

CHAPTER 6

TIME & MOTION SURVEY

6. TIME AND MOTION SURVEY

6.1 Objective of the Survey

Effective and efficient municipal solid waste (MSW) collection activities are not only important because of their apparent need as a sanitary service, especially in urban areas, but also due to the high costs involved. Two equally important factors are considered to improve collection efficiency:

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

However, other factors such as the general condition of the routes and citizen participation also have an impact on efficiency. In order to examine the collection of MSW in Metro Manila, a precise understanding of the present activities is important. This was done through the undertaking of a time and motion survey.

6.2 Contents of the Survey

Among others, the survey includes:

- time, distance and volume of waste collected and hauled,
- types of containers used,
- collection routes, and
- observations on household participation and level of service.

6.3 Methodology

The Metro Manila Development Authority (MMDA) was formerly the organization responsible for MSW collection and disposal in metropolitan areas. However, with the passage of the Local Government Code, the functions have been devolved to local government units (LGU). Within each local government unit (Metro Manila comprises 17 LGUs), the department in charge of collection and disposal of MSW divides the city or municipality into collection areas. Officers belonging to the department (dispatchers) are responsible for assigning collections routes within the collection areas. Aside from residential areas, there are also routes for commercial and market wastes, street sweeping of major thoroughfares, and cleansing of waterways and rivers.

6.3.1 Selection of routes and cleansing works

The JICA Study Team determined the routes and areas to be surveyed, and the MMDA provided assistance in the identification of the responsible collection body. Table 6.1 is a summary of all LGU activities and is considered typical of the areas studied.

Time, distance and other relevant observations concerning collection vehicle activities were recorded on a data sheet, and all relevant stations (dispatch areas, collection points, transfer stations, and disposal sites) on the designated routes were marked on respective maps.

Table 6.1 Collection activities traced by Time and Motion Survey

Local Government Unit	Household Waste			Market Waste	Street sweeping waste	River cleansing waste	Other special collection works
	by MMDA	by LGU	by Contractor				
Manila			x	x		x	
Quezon			x	x (2)	x		
Caloocan			x				
Navotas		x					
Valenzuela			x				
Malabon		x					
Marikina		x			x		
Pasig		x	x	x			
Pateros	x	x					
San Juan			x			x	
Taguig			x				
Makati			x				
Pasay		x*	x			x	*pushcart
Muntinlupa			x				
Mandaluyong			x				
Parañaque			x				
Las Piñas		x					

The amount of waste collected was estimated by comparing visual measurement of the refuse and the vehicles' rated capacity.

6.3.2 Study Crews

Three study crews surveyed activities of the 17 LGUs in Metro Manila. Each study crew consisted of four members including the driver. The following duties and responsibilities of the crew members were assigned during the orientation stage:

- Team Leader — overall coordination, note observations including among others, collection vehicle type, waste containers type, etc.
- Member A — mark points on route map, locations and condition of waste containers.
- Member B — record times, distances and estimate volume of MSW collected.
- Driver — follow collection vehicles being studied on each route.

6.3.3 Recording of Times

The following items were recorded:

- . departure time from dispatch area,
- . arrival and departure times from each collection area,
- . arrival and departure times from transfer stations or disposal sites,
- . arrival time at dispatch area,

The time taken for each cycle was calculated after each survey.

6.3.4 Distance

The following odometer readings (in kilometers) were recorded.

- . initial reading upon departure from dispatch area.
- . reading upon arrival at each station (collection point).
- . reading upon arrival at transfer stations or disposal sites.
- . reading upon arrival at dispatch area.

6.3.5 Observation of collection works

Observations were made regarding the type, condition and size of waste containers used in the different collection sectors, area conditions, road conditions, cooperation manner, and type of waste. The sectors include street sweeping, market waste, and cleansing of waterways and rivers.

6.3.6 Mapping

The following information was marked on a map for all collection routes:

- . location of collection routes
- . location of collection points
- . direction of dispatch area
- . direction of disposal site
- . number of collection points

6.3.7 Survey Schedule

The survey dates were determined after consulting with the LGU's department in charge of collection and disposal of MSW and the dispatchers. In the case of other waste collection activities (e.g. market wastes and river cleansing) the dates were determined after coordinating with the respective units, i.e. market administrators and river cleansing project officers

6.4 Results of the Survey

6.4.1 Collection Activities

Household waste

R-1 Manila (contractor: Leonel)

Manila, capital city, seat of government, center of commerce and industry serves as the reference point to all surrounding cities and municipalities. Collection and disposal of MSW is contracted by the city government to a single private contractor, Leonel. The contractor's garage, which also serves as dispatch area, is located on San Cristobal Street in the Paco district. The collection activities for household waste start at 5:45 a.m. in the Pandacan area. The collection vehicle studied was a 6-wheeler dump truck, capacity 8.0 m³. The collection crew was composed of a driver and 5 collection workers.

Traffic conditions were light from the garage to the collection area and similarly so when returning. Roads are generally in good condition. In the collection area, slow movement of vehicles was observed due to narrow roads.

Residents appeared cooperative during collection time and even offered the crew drinking water. Some residents brought their garbage to the curb where the vehicle was waiting while others loaded their garbage directly onto the truck. In inaccessible areas, the residents brought their garbage out to a street corner where the truck could pick it up. Waste containers used by households are of different sizes and types. Residents use plastic bags, cartons, steel drums (100-210 liter cap.), plastic containers, "kaings" (native rattan baskets), rice sacks, wooden boxes, or 20 liter cans.

The collection area is 8 minutes from the dispatch area (garage). Collection time was 4:44 hours, traveling between collection area, transfer station, and dispatch area took 2:10 hours, and unloading took another 17 minutes. Total time was 7:20 hours.

The collection area is almost 3 km from the dispatch area. The distance covered in the collection area was about 4.2 km, while distance traveled for other trips was 30.8 km. The distance from the transfer station to the collection area is approximately 8 km. Fifty-three(53) collection points exist on this route.

R-2 Quezon City (contractor: R.E.N.)

Coordination of collection and disposal of MSW in Quezon City is carried out by the city government's task force "Clean and Green". While, actual collection work is contracted out to several private companies. The dispatcher is an MMDA officer.

The study area was Barangay Immaculate Concepcion, one of several residential areas in District 4, Quezon City. The collection area and route are, to a certain extent, predetermined. Collection is done 3 times a week (Monday, Wednesday and Friday) by a private contractor, R.E.N.

Morning vehicle inspection consisted of checking brake fluid, clutch, brake hose and tires, usually taking 10-20 minutes. After the check-up at the garage, the collection vehicle proceeded to the dispatch area located on the EDSA (Epifanio de los Santos Avenue) at the corner of East Avenue, Quezon City. A trip ticket from the dispatcher allowed the collection crew to start collection work. The collection crew observed consisted of a driver and 4 collection workers.

Roads within the collection area are mostly concrete paved. Often vehicles are parked on the side of the street and sometimes on both sides, thus slowing down the movement of the collection truck.

Household income levels in the area vary from low to middle income groups. Residents bring out their garbage only as the collection truck approaches. Some residents even hand their garbage directly to collection workers in plastic bags. On several occasions, wastes were not properly placed in containers, just piled on the roadside. In these cases, collection workers had to shovel the waste onto a plastic trays to load it onto the truck.

No uniform waste containers are being used by residents. Commonly waste containers are plastic bags, plastic containers or buckets, cartons, nylon sacks, half drums, or kaings. The collection workers on top of the truck stack the waste to maximize load capacity. When the collection truck is full, the truck returned to the dispatch area to have the load checked before disposal.

A total of 32 m³ of waste was collected in the two trips that were completed in approximately eight (8) hours of operation. Collection took 3:41 hours and another 3:31 hours for traveling between transfer station, collection area, and dispatch area.

The collection distance totaled 4.5 kilometers. While the distance to and from the disposal site was about 77 kilometers. Total distance traveled is 81.40 kilometers.

R-3 Caloocan (contractor: Harley)

Caloocan City is situated 8 km north of Manila. The collection and disposal of MSW is contracted by the local government to a number of private contractors. The dispatch area for the contractor Harley, a major private contractor, is located in Bagong Barrio. The waste collection activities for residential areas usually start at 10:00 a.m. as the early hours are devoted to collection along the major streets of the city. Harley's collection vehicle under study was a mini-dump truck, capacity of 6.0 m³ and a crew of one driver and 3 waste collection workers. The contractor is paid based on the number of trips made so they have to maximize the use of time and be cooperative.

The majority of collected waste comes from households. Other waste collected included yard and garden wastes, wood materials, construction wastes, old galvanized iron sheets, and old clothes. Waste from a plastic factory along the route was also collected.

Waste containers used by households are of different sizes and types. Residents usually use plastic supermarket bags, cartons, steel drums (100-210 liters cap), plastic containers, kaings, rice sacks, wooden boxes, or 20 liter cans.

During the survey traffic conditions were light from the dispatch to the collection area and similarly so when returning. The roads are two-way and in good condition. However, due to the narrowness of the roads vehicle speed was low.

The collection vehicle took around 5 minutes to travel from the dispatch area to the collection area. Waste collection work took 2:28 hours and traveling between the collection area, disposal site, and dispatch area took 5:28 hours. Unloading of waste at the disposal site took 16 minutes. Total time taken for the two round trips was 8:56 hours. After the first trip the collection crew took a rest for about 45 minutes.

The total distance of the two collection trips was 86.8 km. A distance of 2.7 km was traveled within the collection area and a distance of 84.1 km was covered for other activities. According to the driver, the distance from disposal site to the garage is approximately 25 km.

The collection area had a total of 45 collection points.

R-4 Navotas (LGU)

Collection and disposal of MSW in Navotas is done by the local government and some private contractors. The dispatch area is located within the compound of the Navotas municipal hall. This also serves as the garage for the municipality collection vehicles.

MSW collection activities start at 4:00 a.m. along the main streets. The collection vehicle observed was a compactor truck donated to the municipality by JICA (8m³ capacity). First it passed along Gov. Pascual and started collecting waste in the streets of Rajah Tupas, Magat Salamat, Rajah Baginda, Rep. A. Ignacio, J. Alonzo, Rajah Humabon, Kalantiao, T. Gonzalez, Int., Gonzales, Policarpio, Bagong Silang and Union. Collection was also done in Gen. Luna Street in Sipac.

Mainly household waste was collected. Other waste included yard and garden waste, construction waste and old furniture. Waste containers used by households come in different sizes and types. Residents use plastic bags, cartons, steel drums (100-210 liter), plastic containers, kaings, rice sacks, wooden boxes, or cans (20 liter).

Traffic conditions were light to moderate from dispatch to collection area and returning. Roads in the collection area are two-way and in good condition. However, due to their narrowness vehicle speeds were slow.

The times taken for the collection and for the haulage to disposal site and return were 3:34 hours and 38 minutes, respectively. Unloading took 6 minutes. In total 4:18 hours was taken for the two trips.

The total distance covered within the collection area was about 3.25 km. For other trips, between the garage, collection area, and disposal site, a distance of about 6.35 km was covered.

In the waste collection area, there were 49 collection points.

R-5 Valenzuela (contractor: Harley)

The Municipality of Valenzuela is located to the north of Metro Manila. Solid waste management is the responsibility of the sanitation service department of the Valenzuela local government. Collection services are sub-contracted out to a single private contractor (Harley). The dispatch area for all vehicles and personnel is located along McArthur Highway and this also serves as a transfer station where waste from small vehicles is transferred to larger vehicles for transport to the disposal site in Norzagaray, Bulacan. The time and motion survey was conducted in the Serrano subdivision of Marulas in Valenzuela. Streets served by the collection vehicle were Bayani, Dolorito, Dalisay, Feliza and Kalayaan. One trip was also made to the Valenzuela public market.

The waste collection vehicle observed was a mini-dump truck (capacity 6.0 m³). It was manned by a driver and 3 collection workers.

Household waste were collected along with other waste such as yard and garden waste, construction waste; old galvanized iron sheets, bulky waste (tree trunks and used blankets), Waste from garment factories in Valenzuela were also collected.

Waste containers of different sizes and types were observed. Residents used different size plastic bags, cartons, drums (100-210 liter), plastic containers, kaings, rice sacks, wooden boxes, or cans. Further, waste in these containers was placed in sacks by the waste collection workers before loading onto the vehicle to make it easier to later transfer to larger vehicles.

Traffic was light from the dispatch and transfer station to the collection area and likewise when returning. Roads are two-way and in generally good condition. However, in the collection area, slow movement of the mini-dump truck was observed as a result of obstructions caused by parked vehicles on both sides of the road. Within the market, streets were too narrow for two-way traffic.

Of the total time taken for the five trips collection time totaled 3:16 hours and time traveling between dispatch area, transfer station, and collection area was 1:56 hours. Unloading and transferring waste to larger vehicles took 50 minutes while 2:03 hours was spent waiting for the availability of larger vehicles. The five trips by the collection vehicle under study took 8:05 hours, including collection, haulage, unloading, and other trips.

The total distance covered in the collection area was 1 km while the distance covered hauling and traveling between the dispatch area and collection area totaled 30.2 km.

Within the collection area there were 40 collection points. This does not include the collection point at the public market. This was because the market had not been serviced for the past few days and garbage had accumulated.

R-6 Malabon (LGU)

Collection and disposal of MSW is carried out by the local government unit in Malabon and a private collection system. In this municipality, the Catmon disposal site also serves as a dispatch area for the LGUs equipment and personnel. Their collection activities start regularly at 2:00 a.m. collecting waste from the markets, major thoroughfares, and later in the

day from households. The final trip of the collection vehicle passed through major thoroughfares collecting a mix of street sweepings and commercial waste. The collection vehicle is owned by the LGU and has a capacity of 8 m³. The crew is composed of one driver and 3 collection workers.

Waste containers of different sizes and types were observed. Residents used plastic bags of different sizes, cartons, drums (100-210 liter), plastic containers, kaings, rice sacks, wooden boxes, or cans.

Collection crew cooperated with each other. The driver sometimes helped in piling the waste before loading. Collection workers on top of the vehicle also sorted recyclable materials. At the disposal site, the sacks of sorted recyclable materials were unloaded before the vehicle proceeded to the disposal site.

Traffic conditions were light between the dispatch area, disposal area and collection area. Roads are two-way and generally in good condition. However in the collection area, slow movement of the collection vehicle was observed due to narrow streets. Likewise, the presence of the collection vehicle often created traffic congestion in the collection area.

The time taken for the collection of waste in residential areas was 1:58 hours. Time taken unloading and traveling between the dispatch area, collection area and the disposal site was 19 minutes. After waste dumping, the crew rested for 7 minutes before leaving for the second trip. The total time taken for the two trips by the collection vehicle was 2:40 hours.

The total distance covered was 8.2 km. Along the 4.1 kilometers of the collection area there are 34 collection points.

R-7 Marikina City (LGU)

Collection and disposal of waste in Marikina is the responsibility of the city government's waste management office. Collection of waste in the area served by the truck observed is done once a week (Saturday) by the city's collection crew. The crew (composed of a driver and two waste collection workers) utilizes a compactor truck with a loading capacity of 8 m³. An early morning pre-trip check-up consisted of inspection of brake fluids, radiator water, tire pressure, fuel, and hydraulic pressure. Collection is done 24 hours a day consisting of three eight hour shifts. Collection operation started after receiving instructions and assignment from the dispatcher's office.

The city operates its own transfer station located near the back of the city hall. The station is kept clean at all times as this is located within the right-of-way of a main thoroughfare. Personnel are assigned to clean the station after each collection truck dumps its waste and the receiving dump truck leaves. To minimize odor and the proliferation of flies and other insects, personnel spray insecticide on the ground and vehicles.

The strategic location of the transfer station allows the collection crew to make 4 trips within each eight hour shift. Total volume of waste collected is 52 m³ from a total of 182 collection points covering a total distance of about 36.10 kilometers.

Common waste containers in use included plastic bags, nylon sacks, tin cans, cartons, whole and half drums, kaings, and other plastic containers. Some households saw to it that their waste containers were returned by the crew after being emptied into the truck.

The majority of the streets covered were either concrete or asphalt paved. Often there were vehicles parked alongside of the streets. As some streets had dead ends the collection truck, unable to turn around, was forced to reverse out.

Households placed their waste in containers along the roadside in front their premises before the truck arrived. However, occasionally the crew had to alert the residents in order for them to bring out their waste as the truck was already in the area.

Whenever wastes spilled during loading, collection workers swept it up, placing the waste onto plastic trays for loading onto the truck.

Larger dump trucks, which can carry at least two compactor loads, travel between the transfer station to the San Mateo landfill.

Total time to complete all activities was 7:34 hours. While collecting took 3:49 hours.

The distance covered for collection was 4.1 kilometers and another 32 kilometers was covered undertaking other activities. Total distance covered was 36.1 kilometers.

R-8 Pasig (LGU)

Waste management in Pasig is handled by the Environmental Sanitarium Center. However, collection and disposal is contracted out to private collectors while at the same time, the LGU maintains its own fleet of vehicles. For the government's collection activities, the city government utilizes an 8.0 m³ open dump truck.

Typical morning vehicle inspection included a check of brakes, tires, and radiator water level. After the brief check up the crew received their assignment from the dispatcher and the truck proceeded to its assigned collection area.

Waste collected along the route observed was not purely residential, but a mixture of residential and institutional wastes. Although the majority of the waste collected was from residential areas on the first trip some was from the local police station (from prison cells) and small street sweeping works. The second trip was solely devoted to the collection of waste from a hospital compound. With just one collection spot within the hospital compound the truck was filled. Hospital staff were observed to be friendly towards the collection crew as they gave the crew lunch.

In residential areas the roads were mostly concrete paved. There were a few small streets with private vehicles parked along the street sides, resulting in slower movement of the truck.

In most areas, waste is placed on the roadside prior to being picked-up by the collection crew. Plastic bags were the most common waste containers. However, there were other containers such as tin cans, cartons, sacks, half drums, and other plastic containers. Some residents assisted the crew in placing their waste in the truck.

At the transfer station, the dump truck had to line up behind other collection trucks and wait several minutes for a receiving truck to become available before discharging its waste. Collection of waste is done daily.

The time taken collecting was about 2:24 hours, 24 minutes was spent traveling between the collection area and transfer area and a further 2:08 hours was spent waiting and unloading.

Total volume of waste collected from 29 collection points was 16 m³. The length of the collection area was only 1.8 kilometers, while the total distance covered, including all activities, was 8.8 km.

R-9 Pasig City (contractor: SVR Mass Transport)

MSW collection in Pasig is carried out by the city government and by private collectors contracted by the city government. The dispatch area and transfer station are located on C. Raymundo Avenue and is owned by the city. The area also serves as a garage to the city's own fleet of collection vehicles and that of the private contractors

The usual morning vehicle inspections includes a check of brakes, tires, and radiator water which normally takes a few minutes prior to beginning collection works. After receiving the assigned route, the truck proceeded to the collection area. Collection crew consist of a driver and 3 collection workers. Collection frequency in the assigned area is daily and the final disposal site is at the San Mateo landfill site.

The collection route observed covered the main thoroughfare and side streets, all of which are concrete paved. Once on the main thoroughfare, the collection truck was forced to make a U-turn to pick-up waste placed on the opposite side of the street. On some narrow streets, private vehicles were parked slowing down the truck.

The crew played loud recorded music to alert residents to bring out their waste. In some areas residents assisted the crew in loading their waste onto the truck.

Ordinary waste containers in use are plastic bags, cartons, sacks, half drums, kaings, and other plastic containers. One collection point was a permanent bin made of concrete.

At some collection points, wastes were not placed properly in bins and were stockpiled at the side of the street. In this case, the crew had to shovel the waste onto plastic trays and baskets to load it onto the truck. At one instance the truck driver had to assist the collectors in this work.

When the truck was more than half full, it went to the dispatch area. After a few minutes it returned to the collection area to continue collection activities.

Collection time took 2:26 hours, and 3:07 hours was spent between the collection area and the disposal site.

Total distance traveled was 70.8 km, 3.6 km being in collection area.

After the collection activity, one trip collecting 17 m³ of garbage from 66 collection points, the truck was washed at a designated cleaning area.

R-10 Pateros (MMDA)

Solid waste management in the Municipality of Pateros is handled by the garbage collection division. The local government is assisted by the MMDA in managing the solid waste collection and disposal. Two compactors (12 m³) are provided by the MMDA as well as the salaries of the manager and collection crews manning the MMDA vehicles. In addition, a 24 m³ MMDA compactor truck is also available upon request to augment the capacity of available units for MSW collection and transport to the disposal site. The garage and dispatch area is located along Almeda Street, Pateros, Metro Manila.

The study area was one of the collection routes for households in Barangay San Pedro and the Poblacion. The garbage in the study area is collected daily. The collection vehicle, a 12 m³ compactor truck, was manned by a driver and 2 waste collectors. The first shift normally starts at about 4:00 a.m. and the second trip begins at around 1:00 p.m. Between shifts there is a one hour lunch break.

MSW is collected in the early morning (first trip starts at about 4:30 a.m.) everyday. It was observed that some commercial waste was included in the collection. On Sundays, collection is limited to only one trip. Preventive maintenance is also done on this day. Pre-dispatch activities of drivers and collection workers involve the following; vehicle check-up, check of tires, fuel, brakes and lights. MSW collected in the area is dumped at San Mateo landfill which is approximately 35 km from the dispatch area. A considerable amount of time is consumed between the dispatch area and the San Mateo landfill.

The condition of collection and disposal routes was generally good except for a few segments of rough road towards the San Mateo landfill. During the study the traffic was moderate.

Waste containers used by the households were mostly plastic supermarket bags. Other containers included sacks, metal bins, kaings, drums, and cartons. Container sizes vary considerably, from about 40 to 300 liters. Smaller containers were disposed together with the garbage, however, large containers, drums and plastic bins, were emptied and returned for reuse.

Collection time took about 1:20 hours while traveling between the dispatch area, collection area, junk shop, and disposal site took 3:17 minutes.

Total distance traveled was 71.60 km., 1.3 of which was in the collection area.

R-11 Pateros (LGU)

The collection and disposal activities in Pateros are partially handled by the local government unit which has a number of mini-dump trucks. These are used to collect MSW from the narrow streets in Pateros that are not accessible to bigger collection vehicles.

The subject of the study was one of the collection trucks collecting MSW from households of Barangay Santo Rosario Silangan and Kanluran, Pateros, Metro Manila.

The MSW in the study area is collected twice weekly with no definite day of collection. The collection vehicle observed was manned by a driver and 2 waste collection workers. The first shift normally starts at about 5:30 a.m. and the second trip at around 8:00 a.m. A 3 m³ mini-dump truck (Mitsubishi L 300) used for the past five years was observed in this study.

A significant factor which determines the trip schedule of the mini-dump truck is the availability of the 24 m³ compactor truck which can be requested from the MMDA. For the first trip, the garbage collected by the mini-dump truck is transferred to the 24 m³ compactor for transport to the disposal site. Before the second trip the waste collected was transferred to a 12 m³ compactor for disposal.

On Sundays collection is limited to one trip. Preventive maintenance is also done on this day.

Pre-dispatch activities by collection crew included a tire, fuel, brake, and lights check.

MSW collected is dumped at the San Mateo landfill which is approximately 35 km from the dispatch area. The road condition and disposal route is generally good.

Storage containers used by the households are mostly plastic supermarket bags. Other containers used are sacks, metal bins, kaings, drums, and cartons. Sizes vary considerably from about 40 to 300 liter. Smaller containers were disposed together with the garbage, however, big containers, drums and plastic bins, were emptied and returned for reuse.

Collection time totaled 2:10 hours and 23 minutes was spent hauling the waste to the transfer station and returning.

The total distance traveled was around 8 km, 3.9 km in the collection area.

R-12 San Juan (contractor: Metro Wide Movers)

MSW collection and disposal in the Municipality of San Juan is coordinated by one of the councilors who is concurrently in charge of the solid waste management division. On the other hand, actual collection and disposal activities are contracted out to private collectors.

Barangay Little Baguio was chosen as the study area in San Juan. Specific names of streets to be covered were given to the crews at the dispatchers office prior to leaving for collection activities. Work started at about 6:00 a.m. Household income levels vary from low to middle income. Collection in the assigned areas was done once or twice a week.

The collection observed consisted of a driver, and 4 collection workers using an open dump truck with loading capacity of 19 m³. Roads covered were all concrete paved with a few private vehicles parked on some streets.

The collection crew notified the residents that the collection truck was in the area by blowing their horn. Common wastes containers in use were plastic bags, cartons, tin cans, native baskets, half drums, sacks, and other plastic containers. Waste was placed on the roadside in

front of residences. However, occasionally waste not properly placed in containers so the crew had to shovel such waste onto a plastic trays for loading onto the truck. Collection workers on top of the truck segregated waste into sacks.

Following instructions from the dispatch office, priority was given to the collection of household waste. Other types of waste were collected once the truck was nearly full. After the first trip, the crew took their lunch. After lunch, the crew explained that the driver and one collector would be replaced for the second trip as they had to attend to personal matters.

At the dispatch area before final disposal of the second load, the truck changed a flat tire. On the way to the disposal area, the truck made a stop at the contractors field office to get oil and diesel.

The final disposal area is the Payatas open dumpsite. Collection activities ended at the residence of the truck driver near the Payatas dumpsite.

Total collection time was 5:16 hours, and hauling and returning took 3:12 hours.

Total volume of MSW collected was 38 m³ covering 96 collection points in two trips and a total distance traveled of 71.6 kilometers. Of the total distance, 5.1 km was in the collection area.

R-13 Taguig (Contractor: Redfox)

MSW collection and disposal in the Municipality of Taguig is handled by the environmental sanitation center (ESC). The local government has two collection vehicles while the bulk of waste collection is being done by a private contractor (Redfox) which has 15 trucks, 13 of which are 10-wheeler dump trucks (V10, 1990 model Isuzu and Fuso), and the remaining are reconditioned 6-wheeler dump trucks. The garbage and dispatching area is beside the municipal hall.

The subject of the study was a collection route from households in Barangay Napindan Dulo to Ibayo Tipas, Taguig, Metro Manila. This route serves approximately 1000 households. MSW in the study area is collected twice a week (Monday and Friday). The collection vehicle, a reconditioned old model 6-wheeler dump truck, DT-30 Fuso 1980 model, 15 m³ capacity, was manned by a driver and 4 collection workers. The first shift normally starts at about 3:30 a.m. and the second trip at around 1:00 p.m. Between shifts there is one hour lunch break.

The local government has one compactor and two mini-dump trucks servicing difficult to reach areas. These also serve as standby vehicles in case of breakdown of the contractor's trucks.

MSW was collected early morning everyday from the main thoroughfares. This included commercial, institutional and household wastes. Collection for secondary routes is usually done during the second trip (12:00 noon to 1:00 p.m.). Waste collected on these routes was domestic or household waste and the frequency of collection is once or twice a week. The local government has plans in the pipeline to acquire more collection trucks to increase the collection frequency to at least twice a week for all areas.

On Sundays collection is limited to only one trip (early morning, along thoroughfares only). Regular preventive maintenance is also done during this day. Pre-dispatch vehicle inspection by the crew include a tire, fuel, brakes, and lights check. All MSW collected in the area is dumped at San Mateo landfill which is approximately 35 km from the dispatch area.

The road condition of collection and disposal route was generally good except for a few segments of rough roads towards the San Mateo landfill. During the study the traffic was moderate.

Waste containers used by the households were mostly plastic supermarket bags. Other materials used include sacks, metal bins, kaings, drums, and cartons. Sizes vary considerably, ranging from about 40 to 300 liter. Smaller containers were disposed together with the waste; however, big containers, drums and plastic bins, were emptied and returned for reuse.

Collection time was 1:39 hours of the total 6:26 hours. The remaining time was spent traveling between the collection area and the disposal site and unloading. Total distance traveled was 78.1 km, 1.98 km in the collection area.

R-14 Makati City (contractor: A.C.Y.)

Makati's waste collection activities are contracted to private contractors. A truck belonging to A.C.Y. contractors was traced for the time and motion survey. The study area was a residential subdivision near the Makati-Pateros city boundary. The dispatch area is located on a city easement on Kalayaan Avenue. Prior to being dispatched, trucks lined up along this avenue. The usual pre-trip inspection of the trucks includes checking of brakes, tires inflation and water level at the radiator. After reporting to the dispatch area, collection started at about 5:00 a.m.

The collection truck observed had a loading capacity of 15 m³. As with other collection activities, it was observed to be following the flow of traffic and road rules. Common waste containers in use by residents include cartons, sacks, kaings, tin cans, and other plastic containers. When the truck was full, the crew covered the truck with a tarpaulin and proceeded to the dispatch area for checking the volume or waste before going to the final disposal area, the San Mateo landfill site.

For the second trip, the area assigned was not familiar to the crew. They were accompanied by a local resident. Roads were mostly concrete paved, but a little narrow. Vehicles passing had to be cautious, needing to slow down.

Collection time was 3:25 hours, while 8:45 hours was spent traveling. It took a total of 13:06 hours to complete the day's collection activities.

For the day's operation a total of 30 m³ of waste was collected covering a total of 56 collection points. Of the total 169.3 km traveled during the entire collection operation only 2.7 km was traveled in the collection area. The majority was spent hauling the waste between the collection area and the disposal site and returning.

R-15 Pasay City (contractor: L.E.G.)

Collection and disposal of MSW is contracted out by the city government to a number of contractors. However, the city also maintains some collection activities which it does with assistance from the barangay. The dispatch area of the contractor L.E.G. is located along Roxas Boulevard, a reclaimed area. The MSW collection activities for this study covering households started at 5:45 a.m. in Barangay San Isidro.

The collection vehicle traced was a 10-wheeler dump truck with a capacity of 9-12 m³. The collection crew is composed of one driver and three collection workers.

Waste containers used by households were different sizes and types. Residents use plastic bags, cartons, steel drums, plastic containers, kaings, rice sacks, wooden boxes, or 20 liter cans.

The collection area was 9 minutes from the dispatch area. The time spent collecting MSW was 1:53 hours, and 43 minutes was spent traveling between the collection area, dispatch area, and transfer station. At the transfer station the vehicle had to queue for nearly 8 hours before entering the transfer station compound. Unloading took about 8 minutes.

The collection area is about 2.2 km away from the dispatch area. The distance covered in the collection area 1.3 km, while 5.8 km is covered on other trips. There were 36 collection points in the collection area.

R-16 Pasay City (LGU: Pushcart)

Collection of household waste in some barangays in Pasay City is being handled by a group of volunteers under the supervision of the LGU. Sixteen volunteers have organized themselves into an association called "Pasay Inat Linis". The association has 16 pushcarts, each with a capacity of 2 m³. Three pushcarts were observed during the time and motion study. Each pushcart was manned by three persons.

Mainly household wastes were collected. However, other wastes such as yard and garden waste, cans, bottles, papers were also collected.

The sizes of waste containers used by households were irregular. Resident used plastic bags, cartons, plastic containers, kaings, rice sacks, wooden boxes, or 20 liter cans.

Pushcarts serve areas which are not easily accessible to motorized collection vehicles. These small streets and alleys, however, generally have good pavements.

Collection activities took 42 minutes while hauling the waste to the transfer area and returning took 23 minutes. Frequency of waste collection depends on the availability of transfer collection vehicles. A pushcart being studied waited 1.5 days before the waste could be unloaded and transferred to a larger vehicle.

The collection area is three blocks (150 m) away from the dispatch area. There were 20 collection points in the three alleys served by the pushcart collection system in this study.

The LGU does not provide any budget for the operation of the collection system in the area. The volunteers rely on small monetary donations from residents after collection of household waste. The volunteers were very courteous and hardworking. At the transfer station, they segregated waste which has value, and in turn sell to junk shops to further support their needs.

R-17 Muntinlupa City (contractor: Redfox)

Solid waste management, in Muntinlupa is coordinated by the environmental sanitation center headed by Ms. Lorna Misa, whose office is located on Arandia Street Barangay Tunasan, Muntinlupa City

The local government has two 8 m³ compactor trucks (received from JICA). However, the bulk of the MSW collection is being done by private contractors. The contractor Redfox has 23 contracted units. The waste and dispatch area is beside the ESC office in Barangay Tunasan. The MSW collection services are based on a package contract with Redfox.

The study was conducted based on one collection route for households of the Parkhomes subdivision in Tunasan Muntinlupa City.

Collection in the study area is done everyday. The collection vehicle, a reconditioned old model 6-wheeler dump truck, DT-7 Fuso, 1980 model, with 15 m³ capacity, observed was manned by a driver and 4 collection workers. The first shift normally starts at about 5:00 a.m. and the second at around 9:00 p.m.

The local government has two compactors augmenting Redfox's and the collected wastes are transferred manually at Las Piñas transfer station to dump trucks for disposal.

Pre-dispatch activities by the crew included a tire, fuel, brakes, and lights check. The contractor has a resident mechanic at the dispatch area.

All MSW collected is dumped at the Las Piñas transfer station which is approximately 23.5 km. from the dispatch area. A considerable amount of waiting time was consumed at the transfer station, more than 7 hours.

The road condition of collection and disposal route is generally good. During the study traffic conditions were moderate.

Waste containers used by the households are mostly plastic supermarket bags. Other materials used include sacks, metal bins, kaings, drums, and cartons. Size of waste container varies considerably ranging from about 40 to 300 liter capacity. Smaller containers are disposed together with the waste, however, big containers, drums and plastic bins, are emptied and returned for reuse.

Collection time totaled 51 minutes while hauling to disposal site, unloading, returning, and other activities took 10:02 hours. The total distance traveled was 51.65 kilometers.

R-18 Mandaluyong City (contractor: R.M.M.S.)

Waste collection and disposal in Mandaluyong is coordinated by the city's garbage collection division, and part of the work is contracted out to R.M.M.S., a private contractor. The dispatch area is located on a main street in Welfareville.

After a brief inspection of the truck at the dispatch area, the truck proceeded to the assigned area. The assigned collection route was the residential area of Barangay Hagdan Bato. Work started at about 5:43 a.m.

The collection truck observed had a loading capacity of 15 m³ and a crew of a driver and 4 collection workers. Before the actual collection work started, the truck went to the gas station to be fill up.

The collection route covered concrete paved roads and some unpaved streets. Because private vehicles were parked on both sides of some streets, collection activities slowed.

Common waste containers in use included plastic supermarket bags, cartons, tin cans, sacks, kaings, half drums, and other plastic containers. Some street sweepers unloaded wastes into the truck. When the truck was full, it proceeded to the dispatch area before leaving for the San Mateo landfill.

On the way back from the San Mateo landfill (2nd trip) at about 5:04 p.m., the crew stopped at a canteen. They explained they needed to stop to take dinner to pass the time because of heavy traffic on the way to the dispatch area. After more than 2 hours, the crew proceeded to the dispatch area.

Total time was almost 15 hours. Collection took 2:06 hours and hauling and returning took 9:25 hours. Sixty-nine collections points exist, and the total distance traveled was 150.4 kilometers. Volume of waste collected was 30 m³.

R-19 Parañaque(Contractor: E.J.R.)

Collection and disposal of MSW in Parañaque is handled by the municipality's garbage and collection division. Collection and disposal activities are carried out by the local government and private contractors.

The Parañaque local government has six 10-wheeler dump trucks, an 8 m³ compactor truck and 2 mini-dump trucks (5 m³) all as support units to the three private contractors. E.J.R., the major contractor, has twenty 10-wheeler dump trucks.

The study team followed a route collecting household waste in Clinicville, Barangay B.F. Homes. This route serves poor urban communities of approximately 1,200 households. Waste in the area is collected twice a week (Sunday and Wednesday). The collection vehicle traced was manned by a driver and 4 collection workers. The first shift normally starts at about 1:00 p.m. and the second at around 9:00 p.m. The collection vehicle traced was a 10-wheeler dump truck, 1996 model, 18 m³ capacity.

The municipality of Parañaque employs three private contractors for MSW collection, namely, Greenline, Hinterland, and E.J.R. Household garbage collection started at 1:00 p.m. (first trip). And the second normally starts at 9:00 p.m. to collect waste from main thoroughfares.

Pre-dispatch activities of crew included a tire, fuel, brakes and lights check. The contractor employs a resident mechanic at the dispatch area.

The roads used for collection and disposal are generally good.

Waste containers used by the households are mostly plastic supermarket bags. Other types include sacks, metal bins, kaings, drums, paint cans, and cartons. Sizes vary considerably from about 40 to 300 liter. Smaller containers were disposed together with the garbage, however, large containers, drums and plastic bins, were just emptied and returned for reuse.

There is only one designated collection point for the whole community as the alleys are not accessible. Collection took 1:12 hours and traveling between the disposal, collection, and dispatch areas took 2:51 hours. The total distance traveled was about 96 kilometers, all of this is between the disposal, collection, and dispatch areas.

R-20 Las Piñas (LGU)

MSW management including collection and disposal is handled by the local government unit. The local government has 41 compactor trucks (10 m³) and 2 open dump trucks. The garage and dispatch area is located at the back of the municipal hall.

The study was conducted on a collection route, collecting household waste from BF Resort Village, Las Piñas, Metro Manila. Waste is collected twice a week, with no fixed collection days. The collection vehicles were manned by a driver and 2 collection workers. The first shift normally starts at about 5:30 a.m. and the second at around 2:00 p.m. The collection vehicle traced was a 9 - 10 m³ compactor truck (Isuzu).

Pre-dispatch activities included a check of the vehicle's tires, fuel, brakes, and lights.

All MSW collected in the area was dumped at the transfer station located along the coastal road approximately 6.3 km from the final collection point. A considerable amount of time (approximately 6 hours) was spent waiting at the transfer station. Roads along the collection and disposal route are generally good. During the study the traffic was moderate.

Waste containers used by the households are mostly plastic supermarket bags. Other types used include sacks, metal bins, kaings, drums, and cartons. Sizes vary considerably from about 40 to 300 liters. Smaller containers are disposed together with the garbage, while, large containers, drums and plastic bins, are just emptied and returned for reuse.

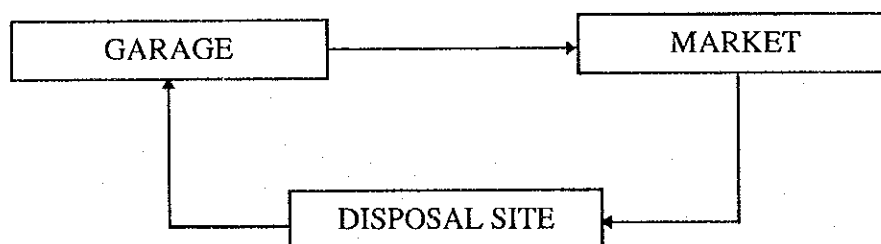
Collection took 4:19 hours and traveling between the collection area, transfer station, and dispatch area took 1:42 hours.

Market Waste

M-1 Market waste (public market: container system)

The study area is located at Caruncho Avenue corner Market Avenue, Pasig City. Solid wastes generated in this market are collected by a private contractor (Greenline Envirotech) normally 3-4 times a day, according to Mr. Francisco.

The study was conducted based on the collection route of the garbage truck to the Pasig Public Market as shown in the diagram below. Time consumed and required for each activity as well as the distance traveled were recorded.



Wastes in the market are collected everyday for 24 hours. Collection and haulage are carried out by janitors and sweepers using rolling containers which are taken to a lift-container stationed in front of the market. The assigned janitors and sweepers work in shifts. Collection vehicles are manned by one (1) driver and two (2) collectors.

The initial collection services for wastes in the Pasig Public Market is irregular, according to Mr. Matinez, due to traffic congestion, weather, condition of the collection vehicle and dumpsite, and availability of collection crew and vehicles. During the time of the study, the first collection commenced at 10:30 p.m.

A six wheeler hook-lift container with a capacity of approximately 30m³ (compacted waste), is used to collect waste in the market.

The findings obtained from the survey are as follows:

1. The market is composed of stalls with separate sections for meat, fish, fruits & vegetables, cooked food and dry goods.
2. There is one established waste collection point in the market. Rolling containers are used to collect and transport waste from this market, which is then transferred to the lift container.
3. There are three (3) lift containers in front of the Pasig Public Market.
4. There are almost twenty (20) janitors and sweepers working in shifts.
5. There are respectively fourteen (14) and twenty (20) 210 and 150 liter rolling containers used by the sweepers to haul waste into the lift container.
6. Most of the janitors and sweepers do not wear any protective gears, e.g. rubber gloves, during waste haulage.

7. There are approximately 1,850 fixed stalls and 2,500 market vendors at the Pasig Public Market.
8. The arrival of the collection truck at the Pasig Public Market, for its first collection in a day, is not fixed.
9. The contractor gives priority to collection points where the lift containers are already full to prevent back-logging.
10. The condition of the road from the garage to the Pasig Public Market and the disposal route is generally good. Traffic was light when the study was conducted.
11. Waste volume is normally expected to peak during Saturdays and Sundays when the market is crowded with people. According to Mr. Francisco, one lift container becomes full for only three hours on these days.
12. All solid wastes from the market are dumped at Payatas open dumpsite.
13. The time consumed in the collection, transport and disposal of waste is shown in the attached forms.

M-2 Market waste (public market: station)

The Murphy public market waste is collected by a private firm contracted by the Quezon City government. A vacant lot (approximately 100 m²) in front of the market master's office, police station and parking lot serves as the station where the market sweeper brings waste for final collection by truck.

The LGU employs four sweepers who clean the market stalls in a single shift, 6 a.m. to 2 p.m. The left and right wings of the market contain about six hundred stalls in four sections: textiles, carinderias (small canteens), meat and fish, and fruit and vegetables. Market stalls usually open at 5:00 a.m. and close at 8 p.m.

Market sweepers sweep the alleys and the stall holders clean their own place. Some stall holders have their own waste containers while the rest rely on the sweepers' containers. The market sweepers use a pushcart to carry waste to the parking lot which also serves as the station where the truck loads the waste. These same pushcarts are used by stall owners in bringing goods from the parking lot to their stalls. Sweepers start at 6 a.m. and end at 8 a.m., after which they stop for a break, usually resuming at 12 p.m. to 1 p.m. in their respective areas.

Some stall owners complained about the sweeping conditions and the irregular collection of waste by the private contractor. The stall holders pay a sanitation fee which is included in the rent paid for their stall.

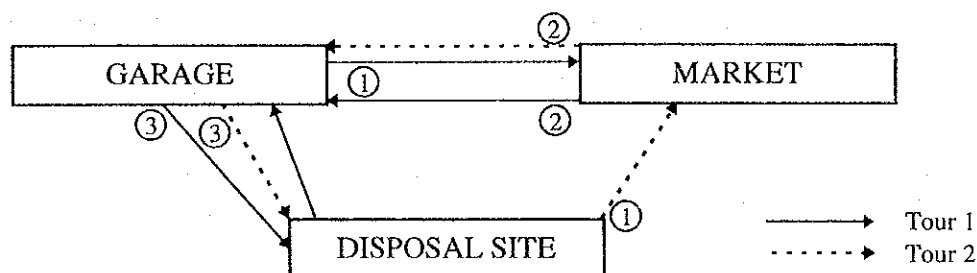
Since waste is left spread over a wide area the collector uses a loader to load waste into a open dump truck. However, the collector did not visit during the study period, he came a few days later causing the waste to pile up and smell. There were also empty containers used by a former collector which have been discarded in the parking lot and are not being used by the market sweepers.

M-3 Market waste (private market: station)

The study team was assisted by Mr. Narciso Balbaras, Building Administration Officer, Farmers Market, Cubao, Quezon City.

Wastes in this market are collected by a private contractor (PLM contractor). Based on the data from the market administrator, the average number of trips is about three (3) to seven (7) per day. The contractor is being paid on a per trip basis, at one thousand (1,000) pesos per trip.

The study was conducted based on the collection route of the garbage truck shown in the diagram below. Time consumed and required for each activity as well as distance traveled were recorded.



Wastes in this market are collected everyday for 24 hours until the area is cleared of waste. Janitors and sweepers work in three shifts. Collection vehicles are manned by one (1) driver and two (2) collectors.

There is no fixed time as to the start of the first shift. The collection trip frequency is dependent on the solid waste volume for disposal. The collection vehicle used is an old model reconditioned dump truck of about 6m³.

The findings of the survey are as follows:

1. The market is composed of about 500 stalls with separate areas for meat, fish, fruits and vegetables, cooked food and dry goods.
2. This market has two main waste collection points. One for wet waste or "wet vault", and the other for dry waste or "dry vault". Wastes from the fish and meat sections and a portion from the cooked food section are temporarily stored in the wet vault prior to collection. The dry vault is for the temporary storage of wastes from the fruit and vegetable section, dry goods and cooked food sections.
3. There are thirty five (35) janitors and sweepers hired in the market for collection and haulage of market wastes. They work in three shifts.
4. The sweepers use six (6) steel buggies and three (3) rolling trash receptacles to haul wastes stored in the dry and wet vaults.
5. The market is constructed with one toilet for the male and another for the female, both provided with waste closets and the men with urinals. Janitors are assigned to keep these toilets clean, and work daily in three shifts.
6. All solid wastes from this market are dumped in the Payatas open dumpsite.
7. Disposal trucks wait for a considerable period of time in the disposal site, at an average of about 2 and a half hours.
8. The condition of the road from the garage and the disposal route is generally good. Traffic was moderate during the conduct of the study.
9. In addition to daily sweeping and cleansing, each section washes their respective areas with water twice a week.
10. Waste volume peaks on market days, which are on Fridays and Saturdays.

11. Other observations

- Collectors perform their job wearing slippers and without any protection such as rubber gloves.
- Recyclable materials are sold along the way to the disposal site. This takes about 10 to 15 minutes.

M-4 Market waste (talipapa: primary collector)

A "talipapa" is a small market usually occupying the whole length of a street, or a group of street vendors selling goods similar to those found in markets. The talipapa studied was the Blumentritt talipapa, one of the biggest in Manila.

Street sweepers and stall holders pile waste on the center traffic island or at the nearest street corner, where private collectors pick it up. The private collector is contracted by the city government of Manila. There are six street sweepers employed by the LGU, and waste is collected using two trucks.

A 12 m³ compactor truck makes two trips to collect the piled up waste: the first trip from 2:00 a.m. to 4:30 a.m. and the second from 10 a.m. to 12 noon. A dump truck, which serves as a support vehicle does mopping up operations at around 9:30 a.m. or as the need arises.

Stall holders are responsible for their own stall's cleanliness. There is no organized body which manages solid waste in the street market. However, the stall holders try to manage things on their own. Stalls open at 2 a.m. and usually close at 10 p.m. As the talipapa occupies the whole length of the street there are multiple waste piles on the traffic island and corners. These are manually loaded onto the truck using spades or plastic trays.

Street sweeping

S-1 Marikina City (LGU mechanical sweeper)

Part of Marikina City's solid waste management program is street cleansing activities. The local government found that a faster and more effective way of cleansing the streets is by the use of a mechanical sweeper (vacuum truck). At present there is only one street sweeper operating in the city. Information as to the age of the machine was not known to operating personnel or the dispatcher.

Street sweeping operation is done daily starting from 3:00 p.m. until 11:00 p.m. The street sweeping crew consists of the driver and a helper with a broom.

At the time of the study, the truck traveled about 600 meters from the dispatch area to a point along Oriol Street where operation started. The truck operated observing traffic flows.

The helper walked by the side of the truck, manually sweeping the sidewalk of litter. The work of the helper is to sweep the waste into the path of the truck. Occasionally, the helper picked-up waste and threw it to within reach of the truck. The helper also sees to it that the truck's path is clear of obstructions such as large stones, timber, etc. When the truck makes a U-turn in some busy streets, the helper controls the traffic.

Sporadically the sweeper had to miss portions of the road because of parked vehicles. The driver just continued passed these parts.

Along the route the sweeper was observed to break down due to unknown mechanical problems. It stopped once to fill up at a gas station.

The driver sensing that the truck was full opened the collection tank to check the amount of waste. Once full, the truck proceeded to the disposal site, a vacant lot at the corner of the Sumulong Highway and P. Tuazon Avenue very near the city's transfer station. Total waste collected from the street sweeping operation was estimated within the range of 0.50 to 1.0 m³.

After unloading, the truck went to the dispatch area where the driver sought assistance to check the mechanical trouble. Because it was already past 5:00 p.m. maintenance personnel were no longer available. Thus sweeping operations for that day had to be stopped.

From dispatch area the study team visited the city's garage located about 1.65 kilometers from the dispatch area. The garage does not provide services exclusively to waste management vehicles but also to the city's other service vehicles and equipment.

S-2 Quezon City (street sweeping - MMDA.)

While some of MMDA's street sweeping operations have been devolved to local governments, some local government operations are still being performed by MMDA personnel. In Quezon City, street sweeping along the busy major thoroughfares is done by MMDA personnel. According to the MMDA officer in charge, along major thoroughfares there is one street sweeper every 250 lineal meters, while along not so busy thoroughfares there is one street sweeper every 500 lineal meters. The rest have one street sweeper every kilometer. If a street sweeper is absent his area is covered by the nearest sweepers.

The area covered in the study is from the corner of Aurora Boulevard and EDSA to Anonas Street, and from the corner Aurora Boulevard and EDSA to San Juan in the opposite direction. Since the Cubao intersection is a busy area 3 street sweepers work on either side, each covering two hundred fifty meters sweeping back and forth. The waste collected was loaded onto a dump truck collecting garbage in the area. Except for the portion of Aurora Boulevard to Anonas, where there were some trash receptacles, waste was piled up on the side walk where sweepers put it while waiting for collection.

A team consisting of a team leader and 6 to 8 street sweepers perform special operations upon instructions from the MMDA central office or upon request of the local government, such as removal of obstacles along major streets, relocation of vendors occupying sidewalks, whitewashing or painting curbs, etc.

The MMDA street sweepers are differentiated from the Quezon City/LGU street sweepers in that they wear yellow long-sleeved shirts with MMDA marks and red pants. While the MMDA street sweepers clean the major thoroughfares, the LGU street sweepers cover secondary streets. The waste they sweep is collected by private contractors serving the area.

River cleansing

RC-1 River cleansing (MMDA)

One of the agencies responsible in cleansing and collection of waste from Pasig River is the MMDA. River cleansing is undertaken by 5 member teams who operate motor boats each with a waste capacity of 1.5 m³. Their field office is located on Arroceros Street near the coast guard patrol post which also serves as the dispatch area.

The area studied is the stretch of river behind the Malacanang Palace. This area is approximately 10 m² (2.5 x 10.0), approximately 1.0 km away from the dispatch area.

Of the collected river waste, 80% were plastic items and the rest were cans, wood, sacks, pieces of bamboo, and water lilies.

Collection of the waste took 4:18 hours, and loading and transport of waste took 43 minutes. Unloading of waste took a total 1:49, including waiting at the transfer station.

The crew members worked on an 8 hour basis, with alternating breaks, in accordance with their respective assignments for collection of river waste. Three of the personnel were assigned to put the waste on the bank to drain, while the other members loaded the waste directly onto the boat.

Large volumes of wastes were observed in the waterways. The first of the two trips managed to collect 1.5 m³ from an area of only 10 m². Plastic waste often hit the propeller of the motor boat, thus delaying the collection time. Deterioration of river water quality due to indiscriminate dumping of garbage was obvious.

The presence of a docked tug boat and barge seeking clearance from the coast guard at the transfer station likewise affected the collection system. Motorboats used for waste collection have to clear the docking area before unloading.

RC-2 River cleansing (DPWH)

The Department of Public Works and Highways (DPWH) is currently implementing the Bantay Estero Program. The program is aimed at promoting and maintaining the cleanliness of the different estuaries in Metro Manila.

The crew together with the engineer in charge arrived at Tramo Bridge, Pasay, at about 9:00 a.m. The study team had a short discussion with the engineer regarding the plan of activities for the day.

For the operation, the crew were provided with 2 dump trucks (3 and 4 m³ loading capacities), ropes, "banyeras", spades, and a bamboo raft. They were also provided with colored T-shirts as their uniform. The bamboo raft once lowered into the creek serves as a platform and waste is piled up on the raft. The banyeras serve as a bucket for lifting up waste from below.

About 16 waste collectors (3 below the bridge and 13 on the bridge), 2 drivers, an area engineer and the engineer in charge make up the collection crew.

Pedicabs (bicycles with sidecars) parked in the area were first removed by their owners to provide enough space for the collection crew and for parking dump trucks.

Loading of waste into the first truck started at 10:17 a.m. and left for disposal at 10:47 a.m. A second truck was filled up and left at about 11:19 a.m. The disposal site is near a floodgate and pumping station, about 3.0 km from the collection site.

Loading for the third trip was not completed because the pumping station on Roxas Boulevard near Libertad Street started pumping water into Manila Bay. This action provided a faster flow of water from this creek to the drainage canal and into Manila Bay, thus the work of the crew below the bridge shifted from waste collection to guiding the waste into the drainage canal.

RC-3 River cleansing (LGU)

The agency responsible for cleansing and collection of waste in the San Juan River is the San Juan LGU sanitation service. They have bancas for transporting personnel and a floating platform (2.5 m x 6.0 m.) that can accommodate 50 sacks of waste. Their dispatch area is located along the San Juan River under the Santa Mesa Bridge near Shoe Mart Center Point.

The area adjacent to the Lambingan Bridge, on the San Juan and Quezon City city boundary, was studied. The LGU has placed chicken wire (4" mesh, 50 cm deep) across the river to trap floating waste. Connected to the mesh were floating drums, from where waste is loaded and bagged. The trapped waste occupied an area of approximately 200 m².

The waste trapped and collected in the river consists of wood, plastic, paper, cans, sacks, and other non-biodegradable waste.

During the study, two persons were assigned to bagging river waste from the top of the platform, while another member (from a boat) released the trapped waste. Bagging activities started at 8:30 a.m. and had to stop at 10:40 a.m. due to a shortage of sacks.

The crew members work on an 8 hour basis, taking alternate breaks, in accordance with their respective assignments.

6.4 Findings

6.4.1 Time, distance and amount of waste collected

The collection time, distance and amount of MSW collected are summarized in Table 6.2. The average time per trip is calculated as follows:

Manila	214 min/2 trips	107 min/trip
Manila (river cleansing)	258 min/2 trips	129 min/trip
Quezon City	222 min/4 trips	111 min/trip
Quezon City (street sweeping)	312 min/2 trips	156 min/trip
Caloocan	114 min/2 trip	57 min/trip
Navotas	180 min/2 trips	90 min/trip

Valenzuela	195 min/5 trips	39 min/trip
Malabon	77 min/2 trips	38 min/trip
Marikina	229 min/4 trips	57.2 min/trip
Pasig (Cont.)	145 min/1 trip	145 min/trip
Pasig (LGU)	134 min/2 trips	67 min/trip
Pateros (MMDA)	79 min/1 trip	79 min/trip
Pateros (LGU)	130 min/2 trips	65 min/trip
San Juan	315 min/1 trip	157.5 min/trip
San Juan (river cleansing)	130 min/1 trip	130 min/trip
Taguig	99 min/3 trips	99 min/trip
Makati	205 min/2 trip	102.5 min/trip
Pasay (Cont.)	75 min/1 trip	75 min./trip
Pasay (LGU-pushcart)	30 min/3 trips	10 min/trip
Muntinlupa	51 min/trip	51 min/trip
Mandaluyong	126 min./2 trips	63 min/trip
Parañaque	72 min/2 trips	72 min/trip
Las Piñas	259 min/4 trips	129.5 min/trip

Average distance traveled in the collection area per trip is calculated as follows:

Manila	3.70 km/2 trips	1.85 km/trip
Quezon City (street sweeping)		
Quezon City	4.50 km./2 trips	2.25 km/trip
Caloocan	2.70 km/2 trips	1.35 km/trip
Navotas	3.25 km/2 trips	1.62 km/trip
Valenzuela	1 km/5 trips	2 km/trip
Malabon	4 km/2 trips	2 km/trip
Marikina	4.10 km/4 trips	1.02 km/trip
Pasig (Cont.)	8.40 km/1 trip	8.40 km/1 trip
Pasig (LGU)	1.8 km/2 trips	.9 km/trip
Pateros (MMDA)	1.3 km/1 trip	1.3 km/trip
Pateros (LGU)	2.10 km/2 trips	1.05 km/trip
San Juan (River cleansing)		
San Juan	5.10 km/2 trips	2.55 km/trip
Taguig	1.98 km/1 trip	1.98 km/trip
Makati	2.70 km/2 trips	1.35 km/trip
Pasay (Cont.)	1.30 km/1 trip	1.30 km/trip
Pasay (LGU-pushcart)		
Muntinlupa	.6 km/1 trip	.6 km/trip
Mandaluyong	2.0 km/2 trips	1 km/trip
Parañaque	0	0
Las Piñas	1.8 km/2 trips	.9 km/trip

The average load/amount of waste per trip are calculated as follows:

Manila	16 m ³ /2 trips	8 m ³ /trip
Manila (river cleansing)	3 m ³ /2 trips	1.5 m ³ /trip
Quezon City (street sweeping)		
Quezon City	32 m ³ /2 trips	16 m ³ /trip

Caloocan	12 m ³ /2 trips	6 m ³ /trip
Navotas	16 m ³ /2 trips	8 m ³ /trip
Valenzuela	32 m ³ /5 trips	6.6 m ³ /trip
Malabon	16 m ³ /2 trips	8 m ³ /trip
Marikina	52 m ³ /2 trips	16 m ³ /trip
Pasig (Cont.)	17 m ³ /1 trip	17 m ³ /trip
Pasig (LGU)	16 m ³ /2 trips	8 m ³ /trip
Pateros (MMDA)	12 m ³ /1 trip	12 m ³ /trip
Pateros (LGU)	10 m ³ /2 trips	5 m ³ /trip
San Juan (River cleansing)		
San Juan	38 m ³ /2 trips	19 m ³ /trip
Taguig	15 m ³ /1 trip	15 m ³ /trip
Makati	30 m ³ /2 trips	15 m ³ /trip
Pasay (Cont.)	12 m ³ /2 trips	12 m ³ /trip
Pasay (LGU-pushcart)	6 m ³ /3 trips	2 m ³ /trip
Muntinlupa	15 m ³ /1 trip	15 m ³ /trip
Mandaluyong	30 m ³ /2 trips	15 m ³ /trip
Parañaque	18 m ³ /1 trip	18 m ³ /trip
Las Piñas	20 m ³ /1 trip	10 m ³ /trip

(2) Types of containers

Waste containers most commonly used by low income areas are plastic supermarket bags, kaings, plastic containers, and sacks, while those from middle to high income areas used plastic supermarket bags, plastic (black) garbage bags, plastic containers, and metal drums. The plastic containers, kaings, and metal drums are emptied into the truck and returned to the owners for reuse. Noticeable here is the householders' ability and practice to reuse things of value such as supermarket bags, kaings, and other plastic containers. There are instances where the waste is thrown onto the streets and the collection crew had to shovel it onto trays for loading onto the trucks. It was noted that this occurred when residents could not wait any longer for the garbage collectors, who often did not collect at scheduled times of the day. Such findings were common to all local governments in Metro Manila where collection times were not adhered to by contractors or LGU collection trucks.

From other sources (markets and institutions), various types and sizes of containers are used such as long plastic bags, metal drums, and cartons. A private contractor, Greenline, employs uniform waste containers compatible with the lifting mechanism of their trucks and Megapac containers. These are made of sturdy plastic with wheels for ease of movement. Although these containers are covered, there are times when they are over filled and waste spills onto the ground.

(3) Collection points

MSW collection trucks normally collect waste from residential areas on designated days and householders bring out their garbage at certain times. Waste in different containers is left out in front of houses and the collection workers load it onto the truck. In other places, households bring their garbage to a certain point when the truck arrives (Parañaque) and it is loaded onto the truck. Usually this happens where the streets are narrow and inaccessible to collection vehicles. There were also instances where the collection workers loaded the waste

on to a slowly moving truck. Other times, residents had to load their own garbage to assist the crew.

In commercial and residential areas, and near major roads and institutions, waste is usually left on street corners or at a designated point from where the trucks loads it. The same is true at markets where the garbage is brought by the sweeper to a collection point. In the case of the Pasig public market, market sweepers place the waste into Megapac containers. This type of container is convenient but costs more than the usual way of collecting waste. Near talipapas the collection points are scattered, while street sweepers just pile the waste where convenient.

(4) Collection routes

It was observed that there seems to be no specific routes for garbage collection vehicles. This was demonstrated when trucks collected from households on the first trip and then from markets or institutions (hospitals) on the second trip. This happened even after the trucks were given specific instructions by the dispatcher.

Annex 1
COLLECTION TIME, DISTANCE AND LOADING AMOUNT OF WASTES OBSERVED IN THE TIME AND MOTION SURVEY (1/6)

ITEM	R-1	R-2	R-3	R-4	R-5
Basic Information					
Date of Survey	6-May	2-May	5-May	4-May	2-May
City/Municipality	Manila	Quezon	Caloocan	Navotas	Valenzuela
Type of Waste	Residential	Residential	Residential	Residential	Residential
Collection Area	-	-	-	-	-
Responsible Office	Leonel Contractor	REN Contractor	Harley Contractor	LGU	Harley Contractor
Crew (incl. driver)	5	5	4	3	4
Type of Vehicle	Dumptruck	Dumptruck	Mini - Dumptruck	Compactor	Mini - Dumptruck
Loading Cap.(m ³)	8	16	6	8	6
Vehicle No.	LN - 3	164	15	1	66
Year of Fabrication	-	-	-	-	-
Working Hour	7:20:00	8:53:30	8:56:00	4:18:00	8:04:30
No. of Trips	2	2	2	2	5
No. of Collect. Pts.	53	128	45	49	40
Time					
Collection Time	4:44:00	3:41:07	2:28:00	3:33:45	3:15:45
Traveling	2:09:45	3:31:00	5:27:30	0:38:00	1:55:45
Unloading Time	0:17:00	0:53:00	0:16:00	0:06:00	2:53:00
Others (Lunch, repairs, etc.)	0:09:15	0:48:07	0:44:30	-	-
Total Time	7:20:00	8:53:30	8:56:40	4:18:00	7:11:51
Distance (km.)					
Collection Area	4.2	4.5	2.7	3.25	1
Other Trip	30.8	76.9	84.1	6.35	30.2
Total Distance	35	81.4	86.8	9.6	31.2
Loading Amount of Waste (m³)					
	16	32	12	16	32

Annex I

COLLECTION TIME, DISTANCE AND LOADING AMOUNT OF WASTES OBSERVED IN THE TIME AND MOTION SURVEY (2/6)

ITEM	R-6	R-7	R-8	R-9	R-10
Basic Information					
Date of Survey	3-May	3-May	5-May	4-May	6-May
City/Municipality	Malabon	Marikina	Pasig	Pasig	Pateros
Type of Waste	Residential	Residential	Res'l. / Inst'l.	Residential	Residential
Collection Area	-	-	-	-	Brgy. San Pedro and Poblacion Area
Responsible Office	LGU	LGU	LGU	SVR Mass Transport	MMDA
Crew (incl. driver)	4	3	5	4	3
Type of Vehicle	Dumptruck	Compactor	Dumptruck	Dumptruck	Compactor
Loading Cap. (m ³)	8	13	8	17	12
Vehicle No.	V - 30	821	3	1	-
Year of Fabrication	-	-	-	-	1990
Working Hour	2:40:00	7:34:07	4:46:31	6:09:09	5:25:06
No. of Trips	2	4	2	1	1
No. of Collect. Pts.	34	182	29	66	64
Time					
Collection Time	1:58:00	3:49:44	2:14:03	2:25:48	1:19:30
Traveling	0:19:00	1:35:35	0:24:27	3:07:16	3:17:27
Unloading Time	0:16:00	2:08:48	2:08:01	0:13:31	0:21:24
Others (Lunch, repairs, etc.)	0:07:00	-	-	0:22:34	0:26:45
Total Time	2:40:00	7:34:07	4:46:31	6:09:09	5:25:06
Distance (km.)					
Collection Area	4.1	4.1	1.8	3.6	1.3
Other Trip	4.1	32	7	67.2	70.3
Total Distance	8.2	36.1	8.8	70.8	71.6
Loading Amount of Waste (m³)					
	16	52	16	17	12

Annex 1

COLLECTION TIME, DISTANCE AND LOADING AMOUNT OF WASTES OBSERVED IN THE TIME AND MOTION SURVEY (3/6)

COLLECTION TIME, DISTANCE AND LOADING AMOUNT OF WASTES OBSERVED IN THE TIME AND MONTHS										
ITEM	R-11		R-12		R-13		R-14		R-15	
Basic Information										
Date of Survey	7-May		8-May		2-May		6-May		7-May	
City/Municipality	Pateros		San Juan		Taguig		Makati		Pasay	
Type of Waste	Residential		Residential		Residential		Residential		Residential	
Collection Area	Brgy. Sto. Rosario, Silangan & Kanluran Area		-		Napindan Dulo to Ibayo Tipas Area		-		-	
Responsible Office	LGU		Metro Wide Movers		Red Fox Contractor		ACY Contractor		LEG Contractor	
Crew (incl. driver)	3		5		5		5		4	
Type of Vehicle	Mini-Dumptruck		Dumptruck		Dumptruck		Dumptruck		Dumptruck	
Loading Cap.(m³)	5		19		15		15		12	
Vehicle No.	-		UEN 875		DT - 30 1980		301		UAL - 966	
Year of Fabrication	-		-		-		-		-	
Working Hour	4:46:37		11:43:36		6:26:18		13:06:23		10:47:00	
No. of Trips	2		2		1		2		1	
No. of Collect. Pts.	67		96		62		71		36	
Time										
Collection Time	2:10:18		5:15:37		1:39:22		3:25:21		1:53:00	
Traveling	0:23:32		3:11:30		4:01:10		8:44:59		0:43:00	
Unloading Time	2:12:47		0:39:55		0:12:13		0:24:28		7:48:00	
Others (Lunch, repairs, etc.)	-		2:36:34		0:33:33		0:31:35		0:23:00	
Total Time	4:46:37		11:43:36		6:26:18		13:06:23		10:47:00	
Distance (km.)										
Collection Area	3.9		5.1		1.98		2.7		1.3	
Other Trip	4.1		66.5		76.12		166.6		5.8	
Total Distance	8		71.6		78.1		169.3		7.1	
Loading Amount of Waste (m³)										
	10		38		15		30		12	

Annex I

COLLECTION TIME, DISTANCE AND LOADING AMOUNT OF WASTES OBSERVED IN THE TIME AND MOTION SURVEY (4/6)

ITEM	R-16			R-17		R-18		R-19		R-20
Basic Information										
Date of Survey	8-May			8-May		7-May		4-May		5-May
City/Municipality	Pasay			Muntinlupa		Mandaluyong		Paranaque		Las Pinas
Type of Waste	Residential			Residential		Residential		Residential		Residential
Collection Area	Brgy. Dolores Area			Parkhomes Subd. Area		-		Clinic Ville, Brgy. BF Homes Area		BF Resort Village Phase III Area
Responsible Office	LGU / Volunteer			Red Fox Contractor		RMMS Contractor		EJR Contractor		LGU
Crew (incl. driver)	9			5		5		5		3
Type of Vehicle	Pushcart			Dumptruck		Dumptruck		Dumptruck		Compactor
Loading Cap.(m³)	2			15		15		18		10
Vehicle No.	39, 14, 147			DT - 7		204		-		C - 33
Year of Fabrication	-			1980		-		1996		1991
Working Hour	1:05:00			10:53:27		14:55:15		5:55:09		14:53:54
No. of Trips	3			1		2		1		2
No. of Collect. Pts.	20			49		69		1		232
Time										
Collection Time	0:42:00			0:51:27		2:06:24		1:12:17		4:18:55
Traveling	0:22:40			2:18:20		9:24:53		2:50:55		1:41:40
Unloading Time	-			7:04:48		0:28:07		0:23:46		8:53:19
Others (Lunch, repairs, etc.)	-			0:38:12		2:55:51		1:28:11		-
Total Time	1:05:00			10:53:27		14:55:15		5:55:09		15:28:26
Distance (km.)										
Collection Area	approx. total - 100m.			0.6		2		0		3.6
Other Trip	-			51.05		148.4		96.3		30.2
Total Distance	100 m.			51.65		150.4		96.3		33.8
Loading Amount of Waste (m³)										
	6			15		30		18		20

Annex I

COLLECTION TIME, DISTANCE AND LOADING AMOUNT OF WASTES OBSERVED IN THE TIME AND MOTION SURVEY (6/6)

ITEM	S-1	S-2	RC-1	RC-2	RC-3
Basic Information					
Date of Survey		13-May	9-May	15-May	15-May
City/Municipality	Marikina	Quezon City	Manila	Pasay City	San Juan
Type of Waste	Streetsweeping	Streetsweeping	River Cleansing	River cleansing	River Cleansing
Collection Area		Cubao Area	Pasig River Area		San Juan River Area
Responsible Office	LGU - Mech.	MMDA	MMDA	DPWH	LGU
Crew (incl. driver)	2	3	4		7
Type of Vehicle			Motorboat	Bamboo raft	Wooden Platform with drum floa
Loading Cap. (m ³)			1.5		15 sq. m.
Vehicle No.			-		39, 14, 147
Year of Fabrication			-		-
Working Hour	8:00:00	8:00:00	7:21:00		6:55:00
No. of Trips		-	2		-
No. of Collect. Pts.		-	2		1
Time					
Collection Time		5:12:00	4:18:00		2:10:00
Traveling		-	0:43:00		0:20:00
Unloading Time		-	1:49:00		-
Others (Lunch, repairs, etc.)		-	0:31:00		4:25:00
Total Time		5:12:00	7:21:00		6:55:00
Distance (km.)					
Collection Area		1000 m.	-		-
Other Trip		-	-		-
Total Distance		1000 m.	-		-
Loading Amount of Waste (m³)					
		-	3		Approx. 8 cu. m.

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-1)

Date	06 May 1997
Type of Waste	Residential
Collection Area	Pandacan Area
City/Municipality or Private Contractor	Manila / Leonel Contractor
Crew (including driver)	5
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	8
Vehicle No. (Year)	LN - 3
Working Hours	7:20:00
Number of Trips	2
Collected Waste Volume (m ³)	16

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
05:45:00 - 05:53:00	00:08:00	2.70	Garage / Disp. Area - Coll. Area (1st Trip)		
05:53:00 - 08:38:00	02:45:00	2.60	Waste Collection	39	8
08:38:00 - 09:12:00	00:34:00	8.00	Coll. Area - Trans. Sta.		
09:12:00 - 09:19:00	00:07:00	-	Unloading		
09:19:00 - 09:52:20	00:33:20	6.90	Trans. Sta. - Coll. Area (2nd Trip)		
09:52:20 - 11:51:20	01:59:00	1.60	Waste Collection	14	8
11:51:20 - 12:27:45	00:36:25	7.40	Coll. Area - Trans. Sta.		
12:27:45 - 12:37:00	00:09:15	-	Waiting		
12:37:00 - 12:47:00	00:10:00	-	Unloading		
12:47:00 - 13:05:00	00:18:00	5.80	Trans. Sta. - Garage / Disp. Area		

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-2)

Date 02 May 1997
 Type of Waste Residential
 Collection Area Certain Area in Barangay Immaculate Conc
 City/Municipality or Private Contractor Quezon City / REN Contractor
 Crew (including driver) 5
 Type of Collection Vehicle Dumptruck
 Loading Capacity (m³) 16
 Vehicle No. (Year) 164
 Working Hours 08:53:30
 Number of Trips 2
 Collected Waste Volume (m³) 32

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
7:19:15 - 7:37:13	00:17:58	2.70	Dispatch Area-Collect Area		
7:37:13 - 9:36:29	01:59:16	2.30	Collection of wastes(1st trip	62	
9:36:29 - 9:44:06	00:07:37	2.80	Coll. Area-Dispatch Area		
9:44:06 - 9:46:16	00:02:10	-	Vol. Check @ Disp. Area		16
9:46:16 - 9:52:46	00:06:30	2.60	Disp. Area to Junkshop		
9:52:46 - 10:04:20	00:11:34	-	Unload Recyclables		
10:04:20 - 10:24:36	00:20:16	5.4	Junkshop to Garage		
10:24:36 - 10:55:10	00:30:34	-	Lunch @ Garage Area		
10:55:10 - 11:29:13	00:34:03	14.0	Garage Area to Dumpsite		
11:29:13 - 11:48:56	00:19:43	-	Disposal Time		
11:48:56 - 12:18:49	00:29:53	14.50	Dumpsite to Dispatch Area		
12:18:49 - 12:24:48	00:05:59	-	Dispatch Area		
12:24:48 - 12:32:41	00:07:53	2.40	Dispatch Area - Coll. Area		
12:32:41 - 14:14:32	01:41:51	2.20	Coll. of Wastes(2nd Trip)	66	
14:14:32 - 14:24:12	00:09:40	3.10	Coll. Area - REN office		
14:24:12 - 14:27:55	00:03:43	-	Crew get salary @ REN		
14:27:55 - 14:33:56	00:06:01	2.40	REN office - Disp. Area		
14:33:56 - 14:36:54	00:02:58	-	Disp. Area (Check Vol.)		16
14:36:54 - 15:07:28	00:30:34	11.50	Disp. Area - Junkshop		
15:07:28 - 15:12:26	00:04:58	-	Junkshop		
15:12:26 - 15:18:55	00:06:29	2.30	Junkshop - Disposal Site		
15:18:55 - 15:35:56	00:17:01	-	Disposal Time		
15:35:56 - 15:53:28	00:17:32	6.40	Dumpsite - Bank		
15:53:28 - 15:56:11	00:02:43	-	Bank(waiting time)		
15:56:11 - 16:12:45	00:16:34	6.80	Bank - Garage		

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-3)

Date	05 May 1997
Type of Waste	Residential
Collection Area	Bagong Barrio Area
City/Municipality or Private Contractor	Caloocan / Halrey Contractor
Crew (including driver)	4
Type of Collection Vehicle	Mini - Dumptruck
Loading Capacity (m ³)	6
Vehicle No. (Year)	No. 15
Working Hours	08:56:00
Number of Trips	2
Collected Waste Volume (m ³)	12

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
10:04:00 - 10:09:00	00:05:00	0.80	Disp. Area - Coll. Area (1st Trip)		
10:09:00 - 11:05:00	00:56:00	1.30	Waste Collection	23	6
11:05:00 - 11:10:30	00:05:30	1.10	Coll. Area - Disp. Area		
11:10:30 - 11:20:00	00:09:30	-	Rest, Waiting		
11:20:00 - 12:13:00	00:53:00	18.50	Disp. Area - Dump Site		
12:13:00 - 12:20:00	00:07:00	-	Unloading		
12:20:00 - 13:10:00	00:50:00	18.10	Dump Site - Disp. Area		
13:10:00 - 13:45:00	00:35:00	-	Break (Lunch)		
13:45:00 - 13:48:00	00:03:00	1.10	Disp. Area - Coll. Area (2nd Trip)		
13:48:00 - 15:20:00	01:32:00	1.40	Waste Collection	22	6
15:20:00 - 15:26:00	00:06:00	1.10	Coll. Area - Disp. Area		
15:26:00 - 15:35:00	00:09:00	-	Waiting		
15:35:00 - 17:00:00	01:25:00	18.40	Disp. Area - Dump Site		
17:00:00 - 19:00:00	02:00:00	25.00	Dump Site - Garage		

* Normal travel time as per the driver of collection vehicle

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-4)

Date	04 May 1997
Type of Waste	Residential
Collection Area	
City/Municipality or Private Contractor	Navotas / LGU
Crew (including driver)	3
Type of Collection Vehicle	Compactor
Loading Capacity (m ³)	8
Vehicle No. (Year)	1
Working Hours	4:18:00
Number of Trips	2
Collected Waste Volume (m ³)	16

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
04:50:00 - 05:04:00	00:14:00	1.00	Disp. Area - Coll. Area (1st Trip)		
05:04:00 - 06:58:00	01:54:00	1.60	Waste Collection	16	8
06:58:00 - 07:06:00	00:08:00	1.70	Coll. Area - Trans. Sta.		
07:06:00 - 07:10:00	00:04:00	-	Unloading		
07:10:00 - 07:17:00	00:07:00	2.00	Trans. Area - Coll. Area (2nd Trip)		
07:17:00 - 08:56:45	01:39:45	1.65	Waste Collection	32	8
08:56:45 - 08:59:00	00:02:15	0.05	Coll. Area - Trans. Sta.		
08:59:00 - 09:01:00	00:02:00	-	Unloading		
09:01:00 - 09:08:00	00:07:00	1.60	Dispatch Area (Garage)		

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-5)

111-3.X15

Date	02 May 1997
Type of Waste	Residential
Collection Area	Marulas, Val. Public Market Area
City/Municipality or Private Contractor	Valenzuela / Harley Contractor
Crew (including driver)	4
Type of Collection Vehicle	Mini - Dumptruck
Loading Capacity (m ³)	6
Vehicle No. (Year)	66
Working Hours	08:04:30
Number of Trips	5
Collected Waste Volume (m ³)	30

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (cu.m.)
07:03:30 - 07:08:15	00:04:45	2.30	Disp. Area - Trans. Sta. - Coll. Area (1st Trip)		
07:08:15 - 07:38:00	00:29:45	0.10	Waste Collection	8	6
07:38:00 - 07:45:00	00:07:00	2.30	Coll. Area - Trans. Sta.		
07:45:00 - 08:38:00	00:53:00	-	Waiting		
08:38:00 - 08:45:00	00:07:00	-	Unloading		
08:45:00 - 09:20:00	00:35:00	4.10	Trans. Sta. - Coll. Area (Market) 2nd Trip		
09:20:00 - 10:26:00	01:06:00	-	Market Waste Collection	1	6
10:26:00 - 10:40:00	00:14:00	3.30	Market Waste Coll. Area - Transfer Station		
10:40:00 - 11:45:00	01:05:00	-	Waiting		
11:45:00 - 12:00:00	00:15:00	-	Unloading		
12:00:00 - 12:05:00	00:05:00	1.90	Trans. Sta. - Coll. Area (3rd Trip)		
12:05:00 - 12:39:00	00:34:00	0.40	Waste Collection	11	6
12:39:00 - 12:48:00	00:09:00	2.30	Coll. Area - Trans. Sta.		
12:48:00 - 12:52:00	00:04:00	-	Waiting		
12:52:00 - 13:05:00	00:13:00	-	Unloading		
13:05:00 - 13:06:00	00:01:00	-	Waiting		
13:06:00 - 13:15:00	00:09:00	2.30	Trans. Sta. - Coll. Area (4th Trip)		
13:15:00 - 13:43:00	00:28:00	0.20	Waste Collection	8	6
13:43:00 - 13:53:00	00:10:00	4.60	Coll. Area - Trans. Sta.		
13:53:00 - 14:08:00	00:15:00	-	Unloading		
14:08:00 - 14:18:00	00:10:00	4.60	Trans. Sta. - Coll. Area (5th Trip)		
14:18:00 - 14:56:00	00:38:00	0.30	Waste Collection		
14:56:00 - 15:08:00	00:12:00	2.50	Coll. Area - Trans. Sta.		

* Note: Last trip load travel goes directly to the garage area to transfer it into a bigger truck

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-6)

Date	03 May 1997
Type of Waste	Residential
Collection Area	Catmon Area
City/Municipality or Private Contractor	Malabon / LGU
Crew (including driver)	4
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	8
Vehicle No. (Year)	V - 30
Working Hours	02:40:00
Number of Trips	2
Collected Waste Volume (m ³)	16

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
07:25:00 - 07:31:00	00:06:00	1.00	Disp. Area - Coll. Area (1st Trip)		
07:31:00 - 09:11:00	01:40:00	3.90	Waste Collection	30	8
09:11:00 - 09:15:00	00:04:00	1.30	Coll. Area - Disposal Site		
09:15:00 - 09:25:00	00:10:00	-	Unloading		
09:25:00 - 09:32:00	00:07:00	-	Rest		
09:32:00 - 09:36:00	00:04:00	1.20	Disp. Area - Coll. Area (2nd Trip)		
09:36:00 - 09:54:00	00:18:00	0.20	Waste Collection	4	8
09:54:00 - 09:59:00	00:05:00	0.60	Coll. Area - Disposal Site		
09:59:00 - 10:05:00	00:06:00	-	Unloading		

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-7)

Date	03 May 1997
Type of Waste	Residential
Collection Area	Industrial Valley Subd. Area
City/Municipality or Private Contractor	Marikina / LGU
Crew (including driver)	3
Type of Collection Vehicle	Compactor Truck
Loading Capacity (m ³)	13
Vehicle No. (Year)	821
Working Hours	07:34:07
Number of Trips	4
Collected Waste Volume (m ³)	52

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
5:45:49 - 5:57:09	00:11:20	3.40	Dispatch Area - Coll. Area		
5:57:09 - 7:16:28	01:19:19	1.30	Waste Collection(1st Trip)	54	13
7:16:28 - 7:26:29	00:10:01	4.60	Coll. Area - Transfer Sta.		
7:26:29 - 7:39:00	00:12:31	-	Disposal Time		
7:39:00 - 7:52:39	00:13:39	4.0	Transfer Sta. - Coll. Area		
7:52:39 - 9:02:31	01:09:52	1.50	Waste Collection(2nd Trip)	62	13
9:02:31 - 9:17:45	00:15:14	4.90	Coll. Area - Transfer Sta.		
9:17:45 - 9:26:00	00:08:15	-	Disposal Time		
9:26:00 - 9:38:23	00:12:23	4.20	Transfer Sta. - Coll. Area		
9:38:23 - 10:22:45	00:44:22	1.10	Waste Collection(3rd Trip)	44	13
10:22:45 - 10:36:00	00:13:15	4.50	Coll. Area - Transfer Sta.		
10:36:00 - 11:31:00	00:55:00	-	Disposal Time		
11:31:00 - 11:40:19	00:09:19	3.10	Transfer Sta. - Coll. Area		
11:40:19 - 12:16:30	00:36:11	0.20	Waste Collection(4th Trip)	22	13
12:16:30 - 12:26:54	00:10:24	3.30	Coll. Area - Transfer Sta.		
12:26:54 - 13:19:56	00:53:02	-	Disposal Time		
Total		36.10		182	52

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-8)

Date	04 May 1997
Type of Waste	Res'l. / Inst'l
Collection Area	
City/Municipality or Private Contractor	Pasig / LGU
Crew (including driver)	5
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	8
Vehicle No. (Year)	03
Working Hours	04:46:31
Number of Trips	2
Collected Waste Volume (m ³)	16

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
7:37:35 - 7:40:20	00:02:45	1.0	Dispatch Area - Coll. Area		
7:40:20 - 8:44:52	01:04:32	1.80	Waste Collection(1st Trip)	28	
8:44:52 - 8:48:48	00:03:56	0.70	Collect. Area - Transfer Sta.		8
8:48:48 - 9:59:00	01:10:12	-	Disposal Time		
9:59:00 - 10:07:10	00:08:10	2.60	Transfer Sta. - Collect. Area		
10:07:10 - 11:16:41	01:09:31	-	Waste Collection(2nd Trip)	1	8
11:16:41 - 11:26:17	00:09:36	2.70	Collect. Area - Transfer Sta.		
11:26:17 - 12:24:06	00:57:49	-	Disposal Time		
Note: 1. Transfer Station is located within the Dispatch Area which also serves as the garage.					
2. Second trip of the truck is devoted to collection of wastes from the hospital.					

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-9)

Date	04 May 1997
Type of Waste	Residential
Collection Area	
City/Municipality or Private Contractor	Pasig / SVR Mass Transport
Crew (including driver)	4
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	17
Vehicle No. (Year)	01
Working Hours	06:09:09
Number of Trips	1
Collected Waste Volume (m ³)	17

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
4:46:21 - 4:49:51	00:03:30	1.50	Dispatch Area - Coll. Area		
4:49:51 - 6:37:23	01:47:32	2.90	Waste Collection	43	
6:37:23 - 6:43:27	00:06:04	2.20	Coll. Area - Dispatch Area		
6:43:27 - 6:50:46	00:07:19	-	Dispatch Area (Rest)		
6:50:46 - 6:56:59	00:06:13	2.60	Dispatch Area - Coll. Area		
6:56:59 - 7:35:15	00:38:16	0.70	Waste Collection	23	
7:35:15 - 7:43:25	00:08:10	2.70	Coll. Area - Dispatch Area		
7:43:25 - 7:54:40	00:11:15	-	Dispatch Area		17
7:54:40 - 8:56:22	01:01:42	26.0	Dispatch Area - Checker		
8:56:22 - 9:00:22	00:04:00	-	Checker		
9:00:22 - 9:10:03	00:09:41	2.30	Checker - Dumpsite		
9:10:03 - 9:23:34	00:13:31	-	Disposal Time		
9:23:34 - 10:55:30	01:31:56	29.90	Dumpsite - Dispatch Area		
			(End of Work)		
Total		70.80			

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-10)

Date	06 May 1997
Type of Waste	Residential
Collection Area	Brgy. San Pedro and Poblacion Area
City/Municipality or Private Contractor	Pateros / MMDA
Crew (including driver)	3
Type of Collection Vehicle	Compactor
Loading Capacity (m ³)	12
Vehicle No. (Year)	(1990)
Working Hours	05:25:06
Number of Trips	1
Collected Waste Volume (m ³)	12

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
04:01:53 - 04:03:27	00:01:34	0.10	Dispatch Area - Coll. Area		
04:03:27 - 05:22:57	01:19:30	1.30	Collection Of Wastes	64	12
05:22:57 - 05:28:37	00:05:40	0.60	Coll. Area - Dispatch Area		
05:28:37 - 05:55:22	00:26:45	-	Volume Check		
05:55:22 - 06:58:38	01:03:16	27.60	Dispatch Area - Junk Shop		
06:58:38 - 07:08:19	00:09:41	-	Unloading Recyclable Mat'ls		
07:08:19 - 07:17:57	00:09:38	5.80	Junk Shop - Disposal Site		
07:17:57 - 07:29:40	00:11:43	-	Disposal Time		
07:29:40 - 09:26:59	01:57:19	36.20	Disposal Site - Disp. Area		

* Disposal Site : San Mateo, Rizal

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-11)

Date 07 May 1997
 Type of Waste Residential
 Collection Area Barangay Santo Rosario Silangan & Kanluran Area
 City/Municipality or Private Contractor Pateros / LGU
 Crew (including driver) 3
 Type of Collection Vehicle Dumptruck
 Loading Capacity (m³) 5
 Vehicle No. (Year)
 Working Hours 04:46:37
 Number of Trips 2
 Collected Waste Volume (m³) 10

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
05:39:15 - 05:41:08	00:01:53	0.10	Dispatch Area - Coll. Area		
05:41:08 - 06:42:55	01:01:47	2.10	Collection of Wastes	19	5
06:42:55 - 06:51:51	00:08:56	1.70	Coll. Area - Trans. Sta. -		
			Dispatch Area		
06:51:51 - 07:08:02	00:16:11	-	Waiting Time		
07:08:02 - 07:32:35	00:24:33	-	Waste Trans. to Compactor		
07:32:35 - 07:38:11	00:05:36	-	Waiting Time		
07:38:11 - 07:45:33	00:07:22	1.10	Dispatch Area - Coll. Area		
07:45:33 - 08:54:04	01:08:31	1.80	Collection of Wastes	48	5
08:54:04 - 08:59:25	00:05:21	1.20	Coll. Area - Trans. Sta. -		
			Dispatch Area		
08:59:25 - 09:56:21	00:56:56	-	Waiting Time		
09:56:21 - 10:25:52	00:29:31	-	Waste Trans. to Compactor		

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-12)

Date	08 May 1997
Type of Waste	Residential
Collection Area	Brgy. Little Baguio Area
City/Municipality or Private Contractor	San Juan / Metro Wide Movers
Crew (including driver)	5
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	19
Vehicle No. (Year)	UEN 875
Working Hours	11:43:36
Number of Trips	2
Collected Waste Volume (m ³)	38

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
6:23:03 - 6:25:09	00:02:06	0.50	Dispatch Area-Collect Area		
6:25:09 - 9:14:16	02:49:07	1.80	Waste Collection (1st Trip)	58	19
9:14:16 - 9:20:24	00:06:08	1.40	Collect Area-Dispatch Area		
9:20:24 - 9:30:15	00:09:51	-	Dispatch Area		
9:30:15 - 10:23:34	00:53:19	18.20	Dispatch Area-Checker Sta.		
10:23:34 - 10:24:10	00:00:36	-	Checker Station		
10:24:10 - 10:25:26	00:01:16	0.30	Checker Sta.- Disposal Site		
10:25:26 - 10:43:38	00:18:12	-	Disposal Time		
10:43:38 - 10:53:45	00:10:07	2.90	Disposal Site - Canteen		
10:53:45 - 11:46:14	00:53:29	-	Lunch Break		
11:46:14 - 12:26:40	00:40:26	17.70	Canteen - Dispatch Area		
12:26:40 - 12:51:20	00:24:40	-	Dispatch Area		
12:51:20 - 12:57:52	00:06:32	1.50	Dispatch Area-Collect Area		
12:57:52 - 15:24:22	02:26:30	3.30	Waste Collection (2nd Trip)	38	19
15:24:22 - 15:32:38	00:08:16	1.40	Collect Area-Dispatch Area		
15:32:38 - 16:20:05	00:47:27	-	Dispatch Area		
16:20:05 - 16:34:37	00:14:32	3.60	Dispatch Area-Contractor's Office		
16:37:37 - 16:54:40	00:20:03	-	Contractor's Office(crew get oil supply)		
16:54:40 - 17:32:43	00:38:03	14.30	Contractor's Office-Junk Shop		
17:32:43 - 17:39:50	00:07:07	-	Junk Shop		
17:39:50 - 17:42:15	00:02:25	1.50	Junk Shop - Checker Sta.		
17:42:15 - 17:42:43	00:00:28	-	Checker Station		
17:42:43 - 17:44:33	00:01:50	0.20	Checker Sta.- Disposal Site		
17:44:33 - 17:59:09	00:14:36	-	Disposal Time		
17:59:09 - 18:06:39	00:07:30	3.0	Disposal Site - Drivers Residence(Completed Day's Operation)		
		71.60			

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-13)

Date	02 May 1997
Type of Waste	Residential
Collection Area	Napindan Dulo to Ibayo Tipas Area
City/Municipality or Private Contractor	Taguig / Red Fox Contractor
Crew (including driver)	5
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	15
Vehicle No. (Year)	DT - 30 / (1980)
Working Hours	06:26:18
Number of Trips	1
Collected Waste Volume (m ³)	15

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
11:43:47 - 12:05:15	00:21:28	4.50	Dispatch Area-Coll. Area		
12:05:15 - 13:44:37	01:39:22	1.98	Collection of Wastes	62	15
13:44:37 - 13:56:29	00:11:52	3.02	Coll. Area-Dispatch Area		
13:56:29 - 14:16:42	00:20:13	-	Vol. Check @ Disp. Area		
14:16:42 - 16:11:56	01:55:14	32.50	Disp. Area-Disposal Site		
16:11:56 - 16:24:09	00:12:13	-	Disposal Time		
16:24:09 - 16:45:10	00:21:01	6.20	Disposal Site-Canteen		
16:45:10 - 16:58:30	00:13:20	-	Break		
16:58:30 - 18:10:05	01:11:35	29.90	Canteen-Dispatch Area		

* Disposal Site : San Mateo Rizal

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-14)

Date 06 May 1997
 Type of Waste Residential
 Collection Area
 City/Municipality or Private Contractor Makati / ACY Contractor
 Crew (including driver) 5
 Type of Collection Vehicle Dumptruck
 Loading Capacity (m³) 15
 Vehicle No. (Year) 301
 Working Hours 13:06:23
 Number of Trips 2
 Collected Waste Volume (m³) 30

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
5:31:00 - 5:34:23	00:03:23	1.60	Dispatch Area - Coll. Area		
5:34:23 - 7:28:44	01:54:21	1.40	Waste Collection(1st Trip)	40	
7:28:44 - 7:40:35	00:11:51	1.40	Coll. Area - Dispatch Area		
7:40:35 - 7:45:12	00:04:37	-	Dispatch Area		15
7:45:12 - 9:03:21	01:18:09	33.0	Disp. Area - Checker Sta.		
9:03:21 - 9:04:24	00:01:03	-	Checker Station		
9:04:24 - 9:18:47	00:14:23	3.90	Checker Sta. - Disposal Site		
9:18:47 - 9:31:49	00:13:02	-	Disposal Time		
9:31:49 - 9:39:43	00:07:54	3.90	Disposal Site - Canteen		
9:39:43 - 9:52:05	00:12:22	-	Crew take meals		
9:52:05 - 11:56:10	02:04:05	32.40	Canteen - Dispatch Area		
11:56:10 - 12:01:14	00:05:04	-	Dispatch Area		
12:01:14 - 12:16:20	00:15:06	4.70	Dispatch Area - Coll. Area		
12:16:20 - 13:47:20	01:31:00	1.30	Waste Collection(2nd Trip)	17	
13:47:20 - 14:12:12	00:24:52	4.60	Coll. Area - Dispatch Area		
14:12:12 - 14:15:58	00:03:46	-	Dispatch Area		15
14:15:58 - 15:47:32	01:31:34	33.90	Disp. Area - Checker Sta.		
15:47:32 - 15:48:49	00:01:17	-	Checker Station		
15:48:49 - 16:15:02	00:26:13	4.30	Checker Sta. - Disposal Site		
16:15:02 - 16:26:28	00:11:26	-	Disposal Time		
16:26:28 - 18:25:03	01:58:35	36.70	Disposal Site-Dispatch Area		
18:25:03 - 18:28:29	00:03:26	-	Dispatch Area		
18:28:29 - 18:37:23	00:08:54	6.20	Dispatch Area - Garage		

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-15)

Date	07 May 1997
Type of Waste	Residential
Collection Area	Brgy. San Isidro Area
City/Municipality or Private Contractor	Pasay / LEG Contractor
Crew (including driver)	4
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	12
Vehicle No. (Year)	UAL - 966
Working Hours	10:47:00
Number of Trips	1
Collected Waste Volume (m ³)	12

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m³)
05:43:00 - 05:52:00	00:09:00	2.20	Disp. Area - Coll. Area		
05:52:00 - 07:45:00	01:53:00	1.30	Waste Collection	36	12
07:45:00 - 07:52:00	00:07:00	2.30	Coll. Area - Disp. Area		
07:52:00 - 08:15:00	00:23:00	-	Waiting		
08:15:00 - 08:30:00	00:15:00	0.70	Disp. Area - Trans. Sta.		
08:30:00 - 16:10:00	07:40:00	-	Waiting		
16:10:00 - 16:18:00	00:08:00	-	Unloading		
16:18:00 - 16:30:00	00:12:00	0.60	Trans. Sta. - Disp. Area		

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-16)

Date	08 May 1997
Type of Waste	Residential
Collection Area	Brgy. Dolores Area
City/Municipality or Private Contractor	Pasay / LGU
Crew (including driver)	3 (pushcart)
Type of Collection Vehicle	Pushcart
Loading Capacity (m ³)	2
Vehicle No. (Year)	39, 14,147
Working Hours	01:05:00
Number of Trips	3 (total)
Collected Waste Volume (m ³)	6

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
02:55:00 - 03:00:00	00:05:00	-	Disp. Area - Coll. Area (Push Cart No. 39)		
03:00:00 - 03:11:30	00:11:30	-	Waste Collection	5	2
03:11:30 - 03:15:00	00:03:30	-	Coll. Area - Disp. Area / Trans. Sta.		
02:45:00 - 02:47:40	00:02:40	-	Disp. Area / Trans. Sta. - Coll. Area(Push Cart No.14)		
02:47:40 - 02:57:30	00:09:50	-	Waste Collection	5	2
02:57:30 - 03:00:00	00:02:30	-	Coll. Area - Disp. Area / Trans. Sta.		
02:45:00 - 02:49:00	00:04:00	-	Disp. Area / Trans. Sta. - Coll.Area(PushCart No.147)		
02:49:00 - 03:10:00	00:21:00	-	Waste Collection	10	2
03:10:00 - 03:15:00	00:05:00	-	Coll. Area - Disp. Area / Trans. Sta.		

Note: Waste load for the pushcart were collected May 10, at 6:00 A.M. up to 8:00 A.M.

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-17)

Date	08 May 1997
Type of Waste	Residential
Collection Area	Parkhomes Subdivision Area
City/Municipality or Private Contractor	Muntinlupa / Red Fox Contractor
Crew (including driver)	5
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	15
Vehicle No. (Year)	DT - 7 (1980)
Working Hours	10:52:47
Number of Trips	1
Collected Waste Volume (m ³)	15

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
05:15:15 - 05:27:35	00:12:20	1.80	Dispatch Area - Coll. Area		
05:27:35 - 06:19:02	00:51:27	0.60	Collection of Wastes	49	15
06:19:02 - 06:31:43	00:12:41	2.20	Coll. Area - Dispatch Area		
06:31:43 - 07:09:55	00:38:12	-	Volume Check		
07:09:55 - 08:16:48	01:06:53	28.70	Dispatch Area - Trans. Sta.		
08:16:48 - 15:21:36	07:04:48	-	Disposal Time		
15:21:36 - 16:08:02	00:46:26	18.35	Trans. Sta - Dispatch Area		

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-18)

Date	07 May1997
Type of Waste	Residential
Collection Area	Brgy. Hagdan Bato Area
City/Municipality or Private Contractor	Mandaluyong / RMMS Contractor
Crew (including driver)	5
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	15
Vehicle No. (Year)	204
Working Hours	14:55:15
Number of Trips	2
Collected Waste Volume (m ³)	30

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
5:43:25 - 5:46:41	00:03:16	1.80	Dispatch Area - Gas Sta.		
5:46:41 - 5:49:57	00:03:16	-	Gas Station		
5:49:57 - 5:54:52	00:04:55	1.40	Gas Sta. - Collect Area		
5:54:52 - 7:01:04	01:06:12	1.20	Waste Collection	47	15
7:01:04 - 7:04:58	00:03:54	0.90	Collect Area -Dispatch Area		
7:04:58 - 7:12:18	00:07:20	-	Dispatch Area		
7:12:18 - 9:32:28	02:20:10	35.0	Dispatch Area-Disposal Site		
9:32:28 - 9:48:34	00:16:06	-	Disposal Time		
9:48:34 - 10:05:25	00:16:51	4.50	Disposal Site - Canteen		
10:05:25 - 10:25:10	00:19:45	-	Lunch Break		
10:25:10 - 12:56:25	02:31:15	30.50	Canteen - Dispatch Area		
12:56:25 - 13:05:07	00:08:42	-	Dispatch Area		
13:05:07 - 13:10:48	00:05:41	1.30	Dispatch Area - Gas Sta.		
13:10:48 - 13:14:02	00:03:14	-	Gas Station		
13:14:02 - 13:17:38	00:03:36	0.60	Gas Sta. - Collect. Area		
13:17:38 - 14:17:50	01:00:12	0.80	Waste Collection	22	15
14:17:50 - 14:26:12	00:08:22	2.10	Collect Area-Dispatch Area		
14:26:12 - 14:34:05	00:07:53	-	Dispatch Area		
14:34:05 - 16:42:14	02:08:09	35.70	Dispatch Area-Disposal Site		
16:42:14 - 16:54:15	00:12:01	-	Disposal Time		
16:54:15 - 17:04:52	00:10:37	4.50	Disposal Site - Canteen		
17:04:52 - 19:09:00	02:04:08	-	Rest / Meal (canteen)		
19:09:00 - 19:19:35	00:10:35	4.30	Canteen -Water Stand Post (to fetch water for radiator)		
19:19:35 - 19:21:08	00:01:33	-	Stop - (fill radiator w/ water)		
19:21:08 - 20:38:40	01:17:32	25.80	Water standpost - Dispatch Area		
		150.40			

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-19)

Date	04 May 1997
Type of Waste	Residential
Collection Area	Clinic Ville, Barangay BF Homes Area
City/Municipality or Private Contractor	Paranaque / EJR Contractor
Crew (including driver)	5
Type of Collection Vehicle	Dumptruck
Loading Capacity (m ³)	18
Vehicle No. (Year)	(1996)
Working Hours	05:55:09
Number of Trips	1
Collected Waste Volume (m ³)	18

T i m e (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
14:12:25 - 14:30:50	00:18:25	7.80	Disp. Area - Brgy. Hall		
14:30:50 - 15:50:48	01:19:58	1.80	Issuance of Permit		
15:50:48 - 15:55:30	00:04:42	1.90	Brgy. Hall - Coll. Area		
15:55:30 - 17:07:47	01:12:17	-	Collection Time	1	18
17:07:47 - 17:13:13	00:05:26	1.90	Coll. Area - Brgy. Hall		
17:13:13 - 17:14:23	00:01:10	-	Brgy. Hall		
17:14:23 - 17:33:33	00:19:10	7.70	Brgy. Hall - Disp. Area		
17:33:33 - 17:40:36	00:07:03	-	Vol. Check @ Disp. Area		
17:40:36 - 18:40:15	00:59:39	36.90	Disp. Area - Disposal Site		
18:40:15 - 19:04:01	00:23:46	-	Disposal Time		
19:04:01 - 20:07:34	01:03:33	38.30	Disposal Site - Disp. Area		

* Disposal Site : Carmona, Cavite

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (R-20)

Date	05 May 1997
Type of Waste	Residential
Collection Area	BF Resort Village Phase III Area
City/Municipality or Private Contractor	Las Pinas / LGU
Crew (including driver)	3
Type of Collection Vehicle	Compactor
Loading Capacity (m ³)	10
Vehicle No. (Year)	C - 33 / (1991)
Working Hours	14:53:54
Number of Trips	2
Collected Waste Volume (m ³)	20

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
05:16:11 - 05:25:03	00:08:52	3.30	Dispatch Area - Coll. Area		
05:25:03 - 07:45:55	02:20:52	1.80	Collection of Wastes	127	10
07:45:55 - 08:05:59	00:20:04	6.30	Coll. Area - Trans. Sta.		
08:05:59 - 13:48:43	05:42:44	-	Disposal		
13:48:43 - 14:09:45	00:21:02	6.50	Trans. Sta - Coll. Area		
14:09:45 - 16:07:48	01:58:03	1.80	Collection of Wastes	105	10
16:07:48 - 16:29:40	00:21:52	8.0	Coll. Area - Trans. Sta.		
16:29:40 - 19:40:15	03:10:35	-	Disposal		
19:40:15 - 20:10:05	00:29:50	6.10	Trans. Sta - Dispatch Area		

* Transfer Station : Las Pinas, Transfer Station

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (M-1)

Date	August 1, 1997
Type of Waste	Market Waste (Container)
Collection Area	Pasig Public Market
City/Municipality or Private Contractor	Private Contractor (Greenline Envirotech)
Crew (including driver)	3
Type of Collection Vehicle	6 wheeler Hook-lift Container Truck
Loading Capacity (m ³)	30
Vehicle No. (Year Manufactured)	805
Working Hours	2:19:00
Number of Trips	1
Collected Waste Volume (m ³)	30

[illegible]

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (M-2)

Date	May 23, 1997
Type of Waste	Market Waste (Station)
Collection Area	Murphy Public Market
City/Municipality or Private Contractor	Private Contractor
Crew (including Driver)	
Type of Collection Vehicle	
Loading Capacity (cu.m.)	
Vehicle No. (Year of Fabrication)	
Working Hours	
Number of Trips	
Collected Waste Volume (cu. m.)	

[illegible]

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (M-3)

Date July 29, 1997
 Type of Waste Market (Wet & Dry)
 Collection Area Farmers Market (Cubao)
 City/Municipality or Private Contractor Private Contractor (PLM)
 Crew (including driver) 4
 Type of Collection Vehicle Dump trucks
 Loading Capacity (m³) 6
 Vehicle No. (Year Manufactured)
 Working Hours 13:33:00
 Number of Trips 2
 Collected Waste Volume (m³) 12

Time (from-to)	Time Required (min)	Distance (km)	Activities	Number of Collection Points	Waste Amount (m ³)
First Trip			Market sweepers bring	2	
Garage/Dispatch			waste in steel buggies to	(one for wet	average amt.
Area to Market	45	14.3	area/station where garbage	waste and	of waste
			is collected by trucks	another for	collected in
Collection time	145	0		dry waste)	the market is
(dry vault)			In addition to daily sweeping		approximately
			& cleaning, market sections	Separate	30m ³ /day
Market to Garage	45	14.9	are cleansed with water	collection for	
			twice a week.	dry & wet	Bigger waste
Garage to Disposal				waste	volume is
Site	15	1.1	35 janitors and sweepers		expected on
			work in three shifts		market days,
Disposal time	180	0			on Fridays &
					Saturdays.
Second Trip					
Disposal Site to					
Market	60	15.4			
Collection Time	132	0			
(dry vault)					
Market to Garage	43	14.3			
Garage to Disposal					
Site	12	1.1			
Disposal Time	131	0			
Disposal Site to	5	1.1			
Garage					

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (M-4)

Date	May 30, 1997
Type of Waste	Market Talipapa
Collection Area	Blumentritt, Talipapa
City/Municipality or Private Contractor	Private Contractor
Crew (including Driver)	
Type of Collection Vehicle	
Loading Capacity (cu.m.)	
Vehicle No. (Year of Fabrication)	
Working Hours	
Number of Trips	
Collected Waste Volume (cu. m.)	

[illegible]

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (S-1)

Date _____

Type of Waste

Street sweeping

Collection Area

Marikina

City/Municipality or Private Contractor LGU-Mechanical

Crew (including Driver)

2

Type of Collection Vehicle

Loading Capacity (cu.m.)

Vehicle No. (Year of Fabrication)

Working Hours

Number of Trips

1

Collected Waste Volume (cu. m.)	0.5-1.0 cu. m.
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[illegible]

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (S-2)

Date	May 13, 1997
Type of Waste	Street sweeping
Collection Area	Cubao, Q.C.
City/Municipality or Private Contractor	MMDA
Crew (including Driver)	3
Type of Collection Vehicle	
Loading Capacity (cu.m.)	
Vehicle No. (Year of Fabrication)	
Working Hours	
Number of Trips	
Collected Waste Volume (cu. m.)	

[illegible]

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (RC-1)

Date	09 May 1997
Type of Waste	Residential / Commercial
Collection Area	Pasig River near Malacanang Palace Area
City/Municipality or Private Contractor	Manila / MMDA
Crew (including Driver)	4
Type of Collection Vehicle	Motor Boat
Loading Capacity (cu.m.)	1.50
Vehicle No. (Year of Fabrication)	
Working Hours	08:00:00
Number of Trips	2
Collected Waste Volume (cu. m.)	3

Time (from-to)	Time Required (min.)	Distance (km.)	Activities	Number of Collection Point	Waste Amount (cu.m.)
06:50:00 - 06:58:00	00:08:00	-	Dock Area - Collection / Cleansing Area (1st Trip)		
06:58:00 - 08:40:00	01:42:00	-	Waste Collection / Loading	1	1.5
08:40:00 - 08:56:00	00:16:00	-	Collection / Cleansing Area - Pier / Trans. Sta.		
08:56:00 - 10:31:00	01:35:00	-	Waiting		
10:31:00 - 10:45:00	00:14:00	-	Unloading		
10:45:00 - 11:16:00	00:31:00	-	Break		
11:16:00 - 11:27:00	00:11:00	-	Pier / Trans. Sta. - Collection - Cleansing Area (2nd Trip)		
11:27:00 - 14:03:00	02:36:00	-	Waste Collection / Loading	1	1.5
14:03:00 - 14:11:00	00:08:00	-	Collection Area - Pier - Trans. Station		

* Note: Due to some barges that docked at the pier, unloading was delayed.

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (RC-2)

Date	May 15, 1997
Type of Waste	River Cleansing
Collection Area	Pasig City
City/Municipality or Private Contractor	DPWH
Crew (including Driver)	Bamboo Raft
Type of Collection Vehicle	
Loading Capacity (cu.m.)	
Vehicle No. (Year of Fabrication)	
Working Hours	
Number of Trips	
Collected Waste Volume (cu. m.)	Approx. 8 cu. m.

[illegible]

ANNEX II - DATA SHEET OF TIME AND MOTION STUDY (RC-3)

Date 15 May 1997
 Type of Waste Residential / Commercial
 Collection Area San Juan River Area
 City/Municipality or Private Contractor San Juan / LGU
 Crew (including Driver) 7
 Type of Collection Vehicle Wooden Platform With Drum Floaters
 Loading Capacity (cu.m.) 15 sq. m.
 Vehicle No. (Year of Fabrication)
 Working Hours 08:00:00
 Number of Trips
 Collected Waste Volume (cu. m.)

Time (from-to)	Time Required (min.)	Distance (km.)	Activities	Number of Collection Point	Waste Amount (cu.m.)
08:05:00 - 08:25:00	00:20:00	-	Dispatch Area - River Clean- sing / Collection Area		
08:25:00 - 08:30:00	00:05:00	-	Orientation / Study Prep.		
08:30:00 - 10:40:00	02:10:00	-	Bagging of waste and placed on top of the floating drums to drain		
10:40:00 - 13:30:00	02:50:00	-	Break / Waiting for sacks delivery		
13:30:00 - 15:00:00	01:30:00	-	Waiting for sacks delivery; end of work		30 sacks