

Figure 2-3: POS Areas by Income Level in Mersin GM

2.2.3 Results of the Survey

The results of the survey in both residential and commercial areas are presented in Data 2 of Data Book.

2.2.4 Findings of the Survey

a. Household Survey

Q.1.1 Do you have refuse collection services?

According to the cleansing section, every district municipality offers collection services to all residents. Nonetheless, 6.01% (3.26% in Adana, 8.75% in Mersin) of the total number of residents replied they do not receive the services. Although almost all of the study area is covered by some type of collection service, it is surmised that in some areas the service is not efficiently carried out.

Q.1.2 Refuse is collected by?

The majority of the residents in Adana and Mersin, 84.25% and 82.50% respectively, said they receive municipal collection services.

Q.1.3 Refuse is stored for collection in?

The residents in the target areas were found to use different kinds of containers for waste storage. While 53.79% use family's refuse cans, 35.03% use plastic bags and less than 2% use common refuse bins.

Q.1.4 Frequency of refuse collection

Approximately 70% of the residents in Adana and Mersin said they receive daily collection services, while 16.88% say they receive the service 3 to 6 times a week. The number of residents receiving collection services more than thrice a week is considerably high at approximately 85%.

Q.1.5 Is your refuse collected at a fixed day and time?

The percentage of residents receiving fixed collection services is higher in Adana than in Mersin: 73.75% and 58.25%, respectively.

Q.1.6 Refuse is collected at?

In Adana, 81.00% of the residents discharge their waste on side walks or curbs; only 8.50% use public containers. It can be said, therefore, that curb-side collection is the collection system mainly adopted in Adana. On the one hand, public container collection is more widespread in Mersin, where approximately half of the residents (48.12%) said they use public containers.

Q.1.7 If no to Q.1.1, how do you dispose refuse?

Only less than 10% of the residents in both greater municipalities said they do not receive the collection services mentioned in *Q.1.1*. But they carry out inadequate self-disposal practices such as illegal dumping in vacant lots or rivers (49.99% in Adana, 31.03% in Mersin), or burning in the premises or vacant lots (16.67% in Adana, 20.69% in Mersin).

Q.1.8 If public container is used, how far is it from your house?

As previously mentioned in **Q.1.6**, the residents of Adana hardly use public containers. Therefore, 69.50% of these residents did not respond to the question. 23.25% of the residents who responded said that public containers are installed within 20m from their houses. In Mersin, where public containers are widely used, over 80% of the residents replied that the containers are installed within 20m from their houses, indicating that the public container collection system is functioning well.

Q.1.9 If public container is used, are you satisfied with this type of collection service?

As previously mentioned in **Q.1.6**, the residents of Adana hardly use public containers. Therefore, 69.68% of the respondents did not answer the question. The majority of those who did indicated satisfaction with the container collection system. In Mersin, where public containers are widely used, 70.50% of the residents expressed satisfaction with the container collection system. This could mean that the container collection services are efficiently carried out.

Q.1.10 Refuse is taken to collection point by?

Wastes at most households in Adana and Mersin are disposed of by the wife/mother or the children. To improve waste collection services, guidance should be extended to the wives/mothers regarding adequate disposal methods and on sanitary issues.

Q.1.11 How do you discharge bulky waste (furniture, electrical appliances, etc.)

In Mersin, almost half of the residents (42.00%) said they do not discharge bulky wastes. Both residents (40.25% in Adana, 29.75% in Mersin) mainly use push carts for the discharge of bulky wastes. These push carts play a major role in the recycling of bulky wastes.

Q.1.12 How do you discharge (or know how to discharge) demolition debris?

In Mersin, 40.75% of the residents said they do not discharge construction debris. 31.62% of the total average number of residents in both areas (43.00% in Adana, 20.25% in Mersin) replied that they mainly dump debris in the neighbourhood. In particular, almost half of the residents in Adana illegally dump their wastes, making the provision of services for the collection of construction debris a major issue.

Q.1.13 How do you discharge garden waste (fallen leaves, branches, grass, etc.)?

When asked about how garden wastes are disposed of, 36.00% of the residents in Adana said they disposed them along with household wastes during ordinary waste collection periods. In Mersin, 41.00% of the residents said they do not discharge garden wastes. This may be attributed to the difference in living conditions in both greater municipalities.

Q.1.14 How do you rate the present refuse collection?

Approximately 85% of the residents in both greater municipalities indicate satisfaction with the current collection services, while approximately 30% expressed dissatisfaction.

Q.1.15 If unsatisfactory, what needs to be improved?

Based on the answers to **Q.1.14**, about 85% of the total number of residents in both greater municipalities receive more than thrice a week collection services. When asked as to what needs to be improved, about half of the residents in both areas who expressed dissatisfaction in **Q.1.14** demand more frequent collection services.

Q.2.1 Do you sell valuable/recyclable wastes to push carts?

The number of residents selling valuable/recyclable wastes to push carts is 46.24% in Adana and 32.83% in Mersin. Approximately 40% of the residents in both greater municipalities recycle wastes by selling them to push carts. Push carts play a major role in waste recycling.

Q.2.2 If yes, how often do you sell them?

95.64% of residents who answered they use push carts in **Q.2.1** say they sell recyclable wastes at an average of less than once a month. It is, therefore, assumed that the residents save up any valuable materials to a certain amount and sell them in bulk.

Q.2.3 Do you think it is important to recycle materials under the public authority's control?

Of the total number of residents in both greater municipalities, around 90% acknowledge the importance of carrying out recycling activities under the supervision and control of public institutions.

Q.2.4 Do you know that some enterprises buy recyclable materials?

The number of residents in both greater municipalities unaware that there are enterprises purchasing recyclable materials totals 63.25%: 56.50% in Adana and 70.00% in Mersin.

Q.2.5 Do you know any campaign for waste segregation before collection?

The number of residents in both greater municipalities unaware of any waste segregation campaign totals 83.74%. It is, therefore, assumed that waste segregation is not being widely practised in either greater municipality.

Q.2.6 If yes to Q.2.5, how did you become aware of it?

Of the total number of residents (15.38%) who responded they are aware of the existence of waste segregation campaigns in **Q.2.5**, 60.02% pointed the radio/TV/newspaper as their sources. The use of the mass media to actively promote such a campaign is considered very effective therefore.

Q.2.7 If you are aware, do you practice refuse segregation?

A high number of residents said they are willing to cooperate in waste segregation if they think it is necessary. The total number of residents who feel this way in both greater municipalities averages 82.37%. Considering

that the residents are quite highly aware of the importance of co-operation, increasing their awareness of waste segregation would most likely lead to gaining their co-operation in this area.

Q.2.8 If you don't practice, why?

Of the residents who answered no to **Q.2.7**, 70.67% pointed out the troublesome nature of the activity as a reason. Accordingly, to gain the co-operation of these residents, they should be made fully aware of the importance of waste segregation. In addition, studies should be made to fully establish a system, e.g., purchase of recyclable materials, that would provide the residents with some form of incentive.

Q.2.9 If yes to Q.2.7, what do you usually segregate?

The residents who answered yes to **Q.2.5** said they mainly segregate paper, bottles, and plastic. Only a small number (3.25%) segregate tin cans, leading to the assumption that the reuse of cans is hardly practised.

Q.2.10 If you were requested to do waste segregation for recycling, would you do so?

Of the total number of residents in both greater municipalities, 74.00% said they are willing to cooperate in waste segregation when and if requested, while 8.75% expressed unwillingness to do so.

Q.3.1 Do you pay for refuse collection fee?

In both greater municipalities, about 94.87% of the residents said they pay the refuse collection fee, indicating how extremely cooperative the residents are even with the payment of the refuse collection fee.

Q.3.2 If yes to Q.3.1, how much do you pay per month (Turkish Lira)?

In Adana, the maximum amount paid for waste collection services is 2 million TL/month, while the average is approximately 180 thousand TL/month. In Mersin, the highest is 9 million TL/month, while the average is approximately 800 thousand TL/month. Based on these figures, the residents of Mersin pay four times as much as the residents of Adana.

Q.3.3 If yes to Q.3.1, to whom do you pay?

Of the residents (approximately 95%) who said yes to **Q.3.1**, around 90% said they pay the fee to the municipality.

Q.3.4 If you pay refuse collection fee, how do you think it?

In Adana, the majority of the residents (56.75%) think the collection fee is reasonably priced; 31.50% think that the current collection fee is high. In Mersin, almost half of the residents (42.25%) think the collection fee is high; only 26.00% thinks it is reasonable. The differences in perception here is a result of the discrepancy in the amount paid (with Mersin being 4 times expensive as Adana) as clearly emphasised in **Q.3.2**.

Q.3.5 If no to Q.3.1, why do you not pay?

Only 3.88% of the residents in both greater municipalities said they do not pay the refuse collection fee in **Q.3.1**. The reasons are unknown as 86.98%

of these residents pointed out [other reasons] in answer to their refusal to pay.

Q.3.6 How much are you willing to pay at most per month (Turkish Lira)?

In contrast with the answers to **Q.3.2**, it is possible to slightly increase the monthly refuse collection fee in Adana from the present 178,876 TL/month to 197,180 TL/month. In Mersin, the current amount paid averages around 800,000 TL/month, but the residents can only afford an average of about 300,000 TL/month. Accordingly, a lot of the residents in Mersin consider the monthly refuse collection fee as expensive.

Q.3.7 How much are you paying for water service per month (Turkish Lira)?

In contrast with the waste collection fee, residents of Adana and Mersin pay the same amount for water supply: around 1,500,000 TL on average.

Q.3.8 How much are you paying for electric power service per month (Turkish Lira)?

Unlike the refuse collection fee, there is not much difference in the electric bill in both greater municipalities.: 3,056,789 TL/month on average in Adana, 2,609,142 TL/month on average in Mersin.

Q.4.1 Liquid wastewater disposal facility

In both greater municipalities, over 95% of the residents (92.75% in Adana, 98.25% in Mersin) use flush toilets. Both greater municipalities have a sewerage system that respectively covers the whole territory.

Q.4.2 Water supply source

Almost all residents (94.75%) in both greater municipalities answered that water supply is provided.

Q.4.3 Are there problems in your house associated to pests?

Almost 75% of the total number of residents in both greater municipalities indicated problems with pests: 26.50% with mosquitoes, 31.37% with cockroaches.

Q.4.4 Have you ever had any guidance on methods of refuse handling?

Of the entire number of residents, 93.98% said they never had guidance in refuse discharge methods. There is, therefore, a need to conduct a program to educate the residents on adequate refuse discharge manners.

Q.4.5 If yes, how did you become aware of it?

The number of residents in both greater municipalities who said yes to **Q.4.4** totalled 40.66% on average. These residents mostly refer to the following sources: TV/radio/newspapers. However, since Q.4.4 indicates that 93.98% of the residents have not received guidance, it is safe to assume that adequate discharge methods are not fully promoted.

Q.4.6 Does anyone in your house clean the drains near the house?

Of the surveyed residents, 75.75% in Adana and 70.75% in Mersin said they clean the drains near their houses everyday or sometimes. Many of the residents in both greater municipalities voluntarily clean public facilities.

Q.4.7 Does anyone in your house sweep the pathway in the front?

Of the surveyed residents, 69.25% in Adana and 55.25% in Mersin said they sweep the area in front of their houses everyday or sometimes. Many of the residents in both greater municipalities voluntarily clean public facilities.

Q.4.8 Which of the following matters do you rate as the most pressing problem of the community?

Residents in both greater municipalities point out pest problems as the most pressing (22.50% in Adana and 40.48% in Mersin: 31.47% on average). Around 11.00% in both Adana and Mersin considered waste collection as the most pressing problem. This being the case, waste collection is considered as the third most pressing problem in both greater municipalities. Water supply is the second most pressing problem in Adana, while in Mersin, it is electricity.

Q.4.9 After collection, do you know where refuse is brought?

The residents were found to be highly ignorant of waste disposal methods as the number unaware about what happens to the refuse after collection totals 79.25% in Adana and 62.00% in Mersin.

Q.4.10 If you know where refuse goes, where it is? (Name of places)

The number of residents who said yes to Q.4.9 totals 63 (19.75%) in Adana and 146 (38.00%) in Mersin. In Adana, 46 of these residents named the disposal site in Sofulu as the final destination of collected wastes, while in Mersin, 53 of these residents pointed out the final disposal site in Cavuslu. As the numbers only correspond to 14.3% and 13.5% of the total number of respondents in Adana and Mersin, the majority of the residents in both greater municipalities are hardly aware of the existence of final disposal sites.

Q.4.11 Which authority do you understand to be responsible for solid waste management?

Of the total number of residents surveyed in both greater municipalities, 57.24% refer to the district municipality as being responsible for solid waste management, 19.25% refer to the greater municipalities, and 19.13% refer to private collection companies.

b. Survey on Commercial/Business Area

Q.1.1 Do you have refuse collection services?

Of the total number of surveyed enterprises, 95.00% (98.00% in Adana, 92.00% in Mersin) replied they receive the services. Almost all of the entire study area is covered by some type of collection service.

Q.1.2 Refuse is collected by?

The majority of the enterprises in Adana and Mersin, 96.00% and 70.00% respectively, said they receive municipal collection services.

Q.1.3 Refuse is stored for collection in?

The enterprises in Adana were found to use different kinds of containers for waste storage. While 43.25% use family's refuse cans, 29.50% use plastic bags and 25.25% use common refuse bins. On the other hand, more than 90% use family's refuse cans in Mersin.

Q.1.4 Frequency of refuse collection

Most enterprises in Adana and Mersin (98.00% and 88.00%) said they receive daily collection services.

Q.1.5 Is your refuse collected at a fixed day and time?

The percentage of enterprises receiving fixed collection services is 98.00% in Adana and 72.00% in Mersin. Collection services in both greater municipalities are regularly carried out.

Q.1.6 Refuse is collected at?

In Adana, 82.25% of the enterprises discharge their waste on side walks or curbs. It can be said, therefore, that curb-side collection is the collection system mainly adopted in Adana. On the one hand, public container collection is more widespread in Mersin, where 70.00% of the enterprises said they use public containers.

Q.1.7 If no to Q.1.1, how do you dispose your refuse?

The enterprises surveyed in Adana did not reply to this question because almost all said they receive collection services in answer to **Q.1.1**. 8.00% of the enterprises surveyed in Mersin that answered they do not receive the services in **Q.1.1** said that they do self-disposal practices such as burning in the premises (25.00%) or dumping in vacant lots (25.00%).

Q.1.8 If public container is used, how far is it from your house?

Enterprises in Adana skipped this question in relation to their answer to **Q.1.6** (the enterprises in Adana hardly use public containers). In Mersin, where public containers are widely used, 56.00% of the enterprises replied that the containers are installed within 20 meters from their houses. It can be said, therefore, that the public container collection system is functioning properly.

Q.1.9 If public container is used, are you satisfied with this type of collection service?

As previously mentioned in **Q.1.6**, the residents of Adana hardly use public containers. Therefore none of the respondents answered this question. In Mersin, where public containers are widely used, 54.00% of the enterprises expressed satisfaction with the container collection system. This could only mean that the container collection services are efficiently carried out.

Q.1.10 Refuse is taken to collection point by?

Wastes at most enterprises in Adana are disposed of by an employee. In Mersin where public containers are widely spread, waste are discharged by an employee (58.00%) or a housekeeper (22.00%). To improve waste collection services, guidance should be extended to the employees and/or housekeeper regarding adequate disposal methods and on sanitary issues.

Q.1.11 How do you discharge bulky waste (furniture, electrical appliances, etc.)?

In Adana, a large number of the enterprises (76.50%) said they do not discharge bulky wastes. In Mersin, only 18.00% said they do not dispose of bulky waste. Therefore, 4.00% use push carts, another 4.00% discharge waste during regular collection, and 2.00% answered they dispose waste during special collection services.

Q.1.12 How do you discharge (or know how to discharge) demolition debris?

In Adana a large number of enterprises (76.50%) said they do not discharge construction debris. In Mersin 4.00% dispose of demolition debris using special collection services and 2.00% during regular collection services for household waste.

Q.1.13 How do you discharge garden waste (fallen leaves, branches, grass, etc.)?

80.00% of the surveyed enterprises in Adana said they discharge garden waste. In Mersin, 77.50% of the enterprises said that they do not discharge garden wastes. This may be attributed to the difference in building structure in both greater municipalities.

Q.1.14 How do you rate the present refuse collection?

Of the enterprises surveyed in Adana, 86.28% expressed satisfaction with the current collection services, while in Mersin, 40.81% showed satisfaction and 57.14% dissatisfaction.

Q.1.15 If unsatisfactory, what needs to be improved?

Based on the answers to *Q.1.14*, 95.00% of the total number of enterprises in both greater municipalities receive more than thrice a week collection services. However, when asked as to what needs to be improved, many enterprises who voiced dissatisfaction in *Q.1.14* demand more frequent collection services.

Q.2.1 Do you sell valuable/recyclable wastes to push carts?

The number of enterprises selling valuable/recyclable wastes to push carts is around 10% in both municipalities. Push carts play a minor role in waste recycling although they do a major role in household waste management.

Q.2.2 If yes, how often do you sell them?

Almost of the enterprises who answered they use push carts in *Q.2.1* say they sell recyclable materials at least once a month. It is, therefore, assumed that the enterprises save up any valuable materials to a certain amount and sell them in bulk.

Q.2.3 Do you think it is important to recycle materials under the public authority's control?

Of the total number of enterprises in both greater municipalities, 92.00% acknowledge the importance of carrying out recycling activities under the supervision and control of public institutions. The ratio of the number of residents who knows enterprises buying recyclable materials is higher than in case of household waste.

Q.2.4 Do you know that some enterprises buy recyclable materials?

The number of enterprises in both greater municipalities unaware that there are enterprises purchasing recyclable materials totals 92.00% in Adana and 50.00% in Mersin.

Q.2.5 Do you know any campaign for waste segregation before collection?

The number of enterprises in both greater municipalities unaware of any waste segregation campaign totals 74.25%. It is, therefore, assumed that waste segregation is not being widely practised in either greater municipality.

Q.2.6 If yes to Q.2.5, how did you become aware of it?

Of the number of enterprises aware of the existence of waste segregation campaigns in Adana, 66.67% pointed radio/TV/newspaper as sources, 25.00% community meetings, and 8.33% word of mouth. In Mersin, 61.54% learned of the campaign from the radio/TV/newspaper. The use of the mass media to actively promote such a campaign is considered very effective, therefore.

Q.2.7 If you are aware, do you practice refuse segregation?

A high number of enterprises said they are willing to cooperate in waste segregation if they think it is necessary. The total number of enterprises who feel this way is 84.25% in Adana and 62.00% in Mersin. Considering that the enterprises are quite highly aware of the importance of co-operation, increasing their awareness of waste segregation would most likely lead to gaining their co-operation in this area.

Q.2.8 If you don't practice, why?

Of the enterprises who answered no to *Q.2.7*, 90.91% in Adana and 77.78% in Mersin pointed out the troublesome nature of the activity as a reason. Accordingly, to gain the co-operation of these enterprises, they should be made fully aware of the importance of waste segregation. In addition, studies should be made to establish a system, e.g., purchase of recyclable materials, that would provide the enterprises with some form of incentive.

Q.2.9 If yes to Q.2.7, what do you usually segregate?

The enterprises in Adana who answered yes to *Q.2.7* said they mainly segregate paper (26.19%). In Mersin, 51.62% segregate paper, 19.35% bottles, and 12.90% plastic. Only a small number (3.23%) in Mersin segregate cans, leading to the assumption that the reuse of cans is hardly practised.

Q.2.10 If you were requested to do waste segregation for recycling, would you do so?

Of the total number of enterprises in both greater municipalities, about 60% said they are willing to cooperate in waste segregation when and if requested.

Q.3.1 Do you pay for refuse collection fee?

In both greater municipalities, about 90% of the enterprises said they pay the refuse collection fee, indicating how extremely cooperative the enterprises are even with the payment of the refuse collection fee.

Q.3.2 If yes to Q.3.1, how much do you pay per month (Turkish Lira)?

In Adana, the maximum amount paid for waste collection services is 2 million TL/month, while the average is approximately 440 thousand TL/month. In Mersin, the highest is 3 million TL/month, while the average is approximately 83 thousand TL/month. Based on these figures, the enterprises in Mersin pay twice as much as the enterprises in Adana.

Q.3.3 If yes to Q.3.1, to whom do you pay?

Of the enterprises (91.00%) who said yes to **Q.3.1**, 96.00% said they pay the fee to the municipality.

Q.3.4 If you pay refuse collection fee, how do you think it?

In Adana, the majority of the enterprises (66.75%) think the collection fee is reasonably priced; 23.50% think that the current collection fee is high. In Mersin, almost half of the enterprises (52.00%) think the collection fee is high; only 36.00% thinks it is reasonable. The differences in perception here is a result of the discrepancy in the amount paid (with Mersin being twice as expensive as Adana) as clearly emphasised in **Q.3.2**.

Q.3.5 If no to Q.3.1, why do you not pay?

Only 7.00% of the enterprises in both greater municipalities say they do not pay the refuse collection fee in **Q.3.1**. The reasons are unknown as all respondents pointed out [other reasons] in answer to their refusal to pay.

Q.3.6 How much are you willing to pay at most per month (Turkish Lira)?

In contrast with the answers to **Q.3.2**, it is possible to slightly increase the monthly refuse collection fee in Adana from the present 438,298 TL/month to 466,784 TL/month. In Mersin, the current amount paid averages 828,425 TL/month, but the enterprises can only afford an average of 626,560 TL/month. Accordingly, a lot of the enterprises in Mersin consider the monthly refuse collection fee as expensive.

Q.3.7 How much are you paying for water service per month (Turkish Lira)?

The enterprises in Adana and Mersin pay an average of around 3,600,000 TL./month and 6,500,000 TL./month respectively for water supply. The enterprises of Mersin pay 1.25 times as much as the ones in Adana.

Q.3.8 How much are you paying for electric power service per month (Turkish Lira)?

The enterprises pay an average of around 14,400,000 TL/month and 19,500,000 TL/month in Adana and Mersin respectively, for electricity. The enterprises of Mersin pay 1.3 times as much as the ones in Adana.

Q.4.1 Liquid wastewater disposal facility

In both greater municipalities, most enterprises (62.75% in Adana, 98.00% in Mersin) use flush toilets. The number of enterprises connected to the sewer system is high.

Q.4.2 Water supply source

Almost all enterprises (90.13%) in both greater municipalities answered that water is provided.

Q.4.3 Are there problems in your house associated to pests?

The enterprises in Adana said that they have problems with cockroaches (31.50%), flies (29.50%) and rats (4.00%). In Mersin, 30.00% pointed out rats, 18.00% cockroaches, and 12.00% flies.

Q.4.4 Have you ever had any guidance on methods of refuse handling?

Of the entire number of enterprises, 89.25% said they never had guidance in refuse discharge methods. There is, therefore, a need to conduct a program to educate the enterprises on adequate refuse discharge manners.

Q.4.5 If yes, how did you become aware of it?

The enterprises (averaging 85.71% of the total number of surveyed enterprises) who said yes to **Q.4.4** mostly refer to the following as their sources: TV/radio/newspapers. However, since **Q.4.4** indicates that a large number of the enterprises (around 90%) have not received guidance, it is safe to assume that adequate discharge methods are not fully promoted.

Q.4.6 Does anyone in your house clean the drains near the house?

96.00% of the enterprises in both greater municipalities said they clean the drains near their houses. Many people in both greater municipalities voluntarily clean public facilities.

Q.4.7 Does anyone in your house sweep the pathway in the front?

Of the surveyed enterprise, 39.50% in Adana and 38.00% in Mersin said they sweep the area in front of their office premises. Few enterprises in both greater municipalities voluntarily clean the pathways compared with the cleansing of drains.

Q.4.8 Which of the following matters do you rate as the most pressing problem of the community?

Enterprises in both greater municipalities indicated electricity shortage as the most pressing problem (approximately 35%). The second most serious problem in both municipalities is pest control, while the third is water supply in Adana and refuse collection in Mersin.

Q.4.9 After collection, do you know where refuse is brought?

The enterprises were found to be highly ignorant of waste disposal methods as the number of enterprises unaware about what happens to their refuse after collection totals 76.50% in Adana and 50.00% in Mersin.

Q.4.10 If you know where refuse goes, where is it? (Name of place)

Seven out of the enterprises who said yes to **Q.4.9** named the disposal site in Sofulu as the final destination of collected wastes, while in Mersin, nobody pointed out the final disposal site in Cavuslu. The majority of the enterprises in both greater municipalities are hardly aware of the existence of final disposal sites.

Q.4.11 Which authority do you understand to be responsible for solid waste management?

Of the total number of enterprises interviewed in both greater municipalities, 45.50% refer to the district municipality as being responsible for solid waste management, 16.75% refer to the greater municipalities, and 31.75% refer to private collection companies.

2.3 Opinion Survey on Medical Institutions

Medical waste, just as any other type of waste, requires adequate management especially considering its physical, chemical, and pathological properties. Authorities responsible for waste management must understand that the considerations for medical waste, and subsequently its needs, go beyond the scope of hospitals and clinics to smaller generators, such as veterinary clinics, research laboratories, and funeral homes.

One of the more recent examples of poor medical waste management is the washing up of syringes, IV tubing, and prescription bottles onto five beaches in the United States in 1988. This resulted in the loss of \$1 billion for beach related businesses and a marked dent in the tourist industry.

Commerce and tourism are not the only ones affected by mismanagement of medical waste. There are environmental, occupational, political, and social risks associated with inadequate medical waste management. Toxic chemicals and pathogens being released into the environment can have both short term and long term effects, for they increase the potential for injury or disease transmission through direct contact.

2.3.1 Objectives of the Survey

This study covers a medical waste survey in consideration of the infectious and hazardous waste materials currently disposed of at the disposal sites in Adana and Mersin. If we are to formulate a tangible solution to the current overall waste management problems in the two GMs, it is inevitable for these problematic waste categories to be investigated. To date, there have been no comprehensive studies in Turkey on hazardous or infectious materials entering the landfill or, possibly, the general waste stream; thus, in order to achieve the objectives of the master plan, the study team needed to examine the waste stream of these substances. The properties

of hazardous and, in particular, infectious wastes are such that even a minute amount being mishandled can result in serious environmental and health repercussions. And, as we have learnt from past blunders and mismanagement of medical waste, the categorising and inventorying of these wastes is an arduous, but important task.

The main purpose of this medical waste management survey is to understand the earlier stages of the waste flow related specifically to infectious, hazardous, and general waste categories generated, during the course of patient care, by large hospitals in Adana and Mersin. The second purpose of this survey, albeit an equally important one, is to see whether either infectious waste or hazardous waste is entering the general waste stream. As an ultimate aim of this study is to create a successful, integrated solid waste management strategy by identifying the current problems, the team needed to identify the handling, storage, and transport of all waste types generated by medical institutions in the target GMs.

2.3.2 Method of the Survey

There are a total of 197 medical institutions in the target areas generating medical wastes as shown in the table below.

Table 2-25: Medical Institutions in the Target Areas

Greater Municipality	Medical Institutions	No. of Institutions
Adana	Public Hospitals	8
	Private Hospitals	9
	Medical Centres & Clinics	68
	Public & Private Laboratories	51
	Sub-total	136
Mersin	Public Hospitals	2
	Private Hospitals	5
	Public Health Centre	13
	Medical Centre	18
	Public & Private Laboratories	23
	Sub-total	61
Total		197

Forty-one of the largest hospitals in the two GMs took part in the questionnaire: the number of medical institutions chosen for this survey (i.e., 13 in Mersin and 28 in Adana) were loosely selected based on the number of citizens in the two GMs as shown in Table 2-26. The survey was conducted by public health doctors of the Cukurova University contracted by the study team. The interview focused on the generation, segregation, storage, discharge, collection, treatment, and disposal of infectious and hazardous medical waste.

Table 2-26: Target Medical Institutions for the Survey

Greater Municipality	Medical Institutions	No. of Samples
Adana	Public Hospitals	8
	Private Hospitals	7
	Medical Centre	8
	Public & Private Laboratories	5
Mersin	Public Hospitals	2
	Private Hospitals	4
	Medical Centre	7
Total		41

Hospital administrators were directly questioned on various waste management practices in their hospitals. The questions were broadly divided into the following topics:

- General questions about the size and location of the medical institution.
- Questions related to storage of all waste types in the departments (point of discharge).
- Questions on storage of infectious and hazardous wastes at the central collection point.
- Questions on treatment of infectious and hazardous wastes at the hospital prior to discharge.
- The cost of both treatment and collection for individual waste categories.
- Questions on handling, storage and treatment methods, recycling, and collection costs for general wastes.
- Questions on training offered by the hospital for individuals who come in contact with medical wastes (waste management staff).
- Opinions of interviewees on in-house waste management and in general.

For the purpose of this survey, the hospital administrators were given a clear definition of the different waste categories mentioned in the survey, which is shown in Table 2-27.

Table 2-27: Definition of Infectious, Hazardous, and General Waste

Classification	Definition
Infectious Waste	All pathological waste; human blood, blood products, and items saturated with human blood; cultures and stocks of infectious agents and associated biologicals (such as vaccines); culture dishes and equipment that has come in contact with any biological agent. Sharps that have been used in patient care, treatment or in medical research; broken or unbroken glassware that have come into contact with any infectious agent; sharp items that are unused but pose a physical threat to those who subsequently handle these items. Items that are tainted with human blood, excrement, or body fluid from humans or animals infected with contagious disease; contaminated animal carcasses, body parts and bedding of all animals exposed to biological agents during clinical trials.
Hazardous Waste	Chemical waste in solid, liquid gaseous states, used for diagnostic, treatment, or experimental purposes. Chemicals used for disinfection, preservation, and cleaning procedures; all pharmaceuticals that have past their expiry dates; any hazardous chemicals that are labelled as toxic, corrosive, flammable, reactive, cytotoxic, mutagenic, teratogenic, carcinogenic, or radioactive.
General Waste	All other waste types including packaging materials, kitchen waste, and other substances that do not require special handling and do not pose a threat to public and environmental health.

On the advice of the counterpart team, X-ray development solutions were specifically identified among the hazardous waste category due to their heavy metal content, and thus their special handling requirements. Paper and glassware were also individually classified among the general waste category because of their recycling properties.

Conclusions are based on both the counterpart team's observations during the questionnaire and the responses given by those responsible for waste management in the hospitals. The counterpart team tried to limit the investigations to only hospitals with inpatient facilities. However, because the number of large hospitals was too small for the results to be statistically viable, the questionnaires included smaller hospitals that generated hazardous and infectious wastes on a daily basis.

2.3.3 Results of the Survey

The results of the survey are summarised below.

a. General Questions about the Size and Location of the Medical Institutions

- Capacity of medical institution

Of the forty-one hospitals that took part in this survey, fourteen (i.e., 34%, 12 in Adana, 2 in Mersin) have no inpatient facilities. The rest of the facilities, 27, (66%, 16 in Adana, 11 in Mersin) have inpatient facilities (see Q.3.A in Data 3¹).

¹ Refer to Data Book.

- **Beds at hospitalising institutions**

Of the hospitals that have inpatient facilities, the average number of beds is 197.2 (252.0 in Adana, 117.5 in Mersin) with an average daily occupancy rate of 81.6% (82.6% in Adana, 78.6% in Mersin) (see Q.3.B in Data 3).
- **Employees**

The average number of employees at hospitals with inpatient facilities is 313.3 (399.8 in Adana, 187.5 in Mersin) (see Q.3.D in Data 3).
- b. Questions Related to Storage of All Waste Types in the Departments (point of discharge)**
 - **Hazardous waste production**

Twenty-five hospitals (61%, 16 in Adana, 9 in Mersin) do not produce any hazardous wastes (incl. X-ray solutions). Ten hospitals (24%, 6 in Adana, 4 in Mersin) reportedly have X-ray solutions on site (refer to Q.4 and Q.12 in Data 3).
 - Two hospitals (4.9%, 2 in Adana, in Mersin) mix all types of waste at the point of discharge, and one hospital (2.4%) mixes infectious and hazardous wastes at this stage (see Q.4 and Q.12 in Data 3).
 - Thirteen hospitals (22.5%, 5 in Adana, 8 in Mersin) separate only glassware, and one (2.4% in Adana) separate only paper. Four (10%, 2 in Adana, 2 in Mersin) hospitals separate both glassware and paper at the central collection point at the hospital (see Q.29 and Q.28 in Data 3).
 - Thirty-five hospitals (85.4%, 22 in Adana, 13 in Mersin) separate all the major waste types (i.e., infectious, hazardous – if produced – and general waste) at the point of discharge (see Q.4 and Q.12 in Data 3).
- c. Questions on Storage of Infectious and Hazardous Wastes at the Central Collection point**
 - Almost all the hospitals (93%, 25 of 28 in Adana, 13 of 13 of Mersin) maintain the storage system used in the departments at the central collection point. The remaining 7.3% subsequently mix infectious, hazardous, and general wastes even though they were discharged separately in the departments (see Q.5 and Q.13 in Data 3).
 - The most preferred storage containers for infectious wastes at the central collection points is the 275 lt. metallic container with a lid and a lock, used by eleven (26.8%, 7 in Adana, 4 in Mersin) of the hospitals that responded. The next common storage containers are 400lt. metallic containers with a lid and a lock (14.6%, 3 in Adana, 3 in Mersin), and 275lt. metallic containers with a lid and no lock (12.2%, 5 in Adana, 0 in Mersin).

Two hospitals (5%) leave their infectious waste outside either in plastic bags or in an uncovered truck (see Q.6 and Q.14 in Data 3).

- One hospital stores infectious waste in 50 lt. plastic containers, and one hospital has a special air-conditioned room with a drainage system, both designated by law(see Q.6 and Q.14 in Data 3).
- All the hospitals that produce X-ray solutions use plastic water barrels for storage. Four hospitals (9.8% in Adana) use lead containers to store radioactive waste (see Q.9 and Q.17 in Data 3).

d. Questions on Treatment of Infectious and Hazardous Wastes at the Hospital Prior to Discharge

- Almost all the hospitals (95%, 27 in Adana, 12 in Mersin) do not treat their infectious waste prior to discharge. Of the two hospitals that treat their infectious waste, one in Mersin uses an incinerator while the other in Adana buries infectious waste in open pits (see Q.8 and Q.16 in Data 3).
- Of the sixteen hospitals that produce hazardous solid waste, fourteen (87.5%, 10 in Adana, 4 in Mersin) do not treat this waste category, while the remaining two in Adana either leave radioactive waste until collected by the Turkish Institute of Atomic Energy (TIAE) or leave the radionuclides in lead containers until discharge (see Q.9 and Q.17 in Data 3).
- The municipality is responsible for the removal of infectious waste from thirty-nine (95%) of the hospitals. It also collects incineration ash from one of the hospitals in Mersin. Only one of the hospitals in Adana is responsible for the removal of its infectious waste(see Q.10 and Q.18 in Data 3).
- The TIAE is responsible for the removal of hazardous (radioactive) solid waste from three (20% 3 in Adana) of the hospitals that produce this waste category. The rest of the responsibility lies with the municipality (25% 4 in Adana), the hospital (6.3% 1 in Adana), and private contractors (50%, 4 in Adana, 4 in Mersin) (see Q.11 and Q.19 in Data 3).
- Half the hospitals (14 of 28 in Adana, 6 of 13 in Mersin) receive waste collection for infectious waste at a frequency of five to six times a week. The other most common responses on infectious waste collection frequencies were: twice a week (12.5%, 3 in Adana, 2 in Mersin); once a week (12.5%, 2 in Adana, 3 in Mersin); twice a day (7.3%, 3 in Mersin); twice a month (4.9% ,2 in Mersin); and three to four times a week (4.9% 2 in Adana). Six of the hospitals in Adana reportedly receives a once or twice or three times a day collection service for this waste category (see Q.12 and Q.20 in Data 3).

e. The Cost of both Treatment and Collection for Individual Waste Categories

- None of the hospitals incur treatment expenses for infectious waste (see Q.16 in Data 3).
- On the collection of infectious waste, the hospitalising institutions in Adana spend 587,500 TL/day, while 1,087,250 TL/day is spent on average by institutions in Mersin (see Q.14BX-1 and Q.21 in Data 3).

- Approximately 601,000 TL/day is spent in Adana, on average, on hazardous waste collection services(see Q.15XA in Data 3).

f. Questions on Handling, Storage and Treatment Methods, Recycling, and Collection Costs for General Wastes

- The most preferred storage vessel for general waste at the central collection points is the 275 lt. metallic container with a lid, used by twenty four (58.5% 15 in Adana, 9 in Mersin) of the hospitals that responded. The next common storage vessel is the 400 lt. metallic container with a lid (19.5% 6 in Adana, 2 in Mersin). Two hospitals (4.9% 2 in Adana) have a specialised, locked room for the storage of general waste (see Q.21 and Q.24 in Data 3).
- The municipality is responsible for the removal of general waste from thirty-eight (95.1%, 26 in Adana, 13 in Mersin) of the hospitals. Only one of the hospitals in Adana is responsible for the removal of this waste category (see Q.23 and Q.25 in Data 3).
- Almost all the hospitals (80.5%, 21 in Adana, 12 in Mersin) receive waste collection services for general waste every day. Four hospitals (9.8%, 4 in Adana, 0 in Mersin) receive collection twice a day (see Q.24 and Q.26 in Data 3).
- Eighteen hospitals (43.9%, 8 in Adana, 10 in Mersin) have a recycling system for paper and for glassware, of which four (10%, 2 in Adana, 2 in Mersin) recycle both these items (see Q.29 and Q.28 in Data 3).
- In twenty-eight hospitals (22 in Adana, 6 in Mersin) no manual separation is carried out for the collection point is used only as a storage area. Of the remaining thirteen that have a manual separation system, two hospitals in Adana manually separate both general and infectious wastes (see Q.28 and Q.27 in Data 3).

g. Questions on Training Offered by the Hospital for Individuals Who Come in Contact with Medical Wastes (Waste Management Staff)

- Almost all the hospitals (87.8%, 23 in Adana, 13 in Mersin) have written instructions on separation and management of medical solid wastes on-site (see Q.30 and Q.29 in Data 3).
- At thirty-six (36) of the hospitals (87.8%) both infectious wastes and hazardous wastes are labelled and special instructions are given in their handling (see Q.31 and Q.30 in Data 3).
- Almost all the hospitals (95.1%, 26 in Adana, 13 in Mersin) provide some form of training on precautions over handling of infectious and hazardous wastes to the waste management staff. Twenty nine hospitals give frequent training to the staff who handle waste, with an average of 38.8 times a year (see Q.32 and Q.31 in Data 3).

- Thirty-eight (92.7%) of the hospitals provide protective clothing for their waste management staff (see Q.33 and Q.32 in Data 3).
- Twenty-nine hospitals (70.7%, 17 in Adana, 12 in Mersin) keep written records on the management of infectious waste, and, of the sixteen hospitals that generate hazardous waste, ten (66.7% 6 in Adana, 6 in Mersin) keep written records on the management of hazardous waste (see Q.34 and Q.33 in Data 3).
- The municipal health authority inspects twenty-seven (65.9%, 17 in Adana, 10 in Mersin) of the hospitals, with the most common response on frequency being once a year (26.8% 3 in Adana, 5 in Adana) (see Q.37 in Data 3).

h. Opinions of Interviewees on In-house Waste Management and in General

- Twenty two (16 in Adana, 6 in Mersin) hospital administrators (53.7%) feel there are no problems, in general, with the present waste management practices in their hospital. Sixteen (9 in Adana, 7 in Mersin), on the other hand, feel that the present system at their institution is satisfactory from an internal view point, but constitutes an unacceptable risk for the environment. Two hospital administrators hold the opinion that waste management practices at their institution constitutes a risk for everybody (see Q.38 and Q.34 in Data 3).
- Twenty hospital administrators(13 in Adana, 7 in Mersin) believe that the city's medical waste management practices are satisfactory from an internal view point, but constitutes an unacceptable risk for the environment (see Q.39 and Q.35 in Data 3).
- Most of the administrators (80.5%, 24 in Adana, 9 in Mersin) are enthusiastic about adopting an extensive recycling system for their hospital. Five (3 in Adana, 2 in Mersin) wished to see the results from other hospitals before they consider introducing a recycling scheme (see Q.40 and Q.36 in Data 3).
- Sixteen administrators (39.0%, 12 in Adana, 4 in Mersin) are keen on having private enterprises or individuals provide collection services for infectious waste and for hazardous waste, whereas twelve (29.3%, 8 in Adana, 4 in Mersin) wished to maintain the current system (i.e., only the municipality is responsible for collection) for infectious waste (see Q.41 and Q.37 in Data 3). Thirteen administrators (31.7% 18 in Adana, 5 in Mersin) wished to maintain the current system (i.e., only the municipality or the TIAE are responsible for collection) for hazardous waste (see Q.42 and Q.38 in Data 3).
- Over half the administrators (58.5% 18 in Adana, 6 in Mersin) prefer the municipality collects general waste; twelve (30%, 7 in Adana, 5 in Mersin) are happy to have private enterprises or individuals handle general waste (see Q.43 and Q.39 in Data 3).

2.3.4 Findings of the Survey

a. General Amount of Medical Wastes in Both GMs

The most important factors in medical solid waste management were based from the results of the questionnaire survey as shown below.

a.1 Infectious Waste

The 1998 infectious waste generation amount in the two greater municipalities (4401kg/day in Adana, 1,539kg/day in Mersin) is estimated and shown in Table 2-28. These values are consistent with those of other cities (see Table 2-29).

Table 2-28: Infectious Waste Generation Amount (1998)

GM	Generation Source	Unit Generation Rate		Generation of Infectious Waste (kg/day)
Adana	Hospitalising institution	0.82 kg/bed/day	4032 beds	3,311
	Non-hospitalising institution	10.6 kg/institution	120 institutions	1,272
	Subtotal			4,583
Mersin	Hospitalising institution	0.59 kg/bed/day	1292 beds	765
	Non-hospitalising institution	9.25/kg/institution	50 institutions	463
	Subtotal			1,228
Total				5,811

Table 2-29: Medical Waste Generation in Other Countries

Country	Medical Waste Generation	Infectious Medical Waste Generation
Santiago, Chile	1.9187 kg/bed/day = 1.82 kg/capita/year (EWI)	0.6561 kg/bed/day = 0.62 kg/capita/year (EWI)
Latin America ¹⁾	3 kg/bed/day	20% = 0.60 kg/bed/day
Belgium	11 kg/capita/year	1.4 kg/capita/year
Denmark		1.95 kg/capita/year 1.3 kg/bed/day
France	12.8 kg/capita/year	1.9 kg/capita/year
Germany	1.15 kg/capita/year	0.4 kg/capita/year
Ireland	6.1 kg/capita/year	2.6 kg/capita/year
Italy	2.6 kg/capita/year	1.0 kg/capita/year
Mexico City	2.4 kg/capita/year 4.73 - 5.38 kg/bed/day	0.24 kg/capita/year
Netherlands	10.8 kg/capita/year 2.3 - 6.5 kg/bed/day	0.6 kg/capita/year
Portugal	4.9 kg/capita/year	1.5 kg/capita/year
Spain	4.9 kg/capita/year 4 - 4.5 kg/bed/day	0.6 kg/capita/year 0.4 - 0.5 kg/bed/day
United Kingdom	5.5 kg/capita/year 2.5 - 3.3 kg/bed/day	5.5 kg/capita/year
USA	4.1 - 5.24 kg/bed/day	

Note: 1) Average assumed generation for Latin America according to *Organizacion Panamericana de la Salud* and *Organizacion Mundial de la Salud (IN/K3)*.
2) Sources: ... and research made by RH&H Consulting in Mexico City.

a.2 General Waste

General waste generated by medical institutions in Adana and Mersin (15980 kg/day in Adana, 3995 kg/day in Mersin) in 1998 is estimated as shown in Table 2-30. The

estimated values are 2.6 to 3.80 times larger than the amount of infectious waste generated in medical institutions (see Q.19 B-1 and 2 in Data 3).

Table 2-30: General Waste Generation Amount (1998)

GM	Generation Source	Unit Generation Rate		Generation of General Waste (kg/day)
Adana	Hospitalising institution	1.67 kg/bed	4,032 beds	6,741
	non-hospitalising institution	42.2kg/institution	120 institutions	5,064
	Subtotal			11,805
Mersin	Hospitalising institution	2.62 kg/bed/day	1,292 beds	3,388
	non-hospitalising institution	25.5 kg/institution	50 institutions	1,275
	Subtotal			4,663
Total				16,468

a.3 Hazardous Waste and X-ray Developing Solutions

Since information obtained regarding hazardous waste and X-ray developing solutions is limited, the generation amount of hazardous waste and X-ray developing solutions was not estimated.

b. Observations on Medical Waste Management in Adana and Mersin

b.1 Generation Source and Central Collection Area

The hospitals' discharge practices and storage methods are consistent, except for two medical institutions (2 in Adana), or 4.9% of the sample, that mix general waste with infectious and hazardous waste at the central collection area even though they are discharged separately. On average, hospitals discharge 5,811 kg (4,583 kg in Adana, 1,228 kg in Mersin) of infectious waste a day, and if this figure is applied to the average daily general waste amount, infectious materials make up nearly 40% of the general waste discharged by these hospitals. Of course this figure is based on average values, so there is a likelihood that the actual contamination rate is much higher or lower. The hospitals should therefore aim to maintain their good discharge practices in their storage phase to reduce the amount of infectious materials entering the general waste stream.

b.2 Manual Sorting and Street Children

Eleven hospitals(4 in Adana, 7 in Mersin) replied that street children manually separate general waste; a further two hospitals (4.9%, 2 in Adana) stated that street children sorted both general and infectious wastes.

It is impossible to ascertain whether these children are adequately protected against injury, or given any formal instructions on proper waste handling procedures, from the questionnaire responses; nor is it possible to calculate the risk factor associated with sorting general waste contaminated with bio-hazardous materials. The perceived risk, however, associated with handling the contaminated general waste is still great,

as 95% of the hospitals(39, 27 in Adana, 12 in Mersin) do not treat infectious waste prior to discharge.

b.3 Perception of the Respondents on Medical Waste Management

Twenty two hospital managers (53.7%, 16 in Adana, 6 in Mersin) expressed that there is no problem with the management of infectious and hazardous waste in their hospital; but, when asked their view on medical waste management in other medical institutions, only two managers (4.9%, 2 in Adana) felt there is no problem. This gives a clearer picture of the real situation in Adana and Mersin: the managers feel that their own hospital is appropriately handling medical waste, but to others their practices are unacceptable in terms of public and occupational health. The objective view of other managers may be an indication of the actual and, perhaps, critical situation of medical waste management in the two GMs.

c. Assessment of Present Medical Waste Management Conditions

In accordance with Law 2872, infectious and hazardous medical waste should be handled separately.

Twenty eight in Adana GM and thirteen medical institutions in Mersin GM were surveyed to identify medical waste management. The survey results indicate that the medical waste management level in both greater municipalities is low despite the fact that the system is fully defined legislatively and that almost all of the institutions were aware of this legislation. People were sufficiently informed about the system and the risks of infectious/hazardous wastes, and many institutions had taken precautionary measures.

All institutions have also reported the insufficient disposal services of both greater municipalities. Although medical wastes in Adana GM are disposed of at the present disposal site in Sofulu together with general waste types, no countermeasures to protect public health and the environment are adopted.

The survey shows that the institutions are willing to cover the necessary expenses to protect the environment and public health from the adverse impacts that waste disposal could incur.

2.4 Time and Motion Survey

2.4.1 Objectives of the Survey

One of the most important issue of solid waste management is to achieve a cost effective and efficient municipal solid waste collection service. There are two significant and essential factors which are considered to improve the solid waste collection service efficiency.

- Maximum use of vehicle capacity
- Maximum use of legal working hours

Besides these relevant factors, others such as, route selection, public participation, general conditions of physical infrastructure and equipment, also impact service efficiency.

In order to examine the Municipal Solid Waste Collection Activities, a precise understanding of the existing collection practices is important.

Time and Motion Survey concluded the following important issues:

- Time, distance and amount of municipal solid waste collected
- Type of containers used in collection service
- The routes of collection vehicles
- Observations on public participation (household level) and the level of service

The Greater Municipalities of Adana and Mersin comprise of 2 and 3 district municipalities, Seyhan and Yuregir, Yenisehir, Akdeniz and Toroslar, respectively. These municipalities are responsible for the collection and haulage services in the cities and therefore should somehow adopt the most technical and cost-effective collection system. To device an appropriate collection and haulage system, the efficiency and constraints of the existing collection system should be thoroughly understood by monitoring the collection vehicles, and therefore, a Time & Motion Survey has been carried out to clarify these important issues.

The areas and items to be covered in Adana and Mersin within this survey are detailed in the following table.

Table 2-31: Survey Areas Covered in Adana and Mersin and Survey Items

GM	DM	Type of Vehicle	Survey duration
Adana	Seyhan	Compaction Truck (12m ³)	2 days
		Compaction Truck (6m ³)	2 days
	Yuregir	Compaction Truck (12m ³)	2 days
		Compaction Truck (10m ³)	2 days
		Open Truck (18m ³)	1 day
		Tractor Trailer (4m ³)	2 days
Mersin	Yenisehir	Compaction Truck (12m ³)	2 days
		Compaction Truck (16m ³)	2 days
	Akdeniz	Compaction Truck (12m ³)	2 days
		Compaction Truck (16m ³)	2 days
	Toroslar	Compaction Truck (12m ³)	2 days
		Compaction Truck (16m ³)	2 days

2.4.2 Method of the Survey

The methodology of the survey is as follows:

- Selection of type of vehicles and routes
- Combination and formation of survey team

- Recording of times: departure from dispatch area, arrival and departure time from collection points, arrival and departure time from disposal sites and arrival time to dispatch area.
- Recording of distances: initial reading on departure area, arrival in collection point, arrival at disposal site and dispatch area.
- Observation of collection activities: type, condition and size of containers, area conditions, road conditions, type of waste and public participation.
- Mapping of location of collection routes/collection points, direction of dispatch area/disposal site, number of collection points.

2.4.3 Results of the Survey

a. Collection Activities in Adana GM

a.1 Yuregir District Municipality

In Yuregir the district municipality is responsible for the solid waste collection service. Although the municipality owns collection vehicles and rents some vehicles from a private company, the district municipality contracts drivers and collectors. Household waste is collected daily and contains demolition debris and agricultural waste such as animal carcasses, vegetation, concrete, and wood. The most common containers used for waste storage are oil drums (200lt.) and standard containers. Oil drums of 200lt. are set out on the main road, and bigger containers (400lt.) are set along trunk roads. Residents also use metal cans, plastic buckets, and plastic bags to discharge waste.

a.1.1 Household Waste

Levent

Household waste is collected by a tractor-trailer (4m³), operated by one driver and two collection workers. Although the residents in this area use both drums and metal cans to store their waste, metal cans were the preferred vessel by an overwhelming majority. Residents' also frequently used plastic bags to discharge waste. The collection method in this area is the bell collection method where residents bring their waste to the collection vehicle after being notified by a bell. As Levent is a low-income area, little amount of waste is discharged; on the day of the survey, approximately half the drums were empty.

PTT Evleri

In PTT Evleri, household waste is collected by a compactor truck (12m³), operated by one driver and two collection workers. Residents use various types of plastic bags, unlike in Levent where residents predominantly used plastic bags to discharge waste. In total, there are 33 containers without wheels and 49 drums in the streets, but household waste is either collected directly from individual houses by the collection workers, or brought to the compactor truck by the residents. This area is a low-income area, and as observed in other low-income areas, very little waste is generated.

The streets in this area are unplanned, unpaved, and narrow; and as a result, there is no enough space to set out the public containers. The collection vehicle has to run all over the road to pass the front of each house. And to do that, they must convey on the same route repeatedly.

On the day of the survey the compactor made only one trip, and the collection vehicle underwent maintenance in the afternoon. Usually the compactor makes two trips a day: one in the morning and the other in the afternoon. The compactor managed to cover the entire collection route by 16 minutes after 1pm without lunch break, collecting a total of only 4.3 tons. The inference is that collection work is highly inefficient, for the compactor is too large for the narrow roads and the amount of waste generated in this area. The collection efficiency would improve greatly with the improvement of the collection system.

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Collection service in this area is provided by a compactor truck (6m³), operated by one driver and two collection workers. Residents mainly use drums as a waste receptacle, but also use containers (without wheels), metal cans, plastic buckets, and plastic bags. Residents preferred to use metal cans when the drums were located too far apart, the drums were too small, or they discharge a large amount of waste. The plastic bucket is used in the same way as metal cans, that is the residents empties the contents directly into the compactor. They use also plastic bags. The number of container is few, and some containers were on the main road in the area.

In general, the public is co-operative, and the waste collectors courteous. In the surrounding area, the collection is well maintained and there is very little waste scattering. A few collection points were dirty, although the collection workers swept the area during the collection work.

The study team conducted the survey over two days: Monday and Tuesday. On Monday, residents discharged a large amount of waste, which had accumulated over the weekend. The compactor usually makes two trips, but was full before the end of the second trip. The remaining area was covered by a tractor-trailer after the compactor's driver informed the municipality of the situation.

On the other hand, residents discharged less waste on Tuesday, of which many of the drums were less than half-full or empty.

Collection service is provided daily, but the waste discharge amount during a weekday is small, as evident from Tuesday's results. Therefore a collection frequency of 2 to 3 times a week would be adequate for this area.

a.1.2 Institutional Waste

Military Installation, Cukurova University and PAKSOY Factory (Private Company)

An open truck (18m³), operated by one driver, collects the waste from this collection route. The military installation has a big storage cubicle, waste near the swimming pool, and a container, that are used as collection points. The soldiers load the waste onto the truck using shovels and spades. As the waste is not stored in containers, loading the waste onto the truck may take up to one hour; and because of the large

discharge amount, the truck is full by the time it leaves the military installation, thus ending its first trip.

The truck then approached to the university to collect the waste from the dormitories. During the survey, the truck collected only 13 plastic bags; although the truck is full by this point, the discharge amount was comparatively small because the survey was conducted during summer holidays. The vehicle continued to the next collection area, PAKSOY, before returning to the disposal site.

PAKSOY is a privately owned factory which produces vegetable oil. The district municipality collects waste from the factory only upon request. The municipality collects only non-hazardous waste and the waste is loaded onto the truck by the factory's loader.

a.2 Seyhan District Municipality

The district municipality of Seyhan is responsible for the solid waste collection throughout its territory. The municipality applies a modified privatisation approach in providing cleansing and waste collection services to a very extensive area. It independently undertaking waste collection and transportation activities essential. Accordingly, the municipality owns collection vehicles and rents some vehicles from a private company. The district municipality contracts drivers and collectors, and only street sweeping and cleansing of market places are contracted to a private company. Household waste is collected daily and contains demolition debris and agricultural waste, such as animal carcasses, vegetation, concrete, and wood. The most common containers used for waste storage are standard containers of 400lt./800lt., oil drums (200lt.) and some cubicles. Residents also use metal cans, plastic buckets, and plastic bags to discharge waste.

a.2.1 Household Waste

Toroslar

Household waste is collected by a compaction vehicle of 12m³, operated by one driver and two collection workers. Although the residents in this area use both wheeled containers of 400lt., oil drums of 200lt., and very few metal cans to store their waste. Wheeled containers were the preferred storage receptacle by an overwhelming majority. Residents' also frequently used plastic bags to discharge waste. The collection method in this area is communal container system.

Hurriyet

Household waste is collected by a compaction vehicle of 6m³, operated by one driver and two collection workers. Although the residents in this area use both wheeled containers of oil drums of 200lt., and very few plastic bags to store their waste. Oil drums were the preferred storage receptacle by an overwhelming majority. Residents' also frequently used plastic bags to discharge waste. The collection method in this area is communal container system.

a.3 Results

- Generally the public is co-operative and most of the collection points are maintained. There was some littering around the collection points, but the

collection workers promptly swept the waste. There is a shovel and a broom on all collection vehicles, so the collectors can sweep up any scattered litter.

- Drum cans are the most predominantly used waste storage container, followed by fixed containers. Waste loading takes an average of about 15 seconds for drum cans. Wastes stored in the fixed containers take about 5 minutes to load by two collection workers using shovels and a broom. Shovels and brooms particularly come handy when truck trailers are used for waste collection because the height of the bed of the truck makes the unloading of waste in drum cans quite difficult. The process takes an average of 3.5 minutes to finish.
- All containers in Yuregir and Seyhan are not wheeled, and therefore, it is very difficult to move; collectors must load the waste using shovel and broom, which is not an easy task to achieve.
- Drums are relatively easy to load if there are two workers assigned to empty the contents into a compactor truck.
- As previously mentioned, with a proper collection route and appropriate containers and vehicle types, the collection efficiency will improve dramatically.

b. Collection Activities in Mersin GM

b.1 Yenisehir District Municipality

Yenisehir District Municipality contracted out the collection and haulage of waste to a private company. The cleansing department is responsible only for controlling solid waste collection and haulage to the disposal site. All the collection vehicles are owned by the municipality. All vehicles are compaction trucks with capacity of 12m³ and 16m³. The collection crew is composed of one driver and two collection workers. The containers used in Yenisehir District were made of galvanised iron or HDPE plastic, and have a capacity of 400lt. and 800lit. Residents use plastic bags and plastic buckets to dispose their wastes to the collection system. The wastes from households were collected daily. All the wastes in the city are disposed to disposal area which is located in the vicinity of the composting plant.

b.1.1 Household Waste

Pirireis, Palmiye and Gazi

The household waste is collected by compaction trucks of 16m³ of capacity. Because of summer season conditions, the collection time was arranged between 18.00-24.00 hours in the first day of the survey. In this collection area the used containers are made of plastic of 800lt. capacity. Although the area is high income area, most of the containers were not full because of the big capacity and excess of the containers used, and residents use plastic and are reluctant to dispose them into the containers. The collection points with waste spills were swept by collection workers. The second survey in the same districts began at 4 a.m. and finished at noon, because of the change in the collection hours made by the municipality. In both surveys, there were 215 collection points and distance travelled was around 40 km; 16 tons of waste were collected in the first day and 18 tons on the second day.

Egricam, Akkent and Mentis

Household waste is collected by a compaction truck of 12m³ capacity. Wheeled containers of 400lt. capacity, which were numerically more than the 800lt. capacity wheeled containers, were in use. In the first day all containers were disposed, while on the second day the route has been changed and the collection vehicle did not collect the waste accumulated in some streets. In the second trip on the second day, the waste produced in the market (bazaar) was collected. The method of collection of market waste is primitive because workers are collecting waste by sweeping the street, it takes long time. A few collection points were dirty but collection workers swept the area during the collection work. The amount of containers are enough. The survey began early in the morning and took around 6 hours. On the first day 11 tons and on the second day 9 tons of waste were collected. In the first and second surveys there were 155 and 111 collection points respectively. Distance covered was 58km in the first survey and 56km in the second survey.

b.2 Toroslar District Municipality

Toroslar District Municipality contracted out the collection and haulage of waste to a private company. The cleansing department is responsible only for controlling solid waste collection and haulage to the disposal site. All collection vehicles are owned by the municipality. All vehicles are compaction trucks with capacity of 12m³ and 16m³. The collection crew is composed of one driver and two collection workers. The containers used in Toroslar District were made of galvanised iron or HDPE plastic, and have a capacity of 400lt. and 800lit. Residents use plastic bags and plastic buckets to dispose their wastes for the collection system. Wastes from households were collected daily. All wastes in the city are disposed to disposal area which is located in the vicinity of the composting plant.

b.2.1 Household Waste

Turunclu, Demirtas and Alsancak

All household waste is collected by a 16m³ compaction truck. The containers used were 400lt. and 800lt. in size. But most of the containers in this region were 400lt. in size. Collection activities began early in the morning and finished during lunch time. The collection area was composed of low-income residents which were using plastic buckets and metal cans to dispose the waste into wheeled containers. Participation of the residents in the collection was high; some residents emptied the plastic buckets or cans into the compactor directly being witnessed by the surveying team. Collection workers faced with some important difficulties because the roads were narrow and unpaved, collection of containers was difficult and dust is a problem for the workers and as well as the residents. Some of the collection points were dirty since the capacity of the containers were insufficient. Another problem for the collection crew were children playing in the roads and following the collection vehicles. The first and second days of the survey lasted around 6 hours: 21 tons of waste were collected on the first day, and 18 tons were collected on the second day. Distance travelled was 46km and 44km, respectively.

Saglik, Tozkoporan, Cavuslu

All household waste is collected by a 12m³ compaction truck and there were containers with 400lt. and 800lt. in size; most of the containers were galvanised iron.

Collection began early in the morning and finished at lunch time. Residents were using plastic bags, plastic buckets and metal cans for waste storage. This area is a middle-income area and collection efficiency was satisfactory. Collection lasted almost 5 hours: 238 and 181 containers were collected on the first and second survey day, respectively. The amount of waste collected was 18 and 14 tons, and the distance hauled were 46km and 39km, respectively.

b.3 Akdeniz District Municipality

Akdeniz District Municipality contracted out the collection and haulage of waste to a private company. The cleansing department is responsible only for controlling solid waste collection and haulage to the disposal site. All collection vehicles are owned by the municipality. All vehicles are compaction trucks (12m³ and 16m³). The collection crew is composed of one driver and two collection workers. The containers used in Akdeniz district were made of galvanised iron or HDPE plastic, and have a capacity of 400lt. and 800lit. Residents use plastic bags and plastic buckets to dispose their wastes for the collection system. The wastes from households were collected daily. All wastes in the city are disposed of into the disposal area which is located in the vicinity of the composting plant.

In the boundary of the Municipality there are some factories and military zone. Factories and military store their household waste in wheeled containers which are collected by trucks during the collection trips.

b.3.1 Household Waste

Atlas yolu, Karaduvar

Household waste was collected by a 12m³ compaction truck and collection started early in the morning and finished at lunch time. The survey area was a low-income area and roads were narrow and unpaved. Therefore, it was difficult for the driver of the vehicle to collect the waste efficiently. Residents use different types of receptacles to dispose their waste. Participation of residents in the collection activity is satisfactory. Most of the collection points were dirty. The first and second days of the survey covered 7 hours and 159 collection points, and 6 hours and 112 collection points, respectively. The amount of waste collected and distance covered were 13 tons and 73km on the first day and 13 tons and 86km on the second day.

c. Major Data Gathered

The following have been gathered from the relevant survey:

- Compilation of data on collection time, average collection distance and average amount of waste collected per trip.
- Information related to the collection of household waste, market waste.
- Type and condition of containers
- Number and condition of collection points

Data on collection time, average collection distance and average amount of waste collected per trip in Adana and Mersin is given in Table 2-32 and Table 2-33.

Table 2-32: Compiled Data on Adana GM

Mahalles/capacity of collection vehicles (m ³)	1 st trip			2 nd trip			3 rd trip		
	Time (min)	Distance (km)	Waste Amount (ton)	Time (min)	Distance (km)	Waste Amount (ton)	Time (min)	Distance (km)	Waste Amount (ton)
Military, Paksoy, Cukurova University (18)	323	26	18m ³	159	34	6m ³			
PTT Evleri (12)	150	36	4.3						
Seyhan, Haydaroglu, Yamacli, Cumhuriyet (10)	189	26.4	5.5	290	48.5	5.1			
	231	34.3	4.1	214	41.4	2.3			
Levent (4)	294	32.6	2.7m ³	214	41.8	2m ³			
	223	33.3	1.8	213	39.3	0.72			
Toroslar (12)	187	37.2	7.3	286	64.8	4.6			
	193	34.1	7.5	268	62.3	4.9			
Hurriyet (6)	149	29.6	3.68	131	33.6	2.94	163	55.9	2.18
	158	31.1	2.62	228	57.6	2.36			

The average time per trip for the *mahalles* of Adana is calculated as follows:

Military, Paksoy Factory and Cukurova University (18m ³)	482 min/2 trips	241 min/trip
PTT Evleri (12 m ³)		150 min/trip
Seyhan, Haydaroglu, Yamacli and Cumhuriyet (6m ³)	479 min/2 trips	240 min/trip
	445 min/2 trips	223 min/trip
Levent (4m ³)	508 min/2 trips	254 min/trip
	436 min/2 trips	218 min/trip
Toroslar (12m ³)	473 min/2 trips	237 min/trip
	461 min/2 trips	231 min/trip
Hurriyet (6m ³)	443 min/3 trips	148 min/trip
	386 min/2 trips	193 min/trip

The average distance travelled per trip in the *mahalles* of Adana is as follows:

Military, Paksoy Factory and Cukurova University (18m ³)	60 km/2 trips	30 km/trip
PTT Evleri (12m ³)		36 km/trip
Seyhan, Haydaroglu, Yamacli and Cumhuriyet (6m ³)	75km/2 trips	38km/trip
	76 km/2 trips	38 km/trip
Levent (4m ³)	75 km/2 trips	38 km/trip
	73 km/2 trips	37 km/trip
Toroslar (12m ³)	102 km/2 trips	51 km/trip
	97 km/2 trips	48 km/trip
Hurriyet (6m ³)	119 km/3 trips	40km/trip
	89 km/2 trips	45km/trip

The average load (amount) of waste collected per trip in the *mahalles* of Adana is calculated as follows:

Military, Paksoy Factory and Cukurova University (18m ³)	24 m ³ /2 trips	12 m ³ /trip
PTT Evleri (12m ³)		4.3 ton/trip
Seyhan, Haydaroglu, Yamacli and Cumhuriyet (10m ³)	10.6 ton/2 trips	5.3 ton/trip
	6.3 ton/2 trips	3.2 ton/trip
Levent (4m ³)	4.7 m ³ /2 trips	2.4 m ³ /trip
	2.5 ton /2 trips	1.3 ton/trip
Toroslar (12m ³)	11.6 ton/2 trips	5.8 ton/trip
	12.4 ton/2 trips	6.2 ton/trip
Hurriyet (6m ³)	8.8 ton/3 trip	2.93 ton/trip
	5.0 ton/2 trips	2.5 ton/trip

Table 2-33: Compiled Data on Mersin GM

Mahalles/Capacity of Collection Vehicles (m ³)	1 st trip			2 nd trip			3 rd trip		
	Time (min)	Distance (km)	Waste Amount (ton)	Time (min)	Distance (km)	Waste Amount (ton)	Time (min)	Distance (km)	Waste Amount (ton)
Piri Reis, Palmiye, Gazi (16)	203	18.1	9.5	157	22.0	6.0			
	246	26.0	9.8	170	15.3	7.7			
Turunclu, Demirtap, Alsancak (16)	248	24.5	11.5	169	21.0	10.1			
	200	22.5	10.5	175	21.3	7.4			
Nusretiye, Mesudiye (16)	215	24.2	11.6	246	28.7	8.2			
	229	24.7	11.3	189	29.3	7.4			
Atas yolu, Karaduvar (12)	208	37.2	6.4	179	36.2	7.1			
	194	46.8	4.9	204	39.2	7.8			
Saglik, Tozkoparan, Cavuslu (12)	130	13.2	6.4	130	16.8	5.7	60	16	5.7
	161	17.9	8	184	21	5.6			
Egricam, Akkent, Menten (12)	195	27.1	5.1	185	31.6	5.9			
	252	27	6	132	29	3.2			

The average time per trip for mahalles of Mersin is calculated as follows:

Pirireis, Palmiye and Gazi (16m ³)	360 min/2 trip	180 min/trip
	416 min/2 trip	208 min/trip
Turunclu, Demirtas and Alsancak (16m ³)	417 min/2 trip	209 min/trip
	375 min/2 trip	188 min/trip
Nusretiye and Mesudiye (16m ³)	461 min/2 trip	231 min/trip
	418 min/2 trip	209 min/trip
Atas Yolu and Karaduvar (12m ³)	387 min/2 trip	194 min/trip
	398 min/2trip	199 min/trip
Saglik, Tozkoparan and Cavuslu (12m ³)	320 min/3 trip	107 min/trip
	345 min/2 trip	173 min/trip
Egricam, Akkent and Menten (12m ³)	380 min/2 trip	190 min/trip
	384 min/2 trip	192 min/trip

The average distance travelled per trip in the mahalles of Mersin is as follows:

Pirireis, Palmiye and Gazi (16m ³)	41 km/2 trip	21 km/trip
	42 km/2 trip	21 km/trip
Turunclu, Demirtas and Alsancak (16m ³)	46 km/2 trip	23 km/trip
	44 km/2 trip	22 km/trip
Nusretiye and Mesudiye (16m ³)	53 km/2 trip	27 km/trip
	54 km/2 trip	27 km/trip
Atas Yolu and Karaduvar (12m ³)	74 km/2 trip	37 km/trip
	86 km/2trip	43 km/trip
Saglik, Tozkoparan and Cavuslu (12m ³)	46 km/3 trip	16 km/trip
	39 km/2 trip	20 km/trip
Egricam, Akkent and Menten (12m ³)	59 km/2 trip	30 km/trip
	56 km/2 trip	28 km/trip

The average load (amount) of waste collected per trip in the *mahalles* of Mersin are calculated as follows:

Pirireis, Palmiye and Gazi (16m ³)	16 ton/2 trip	8 ton/trip
	18 ton/2 trip	9 ton/trip
Turunclu, Demirtas and Alsancak (16m ³)	22 ton/2 trip	11 ton/trip
	18 ton/2 trip	9 ton/trip
Nusretiye and Mesudiye (16m ³)	20 ton/2 trip	10 ton/trip
	19 ton/2 trip	10 ton/trip
Atas Yolu and Karaduvar (12m ³)	14 ton/2 trip	7 ton/trip
	13 ton/2trip	7 ton/trip
Saglik, Tozkoparan and Cavuslu (12m ³)	18 ton/3 trip	6 ton/trip
	14 ton/2 trip	7 ton/trip
Egricam, Akkent and Menten (12m ³)	11 ton/2 trip	6 ton /trip
	10 ton/2 trip	5 ton/trip

2.4.4 Findings of the Survey

- In all municipalities, collection activity was proceeding in smooth, but unplanned and inefficient manner.
- Allocation of the containers must be done according to needs and amount of waste produced by the residents.
- In general, waste collection workers use their time efficiently. But collection of market waste take long time because workers collecting the waste by sweeping. Generally containers are new, but not maintained in a proper way.
- There was some littering around the collection points, but the collection workers promptly swept the waste. There is a shovel and a broom on all collection vehicles, so the collectors can sweep up any scattered litter.
- With a proper collection routing and appropriate capacity and number of containers and vehicle types, the collection efficiency will improve dramatically.

2.5 Survey on Recycling Activities

2.5.1 Compost Market Survey in Mersin

a. Objectives of the Survey

While the Cukurova plain by nature is very fertile many farmers live in the mountain areas surrounding the plain. The soil in these areas is more “hard” and requires soil conditioning.

The composting plant in Mersin is selling two products of compost:

- “Coarse compost”, which is compost that has been stored and to some degree treated in the plant for maybe 2 months; but has not obtained the final screening.
- “Fine compost” which is material that has been stored and to some degree treated in the plant for maybe 2 months, and also obtained the final screening.

The capacity of the final screening plant is very limited. Therefore, the production of fine compost is limited.

This survey has the propose of investigating the demand for compost amongst farmers living in the vicinity of Mersin Composting Plant.

b. Methods of the Survey

b.1 Questions to Individual Farmers Using Compost

The individual farmers who use compost were found on the Mersin Composting Plant when they came to buy compost. A questionnaire was prepared, and farmers were questioned during a period of one month at the weigh bridge of the composting plant.

b.2 Questions to Group of Farmers Met in Villages

Farmers in groups were easily found in local pubs (kahave hane) in the villages. Almost all people met in these pubs were farmers, and very co-operative. After having questioned a few farmers one by one it was found that most farmers living in the same village had a common opinion regarding compost from Mersin Composting Plant. Therefore, it was more appropriate to put questions to the whole group of farmers gathered in a pub. Sometimes more than 30 farmers were listening, discussing, and giving their opinion.

A questionnaire was prepared. And a survey was carried out amongst groups of farmers met in 15 villages. The locations of villages are presented in the following figure.

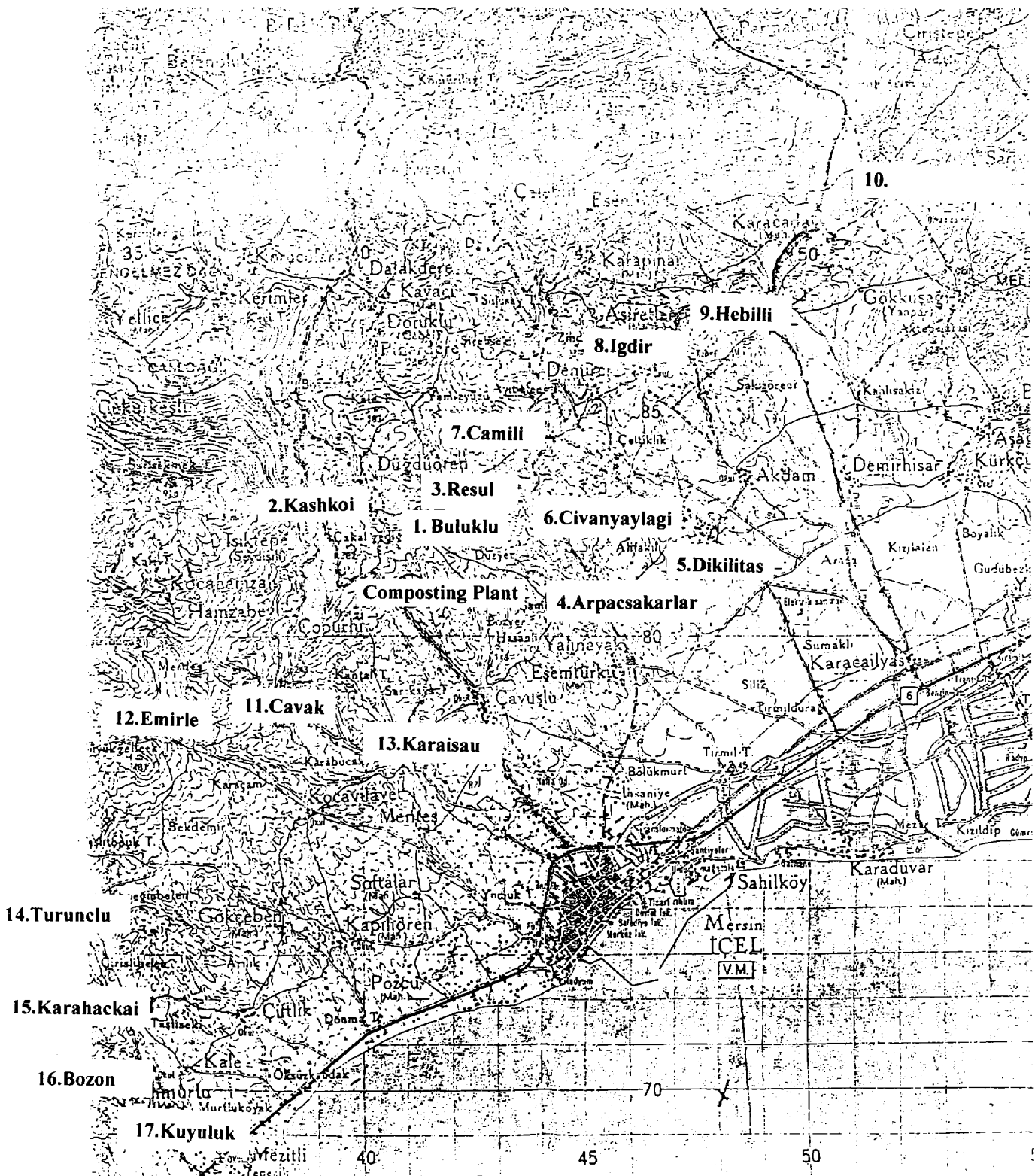


Figure 2-4: Location of Villages Included in the Market Survey (1:10,000)

c. Findings of the Survey

c.1 Findings from Questioning Individual Farmers Using Compost

During October 9 farmers filled in the questionnaire. Answers were as follows.

Y 1 What kind of compost do you buy ?

Two (2) farmers answered they bought coarse compost. One (1) farmer bought fine compost only, and 6 farmers bought both fine compost and coarse compost.

Y 2 When do you buy compost ?

All 9 farmers answered: during the period September - November.

Y 3 How Much Compost do you buy ?

Four (4) farmers answered they bought 30 to 50 ton/year. Five (5) farmers did not know.

Y 4 Do you think that the present price for compost is OK ?

All 9 farmers answered that the present price (500,000 TL/ton for coarse compost and 750,000 TL/ton for fine compost) was reasonable.

Y 5 What do you think about the quality of the compost?

All 9 farmers answered that the compost contains too much plastic and other harmful material.

Y 6 For which corps do you apply compost ?

The farmers use compost for the following crops:

- Citrus or orange trees
- Vegetables like onions, watermelon, etc.
- grapes (vineyards)

Y 7 Do you also use other fertilisers in your field ? What is the price ?

Four (4) farmers answered that they also use mature cow manure which they buy at a present price of 2 million TL/ton.

c.2 Findings from Questioning Groups of Farmers Met in Villages

The common opinion of groups of farmers was obtained as follows:

- **Buluklu Village** (200 farmers in the village. A group of 10 farmers was met)

The village do not use compost; but they are former users. Only the village wants to buy fine compost. Coarse compost contains too much harmful materials (plastics, metals, etc.). The composting plant does not produce enough fine compost. They have to wait so long if they order fine compost.

- **Kashkoi Village** (200 farmers in the village. A group of 30 farmers was met)
The village does not want to buy coarse compost because it contains too much plastic, big size metal, etc. The village wants to buy fine compost; but it is never available. The price for fine compost can be doubled.
- **Resul Village** (200 farmers in the village. A group of 7 farmers was met)
They used compost 5 years ago, when the composting plant produced fine compost. They do not want buy coarse compost because of plastics and other admixtures. They are prepared to pay 1 million TL/ton for fine compost.
- **Arpacsakarlar Village** (900 farmers in the village. A group of 20 farmers was met).
They used compost 5 years ago. Now they do not buy compost because it contains too much plastics, and they believe industrial waste (oil, etc.) is mixed into the waste that is used for the production of compost. They would pay 1 million TL/ton if a good quality compost was produced. However, they would have to test the compost before they could start buying again. They have lost their confidence in the composting plant.
- **Dikilitas Village** (100 farmers in the village. 2 groups, each 10 farmers was met).
The village uses compost. The quality of fine compost is reasonable; but price (1 million TL/ton) is too high for the present quality of compost, and the composting plant does not produce enough fine compost. Some farmers buy coarse compost.
- **Civanyaylagi Village** (250 farmers in the village. A group of 8 farmers was met).
The village do not use compost. They used compost when it did not contain too much plastic. The village prefer cow manure and compost is too expensive, considering its bad quality.
- **Camili Village** (200 farmers in the village. A group of 30 farmers was met)
The village do not use compost; but they are former users. The village wants to buy fine compost; but it is never available, even if they could pay 1 million TL/ton.
- **Igdir Village** (250 farmers in the village. A group of 20 farmers was met)
The village do not use compost; and they never did. They use cow manure that they buy from supplier in Adana; but not enough cow manure is available. The compost plant in Mersin does not produce enough suitable compost (fine compost) and they are afraid of using coarse compost. They can pay 2.5 million TL/ton if good compost was available.
- **Hebilli Village** (100 farmers in the village. A group of 7 farmers was met)
The village do not buy compost. They used compost when it did not contain too much plastic. Fine compost is never available.

- **Pug-Karacadag Village** (200 farmers in the village. A group of 15 farmers was met).

The village do not buy compost. The distance (30 km) to the composting plant is too big. They do not know the quality of the compost.

- **Cavak Village** (300 farmers in the village. A group of 15 farmers was met)

The village does not buy compost; and they never did. The compost plant in Mersin does not produce enough suitable compost (fine compost) and they are afraid of using coarse compost and do not want to buy it. They prefer other fertilisers such as cow manure. They use cow manure that they buy from supplier.

- **Emirle Village** (200 farmers in the village. A group of 30 farmers was met)

The village does not buy compost, and they never did. The compost plant in Mersin never has fine compost and we do not want to buy coarse compost. They use cow manure by themselves and chemical fertilisers that they buy from supplier.

- **Karaisali Village** (100 farmers in the village. A group of 20 was met)

The village does not use compost. They used compost when it did not contain too much plastic. The compost plant in Mersin never has fine compost and we do not want to buy coarse compost. The village prefers cow manure and compost is too expensive, considering its bad quality. They use cow manure and chemical fertiliser that they buy from the supplier.

- **Turunclu Village** (50 farmers in the village. A group of 10 was met)

The village does not use compost. They used compost when it did not contain too much plastic. The village prefers cow manure and compost is too expensive, considering its bad quality. They use cow manure by themselves and chemical fertiliser that they buy from supplier.

- **Karahackai Village** (200 farmers in the village. A group of 15 was met)

The village does not buy compost, and they never did. They do not know the compost plant. The village prefers other fertilisers such as cow manure by themselves. They use cow manure by themselves and chemical fertiliser that they buy from supplier.

- **Bozon Village** (500 farmers in the village. A group of 10 was met)

The village used compost 4 years ago, when the composting plant produced fine compost. They do not want to buy coarse compost because of plastics and other admixtures. The village prefers cow manure and compost is too expensive, considering its bad quality. They use cow manure and chemical fertiliser that they buy from supplier.

- **Kuyuluk Village** (500 farmers in the village. A group of 10 was met)

The village used compost 4 years ago, when the composting plant produced fine compost. They do not want to buy coarse compost because of plastics and

other admixtures. They use cow manure and chemical fertiliser that they buy from supplier.

c.3 Other findings

Other findings from the survey in villages were as presented in the following figures and table.

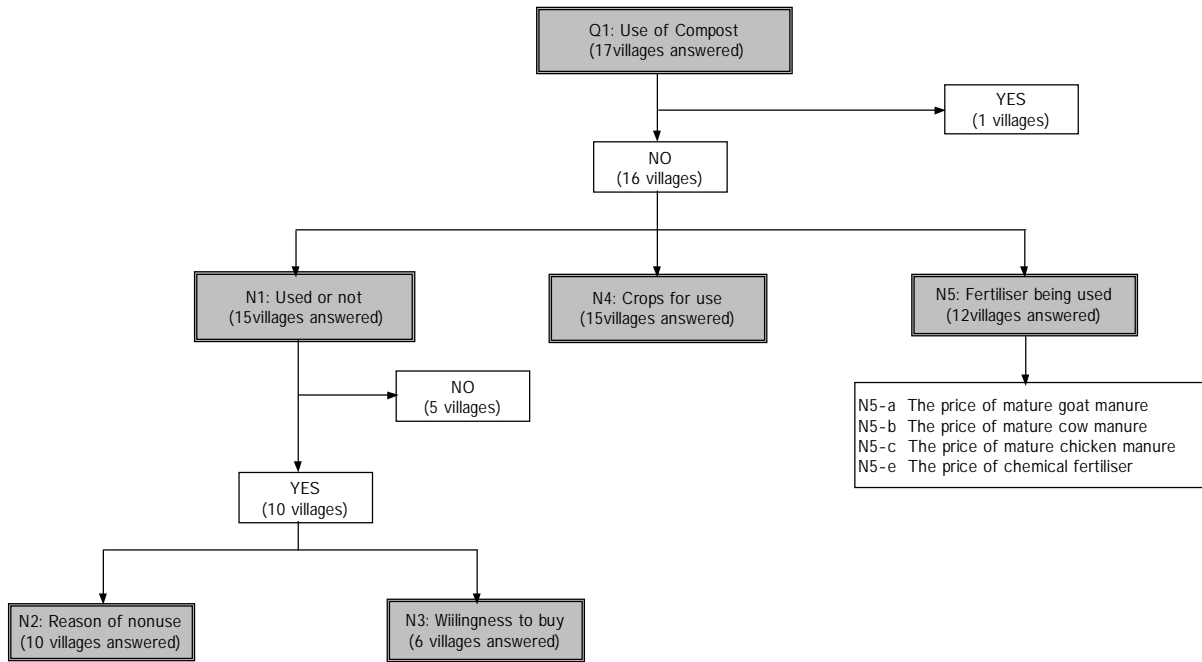


Figure 2-5: Relationship of Questions/Answers and Numbers of Villages

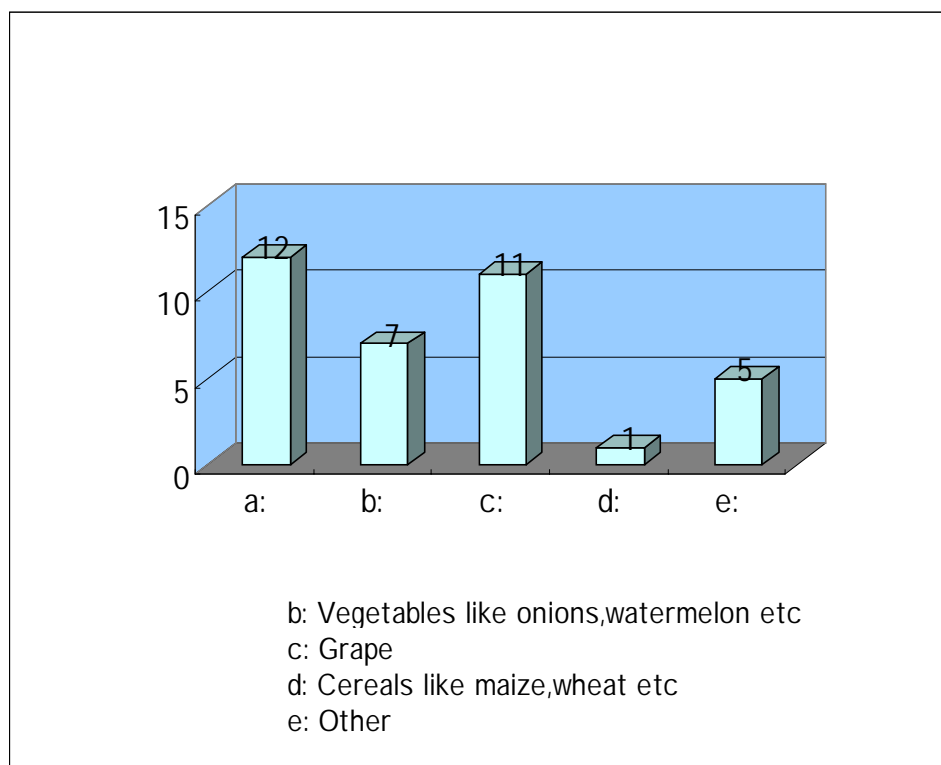
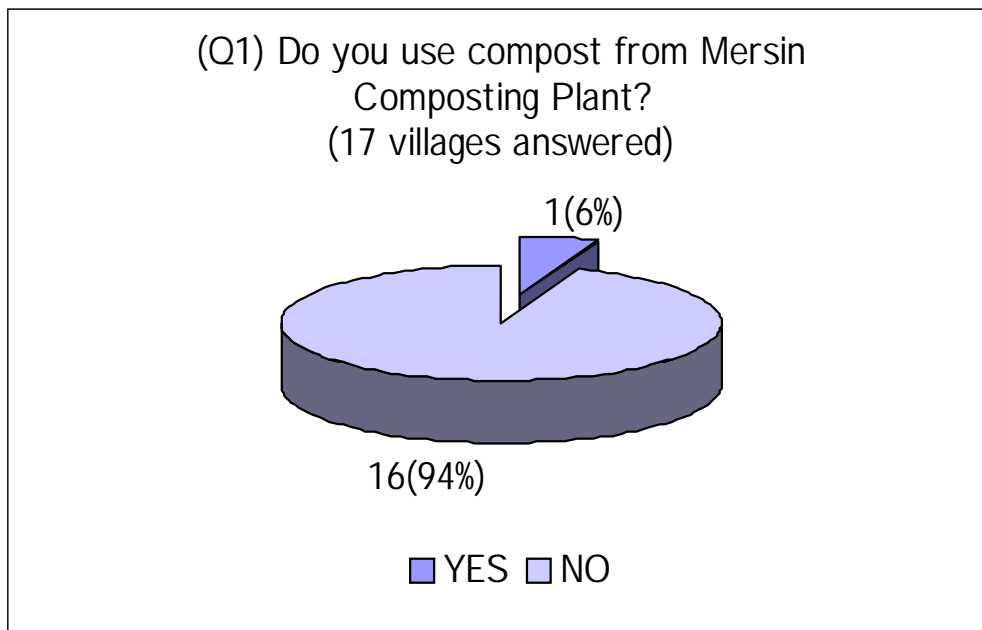
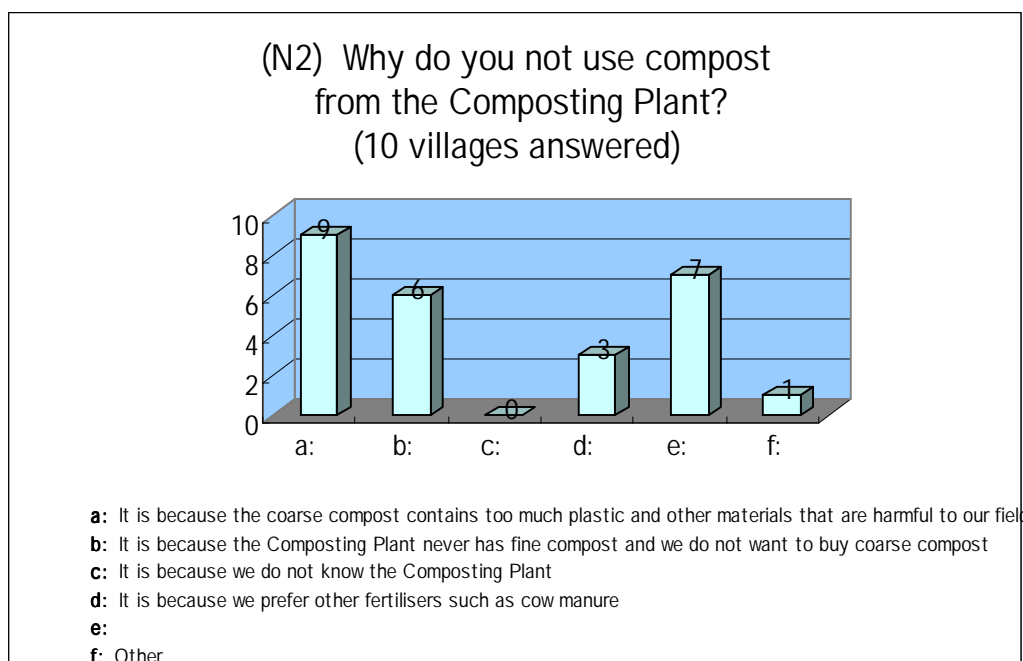


Figure 2-6: Answers to Q1 and N1



N3	Would you pay 1,000,000 TL/ton if the Composting Plant had fine compost enough? (6villages answered)	Number of village chose each item	% of village chose each item
a:	YES	6	100%
b:	NO	0	0%

Figure 2-7: Answers to N2 and N3

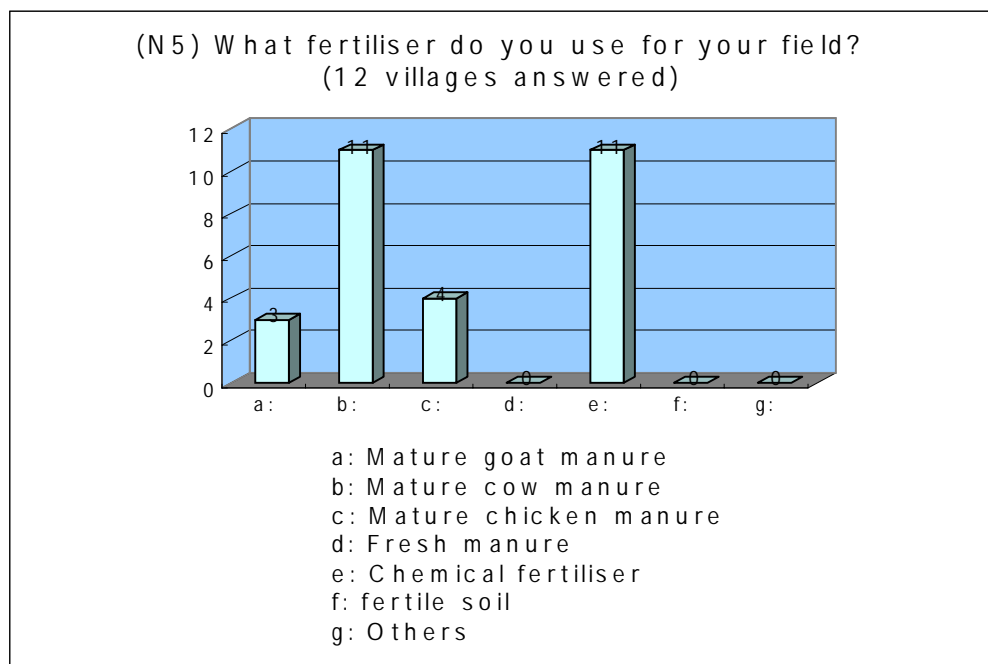
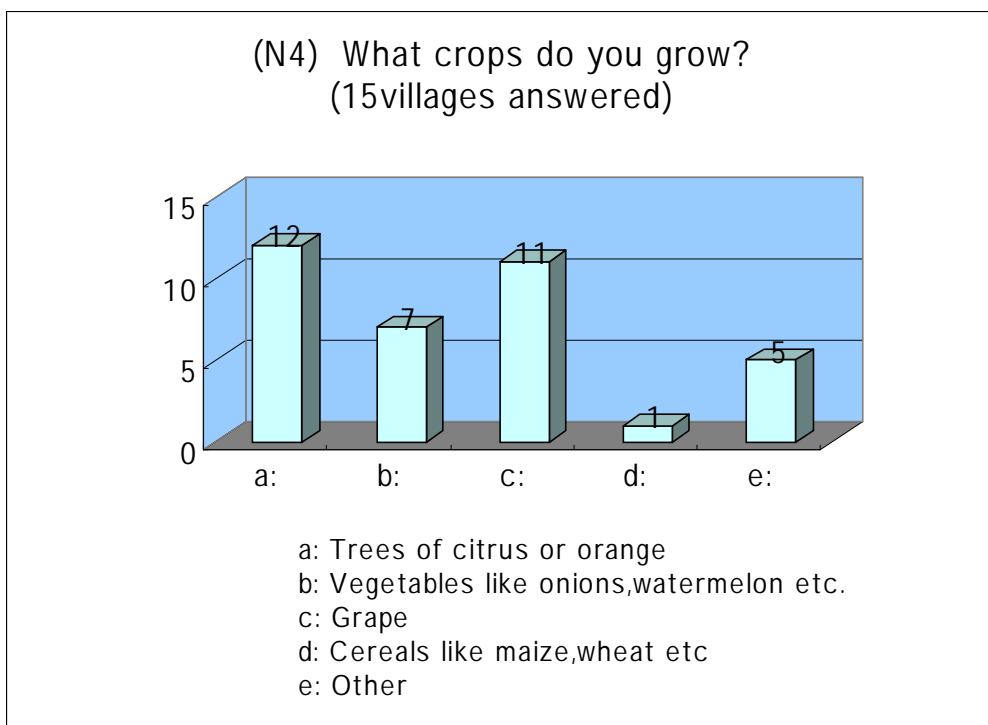


Figure 2-8: Answers to N4 and N5

Table 2-34: The Price of Fertilisers

unit : TL/ton

Village	Alternative fertilisers				Remark
	N5-a Mature goat manure	N5-b: Mature cow manure	N5-c Mature chicken manure	N5-e Chemical fertiliser	
1	4,000,000	4,000,000	4,000,000	60,000,000	Each farmer owns approximately 1 ha.
2	4,000,000	4,000,000	4,000,000	50,000,000	
3					
4					
5			4,000,000	21,000,000	
6		2,000,000		22,000,000	
7		7,000,000		30,000,000	Each farmer owns 30 to 50 ha. Compost should be applied in October and April. 2 ton/ha is required each year.
8					Each farmer owns 30 to 50 ha.
9					Each farmer owns 30 to 50 ha.
10	4,000,000	4,000,000	2,000,000		
11		3,000,000			
12				30,000,000	
13		5,000,000		60,000,000	
14				33,000,000	
15				30,000,000	
16		3,000,000		35,000,000	
17		3,000,000		40,000,000	
Average	4,000,000	3,889,000	3,500,000	37,364,000	

d. Findings

d.1 Findings from Questioning Individual Farmers Using Compost

All farmers asked complained that the compost contains too much plastic and other harmful material.

d.2 Findings from Questioning Groups of Farmers Met in Villages

Regarding the survey in villages, findings for each village are summarised in the following table.

Table 2-35: Summary of Findings for Each Village

Village	
1. Buluklu	Only the village wants to buy fine compost. Coarse compost contains too much harmful material. The composting plant does not produce enough fine compost.
2. Kashkoi	The village does not want to buy coarse compost but fine compost. Coarse compost contains too much plastics.
3. Resul (200 farmers)	They do not want buy coarse compost but fine compost.
4. Arpacakarlar (900 farmers)	They do not buy compost because it contains too much plastics. They have lost confidence in the composting plant.

Village	
5. Dikilitas (100 farmers)	The quality of fine compost is reasonable; but price is too high, and the composting plant do not produce enough fine compost.
6. Civanyaylagi (250 farmers)	The village would buy compost if the quality was improved.
7. Camili (200 farmers)	The village wants to buy fine compost; but it is never available.
8. Igdır (250 farmers)	The compost plant does not produce enough suitable compost (fine compost) and they are afraid of using coarse compost.
9. Hebilli (100 farmers)	Fine compost is never available.
10. Pug-Karacadag	The distance to the compost plant is too big.

The general conclusion is that farmers require compost produced on the basis of solid waste. However, they do not want their fields to be polluted by plastics, etc.

e. Recommendations

It is recommended that:

- A pilot project is carried out having aims of at least provisionally to improve the compost quality and to estimate the price that can be obtained for this product.
- A more detailed market survey be carried out amongst farmers met in villages. The survey should include but not be limited to issues like:
 - i. To investigate the quantity that can be sold. How big are the farmers' fields and how much and how often do they require compost?
 - ii. How far from the composting plant can compost be sold?
 - iii. Are there seasonal variations in the demand of compost?
 - iv. As the candidate site for a landfill may also be the candidate site for a new composting plant, it should be investigated if there are many farmers near (30km) the candidate landfill sites in Adana and Mersin?
 - v. To better understand why a soil conditioner is required on the farmers' fields.
 - vi. To investigate the price that can be obtained for a better quality of compost. (Bring sample of compost from the recommended pilot project.)

The Cukurova plain is by nature very fertile. Thus it will in the long term be difficult to sell compost derived from waste, unless the compost is of very high quality without plastic and does not contain heavy metals. Thus, it should be considered:

- At first only to receive waste from markets and restaurants on the composing plant, and at a later stage maybe to introduce source segregation of waste.
- To construct a new composting plant, as the present composting plant has many deficiencies and is producing a bad quality of compost.

2.5.2 Survey on Recycling System

a. Objectives of the Survey

This section of the Survey on Recycling Activities intends to find the present situation of recycling in the study area, based on data obtained by questionnaire survey and interview survey with every related parties in recycling activities from generation source to disposal site.

The objectives of this survey are described below:

- To understand the present recycling system
- To understand the present waste amount recycled
- To understand the trends and potential demands for recycled materials
- To diagnose the present recycling system
- To obtain the basic data to forecast the impact by the master plan to recycling and also to formulate the appropriate recycling plan.

b. Method of the Survey

Since recycling activities are concerned with many parts in the waste stream from generation source to final disposal site, the study team firstly drew the recycling flow diagram in the target area according to the information given by the counterparts. The recycling flow diagram is shown in Figure 2-9 below.

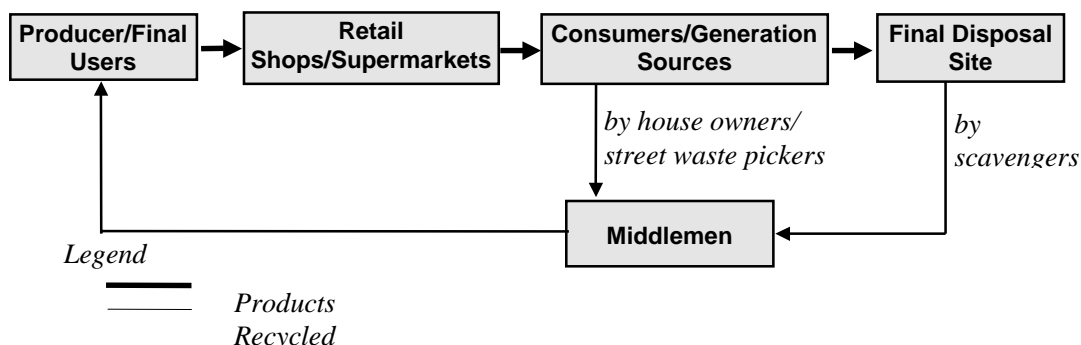


Figure 2-9: Estimated Recycling Flow Diagram in the Target Area

In order to verify this flow diagram and also to grasp the waste amount of each flow, the questionnaire and/or interview survey were conducted with the following related parties.

- Consumers/generation source
- Scavengers in the cities (refer to 2.5.3, *Survey on Scavengers*)
- Scavengers at the final disposal sites (refer to 2.5.3, *Survey on Scavengers*)
- Middlemen
- Producers/final users

The questionnaire survey and interview survey have been carried out to determine the characteristics of the present recycling system and the total amount of waste recycled to the following number of interviewees.

Table 2-36: Number of Samples and Method of Survey

Greater Municipality Related Party	Adana	Mersin	Method of Survey
1. Consumers/house owners	75	75	Questionnaire survey
2. Street waste pickers	30	30	Questionnaire survey
3. Scavengers at dumpsite	5	5	Interview survey
4. Middlemen	19	15	Questionnaire survey
5. Producers/final users	7	1	Questionnaire survey

c. Results of the Survey

c.1 Adana

c.1.1 Consumers/Generation Sources

The primary recycling activity starts at generation source. While discharge waste, they also practice recycling activities by sorting out valuable/reusable waste for selling or reuse. Therefore, representatives of each of the WACS sampling points were investigated by the study team using a questionnaire whether they recycle any waste items. In case of a reply brought unclear answer, the study team proceeded face to face interview to the sampling point for clarification.

From the questionnaire survey outcomes, the practice of reuse/recycling of items within the premises of the sources, or selling recyclable wastes to middlemen is not active. However, among household samples for WACS, high income household and low income household engaged in recycling activities amount to about 33% and 30%, respectively. While only 13% of the middle income household samples practised recycling.

They mainly sort paper, cardboard and metals from their wastes. After sorting these materials, they mainly sell them to middlemen. The selling prices of recyclable wastes from generation source to middlemen are the same as the buying prices of sorted materials by middlemen (refer to Table 2-37).

Some households recycle food waste by feeding their animals and garden waste such as branch of tree is stored in their premises in order to use as fuel for heating during the winter season. Figure 2-10 shows the daily total quantity of recyclable materials sorted by sampling points for the WACS. However, the figure is not classified resource recovery amount by income level among household groups. For other sample representative sectors of WACS like commercial and institutional sectors, only one other shop in commercial sector recycles paper. The amount of paper being recycled by WACS sampling points is fine.

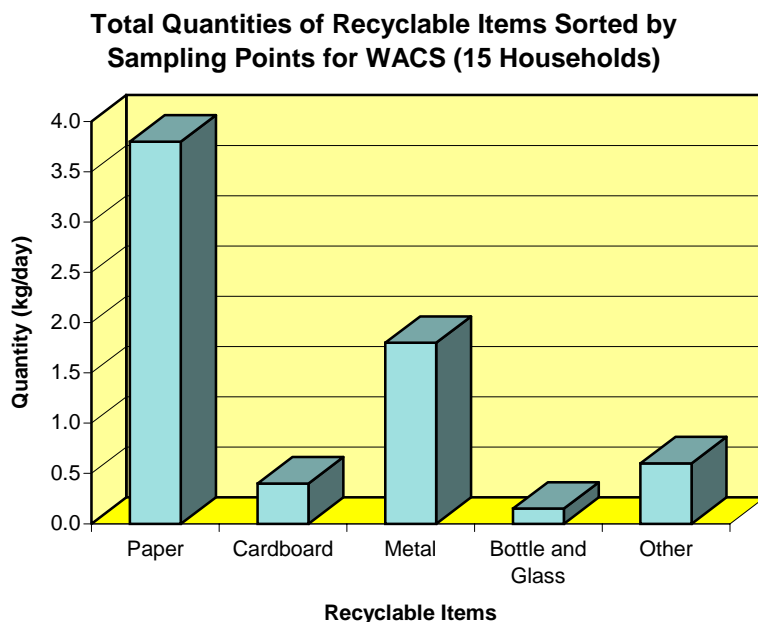


Figure 2-10: Daily Total Quantity of Recyclable Items Sorted by Samples for WACS

From the results of the POS regarding selling recyclable waste items by generation source, 46.25% of sampled households practised this activity. However, more than 96% of the households who practice recycling replied that they sold it sometimes (less than once a month). Since the recycling amount differs much by income level, the study team took the recycled amount by income level into account. The amount of recycled materials by each income level is shown in the following table.

Table 2-37: Amount of Recycled Materials by Income Level

Household Income	Recycled Items						Total Amount	Average Amount Per Person
	Paper	Cardboard	Metal	Plastic	Bottle & Glass	Others		
High	1,750	230	1,125	70	80	0	3,255	36
Middle	1,130	190	370	60	30	40	1,820	20
Low	990	0	350	100	60	620	2,120	17
Total	3,870	420	1,845	230	170	660	7,195	

unit: g/day

Finally, the total amount of recyclable materials sorted by generation source is calculated as shown below.

$$(36 \times 0.09 \times 1,196,620) + (20 \times 0.47 \times 1,196,620) + (17 \times 0.44 \times 1,196,620) / 1,000,000 = 24 \text{ ton/day}$$

c.1.2 Scavengers in the Cities (Street Waste Pickers)

While the recycling activities of the public sector are dormant, those by the private sector are very active, particularly by street waste pickers who are often seen in the study area from early morning to late afternoon or even at night.

The questionnaire survey to street waste pickers was carried out for 15 persons from each district municipality, namely Seyhan and Yuregir by study assistants. The outcome of the questionnaire survey states that most street waste pickers mainly sort out paper, aluminium cans, tin cans, metals, copper and plastics. The total amount of recyclable material sorted by street waste pickers is estimated to be 15 ton/day based on the questionnaire survey with street waste pickers and middlemen. The results are detailed in section 2.5.3, *Survey on Scavengers (Waste Pickers)*.

c.1.3 Scavengers at the Final Disposal Site

Approximately 60-70 scavengers work daily full time at the existing landfill site in Sofulu to sort out recyclable materials. They mainly collect metals, bottles and glasses, plastics, and cardboard. Scavengers at the disposal site belong to a group of “big five scavengers” who control recycling activities from management, accounting, dealing with buyers or even commuting service for scavengers. The scavengers at the disposal site are well organised, working systematically and efficiently. From the interview survey of the head of the “big five scavengers”, it is estimated that the total amount of recyclable materials sorted at the disposal site is approximately 9 ton/day. The outcome is detailed in section 2.5.3, *Survey on Scavengers (Waste Pickers)*.

c.1.4 Middlemen

The questionnaire survey was conducted to 19 middlemen in Adana and they were very cooperative to the survey. Most of the middlemen purchase recycled materials from street waste pickers and some house owners who bring collected items to them. The materials are stored and subsequently sold to final users or even to middlemen again depending on the type of material and the business scale of the middlemen. Because most middlemen in the study area are keen in some type of recyclable item, they, therefore, resell materials that are not directly concerned with other middlemen who have more speciality or directly liking in business of recycled materials. Some small middlemen also after purchasing sorted items, they resell to bigger middlemen.

However, due to the strong earthquake that hit Adana in June 1998, nearly half of the middlemen surveyed were directly or indirectly affected. Some damaged constructions in the middlemen’s premises were seen by the study team. In serious cases, some middlemen who are still operation also stated that their businesses are facing difficulties. In particular, recycled materials that they do not specialise in are hard to resell to other middlemen. However, the study team obtained the buying and selling price of sorted materials by middlemen and are tabulated in Table 2-38. The estimated quantity of each recycled item by middlemen is shown in Table 2-39.

Table 2-38: Buying and Selling Price of Materials Sorted by Middlemen in Adana

unit: TL/kg

Materials	Buying Price	Selling Price
Metal	8,500 - 15,000	10,000 - 18,000
Aluminium cans	130,000 - 160,000	170,000 - 200,000
Plastic	12,000 -30,000	25,000 - 50,000
PET	15,000 - 30,000	40,000 - 50,000
Bottle and glass	3,000 - 5,000	5,000 - 12,500
Paper	5,000 - 8,000	10,000 - 20,000
Cardboard	10,000 - 16,000	13,000 - 23,000

Table 2-39: Daily Quantity of Recyclable Materials Purchased by Middlemen

Item	Metal	Aluminium Can	Plastic	PET	Bottle & Glass	Paper	Others
No. of middlemen buyers	16	9	9	1	2	3	2
Quantity purchased (t/day)	6	2	4	1	1	12	very little

As stated before, most middlemen prefer to deal with recyclable materials they specialise in, therefore, they sell other sorted items to other middlemen. The list of companies the middlemen directly sell the materials they have recycled is shown in Table 2-40.

Table 2-40: List of Companies Buying Recyclable Materials from Middlemen in Adana

Material	Company
Metal	Ekinciler Denir Celik Fabrikasi, Iskenderun Yazicilar, Iskenderun Yeni Sanayi Carsisi Karaka Ticaret Cuma Deniz, Adana (Middleman) Musa Esme (Middleman) Ziya Nazar (Middleman)
Aluminium Can	Ekinciler Demir Celik A.S., Iskenderun Kiliglar Pres, Yeni Sanayi Carsisi Cuma Deniz, Adana (Middleman) Muzaffer Kara (Middleman)
Plastic	Cafar Uluisik, Adana Ulucan Ticaret, Adana Ozman Plastic, Adana Guney Nylon Plastic, Adana Plastic Factory from Gazientep Cetin Plastic Factory, Adana (Middleman and Final User) Murut Sardikli (Middleman) Cuma Deniz, Adana (Middleman) Guney Dogu Plastic, Adana (Middleman)
PET	SASA Artificial and Synthetic Fibers Inc., Adana
Bottle and glass	Anadolu Cam Sanayi A.S., Mersin

Material	Company
Paper	Donkasan, Adana (Middleman and Final User) Kimaras Paper Factory, Adana Omas Ozaltin Oluklu Mukavva Ambalaj San A.S., Adana Guney Dogu Plastic, Adana (Middleman)
Cardboard	Donkasan, Adana (Middleman and Final User) Kimaras Paper Factory, Adana

The estimation of middlemen surveyed on the quantity of recycling materials is taken into account to consider waste amount recycled in each sector, particularly the amount of recycled items by street waste pickers and house owners. However, the study team took a note that estimated recycled amount by middlemen is also included the amount of reusable material that transact among them.

c.1.5 Producers/Final Users

According to the list of producers/final users given to the study team by the counterparts, there are about 20 final users in Adana and more than half of them (13 companies) are plastic factories. The study team conducted questionnaire survey on 7 producers/final users in Adana, and 3 of the 7 final users surveyed give priority to large scale factories that do not recycle plastic. One of the final users recycles PET, while the other two recover paper. Then the study team visited 4 plastic final users recommended by the counterpart. Regarding the reuse of bottles and glass in the target area, only one final user was observed in the target area in Mersin (*refer to section c.2.3, Producers/Final Users in Mersin*). For all types of metal, such as aluminium can, tin can, iron sheets, vehicular bodies, etc., the final users are located outside of the study area, e.g., Iskenderun. Table 2-41 shows the list of final users surveyed in Adana and the amount of recyclable materials they purchase.

Table 2-41: List of Final Users Surveyed in Adana

Category	Material	Producer/Final User	Product from Recycled Material	Purchased Amount (t/month)	Demand
Paper & cardboard	newspaper	Donkasan	Brown paper	700	more demand
	magazine	Omas Ozatlin		130	
	cardboard				
	office paper				
PET	PET bottles	Sasa	PET Resin	370	more demand
Plastic	Soft plastic Hard plastic	Damla plastic	Plastic bag	90	more demand
		Vural plastic		10	
		Cetin plastic		80	
		Guney nylon		10	

However, one should bear in mind that the amount of resource recovery purchased by the final users as shown in the table above is included in the amount of recycled materials from both cities. Furthermore, some final users purchased and resold waste items that they do not use in their production line, particularly paper, plastic and PET, for profit to other final users. This outcome is based on data obtained from final users surveyed. The study team found that some final users are not being only producers to produce product from recycled material but are dealing like middlemen as well.

For example, a plastic factory buying soft and hard plastic but only uses soft plastic for production. For hard plastic, the company purchases, stores and resells whenever someone offers a good price. Another example is a paper factory that produces brown paper for wrapping using only cardboard as raw material. This factory also buys white paper, newspaper, etc., and sells it for profit. However, it should be noted that all final users have more demand for recycled items, particularly cardboard, plastic and PET.

c.2 Mersin

c.2.1 Consumers/Generation Sources

As in Adana, the recycling activities of the generation sources in Mersin are not satisfied. From the results of the questionnaire survey to all WACS sampling points in Mersin, about 50% and 55% of high and middle income households, respectively, engage in recycling activities, while only 5% of low income households do. These households mainly recycle paper including cardboard from their daily consumption such as newspaper, magazine, paper box, wrapping paper, etc. For metal recovery, the amount recycled is considerably fine while other reused items such as textile, food waste, garden waste, etc., is less.

Daily total quantity of recycled materials sorted by sampling points for WACS is shown in Figure 2-11. For other representative sectors of WACS, recycling is practised through commercial sector by only one restaurant. The restaurant often gives food waste to someone for use as animal feed. Daily total amount of resource recovery sorted by sampling points for WACS is shown in Figure 2-11. However, the figure does not show the recycling amount by household income level.

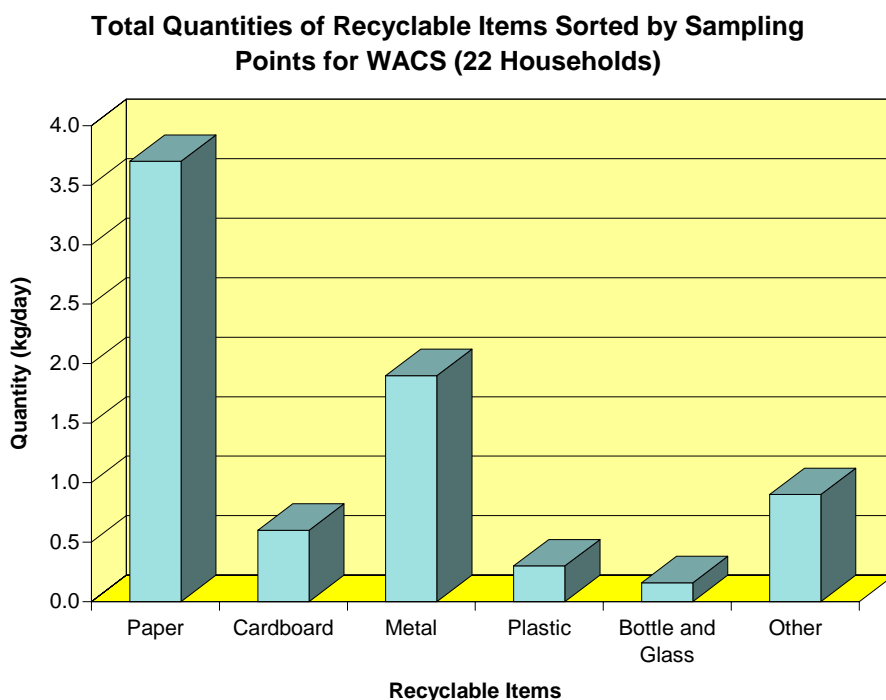


Figure 2-11: Daily Total Quantity of Recyclable Items Sorted by Samples for WACS

From the results of the POS regarding recycling by generation source, 32.83% of the sampled households do recycling. However, more than 94% of these households replied that they sometimes sell recyclable materials (less than once a month on average). Due to the fact that the recycling amount differs by income level, the study team considered the recycled amount by income level. The amount of recycled materials by income level is shown in the following table.

Table 2-42: Amount of Recycled Items by Income Level

Household Income Level	Recycled Items						Total Amount	Average Amount Per Person
	Paper	Cardboard	Metal	Plastic	Bottle & Glass	Others		
High	1,730	300	690	80	50	340	3,190	36
Middle	1,320	320	740	40	110	300	2,830	32
Low	650	0	450	190	0	270	1,560	13
Total	3,700	620	1,880	310	160	910	7,580	

unit : g/day

Finally, the total amount of recyclable materials sorted by generation source is estimated as:

$$(36 \times 0.09 \times 634,850) + (32 \times 0.47 \times 634,850) + (13 \times 0.44 \times 634,850) / 1,000,000 = 15 \text{ ton/day}$$

c.2.2 Scavengers in the Cities (Street Waste Pickers)

The questionnaire survey on street waste pickers was carried out for 10 persons from each district municipality, namely Akdeniz, Yenisehir, and Toroslar by study assistants. The outcome of the questionnaire survey stated that most street waste pickers mainly sort paper, plastic, PET and all types of metal. The total amount of recyclable material sorted by street waste pickers is estimated to be 10 ton/day based on the questionnaire survey with street waste pickers and middlemen. The outcome is detailed in section 2.5.3, *Survey on Scavengers (Waste Pickers)*.

c.2.3 Scavengers at the Final Disposal Site

Approximately 10 scavengers work daily full time at Mersin Composting Plant to collect recyclable materials while another 20 work at the present landfill which is located just at the back of the composting plant. They mainly sort bottle and glass, aluminium cans, tin cans, metals, and plastics. All sorted items collected by scavengers both at the composting plant and the final disposal site have been sold to a middleman who only has a concession with Mersin GM to purchase recyclable materials. Therefore, the estimation for recycled amount from composting plant and present landfill by scavenging activities is highly based on the middleman information. The total amount of recovery items by scavengers from composting plant is approximately 0.35 ton/day, while 1.5 ton/day is collected from disposal site. The results are detailed in section 2.5.3, *Survey on Scavengers (Waste Pickers)*.

c.2.4 Middlemen

As mentioned before, recycling activities at the Mersin Composting Plant and the present landfill site is obtained from the middleman who has a sole right to purchase sorted materials from scavengers. In order to know the amount of recyclable materials collected at generation/discharge points and street waste pickers, the

questionnaire survey was conducted with 15 middlemen in Mersin to estimate amount of waste recycled.

Fortunately, middlemen in Mersin GM has an organisation calling the “Middlemen Business Association”. This association has been established for as long as 20 years. According to an interview with the chairman of the association, who is the middleman that has a sole right to operate recycling system at composting plant and landfill, the main objective for establishment the association is to get more closer business co-operation among middlemen and to solve problem happened to their business together. For example, when the middlemen stored recyclable materials that they are not keen on or when they need a specified recovery item ordered by final users, they will contact among members to resell or to purchase it. The association has a permanent office and a full time secretary to do office work. The running cost of the office is covered from annual membership fees; there are about 100 members in total.

Hence the study team distributed 100 questionnaires to all association’s members through the chairman of the association. However, the replied questionnaires that the study team received were only 15 sets at the time being. Therefore, all 15 questionnaires are used as one of the reference data to estimate recycling amount in the city by generation sources directly to the middlemen and street waste pickers. When the project starts second field work in Turkey, the study team may be able to receive more replied questionnaires. Then, the estimated recycling amount will be modified.

The outcome of the questionnaire survey to middlemen stated the buying and selling price of sorted materials by them and are tabulated in Table 2-43. The estimated quantity of each item recycled by the middlemen are shown in

Table 2-44.

Table 2-43: Buying and Selling Price of Materials Sorted Out by Middlemen in Mersin

Materials	Buying Price	Selling Price
Metal	10,000-20,000 TL/kg	15,000-25,000 TL/kg
Aluminium Can	150,000-200,000 TL/kg	200,000-270,000 TL/kg
Plastic	30,000-40,000 TL/kg	35,000-80,000 TL/kg
PET	30,000-45,000 TL/kg	40,000-50,000 TL/kg
Bottle and Glass	5,000-10,000 TL/kg	7,000-12,500 TL/kg
Paper	5,000-10,000 TL/kg	13,000-15,000 TL/kg

Table 2-44: Quantity of Recyclable Materials Purchased Daily by Middlemen

Item	Metal	Aluminium Can	Plastic	PET	Bottle & Glass	Paper	Others
No. of middlemen purchasing each item	13	7	9	7	5	6	2
Quantity of each item purchased by middlemen (ton/day)	5	1.2	3	1	1	10	1.5

Table 2-45 shows the list of companies purchasing recyclable materials from middlemen.

Table 2-45: List of Companies Purchasing Materials from Middlemen

Material	Name of Customer Company
Metal	Ekinciler Demir Celik Fabrikasi, Iskenderun Yazici Demir Gelik A.S., Iskenderun Birlik Meteroloji, Ankara Ekamet Aluminium Pazarlama A.S., Izmit Hazi Ali Koyuncu (Middleman)
Aluminium Can	Ekinciler Demir Celik Fabrikasi, Iskenderun Kilig Tic., Adana
Plastic	Ozlem Plastic, Mersin Ismail Boztas (Middleman)
PET	SASA Artificial and Synthetic Fibers Inc., Adana Ismail Boztas (Middleman)
Bottle and Glass	Anadolu Cam Sanayi A.S., Mersin Arif Kaya (Middleman)
Paper	Donkasan, Adana Kimaras Paper Factory, Adana Adnan Akbas (Middleman) Emre Kagitcilik (Middleman)

As stated before, the middlemen working system in Mersin is similar to Adana. Most middlemen prefer to deal with some types of recycled materials that they specialise or they had their own market channels. Therefore, the amount of recycled materials estimated by middlemen is certainly included the amount of recovered items transacted among them. However, the data from questionnaire survey to middlemen is taken into account to estimate the amount of waste recycled by house owners and street waste pickers.

c.2.3 Producers/Final Users

Only one producer/final user is located in Mersin and has been surveyed by the study team. This final user, Anadolu Cam Sanayi A.S., is a large scale glass factory and produces new glass bottles by using recycled glass as raw material. According to the results of the questionnaire survey, the factory purchased recycled materials only bottle and glass totally from middlemen with the price somewhere around 12,500 TL/kg. In a month, the factory roughly purchase recycled bottle and glass from middlemen about 30 tons from Mersin and 50 tons from Adana.

Meanwhile, Anadolu Cam Sanayi is promulgating recycling campaign to recover glass bottle in both cities by providing special designed containers at someplace in core city area and residential complex. Then, the factory has an organised collection of bottle and glass when its container full. The income from this part is donated to social welfare to public. From this campaign, the factory collects glass bottle about 15 ton/month from Adana and 10 ton/month from Mersin.

d. Findings of the Survey

d.1 Adana

As stated in the objectives of this survey, understanding the present recycling system is the first aim of this part. Then, the study team processed to next key objective: estimation of the present waste amount recycled. From results of the survey, the

present recycling flow diagram of all recovered materials in Adana are almost in a similar way as shown in the following figure. Furthermore, the total waste amount recycled and breakdown by major recovered items, the study team estimated as shown in Table 2-46.

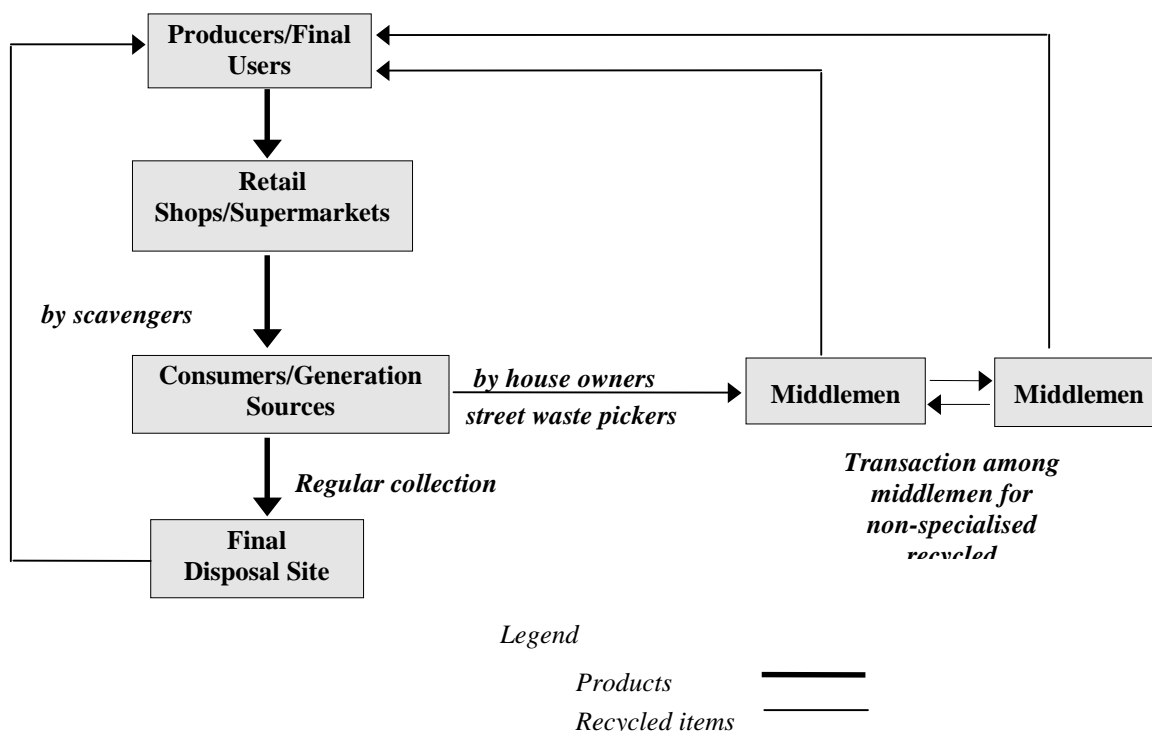


Figure 2-12: Recycling Flow Diagram for Recovered Materials in Adana (Excluding Paper, Plastic)

Table 2-46: Total Recycling Amount and Breakdown by Major Waste Items in Adana

unit : ton/day

Recycling Activity	Metal	Plastic	Bottle and Glass	Paper	Others*	Total
Recycling at Generation Sources:						
Household	5.30	0.90	0.50	15.30	2.90	24.90
Commercial (Restaurant)	0.00	0.00	0.00	0.00	0.00	0.00
Commercial (Other Shop)	0.00	0.00	0.00	0.10	0.00	0.10
Institution	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total	5.30	0.90	0.50	15.40	2.90	25.00
Recycling by Street Waste Pickers	2.90	4.80	0.10	6.20	1.00	15.00
Recycling by Scavengers	3.00	2.00	2.60	1.00	0.40	9.00
Total Recycling Amount	11.20	7.70	3.20	22.60	4.30	49.00

Note : * Other includes food waste, garden waste, textile, battery, etc.

d.1.1 Metals, Aluminium Cans, Tin Cans

Recyclable materials such as metals, aluminium cans and tin cans are collected through recycling activities at generation sources and scavenging activities by street waste pickers and scavengers at the final disposal site. Then, the items recovered by house owners and street waste pickers will be sold to middlemen while recyclable

materials from scavengers at disposal site are mainly purchased by final users. Finally, these items are transported to metal smelting factories located far away from the study area, like Iskenderun. The most metal and aluminium can recycled are being used as raw materials. The amount of recycled metal is satisfied. This outcome is due to many parts of the recycling system such street waste pickers, scavengers and middleman are interested in recycled metal that easily find market. For aluminium cans, the price of sorted aluminium is quite impressive, thus street waste pickers and scavengers are quite active to collect.

d.1.2 Bottles and Glass

Only one large glass recycled factory in the study area, Mersin, is using glass bottles as raw materials, because the price of recovered glass bottle is very competitive with raw material imported. The demand of glass has been recognised, however, the recycling system for bottle and glass is not well done, particularly in the city. This outcome is due to number of middlemen dealing with recovered glass bottle is quite less because its difficulty to find buyer. Hence, street waste pickers are dormant to collect. Another reason, because not all type of bottles are recycled and the price varies according to type of bottles. Therefore, street waste pickers will collect only bottles that can be recycled such as beer, whisky, soda bottles, etc. On the other hand, scavengers at disposal site who are very active in their work chiefly collected reusable glass and sold through their market channel. The total amount of bottle and glass being recovered is estimated at 3.2 ton/day.

d.1.3 Other Recyclable Items

As mentioned in the objectives of the survey, the emphasis has been placed on large amount of recyclable materials being recovered like metals, plastics, glass and paper. For other materials (textiles, bones, batteries, sacks, etc.) because of their low potential for increases in recycling, the study team estimated the total amount of other items into account of waste stream only.

The following figure shows the recycling flow diagram for paper and plastic.

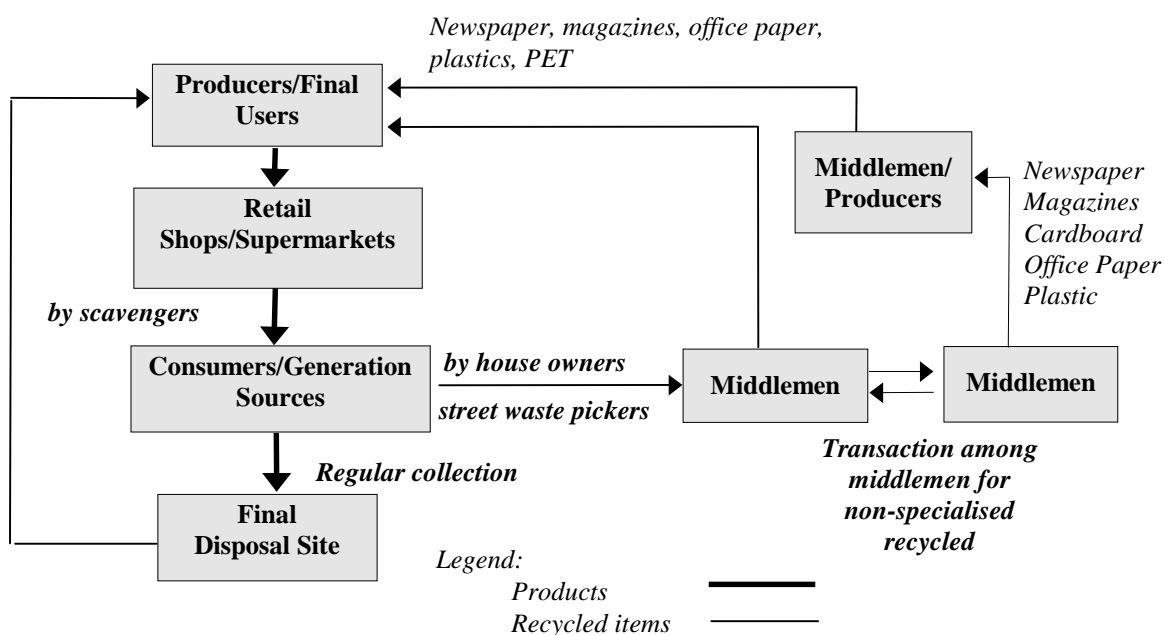


Figure 2-13: Recycling Flow Diagram for Paper and Plastic in Adana

d.1.4 Paper

Although recycling activities are not satisfied in public sector. However, paper is the most active recycling item at generation sources. Because they easily collected paper from their daily life such as newspaper, magazines, paper boxes, etc. There are at least 5 recycled paper factories/representatives in the target area. One part of paper is being reproduced in Adana and another part is collected by factory representative and transported to its large paper mill in Istanbul, particularly cardboard to produce brown paper for packaging. For office paper, newspapers, magazines, etc., the factory buys, stores and resells whenever other paper mills offer an attractive price.

As also shown in Figure 2-13, only cardboard is being sold from some supermarkets to final users in Adana directly. Street waste pickers and scavengers are much more interested to collect cardboard or brown paper than office paper because its higher price and wider market. Therefore, the amount of cardboard and brown paper being recovered is estimated at a high rate.

d.1.5 Plastic

Plastic is being utilised as raw material to produce mainly plastic products, particularly plastic bags. There are at least 13 plastic final users in Adana. Among these, 3 factories are large scale producers while all remaining plants are small scale. Because of its high potential to find market, plastic is being recovered at a good rate. However, some final users of plastic is also doing business as the middlemen. They buy all kind of plastics like soft plastic, hard plastic, PET, etc. Only the kind of plastic that needed as their raw material will be used, another type of plastics will be sold to another final users who is using that materials.

d.1.6 PET Bottle

PET (Polyethylene Terephthalate) is reused by one large scale factory in Adana. It produces many raw polyethylene products such as polyethylene fibre, polyethylene food grade resin, etc. Basically, due to its valuable qualification, PET is quite useful as raw material to produce varieties of products such as bottle to contain all liquid including acid, video tape, film and textile. Therefore, possibility to increase recycling amount of PET has high potential in future. In terms of waste composition of this study, PET is considered as plastic.

d.2 Mersin

As described before, recycling system through scavenging activities in Mersin is divided by 3 main sources. First source is recycled in the city by house owners and street waste pickers. Other 2 remaining sources are done at the Mersin Composting Plant and the present disposal site. The present recycling flow diagram of most recovered materials is shown in the following figure. Furthermore, the total waste amount recycled and breakdown by major recovered items, the study team estimated and tabulated in Table 2-47.

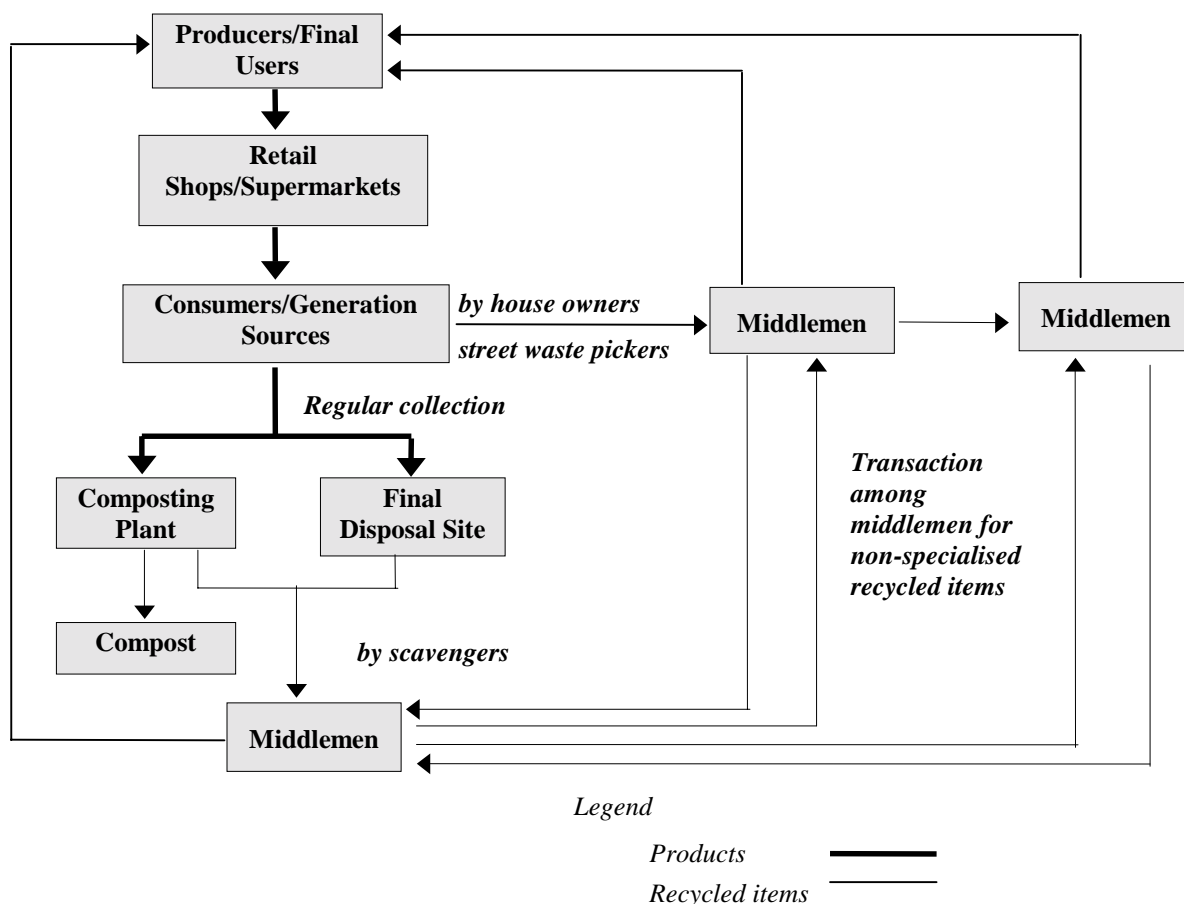


Figure 2-14: Recycling Flow Diagram for All Recovered Materials in Mersin

Table 2-47: Total Recycling Amount and Breakdown by Major Waste Items

unit : ton/day

Recycling Activity	Metal	Plastic	Bottle and Glass	Paper	Others*	Total
Recycling at Generation Sources:						
Household	3.90	0.60	0.40	8.20	1.80	15.00
Commercial (Restaurant)	0.00	0.00	0.00	0.00	0.10	0.00
Commercial (Other Shop)	0.00	0.00	0.00	0.00	0.00	0.00
Institution	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total	3.90	0.60	0.40	8.20	1.90	15.00
Recycling by Street Waste Pickers	1.60	3.70	0.00	4.60	0.10	10.00
Recycling at Compost Plant	0.11	0.04	0.17	0.03	0.00	0.35
Recycling by Scavengers at Landfill	0.27	0.21	0.93	0.09	0.00	1.50
Total Recycling Amount	5.88	4.55	1.50	12.92	2.00	26.85

Note : * Others includes food waste, garden waste, textile, battery, etc.

d.2.1 Metal, Aluminium Can, Tin Can

In this description, metal refers to all types of metal including aluminium can, tin can, iron sheets, etc. Metal is mainly recovered through house owners and scavenging

activity of street waste pickers. Collected metal has been sold to middlemen before transported to final users in Iskenderun. Amount of recycled metal seems to be high, particularly by street waste pickers while recovered metal at composting plant and landfill is little.

d.2.2 Plastic

Both soft and hard plastic are actively recycled through street waste pickers. Then, all recovered plastic is sold to middlemen. Amount of recycled plastic at composting plant and final disposal site is far from satisfactory.

d.2.3 PET

As described before, the only PET recycled factory, SASA, is situated in Adana. Therefore, all or almost all of the recycled PET is collected through waste pickers and finally sold to SASA.

d.2.4 Bottle and Glass

As a result of its poor market and not all type of glass bottles are recycled, the glass recycling rate stands in the dormant position. The total amount of bottle and glass being recovered is estimated at 1.5 ton/day.

d.2.5 Paper

Paper is received more recycling eagerness from many parts of waste stream, particularly generation sources and street waste pickers. Thus, recovery rate of paper being recycled is appreciated.

d.2.6 Other Recyclable Items

Other recyclable items like food wastes, garden wastes, batteries, sacks, etc., are clearly seen to be very dissatisfied in terms of recovered rate from all parts of the waste stream, particularly food wastes. This outcome is highly depend on house style condition in the study area. Practically, living in apartment is not allowed the owner to take care pets. Hence, food wastes from daily food preparation/consumption is not reused by feeding animal.

2.5.3 Survey on Scavengers (Waste Pickers)

a. Objectives of the Survey

This section aims to attain the following:

- To understand the present role of scavengers in SWM.
- To understand the system and organisation concerning scavengers.
- To understand the present working condition and environment.
- To forecast social impacts of the master plan.
- To obtain recycling amount through scavenging activities.

b. Method of the Survey

The survey on scavengers is a part of section 2.5.2, *Survey on Recycling System*. The following survey methods were conducted:

- Interview of 30 street waste pickers in each greater municipality.
- Interview of 5 scavengers at disposal site in each greater municipality.
- Interview of related parties.

c. Scavengers in the Cities (Street Waste Pickers)

c.1 Adana

Street waste picker is an individual who collects recyclable materials from private waste bin or communal container. Most street waste pickers have their tools only push cart and a huge size sack to store collected wastes.

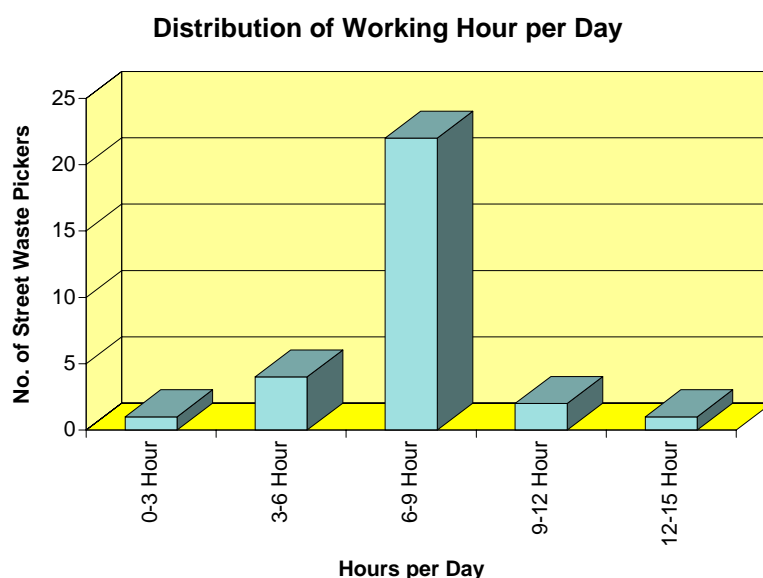


Figure 2-15: Distribution of Working Hour for Street Waste Pickers in Adana

From the above figure based on survey outcomes, it is seen that most street waste pickers interviewed (22 persons) work 6-9 hours/day. The average working hour of a street waste picker is about 8 hours/person/day. Most of them work 7 days a week including Saturdays and Sundays.

The age of street waste pickers being interviewed varies from 13 to more than 40 years old. However, it can be said that most street waste pickers are boys and young (10-19 years old). Mainly, street waste pickers have fixed collection route to work while a few do not. The reason to select their working route is near their house, near middlemen office or area where they know well. It can be concluded that working route of street waste picker is mainly located in city centre and its surrounding where they easily find a big volume of valuable/recyclable materials.

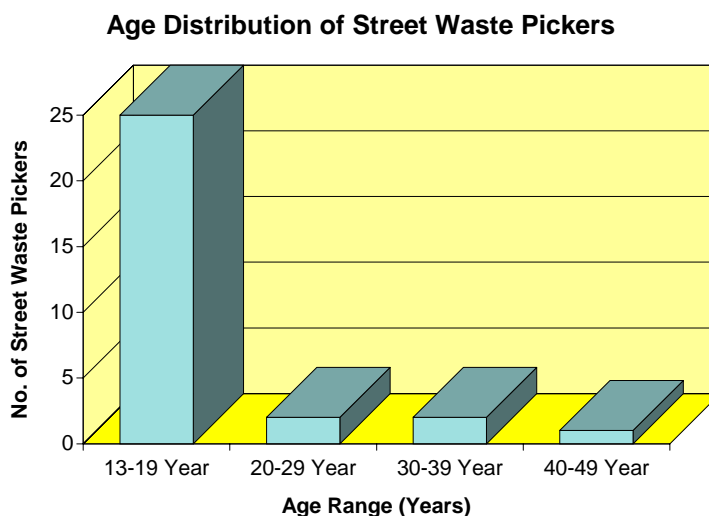


Figure 2-16: Distribution of Age of Street Waste Pickers in Adana

It should be noted that collected recyclable materials by street waste pickers are totally sold to middlemen. The selling price of recycled materials from street waste pickers to middlemen are summarised in Table 2-48.

Table 2-48: Selling Price of Recycled Materials from Street Waste Pickers (as of October 1998)

Materials	Selling Price
Metal	8,000-11,000 TL/kg
Tin can	9,000-11,000 TL/kg
Plastic	11,000 TL/kg
PET	11,000 TL/kg
Copper	130,000-200,000 TL/kg
Aluminium can	130,000-200,000 TL/kg
Bottle and glass	10,000-15,000 TL/each
Paper	8,000-10,000 TL/kg

The main recycled items collected are paper, plastic, metal. The most valuable recycling materials among these are copper and aluminium can which their price are somewhere around 130,000 to 200,000 TL/kg. However, the most recycled material amount which street waste pickers easily collect is paper. Most of them collect paper vary from 50 to 100 kg/day. The collected quantities of recyclable items by street waste pickers in Adana is shown in Table 2-49.

Table 2-49: Daily Collected Quantity of Recyclable items by Street Waste Pickers Surveyed (30 persons)

Item	Metal	Tin Can	Plastic	PET Bottle	Aluminium Can	Copper	Bottle & Glass	Paper
No. of Street Waste Pickers collecting each item	26	26	19	16	27	21	7	29
Quantity of each item collected by street waste pickers (kg/day)	344	94	291	134	59	very little	very little	2,162

Distribution in Daily Income for Street Waste Pickers

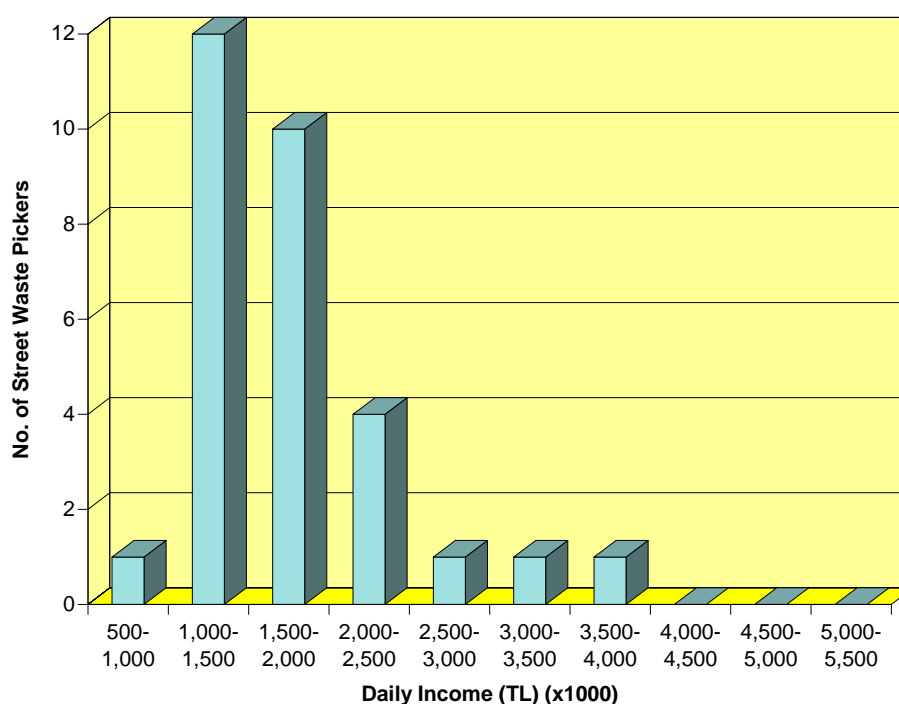


Figure 2-17: Distribution in Daily Income of Street Waste Pickers Surveyed (30 persons) in Adana

As can be seen from the above figure, 40% of the street waste pickers stated that their daily income ranges from 1 to 1.5million TL, while 33% replied that their income ranges from 1.5 to 2 million TL. The average income from scavenging is 1.78 million TL/day.

The amount of recycling material collected by street waste pickers varies from 60 to 200kg/person/day. The average collected amount is 100kg/person/day. Based on this figure and questionnaire survey to middlemen, the study team estimated number of street waste picker in Adana is somewhere about 150 persons. Therefore, total recycled waste amount by street waste pickers is estimated at 15 ton/day (100kg x 150 persons).

c.2 Mersin

Street waste pickers are commonly seen in the target area. In particular, collection along streets that are in core city area. Typically, tools of street waste pickers are used only push cart and a big sack. However, street waste pickers surveyed in Mersin (11 from a total of 30 persons) are additionally using horses to move far away and to increase carrying amount of valuable recovered materials. A horse may be rented or belong to street waste picker himself. From the outcome of the questionnaire survey, scavengers who worked with horses collected an average recycled amount of more than one without horses. Certainly, his revenue is also higher than average.

From other results of the questionnaire survey, street waste pickers in Mersin seem to be work harder than Adana. Thirteen street waste pickers replied that they work 6-9 hours/day while 12 persons stated their working hours to be about 9-12 hours/day. Most of them work 7 days a week. The distribution of working hours for street waste pickers is shown in the following figure.

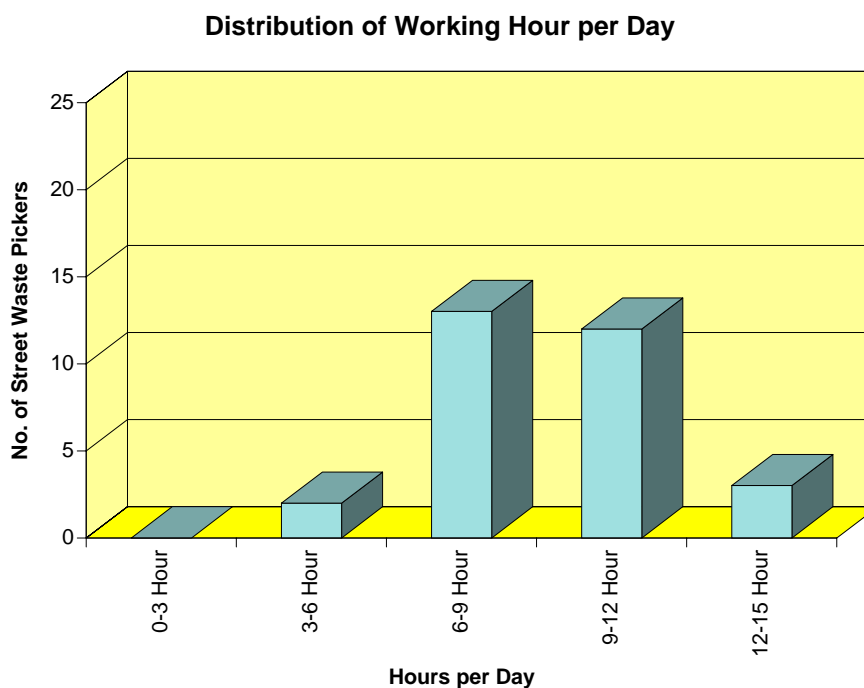


Figure 2-18: Distribution of Working Hour for Street Waste Pickers Surveyed (30 persons) in Mersin

The age of street waste pickers vary from 13 to more than 40 years. But more than half of them (17 persons) are young and all are men. Normally, street waste pickers work independently and most of them have fixed collection route which near their houses or middlemen. Figure 2-19 shows the distribution of street waste pickers' age. For the selling price of recovered items from street waste pickers to middlemen are stated in Table 2-50.

Age Distribution of Street Waste Pickers

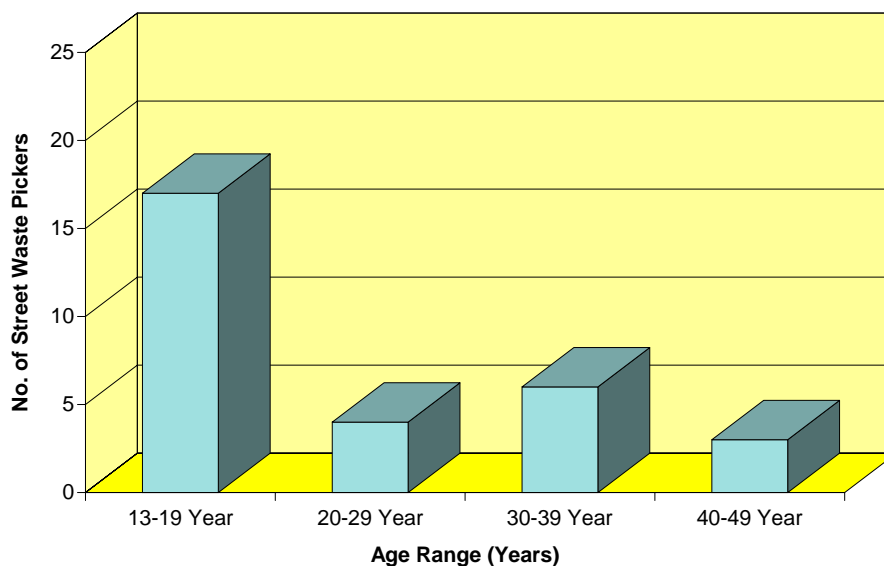


Figure 2-19: Distribution of Age of Street Waste Pickers Surveyed (30 persons) in Mersin

Table 2-50: Selling Price List of Recycled Materials from Street Waste Pickers (as of October 1998)

Materials	Selling Price
Metal	8,000-10,000 TL/kg
Tin can	8,000-10,000 TL/kg
Plastic	15000-25,000 TL/kg
PET	15,000-25,000 TL/kg
Aluminium can	150,000-200,000 TL/kg
Bottle and glass	5,000-10,000 TL/each
Paper	8,000-15,000 TL/kg

The main collected material by scavengers in the city are paper, plastic, metal, PET bottles and aluminium cans, particularly aluminium cans which price is very promulgated to be recovered. As some outcome of Adana, the most recycled amount by street waste pickers is paper. The collection amount of recovered items by street waste pickers being surveyed is stated in the following table.

Table 2-51: Daily Quantity of Recyclable Items Collected by Street Waste Pickers Surveyed (30 persons)

Item	Metal	Aluminium Can	Plastic	PET Bottle	Bottle & Glass	Paper
No. of Street Waste Pickers collecting each item	30	30	30	30	5	30
Quantity of each item collected by street waste pickers (kg/day)	463	153	526	379	very little	1,797

As described before, street waste pickers who are using horses to facilitate their work obtain higher income than the common one. According to the survey, income of 3 street waste pickers is more than 4,500,000 TL. Furthermore, it may be due to another reason of harder working, the average income of street waste pickers in Mersin is 2,156,800 TL/day that higher than in Adana. The following figure shows the distribution in daily income for street waste pickers in Mersin.

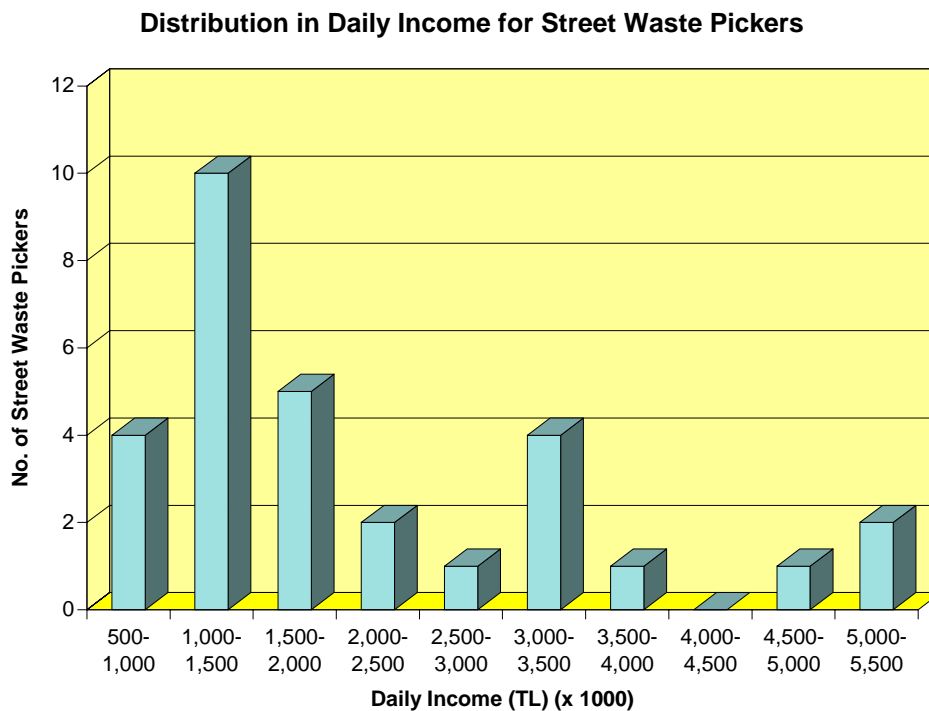


Figure 2-20: Distribution in Daily Income of Street Waste Pickers Surveyed (30 persons) in Mersin

The amount of recycling material through scavenging activities in the city widely varies from 25-378 kg/person/day. However, the average collected amount of street waste pickers is estimated at 110kg/person/day.

Based on the outcome of the questionnaire survey on street waste pickers and middlemen, the study estimated the number of street waste pickers in Mersin as somewhere about 90 persons. Therefore, the study team assumed total recycled amount by street waste pickers in Mersin is 10 ton/day (110kg x 90 persons).

d. Scavengers at the Final Disposal Site

d.1 Adana

According to the Municipality and the private contractor who operating disposal site, they allow scavengers to do scavenging activities in the landfill without any money being paid by scavengers to neither the municipality nor the contractor. Furthermore, based on the data obtained from the manager of the disposal site and preliminary survey to scavengers, the study team acknowledged that all scavengers at

disposal site have established an informal organisation controlled by 5 scavengers called “big five scavengers”.

Therefore, the study team carried out an interview survey on 5 scavengers at the dump site. Among these 2 of them being surveyed are top of the “big five scavengers”. However, the study team did the survey when WACS was conducting at the final disposal site and tried to interview as informal as possible. Because the study team felt that if a survey was processed officially, the co-operation from the scavengers may be hard to obtain.

From the outcome of the informal interview survey on scavengers, it is believed that they are quite well organised and working efficiently without any internal problem. This part of the outcome may be due to all scavengers knowing each other well.

As observed by the study team for a week, no children scavenger works at the disposal site. The age of scavengers ranges from 20 to more than 40. Even the work environment, i.e., condition of Sofulu where simple dumping is carried out, may possibly bring infections, diseases and accidents to scavengers. However, it was not observed that no scavengers wore any protective clothing such as glove, mask, or hard hat. Under unfavourable working conditions, all scavengers are in good health. There are also no reports stating that scavengers are infected with communicable diseases including minor diseases and bodily pains. Therefore, there seems to be no relationship between health of scavengers and the conditions of the dump site.

No doubt, the conditions at Sofulu, the final disposal site, are very severe. However, scavengers are very active to their work. Also, all big five scavengers are scavenging recyclable materials daily. One of the top “big five scavengers” stated that they themselves are controlling all scavenging works at dump site and sharing benefit of income among them. The detailed benefit sharing or amount of income of “big five scavengers” is kept as confidential matter to the study team. However, the study team estimated their total income from total amount of recycled items approximately 53,000 million TL/year, which is quite impressive (refer to Table 2-50).

According to the survey outcome, the big five have accounting responsibility for each three months. They have arrangements among themselves to share their duties. For example, one takes accounting, one controls the scavengers, one supervises loading the wastes that sorted out, one gets in touch with the buyers and one drives the big truck for commuting scavengers.

Most of the scavengers are not staying at the disposal site. Therefore, the “big five scavengers” provide transportation for employed scavengers. This service contributes the number of scavengers working daily to be stable. Therefore, the number of scavengers is constantly somewhere around 60-70 persons/day and all of them are full time scavengers. Normally, from the early morning at 6 a.m., the scavengers are transported to the disposal site by the big five’s truck. After reaching, the work is started and finished at 5 p.m. They work 6 days a week and absent on Sundays.

The employed scavengers are being paid by recycled amount basis. Basically, each employed scavenger gets about 2,500,000-3,000,000 TL/day based on their working effort. Certainly, it is highly depended on the amount and type of recovered

materials that they collect a day or the progress of work on their duties. The employed scavengers will be received about half of selling price of the scavenged materials. Mainly, recycled items are directly sold to final users. The transportation of recovered wastes from dump site is normally arranged by final users or factories.

The scavengers collected recyclable materials such as metal, glass, plastic, cardboard, aluminium can, PET bottles and others. Materials recovered by scavengers and price are presented in the following table.

Table 2-52: Wastes Recycled by Scavengers at Sofulu Landfill and Price

Item	Ton/month (1997)	Price (TL/kg)	Total Income (Million TL/Year)
Metal	80	8,000	7,680
Aluminium Can	10	80,000	9,600
Glass	80	5,500	5,280
Plastic	40	32,500	15,600
PET	20	35,000	8,400
Cardboard	30	12,000	4,320
Bone	10	15,000	1,800
Total	270		52,680

From the table it is estimated that the recovered waste amount by scavengers at the disposal site totals 9 ton/day.

d.2 Mersin

Even the present conditions of composting plant and landfill is far from a favourable environment, no scavengers wore any preventive item like masks, gloves, rubber boots, etc.

Approximately 10 scavengers work daily full time at Mersin Composting Plant to pick recyclable materials while another 20 scavengers work at present landfill that located backward of the plant. Recycling at both places are basically controlled by a middlemen who has sole right from Mersin Greater Municipality to purchase sorted materials from scavenging activities.

As in Adana, the interview survey was conducted on scavengers during WACS period. Five scavengers are interviewed, one of them is chief of scavengers who being employed by a middleman to supervise scavenging works at compost plant and disposal site.

According to the interview survey to scavengers and the middleman, number of scavengers fluctuate seasonally. During cultivating and harvesting periods in summer season, the number of scavengers, particularly at composting plant, is reduced because of their participated in agricultural works. On the other hand, their numbers increase in winter season when the work is hardly found in other sectors.

The scavengers at composting plant are full time scavengers. However, they are not staying at the plant. Based on chief of scavenger being interviewed, the scavengers working at composting plant are single or live far away from their families. They

left their families to compost plant for working. Therefore, they come to compost plant and get back daily to their living place but not with families. They visit their families sometimes when an opportunity comes, mostly once a month or once a two or three months. Recruitment of scavenger is depended on the middleman. No strange scavenger is allowed to scavenge at the composting plant or landfill without permission of him or his scavenger's chief.

Also, recycling works at composting plant are managed by the middleman. Each scavenger is assigned to his duty such as collecting, bringing, sorting or packaging recovered materials. A conveyor belt to hammer mill is applied for picking recyclable materials. Recovered wastes sorted out during the picking contributes main income for scavengers and the middleman.

Scavengers are paid by total monthly revenue from selling reused wastes to middlemen dividing by number of scavenger's working day. Their sharing income system seem to be very clear. The average income of scavengers is somewhere around 3-4 million TL/day. However, scavengers are not satisfied to these amount. Most of them stated that they scavenged because they had no other better job even income from scavenging work was low. Whenever they have a chance, they intend to resort to another job. Therefore, among scavengers being interviewed, 2 of them have just worked at composting plant less than 3 months.

The age of scavengers at composting plant varies from 18 to more than 60 years old. No children is working at the plant. Under unpleasant conditions of composting plant, all scavengers are in good health. However, the accident was happened seldom. Once, one scavenger lost his finger by a compactor truck during discharge waste to feed hoppers.

The following table presents recovered materials by scavengers at Mersin Composting Plant and price that scavengers obtained.

Table 2-53: Recycled Materials by Scavengers at Mersin Composting Plant

Material	TL/kg		Ton/Year		
	Middleman's Selling Price	Scavenger's Selling Price	1997	1996	1995
Steel	22,000	11,000	12	13	15
Aluminium Can	180,000	90,000	2	1.5	1
Can, Fe*	11,000	5,000	25	30	35
Plastic	30,000	15,000	10	8	7
PET	50,000	25,000	5	4	3.5
Bottle and Glass	6,500	3,000	60	65	70
Paper	11,000	5,000	10	12	12
Others			very little	very little	very little
Total			124	133.5	143.5

Note: * Also includes materials from the magnet.

From the table it is calculated that amount of waste picking by scavengers at composting plant is 124 ton/year (0.35 ton/day).

Regarding recycling at dump site, 20 scavengers are working there to collect reusable items. Most scavengers start work from early morning at 6:30-7:00 a.m. and finishes around 4-7 p.m. All of them are full time scavengers and work about 8 hours/day. The scavengers guide the unloading at the site to obtain the best possibilities for examination of the waste.

They were homeless people, therefore, scavengers and their families are living at the disposal site. This contributes to increase in number of part time scavengers. Whenever their families having free time, scavenging works are often practised by members of scavengers' families. Therefore, scavenging work at the disposal site is engaged by women and children sometimes.

Table 2-54: Recycled Materials by Scavengers at Mersin Disposal Site

Material	TL/kg		Ton/Year		
	Middleman's Selling Price	Scavenger's Selling Price	1997	1996	1995
Steel	22,000	11,000	33	13	35
Aluminium Can	180,000	90,000	6	4.5	3
Can, Fe	11,000	5,000	60	60	65
Plastic	30,000	15,000	50	42	38
PET	50,000	25,000	25	19	16.5
Bottle and Glass	6,500	3,000	340	355	380
Paper	11,000	5,000	35	38	38
Others			very little	very little	very little
Total			549	531.5	575.5

As can be seen from the table, the total amount of waste recycled in 1997 is 549 tons. Therefore, the average collected amount by each scavenger is about 75kg/person/day. Finally the study team estimated total recycled amount at disposal site is 1.5 ton/day.

e. Recommendations

e.1 Adana

It is recommended to establish registration system for scavengers at the landfill in order to control their activities and minimise the number of scavengers.

Approximately 60-70 scavengers in Sofulu are engaged in scavenging work daily. Their experience as scavengers tend to be very long, particularly revenue from their recycling business is rather high. It is recommended that to force them changing their jobs when sanitary landfill is applied may bring a conflict and social problem to municipality. In formulating a master plan, this point should be taken into account how to avoid scavenging or how to harmonise between scavenging activities and a proper landfill operation.

The present landfill is also serving hospital waste and industrial waste that may cause bad effect on scavengers. Proper protection measurements to this issue should be done by separation of hazardous wastes disposed clearly.

Due to its high demand on resource recovery by final users, therefore, municipality should promulgate recycling activities at generation source. By any means in terms

of SWM, public co-operation is one of the most important issue that contribute to the success of waste management.

e.2 Mersin

Recycling operation at composting plant/landfill is licensed to a middleman. However, it is recommended to establish registration system for scavengers in order to control their activities and minimise number of scavengers, particularly to prevent children scavengers. In addition, accidents have been occurred sometimes because scavengers are working close to heavy equipment and compactor trucks.

The elimination of the scavengers from landfill may cause a social problem due to the deprivation of their jobs. The plan for SWM is necessary to consider this matter.

The present landfill is also serving hospital waste and industrial waste that may cause negative effects on health of scavengers. Preventive measurements to this issue should be processed by separation of harmful wastes disposal clearly.

Because its high demand on resource recovery by final users, therefore, municipality should run campaign to promote recycling activities at generation source that contribute not only to increasing amount of resource recovery but also decreasing discharged waste to the disposal site.

2.6 Survey for Feasibility Study

2.6.1 Survey for Feasibility Study for Sofulu Site

2.6.1.1 Topographic Survey

A topographic survey has been conducted in order to obtain the current topographical data of the Sofulu site and its environs for designing a rehabilitation plan of the present site and a new final disposal site as well as sorting/compost plant for Adana Greater Municipality (See Data 7 and 8 of Data Book). A topographic map was prepared and the content of it is:

- Scale: 1/2,000,
- Area covered: about 100 ha
- Contour interval: 1.0 meter

2.6.1.2 Geological Survey

A geological survey has been conducted to obtain the current geological data of the Sofulu site in Adana for designing overall development plans of a final disposal site as well as sorting/composting plant (See Data 6 of Data Book). The main contents of the geological survey are described below.

a. Geological Investigation

a.1 Boring Work

- Number of boreholes: 3 boreholes
- Depth of the boreholes: 15 meters

a.2 Preparation of Borehole Log Diagrams and Geological Profiles

- Borehole log diagrams including engineering geological descriptions
- Geological profiles (soil structure layer diagram) of the cross-sections with the underground water table shall be drawn up based on the borehole log diagrams and data obtained by the geo-electric survey.

a.3 Laboratory Test

The following laboratory tests were conducted for two samples taken from two representative layers of each borehole:

- Unit weight test of soil
- Density test of soil particles
- Water content test of soil
- Mechanical analysis of soil, including sieve analysis and wet mechanical analysis
- Atterberg limit (liquid and plastic limit test)
- Permeability test

b. Test of Borrow Soil

Three samples were taken from three possible soil borrowing sites at the site. The following laboratory tests were conducted for each sample:

- Unit weight test of soil
- Density test of soil particles
- Water content test of soil
- Mechanical analysis of soil, including sieve analysis and wet mechanical analysis
- Atterberg limit (liquid and plastic limit test)
- Soil compaction test

2.6.1.3 Survey for Environmental Impact Assessment

a. Economic Survey

Economic survey is conducted to determine the number and income of individual farmers whose work will be affected by the loss of farms in the northern part of the proposed site, and to assess the impact on the recycling system by prohibiting the scavenging activity at the disposal site and by the operation of a sorting and composting plant. The following items are analysed;

- the recycling and scavenger survey data,
- the information from the relevant farmers,
- any other relevant data.

b. Public Health Survey

Public health survey was conducted on 16th in April 1999 in order to assess the occurrence and incidence of diseases amongst residents in the vicinity of the disposal site, to provide some baseline health data, and to forecast the impact of the landfill

site (construction, operation and after-care) on public health in the area. Instead of an interview survey of residents, data collection from medical institutes is carried out for this purpose.

c. Groundwater

A groundwater survey was conducted on 5th in May 1999 to identify the groundwater table. The groundwater table level is measured at three existing wells. The available geological/groundwater data regarding the proposed site and its downstream is also collected.

d. Hydrological Survey

In order to identify the hydrological system of the stream, which treated wastewater from the proposed disposal site will be discharged into, the existing hydrological data on the stream is collected. In addition to the above-mentioned works, surface water flow rates are measured at 2 points, one upstream and one downstream, of the discharge point.

e. Fauna and Flora

A survey of flora and fauna was made of the area within the proposed Sofulu site on 13th and 14th in May 1999, and covered an area of radius 1 km outside the boundary of the site.

f. Landscape/Aesthetics

In order to analyse whether the new disposal site is viewed from the surrounding villages within radius 1.5 km outside the boundary of the proposed site or not, the site survey was conducted on 19th and 22nd in May 1999.

g. Air Quality Survey

The air quality survey was conducted on 15th in May 1999. It covers the following survey items: air temperature, humidity, wind direction, wind velocity, settled dust, SO₂, NO_x, Cl₂, PM(particulate matter), Pb.

h. Water Quality Survey

The water quality survey was conducted on 27th in April and on 5th, 13th, 24th in May 1999. Analysis items are colour, pH, total dissolved matter, DO, COD, BOD, Fecal coliform, T-N, T-P, NH⁴⁺, Na⁺, Cl⁻, SO₄²⁻, Cr⁶⁺, Hg, Cd, Pb and As.

i. Land Use Survey

A land use survey is made of the area within the proposed site and covers an area of radius 1 km outside the boundary of the proposed Sofulu site. Land use development plans for the area is also obtained.

j. Water Use Survey

Water use from surface water and groundwater was investigated. As for groundwater, all existing wells within a radius of 5 km south of the site will be identified/described and locations of them will be presented on a map.

For surface water, water use will be identified and described regarding the stream, where treated waste water from the disposal site will be discharged.

k. Meteorological Data

Meteorological data was collected for the following items: wind direction, wind velocity, precipitation, evaporation and air temperature.

2.6.2 Survey for Feasibility Study for CIMSA Site

2.6.2.1 Topographic Survey

A topographic survey has been conducted in order to obtain the current topographical data of the CIMSA site and its environs for designing a new final disposal site as well as sorting/compost plant for Mersin Greater Municipality. A topographic map was prepared and the content of it is:

- Scale: 1/2,000,
- Area covered: about 100 ha
- Contour interval: 1.0 meter

2.6.2.2 Geological Survey

A geological survey has been conducted to obtain the current geological data of the Cimsa site in Mersin for designing overall development plans of a final disposal site as well as sorting/composting plant. The main contents of the geological survey are described below.

a. Geological Investigation

a.1 Boring Work

- Number of boreholes: 3 boreholes
- Depth of the boreholes: 15 meters

a.2 Preparation of Borehole Log Diagrams and Geological Profiles

- Borehole log diagrams including engineering geological descriptions
- Geological profiles (soil structure layer diagram) of the cross-sections with the underground water table shall be drawn up based on the borehole log diagrams and data obtained by the geo-electric survey.

a.3 Laboratory Test

The following laboratory tests were conducted for two samples taken from two representative layers of each borehole:

- Unit weight test of soil
- Density test of soil particles
- Water content test of soil
- Mechanical analysis of soil, including sieve analysis and wet mechanical analysis
- Atterberg limit (liquid and plastic limit test)

- Permeability test

b. Test of Borrow Soil

Three samples of were taken from three possible soil borrowing sites at the site. The following laboratory tests were conducted for each sample:

- Unit weight test of soil
- Density test of soil particles
- Water content test of soil
- Mechanical analysis of soil, including sieve analysis and wet mechanical analysis
- Atterberg limit (liquid and plastic limit test)
- Soil compaction test

2.6.2.3 Survey for Environmental Impact Assessment

a. Economic Survey

Economic survey is conducted to determine the status and scale of quarry operation within the boundary of the proposed site, and to assess the impact on the recycling system by prohibiting the scavenging activity at the disposal site and by the operation of a sorting and compost plant. The following items are analysed;

- the recycling and scavenger survey data,
- the information of existing compost plant,
- any other relevant data.

b. Traffic Volume Survey

Traffic volume survey was conducted on 21st May 1999. The categories of vehicles to have been measured are large vehicles, small vehicles, motorbikes and pedestrians who pass the access road. Number of vehicles and pedestrians were recorded hourly from 7 a.m. until 7 p.m. for 1 day at 3 points.

c. Public Health Survey

Public health survey is conducted in order to assess the occurrence and incidence of diseases amongst residents in the vicinity of the disposal site, to provide some baseline health data, and to forecast the impact of the landfill site (construction, operation and after-care) on public health in the area. Instead of an interview survey of residents, data collection from medical institutes is carried out for this purpose.

d. Groundwater

A groundwater survey was conducted on 23rd April and on 21st May 1999 to identify the groundwater table. The groundwater table level is measured at three existing wells. The available geological/groundwater data regarding the proposed site and its downstream is also collected.

e. Hydrological Survey

In order to identify the hydrological system of the stream, which treated wastewater from the proposed disposal site will be discharged into, the existing hydrological data on the stream is collected. In addition to the above-mentioned works, surface water

flow rates are measured at 2 points, one upstream and one downstream, of the discharge point.

f. Fauna and Flora

A survey of flora and fauna was made of the area within the proposed Cimsa site on 23rd April and 28th May 1999, and covered an area of radius 1 km outside the boundary of the site.

g. Landscape/Aesthetics

In order to analyse whether the new disposal site is viewed from the surrounding villages within radius 1.5 km outside the boundary of the proposed site or not, the site survey was conducted on 23rd April and 16th May 1999.

h. Air Quality Survey

The air quality survey was conducted on 16th in May 1999. It covers the following survey items: air temperature, humidity, wind direction, wind velocity, settled dust, SO₂, NO_x, Cl₂, PM(particulate matter), Pb.

i. Water Quality Survey

The water quality survey was conducted on 23rd in April and on 11th, 14th, 21st, 28th in May 1999. Analysis items are colour, pH, total dissolved matter, DO, COD, BOD, Fecal coliform, T-N, T-P, NH⁴⁺, Na⁺, Cl⁻, SO₄²⁻, Cr⁶⁺, Hg, Cd, Pb and As.

j. Land Use Survey

A land use survey was made of the area within the proposed site on 8th, 13th, 28th in May 1999 and covered an area of radius 1 km outside the boundary of the proposed Cimsa site. Land use development plans for the area is also obtained.

k. Water Use Survey

Water use from surface water and groundwater was investigated. As for groundwater, all existing wells within a radius of 5 km south of the site will be identified/described and locations of them will be presented on a map.

For surface water, water use will be identified and described regarding the stream, where treated waste water from the disposal site will be discharged.

l. Meteorological Data

Meteorological data was collected for the following items: wind direction, wind velocity, precipitation, evaporation and air temperature.

2.7 Weighbridge Installation and Operation

2.7.1 Objectives of the Weighbridge Installation

A weighbridge will be installed to obtain data on the amount of waste hauled and disposed of at the existing disposal site in Sofulu, Adana. The weighbridge will be installed at the entrance of said disposal site.

2.7.2 Weighbridge Specifications

a. Type

Maximum graduation: 60,000kg
Minimum graduation: 20kg
Scale/dimension: not less than 12m x 3m

For surface mounting, a non-self contained modular steel weighbridge shall be used.

b. Strength

The weighbridge loading capacity shall be more than 30 tonnes per uniformly distributed module.

c. Weighbridge Indicator System

The indicator system shall be digital type and microprocessor based industrial weighing system.

d. Finish

One coat weldable red etch-primer and one coat air-drying blue gloss finish paint shall be applied.

e. Environment

Resistant to dirt and moisture, and consistent with conditions pertaining to well drained outdoor installation. Operating temperature range shall be -10°C to +50°C, depending on weights and measures regulation applicable.

f. Installation and Access

Approach shall be concrete ramps with reinforced concrete end curbs. Access for maintenance shall be from side of weighbridge.

g. Platform Height

Surface mounted models shall be 380mm above ground level.

h. Ticket Printer

Ticket printer shall be free standing microprocessor controlled dot matrix ticket printer.

i. Weighbridge Foundation

The foundation for the weighbridge shall be reinforced concrete slab and shall have enough strength for maximum load. The height of the foundation shall be high enough so that the load cell shall not be below water level under flooding.

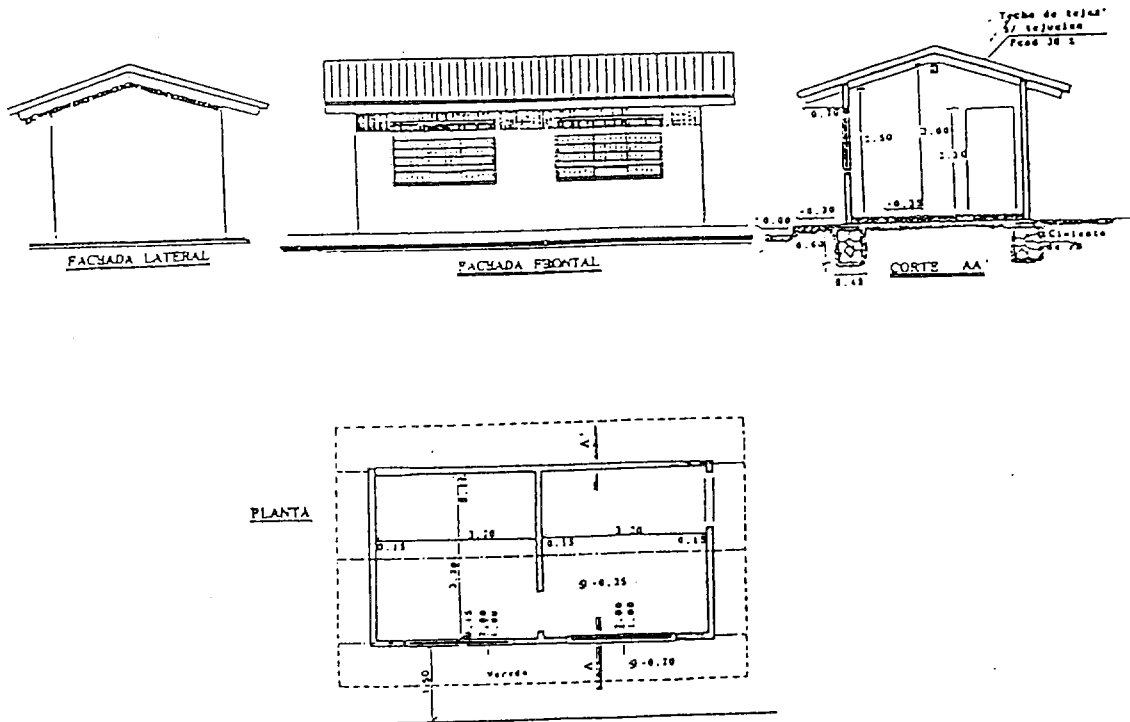
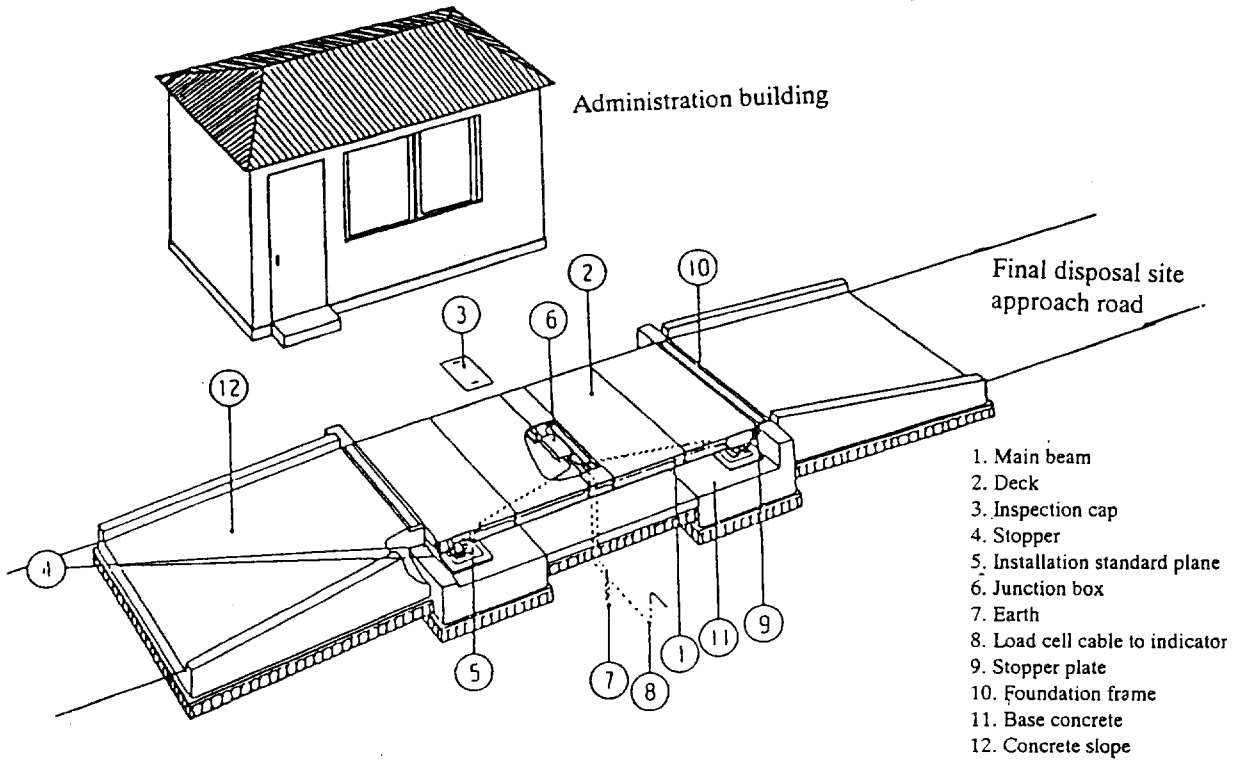


Figure 2-21: Weighbridge Installation