7	4				19
AK		9.18							
2.82	1	11	7	4	3	7		1	34
AB	2.82	31.02							
1.77	2								2
MK	3.54								
2.85	1								1
MB	2.85								
Total	21	153	134	65	52	35	73	7	540
(t)	70.38	549.04	510.70	240.58	188.76	125.91	290.37	15.66	1,991.40

2.4.12 Interview to Scavengers

In order to understand the existing status on recovering reusable materials in DKI Jakarta, interview survey was carried out on 22 Sept. 1986 at the seven depots and three disposal sites and the result was arranged as follows.

1. Depot

2.4-35 Results of Interview on Scavengers at Depots in 1986

Name of Depot	Gender	Age	Material	Kg/day	Price Rp/Kg	Income Rp/day
1. Pelita Tomang Raya	Nobody					
2. Pelita Tomang Raya	Nobody					
3. Sawah Besar	M	24	.Paper	100	15	4000
			.Plastic (all)	50	60	
			.Tin	80	20	
			.Wire	1	50	
			.Paper (cardboard)	25	80	
			.Fragment	2	15	
4. Sawer Besar	M	61	.Paper	70	25	3000
			.Plastic (all)	25	40	
			.Tin	50	20	
5. Pintu Air II	M	46	.Paper	40	35	1500
			.Plastic (all)	5	75	
			.Tin	40	20	
6. Pintu Air II	M	50	.Paper	25	35	600
			.Plastic (all)	5	75	
			.Tin	5-10	20	
			.Paper (cardboard)	3	70	
7. Matraman	M	48	.All things mixed	-	-	1000
8. Matraman	M	55	.All things mixed	-	-	1000
9. Jembatan Tinggi	Nobody					
10. Jembatan Tinggi	Nobody					

- continued

Name of Depot	Gender	Age	Material	Kg/day	Price Rp/Kg	Income Rp/day
11. Pambaru Raya	M	50	.Paper	2	50	840
			.Plastic (vessel)	1	100	
			.Plastic (bag)	3	75	
			.Fragment	1	10	
			.Aluminum	1	350	
12. Pambaru Raya	M	54	.Paper	20	25	700
			.Plastic (vessel)	1.5	140	
			.Plastic (bag)	0.6	75	
			.Metal	4	40	
			.Paper (cardboard)	1	80	
			.Fragment	0.8	10	
			.Bottle	4B	5B	
13. Karat Tengsin	M	36	.Paper	5	150	?
14. Karat Tengsin	M	33	.Paper (cardboard)	1	70	200
			.Plastic (vessel)	0.5	50	

Depot	Approx. Number of Scavenger	Amount of Waste Dealt in a day (Capacity of Depot)
1. Pelita Tomang Raya	Nobody	-
2. Sawah Besar	15	200 m ³
3. Pintu Air II	40	60 m ³
4. Matraman	3	100 m ³
5. Jembatan Tinggi	Nobody	-
6. Pambaru Raya	15	180 m ³
7. Karet Tengsin	6	?

2. Final Disposal Sites

Table 2.4-36 Results of Interview at Final Disposal Sites

Name of Final Disposal Site	No.	Gender	Age	Material	Kg/day	Price Rp./Kg	Income Rp./day
Cakung Cilincing	1	F	20	.Paper (cardboard)	6	80	800
				.Plastic (sheet)	5	75	
	2	M	21	.Wood	25	80	2000
	3	F	23	.Plastic (all)	3	200	2000
				.Metal (all)	10	25	
				.Glass	5	20	
	4	M	41	.Feather/Plume	200	15	2500
	5	M	50	.Paper	15-20	40	4000
				.Tin	30	50	
	6	M	42	.Wood	1.5 m ³	-	3000
	7	M	35	.Chicken Feather	300	15	4000
	8	F	35	.Paper	5	30	1500
				.Plastic (sheet)	1	75	
				.Plastic (bag)	1	200	
				.Toy wreckage	2	80	
				.Tin	10	15	
				.Fragment	5	15	
				.Bottle	20B	5B	
	9	M	30	.Paper	25	35	1500
				.Plastic (vessel)	10	100	I
			.Plastic (bag)	7	200	5000	
			.Soap case	0.5	75		
			.Tin	25	35		
			.Wire	10	40		
			.Fragment	15	20		
			.Bottle	10B	15/B		
			.Paper (cardbord)	5	60		
10	F	26	.Paper	20	35	2000	
			.Plastic (all)	7	80		
			.Toy wreckage	2	100		
			.Tin	20	20		
			.Metal	0.5	40		
			.Fragment	2	20		
			.Bottle	15B	5/B		

Name of Final Disposal Site	No.	Gender	Age	Material	Kg/day	Price Rp./Kg	Income Rp./day
Kapuk Kamal 24-09-86	1	M	46	.Paper	100	20	2000
				.Plastic (all)	2	150	I
				.Tin	10	20	2500
				.Fragment	10	20	
				.Bottle	-	100/day	
	2	M	28	.Paper	100	25	2500
				.Plastic (vessel)	5	100	I
				.Plastic (bag)	5	150	5000
				.Tin	50	25	
				.Shoes	10	150	
				.Sandal	2	300	
				.Fragment	30	25	
	3	M	15	.Bottle	10B	25/B	
				.Paper	?	?	1300
				.Plastic (bag)	?	?	
	4	F	35	.Tin	?	?	
				.Paper	10	20	1000
	5	M	22	.Plastic (all)	5	150	
				.Tin	5	25	
				.Sandal	0.5	150	
				.Fragment	2	15	
				.Plastic (vessel)	15	125	5500
				.Plastic (bag)	10	200	
				.Tin	60	25	
				.Fragment	20	20	
				.Shoes	3	150	
				.Sandal	1	350	
	6	F	40	.Bottle	20B	25/B	
				.Paper	2	20	1500
.Plastic (vessel)				3	200		
.Tin				5	25		
.Plastic Bottle				5	50		
7	M	17	.Plastic Fragment	10	15		
			.Plastic (vessel)	5	150	3000	
			.Plastic (bag)	5	150		
			.Tin	25	20		
8	M	20	.Plastic Bottle	5	175		
			.Plastic Fragment	10	20		
			.Plastic (vessel)	5	20	2000	
9	M	20	.Tin	30	20		
			.Plastic Bottle	5	20		
			.Plastic Fragment	20	20		
			.Paper	20	15	2500	
			.Plastic (vessel)	3	100		
			.Tin	10	25		
			.Plastic Bottle	5	50		
			.Plastic Fragment	5	15		

- continued

Name of Final Disposal Site	No.	Gender	Age	Material	Kg/day	Price Rp./Kg	Income Rp./day
	10	F	30	.Paper	10	20	1000
				.Tin	5	25	
				.Wire	2	25	
				.Plastic Bottle	2	50	
				.Plastic Fragment	2	15	
Srengseng 18-09-86	1	M	15	.Paper	10	100	3000
				.Plastic (all)	15	100	
				.Tin	7	20	
				.Wire	5	50	
				.Metal (plate)	10	25	
				.Plastic Bottle	5	100	
				.Plastic Fragment	10	30	
	2	M	27	.Plastic (vessel)	6	100	3000
				.Plastic (sheet)	7	100	
				.Tin	20	20	
				.Metal (plate)	5	5	
				.Plastic Bottle	5	100	
				.Plastic Fragment	5	20	
	3	M	10	.Plastic (vessel)	15	100	3000
				.Plastic (bag)	7	80	
				.Tin	30	20	
				.Metal (stick)	50	75	
				.Wire	10	75	
				.Plastic Bottle	10	95	
				.Plastic Fragment	5	20	
	4	M	16	.Paper	1	20	1500
				.Plastic (bag)	40	20	
				.Plastic Bottle	5	100	
				.Plastic Fragment	8	20	
	5	F	30	.Paper	10	25	1500
				.Plastic (vessel)	5	100	
				.Plastic (bag)	2	200	
				.Tin	10	25	
			.Wire	2	25		
			.Plastic Bottle	30	100		
			.Plastic Fragment	20	15		
6	M	16	.Plastic (all)	7	100	2000	
			.Metal (all)	25	20		
			.Fragment	10	20		
7	M	18	.Plastic (sheet)	2	75	2000	
			.Plastic (bag)	2	75		
			.Tin	30	10		
8	F	20	.Paper	5	15	1000	
			.Plastic (all)	3	50		
			.Metal (all)	4	10		
			.Fragment	2	10		

- continued

Name of Final Disposal Site	No.	Gender	Age	Material	Kg/day	Price Rp./Kg	Income Rp./day
	9	F	55	.Plastic (all)	2	150	750
				.Tin	3	15	
				.Fragment	2	15	
	10	F	45	.Paper	4	15	450
				.Plastic (all)	1	50	
				.Tin	5	15	
				.Fragment	2	15	

Average Amount/Income of/from Recovered Materials per a Scavenger

Name of L.P.A. Amount/Income	-Cakung Gilincing		-Kapuk Kamal		-Srengseng	
	Amount	Income	Amount	Income	Amount	Income
1	10	800	120	2200	60	3000
2	25	2000	200	3500	50	3000
3	20	2000	?	1300	120	3000
4	200	2500	25	1000	50	1500
5	45	4000	110	5500	60	1500
6	225	3000	25	1500	40	2000
7	300	4000	50	3000	30	2000
8	30	1500	55	2000	15	1000
9	95	3500	40	2500	10	750
10	60	2000	20	1000	15	450
	101	2530	72	2350	45	1820
Net Profit/Kg (average Rp. 33/Kg)		25		33		40

2.4.13 Interview to Major Building

2.4.13.1 Interview to Major Building

Interview to 16 major buildings was carried out about solid waste generation and management. The result is shown in Table 2.4-37.

2.4.13.2 Summary of Interview to Jakarta Hilton International Hotel

Date : Sept. 25, 1986

BUILDING FACILITIES

1. This is one of the largest hotel buildings in the city of Jakarta, 14 story building having 664 rooms and about 400 employees. Every day there are averagely 2000 visitors coming there using hotel facilities, such as restaurants, shops, etc., including about 400 paying guests.

SOLID WASTE MANAGEMENT

2. Every day, this hotel discharges waste consisting of:

Dry Waste : $\pm 15 \text{ m}^3$ per day ($\pm 450 \text{ m}^3$ per month) collected by Dinas Kebersihan 2 x (twice) per day except on Sunday 1 x (once) only, for which the collection service is paid Rp. 1,625 per m^3 to Dinas Kebersihan's personnel. For collection/transportation, Dinas Kebersihan uses Flat-Truck (large).

Wet Waste : $\pm 2 \text{ m}^3$ per day which is sold to outsiders (for the purpose of fertilizer, etc.) and collected directly by the buyers.

The selling price being obtained by the hotel from the wet waste buyer is around Rp. 400,000 - Rp. 500,000 per month.

3. This hotel has a concrete-bin for discharging garbage at the capacity of 32 m^3 on the area of 16 m^3 .

CONCLUSION

4. a. For hotel cleaning, waste collection is handled by two services
 - dry waste by Dinas Kebersihan which needs expenditure around
Rp. 600,000/month
 - wet waste by private buyers which make income around
Rp. 400,000 - Rp. 500,000/month
- b. For better services, this hotel submitted proposal to the interviewer as below:
 - collection facilities should be increased
 - there should be extra collection schedule for coping with extra generated waste
 - compactor truck shall be made available for hotel.

Table 2.4-37 Results of Interview to Major Buildings

Name of building	Classification	Number of shops, offices, restaurants and others				Nos. of visitors/day	Generation amount of the waste/day	Type of collection vehicle	Storage capacity for the waste in the premises	Frequency of collection	Who collects the waste?	Are you satisfied with the collection service?	How much do you pay for the waste collection?	To whom do you pay?	How much are you willing to pay for the collection?	Do you have any opinion or problem for the present collection service?
		Shop	Office	Restaurant	Others											
Boreobudur	Hotel	10 30	18 180	6 200	1205 1585	34 1585	15 m ³	Tipper (L)	76.5 m ³	—	—	Rp. 400000/month	Dinas	Same as present	Some problem was in the case of extraordinary increase of waste. An automatic collection is necessary for such services.	
Sari Pasific	Ditto	14 30	30 300	6 115	1302 1647	40 1647	Flat Truck (L)	38 m ³	—	P. T. Kariuk	Fair	Rp. 450000/month	Private Company	Over Rp. 200000/m ³	No problem	
Milton	Ditto	—	—	8	1400	1400	Flat Truck (L)	32 m ³	2/day	Dinas Buyers	Good	Rp. 750000/month	Dinas Personnel	Under Rp. 20000/m ³	To extend the facility of collection. Collection should be more general waste collector identification for house in road.	
Indonesia	Ditto	11 45	48 915	7 450	84 1410	84 1410	Flat Truck (L)	35 m ³	2/day	Private	Dad	Darker system	Private Company	Rp. 50000 100000/m ³	—	
Galuhada Plaza	Shopping Complex	275 ± 1280	42 ± 500	7 350	450 2500	3000 ± 3000	Flat Truck (L)	12.3 m ³	1/day	Dinas	Fair	Rp. 550000/month	Dinas	Over Rp. 20000/m ³	Good enough	
Ratu Plaza	Ditto	145 1545	30 300	15 180	213 2000	8 m ³ ± 3000	Compactor (S)	48 m ³	4-5/week	Private	Dad	Rp. 800000- 900000/month	Private company	Over Rp. 200000/m ³	*To secure certain collection to extra generated waste on holidays	
Sarimah Jaya	Department Store	320	574	8	805	± 8 m ³ ± 5350	Flat Truck (L)	5 m ³	10/monthly 2/week	Dinas	Fair	Rp. 180000/month	Dinas	—	*Sometimes waste is discarded into the top of building from outside. This is one of the problems other than collection.	
Bami Galuhada IT	Restaurant	—	—	60	60	± 400	Container	2 m ³	1/day	Dinas	Fair	Rp. 12000/month	Dinas	Rp. 10000- 20000/month	No problem	
Condy Steak House	Ditto	—	—	52	52	± 100	Handcart	3 m ³	1/day	Dinas	Good	Rp. 15000/month	Dinas	Rp. 10000- 20000/month	No problem	
Sea Food Sunayun	Ditto	—	—	40	40	± 55	Compactor (S)	Press Machine	1/day	Dinas	Fair	Rp. 38000/month	Sukadina Personnel	Over Rp. 20000/month	Certain collection on holidays	
P. T. Sumbalawa Property	Office	15	722	30	18	300 (7)	Flat Truck (L)	24 m ³	1/2week	Dinas	Good	Rp. 20000- 25000/month	Dinas driver	Over Rp. 20000/month	Appropriate at present	
Nusanata / President Hotel	Office & Hotel	52 1200	77 250	30 —	1500	± 250	Box Truck	48 m ³	1/day	P. T. Kariuk	Good	?	?	?	—	
CIPTA KARYA	Office	1	1200	1	No	± 150	Compactor	18 m ³	2/week	Dinas	Good	Rp. 100000/month	Dinas	Over Rp. 200000/m ³	—	
Hospital	Hospital	In-patient	doctor	nurse	clinical engineer	total employee	waste amount	vehicle								
R. S. Dr. Cipio Mangrove	Ditto	940 /day	585	1578	2407	4570	10 m ³	Flat Truck	50 m ³	1/day	Dinas	Dad	Rp. 300000/month	Dinas	Rp. 2000- 10000/month	—
R. S. Islam Jakarta	Ditto	5285 / month	48	283	447	770	4 m ³	Container Truck	8 m ³	1/week	Dinas	Fair	Rp. 375000/month	Dinas	No Comment	—
Air Port							150 m ³ /day									

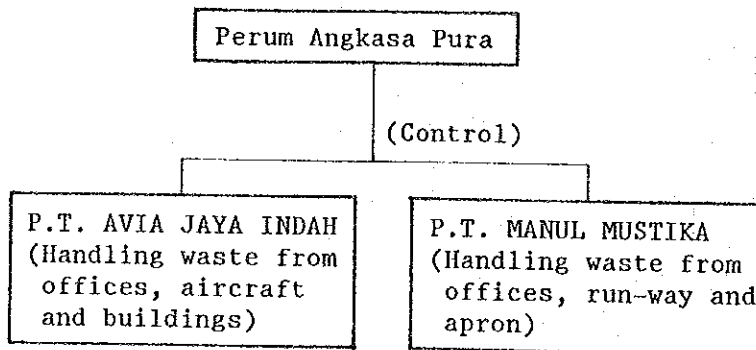
2.4.13.2 Summary of Interview to Soekarno-Hatta Airport

1) Outline

- a) Open 5 July, 1985
- b) Size
 - Run way/Apron 1,800 ha (Planned 2,800 ha)
 - Floor area of the buildings 125,000 m²
- c) Number of Employee and Passengers
 - Number of employee 10,000
 - Number of passengers 9,000,000/year (capacity)
6,000,000/year (actual)
[16,500/day (actual)]
- d) Number of Landing Planes (Domestic + International)
300 planes/day (actual)

2) Solid Waste Management

a) Organization

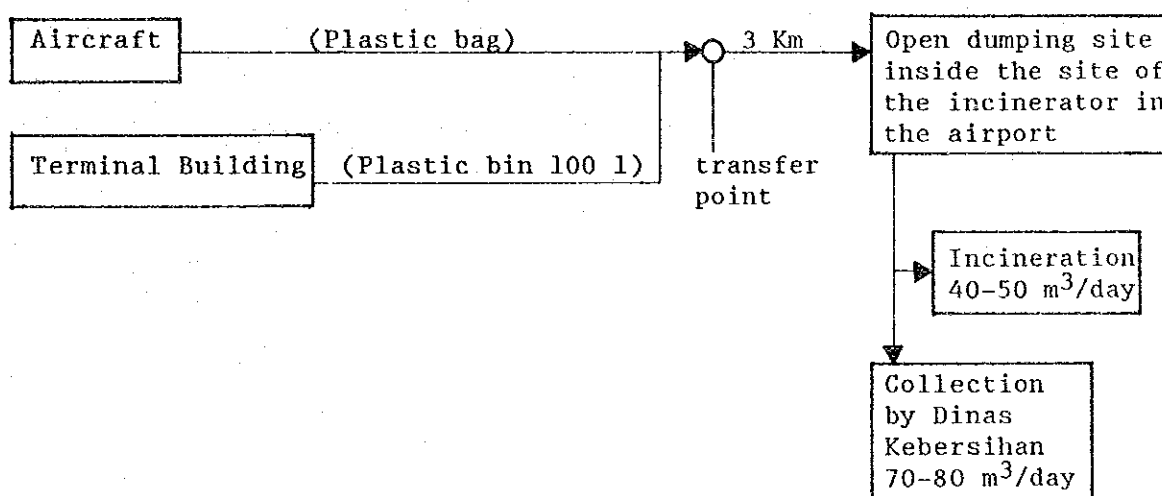


b) Amount of Waste

Table 2.4-38 Amount of Waste from the Airport

from aircraft	AVIA		MANUL	TOTAL
	from terminal building	from other buildings	RUNWAY (turf)	
+60 m ³ (+50%)	+60 m ³ (+50%)	Under 1 m ³ (Under 1%)	Not measured (mostly turf)	+120 m ³ /day

c) Treatment



4) Personnel

- AVIA 650 < 14 Solid Waste Management
636 Cleaning
- MANUL MUSTIKA 130

5) Cost

- AVIA Rp. 50,000/day (not including personnel expenses)

6) Collection vehicle, Frequency

- AVIA 10 m³ truck: 2 numbers
6 times/day (24 hours operation)
- DINAS Compactor 055B 2 times/day (everyday except Sunday)
3 times/day (in case of large amount of waste)

7) Incinerator (owned by AVIA)

- Site 6.5 ha
- Capacity 40 - 50 m³/day
(3 m³/h x 2, 7 hours/day - minimum operation)
- Personnel 6 persons

2.4.14 Quality of Waste in Wet Season

1) General

For the purpose of clarifying the difference in composition between waste in the dry season and in the wet season, sampling and analysis in the wet season was done on household waste from the shopping center along Soeprapto Street, same survey area as in the dry season according to the following schedule:

Table 2.4-39 Sampling Schedule

Date	Contents	Nos of Samples	Place	Time
2/2 Mon	Preparation			
3 Tue	ditto			
4 Wed	Sampling	2	C.P.Timur R 7RT 09n/08	9:30-12:00
5 Thu	ditto	2	C.P.Timur R 7RT 09s/11	9:30-12:00
6 Fri	-			
7 Sat	-			
8 Sun	-			
9 Mon	Sampling	2	C.P.Barat R 3 RT 02/04	9:30-12:00
10 Tue	ditto	2	C.P.Barat R 3 RT 01/10	9:30-12:00
11 Wed	ditto	2	C.P.Barat R 1 RT 05/06	9:30-12:00
12 Thu	ditto	2	C.P.Barat R 1 RT 03/04	9:30-12:00
13 Fri	-	2	C.P.Barat R 1 RT 03/04	9:30-12:00
14 Sat	-			
15 Sun	-			
16 Mon	Sampling	1	Shopping center (Super Market)	9:30-11:00
17 Tue	ditto	1	Shopping center (Complex)	9:30-11:00
18 Wed	Aux.day			
19 Thu	Aux.day			

Location of survey area is shown in the following map.

LEGEND

Fig.2.4-8 Location of the sampling points

Solid Waste Management System Improvement Study in The City of Jakarta

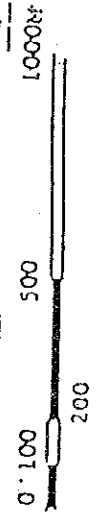
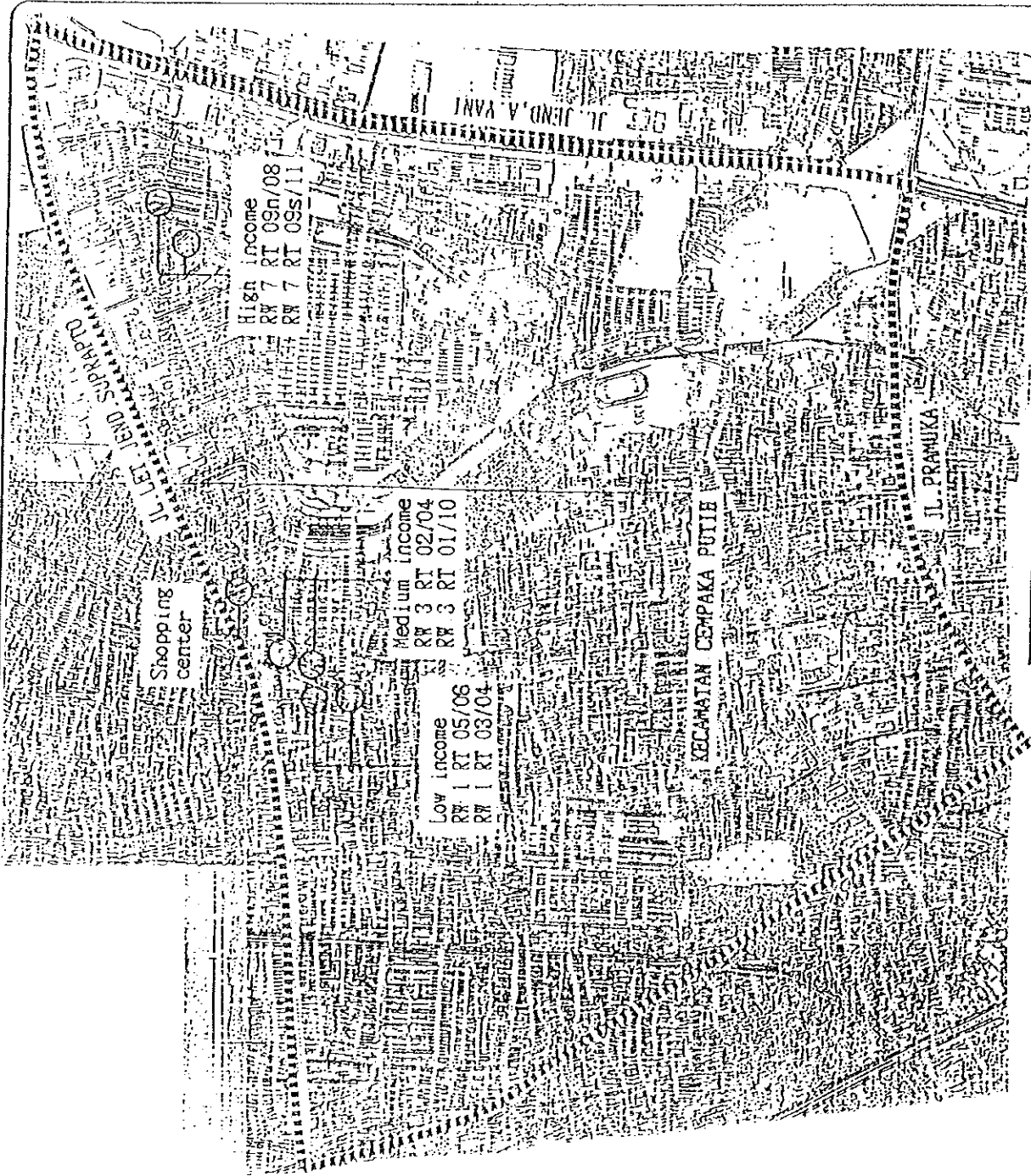


Fig. Location of the sampling points

2) Method

The sampling process, collection and analysis, was followed to the same procedures applied in the survey of 1986.

- Take out all waste from a handcart
- Mix and cut the waste into small pieces
- Classify by material
- Weight of each material in wet base
- Drying
- Weight of each material in dry base
- Analysis of each materials and calculation

3) Results

The results of the analysis are shown in the following table:

1. Moisture Content

Table 2.4-40 Moisture Content (wet season)

Sample from	Net Weight before Drying	Net Weight after being dried	Weight of Moisture	Moisture Content
HIGH				
Income Area (C.P.T. RW 07)				
RT 09 N	14.4 kg/42.4 l	5.4	9	62.5%
RT 08	15.2	6	9.2	60.5
RT 09 S	15.8	6.15	9.65	61.1
RT 11	17.3	7.2	10.1	58.4
Ave.	15.7	6.2	9.5	60.5
MEDIUM				
Income Area (C.P.B RW 03)				
RT 02	16.8	5.7	11.1	66.1
RT 04	18.1	5.8	12.3	68
RT 01	14.8	7.3	7.5	50.7
RT 10	14.3	8.35	5.95	41.6
Ave.	16	6.8	9.2	57.5
LOW				
Income Area (C.P.B RW 01)				
RT 05	15.65	7	8.65	55.3
RT 06	18.6	5.9	12.7	68.3
RT 03	17.3	6.5	10.8	62.4
RT 04	17.9	6.15	11.75	65.6
Ave.	17.4	6.4	11	63.2
COMMERCIAL				
Super Market	13.25	7.1	6.15	46.4
Super Complex	12.1	4.5	7.6	62.8
Ave.	12.7	5.8	6.9	54.3

2. Physical Composition (dry base)

Table 2.4-41-1 Results of Physical Composition (wet season)

unit: ratio in weight %

Sample from Items	High Income (RW 07)					Medium Income (RW 03)				
	RT 09n	RT 08	RT 09s	RT 11	Ave.	RT 02	RT 04	RT 01	RT 10	Ave.
Plastic	8.3	8.3	5.2	2.9	6.2	14.3	11.9	8.4	8.6	10.8
Paper	16.5	9.2	13.8	10.1	12.4	25.0	31.2	16.8	13.3	21.6
Textile	5.0	4.2	1.7	3.6	3.6	5.4	3.7	22.4	16.4	12.0
Wood/Leaf/ Bamboo	40.7	40.0	21.6	26.8	32.3	11.6	12.8	7.0	0.8	8.5
Garbage	8.3	7.5	15.5	15.2	11.6	12.5	13.8	11.2	10.9	12.1
Others										
over 5 mm	8.3	13.3	12.1	9.4	10.8	11.6	8.3	11.2	31.3	15.6
under 5 mm	9.1	6.7	15.5	13.0	11.1	3.6	3.7	9.8	5.5	5.7
Sub total	96.2	89.2	85.4	81.0	88.0	84.0	85.4	86.8	86.8	85.0
Metal	1.3	1.7	5.7	2.9	2.9	7.1	5.5	2.1	7.8	5.6
Glass	2.1	4.2	6.0	5.8	4.5	6.3	7.3	1.4	0.0	3.8
Stone	0.4	5.0	3.5	10.2	4.8	2.7	1.8	9.8	5.5	5.0
Sub total	3.8	10.9	14.7	18.9	12.1	16.1	14.6	13.3	13.3	14.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2.4-41-2 Results of Physical Composition (wet season)

unit: ratio in weight %

Sample from Items	Low Income (RW 01)					Commercial		
	RT 03	RT 04	RT 05	RT 06	Ave.	Super Market	Shopping Complex	Ave.
Plastic	8.5	6.6	11.9	13.5	10.1	8.6	10.0	9.3
Paper	14.6	9.8	25.4	21.6	17.8	15.7	22.1	18.9
Textile	1.5	3.3	0.8	3.6	2.3	0.7	10.0	5.4
Wood/Leaf/ Bamboo	9.2	29.5	7.5	14.4	15.2	33.6	7.7	20.7
Garbage	14.6	9.8	15.7	13.5	13.4	2.9	31.0	17.0
Others								
over 5 mm	18.5	13.1	12.7	15.3	14.9	17.1	11.1	14.1
under 5 mm	13.9	16.4	6.0	2.7	9.8	5.7	4.4	5.1
Sub total	80.8	88.5	80.0	84.6	83.5	84.3	96.3	90.3
Metal	2.3	1.6	3.0	3.6	2.6	0.7	0.4	0.55
Glass	3.9	0.0	9.7	3.6	4.3	1.4	1.1	1.25
Stone	13.1	9.8	7.5	8.1	9.6	13.6	2.2	7.9
Sub total	19.3	10.8	20.2	15.3	32.8	15.7	3.7	9.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

3. Density

Density by samples are shown in the following table.

Table 2.4-42 Density of the Sampled Waste (Kg/m³)
(): dry season

- High income area

Sample	RT 09n	RT 08	RT 09s	RT 11	Average
Density	339	358	372	407	369(336)

- Medium income area

Sample	RT 02	RT 08	RT 01	RT 10	Average
Density	396	426	348	337	377(334)

- Low income area

Sample	RT 03	RT 04	RT 05	RT 06	Average
Density	407	421	368	438	409(316)

- Commercial area

Sample	Super Market	Shopping Complex	Average
Density	312	285	299(298)

2.4.15 Survey on Large Amount Dischargers

Considering the possibility and necessity for the special collection of waste, as well as direct fee collection, major facilities which are regarded as large amount dischargers in Jakarta Pusat should be specified. Herewith, some proposed 600 facilities for the above purpose have been picked out according to the following criteria;

1. Factories, Hospitals, Schools and Mosques $\geq 1,000 \text{ m}^2$
2. Offices, Shops (Shopping Centers), Hotels ≥ 4 floors
and Restaurants
3. Markets ≥ 2 floors
4. Others - Gambir railway station
- Senen railway station
- Senayan Complex
- Monas
- Jakarta Fair

Note: In principle, most waste from factories and hospitals should not be collected by Dinas Kebersihan in the future.

The number of major facilities are shown in the following table. Their locations (excluding schools) are shown in the next figure.

An interview survey was conducted in 150 facilities and the prompt are shown in Table 2.4-44.

The number shown in Table 2.4-44 seems overestimated, which was based on the oral interview. The number of employee (students in school, patients in hospital) are more reliable.

Table 2.4-45 shows reported number of collection of large amount dischargers in Jakarta Pusat.

Table 2.4-43 Large Amount Discharger in Jakarta Pusat

(): Number of the interviewed discharger
 - : Not applicable

Kecamatan	Factory		Hospital		School		Hotel/Restaurant		Office		Market		Miscellaneous		Total
	1000 m ²	1,000 m ²	1,000 m ²	1,000 m ²	Mosque	1,000 m ²	Shopping Center	4F	4F	2F	2F	Park/Stadium	Station		
1. Gambir	3 (3)	4 (4)	30 (2)	11 (6)	72 (35)	2 (2)	3 (3)	125 (55)							
2. Sawah Besar	32 (7)	2 (2)	26 (1)	6 (4)	22 (7)	2 (1)	4 (3)	94 (25)							
3. Kemayoran	1 (1)	0 -	33 (0)	0 -	0 -	0 -	0 -	34 (1)							
4. Senen	0 -	6 (3)	51 (6)	2 (1)	14 (4)	1 (1)	1 (1)	75 (16)							
5. Cempaka Putih	3 (1)	1 (0)	52 (0)	2 (1)	6 (1)	1 (0)	0 -	65 (3)							
6. Menteng	0 -	6 (5)	45 (6)	12 (5)	35 (10)	0 -	2 (1)	100 (27)							
7. Tanah Abang	13 (2)	4 (2)	54 (1)	6 (6)	17 (13)	2 (1)	1 (1)	97 (26)							
Whole Jakarta Pusat	52	23	291	39	166	8	11	590							

LEGEND :

- ▲ FACTORY
- COMMERCIAL (HOTEL, RESTAURANT, SHOPPING CENTER)
- / □ OFFICE
- HOSPITAL
- MARKET
- ▲ OTHERS

Fig. 2.4-9

LOCATION OF LARGE AMOUNT DISCHARGER

Solid Waste Management System Improvement Study in the City of Jakarta



Table 2.4-44 Result of the Interview Survey on Large Amount Dischargers

Item	1) Number of facility	2) Number of employee	3) Amount of Waste/week ³	4) Amount of paid ³ fee/month x 10 ³ Rp		5) Averaged amount of waste /facility /employee /day ³	6) Fee/m ³		
				-to RT/RW Kebersihan	-to Dinas private company				
1. Factory	13	1,724	173	24	270	90	1.8	14.3	555
2. Hospital	16	12,123	276	4	900	90	2.5	3.3	900
3. School/Mosque	16	8,092	396	18	116	-	8.1	7.0	85
4. Hotel/Restaurant	13	6,534	968	-	1,796	15	10.6	21.2	468
5. Shopping Center/	7	1,425	326	9	595	-	6.7	32.7	463
6. Office (Gov.)	34	41,181	1,807	22	844	965	7.6	6.3	253
7. Office (Priv.)	31	10,553	432	39	2,263	1,190	2.0	5.8	2,021
8. Market	4	180	595	-	-	-	21.3	472.2	-
9. Public Facility	3	1,214	176	-	34	-	8.4	20.7	48
10. Miscellaneous	4	32	16	-	115	6	0.6	71.4	1,890
Total	141	83,058	5,165	116	7,239	2,356	5.2	8.9	470

Note: All the numbers were found from only valid respondents on each items.

Table 2.4-45 Report of Collection Amount of Large Amount Dischargers
(Source: Suku Dinas and Sekesi Kebersihan in Jakarta Pusat)

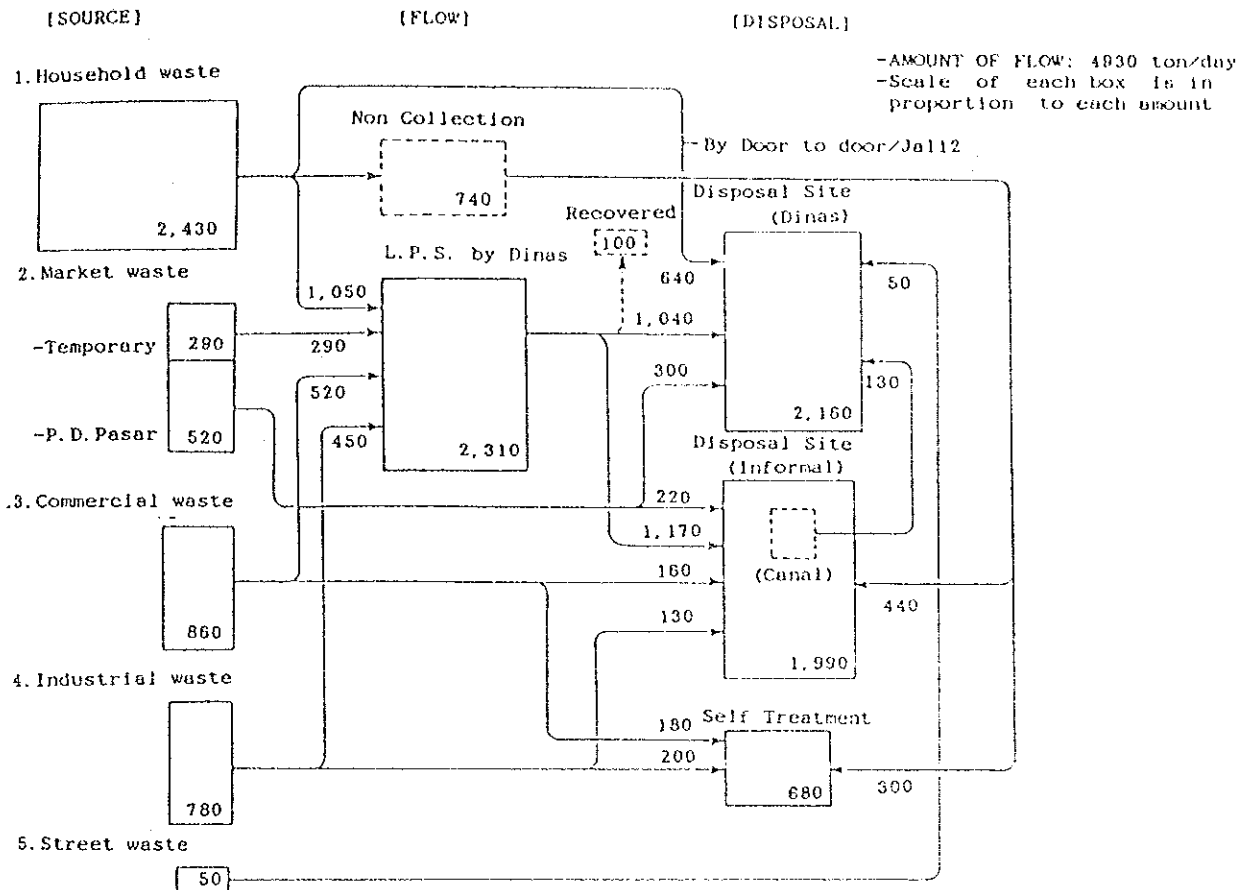
	Number of enterprises			Reported number (Estimated number)				
	Volume of waste			(m ³ /month)				
	O	S	P	M	F	HO	H	Total
1. Jakarta Pusat	15(0) 532	2(0) 360	1(0) 60	0 0	0 0	2(0) 420	22(0) 495	22(0) 1,867
2. Tanah Abang	6(0) 140	0 0	3(0) 165	6(0) 1,779	0 0	2(0) 70	5(0) 312	22(0) 2,466
3. Menteng	19(0) 229	10(0) 129	9(0) 144	3(0) 486	0 0	2(0) 150	6(0) 146	49(0) 1,284
4. Senen	-	-	-	-	-	-	-	-
5. Cempaka Putih	4(0) 88	1(0) 30	1(0) 15	4(0) 1,860	2(0) 80	1(0) 40	0 0	13(0) 2,113
6. Sawah Besar	6(3) 125	0(2) 0	2(0) 285	3(0) 180	8(1) 311	2(0) 110	0 0	21(7) 1,011
7. Gambir	11(11) 574	3(1) 252	3(1) 260	4(1) 410	0(2) 0	0 0	2(1) 62	23(17) 1,558
8. Kemayoran	8(0) 240	0 0	3(0) 61	3(0) 690	1(0) 60	0 0	2(0) 16	17(0) 1,067
Total	69(14) 1,928	16(3) 771	22(1) 990	23(1) 5,405	11(3) 451	9(0) 790	17(2) 1,031	167(24) 11,366

(No data was reported from Senen.)

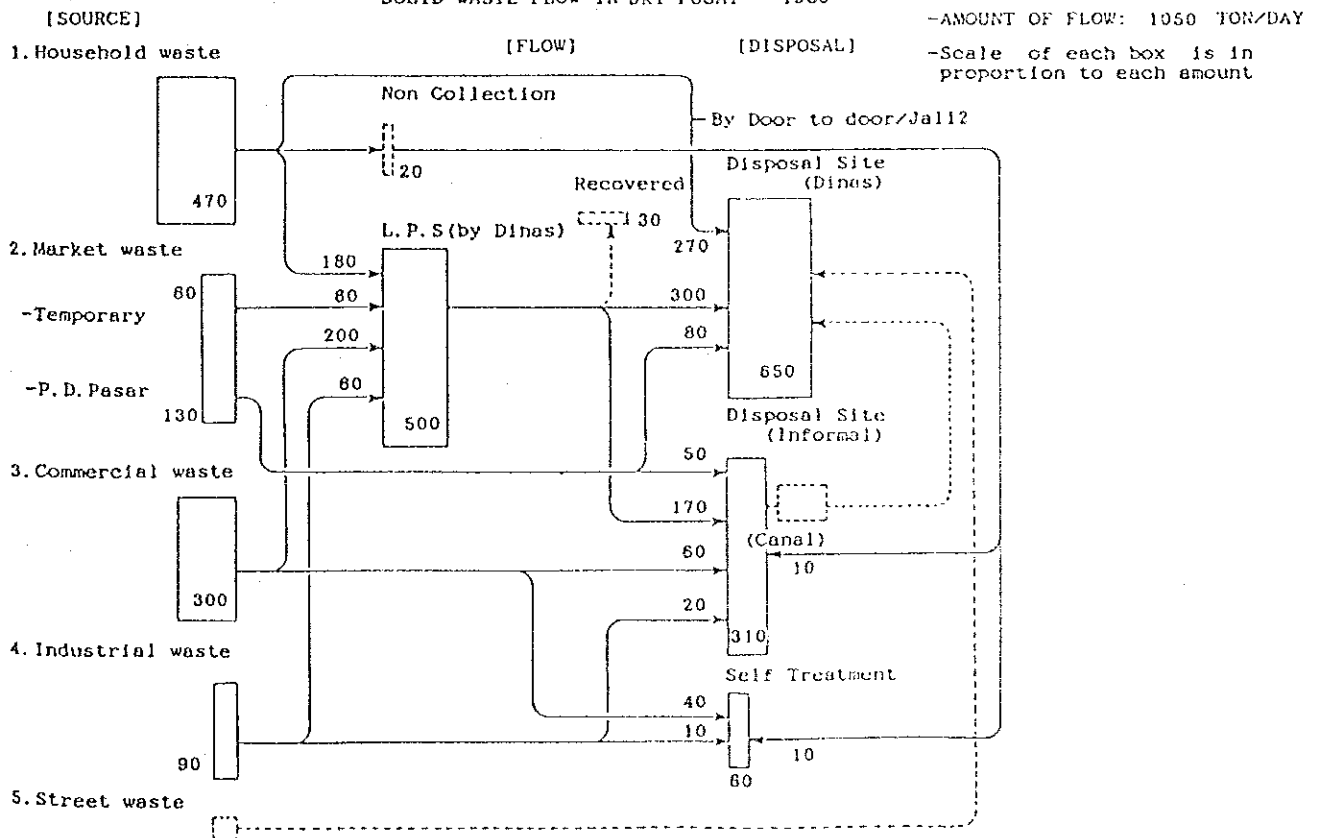
F Factory
S Shops
P Public Facilities
M Market
O Office
HO Hospital
H Hotel

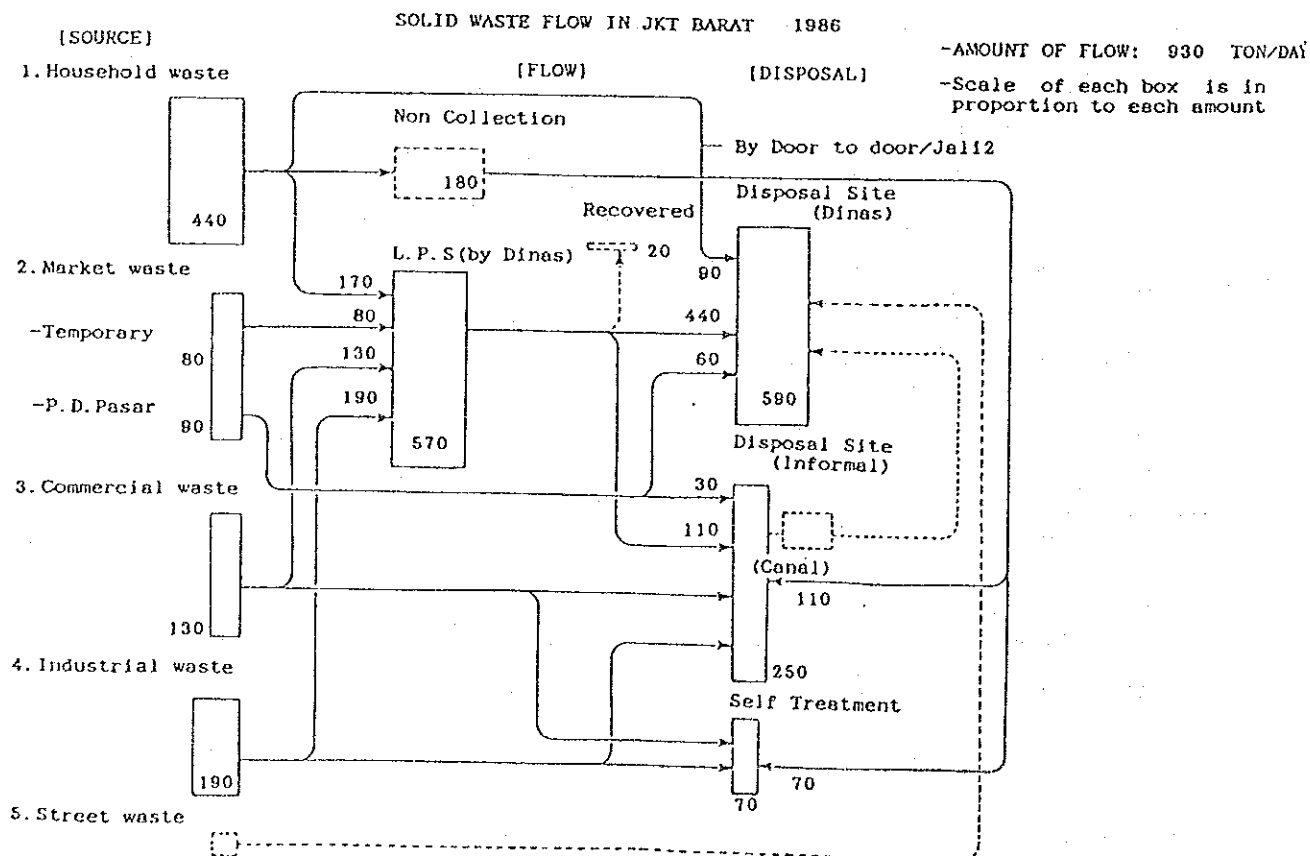
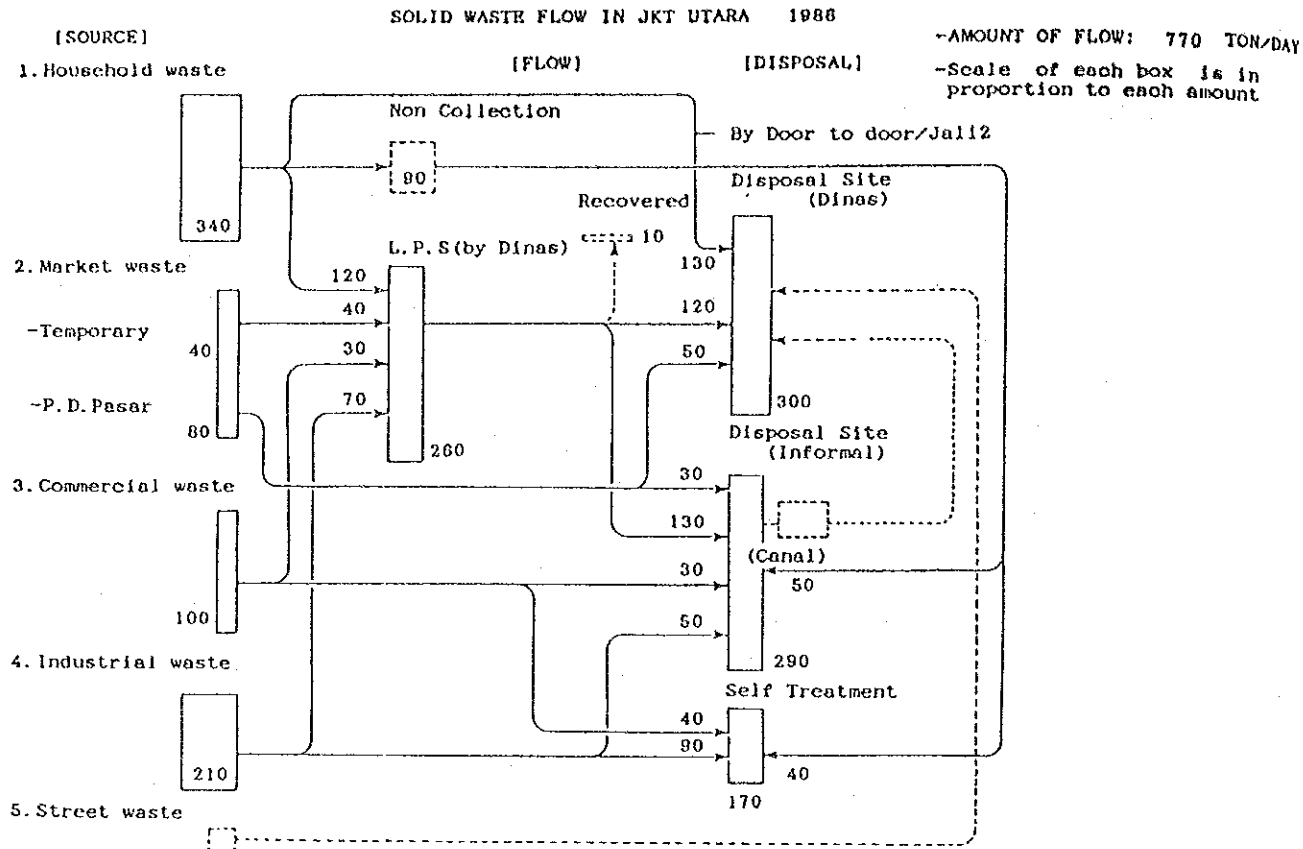
APPENDIX

SOLID WASTE FLOW IN DKI JAKARTA 1986

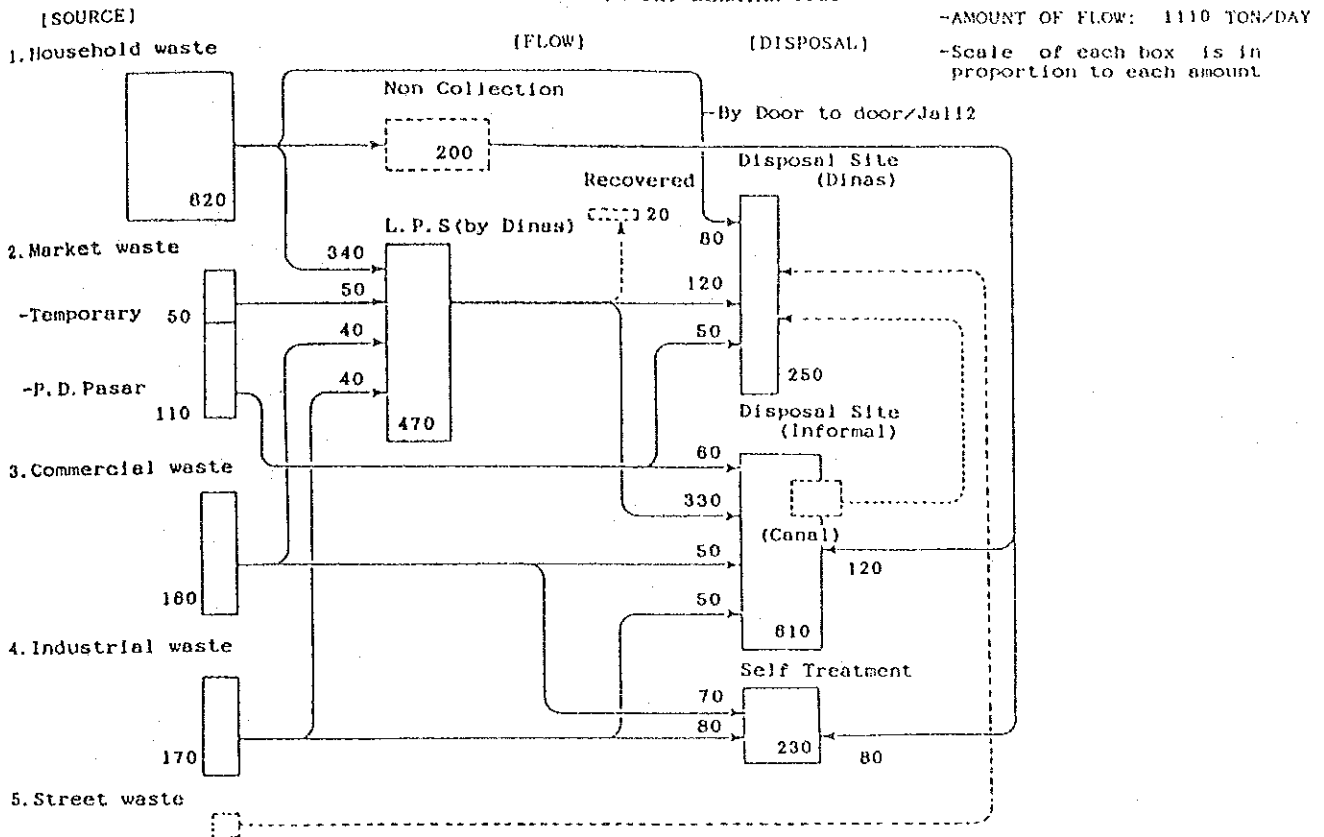


SOLID WASTE FLOW IN JKT PUSAT 1986

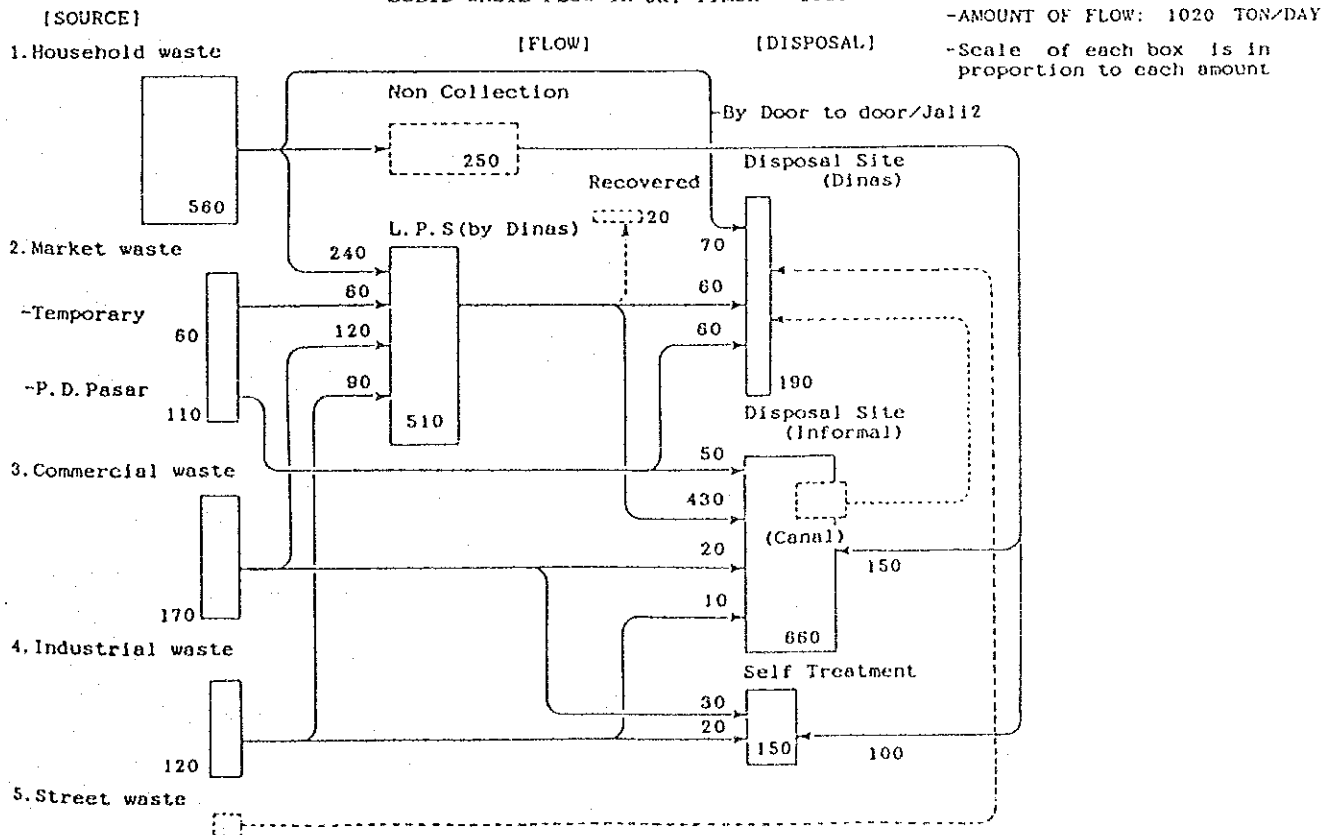




SOLID WASTE FLOW IN JKT SELATAN 1986



SOLID WASTE FLOW IN JKT TIMUR 1986



3. Collection Pilot Study

3. Collection Pilot Study

3.1 Outline of the Collection Pilot Study

3.1.1 Objectives

The collection pilot study was planned and carried out with the following objectives.

- To examine the feasibility of the improved collection system
- To supplement the shortcomings of theory

The following are features of the study for each area:

a. Door to door (A type area)

- Feasibility of scheduled collection
- Usage of plastic containers instead of concrete bins
- Improvements in service level
- Improvements in collection efficiency, sanitary conditions and appearance of the city

b. Communal container (B1 type area)

- Feasibility of introduction of communal containers in Kampung areas
- Improvements in collection service level, and collection efficiency

c. Handcart (B2, C type area)

- Improvements in efficiency of collection and sanitary conditions

d. D type Area

- Investigation of present conditions
- Investigation of consciousness of inhabitants
- An extra survey for canal waste was carried out

3.1.2 Outline

The following table shows the outline of the pilot study:

The design of the experiment for the handcart and D type area was modified from that of Interim Report I after discussion with Cipta Karya and Dinas Kebersihan.

Table 3.1-1 Outline of Pilot Study

Type of Residential Area	Description of Area	Service Mode	Collection Location	Pilot Study
A Type Area	Where collection vehicles can reach each household (High Income Area)	Door to Door	Entrance of premises Concrete bin	Portable plastic container of about 40 liters
B Type Area	Where there is no space for transfer-depots and large communal containers (6-10 m ³)	Jali-jali service (B-1; Handcart is not used)	On the main street in the Area	Introduction of communal containers with capacity of 1.2 m ³
		Handcart collection from each household (B-2; Handcart is used)	At the handcart pool	Introduction of new type of handcart with 0.8 m ³ container
C Type Area	Where there are transfer depots and large communal containers (6-10 m ³) (Kampung)	Handcart collection from each household	Transfer-depot	Ditto
D Type Area	Where citizens' participation is not sufficient, such as along canals, railways	Jali-jali etc.	Entrance to the area	Campaign for residents' participation and interviews

3.1.3 Study Area

The present condition of Kecamatan Cempaka Putih is as follows:

- Land use (Fig. 3.1-1)
 - . Main land use is residential.
 - . Commercial facilities and offices such as shops and supermarkets are distributed along the main streets, Jl. Suprpto, Jend. A. Yani, Jl. Pramuka, Jl. Rawa Sari Selatan, Jl. Rawa Selatan Raya.
 - . Public facilities are distributed along Jl. Percetakan Negara.

- Collection system (Fig. 3.1-2)
 - . Distribution of the present collection system is rather complicated.
 - . Generally door-to-door in the high income areas, handcart and Jali-jali in middle and low income areas.
 - . 1/5 of the area is not served by Dinas Kebersihan and collection is by private company of person.
 - . There is one depot and two 10 m³ containers for arm roll where waste is gathered by handcarts.

The study areas were selected in Kecamatan Cempaka Putih with consideration of collection systems, characteristics of the area and units of RWs, excluding areas with mixed collection systems and the area which Dinas Kebersihan does not serve. (Fig. 3.1-3)

Table 3.1-2 Study Area

Study	Area	Collection System	No of Household
Door to door	Kel. Cempaka Putih Timur RW 06, 08	Door to door	575
Communal Container	Kel. Kampung Rawa RW 05	Jali-jali	508
Handcart	Kel. Rawa Sari RW 01, 02	Handcart	1000
D type	Along Jl. Kramat Pulo Gundul Kel. Tanah Tinggi RW 05, 08, 09, 10, 11	(Jali-jali)	-

3.1.4 Study Period

The experiment was conducted from 14 August 1986 to 6 September 1986.

- INDUSTRY
- COMMON FACILITIES
- WARE HOUSES
- HARBOUR
- COMMERCIAL AREA
- MARKET
- WELL ESTABLISHED HOUSING
- SMALL HOUSING
- RICE FIELD
- VARIOUS GARDEN
- OPEN SPACE
- UNOCCUPIED LAND
- FISH POND
- ISLAMIC CEMETERY
- CHRISTIAN CEMETERY
- CHINESE CEMETERY

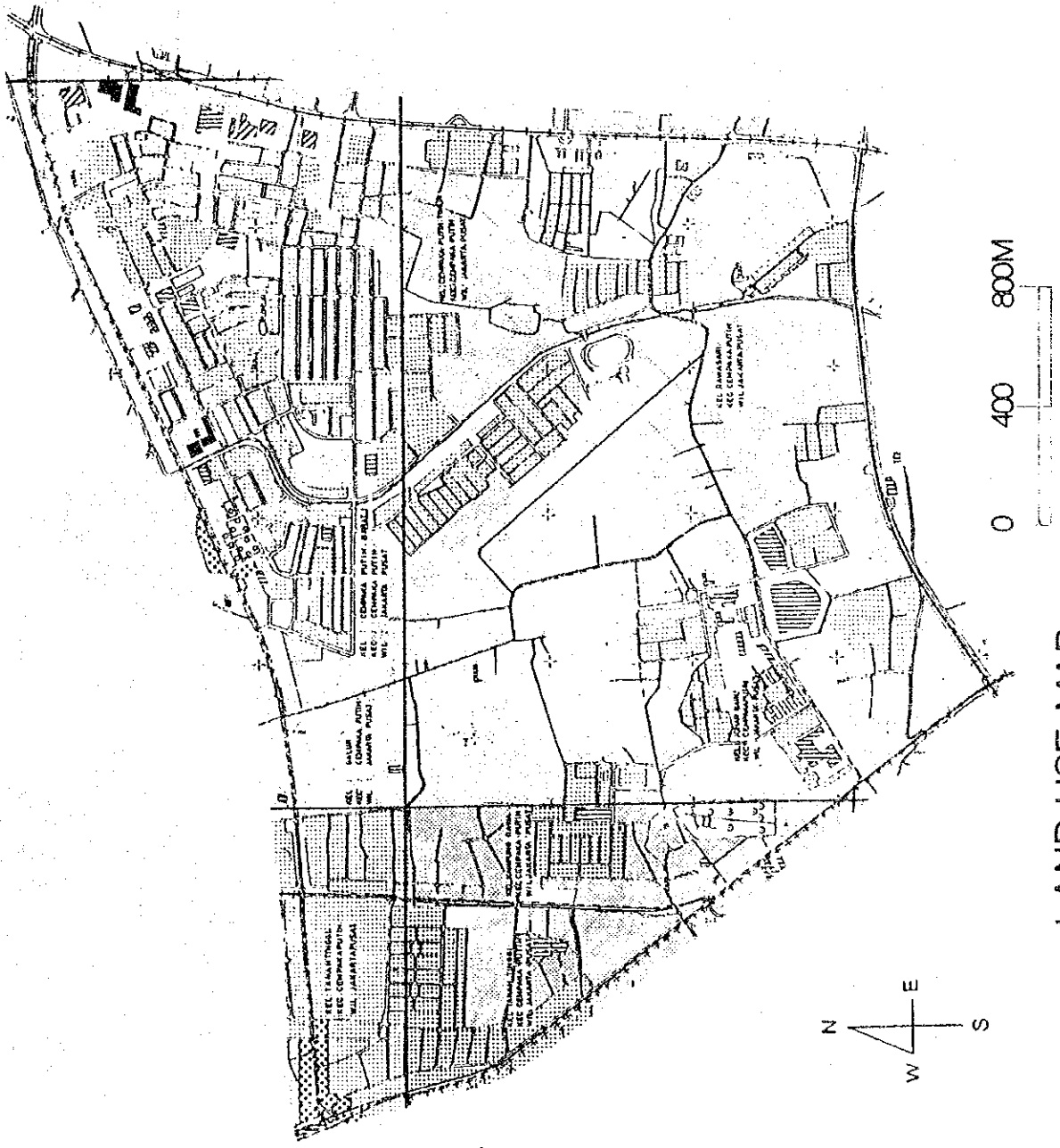


Fig. 3.1-1 LAND USE MAP

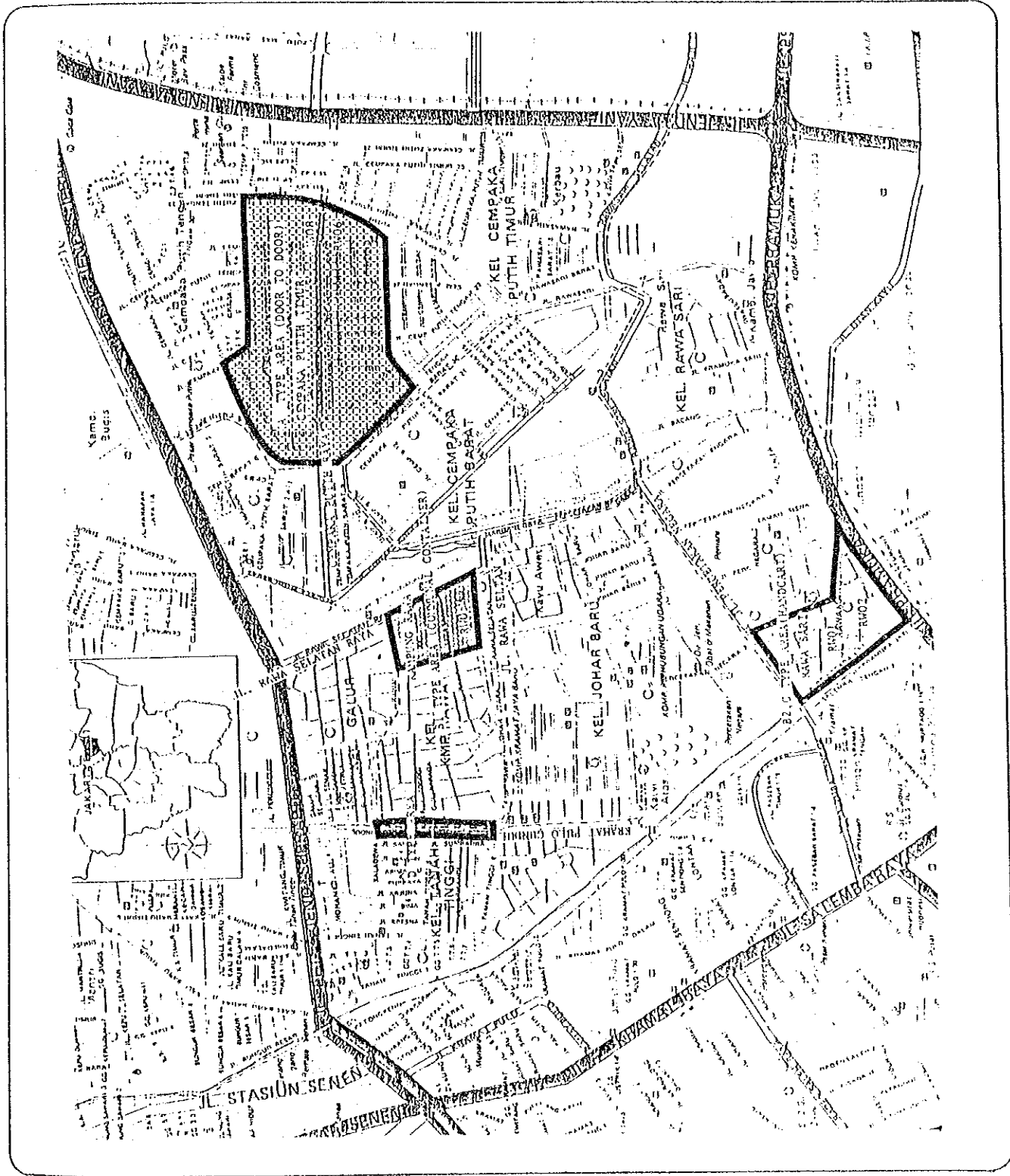


Fig. 3.1-3 Study Area

STUDY ON
SOLID WASTE MANAGEMENT SYSTEM
IMPROVEMENT PROJECT
IN JAKARTA

Preliminary preparations included:

- Meeting with Cipta Karya, Dinas Kebersihan and others concerned the study
- Preparation of materials (40 lit. plastic containers, 1.2 m³ communal containers, new-type handcarts)
- Permission from DKI Government for the experiment
- Instruction and campaign

3.1.5 Design of Pilot Study Plan

Before the start of the experiment, the design for the study was made and discussed with Seksi Kebersihan. Personnel and vehicles were arranged, the collection area, schedules and routes were determined.

3.2 Door-to-door (A type area)

3.2.1 Situation of the Area

- a. Population : 3,055
 - Number of houses : 575
 - Area : Approx. 45 ha
(east-west 900 m, north-south 500 m)

- b. Income level : High income

- c. Residential area, detached house with garden in the main
 - High school : 1
 - Facility for the
handicapped : 1
 - Hall for an oil
company : 1
 - Restaurant : 2

- d. Road patterns : Grid (See Attachment A3-1)
 - Main road : Net width 11.5 m
including ditch 14 m
 - Secondary roads : Net width 6.5 m
including ditch 7.5 m
 - Access to each house by truck
 - Cul-de-sacs : 3

3.2.2 Present Collection System

- a. Door to door system : Collection from concrete bin at each house

Inhabitants discharge waste in their concrete bins every day.
The workers collect waste using a rake and basket.

- b. Vehicles : Two 4 m³ compactor truck for RW 6 and RW 8
- c. Frequency : Twice a week

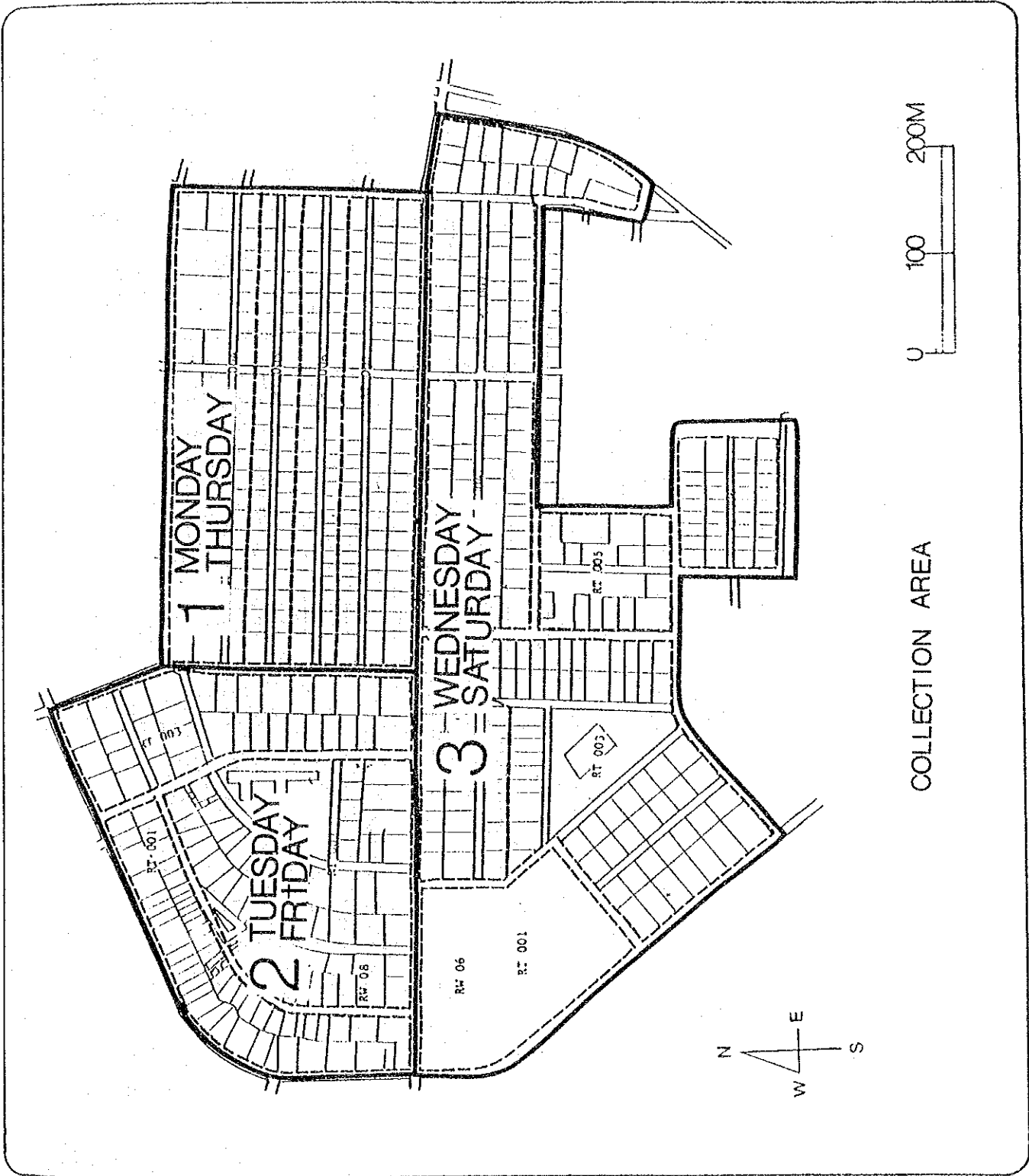


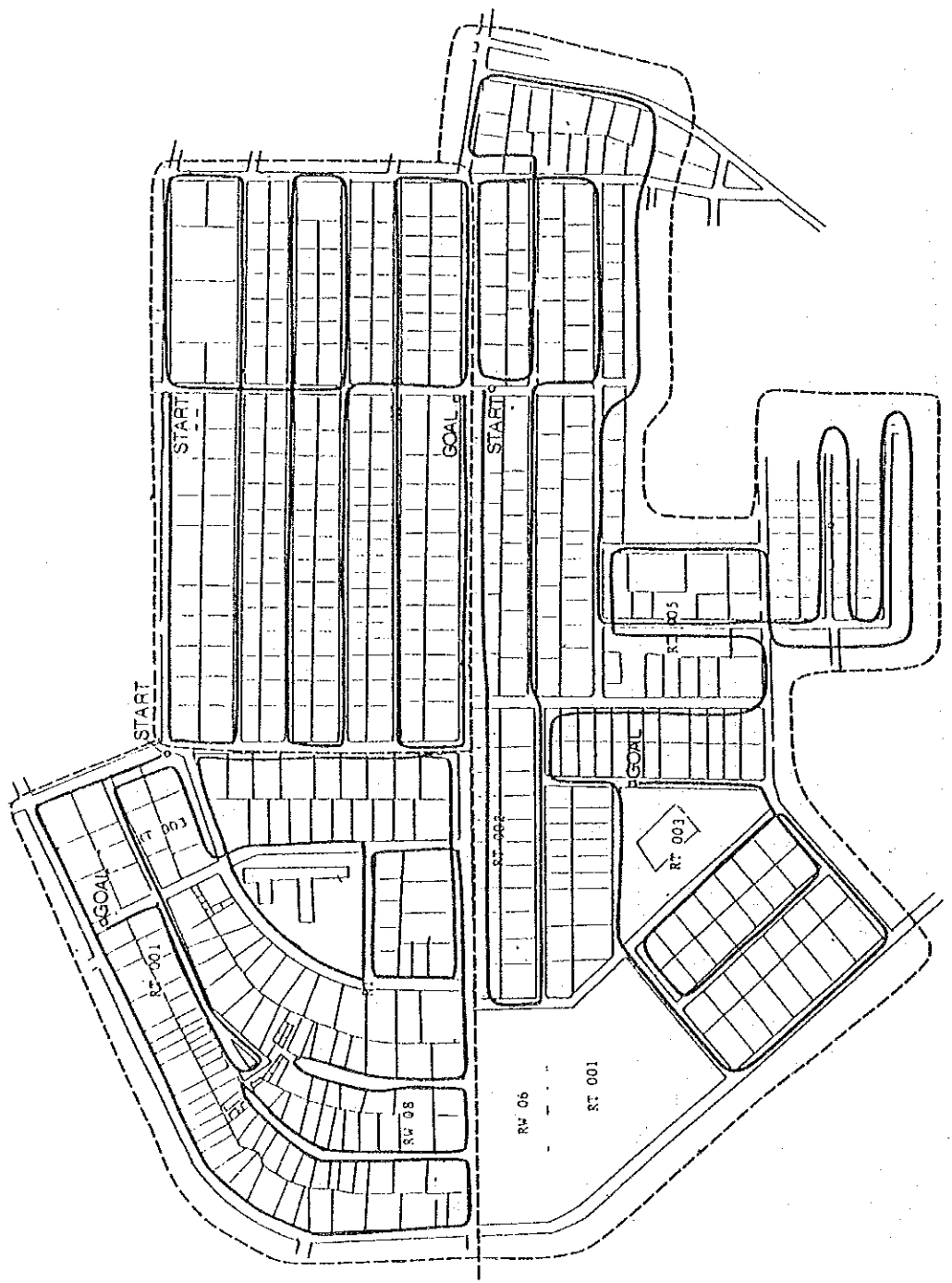
Fig. 3.2-1

Collection Area



COLLECTION AREA

STUDY ON
SOLID WASTE MANAGEMENT SYSTEM
IMPROVEMENT PROJECT
IN JAKARTA



COLLECTION ROUTE

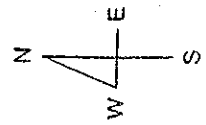


Fig. 3.2-2

Collection Route

STUDY ON
SOLID WASTE MANAGEMENT SYSTEM
IMPROVEMENT PROJECT
IN JAKARTA

The system of putting the container in front of the gate was followed in the beginning, because the inhabitants were afraid that it would be stolen. Some concrete bins were still used. To improve this situation, additional instruction sheets were distributed and an explanation was given to the inhabitants on 19, 20 Aug. 86. (See Attachment A5-2)

Later they placed the containers in front of the gate.

Plant waste such as tree branches and leaves was sometimes discharged in such an amount that it disturbed regular collection schedules. It was collected separately from concrete bins.

The starting time for collection was not accurate. The driver sometimes started without information. He sometimes neglected the collection route and make the second trip and another truck was prepared for the second trip. He liked to follow his previous method. The number of the crew was not maintained. Sometimes they only had a crew of 1 or 2.

Collection time for 1 trip was about 100 mins. or 50 mins./ton. Net collection time, excluding trip time, was 76 mins. compared to 90 mins. using the previous system.

Considering the occasional crew shortages and waiting time for discharging waste from a house, collection time can be improved later.

The amount of waste collected is calculated at 4.0 kg per household of 0.75 kg per day per capita.

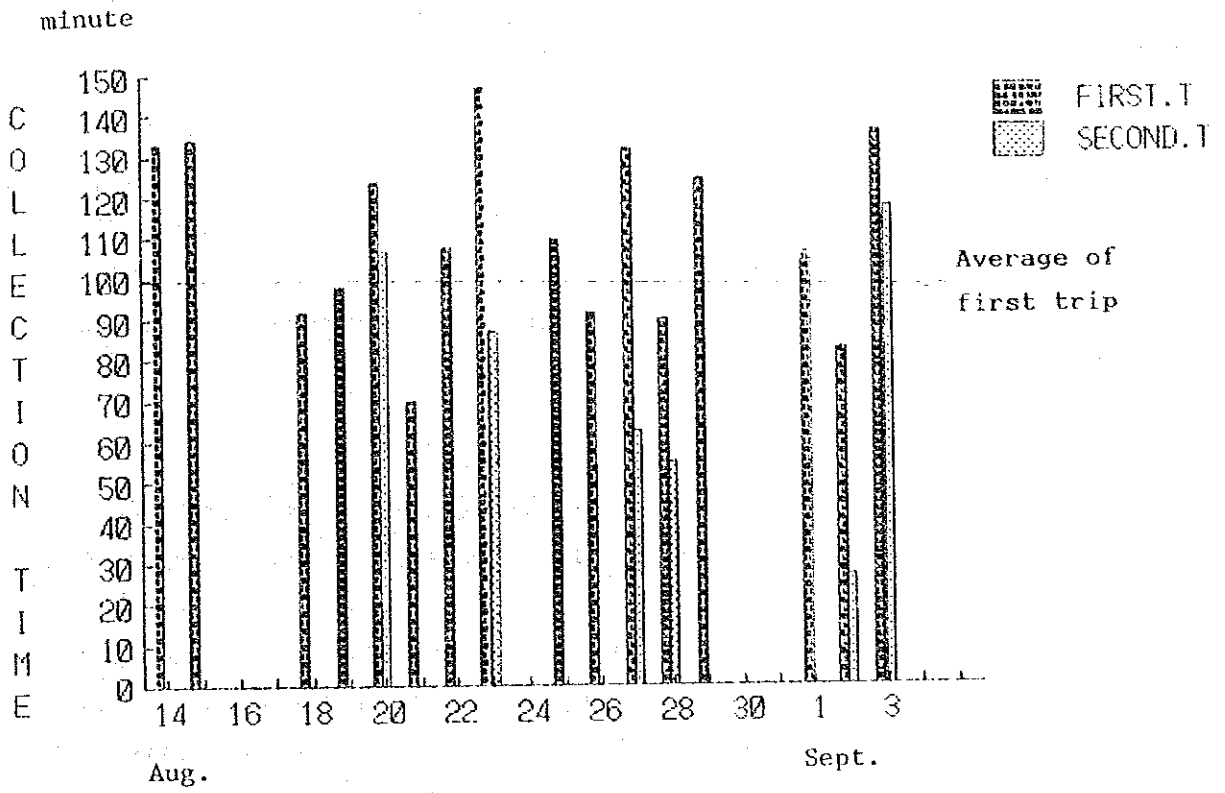


Fig.3.2-3 Record of Collection Time (DOOR-TO-DOOR)

3.3 Communal Container (B type area)

3.3.1 Situation of the Area

- a. Population : 3,376
- Number of households : 508
- Area : Approx. 7 ha
(east-west 250 m, south-north 350 m)

- b. Low to medium income

- c. Residential area, small houses adjacent to each other shops along Jl. Selatan Raya
Kindergarten : 1

- d. Main roads : Jl. Selatan Raya, east side, width 9 m
- Secondary roads : Jl. Selatan 1, 2, 3, Jl. Raya Selatan, width 6 m
- Footpaths : Inside the residential area, width 1.5 m
Vehicles can only use surrounding 5 roads.
Many houses are accessible only by footpath.
(See Attachment A3-2)

3.3.2 Present Collection System

- a. Jali-jali system

- b. Frequency : Twice a week

- c. Collection schedule : Regular but sometimes no collection

- d. Vehicle : 6 m³ open dump trucks

- e. Collection time : (observed on 9 Aug. 86 in Kel. Kampung Rawa)
(crew: 4)
60 min. (90 min. including collection of
plant waste)
70 min. including trip time to next station
120 min. including collection of accumulated
waste beside the road

3.3.3 Record of the Study

- a. Distribution of Instruction Sheet and Communal Container (See Attachment A5-3)

The instruction sheets were delivered to the chief of RW 05 to be distributed to inhabitants on 12 Aug. 86.

14 communal containers were distributed to each RT on 13 Aug. 86.

- b. Implementation

The location of the communal container was decided through discussion with RW and Seksi Dinas Kebersihan. Some inhabitants of houses just behind the container complained and some container were shifted and adjusted. No serious objection were made about the container. The container did not disturb traffic.

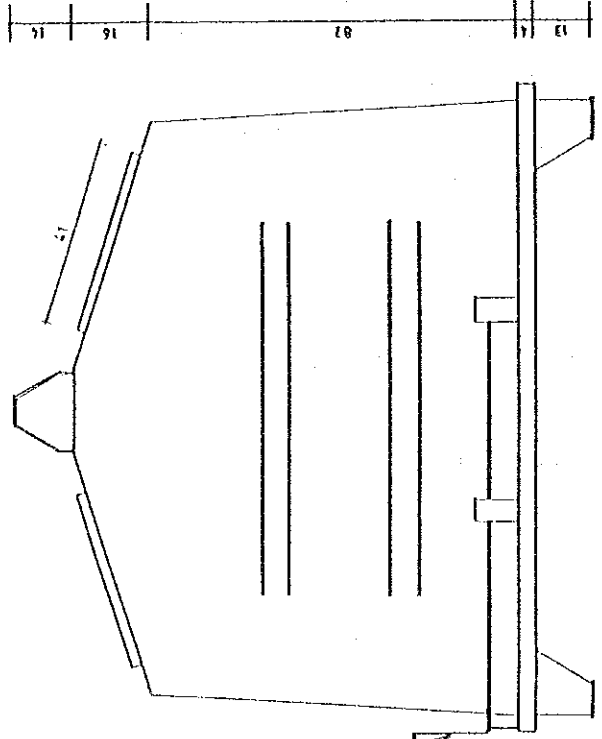
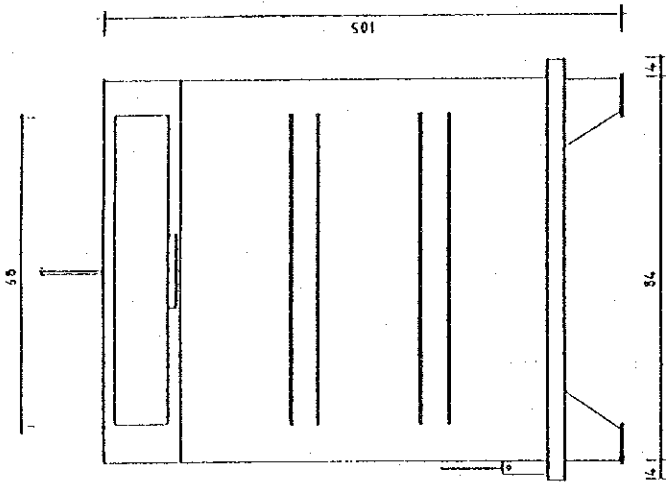


Fig. 3.3-1

Communal Container

STUDY ON
SOLID WASTE MANAGEMENT SYSTEM
IMPROVEMENT PROJECT
IN JAKARTA

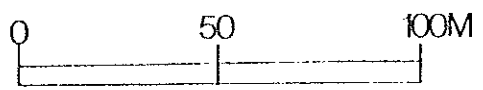
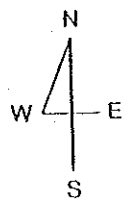
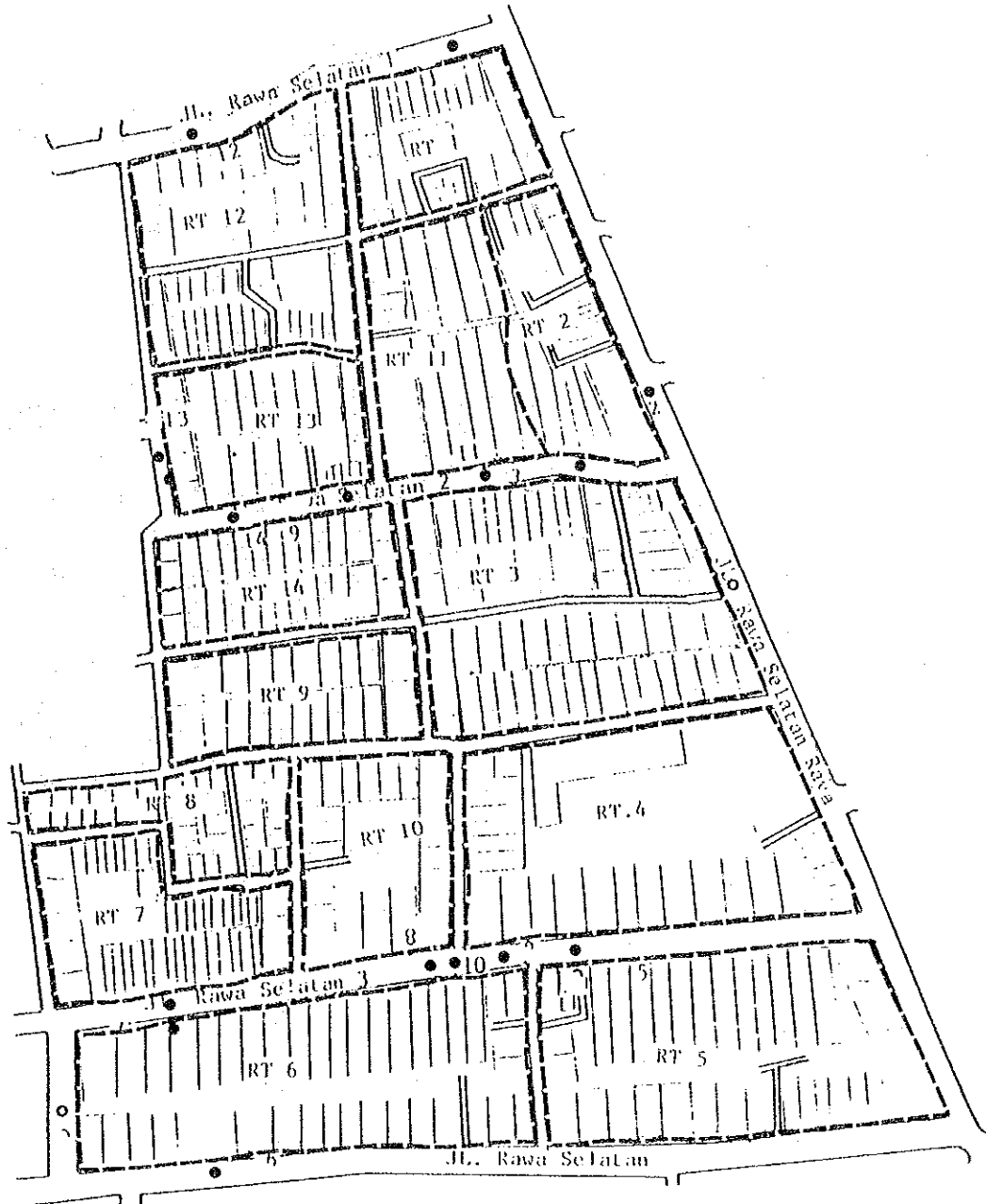


Fig. 3.3-2 Location of Communal Container

The container were used properly and it did not get dirty around them. Some containers overflowed after a 3 day interval. Overflowed waste was put beside the containers in small plastic bags.

Because 16 and 17 Aug. 86 were holidays, on 18 Aug. most containers filled up and some overflowed. To cope with this, 2 containers were added and the situation was improved.

1 driver and 1 crew was enough to operate the lifting and dumping of the container.

In the original plan, half j.e 7 of the containers were to be collected a day, but the truck conducted collection until filled up.

The average collection time for the first trip was 65 min. (or 50 mins./ton). (See Attachment A7)

It took time for collection when the driver tried to load waste to the limit of the truck.

Amount of waste collection is calculated as follows:

2.9 kg per day per household

0.44 kg per day per capita

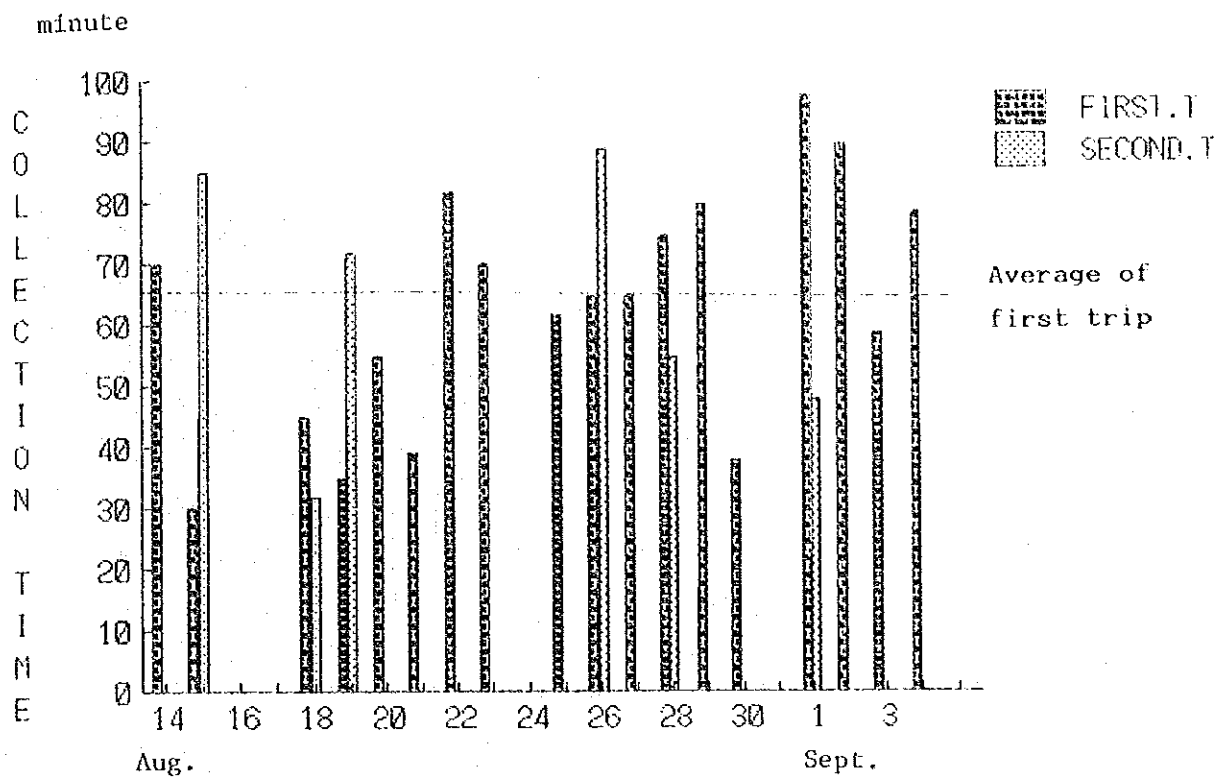


Fig. 3.3-3 Record of Collection Time (Communal Container)

3.4 Handcart (B2, C type area)

3.4.1 Situation of the Area

- a. Population : 4,526
Number of household : 1,000
Area : Approx. 15 ha
(east-west 300 m, north-south 500 m)
- b. Medium income
- c. Residential area, small houses adjacent to each other shops along Jl. Percetakan Negara
Small shops in the east of RW 2
- d. Each RW is surrounded by roads with access to vehicles. (See Attachment A3-3)
Inside the RW only footpaths serve for access.
Protocol streets : Jl. Pramuka
Main roads : Jl. Percetakan Negara (width 12 m)
Secondary roads : Jl. Perc Negara 1, 2, Jl. Rawamangun (width 6 m)

3.4.2 Present Collection System

a. Handcart-pooling

	Handcart	Handcart worker	Transfer to truck	Transfer point
RW 1 :	4	4	Daily	Road side
RW 2 :	6	3	3 times a week	Closed railroad crossing

b. Collection schedule and frequency of handcart : Irregular

c. Transfer time : 18 min. per handcart (2 workers)
15 min. per m³

3.4.3 Record of the Study

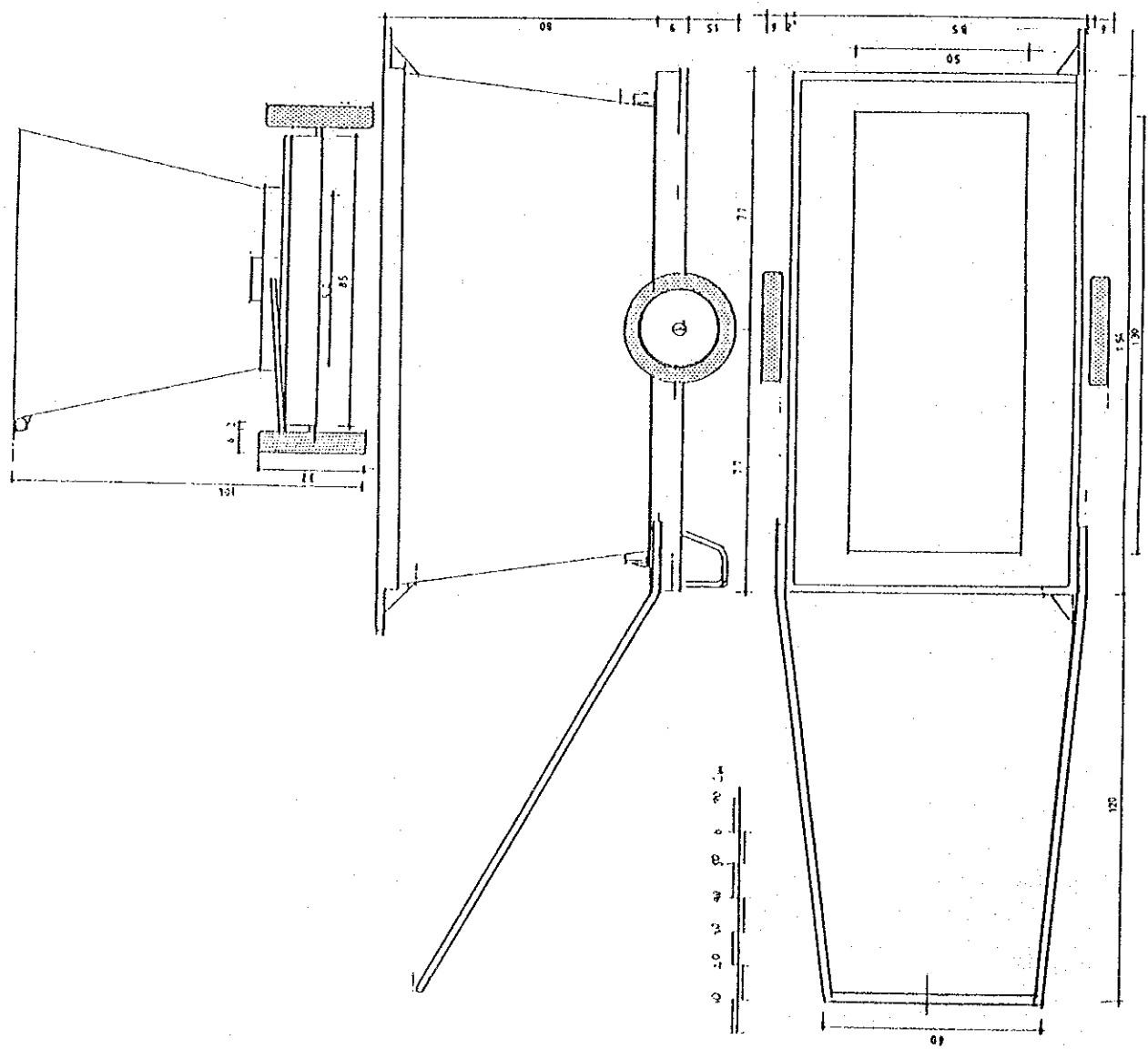
- a. Distribution of Instruction Sheet (See Attachment A5-4) and New-type Handcart

The instruction sheets were delivered to the chiefs of RW 01 and 02 to be distributed to inhabitants and handcart workers.

14 movable container which have a container suitable for loading equipment for a 10 m³ compactor truck were delivered to the site on 13 Aug. 86.

At first, the crew did not get used to the operation, and it took time. However, soon they came to handle them efficiently.

Fig. 3.4-1
 Movable Container



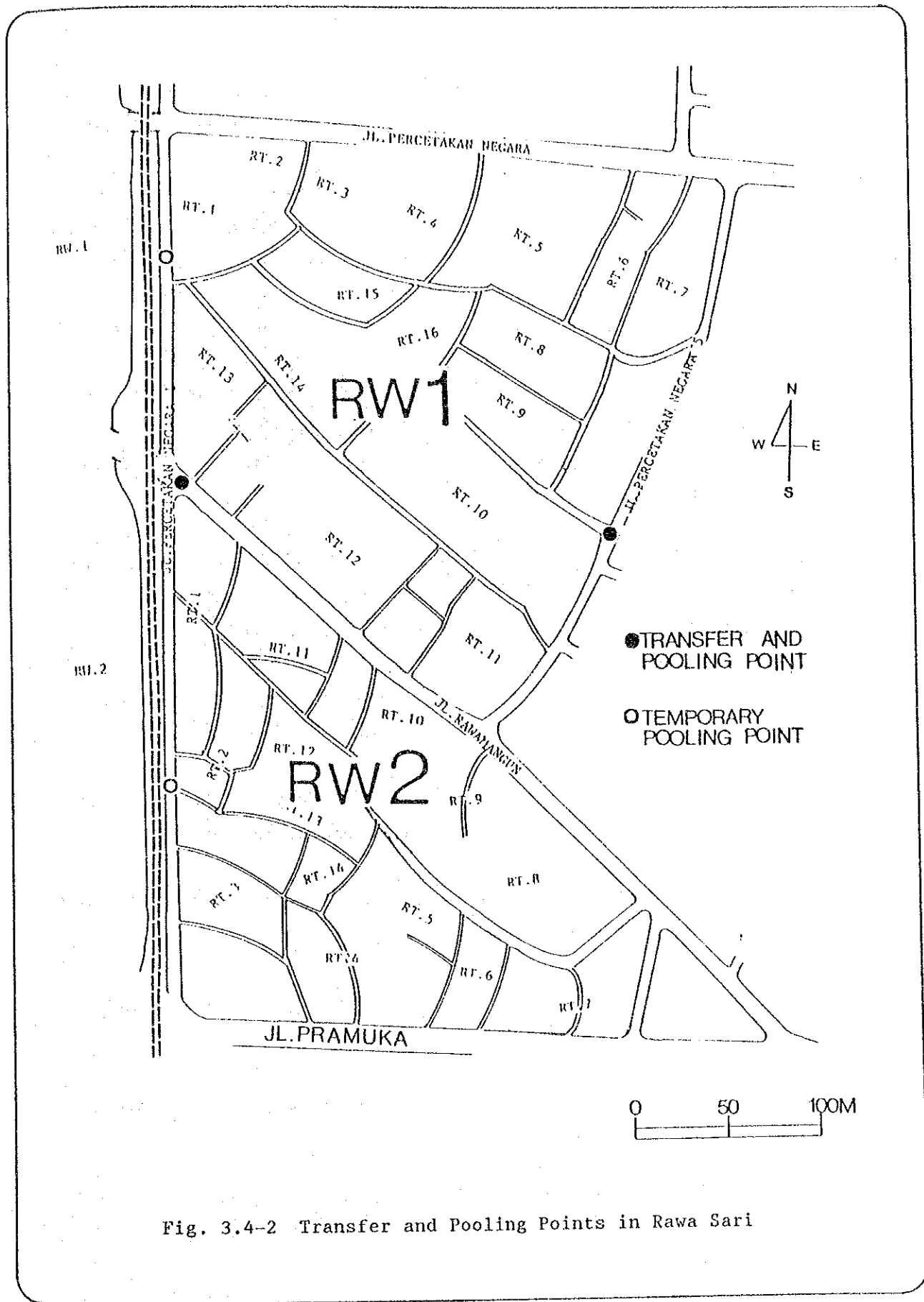


Fig. 3.4-2 Transfer and Pooling Points in Rawa Sari

Operation of the new type handcart inside Kampung areas was very difficult because it is larger and heavier and the wheels are small and the small paths are rough.

Due to the short period available for preparation, we only used materials which were available at the time. The above shortcoming of the handcart could be improved upon technically.

Actually, the old handcarts are still used and waste is transferred to the new type handcarts.

The new-type handcarts are used as stationary containers.

The new system did not change the collection from each houses.

However accumulated waste in the road side was cleared and the new handcarts were pooled neatly.

It is hard for Dinas Kebersihan to control the handcart workers of the RW.

The handcart collection for each house is quite irregular.

Usually 12 - 13 handcarts were transferred a day in 45 mins. of the average collection time was 51 mins. The transfer efficiency was 15 min./ton.

On Monday, more than 14 handcarts were transferred. During transfer, emptied handcarts were filled again from old handcarts.

About 80% of the large compactor truck was filled with waste from 16 - 17 handcarts or 60% was filled from 12 - 13 handcarts.

The average number of handcarts collected was 13.2 and average collection time per handcart was 3.8 min.

Amount of waste collected calculated as follows (See Attachment 8):

2.7 kg per day per household

0.6 kg per day per capita

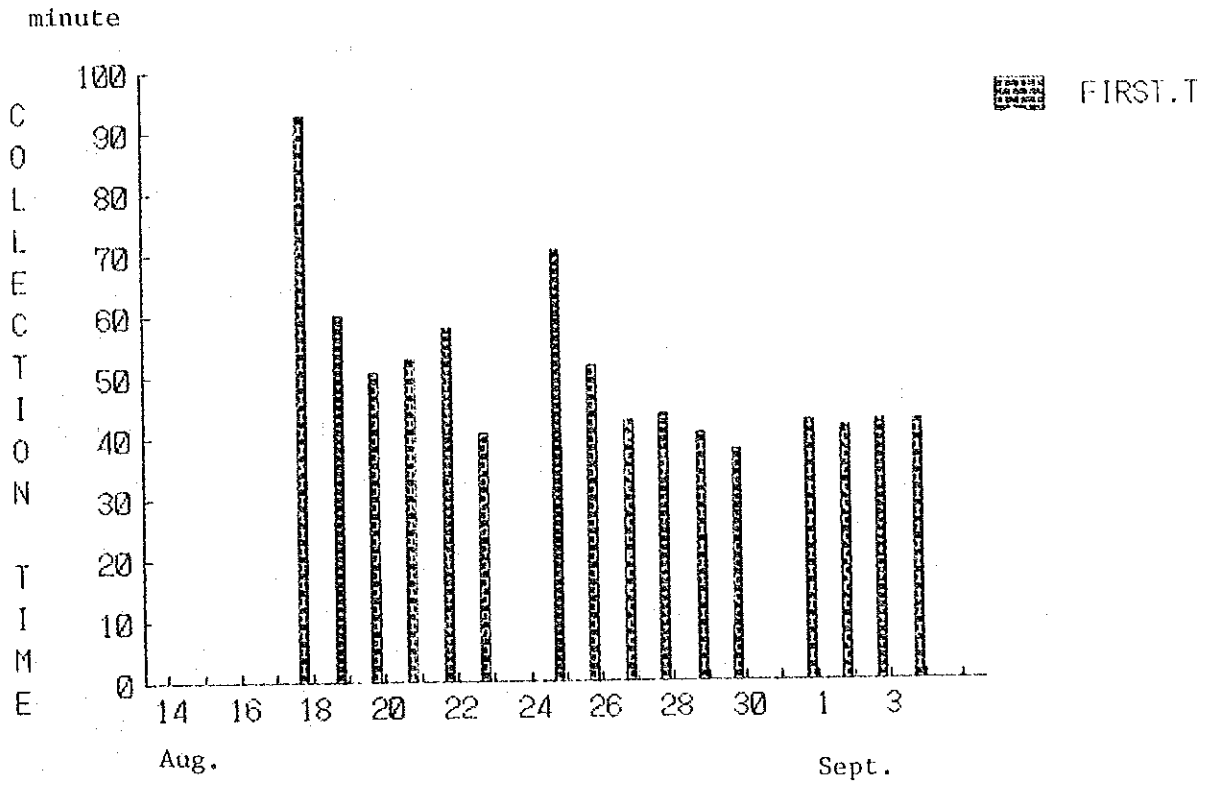


Fig. 3.4-3 Record of Collection Time (Handcart)

3.5 D Type Area

3.5.1 Situation of the Area

The study area is on the west side of the canal. A road runs along the canal on the west side.

There are small temporary shops between the canal and the road in 2/3 of the study area. The road touches the canal directly in the other 1/3. On the east side, there is no side road and houses are located directly on the canal side.

The canal is dirty and a lot of waste is scattered there, especially around the temporary market which is in a bad condition and waste is disposed beside the bridge.

3.5.2 Present Collection System

The collection system is Jali-jali. The inhabitants discharge waste directly into a truck.

Also there are places beside the canal where waste is gathered.

The truck collects waste there.

Collection is made every day.

3.5.3 Campaign

A campaign to clean the area was carried out on 15 and 18 Aug. 1986 by campaign car distributing pamphlets to the inhabitants (See Attachment A5-5).

3.5.4 Interview

Interviews were conducted with inhabitants and temporary shop keepers along the canal on 3, 4 Sept. 1986.

The results are shown in Section 3.7.

3.6 Campaign

1) Instructions and Campaign

Residents and owners/caretakers of shops and offices in the Pilot Study areas had to be instructed to properly handle their refuse to meet the collection schedule. The instructions given to them by the Study team were in a clear and easy-to-understand format. The contents of the instructions differ from one collection area to another according to the specifications of the collection methods.

Campaigning for the Pilot Study is also important to get the attention of the people living in the areas. Both instructions and campaigning were provided for the Pilot Study. The following are a list of methods used for the instructions and campaign. The choice of the methods adopted for the Pilot Study were made through discussions with the Study team.

- Leaflets given to each household or shop/office in the collection area (Attachments A5-1 to -5)
- Posters placed on building walls and collection stations in the study area (Attachment A6)
- Campaign messages given to the people in the study area by campaign cars

2) Pamphlets

In addition to campaigning for the Pilot Study, pamphlets giving information on the current solid waste management system, its problems and this JICA study were distributed.

3) Video Programs

The Pilot Study was recorded in video for later use in seminars and lectures by Dinas Kebersihan.

4) Staff

JICA Team : One JICA member
 Dinas Kebersihan : Personnel from the Information and
 Community Participation Department (Sub
 Dinas Penyuluhan dan Peran Serta
 Masyarakat)
 Others : Illustrator and Printshop

5) Printing of Materials

Printed materials were prepared and finished by the contracted
 illustrator and printshop. The following table gives the features of
 the printed materials.

Materials	Illustration	Photo	Color	Size	Pages	Quantity
Instruction leaflet						
P.S.						
A area	Y	N	2	B4	1	1,800
B area	Y	N	2	B4	1	3,000
C area	Y	N	1	B4	1	3,000
D area	Y	N	2	B4	1	3,000
Posters	Y	N	full	A2	1	1,000
Pamphlets	Y	Y	full	B5	16	4,000

Notes: Y = Illustration or photo used;
 N = Illustration or photo not used

3.7 Interview

3.7.1 Implementation

Interviews were conducted before and after the experiment using an interview sheet. The details of the results are attached in the Appendix.

Pre-experiment Interview

Date	Study Area	No. of Interviews	Area
11, 12 Aug.	Door-to-door	90	Cempaka Putih Timur RW 6, 8
13 Aug.	Communal Container	96	Kampung Rawa RW 5
15 Aug.	Handcart	100	Rawa Sari RW 1, 2

Post-experiment interview

27 Aug.	Handcart	96	Rawa Sari RW 1, 2
28 Aug.	Door-to-door	90	Cempaka Putih Timur RW 6, 8
29 Aug.	Communal Container	100	Kampung Rawa RW 5

Interviews were selected randomly from houses in the whole area. Half of them were wives and the others were family members, house keepers, etc. The places of interview were mostly residences and a few small offices and shops.

In communal container and handcart areas, most inhabitants had lived there for a long time, and half of them had lived there since birth. In door-to-door areas, 1/5 of them answered that they have lived there since their birth.

3.7.2 Door-to-door

a. The condition before the experiment was as follows:

- Plastic containers had been used in many houses.
- Collection was quite irregular.
- 60% were not satisfied with the collection service and hoped for a better service.
- 36% could pay more than Rp. 5.000, per month.

b. Comments on the new system were as follows:

- 82% thought the service had been improved and 96% accepted this system, but some preferred the previous concrete bin.
- The service level was acceptable to most inhabitants and many thought it had improved.
Some inhabitants gave negative responses about the system.
- Apart from these interviews, one RT expressed disagreement with the new system and wanted the previous concrete bin system, due to the following reasons:
 - . The frequency of collection was not enough.
 - . Waste smelled very bad after being kept in the plastic container for a few days.
The container needed to be washed.
 - . The container was weak and that would cause additional expenditure.
 - . The only disadvantage of the old system is that it does not look nice.

The inhabitants do not like to keep waste inside their houses for long. Because concrete bins are located in the corner opposite the gate and exposed to open air, they do not like waste in concrete bins.

- Generally, a new system is not immediately accepted in the beginning but gradually people get used to it. The new plastic container system requires cooperation and extra effort, from inhabitants. However, on the condition that a regular collection service is provided, it is sure to be accepted to inhabitants and collection efficiency, the appearance of the environment and sanitary conditions will be improved.

3.7.3 Communal Container

a. The conditions before the experiment were as follows:

- Plastic containers and plastic bags were used to keep and discharge waste in about half the houses.
- 2/3 were not satisfied with the previous collection service mostly because of irregular collection.
- Rp. 500 - Rp. 1000 could be paid for the service.

b. Comments on the new system were as follows:

- Almost all thought this system convenient and acceptable.

3.7.4 Movable Container

a. The condition before the experiment were as follows:

- Half were satisfied with the present collection service and the other half were not because of the irregularity and insufficient frequency of collection.
- Most could pay about Rp. 1.000, - per month for collection.

b. Comments on the new system were as follows:

- 80% thought usage of the new handcart was good and 85% thought the service level was acceptable.

However 50% did not like to pay more expensive charge for the new handcart.

3.7.5 D Type Area

Interviewees were not squatters but temporary shop keepers and inhabitants beside the canal.

Most of them felt that the conditions beside the canal were dirty or not sanitary.

About 80% of the interviewees answered that they never threw waste into the canal. This number is not thought to be 100% reliable.

Although 40% of the interviewees answered that collection is made every day, most wanted better collection service.

Considering the present conditions of the area and the answers of inhabitants, their consciousness about cleanliness along the canal is thought to be high, while their efforts to achieve it are low.

3.7.6 Level of Satisfaction with the Collection Services

Before the experiment, in door-to-door and handcart areas, the number of inhabitants expressing both satisfaction and dissatisfaction with the present collection service were about half-and-half, with the dissatisfied rather more than the satisfied.

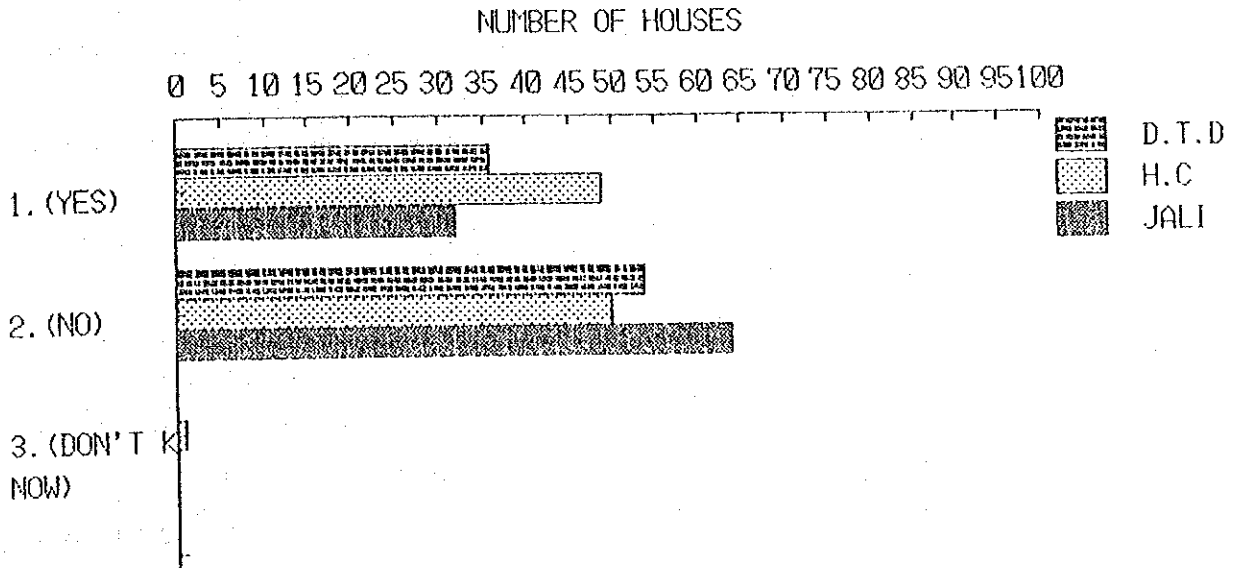


Fig. 3.7-1 Opinion to Present Collection Service

After the experiment, most interviewees considered the service level during the Pilot Study to be acceptable.

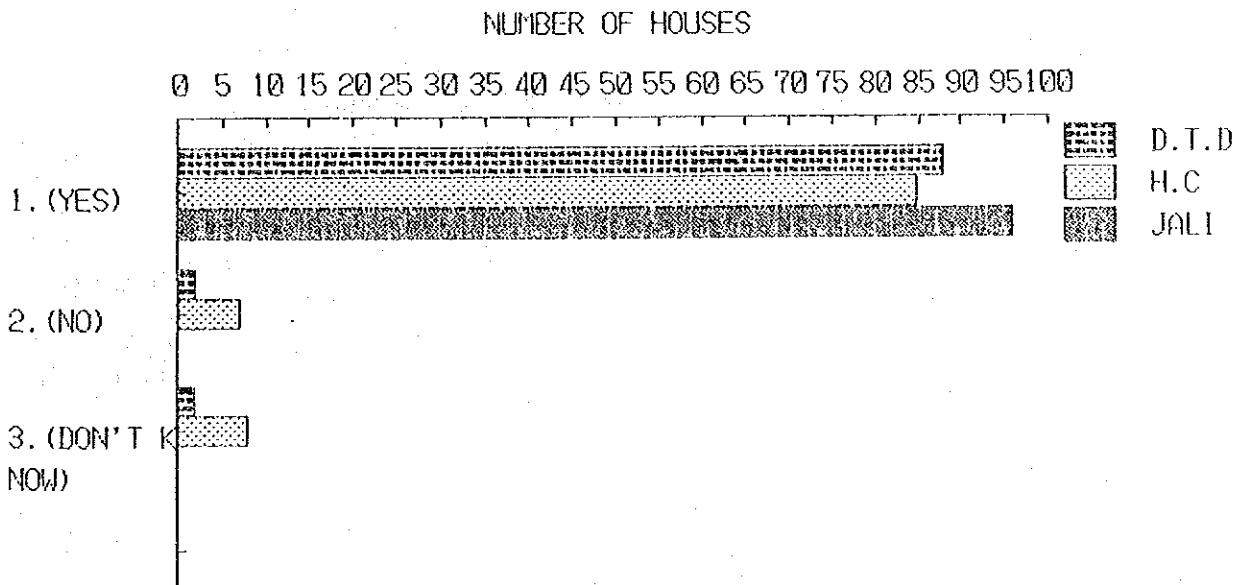


Fig. 3.7-2 Opinion to New Collection Service

3.7.7 Collection Charge

In door-to-door areas, most inhabitants pay Rp. 3,000 (~ 4,000) and 5,000 (~10,000). (per month)

In handcart areas, more than half the interviewees pay Rp. 1,000 (~2,000) and the maximum affordable charge is almost the same. In Jali-jali areas, more than half the interviewees pay Rp. 500 (~1,000) and the maximum affordable charge is almost the same.

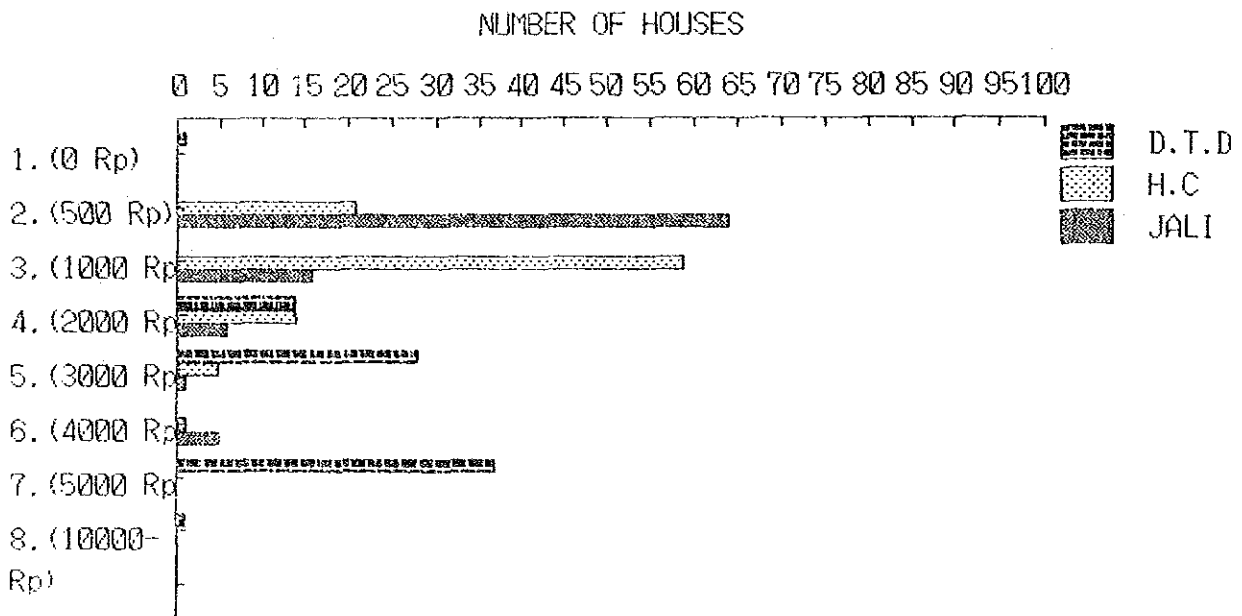


Fig. 3.7-3 Present Collection Charge

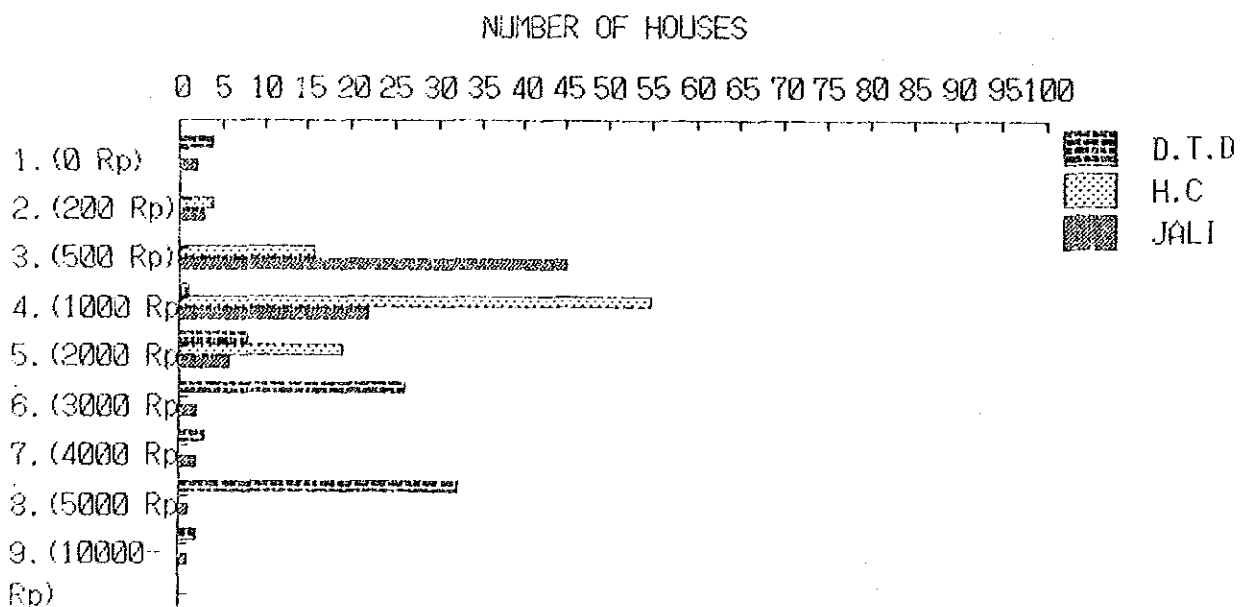


Fig. 3.7-4 Maximum Willing-to-pay Charge

3.8 Evaluation

3.8.1 Evaluation

1) Results

The collection pilot study has been evaluated according to the following criteria:

- Improvement in efficiency
- Improvement in service
- Improvement in discharge method
- Appropriateness of equipment
- Stability of operation
- Cost
- Inhabitants cooperation and evaluation

These items were judged by the analysis of the operational records, records of the interviews to inhabitants, inspection of crew's behaviour and situational observations. The results are shown in Table 3.8-1.

Table 3.8-1 Evaluation of the Collection Pilot Study

	Door to Door	New Communal Container	Movable Container
Efficiency	+	+	+++
Service level	+	+++	++
Discharge method	++	++	
Appropriateness of equipment	+++	+	+++ (transfer)
Stability of operation (Collection operation)	-	+	++
Cost	+	-	++
Inhabitants cooperation	++	+++	+
Inhabitants evaluation	+	+++	++

- : Bad + : Fair ++ : Good +++ : Very good

2) Conclusions

As a result of the above evaluation, the introduction of the following collection systems, which were applied in the Pilot Study, are examined.

- Door to door (A type area)

To achieve higher efficiency and to keep two round trips by collection vehicles, a new door to door system should be extended to all A type areas on the following conditions:

- . When new discharge methods are applied, inhabitants will inevitably criticize them by saying they cannot discharge waste anytime.

To overcome that, it is necessary to persuade them by giving sufficient information concerning the need for improvement and discussing it.

. An operation control system must be established to maintain a regular, stable and reliable service.

- New communal container (B1 type area)

The introduction of a communal container system inside Kampung areas should be studied further since at present communal container system like the one in the pilot study is expensive, although the service level was much improved.

Therefore, the jali-jali system should be maintained in this type of area on the condition that a small compactor vehicle is utilized which is more efficient than a small tipper truck.

- Handcart (B2, C type area)

The new handcart system should be changed into a communal container systems, because it is difficult for one worker to handle it. On the other hand, it is quite useful to distribute small communal containers on the main streets around Kampung areas, and that practice should be extended. The management of handcart collection should be left to RW. If Suku Dinas Kebersihan employs handcart collectors directly, one controller would be needed for controlling every two collectors.

- D type area

It appeared that canal waste was not caused only by squatters. Inhabitants living around canals throw waste into canals as a habit. Possible solutions to this problem are as follows:

. Inspection roads should be constructed on both sides of the canal.

. Good relationships between collection service personnel and inhabitants should be established.

. Sufficient information on how to manage the waste should be given to inhabitants in a format which they are able to understand.

3) Recommendations

The most important issue concerning a waste collection system is not only that of collection techniques. If it were, the solution to problems would be much easier. In general, whatever systems may exist, if operational support is not planned properly, these systems will not work efficiently and effectively. In the case of a waste collection system, the role of such support within the total system is comparatively large. From observations of the actual situation of the present collection system, bearing in mind the point made above, it would appear that of special importance is an operational control system and this would appear to be, as yet, insufficiently established. Since this is a most urgent requirement, every effort should be made to improve it. All solutions would evolve from this development.

3.8.2 Comments and Analysis

1) Door to Door (A type area)

a. Efficiency

A comparison between the old and the new door to door system is as follows:

	Old door to door	New door to door
No of households per 1 trip	50 - 80 (concrete bin)	100
Trip	1 - 2	2
Distance	1 km	1.5 km
Collection time per house	2 - 3 min.	1 min.
Necessary for collection	100 - 160 min.	100 mins

Note: The crew number remains the same.

Although the number of house collections the distance increases with the new system resulting in a negative effect on collection efficiency, the new system is in general more efficient than the old system.

On the condition that inhabitants keep to the discharge rules collection per house would be reduced by 15% and efficiency would be improved 1.2 times.

b. Service level

A comparison of the service level is as follows:

	Old door to door	New door to door
Collection point	Concrete bin	Entrance, gate
Regularity of collection	Irregular	Regular
Time of discharge	Free	Fixed
Rule of discharge	Free	Ruled
Frequency	Principally 2 times/week (irregular)	2 times/week

For the inhabitants, the service level gets lower because discharging is ruled by schedule and they cannot discharge freely. Actually one RT disagreed with the new system, because containers had to be kept inside the premises and that generated a bad smell. On the other hand, according to the results of the interviews, many inhabitants thought the service had improved as the collection got regular and reliable, and the concrete bin was always clean.

To cope with the complaint concerning the bad smell, plastic bags should be used and collection frequency should be increased. As the service level for door to door collection is quite high and requires a higher cost, in order to continue this service inhabitants should accept the new method of discharge way at least.

So that inhabitants keep to the discharge rule, it is necessary to maintain a reliable and regular collection service as well as make efforts to encourage strong cooperation.

c. Discharge methods

As mentioned in section b, restriction on discharge time and the bad smell is problem, but it is considered that this will be accepted.

d. The Collection equipment

Considering the net collection time and the number of round trips, a small compactor truck is most suitable for the door to door system . A large compactor truck can collect a larger amount of waste but the number of round trip will only be one, and therefore the cost will be higher.

e. Stability of operation

At present the stable cooperation service is difficult since an operation management system (operation schedule, data etc.) is not established; control of the drivers and crews is not strong, and bulky waste is not collected separately. The establishment of a management system is most important for improvement.

f. Cost

2 round trips should be made with the new system. This makes the new system cheaper than the old system where a second trip sometimes could not be made.

i. Opinion of inhabitants

As mentioned in section b, the restriction on discharge times and the bad smell is problem for inhabitants, but it is considered that this will be accepted.

According to the result of interviews, most interviewees considered the new system to be acceptable.

h. Others

- Collection work has become easier and more sanitary for collections.

- The amount of waste generated in the study area was calculated 2.3 ton/day and one 4 m³ compactor truck should be enough for collection.

However two truck had been assigned to the area before the experiment.

- Design collection rate was calculated as follows:

A: Amount of waste generated	2.3 ton/day
B: Design waste amount (Ax4/3)	3.0 ton/day
C: Capacity load of 4 m ³ truck	2.0 ton/day

Design collection rate (B/C) 1.5

- The following are considered important in the collection:

- . To keep collection schedules strictly.
- . To inform to inhabitants of the schedules.
- . To establish an operational data system which would include details of amounts of waste, collection areas names of workers etc.
- . To give training to drivers and crew.

2) Communal Container (Bl, C type area)

a. Efficiency

- Collection efficiency was not improved sufficiently compared to Jali-jali system:

	Communal Container	Jali-Jali
Capacity of vehicle	4 m ³	6 m ³
Waste load	1.8 ton	2.5 ton
Collection time	68	70 - 120
Number of crew	2	5 - 3
Collection efficiency (min/ton)	38	28 - 48

b. Service level

The service level of Jali-jali and the communal container system is as follow:

	Jali-jali	Communal Container
	No station	Station
Collection point	(Stop point of truck)	(Container)
Frequency	2 times/week	3 times/week
Discharge time	Restricted (only when the truck comes)	Free

Since inhabitants could discharge waste at any time the service became very high.

c. Discharge method

Control of the container by each RT was possible.

d. Suitability of vehicles

The minimum width of road required for this system is 5 m for the operation of the crane.

Because the roads in Kampung area are narrow, the safety of the operation is difficult in such areas.

e. Cost

- The collection cost per ton of the Jali-jali system was cheaper than that of the communal container system. Because the transfer amount of waste by crane truck is limited due to the narrow streets in Kampung areas.

	Communal Container	Jali-Jali
Capacity (m ³)	6	6
Waste load (ton)	2.0	2.5
Cycle time (min)	150	210
No. of trip	2.0	1.5
Collected waste amount (ton/day)	4.0	3.75
Crew	2	3
No. of containers	2	2
Vehicle cost (Rp)	36,690,000	20,328,000
Depreciation (Rp)	5,100,000	2,900,000
Maintenance cost (Rp)	1,900,000	1,900,000
Fuel cost (Rp)	860,000	650,000
Labor cost (Rp)	1,900,000	2,700,000
Total (Rp)	9,760,000	7,450,000
cost/ton	8,100	6,700

f. Opinion of inhabitants

Almost all inhabitants thought that the service was improved and appreciated the new system.

g. Others

- The collection schedule must be maintained to avoid the problem of overflow from communal containers.

3) Movable Container (B2, C type area)

a. Efficiency

The efficiency of transfer from handcart to vehicle has been improved a great deal:

	Movable Container	Old Handcart
Vehicle	Compactor (10 m ³)	Open cargo (10 m ³)
Pay load	6 tons	4 tons
Grew	4	4
Net collection time	60	120
Collection time/ per ton	10 mins/ton	43 mins/ton
Collection efficiency	2.5	10.8
Cycle time	150	240
Transfer time from handcart	5 mins/m ³	15 mins/m ³

b. Service level

As the movable containers have been used as stationary containers, heaped waste on roadsides was contained and the operation of the old handcart became easier.

c. Discharge method

The method of discharge by inhabitants to handcarts and placement was managed well. No overflow from the container occurred.

d. Suitability of containers and vehicles

It was very difficult to get the new container into Kampung areas and one-man operation was not possible.

The size and wheels of the movable container could be adjusted, but it is difficult to reduce weight of the container.

Considering one-man operation and efficiency, it is not economical.

Therefore in Kampung areas collected by handcart, a combination of the container and the old handcart is judged to be appropriate.

e. Cost

The new system of a large compactor truck has advantages in cost when compared with the old system.

	New Container 10 m ³ Compactor	Old Handcart Pool 10 m ³ Open Cargo
Vehicle price (Rp.)	56,000,000	16,000,000
Container (Rp.) (New handcart)	250,000	-
Crew	4	4
Amount transferred/day	12 ton	2.8 ton
Cost/ton (Rp./ton)	5,000	10,000

The cost does not include handcart collection costs.

f. Opinion of inhabitants

From the results of interview, the inhabitants thought the service had been improved.

g. Others

- The sanitary conditions of transfer was improved.
- From observations of the operations of the present handcart workers, regular and stable collection in Kampung areas was thought to be very difficult, considering the quality of the workers.
- It is not considered easy nor advantageous that Dinas Kebersihan directly manages and conducts handcart collection.
- A specific vehicle was prepared for this experiment and regular collection was made.
Because operational management system has not been established, regular collection is considered difficult under present collection.

4) D Type Area

A campaign and interviews were carried out in the area. Also, an investigation for canals was carried out.

Residential areas along rivers or canals are very small and collection service are somehow provided around the area.

The problems of canal waste derive from the following:

- . Contact points between inhabitants and collection have not been made.
- . Inhabitants awareness of cleanliness along canals is low.

To cope with this problem, relations between inhabitants and collection services should be strengthened, good collection services are provided and inhabitants clear and practical information.

Supplementary investigations on the conditions of the rivers and canals in Jakarta were carried out.

Figure 3.8-1 shows the areas where rivers or canals are heavily polluted. This figure was based on both site reconnaissance by the JICA Study Team and information provided by the Department of Public Work of DKI Jakarta. Rivers and canals are contaminated by waste mainly in areas where both embankments are occupied by squatters or slums and where rivers or canals tends to flood. The main reasons are:

- . Poor and low income people, including squatters tend to live on banks of rivers or canals which tend to flood. Also, solid waste collection services in these areas are not sufficient.
- . Where banks of rivers and canals are the sites of dense housing and where there is no inspection road along rivers or canals, dredging and cleaning is difficult. Waste accumulates in these sorts of places and inhabitants are not conscious of throwing waste into a canal or a river.

3.9 Street Sweeping Survey

1) Purpose

A street sweeping survey was conducted to get basic information for making a plan of street sweeping.

2) Survey method

The time a sweeper took to sweep a certain distance of street and the amount of street rubbish collected was measured.

A balance scale was prepared to measure the weight of rubbish in portable plastic containers. The Survey was conducted in Jl. Let Jend. Suprpto in Cempaka Putih in the second week of September.

3) Present situation

The present street sweeping situation is as follows:

- Assigned net length of road is about 1,500 m per sweeper.
- The sweeping equipment is a broom, which is made from a bundle of long fibres.
- Actual working time is from 5:00 a.m. to 9:00 a.m.
- Street rubbish is put on a central reserve and small heaps are formed at regular intervals.
- Another sweeper collects the rubbish accumulated on the central reserve by using a handcart.
- Street rubbish collected by a handcart is loaded on a collection vehicle at a handcart pool.
- Sweeping is done daily, except Sunday.

4) Result

Observation of two sweepers activity were made from 6:00 to 8:00 a.m. Waste amount swept and moving speed was measured. The result is shown in the following table.

Table 3.9-1 The Result of Street Sweeping Survey

	Unit	A	B
Street length	m	56.3	56.3
Sweeping length	m	112.6	112.6
Time spent minutes	minute	13	15
Weight of rubbish	ton/m ³	2.3*	6
Contents of rubbish		Dead leaf	Sand
Density	ton/m ³	0.06	0.6
Moving speed	m/min	8.7	7.5
	m/h	522	450
Weight/distance	Kg/km	40	107

5) Comments

- In case A, the sweeper collected the rubbish accumulated on a central reserve but did not collect sand. Therefore, the data on weight, which is marked *, is not a reliable figure. On the other hand, in case B, 107 kg/km is judged as a reasonable figure based on the actual situation.

- The record of sweeping speed is also reasonable. Supposing a sweeper covers a distance of 1,500 m, where necessary working time corresponds to actual working time. If the standard length assigned to each sweeper is 2,000 m, as stated, it is necessary to set a figure of 4.5 hours as actual working time. However, for manual street sweeping it is assumed that 4 hours without a break would be the work limit. Working conditions for sweepers are obviously not good. Sweeper can not escape from car fumes and high temperatures.

- Traffic congestion is quite heavy from 7:30 a.m. onwards and it was observed that work is very dangerous from 7:30 to 9:00 a.m. Therefore, it would be better if manual sweeping finishes before 7:30 a.m.

ATTACHMENT

ATTACHMENT A1 PROGRESS OF THE PILOT STUDY

PREPARATION

	(A) Door to door	(B) Communal Container	(C) Handcart
	Preparation / permission		
Aug 11 (Mon)	Distribution of Plastic containers and	Interview	Briefing to the Staff
12 (Tue)	Instruction Sheet	Delivery of Instruction Sheet to chief of RW and location of Communal Containers	Delivery of instruction sheets to Chief of RW
13 (Wed)		Delivery of Communal Containers / Campaign Interview	Delivery of new type handcart (14) Campaign

IMPLEMENTATION

14 (Thu)	Campaign clean up	Campaign	Campaign
	<----- S T A R T ----->		
	RW 8, RT 4,5,6,7	Collection from 8 containers (1 trip)	Trial
	Daily Instruction	Daily Instruction	Daily Instruction
15 (Fri)	Campaign Clean Up R w 8, RT 1,2,3	Campaign Collection from 14 containers (2 trips)	Interview Campaign Trial
16 (Sat)		National holiday	
17 (Sun)		National holiday	

18 (Mon)	Rw 8, RT 4,5,6,7 (1 trip)	Collection from Delivery of Campaign	10 Containers (2 trips)	Collection from 16 Handcarts
19 (Tue)	RW 8 RT 1,2,3 (1 trip)	additio- nal Ins- truction Sheet v	Addition of 2 containers collection from 13 containers (2 trips)	Collection from 15 Handcarts
20 (Wen)	Rw 6 RT 1 ~ 7 (2 trips) (2 trucks)		Collection from 8 containers (1 trip)	Collection from 14 Handcarts
21 (Thu)	RW 8, RT 4,5, 6,7 (1 trip)		Collection from 7 containers (1 trip)	Collection from 14 Handcarts
22 (Fri)	RW 8, RT 1,2,3 (1 trip)		Collection from 8 containers (1 Trips)	Collection from 13 Handcarts
23 (Sat)	RW 6, RT 1 ~ 7 (2 trips) (2 trucks)		Collection from 8 containers (1 trip)	Collection from 12 Handcarts
24 (Sun)				
25 (Mon)	RW 8, RT 4 ~ 7 (1 trip)		Collection from 8 containers	Collection from 17 handcarts
26 (Tue)	RW 8, RT 1 ~ 3 Plant waste (3 trips, 2 trucks)		Collection form 8 containers	Collection from 13 handcarts
27 (wed)	RW 6, RT 1 ~ 7 (2 trips)		Collection from 10 containers	Collection from 11 handcarts
28 (Thu)	RW 8, RT 4 ~ 7 (2 trips)		Collection from 8 handcarts	Collection from 13 handcarts
29 (Fri)	RW 8, RT 1 ~ 3 (1 trip)		Collection from 11 containers	Collection from 12 handcarts
30 (Sat)	RW 6, RT 1 ~ 7 (2 trips)		Collection from 4 containers	Collection from 13 handcarts
31 (Sun)				

1	RW 8, RT 4 ~ 7 (Mon) (1 trip)	Collection from 14 containers	Collection from 14 handcarts
2	RW 8, RT 1 ~ 3 (Tue) Plant waste (2 trips)	Collection from 8 containers	Collection from 13 handcarts
3	RW 6, RT 1 ~ 7 (Wed) (2 trips)	Collection from 9 containers	Collection from 12 handcarts
4	RW 8, RT 4 ~ 7 (Thu) (1 trip)	Collection from 9 containers	Collection from 13 handcarts
5	(Fri)	National holiday	
6	RW 6, RT 1 ~ 7 (Sat)	Withdrawal of containers	Collection from 13 containers

ATTACHMENT A2 PILOT STUDY SCHEME

A Type Area (door to door)

1. Vehicle number :

Driver Name :

Crew Name :

2. Time schedule

- Vehicle and crew should be at Cempaka Putih office at 8:30.
- Collection of 1st round trip will be started at 9:00 am according to the certained collection schedule a week.
- Collection of 2nd round trip will be done at 11:00 am.
- Collection of 2nd round trip on Tuesday should be done for collection of remained tress and leaves in all study area.

3. Special schedule

- Ordinary collection by the vehicle which is not used for P.S. need to be done for collecting waste from concrete bins completely from 13th to 15th August.

4. Additional instruction to each household.

- Big amount of waste will be collected only on Tuesday.
- When waste amount is over flowed from portable plastic bin, please discharge it into plastic bags and put next to the bin.

B. Type Area (Communal Container)

1. Vehicle number :

Driver Name :

Crew Name :

2. Location of communal containers

- Location of communal container will be added according to situation of waste amount.

3. Time schedule

- Vehicles and crew should be at the Cempaka Putih office at 8:30 am.
- Collection of 1st round trip will be started from 9:00 am.
- Collection of 2nd round trip will be started from 11:00 am.

4. Weekly schedule

- Monday, Wednesday, Saturday
RT 001, RT 012, RT 002, RT 003, RT 011, RT 013, RT 014
- Tuesday, Thursday, Friday
RT 009, RT 008, RT 007, RT006, RT 005, RT 010, RT 004.

5. When we judge that the location is not suitable, we will cope with reallocation of communal containers.

6. Collection route.

B-2. C Type Area

1. Vehicle Number :
Driver Name :
Crew Name :

2. Handcart Worker

3. Designated Handcart Pool

4. Time schedule of Handcart collection.

- Collection by using handcart will be done from 07:00 am.
- Handcarts must be carried at disignated place until 09:00 am.
- 2nd round trip collection will be done from 09:00 to 10:30 am.
- Handcarts must be carried at disignated place until 11:00 am.

5. Collection Time Schedule

- Vehicle and crew should be at the office at 08:30.
- Collection of 1st round trip will be started at 09:00 am.
- Collection of 2nd round trip will be started at 11:00 am.

6. Weekly schedule

- Daily collection (exclude sunday)
- Only 1st round trip will be done on friday.

7. Collection route.

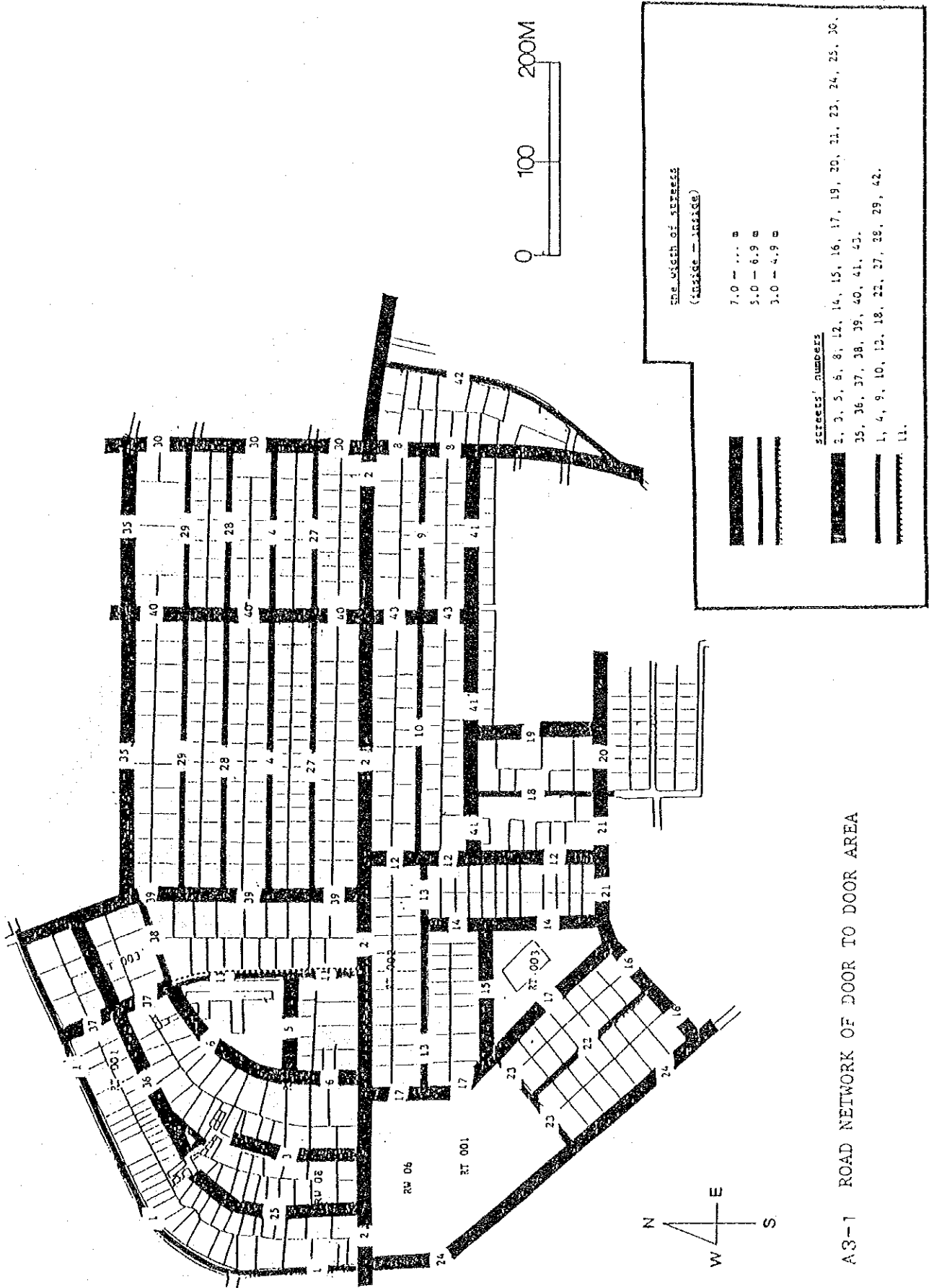
In Charge of Daily Instruction

	Dinas Kebersihan	JICA	Student
A. (Door to door)

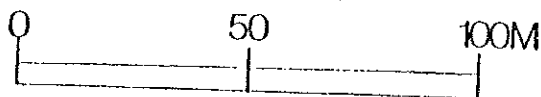
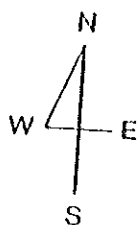
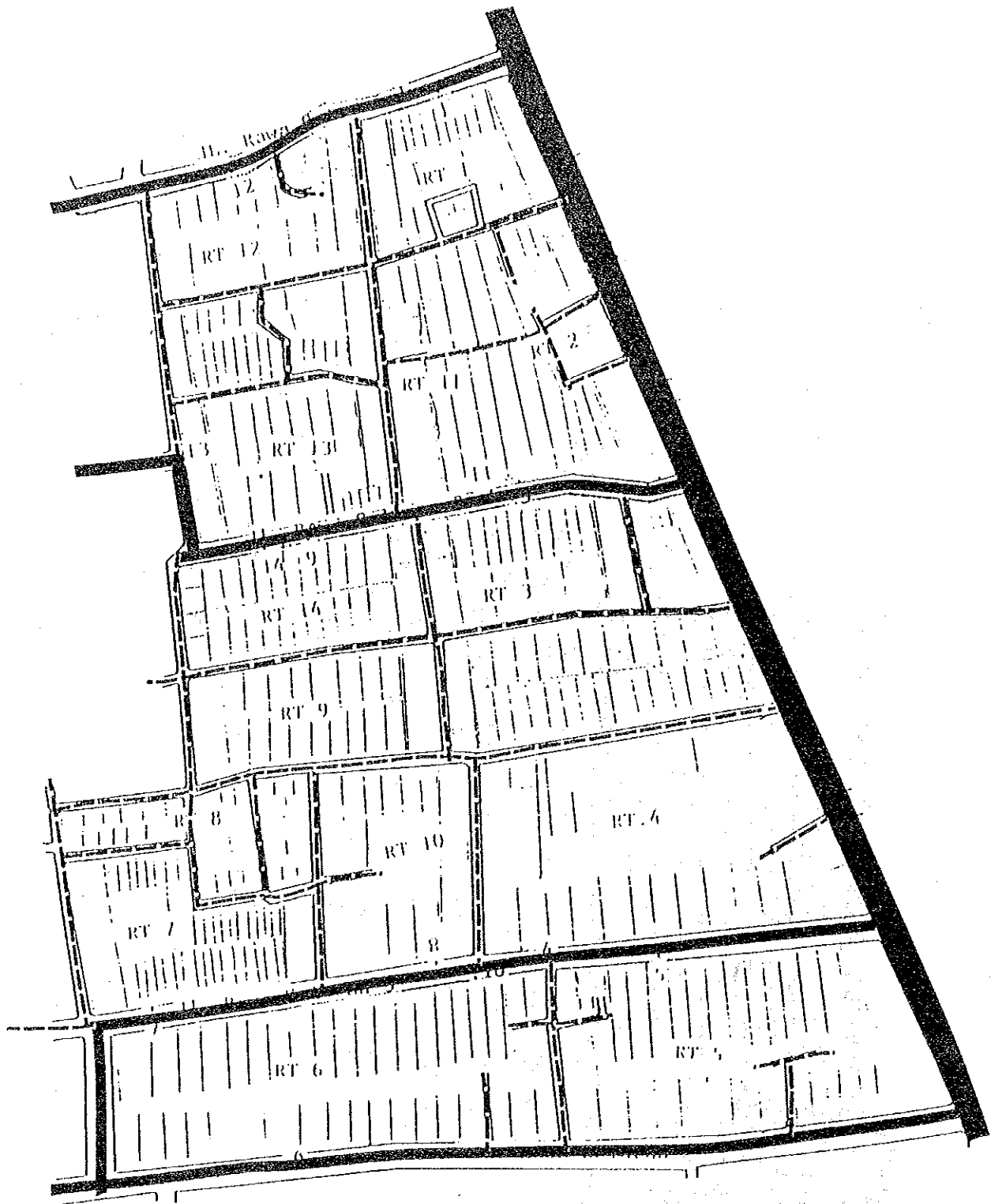
B (Communal Container)




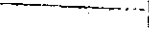
B-1 C (New handcart)

ATTACHMENT A3 ROAD NETWORK OF THE STUDY AREA

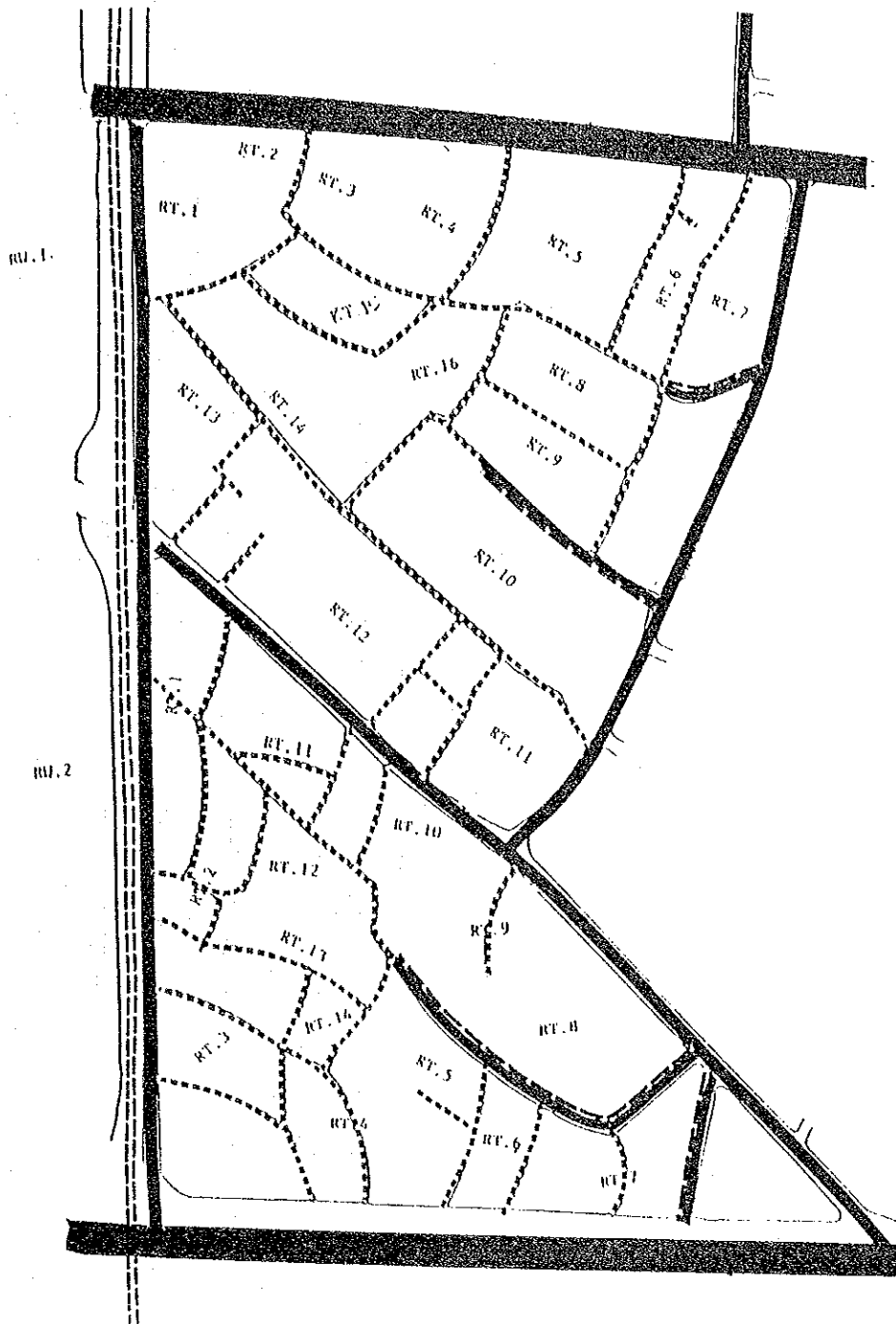


A3-1 ROAD NETWORK OF DOOR TO DOOR AREA

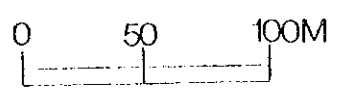


WIDTH EXCLUDING DITCH	
	7.0 - m
	5.0 - 6.9 m
	1.5 - 4.9 m
	0.0 - 1.5 m

A3-2 ROAD NETWORK OF COMMUNAL CONTAINER AREA

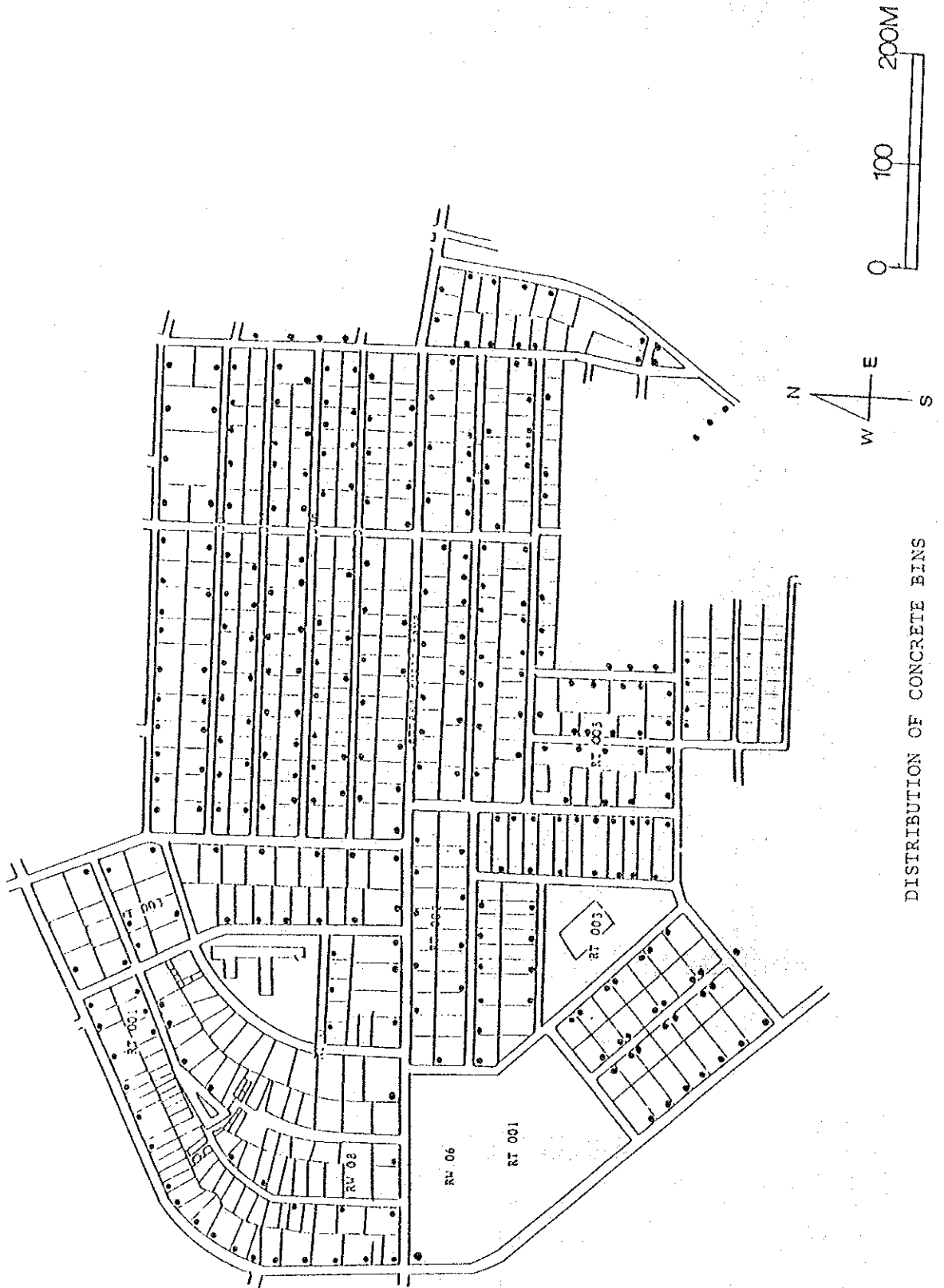


	7.0 - M
	5.0 - 6.9 M
	1.5 - 4.9 M
	0.0 - 1.4 M



A3-3 - ROAD NETWORK OF HANDCART AREA -

ATTACHMENT A4 DISTRIBUTION OF CONCRETE BINS

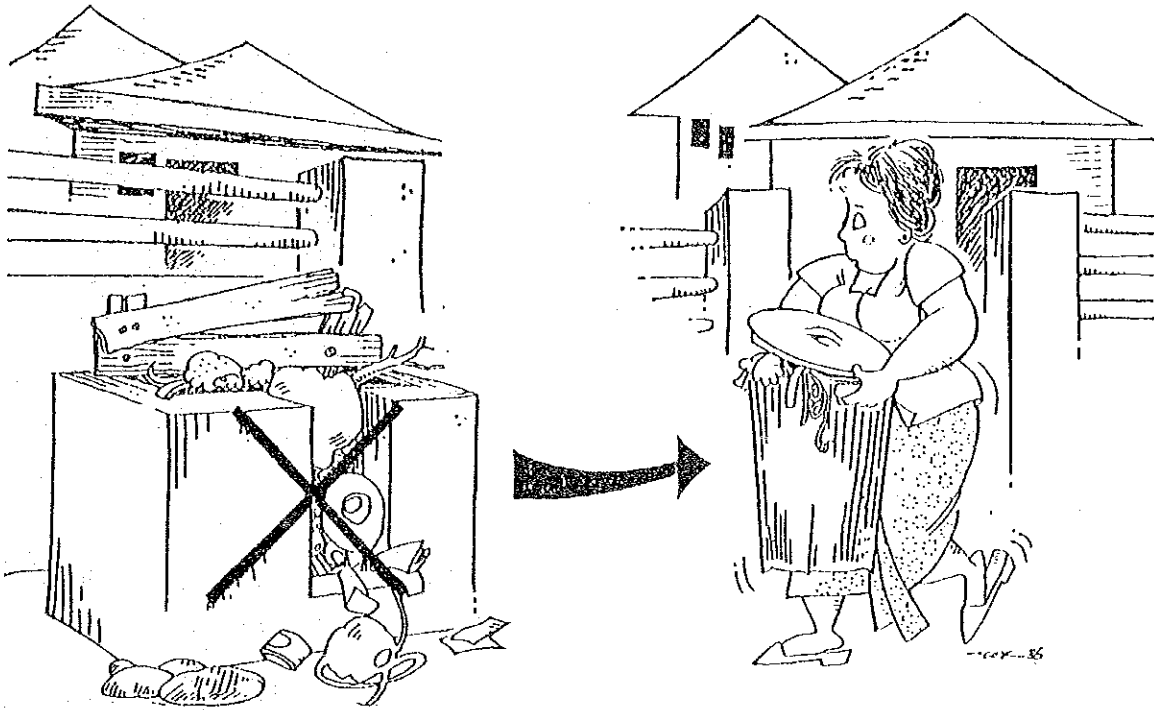


DISTRIBUTION OF CONCRETE BINS

Percobaan Sistem Pengangkutan Sampah

Dinas Kebersihan bersama-sama dengan Team JICA dari Jepang akan mengadakan percobaan sistem pengangkutan sampah dilingkungan ini. Diharapkan partisipasi/kerjasama dari masyarakat untuk membantu kelancaran percobaan ini antara lain dengan cara memelihara kebersihan lingkungan jalan-jalan dsbnya.

Pengangkutan dengan mempergunakan bak sampah dilaksanakan selama ini dirasa kurang efisien dan tidak begitu sehat. Dengan mempergunakan container plastik yang mudah dibawa-bawa dapat menciptakan pengumpulan sampah yang lebih efisien dan lebih sehat serta dapat memelihara estetika lingkungan.



Guna memperlaenar jalannya percobaan ini diharapkan masyarakat untuk memperhatikan petunjuk-petunjuk dibawah ini :

1. Periode percobaan : 14 Agustus - 6 September 1986.
2. Daerah percobaan : RW 06; RW 08; Kelurahan Kayumanis, Cempaka Putih Timur.
3. Tempat sampah : Disediakan dari Team JICA dan akan dibagikan diantara tanggal 11 Agustus dan tanggal 13 Agustus 1986 secara cuma-cuma.
4. Petunjuk-petunjuk dan penanganan sampah yang perlu diperhatikan oleh masyarakat :
 1. Letakkan tong sampah dirumah anda. Masukkan sampah kedalam tong sampah yang telah disediakan oleh Tim JICA. Bilamana tong sampah tidak mencukupi, gunakan kantong plastik untuk menampung kelebihan sampah. Untuk menjaga agar tong sampah tersebut tidak pecah, jangan memadatkan sampah dilalam tong sampah tersebut. Sampah yang berukuran besar seperti sisa-sisa tebangn pohon dan lain sebagainya agar dipotong kecil dan diikat serta diletakkan dekat tong sampah.
 2. Sampah diangkat dua kali dalam seminggu oleh truk sampah pada hari dan hari setiap kali diangkat setelah jam 09:00 pagi. Sampah dikumpulkan ditempat yang telah disediakan oleh Team JICA dan sebelum diletakkan didepan rumah, tong sampah harus ditutup rapat-rapat, untuk itu tong yang telah terisi sampah ditutup rapat diletakkan dirumah sebelum jam 09:00 yang kemudian akan diangkat oleh kendaraan dari Dinas Kebersihan DKI Jaya pada waktu-waktu tersebut diatas.
 3. Tong Sampah yang telah kosong agar kembali diletakkan di rumah anda. Tong sampah tersebut digunakan selama percobaan ini berlangsung.
 4. Dalam percobaan ini, kami tidak akan melayani/mengangkut sampah yang ditaruh atau dimasukkan kedalam bak-bak sampah, kecuali dalam tong sampah yang telah disediakan.
 5. Pemberitahuan tersebut diatas agar supaya disampaikan dan dimengerti oleh orang yang menangani sampah dirumah anda.

A5-2 ADDITIONAL INSTRUCTION SHEET FOR DOOR TO DOOR AREA

P E M B E R I T A H U A N (T A M B A H A N)

(Kelurahan Cempaka Putih Timur RW 6 dan RW 8)

Seperti kita ketahui bersama bahwa sejak tanggal 14 Agustus 1986, di Kecamatan Cempaka Putih ini telah diadakan suatu Penelitian Percobaan (Pilot Study) oleh DINAS KEBERSIHAN DKI JAKARTA dan JICA STUDY TEAM dari Jepang dalam rangka menciptakan Jakarta yang sehat dan bersih. Dalam hubungan ini, disampaikan kepada setiap rumah tangga yang tercakup dalam areal studi percobaan ini, untuk sementara waktu diharapkan :

1. Tidak membuang sampahnya di bak sampah beton (concrete box) yang dilakukan seperti biasa dan dipersilahkan untuk membuangnya di tong plastik yang telah dibagikan kepada masing-masing rumah tangga yang termasuk dalam areal studi percobaan ini.
2. Khususnya pada hari Selasa , pengumpulan sampah dilakukan untuk sampah yang besar-besar dan bukan dari dapur, seperti ranting-ranting kayu, daun-daunan dan jenis sampah besar lainnya.
3. Penduduk membuang kelebihan sampahnya didalam kantong-kantong plastik atau sejenisnya bila tong sampah yang dibagikan sudah penuh.
4. Bagi rumah tangga yang tidak mempunyai pembantu atau pelayan, dan mengkhawatirkan hilangnya tong plastiknya selama tidak berada di-rumah, diminta untuk memasukkan sampahnya didalam kantong plastik/ kertas kemudian meletakkannya didepan rumahnya masing-masing, pada waktu jadwal pengambilan sampah seperti tersebut dibawah ini :

Route Giliran	Senin		Selasa		Rabu		Kamis		Jumat		Sabtu	
	1	2	1	2	1	2	1	2	1	2	1	2
RW 08 RT 01, 02, 03			0						0			
RW 08 RT 4, 5, 6, 7	0	0					0	0				
RW 06 Semua RT					0	0					0	0
Sampah Besar (Ranting Kayu, dll) RW 08, RW 06				0								

* 0 : Hari giliran pengumpulan sampah

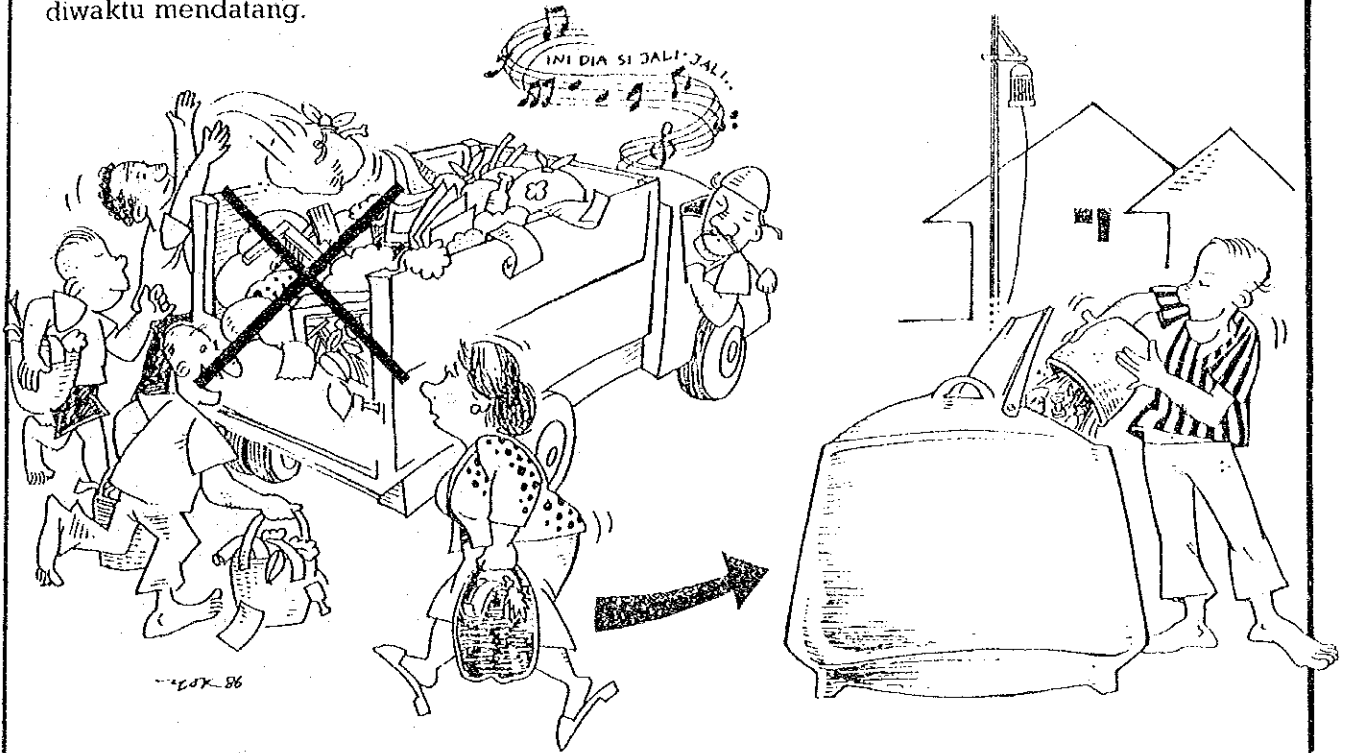
DINAS KEBERSIHAN - JICA - CITA KARYA

Percobaan Sistem Pengangkutan Sampah

Dinas Kebersihan bersama-sama dengan Team Jica akan mengadakan percobaan sistem pengangkutan sampah dilingkungan ini. Diharapkan partisipasi/kerjasama dari masyarakat membantu kelancaran percobaan ini antara lain dengan cara memelihara kebersihan lingkungan, jalan-jalan dsbnya.

Pengumpulan sampah dengan menggunakan Communal Container (tong sampah gabungan) memberi kesempatan untuk membuang sampah setiap saat dan memungkinkan pekerjaan pengumpulan sampah dalam kota mengangkut sampah tersebut secara efisien.

Percobaan ini akan dilakukan untuk menguji kelayakan sistem ini untuk pengumpulan sampah diwaktu mendatang.



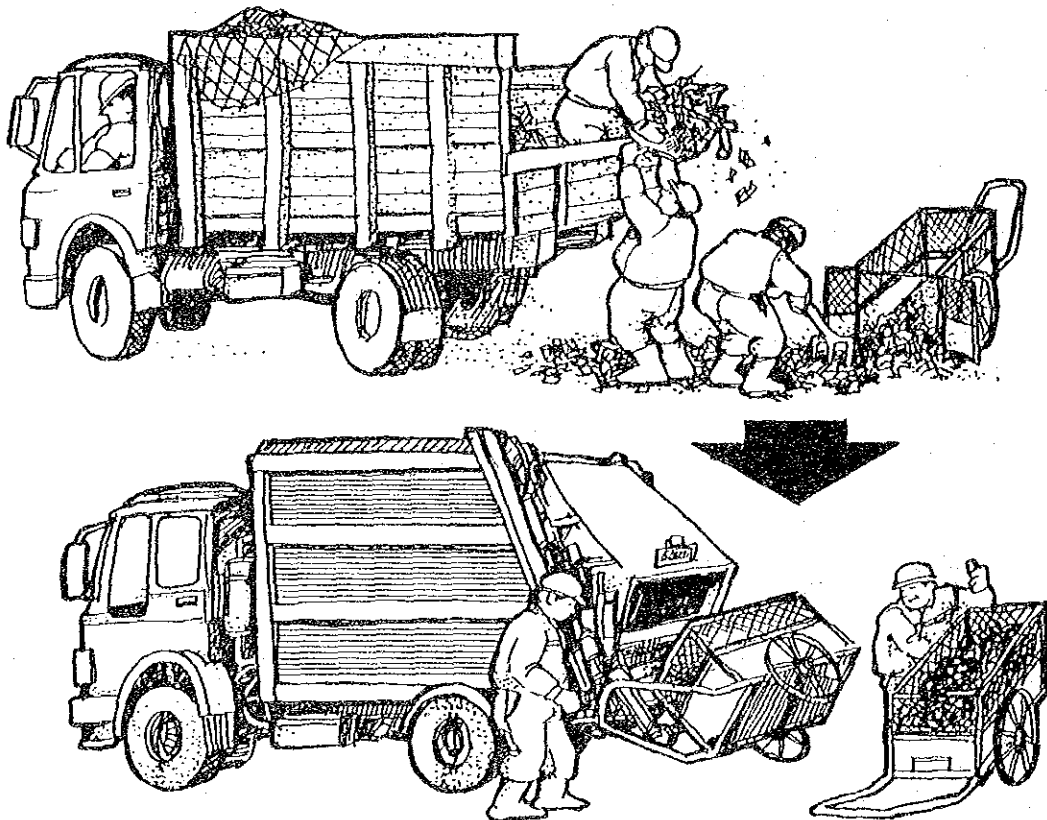
Guna memperlancar jalannya percobaan ini diharapkan masyarakat untuk memperhatikan petunjuk-petunjuk dibawah ini :

1. Tanggal percobaan : 14 Agustus - 6 September 1986.
2. Lokasi percobaan : Kampung Rawa, RW 05.
3. Petunjuk-petunjuk penanganan sampah :
 1. Sampah akan dikumpulkan dari Communal Container (lihat gambar ilustrasi) yang terletak di Jl. Rawa Selatan Raya. Harap diperhatikan bahwa truk dengan sistem "Jali-Jali" tidak akan dipergunakan selama periode percobaan tersebut.
 2. Kantong-kantong apa saja dapat dimanfaatkan untuk tempat pembuangan sampah. Harap membuang sampah didalam Communal Container yang terdekat di rumah anda.
 3. Ketika anda membuang didalam Communal Container bukalah penutup container. Kemudian masukkan dengan hati-hati sampah tersebut kedalam container dan tutuplah rapat-rapat setelah membuang sampah.
 4. Agar kiranya diyakini betul bahwa semua sampah telah terbuang didalam Container; sama sekali jangan sampai ada sisa-sisa sampah yang tercecer disekitarnya. Jangan membuang sampah di Container yang sudah penuh. Buanglah sampah di Container yang belum penuh.
 5. Harap dijaga agar Communal Container dan sekitarnya tetap bersih.
 6. Jangan menyimpan sampah bahan bangunan atau lumpur di dalam Communal Container tersebut.
 7. Pemberitahuan tersebut diatas agar supaya disampaikan dan dimengerti oleh orang yang menangani sampah di rumah anda.

Percobaan Sistim Pengangkutan Sampah

Dinas Kebersihan bersama-sama dengan Team JICA dari Jepang akan mengadakan percobaan sistim pengangkutan sampah dilingkungan ini. Diharapkan partisipasi/kerjasama dari masyarakat untuk membantu kelancaran percobaan ini antara lain dengan cara memelihara kebersihan lingkungan jalan-jalan dsbnya.

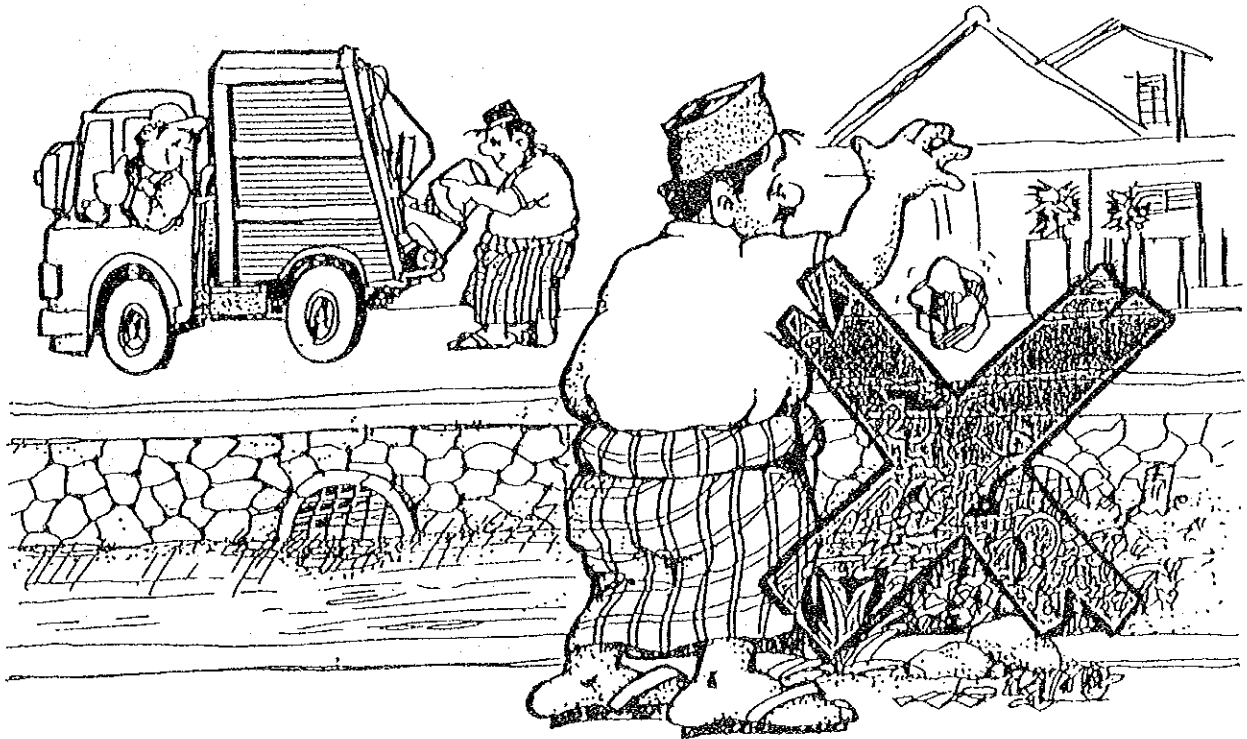
Pemindahan sampah dari gerobak ke mobil pengangkutan sampah kurang effisien dan tidak baik untuk lingkungan. Digunakan gerobak baru untuk memindahkan sampah ke mobil pengangkutan sampah, caranya mudah dan baik untuk lingkungan.



1. Periode percobaan : 14 Agustus – 6 September 1986.
2. Lokasi percobaan : Rw 01, 02 Kel. Rawasari.
3. Gerobak Baru : JICA Study Team akan menyediakan gerobak baru pada tanggal 13 Agustus 1986.

Percobaan Sistim Pengangkutan Sampah

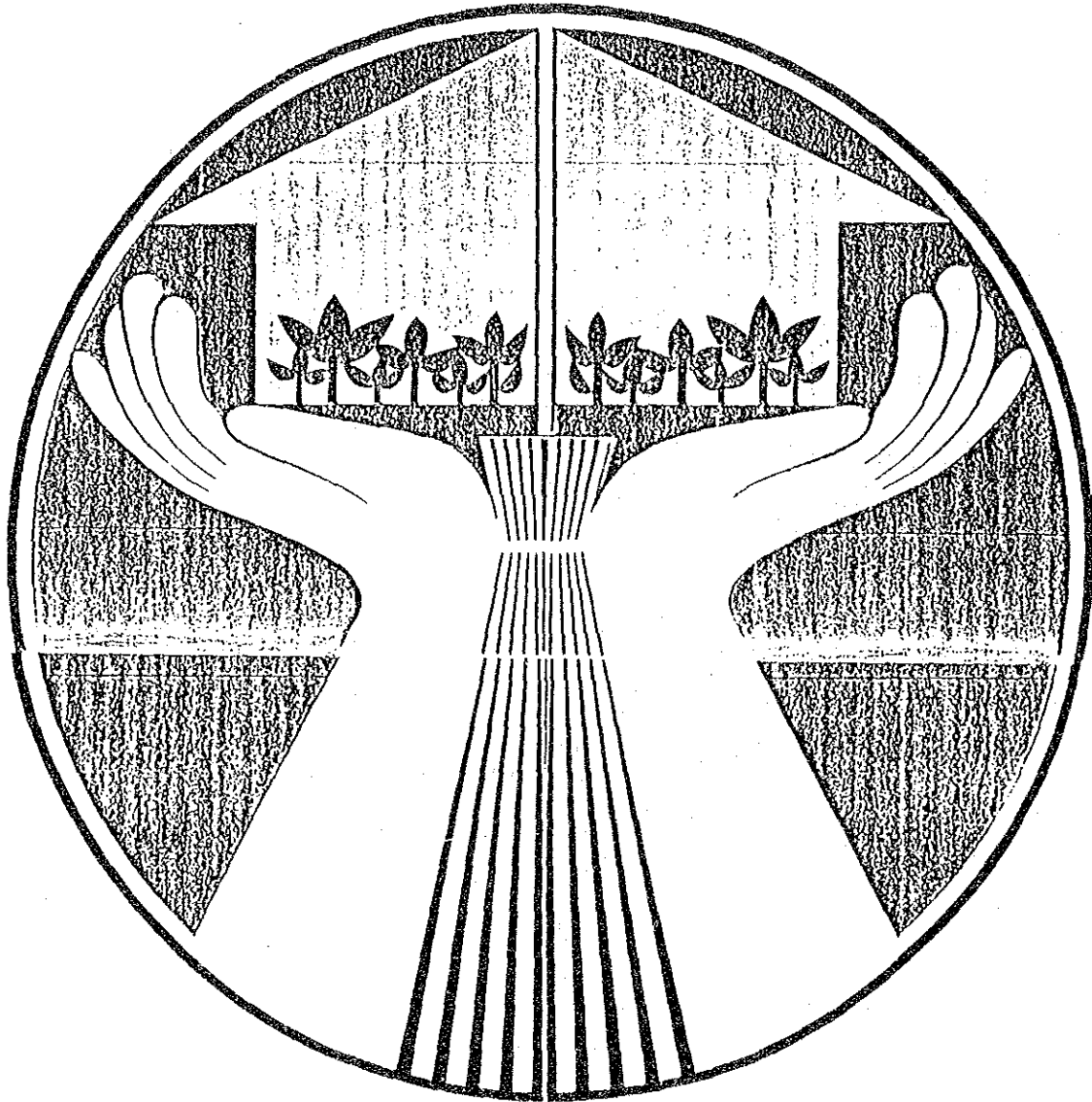
Dinas Kebersihan bersama-sama dengan Team JICA dari Jepang akan mengadakan percobaan sistim pengangkutan sampah dilingkungan ini. Diharapkan partisipasi/kerjasama dari masyarakat untuk membantu kelancaran percobaan ini antara lain dengan cara memelihara kebersihan lingkungan jalan-jalan dsbnya.



1. Periode percobaan : 14 Agustus -- 6 September 1986.
2. Hal-hal yang penting untuk mengangkut :
 - Tidak boleh buang sampah ke dalam canal.
 - Pada waktu datang mobil untuk mengangkut sampah baru, maka keluarkanlah sampah.

KEBERSIHAN ADALAH CERMIN BUDAYA BANGSA

Dengan pola penanggulangan sampah secara baik serta peran serta masyarakat akan menciptakan Jakarta yang bersih dimasa yang akan datang.



PENELITIAN TERPADU MENGENAI PENANGGULANGAN SAMPAH DI DKI JAKARTA

Selama Bulan : Agustus / September 1986
Daerah Percobaan : Kecamatan Cempaka Putih
Jakarta Pusat.

DINAS KEBERSIHAN - JICA - CIPTA KARYA

ATTACHMENT A7 TIME STUDY
DOOR TO DOOR
COLLECTION RECORD

Date	1 st Trip			2 nd Trip			Total Collection Time	Area
	Start Time	Finish Time	Time	Start Time	Finish Time	Time		
Aug 14	10:32	12:45	2:13	-	-	-	2:13	1
15	9:07	11:21	2:14	-	-	-	2:14	2
16	-	-	-	-	-	-	-	
17	-	-	-	-	-	-	-	
18	9:10	10:42	1:32	-	-	-	1:32	1
19	8:59	10:37	1:38	-	-	-	1:38	2
20	9:23	11:27	2:04	13:05	14:52	1:47	3:51	3
21	8:48	9:58	1:10	-	-	-	1:10	1
22	8:46	10:34	1:48	-	-	-	1:48	2
23	9:24	11:51	2:27	14:09	15:36	1:27	3:54	3
24								
25	8:30	10:20	1:50				1:50	1
26	8:40	10:12	1:32				1:32	2
27	9:00	11:12	2:12	12:15	13:18	1:03	3:15	3
28	8:30	10:00	1:30	12:20	13:15	0:55	2:25	1
29	8:15	10:20	2:05					2
30								
31								
1	8:10	9:57	1:47					1
2	8:57	10:20	1:23	11:07	11:32	0:27	1:50	2
3	8:37	10:54	2:17	13:11	15:09	1:58	4:15	3
average			98 min. per 1 trip collection					

DISCHARGE WAY

- A - Putting the container in front of the gate (correct way)
- B - Discharging the container just at collection
- C - Keeping the container inside premises
- D - No one in house

Date	Area	A	B	C	D
Sept 1	RW 8, RT 4 ~ 6	46 %	15 %	31 %	8 %
		61 %			
2	RW 8, RT 1 ~ 3	82 %	8 %	10 %	0 %
		90 %			
3	RW 6	67 %	11 %	21 %	1 %
		78 %			

COMMUNAL CONTAINER

COLLECTION RECORD

Date	1st Trip				2nd Trip				Total		Average
	Start	Finish	Time	Con- tai- ner	Start	Finish	Time	Con- tai- ner	Time	Con- tai- ner	Min/con- tainer
Aug 14	10:50	12:00	1:10	8	-	-	-	-	1:10	8	8.8
15	9:24	9:54		5	1:29	2:54		9	14	8.5	
16	-	-	-	-	-	-	-	-	-	-	
17	-	-	-	-	-	-	-	-	-	-	
18	9:29	10:14	0:45	5	11:00	11:32	0:32	5	1:17	10	7.7
19	9:45	10:20	0:35	4	1:08	2:20	1:12	8	1:47	12	8.9
20	10:20	11:15	0:55	8	-	-	-	-	0:55	8	6.9
21	9:13	9:52	0:39	7	-	-	-	-	0:39	7	5.6
22	9:19	10:31	1:22	8	-	-	-	-	1:12	8	9.0
23	9:20	10:30	1:10	8	-	-	-	-	1:10	8	8.8
24											
25	9:00	10:02	1:02	8					1:02	8	7.8
26	9:00	10:05	1:05	5	12:26	12:55	0:29	3	1:34	8	9.6
27	9:25	10:30	1:05	10					1:05	10	6.5
28	9:50	11:05	1:15	8					1:15	8	9.6
29	9:15	10:35	1:20	11					1:20	11	7.3
30	9:30	10:08	0:38	4					0:38	4	9.5
31											
1	9:46	11:24	1:38	7	13:30	14:18	0:48	7	2:26	14	10.9
2	10:12	11:42	1:30	8					1:30	8	11.3
3	9:49	10:48	0:59	9					0:59	9	6.6
4	9:45	11:04	1:19	9					1:19	9	8.8
average			68 min.						average		8.4

AVERAGE NET COLLECTION TIME (EXCLUDING TRIP TIME)
 (COMMUNAL CONTAINER)

Date	Net collection time (min.)	Average collection time (min.)
Aug. 18	61	6.1
19	70	5.8
20	26	3.3
21	27	3.9
22	44	5.5
23	51	6.4
Spt. 1	135	9.6
2	54	6.7
3	52	5.8
Average		5.9

HANDCART

COLLECTION RECORD

Date	Start	Finish	Time	No. of hand- cart collec- tion	Average time Min/ Handcart	Remarks
Aug 14						Trial
Aug 15						Trial
Aug 16						National Holiday
Aug 17						National Holiday
Aug 18	9:32	11:05	93	16	5.8	
Aug 19	9:20	10:20	60	15	4.0	
Aug 20	9:24	10:15	51	14	3.6	
Aug 21	9:00	9:53	53	11	4.8	
Aug 22	9:08	10:05	58	13	4.5	
Aug 23	9:14	9:55	41	12	3.4	
24						
25	9:11	10:22	71	17	4.2	
26	10:20	11:12	52	13	4.0	
27	9:07	9:50	43	11	3.9	
28	9:07	9:51	44	13	3.4	
29	9:07	9:48	41	12	3.4	
30	9:20	9:58	38	13	2.9	
31						
SEPT 1	9:11	9:54	43	14	3.1	
2	9:19	10:01	42	13	3.1	
3	9:11	9:54	43	12	3.6	
4	9:08	9:51	43	13	3.3	
Average			51min.	13.2	3.8	

ATTACHMENT A8 CALCULATION OF WASTE COLLECTED

1. DOOR TO DOOR

Pay load	2.0 ton
No. of trip per wee	8
Amount of waste per week	16.0 ton

No. of household	575
Amount of waste per day per household	4.0 kg

Population	3,055
Amount of waste per day per capita	0.75 kg

2. COMMUNAL CONTAINER

Pay load	1.3 ton
No. of trip per week	8
Amount of waste per week	10.4 ton

No. of household	508
Amount of waste per day per household	2.9 kg

Population	3,376
Amount of waste per day per capita	0.44 kg

3. HANDCART

Pay load	5.0 ton
No. of trip per week	3.8 (60 % x 5 trip + 80 % x 1 trip)
Amount of waste per week	19.0 ton

No. of household	1000
Amount of waste per day per household	2.7 kg

Population	4,526
Amount of waste per day per capita	0.60 kg

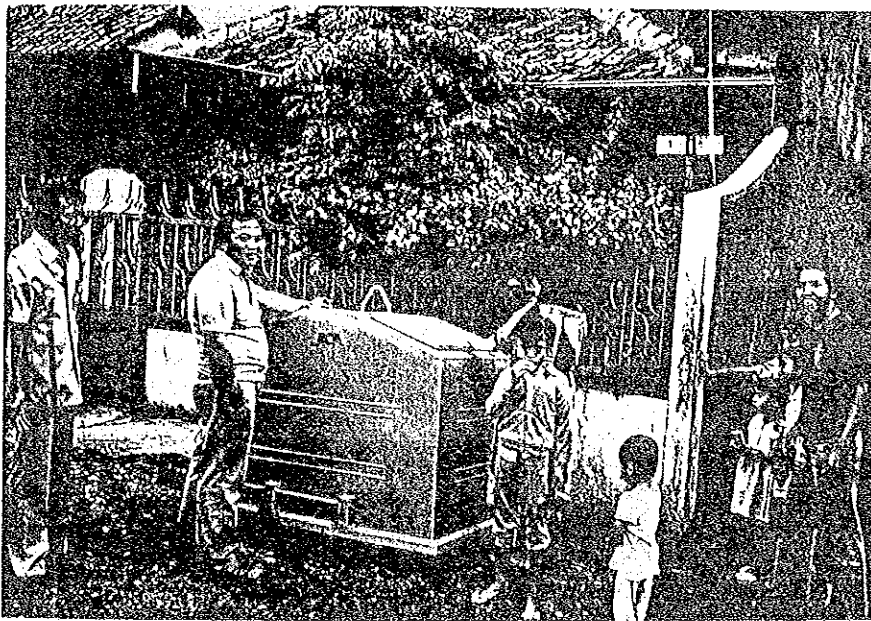
The amount of waste collected is calculated also from the handcarts collected and the same result was obtained:

Capacity	0.8 M3
Density	0.3
No. of handcart collected / day	13.2
Amount of waste per week	$0.8 \times 0.3 \times 13.2 \times 6 \text{ days} = 19.0 \text{ ton}$

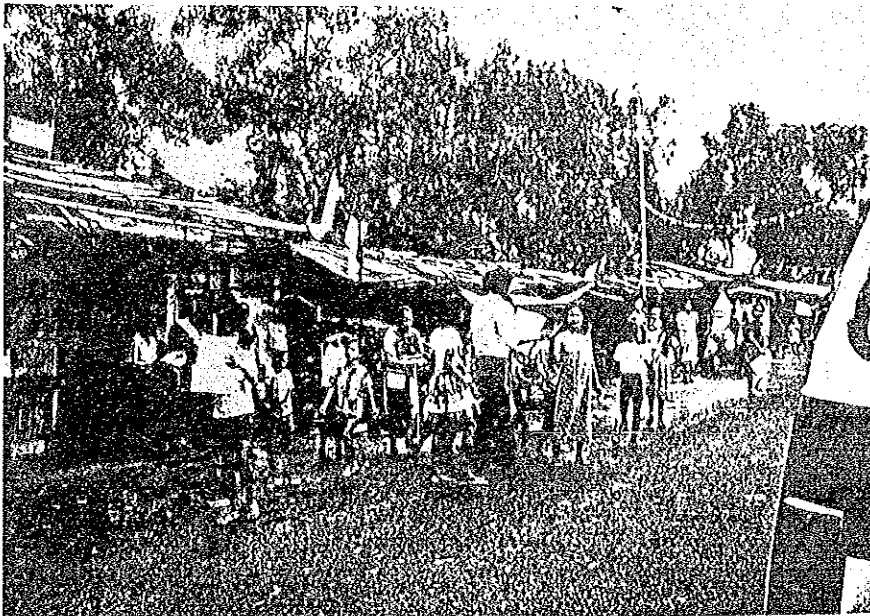
ATTACHMENT A9 PHOTOGRAPH OF THE PILOT STUDY



Campaign messages announced from the campaign car in A type area



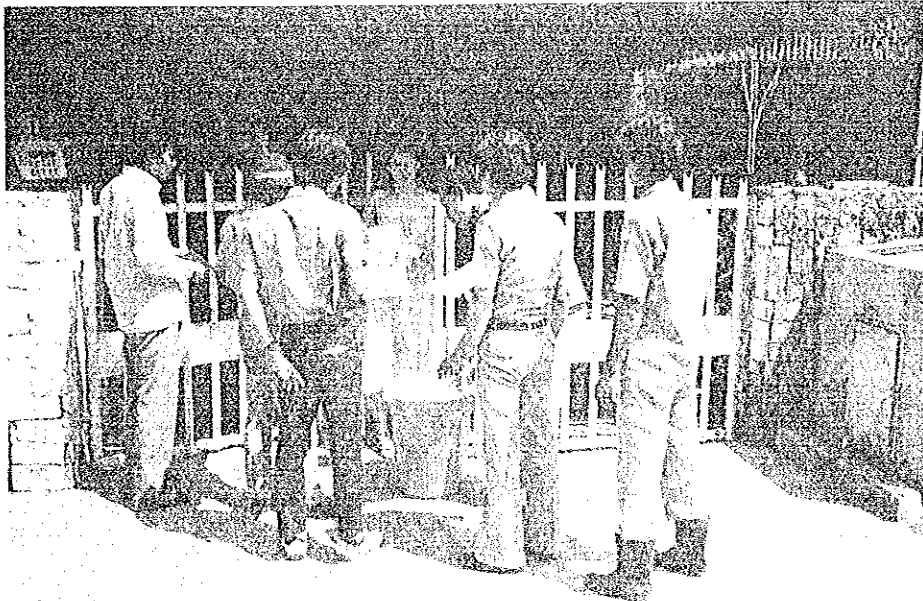
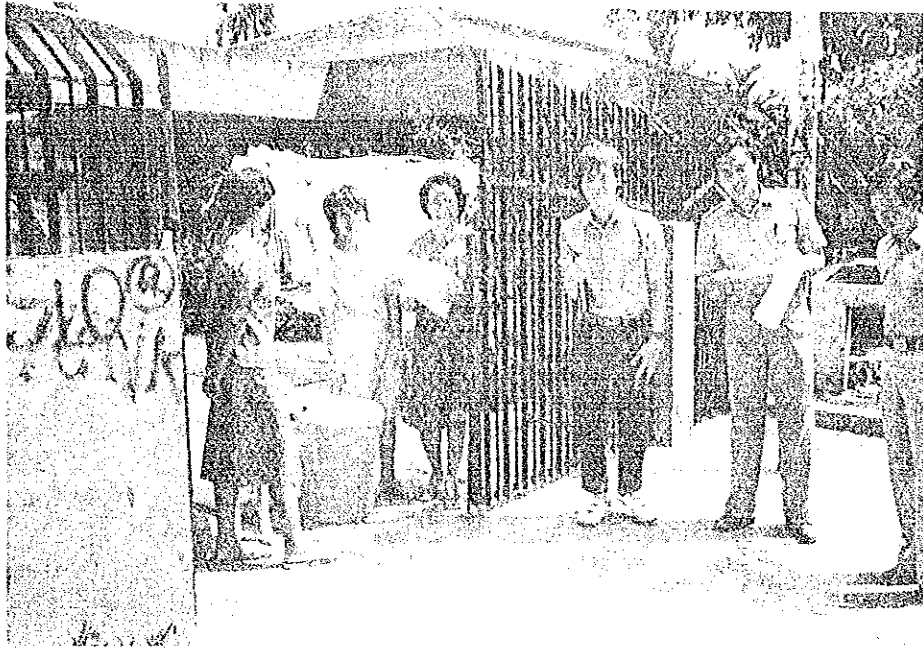
Instructions of how to discharge refuse properly are given to residents in B type area



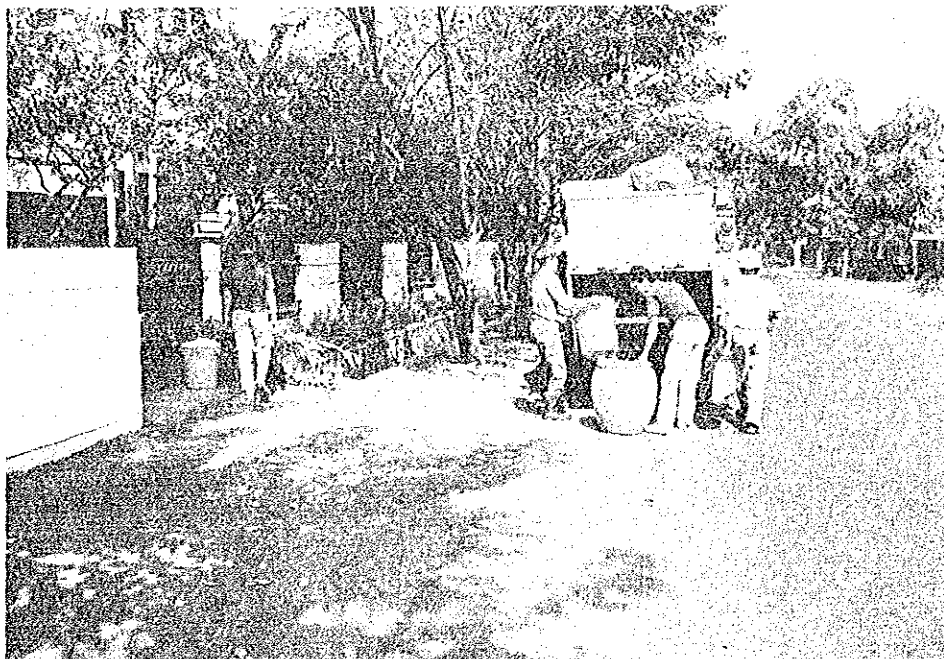
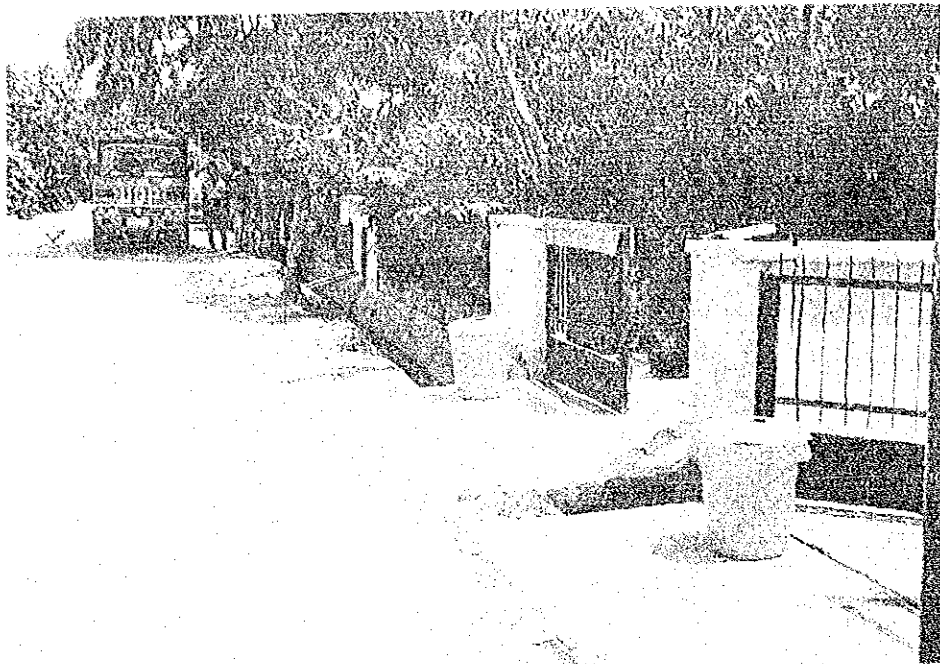
Instruction leaflets are distributed and campaign messages announced in D type area



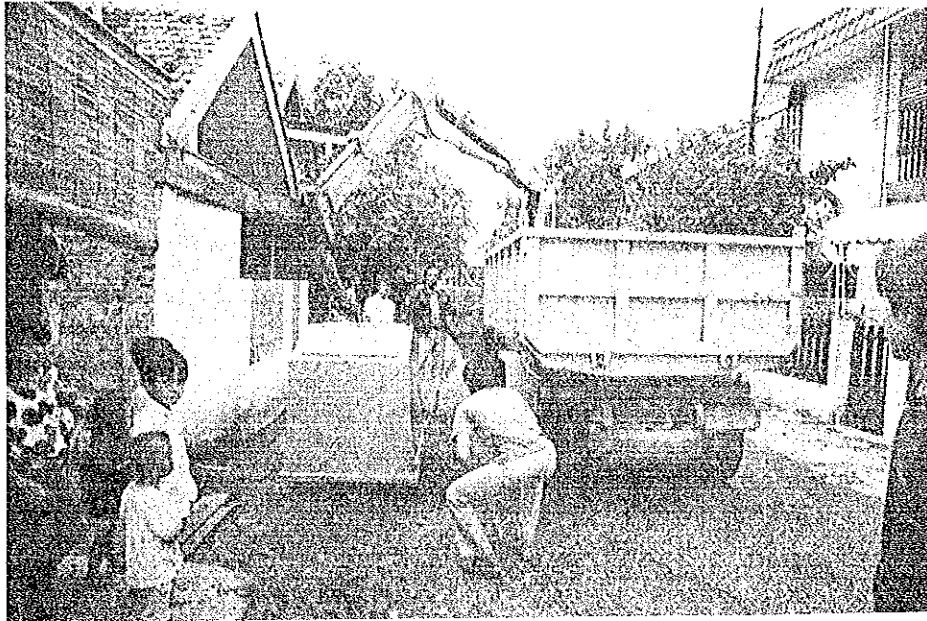
INTERVIEW TO RESIDNTS



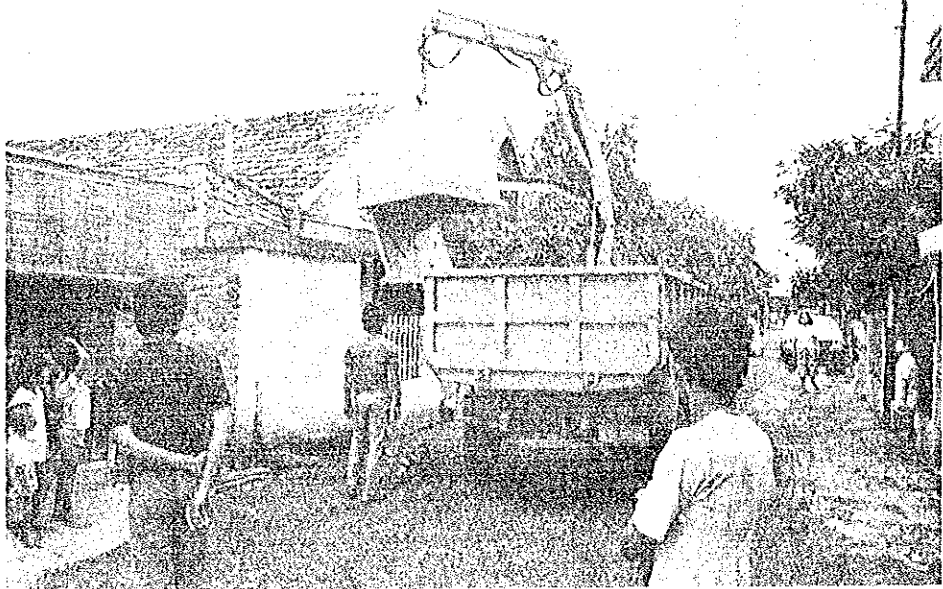
DISTRIBUTION OF PLASTIC CONTAINER AND INSTRUCTION SHEET



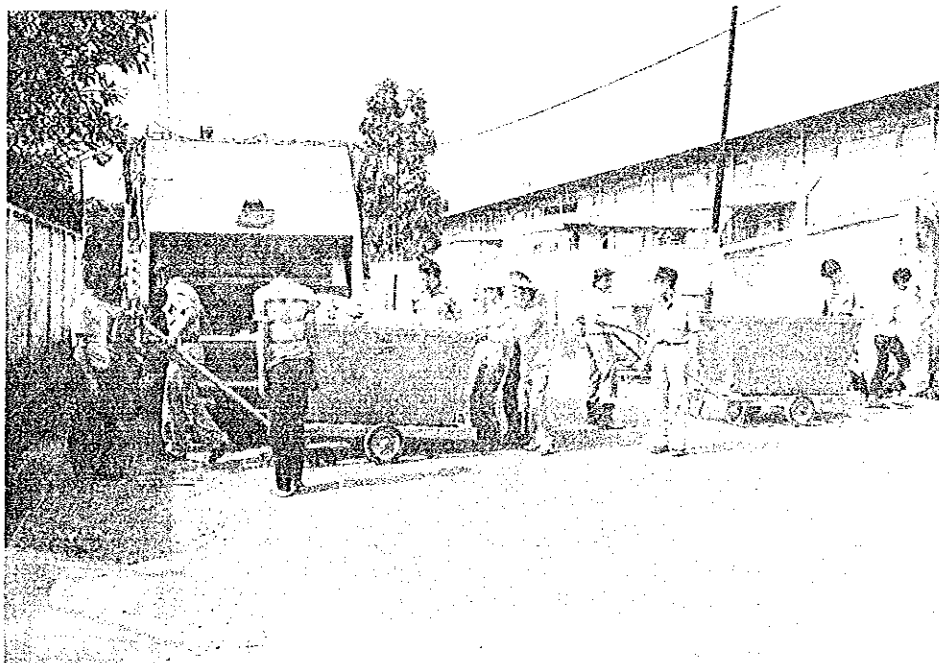
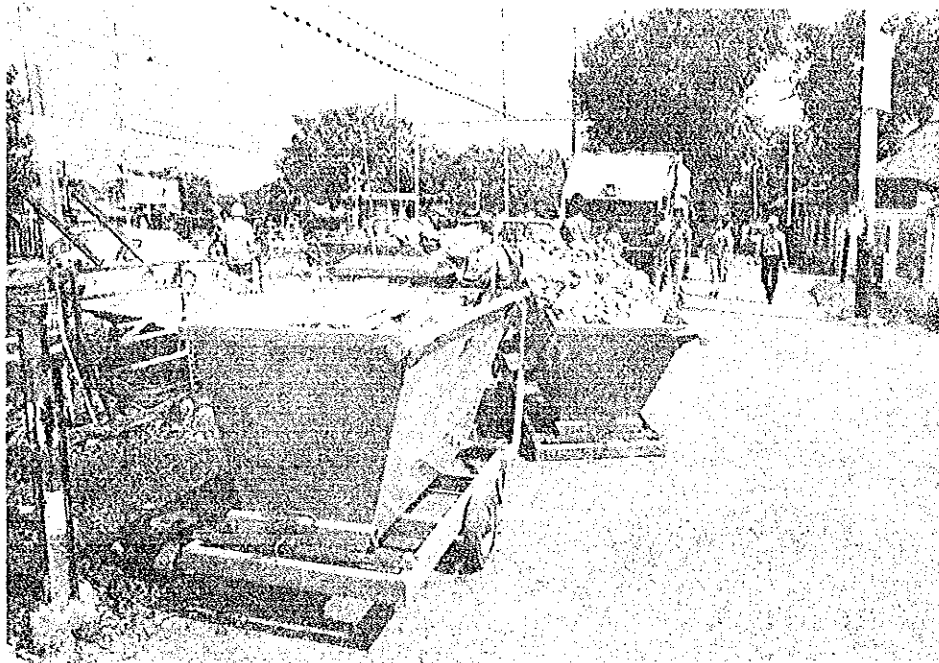
PLASTIC CONTAINER SYSTEM



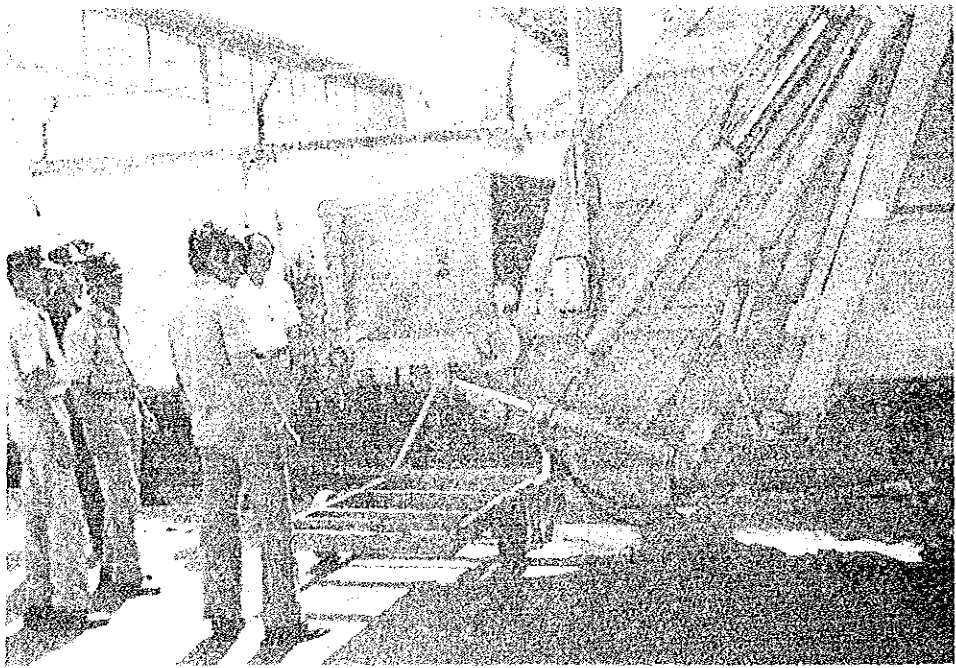
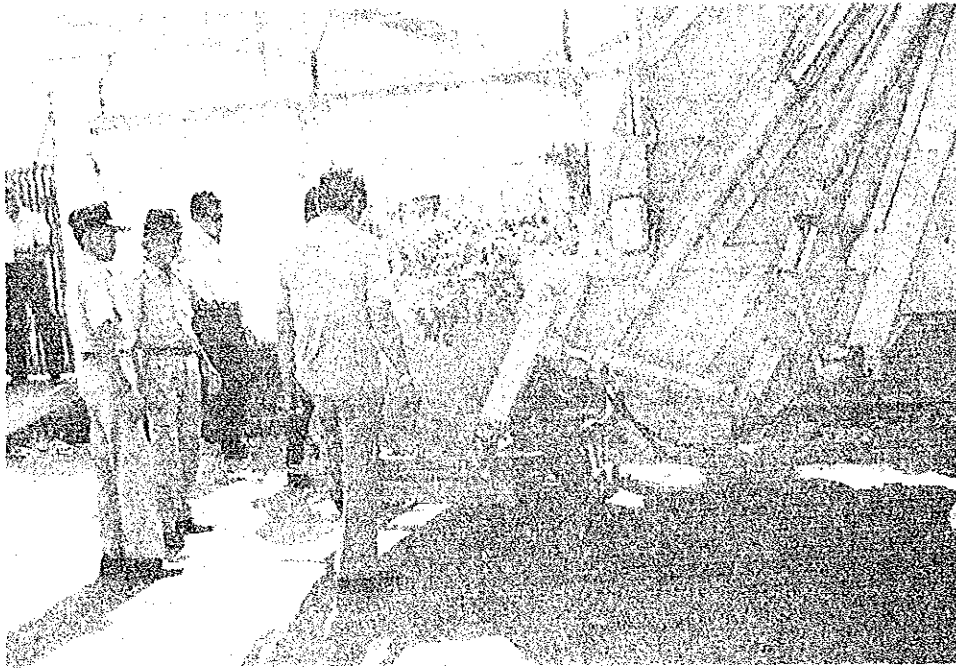
COMMUNAL CONTAINER 1



COMMUNAL CONTAINER 2



NEW TYPE HANDCART



NEW TYPE HANDCART - LOADING