New York City Commercial Solid Waste Study and Analysis, 2012

Summary Report

Prepared by NYC Department of Sanitation

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1 Overview

1.1 Introduction and Background

New York City (NYC) residential, institutional, and commercial sectors discard as much as 14 millions of tons of waste each year. The NYC Department of Sanitation (DSNY) regulates, collects, manages, and provides for the disposal or diversion of the residential and institutional waste streams. Commercial waste is collected and managed by private carters, with the generators and transfer stations regulated by DSNY, and the private carters regulated by the NYC Business Integrity Commission (BIC).

As part of its responsibilities, DSNY conducts research to provide insight for planning purposes on the waste streams generated in NYC. The 2012 Commercial Solid Waste Study and Analysis was conducted to gain an improved understanding of the commercial waste system in New York City with a specific eye toward documentation of existing recycling practices and latent potential for additional recovery of recyclables. An additional goal of the Study was to map the flows of commercial putrescible waste, to the extent possible, including the removal of waste from individual generators, the delivery of waste to transfer stations or recycling facilities, and the final movement of waste materials to their points of disposal or diversion (recycling, composting etc.).

Such a Study was originally called for in the 2006 NYC Solid Waste Management Plan, to perform a "comprehensive study of the current recycling practices of commercial waste carters in the City" and "commercial establishments". Through a Request for Proposals process, a consultant team, led by Halcrow, Inc. (a CH2M Hill company), was chosen in 2008. The subsequent 2008 fiscal crisis delayed implementation of the Study due to budget cuts. Local Law 32 of 2010 once again required the implementation of the study, but with a streamlined scope that focused on the putrescible portion of the commercial waste stream, and excluded any direct waste characterization. The analysis was completed in 2012.

While the reduced scope does not answer all of the questions posed by the full study, it does provide insight into

- Knowledge and Behavior of Commercial Establishments ("Generators")
    - What do businesses know, think and do in relation to recycling?
    - How does it compare to the commercial recycling law?
- Behavior of Commercial Waste Carters ("Carters")
    - What are current collection practices in relation to the law?
    - How efficient are current routes?
- Estimates of Commercial Putrescible Refuse & Recycling
    - How much, what's in it: generation, diversion, disposal, composition
    - Where is there potential for more diversion?

NOTE: The Study's reduced scope and budget also excluded a comprehensive final report deliverable from the Consultants. Rather, the Halcrow Team submitted method, results and analysis in a series of technical memos, datasets and supporting documentation. These technical memos are available upon request from DSNY.

1.2 Laws and Rules

In the 1950's, NYC mandated a uniform system of private collection of trade waste. The Department of Sanitation stopped collecting commercial waste, transferring the responsibility to the private hauling industry with oversight by the City. Since then, there have been multiple proposals to reform the commercial waste system that fall into two main methods: regulation through DSNY competition, in which the Department could compete for customers alongside private hauler, and regulation through agency oversight. Also proposed has been the franchising of commercial waste collection, in which NYC enters into agreements with private carters to service trade waste districts. To date, DSNY competition has always been rejected for a purely privatized approach.

Waste Generators:
In 1992, NYC passed Local Law 87 making recycling mandatory by businesses and buildings that have their waste collected by a private carter or recycler. DSNY enforces this law and developed rules that articulate what materials commercial waste generators are required to recycle ("designated materials"), and how they need to be source separated before collection by a private carter. (Rules of the City of New York, Title 16: Sanitation, Chapter 1, §1-10 Recycling of Private Carter-collected Waste)

Business requirements were divided into generator groups based on the major types of waste expected to be generated by each group. At the time of this Study, the DSNY website www.nyc.gov/wasteless summarizes the commercial recycling rules for generators as shown in the table below.

If a generator commingles designated recyclable materials with non-designated materials, the business must enter into a written agreement with the private carter that provides for the recycling, reuse or sale for reuse of all commingled materials. The generator must also post a sign identifying, by type, each non-designated material that will be commingled with designated materials.

The generator also must follow requirements to post signage, provide labeled bins, and notify staff and customers about where and how to properly source separate recyclable materials.

Commercial Waste Generator Recycling Rules

Food or Beverage Service Establishments

(restaurants, delicatessens, bars, caterers, cafeterias, street events, etc.)

REQUIRED TO RECYCLE	PRE-COLLECTION, SOURCE-SEPARATION REQUIREMENTS
corrugated cardboard	**Keep separate from:** 1) trash; 2) designated metal, glass, and plastic containers and aluminum foil products; 3) and designated construction waste **May be commingled with:** bulk metal
bulk metal	**Keep separate from:** 1) trash and 2) construction waste **May be commingled either with:** 1) corrugated cardboard OR 2) designated metal, glass, and plastic containers and aluminum foil products
metal cans, aluminum foil products, glass bottles and jars, plastic bottles and jugs (includes materials generated from customers)	**Keep separate from:** 1) trash, 2) corrugated cardboard, and 3) construction waste **May be commingled with:** other metal, glass, and plastic materials **Place out for collection in clear bags** (unless collected in a vehicle compartment that only has other metal, glass and plastic materials).
construction waste *excludes plaster, wall coverings, drywall, roofing shingles, wood and lumber, and glass window panes*	**May only be commingled with:** other construction waste

Other Businesses

(offices, retail stores, supermarkets, manufacturers, etc.)

REQUIRED TO RECYCLE	PRE-COLLECTION, SOURCE-SEPARATION REQUIREMENTS
high grade office paper, newspaper, magazines, catalogs, phone books (includes materials generated from customers)	**Keep separate from**: 1) trash and 2) designated construction waste **May be commingled with:** 1) designated and non-designated paper, 2) wood materials, 4) textiles, and 5) bulk metal
corrugated cardboard	**Keep separate from:** 1) trash and 2) designated construction waste **May be commingled with:** 1) designated and non-designated paper, 2) wood materials, 3) textiles, and 2) bulk metal
textiles (if more than 10% of waste stream)	**Keep separate from**: 1) trash and 2) designated construction waste **May be commingled with:** 1) designated and non-designated paper, 2) wood materials, and 3) bulk metal
bulk metal	**Keep separate from:** construction waste **May be commingled either with:** 1) designated paper materials and textiles OR 2) non-designated materials
construction waste *excludes plaster, wall coverings, drywall, roofing shingles, wood and lumber, and glass window panes*	**May only be commingled with:** other construction waste

Waste Carters:

With few exceptions, businesses must use a private carter to collect their waste, or become registered as a self-hauler. In 1996, NYC passed Local Law 42 to regulate the private hauling industry and create the Trade Waste Commission (subsequently renamed the Business Integrity Commission or BIC through Local Law 21 of 2002). All private hauling companies that transport putrescible waste must be licensed, and non-putrescible (construction and demolition) and self-carters must be registered through BIC. Local Law 42 of 1996 also allows BIC to conduct a project to pilot no more than two special trade waste districts.

The Rules, as developed and enforced by BIC, define maximum rates, designated and non-designated recyclable materials, collection requirements and restrictions, and reporting requirements for private carters. (Title 17, Subchapter E, Section 5-12: Recycling Requirements for Licensees and Subchapter G, Section 7-04: Recycling Requirements)

A general summary of BIC recycling requirements related to licensed carters:

- Commercial waste generators must prominently post a BIC decal that displays the licensed carter.
- Licensed carters must charge at or below the maximum rates allowed by BIC.
- Licensed carters must provide a bi-annual Customer Register to BIC that lists all customers, the quantity of material collected from each customer by material type, and the amount changed for service.
- Licensed carters must follow a set of collection rules to ensure materials that have been source-separated by the waste generator get recycled. With some exceptions,
    - "Designated paper materials and textiles shall not be collected and transported in the same vehicle compartment with non-designated materials … with metal components of bulk waste that are substantially soiled with a contaminating material; or with construction waste."
    - "Designated paper materials and textiles shall not be collected and transported in the same vehicle compartment with non-designated materials…with metal components of bulk waste that are substantially soiled with a contaminating material; or with construction waste."
    - "Designated glass, metal and plastic containers and aluminum foil and aluminum foil products that have not been separately bagged in transparent or translucent bags shall be collected and transported in a vehicle compartment that contains only such designated materials or materials that have been commingled pursuant to…" (an acceptable exception)
    - "Metal components of bulk waste that are substantially soiled with a contaminating material shall not be collected and transported in the same vehicle compartment as designated paper materials or textiles."
    - Commingling allowance: commingling of designated and non-designated materials by the licensed private carter is allowed with written agreement with the waste generator that the carter will ensure all such commingled materials to be recycled, reused or sold for reuse.

2 Commercial Putrescible Waste Generator Knowledge and Behavior

The Study documented the knowledge and behaviors of NYC commercial waste generators (businesses) using field observations and interviews to gain insight into the dynamics of waste generation and recovery as it occurred at the street level.

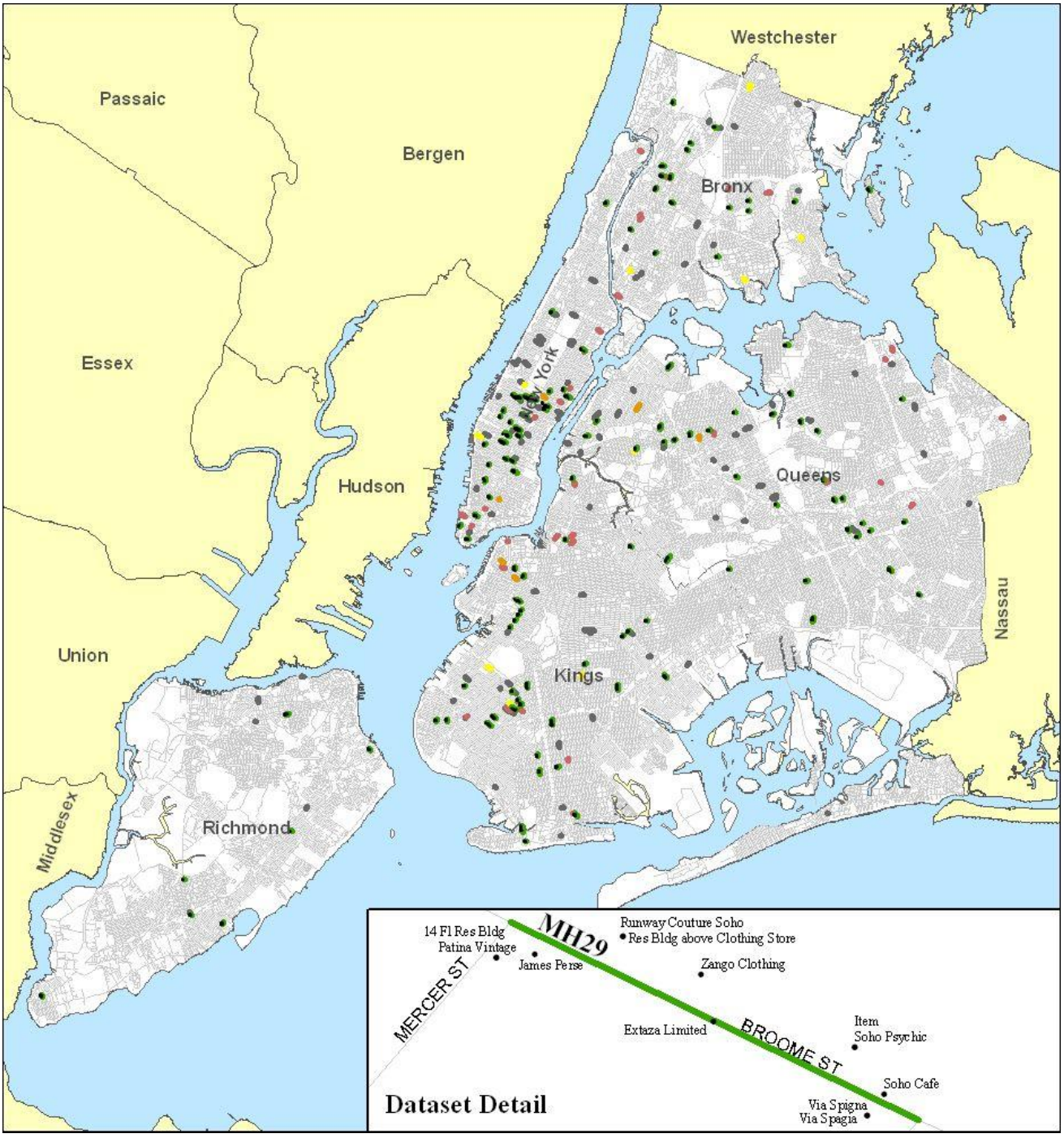
There is no definitive "census" of businesses in New York City. According to the US Census, NYC is home to well over 200,000 business establishments, but commercial activity is constantly growing, shrinking, being built, being torn down, and moving. To account for NYC's diverse and unevenly distributed business landscape, the Consultants designed the waste generator data collection to be statistically representative of the spatial variation of commercial activity throughout the city and to provide a sample size that would permit the drawing of meaningful conclusions. Field research was carried out between January 2011 and July 2011 by researchers in the Geography and Urban Planning Departments at Hunter College of the City University of New York.

2.1 Method

The Consultants selected a sample of 125 street segments representative of business activity in the city based on a statistical sampling process using business census, demographic, and geographic inputs. The researchers interviewed the businesses and observed their waste management practices on each street segment. The map below shows the locations of the selected street segments, and an example of the dataset detail of information on a block.

Businesses that are inaccessible from the street, or do not set out waste on the curb are by their nature excluded from this generator research, such as individual offices within a large office building, or businesses/buildings that manage their waste in a loading dock or container inaccessible to observation from the street.

Study Street Segments



The following surveys were carried out:

- 6 Rapid Ethnographic Assessments including interviews and night observations
- 158 Pre–Surveys of Street Segments
- 686 Generator Surveys (in-person interviews)
- 125 Night-time Street Segment Observations

2.1.1 Rapid Ethnographic Assessments

The researchers implemented six rapid ethnographic assessments to gain initial understanding of the populations and environments to be studied, and to further refine the research questions, and survey instruments.

2.1.2 Pre-Surveys of Street Segments

Each and every sample street segment was visited prior to study to ensure that a) it was a valid segment for study, and b) to collect preliminary information to inform and help organize data collection. The pre-surveys were designed to gather information that was likely to be readily available without speaking to business owners and/or workers, including information such as business name, street address, business type, business opening and closing hours, and the name of the carter (based on the BIC label), and any other pertinent information about the street segment itself that would provide contextual information for day-time interviewers or for night-time observers.

Through this pre-vetting process, 28 street segments needed to be replaced. Alternate, equivalent representative street segments were chosen through a statistical resampling procedure. Criteria to reject a street segment included a block being under construction (i.e. the expected buildings were no longer there), and a block where the businesses do not face the street, are inaccessible, or do not set out their waste on the street, which would preclude the ability to observe their behavior.

2.1.3 Generator Surveys

DSNY staff collaborated with the Hunter researcher team to design and field test a standard waste generator survey. The generator surveys were intended to indicate the extent to which business owners are aware of laws regarding commercial recycling, their sources of information on recycling requirements, their typical practices regarding waste set-outs of recyclable and non-recyclable putrescible waste, and their sources of difficulty, if any, with the requirements of the law. Generators also were queried on their relationship with their waste carters and the perceived financial impact of waste hauling on their business's viability. The survey was also translated into Spanish, Russian, and Chinese.

Field researchers, some multi-lingual, were recruited from a pool of urban planning graduate students at Hunter College. Working in teams of two, they surveyed business owners, managers, and other employees at businesses along the selected street segments. They were instructed to approach businesses in a friendly but professional manner, asking for voluntary participation in the survey effort, and making sure to identify themselves as researchers so as

maximize unbiased responses from businesses. No DSNY personnel accompanied the field researchers, nor did any enforcement activities follow the research effort. This approach maximized the chance that survey respondents would be forthcoming in their answers, and, along with the very large number of surveys administered, makes it likely that the statistics derived from the survey are representative of what is actually going in businesses throughout the city.

2.1.4 Night-time Street Segment Observations

Using the same set of 125 randomly selected street segments, Hunter researchers pursued a parallel strategy of information gathering that entailed direct observation of commercial setouts and carter collection behavior during the night hours of commercial collection. Night observation teams worked in groups of three making observations unobtrusively from unmarked vehicles.

DSNY staff collaborated with the Hunter field team to design and field test a standard field data collection sheet to record night-time observations. The intention of the night-time observations were to observe generator and carter behavior with regard to recycling: Did the generator source separate recyclables? Did it appear the material set out for collection by the generator was intended for recycling? Did the carter collect everything in the same truck? Did the carter keep recyclables separated from non-designated materials?

Data points recorded included:

- generator set-outs by material type, counting individual set-out "pieces"
- instances of collection
- carter collection behavior,
- instances of drive-throughs by carters traversing the streets.
- street conditions before and after collection,

2.2 Results

2.2.1 Generator Survey Results

A total of 686 generator in-person surveys were conducted across NYC's five boroughs representing 23 business types, as shown in the tables and graph below.

Generator Surveys by Borough

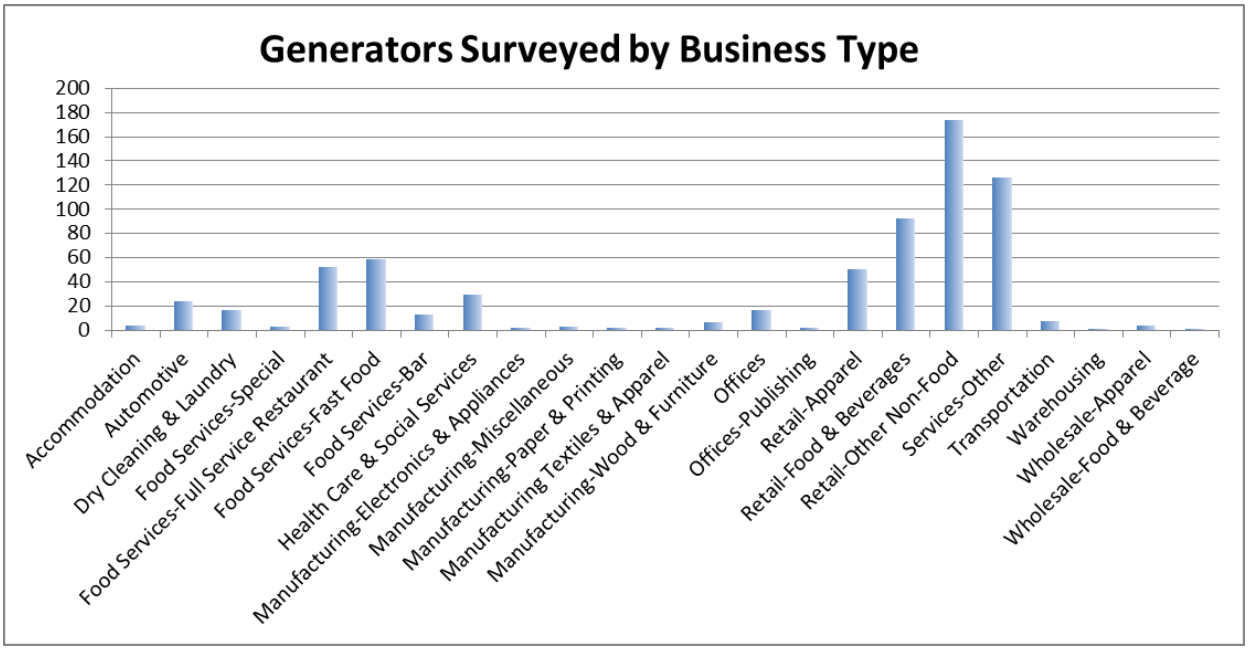
Borough		
	Frequency	Percent
Bronx	86	12.5
Brooklyn	189	27.6
Manhattan	210	30.6
Queens	167	24.3
Staten Island	34	5
Total	686	100

The largest groups of interviewees by business type were “Retail Non-Food”, “Services Other”, “Retail-Food & Beverage”, “Food Services-Fast Food”, “Food Services –Full Service Restaurant”, and Retail- Apparel.

Generator Surveys by Business Type

Generator Business Types		
	Frequency	Percent
Accommodation	4	0.6
Automotive	24	3.5
Dry Cleaning & Laundry	16	2.3
Food Services-Special	3	0.4
Food Services-Full Service Restaurant	52	7.6
Food Services-Fast Food	58	8.5
Food Services-Bar	13	1.9
Health Care & Social Services	29	4.2
Manufacturing-Electronics & Appliances	2	0.3
Manufacturing-Miscellaneous	3	0.4
Manufacturing-Paper & Printing	2	0.3
Manufacturing Textiles & Apparel	2	0.3
Manufacturing-Wood & Furniture	6	0.9
Offices	16	2.3
Offices-Publishing	2	0.3
Retail-Apparel	50	7.3
Retail-Food & Beverages	92	13.4
Retail-Other Non-Food	173	25.2
Services-Other	126	18.4
Transportation	7	1
Warehousing	1	0.1
Wholesale-Apparel	4	0.6
Wholesale-Food & Beverage	1	0.1
Total	686	100

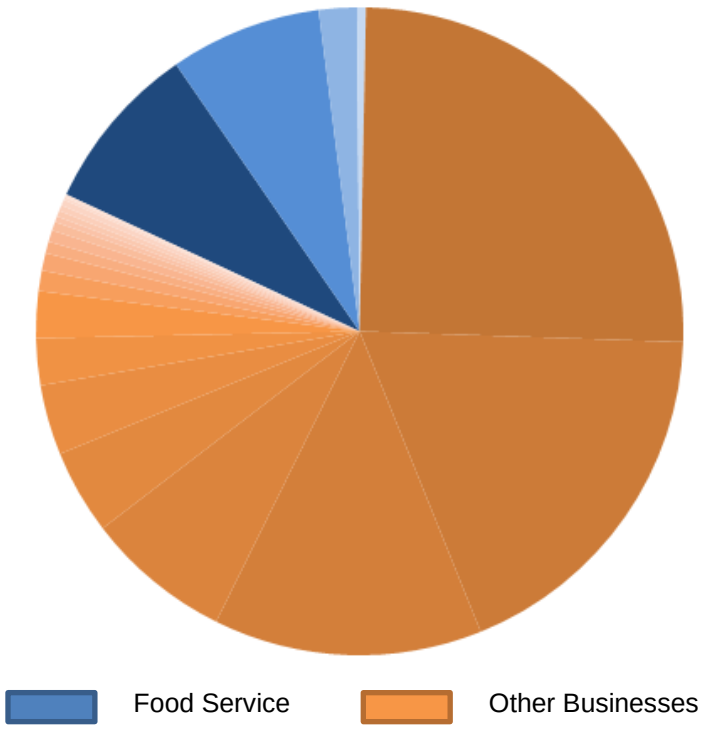
Generator Surveys by Business Type



For analysis, businesses were also grouped by their commercial recycling requirements.

- Food or Beverage Service Establishments: n=126
- Other Businesses: n=560

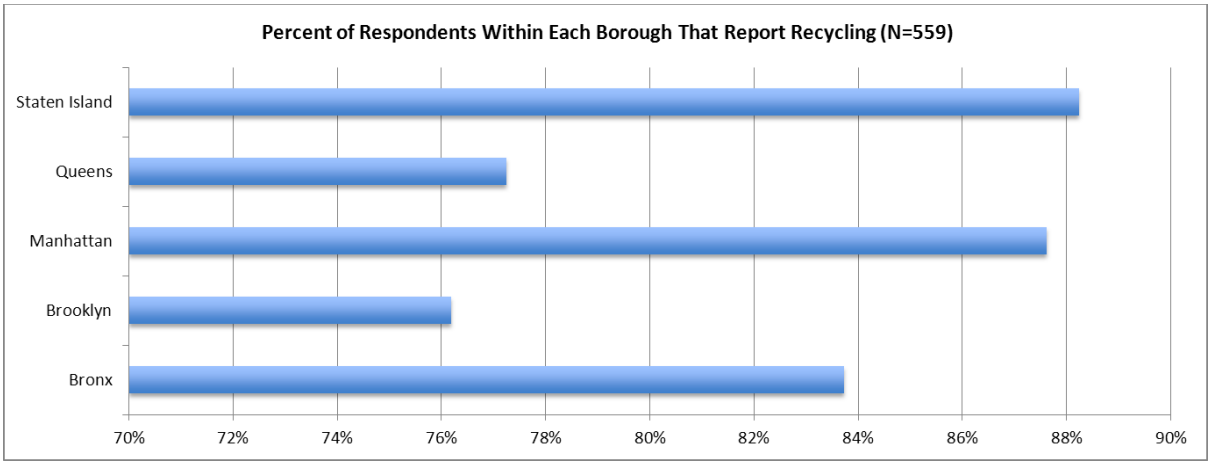
Generator Surveys by Recycling Requirement



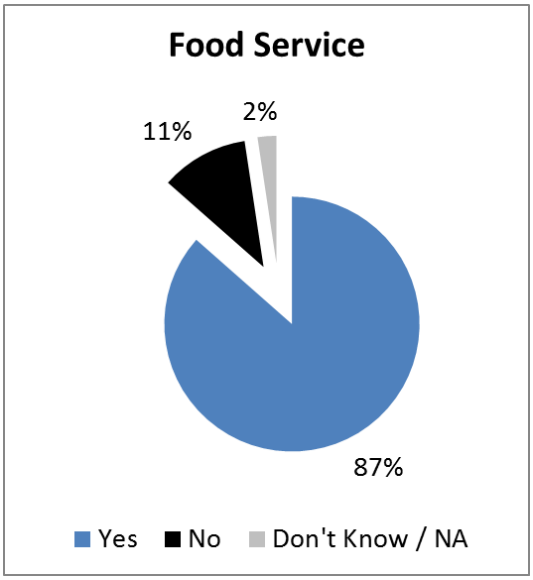
Major Findings

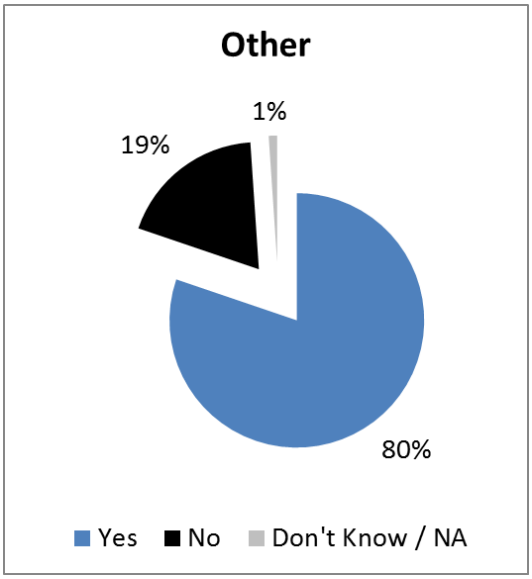
- **Businesses report that commercial recycling is taking place.**

Citywide, 82% of interviewees reported that their business did recycle at least some types of materials. Rates were high in all boroughs, but highest in Staten Island and Manhattan.



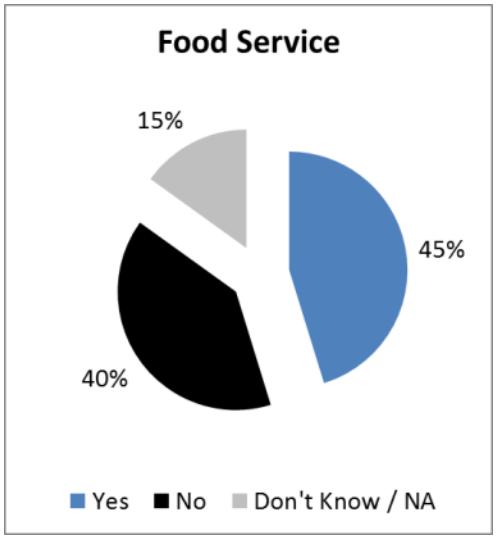
Broken out by recycling requirements, food service establishments were even more likely to say they recycle than other businesses.

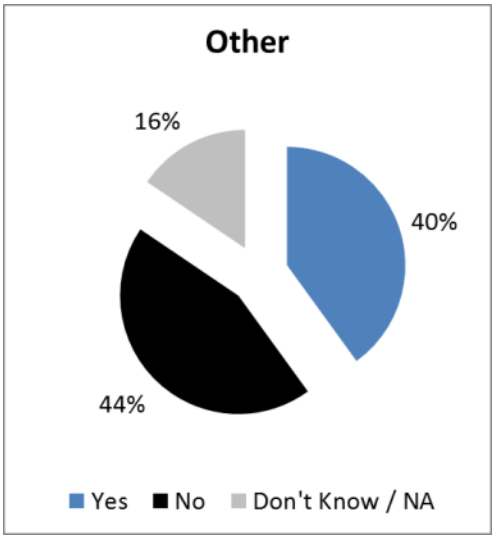




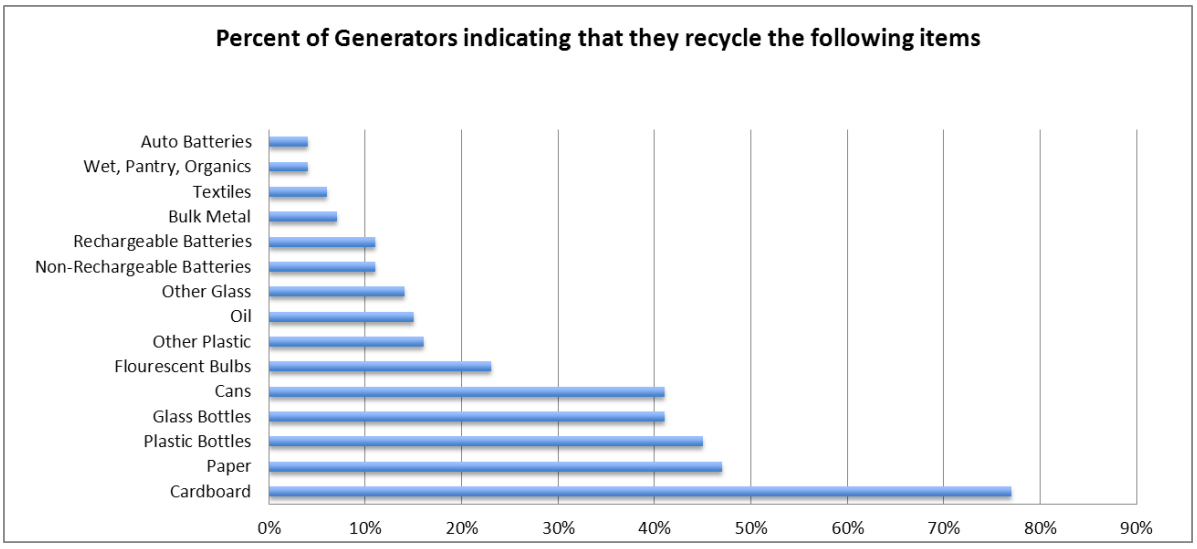
- **Businesses are aware of the recycling rules, but many equate it with the residential recycling rules**

Nearly all generators interviewed were aware that recycling is required by law in NYC, but about half of these believed that residential and commercial regulations were identical.

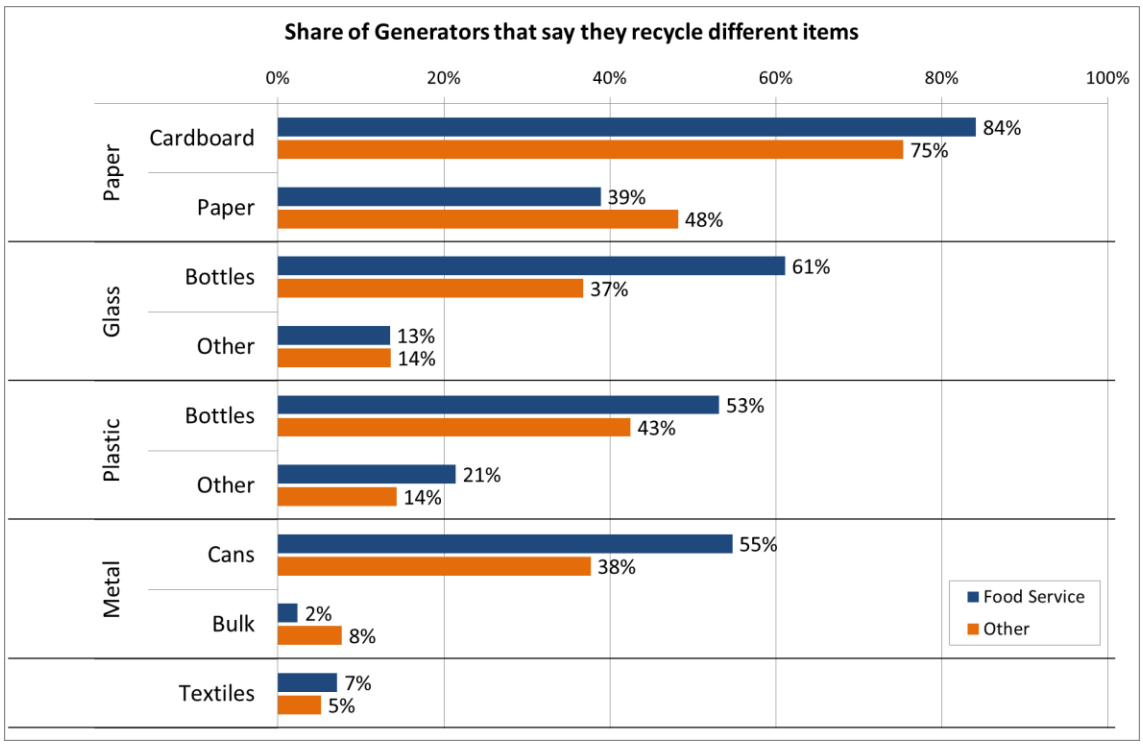




This is further illustrated by what businesses said they recycle. Cardboard was reported as the most frequently recycled material, followed by paper, glass/plastic containers, and cans.

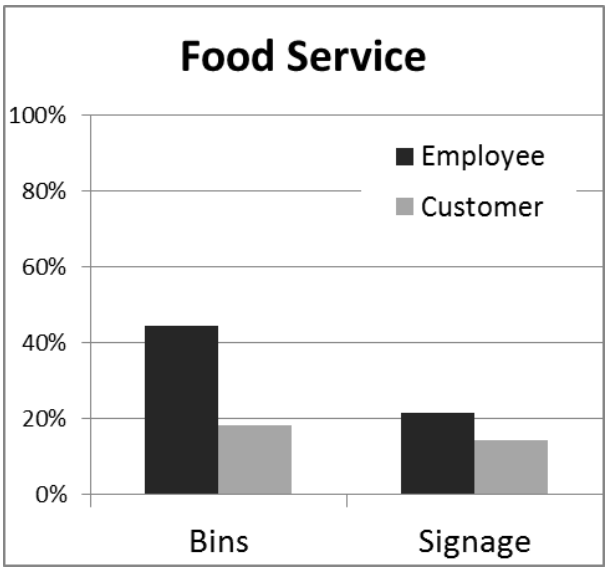


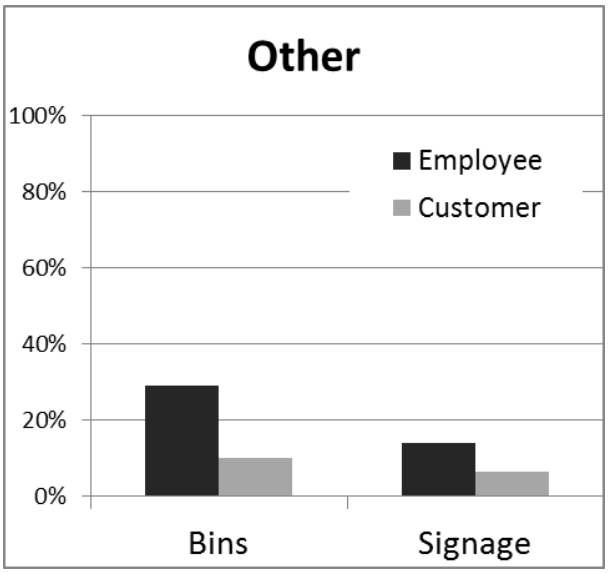
Broken out by recycling requirements, it is interesting to note that many businesses indicate they are recycling materials that are not required. For example, though they are not required to, 39% of food service establishments indicated they recycle paper, and 42%, 37%, and 38% of other businesses indicated that they recycle plastic bottles, glass bottles, and metal cans respectively.



➢ Few businesses provide the tools for employees or customers to recycle

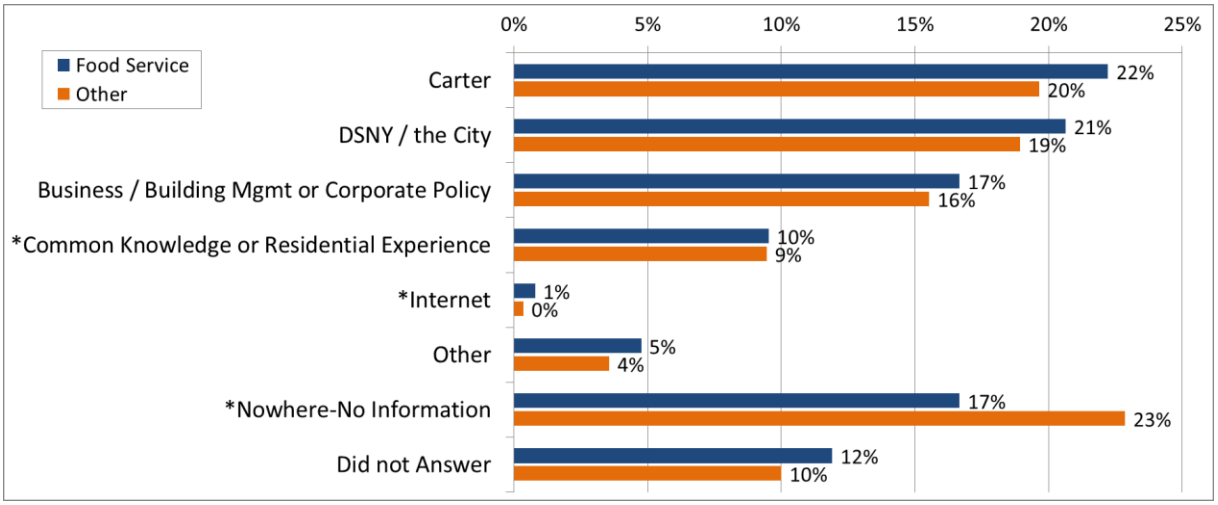
Only a minority of food service or other businesses indicated that they provide recycling bins or post signage about where and how to recycle. This confirms anecdotal observations DSNY outreach and enforcement personnel.





- **There is no dominant source of information about recycling requirements for businesses. (Almost no one uses the Internet to get this information.)**

Businesses reported learning about recycling requirements from a variety of sources, with carters themselves being the single most frequently identified information provider. Interestingly, the internet was reported least often as their source for recycling information.



- **Businesses report carrying out their own source separation**

With regard to the role of the carter in recycling service provision, seventy one percent of those interviewed indicated that their waste collector also collected their recycling, 15% indicated that they had separate collectors for recycling, 8% indicated that they don't recycle at all or that they don't know who collects.

Despite this dual provision of service, most generators reported source separating recyclables from trash themselves. Some 73% of generators indicated that they separated out cardboard themselves, and 9% indicated that their carter did this for them. Forty seven percent of generators indicated they separated out paper themselves, and 11% indicated the carter did this for them. Roughly 40% of all generators indicated that they separated out metal, plastic and glass themselves, and 9% left it to their carter.

- **Businesses report satisfaction with or no opinion about the current system**

Surprisingly, few generators expressed dissatisfaction with commercial recycling in New York City. When asked, in an open ended question, how the system could be improved, suggestions were wide ranging when provided, but the most dominant responses were that the system works, or they have no opinion.

What is your opinion of the commercial recycling system & what improvements are needed?		
	Frequency	Percent
System works	271	39.5
No opinion	135	19.7
Needs improvement-compliance with law & enforcement	59	8.6
Needs improvement-general	46	6.7
General Comments-Recycling is Needed	44	6.8
Needs improvement-education & information	32	4.7
Needs improvement-too much mixing	20	2.9
Needs improvement-expensive	18	2.6
Needs improvement-infrastructure (bins, bags & containers)	17	2.5
Make it easier	12	3
Needs improvement-street cleanliness	10	1.5
Businesses & residential should be one system	7	1
More pick-ups	6	0.9
Needs improvement-communication between system componen	4	0.6
Needs improvement-rewards	3	0.3
Needs improvement-Streamline systems	2	0.3

2.2.2 Night-time Observations Results

The night observation teams recorded 6,418 individual set outs and 571 instances of collection along these segments.

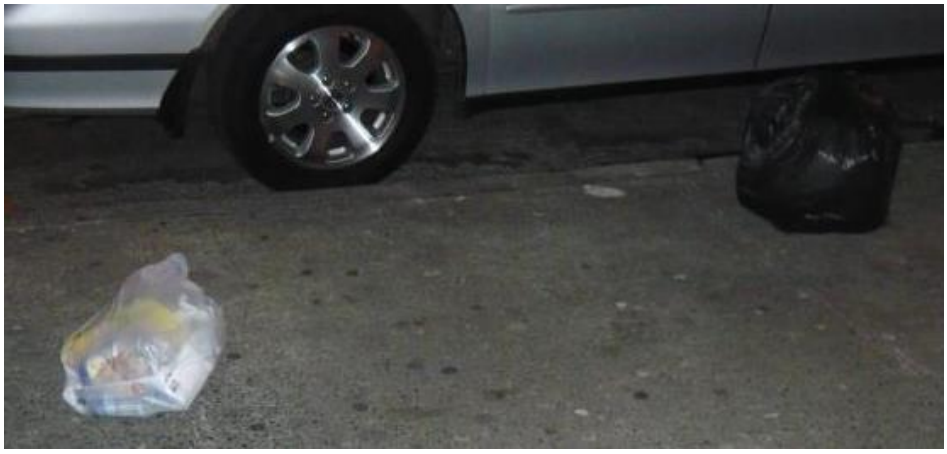
Borough	Brooklyn	The Bronx	Manhattan	Queens	Staten Island
Observed pickups	132	93	217	109	20

Major Findings

- **Night-time observations of generator set-outs substantiate claims from the surveys that they participate in recycling behavior.**

Individual set-outs were counted and categorized by the assumed intention of the generator: Intended for recycling, Intended for refuse, Unclear intention. "Individual set-outs" equate to individual pieces put at the curb for collection. As illustrated in the photos below,

- a heavy porcelain toilet = 1 item
- a bundle of cardboard = 1 item (large or small)
- a bag of discards = 1 item (no matter its size, how full it is, or its contents).

# Individual Set-outs	Example Observation
10+ individual set-outs	
2 individual set-outs	

Based on this analysis, 46% of individual items set out by generators were intended for recycling.

Individual Set-Outs - Assumed Intentions	
How individual items were set-out	%*
Intended for Recycling	**46%**
properly separated paper/cardboard	28%
properly separated metal, glass, and/or plastic	16%
improperly setout (paper & plastic in clear bags)	2%
Intended as Refuse	**53%**
black bags	46%
clear bags with pantry refuse	4%
residential refuse bags (illegal dumping)	0.50%
bulk items (shelves, floor covering etc.)	3%
Unclear Intention	**1%**
cooking oil	1%
machine oil	0.00%
textiles	0.20%
organics	0.20%

** Important Caveat:*
These field observations should be interpreted only to document if there is any generator participation in source-separation and recycling behavior. The percent of items intended for recycling **does not equate to a diversion rate**, because the size, weight and manner of set-out items vary greatly.

- **Generators could do more to maximize recycling behavior.**

Anecdotal observations on the street segments indicate the presence of recyclables commingled in refuse set-outs, such as glass bottles, metal cans in refuse bags at food service establishments.

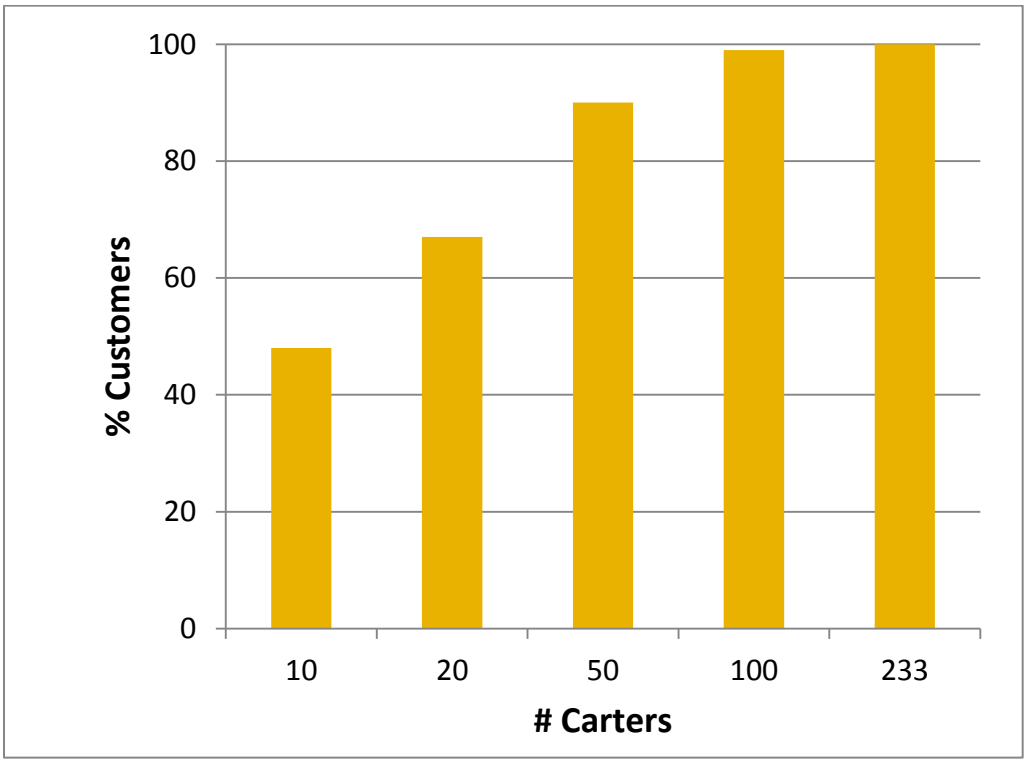
3 Commercial Putrescible Carter Behavior

The Study documented the behaviors of NYC commercial waste carters through direct observation on the street level as trucks performed their work collecting customer material. The goal of these observations was to gain insight into compliance with BIC's commercial recycling rules.

In addition, the Consultants developed a model of carter truck behavior system-wide using data on the city's licensed carters and their customers. The goal of the truck model was to understand how efficient or inefficient the commercial hauling industry is system-wide.

As of the time of the Study, there were over 230 private hauling companies licensed by BIC, with a few major players. Approximately 50 carters serve the vast majority of NYC businesses.

- The 10 largest carters (ranked by the number of their customers) serve almost 48 percent of the customers.
- The 20 largest carters serve almost 67 percent of the customers.
- The 50 largest carters serve more than 90 percent of the customers.
- The 100 largest carters serve more than 99 percent of the customers.



3.1 Method

3.1.1 Night-Time Street Segment Observations

As described in Section 2.1.4, a team of field researchers performed night-time street segment observations on the 125 sample street segments. In addition to observing waste generator (business) behavior, it provided an opportunity watch the waste carters in action.

3.1.2 System-wide Truck Route Network Model

Consultants from Eng-Wong, Taub (now VHB) developed a spatial analytical tool to model a hypothetical optimized truck route network for hauling commercial waste in New York City, and to assess the impacts and benefits of baseline and alternate scenarios.

The tool was developed in ArcGIS using Network Analyst. In developing the tool, the VHB team ran a series of test cases, and performed field observations. The BIC Customer Register provided the primary source data for the model. The Customer Register is a bi-annual reporting requirement for all licensed carters to BIC. It includes a self-reported list of all customers for each licensed carting company, including customer address, the type and quantity of material collected, and the destination of the material. Halcrow also used local and state sources to identify transfer station and recycling facility locations, and carter garage locations, to be used as the start and end points for the model.

With these data and broad assumptions on current waste hauling practices in NYC, the Consultants constructed an initial baseline scenario and an alternative scenario. The data sources were never intended for this type of analysis, yet served as very useful resources in doing a network-based analysis of truck operations for commercial waste hauling.

The tool yields standard system-wide performance measures of vehicular traffic: vehicle-miles travelled (VMT), vehicle-hours travelled (VHT), Average Operating Speed and Average Running Speed. The results presented by the model are not intended to be a precise estimate of VMT and VHT figures for NYC commercial solid waste collection process, but are reasonable estimates based on the parameters and broad assumptions used. As such, the proportionate changes in VMT and VHT from the baseline scenario to other scenarios to measure the relative benefits and impacts are more meaningful than the actual VMT and VHT figures themselves.

3.2 Results

3.2.1 Night-Time Observation Results

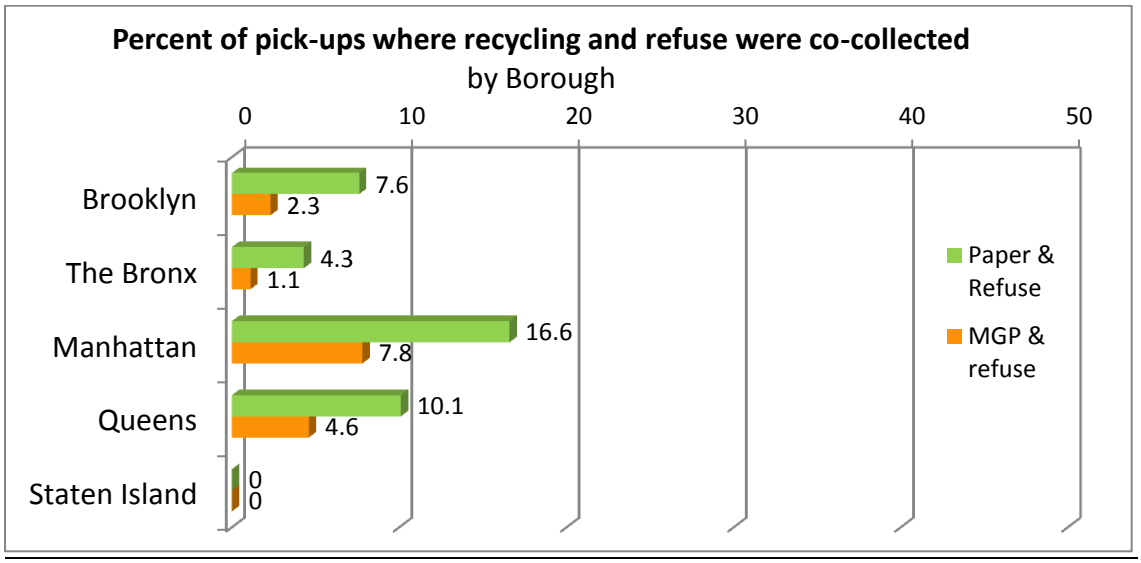
The night observation teams recorded 6,418 individual set outs and 571 instances of collection along these segments.

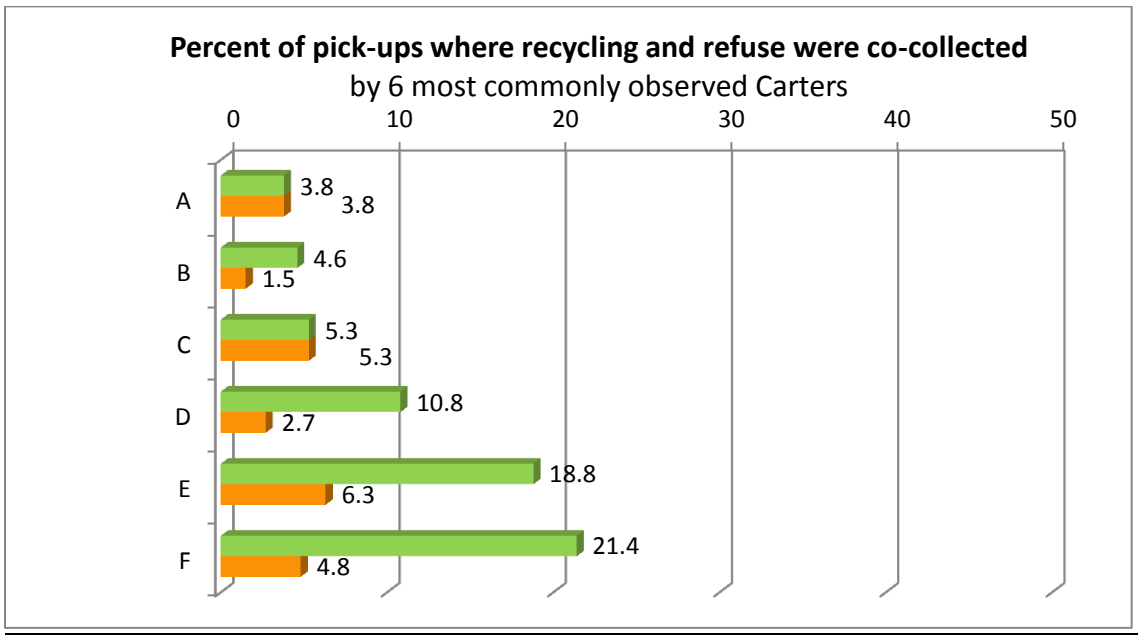
Borough	Brooklyn	The Bronx	Manhattan	Queens	Staten Island
Observed pickups	132	93	217	109	20

Major Findings

- **Carters were observed to generally comply with their requirement to collect source-separated recyclables in separate trucks from refuse.**

Collection of source-separated recyclables in the same truck as black-bagged refuse was *not* the norm. Contrary to anecdotal reports of this phenomenon from citizens and even DSNY personnel observing collections in the field, bundled cardboard, bulk metal, and/or clear bags of paper, cans, and bottles were co-collected with refuse in only a minority of cases, as summarized below.





3.2.2 System-wide Truck Route Network Model Results

The field work and analyses performed to develop the truck route network tool revealed that the status quo system of waste collection, as it currently is structured, runs quite efficiently. Carters go to great lengths to implement their routes as efficiently as they can. Incremental changes on a carter-by-carter basis will not likely deliver significant overall efficiency savings. That being said, system-wide changes to hauling practices have the potential to yield substantial improvements to the performance measures of vehicular traffic from commercial waste transportation in NYC.

The consultant team compiled the following insights about commercial waste hauling efficiency and impacts in NYC.

- Commercial waste carters observed during the course of this project operate very efficient routes, serving customers in a manner that minimizes travel time and truck-miles travelled, and maximizes the use of their resources (labor, truck operating time, etc.).
- Some of these carting firms also engage in practices that enable them to cover their routes more efficiently than the GIS-based route optimization process used in this study would allow. This is done by employing measures such as reverse moves, illegal right turns on red, and even the blatant disregard of one-way street restrictions in some limited cases.
- One of the most substantial impacts of commercial waste collection from an environmental standpoint (idling engines) is seen in the time it takes to serve individual customers, not necessarily the time it takes for a garbage truck to travel from one location to another.
- For carting firms that operate efficient routes and assign trucks based on customers located in close proximity to each other, a substantial portion of the vehicle-miles travelled for any given route involves the movement of a truck from the carter's terminal location to the first customer on the route, and the movement of that truck from the last customer on the route to the transfer station. The actual distance travelled between customers is often very short during the course of a route, especially if they are clustered close together and scheduled for pick-ups in a rational order.
- Related to the previous point, the three most important factors in the efficiency of a carter's operations, as measured by VMT, are (not ranked):
    - The location of the carter's terminal relative to its customer base;
    - The location of the customers relative to the transfer station(s) used to process their waste; and
    - The "density" of the customers in terms of how close they are to each other. Substantial VMT are expended by carters to serve outlying customers located in the outer boroughs that have few other customers around them.
- Businesses that use containers and compactors for their waste disposal typically involve more VHT for their pick-ups because there are no opportunities for the carter to develop

efficient routes based on customer clusters and optimized routing between customers. The process of picking up a container/compactor is done for a single customer at a time and involves an inherent 50% loss of efficiency because the return trip from the transfer station to the customer location is done with an empty container. However, these containers are used to transport large quantities of waste and may be more efficient when measured on a VMT per ton basis. In addition, the movement of a container to and from a customer's location is a single stop that does not require extensive lost time due to multiple stops and starts along a route for a standard garbage truck.

Results from the two scenarios run through the Traffic Model

Scenario 1: The Baseline Condition scenario modeled the approximately 138,000 commercial customers listed in the BIC database and the carters that serve them. The purpose of this scenario was to establish a baseline condition that can serve as the basis for comparison to other potential scenarios with different waste streams, constrained or refined carter-generator relationships based on geographic limitations, and other considerations. In this scenario, refuse is collected in one set of trucks, and recycling in a separate set of trucks.

Scenario 2: The Combined Stream scenario consolidates the recyclables (clear bag or separated) and the putrescible waste stream (black bag) into a single unit, where possible, so they can be picked up and transported in the same collection trucks. In Scenario 2, if a customer has daily pickups of both putrescible waste and recyclables assigned to it, they have been assigned and sent to the putrescible waste transfer station only. In addition, a customer with only recyclable waste will go to the recyclable transfer station listed in the database.

Summary of Scenarios 1 and 2

Category	Scenario 1	Scenario 2	Percent Difference
Total "Customers" *	152,740	107,994	-29.3
Total Tonnage (Putrescible + Recyclable)	8,385	8,385	N/A
Vehicle-Miles Travelled (VMT)	99,798	65,558	-34.3
Vehicle-Hours Travelled – Total (VHTT)[c]	6,388	4,946	-22.6
Vehicle-Hours Travelled – Running (VHTR)[d]	2,467	1,783	-27.7
Average Operating Speed	15.6 mph	13.3 mph	-15.2
Average Running Speed	40.5 mph	36.8 mph	-9.1
VMT per Ton	11.90	7.82	-34.3
VHT (total) per Ton	0.76	0.59	-22.6

* NOTE: "Customer" here refers to a unique Customer- Destination combination. In Scenario 1, a customer that had both putrescible waste and recyclable pickups would be counted twice.

Case Study of Three Sample Carters

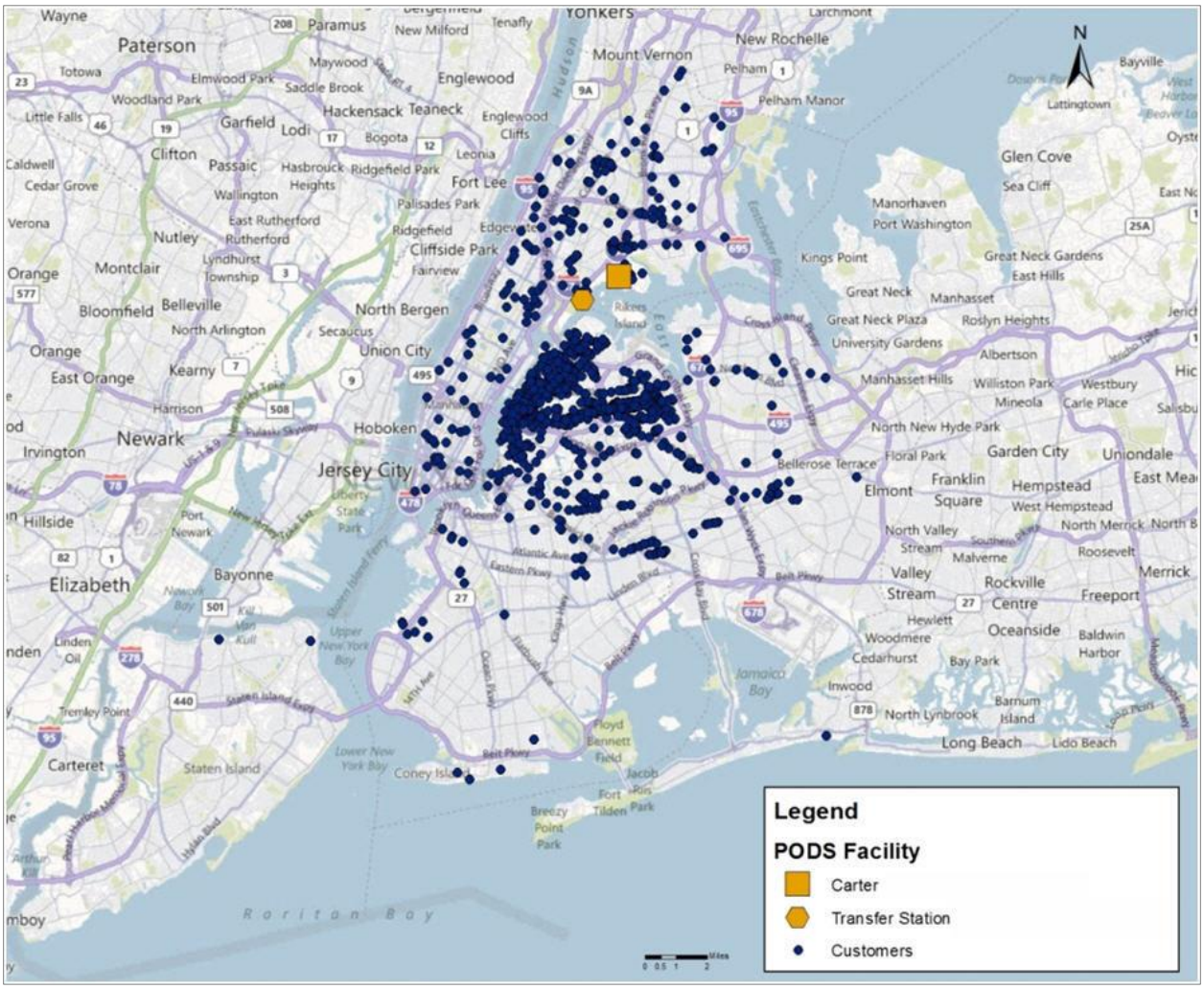
A detailed examination of three sample carting firms illustrates some of the complexities of the commercial solid waste collection process in New York City. These three carters are located in a similar area east of Manhattan and serve customer bases that are somewhat similar. The terminal locations for these carting firms, the primary transfer stations they use to serve their customers, and the customer locations are shown in the accompanying figures.

Carter No. 1 serves customers that are heavily concentrated in Queens, but also have customers scattered throughout the other boroughs. The company's primary transfer station is in the Bronx, which is a relatively short distance from most of their customers. Nearly all of their customers (99.3 percent) are served using standard rear-load or front-load garbage trucks.

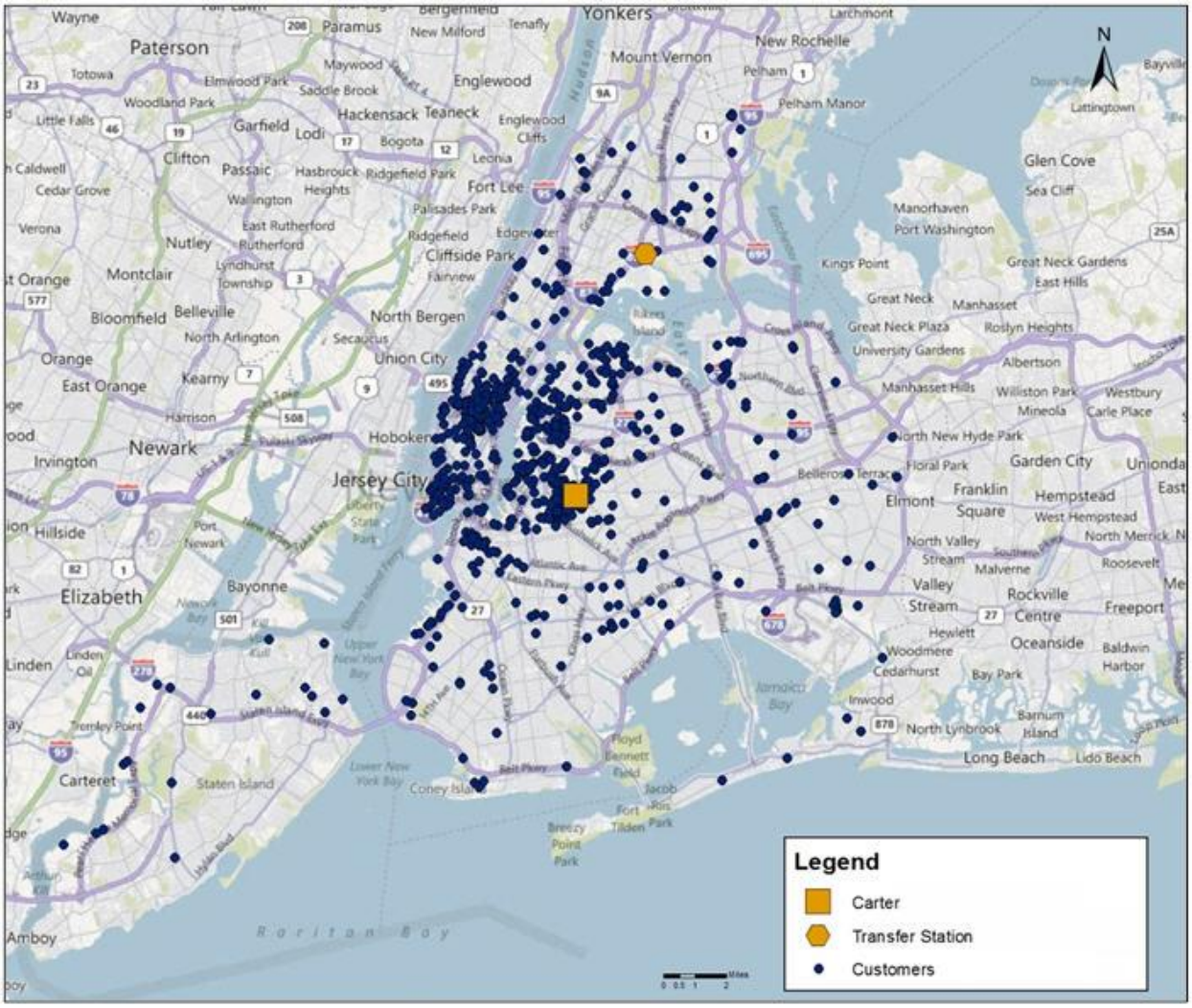
Carter No. 2 has a facility in Queens and serves customers scattered over a large area, but has a concentration of large customers in Midtown Manhattan that are handled using container/compactor trucks. More than 90 percent of Carter No. 2's customers are served using standard rear-load or front-load garbage trucks.

Carter No.3 has the tightest concentrations of customers in two distinct clusters in Queens. Of the three carters examined in this case study; Carter No.3 has the heaviest use of container/compactor trucks (more than 21 percent). The company's main transfer station is in Queens, which is some distance from one customer cluster but not far away from the other cluster. Carter No.3 serves very few customers outside of Queens.

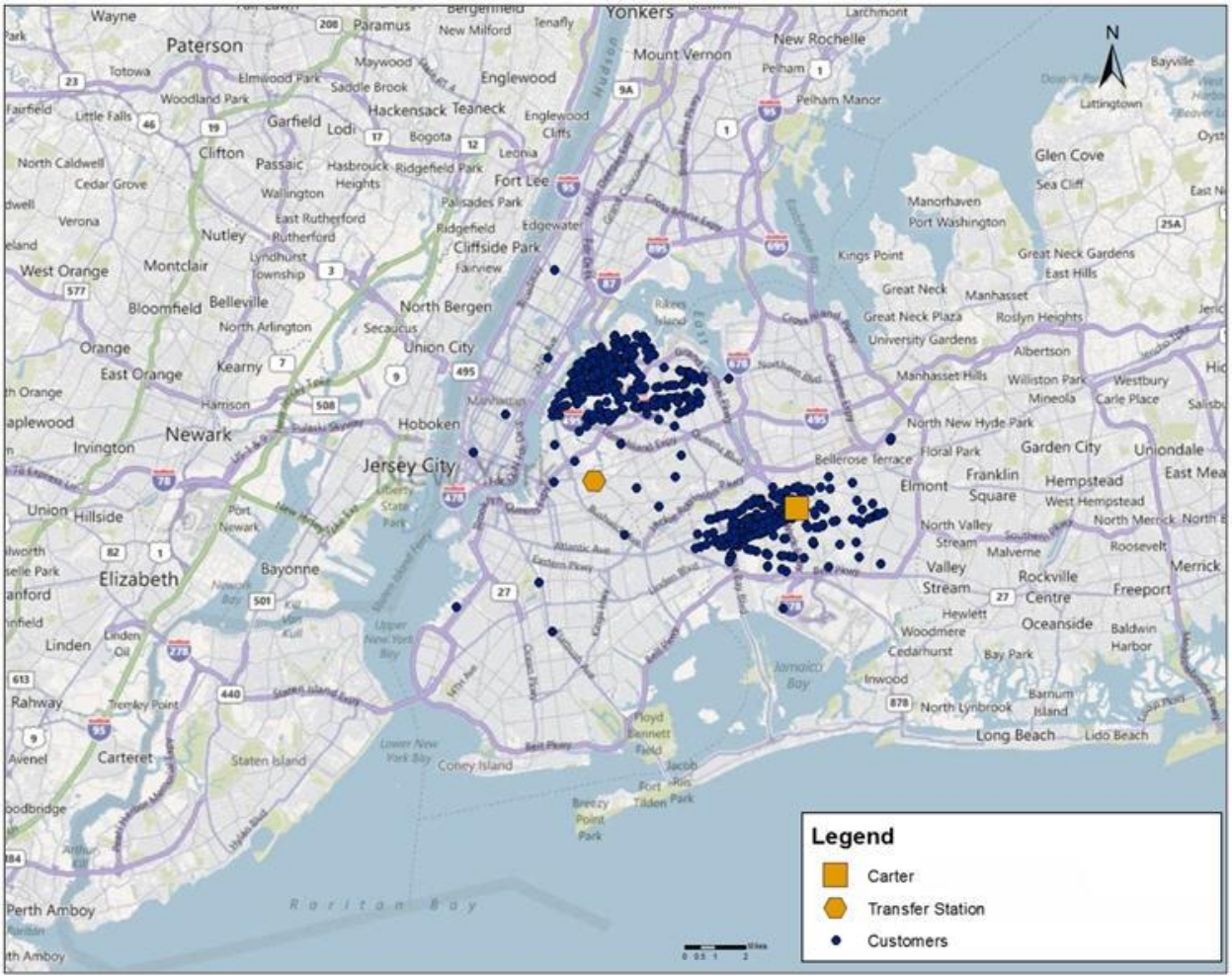
Carter No. 1


Legend
PODS Facility
Carter
Transfer Station
Customers
N
Raritan Bay

Carter No. 2


Legend
Carter
Transfer Station
Customers
N
Yonkers
Paterson
Newark
Jersey City
Elizabeth
Hoboken
Union City
North Bergen
Bayonne
Staten Island
Coney Island
Long Beach
Lido Beach
Raritan Bay

Carter No. 3


N
Legend
Carter
Transfer Station
Customers
Yonkers
Paterson
Newark
Jersey City
Elizabeth
Hoboken
Bayonne
Carteret
Perth Amboy
Staten Island
Coney Island
Long Beach
Raritan Bay

The VMT and VHT baseline summaries for these three companies are shown in in the following table. Based on the customer and transfer station locations, and the types of trucks used to serve their customers, the information in the table indicates that the use of container and compactor trucks is a major factor in VMT and VHT measurements for carters serving customers. Carter No. 3 has the most heavily concentrated groups of customers and also processes their waste through transfer stations located close to them; however, is the least efficient of the three carriers when measured on a VMT/ton and VHT/ton basis. This is because there is a substantial use of travel time and mileage when processing loads with a container/compactor truck, since there is an empty return trip from the transfer station to the customer for every trip made to pick up a customer's waste. There is also an inherent inefficiency in VMT/ton and VHT/ton for these trucks in trips where a customer's container is transported without regard to whether it has reached its maximum load (i.e., a truck hauling a container that is 100 percent full by weight will expend fewer VMT and VHT per ton than a truck making the same trip with a container that is 75 percent filled).

Carter No. 1, which is the most efficient of the three carters on a VMT/ton and VHT/ton basis, has a combination of three factors that all tend to support efficiency:

- Customers concentrated in close proximity to each other.
- Transfer stations located in close proximity to their heaviest concentration of customers.
- Very few customers who use containers and compactors for their waste disposal.

VMT and VHT Summary for Case Study Carters

Carter Name	Combined Tonnage	Number of Customers	Total Mileage	Total Travel Time (in Hours)	VMT per Ton	VHT per Ton
Carter No. 1	101	1,853	1,162	54	11.5	0.5
Carter No. 2	65	1,850	1,102	80	17.1	1.2
Carter No. 3	34	1,283	652	102	19.0	2.9

System Redundancy

By mapping commercial waste customers and carters servicing them, system redundancy under the current commercial waste process can be analyzed. An illustration of how multiple carting firms serving customers in an area that requires overlapping use of the street network can be seen when customers are mapped in areas at a sub-borough level and the number of different carters serving those customers. The map below shows New York City's 59 community districts, along with 13 additional areas designated as "green" or "grey" areas that have public recreational or institutional uses, but have commercial waste customers. The table below lists a random sample of Community Districts from the five boroughs, along with the total customer count and the number of carters serving these customers. Manhattan District 5, for example,

has 13,931 customers served by seventy nine carters. The number of carting firms serving customers in a single district can be used to estimate overlapping services and potential inefficiencies in the commercial waste system in New York City.

New York City community districts and redundancy of commercial waste activity

District	Customers	Carters
MA-1	2787	68
MA-5	13931	79
MA-11	1534	55
GREEN	29	10
BX-2	1432	39
BX-4	1487	38
BX-8	930	30
BX-12	1691	43
GREEN	14	6
BK-4	1363	49
BK-9	792	43
BK-14	1442	59
GREEN	16	8
QN-1	4771	69
QN-6	1806	48
QN-10	1471	44
QN-14	812	26
GREEN	83	9
SI-2	1772	31
SI-3	1474	25

4 Commercial Putrescible Waste Estimation

In contrast to the field research portion of the Study, efforts to estimate commercial putrescible waste quantities were carried out through literature review and waste modeling, and an analysis of existing data sources, plus efforts to gather additional data. Halcrow, Inc. and its subcontractor, CalRecovery Inc. performed this work.

4.1.1 Method

The Halcrow Team employed two general strategies to estimate commercial putrescible waste from existing resources. These efforts yielded two estimation tools which, below, provide preliminary estimates of the quantity and composition of disposed commercial putrescible waste in NYC, as well as an estimate of the overall diversion rate. Note that these tools are designed to be updatable with improved data inputs in the future. Thus the estimates below are shown as examples, not firm measurements.

Two primary methods were employed to generate estimates.

4.1.2 Theoretical Model Development:

The only reliable, consistent source for municipal solid waste tonnages generated by the commercial sector come from the official reporting requirements by licensed carters and transfer stations to DSNY. However, it is known that these tonnages do not capture the complete universe of commercial waste, because material delivered directly to transfer stations or facilities outside of New York City are not required to report to DSNY. In addition, it does not provide the sectoral specificity desired. Halcrow endeavored to capture some of this missed material by surveying New York and surrounding states, but found New York City-specific data either unavailable or inconsistent.

To achieve a more comprehensive theoretical estimate, the Halcrow team developed an "Employee-based Disposal Model" using per-employee waste factors derived from a comprehensive literature review of previous commercial waste studies, and employee counts for NYC businesses for the year 2009 from InfoUSA, a marketing database, which provided the best available data on NYC businesses (type, number of employees).

Sixty-seven previous studies were reviewed to identify if they met the criteria required for the Study as summarized in the table below.

Criteria Used to Assess the Value of Published Reports

Criteria
Geographic scale of the contributing 'wasteshed' (national, state-wide, county, or municipality)
Commercial waste was subject of the study
Results based on field work
Includes generation factors (per employee generation or composition by sector/industry code)

Only a few studies met the criteria for applicability to the commercial waste model for DSNY. See table below. Relatively few studies solely characterize commercial solid waste, and most of them have only analyzed disposed commercial solid waste, as opposed to generated or diverted commercial waste. Additionally, the number of studies that target commercial waste is small compared to those focused on residential waste, and the proportion of those that contain useful numerical data is smaller still. The table below summarizes reports that were most useful in this project.

Source Literature Input to Disposed Waste (LDW) and Generated Waste (LGW) Models

		California Integrated Waste Management Board 2006	City of Los Angeles 2002	Los Angeles County 2005	City of Los Angeles 1997	City of Ottawa, Canada 2007
Unit Factors (lbs/employee/per duration)	LDW Model	used	used	used	not used	used
	LGW Model	used	not used	not used	not used	not used
Composition Factors (percentage)	LDW Model	used	used	used	used	used
	LGW Model	used	not used	not used	not used	not used

There were only sufficient data to create a model estimating waste disposed for all business sectors and material types. This means that diverted waste had to be estimated through a different approach – the data integration exercise described below.

Business sectors were categorized by the following 2-digit North American Industry Classification or NAICS classifications that can be summarized by the following list.

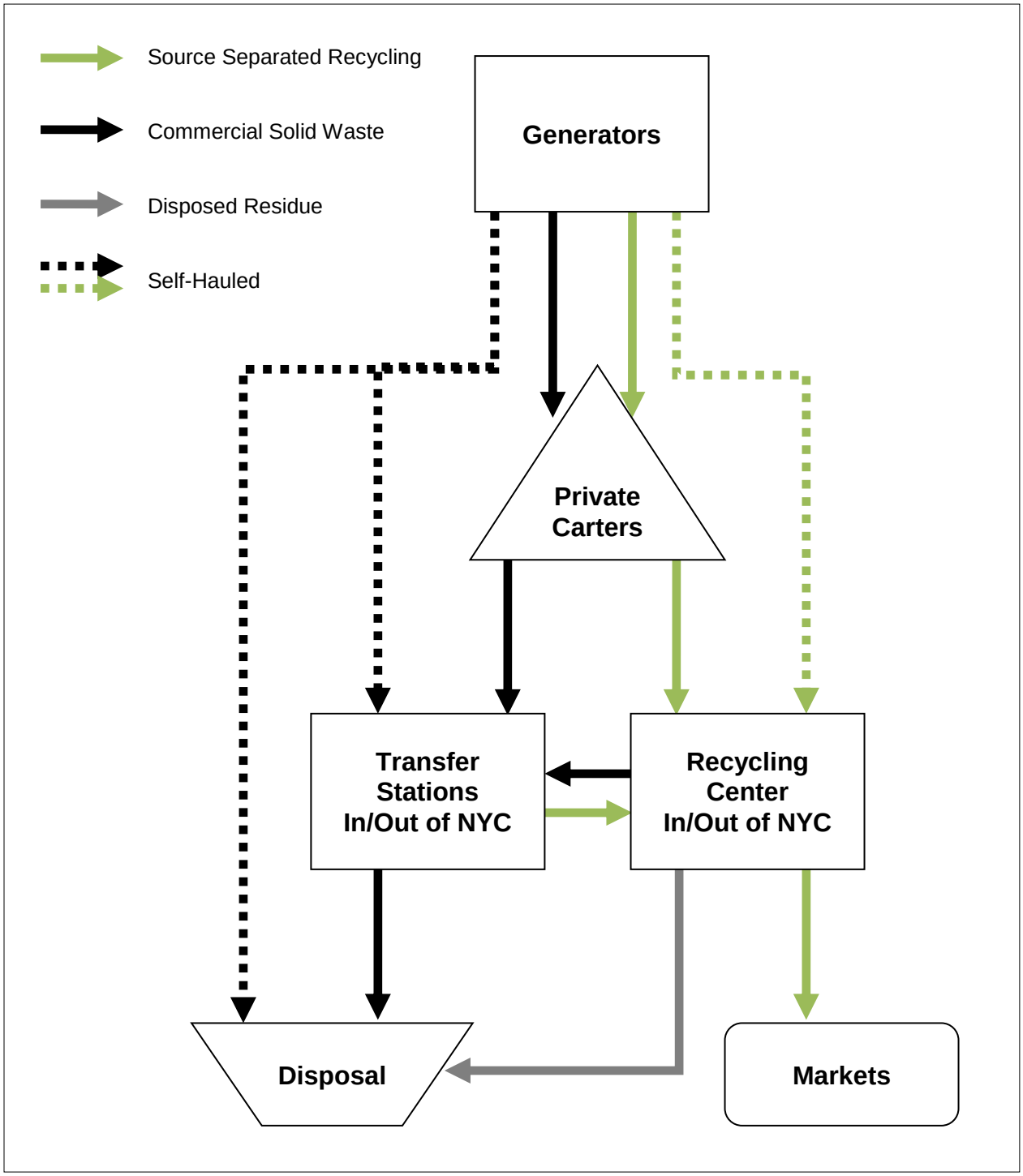
Business Sectors
Accommodation and Food Services
Administrative and Support and Waste Management and Remediation Services
Agriculture, Forestry, Fishing and Hunting
Arts, Entertainment, and Recreation
Finance and Insurance
Health Care and Social Assistance
Information
Management of Companies and Enterprises
Manufacturing
Mining
Other Services (except Public Administration)
Professional, Scientific, and Technical Services
Real Estate and Rental and Leasing
Retail Trade
Transportation and Warehousing
Utilities
Wholesale Trade

4.1.3 Data Integration Exercise

To estimate diversion, a mass-balance approach was utilized in which existing disparate data sources of commercial waste stream tonnages that are required to be reported to local and state government agencies were assessed, checked against each other, and integrated to form a complete picture of the flows of commercial putrescible waste from generator, to carter to transfer station, and final destination. See simplified diagram below. These included data compiled in DSNY's Private Operator Disposal System (PODS) Database, which houses the required reporting from licensed carters and NYC-based transfer stations, and data reported by transfer stations to the New York State Department of Environmental Conservation.

Through this exercise, the Halcrow Team estimated a citywide diversion rate by subtracting tonnages shipped to disposal destinations (landfill, incinerator, other) from overall tonnages flowing through the commercial waste system.

Simplified Waste Management Scheme



While the waste estimation tools developed are grounded in sound methodology, the Halcrow Team stressed that accuracy of the estimates generated by these methods is limited by data availability, accuracy and completeness in terms of employment estimates, previous commercial waste studies, and local and state-level reporting. Halcrow's literature review, performed for the Employee-based Disposal Model, revealed that few commercial waste studies exist that are applicable to NYC conditions and quantify commercial waste at the level of detail desired by this study. Halcrow's Flow Analysis uncovered inadequacies in State data sources, and also confirmed that there is no comprehensive tracking of diverted commercial tonnages (as opposed to those going to disposal) by any agency – City or State.

Preliminary estimates based on the above methods are presented below. Future estimates will be enhanced in both accuracy and detail by improved employment data for NYC, more NYC-specific estimates of commercial waste composition, and direct measurements of diverted quantities of material from Commercial Generators.

4.1.4 Waste Estimation Results

The table below shows the commercial putrescible waste disposal estimates by borough based on the Employee-based Disposal Model, diversion rate estimate based on DSNY-reported data. Using the diversion rate, overall commercial putrescible waste generation estimates were inferred from disposal estimates to an accuracy of 100,000 tons.[1] It should be noted that this diversion estimate is not based on direct measurement of diverted commercial tonnages, as no public or private entity tracks this information.

	Tons/Year	How Estimated	Detail Available
Disposed Waste (modeled)	2,583,000	Employee-based Disposed Waste Model	by Borough by 63 material types by 21 business sectors
Diversion Rate Total Recyclables*	26%	Derived from DSNY transfer station data	Citywide only by limited material categories
Generated Waste	3,490,000	Calculated using the formula: Disposed / (1.0 – Diversion Rate)	Citywide only no composition

The Halcrow Team created three models of disposed waste based on the literature review: a minimum, average and maximum estimate.[2] Given the literature review sources (primarily

1 Neither method was able to achieve a direct estimation of quantity diverted from disposal. The literature review revealed almost no useful diversion factors that could be applied to NYC, and the data integration exercise revealed highly inconsistent and incomplete data on diversion quantities.

2 Halcrow's maximum estimate of generated waste based on the literature review model was over 5.5 million tons.

California), DSNY determined that the minimum estimate provided the best fit to New York City based on the known tonnages flowing through transfer stations. The minimum estimate also most closely aligned with previous studies of the city's commercial putrescible waste.

The diversion rate includes Traditional Recyclables (Metal, Glass, Paper, and Plastic) + Organics (Oil/Fat/Grease, Landscaping) that found their way to recycling or composting facilities as opposed to disposal. It does not include food waste diversion because it was not sufficiently identifiable in source data in 2009. It also excludes C&D and Fill material.

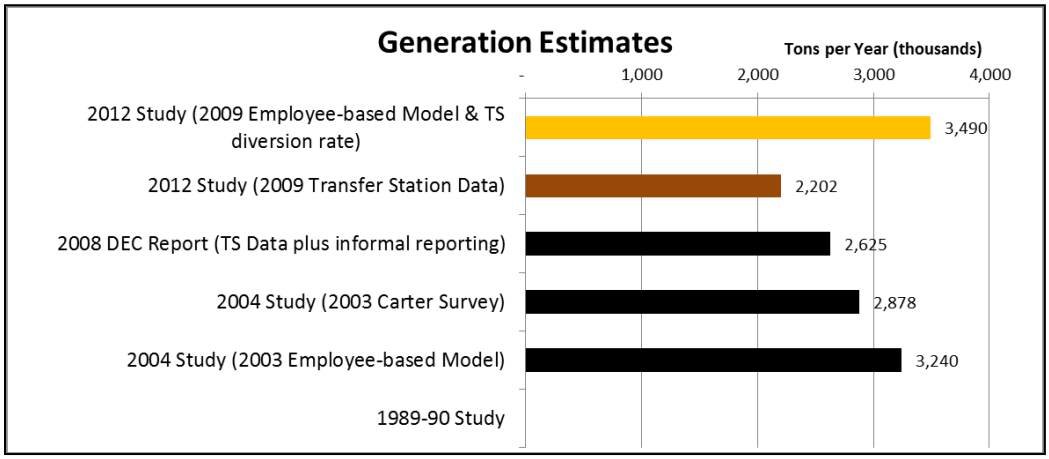
4.1.5 Comparison to prior Estimates

The diversion rate estimated by the Halcrow Team documents the known diversion through officially reported sources. Previous efforts to capture additional sources of diversion of commercial putrescible waste have involved the collection of informal feedback from recycling processors, showing possible diversion as high as 42%. See the 2008 estimates listed in the table below, which shows previous methods used to estimate quantities of Commercial Putrescible Waste, each of which has had limitations of its own.

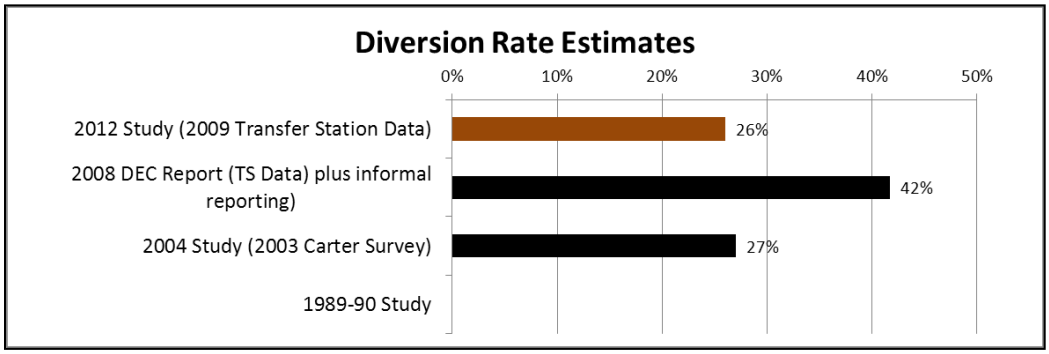
Past Estimates of NYC Commercial Putrescible Waste Disposal and Diversion							
	most recent year	**disposal**	**diversion**	**generation**	**diversion**	**Pros**	**Cons**
DSNY Estimates Compiled for DEC Reporting							
Estimates based on data reported by NYC-based commercial transfer stations to DSNY, as reported in PODS, supplemented by informal estimates of diversion of metal and paper of NYC commercial origin, provided to DSNY as a courtesy by its contracted processors.	2008	1,530,000	1,095,000	2,625,000	42%	directly reported to DSNY	diversion informally estimated; no outside NYC activity reflected)
Estimates from the last comprehensive study of Commercial Waste in NYC.							
Carter Surveys	2003	2,106,000	772,000	2,878,000	27%	reflect activity inside and outside NYC	both disposal and diversion informally estimated
Carter Interviews	2003	2,244,000	876,000	3,120,000	28%		
Generation by Employment	2003			3,240,000	N/A	acts as a check on NYC-specific estimates	based on national statistics; diversion and disposal not assessed separately
Estimates from the 1989/1990 Waste Composition Study	1990	2,330,000	N/A	N/A	N/A	Directly measured	No diversion assessed; out of date
rounded to nearest 10,000							

The estimates derived by Halcrow are generally in line with the range of estimates listed above, providing confidence in the orders of magnitude discussed.

As illustrated in the graph below, the estimates derived by Halcrow are generally in line with the range of estimates listed above, providing confidence in the orders of magnitude discussed.



The diversion rates are similar to the 2004 study.



4.1.6 Summary of Results

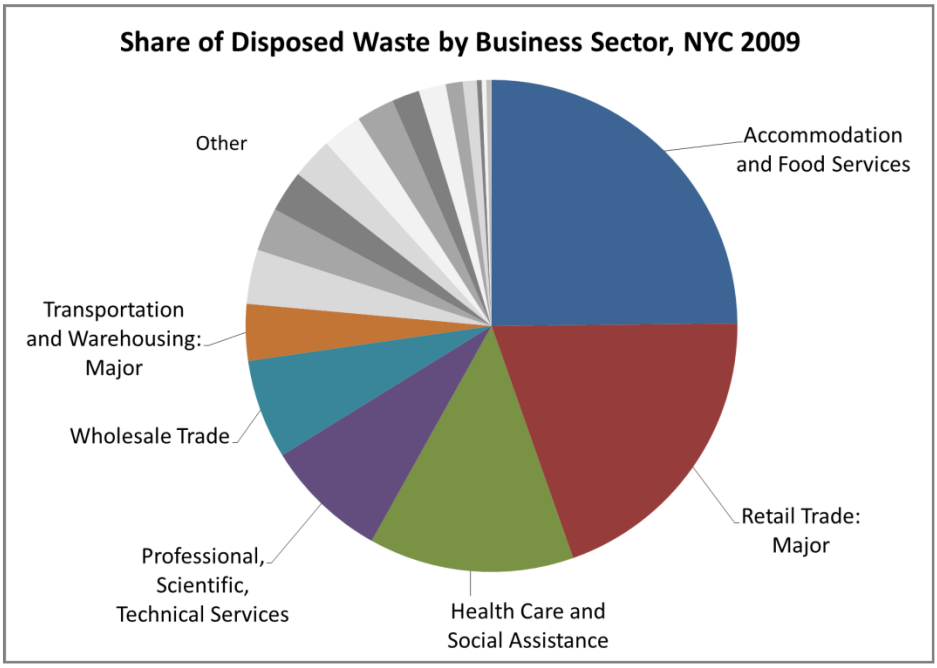
Disposal by Borough

The Employee-based Disposal Model allows for the estimation of waste tonnages being thrown away (and not diverted) by business sector and material type. Manhattan disposes over half of the commercial waste in NYC.

Tonnage Disposed by Borough, 2009		
Borough	**Tons/Year**	**% Total**
The Bronx	217,000	8%
Brooklyn	425,000	17%
Manhattan	1,458,000	56%
Queens	391,000	15%
Staten Island	92,000	4%
Citywide	2,583,000	100%

Disposal by Business Sector

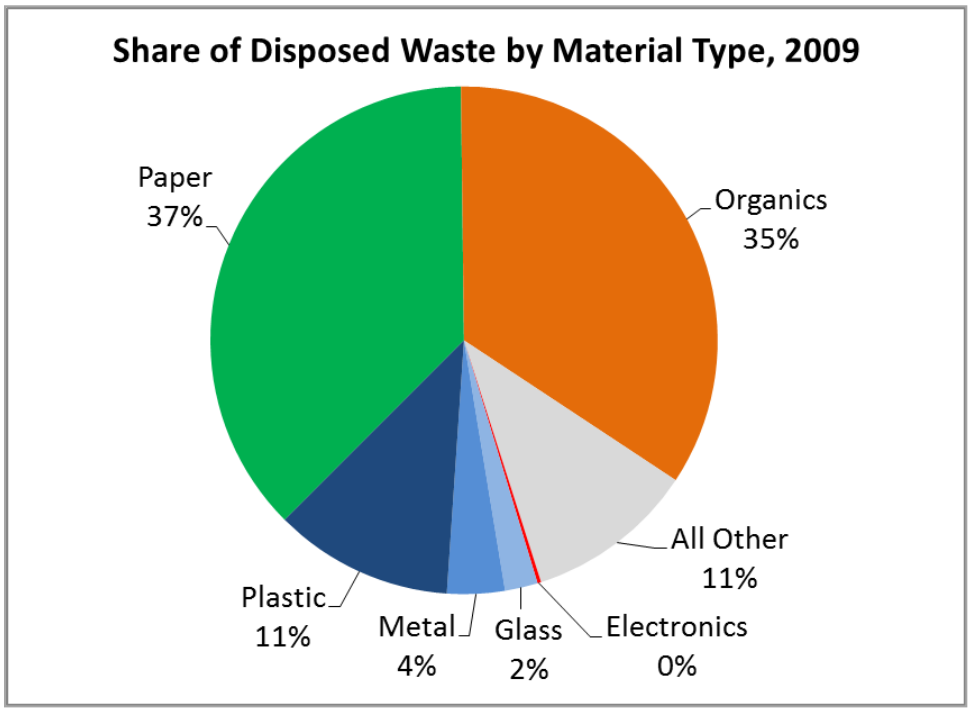
The majority of commercial waste disposed comes from Accommodation and Food Service, Major Retail Trade, and Health Care and Social Assistance. See graph and table below.



Tonnage Disposed by Business Sector, 2009	
Business Sector	**Tons Disposed**
Citywide	2,583,000
Accommodation and Food Services	822,000
Retail Trade	575,000
Health Care and Social Assistance	358,000
Professional, Scientific, and Technical Services	167,000
Wholesale Trade	121,000
Transportation and Warehousing	113,000
Manufacturing	105,000
Other Services (except Public Administration)	73,000
Administrative and Support and Waste Management and Remediation Services	56,000
Arts, Entertainment, and Recreation	50,000
Finance and Insurance	48,000
Information	47,000
Real Estate and Rental and Leasing	33,000
Agriculture, Forestry, Fishing and Hunting	8,000
Management of Companies and Enterprises	6,000
Utilities	1,000
Mining	-

Composition of Disposed Waste

Disposed waste composition was aggregated into 10 broad material categories. Based in this estimate, paper products make up 37% of disposed waste. Organics (two-thirds of which is Food) makes up another 34% of disposed waste.



Tonnage Disposed by Material Category	
Material Category	**Tonnage**
Paper	964,000
Glass	54,000
Metal	95,000
Plastic	295,000
Electronics	6,000
Organics	891,000
C&D	226,000
HHW	12,000
Special Waste	26,000
Mixed Residue	14,000
Total	2,583,000

Organics Material Types				
Food	Yard	Textiles	Carpet	Other
657,000	90,000	51,000	7,000	86,000

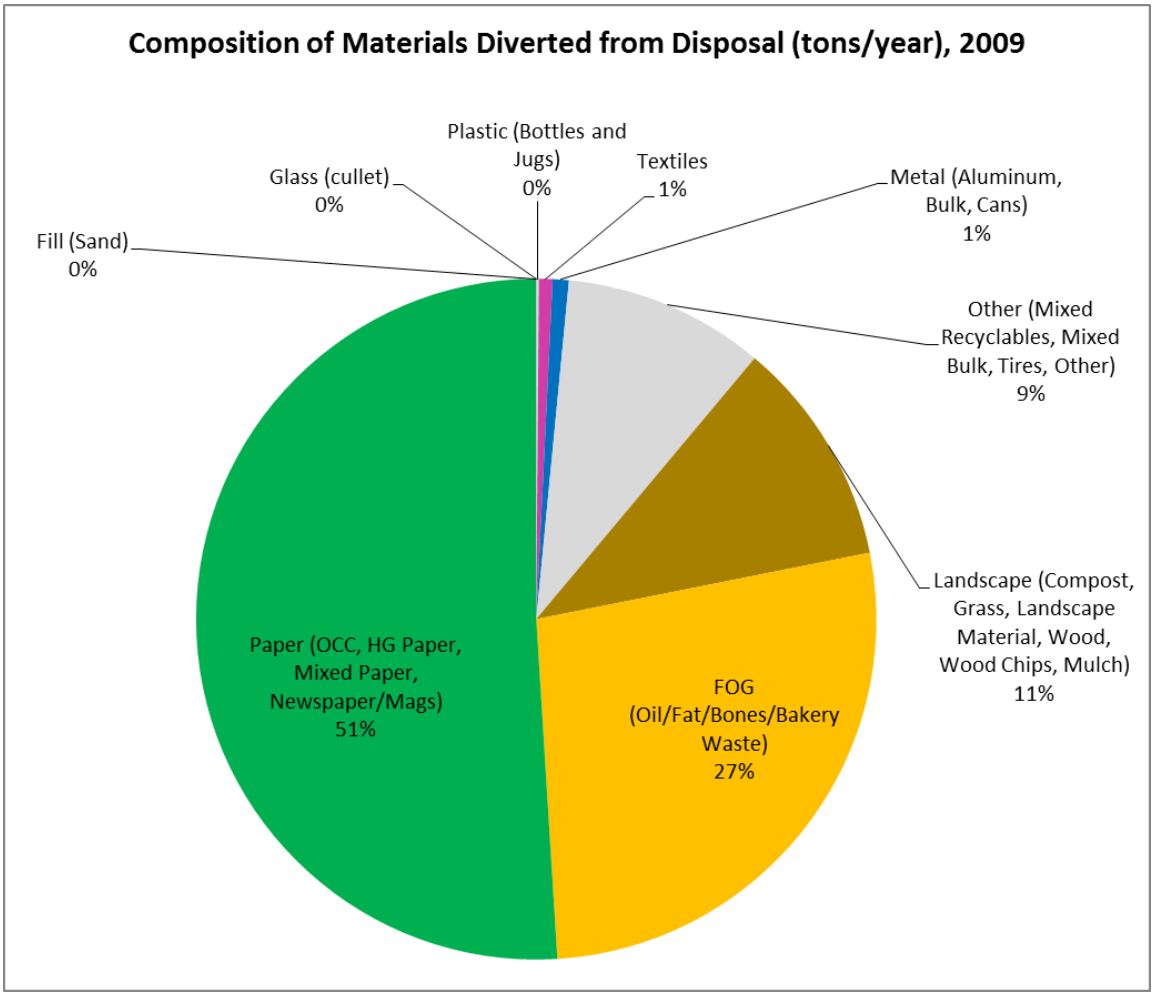
Composition of Diverted Waste

Halcrow estimated an overall diversion rate of 26%, which includes both traditional recyclables and organic recyclables (oil, fat, bones, and bakery waste).

Composition of Materials Diverted from Disposal (tons/year) 2009	
Traditional Recyclables	360,775
Organic Recyclables*	220,266
Total Diverted	**581,041**
Diversion Rate	
Traditional Recyclables (paper, metal, glass, plastic, textiles, other)	16%
Common Recyclables (traditional plus FOG)	24%
Total (traditional & all organic)	26%

* Food waste was not included in this analysis because it was not sufficiently identifiable in the source data.

By material type, the majority of diverted material is paper and cardboard.



5 Expert Interviews

In addition to the hundreds of generator surveys conducted along the sample street segment, Hunter College researchers and members of the Halcrow Team conducted interviews with important stakeholders in the NYC commercial waste system. A total of 20 expert interviews were conducted. Interviewees included NYC businesses (waste generators), and NYC-based professionals working in waste management and collection. The goal of these interviews was to gather data from those who were experts in their fields, and who had a "big picture" view of commercial waste generation and management. Interviewees were as follows:

Generators:	**Waste Management and Collection:**
Bloomberg Information - Large Office (Michael Barry, Sustainability Project Manger/Analyst) Face-to-Face	National Solid Waste Management Association-Industry Trade Representative (David Biderman,
BMS Building Management - Building Maintenance Services (Naser Gjelosi, Director of Sustainability & Training) Face-to-Face	Atlantic Waste Disposal - Landfill (Rich Nolan, District Manager) Telephone-Conference Call
Chiplotle Mexican Grill - National Fast Food Chain-Sit Down (Caitlin Leibert, Sustainability Coordinator) Telephone-Conference Call	Five Star- Carter –Large Carter (Anthony Tristani) Face-to-Face
Design Tex - Textile Design and Distribution (Dierdre Hoguet, Manager of Environmental Strategy & LEED Green Associate) Telephone -Conference Call	Great Forest - Waste Broker (Ken Richards, Director of Management Services and Amy Marpan, Director of Recycling Services) Face-to-
Downtown Alliance - Business Improvement District (Dan Ackerman, Chief of Staff) Face-to-Face	Metropolitan Paper Company – Paper Recycling Facility (Gregg Bianco, Owner) Face-to-Face
JP Morgan Chase - Largest Corporate Facility (Bosch Ganev, Environmental Responsibility Manager) Face-to-Face	Midland Carting – Geographic Carter (Gregg Tricola, President) Face-to-Face
Mt. Sinai Medical Center - Large Hospital (Anthony Schifano Jr., Director of Environmental Initiatives) Face-to-Face	Peninsula Compost Group - Compositing Landfill (Nelson Widell, Marketing and Sales Director, and
Starbucks - National Fast Food/Beverage - Take Out (Susan Long, Environmental Impact Manager, Global Responsibility Group) Telephone-Conference Call	Shred Services Inc. – Specialized Carter (Sean Gilligan, Chief Operating Officer) Face-to-Face
Union Square Hospitality - Large Sit Down Restaurant-Fine Dining (Dan Soloway, Operations Manager, Purchasing & Facilities; Austin Publicover (Restaurant Facilities Manager) Face-to-Face	Action –Large Carter (Joe Burke, Director of Sales) Face-to-Face
Vornado Realty Trust - Real Estate and Building Management (Suki Paciorik, Vice President of Corporate Sustainability) Face-to-Face	
Whole Foods - Retail - Food - Supermarket (Tristam Coffin, Green Missions Specialist, North East Region) Face-to-Face	
[*] *An interview was also conducted with the largest Subway Fast Food franchise manager in New York. This interview was thrown out, because the store was a single franchise, located inside Rockefeller Center. The manager lacked an "expert perspective." Face-to-Face*	

5.1.1 Major Themes

The interviews were structured to bring out common major areas of concern to the actors in the system, and the following stand out as important themes reported, with sample quotations from interviewees themselves:

- Among all generators interviewed, a **lack of space or lack of control over space** was the most commonly provided answer to questions regarding barriers to increased recycling or composting rates.

- "In our company-owned stores we often manage the waste ourselves. But half of our company stores are in rented spaces in which the landlord determines how the waste is managed. That's very applicable for waste services. So for example, if we have a store in a mall, but the mall does not have extensive recycling, then it is really hard for us to do recycling in that space. It's not up to the tenants, especially in a multi-tenant space. In a free standing space we tend to manage it, but not in those other scenarios… Then it is critical that we get the landlords involved as well, that is the way to move this forward (Starbucks)."

- Among all generators interviewed, there was a **clear interest in composting**. Generators require more education on the requirements, technology, and limitations of composting waste. Space and technical requirements are considered to be significant obstacles to implementation.

    - "We are avid users of the green market system across the street at Union Square where we are supporting what people call local farmers. Of course some of them drive between 2 1/2 and five hours so they're not as local as other markets in the country, but it's as local as it's going to get, and now with the "slow food" movement, and the "farm to table" and the "green movements," everybody is kind of merging into one group, with the sustainability movement…For example there's a small composting operation on top of the Gramercy Park Hotel, that's at Maialino restaurant…In our view it's a little bit that helps but it fits into the philosophy of what we are doing as far as keeping being sustainable, and keeping it within the economics of the local and regional community, and minimizing waste that's going out via truck. Now it's goes up to the roof. Obviously not in the tonnage that could be utilized, but we're going in that direction, and people are interested in (Union Square Hospitality).

- Regarding **composting**, generators and waste carters cited the **need for infrastructure** such as designated refrigeration areas, and sufficient odor control to support this as a feasible practice. Carters indicated that waste composting is a potentially significant element in the waste stream, but is not at this time. Several indicated that it would be significantly encouraged if some infrastructure were provided by the city.

    - "To New York City I would just say the biggest thing that you can do is to require landlords to allow recycling and composting without the getting too specific about what... even require that if tenants do desire composting that they can. …when you have companies like us that are doing everything, we can and for us to be tied up in litigation about it such a huge waste. The biggest thing that they could pass tomorrow with very little output is a stipulation that if tenants desire to recycle and compost to allow that. (Chipotle)."

- About composting, “I like infrastructure, because it solves the problem. Whether we are incentivized to do that, I think that is a personal opinion. I think it's about infrastructure. I think that if the facilities were there to do it, more people would latch. Ultimately it has to be easy. The logistics have to be set up. The infrastructure has to be there. If somebody wants to incentivize me to do it… that's great! But I kind of feel like we don't need the dangling carrot, we just need an easier road to pull the cart (Union Square Hospitality).”

- Many generators mentioned **perceptions among staff about mixing trash and recycling**. The perception among most staff is that even when properly separated, few items are actually recycled. This belief often affects the degree to which they will be vigilant about recycling. This appears to be a clear contradiction to the interests expressed by carters, i.e., that better waste separation leads them to divert/recycle more.

    - “The biggest barrier we face is the perception that tenants have. When they see one of my cleaners passing by, they ask ‘how are we recycling when everything appears to go into one barrel?’ (BMS)”

- All generators pointed to the fact that **strong markets** for recycled materials increases diversion, and that waste carters often award financial advantages to clients based upon the amount of clean and marketable (to third party users) recyclable materials they provide in their waste stream.

    - In New York that I think recycling is above average good, because there is a requirements and because there are pretty good commercial offerings in terms of commercial services. I think that we need to think about closing the loop, before talking about recycling…let's talk about this from the purchasing perspective. If you start demanding products with recycled content, then it creates a market. Then you will have a greater demand for recovered materials. So that would help the problem, and help prop up the price for recyclables. Make it commercially viable. (JP Morgan Chase).”

- Generators indicated that **sustainability** is a key feature of current corporate culture, irrespective of the industry. Recycling is consistent with this corporate cultural value.

    - “So last year, we did a full host of tenant meetings at every building on sustainability. …. For tenants, the one question that came up over and over again was about recycling. It's the most tangible piece it is what the tenants see. … They wanted to know why the cleaners put two bags in the same bin, etc. So I fully appreciate how important this issue is. The tenants really do view green and corporate responsibility as recycling. So this is also a clear advantage of being in one of our building. We can show them pictures and images, we show them images of where waste and recycling goes. We have the information that they are interested in (Vornado).”

- **Carters have an interest in and desire to achieve regulatory compliance**. This is driven by a combination of factors: interest in "being green" or viewed as a sustainable practice; and ensuring compliance to minimize costs/fines for noncompliant practices.

    - "First of all, we're trying to do the right thing environmentally, I mean, we're heating our mechanic shop with reusable oil, got all these dimmers on here so that if you walk out of the room the lights shut off, in our home building we're trying to do the right thing. We're also trying to stay ahead of the curve… [We have a group of young innovative] people that are looking to try to keep the pulse right in their hand and move in the right direction. Like I said when we first sat down, we have a state of the art recycling facility (Action)"

- Virtually all carters interviewed indicated that **increased enforcement** applied to generators, their clients, would likely result in increased diversion. That is, increased waste separation by clients would bring about more recycling. Note that this contradicts the view expressed by many generators. Addressing this great discrepancy in perception might yield benefits to the diversion rate.

    - "A lot of people won't enforce things, you get resistance. Generators say that they don't need to do, or want to. . So, if there's a way for enforcement or some kind of incentive (Great Forest)."
    - "If you're a resident of the city and you don't separate recyclables, sanitation will give you a fine for co-mingling. The city shows up and they say your trash is mixed with newspaper, or it's in the wrong color bag, you get a ticket for that. If on the other hand you go to a commercial office building, and mix everything together, there is no regulatory enforcement on the commercial side. Business is required to separate. But it's not enforced…. Look, there are already enough rules and regulations on the books, I am not asking for more of them. (Five Star)."

- Carters and generators **feel that they understand the regulations regarding waste recycling, with one significant exception**. While all are clear on the need for separation of recyclables by residential and commercial generators, it is unclear to the carters if the **responsibility for separation** falls on the generator or the carter in the commercial waste sector.

    - "The law say that everyone must source separate, but the question is off-site or on-site separation. That's often a 'gray area.' A lot has to do with enforcement of off-site separation. So the carter will say one thing, the business another thing. There is a lot of confusion on the part of businesses as to what needs to happen. As for composting, often times when the question comes up, it comes up because a company may want to do the right thing. It may be as the top down sustainability program. Typically for larger corporations, or large financial

institutions, businesses with large stable programs. They often want to do that in their cafeteria spaces (Great Forest)."

6 Recommendations

The major findings of the 2012 Commercial Solid Waste Stream Analysis and Study have been presented above. The generator survey does provide valuable insights into generator behavior, but much more information is needed to provide a full accounting of the flows of commercial putrescible waste through New York City.

To fully realize a comprehensive view of commercial waste generation and diversion, the consultant team recommended improvements to data and reporting, and the implementation of direct waste characterization of commercial waste.

The challenges for commercial waste estimation experienced in this study were also reflected in past studies:

- Modeled data not able to directly estimate diversion (and thus generation)
- Diversion based on incomplete reported data and/or informal data gathering
- No common, established method to integrate disparate datasets in a consistent manner

Consultant recommendations include:

- Improve quality and scope of required reporting to make commercial waste estimation more accurate and consistent and comprehensive, including recycling facilities in addition to transfer stations.
- Improve coordination of required reporting between agencies to make reporting less onerous for reporting parties to maximize potential for complete and timely submissions

Direct waste characterization of commercial waste was excluded from the final scope of this project. The consultants advised that given the currently available data, a solid measure of the latent potential for the commercial sector to recycle, the recycling capture rate, cannot be determined without direct waste characterization.

- The night-time observations documented the occurrence of source-separation, and intent to recycle, the consultants also observed recyclable material commingled in refuse indicating only partial compliance with the recycling rules.
- Direct waste characterization would measure to what extent designated recyclables are still being thrown away.

The consultants also acknowledged the challenges posed by such a direct waste audit:

- To implement a commercial waste characterization in NYC, it will require resources and cooperation of multiple agencies, and regulated commercial entities, which may continue to pose challenges in the current (as of 2012) budgetary climate and regulatory conditions.