Annex 2

Field Investigations

Contents

List of Tables

List of Figures

2 Field Investigations

2.1 Waste Amount and Composition Survey (WACS)

2.1.1 Objectives and Definitions

a. Objectives of the Survey

This part of the Waste Amount and Composition Survey (WACS) intends to provide an overview of the solid waste situation in the target area, based on data from sample representative sectors. The subject sectors of the study are residential, which is divided further into income groups (low, middle, and high), commercial, market, institution, street and park, which compose the cross-section of waste generators in the municipality. They are also considered the major contributors to the city's day to day waste generation.

The survey seeks to find out the types, amount and composition of wastes generated by the representative sectors. The results of the survey will be used to clarify the waste stream in the target area and to formulate an appropriate system of solid waste management, specifically in formulating effective collection and disposal systems, developing waste utilisation plans and strategies, planning multi-sectoral involvement and designing a workable mechanism for managing the system. A WACS, therefore, was carried out 2 time, first in September 1998 in order to obtain waste data for the summer season. The second survey was conducted in March 1999 in order to obtain waste data for the winter season. The average data was determined by using both survey results.

b. Definition of Waste

For purposes of the WACS and waste stream, the words used in the Study are defined as follows.

b.1 Household Waste

Also referred to as residential waste, this category comprises wastes that are the consequence of household activities such as food preparation, sweeping, cleaning, gardening, etc.

b.2 Commercial Waste

The category of waste in this category is divided into 2 sub-sectors. The first sub-sector is waste discharged from catering business like restaurant and food shop. The second is waste from other commercial shops such as stationery, book store, electric appliance shop, etc. The wastes from the latter are mainly discharged through commercial activities.

b.3 Market Waste

Waste generated in or discharged from markets both from fixed place market, mobile market (pazar) and wholesale market.

b.4 Institutional Waste

Government offices, state enterprises, banks, private offices are included in this category. Generally, this category involves a large portion of paper from daily office work.

b.5 Street Sweeping Waste

This category of waste includes all waste generated by the street sweeping cleansing service.

b.6 Park Waste

Park waste includes all waste generated by the park cleansing and maintenance activities. This category of waste always includes grass and wood.

b.7 Bulky Waste

Abandoned bulky waste components such as old furnishings and vehicles which are thrown away from the above-mentioned sources, is considered as bulky waste in the Study.

b.8 Other Wastes

Other wastes in the Study refers to the wastes which are disposed of at the present disposal site in the target area. This category of wastes includes direct hauled wastes by the industry and municipal waste (MSW) from municipality other than those in the target area.

2.1.2 Method of the Survey

a. Methodology

This survey totally selected 79 sampling points from each representative sectors in order to obtain the waste amount discharge ratio by generation source. The initial stage of the study was made through discussion between Turkish side and the study team to select sampling areas for each category. The sampling points are summarised in Table 2-1.

Table 2-1: Generation Source and Number of Waste Sample

Generation Source		Area	Samples Per Area	Samples Per Day	Survey Days	Total Samples
Residential (by income)	High	4	5	20	7	140
	Middle	4	5	20	7	140
	Low	4	5	20	7	140
Commercial Area	Restaurant	1	5	5	7	35
	Other Shop	1	5	5	7	35
Market		2	1	2	7	14
Institution		1	5	5	7	35
Street		1	1	1	7	7
Park		1	1	1	7	7
Total				79		553

b. Selection of Sampling Points for WACS

b.1 Household Waste

As described in the above-mentioned section, *Objectives and Definitions*, the household waste sector is further divided into the following income groups;

- household waste generated at high income residential areas
- household waste generated at middle income residential areas
- household waste generated at low income residential areas

For the residential sector, 11 *mahalles* (sub-district) in Adana and 9 *mahalles* in Mersin were chosen to represent the income groups in both cities. The classification of these income areas is also used for the Public Opinion Survey (POS).

b.2 Commercial Waste

Commercial waste is categorised as restaurant waste and shop waste, as waste from these two commercial establishments quite differs in terms of amount and composition. The sampling area for commercial waste was selected from each greater municipality.

b.3 Market Waste

Regarding market waste, mobile market (*pazar*) was chosen for sampling because these were clearly clarified to be representative of main typical markets in the target area. Therefore, mobile markets in Adana and Mersin had been selected as many as possible for survey.

b.4 Institutional Waste

The institutional sector was represented by municipal office, state enterprises and private offices in selected areas from each greater municipality.

b.5 Street Sweeping Waste

A street in each greater municipality was selected as sampling point to represent street sweeping waste data.

b.6 Park Waste

In order to obtain data for park cleaning activities, a park has been selected as sampling point for WACS in each greater municipality.

c. Method of Waste Amount Survey

The WACS in both seasons was conducted for eight days. It was necessary that sampling be conducted for a duration of eight days getting only the data of the seven consecutive sampling days minus the first day generation, assuming the first day may have some waste accumulated on the previous days. The first day was also used to familiarise the participating sectors and the study team personnel on the collection of the sampling.

Before the execution of the survey, the required number of plastic bags were distributed to all selected sampling points except market waste. Samples discharged from markets were collected by a collection vehicle specially assigned to the project.

All of collected waste from sampling points by using plastic bag was bound with colour string according to the generation sources, so that there no intermingling of the samples would result. Then, the amount of waste was measured at the collection point by weighing plastic bags containing samples with a spring balance and recorded in waste amount recording sheet.

For market waste which transported by truck, the collection truck was measured by weighbridge before going to disposal site for waste composition analysis.

d. Method of Waste Composition Survey

After transporting wastes from all samples to sorting place, waste samples from each representative sector were gathered and mixed together. Then, the volume of the mixture of waste was reduced through the reducing method described below until the volume became 20-30 litters, as shown in Figure 2-1.

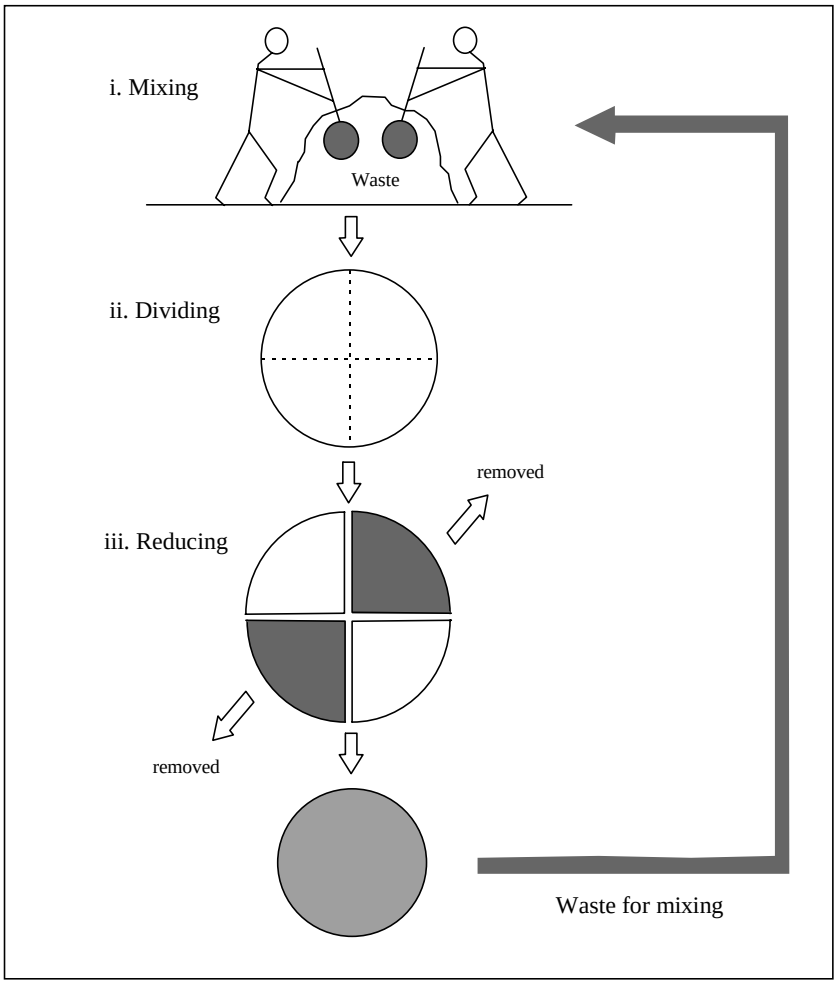

Figure 2-1: Waste Reduction Method

The above method continued until the volume of the remaining waste was reduced to the amount designated for the waste composition analysis (20-30 lit.). Then, the waste

was loaded into a plastic bucket. The plastic bucket containing the wasted was tapped three times from a height of 30 cm. to the ground, then the volume was measured visually and the total weight by a platform balance.

The Apparent Specific Gravity (ASG) was calculated through the following formula.

$$ASG = \frac{\text{Weight of Waste (kg)}}{\text{Volume of Waste (lit.)}}$$

Then, the physical composition of waste was sorted into the following 10 items:

- kitchen waste
- paper
- textile
- grass and wood
- plastic
- leather and rubber
- metal
- bottle and glass
- ceramic and stone
- miscellaneous (soil, etc.)

The results of the physical composition are presented as percentages.

e. Period and Schedule of the Survey

The survey was conducted 2 times for summer and winter as shown in Table 2-2.

Table 2-2: Survey Period of the WACS

Items	Survey Period			
	Adana		Mersin	
	Summer	Winter	Summer	Winter
Delivery of plastic bags and instruction papers	Sep. 6th	Mar. 1st	Sep. 21st	Mar. 15th
Waste collection from each generation source	Sep. 7th-Sep. 14th	Mar. 2nd-Mar. 9th	Sep. 22nd-Sep. 29th	Mar. 16th-Mar. 23rd
Waste amount and composition survey	Sep. 8th-Sep. 15th	Mar. 3rd-Mar. 10th	Sep. 23rd-Sep. 30th	Mar. 17th-Mar 24th

2.1.3 Results of the Survey

a. Waste Amount

a.1 Household Waste

Before WACS was conducted, the study's assistants had explained to each sampling point to discharge all of wastes including recyclable materials to plastic bags provided by the study team. However, during WACS period in summer season, the study team observed waste collected from sample representative sectors and noticed that

recycling items such as newspaper, magazine, aluminium can, glass bottle, etc. were hardly found in waste samples. This outcome may due to sampling points usually accustomed to do recycling as their daily life. For example, used newspaper and magazine will be deposited in a place until getting enough amount then they are sold to middleman or gave to someone.

This observation was confirmed by the study team to sampling points of WACS when starting the second phase of the study. Therefore, all waste stream components were modified and estimated according to this observation and both survey results. **From this observation, the study team adopted the results of WACS as discharge ratio.** The generation ratio was estimated by adding recycling amount to discharge amount.

Based on this description, the summary results of the waste amount survey both in summer and winter is tabulated in Table 2-3.

Table 2-3: Household Waste Discharge Ratio in the Target Area

unit : g/person/day

Discharge Source	Discharge Ratio					
	Adana			Mersin		
	Summer	Winter	Average	Summer	Winter	Average
High Income	509	512	511	461	499	480
Middle Income	444	484	464	473	480	477
Low Income	470	479	475	386	395	391

a.1.1 Adana

The average discharge ratio of solid waste in both season in all income levels, namely: high income, middle income and low income differs by different socio-economic groupings. The average discharge ratio in both season was 511 g/person/day for high income, 464 g/person/day for middle income, and 475 g/person/day for low income.

Due to the fact that most of the residents in the study are living in apartments or condominiums, household waste hardly contains garden waste. Accordingly, the waste discharge ratio in the target area is low.

a.1.2 Mersin

The outcome of WACS in both seasons shows that waste discharge ratio varies by income level. It goes without saying therefore that high income and middle income areas have higher waste discharge ratios. The average discharge ratio in both season is 480 g/person/day in high income areas, 477 g/person/day in middle income areas, and 391 g/person/day in low income areas.

a.2 Commercial, Market, Institutional, Street Sweeping and Park Waste

The results of the waste amount survey in both greater municipalities are shown in the following table.

Table 2-4: Discharge Ratio of Other Types of Waste

Items	Unit	Discharge Ratio					
		Adana			Mersin		
		Summer	Winter	Average	Summer	Winter	Average
Commercial Waste (Restaurant)	g/table/day	1,110	930	1,020	1,451	1,345	1,398
Commercial Waste (Other Shop)	g/shop/day	1,033	1,326	1,180	840	1,283	1,062
Market Waste	g/stall/day	6,300	5,500	5,900	8,700	12,400	10,550
Institutional Waste	g/person/day	129	154	142	72	53	63
Street Sweeping Waste	g/km/day	72,063	69,302	70,683	40,457	27,238	33,848
Park Waste	g/m^2/day	3	4	4	1	1	1

a.2.1 Adana

For restaurants, the average waste discharge ratio in both season is 1,020 g/table/day while other shops generate an average of 1,180 g/shop/day.

The average discharge ratio in market, institutional, street sweeping and park wastes for both season is 5,900 g/stall/day, 142 g/person/day, 70,683 g/km/day and 4 g/m^2/day, respectively.

a.2.2 Mersin

The average discharge ratio of waste generated by restaurants and shops in both season is 1,398 g/table/day and 1,062 g/shop/day, respectively.

The average discharge ratio of market, institutional, street sweeping and park wastes is 10,550 g/stall/day, 63 g/person/day, 33,848 g/km/day and 1 g/m^2/day, respectively.

2.1.4 Waste Stream in Adana

a. Waste Discharge Amount

a.1 Household Waste

The results of the WACS and data obtained from both greater municipalities regarding population by income level are shown in Table 2-5.

Table 2-5: Population by Income Level & Household Waste Discharge Ratio

unit: g/person/day

Item	Population by Income Level	Discharge ratio	
		Adana	Mersin
High Income Household	9%	511	480
Middle Income Household	47%	464	477
Low Income Household	44%	475	391
Weight Average		473	439

Adana Greater Municipality acknowledged the study team to adopt percent of population by income level provided by Mersin's counterpart to calculate the weight average in Adana. Hence, a weight average of discharge ratio in Adana was calculated as shown below:

$$511 \times 0.09 + 464 \times 0.47 + 475 \times 0.44 = 472.80 \text{ or } 473 \text{ g/person/day}$$

The generation ratio of household waste in target area, 473 g/person/day for Adana and 439 g/person/day for Mersin, was less in comparison with those of the other countries as shown in Table 2-6. As explained before, this due to the housing style of the target area is mainly apartments or condominiums. Therefore, wastes from some activities such as sweeping, cleaning, gardening, etc. were lack from daily waste discharge.

Table 2-6: Comparison of Generation of Household Waste in the Study Area and Other Study

Country	City	Year	Population	Household waste (g/person/day)	MSW (g/person/day)
Tanzania*1	Dar es Salaam	1996	2,030,230	698	916
Nicaragua*2	Managua	1994	834,427	664	798
Paraguay*3	Asuncion	1993	506,445	961	1,312
Poland*4	Poznan Lublin	1992 1992	590,500 352,500	654 400	769 508
Laos*5	Vientiane	1991	142,700	753	987
Malaysia*6	Pulau Pinang	1988	559,300	504	640

Source : *1 The Study on Solid Waste Management for Dar es Salaam City in the United Republic of Tanzania, Progress Report (2), August 1996
*2 The Study on the Solid Waste Management System of the City of Managua, Final Report, May 1995.
*3 The Study on the Solid Waste Management for the Metropolitan Area of Asuncion in the Republic of Paraguay, Progress Report (2), March 1994.
*4 The Study on the Solid Waste Management for Poznan City, the Republic of Poland, Final Report, May 1993.
*5 The Study on the Solid Waste Management System Improvement Project in Vientiane, Lao People's Democratic Republic, Final Report, August 1992.
*6 The figure is not generation ratio but disposal amount from "Solid Waste Management Study for Pulau Pinang and Seberang Perai Municipalities, Final Report, August 1989"

Therefore, the total household waste discharge amount was calculated by multiplying the weight average by the number of population in the target area. The number of population in Adana that applied for waste stream calculation is described in 1.2.4, *Population.*

a.2 Commercial, Market, Institutional, Street Sweeping and Park Waste

The total waste generation amount of other categories than household waste were calculated by multiplying discharge ratio of each category by the number of units of that category. All results of these amounts were then summed to get the total waste discharge amount as shown in Table 2-7.

Table 2-7: Daily Waste Discharge Amount in Adana (1999)

Discharge Source	Unit	Number of Discharge Source	Discharge Ratio	Daily Discharge Amount (ton/day)
Household Waste	g/person/day	1,196,620	473	566
Commercial Waste (Restaurant)	g/table/day	77,790	1,020	79
Commercial Waste (Other Shop)	g/shop/day	70,000	1,180	83
Market Waste	g/stall/day	2,407	5,900	14
Institutional Waste	g/person/day	53,813	142	8
Street Sweeping Waste	g/km/day	718	70,683	51
Park Waste	g/m^2/day	600,000	4	2
Total				803

b. Bulky Waste

From results of POS, nearly half of samplings (40%) discharged bulky waste by push cart while another 10% were collected by regular collection. However, from the observation of the study team at present landfill, bulky waste items such as furniture, electric appliance, old vehicle, etc. have never been found at the time being. This outcome may due to most of bulky wastes were recycled by someone to reused it. Therefore, the study team considered amount of bulky waste is negligible.

c. Self-disposed Waste Amount

The outcome of POS stated that 3% of samplings have not received collection service. Among these people (no refuse collection service), 33% of samplings disposed their waste by themselves such as burned/buried in their premises or vacant lot. The questionnaire results to all of sampling points for WACS and POS were used to determine the amount of household waste disposed by self-disposal method.

The study team calculated self-disposed waste amount in Adana as shown below:

$$1{,}196{,}620 \times 0.03 \times 0.33 \times 473 \times 10^{-6} = 5.6 \text{ or } 6 \text{ ton/day}$$

d. Illegally Dumped Waste Amount

From the observation of the study team, illegally dumped waste was found in the target area even it was rarely seen. As same as the method to estimate self-disposed wasted amount, the questionnaire results to all of sampling points for WACS and POS were used as tools to find amount of illegal dumping waste amount in the target area.

In case of Adana, 50% among total 3% of POS's samples which have not received collection service clarified that they dumped their waste in the vacant lot. Therefore, the study team calculated amount of illegally dumped waste amount as shown below:

$$1{,}196{,}620 \times 0.03 \times 0.5 \times 473 \times 10^{-6} = 8.5 \text{ or } 9 \text{ ton/day}$$

e. Collected Waste Amount

Weighbridge at the disposal site in Sofulu has been completely installed by the study team. During daily weighbridge operation, a record on the number of trips, type of

vehicle, type of waste, waste amount, vehicle ownership and direct haulage vehicle is recorded around the clock. Therefore, collected waste amount for Adana has been obtained from weighbridge data. The results are summarised and presented in the following table.

Table 2-8: Summary Results of DWAS at Sofulu Landfill Site

Type of Waste	Solid Waste Generation Area	Responsible Organisation	Waste Amount Collection (t/d)
Municipal Solid Waste	Adana	AGM	2
		Seyhan Municipality	546
		Yuregir Municipality	231
	Other Municipalities		12
	Sub-total		791
Medical Solid Waste	Adana	AGM	-
		Seyhan Municipality	4.4
		Yuregir Municipality	
		Private	-
	Other Municipalities		-
	Sub-total		4
Industrial Solid Waste	Adana	AGM	-
		Seyhan Municipality	-
		Yuregir Municipality	-
		Private	9
	Other Municipalities		-
	Sub-total		9
Total			804.4

From the table it is seen that collected waste amount is estimated at 779 ton/day. The breakdowns of waste amount collection for municipal solid waste in Adana GM by AGM, Seyhan and Yuregir Cleansing Departments are 2 ton/day, 546 ton/day and 231 ton/day respectively.

f. Recycled Waste Amount

Recycling activity is concerned with many parts of waste stream, from discharge source, collection and final ending at final disposal site. In order to obtain data for recycled waste amount in each part concerned in waste stream, many efforts have been done by the study team to access data with all related parties. Discharge sources, street waste pickers, scavengers at dumpsite, middlemen and final users have been interviewed by the study team. The outcome from the survey is concluded as the following table.

Table 2-9: Daily Recycled Waste Amount in Adana

Recycling Source	Ton/Day
Generation Sources	25
Street Waste Pickers	15
Scavengers at the Sofulu Dump Site	9

g. Final Disposal Amount

Estimation of final disposal amount is calculated from data on collected waste amount, other wastes and recycled amount at disposal site. In conclusion, the study team assumed final disposal amount at 793 ton/day.

h. Other Wastes

As can be observed from the Table 2-8, Sofulu, the disposal site, is not only serving municipal waste from the target area but also receiving medical waste, industrial waste from Adana even municipal wastes from other municipalities. Medical waste from Adana has been collected totally 4.4 ton/day. Industrial waste in Adana is transported and disposed by private sector 9 ton/day. Municipal waste from other municipalities is also dumped at Sofulu 12 ton/day.

In conclusion, the study team concluded other waste amount is 25.4 ton/day.

i. Waste Stream in Adana

In final conclusion, the waste stream is tabulated in Table 2-10.

Table 2-10: Waste Stream in Adana

Waste Stream Component	Ton/Day
Waste Generation Amount	834
Recycling by Discharge Source	25
Discharge Amount	803
Self-Disposed Amount	6
Recycling by Street Waste Pickers	15
Waste Collection Amount	780
Illegally Dumped Waste Amount	8
Recycling by Scavengers	9
Other Wastes	25
Final Disposal Amount	796

2.1.5 Waste Composition Analysis for Adana

a. Physical Composition

The results of the waste composition survey in summer and winter season are summarised in Table 2-11. Average results of waste composition survey from both seasons and MSW are tabulated in Table 2-12.

a.1 Household Waste

The characteristics of the composition of the household waste in both seasons are described as follows;

- Kitchen waste in all generation sources of household waste is the most dominant constituent which occupies 67-80% of the composition in both season. This may due to housing style in the target area is mainly apartment and food consumption style of people who take a lot of vegetables and fruits. In

addition, the use of package for selling is not so popular in the target area. Therefore, waste from kitchen for food preparation shares much more than the other types of waste. On the other hand, waste from another activities such as sweeping, cleaning and gardening is quite less. From results of WACS in both season, average ratio of kitchen waste occupies about 74% for high income and middle income household and 77% for low income household. The weight average of kitchen waste for household waste is 75%.

- Paper and plastic constitute the second and third large percentages of waste in household waste. The average result from both season shows that high income, middle income discharge paper 11% while low income 7%.
- Plastic is also the main component for household waste which occupies 6% for high income and 5% for middle income and low income household.

a.2 Commercial Waste

The average composition result of commercial waste in both season is as follows:

- Kitchen waste occupies about 70% of waste from restaurant.
- Paper occupies about 48% of waste from “other shops”.

a.3 Market Waste

- Kitchen waste constitutes 81% while paper and ceramic and stone constitute 5% and 4% respectively for market waste.

a.4 Institutional Waste

- Paper is the main component for institutional waste which occupies about 57%.

a.5 Street Sweeping Waste

- Overall, miscellaneous is the most common constituent of street sweeping waste, occupying 47% of the street sweeping waste.

Table 2-11: Results of the Waste Composition Survey in Summer and Winter Season for Adana GM

Classification				Household				Commercial		Market	Institution	Street Sweeping	Park
				High Income	Middle Income	Low Income	Weight Average	Restaurant	Other Shop				
Result in Summer													
Physical Composition (Wet Base)	Apparent Specific Gravity (ASG)		Kg/l	0.31	0.29	0.33	0.31	0.47	0.05	0.42	0.08	0.16	0.07
	Combustible Wastes	Kitchen Waste	(%)	67.29	72.25	76.15	73.52	70.40	8.38	72.77	25.35	1.75	0.00
		Paper	(%)	12.63	13.85	7.82	11.09	21.56	58.12	8.02	57.50	3.38	0.22
		Textile	(%)	2.58	2.15	3.28	2.69	0.66	3.03	0.62	0.88	0.33	0.00
		Grass and Wood	(%)	1.39	1.65	2.94	2.19	0.17	7.84	1.63	1.01	12.77	68.93
		Plastic	(%)	8.31	6.14	6.48	6.48	1.80	9.80	1.97	5.93	4.26	0.22
		Leather and Rubber	(%)	1.25	0.29	0.08	0.28	0.25	0.71	0.49	0.00	0.22	0.00
		Sub-total	(%)	93.45	96.33	96.75	96.26	94.84	87.88	85.50	90.67	22.71	69.37
	Incombustible Wastes	Metal	(%)	1.97	0.47	0.50	0.62	1.08	3.92	0.00	3.03	3.93	0.66
		Bottle and Glass	(%)	2.26	2.73	1.52	2.16	3.04	5.17	0.67	4.16	0.87	0.22
		Ceramic and Stone	(%)	2.32	0.47	1.10	0.91	1.04	0.00	7.24	0.00	15.94	9.63
		Miscellaneous	(%)	0.00	0.00	0.13	0.06	0.00	3.03	6.59	2.14	56.55	20.13
		Sub-total	(%)	6.55	3.67	3.25	3.74	5.16	12.12	14.50	9.33	77.29	30.64
	Total		(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Result in Winter													
Physical Composition (Wet Base)	Apparent Specific Gravity (ASG)		Kg/l	0.28	0.24	0.39	0.31	0.34	0.06	0.31	0.08	0.26	0.29
	Combustible Wastes	Kitchen Waste	(%)	80.90	76.50	77.97	77.54	70.80	29.15	90.95	34.05	6.77	5.72
		Paper	(%)	10.54	10.08	6.78	8.67	16.38	39.07	2.36	57.09	9.30	3.94
		Textile	(%)	0.17	0.91	0.92	0.85	0.33	1.67	0.99	0.38	1.55	0.28
		Grass and Wood	(%)	0.41	1.03	1.19	1.04	0.69	0.96	1.33	0.63	15.84	17.39
		Plastic	(%)	3.87	5.72	5.06	5.26	1.65	16.13	1.33	5.95	1.55	1.39
		Leather and Rubber	(%)	0.10	0.41	0.20	0.29	0.05	0.48	0.08	0.51	0.19	0.06
		Sub-total	(%)	95.99	94.65	92.12	93.66	89.90	87.46	97.04	98.61	35.20	28.78
	Incombustible Wastes	Metal	(%)	0.24	0.45	0.48	0.44	1.73	9.92	0.08	0.63	1.63	0.67
		Bottle and Glass	(%)	3.76	3.62	5.59	4.50	1.42	2.63	0.38	0.00	1.59	0.56
		Ceramic and Stone	(%)	0.00	1.28	1.74	1.37	0.08	0.00	2.28	0.00	22.72	14.61
		Miscellaneous	(%)	0.00	0.00	0.07	0.03	6.87	0.00	0.23	0.76	38.87	55.39
		Sub-total	(%)	4.00	5.35	7.88	6.34	10.10	12.55	2.97	1.39	64.81	71.23
	Total		(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 2-12: Average Results of Waste Composition Survey from Both Seasons in Adana GM

Classification				Household				Commercial		Market	Institution	Street Sweeping	Park	MSW*[1]	Whole MSW*[2]
				High Income	Middle Income	Low Income	Weight Average	Restaurant	Other Shop						
Physical Composition (Wet Base)	Apparent Specific Gravity (ASG)		Kg/l	0.30	0.27	0.36	0.31	0.41	0.06	0.37	0.08	0.21	0.18	0.29	0.29
	Combustible Wastes	Kitchen Waste	(%)	74.09	74.37	77.05	75.53	70.59	18.76	81.84	29.70	4.26	2.86	68.54	64.41
		Paper	(%)	11.58	11.96	7.30	9.88	18.96	48.59	5.19	57.29	6.34	2.08	15.39	14.80
		Textile	(%)	1.38	1.53	2.10	1.77	0.50	2.35	0.81	0.63	0.94	0.14	1.67	1.62
		Grass and Wood	(%)	0.90	1.34	2.07	1.62	0.43	4.40	1.48	0.82	14.31	43.15	1.79	2.66
		Plastic	(%)	6.09	5.93	5.77	5.87	1.73	12.96	1.65	5.94	2.91	0.81	6.14	5.92
		Leather and Rubber	(%)	0.68	0.35	0.14	0.29	0.15	0.60	0.29	0.26	0.21	0.03	0.31	0.30
		Sub-total	(%)	94.72	95.48	94.43	94.96	92.36	87.66	91.26	94.64	28.97	49.07	93.84	89.71
	Incombustible Wastes	Metal	(%)	1.11	0.46	0.49	0.53	1.41	6.92	0.04	1.83	2.78	0.67	1.31	1.40
		Bottle and Glass	(%)	3.01	3.18	3.56	3.33	2.23	3.90	0.53	2.08	1.23	0.39	3.21	3.08
		Ceramic and Stone	(%)	1.16	0.88	1.42	1.14	0.56	0.00	4.76	0.00	19.32	12.12	1.01	2.17
		Miscellaneous	(%)	0.00	0.00	0.10	0.04	3.44	1.52	3.41	1.45	47.70	37.75	0.63	3.64
		Sub-total	(%)	5.28	4.52	5.57	5.04	7.64	12.34	8.74	5.36	71.03	50.93	6.16	10.29
	Total		(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note:

*[1] Waste Composition of MSW is calculated from composition ratio multiplied total amount of waste in each category (except street sweeping and park wastes) divided by total amount of waste generation.

*[2] Waste Composition of Whole MSW is calculated from composition ratio multiplied total amount of waste in each category divided by total amount of waste generation

a.6 Park Cleansing Waste

- The garden waste, which consists of grass/wood and miscellaneous, occupies about 80% of the park cleansing waste.

b. Apparent Specific Gravity (ASG)

ASG of household wastes ranged from 0.27 to 0.36, and the weight average was 0.31. ASG of the other wastes than household ranged from 0.06 to 0.41.

c. Chemical Analysis

The results of chemical analysis for middle income household and market wastes are shown in Table 2-13 and Table 2-14 respectively.

Table 2-13: Results of Chemical Analysis for Middle Income Household in Adana

unit : %

Classification for Chemical Analysis		Middle Income Household						
		Three Contents				Ultimate Analysis		
		Combustible	Moisture	Ash	Total	Carbon	Nitrogen	C/N Ratio
RESULT IN SUMMER								
Combustible Waste	Kitchen waste	15.13	79.73	5.15	100	29.68	1.85	16.04
	Paper	42.80	56.69	0.52	100	32.69	1.11	29.45
	Textile	40.78	58.58	0.64	100			
	Grass and Wood	41.16	58.21	0.63	100	24.65	1.61	15.31
	Plastic	55.38	41.72	2.90	100			
	Rubber and Leather	N/A*	N/A*	N/A*				
Non-combustible Waste	Metal		N/A*					
	Bottle and Glass		1.68					
	Ceramic and Stone		29.57					
	Miscellaneous		N/A*					
RESULT IN WINTER								
Combustible Waste	Kitchen waste	14.39	79.84	5.78	100	25.46	1.54	16.53
	Paper	35.26	56.35	8.39	100	41.03	1.00	41.03
	Textile	48.31	44.85	6.84	100			
	Grass and Wood	39.50	48.64	11.86	100	29.15	1.70	17.15
	Plastic	58.29	35.22	6.50	100			
	Rubber and Leather	37.25	18.08	44.67	100			
Non-combustible Waste	Metal		15.00					
	Bottle and Glass		10.77					
	Ceramic and Stone		N/A*					
	Miscellaneous		N/A*					
AVERAGE RESULT FROM BOTH SEASONS								
Combustible Waste	Kitchen waste	14.76	79.79	5.47	100	27.57	1.70	16.29
	Paper	39.03	56.52	4.46	100	36.86	1.06	35.24
	Textile	44.55	51.72	3.74	100			
	Grass and Wood	40.33	53.43	6.25	100	26.90	1.66	16.23
	Plastic	56.84	38.47	4.70	100			
	Rubber and Leather	37.25	18.08	44.67	100			
Non-combustible Waste	Metal		15.00					
	Bottle and Glass		6.23					
	Ceramic and Stone		29.57					
	Miscellaneous		N/A*					

N/A* : The type of waste was not found on the day samples sent to laboratory.

Table 2-14: Results of Chemical Analysis for Market

unit : %

Classification for Chemical Analysis		Market						
		Three Contents				Ultimate Analysis		
		Combustible	Moisture	Ash	Total	Carbon	Nitrogen	C/N Ratio
RESULT IN SUMMER								
Combustible Waste	Kitchen waste	13.01	73.47	13.52	100	29.93	1.85	16.18
	Paper	45.93	53.50	0.57	100	28.27	1.28	22.09
	Textile	39.59	59.73	0.68	100			
	Grass and Wood	37.75	61.61	0.64	100	28.24	1.72	16.42
	Plastic	73.63	22.83	3.54	100			
	Rubber and Leather	80.16	12.01	7.83	100			
Non-combustible Waste	Metal		N/A*					
	Bottle and Glass		19.61					
	Ceramic and Stone		5.63					
	Miscellaneous		24.39					
RESULT IN WINTER								
Combustible Waste	Kitchen waste	11.03	81.12	7.85	100	27.78	1.66	16.73
	Paper	30.99	58.76	10.25	100	41.06	0.54	76.04
	Textile	28.40	68.00	3.60	100			
	Grass and Wood	31.49	57.13	11.38	100	27.08	1.24	21.84
	Plastic	48.49	41.84	9.67	100			
	Rubber and Leather	34.00	16.00	50.00	100			
Non-combustible Waste	Metal		N/A*					
	Bottle and Glass		10.74					
	Ceramic and Stone		5.98					
	Miscellaneous		48.33					
AVERAGE RESULT FROM BOTH SEASONS								
Combustible Waste	Kitchen waste	12.02	77.30	10.69	100	28.86	1.76	16.46
	Paper	38.46	56.13	5.41	100	34.67	0.91	49.06
	Textile	34.00	63.87	2.14	100			
	Grass and Wood	34.62	59.37	6.01	100	27.66	1.48	19.13
	Plastic	61.06	32.34	6.61	100			
	Rubber and Leather	57.08	14.01	28.92	100			
Non-combustible Waste	Metal		N/A*					
	Bottle and Glass		15.18					
	Ceramic and Stone		5.81					
	Miscellaneous		36.36					

Note
N/A* : The type of waste was not found on the day samples sent to laboratory.

2.1.6 Waste Stream in Mersin

a. Waste Discharge Amount Summary

a.1 Household Waste

From Table 2-5, the study team calculated the weighted average of the discharge ratio in Mersin as shown below:

$$480 \times 0.09 + 477 \times 0.47 + 391 \times 0.44 = 438.97 \text{ or } 439 \text{ g/person/day}$$

The total household waste discharge amount was calculated by multiplying the weight average by the number of population in the target area. The number of population in Mersin that applied for waste stream calculation is described in 1.3.4, *Population*.

a.2 Commercial, Market, Institutional, Street Sweeping and Park Wastes

The total waste discharge amounts for other categories than household waste were simply calculated by multiplying average discharge ratio of each category by the number of units of that category. For number of commercial shop (restaurant) in Mersin, because its lack of reliable data, the study team estimated number of restaurant by applying the ratio of number of restaurant to population in Adana for Mersin.

The results were added to get the total waste discharge amount as shown in Table 2-15.

Table 2-15: Daily Waste Discharge Amount in Mersin

Discharge Source	Unit	Number of Discharge Source	Discharge ratio	Daily Discharge Amount (t/day)
Household Waste	g/person/day	634,850	439	279
Commercial Waste (Restaurant)	g/table/day	39,895	1,398	56
Commercial Waste (Other Shops)	g/shop/day	50,000	1,062	53
Market Waste	g/stall/day	1,248	10,550	13
Institutional Waste	g/person/day	38,048	63	2
Street Sweeping Waste	g/km/day	624	33,848	21
Park Waste	g/m^2/day	730,000	1	1
Total				425

b. Bulky Waste

From results of POS, 42% of samplings clarified that they don't discharge bulky waste. On the other hand, another 29% discharged bulky waste by push cart while only 2% were collected by regular collection. In addition, from the observation of the study team at dump site, bulky waste have never been seen at the present. This outcome may due to most of bulky wastes were recycled. Therefore, the study team considered amount of bulky waste is negligible.

c. Self-disposed Waste Amount

From the outcome of POS mentioned that nearly 9% of samplings have not received refuse collection service. Among these people (no refuse collection service), 24% of samplings clearly replied that their wastes were disposed by themselves either burned or buried in the premise or vacant lot. The questionnaire results to all of sampling points for WACS and POS were used to determine the amount of household waste disposed by self-disposal method.

The study team calculated self-disposed waste amount in Mersin as shown below:

$$634{,}850 \times 0.09 \times 0.24 \times 439 \times 10^{-6} = 6 \text{ ton/day}$$

d. Illegally Dumped Waste Amount

From the observation of the study team, illegally dumped waste was found in the target area even it was rarely seen. The results of questionnaire survey to all samples of WACS and the outcome of POS were used as tools to find amount of illegal dumping waste amount in the target area.

As mentioned before nearly 9% of samplings being interviewed by POS replied that they have not received collection service. Among these number, 31% clarified that they dumped their waste in the vacant lot or river.

The study team calculated illegally dumped waste amount in Mersin as shown below:

$$634{,}850 \times 0.09 \times 0.31 \times 439 \times 10^{-6} = 7.75 \text{ or } 8 \text{ ton/day}$$

e. Collected Waste Amount

The weighbridge has been operating since 1985 for serving both the landfill and the composting plant. Practically, the waste collection is worked 7 days a week plus night-shift collection in all 3 district municipalities. However, weighbridge operation is functioned only 5 days a week in 1 shift without night shift work. In order to precisely examine collected waste amount, therefore, during the second phase of the project the study team carried out Disposal Waste Amount Survey (DWAS) for 7 continuous day by using present weighbridge at the Mersin Compost Plant.

During the survey, a record on the number of trips, type of vehicle, type of waste, vehicle ownership and direct haulage vehicle is kept each day around the clock. The results of this survey are summarised and presented in the following table.

Table 2-16: Summary of DWAS Results at Mersin Compost Plant

Type of Waste	Solid Waste Generation Area	Responsible Organisation	Average No. of Trip/Day	Waste Amount Collection (t/d)
Municipal Solid Waste	Mersin	Akdeniz	28	203.0
		Yenisehir	12	83.0
		Toroslar	16	121.0
	Sub-total		56	407.0
Medical Solid Waste	Mersin	Akdeniz		1.5
		Yenisehir		
		Toroslar		
		Private		-
	Sub-total			1.5
Industrial Solid Waste	Mersin	Akdeniz	2.29	13.5
		Yenisehir	0.14	1.0
		Toroslar	-	-
		Private	-	-
	Sub-total		2.43	14.5
	Total		59	423.0

From the table it is seen that collected waste amount is calculated at 407 ton/day. The breakdown of waste amount collection for municipal solid waste in Mersin GM by Akdeniz, Yenisehir and Toroslar municipalities are 203 ton/day, 83 ton/day and 121 ton/day respectively.

From the results of DWAS together with results of weighbridge data at Mersin compost plant, finally, the study team adopted collected waste amount at 407 ton/day.

f. Recycled Waste Amount

Recycling has been practised in many sources, certainly, some parts are active and some are dormant. The outcome of recycled waste amount estimation is tabulated in Table 2-17.

For compost, the study team estimated amount of compost from injected waste 40 ton/day. Basically, half of injected waste will be processed to compost that equivalent to 20 ton/day. Then, non-compost wastes will be rejected from compost plant about 25% of injected waste that means 10 ton/day. Some amount of wastes are disappeared during maturation period.

Table 2-17: Daily Recycled Waste Amount in Mersin

Recycling Source	Ton/Day
Generation Sources	15
Street Waste Pickers	10
Compost Plant	20
Scavengers at Compost Plant	0.35
Scavengers at Dumpsite	1.5

g. Final Disposal Waste Amount

The final disposal waste amount is obtained from data on amount of collected waste, other wastes and recycling. In conclusion, the final disposal amount is adopted at 391.5 ton/day.

h. Other Wastes

The landfill at composting plant is mainly serving 3 district municipalities in Mersin GM; namely Akdeniz, Yenisehir and Toroslar. It is allowed medical waste and industrial waste to be dumped also (refer to Table 2-16). Therefore, the study team estimated other waste at 16 ton/day.

i. Waste Stream in Mersin

From all components of waste stream which described before, the study team presented waste stream in Mersin as shown in Table 2-18.

Table 2-18: Waste Stream in Mersin

Waste Stream Component	Ton/Day
Waste Generation Amount	446
Recycling by Discharge Source	15
Discharge Amount	425
Self-Disposed Amount	6
Recycling by Street Waste Pickers	10
Waste Collection Amount	407
Illegally Dumped Waste Amount	8
Injected Waste to Compost Plant	40
Compost	20
Recycling by Scavengers at Compost Plant	0.35
Rejected Waste from Compost Plant	10
Recycling by Scavengers at Dumpsite	2
Other Wastes	17
Final Disposal Amount	392

2.1.7 Waste Composition Analysis for Mersin

a. Physical Composition

The results of the waste composition survey in summer and winter seasons are summarised in Table 2-19. Average results of waste composition survey from both seasons and MSW are tabulated in Table 2-20.

Table 2-19: Average Results of the Waste Composition Survey in Summer and Winter Season for Mersin GM

Classification				Household				Commercial		Market	Institution	Street Sweeping	Park
				High Income	Middle Income	Low Income	Weight Average	Restaurant	Other Shop				
Result in Summer													
Physical Composition (Wet Base)	Apparent Specific Gravity (ASG)		Kg/l	0.31	0.23	0.35	0.29	0.51	0.08	0.34	0.04	0.15	0.08
	Combustible Wastes	Kitchen Waste	(%)	73.53	70.34	75.02	72.69	73.95	30.24	73.31	15.95	3.39	0.00
		Paper	(%)	12.17	17.21	11.63	14.30	15.16	50.44	10.60	68.09	6.36	0.42
		Textile	(%)	1.19	1.68	4.24	2.76	0.38	0.87	1.33	0.85	0.42	0.00
		Grass and Wood	(%)	0.38	1.46	0.73	1.04	0.04	0.44	2.43	2.28	30.08	63.60
		Plastic	(%)	6.63	5.78	4.76	5.41	5.19	9.93	2.80	7.41	8.47	0.42
		Leather and Rubber	(%)	0.35	0.13	0.19	0.18	0.02	0.22	0.94	0.28	0.00	0.00
		Sub-total	(%)	94.25	96.60	96.57	96.38	94.74	92.14	91.41	94.86	48.72	64.44
	Incombustible Wastes	Metal	(%)	0.52	0.71	0.41	0.56	0.56	2.51	0.73	1.42	3.81	0.00
		Bottle and Glass	(%)	3.31	2.34	0.98	1.83	3.94	4.69	2.04	3.13	1.27	1.26
		Ceramic and Stone	(%)	1.53	0.26	1.85	1.07	0.76	0.44	5.63	0.57	7.63	11.30
		Miscellaneous	(%)	0.38	0.09	0.19	0.16	0.00	0.22	0.18	0.00	38.56	23.01
		Sub-total	(%)	5.74	3.40	3.43	3.62	5.26	7.86	8.58	5.12	51.27	35.57
	Total		(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Result in Winter													
Physical Composition (Wet Base)	Apparent Specific Gravity (ASG)		Kg/l	0.29	0.26	0.30	0.28	0.43	0.10	0.34	0.04	0.10	0.08
	Combustible Wastes	Kitchen Waste	(%)	68.17	68.06	69.81	68.84	72.68	39.18	71.25	9.04	8.17	10.99
		Paper	(%)	10.87	14.60	12.43	13.31	18.19	41.76	11.95	68.44	22.96	16.06
		Textile	(%)	4.82	4.45	3.57	4.10	0.56	1.00	1.25	2.55	4.37	4.71
		Grass and Wood	(%)	0.54	0.66	1.57	1.05	0.27	2.50	1.94	1.86	15.35	18.24
		Plastic	(%)	13.15	6.94	6.80	7.44	3.58	8.40	2.82	5.57	16.34	18.48
		Leather and Rubber	(%)	0.03	0.24	0.08	0.15	0.00	0.08	0.63	0.70	3.66	0.60
		Sub-total	(%)	97.58	94.95	94.26	94.88	95.28	92.92	89.84	88.16	70.85	69.08
	Incombustible Wastes	Metal	(%)	0.76	0.90	0.89	0.88	1.02	1.08	1.28	8.82	11.41	10.99
		Bottle and Glass	(%)	1.24	3.22	3.74	3.27	3.31	1.33	3.54	3.02	16.20	15.46
		Ceramic and Stone	(%)	0.42	0.87	0.92	0.85	0.22	4.66	3.06	0.00	1.41	0.00
		Miscellaneous	(%)	0.00	0.06	0.19	0.11	0.17	0.00	2.28	0.00	0.14	4.47
		Sub-total	(%)	2.42	5.05	5.74	5.12	4.72	7.07	10.16	11.84	29.16	30.92
	Total		(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 2-20: Average Results of Waste Composition Survey from Both Season in Mersin GM

Classification				Household				Commercial		Market	Institution	Street Sweeping	Park	MSW*[1]	Whole MSW*[2]
				High Income	Middle Income	Low Income	Weight Average	Restaurant	Other Shop						
Physical Composition (Wet Base)	Apparent Specific Gravity (ASG)		Kg/l	0.30	0.25	0.33	0.29	0.47	0.09	0.34	0.04	0.13	0.08	0.29	0.28
	Combustible Wastes	Kitchen Waste	(%)	70.84	69.19	72.41	70.77	73.31	34.71	72.27	12.50	5.78	5.50	66.15	63.01
		Paper	(%)	11.52	15.90	12.02	13.80	16.67	46.09	11.27	68.26	14.66	8.24	18.63	18.42
		Textile	(%)	3.01	3.07	3.91	3.43	0.47	0.94	1.29	1.70	2.40	2.36	2.61	2.60
		Grass and Wood	(%)	0.46	1.06	1.15	1.04	0.16	1.47	2.19	2.07	22.71	40.91	1.02	2.18
		Plastic	(%)	9.89	6.35	5.78	6.42	4.38	9.17	2.81	6.49	12.41	9.45	6.38	6.69
		Leather and Rubber	(%)	0.19	0.19	0.14	0.17	0.01	0.15	0.79	0.49	1.83	0.30	0.17	0.25
		Sub-total	(%)	95.91	95.76	95.41	95.63	95.00	92.53	90.62	91.51	59.79	66.76	94.96	93.15
	Incombustible Wastes	Metal	(%)	0.64	0.81	0.65	0.72	0.79	1.80	1.01	5.12	7.61	5.50	0.90	1.25
		Bottle and Glass	(%)	2.28	2.78	2.36	2.55	3.63	3.01	2.79	3.08	8.74	8.36	2.77	3.08
		Ceramic and Stone	(%)	0.98	0.57	1.39	0.96	0.49	2.55	4.35	0.29	4.52	5.65	1.21	1.38
		Miscellaneous	(%)	0.19	0.08	0.19	0.14	0.09	0.11	1.23	0.00	19.34	13.73	0.16	1.14
		Sub-total	(%)	4.09	4.24	4.59	4.37	5.00	7.47	9.38	8.49	40.21	33.24	5.04	6.85
	Total		(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note:

*[1] Waste Composition of MSW is calculated from composition ratio multiplied total amount of waste in each category (except street sweeping and park wastes) divided by total amount of waste generation.

*2 Waste Composition of Whole MSW is calculated from composition ratio multiplied total amount of waste in each category divided by total amount of waste generation

a.1 Household Waste

The average result of household waste composition in both season is described as follows:

- Regardless of income level, kitchen waste constitutes 69-72% of the household waste. This may due to housing style in the target area is mainly apartment and food consumption style of people who take a lot of vegetables and fruits. In addition, the use of package for selling is not so popular in the target area. Therefore, waste from kitchen for food preparation shares much more than the other types of waste. On the other hand, waste from another activities such as sweeping, cleaning and gardening is quite less. Kitchen waste occupies about 70%, 69% and 72% for high income, middle income and low income household respectively.
- Paper constitutes large percentage of waste in household waste, which occupies 11%, 15% and 12% for high income, middle income and low income household respectively.
- Plastic shares 9% for high income, 6% for middle income and 5% for low income household.

a.2 Commercial Waste

The characteristics of the composition of the commercial waste from both season are summarised as follows;

- Kitchen waste occupies about 73% of waste in restaurant.
- Paper occupies about 34% of waste in other shop.

a.3 Market Waste

- Kitchen waste, paper and ceramic and stone constitute 72%, 11% and 4% respectively for market waste.

a.4 Institutional Waste

- Paper occupies about 68% in institutional waste.

a.5 Street Sweeping Waste

- Grass and wood occupies about 22% of the street sweeping waste.

a.6 Park Cleansing Waste

- The garden waste, which consists of grass/wood and miscellaneous, occupies about 53% of the park cleansing waste.

b. Apparent Specific Gravity (ASG)

Average result of ASG of household wastes ranged from 0.25 to 0.33 and its weight average was 0.29 while ASG of the other wastes ranged from 0.04 to 0.47.

c. Chemical Analysis

The results of chemical analysis for middle income household and market wastes are shown in Table 2-21 and Table 2-22 respectively.

Table 2-21: Results of Chemical Analysis for Middle Income Household in Mersin

unit : %

Classification for Chemical Analysis		Middle Income Household						
		Three Contents				Ultimate Analysis		
		Combustible	Moisture	Ash	Total	Carbon	Nitrogen	C/N Ratio
RESULT IN SUMMER								
Combustible Waste	Kitchen waste	18.44	75.40	6.15	100	40.64	2.60	15.63
	Paper	39.06	60.47	0.47	100	25.44	0.93	27.35
	Textile	49.88	48.52	1.60	100			
	Grass and Wood	17.00	82.68	0.31	100	30.66	1.80	17.03
	Plastic	51.18	45.36	3.46	100			
	Rubber and Leather	11.82	88.00	0.18	100			
Non-combustible Waste	Metal		39.75					
	Bottle and Glass		29.60					
	Ceramic and Stone		54.89					
	Miscellaneous		37.50					
RESULT IN WINTER								
Combustible Waste	Kitchen waste	16.24	75.90	7.86	100	27.57	1.54	17.90
	Paper	36.61	55.55	7.83	100	41.31	0.84	49.18
	Textile	42.11	49.03	8.86	100			
	Grass and Wood	35.21	54.95	9.84	100	34.37	1.78	19.31
	Plastic	49.72	42.17	8.11	100			
	Rubber and Leather	63.60	4.67	31.69	100			
Non-combustible Waste	Metal		9.55					
	Bottle and Glass		5.46					
	Ceramic and Stone		7.40					
	Miscellaneous		N/A*					
AVERAGE RESULT FROM BOTH SEASONS								
Combustible Waste	Kitchen waste	17.34	75.65	7.01	100	34.11	2.07	16.77
	Paper	37.84	58.01	4.15	100	33.38	0.89	38.27
	Textile	46.00	48.78	5.23	100			
	Grass and Wood	26.11	68.82	5.08	100	32.52	1.79	18.17
	Plastic	50.45	43.77	5.79	100			
	Rubber and Leather	37.71	46.34	15.94	100			
Non-combustible Waste	Metal		24.65					
	Bottle and Glass		17.53					
	Ceramic and Stone		31.15					
	Miscellaneous		37.50					

Note
N/A* : The type of waste was not found on the day samples sent to laboratory.

Table 2-22: Results of Chemical Analysis for Market in Mersin

unit : %

Classification for Chemical Analysis		Market						
		Three Contents				Ultimate Analysis		
		Combustible	Moisture	Ash	Total	Carbon	Nitrogen	C/N Ratio
RESULT IN SUMMER								
Combustible Waste	Kitchen waste	12.48	70.51	16.61	100	39.46	3.45	11.44
	Paper	44.06	55.30	0.65	100	25.40	0.99	25.66
	Textile	53.41	45.53	1.01	100			
	Grass and Wood	38.58	60.70	0.73	100	35.89	1.57	22.86
	Plastic	58.79	37.66	3.80	100			
	Rubber and Leather	78.31	13.80	7.90	100			
Non-combustible Waste	Metal		23.05					
	Bottle and Glass		13.91					
	Ceramic and Stone		23.25					
	Miscellaneous		62.75					
RESULT IN WINTER								
Combustible Waste	Kitchen waste	16.59	70.18	13.24	100	28.72	1.66	17.30
	Paper	23.08	70.48	6.44	100	41.85	0.52	80.48
	Textile	29.72	54.14	16.15	100			
	Grass and Wood	41.58	45.66	12.75	100	35.55	1.79	19.86
	Plastic	55.44	37.02	7.54	100			
	Rubber and Leather	48.57	14.29	37.14	100			
Non-combustible Waste	Metal		22.92					
	Bottle and Glass		1.78					
	Ceramic and Stone		7.44					
	Miscellaneous		N/A*					
AVERAGE RESULT FROM BOTH SEASONS								
Combustible Waste	Kitchen waste	14.54	70.35	14.93	100	34.09	2.56	14.37
	Paper	33.57	62.89	3.55	100	33.63	0.76	53.07
	Textile	41.57	49.84	8.58	100			
	Grass and Wood	40.08	53.18	6.74	100	35.72	1.68	21.36
	Plastic	57.12	37.34	5.67	100			
	Rubber and Leather	63.44	14.05	22.52	100			
Non-combustible Waste	Metal		22.99					
	Bottle and Glass		7.85					
	Ceramic and Stone		15.35					
	Miscellaneous		62.75					

Note
N/A* : The type of waste was not found on the day samples sent to laboratory.

2.2 Public Opinion Survey

2.2.1 Objectives of the Survey

Since SWM is closely concerned with the people's behaviour, way of thinking, habits in everyday life, preference, etc., it is indispensable and inevitable to understand the study area's social aspects for better formulation of the SWM Master Plan. The public opinion survey (POS) was, therefore, conducted to understand these aspects.

The major objectives of the POS are as follows:

- Understanding the general situation surrounding people's everyday life concerning environment, especially garbage and its collection,
- Understanding people's demand
- Obtaining enough and reference data for other aspects of the Study.

2.2.2 Method of the Survey

The POS was conducted by the Turkish consulting firm, KENTKUR, and supervised by the study team. The sample areas were selected by the study team with a serious reconnaissance and discussion with the staff of the two greater municipalities involved, considering upon their income level and educational level as follows:

a. Household Survey

Household samples, in principle, were selected randomly from the whole survey area, *mahalle*, except some cases which includes different characteristics, i.e., population density, building structure, some subdivisions under construction, etc. In these cases, the survey areas were subdivided and samples were to be derived from the total sample number of the survey area, as mentioned below:

In Cavuslu subdistrict (Mersin), because of its oblong shape (north-south), housing/population density quite differs by parts of subdistrict. In these cases, samples were selected as shown in the table below.

Case I: Sampling in Cavuslu

Mahalle	High Density	Medium Density	Low Density	Total No. of Samples
Cavuslu (Mersin)	10	25	10	45

In Demirtas subdistrict (Mersin), it is divided by the major road (Okan Merzeci Bulvari). The southern part is already built-up and constructed. While the northern part is, however, now under construction, according to the study team observation, built-up ration is about 40 % at maximum. In these subdistricts, from both part interview were carried out like shown in the table below.

Case 2: Sampling in Demirtas

Mahalle	No. of Samples in Completed Areas	No. of Samples in Areas Under Construction	Total No. of Samples
Demirtas (Mersin)	30	15	45

Survey data were compiled per survey area, *mahalle*. In case of some special purposes and necessities, more detailed subdivision data will be re-compiled. Survey areas, *mahalle*s, which require some attentions are shown below:

Adana

Yesil Yurt — Mixture of high-rise apartments on major streets and medium ones behind them

Mersin

Cilek — Divided into high, medium, low density subdivisions
Cavuslu — divided into high, medium, low density subdivisions
Demirtas — Some parts are fully constructed and some parts are still under construction.
Kultur — High-rise apartments line the main streets, covering one storey houses.

Table 2-23: Household Samples for POS

Greater Municipality	District	Income Level	Mahalles	No. of Samples
Adana Greater Municipality	Seyhan	High	Cemal Pasa	45
			Beyazevler	40
		Middle	Yesil Yurt	45
			Toros	40
		Low	Denizli	45
			Sucuzade	45
	subtotal			360
	Yuregir	High	Universite	25
		Middle	PTT Evleri	45
			Dadaloglu	25
		Low	Sehit Erkut Akbay	45
	subtotal			140
	Total			400
Mersin Greater Municipality	Akdeniz	High	Kultur	45
		Middle	Ihsaniye	45
		Low	Cilek	50
	subtotal			140
	Toroslar	Middle	Alsancak	40
		Low	Cavuslu	45
			Demirtas	45
	subtotal			130
	Yenisehir	High	Palmiye	45
			Barbaros	40
		Middle	Guvenevleri	45
	subtotal			130
	Total			400

See Figure 2-2 and Figure 2-3 for the location of the areas sampled for POS.

b. Survey on Commercial/Business Area

Survey samples for commercial/business enterprises were selected beside those of household. They were selected mainly from the city centre and their neighbours, and district centre. As exceptional cases, some medium scale factories were to be chosen from estates, shops and groceries from district centre. Sample selection for this survey followed that of the foregoing WACS survey, in principle, as compiled below:

Table 2-24: Commercial/Business Samples for POS

Type of Service	Adana	Mahalle	Mersin	Mahalle
Private Office	From the CBD *[1]	Cinarli, Resat Bey	From the CBD *[1]	Cankaya, Kiremithane
Public Office	From the CBD *[1]	Cinarli, Resat Bey,	From the CBD *[1]	Cankaya, Kiremithane
Medium Factory	From estate sites and isolated ones	Doseme, Istiklal, Cumhuriyet,	From estate sites and isolated ones	Siteler, Yeni Pazar
Small Workshop	From the CBD, *carsi*	Sucuzade, Cumuhuriyet	From the CBD, *carsi*	Ihsaniye,
Market	From the CBD, *carsi*		From the CBD, *carsi*	
Restaurant/ Butcher	From the CBD and the district centre	Kurukopuru,	From the CBD and the district centre	Cami-i Serif, Cankaya
Shop/Grocery	From the CBD and the district centres		From the CBD and the district centres	

Note:

*1 : Large, medium and small scale samples were selected impartially and randomly.

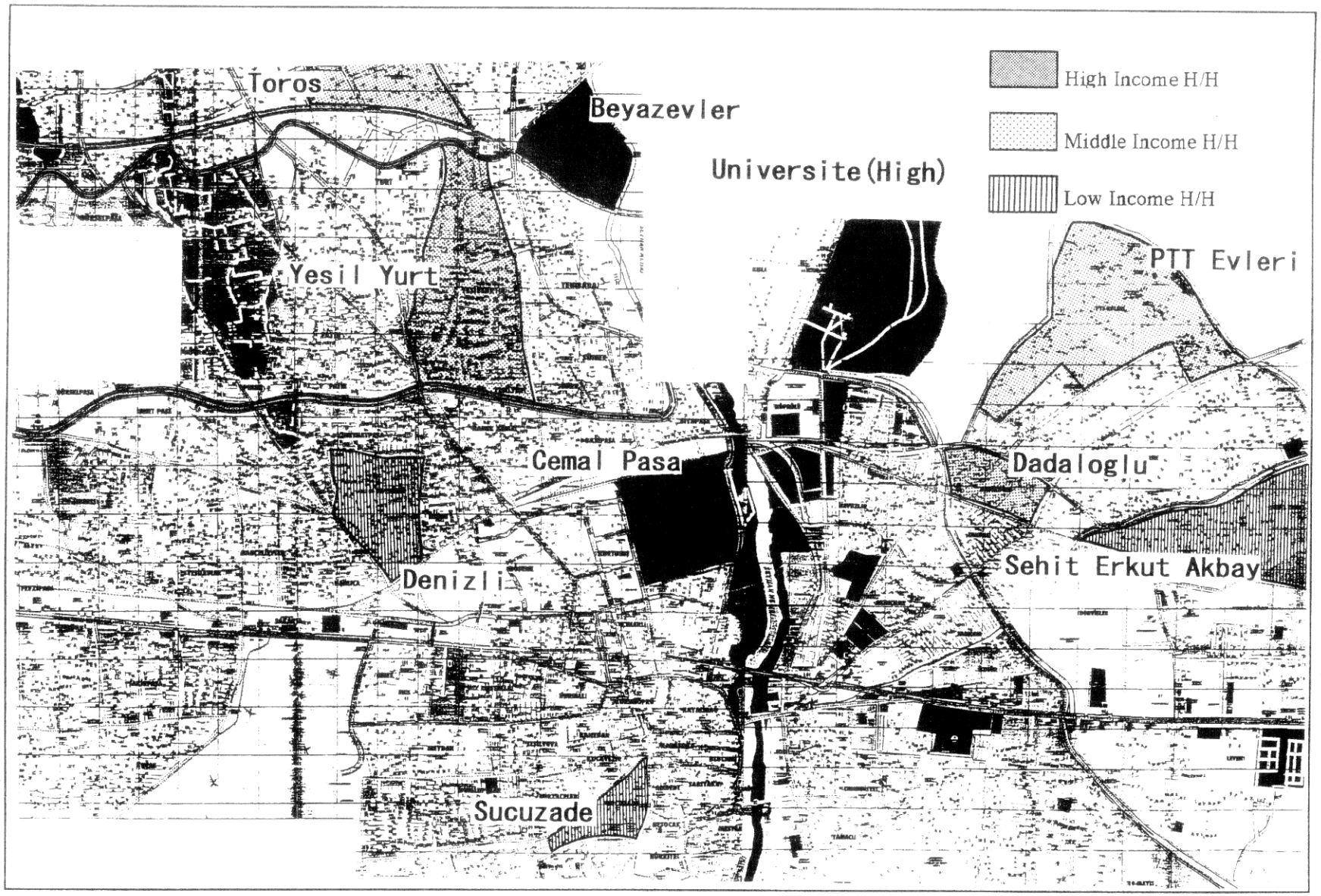

Figure 2-2: POS Areas by Income Level in Adana GM