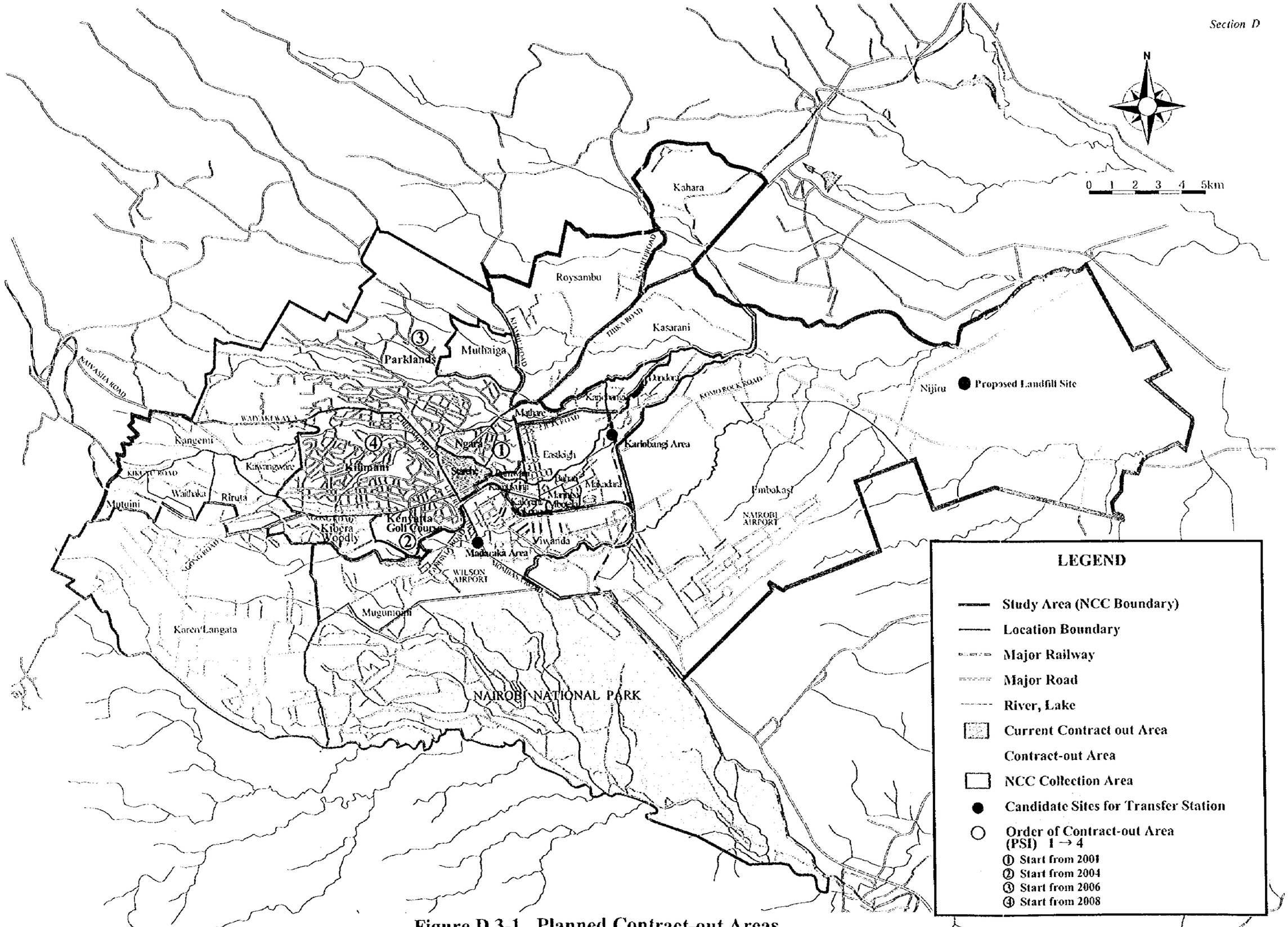

Figure D.3-1 Planned Contract-out Areas

3.3 Cost and Finance of Contracted Services

3.3.1 Estimated Cost of Contracted Services

A World Bank Report, *Private Sector Participation in Municipal Solid Waste Services in Developing Countries, 1994*, estimates collection cost and cleansing cost as follows:

Table D.3-7 Cost Estimation by World Bank

Unit: US$/ton; as of 1994

	Low-income Country	Middle-income Country	Industrialized County
Collection	15-30	30-70	70-120
Cleansing	30-60	60-140	140-240

Source: *Private Sector Participation in Municipal Solid Waste Services in Developing Countries, 1994*

Cost of SWM services contracted to private companies by NCC is estimated at Kshs 2,155 or US$ 36.66 per ton of waste. Services include waste collection and street cleansing in the designated area. See **Subsection 3.1.3, Financial Model Analysis** for details. It is reasonable amount based on the World Banks estimation. See **Table D.3-8** for the breakdown. According to the contract-out schedule, total cost of the services is estimated at Kshs 2,142 million for 2000-2008. See **Table D.3-9.**

Table D.3-8 Breakdown of Estimated PSI Cost (per ton of waste)

Unit: Kshs

Item	Amount
Operating Cost	
Fuel/Oil	395
Maintenance	43
Waste Bags	214
Wages	485
Overhead	645
Depreciation	178
Total (1)	1,959
Financial Cost (2)	196
Cost Total (3) = (1) + (2)	2,155

Table D.3-9 Total Cost of PSI Service Contract

	2000	2001	2002	2003	2004	2005	2006	2007	2008	total
Waste Collection by Contract PSI (ton/day)	138	188	198	208	237	248	466	494	546	2,723
Cost (Kshs million)	109	148	156	164	186	195	367	389	430	2,142

3.3.2 Finance of Contracted Services

Cost of contacted services is combined with the operating cost of all other areas and charge revenues from all area users including households and commercial entities are used to finance the total cost. The total costs are shared by each user groups in proportion to the waste collection amounts for collection/transportation costs and the waste damping amounts for the final disposal costs. When the charge revenue is not

enough, funds from the general account or subsidies from the central government are expected to finance the shortage.

Same billing system, namely the water charge billing system should be employed. Even if contracted-out areas are enjoying higher quality of services than other areas, same tariff system should be applied to both areas with the following reasons:

(1) Contracting-out is planned to be implemented in the high income areas where higher charges are expected to be applied by the new tariff system.

(2) If two kinds of tariff system is employed, it would be complicated to enforce the systems. In addition, since contracted-out areas are planned to increase in every two or three years, charging system has to be adjusted frequently.

(3) Since water charge areas are not necessarily coincide with the administrative areas where contracting-out schedule is based, it causes troubles to adjusting the water billing system.

Cost sharing among households, commercials and non-contract PSI users is shown in **Table D.3-10.** See **Section 4.9, Financial Improvement Plan, Main Report - Master Plan Study** for details on cost allocation.

Table D.3-10 Cost Sharing (100% Collection)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Collect./Tranport.									
Household	92.90%	92.98%	93.09%	93.20%	93.26%	93.39%	93.46%	93.55%	93.64%
Commercial	7.10%	7.02%	6.91%	6.80%	6.74%	6.61%	6.54%	6.45%	6.36%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Final Disposal									
NCC and Contract PSI									
Household	81.82%	84.05%	84.02%	83.98%	84.67%	84.61%	92.79%	92.81%	93.64%
Commercial	6.26%	6.34%	6.24%	6.12%	6.12%	5.99%	6.49%	6.40%	6.36%
Non-Contract PSI									
Household	11.08%	8.94%	9.06%	9.22%	8.59%	8.78%	0.67%	0.73%	0.00%
Commercial	0.85%	0.67%	0.67%	0.67%	0.62%	0.62%	0.05%	0.05%	0.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

3.4 Responsibilities and Roles of NCC on PSI Promotion

The Contract Management Section (CMS) under the SWM Division of the DoE, NCC would be responsible for the entire promotion of private sector involvement (PSI) for SWM. The functions and procedures in the PSI promotion will be established in the Capacity Building Assistance Program (CBAP). The responsibility and roles of NCC, specifically CMS for both pre contract award and post contract award are described in the following subsections.

3.4.1 Responsibilities and Roles in the Pre-Contract Award Process

(1) Organisational Responsibilities and Roles

Responsibilities for preparing and awarding a contract are assigned among the DoE's proposed Contract Management Section (CMS), a proposed Contract Team (CT) and the Council's existing Tendering Committee (TC).

A Contract Team (CT) is set up for each contract and oversees the contracting process up to award.

The Contract Management Section (CMS) is responsible for each stage of the preparation and award of the contract, i.e., it formulates the contract strategy, prepares a contracting plan, carries out prequalification as appropriate, prepares the "tender documentation", manages the invitation to tender, evaluates and selects the tender and awards the contract award. In this capacity the CMS acts as the Secretariat of the Contract Team (CT).

The CT's role is (1) to advise and approve the Contract Management Section's activities at each stage of the contracting process and (2) to ensure that the preparation and award of the contract complies with Local Government legislation NCC policy, rules and regulations.

Membership of the CT would be drawn from the DoE, the Administration and Legal Sections of the Town Clerk's Office and the City Treasurer's Department. The member from the Administration Section would head the CT. The life of CT would only be for the period of contract preparation. The CT would cease on the execution of the contract.

The role of the Tendering Committee is to formally evaluate and select the winning tender on behalf of the Council.

(2) The Pre-Award Contracting Process

The stages of the pre award procedures and process would be as follows:

(a) the DoE through the CMS prepares the contract specification, formulates a contract strategy and prepares a contracting plan including a tendering plan. The CT gives advice.

(b) the CT approves the specification, strategy and plan;

(c) if appropriate the CMS carries out prequalification, short lists the bidders and prepares a prequalification report. The CT reviews the report and approves the short list;

(d) the CMS with the assistance of the Legal Section prepares the Tender Documentation. The CT approves the Tender Documentation and the CMS then invites tenderers to bid;

(e) bids are received and evaluated by the CMS which co-opts assistance as necessary from the Internal Audit Section of the City Treasurers Department and the Legal Section. The CMS selects the preferred bid and prepares a Bid Evaluation Report. The CT reviews and approves the Bid Evaluation Report;

(f) the DoE passes the Bid Evaluation Report to the Tendering Committee;

(g) the Tendering Committee assess the bids and formally selects the winning tender. Full Council approval is obtained in the usual way;

(h) the CMS then prepares the Contract Documentation. The CT reviews and approves the Contract which is then formally executed.

The tendering plan would specify the CMS's TORs covering, tendering responsibilities, tendering criteria to be used in the evaluation of bids and the method of evaluation: the technical and financial trade off.

3.4.2 Responsibilities and Roles in the Post-Contract Award Process

(1) Organisational Responsibilities and Roles

The CMS would be responsible to monitor the contract terms and conditions and needs to implement robust procedures.

The robust procedures need to implemented to manage the important terms and conditions of the contract which are:

(i) variations to the contract;
(ii) defaults;
(iii) disputes;
(iv) termination; and
(v) carrying out VFM assessment.

(2) The Post-Award Contracting Process

The post award procedures and process would be divided into "monitoring" and "running or managing the Contract". The vital distinction between the activities are:

(i) **"monitoring"** the performance of collection services, on the basis of the specification and the "Work Program"; and

(ii) **"running or managing the Contract"**, which ensures compliance with the contract's terms and conditions.

(a) "Monitoring" Service Performance

A good monitoring system enables a local authority to identify where the contractor has "failed to perform" the service to the standard required in the contract.

Monitoring systems need to be carefully planned and should consider:

(i) whether the services in the specification are defined in input or output terms;

(ii) the monitoring priorities, ie which parts of the services are the most important to monitor;

(iii) the performance indicators to be used;

(iv) the information required for performance measurement and reporting;

(v) how the "customer" is to be built into the systems, eg through surveys or complaints; and

(vi) how the "contractor's self monitoring" is to be built into the systems.

There are numerous ways of monitoring. Some of the more common methods used are:

(i) Continuous monitoring: where there is close daily monitoring of activities;

(ii) Random or sample monitoring: where the contractor's performance is directly monitored without the contractor's advance knowledge;

(iii) Planned or scheduled monitoring: which is arranged in advance with the contractor;

(iv) Outcome based monitoring: which is based on assessment of the service delivery by the Customer - usually through surveys;

(v) Complaints based monitoring: where the Customer reports directly to the local authority or the contractor about poor services; and

(vi) Self-monitoring: by the contractor.

The choice of monitoring method and the emphasis will vary depending on how the specification is drafted. An "input" specification directs the contractor on how to carry out the work. Typically specifications for waste collection contracts are structured in this way and monitoring focuses on the service process. An "output" specification is concerned with the outputs and the standards achieved rather than the contractor's method of working. Here monitoring focuses on the service outputs.

Typically a local authority will use a combination of monitoring methods for different aspects of the service.

Under self-monitoring the contractor is responsible to report performance data to the local authority which assess performance. In this way the contractor can be made responsible for early identification of problems and make proposals on how to resolve them.

(b) Managing or "Running" the Contract

Managing or "running" the contract essentially means that the local authority must ensure that the contract's terms and conditions are complied with, ie both parties fulfill their contractual obligations. It also incorporates the responsibility of carrying out VFM assessments to ensure that all contracting goals and objectives have been met.

4. "CONTRACT MANAGEMENT" DEVELOPMENT WORKSHOP FOR THE DEPARTMENT OF ENVIRONMENT

4.1 Introduction

The "Contract Management" Workshop was a joint and cooperative effort among the Ministry of Local Government (MOLG), Nairobi City Council (NCC) and the JICA Study Team to formulate and coordinate actions to strengthen the Department of Environment (DoE), NCC.

The Workshop was held for two days on the 8 and 9 of January 1998 at the Holiday Inn, Nairobi Mayfair Court. It was opened by the Town Clerk, Nairobi City Council and closed by the Deputy Permanent Secretary, Administration, of the Ministry of Local Government (MOLG).

Altogether 25 participants from NCC, MOLG and also from the Ministry of Environment and Natural Resources and the Ministry of Health attended the Workshop.

This Section presents and describes:

(a) the background of the Workshop;
(b) the Workshop objectives;
(c) the Workshop structure;
(d) the description of the Workshop's key components;
(e) the Workshop's outputs and results; and
(f) conclusions and the Way Forward.

Section 4.3 of Data Book (1) contains the complete Contract Management Workshop "Package" which was prepared for the participants to guide them through the Workshop.

The Package comprehensively details the Workshop's objectives, structure, key components and methodology and it is strongly recommended it should be read in conjunction with this Section to obtain a comprehensive understanding of the Workshop.

4.2 Background of the "Contract Management" Workshop

The initiative for the Workshop arose from the *"The Study on Solid Waste Management in Nairobi City in the Republic of Kenya"* (the Study) which is being carried out by the JICA Study Team.

Under the Study, an Institutional Restructuring Plan (IRP) has been prepared in draft which contains a number of recommendations concerning the organisation and management of the Department of Environment (DoE).

These draft recommendations include proposals for implementing contract management arrangements including the establishment of a Contract Management Section (CMS). These proposals were made on the basis that as NCC increases the amount of private sector provision of waste collection services the Council will need

to implement robust and effective contract management arrangements to properly manage waste collection contracts.

These proposals have been discussed and agreed in principle among MOLG, NCC and the JICA Study Team. Proposals for the Unit's establishment were also formulated at the "Organisation and Management" Workshop in December 1997.

Currently NCC has one contract for collection and street cleansing services in the Central Business District (CBD). NCC intends to wait and see how private sector involvement (PSI) in the CBD works before it extends PSI to other parts of the city. At the moment the major constraint to increasing PSI is financial.

4.3 The Workshop's Objectives

The Workshop objectives were to:

(a) present and inform Workshop participants of the best practice of contract management for waste collection contracts; and

(b) for participants to jointly formulate arrangements and procedures for NCC and the Department of the Environment to manage waste collection contracts before and after they are awarded.

The recommendations which were jointly agreed by the participants now form a basis to establish contract management arrangements including the set up of the Contract Management Section and establishing its tasks and responsibilities. The recommendations are also used to complete the formulation of the Institutional Restructuring Plan and Private Sector Involvement Plan in **Sections 4.6** and **4.8**, respectively, in **Volume 2, Main Report, Master Plan Study**.

For the purposes of the Workshop waste collection was defined as including street cleansing services, but the focus was on collection. **Figure D.4-1** below illustrates the role of the Workshop within the Study.

Role of Contract Management Workshop within the Study

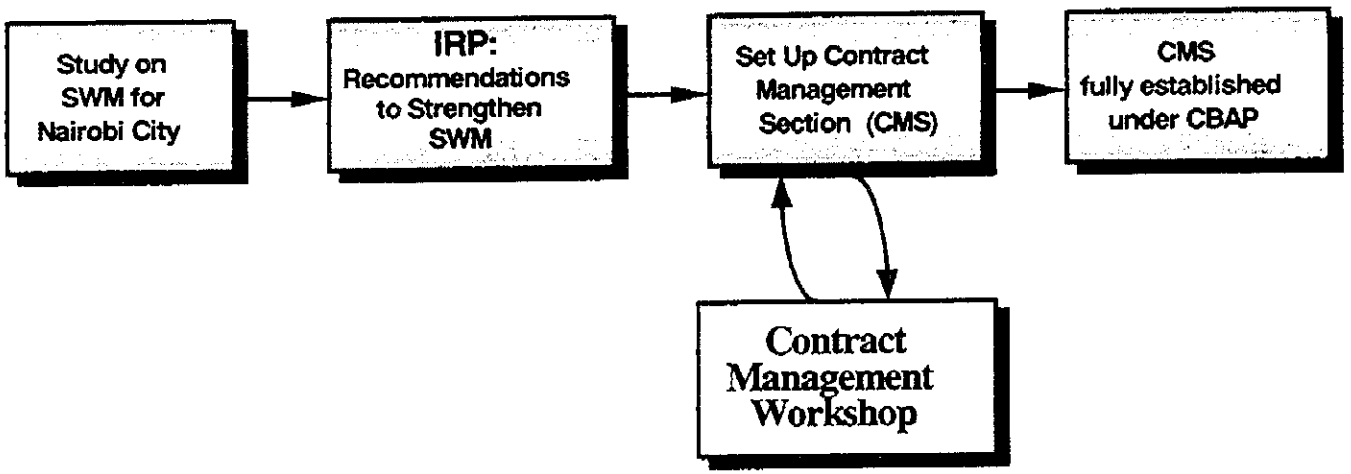

Figure D.4-1 The Role of the "Contract Management" Workshop

4.4 The Structure of the Workshop

The main sessions of the Workshop were:

(a) Private Sector Involvement in Waste Collection;
(b) What is Good Contract Management?;
(c) Good Practice for Pre Contract Award Arrangements;
(d) Current Tendering Arrangements in NCC;
(e) Formulate Pre Contract Award Arrangements for NCC;
(f) Good Practice for Post Contract Award Arrangements;
(g) Formulate Contract Monitoring Arrangements for NCC; and
(h) The Closing Session.

The Workshop began by considering private sector involvement in waste collection. This covered why the private sector should be involved, how to decide whether to involve the private sector or not, and the method of involvement.

This was followed by the Session "What is Good Contract Management?" which defined the scope, strategic objectives and the main stages of good practice of contract management from the very inception of a contract, ie identifying the contract requirement, to the contract's final completion.

Best practice for the detailed arrangements of each stage of the contract management process were then dealt with. These Sessions drew on the experience of the City of Westminster's, London, waste collection and street cleansing contract.

The detailed **pre-contract award** arrangements were presented to the Workshop participants first. This covered best practice in the stages up to and including the award of the contract. This was a lengthy and detailed Session. This was followed by a brief Session describing and evaluating NCC's current tendering arrangements. This is summarised in the preceding **Chapter 2.**

After this participants formulated arrangements for managing the "pre-contract award" process. The formulation was done in group work for which participants split into two groups. Each group prepared outputs and presented their recommendations in plenary which jointly discussed them. Final recommendations were then agreed. These recommendations formed the key outputs from the Workshop.

Best practice for the detailed **post-contract award** arrangements were then presented to the participants. This Session covered the management and monitoring of a contract after it is awarded. After this Session participants briefly formulated arrangements for monitoring contracts in plenary.

The Closing Session presented a summary of the Workshop and key recommendations to the Town Clerk who kindly closed the Workshop.

Summarised descriptions of the four key Sessions - Private Sector Involvement in Waste Collection, "What is Good Contract Management?", Pre-Contract Award and Post-Contract Award arrangements, are given in **Sections 4.5 to 4.8 below.** Relevant comments and observations made by the participants during these sessions are also

reported "verbatim". These were thoughtful, clear and useful. The participants positive commitment to the Workshop was greatly appreciated.

After this the participants recommendations and outputs for both pre and post-contract award arrangements are given in **Sections 4.9 and 4.10,** respectively. The participants recommendations are reported "verbatim", i.e., as they were actually presented by the participants at the Workshop. To improve the expression and clarity of the outputs and key recommendations they have where necessary been subject to minor literary edits.

4.5 Private Sector Involvement in Waste Collection

4.5.1 Summary of Session

The purpose of this Session was to inform participants on what private sector involvement (PSI) in waste collection and street cleansing services means.

The Session covered why the private sector should be involved, how to decide whether to involve the private sector or not, the method of involvement, competition strategy and a brief look at the current situation in Nairobi.

(I) Principles and Objectives of PSI in SWM in Nairobi City

The overriding reason to involve the private sector is that it improves the delivery of services which are either too costly and/or are of poor quality. World wide experience in both the developing and developed world clearly demonstrates this.

However, PSI is not a substitute for local government's "primary duty of care" to provide SWM services. Private operators are motivated to make profit rather than a duty to serve the public. Private sector involvement should only be selected as an alternative to the in-house service if it is:

(i) more economic and enhances efficiency; and
(ii) improves or delivers at least the same quality of service.

PSI must meet these two basic criteria.

In addition two other important criteria concerning purchaser's capacity must be also satisfied. These are:

Firstly, the local authority, in our case NCC, must be able to afford PSI services.

Secondly, the local authority must have a contract management capability which effectively:

(i) manages the contract award process, i.e., contract specification, contract strategy, prequalification, tendering and contract award;

(ii) monitors contract performance; and

(iii) enforces contract terms and conditions.

Other factors which need to be considered are the private sector's capabilities, the level of competition in the market, the adequacy law of contract and the reliability of the judicial system and lastly, the regulatory costs of managing contracts must not be onerous.

(2) What is the most Suitable Method of PSI for Collection?

The appropriate type of PSI and contracting arrangements have to be selected. There are essentially three types of PSI arrangements for collection services. These are:

(i) Open Competition;
(ii) Operating Contract sometimes called "contracting"; and
(iii) Franchise.

(a) Open Competition

Under open competition private companies are free to provide collection services to whom and where they like and collect tariffs directly from customers. Generally open competition is not the best arrangement for PSI but where the level of collection is low it may be, as it is in Nairobi, a vital necessity.

(b) Operating Contract

The most usual contracting method is a simple operating contract under which a finite term contract is awarded, usually for a fixed price and as a zonal monopoly. Typically it is retendered every 3 to 5 years.

Operating Contracts vs. Open Competition:

Operating contracts are preferable to "open" competition for the following reasons:

(i) operating contracts give local authorities stronger regulation of operators;

(ii) operating contracts are generally more economical because they give "economies of contiguity" and the opportunity for contractors to realise efficiency gains and reduce costs;

(iii) managing and regulating competition is less complex and cheaper;

(iv) economic regulation is easier and cheaper under operating contracts;

(v) operators under "open competition" have to bear the cost of billing and collection from customers which can add considerable cost;

(vi) the opportunities for price collusion are high under "open competition"; and

(vii) operating contracts are established worldwide practice.

(c) Franchises

Under a franchise the local authority gives a contractor a zonal monopoly. The contractor pays the local authority a fee for the right to operate in that area and levies charges and collects revenues from customers. Tariffs and performance are regulated by the local authority through the franchise agreement.

The disadvantages of franchises are:

(i) contractors bear the cost billing and collection adding considerable cost;

(ii) economic regulation adds cost; and

(iii) they only work where everyone in the franchised zone can afford the contractor's tariffs and will cooperate with the franchiser.

Operating contracts are therefore generally preferable to franchises.

(3) Competition

Healthy competition is essential to ensure that PSI reduces costs. Achieving optimal competition requires local authorities to intelligently zone their cities, tender zonal contracts and prequalify contractors. They also formulate policies for their in-house services, e.g., enhancing their efficiency by making them compete with the private sector.

4.5.2 Participants Comments and Observations

Participants comments are reported verbatim.

"Although franchises are not as recommendable as operating contracts, franchising may be preferable as a short term solution to involving the private sector because it is a way of getting around the cash flow problem which constrains the ability of NCC to meet the payments to contractor under an operating contract."

"At present NCC has no information on how much it costs to provide the collection service and therefore cannot make comparisons with the private sector."

4.6 Session on Good Contract Management

4.6.1 Summary of Session

By contract management is meant the system of controlling and managing contracts from their very inception, i.e., the identification of the contract requirement to their final completion when the contractor ceases to provide services.

Good contract management ensures that the most suitable contractor is selected, the contract is carried out efficiently and effectively, that both parties fulfill their contractual obligations and that the contract provides best Value For Money (VFM).

Good contract management will also ensure that the following contracting objectives are met:

(1) a system of effective contract control is established over the whole contracting process;

(2) service performance is to the required standard and quality;

(3) basic contract terms and conditions are complied with;

(4) documentation is properly maintained;

(5) there is effective control over change to the contract;

(6) problems are anticipated;

(7) senior management is kept appropriately informed of the contract status;

(8) a workable structure to resolve disputes is implemented; and

(9) a workable structure to deal with default and contract termination is implemented.

Contract Management falls into two distinctive types of activity; those activities before a contract is awarded, i.e., "pre-contract award", and those activities after a contract is awarded, i.e., "post-contract award". **Figure D.4-2** below summarises the Contract Management process in its entirety.

(1) Pre-Contract Award Arrangements

The main stages of the pre-contract award process include identifying the contract requirement, preparation of the contract specification, formulating the contract strategy, setting tender evaluation criteria, prequalification, the invitation to tender, i.e., from preparation to issuing the tender documentation, tender evaluation and selection, and post-tender contract negotiation and award of the contract.

Figure D.4-3 below shows the typical stages of the pre-contract award process.

The Contract Management Process

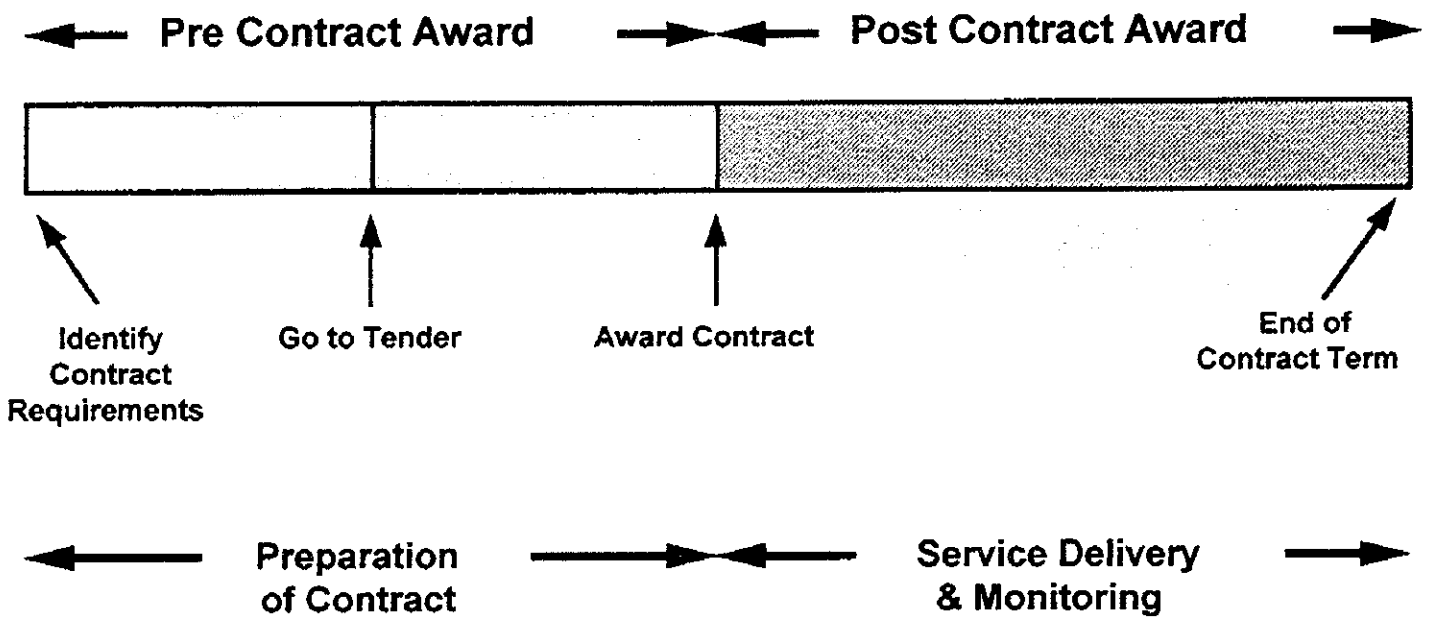

Figure D.4-2 The Contract Management Process

The Pre Contract Award Process

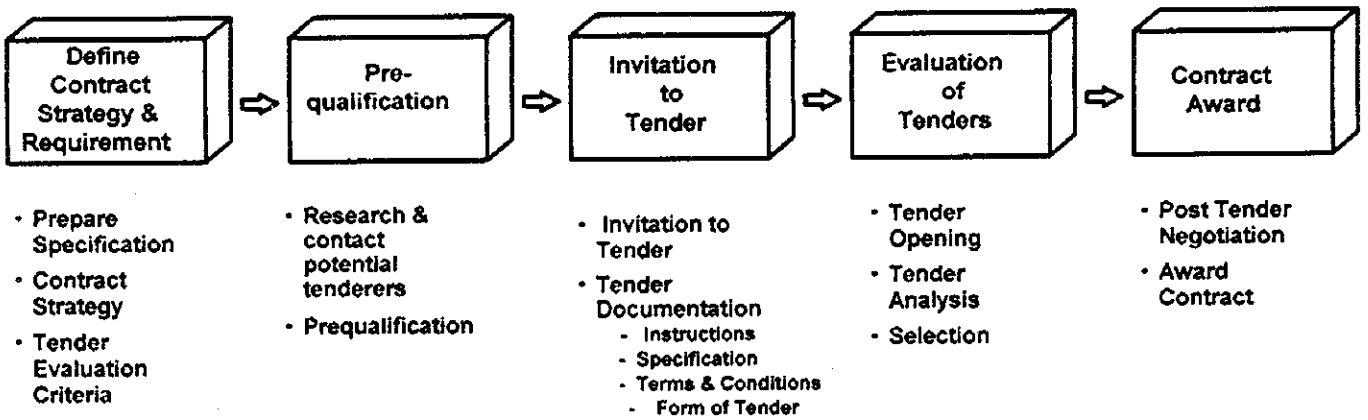

Figure D.4-3 The Pre Contract Award Process

(2) Post-Contract Award Arrangements

Post-contract award arrangements are the systems of contract control and monitoring which ensure that after the contract is awarded, it is executed and carried out to the required performance, standard and quality specified in the contract, and to the contract's terms and conditions.

These arrangements include procedures to monitor service delivery, to monitor for compliance with contract terms and conditions, to manage change to contract requirements and/or terms and conditions, to maintain documentation, to deal with failures to perform, default and contract termination, to provide a workable structure to resolve disputes and to carry out a VFM assessment.

Figure D.4-4 below shows the typical components of the post contract award process.

4.6.2 Participants' Comments and Observations

Participants comments are reported verbatim. The participants clearly understood the scope of the contract management process. Most comments focused on VFM aspects of contract management. The comments were:

"The contract must be robust and capable of implementation."

"Value for Money (VFM) must be integral to the contract management process and a good monitoring system is essential to ensure that VFM can be properly assessed."

"VFM analysis depends on NCC knowing what its costs to deliver the collection service before contracting it out. However at present NCC has no information on how much it costs to provide the collection service."

"It is important to set parameters at the beginning to have a basis for VFM and an evaluation of the cost of service. Fixed price contracts may include additional services to be costed separately in the VFM assessment."

"The VFM evaluation takes into account all aspects of collection and must be made from a broad perspective of effectiveness, efficiency and total performance not just financial. VFM evaluation looks at whether they provided the service required."

The representative from the MENR asked whether "an abstract value like "clean environment" is assessed in VFM? This may be too general and would depend on the breadth of the parameters used. Abstract values cannot be easily quantified."

The Post Contract Award Process

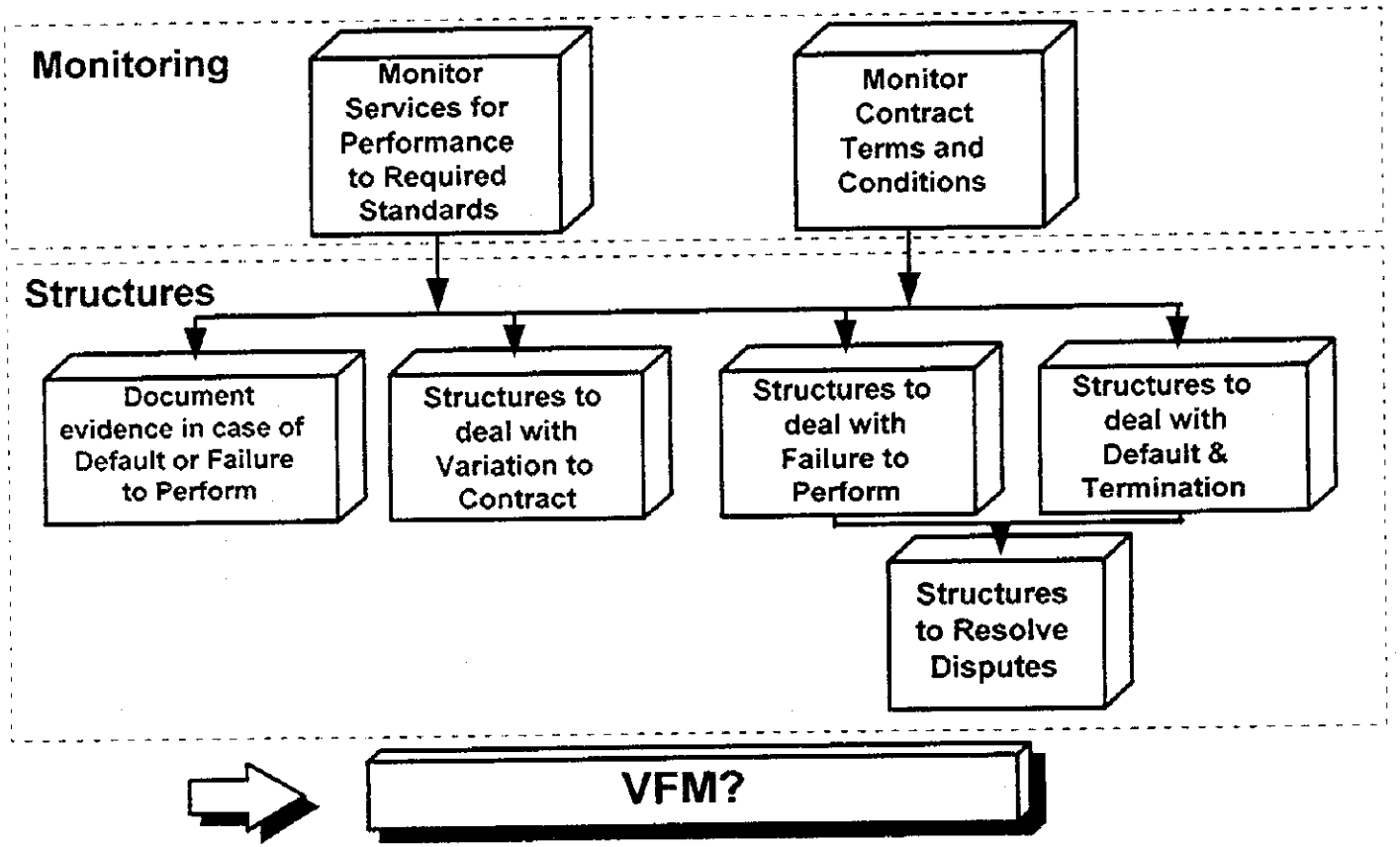

Figure D.4-4 The Post Contract Award Process

4.7 Best Practice for Pre-Contract Award Arrangements

The best practice for the detailed Pre-Contract Award arrangements were presented to the participants by the Workshop facilitator.

4.7.1 Summary of Session

This was a lengthy and detailed Session covering the following points.

(1) The Contract Strategy and Formulating the Contract Specification

The contract management process begins with the formulation of the contract strategy. Preparing the right strategy is essential for the success of the contract. The strategy should take account of all aspects of the contract management process, namely:

(a) the basic service requirements or the contract "specification" which defines the service, standards and quality required;

(b) the type of contract and its basic conditions, i.e., operating contact or franchise, pricing structures, etc.;

(c) contract duration;

(d) the "competition strategy" including the need for prequalification;

(e) the policy on the Council's assets, i.e., vehicles and premises;

(f) the policy on the Council's employees, e.g., whether the contractor is required to re-employ Council employees;

(g) the plan for the tendering process covering the tender evaluation criteria, tendering timetables, and Terms of Reference for the Tendering Committee;

(h) the avoidance of conflicts of interest;

(i) the tender documentation to be prepared;

(j) procedures for variation to the contract;

(k) review of the basic terms and conditions of the contract, e.g., payment conditions, default, etc.;

(l) length of the commissioning period - usually 8 weeks; and

(m) the procedures to manage and monitor the contract after it is awarded.

The formulated strategy should then be set out in a contracting plan. The plan should delineate the path to be followed, and the procedures and the controls to be implemented to ensure that the contract's objectives are achieved.

(2) Prequalification

The purpose of the prequalification of prospective tenderers is to ensure that only those assessed as being capable of delivering the services are allowed to

continue to bid for the contract. The output of the prequalification process is drawing up a short tender list of potential bidders.

(3) Invitation to Tender - the "Tender Documentation"

Once prequalification is completed potential contractors can be invited to bid and submit their tenders. The invitation to tender comprises the "tender documents". These will typically include:

(a) Instructions to Tenderers;
(b) The "Specification";
(c) Bill of Quantities;
(d) Standard Contract Terms and Conditions;
(e) The Form of Tender;
(f) The Tender Certificate or Confidentiality Statement; and
(g) Performance Bond.

The Specification may also contain a number of proforma schedules which the Tenderer is requested to submit in his bid, e.g., a proforma "Work Program".

The Specification is the key document in the contract process and its importance cannot be overstated. It defines the work to be undertaken, the conditions and standards of the work to be performed and the quality required by the local authority. The contract's "terms and conditions" set out the general rights and obligations in a contract between the local authority and the contractor.

(4) Clarification of Meaning of Contract - Tenderers' Questions

Before submission of the tender bidders may wish to raise questions about the tender. Clarifications should be given by the local authority and must be copied to all the other tenderers.

(5) Evaluation and Selection of the Tender

The objective of the evaluation process is to select the tender which represents the best overall value for money by a balance between quality, performance, delivery and risk.

Typically local authorities select tenders on the basis that they are the most "advantageous" or "economically advantageous". This does not mean just lowest price and needs to be given concrete definition, attaching weight to each criterion used in the evaluation. Typically, criteria include capability (including the company's reputation and experience), technical compliance, quality of the proposed services to be performed and the relative costs of the tenders.

The choice of bid and the reasons for the selection should be reported both for accountability and for the information of those who will monitor, manage and later renew the contract.

(6) Contract Award

The formal award should made through a properly executed contract and the contractor should not start work until it is executed. Sometimes the tender may be negotiated prior to award of the contract with a view to obtaining an improvement to the selected tender. This is known as "post-tender negotiation". This practice, however, is fraught with risks of putting other tenderers at a competitive disadvantage.

4.7.2 Participants Comments and Observations

Participants comments are reported verbatim. Participants were particularly concerned that not only the contractor but NCC would be able to meet its obligations under the contract.

(1) Defining the Specification and Failures to Perform

"In a situation where the contractor's failure to comply with contract conditions is caused by the Council how can you impose penalties on the contractor? For example in the situation of NCC being unable to provide a disposal site thereby forcing the contractor to illegally dump waste and therefore to default."

"A proper contract is impossible unless the Council meets its obligations. The Council has to identify possible areas where it might fail to execute contract conditions. Contracts must have feasible obligations."

"The contract Specification must be properly designed to take account of the existing constraints, eg lack of facilities. Good contract formulation should ensure that parties avoid promises that cannot be met."

"A failure to perform on the part of the council will often lead to claims by contractor. Contractors will often make detailed notes of a breach of contract and use this to make a claim."

(2) Bill of Quantities

"The issue arose as to whether on the amount appearing on Form of Tender overrides the sum appearing in the Bill of Quantities should there be a difference between them. It was confirmed that amount on the Form of Tender overrides the amount in the Bill of Quantities unless the difference is arises from a mathematical errors, eg the addition of the items in the Bill of Quantities is incorrect."

(3) Criteria

"Contracts are generally awarded by NCC to the lowest bid which is also shown to be economically advantageous. But criteria are not well developed or defined."

(4) Tenderers' Questions

"Tenderers' questions are generally discouraged because of the risk of influence, bribery, etc. Guidelines on answering tenderers questions should be prepared for NCC."

(5) The Tendering Process

"Participants also mentioned that excessive controls in MOLG's Financial Regulations (1986) especially in case of Nairobi, impact negatively on the tendering process."

"Written guidelines for NCC officers on the tendering process outlining the procedures and rules to be followed should be prepared for NCC."

(6) Post-Tender Negotiation

"Post-tender negotiation is generally restricted in Kenyan local authorities. The Ministry of Local Government discourages post-tender negotiation as it can lead to corruption."

"There has been a substantial erosion of public confidence in NCC and any attempt to negotiate a contract is likely to be seen as suspicious. Maintaining a positive public image demands that any post-tender negotiation is therefore strictly controlled."

"If any collusion between a tenderer and the Council's officers was discovered the effect would be devastating. Regaining the public confidence would take a lot of effort."

"Participants questioned what safeguards would protect post-tender negotiation. Should NCC set minimum or maximum price limits within which the tender is negotiated? A rule could be that NCC would not negotiate with the winning bidder to a figure below the next best bid."

"Clauses should be included in the contract that the contract can be terminated if the contractor has engaged in bribery and corruption in the tendering process."

4.8 Best Practice for Post-Contract Award Arrangements

The best practice for the detailed Post-Contract Award arrangements were presented to the participants by the Workshop facilitator.

4.8.1 Summary of Session

This covers the management and monitoring of a contract after it is awarded.

The objectives of post contract management are that:

(a) services are performed to the level, standards and quality required in the Specification and the contractor's "Work Program" (operational plan), both of which form part of the contract;

(b) the contract's terms and conditions are complied with, i.e., both parties fulfill their contractual obligations; and

(c) the contract provides best Value For Money (VFM) for NCC.

These objectives express the vital distinction between the activities of:

(a) **"monitoring"** the performance of collection services, on the basis of the specification and the "Work Program"; and

(b) **"running or managing the Contract"**, which ensures compliance with the contract's terms and conditions.

This distinction needs to be clearly understood.

(1) "Monitoring" Service Performance

A good monitoring system enables a local authority to identify where the contractor has "failed to perform" the service to the standard required in the contract.

Monitoring systems need to be carefully planned and should consider:

(i) whether the services in the specification are defined in input or output terms;

(ii) the monitoring priorities, ie which parts of the services are the most important to monitor;

(iii) the performance indicators to be used;

(iv) the information required for performance measurement and reporting;

(v) how the "customer" is to be built into the systems, eg through surveys or complaints; and

(vi) how the "contractor's self monitoring" is to be built into the systems.

There are numerous ways of monitoring. Some of the more common methods used are:

(i) Continuous monitoring: where there is close daily monitoring of activities;

(ii) Random or sample monitoring: where the contractor's performance is directly monitored without the contractor's advance knowledge;

(iii) Planned or scheduled monitoring: which is arranged in advance with the contractor;

(iv) Outcome based monitoring: which is based on assessment of the service delivery by the Customer - usually through surveys;

(v) Complaints based monitoring: where the Customer reports directly to the local authority or the contractor about poor services; and

(vi) Self-monitoring: by the contractor.

The choice of monitoring method and the emphasis will vary depending on how the specification is drafted. An "input" specification directs the contractor on how to carry out the work. Typically specifications for waste collection contracts are structured in this way and monitoring focuses on the service process. An "output" specification is concerned with the outputs and the standards achieved rather than the contractor's method of working. Here monitoring focuses on the service outputs.

Typically a local authority will use a combination of monitoring methods for different aspects of the service.

Under self-monitoring the contractor is responsible to report performance data to the local authority which assess performance. In this way the contractor can be made responsible for early identification of problems and make proposals on how to resolve them.

(2) Managing or "Running" the Contract

Managing or "running" the contract essentially means that the local authority must ensure that the contract's terms and conditions are complied with, ie both parties fulfill their contractual obligations. It also incorporates the responsibility of carrying out VFM assessments to ensure that all contracting goals and objectives have been met.

Robust procedures need to implemented to manage the important terms and conditions of the contract which are:

(i) variations to the contract;
(ii) defaults;
(iii) disputes;
(iv) termination; and
(v) carrying out VFM assessment.

4.8.2 Participants Comments and Observations

Very little time was available for discussion at the end of this Session and therefore few comments were made by the participants. None are reported.

4.9 Recommendations and Outputs: Formulation of the Pre-Contract Award Arrangements

The participants were asked to formulate organisational arrangements for managing the pre-contract award process, focusing on the key stages of:

(a) formulation of contract strategy and preparation of a contracting plan;
(b) prequalification;
(c) the invitation to tender - the "tender documentation";
(d) evaluation and selection of the tender; and
(e) contract award.

Participants were asked to consider setting up a "Contracting Committee or Team" with responsibility for oversight of the contract process up to award. Participants also used the material from the Sessions on "Best Practice for Pre Contract Award Arrangements" and "Current Tendering Arrangements in NCC" to formulate their recommendations.

The formulation was done in group work for which participants split into two groups. Each group prepared outputs and presented their recommendations in plenary. Final recommendations were then jointly agreed by the participants in plenary.

The following are their recommendations and outputs:

(1) Organisational Responsibilities and Roles

Responsibilities for preparing and awarding a contract are assigned among the DoE's proposed Contract Management Section (CMS), a proposed Contract Team (CT) and the Council's existing Tendering Committee (TC).

A Contract Team is set up for each contract and oversees the contracting process up to award.

The Contract Management Section is responsible for each stage of the preparation and award of the contract, ie it formulates the contract strategy, prepares a contracting plan, carries out prequalification as appropriate, prepares the "tender documentation", manages the invitation to tender, evaluates and selects the tender and awards the contract award. In this capacity the CMS acts as the Secretariat of the Contract Team.

The CT's role is (1) to advise and approve the Contract Management Section's activities at each stage of the contracting process and (2) to ensure that the preparation and award of the contract complies with Local Government legislation NCC policy, rules and regulations.

Membership of the CT would be drawn from the DoE, the Administration and Legal Sections of the Town Clerk's Office and the City Treasurer's Department. The member from the Administration Section would head the CT. The life of CT would only be for the period of contract preparation. The CT would cease on the execution of the contract.

The role of the Tendering Committee is to formally evaluate and select the winning tender on behalf of the Council.

(2) The Pre-Award Contracting Process

The stages of the pre award procedures and process would be as follows:

(a) the DoE through the CMS prepares the contract specification, formulates a contract strategy and prepares a contracting plan including a tendering plan. The CT gives advice.

(b) the CT approves the specification, strategy and plan;

(c) if appropriate the CMS carries out prequalification, short lists the bidders and prepares a prequalification report. The CT reviews the report and approves the short list;

(d) the CMS with the assistance of the Legal Section prepares the Tender Documentation. The CT approves the Tender Documentation and the CMU then invites tenderers to bid;

(e) bids are received and evaluated by the CMS which co-opts assistance as necessary from the Internal Audit Section of the City Treasurers Department and the Legal Section. The CMS selects the preferred bid and prepares a Bid Evaluation Report. The CT reviews and approves the Bid Evaluation Report;

(f) the DoE passes the Bid Evaluation Report to the Tendering Committee;

(g) the Tendering Committee assess the bids and formally selects the winning tender. Full Council approval is obtained in the usual way;

(h) the CMS then prepares the Contract Documentation. The CT reviews and approves the Contract which is then formally executed.

The tendering plan would specify the CMS's TORs covering, tendering responsibilities, tendering criteria to be used in the evaluation of bids and the method of evaluation: the technical and financial trade off.

Figure D.4-5 below illustrates the proposed organisational structure of the pre-contract award process within NCC.

Organisational Structure of the Pre Contract Award Process in NCC

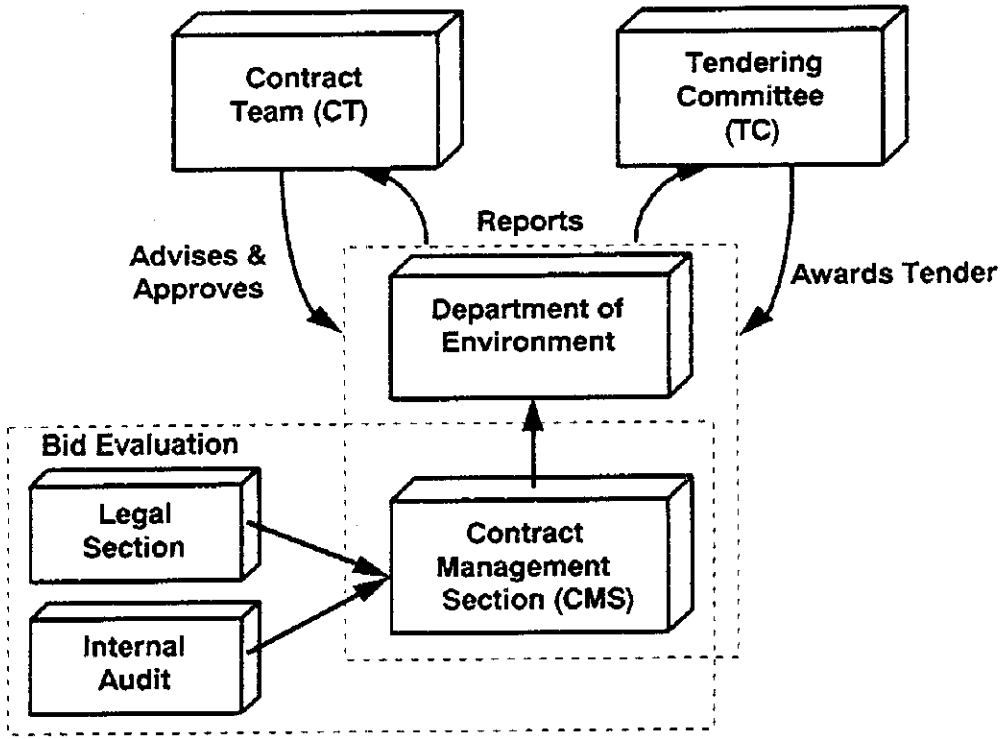

Figure D.4-5 Organisational Structure of the Pre-Contract Award Process

4.10 Recommendations and Outputs: Formulation of the Post-Contract Award Arrangements

Very little time was available for participants to consider arrangements for managing and monitoring post contract award. The materials from the Session on "Best Practice for Post Contract Award Arrangements" were use a basis for the formulation. The following brief recommendations were agreed by the participants in plenary.

(1) "Monitoring" the Performance of Collection Services

The DoE should use a mixture of continuous monitoring for problematic and difficult areas, eg high density commercial areas, random or sample monitoring in residential areas and both to be augmented by "self-monitoring" by the contractor.

Under "self-monitoring" the contractor would be responsible to report performance data to the DoE which would assess his performance.

In addition it was agreed that "complaints based monitoring" is useful but it would require a well resourced capability which the DoE could not afford in the short or medium term. Nevertheless the DoE should as far as possible be responsive to all complaints.

(2) Managing or "Running" the Contract

The CMU would be responsible to monitor the contract terms and conditions and needs to implement robust procedures.

4.11 Conclusions and the Way Forward

The Workshop was successful in achieving its objectives. A strong consensus was achieved among participants in formulating the recommendations to set up contracting arrangements for the DoE. Participants' recommendations were positive, clear and objective and added constructive ideas to the draft IRP recommendations, in particular for the future role and status of the DoE.

These recommendations now form a comprehensive basis for establishing the management arrangements for contracts, and have been included in the IRP in **Volume 2, Chapter 4.6.** They also compliment the IRP's recommendations for setting up the Contract Management Section and establishing its tasks and responsibilities toward promotion of private sector involvement for SWM.

SECTION E

COLLECTION AND TRANSPORTATION STUDY

THE STUDY ON SOLID WASTE MANAGEMENT IN NAIROBI CITY IN THE REPUBLIC OF KENYA

FINAL REPORT

SECTION E

COLLECTION AND TRANSPORTATION STUDY

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SECTION E

COLLECTION AND TRANSPORTATION STUDY

1. SOLID WASTE AMOUNT SURVEY

1.1 General

Solid waste amount survey was conducted twice at the Dandora Disposal Site with each survey lasting consecutively for seven (7) days to count all collection vehicles entering the site. The first survey was from 9th to 15th of May 1997 and the second was from 24th to 30th of November 1997. The weights of some collection vehicles loaded with waste and when empty were also measured simultaneously by using a truck scale at the premises of the Nairobi City Council (NCC) in Nanyuki. Based on the results of the two surveys, the current collection amount of municipal solid waste (MSW) was determined for the comparison of solid waste amounts generated in the present and future conditions in Nairobi.

1.2 Objective of the Survey

The objective of the survey was to clarify the present conditions including collection ratio to the total amount and kind of solid waste transported to the existing final disposal site at Dandora.

1.3 Outline of the Survey

The standard weight and apparent specific gravity of solid waste loaded for each type of collection vehicle were calculated by measuring the weights and volumes of waste loaded on NCC, National Youth Service (NYS) and private company collection vehicles just before they entered the final disposal site at Dandora by using a truck scale owned by NCC. For vehicles other than those mentioned above, weights were calculated by ocular measurement of volumes because it was difficult to use the truck scale for such vehicles.

In addition, data were recorded for all the vehicles entering the final disposal site and the waste amounts were calculated using the standardized load weights. The data recorded were vehicle number, arrival time, load volume, calculated load weight, collection area, kind of waste (ordinary residential, market, hospital, offices, industrial, etc.).

The procedure of the survey is illustrated in **Figure E.1-1**.

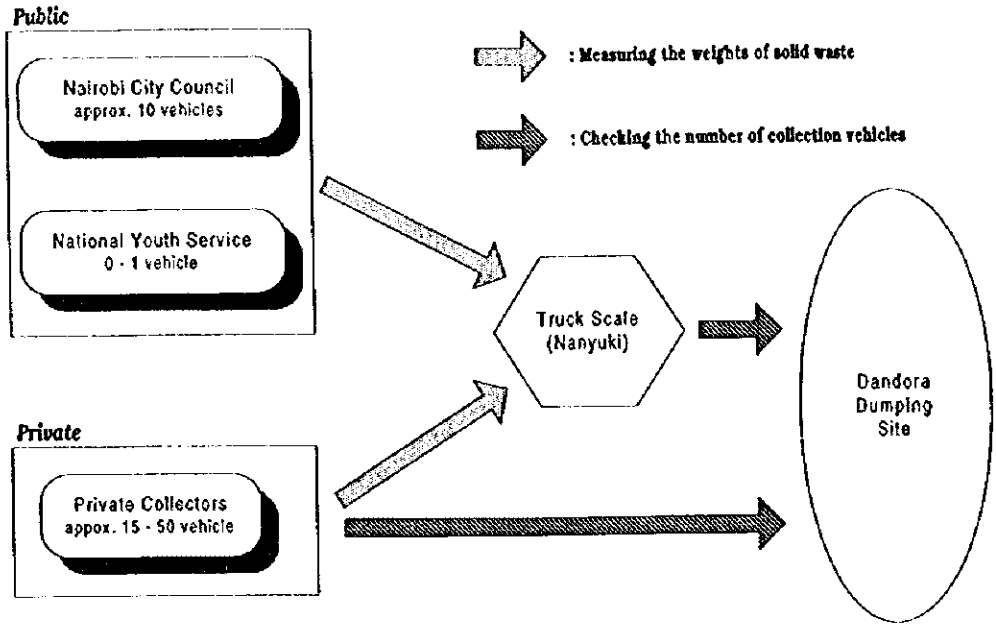


Figure E.1-1 Procedure of Solid Waste Amount Survey

1.4 Results of the Survey

1.4.1 Unit Weight of Collected Solid Waste

The total number of collection vehicles measured at the truck scale at Nanyuki was as follows:

Table E.1-1 Total Number of Vehicles Measured at Nanyuki

	Survey Period	Total Number of Vehicles	Number of NCC Vehicles
First Survey	9 - 15 May 1997	13	12
Second Survey	24 November - 1 December 1997	22	19

The unit weight of collected solid waste was estimated by dividing the weight measured by truck scale with the loading volume of solid waste by inspection, as below.

$$\textit{Unit weight of collected solid waste (ton / m3)} = \frac{\textit{Measured weight by the truck scale (ton)}}{\textit{Loading volume of the solid waste by inspection (m3)}}$$

The weight of collected solid waste for each collection vehicle was recorded and the unit weight was estimated, as shown in **Subsection 5.1.1 of Data Book (1).** From these tables, the measured weight and loading volume of solid waste for collection vehicles are as summarized in **Table E.1-2.**

The average measured weight and loading volume of solid waste are approximately 4 tons per vehicle and 14 cubic meters (m^3) per vehicle, respectively. The averaged unit weight of solid waste is therefore estimated at about 0.3 ton/m^3.

Table E.1-2 Unit Weight of Collected Solid Waste

	Averaged Measured Weight (ton)	Loading Volume by Inspection (m^3)	Unit Weight (ton/m^3)
First Survey	3.84	13.80	0.30
Second Survey	4.38	14.56	0.31

1.4.2 Number of Collection Vehicles Coming to Dandora

Apart from the measurement of weight of solid waste by truck scale, the number of collection vehicles entering the Dandora Disposal Site was recorded along the Komo Rock Road from 9th to 15th of May and 24th to 30th of November 1997. At the same time, the number of crew, amount of solid waste and kind of waste to be loaded on a collection vehicle were also surveyed. The original daily records compiled by spreadsheets are shown in **Subsection 5.1.2 of Data Book (1)**.

The number of collection vehicles coming to Dandora was between 29 and 87, and 13 to 34 of them were from NCC. All the vehicles from NYS were not in operation during the second field survey in November due to mechanical problems such as engine and starter failures, while one vehicle was in operation in May.

The comparison of recorded number of vehicles is shown in **Table E.1-3**, and **Figures E.1-2** and **E.1-3**. The number of private vehicles was always two or three times those of NCC except on Sunday, 11th of May and 30th of November. The largest number of NCC and private vehicles recorded were 34 on Saturday, 29th of November and 57 on Saturday, 10th of May, respectively. The average number of NCC vehicles increased in the second survey but the private ones slightly decreased.

Table E.1-3 Averaged Number of Operating Collection Vehicles

	NCC	Private
First Survey	15.7	34.0
Second Survey	19.4	28.3

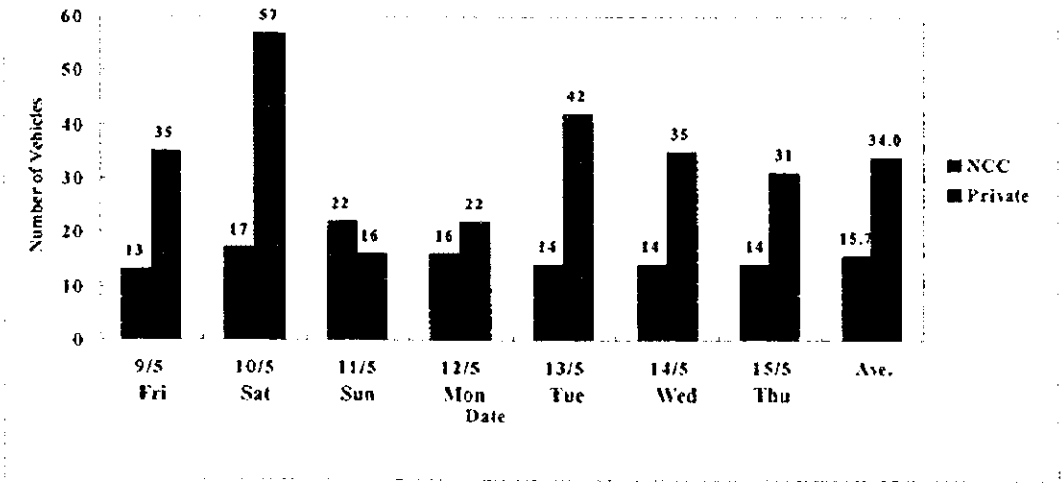


Figure E.1-2 Number of Collection Vehicles Operating in the First Survey Period

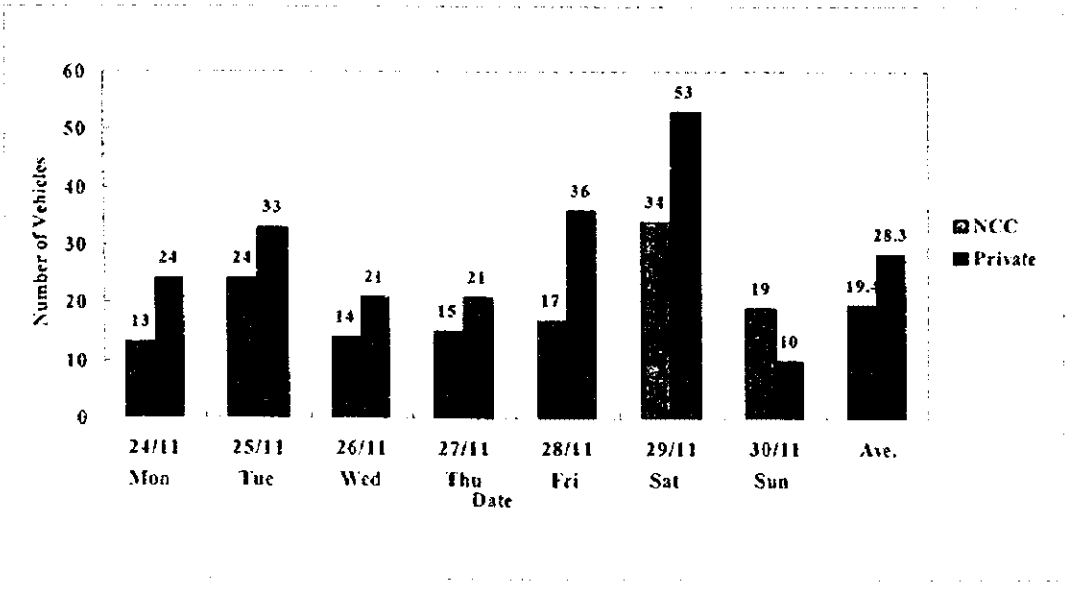


Figure E.1-3 Number of Collection Vehicles Operating in the Second Survey Period

During the survey periods, the largest number of collection vehicles came between 16:00 and 17:00 p.m. and the second largest number was recorded between 13:00 and 14:00 p.m. **Figure E.1-4** shows the accumulated number of vehicles depending on the arrival time at the Dandora site.

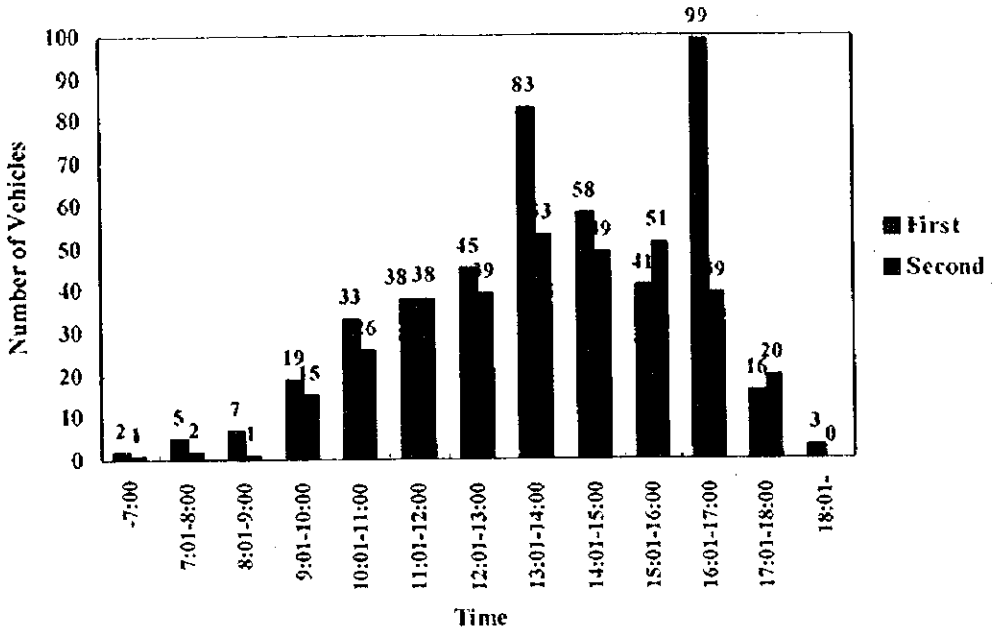


Figure E.1-4 Accumulated Number of Collection Vehicles Depending on the Arrival Time at Dandora Site

1.4.3 Number of Trips of Collection Vehicles

The number of trips of collection vehicles were approximately 1.3 on average; however, NCC vehicles made between 1.6 and 1.8 trips per day and the private ones made only about 1.1 trips per day on the average. The number of daily trips for NCC was not constant in a week; for example, 2.43 trips was recorded on Saturday, 29th of November while only 1.06 trips was made on Friday, 28th of November. A comparison of both survey results is presented in **Table E.1-4**, and **Figures E.1-5** and **E.1-6** show the number of trips of the collection vehicles on a daily basis.

Table E.1-4 Averaged Number of Trips of Collection Vehicles

	NCC	Private	Total
First Survey	1.75	1.07	1.25
Second Survey	1.62	1.15	1.30

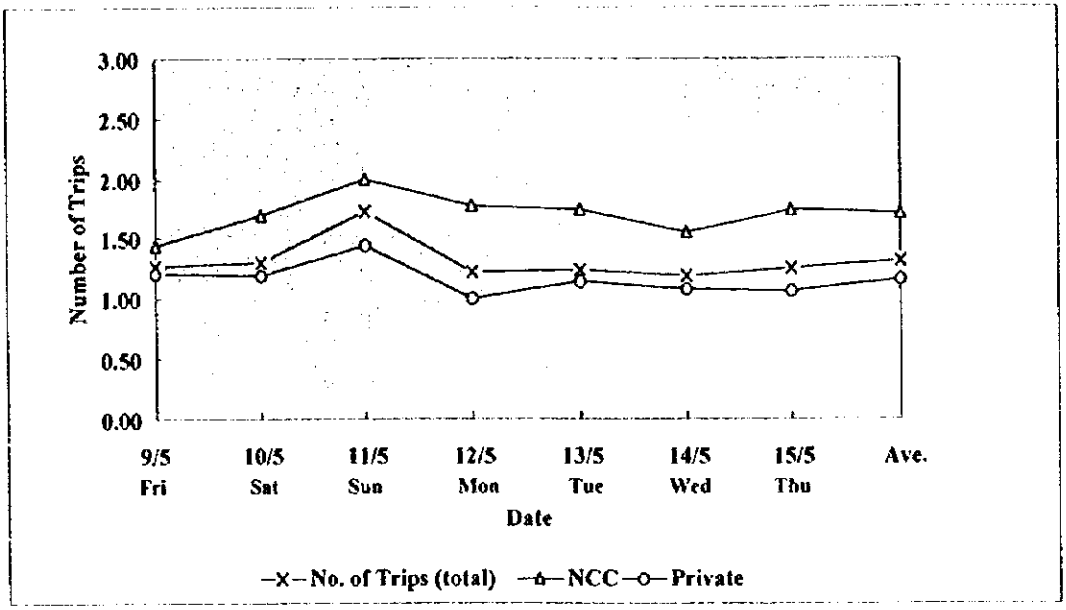


Figure E.1-5 Number of Trips of Collection Vehicles (First Survey)

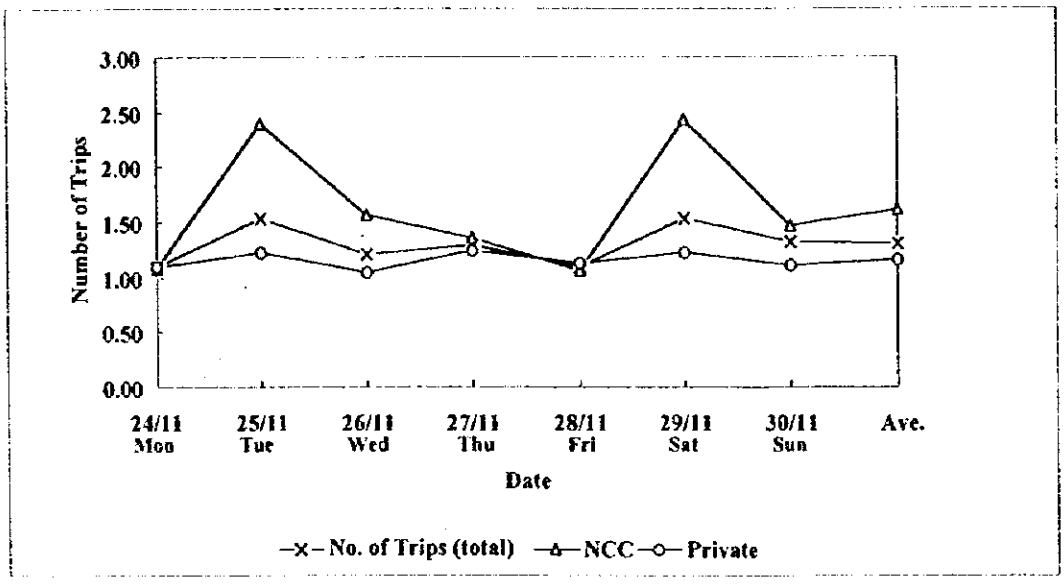


Figure E.1-6 Number of Trips of Collection Vehicles (Second Survey)

1.4.4 Number of Vehicle Crew

The average number of crew of each collection vehicle did not significantly vary between 3 and 4 persons daily as shown in **Table E.1-5** and **Figures E.1-7** and **E.1-8.** The largest number of crew of NCC vehicles was, however, recorded at 8.3 persons on Friday, 9th of May. The average number of crew of NCC and private vehicles were 4.0 and 3.3, respectively.

Table E.1-5 Averaged Number of Vehicle Crew

	NCC	Private	Total
First Survey	4.0	3.2	3.4
Second Survey	4.0	3.3	3.5

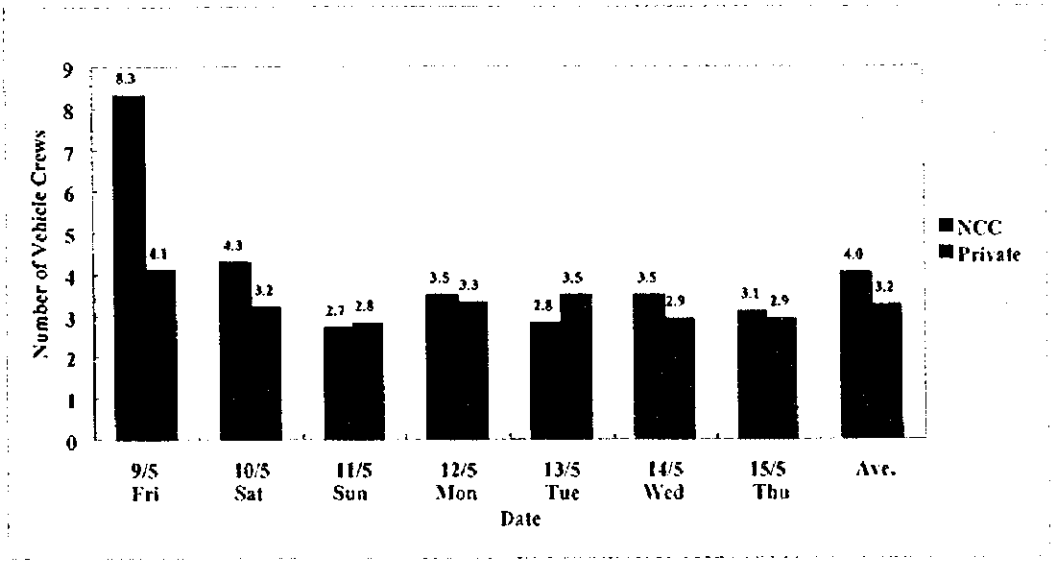


Figure E.1-7 Number of Vehicle Crew (First Survey)

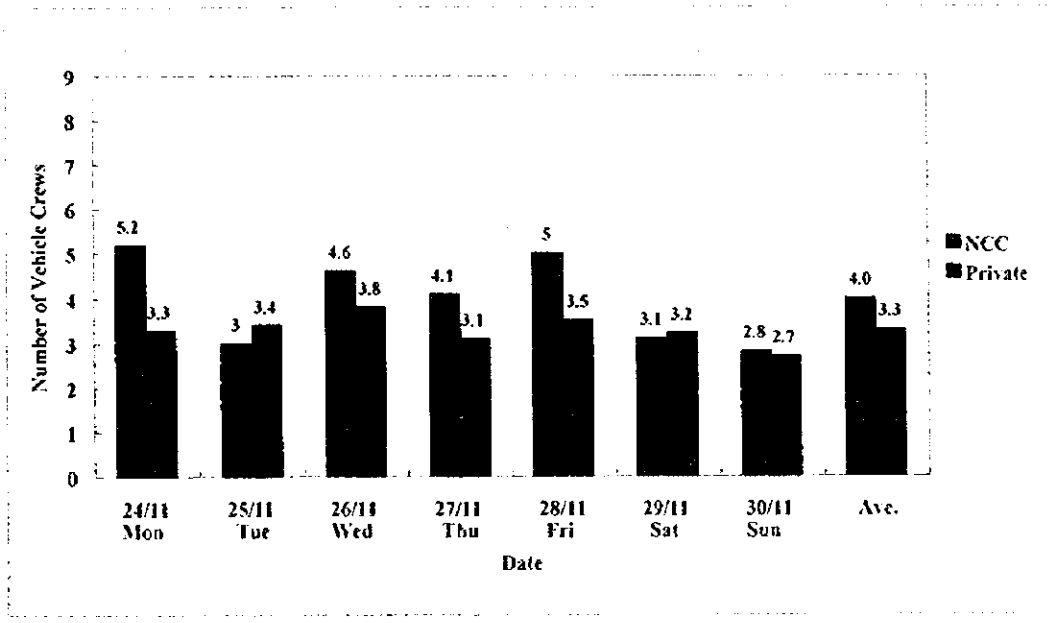


Figure E.1-8 Number of Vehicle Crew (Second Survey)

1.4.5 Arrival Time at the Dandora Disposal Site

Private vehicles always came to the Dandora site earlier than the NCC vehicles; around 6:30 to 9:00 o'clock in the morning. Although the last trip of NCC vehicles showed up earlier compared to the private ones, the survey could not be carried out before 6:30 a.m. and after 6:30 p.m. due to security reasons at the Dandora site. An NCC official informed that a couple of NCC vehicles work at night but the survey did not observe the nighttime operation. The arrival times of each collection vehicle are presented in **Figures E.1-9** and **E.1-10**.

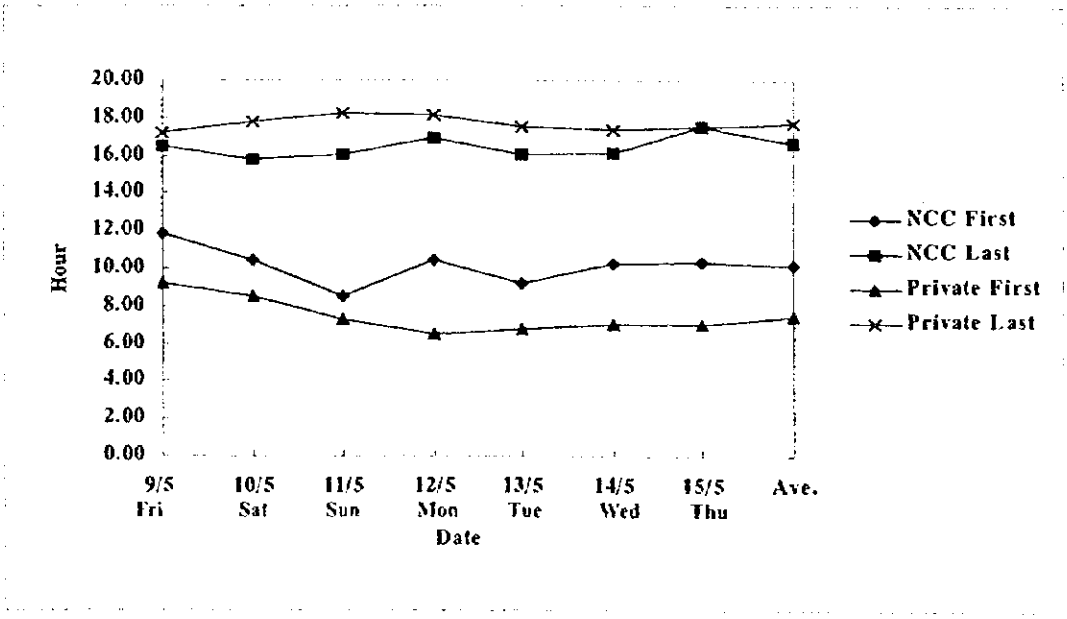


Figure E.1-9 Arrival Time at Dandora Dumpsite (First Survey)

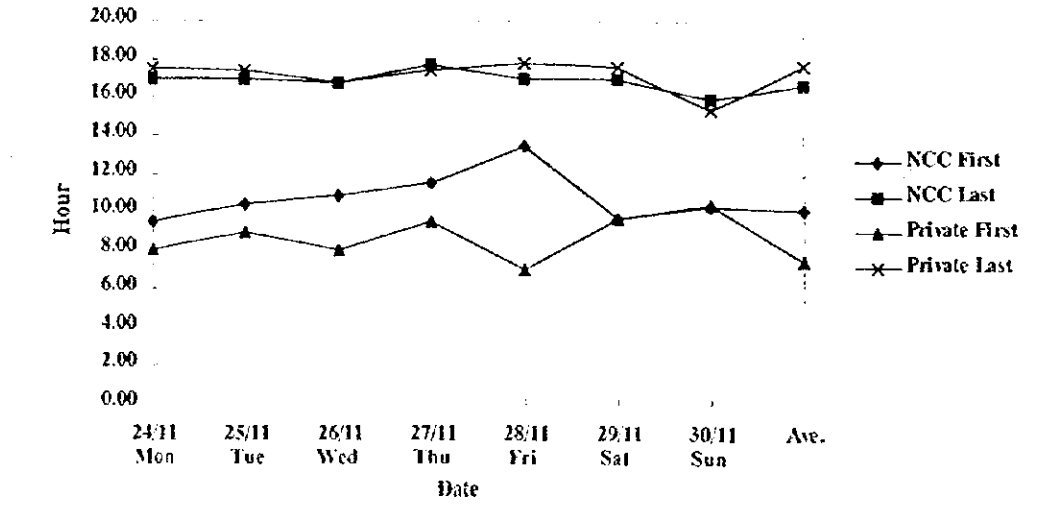


Figure E.1-10 Arrival Time at the Dandora Dumpsite (Second Survey)

1.4.6 Amount of Carried Solid Waste

The amount of waste carried daily by collection vehicles vary as shown in **Figures E.1-11** and **E.1-12**. The maximum and minimum amounts of carried waste were about 370 tons per day and 100 tons per day, respectively. The average amount of solid waste carried to the Dandora site was approximately 200 tons per day, i.e., 35-40% of the total amount or about 70-80 tons were collected by NCC and the remaining 60-65% or 120-130 tons were collected by private companies. A collection vehicle of both NCC and private carry approximately 4 tons of solid waste per trip on the average.

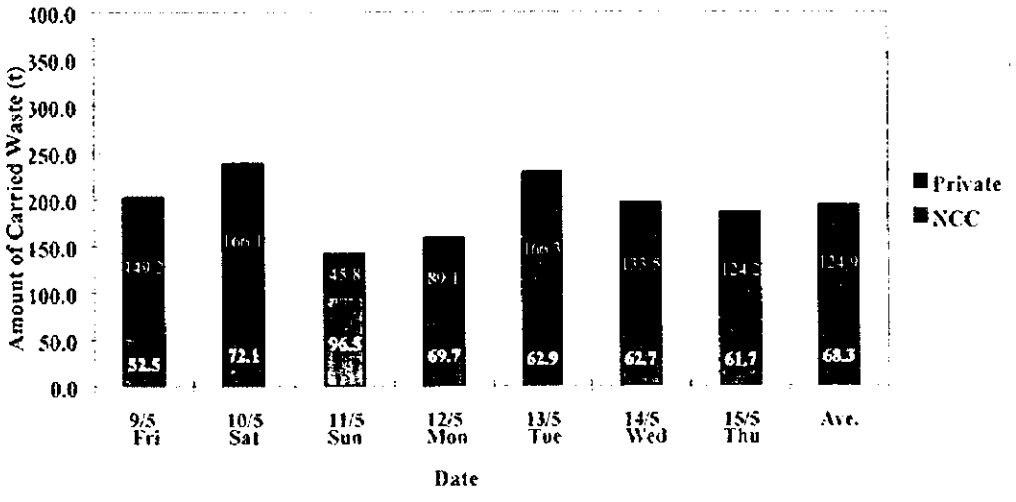


Figure E.1-11 Amount of Carried Solid Waste (First Survey)

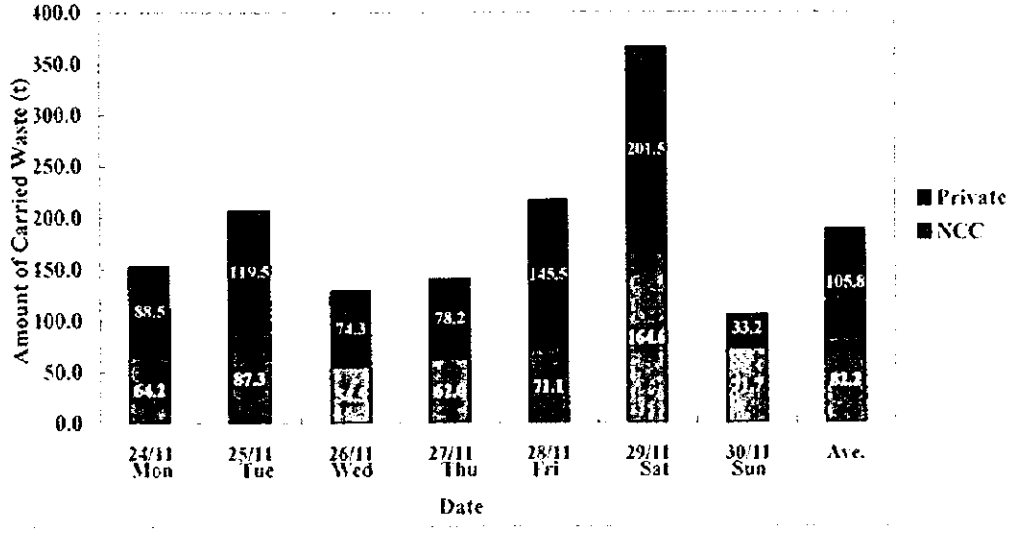


Figure E.1-12 Amount of Carried Solid Waste (Second Survey)

1.4.7 Kind of Solid Waste

About 50-70% of carried solid waste came from residential areas while 14-28% came from industrial areas and 4-8% from roads on average, as shown in **Figures E.1-13** and **E.1-14**. Household waste seemed to be the single largest source of solid waste carried by collection vehicles in the city. Although the proportion of residential waste varied from day to day and was recorded between 40% and 87% in both surveys, collection of waste from industrial areas also fluctuated daily from 6% to 41%. In comparison, residential waste increased in the second survey while market and industrial waste decreased as shown in **Figure E.1-15**. Site observation showed that the waste from residential areas included hospital waste and the waste from industrial areas were mixed with residential waste. This information is thus only showing one of the tendencies of composition of solid waste generated in the city.

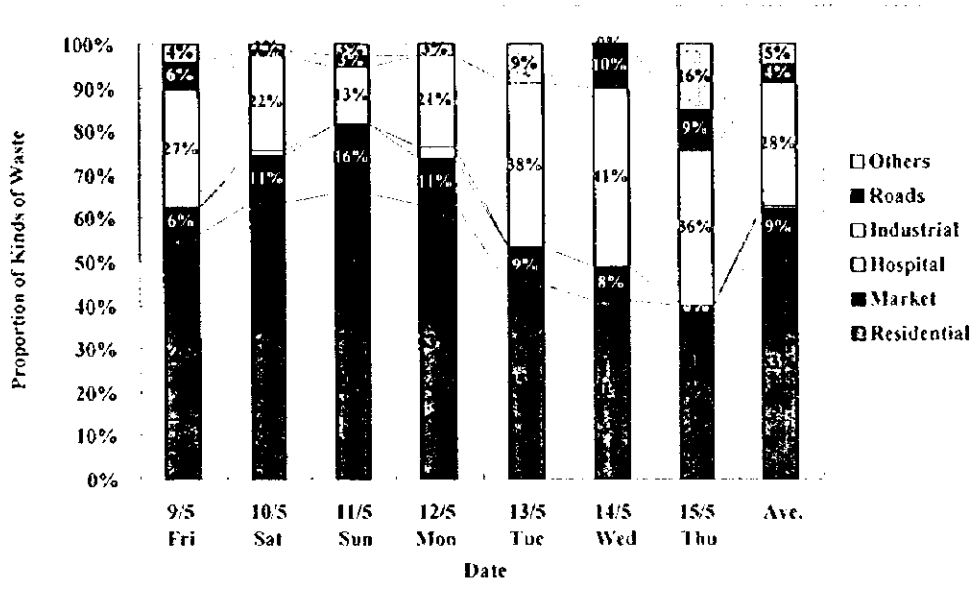
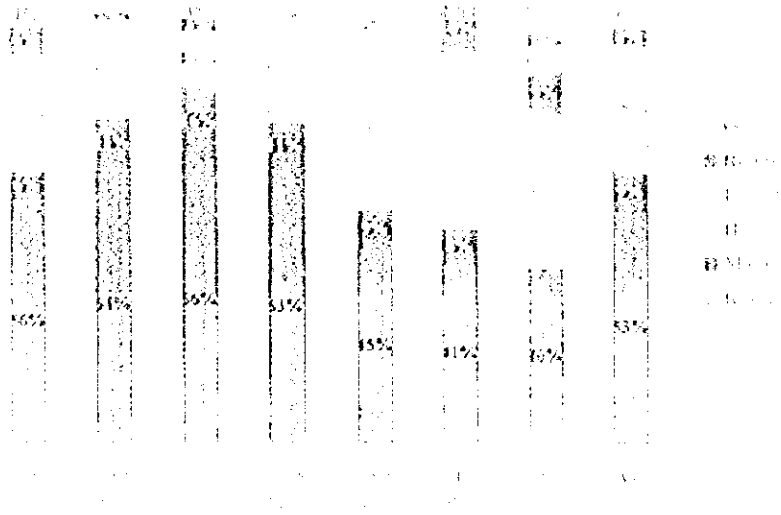


Figure E.1-13 Kind of Solid Waste (Daily Proportion, First Survey)

Figures 1.1-13

Figure 1.1-13



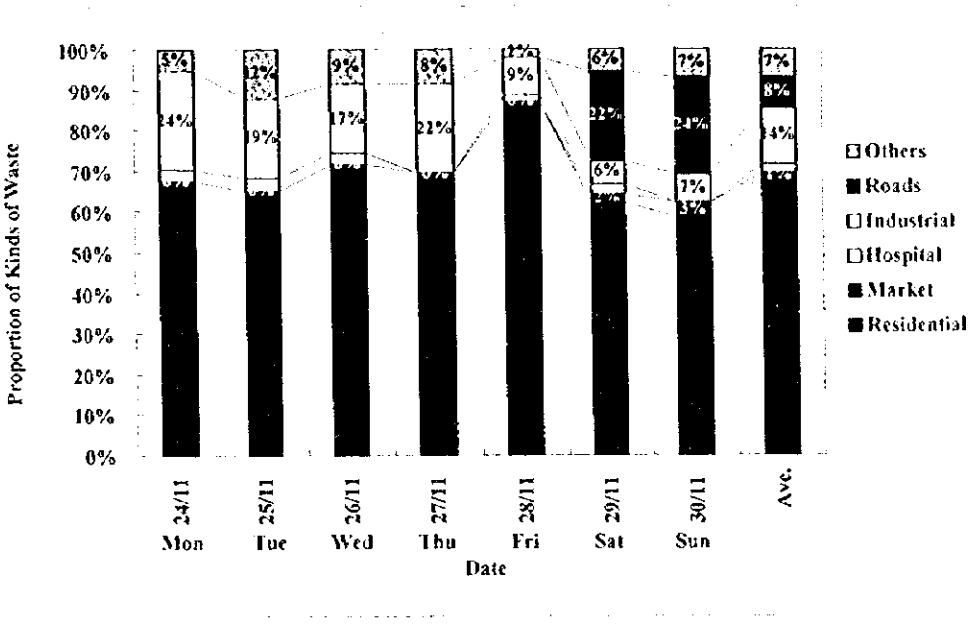


Figure E.1-14 Kind of Solid Waste (Daily Proportion, Second Survey)

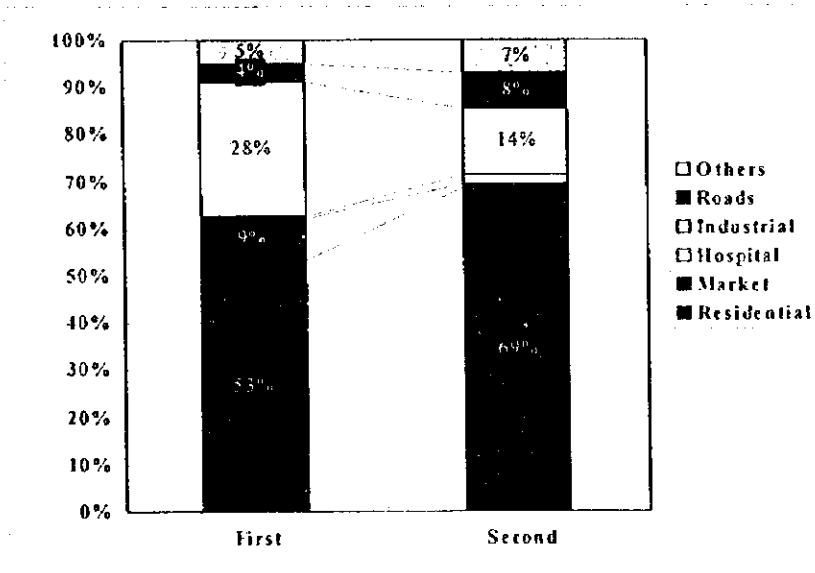
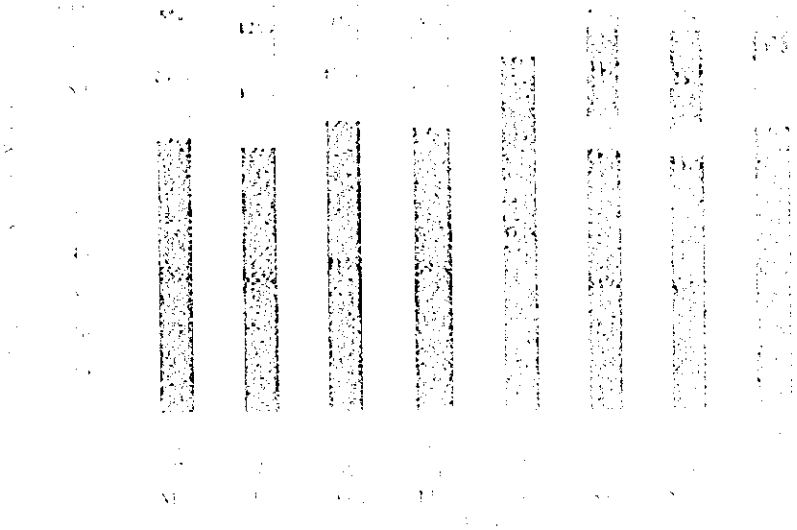
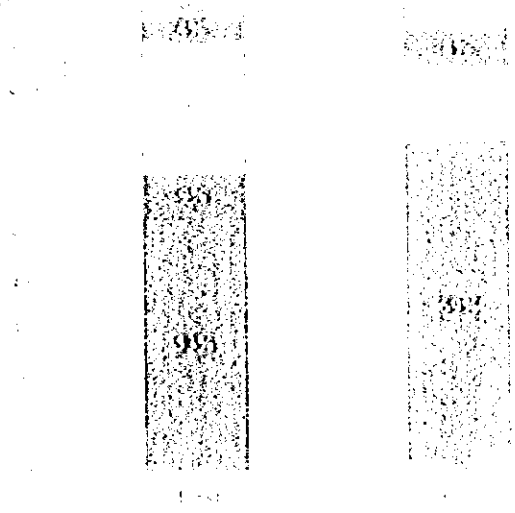


Figure E.1-15 Kind of Solid Waste (Average Proportion)

1.4.8 Kind of Collectors

A wide variety of waste collectors were observed and a total of 54 organisations in the first survey and 55 organisations in the second were identified to be involved in carrying solid waste to the Dandora site. Approximately 60% of all organisations visiting the site came from several industries such as chemical, tannery, foodstuff manufacturers and so on, operating only once or two to three times a week. On average, NCC vehicles carried solid waste 14 to 19 times per day while Bins, one of the largest private collectors in Nairobi, came to the Dandora 8 times a day. The





1.1.8 Kind of Collectors

proportion of the number of arrivals for each organization is shown in **Figure E.1-16**, and a list of the top 10 organisations in the order of number of arrivals is given in **Table E.1-6** below.

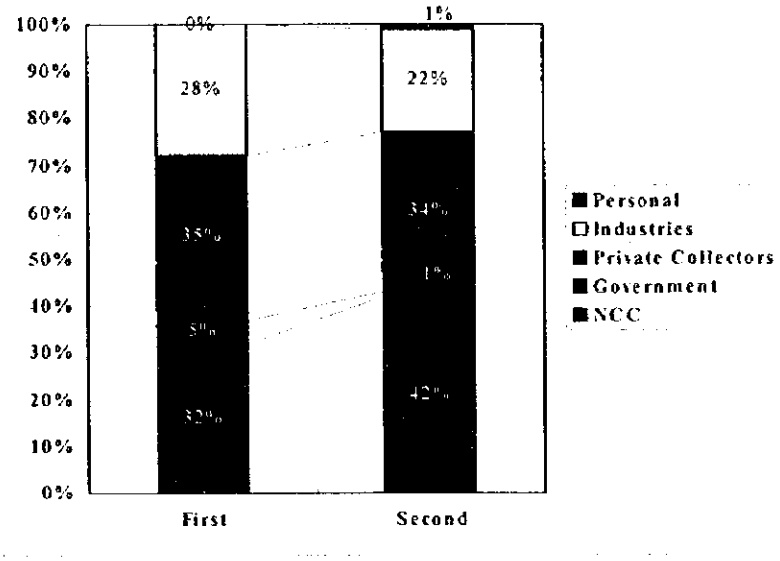


Figure E.1-16 Proportion of Number of Arrivals for Each Collection Vehicle

Table E.1-6 Top Ten Organisations in the Order of Number of Arrivals

No.	Name of Organisation (Classification)			
	First Survey		Second Survey	
1	NCC	28%*	NCC	41%
2	Bins (Private collector: PC)	16%	Bins (Private collector: PC)	17%
3	DRDS (PC)	5%	DRDS (PC)	7%
4	EAI (Industry)	4%	EAI (Industry)	3%
5	NYS	3%	Neighbourhoods Professionals (PC)	3%
6	City Bins (PC)	3%	JKA (Industry)	2%
7	Private (Affiliation unknown)	3%	Kenya Investment (PC)	2%
8	KAPA (Industry)	2%	City Bins (PC)	2%
9	Clean Home (PC)	2%	Camasi Company (PC)	1%
10	Kaniti Tanners (Industry)	2%	Clean Home (PC), KAPA (Industry)	1%

* Figure indicates percentage of arrivals to the total number of arrivals.

1.4.9 Collection Area

The proportion of the number of visits to each district is illustrated in **Figure E.1-17**, and 24% of the total visits for collecting waste in the first survey covered the Southern District including Mugumoini. In the second survey, collection areas in the East and West districts almost doubled those of the first portion instead of considerably decreasing the Central portion due to a private contract. In the first survey, the East, Central, West, Embakasi and North districts have mostly the same proportion to each other, namely, 16%, 16%, 15%, 14% and 13%, respectively. The total number of

places where the collection vehicles had visited to collect waste were 85 in the first survey and 68 in the second. Although the place that had the largest number of visits for collection was the Industrial Area and its percentage to the total is 14% in the first survey, estates in the East and West such as Eastleigh (12%), Madaraka (6%) and Buru Buru (5%) were the major visiting areas in the second. **Table E.1-7** shows a list of top 10 collection areas in the order of number of visits.

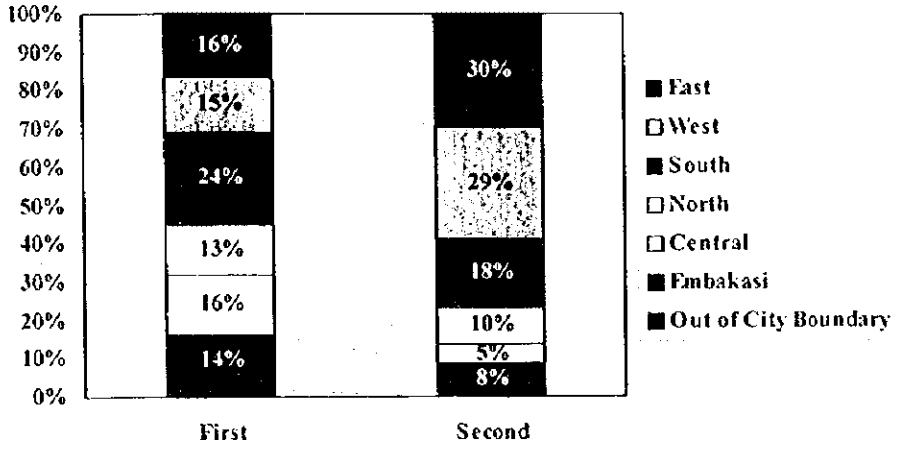


Figure E.1-17 Proportion of Number of Visits for Each District

Table E.1-7 Top Ten Collection Areas in the Order of Number of Visits

No.	Name of Collection Area (District)			
	First Survey		Second Survey	
1	Industrial Area (South)	14%*	Eastleigh (East)	12%
2	Town (Central)	8%	Madaraka (West)	6%
3	Westlands (West)	3%	Buru Buru (East)	5%
4	Umoja (East)	3%	Westlands (West)	5%
5	Buru Buru (East)	3%	Umoja (East)	5%
6	Pumwani (East)	3%	Industrial Area (South)	5%*
7	JKA (South)	3%	Jericho (East)	5%
8	Eastleigh (East)	3%	JKA (South)	5%
9	Athi River (Out of City Boundary)	2%	Makadara (East)	5%
10	City Market (East)	2%	Umoja (Embakasi)	4%

* Figures indicate percentages of visits to the total number of visits.

2. TIME AND MOTION STUDY

2.1 General

The time and motion study of collection vehicles was conducted for 11 days from 16th to 26th of May shortly after the solid waste amount survey was completed

because some of the private company vehicles were not operating everyday. The results were analysed and used for the demarcation of collection area and the calculation of the required number of collection vehicles and collection crew for the improvement of collection efficiency.

2.2 Objective of the Study

The objective of the study was to clarify the present conditions of collection and transportation works and identify the appropriate number and use of collection vehicles by evaluating efficiency/environment of the works.

2.3 Outline of the Study

The study was carried out for vehicles of the following:

(a) NCC (including NYS): approximately 10-15 vehicles
(b) Private companies: approximately 20-25 vehicles

The vehicles were traced from the parking lot and return with recording time spent for separate pieces of work and moving distances. Major items recorded were as follows:

(a) Moving time from the final disposal site (or a collection station) to the first gathering station

(b) Moving speed from the final disposal site (or a collection station) to the first gathering station

(c) Moving time between gathering stations

(d) Moving speed between gathering stations

(e) Working time at a gathering station

(f) Moving time from the final gathering station to the final disposal site

(g) Moving speed from the final gathering station to the final disposal site

Simultaneously, the following items were recorded for all the working vehicles: starting/ending time, number of trips, load volumes/weights, arrival times at the final disposal site, collection routes and number of workers.

2.4 Results of the Study

With the results of the study, time spent for moving and loading solid waste and distance between each collection point and transportation from the parking lot to the first collection point, etc., were calculated for each vehicle traced. The study results are summarised in **Subsections 5.2.1** and **5.2.2** of **Data Book (1)**, and the daily records of time and motion study for each vehicle are as shown in **Subsections 5.2.3 and 5.2.4 of Data Book (2)**. The collection route of each collector is illustrated in **Subsection 5.2.5 of Data Book (1)**.

2.4.1 Operation Time

Total operation time of NCC is mostly the same as that of private companies; in other words, 330 to 416 minutes for NCC and 376 to 402 minutes for private on average which is approximately 6 to 7 hours. However, three major private companies, i.e., Bins (Nairobi) Services Ltd., City Bins and Domestic Refuse (K) Disposal Ltd. (usually called as "DRDS"), work longer than NCC. The average operation time for those three was calculated at 468 minutes (approximately 8 hours). The total operation time for each organisation is shown in **Figure E.2-1**.

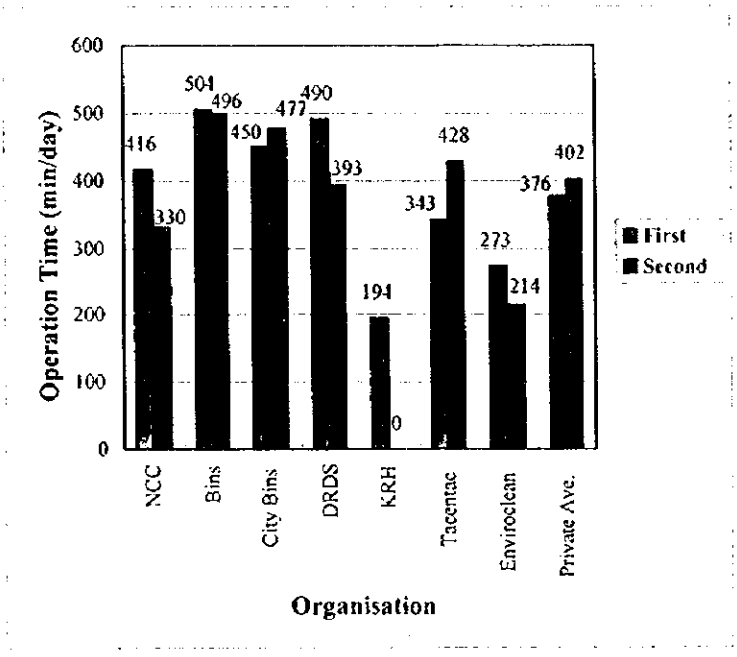


Figure E.2-1 Total Operation Time for Collection/Transportation Work

The proportions of time spent for each activity per trip such as collection, transportation and idling, are shown in **Figures E.2-2** and **E.2-3** below. According to these figures, NCC spent a longer time for transportation than collection while the private companies take a longer time for collection than transportation.

The time for each activity is as shown in **Figures E.2-4** to **E.2-7**. Focusing on collection time in particular, NCC had only about 80 minutes while the privates spent 180 to 200 minutes which was more than twice as much as that of NCC **(Figure E.2-4)**. Also, NCC has 11 to 22 minutes for idling in one trip on average, which is less than the privates **(Figure E.2-7)**.

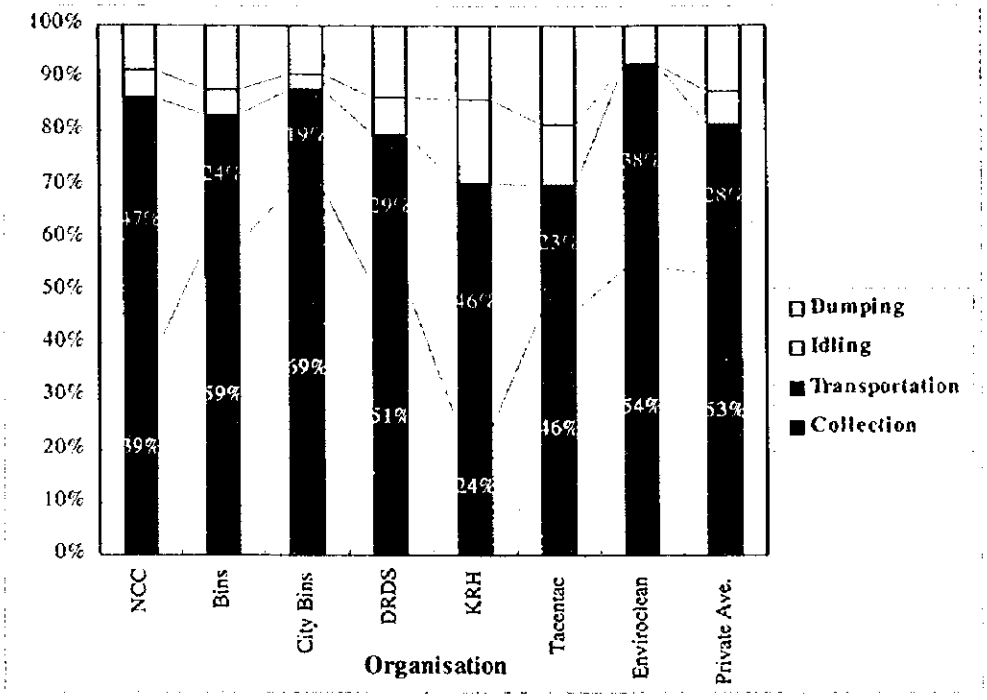


Figure E.2-2 Proportion of Time Spent for Each Activity to Total Operation Time (First Survey)

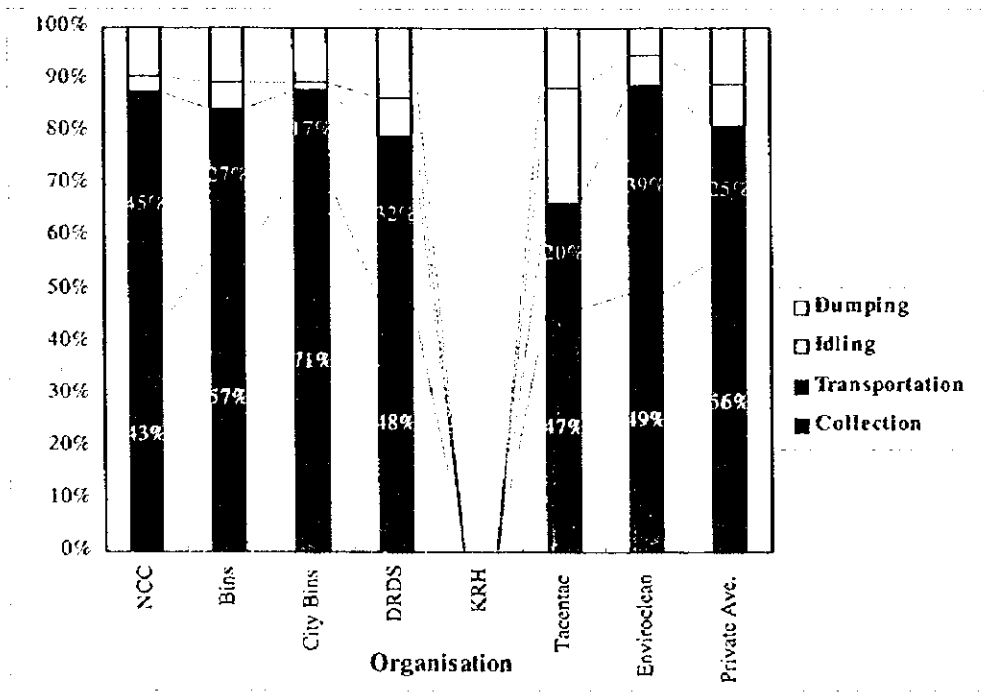


Figure E.2-3 Proportion of Time Spent for Each Activity to Total Operation Time (Second Survey)

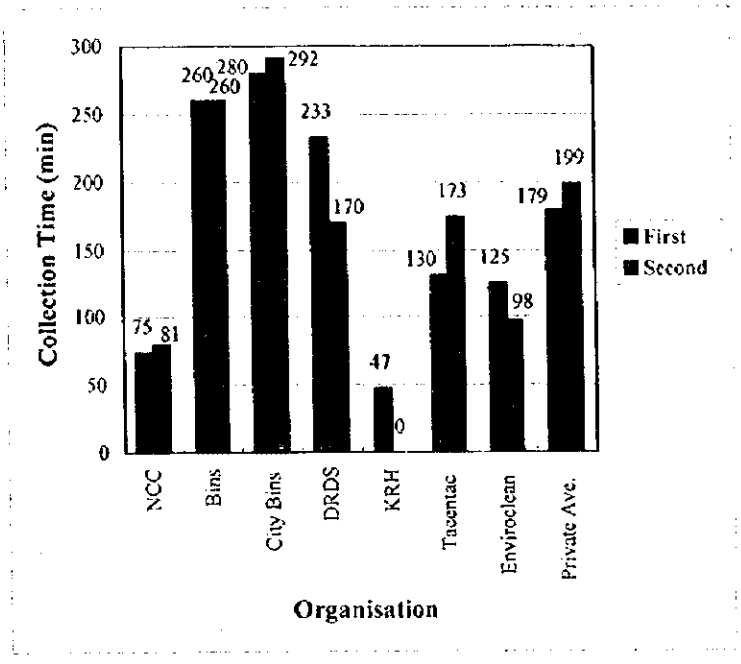


Figure E.2-4 Collection Time in Collection/Transportation Work

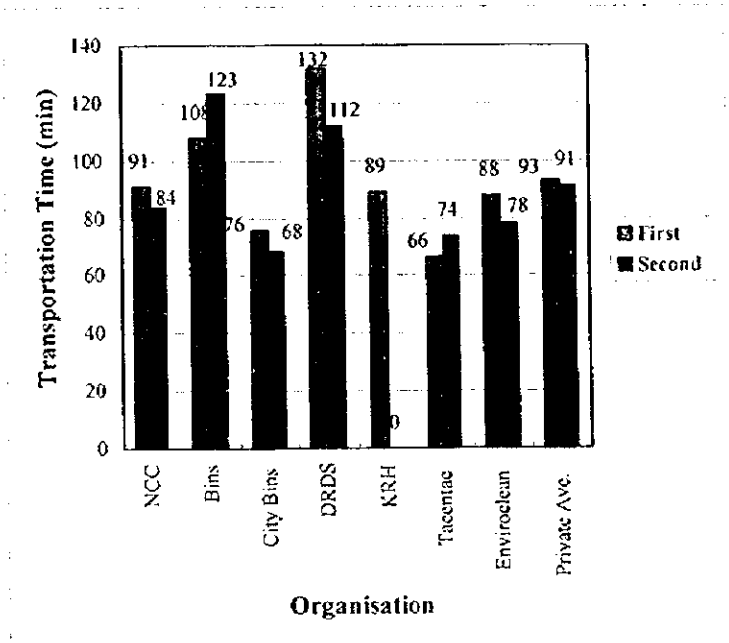


Figure E.2-5 Transportation Time in Collection/Transportation Work

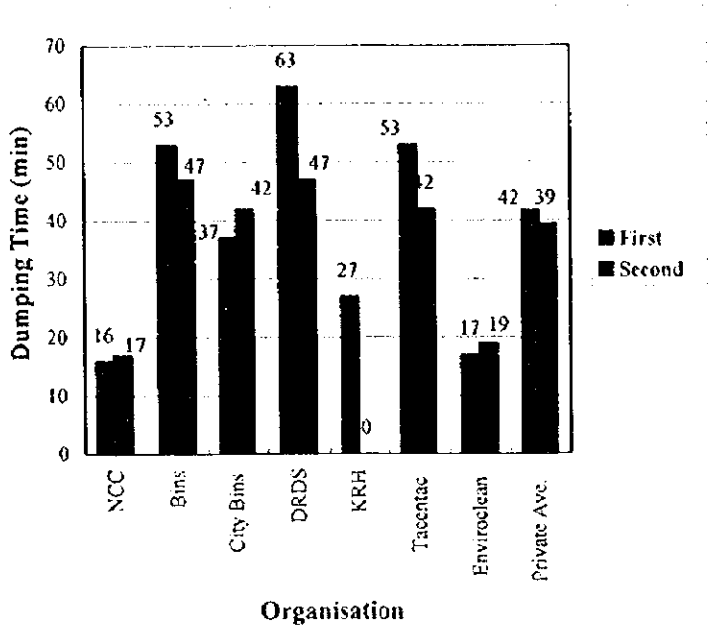


Figure E.2-6 Dumping Time in Collection/Transportation Work

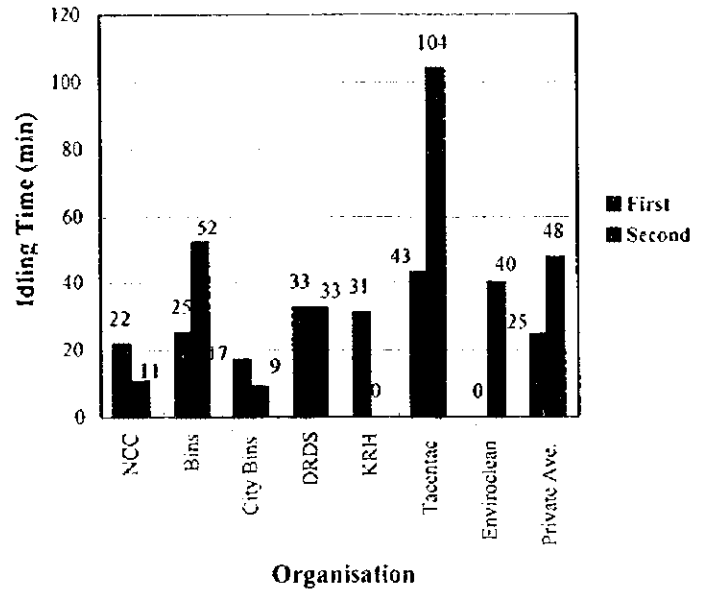


Figure E.2-7 Idling Time in Collection/Transportation Work

2.4.2 Starting/Closing Time

Starting time from the workshop of almost all organisations in the first survey was between 8 to 9 o'clock in the morning while the ending time varied. In the second survey, the starting time of NCC was later than that of some private companies, and the time was around 9:30 am. The ending time of NCC in the second survey was

nearly 15:00 p.m. although some of the private companies worked until 16:00 to 18:00 p.m. The starting and ending time for each organisation in both surveys are as shown in **Figure E.2-8** below.

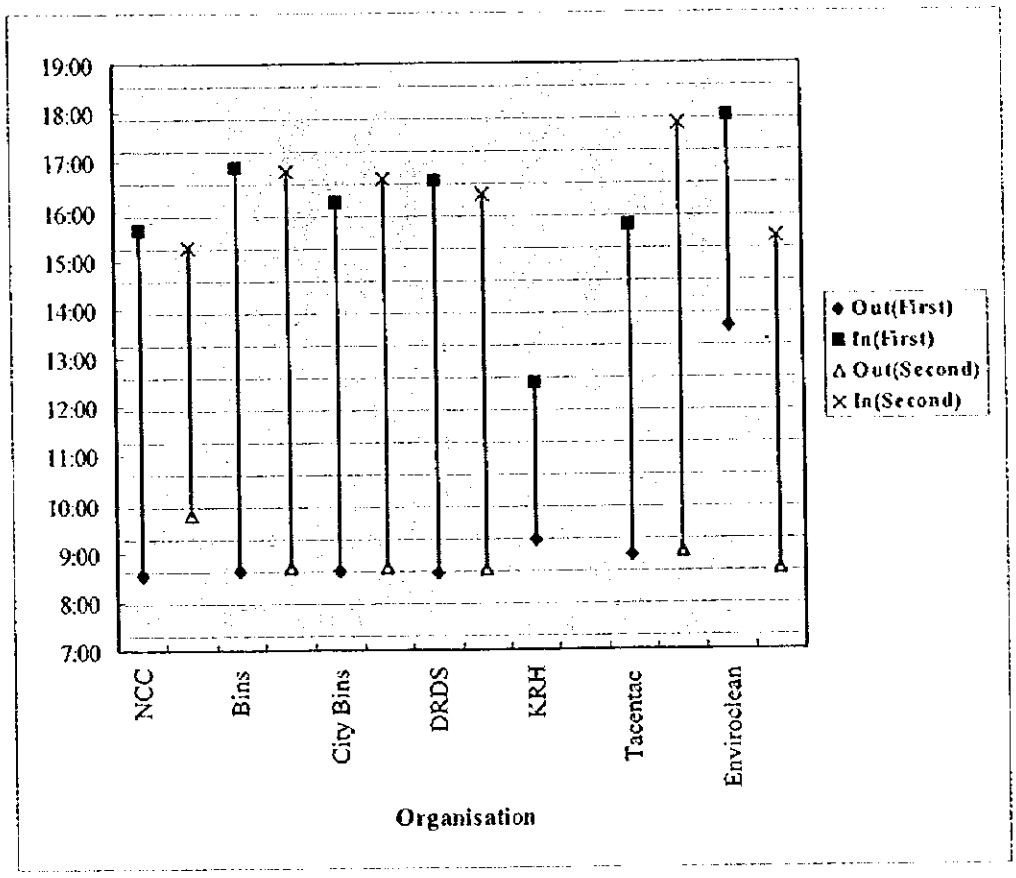


Figure E.2-8 Starting/EndingTime in Collection/Transportation Work

2.4.3 Operation Distance

The average distance for daily collection and transportation operation was from 56 to 78 km for NCC although private collectors operate on approximately 56 km per day on average as shown in **Figure E.2-9**. City Bins whose records show about 80 km was the longest transporter among the major waste collectors in Nairobi.

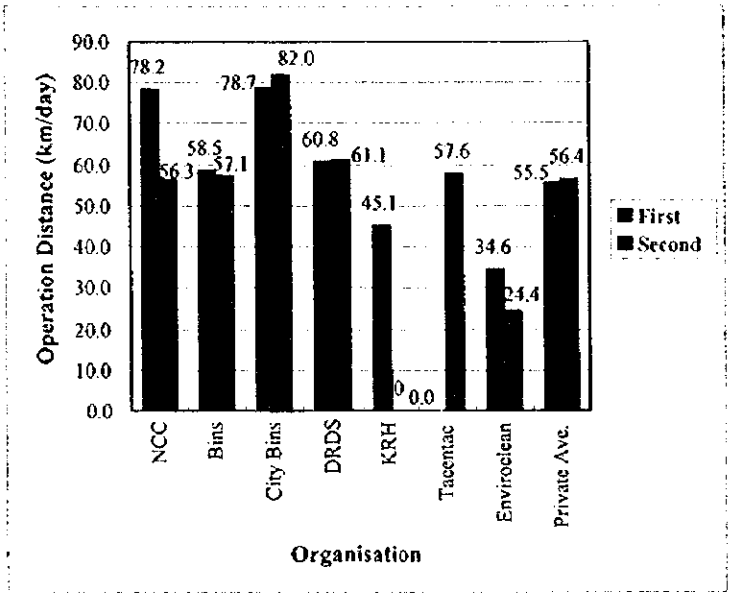


Figure E.2-9 Daily Operation Distance for Collection/Transportation Work

The average distance per trip is also presented in **Figures E.2-10** and **E.2-11**. While NCC travels about 30 to 35 km in a trip, the private collectors, especially the three major companies, i.e., Bins, City Bins and DRDS, have more than 50 km per trip.

Meanwhile, NCC is less involved in collection work in terms of mileage since the collection system by NCC primarily depends on a station type collection.

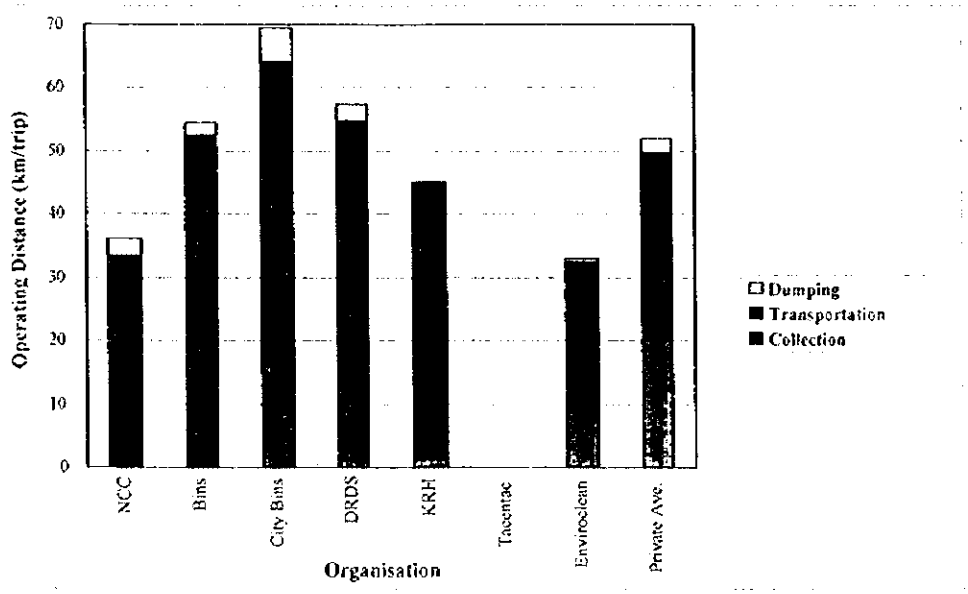


Figure E.2-10 Daily Operation Distance for Collection/Transportation Work (First Survey)
(Note: Data of Tacentac is not available due to insufficient original records.)

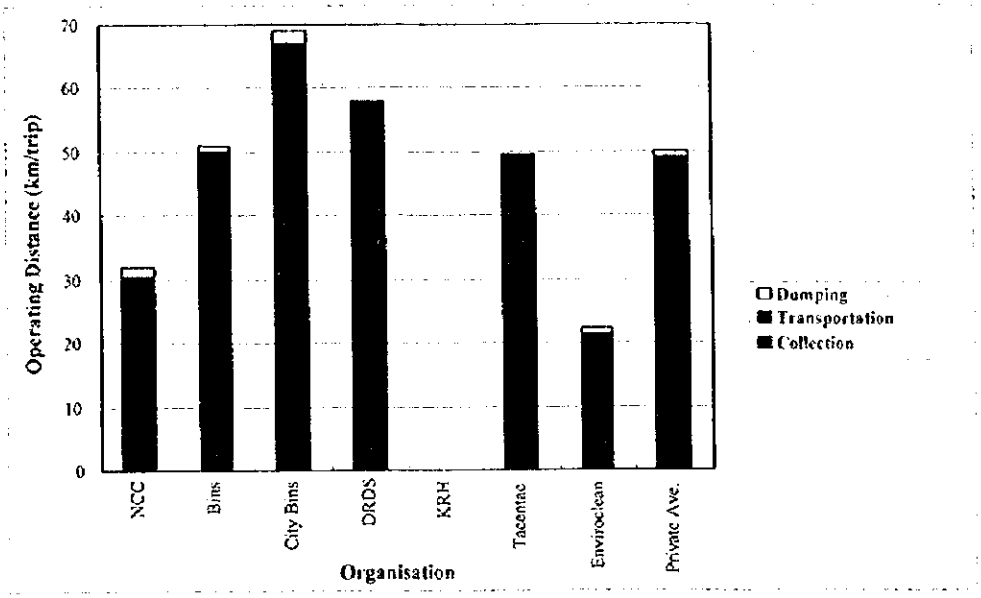


Figure E.2-11 Daily Operation Distance for Collection/Transportation Work (Second Survey)
(Note: Data of KRH is not available due to non-approval of field survey by KRH.)

2.4.4 Transportation Speed

From the result of time and motion study, no big difference was observed between NCC and the private companies in terms of average transportation speed in a trip. The average speed was calculated at about 21-22 km/hr, as shown in **Figure E.2-12.**

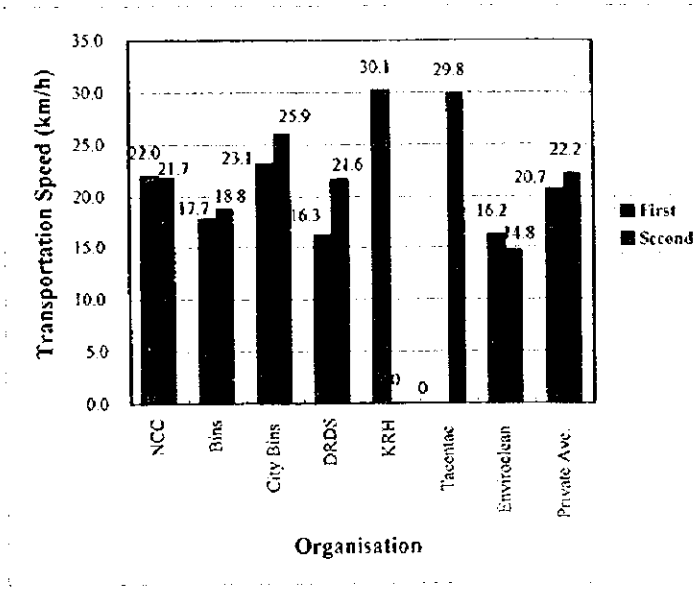


Figure E.2-12 Transportation Speed for Collection/Transportation Work
(Note: Data of Tacentac in the first survey and KRH in the second survey are not available due to insufficient original records.)

2.4.5 Number of Trips

The average number of trips per day for each collection vehicle are 1.8 to 2.2 trips for NCC and 1.2 to 1.5 trips for private collectors, as shown in **Figure E.2-13.** It is considered that this larger number of trips for NCC resulted from the different types of collection method between NCC and private companies; that is, NCC depends on collecting waste from some sort of stations such as communal containers and heaps of waste accumulated in open spaces while the private collectors mainly drop in each household or collection points in condominiums to pick up the waste.

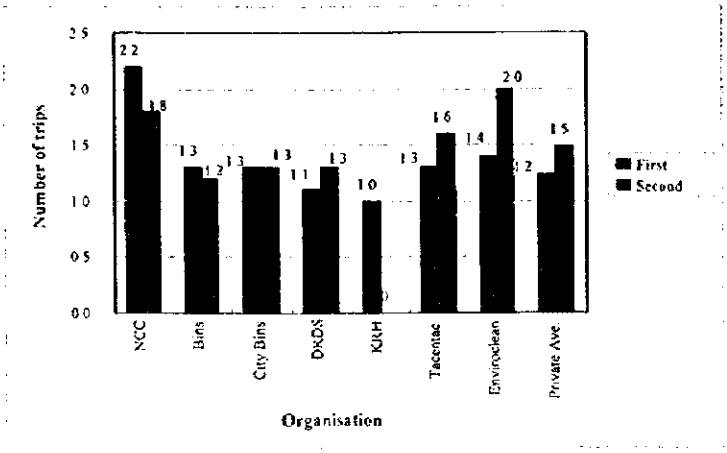


Figure E.2-13 Number of Trips a Day for Collection/Transportation Work

2.4.6 Number of Crew

The average number of crew for each NCC collection vehicle was 4.5 to 5.1 while the private companies' average was 3.9 to 4.1. This crew number of NCC included one driver so that the number of workers for loading waste was 3 to 4 people, which was slightly larger than the crew of private companies.

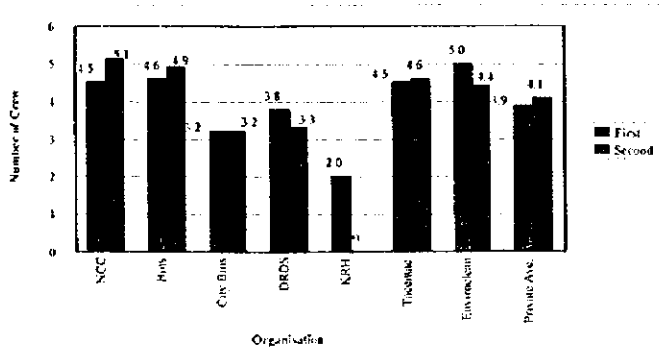


Figure E.2-14 Number of Crew a Day for Collection/Transportation Work

2.4.7 Collection Area

Figures E.2-15 and **E.2-16** present the proportion of collection area in both first and second surveys. The study results show that NCC collected waste mainly from the

Central and Northern Districts in the first survey. The collected waste from the two districts was about 70% of the total. In the second survey, NCC had started a contract with a private company for waste collection services in the central business district (CBD). Therefore, the collection proportion from the Central District remarkably decreased from 38% to 10% between the two surveys. Release from the burden of waste collection from the Central district resulted in an almost equal level of service for every District.

On the other hand, the private collectors mostly collect waste from the Western District where many high income residents live. **Figures E.2-17** to **E.2-18** illustrate the frequency of collection by location. In the first survey, NCC focused on "Starehe" in the Central District although the private companies visited "Kilimani" in the Western District many times. In the second survey, NCC collected waste not only from the central area but also the West and Embakasi districts, while the private companies did not make a big difference as to location between the two surveys. The second survey results are shown in **Figures E.2-19** and **E.2-20**.

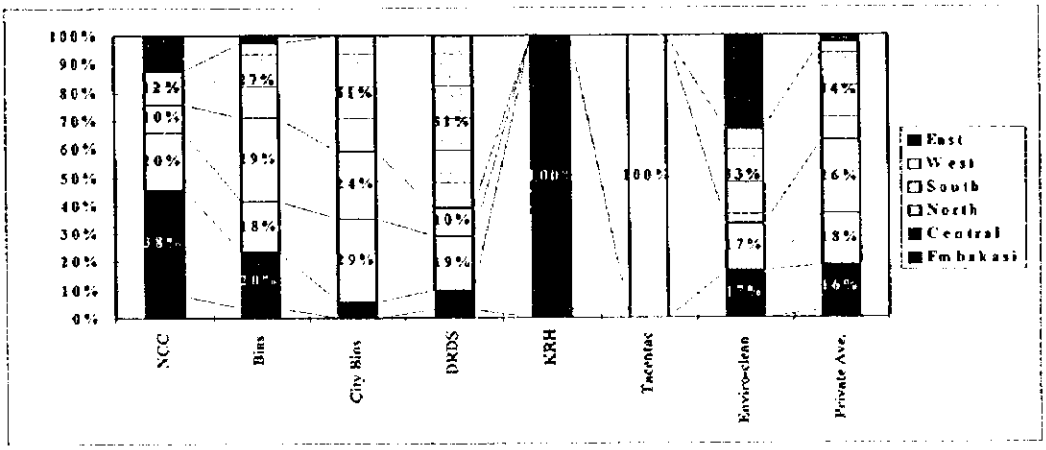


Figure E.2-15 Proportion of Collection Area (First Survey)
(Note: Numbers in the above figure show percentages of each district.)

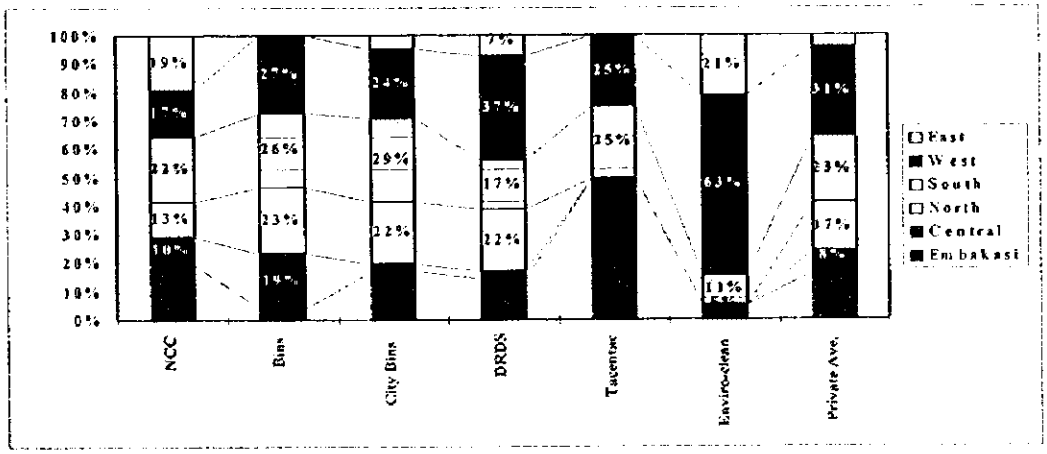


Figure E.2-16 Proportion of Collection Area (Second Survey)
(Note: Numbers in the above figure show percentages of each district.)

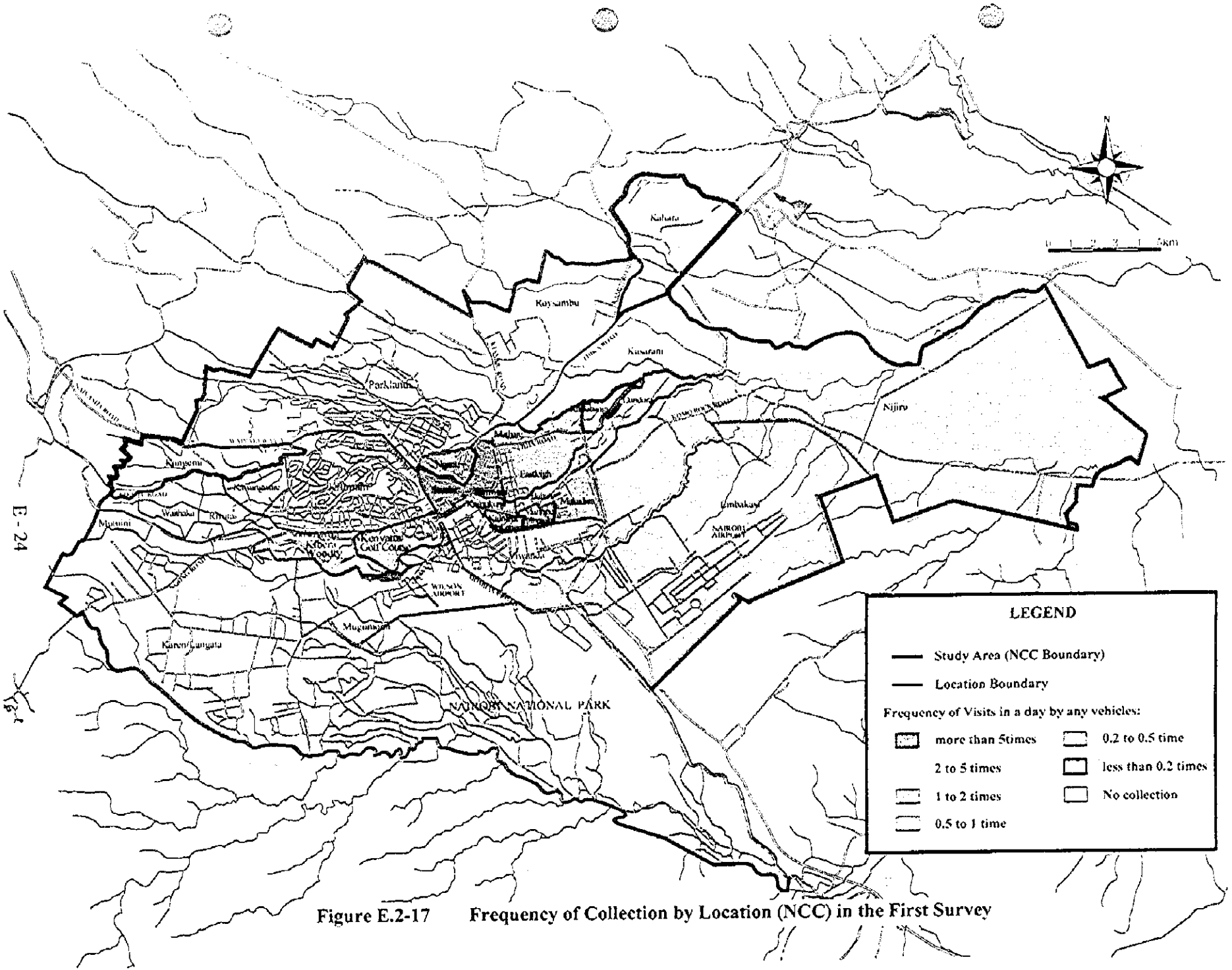


Figure E.2-17 Frequency of Collection by Location (NCC) in the First Survey

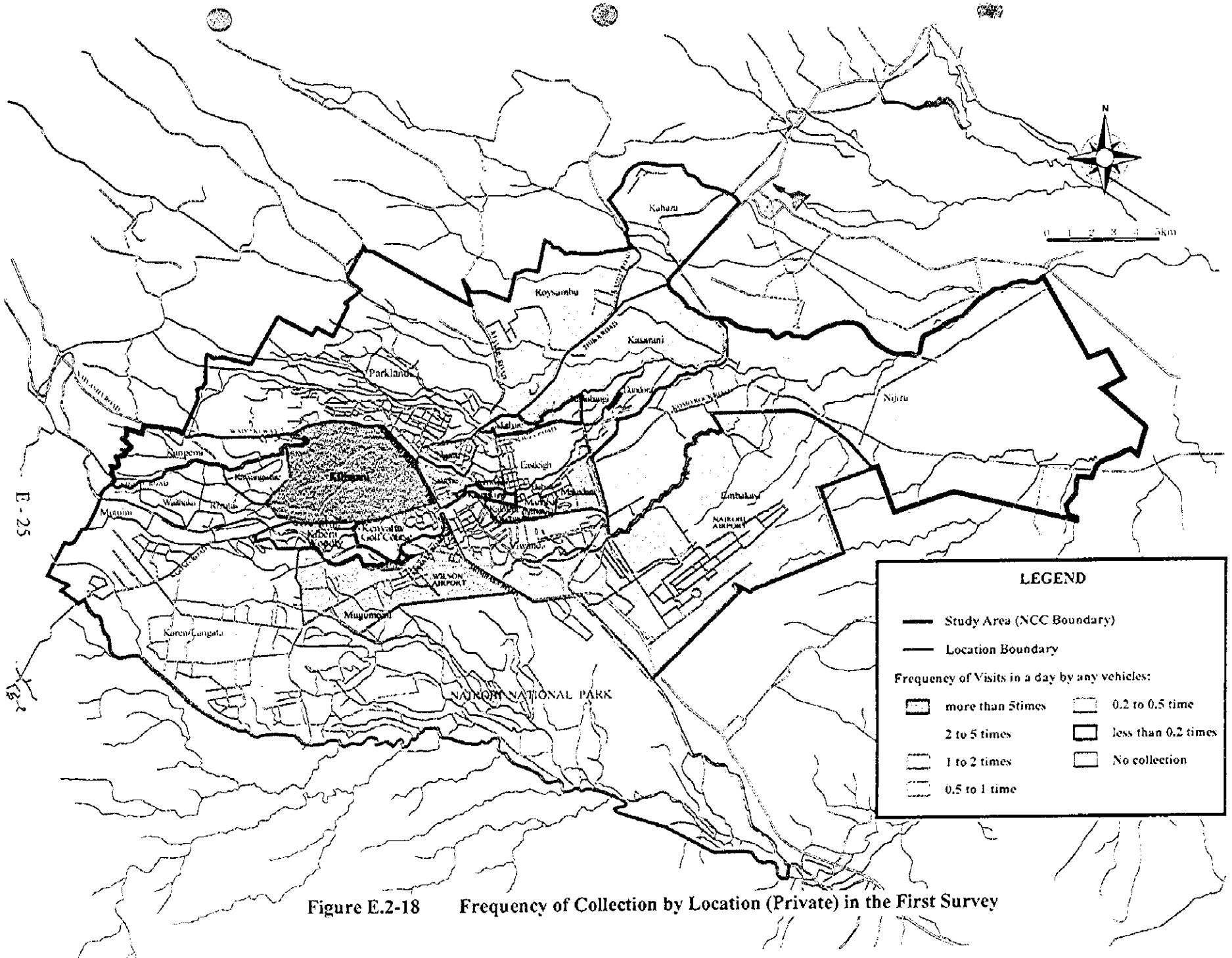


Figure E.2-18 Frequency of Collection by Location (Private) in the First Survey

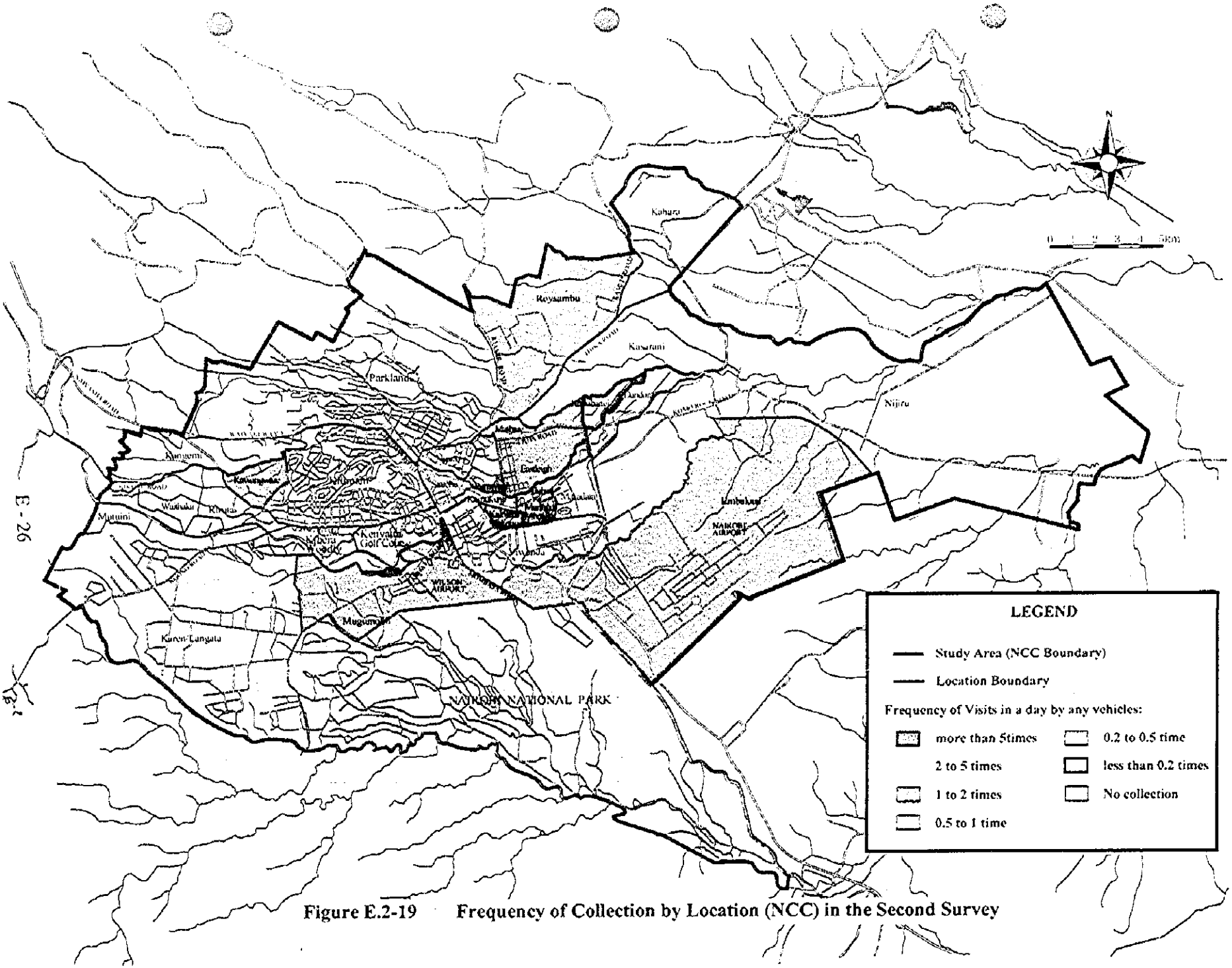


Figure E.2-19 Frequency of Collection by Location (NCC) in the Second Survey

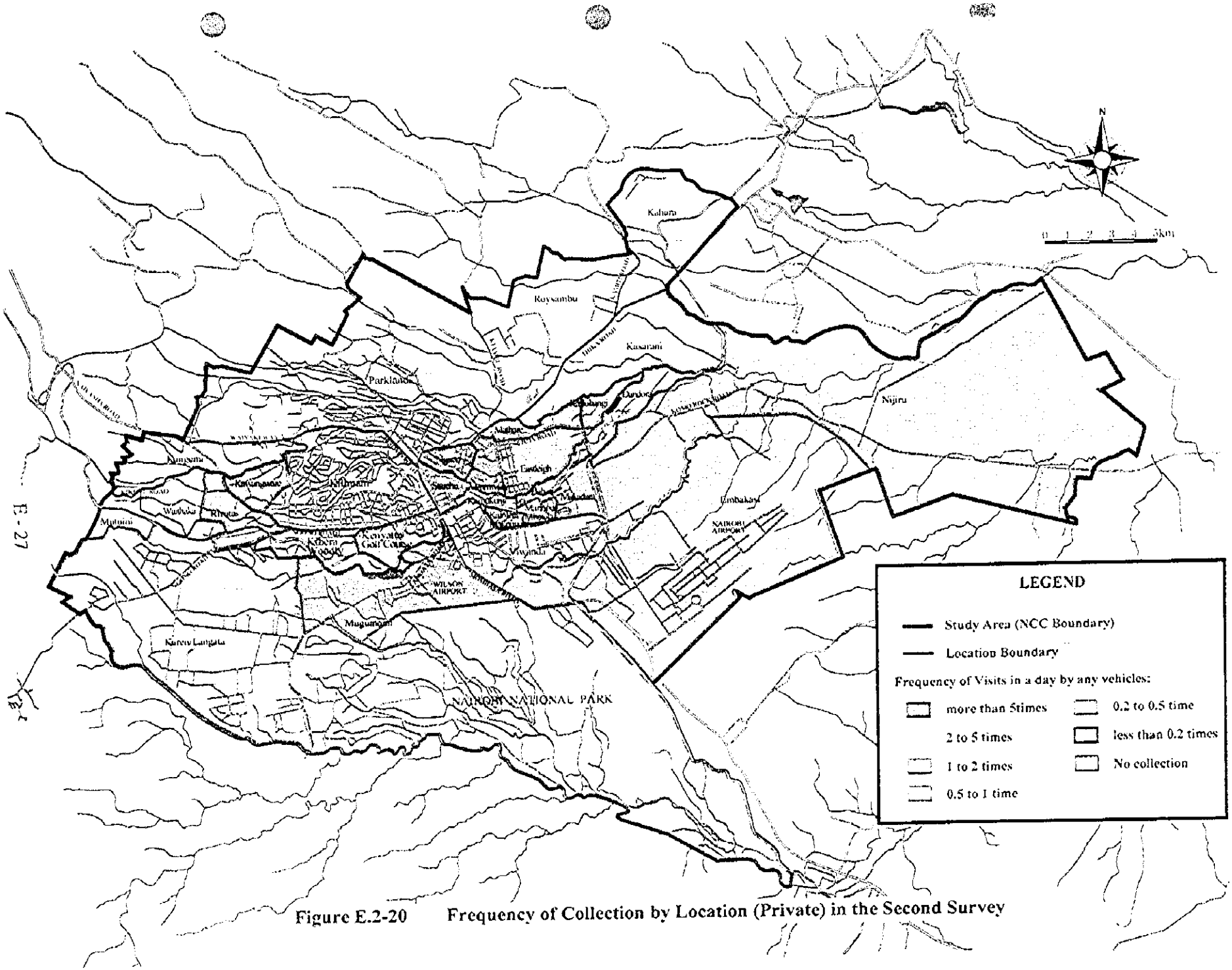


Figure E.2-20 Frequency of Collection by Location (Private) in the Second Survey

2.4.8 Collection Method

There are two types of collection methods prevailing in Nairobi: station type and door-to-door type. **Figures E.2-21** and **E.2-22** show the distribution of the two methods. Although the proportion of station collection by the private companies is relatively lower than that of the station method except for the case of Enviroclean, about 90% of the collection by NCC depends on the station type.

The number of collection points recorded in the first and second surveys are presented in **Figure E.2-23**. This figure clearly shows that NCC depends mainly on station type of collection since the number of collection points are approximately 3 to 4 while those of the privates are about 22 on average.

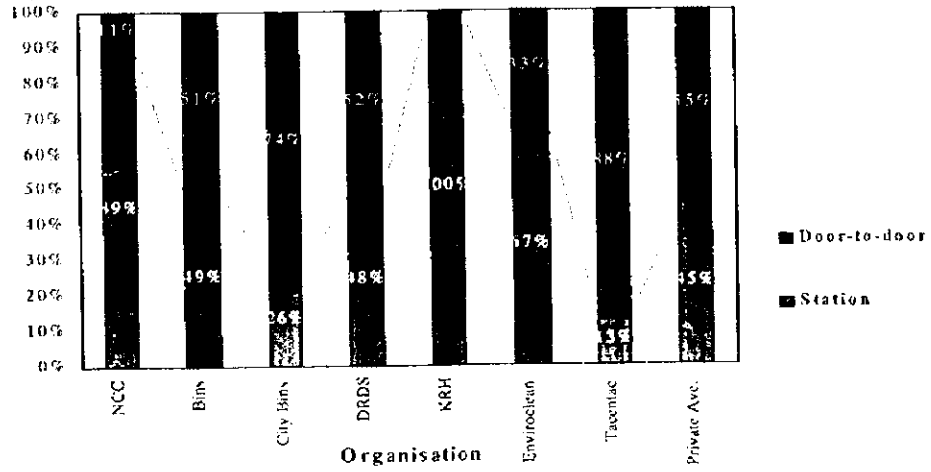


Figure E.2-21 Proportion of Collection Method for Each Organisation (First Survey)

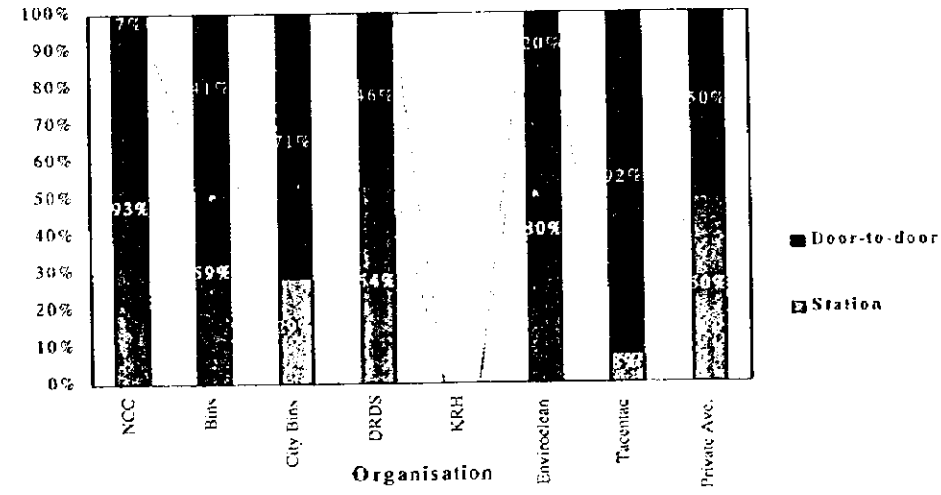


Figure E.2-22 Proportion of Collection Method for Each Organisation (Second Survey)

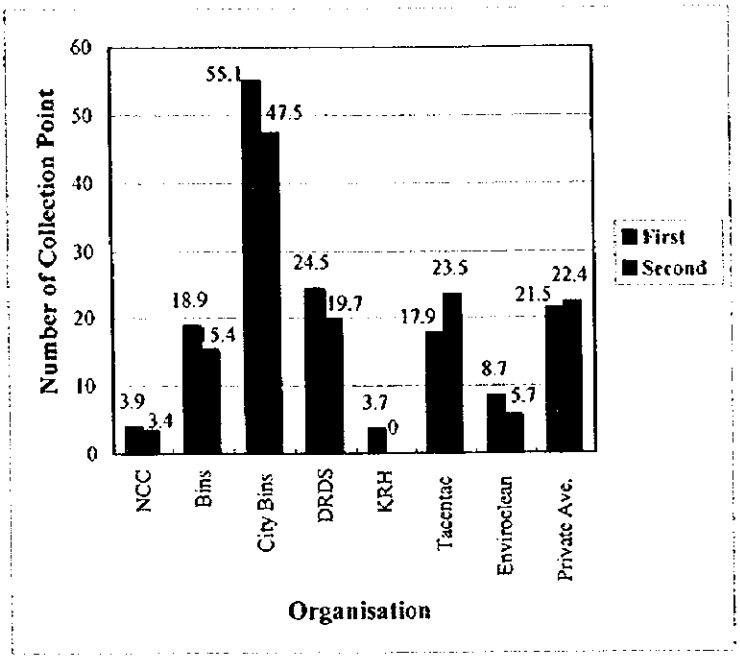


Figure E.2-23 Number of Collection Points for Each Organisation

3. SUMMARY OF SURVEY FINDINGS

3.1 General

This section describes the major findings of the first and second field waste amount, time and motion surveys conducted in Kenya. The findings show the daily operation of NCC and private collection vehicles.

3.2 Major Findings

3.2.1 Collection Method

Collection methods in Nairobi are primarily classified into the following two types:

(a) Station type collection
(b) Door-to-door type collection

The results of the time and motion study show that distributions of the station type are 91% for NCC and 48% for private, while those of the door-to-door type are 9% for NCC and 52% for private, as shown in **Figure E.3-1** below. This clearly shows that NCC depends mainly on the station type collection.

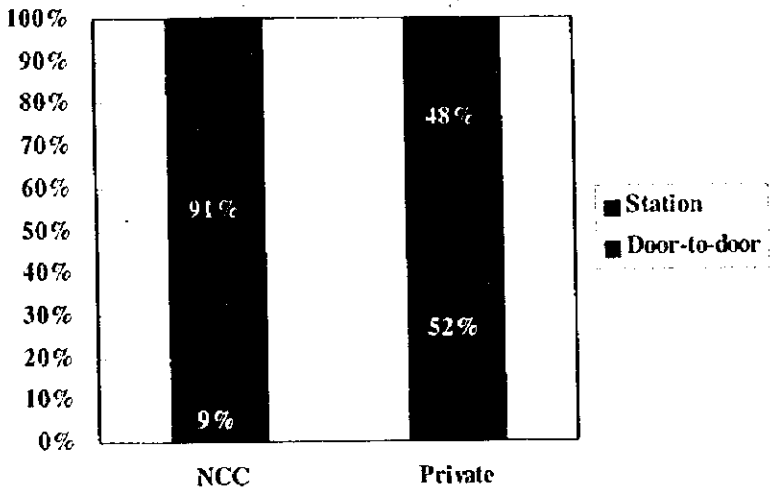


Figure E.3-1 Proportion of Station and Door-to-Door Types of Collection
(Source: *Time and Motion Study*, JICA Study Team)

In addition, the station type collection is used by NCC mainly for commercial and middle and low income residential areas. Due to lack of collection vehicles, it is much easier and more efficient to collect waste from the edge of alleys and in open derelict spaces rather than have collectors drop in each household. The station type, according to site observation, is being used by private companies for waste collection from the commercial area and flats or housing complexes where a large amount of wastes are generated.

On the other hand, the door-to-door type collection is widely used by private collectors especially in high income residential areas, because almost all high income residents are living in separate houses where it is more convenient for waste collection on a contract basis. Also, by the door-to-door type, private companies can easily collect the waste charge from each household based on the contract.

3.2.2 Solid Waste Collection

(1) Amount of Solid Waste Collected

The solid waste amount survey shows that the average amount of solid waste carried by collection vehicles is 195 tons per day. Some 40% of the total amount, i.e., about 80 tons are collected daily by NCC and the remaining 60%, i.e., 115 tons are collected by private companies. The same survey shows that a collection vehicle of either the NCC or a private company carries approximately 4 tons of solid waste per trip on average.

(2) Amount of Solid Waste Collected from the CBD Area

According to the data submitted by a private collector, Kenya Refuse Handlers (KRH), to the Cleansing Section of DoE, the amount of solid waste collected from the Central Business District (CBD) area was 557 tons per day, as shown in **Table-E.3-1**. However, this figure seems to be unrealistic because the

tonnage carried per trip was 9.4 tons on average despite the result of the waste amount survey which gave the average weight of carried waste at generally 2 to 3 tons per trip.

It was also observed that KRH either did not have any weigh bridge or tried to weigh somewhere. In addition, KRH refused to be subjected to the waste amount and time and motion study, so that no data were collected on its daily operation. Thus, the data presented for KRH have to be revised on the assumption that the recorded tonnage was volume of carried waste and not the weight. The averaged carried waste is estimated at 167 tons per day. This estimation is almost double of the waste amount collected by the NCC.

(3) Total Amount of Solid Waste Collected

Combining the above two estimates, the average amount of solid waste carried by collection vehicles is approximately 360 tons per day that is about 25% of total amount of waste generated in the city. In the first field survey, the carried waste amount was estimated at 200 tons per day. This result shows a considerable increase of waste carried in the city after a contract for waste collection was started in the CBD area.

NCC collected 22% of the total amount and privates, 32%. The contract in the CBD has the largest part of waste amount collected in the city, i.e., 46%, as shown in **Figure E.3-2.**

Table E.3-1 Amount of Solid Waste Collected from the CBD Area

Date	Tonnage carried by own vehicle	Tonnage carried by own vehicle	Tonnage carried per day	Number of trips per day	Tonnage carried per trip
27/10/97	220	250	470	51	9.2
28/10/97	240	200	440	48	9.2
29/10/97	270	295	565	62	9.1
30/10/97	170	400	570	62	9.2
31/10/97	280	280	560	61	9.2
1/11/97	390	450	840	92	9.1
2/11/97	210	250	460	50	9.2
3/11/97	190	230	420	46	9.1
4/11/97	230	220	450	49	9.2
5/11/97	260	280	540	59	9.2
6/11/97	160	300	460	50	9.2
7/11/97	270	320	590	64	9.2
8/11/97	300	280	580	63	9.2
9/11/97	350	500	850	73	11.6
Average	253	304	557	59	9.4

Source: NCC

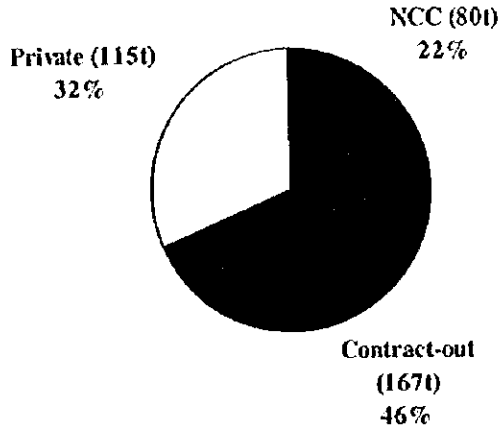


Figure E.3-2 Amount of Solid Waste Collected
(Source: *Solid Waste Amount Survey*, JICA Study Team and NCC)

3.2.3 Kind of Solid Waste Collected

On average about 61% of the solid waste collected come from residential areas, while 21% are from industrial areas and 6% from roads, as shown in **Figure E.3-3**. Household waste seems to be the single largest source of solid waste carried by collection vehicles in the city. Site observations show that waste from residential areas include hospital waste and waste from industrial areas is mixed with residential waste. This observation shows one tendency of solid waste composition in the city.

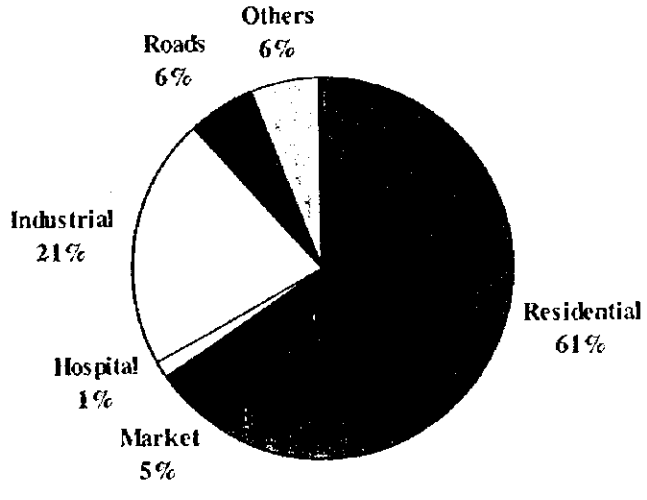


Figure E.3-3 Kind of Solid Waste Collected (Average Proportion)
(Source: *Solid Waste Amount Survey*, JICA Study Team)

3.2.4 Kind of Collectors

A wide variety of some 54 to 55 organisations of waste collectors carrying solid waste to the Dandora dumpsite were observed during the solid waste amount surveys. The proportion of the number of arrivals at Dandora for each organization is shown in **Figure E.3-4.**

The NCC and private companies are the two major waste collectors in the city. About 70% of those coming to Dandora are NCC and private collectors. Industries are the second largest organisation among the collectors involved in the waste collection work.

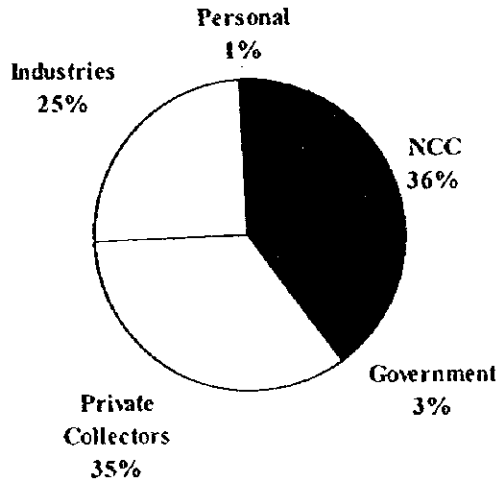


Figure E.3-4 Proportion of Number of Arrivals at Dandora
(Source: *Solid Waste Amount Survey*, JICA Study Team)

3.2.5 Collection and Transportation Operation

(1) Operation Time

Collection and transportation work of both NCC and private collectors usually starts at 7 to 8 o'clock in the morning and ends at around 5 to 6 o'clock in the afternoon. Total operation time of NCC is almost equal to those of private collectors; i.e., 330 to 416 minutes for NCC and 376 to 402 minutes for private collectors on the average which is approximately 6 to 7 hours. However, three major private companies, i.e., Bins (Nairobi) Services Ltd., City Bins and Domestic Refuse (K) Disposal Ltd. (usually called "DRDS"), work longer than NCC. Their average operation time was calculated at 468 minutes (approximately 8 hours).

The proportion of time spent for each activity such as collection, transportation and idling is shown in **Figure E.3-5** below. This clearly shows that NCC spends much longer time for transport than collection although the privates mostly take a longer time for collection.

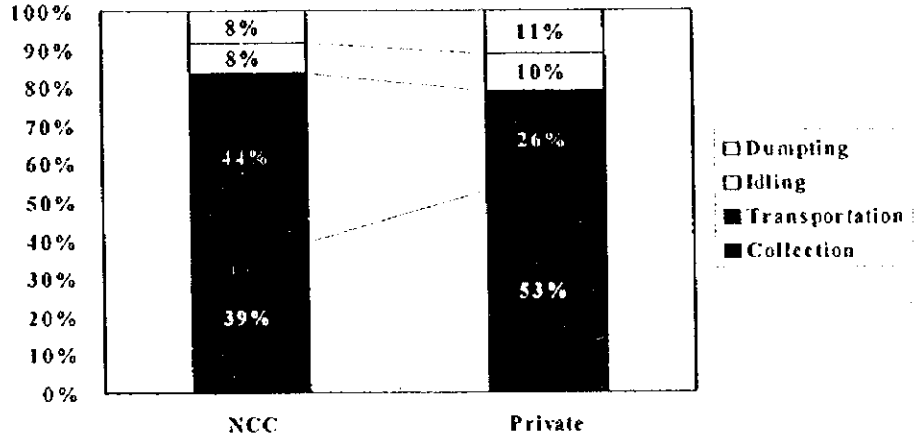


Figure E.3-5 Proportion of Time Spent for Each Activity to Total Operation Time
(Source: *Time and Motion Study*, JICA Study Team)

(2) Operation Distance

In terms of average distance for daily collection and transportation operation, the study results show that NCC has the longest transportation distance among the major waste collectors in Nairobi. As to operating distance per trip, the private collectors, on the contrary, had longer operating distance than that of NCC; in other words, approximately 35 km per trip for NCC, and 50 km per trip for the privates, as shown in **Figure E.3-6.**

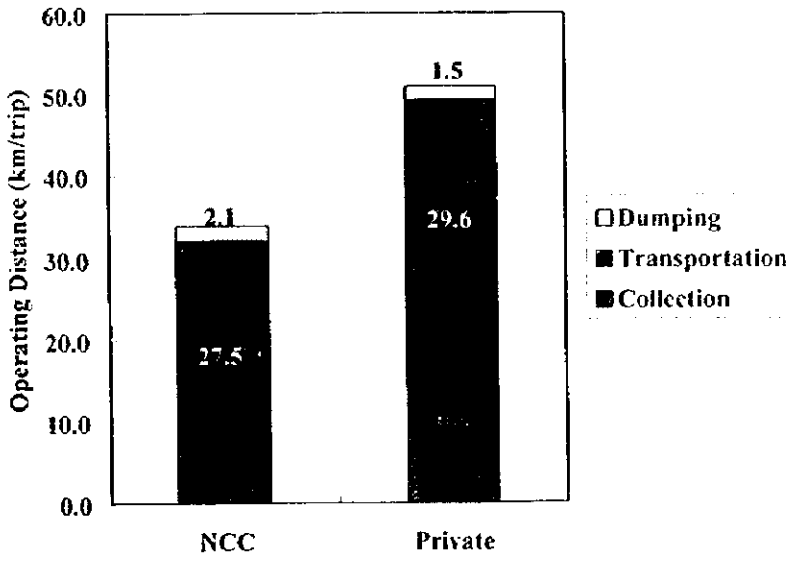


Figure E.3-6 Proportion of Operating Distance per Trip
(Source: *Time and Motion Study*, JICA Study Team)

(3) Number of Trips

The two surveys, i.e., the solid waste amount survey and the time and motion study, bring nearly the same results; that is, the average number of trips per day for each collection vehicle is 1.4 to 2.2 trips for NCC while private collectors make only 1.2 to 1.7 trips, as shown in **Figure E.3-7**. The larger number of trips for NCC results from the different type of collection method between NCC and private entities as previously mentioned.

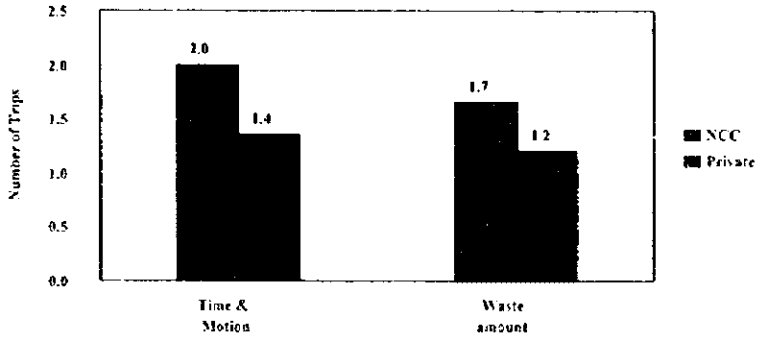


Figure E.3-7 Comparison of Number of Trips
(Source: *Time and Motion Study* and *Waste Amount Survey*, JICA Study Team)

(4) Number of Crew

From the time and motion study, the average number of crew for each NCC collection vehicle is 4.8 while the private average is 4.0, as presented in **Figure E.3-8**. The results of the waste amount survey also show the same tendency. Since this crew includes one driver, the number of workers for loading waste may be 3 to 4 people. This is slightly larger than the privates but it is not a large number.

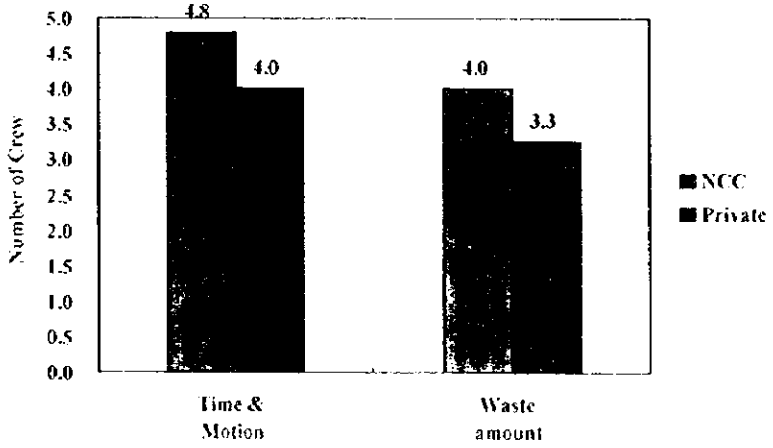


Figure E.3-8 Comparison of Number of Crew
(Source: *Time and Motion Study and Waste Amount Survey*, JICA Study Team)

(3) Number of Trips

Both two surveys, i.e., the solid waste amount survey and the time and motion study, bring nearly the same results, that is, the average number of trips per day for each collection vehicle is 1.4 to 2.2 trips for NCC while private collectors make only 1.2 to 1.7 trips, as shown in **Figure I.3-7**. The larger number of trips for NCC results from the different type of collection method between NCC and private entities as previously mentioned.

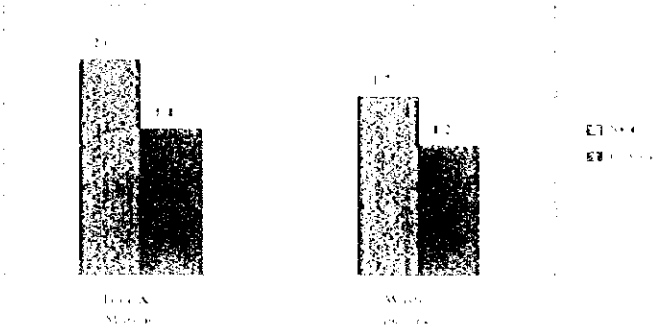


Figure I.3-7 Comparison of Number of Trips

(4) Number of Crew

From the time and motion study, the average number of crew for each NCC collection vehicle is 4.8 while the private average is 3.0, as presented in **Figure I.3-8**. The results of the waste amount survey also show the same tendency. Since this crew includes one driver, the number of workers for collection work is actually 4 people. This is slightly larger than the privates [illegible].

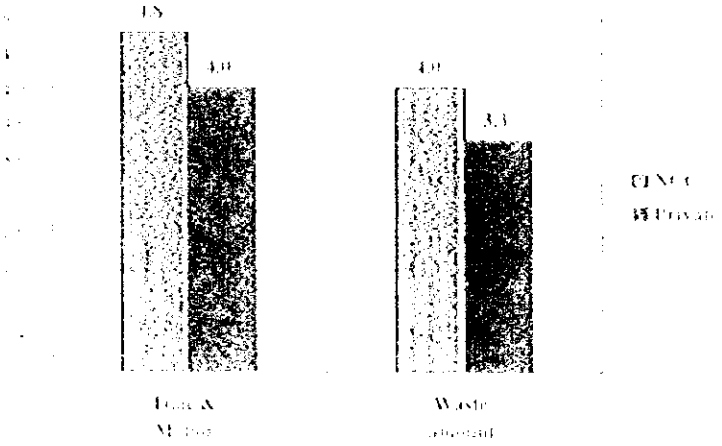


Figure I.3-8 Comparison of Number of Crew

(5) Collection Area

Figures E.3-9 and **E.3-10** present the comparisons of proportion of collection area. Although the collection area varies from survey to survey (the first figure), the collection services by both NCC and privates on the average seem to cover all the districts in the city. The second figure gives different collection areas depending on the collectors and shows that NCC collects the waste almost equally from the each district. The proportion of each district is between 14% and 23% of the total. On the other hand, the private collectors are mostly picking up the waste from the West District where many high income residents are living.

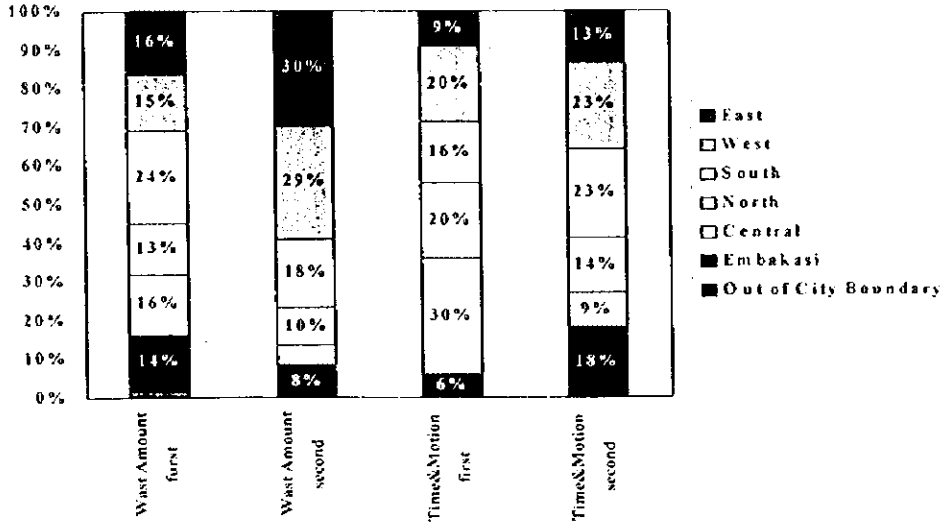


Figure E.3-9 Comparison of Proportion of Collection Area (1)
(Source: *Time and Motion Study* and *Waste Amount Survey*, JICA Study Team and NCC)

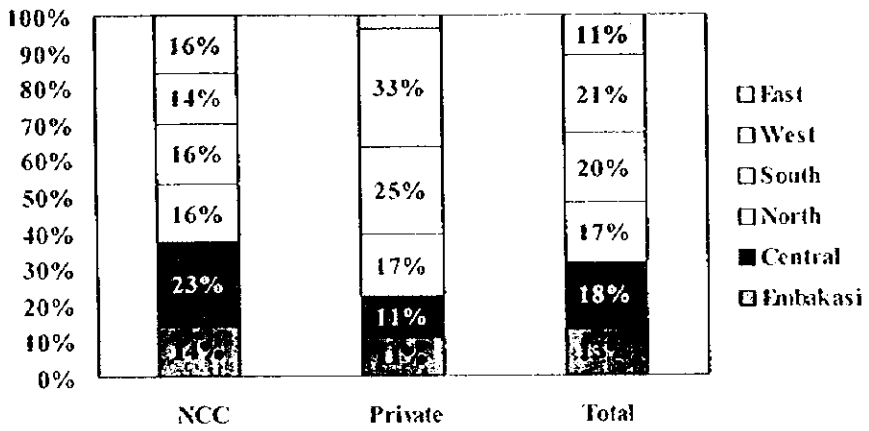


Figure E.3-10 Comparison of Proportion of Collection Area (2)
(Source: *Time and Motion Study*, JICA Study Team)

(5) Collection Area

Figures F.3-9 and **F.3-10** present the comparisons of proportion of collection area. Although the collection area varies from survey to survey as these figures, the collection services by both NCC and private companies are not always to cover all the districts in the city. The second figure shows collection areas depending on the collectors and shows that NCC collects waste almost equally from the each district. The proportion of each district between 14% and 23% of the total. On the other hand, the private collectors are mostly picking up the waste from the West District where many high income residents are living.

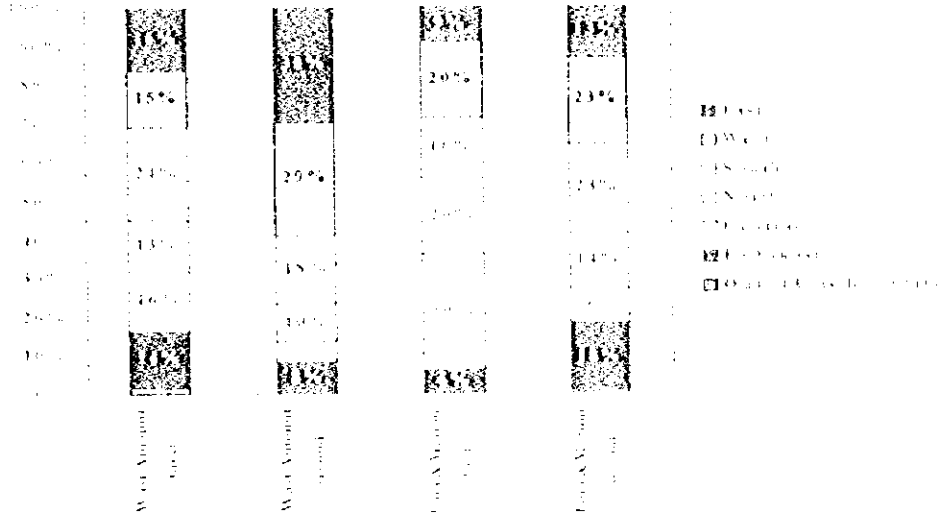


Figure F.3-9 Comparison of Proportion of Collection Area (1)

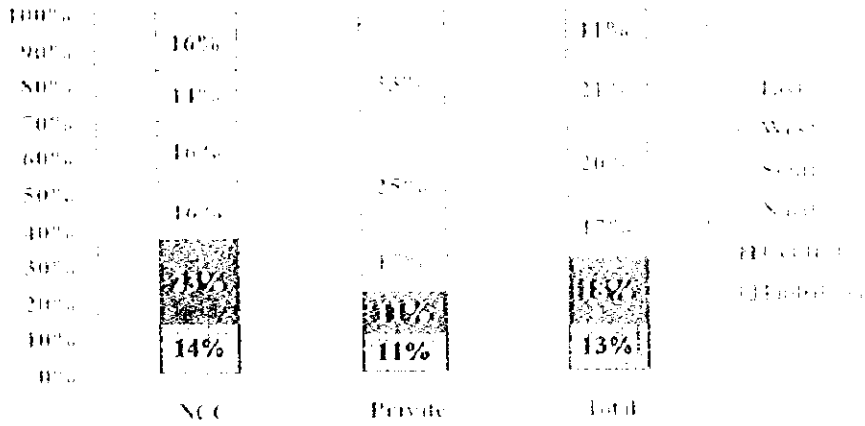


Figure F.3-10 Comparison of Proportion of Collection Area (2)