GOODS MOVEMENT: REGIONAL ANALYSIS AND DATABASE

FINAL REPORT

DISCLAIMER

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REGIONAL ANALYSIS AND DATABASE

Draft Final Report

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CHAPTER 1

INTRODUCTION

Transportation planners are becoming increasingly interested in freight movements. This interest, however, highlights the inadequacy of existing data on freight movements, especially in urban areas. Ogden [1992], for example, in his recent book on urban goods movement, has noted that most urban areas in the U.S., Canada, Britain and Australia have not collected comprehensive data on freight movements since the 1970's. The more recent data are mostly fragments -- small sets of partial data on movements in specific areas, across particular bridges or highway sections, etc.

Against this backdrop, the project reported here has been undertaken to create and test methods for synthesizing truck flow patterns from partial and fragmentary observations. To accomplish this goal, the project has focused on assembling all available data on truck flows in a particular urban area (New York City), developing a useable database from these separate data sets, and using the database to support a modeling effort aimed at estimating both origin-destination patterns and link flows.

1.1 Background and Motivation

Increased levels of congestion seem to be problematic nationwide. Gone is the option of building highway capacity fast enough to keep pace with the growth in demand. In addition, what capacity we do have is in need of repair, much of it having been built in the 1960's and 1970's. Network rehabilitation is a key focal point of current planning efforts.

This means that planners need to focus on how to get greater capacity from existing facilities. They must also determine how to make minor improvements and investments that make it possible for the network to function more efficiently and effectively. Historically, such efforts focused on improving auto flow, reducing auto-minutes of delay, and increasing personal mobility. But a shift in focus is underway, not only away from autos toward high occupancy vehicles, but also from passenger travel toward goods movement. Planners are beginning to emphasize the fact that an area's economy can prosper only if jobs are plentiful, and jobs can exist only if raw materials, semi-finished goods and finished products can get to and from manufacturing plants, retail and wholesale facilities, and service facilities.

Air quality is another issue driving the focus on goods movement. There is an interest in reducing the freight-related emissions, particularly nitrous oxides (NO_x) and particulates (PM_{10}) from diesel trucks. Lower travel times, achieved through higher average speeds and less delay, translate into smaller quantities of fuel consumed and lower emissions, even without changing the distribution of trips among truck classes, or among modes.

This emphasis on goods movement is needed, and it should produce the benefits expected -- a more stable employment base and sustained economic vitality -- because businesses can grow and prosper if they can ship to and from the businesses with which they interact. To achieve these benefits, however, we must know more about the flow patterns of goods in most urban areas. Planners do not have much data on how many trucks are traveling from one place to another, or what the distribution of truck sizes is among these flows. There are also questions about the extent to which commercial vans are used, how the flow patterns vary by time of day, and what facility improvements, or changes in operating practices, would facilitate these movements. Moreover, can changes in these flow patterns relieve congestion in general? Could auto flow be improved as well?

To answer these questions, a sense of the flow patterns is needed. It is necessary to develop OD matrices, by truck class and time period, so that diversion studies can be performed, and so that the impacts of changes to the network's characteristics can be assessed. For example, if commercial vans are allowed to use auto-only parkways, during off-peak hours, what would be the impact? How would trips be diverted? If a major expressway is taken out of service, in whole or in part, for reconstruction and rehabilitation, what changes in truck flow patterns will result? Will certain businesses be forced to close? Will their transport costs increase dramatically? How will the overall network flow patterns be affected? Questions like these can only be answered if flow matrices are available.

Moreover, if one is to develop such matrices, from data currently available, how can the quality of the flow estimates be improved? Where should data be collected next? What types of data would be most helpful? Link classification counts? A partial OD survey? Answering these questions is a complex problem. It takes carefully designed methods and analysis tools to sift through the existing data and determine what additional data would have the greatest value.

Other problems complicate the situation. Often, the data are collected and kept by different agencies, the sampling bases are different (e.g., include/exclude vans, westbound flows only, tolled facilities only), different definitions are used for the items being collected (e.g., heavy truck, medium truck), and different time frames (e.g., different years, seasons, starting and ending times during the day). This suggests a need for an analysis tool that is tolerant of differences in the input data and robust in its estimation of flows.

1.2 Objective and Scope

In response to this need for better truck flow analysis tools, the purpose of this research project is to develop a way to estimate OD trip matrices from data typically available: link volumes, classification counts, cordon counts of trucks entering and/or exiting the study area, and partial observations of the OD flows themselves.

This method should:

- make maximum possible use of existing information;
- work with many different types of data and combinations of data;
- deal effectively and efficiently with new types of data, and new forms of information;
- generate multi-truck class OD flow matrices;
- deal with multi-time period problems; and
- accommodate network use restrictions (e.g, no trucks or no heavy trucks) and changes in those restrictions.

The product of this project is a new battery of software that helps transportation planners estimate multi-class truck trip matrices for a given network and time period. These matrices and the associated link flows can be displayed using a Geographic Information System (GIS) platform. This contributes to rapid understanding of the results from a large, complex model.

1.3 Document Overview

Beyond this introduction, Chapter 2 presents the methodology that has been developed. Chapters 3 and 4 present case study analyses from two areas in New York City; Chapter 3 focuses on the Bronx, and Chapter 4 on Brooklyn. Chapter 5 presents a summary of the findings, and conclusions and recommendations. Appendices A and B contain listings of the input data sets created for the two case study analyses.

CHAPTER 2

METHODOLOGY

This chapter describes the process by which the multiclass truck origin-to-destination (OD) trip matrices are generated. First the basic functional requirements are described, followed by the underlying assumptions upon which the process is based. The discussion then turns to the models, imbedded within the process, that actually estimate the OD matrices.

2.1 Functional Requirements

The method for estimating truck flows must address two major objectives. The first is to generate the best possible multiclass truck OD matrices (and associated link flows) based on whatever flow information is available. The second is to provide indications of where holes exist in the data, so that subsequent data collection efforts focus on critical data needs. As Figure 2.1 shows, application of this methodology yields an iterative process where better and better OD matrices are generated from ever improving information acquired through targeted, efficient and prioritized data collection.

Put another way, the method is aimed at synthesizing multiclass truck trip tables from data typically collected during corridor studies: link counts, classification counts, and partial OD surveys. Moreover, it is to provide feedback about weak spots in these data, so that future data collection efforts can focus on the most critical needs.

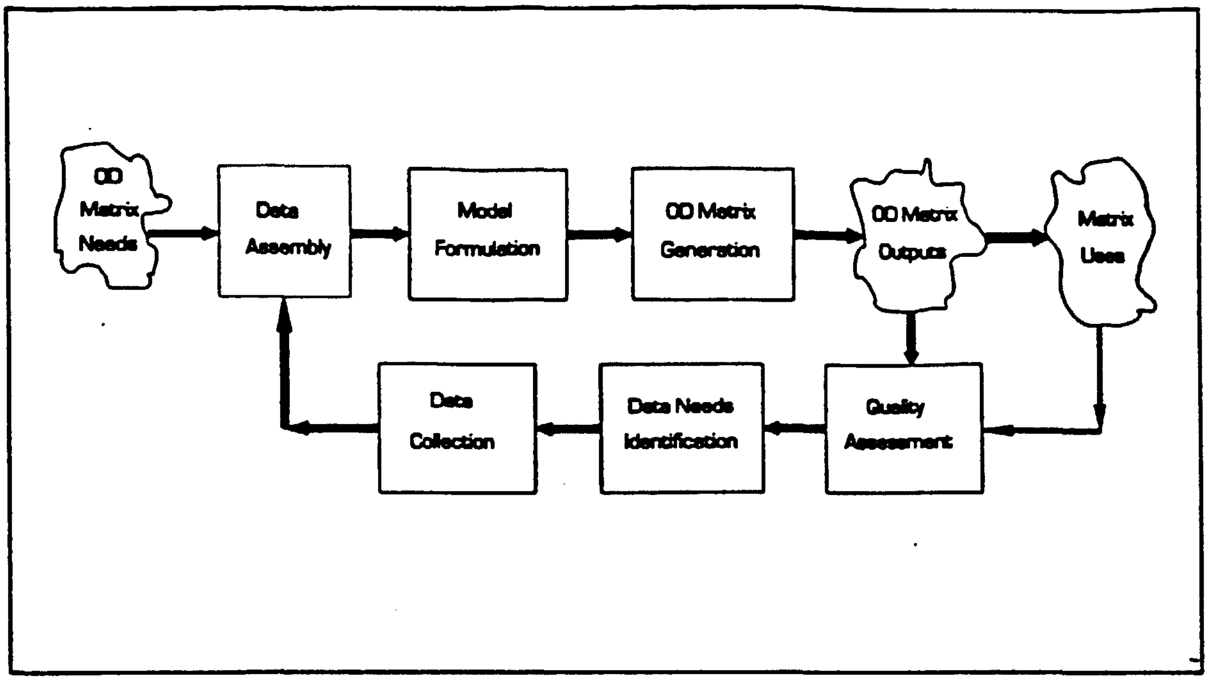


Figure 2.1 The OD matrix refinement process.

Recognizing that the inputs employed are typically collected by different agencies and/or consultants, for different purposes, at various locations, and at varying times, the method must be designed to tolerate inconsistencies in truck class definitions, zone definitions, hours of observation, and geographic extent. Moreover, it should also accommodate variations in origin and destination specificity, data collection location identification, and truck class coding.

2.2 Basic Assumptions

To meet the functional requirements listed above, we have developed a solution process based on as few assumptions as possible. However, some basic assumptions are necessary. First, the network is assumed to consist of links, joined at nodes, and each link is assumed to have at least the following attributes: 1) a directional flag (only forward, only backward, or two-way), 2) a use label (all truck classes, some, or none), and 3) a travel time (which may vary by time of day).

Further, it is assumed that the underlying geography is divided into an exhaustive, non-overlapping set of zones. Zipcodes are a suitable example; census tracts are another. Each zone has a centroid, designating the point at which trips originate and terminate. If the centroid is on the network, it must be a network node. If off, it must be attached to one or more network nodes by centroid connectors.

It is assumed that a set of truck classes exists such that one can distinguish among the types of trucks generating trips. The FHWA truck classes ("F" classes) are a suitable example. This specific truck classification scheme is discussed more thoroughly in Chapter 3. The case studies in Chapters 3 and 4 differentiate among commercial vans, two-axle trucks with six tires, three-axle trucks, and trucks with four-or-more axles. It is assumed that OD matrices are to be developed for each truck class for each time period.

Also postulated are link impedances and use restrictions that relate to these truck classes. For example, each link indicates whether or not a particular class of truck is permitted to use it. The truck classes chosen must be compatible with these restrictions. For example, if certain links prohibit tractor-trailers, at least two classes are required so that separate link utilization coefficients can be developed for the tractor-trailer flows.

Finally, it is assumed that a routing algorithm is available. The routing algorithm is used to specify link utilization coefficients for each OD pair -- i.e., the proportion of that OD pair volume which will appear on a given link. For example, in the case of the network shown in Figure 2.2, if O and D were the origin and destination of interest, a routing algorithm might predict that 50% of the traffic will travel from O to D via path ORD, 30% will travel via path OSD, and the remaining 20% will travel via path ORSD.

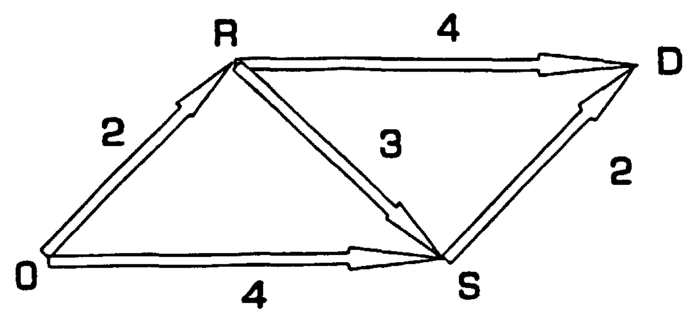


Figure 2.2 Example network.

From these path proportions, one can develop link utilization coefficients for the ten directed links in the network, as follows:

Link	Utilization Coefficient	Link	Utilization Coefficient
O -> R	0.7	S -> O	0.0
O -> S	0.3	S -> R	0.0
R -> O	0.0	S -> D	0.5
R -> S	0.2	D -> R	0.0
R -> D	0.5	D -> S	0.0

The link utilization coefficients are computed by summing the proportions for all paths which use that particular link. Thus, the utilization coefficient of 0.7 for the link from O to R includes the proportions of total traffic on paths ORD and ORSD. Note also that many links have utilization coefficients of 0.0, implying that they are not used for travel from O to D.

For another origin-destination pair in this same network, say S to R, there will be a completely different set of link utilization coefficients for the ten links. The method for estimating origin-destination matrices developed in this project relies on our ability to generate all of the link utilization coefficients, for every origin-destination pair on every link in the network. It further assumes that these coefficients are constants, not affected by the actual origin-destination volumes.

In general, these assumptions can be summarized via the following equations:

$$\sum_{p \epsilon P_{od}} v_p = V_{od} \qquad \forall \, (o,d) \tag{1}$$

and

$$\sum_{p \epsilon P_l} v_p \approx V_l \qquad \forall \, l \tag{2}$$

where V_{od} is the total estimated volume traveling from O to D, v_p is the volume using path p, P_{od} is the set of paths p that go from O to D, P_l is the set of paths p using link l, and V_l is the observed volume for link l. The approximation symbol indicates that this observed volume is to be matched as closely as possible by the sum of the path volumes v_p estimated by the model. Although equations (1) and (2) are expressed in terms of path volumes, the link utilization coefficients can be determined without explicit path enumeration for each origin-destination pair. This is an important computational consideration.

It is important to note that changes in link travel times will affect the routes obtained, as will changes in link use restrictions. In fact, it is changes in these parameters that will ultimately cause diversion of trucks from one path to another, as traffic rerouting options are explored for freeway reconstruction projects, goods mobility enhancement initiatives, etc.

In the current implementation of the methodology, Dial's routing algorithm [Dial, 1971] is used to generate the link utilization coefficients. This algorithm is computationally efficient, and typically selects multiple paths between any origin and destination, which is an advantage in this application. Other routing algorithms could be used, as long as a set of constant link utilization coefficients can be generated.

2.3 Representing the Observed Data

The basic assumptions are augmented by postulates concerning flow-related data. The observed data are grouped into three basic types of observations - LV, OD, and OT data - as described below.

Link Volume (LV) Data

LV data represent observations of link flows for the network. Often they are specific to direction, type of vehicle, and time of day. Classification counts are a good example, as are turning counts, and data from automatic counters, if they can classify vehicles (e.g., based on the number of axles).

The interchange between the Bruckner and Sheridan Expressways in the Bronx provides a good example of such data. As shown in Figure 2.3, the available information includes Annual Average Daily Traffic (AADT) volumes, average AM and PM peak hour volumes, and total daily truck volumes. Both the AADT counts and peak hour counts include all vehicles. For use in the process of estimating OD matrices by truck class for three different time periods (AM Peak, Midday, and PM Peak), these counts had to be transformed into estimates of link volumes by truck class and direction for all three time periods. (Chapter 3 describes this particular input data development effort in detail.)

Sometimes, different sets of LV data use different aggregations of the truck classes. In the Brooklyn case study, for example, three-axle trucks were classified as "heavy trucks" in one data set, and grouped with two-axle, six-tire ("medium") trucks in another. Sometimes commercial vans are counted; sometimes they are not.

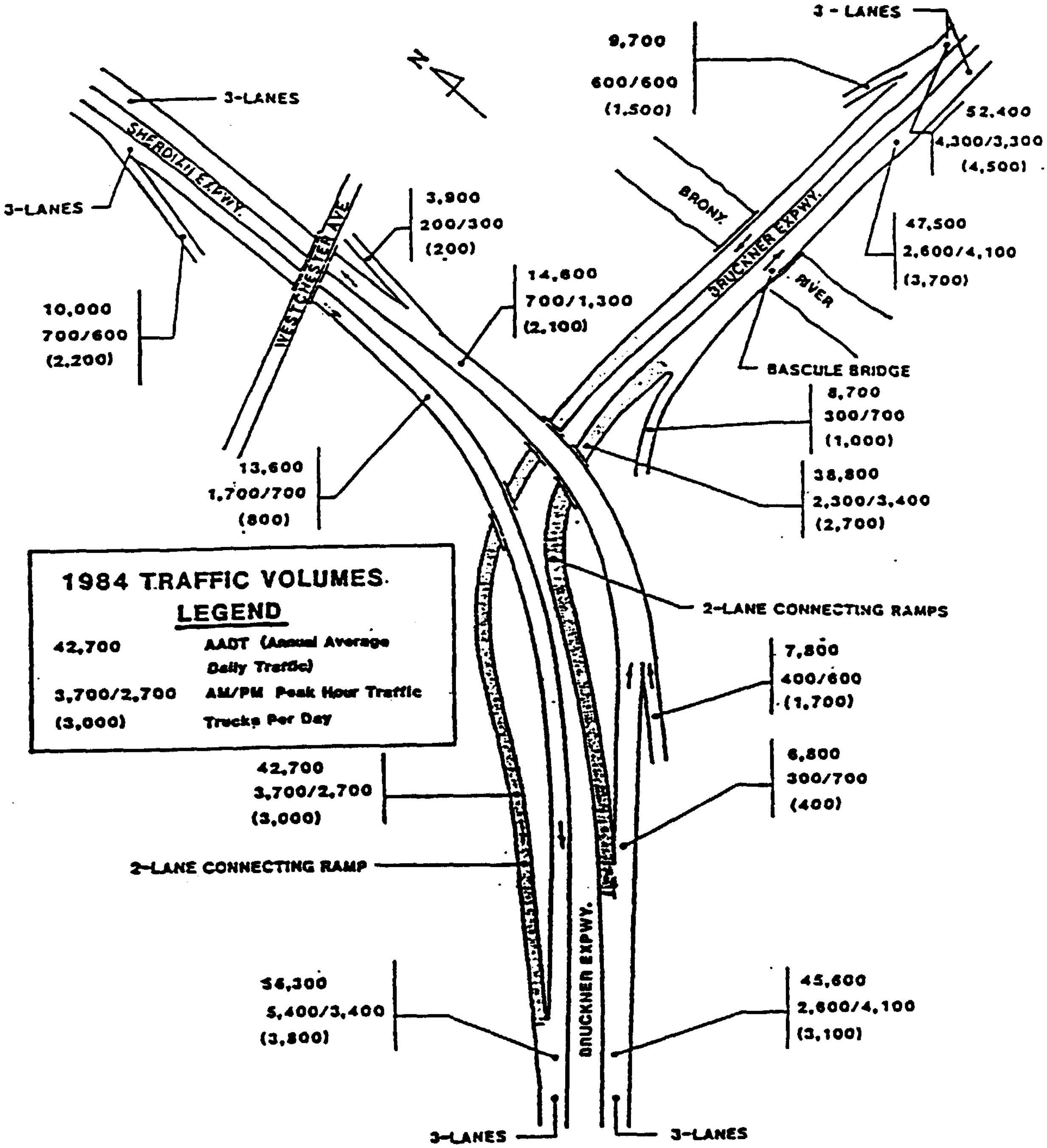


Figure 2.3 Bruckner/Sheridan Interchange.

To deal with these variations, constraints are needed that map the aggregations in the observed values into model variables. For example, suppose that on one link, *j*, a count is reported which includes both two-axle, six-tire trucks and three-axle trucks, while on another link, *k*, a different count reports three-axle trucks together with four-or-more axle trucks. Denote the two counts as C_j and C_k respectively, and let the model variables V_{2j} and V_{2k} refer to link flows of two-axle, six-tire trucks; V_{3j} and V_{3k} represent three-axle trucks; and V_{Hj} and V_{Hk} represent four-or-more axle trucks. Then the following contraints would pertain:

$$V_{2j} + V_{3j} = C_j \tag{3}$$

$$V_{3k} + V_{Hk} = C_k \tag{4}$$

<u>OD Data</u>

OD data provide direct estimates of entries in the OD matrices. The available data typically provide selective information, based on interviews of vehicles crossing a given link, or through a network gateway. Inbound data collected at gateways generate rows ("from" entries) in the OD matrices; outbound data generate columns ("to" entries).

Here, there can be incompatibilities not only with truck class definitions or coverage, but also zone definitions. For example, the East River Crossing Survey, performed by the New York City Department of City Planning, collected data on trucks crossing the East River westbound (into Manhattan) and used a zone structure based on political boundaries (aggregations of City wards). A second survey, performed by the Gowanus Expressway TSM Study consultant, used zipcodes as zones. Both of these sources of data are useful in our

Brooklyn case study (Chapter 4), but to make use of these data, mapping functions are needed that link the network model zones with those used in each survey.

This is illustrated in Figure 2.4. Zone X, which represents a zone definition employed in some OD survey, lies within Zones A, B, and C. Hence a mapping is developed which says that trips which originate within Zone X must originate (can be mapped into trips that originate) in network zones A, B, and C. If we are interested in trips destined to some zone, *j*, and have an observation (from the survey) on trips from X to *j*, denoted T_{Xj}, we can create a constraint as follows:

$$T_{Aj} + T_{Bj} + T_{Cj} \geq T_{Xj} \qquad \forall j \tag{5}$$

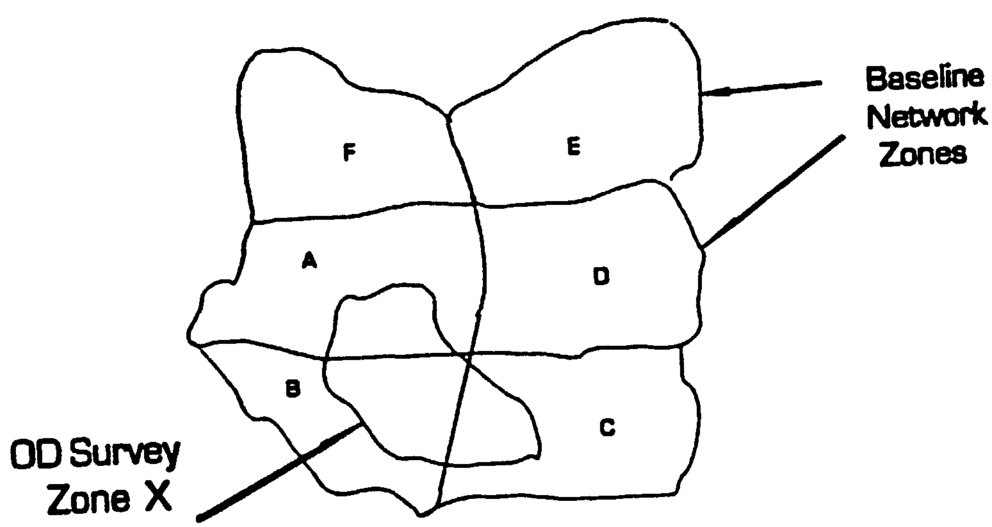


Figure 2.4 Zone mapping illustration.

Note that the constraint is written as an inequality because the aggregation of model zones A, B and C is larger than the survey zone X. Hence, the observation should be a lower bound on the total estimated trips from the three zones (A, B and C) to zone *j*.

OT Data

OT data are observations of flows originating or terminating at some specific location in the network. They represent row and column totals in the OD matrices. Screenline counts exemplify such data, particularly when the count is taken at a gateway node (e.g., at a bridge or toll plaza). Information about truck trips into or out of a given region or zone represent another good example. The Bronx Truck Route Study, for example (described in more detail in Chapter 3), provides estimates of truck trip generation rates per square mile for all of Bronx County.

As with the LV and OD data, truck class cluster conflicts can exist between the groupings used for data collection and those used by the model; and, again a mapping function is needed from the observation-related truck class clusters to the truck class variables being used in the model:

$$\sum_{k \in K_x} \sum_{d} v_{odk} \geq V_{ox} \qquad \forall\, o, x \tag{6}$$

where V_{ox} is the observed volume in truck class cluster x originating at node (zone centriod or gateway node) *o*, K_x is the set of truck classes k contained in the observation, and v_{odk} is the model variable for the number of trucks of type k going from origin *o* to destination *d*.

2.4 Model Description

The model for developing multiclass truck trip matrices treats the task as an optimization problem. The objective is to minimize a cost (or penalty) function representing the weighted sum of all deviations between the observed values and those predicted by the model. The cost function associated with each observed value is a two-sided piecewise-linear function, like that depicted in Figure 2.5.

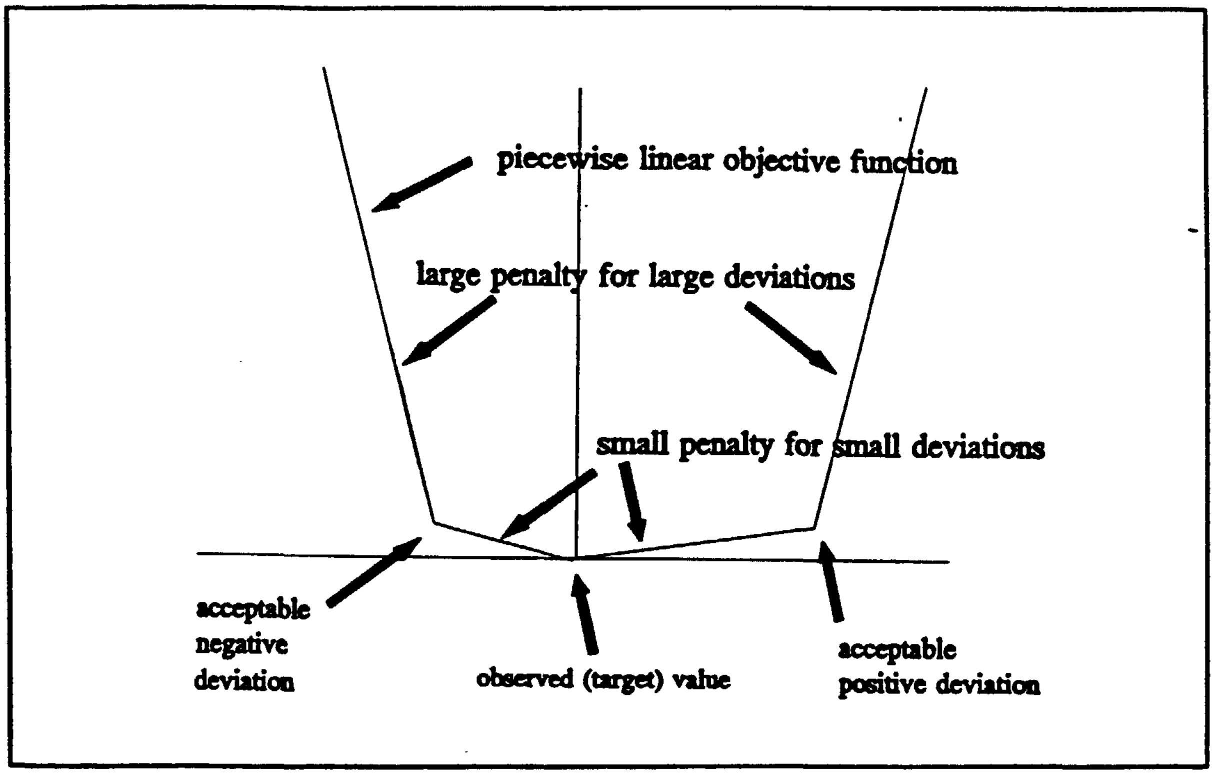


Figure 2.5 The piecewise linear penalty function.

This type of piecewise-linear function has four major advantages. First, it allows the model to be much more sensitive to large errors than to small ones, in the same way that would be accomplished by minimizing a squared-error function. However, by using a piecewise-linear function, we can maintain the computational advantage of formulating the model as a linear programming problem. Third,by varying the weights associated with different observations, we can reflect differing degrees of confidence in various observations. Finally, by varying the weights associated with positive or negative deviations from the observed (target) value, we can can create asymmetric error functions for specific observations and reflect the fact that it may be important for the model not to underestimate (or overestimate) certain values.

The minimization of total weighted deviations from the observations is subject to a series of constraints which are formed from the three types of observed data values discussed in the previous section. Hence, the model can be described as follows:

Minimize:

$$\sum_{k} w_k^d \, (d_k^- + d_k^+) + w_k^e \, (e_k^- + e_k^+) \tag{7}$$

Subject to:

$$\sum_{m \epsilon M_k} \alpha_{mk} \, x_m + e_k^- - e_k^+ + d_k^- - d_k^+ = b_k \qquad \forall \, k \tag{8}$$

$$e_k^- \leq E_k^- \qquad \forall \, k \tag{9}$$

$$e_k^+ \leq E_k^+ \qquad \forall \, k \tag{10}$$

$$d_k^-, d_k^+ \geq 0 \qquad \forall \, k \tag{11}$$

where the b_k are observations (LV, OD, OT) relevant to the problem under consideration, w_k^d and w_k^e are weights ($w_k^d > w_k^e$) attached to "large" and "small" deviations, respectively, from the observed value of b_k, d_k^- and d_k^+ are the magnitudes of "large" deviations from

b_k, e_k^- and e_k^+ are the magnitudes of "small" deviations from b_k, and E_k^- and E_k^+ are limits on the magnitude of deviations that may be considered "small." In addition to the b_k, the values of w_k^d, w_k^e, E_k^- and E_k^+ are inputs to the model which characterize the penalty functions for observation *k*. The values of d_k^-, d_k^+, e_k^- and e_k^+ are model outputs which reflect the deviations to be minimized.

The other major outputs of the model are the variables x_m, which represent the entries in the OD matrices for the truck classes considered. We will use the subscript *m* to denote a "market" -- a combination of an OD pair and truck class. Thus, vans from origin A to destination B constitute one market, while three-axle trucks from A to B are a second, and vans from C to D are a third.

The values of α_{mk}, which measure the extent to which x_m contributes to creating b_k, are inputs to the model. These are specified in different ways for different types of observations, as described more fully in the next section. M_k is the set of markets which contribute to the generation of b_k.

2.5 Illustrative Realizations of Equation (8)

As the reader probably realizes, Equation (8) represents a generalization of the LV, OD, and OT constraints. It is helpful, though, to consider how Equation (8) is custom-tailored to each of these constraints when actually implemented. Each involves a particular set of variables and constants.

<u>LV Observation Realization</u>

In the case of an LV (link volume) observation, the realization of Equation (8) is interpreted as follows. The value of b_k is the number of vehicles that have been observed crossing a given facility (link), in a given direction (e.g., eastbound), within a given time span (e.g., between 6 and 10 AM), over some cluster of truck classes (e.g., 2-axle, six-tire and three-axle trucks). Subscript l references the link (actually, the directional arc) to which the observation b_k pertains, and the set of all LV observations is denoted by L. Equation (8) then transforms into:

$$\sum_{c} v_{lc} + e_k^- - e_k^+ + d_k^- - d_k^+ = b_k \qquad \forall\, k \in L \tag{12}$$

where:

$$v_{lc} = \sum_{m \in M_{lc}} \alpha_{lm}\, x_m \tag{13}$$

is the volume on link l for truck class cluster c, M_{lc} is the set of markets contributing to v_{lc} and α_{lm} is the link utilization coefficient for link l and market m.

OD Observation Realization

In the case of an OD (origin-to-destination) volume realization, b_k is the number of trucks in a given truck class cluster observed moving from an origin zone/area to a destination zone/area. We will denote by F the set of all such observations. If r is the origin zone/area to which b_k pertains, s is the destination zone/area and c is the cluster of truck classes observed, then Equation (8) becomes:

$$y_{rsc} + e_k^- - e_k^+ + d_k^- - d_k^+ = b_k \qquad \forall\, k \in F \tag{14}$$

where:

is the volume within truck class cluster c predicted by the variables x_m as flowing from r to s. In this case, α_{km} will be 1 if the origin and destination represented by market m are

$$y_{rsc} = \sum_{m \in M} \alpha_{km} \, x_m \tag{15}$$

included in regions r and s, and the truck class represented by market m is included in cluster c. Otherwise α_{km} will be 0.

OT Observation Realization

In the instance where b_k represents an originating observation, it is the number of trucks observed in a given truck class cluster that originate in an origin zone/area (or at network node) r. Let R denote the set of all originating observations. Equation (8) then becomes:

$$y_{rc} + e_k^- - e_k^+ + d_k^- - d_k^+ = b_k \qquad \forall \; k \in R \tag{16}$$

where:

$$y_{rc} = \sum_{m \in M} \alpha_{km} \, x_m \tag{17}$$

is the volume in truck class cluster c originating in region r as predicted by the variables x_m. In this case, α_{km} will be 1 if the origin zone represented by market m overlaps region r and the truck class represented by market m is included in cluster c. Otherwise α_{km} will be 0.

In the case of a terminating volume observation, b_k is the number of trucks in a given truck class cluster observed to terminate in a destination zone/area (or network node) s. Let S denote the set of all terminating observations. Equation (8) is then rewritten as:

where:

$$y_{sc} + e_k^- - e_k^+ + d_k^- - d_k^+ = b_k \qquad \forall\, k \in S \tag{18}$$

$$y_{sc} = \sum_{m \in M} \alpha_{km}\, x_m \tag{19}$$

is the volume terminating in region *s* as predicted by the variables x_m. α_{km} will be 1 if the destination zone represented by market m overlaps region s and the truck class represented by market m is included in cluster c. If not, α_{km} will be 0.

2.6 Relationship to Previous Modeling Efforts

The linear programming model described in the previous two sections builds upon the work of several previous researchers. One of the earliest efforts to formulate the problem of estimating an OD matrix which would produce an observed set of link flows was by Robillard [1975]. He proposed a nonlinear regression model, but did not fully appreciate the degree to which the problem is underconstrained. A much more complete solution based on nonlinear programming was offered by Turnquist and Gur [1979]. This work also introduced the concept of a "target matrix" as a way of incorporating information other than link counts, but did not develop the idea fully.

Van Zuylen and Willumsen [1980] adapted Wilson's [1970] idea of "entropy maximization" to the problem, as a way of differentiating among alternative OD matrices, each of which would produce the same set of link volumes. This work was followed by several other authors (Van Zuylen and Branston [1982], Bell [1983, 1984], Fisk and Boyce [1983], Willumsen [1984], and Brenninger-Gothe, *et al.* [1989]), resulting in a series of improvements to the basic ideas. Through this series of contributions, the underlying theory was improved and greater recognition was given to important empirical problems, like inconsistent or missing link data.

An alternative approach to the problem also developed in the early 1980's, based on a more statistical view. This is represented by the work of Carey, *et al.* [1981], Maher [1983], Cascetta [1984], McNeil and Hendrickson [1985], and Spiess [1987]. This line of thought is oriented around viewing the problem as a constrained regression problem, in which parameters of an underlying model are to be estimated so as to yield the "best fit" to the set of observed data. Both ways of viewing the problem lead to some form of optimization formulation, and Brenninger-Gothe, *et al.* [1989] have provided a good summary of the relationships among many of the models.

The approach taken in this project contains elements from several of these earlier efforts, but extends the formulation in some important respects. First, because we are interested in truck movements, we must deal with multiple vehicle classes and data which include observations over different subsets of classes. Some of the previous authors have mentioned multiple-class problems briefly, but their main emphasis has been on passenger cars.

Secondly, we want to provide control parameters sufficient to allow specification of both varying degrees of confidence in different observations as well as asymmetric error functions for overestimation and underestimation of observed values. This is similar in some respects to the previous work of Maher [1983] and Brenninger-Gothe, *et al.* [1989], but more extensive.

Third, we have developed a model which is designed to accept data in forms other than link counts. Our objective is to be able to use all of the available data, in whatever form, and from whatever source, it can be obtained. This is a much broader objective than is present in the earlier efforts, and requires a more general formulation. Our formulation is different from the specification of a "target matrix" which is embedded in most of the earlier efforts, because we can explicitly create constraints on row-sums or column-sums (OT constraints), for example, in the OD matrices to be estimated.

2.7 Model Implementation

The implementation of the model described in Sections 2.4 and 2.5 consists of a workspace integrating three main application packages -- TransCAD, dBASE III+, and LINDO. This is all done on a PC platform. The minimum hardware requirements are a 80386 processor (with 80387 math co-processor) and 4 Mbytes of memory. Figure 2.6 illustrates the connections among the three application packages.

TransCAD is a GIS-based (Geographical Information System) transportation network analysis package capable of managing, manipulating, and graphically displaying network and spatial data pertaining to a geographic area of interest. It is a product of Caliper Corporation. TransCAD acts as the main display medium and the manager of the network-related data (links, nodes, link characteristics). For example, it is used to display the flow maps (network diagrams that indicate with directional thicknesses the volumes passing over the links). An example is shown in Figure 2.7.

dBASE III+ is a software package often used to create customized, menu-driven database management systems. It is a product of Borland International, Inc. In our application, dBASE III+ is used to operate the menu system, edit data, and invoke various computational modules which are part of the model.

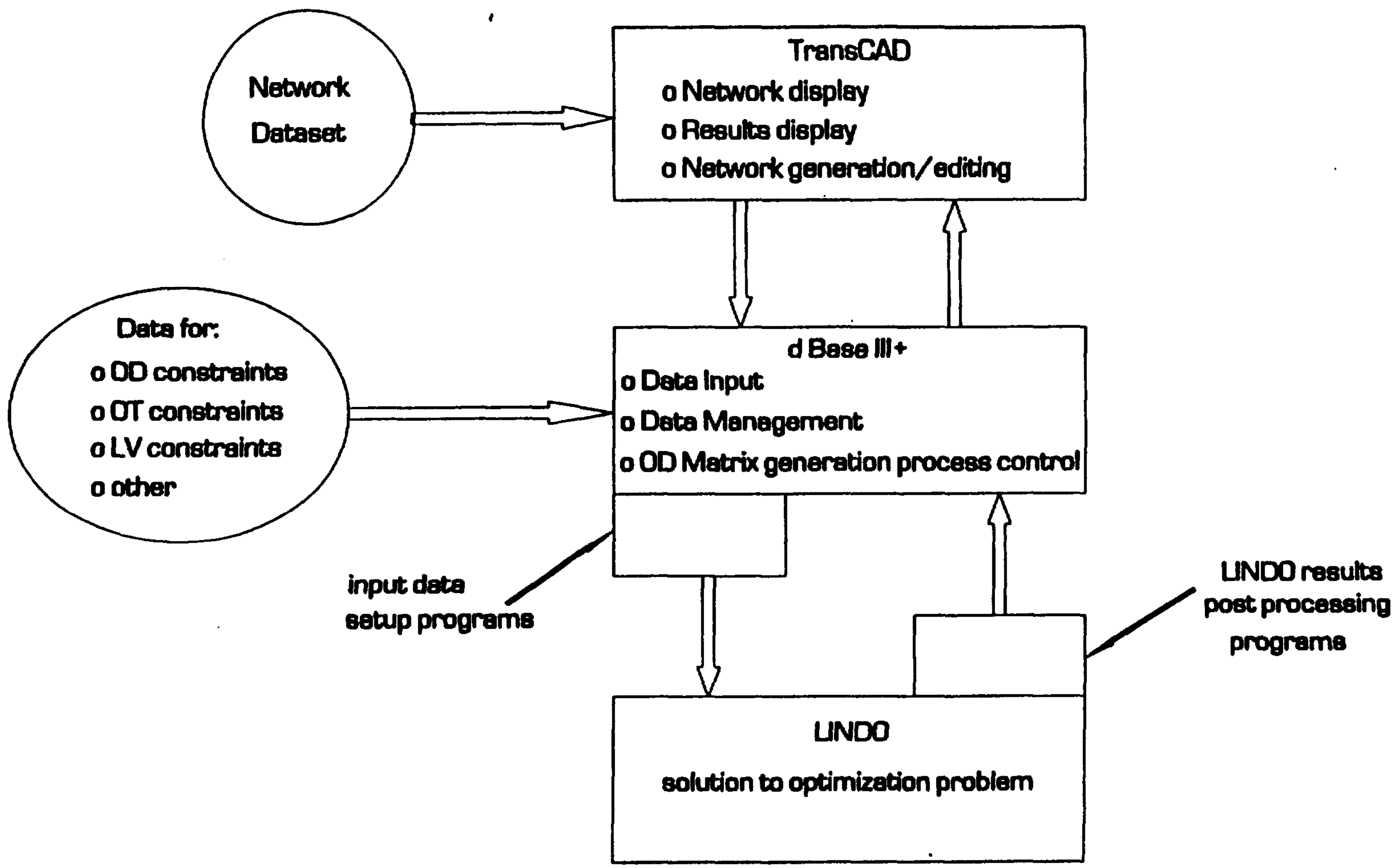


Figure 2.6 The TransCAD/dBASE III$^+$/LINDO Workspace.

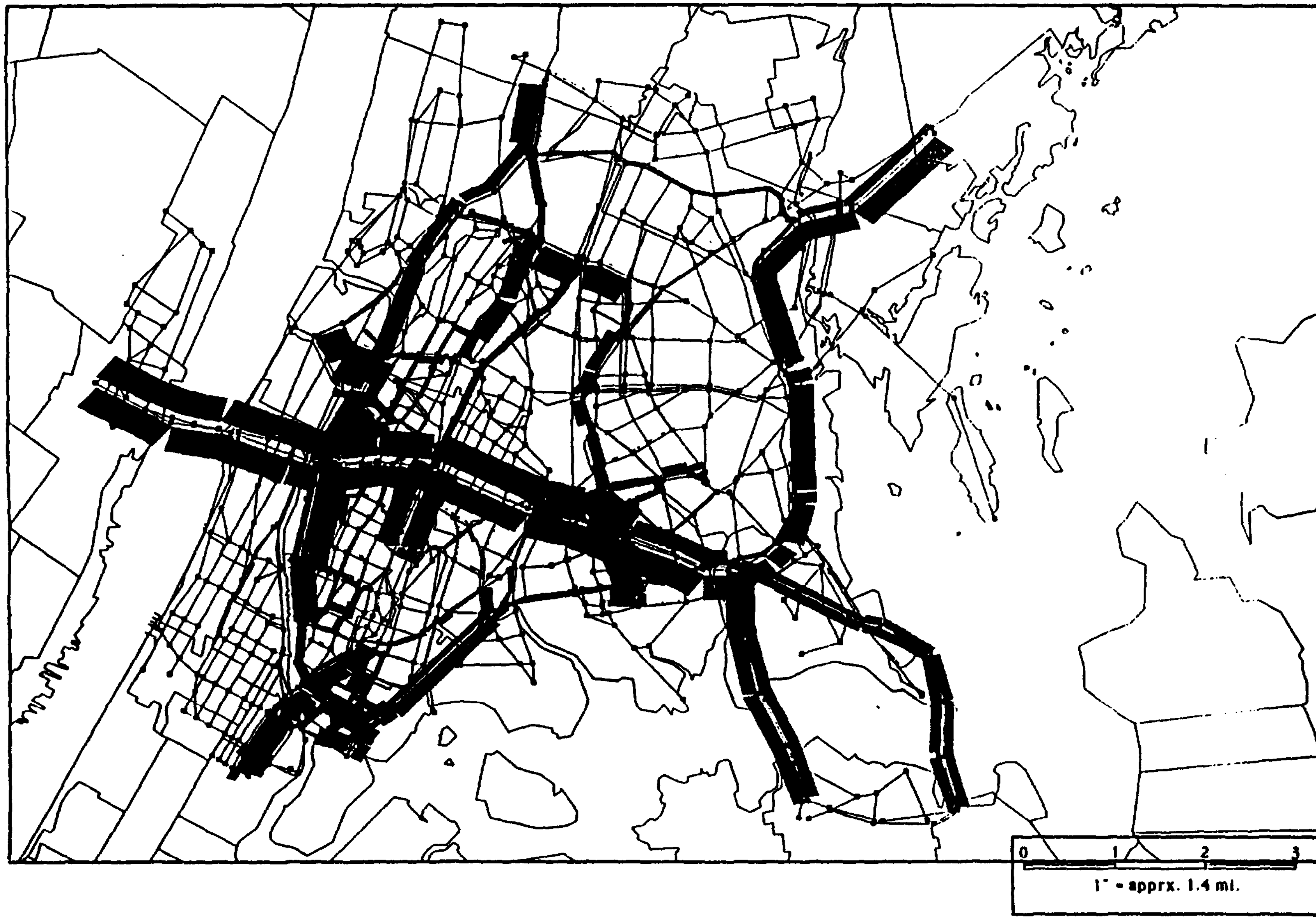


Figure 2.7 Example Flow Map Output.

LINDO is a stand-alone optimization package designed to solve linear and mixed-integer linear programming problems. It is a product of LINDO Systems, Inc., and is used here to solve the large linear programming model described in Sections 2.4 and 2.5.

A more comprehensive picture of how the workspace is used can be seen by focusing on Figures 2.8 through 2.11. Figure 2.8 shows the main screen of TransCAD with the Bronx network (to be described more fully in Chapter 3) displayed. Across the top banner are the main control options available. In this case, the TransCAD option is invoked to select the database layer of interest (links, nodes or zipcodes), reset the base map, and reach the data editor. Display lets you refresh the screen and set specifications about what is being displayed. Layer is accessed to create the flow maps, including the selection of the specific flow variables to be displayed (e.g, light, medium, heavy trucks, or total). Query is used to learn specifics about both links and nodes (e.g., names, volumes, other attributes). Select allows you to highlight links, nodes, or zones that meet specific criteria set by the user (see the later discussion about the Data Editor). Geography lets you add links and nodes to the network, as you might need to do if a newly snipped network is incomplete, or if nodes and/or links need to be added to an old network (e.g., new zone centroids or zone centroid connectors).

The data editor, reached through the TransCAD option, allows you to review the node or link data in tabular form. Figure 2.9 shows a representative screen. The links shown are from the datafile for the Brooklyn case study described in Chapter 4. Each row corresponds to a specific link; link attributes are arrayed across the columns. You can create conditions for selecting certain types of facilities, edit data entries, search for specific records, or engage in data input/output (e.g., dumping the links of an excised network into an ASCII datafile, importing the results of a flow estimation run).

Figure 2.8 Trans CAD Main Menu (Example).

TransCAD 2.0 Data Editor - (c) 1990 Caliper Corp. All Rights Reserved.

TransCAD Layer Edit Record Select Procedure

ID	Calc. Length	Dir	State	County	Net Lvl	Rt Type
933442	0.454	0	4	24	No Code	No Code
933443	0.513	0	4	24	No Code	No Code
933445	0.462	0	4	24	No Code	No Code
12340	0.930	0	4	24	No Code	w/Full Access Control
633430	0.146	0	4	24	No Code	w/Full Access Control
12331	0.193	0	4	24	No Code	w/Full Access Control
651560	0.040	0	4	24	No Code	Undivided
933430	0.632	0	4	24	No Code	w/Full Access Control
933444	0.498	0	4	24	No Code	No Code
51560	0.163	0	4	24	No Code	Undivided
51561	0.240	0	4	24	No Code	w/No Access Control
51570	0.177	0	4	24	No Code	Undivided
51571	0.336	0	4	24	No Code	Undivided
51580	0.583	0	4	24	No Code	Undivided
58580	0.153	0	4	24	No Code	Undivided
933420	0.200	0	4	24	No Code	w/Full Access Control
14830	0.563	0	4	24	No Code	Undivided
58600	0.214	0	4	24	No Code	Undivided
658600	0.083	0	4	24	No Code	Undivided
58590	0.112	0	4	24	No Code	Undivided
51590	0.438	0	4	24	No Code	Undivided
612370	0.064	0	4	24	No Code	Undivided

All Data

Figure 2.9 Trans CAD Network Data Editing Screen (Example).

The dBASE III+ portion of the workspace creates the link utilization coefficients and the OD matrix estimates. Figure 2.10 shows the main screen from the dBASE III+ workspace. TC lets you import network data exported from TransCAD into an ASCII file. This effectively starts the analysis of a given network situation. LK lets you review the link data, so you can ensure they are correct. ND provides the same capability for the nodes in the network. ZN is invoked to enter the zone centroid numbers (user defined) and their corresponding TransCAD node numbers. DP is used to enter control parameters for "Dials Algorithm." DA invokes the FORTRAN program that creates the coefficients.

```
                         FLOW ESTIMATION PACKAGE

                       Select the function you want.

Link Utilization Coefficients                   Network Flows

                            Input Data Editing

TC: Import TransCAD Data                OD: OD Flow Constraints
LK: Review Link Data                    OT: OT Flow Constraints
ND: Review Node Data                    LV: LV Flow Constraints
ZN: Zone Centroid Data                  ZO: OD Zone Clusters
DP: Control Parameters                  ZT: OT Zone Clusters
                                        FP: Control Parameters

                               Run Programs

DA: Dials Algorithm                     CF: Flow Estimation

                                 Q: Quit

                                  Choice:   Q
```

Figure 2.10 dBASE III^{+} Workspace Main Menu.

On the right-hand side are functions most closely tied to creating the OD flow matrices. OD is used to enter the OD flow constraint data. It brings up a spreadsheet-like form where each row is an observation, and each column is a field. OT invokes a similar spreadsheet for the OT observations; LV is for the link volume observations. ZO and ZT are used to specify the mappings of observation zones into the network model zones. FP allows the entry of a handful of control parameters needed by LINDO. CF invokes a series of data processing steps that: 1) ready the OD, OT, LV, etc. data for input to LINDO; 2) invoke LINDO to solve the linear programming problem described in Equations (7)-(12); and 3) postprocess the results to generate datasets that can be uploaded into TransCAD for display.

Not portrayed here, but of importance to someone who wants to use the workspace, is a fourth program called TCBuild (actually a part of TransCAD) that is used to expand, contract, and modify the network datasets maintained by TransCAD. The User's Manual for the workspace, a stand-alone document not contained in this report, provides additional details about how to use TCBuild, and all the other programs involved in generating the flow estimates.

2.8 Summary

Figure 2.11 provides a good summary of the methodology. It helps put the methodology and its models into context. Let's assume you have a traffic and/or truck movement problem of interest, and that you have examined it to determine what network should be used for analysis. Once you have done this, truck flow data are collected, so that OD, OT, and LV observations can be generated. In parallel with this, you construct the network database by excising the network of interest from some master database, or by

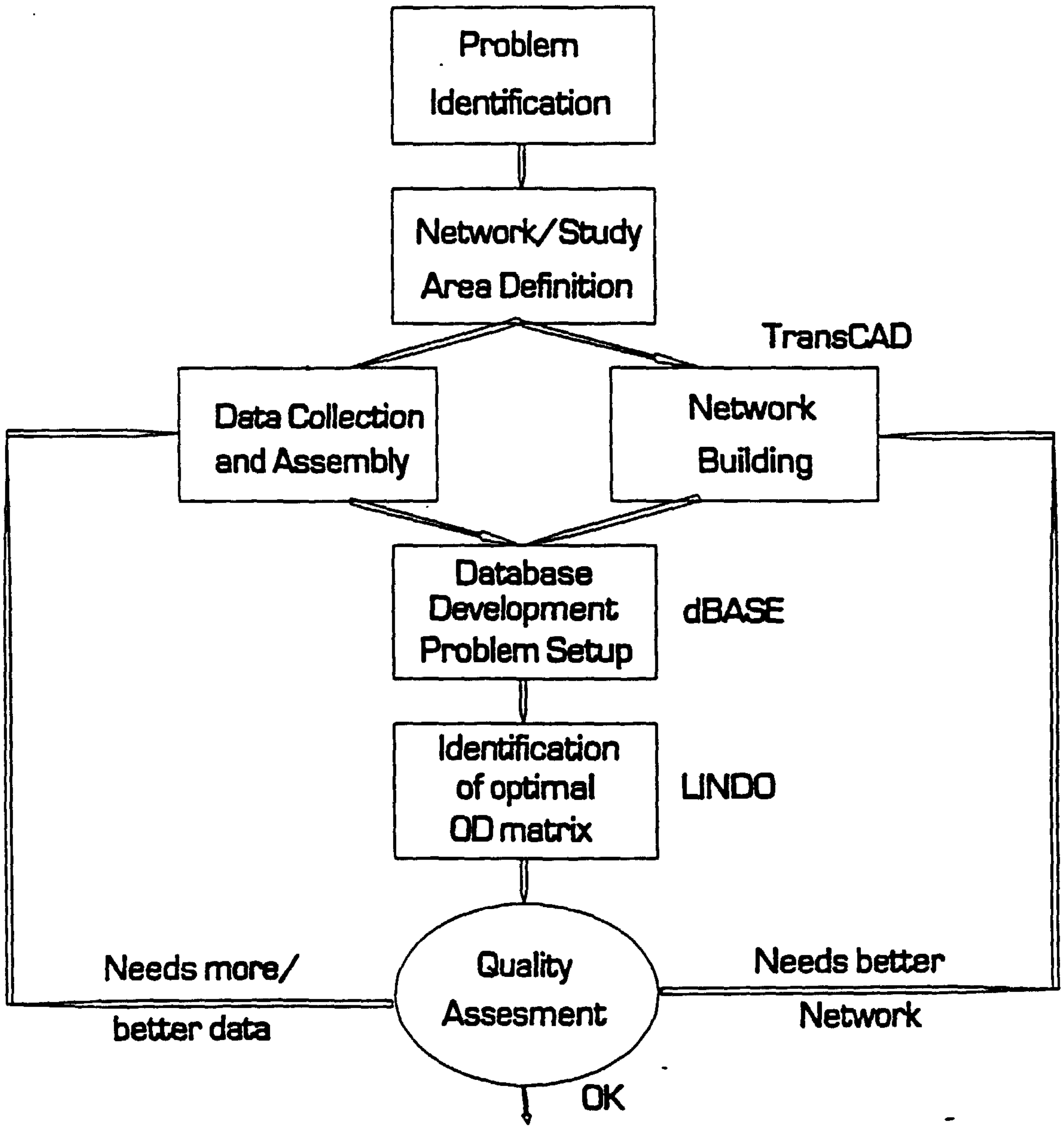


Figure 2.11 OD Matrix Development/Refinement Process.

creating it from scratch. (In our case, TransCAD is used to select from the NYMTC master metropolitan New York network database, that portion needed for a given case study). You then transfer the network data from TransCAD to dBASE III+, specify the nodes corresponding to the various zone centroids, and compute the link utilization coefficients. In parallel with this, you enter the OD, OT, and LV observations into their respective datasets. Once both of these processes are complete (i.e., the link utilization coefficients exist and the OD, OT, and LV data have been entered), you invoke the "Create Flows" process, which sets in motion the dBASE III+ routines and FORTRAN programs that prepare a master dataset for LINDO, invoke LINDO, and then postprocess the LINDO outputs to create the OD matrix dataset and the link volume estimates. These latter outputs, plus others, are then uploaded into TransCAD for display and/or printing so that the results of the OD matrix estimation process can be analyzed.

When a need arises to revise or expand the study scope, you iterate back through this process, changing the network if it needs to be adjusted, adding or deleting links, or making other changes. Independently, or in conjunction with such a change, you collect and/or enter more OD, OT, or LV data to sharpen the model's ability to find the best possible OD matrices. The result, at the end of this process, is either: 1) a set of OD matrices of sufficient quality that no further data collection or analysis seems prudent, or 2) an identification of data that must be collected in order to make the generation of such matrices feasible. The two case studies described in the following two chapters illustrate the steps of this process more explicitly.

CHAPTER 3

CASE STUDY I: THE BRONX

3.1 The Case Study Setting

As an application of the methods described in Chapter 2, this chapter is a case study focusing on the Bronx, the northernmost of the five boroughs which make up New York City. Figure 3.1 shows a map of the study area. The Cross-Bronx Expressway (I-95), from the George Washington Bridge at the western side of the study area to the Bronx-Whitestone and Throg's Neck Bridges in the southeastern corner of the area, is a primary corridor for truck flows. The connection to the Bruckner Expressway (I-95 and I-278) at the eastern side of the study area forms the most heavily used route to New England. The Major Deegan Expressway (I-87) is a principal north-south corridor along the western side of the Bronx, connecting with the Bruckner Expressway at the entrance to the Triborough Bridge. Although the study area focuses on the Bronx, the northern (uptown) end of Manhattan (north of 110th St.) is also included.

This area is of particular interest as a case study for two reasons. First, the Cross-Bronx Expressway is scheduled for a major rehabilitation, requiring sections of it to be closed for extended periods. This will require that traffic be diverted to other routes, and the ability to predict flows for diversion studies is of considerable importance. Second, this area has a very high concentration of truck traffic. Data from the Port Authority of New York and New Jersey (PANYNJ), for example, show that more than 13,000 trucks cross the George Washington Bridge eastbound on an average weekday [PANYNJ, 1992]. In addition, the Hunt's Point area (south of the interchange between the Bruckner Expressway and the Sheridan Expressway -- I-895) is the location of the major fresh meat and produce

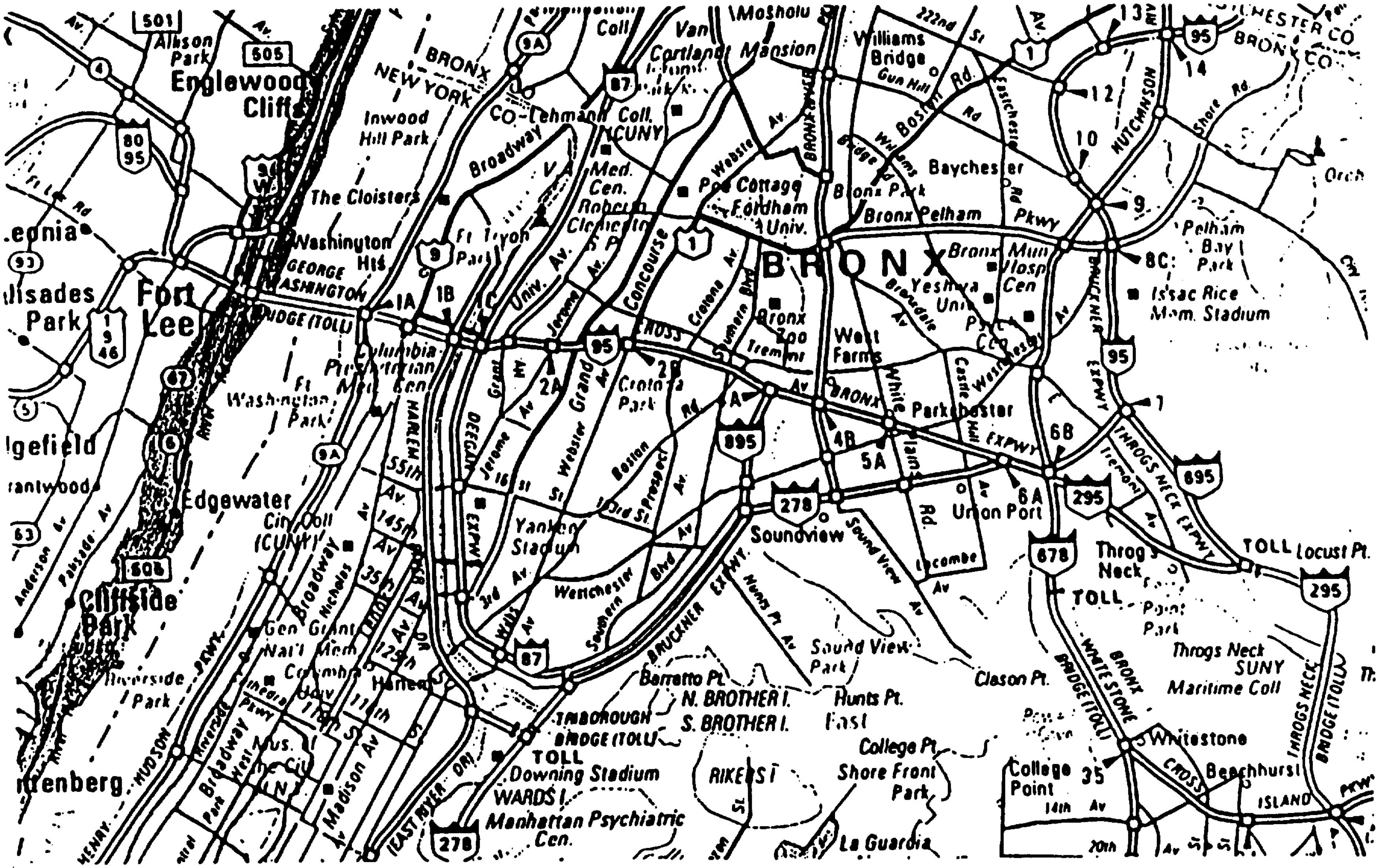


Figure 3.1 Map of the Bronx case study area.

wholesale markets for New York City, generating approximately 15,000 truck trips per day [NYSDOT, 1985].

3.2 Purpose and Scope of the Study

The primary purpose of this case study is to test the methods developed in Chapter 2, in order to understand how well they work, and to identify both strengths and weaknesses in the approach and its results. To accomplish this, we must assemble all the available data on truck flows in this area, create model constraints from the data, and then estimate truck origin-destination (OD) matrices, by time-of-day and vehicle class. These resulting trip matrices are the basis for conclusions regarding the nature of truck flows in the area, and identification of "holes" in the available data -- additional pieces of information which would be most helpful in building more precise estimates of truck flows. They also provide an important set of inputs for analyses of how such flows might change under specific changes in the network (such as closing the Cross-Bronx Exprssway), although that sort of diversion study is not included here.

Our analysis includes three separate time periods and three truck classes. The time periods defined are 6-10 AM (AM Peak), 10 AM - 3 PM (Midday), and 3-8 PM (PM Peak). Separate OD matrices are estimated for each time period, based on data pertaining to that time period. The analysis does not include the nighttime hours between 8 PM and 6 AM. The three truck classes used are VANS (light-duty trucks with two axles and four tires), MEDIUM (two-axle and three-axle single unit trucks), and HEAVY (trucks with four or more axles, and all tractor-trailer units).

The combination of vehicle classes and time periods means that a total of nine separate OD matrices are estimated, in three separate analyses. The three truck classes are estimated together for each time period, but the time periods are done as separate analyses.

As part of the analysis of truck flows in this case study, we want to pay special attention to separating flows of local, originating, terminating and overhead trips, defined as follows:

Local: trips whose origin and destination are both internal to the study area;

Originating: trips whose origin is internal, but whose destination is outside the study area;

Terminating: trips whose origin is outside, but whose destination is inside the study area;

Overhead: trips which pass through the study area, but whose origin and destination are both outside.

The reason for this separation is that there is evidence of large overhead flows in the Cross-Bronx corridor, particularly of heavy trucks moving from New Jersey to New England and Long Island. One of the objectives of the case study is to provide additional insight into the nature of these movements, by time-of-day, and to differentiate the temporal patterns of the overhead movements from those of local, originating and terminating traffic.

3.3 Zone and Network Definition

The zone definition (points of origin and destination for truck trips) is based on postal zipcodes. Figure 3.2 shows a zipcode map for the study area, and illustrates the zone definiton used. There are 36 zipcodes in the study area -- 25 in the Bronx and 11 in northern Manhattan (including Ward's Island - area 10035). For our analysis, we have aggregated some of the areas across the northern end of the Bronx and in Manhattan, to reduce the number of actual analysis zones (internal to the study area) to 20. The zone numbers are indicated in Figure 3.2. As shown in Figure 3.2, zipcode areas 10458, 10463,

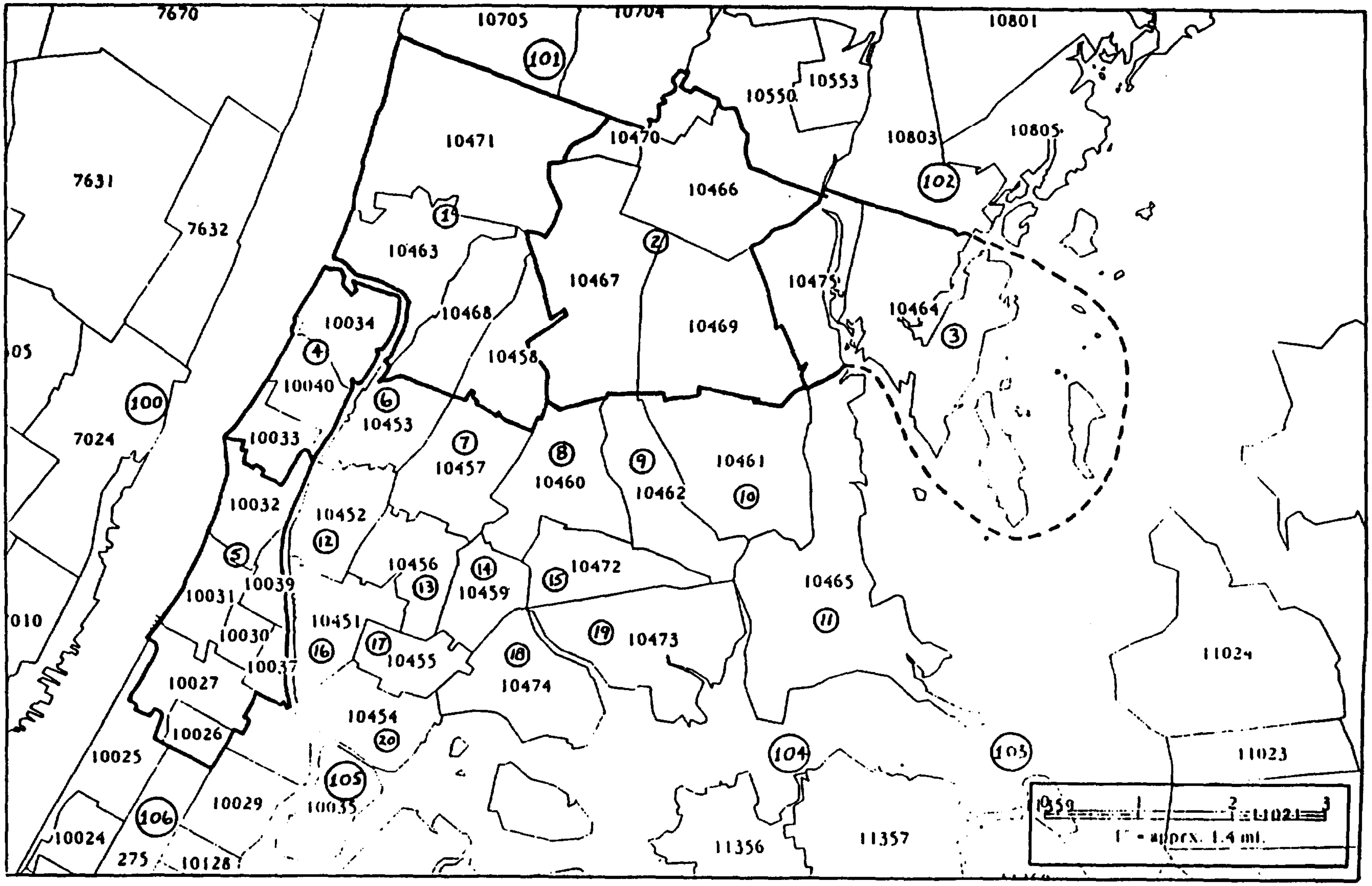


Figure 3.2 Bronx area zipcodes.

10468 and 10471 are combined into zone 1 in the northwest corner of the Bronx. Zipcodes 10466, 10467, 10469 and 10470 are combined into zone 2, and zipcodes 10464 and 10475 are combined into zone 3. These aggregations are based on the fact that the land use in the northern Bronx is mostly residential, and generates relatively few truck trips.

In Manhattan, zipcodes 10033, 10034 and 10040 are combined into zone 4; and zipcodes 10026, 10027, 10030, 10031, 10032, 10037 and 10039 are combined into zone 5. The basis for this aggrregation is to group those areas north of the George Washington Bridge and Cross-Bronx Expressway together, and separate them from areas south of the Bridge and Expressway. However, since we are interested primarily in truck flows in and through the Bronx, the loss of detail within these areas in Manhattan is not critical to the analysis, and allows us to reduce the overall problem size. Finally, zipcode area 10035 has been treated as part of the cordon (external) zone associated with the Triborough Bridge.

The seven external zones used in the analysis are also indicated in Figure 3.2. These zone definitions are as follows:

100: George Washington Bridge, to/from New Jersey
101: I-87 (New York State Thruway) north to/from Yonkers and western Westchester County
102: I-95 (New England Section of New York State Thruway) northeast to/from eastern Westchester County and Connecticut
103: Throg's Neck Bridge (I-295) to/from eastern Queens and Long Island
104: Bronx-Whitestone Bridge (I-678) to/from Queens
105: Triborough Bridge (I-278) to/from Queens
106: Manhattan south of 110th Street.

The trip tables estimated are thus 27 x 27. We exclude intrazonal trips, so there are 27 x 26 = 702 unknowns for each truck class. These trip tables can be separated into sections for the various trip types:

Local: internal zone --> internal zone

Originating: internal zone --> external zone

Terminating: external zone --> internal zone

Overhead: external zone --> external zone.

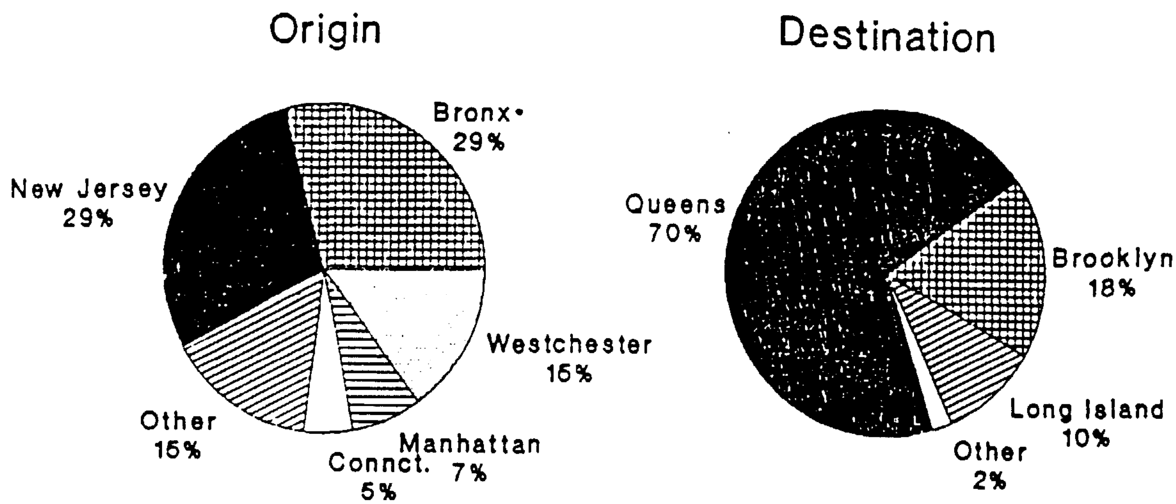
The network for which flows are predicted is shown in Figure 3.3. This network has been extracted from a larger, regionwide network maintained by the New York Metropolitan Transportation Council (NYMTC). The network for the case study includes approximately 750 nodes and 900 links. Most of the links are two-way. However, the toll bridges which collect tolls in one direction only have directional links separated. There are also some one-way bridges over the Harlem River, and some expressway interchanges which are "exploded" using directional links.

The zone centroids, which serve as origin and destination points for truck trips, are coded as nodes on the network. We have not created special zone-nodes, with connector links to the network, except for some of the external (cordon) zones.

Because we are analyzing only truck trips, several facilities which do not allow trucks have been removed from the network, at least in a logical sense, so that no trips are assigned to them. These facilities include the Henry Hudson Parkway, the Bronx River Parkway and the Hutchinson River Parkway.

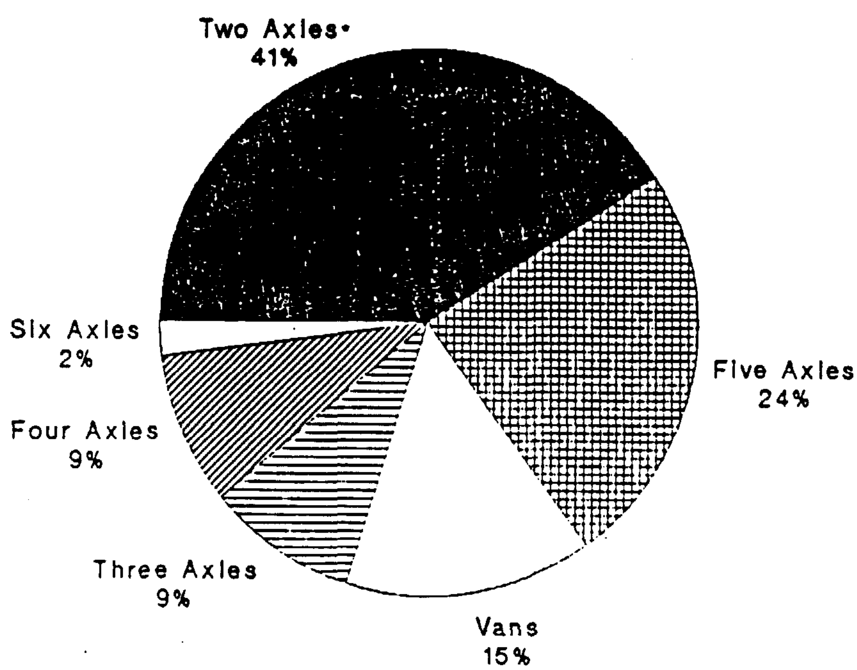
3.4 Data Sources

Apart from the network itself, there are nine major data sources that have been used in this case study. The following subsections describe each of these sources briefly, including the type of data obtained from each, the originating organization, and the dates during which the data were collected.



• Riverdale is with Westchester
Sample size • 1,148
Source: TBTA Truck Survey.

Figure 3.4 Origin and destination areas for Queens-bound trucks at the Bronx-Whitestone Bridge.



Sample Size • 1,522
• Trucks only, excludes vans.
Source: TBTA Truck Survey.

Figure 3.5 Distribution of truck types for Queens-bound trucks at the Bronx-Whitestone Bridge.

Table 3.1 Example of a toll plaza profile for the Throg's Neck Bridge.

Triborough Bridge & Tunnel Authority
Throgs Neck Bridge
Plaza Profile
Wednesday, 8/7/81

Hour Ending	23 M	22 M	21 M	20 M	18 E	15 A	15 M	14 M	13 A	12 M	11 A	10 E	9 A	8 M	8R A	Total Bronx Bound
1:00						61		94	82	161	159		0			557
2:00						12		42	26	155	106		0			341
3:00						0			14	150	97		0			261
4:00						0			19	160	86		0			265
5:00						28		94	36	168	113		38		4	481
6:00				8	120	74		179	83	222	200	102	250		187	1,425
7:00	187	190	158	142	288	314		167	373	265	407	380	471		364	3,732
8:00	285	260	219	253	448	452		260	484	295	495	490	64	270	521	4,774
9:00	253	248	177	217	383	454		229	457	242	443	490	0	292	78	3,961
10:00	253	259	160	215	306	386		184	399	264	420	403	0	249		3,498
11:00	253	251	173	204	248	212		245	340	280	396	358	249	86		3,295
12:00	232	223	139	180	204	129		211	196	248	314	313	298			2,887
13:00	170	164	149	144	153	148		208	202	243	224	287	218			2,290
14:00	146	147	101	124	163	183		191	244	247	285	308	73			2,190
15:00	186	184	105	129	174	235		165	311	262	371	331	0			2,453
16:00	189	217	187	199	299	307		222	449	250	427	8	0			2,754
17:00	254	241	175	194	350	477		255	451	254	471		0			3,122
18:00	230	187	174	207	401	489		256	476	240	489		0			3,149
19:00	139	133	145	141	228	358		236	365	238	401	12	0			2,394
20:00			198	185	302	367		272	354	230	405	353	135			2,801
21:00			97	96	180	273		216	159	205	291	230	216			1,913
22:00			59	75	140	234		180	238	202	329	181	22			1,860
23:00					127	233		182	241	208	339	254	0			1,584
24:00						156		139	181	232	313	182	0			1,203
	2,757	2,712	2,416	2,713	4,508	5,532	0	4,227	6,180	5,441	7,581	4,860	2,034	887	1,152	52,790

Hour Ending	11R A	10R M	9R M	8 A	7 E	6 A	5 M	4 A	4 M	3 M	2 E	19 M	31 M	Total Queens Bound	Grand Total
1:00				116		236	198	135		115				800	1,357
2:00						150	144	70		91				455	796
3:00						67	110	42		69				288	549
4:00						65	120	18		72				275	540
5:00						79	138	29		93				339	820
6:00					24	225	209	58		190	1			707	2,132
7:00					342	392	213	329		166	184	128	109	1,863	5,595
8:00					514	524	238	7	214	297	405	285	280	2,764	7,538
9:00				358	383	476	241	0	221	308	417	309	243	2,956	6,917
10:00				392	345	407	226	0	195	251	290	247	197	2,550	6,048
11:00				343	335	306	218	248	0	271	260	201	245	2,427	5,722
12:00				335	307	305	221	246		218	232	253	193	2,310	4,997
13:00				414	327	363	224	259		287	238	202	181	2,495	4,785
14:00			116	392	370	384	223	361		258	222	166	168	2,660	4,850
15:00			273	415	411	432	205	438		270	304	204	128	3,078	5,531
16:00		284	281	495	498	448	272	48	329	348	472	274	243	3,990	6,744
17:00		411	361	497	520	489	345	0	355	327	522	246	209	4,282	7,404
18:00		417	351	517	517	511	345	87	304	312	541	228	211	4,321	7,470
19:00		243	228	527	504	511	282	509		311	424	209	169	3,917	6,311
20:00				404	376	399	268	420		280	356	208	202	2,913	5,714
21:00				388	389	378	251	375		226	212	136	109	2,445	4,358
22:00				358	284	324	215	341		236	147	100	88	2,093	3,753
23:00				323	249	332	213	312		193	197		100	1,919	3,503
24:00				278	204	306	236	258		176	144			1,802	2,805
	0	1,355	1,610	6,533	6,897	8,109	5,355	4,568	1,618	5,365	5,568	3,396	3,075	53,449	106,239

M=Full Service
E=Exact Toll
A=ACM

Prepared by Revenue Management Division
8/23/81

Table 3.2 Example of a monthly vehicle report for the Throg's Neck Bridge.

TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY
REVENUE MANAGEMENT DIVISION

MONTHLY VEHICLE REPORT

THROGS NECK BRIDGE

MAY - 1991

Date	Day of Week	Class 1 Car	Class 2 Car w/1 ax.	Class 3 Car w/2 ax.	Class 4 2 axle Truck	Class 5 Fran. Bus	Class 6 3 axle Truck	Class 7 4 axle Truck	Class 8 5 axle Truck	Class 9 Motorcycle	6 Axle Truck	7 Axle Truck	Other Vehicles	Total Paid Vehicles	Class 10 Non Revenue	Total Vehicles
5/1/91	Wednesday	87,130	70	69	4,236	1	775	1,091	4,374	76	130	5	3	98,069	550	98,619
5/2/91	Thursday	91,945	85	60	4,639	0	737	1,135	4,518	85	171	4	6	103,406	508	103,914
5/3/91	Friday	103,333	137	107	4,324	0	821	1,047	4,421	88	134	1	3	114,319	481	114,800
5/4/91	Saturday	98,297	176	118	1,026	1	318	203	1,270	203	41	0	0	101,141	503	101,644
5/5/91	Sunday	103,519	223	123	505	0	274	138	561	348	6	0	3	105,724	536	106,260
5/6/91	Monday	86,155	63	72	3,321	4	641	889	4,184	20	116	1	1	95,443	515	95,958
5/7/91	Tuesday	87,818	64	73	4,193	10	726	1,137	4,400	115	99	1	3	98,656	568	99,224
5/8/91	Wednesday	95,330	62	88	4,630	0	771	1,186	4,649	173	142	5	2	106,536	563	107,099
5/9/91	Thursday	94,682	72	72	4,613	0	838	1,158	4,719	79	125	0	4	106,358	620	106,978
5/10/91	Friday	110,030	124	81	4,212	0	810	1,008	4,362	126	167	2	4	121,013	584	121,597
5/11/91	Saturday	115,470	156	129	1,406	1	299	335	1,374	328	30	0	7	119,533	414	119,947
5/12/91	Sunday	105,888	111	63	423	0	106	136	362	276	1	0	1	107,367	339	107,706
5/13/91	Monday	98,172	92	127	3,001	0	736	902	4,298	183	105	0	3	108,419	576	108,995
5/14/91	Tuesday	91,301	60	70	4,320	1	750	1,110	4,533	140	134	0	1	102,828	536	103,364
5/15/91	Wednesday	94,875	63	60	4,206	0	791	1,135	4,427	160	139	0	4	105,868	604	106,472
5/16/91	Thursday	99,518	100	83	4,490	0	772	1,150	4,608	190	160	1	4	111,364	611	111,975
5/17/91	Friday	110,858	221	122	4,303	0	788	1,101	4,288	155	169	0	1	121,206	586	121,792
5/18/91	Saturday	111,331	221	121	1,456	3	317	340	1,324	139	66	0	2	115,321	521	115,842
5/19/91	Sunday	110,360	140	157	393	0	238	139	415	508	2	0	5	112,677	535	113,212
5/20/91	Monday	96,393	86	117	3,021	3	778	979	4,426	124	320	3	11	106,864	602	107,466
5/21/91	Tuesday	90,162	92	66	4,385	0	762	1,104	4,540	187	129	3	5	102,062	570	102,632
5/22/91	Wednesday	93,911	99	81	4,451	0	746	1,101	4,623	222	133	0	0	105,375	589	105,964
5/23/91	Thursday	98,705	154	126	4,718	0	859	1,173	4,726	243	169	1	9	110,883	571	111,454
5/24/91	Friday	107,857	450	198	4,085	0	833	1,071	4,165	324	125	0	3	119,[illegible]	493	119,807
5/25/91	Saturday	104,256	345	144	1,243	0	240	344	1,323	322	24	0	7	108,248	316	108,564
5/26/91	Sunday	104,699	319	114	499	0	117	126	379	408	4	0	2	106,567	325	106,892
5/27/91	Monday	93,284	416	177	564	0	194	142	535	244	8	0	1	95,565	319	95,884
5/28/91	Tuesday	103,208	194	111	4,026	1	631	939	4,382	181	114	0	1	113,788	514	114,302
5/29/91	Wednesday	89,755	80	69	4,390	0	751	1,179	4,546	205	149	0	3	101,096	557	101,653
5/30/91	Thursday	95,259	75	85	4,042	0	880	1,101	4,754	125	152	2	2	107,357	544	107,901
5/31/91	Friday	107,299	151	100	4,555	0	900	1,158	4,472	145	119	1	0	118,909	556	119,465
	TOTAL	3,081,115	4,719	3,203	102,798	25	19,227	25,995	106,003	6,122	3,141	37	113	3,352,501	16,115	3,368,616

and 7-axle trucks). Note that vans are included with passenger cars in the toll data. The average weekday volume, by truck class, is then broken down by time period using the total vehicle breakdown from the plaza profile. This implicitly makes the assumption that the temporal distribution of truck trips is the same as that for the traffic stream as a whole. This is not entirely accurate, and additional data could be used to improve this assumption.

These toll counts allow us to create a series of originating-terminating (OT) constraints at the TBTA bridges. Combining the toll data with the TBTA Truck Survey data, we can also estimate the van proportion of the total traffic count, and construct an estimate of total van originations and terminations at the TBTA bridges.

3.4.4 Thruway Toll Data

The New York State Thruway Authority has provided data from the New Rochelle Toll Plaza (external zone 102), representing I-95 to/from Connecticut. The toll data are illustrated by Table 3.3, and included a total of ten weekdays' data from May and June, 1992. For each day, the data show numbers of vehicles, by class and by hour, passing eastbound through the toll plaza. Because tolls are only collected in the eastbound direction at the New Rochelle Plaza, there are no data on westbound traffic.

Figure 3.6 shows the vehicle classification system for the Thruway, and illustrates some of the difficulty in interpreting the count data. It is clear that vans are considered in Class 1, along with passenger cars, so the data provide no van counts. Class 4 includes medium trucks with two axles and six tires, but also includes some motor homes, limousines, etc., so the count is likely to overestimate the number of trucks in this category. Similarly, Class 8 includes 3-axle trucks, but also includes buses, some motor homes, etc. Classes 5, 6 and 7 include the heavy trucks in which we are interested, but also include some other types of vehicles.

Table 3.3 Example of Thruway toll data from the New Rochelle Plaza.

05/11/92

TA-PRSTH

New York State Thruway Authority
Toll Audit System

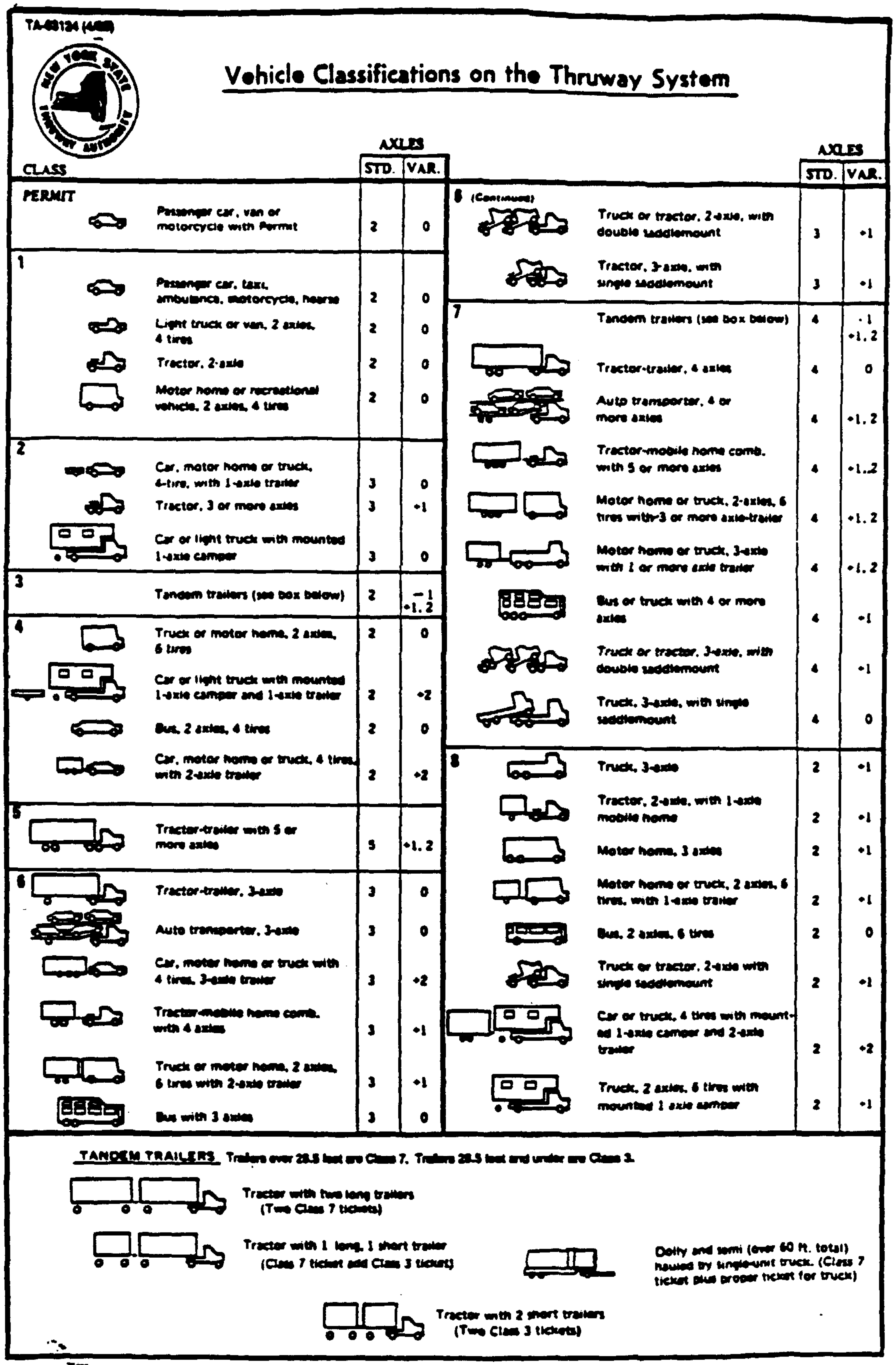
Hourly Station Stats by Vehicle Class

Statistics for NEW ROCHELLE - 05/11/92 (manual lanes)

Hour	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Total
1	0	724	6	17	17	160	6	19	4	1	954
2	0	324	3	6	19	199	3	28	2	0	584
3	0	225	0	14	22	203	3	23	2	0	492
4	0	179	4	12	24	245	6	15	5	0	490
5	0	284	0	4	24	214	4	19	4	0	553
6	0	477	2	8	60	234	6	29	10	10	836
7	0	1291	5	11	97	195	13	20	15	20	1667
8	0	2497	2	0	117	112	13	23	18	12	2794
9	0	2864	1	2	134	97	21	21	16	11	3167
10	0	1800	4	0	153	137	29	23	33	3	2182
11	0	1623	2	4	141	171	15	22	17	6	2001
12	0	1594	3	4	121	170	9	27	18	14	1960
13	0	1529	4	2	144	156	10	22	18	10	1895
14	0	1589	9	8	143	178	9	29	22	17	2004
15	0	1901	8	0	168	200	14	26	22	15	2354
16	0	1891	2	4	106	138	12	23	31	8	2215
17	0	1845	7	2	93	136	10	18	9	3	2123
18	0	2023	1	11	60	108	17	13	5	4	2242
19	0	1905	3	20	53	128	11	24	4	4	2152
20	0	1565	6	18	48	136	7	26	3	2	1811
21	0	1175	5	26	40	133	10	15	2	0	1406
22	0	1075	6	16	31	113	8	18	3	6	1276
23	0	1027	4	23	29	133	3	17	1	2	1239
24	0	948	0	40	33	173	7	25	6	0	1232
	0	32355	87	252	1877	3869	246	525	270	148	39629

3.4.5 NYCDOT Bridge Traffic Volumes

The New York City Department of Transportation (NYCDOT) operates 47 bridges within the City. Figure 3.7 is a map which shows the locations of these bridges. Eight of these bridges are in the Bronx and nine others cross the Harlem River, connecting the Bronx and Manhattan. These 17 bridges are within the case study area, and all but one (on the Hutchinson River Parkway) carry trucks.



TA-03134 (4/88)

Vehicle Classifications on the Thruway System

CLASS	Description	AXLES STD.	AXLES VAR.
PERMIT	Passenger car, van or motorcycle with Permit	2	0
1	Passenger car, taxi, ambulance, motorcycle, hearse	2	0
	Light truck or van, 2 axles, 4 tires	2	0
	Tractor, 2-axle	2	0
	Motor home or recreational vehicle, 2 axles, 4 tires	2	0
2	Car, motor home or truck, 4-tire, with 1-axle trailer	3	0
	Tractor, 3 or more axles	3	+1
	Car or light truck with mounted 1-axle camper	3	0
3	Tandem trailers (see box below)	2	−1 +1, 2
4	Truck or motor home, 2 axles, 6 tires	2	0
	Car or light truck with mounted 1-axle camper and 1-axle trailer	2	+2
	Bus, 2 axles, 4 tires	2	0
	Car, motor home or truck, 4 tires, with 2-axle trailer	2	+2
5	Tractor-trailer with 5 or more axles	5	+1, 2
6	Tractor-trailer, 3-axle	3	0
	Auto transporter, 3-axle	3	0
	Car, motor home or truck with 4 tires, 3-axle trailer	3	+2
	Tractor-mobile home comb. with 4 axles	3	+1
	Truck or motor home, 2 axles, 6 tires with 2-axle trailer	3	+1
	Bus with 3 axles	3	0
6 (Continued)	Truck or tractor, 2-axle, with double saddlemount	3	+1
	Tractor, 3-axle, with single saddlemount	3	+1
7	Tandem trailers (see box below)	4	-1 +1, 2
	Tractor-trailer, 4 axles	4	0
	Auto transporter, 4 or more axles	4	+1, 2
	Tractor-mobile home comb. with 5 or more axles	4	+1, 2
	Motor home or truck, 2-axles, 6 tires with 3 or more axle-trailer	4	+1, 2
	Motor home or truck, 3-axle with 1 or more axle trailer	4	+1, 2
	Bus or truck with 4 or more axles	4	+1
	Truck or tractor, 3-axle, with double saddlemount	4	+1
	Truck, 3-axle, with single saddlemount	4	0
8	Truck, 3-axle	2	+1
	Tractor, 2-axle, with 1-axle mobile home	2	+1
	Motor home, 3 axles	2	+1
	Motor home or truck, 2 axles, 6 tires, with 1-axle trailer	2	+1
	Bus, 2 axles, 6 tires	2	0
	Truck or tractor, 2-axle with single saddlemount	2	+1
	Car or truck, 4 tires with mounted 1-axle camper and 2-axle trailer	2	+2
	Truck, 2 axles, 6 tires with mounted 1 axle camper	2	+1

TANDEM TRAILERS Trailers over 28.5 feet are Class 7. Trailers 28.5 feet and under are Class 3.

Tractor with two long trailers (Two Class 7 tickets)

Tractor with 1 long, 1 short trailer (Class 7 ticket and Class 3 ticket)

Dolly and semi (over 60 ft. total) hauled by single-unit truck. (Class 7 ticket plus proper ticket for truck)

Tractor with 2 short trailers (Two Class 3 tickets)

Figure 3.6 New York State Thruway vehicle classification.

MAP #	NAME	WATER CROSSINGS
1	Brooklyn	East River
2	Manhattan	East River
3	Williamsburg	East River
4	Queensboro	East River
5	Willis Ave.	Harlem River
6	Third Ave.	Harlem River
7	Madison Ave	Harlem River
8	145th Street	Harlem River
9	Macombs Dam	Harlem River
10	Alexander Hamilton	Harlem River
11	Washington	Harlem River
12	University Heights	Harlem River
13	Broadway	Harlem River
14	Eastern Boulevard	Bronx River
15	Westchester Ave.	Bronx River
16	E-174th Street	Bronx River
17	Unionport	Westchester Creek
18	City Island	Pelham Bay Narrows
19	Pelham	Eastchester Creek
20	Hutchinson River Parkway	Eastchester Creek
21	Eastchester	Eastchester Creek
22	Mill Basin	Mill Basin
23	Stillwell Ave	Coney Island Creek
24	Cropsey	Coney Island Creek
25	Hamilton Ave	Gowanus Canal
26	Ninth Street	Gowanus Canal
27	Third Street	Gowanus Canal
28	Carroll Street	Gowanus Canal
29	Union Street	Gowanus Canal
30	Third Ave.	5th St. Basin
31	Metropolitan Ave.	English Kills
32	Grand Street	Newtown Creek
33	Kosciusko	Newtow:: Creek
34	Greenpoint Ave	Newtown Creek
35	Pulaski	Newtown Creek
36	Borden Ave.	Dutch Kills
37	Midtown Highway	Dutch Kills
38	Hunters Point Ave,	Dutch Kills
39	Roosevelt Island	East River East Channel
40	Rikers Island	Riker's Island Channel
41	Roosevelt Ave.	Flushing River
42	Flushing	Flushing River
43	Whitestone Expy	Flushing River
44	Little Neck	Alley Creek
45	Hook Creek	Hook Creek
46	North Channel	Jamaica Bay
47	Fresh Kill	Richmond Creek

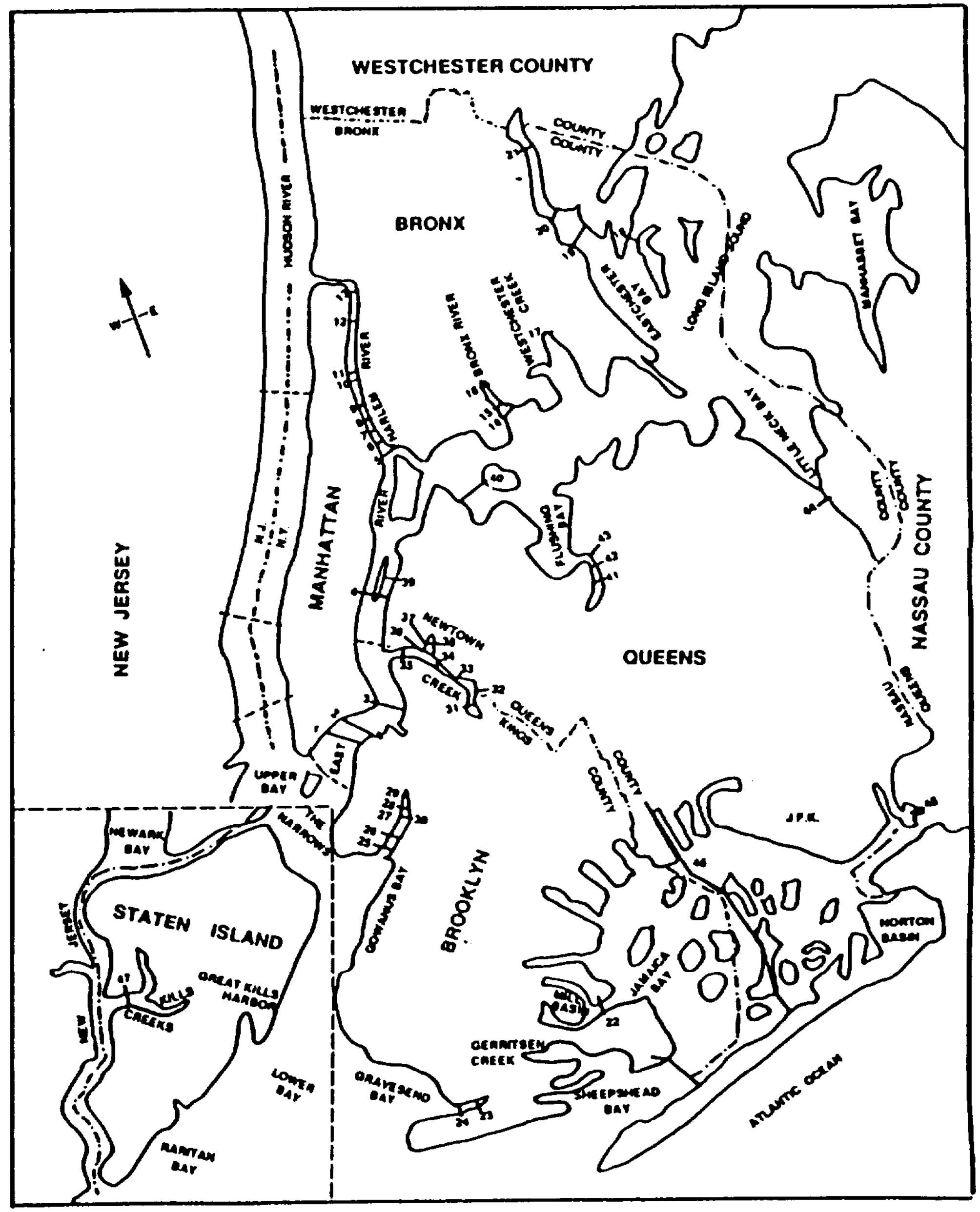


Figure 3.7 Bridges maintained by the City of New York.

Each year, usually during one week in the fall, NYCDOT performs a survey of traffic on the bridges. The reported values include counts of commercial vans and other trucks, in both directions (unless the bridge is one-way), by hour of the day. The "other trucks" category includes all trucks larger than vans.

These counts are quite important because they are a source of data on van movements. There are few sources of van data in the New York Metropolitan area, despite the general acknowledgement that vans are a major element of the freight movement system within the area.

3.4.6 Highway Sufficiency (S-1) Data

The New York State Department of Transportation maintains a set of data for all state highways that includes a variety of physical and traffic information. This dataset is known as the Highway Sufficiency Data, or S-1 Data. The basic traffic data from this source are Annual Average Daily Traffic (AADT) counts for individual highway segments. The Planning Division at NYSDOT has developed a set of factors which can be used to approximate the breakdown of this total daily volume by hour, and by vehicle class.

Each count location is classified into a "factor group" based on diurnal and seasonal variations in traffic. Most facilities in the New York City area are in Factor Group 3, which shows little seasonal variation. Within factor groups, volumes over specific periods of the day can be estimated, based on the values shown in Table 3.4.

Thus, for the three periods of interest to us, the proportions of AADT can be constructed as follows:

6 AM - 10 AM: .195

10 AM - 3 PM: .316

3 PM - 8 PM: .338

Table 3.4 Fractions of AADT by hour for Factor Group 3.

Hour Ending	AADT Fraction	Hour Ending	AADT Fraction	Hour Ending	AADT Fraction
0100	.010	0900	.058	1700	.081
0200	.005	1000	.051	1800	.076
0300	.004	1100	.054	1900	.058
0400	.003	1200	.061	2000	.049
0500	.003	1300	.067	2100	.040
0600	.008	1400	.066	2200	.033
0700	.028	1500	.068	2300	.025
0800	.058	1600	.074	2400	.019

Source: NYSDOT Planning Division

From the counting stations in various regions of New York State where vehicle classification counts have been made, an estimate can be made of the proportion of total traffic which is pickup/vans, and the proportion which is larger trucks. For Region 11 (New York City), on arterials and expressways, the proportion of pickups/vans is approximately 10%, and larger trucks (medium and heavy) make up approximately 7% of the traffic. (See Table 3.5.)

Putting these two pieces of information together, we can estimate the proportions of AADT in each time period, by vehicle class, as follows:

Vehicle Class	6 AM - 10 AM	10 AM - 3 PM	3 PM - 8 PM
Pickups/vans	0.0195	0.0316	0.0338
Medium + Heavy	0.0137	0.0221	0.0237

Table 3.5 Approximate vehicle classification breakdowns, by region and functional class.

REGIONS	<----FC----> RURAL	URBAN	NUMBER of STATIONS RURAL	URBAN	TOTAL	PERCENT BY AXLE CLASS (1) CLASS F3 RURAL	URBAN	CLASS F4-F13 RURAL	URBAN	PERCENT CLASS F1-F2 RURAL	URBAN	TOTAL CLASS F1-F13 RURAL	URBAN
1,3,4	01	11,12	12	14	26	15.2	19.2	14.0	7.1	70.8	73.7	100.0	100.0
	02,06	14,16	51	45	96	19.3	16.3	9.3	5.9	71.4	77.8	100.0	100.0
	07,08,09	17,19	33	18	51	21.7	15.7	5.7	3.4	72.6	80.9	100.0	100.0
2,6,9	01	11,12	9	24	33	15.1	17.5	28.9	11.0	56.0	71.5	100.0	100.0
	02,06	14,16	63	56	119	21.1	19.7	11.8	6.5	67.1	73.8	100.0	100.0
	07,08,09	17,19	46	9	55	24.8	17.9	7.1	4.8	68.1	77.3	100.0	100.0
5	01*	11,12	1	10	11	13.5	18.0	37.0	11.6	49.5	70.4	100.0	100.0
	02,06	14,16	17	17	34	23.0	17.7	13.9	5.9	63.1	76.4	100.0	100.0
	07,08,09	17,19	11	4	15	24.9	15.2	8.1	2.9	67.0	81.9	100.0	100.0
7	01	11,12	4	1	5	18.0	12.7	20.0	10.8	62.0	76.5	100.0	100.0
	02,06	14,16	23	17	40	20.6	18.6	8.1	6.8	71.3	74.6	100.0	100.0
	07,08,09	17,19	16	8	24	22.3	19.7	7.8	4.6	69.9	75.7	100.0	100.0
8	01	11,12	6	13	19	13.5	13.4	19.0	8.6	67.5	78.0	100.0	100.0
	02,06	14,16	17	31	48	14.9	13.8	6.8	5.5	78.3	80.7	100.0	100.0
	07,08,09	17,19	9	5	14	16.0	13.3	4.0	3.1	80.0	83.6	100.0	100.0
10,11	01**	11,12	0	5	5	16.7	9.9	14.6	7.2	68.7	82.9	100.0	100.0
	02,06	14,16	2	16	18	19.5	10.2	7.0	7.1	73.5	82.7	100.0	100.0
	07,08,09	17,19***	4	0	4	15.2	16.6	4.8	3.8	80.0	79.6	100.0	100.0

<-----------FUNCTIONAL CLASS CODES----------->

RURAL	URBAN	
01	11	PRINCIPAL ARTERIAL – INTERSTATE
02	12	PRINCIPAL ARTERIAL – EXPRESSWAY
02	14	PRINCIPAL ARTERIAL – OTHER
06	16	MINOR ARTERIAL
07	17	MAJOR COLLECTOR
08	17	MINOR COLLECTOR
09	19	LOCAL
99	99	THRUWAY

Notes:
* N.Y.S. Thruway
** Used 1 Station in Suffolk Co. With FC = 11
*** Statewide Value for 44 Stations

(1) FHWA F Scheme axle classification is based on axle spacing. Axle class F3 is closest to the <= 9000 pound category, while axle classes F4–F13 are approximately the >9000 pound category. However, F Scheme uses axle spacing, not weight to make the distinction between classes. As such, the translation to the <= 9000 & > 9000 weight categories is not precise. A few of the F3 class vehicles may exceed 9000 pounds and likewise, some of the F5

VEHICLE AXLE CLASSIFICATION CODES

- F1 MOTORCYCLES
- F2 AUTOS #
- F3 2 AXLE, 4 TIRE PICKUPS, VANS, MOTORHOMES #
- F4 BUSES
- F5 2 AXLE, 6 TIRE SINGLE UNIT TRUCKS
- F6 3 AXLE SINGLE UNIT TRUCKS
- F7 4 OR MORE AXLE SINGLE UNIT TRUCKS
- F8 4 OR LESS AXLE VEHICLES, ONE UNIT IS A TRUCK
- F9 5 AXLE DOUBLE UNIT VEHICLES, ONE UNIT IS A TRUCK
- F10 6 OR MORE AXLE DOUBLE UNIT VEHICLES, 1 UNIT IS A TRUCK
- F11 5 OR LESS AXLE MULTI-UNIT TRUCKS
- F12 6 AXLE MULTI-UNIT TRUCKS
- F13 7 OR MORE AXLE MULTI-UNIT TRUCKS

INCLUDING THOSE HAULING TRAILERS

Where better, site specific information is available, it is used for vehicle counts, but in the absence of such information, these factors are used to estimate the applicable counts from AADT data.

3.4.7 Bronx Truck Route Study

In 1980, the City of New York contracted with DeLeuw, Cather and Co. to perform a study of truck routes in the Bronx. The report, produced in 1981, includes estimates of truck trip-end density for one-square-mile areas in the Bronx. These estimates are reproduced as Figure 3.8.

We have used these estimates to form "originating-terminating" (OT) constraints for the internal zones of the study area, covering medium and heavy trucks (excluding vans). The estimates are based on overlaying the square-mile grid on the zipcode areas, and estimating the fraction of each zipcode area in a particular trip-end density category. For each zipcode, the area (in square miles) is then used to convert trip-end density (trip-ends per square-mile per day) to an estimate of total truck trip-ends in each zone. Because the map in Figure 3.8 lists trip-end density as a range (e.g., 2500 - 5000 trip-ends per square-mile per day), we have used the mean (middle) value of each range to construct our estimates.

To allocate the total daily values among the three time periods (6 - 10 AM, 10 AM - 3 PM, and 3 - 8 PM), we have used the factors described in Section 3.4.6 (i.e., 0.195, 0.316, and 0.338).

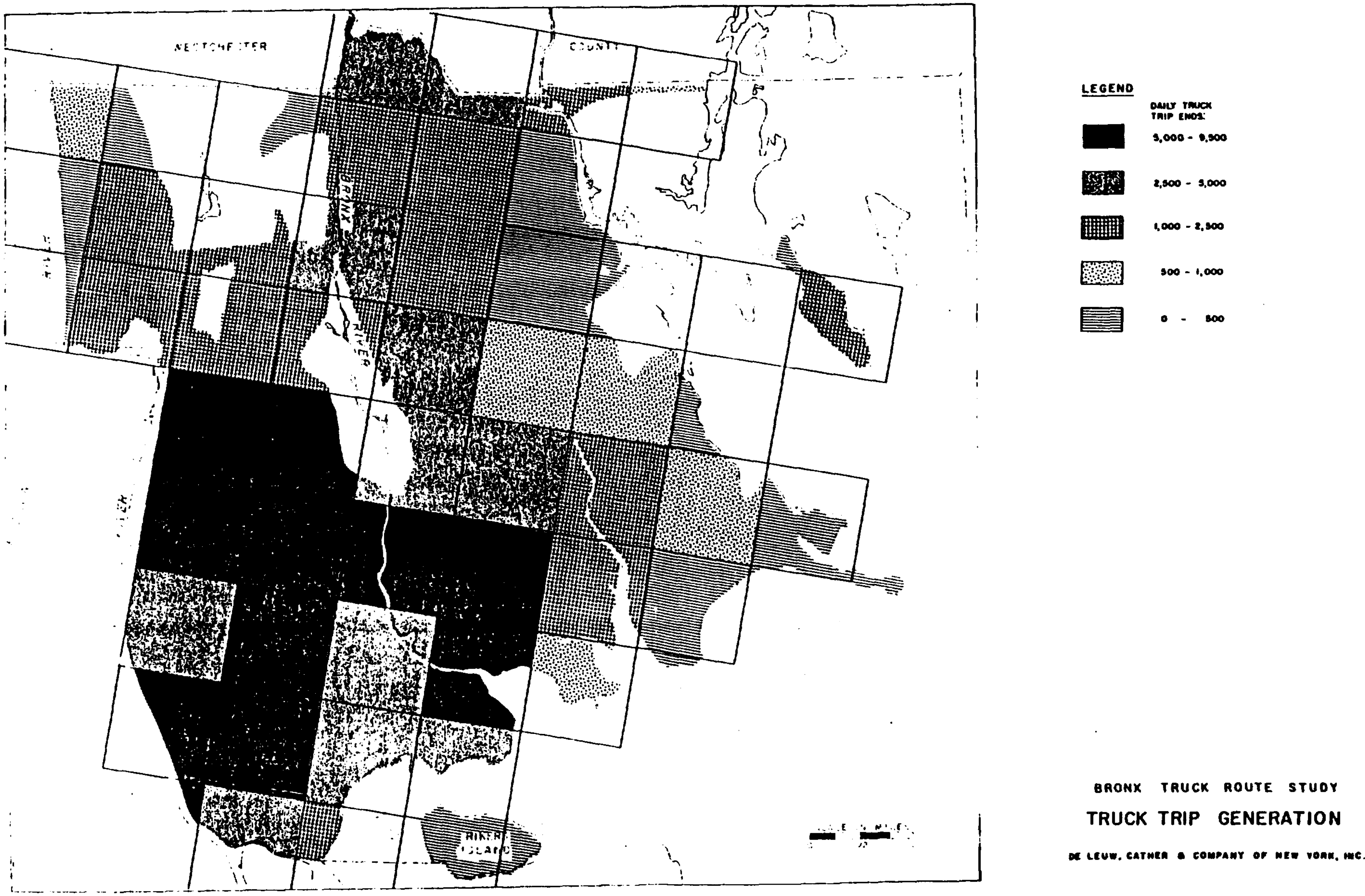


Figure 3.8 Truck trip ends per square mile in the Bronx.

3.4.8 Hunt's Point Access Study

In 1984, a set of data was collected on truck movements into and out of the Hunt's Point area, where the main wholesale fruit, vegetable and meat markets for New York City are located. These data were provided for our use by the Region 11 office of NYSDOT.

The data contain three important pieces of information for the purposes of this study:

1) Approximately 15,500 trucks enter and leave the Hunt's Point area each day.

2) About 500 of these are tractor-trailer trucks, mostly arriving loaded from the west, and mostly at night.

3) A set of detailed vehicle counts was collected in the area of the Bruckner-Sheridan Interchange, including truck volumes on the expressways, the exit ramps and the entrance ramps.

The first two of these pieces of information provide an estimate of total originating and terminating truck traffic in the Hunt's Point zone (Zone 18 on the map in Figure 3.2). They also tell us that these truck trips are medium trucks and vans -- the heavy trucks are entering and leaving outside the time period of our analysis. Finally, the vehicle count data are important for constructing link volumes around this important interchange; this process is described more fully in Section 3.5.3.

3.4.9 Vehicle Classification Counts on Expressways

The Region 11 Office of NYSDOT also provided a series of vehicle classification counts from various locations on the Cross-Bronx Expressway, the Sheridan Expressway and the Bruckner Expressway. These counts provided breakdowns of vans, medium trucks and heavy trucks, by direction, during the three time periods under analysis.

3.5 Creating the Model Constraints

The optimization model which finds origin-destination matrices contains three major types of constraints, derived from the data sources discussed in the previous section. Some of the observations are directly related to specific origin-destination pairs -- these produce "OD" constraints. Other observations are related to total trip-ends in some zone -- these produce "OT" constraints. Still other observations relate to vehicle volumes on network links -- these produce "LV" constraints. The following three subsections illustrate the creation of each of these three types of constraints. Full listings of the constraint sets generated for the Bronx Case Study appear in Appendix A. Section 3.5.4 discusses the problem of inconsistencies among the various data sources, and how the model deals with those inconsistencies.

3.5.1 Origin-Destination (OD) Constraints

In total, the combination of the 1991 PANYNJ Truck Commodity Survey and the 1988 TBTA Truck Survey allowed us to create 40 OD constraints. None of these constraints pertain to local trips -- all have one or both ends at one of the major toll bridges which are external zones for the case study because those were the locations at which the surveys were done. In addition, these constraints all apply to eastbound movements at the George Washington Bridge and southbound movements at the Triborough, Whitestone and Throg's Neck Bridges, because that is the direction in which tolls are collected.

As an illustration of creating OD constraints, we will focus on the use of the PANYNJ Truck Commodity Survey data, collected in December, 1991, at the George Washington Bridge. The survey data provided by the Port Authority contained 4,539 responses, of which 3,003 were useful in this case study. To be useful here, a response had to have been collected between 6 AM and 8 PM, and have both number of axles and destination codes recorded properly.

A major element in creating OD constraints from these survey responses is relating the PANYNJ zone definitions to the zone structure used in the case study, based on zipcodes. There are two separate aspects to this relationship: 1) determining which PANYNJ zones correspond to which internal zones for destinations within the study area, and 2) determining which PANYNJ zones should be mapped to which external zones for destinations outside the study area.

As an example of the first (internal zone) relationship, Figure 3.9 shows the PANYNJ zones within the Bronx. These six zones must be overlayed on the 18 zones defined from zipcode boundaries for use in the case study. Although the boundaries of zipcode areas and PANYNJ zones do not align exactly, we have used the following definitions:

PANYNJ Zone	Included Analysis Zones
2510	16, 17, 18, 20
2520	6, 7, 8, 12, 13, 14
2530	9, 15, 19
2540	1
2550	2, 3
2560	9, 10, 11

In the constraints generated for the optimization model, this correspondence implies that a number of truck trips in a certain vehicle class observed at the George Washington Bridge and destined for zone 2510, for example, would be represented as a constraint which says that the sum of trips in that vehicle class from zone 100 (GW Bridge) to zones 16, 17, 18 and 20 should be approximately the value observed (expanded from the survey results to approximate the total volume).

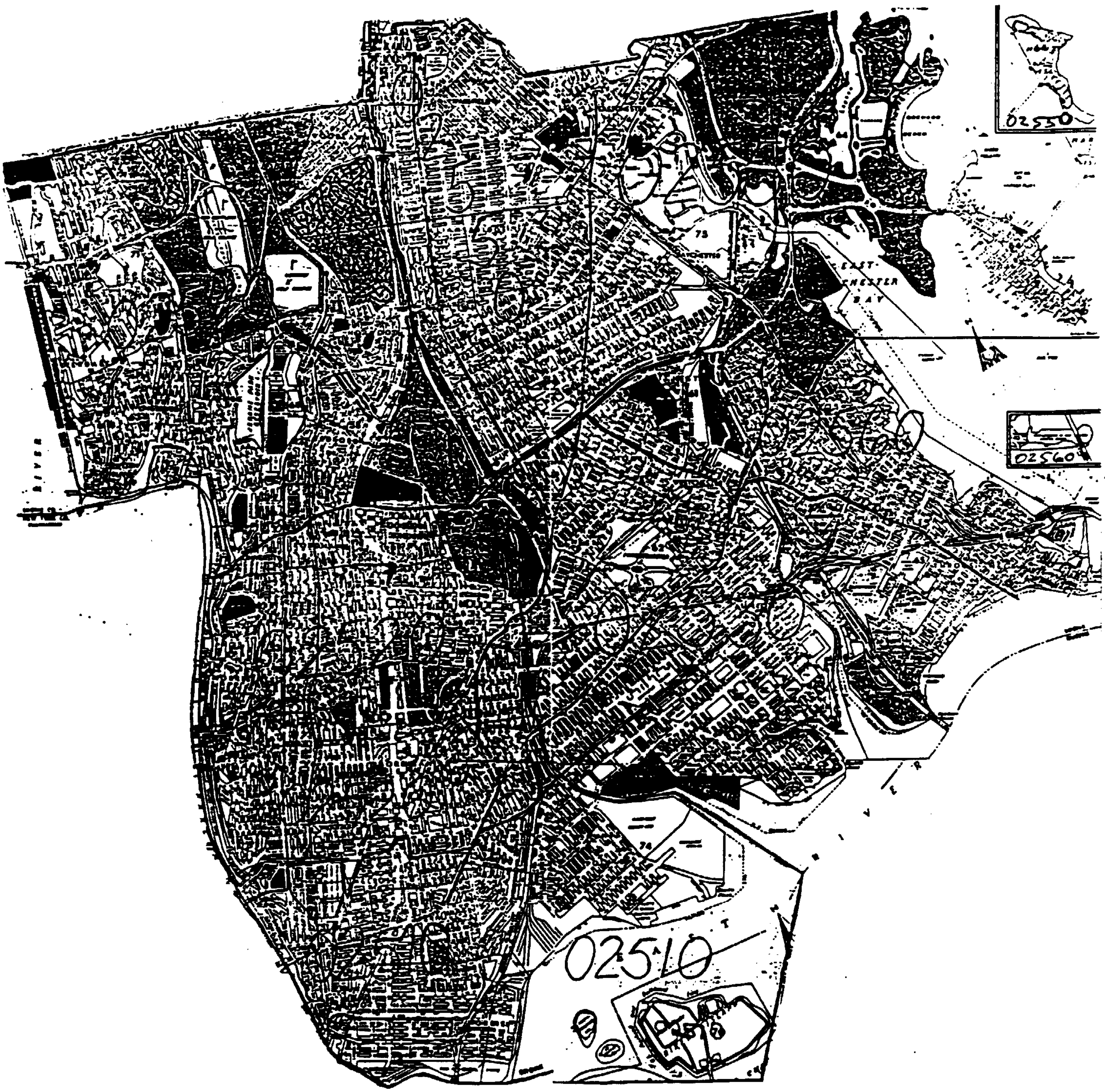


Figure 3.9 Port Authority zones in the Bronx.

To be specific, the survey results found a total of 89 heavy trucks (4 or more axles) destined for zone 2510 in the PM Peak (3 - 8 PM). Expanding the survey responses to account for the total volume through the toll plaza over the PM Peak period, this "observed" value becomes 145 trucks. If we define the generic variable Hxxxyyy to mean "heavy trucks from zone xxx to zone yyy" the following constraint can be written for the optimization:

$$H100016 + H100017 + H100018 + H100020 + \text{deviation} = 145.$$

For the external zones, the relationship of PANYNJ zones to case study zones is somewhat different. Because the PANYNJ zone structure covers a much wider area than our study area, several PANYNJ zones are coalesced into a single external zone. For example, trucks destined for PANYNJ zones 5100, 5150 and 5210 in Queens, as well as all zones in Brooklyn (4700 - 4840), are assumed to exit the study area via the Triborough Bridge (external zone 105). Similar aggregations are defined for the other external zones.

The raw survey responses for trips terminating outside the study area were aggregated according to these definitions, creating observed values for "overhead" traffic originating at zone 100 (GW Bridge). For example, in the 6 AM - 10 AM period, there were 34 medium trucks (2 or 3 axle single unit) surveyed who reported destinations in Brooklyn (PANYNJ zones 4700 - 4840); or PANYNJ zones 5100, 5150 or 5210 in Queens. After expansion to account for the sampling rate, this became an "observed" value of 119 medium trucks with origin at zone 100 and destination at zone 105.

3.5.2 Originating-Terminating (OT) Constraints

A total of 48 OT constraints were constructed, based on information from four sources -- TBTA toll data, the Hunt's Point Access Study, the Bronx Truck Route Study and toll data from the Thruway Authority. As an example of creating these constraints, let us consider the use of the Thruway data. As mentioned in Section 3.4.4, the raw data were toll plaza counts from New Rochelle, giving eastbound volumes by truck class and by hour for ten weekdays. Because the data are for eastbound movements and pertain to a point on the northeast edge of the study area, the resulting observations produce "terminating" constraints -- truck trips destined for zone 102.

Referring back to Table 3.3, which shows an example of one day's data, we see that the first step in creating constraint observations is to accumulate truck volumes over the appropriate hours (6 - 10 AM, 10 AM - 3 PM and 3 - 8 PM) for medium trucks (classes 4 and 8) and heavy trucks (classes 5, 6 and 7). The result is six observed counts. This process is repeated for all ten days' observations.

Since we have repeated observations, we can compute both a sample mean and a sample standard deviation for each of the six counts. For the data obtained from the Thruway Authority, this process results in the following values:

	Medium Trucks		Heavy Trucks	
Time Period	Mean	Std. Dev.	Mean	Std. Dev.
6 AM - 10 AM	618	37	784	44
10 AM - 3 PM	852	52	1118	81
3 PM - 8 PM	458	22	787	106

The coefficient of variation (standard deviation divided by the mean) ranges from about 5% to about 13% for these six observations.

One of the interesting opportunities afforded by the presence of multiple days' observations, and the resulting ability to compute standard deviations in the counts, is that we have an empirical basis from which to specify the limits for the "small deviations" in the optimization model. In Chapter 2, where we introduced the nature of the error function which is minimized in the linear programming model, there are small deviations, e_k, and large deviations, d_k, for each observation k. The e_k terms have a smaller slope in the error function, but can be no larger than the positive and negative limits, E_k^+ and E_k^-. These limits on the "small" deviations in the model solution allow us to specify our level of confidence in any particular observation.

The ability to compute sample standard deviations for the observations from the Thruway data offers us the opportunity to specify the limits E_k^+ and E_k^- with direct empirical support. We have set these limits to the value of the standard deviations for the six observations from this data set. This implies that any model solution within one standard deviation of the observed sample mean will be considered "close," in the sense of having only a small deviation from the observed values.

For most of the data from which we have created model constraints, there is only a single observation. Hence, the specification of the limits, E_k^+ and E_k^-, for these observations is relatively arbitrary. However, in this data set, we have an explicit statistical rationale for specifying the values. This is certainly a preferred situation. The Thruway data provide a good example of how multiple observations of the same volume can be used to improve our overall model input.

3.5.3 Link Volume (LV) Constraints

A total of 154 link volume constraints have been generated, based on count data from several of the sources described in Section 3.4. As an example of creating these constraints, the set of constraints generated for the links representing the Sheridan-Bruckner interchange will be described.

Figure 3.10 shows the count data obtained from the Hunt's Point Study for the Sheridan-Bruckner interchange. This figure also illustrates the geometry of the interchange itself. Figure 3.11 shows the coded version of the interchange as it appears in the NYMTC network, with the link numbers listed along the relevant links. Note, in particular, that the collection of two entrance and three exit ramps has been aggregated into a single link (649190) in the coded network, connecting the expressways with Westchester Ave.

The 1984 traffic volumes include total vehicles in the AM peak hour and PM peak hour, as well as total daily trucks. To derive truck counts for the 6 - 10 AM and 3 - 8 PM periods, we first expand the peak hour vehicle counts to the full periods, using the values in Table 3.4. The peak hour in the morning is either 7 - 8 AM or 8 - 9 AM, both having a proportion of AADT equal to 0.058. The total 6 - 10 AM proportion of AADT is 0.195. Thus, the AM Peak period volume is likely to be 0.195/0.058 = 3.36 times the AM peak hour volume. Similarly, the PM Peak volume is approximately 0.338/0.081 = 4.17 times the PM peak hour volume.

For the midday period, we take the AADT value, and multiply by the average fraction in the 10 AM - 3 PM period from Table 3.4, which is 0.316. This gives an estimate of total vehicle traffic during the midday period.

Then, using the vehicle classification counts for the Sheridan and Bruckner Expressways shown in Tables 3.6 - 3.8, we have approximate fractions of total traffic volume

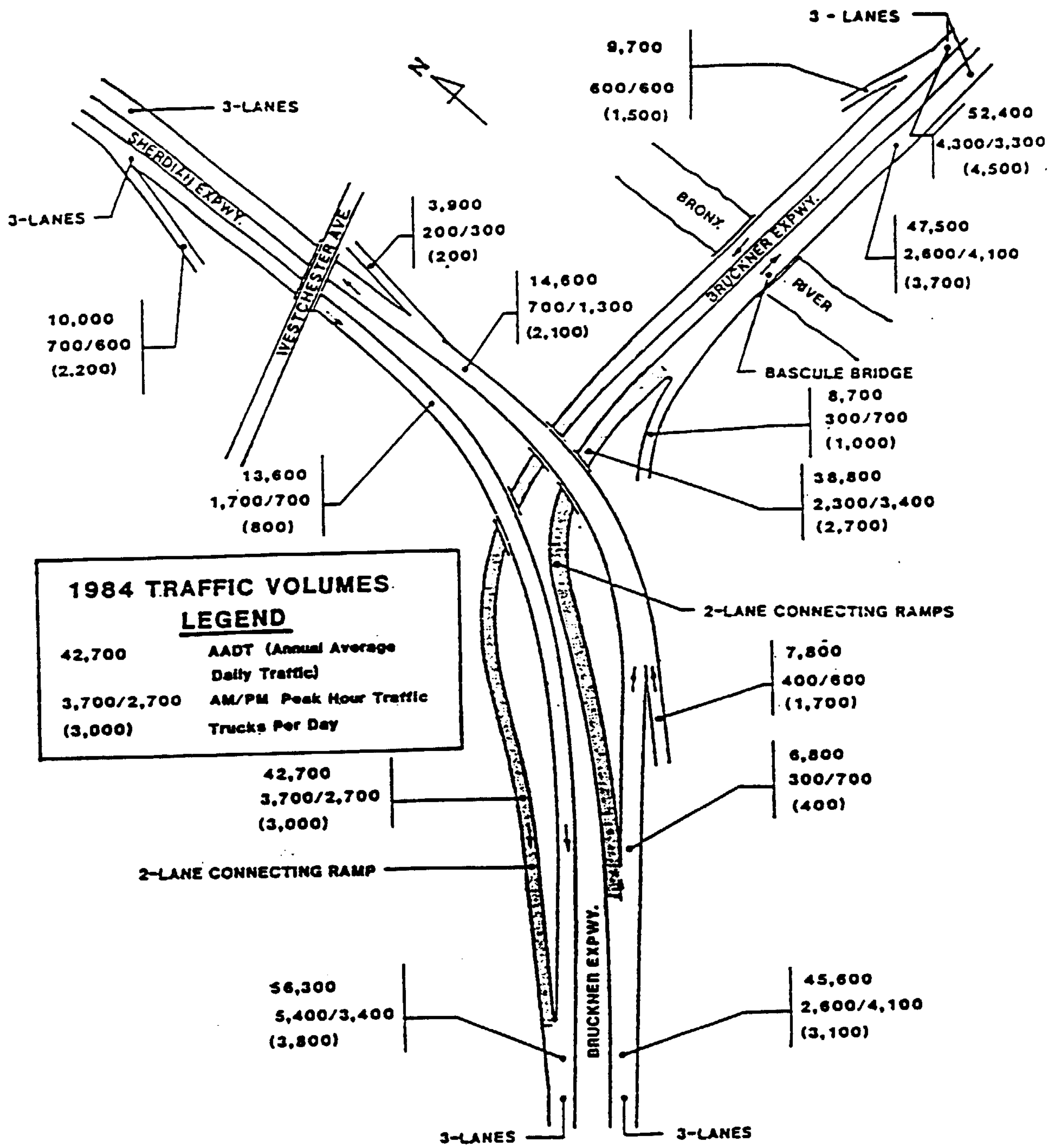


Figure 3.10 Traffic volumes and geometry at the Bruckner-Sheridan Interchange.

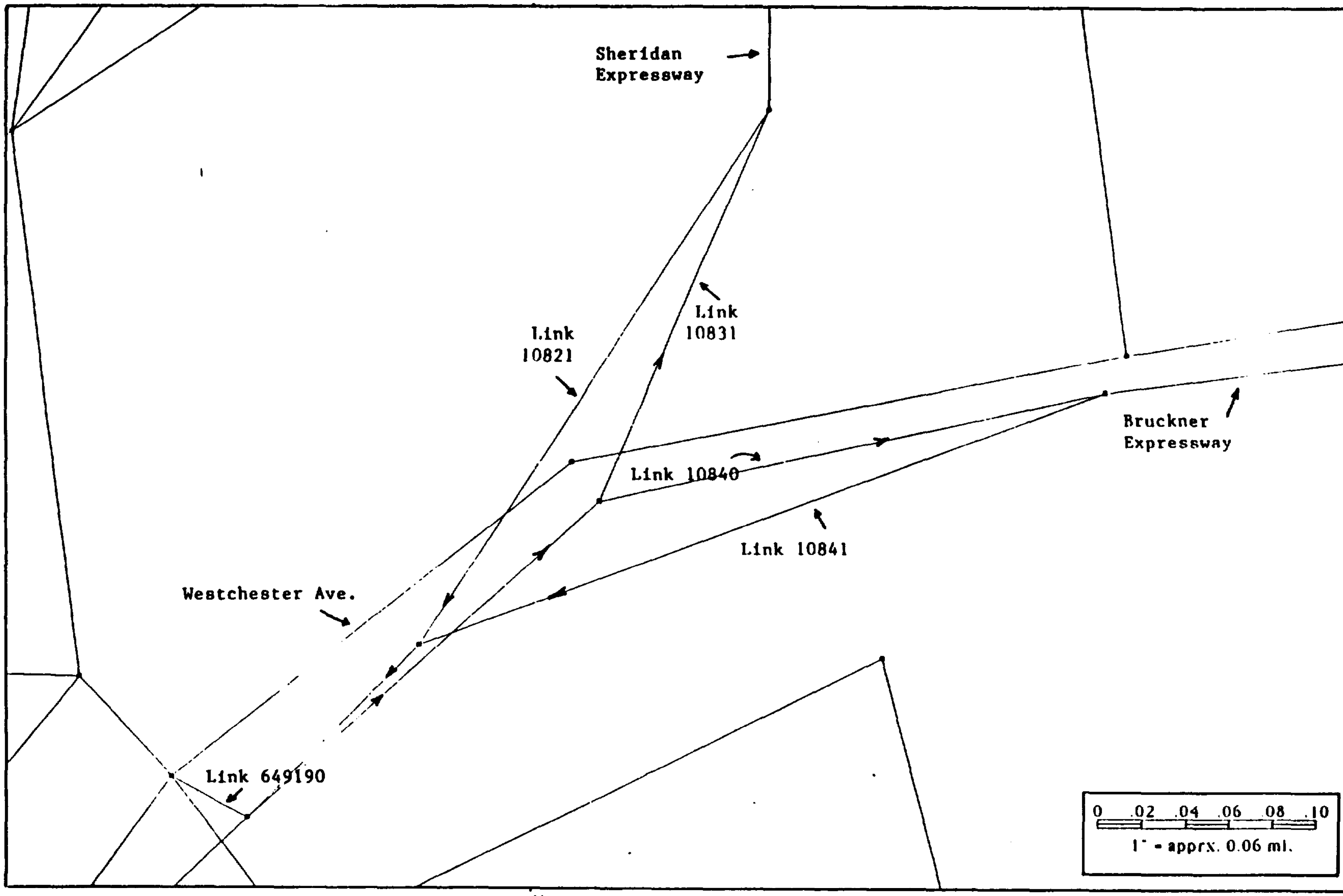


Figure 3.11 Coded network representation of the Bruckner-Sheridan Interchange.

Table 3.6 Vehicle classification percentages on Bronx expressways in the AM Peak.

LOCATIONS	DIRECTION	% CARS	% MOTOR CYCLE	% BUS	% MINI BUS	% LIGHT TRUCK	% MEDIUM TRUCK	% HEAVY TRUCK I	% HEAVY TRUCK II	% YELLOW TAXI	VEH OCCUPANCY
CROSS BRONX-EASTERN END	EB	71.39	0.11	2.06	6.48	4.36	4.21	0.47	7.74	0.26	1.1
(BET ROSEDALE & WHITE PLAINS RD.)	WB	85.44	0.03	0.42	7.86	3.43	0.82	0.42	1.50	0.06	1.2
CROSS BRONX-WESTERN END	EB	74.68	0.13	0.65	3.06	5.61	5.48	2.77	7.53	0.09	1.3
(BET JEROME & WEBSTER AV)	WB	77.34	0.16	0.41	6.80	3.44	5.05	0.83	5.67	0.20	1.2
SHERIDAN EXPWY	NB	72.57	0.00	1.39	10.19	3.00	7.87	1.16	3.59	0.23	1.3
(BET E 172 ST & WESTCHESTER AV)	SB	84.68	0.03	1.30	3.13	5.43	2.17	0.57	1.93	0.76	1.3
BRONX RIVER PKWY	NB	90.06	0.17	0.84	8.16	0.57	0.03	0.00	0.00	0.17	1.4
(NORTH OF CBE PRIOR TO BRONX ZOO EXIT)	SB	92.78	0.13	0.38	4.04	2.46	0.00	0.00	0.00	0.23	1.3
BRUCKNER EXPWY	EB	80.48	0.06	1.75	2.32	7.66	4.46	1.95	1.26	0.06	1.2
(AT BRP INTERCHANGE)	WB	79.70	0.25	1.51	5.69	6.46	3.27	0.98	1.43	0.81	1.3

LEGEND:
- LIGHT TRUCK— INCLUDES 2 AXLES, 4 TIRES.
- MEDIUM TRUCK— INCLUDES 2 AXLES, 6 TIRES.
- HEAVY TRUCK I— INCLUDES 3,4 AXLES SINGLE [illegible] TRUCKS
- HEAVY TRUCK II— INCLUDES 3,4,5,6+AXLES SEM[illegible]AILERS

Table 3.7 Vehicle classification percentages on Bronx expressways in the Midday.

LOCATIONS	DIRECTION	% CARS	% MOTOR CYCLE	% BUS	% MINI BUS	% LIGHT TRUCK	% MEDIUM TRUCK	% HEAVY TRUCK I	% HEAVY TRUCK II	% YELLOW TAXI	VEH OCCUPANCY
CROSS BRONX-EASTERN END	EB	70.43	0.15	0.33	8.79	3.00	4.30	1.97	10.91	0.12	1.3
(BET ROSEDALE & WHITE PLAINS RD)	WB	61.51	0.04	0.30	9.58	5.10	4.62	1.34	17.40	0.11	1.2
CROSS BRONX-WESTERN END	EB	74.37	0.30	0.07	2.98	5.79	5.52	3.50	7.42	0.05	1.2
(BET JEROME & WEBSTER AV)	WB	63.44	0.16	0.32	7.40	5.44	7.02	1.03	14.97	0.22	1.4
SHERIDAN EXPWY	NB	69.95	0.21	0.43	6.63	6.95	6.10	2.03	7.59	0.11	1.4
(BET E.172 ST & WESTCHESTER AV.)	SB	80.66	0.25	0.85	4.37	6.53	3.02	1.36	2.41	0.55	1.4
BRONX RIVER PKWY	NB	86.47	0.00	0.31	12.01	0.90	0.22	0.00	0.00	0.09	1.1
(NORTH OF CBE PRIOR TO BRONX ZOO EXIT)	SB	89.99	0.05	0.21	5.54	3.75	0.12	0.00	0.00	0.34	1.3
BRUCKNER EXPWY	EB	76.89	0.20	1.50	3.00	9.46	5.04	0.78	2.61	0.52	1.4
(AT BRP INTERCHANGE)	WB	70.45	0.14	0.98	5.12	6.89	5.91	1.35	8.56	0.60	1.4

LEGEND:

LIGHT TRUCK— INCLUDES 2 AXLES, 4 TIRES.
MEDIUM TRUCK— INCLUDES 2 AXLES, 6 TIRES.
HEAVY TRUCK I— INCLUDES 3,4 AXLES SINGLE UNIT TRUCKS.
HEAVY TRUCK II— INCLUDES 3,4,5,6+AXLES SEMI TRAILERS.

Table 3.8 Vehicle classification percentages on Bronx expressways in the PM Peak.

LOCATIONS	DIRECTION	% CARS	% MOTOR CYCLE	% BUS	% MINI BUS	% LIGHT TRUCK	% MEDIUM TRUCK	% HEAVY TRUCK I	% HEAVY TRUCK II	% YELLOW TAXI	VEH OCCUPANCY
CROSS BRONX-EASTERN END	EB	83.58	0.06	0.06	7.75	1.91	1.68	0.19	4.64	0.13	1.3
(BET ROSEDALE & WHITE PLAINS RD.)	WB	73.82	0.26	0.20	9.02	3.33	3.30	0.65	9.38	0.04	1.1
CROSS BRONX-WESTERN END	EB	84.48	0.10	0.42	3.32	4.67	2.88	0.91	3.14	0.06	1.3
(BET JEROME & WEBSTER AV)	WB	79.26	0.26	0.05	5.44	4.11	3.56	0.43	6.74	0.15	1.2
SHERIDAN EXPWY	NB	83.54	0.21	0.63	3.14	7.88	1.74	0.63	1.81	0.42	1.4
(BET E.172 ST & WESTCHESTER AV.)	SB	88.81	0.43	1.40	2.51	3.86	1.11	0.38	1.16	0.34	1.3
BRONX RIVER PKWY	NB	90.76	0.08	0.57	7.56	0.97	0.00	0.00	0.00	0.05	1.1
(NORTH OF CBE PRIOR TO BRONX ZOO EXIT)	SB	92.19	0.03	0.19	4.82	2.58	0.00	0.00	0.00	0.19	1.3
BRUCKNER EXPWY	EB	85.02	0.18	1.70	2.86	6.85	2.00	0.48	0.98	0.15	1.4
(AT BRP INTERCHANGE)	WB	81.82	0.30	2.08	4.01	5.44	3.25	1.44	1.21	0.45	1.4

LEGEND:
LIGHT TRUCK— INCLUDES 2 AXLES, 4 TIRES.
MEDIUM TRUCK— INCLUDES 2 AXLES, 6 TIRES.
HEAVY TRUCK I— INCLUDES 3,4 AXLES SINGLE UNIT TRUCKS
HEAVY TRUCK II— INCLUDES 3,4,5,6+AXLES SEMI TRAILERS.

that are vans, medium trucks and heavy trucks, for all three periods of the day. This allows us to estimate truck volumes for each vehicle class in each period of the day.

Finally, the various values need to be assigned to specific links in the network. The only unusual part of this process is the aggregation of the exit and entrance ramp counts. The total exiting and entering volume is assigned to link 649190, the ramp link representing all of the exiting/entering movements in this section of the network.

3.5.4 Resolving Inconsistencies in the Data

Because data have been obtained from several different sources, and those sources collected the data in different ways and at different times, the individual observations are not always consistent. A good example of the type of inconsistency which exists among observations involves the estimated flow from the George Washington Bridge to the Throg's Neck Bridge (zone 100 to zone 103).

One source of data on this movement is the Port Authority Truck Commodity Survey. This survey was conducted in 1991, and sampled trucks eastbound at the George Washington Bridge. One of the data items collected was the reported destination (or next stop) for the truck. Based on that data source, and using the methods described in Section 3.5.1, we have estimated the "OD" values shown in Table 3.9.

Table 3.9 Estimated flows from zone 100 to zone 103 based on Port Authority Truck Commodity Survey.

	Number of Trucks		
Vehicle Class	AM Peak	Midday	PM Peak
Medium	327	220	150
Heavy	481	381	190

A second source of data on this same movement is the TBTA Truck Survey. This survey was conducted in 1989, and sampled trucks Queens-bound at the Throg's Neck Bridge. One of the questions asked was the origin of the trip. Based on that data, we have estimated the "OD" values shown in Table 3.10.

Table 3.10 Estimated flows from zone 100 to zone 103 based on TBTA Truck Survey.

	Number of Trucks		
Vehicle Class	AM Peak	Midday	PM Peak
Medium + Heavy	180	190	250

The Port Authority-based values are between 1.3 and 4.5 times larger, with the largest difference in the AM Peak. There are several possible reasons for this difference, including the following:

1) The expansion from survey proportions to total flow proportions is in error.

2) The translation of survey origins and destinations into zone definitions used in this analysis is incorrect.

3) The estimate of flow proportions by time-of-day in the TBTA data is in error.

4) The differences exist because the data were collected about two years apart.

5) The survey results are erroneous in one or both surveys.

6) Some combination of reasons 1 - 5.

The expansion from survey proportions to total flow estimates has been done differently for the two surveys. For the PANYNJ survey, we have both the raw survey responses and the toll booth counts of trucks by hour during the survey period. For the TBTA survey, we have only the total percentages of trucks by aggregated origin areas (see

Figure 3.4) and the aggregate estimate of truck flows by time of day based on plaza profiles of total vehicles and monthly classification breakdowns (see Tables 3.1 and 3.2). Thus, the expansion of the TBTA survey results is subject to much larger potential errors, particularly by time-of-day.

The specification of origin and destination areas in our processing of the two surveys is also done differently. In the TBTA survey, we have assumed that the reported origin area "New Jersey" (see Figure 3.4) corresponds to the George Washington Bridge (zone 100). In the Port Authority survey, the reported destination is a PANYNJ zone number, and we have aggregated several of these zones in eastern Queens, Nassau County and Suffolk County into our zone 103, as described in Section 3.5.1.

The fact that the surveys were done about two years apart is a potential source of significant variation in results. However, to minimize this likelihood, we have expanded the TBTA survey proportions using May, 1991, toll data. This should effectively remove the differences in time period as a significant source of error.

Although the differences in these observations are quite substantial, particularly in the AM Peak period, we have decided to use both observations, with relatively loose "small deviation" limits indicating low confidence in the specific observations. The optimization model then balances off the differences, together with all other observed values entered as data.

3.6 Results of the Analysis

The results of the analysis are nine OD matrices and the associated sets of link flows on the network. As illustrations of the most interesting aspects of these results, we will focus on four subsets of the information:

1) the breakdown of total truck link flows in the PM Peak by truck class;

2) the changing pattern of overhead heavy truck link flows across times of the day;

3) the deviations from observed link counts for the PM Peak; and

4) the composition of the heavy truck trip table in the PM Peak.

Figure 3.12 shows the flow pattern for all trucks in the PM Peak period. Notice the large volumes on the major expressways and bridges: 1) across the George Washington Bridge, particularly in the westbound direction; 2) in both directions on I-87 running north into Westchester County; 3) on the Cross-Bronx Expressway and out to the northeast on the New England Section of the New York State Thruway; 4) on the Bruckner Expressway, particularly southbound toward the Triborough Bridge; and 5) across the Bronx-Whitestone and Throg's Neck Bridges, in both directions.

There are also very significant flows on some arterials, notably Westchester Ave. and White Plains Road, as well as a major concentration of truck traffic in the southwestern section of the Bronx. The concentration in the southwest Bronx is a direct result of the land use data input to the model (see Figure 3.8), which indicates a very high density of truck trip-ends in that part of the analysis area.

Figures 3.13 - 3.15 show the breakdown of the total link flows by vehicle class. Figure 3.13 shows the van flows and illustrates that much of the total flow in the southwest part of the Bronx, as well as on Westchester Ave. and White Plains Road, is van traffic. The concentration of vans for local trips is to be expected, but there are also large van flows on I-87, on the eastern section of the Cross-Bronx expressway and on I-95 headed for New England.

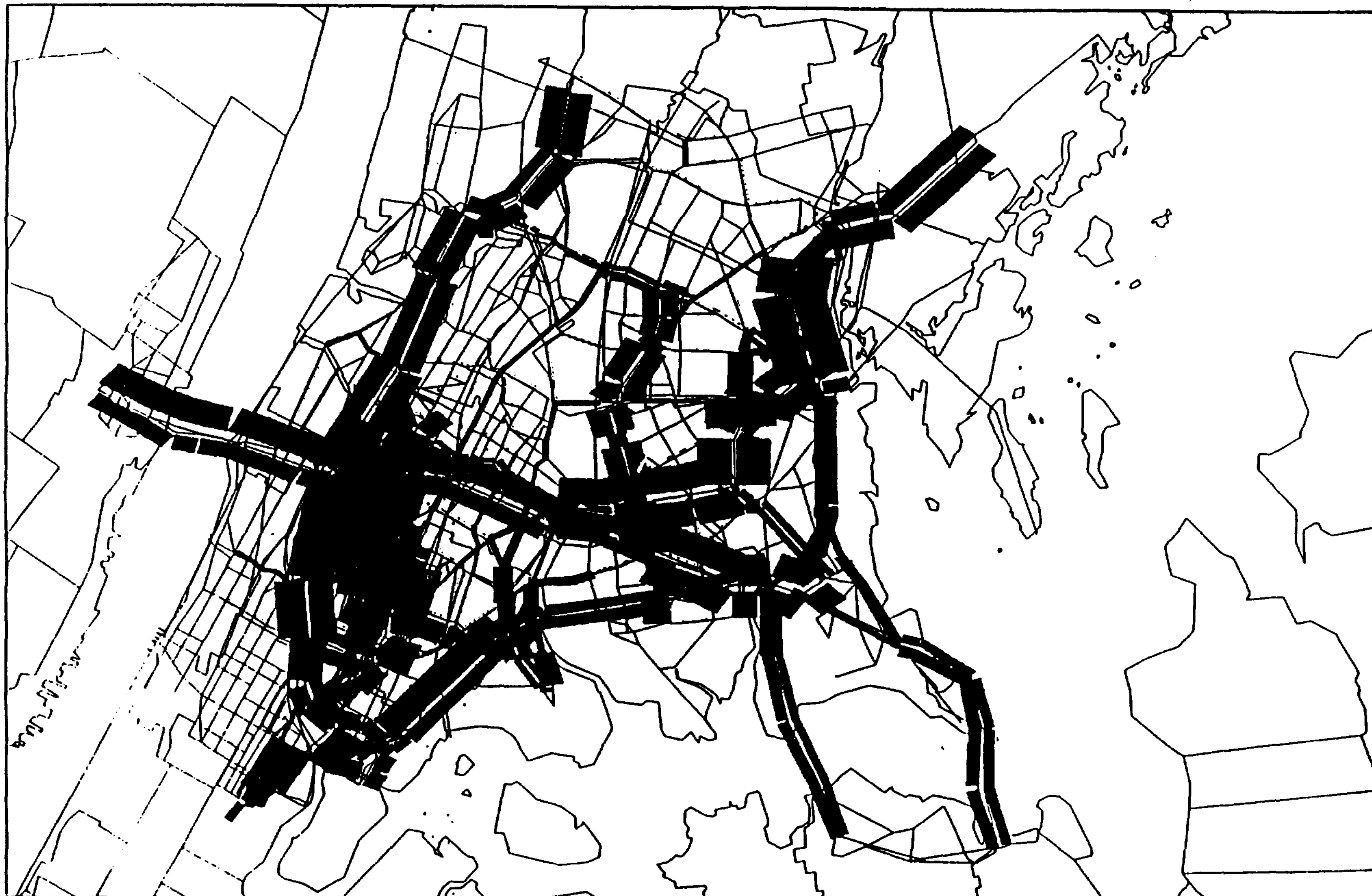


Figure 3.12 **Total truck flows for the PM Peak (3-8 PM).**

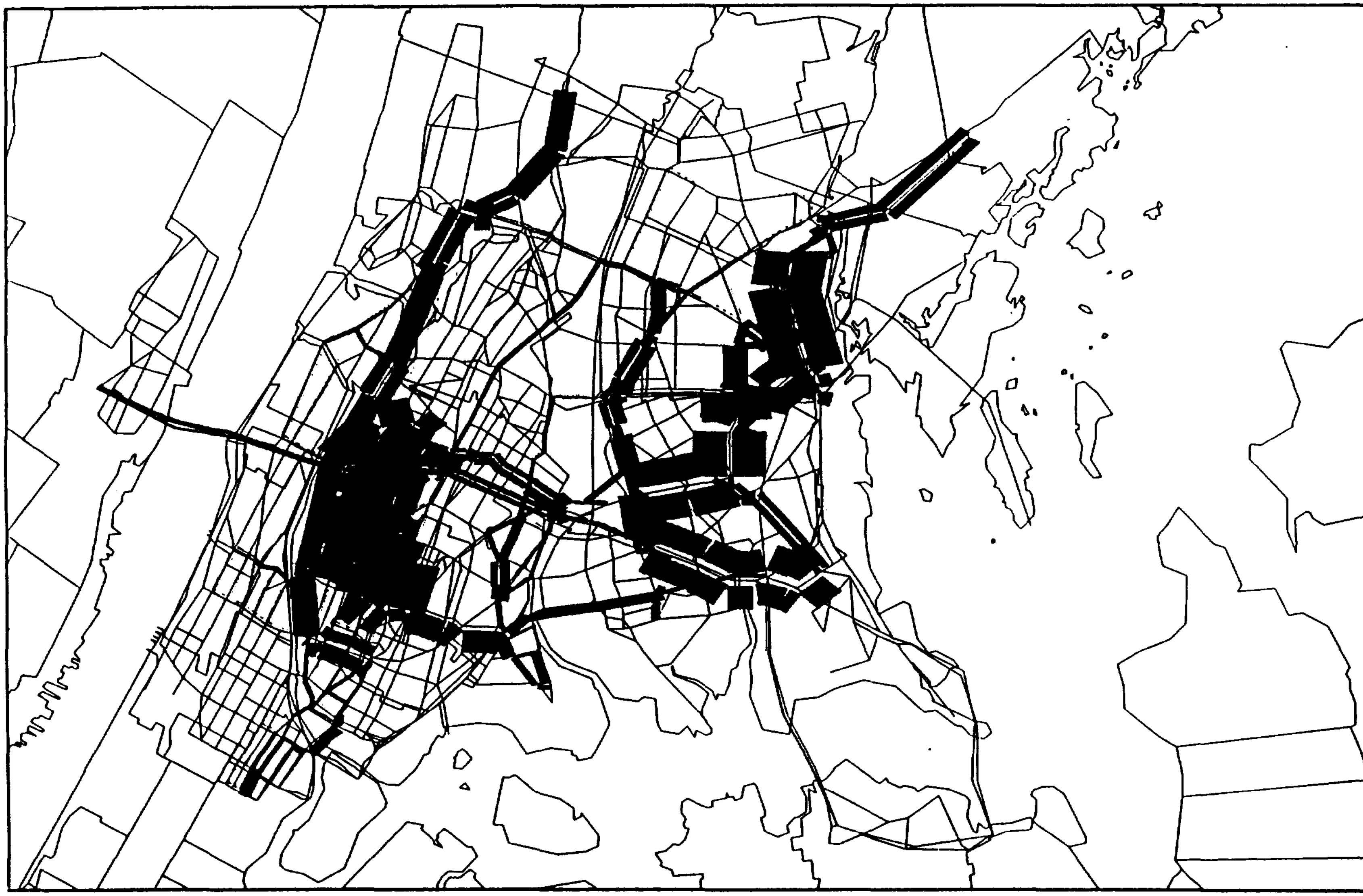


Figure 3.13 Van flows in PM Peak (3-8 PM).

The medium truck flows, shown in Figure 3.14, are more concentrated on the expressway network, and constitute a larger fraction of the traffic on the major bridges. Note the very large flow out of the Hunt's Point area, and south on the Bruckner Expressway toward the Triborough Bridge.

The heavy truck flows are almost all on the expressway system, as illustrated in Figure 3.15. The largest volumes are on the George Washington Bridge, the Cross-Bronx Expressway and the Bruckner Expressway.

Additional insight into the flow patterns of heavy trucks is provided by Figure 3.16, which shows overhead (i.e., external to external) heavy truck flows in the PM Peak period. Notice that to make these flows clearer, the scale has been changed on the link widths. Figure 3.16 illustrates the dominant flow of heavy trucks eastbound across the George Washington Bridge and the Cross-Bronx Expressway, then north on the Bruckner Expressway and the Thruway toward New England. This flow pattern is quite evident in the input data from the PANYNJ Truck Commodity Survey, gathered at the George Washington Bridge. Secondary flows of importance in the overhead heavy truck movements are: 1) northbound traffic on I-87 into Westchester County, and 2) southbound traffic across the Throg's Neck Bridge to Long Island.

Figures 3.17 and 3.18 show the overhead heavy truck trips for the AM Peak and Midday periods, respectively. (add more when figures are available)

Figure 3.19 shows the deviations from observed link counts during the PM Peak. There are six locations where the model is unable to create a solution which closely matches the observed counts. The largest of these deviations is 213 vehicles, or about 42 trucks/hour, on I-87 just north of the Cross-Bronx Expressway. The deviations on I-87 both north and south of the Cross-Bronx Expressway may reflect some problems in coding the

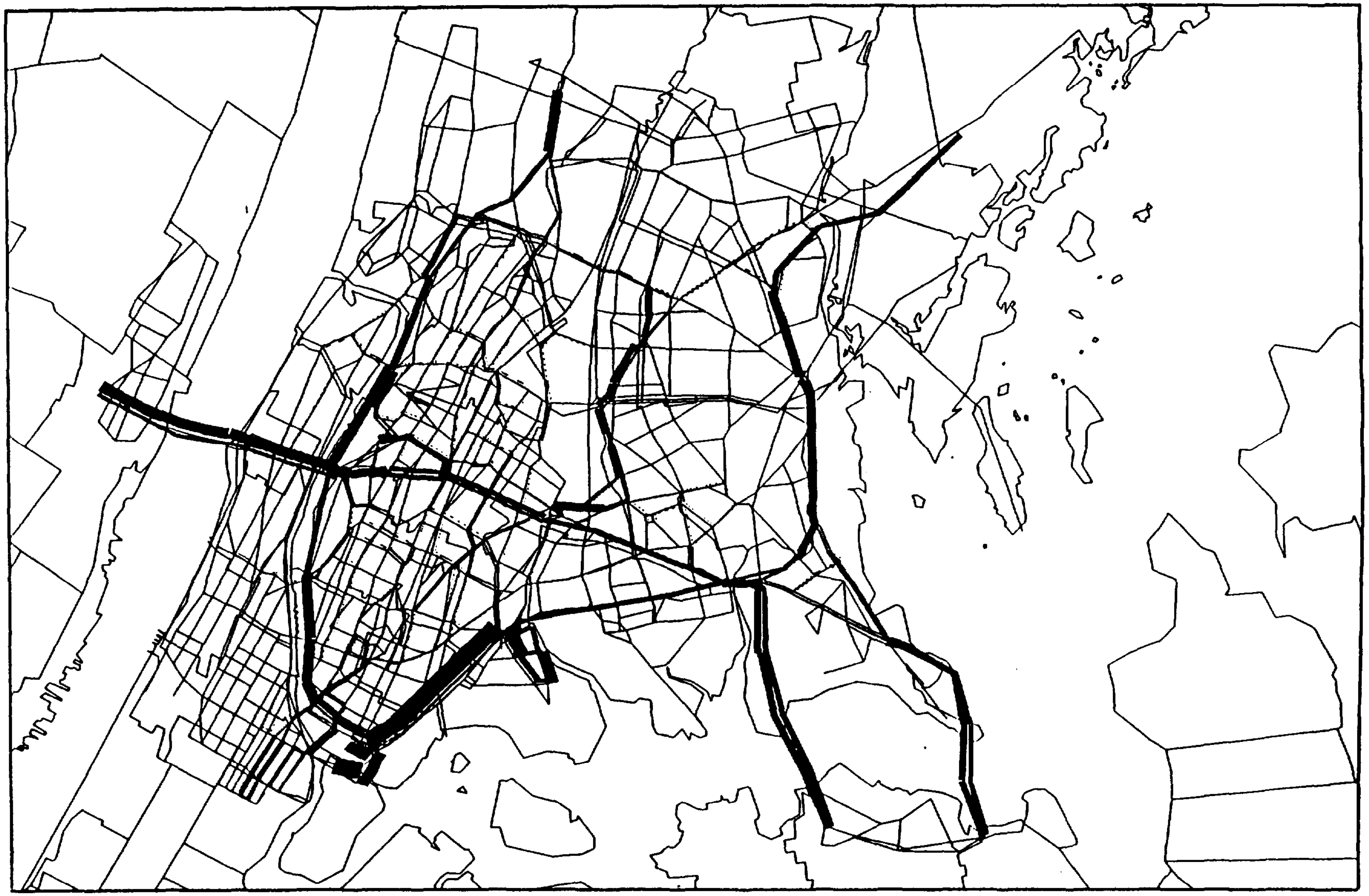


Figure 3.14 Medium truck flows in the PM Peak (3-8 PM).

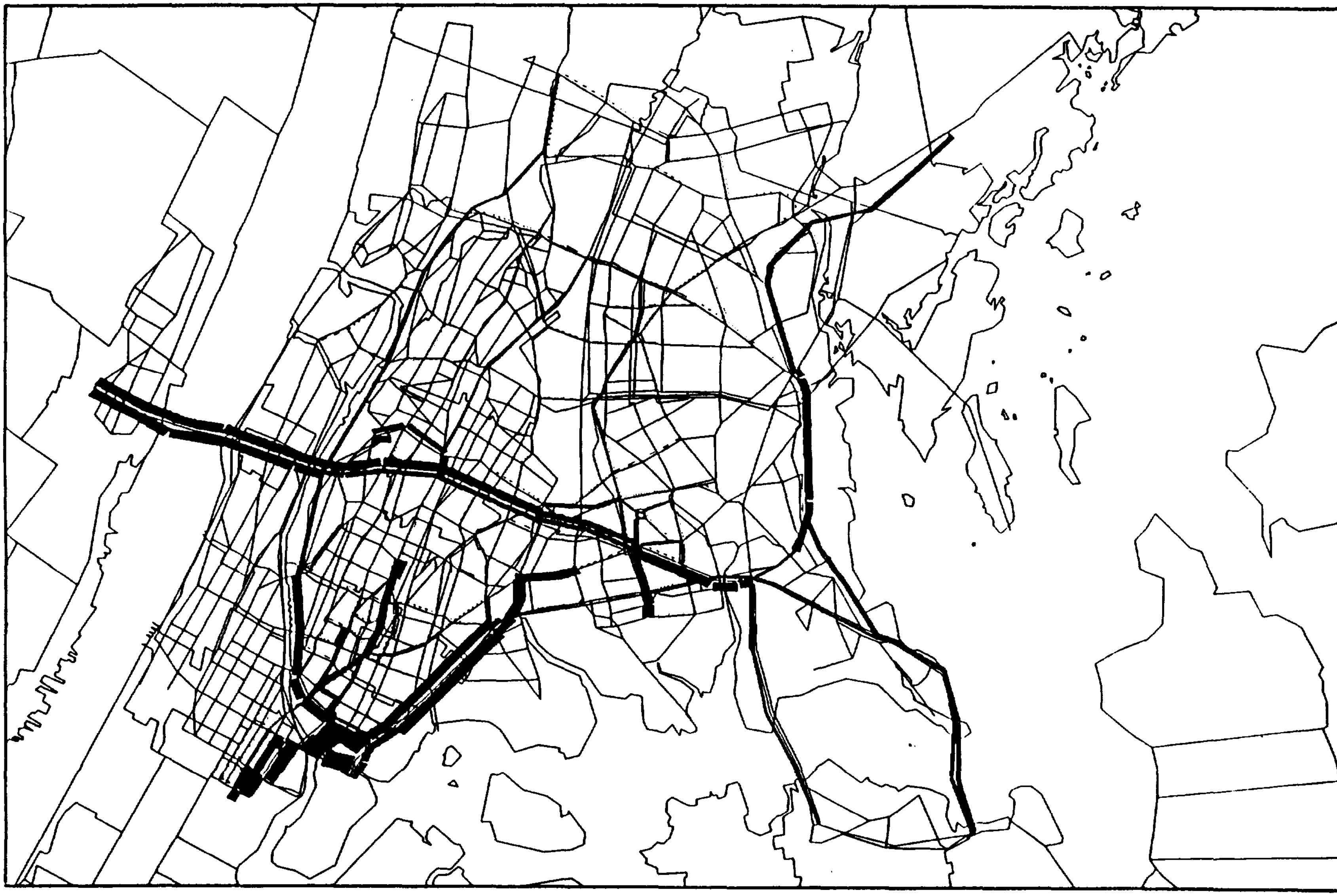


Figure 3.15 Heavy truck flows in the PM Peak (3-8 PM).

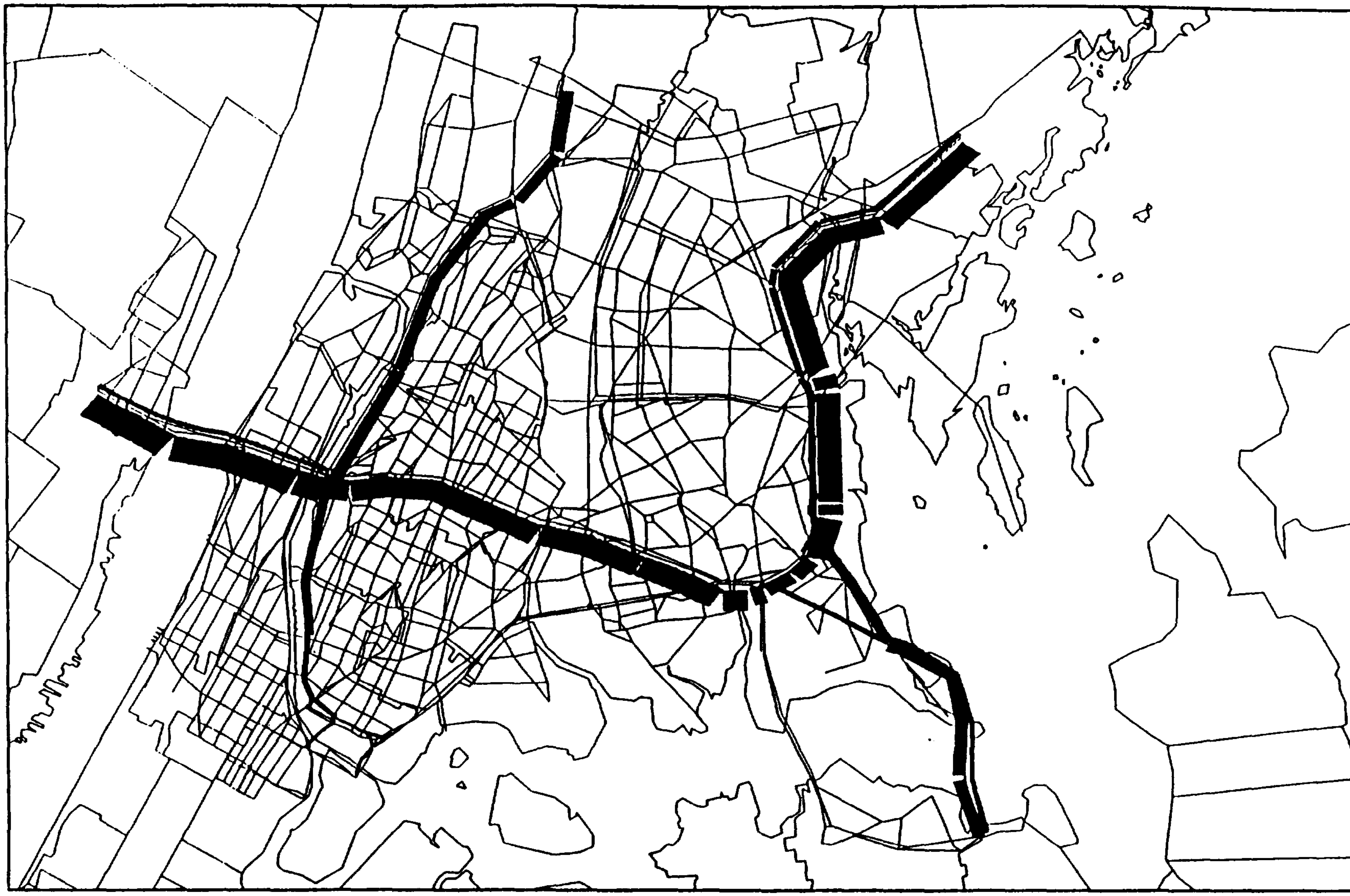


Figure 3.16 Overhead flows of heavy trucks in the PM Peak (3-8 PM).

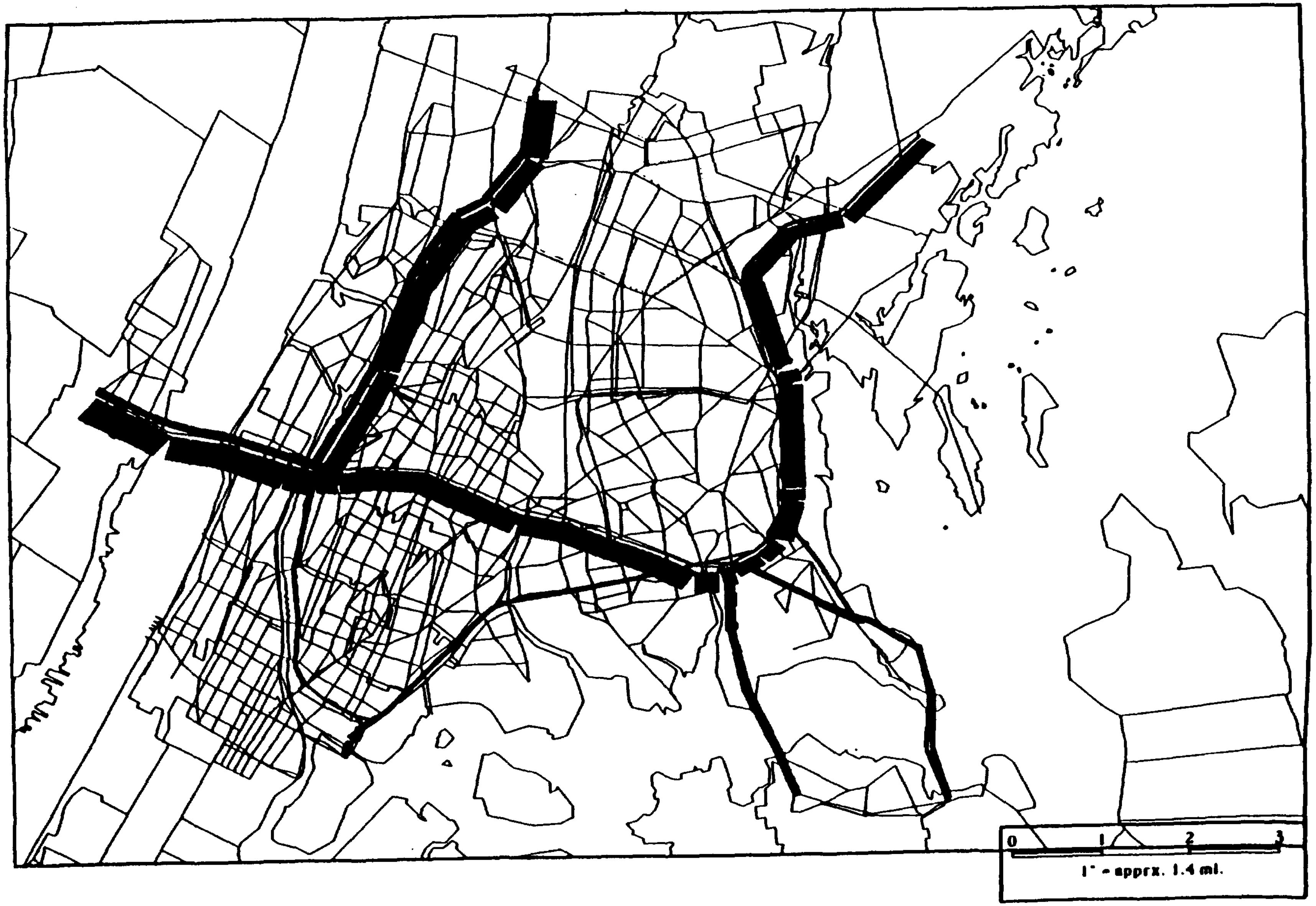


Figure 3.17 Overhead flows of heavy trucks in the AM Peak (6-10 AM).

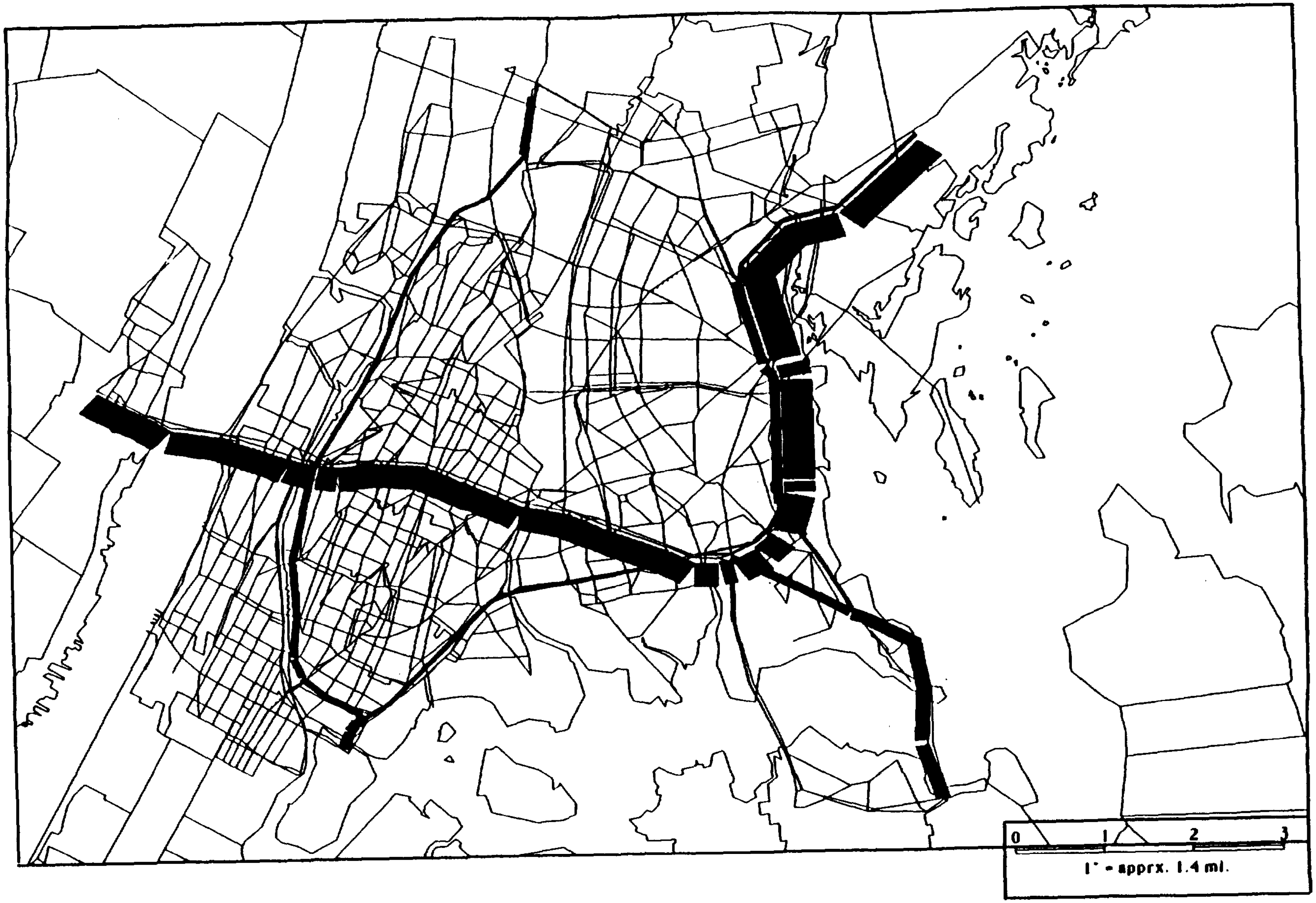


Figure 3.18 Overhead flows of heavy trucks in the Midday (10 AM - 3 PM).

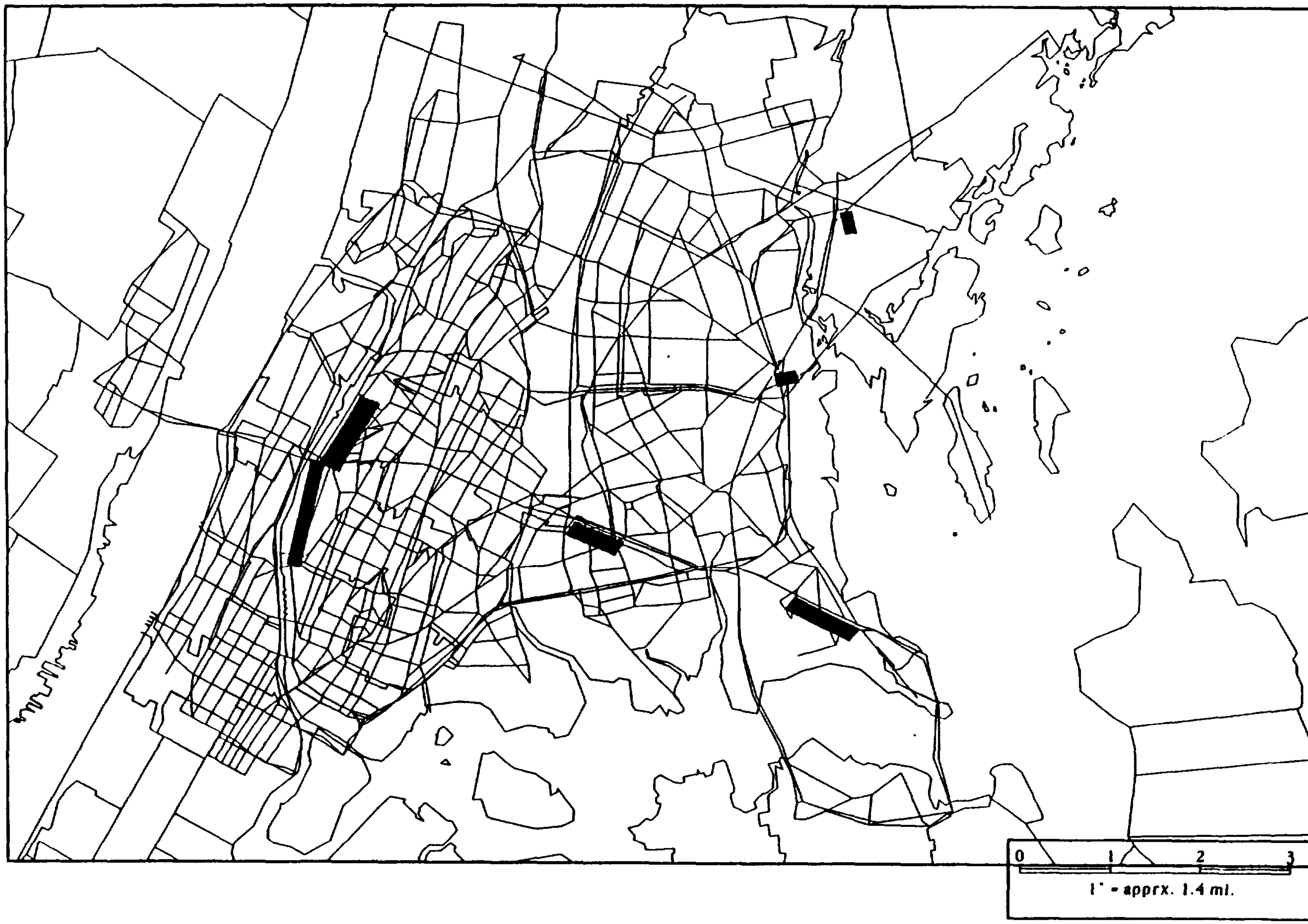


Figure 3.19 Derivations from observed link volumes, in the PM Peak (3-8 PM).

truck movement restrictions on the ramps leading from the Cross-Bronx Expressway to I-87 (the Major Deegan Expressway).

The composition of the heavy truck origin-destination table for the PM Peak period is the fourth set of results to be discussed. Figures 3.20 - 3.23 illustrate the parts of this trip table graphically. Figure 3.20 shows the local (internal zone to internal zone) trips. Figure 3.21 shows originating trips, and Figure 3.22 shows the terminating trips. Finally, Figure 3.23 shows the overhead (external zone to external zone) trips. For the purposes of creating these graphs, zones 8, 9, 10, 11, 15 and 19 have been grouped together and labeled "SE Bronx." Zones 12, 13, 14, 16, 17, 18 and 20 are grouped together under the label "SW Bronx." This aggregation results in some apparent "intrazonal" trips (e.g., SE Bronx to SE Bronx in Figure 3.20). These trips are not intrazonal in the original disaggregated trip table.

Figures 3.20 - 3.23 show that the resulting trip tables from the model are relatively sparse. This must be expected from an optimization which is based on linear programming. We are currently exploring an additional step in the overall model which would produce more highly populated trip tables.

In Figure 3.21 (originating trips) notice the very large volumes of trips from SE Bronx to Zone 100 (New Jersey via the George Washington Bridge), and from SW Bronx to Zone 105 (Queens via the Triborough Bridge). It is unlikely that the real trip pattern is this concentrated. The model produces this result because there are relatively few link volume observations to force more dispersed OD flows, and the easiest way for the model to match the total volumes on the bridges along with the OT constraints by zone, is to create a small number of large interchange volumes.

A similar pattern is present in the terminating volumes, shown in Figure 3.22. Notice the very large volumes from Zone 106 (Manhattan) to both SE Bronx and SW Bronx. This

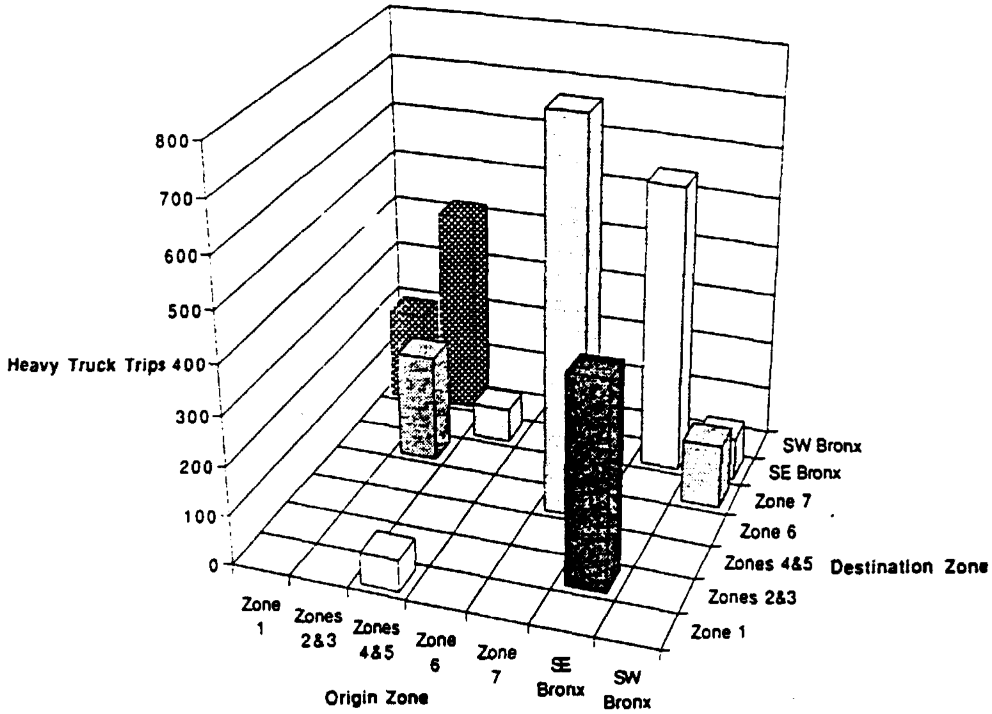


Figure 3.20 Local heavy truck trips in the PM Peak (3 - 8 PM).

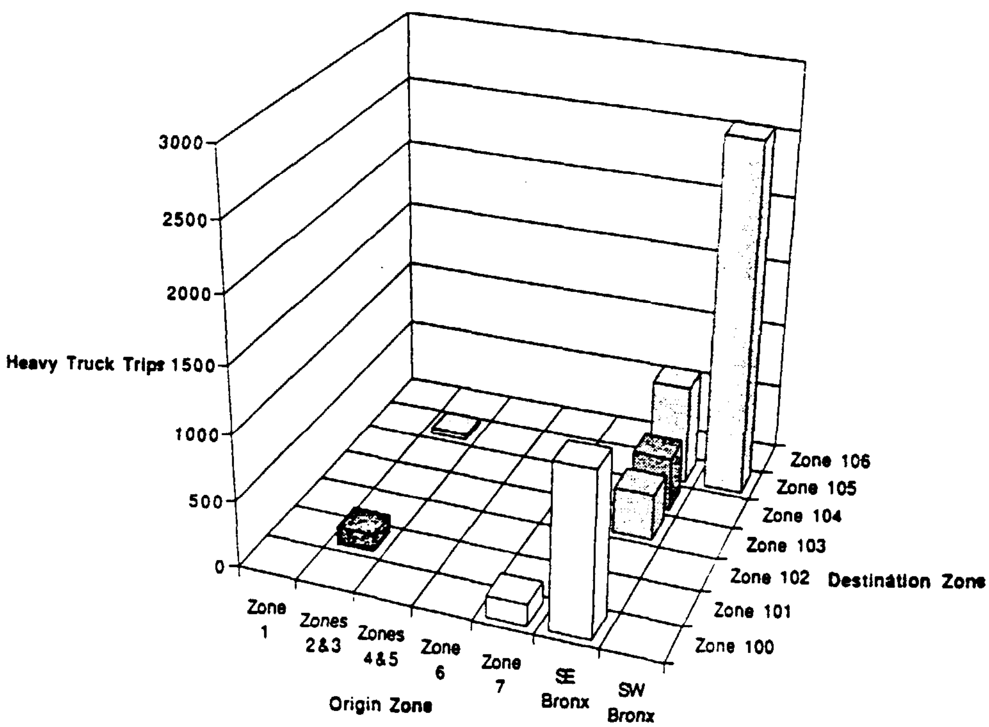


Figure 3.21 Originating heavy truck trips in the PM Peak (3 - 8 PM).

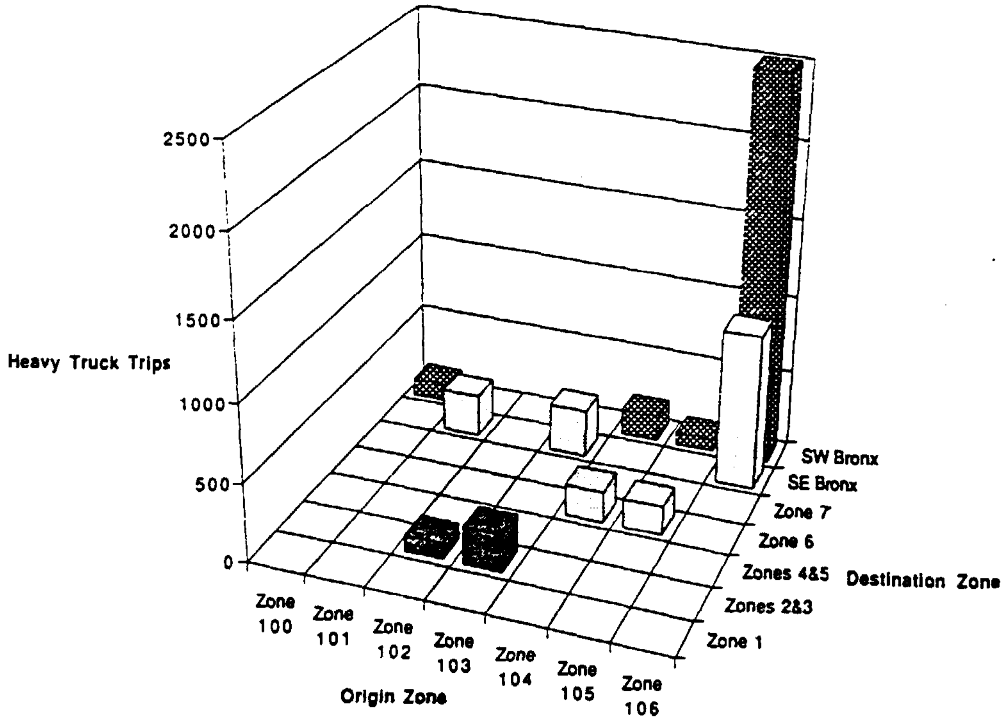


Figure 3.22 Terminating heavy truck trips in the PM Peak (3 - 8 PM).

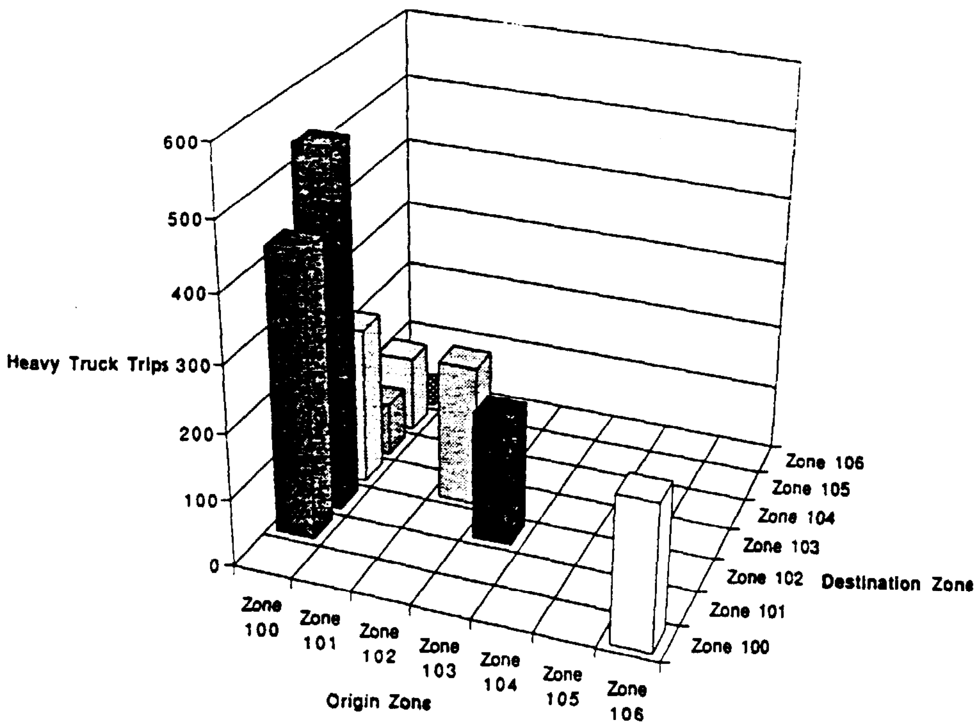


Figure 3.23 Overhead heavy truck trips in the PM Peak (3 - 8 PM).

result appears to derive from the observed volumes on the NYC bridges crossing the Harlem River.

Finally, in Figure 3.23 (overhead trips) notice that most of the volume is originating at Zone 100. This is the result of the OD constraints from the PANYNJ Truck Commodity Survey, taken at the George Washington Bridge. These constraints force a large number of origins at Zone 100, and distribute the destinations roughly as they appear in the final solution. Since these constraints only apply to eastbound trips, there is little to force overhead trips in the westbound direction.

3.7 Conclusions

The first major conclusion from this case study is that it has shown that the methods developed in the project work. We have taken data from nine different sources, collected in different ways and at different times, and have synthesized all of these observations into a coherent database. This database is represented as a set of constraints for a linear programming problem which finds a set of trip tables. In this case study we have demonstrated the ability to find trip tables for three truck classes and three separate time periods during the day.

The analysis produces very plausible link flows over the network. The link flow results of the analysis are likely to be more reliable than the OD tables themselves. As described in the previous section, the OD tables have a relatively small number of non-zero entries, and those entries tend to be quite large. It is likely that a better solution would have more, and smaller, non-zero entries in the OD tables. This result is evidence of lack of data in a few crucial areas.

By looking carefully at both the OD tables and the link flows, we can identify several important "holes" in the input data. The three most important of these are:

1) the paucity of data on van movements;

2) the lack of survey data on westbound movements; and

3) the need for more complete ground counts over more of the network.

The lack of van data is particularly troubling, because of the large amount of anecdotal evidence that vans form a major element of the goods movement system within New York City. We have created OD tables for vans, but these would benefit greatly from additional data. Ideally, this additional data should include survey data on origins and destinations as well as ground counts on network links.

The truck survey data which do exist in this area are all for eastbound movements, because that is the direction in which tolls are collected at the major bridges. The result is that we have relatively little confidence in the estimates of westbound truck trips. Since surveying truck in the westbound direction is difficult, additional ground counts on the arterials as well as the expressways would help greatly.

In general, there is little link volume data in this case study. What exists is mostly on the expressways. We have almost no information on truck flows on the arterial streets.

When there is little link volume data, the results are very sensitive to the estimated link-utilization coefficients on the facilities which do have counts. This is particularly noticeable on the bridges crossing the Harlem River. The fact that we have counts on those bridges, and on virtually no streets in their vicinity, gives those bridge counts enormous leverage on estimated OD volumes for local trips. This produces some of the results noted in the discussion of Figure 3.20. Additional vehicle classification counts, particularly on the arterial streets, would be most helpful to improve the reliability of the results.

CHAPTER 4

BROOKLYN CASE STUDY

This chapter describes the Brooklyn case study, its conduct, and the results obtained. While all of Brooklyn is included, the primary focus is on the area surrounding the Gowanus expressway. NYSDOT is in the process of rehabiliting that facility through a multi-year, multi-million dollar highway reconstruction project.

4.1 Purpose and Scope

The case study has three main purposes. The first is to test the methodology, and learn about its strengths and weaknesses. The second is to develop trip matrices for the network, using the methodology, and compare them with other known information about flow patterns in the area. The third is to identify holes in the data used to generate the matrices and identify ways to fill those holes.

Brooklyn is a natural choice because the Gowanus Expressway study has generated a rich set of truck-related data. Truck movements are heavy on the Gowanus, and many truck-based activites lie within the Gowanus corridor, so the engineering consultant has collected considerable traffic data, much of it focusing on truck flows.

The case study does not supplant or replace the engineering consultant's work, but rather, supplements it. In addition, and perhaps more importantly, it takes advantage of the rich supply of truck related data available to test and exercise the methodology. Also, since the engineering consultant has also been in the process of generating such OD data, there is an opportunity to cross-check the quality of the matrices obtained based on the engineering consultant's efforts.

The scope of the study includes all of Brooklyn plus the southern end of Manhattan, as shown in Figure 4.1, having major points of entry via the Verrazano Narrows Bridge, the Brooklyn Battery Tunnel, the Manhattan Bridge, the Williamsburg Bridge, the Brooklyn-Queens Expressway, Atlantic Avenue, Linden Avenue, and Flatlands Avenue. (See Figure 4.4 for a map that shows street names.)

Three truck classes are considered: 1) commercial vans, 2) single unit trucks (primarily two-axle-six-tire or three axle), and 3) trucks with four or more axles. In some instances, it is possible to distinguish between two and three-axle trucks, but neither of the two primary data sources available do so. The data collected by the engineering consultant classifies trucks as either light (two-axle, four tire), medium (two-axle, six tire) or heavy (all other) and the data collected by the New York City Department of City Planning categorizes them as being either a) vans and pickups, b) single unit trucks, or c) combination trucks. The scheme we have chosen matches that used in the Bronx case study, and helps delineate between trucks used for local deliveries as opposed to long-haul movements.

Three time periods are considered: AM peak (from 6-10 AM), midday (from 10AM to 3PM), and PM peak (from 3-8 PM). These time periods match those commonly used to analyze traffic flows within the New York metropolitan area.

Figure 4.1: The Brooklyn Case Study Environment and Network

4.2 Problem Setting

4.2.1 Description of the Area

A dense grid of major and minor arterials exists throughout the network, including Ocean Parkway, Ocean, Flatbush, Utica, and Remsen Avenues and Rockaway Parkway, all of which run north-south, and Flushing, Myrtle, Fulton, Atlantic, Linden, and Flatlands Avenues and Eastern Parkway, which run east-west. (See Figure 4.4, presented later, for the locations of these streets.)

Not far beyond the network's eastern boundary is the Van Wyck Expressway which runs north-south in Queens between JFK and LaGuardia airports. On the north is the Long Island Expressway, which runs east-west through Queens from Manhattan, past the BQE to the Van Wyck and beyond.

As shown in Figure 4.2, the area within Brooklyn is divided into 27 zones, one for each of the borough's 5-digit zipcodes. Seven external zones are also employed, focusing primarily on major entry points into the network. Table 4.1 gives details about both the internal and external zones.

4.2.2 The Network

The network, which is derived from the NYMTC highway database, contains 523 nodes and 901 links. Most of the links are bi-directional, with the exception of a few one-way streets, and the bridges and tunnels, which are represented by separate links in each direction. Zone centroids are defined as network nodes. Facilities whose use by trucks is prohibited include the Shore Parkway, the Interboro Parkway, and the Brooklyn Bridge.

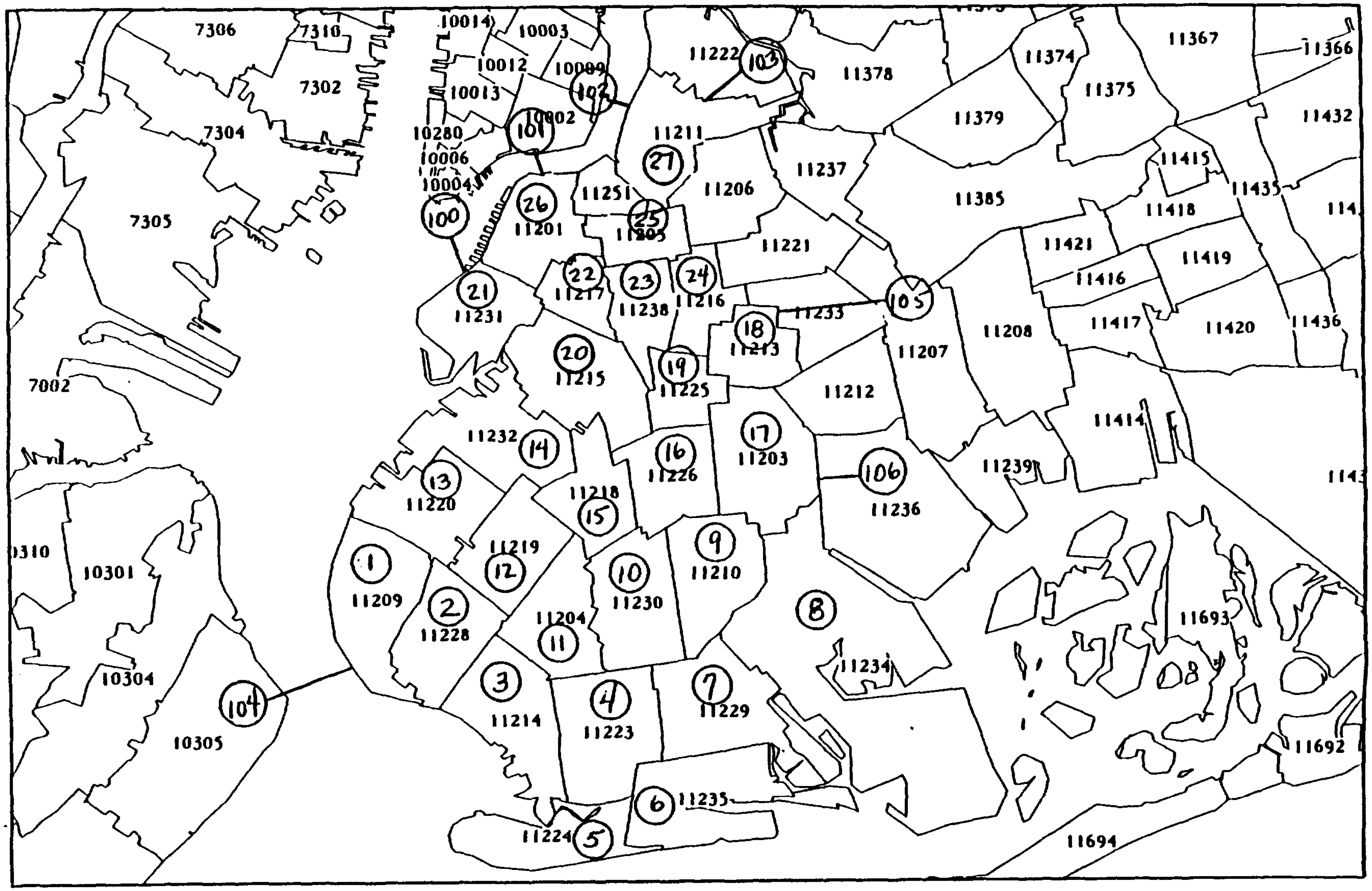


Figure 4.2: The Brooklyn Case Study Zone Structure

Table 4.1: Zone Descriptions for the Brooklyn Case Study

Zone	Network Node #	Zipcode	Area sq-mi	Post Office Name or Description
1	5683	11209	2.03	Fort Hamilton
2	6219	11228	1.64	Dyker Heights
3	6221	11214	1.98	Bath Beach
4	5750	11223	2.1	Gravesend
5	6225	11224	1.59	Coney Island
6	5822	11235	2.14	Bay
7	5838	11229	2.16	Homecrest
8	6211	11234	10.09	Ryder
9	5835	11210	1.7	Vanderveer
10	5757	11230	1.83	Midwood
11	6210	11204	1.52	Parkville
12	5726	11219	1.51	Blythbourne
13	5685	11220	1.7	Bay Ridge
14	5686	11232	2.19	Bush Terminal
15	5744	11218	1.3	Kensington
16	2129	11226	1.42	Flatbush
17	2133	11203	2.16	Rugby
18	2105	11213	1.07	Saint Johns
19	6171	11225	0.86	Lefferts
20	5715	11215	2.23	Van Brunt
21	7222	11231	1.52	Red Hook
22	2081	11217	0.77	Times Plaza
23	2082	11238	1.05	Adelphi
24	2084	11216	0.96	Brevoort
25	5774	11205	0.82	Pratt
26	1819	11201	1.46	Brooklyn
27	6122	11211	1.93	Williamsburg
100	11683	-	-	Brooklyn Battery Tunnel
101	11684	-	-	Manhattan Bridge
102	11686	-	-	Williamsburg Bridge
103	11687	-	-	Brooklyn-Queens Expressway
104	11682	-	-	Verrazano Narrows Bridge
105	1922	-	-	Atlantic Avenue @ Brooklyn Line
106	1863	-		Linden Boulevard @ Brooklyn Line

Congested travel times are provided for each link, based on the Tri-State Planning Agency's experience (originally the metropolitan area's Metropolitan Planning Organization) with assigning trips to the network.

4.2.3 Data Sources

Data for the case study come from seven sources, not counting the NYMTC network database from which the network is derived:

The **Gowanus Study Engineering Design Consultant** provided link volumes and classification counts for the Gowanus Expressway, the BQE and several arterials. Table 4.2 illustrates these data. Light trucks are defined as two-axle-four-wheel vehicles other than cars, medium trucks are two-axle-six-tire, and heavy trucks have three or more axles. In some cases, the data show hourly volumes as well as a percentage breakdown. In other cases, either just the hourly volume or just the classification data are provided.

For the Brooklyn Battery Tunnel, the Queens-Midtown Tunnel and the Verrazano Narrows Bridge, the **Triboro Bridge and Tunnel Authority** (TBTA) provided 1991 counts by direction and hour across a typical day (see Table 4.3) and vehicle counts by vehicle class and day for a typical month (see Table 4.4). The volume profiles by hour (Table 4.3) do not differentiate among vehicle classes wheras the monthly vehicle reports (Table 4.4) do. Class 4, Two-axle trucks, refers to trucks with six tires. Vans, whether commercial or not, are grouped in with Class 1, cars. Otherwise, the number of axles is the basis for classification.

Gowanus Expressway TSM Study
Traffic Data

Roadway: GOWANUS EXPRESSWAY

Location: Between BBT And BQE MERGE

G-2/1 *	Inbound MP	Inbound MD	Inbound AP	Inbound N	Outbound MP	Outbound MD	Outbound AP	Outbound N
# of Moving Lanes	3	2	1	2	1	2	3	2
# of Parking Lanes	-	-		-	-	-	-	-
Capacity	4200	2800	1400	2800	1400	2800	4200	2800
Hourly Volume	3600	1420	660	760	1060	2670	2570	2210
% Bus	3	5	6		13	2	4	
% Minibus	1	1	1		1	1	2	
% Taxi	1	3	5		1	2	7	
% Motorcycle	1	0	0		0	1	1	
% Light Truck	9	4	3		7	7	5	
% Medium Truck	1	2	1		6	2	1	
% Heavy Truck	0	0	0		2	0	0	
% Car	82	85	83		70	86	86	
Single Occupant %								
2 Occupant %								
3 Occupant %								
4 + Occupant %								

Location: BQE Between RAPELYE ST. (BQE) And GOWANUS MERGE

G-4/3 *	Inbound MP	Inbound MD	Inbound AP	Inbound N	Outbound MP	Outbound MD	Outbound AP	Outbound N
# of Moving Lanes	2	2	2	2	3	3	3	3
# of Parking Lanes	-	-	-	-	-	-	-	-
Capacity	3200	3200	3600	3600	4200	4800	5400	5400
Hourly Volume	3000	2320	3090	3030	2860	2010	3530	2830
% Bus	0	0	0		1	0	0	
% Minibus	0	1	0		1	0	0	
% Taxi	1	1	1		0	1	1	
% Motorcycle	0	0	0		0	1	0	
% Light Truck	12	7	6		7	8	8	
% Medium Truck	2	6	9		5	2	2	
% Heavy Truck	6	3	3		5	3	3	
% Car	78	81	84		79	84	84	
Single Occupant %	-							
2 Occupant %								
3 Occupant %								
4 + Occupant %								

Table 4.2: Gowanus TSM Project Classification Data (Example)

Triborough Bridge & Tunnel Authority
Brooklyn-Battery Tunnel
Plaza Profile
Wednesday, 8/7/91

Hour Ending	19 M	20 M	1 M	2 A	4 M	6 A	8 M	21 M	23 M	11 A	13 M	15 A	17 M	Total Brooklyn Bound	3 M	5 A	7 M	9 A	22 M	24 M	10 M	12 A	14 M	16 A	18 M	25 M	26 M	Total Manhattan Bound	Grand Total
1.00			91	88	81	192	210							670							19	65	128	25	37			274	944
2.00			2	39	73	113	81							288							0	14	46	8	0			68	356
3.00			0	37	80	34	0							151							0	16	59	7	0			82	233
4.00			28	40	31	0	0							99							0	10	31	4	0			45	144
5.00			63	3	0	2	0							68							0	39	77	18	0			134	202
6.00			96	0	0	0	0							96							95	165	197	117	0			574	670
7.00	48	82	125	3	0	2	0							260	45	24	81	72	204	202	309	466	273	398	204		154	2,430	2,690
8.00	143	152	213	0	0	0	0							508	219	148	337	302	279	301	251	438	301	412	269	292	278	3,905	4,413
9.00	238	212	231	0	0	0	0							681	263	200	324	379	335	284	296	473	298	483	283	333	340	4,291	4,972
10.00	203	180	209	58	35	0	0							763	68	60	204	189	204	245	225	471	258	402	264	256	250	3,076	3,839
11.00	198	120	198	229	217	0	0							870			77	82	233	238	224	348	272	304	242	7	7	2,014	2,884
12.00	126	158	210	310	215	0	0							1,019			23	19	148	207	258	329	281	252	218	0	0	1,733	2,752
13.00	105	132	233	345	232	0	0							1,047			22	13	188	171	214	263	254	213	226	0	0	1,564	2,611
14.00	98	129	203	303	233	80	92							1,118					160	204	175	309	272	197	238	0	0	1,555	2,671
15.00	84	148	170	278	215	298	198							1,395					53	101	235	346	272	244	277	0	0	1,608	3,003
16.00	149	199	298	358	254	393	282	41	47	7				1,686					25	47	192	318	292	262	302	149	70	1,857	3,543
17.00	200	181	250	448	250	425	255	115	149	159				2,432							0	228	183	284	318	302	180	1,475	3,907
18.00	245	225	265	454	288	462	270	127	176	194				2,702							0	277	285	278	255	208	167	1,468	4,170
19.00	194	155	219	398	283	404	205	113	133	87				2,136							0	265	214	282	283	205	186	1,415	3,551
20.00	188	28	211	331	248	408	208	84	112					1,794							180	212	282	188	103	53	35	1,051	2,845
21.00	124	78	181	345	238	372	228	123	124					1,824							188	202	236	147	153			926	2,750
22.00	48	56	175	274	228	320	185	87	130					1,402							171	163	235	125	142			838	2,310
23.00			168	240	217	313	178	57	83					1,248							105	124	202	78	105			614	1,860
24.00			111	248	193	257	198	20	25					1,050							178	123	225	82	191			798	1,848
	2,258	2,206	3,931	4,831	3,589	4,041	2,534	787	979	447	0	0	0	25,583	595	432	1,068	1,096	1,829	2,080	3,315	5,664	5,173	4,764	4,108	1,805	1,665	33,594	59,177

M-Full Service
A-ACM

Prepared by Revenue Management Division
8/20/91

Table 4.3: Hourly Breakdown of Vehicle Arrivals (Example)

-94-

TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY
REVENUE MANAGEMENT DIVISION

MONTHLY VEHICLE REPORT

BROOKLYN BATTERY TUNNEL

MAY - 1991

Date	Day of Week	Class 1 Car	Class 2 Car w/1ax.	Class 3 Car w/2 ax.	Class 4 2 axle Truck	Class 5 Fran. Bus	Class 6 3 axle Truck	Class 7 4 axle Truck	Class 8 5 axle Truck	Class 9 Motorcycle	6 Axle Truck	7 Axle Truck	Total Paid Vehicles	Class 10 Non-Revenue	Total Vehicles
5/1/91	Wednesday	60,161	1	0	1,155	1,957	310	25	30	156	2		63,815	1,181	64,996
5/2/91	Thursday	58,303	6	3	1,409	2,066	449	28	140	272	6		61,764	1,161	63,[illegible]
5/3/91	Friday	57,556	4	1	1,364	2,010	387	32	59	208	4		61,633	1,138	62,771
5/4/91	Saturday	44,309	3	2	373	307	56	13	9	236	0		45,303	583	45,[illegible]
5/5/91	Sunday	44,559	4	2	95	18	35	3	6	194	1		44,937	549	45,486
5/6/91	Monday	49,570	0	1	1,166	1,997	377	29	79	41	3		53,253	1,026	54,279
5/7/91	Tuesday	51,540	2	0	1,551	2,025	300	19	44	150	0		55,599	1,306	56,905
5/8/91	Wednesday	56,115	1	1	1,207	2,019	433	37	41	306	14		60,234	1,257	61,511
5/9/91	Thursday	57,378	5	0	1,403	2,029	478	26	51	182	5		61,561	1,234	62,781
5/10/91	Friday	63,015	0	0	1,331	2,003	452	28	40	250	6		67,131	1,177	68,308
5/11/91	Saturday	30,941	4	1	307	201	122	12	7	283	0		31,880	515	32,395
5/12/91	Sunday	32,777	4	0	92	13	30	1	2	244	2		33,173	465	33,638
5/13/91	Monday	54,331	2	1	1,310	2,038	419	23	16	313	3		58,327	1,064	59,391
5/14/91	Tuesday	55,009	3	1	1,320	1,935	373	23	44	255	6		58,973	1,303	60,276
5/15/91	Wednesday	57,406	1	0	1,306	2,012	447	34	15	293	7		61,480	1,205	62,685
5/16/91	Thursday	60,351	6	0	1,376	2,011	416	20	11	350	9		64,570	1,323	65,893
5/17/91	Friday	61,699	9	2	1,567	2,033	331	26	54	277	2		65,920	1,330	67,250
5/18/91	Saturday	46,105	7	2	329	226	84	6	6	184	0		47,029	633	47,661
5/19/91	Sunday	38,990	2	3	95	15	43	7	5	172	0		39,332	548	39,880
5/20/91	Monday	46,973	2	1	1,185	2,010	460	21	45	282	10		50,991	1,116	52,107
5/21/91	Tuesday	56,470	1	0	1,333	2,090	303	21	56	329	5		60,696	1,255	61,951
5/22/91	Wednesday	58,290	4	0	1,444	2,040	364	16	65	327	10		62,560	1,097	63,737
5/23/91	Thursday	61,259	7	3	1,502	2,061	476	22	64	332	4		66,730	1,195	68,025
5/24/91	Friday	60,802	15	1	1,447	2,046	452	26	58	425	2		65,068	1,214	66,282
5/25/91	Saturday	35,400	5	1	219	197	88	10	9	189	0		36,140	400	36,540
5/26/91	Sunday	34,970	5	2	147	16	27	5	1	161	0		35,304	396	35,700
5/27/91	Monday	29,329	4	1	89	8	74	3	1	144	0		29,653	493	30,146
5/28/91	Tuesday	55,437	6	0	1,376	1,910	335	19	54	279	1		59,401	1,243	60,634
5/29/91	Wednesday	55,443	3	3	1,451	2,053	454	30	33	375	6		59,811	1,338	61,149
5/30/91	Thursday	59,354	5	2	1,454	2,056	347	30	52	270	2		63,563	1,351	64,913
5/31/91	Friday	61,767	3	1	1,443	2,046	377	28	19	298	6		66,008	1,354	67,361
	TOTAL	1,630,628	131	35	31,383	45,382	9,398	595	1,156	7,787	115	0	1,734,620	31,379	1,765,999

Table 4.4: Monthly Vehicle Counts by Vehicle Class (Example)

The New York City Department of City Planning (NYCDCP) provided both volume observations and survey data for the Manhattan Bridge, the Williamsburg Bridge, the Queens-Midtown Tunnel and the Queensboro Bridge. The counts were for 1989 and showed volumes by vehicle class and 15-minute time period, westbound into Manhattan for a typical day (see Table 4.5). Vans and pickups are separated from passenger cars. Only commercial vans and pickups were counted in the vans and pickups category. Single unit trucks refers to vehicles without trailers that are two-axle-six-tire, three axle, etc. Combination trucks have trailers or semitrailers.

The survey data show trip origin, destination, purpose, frequency, etc. for trips crossing westbound into Manhattan across these same four facilities (see Figure 4.3). It is possible to differentiate among vehicle types based on the number of axles (question 4), the type of vehicle (question 3) and/or the type of trailer involved (question 5). For purposes of the case study investigation, we only made use of a portion of the information actually available. The focus was mainly on answers to questions 1, 9, 3, and 4.

From the New York City Department of Transportation (NYCDOT) we obtained traffic counts for the Manhattan Bridge, the Williamsburg Bridge, and five bridges within Brooklyn - Hamilton Avenue, Union Street, Third Avenue, Stillwell Avenue and Crospey Avenue. The data are for 1988 and show counts by vehicle type and hour across typical weekdays (see, for example, Table 4.6). Trucks includes vehicles that have more than six tires and/or two axles, so vans and pick-up trucks counted as autos. For several intersections in northern Brooklyn, we also obtained percentage breakdowns by vehicle class: Myrtle

MANHATTAN BRIDGE - AM MANHATTANBOUND
TOTAL TRAFFIC

TIME	PASSEN. CARS	VANS + PICK-UPS	BUSES	SINGLE-U TRUCKS	COMBIN. TRUCKS	ALL TRAFFIC	VANS + TRUCKS
4-4:15 AM	79	12	0	11	11	113	34
4:15-4:30AM	54	13	0	14	10	91	37
4:30-4:45AM	114	25	0	22	5	166	52
4:45-5 AM	104	19	0	13	5	141	37
5-5:15 AM	128	24	0	28	13	193	65
5:15-5:30AM	169	26	0	31	11	237	68
5:30-5:45AM	210	39	0	21	18	288	78
5:45-6 AM	291	33	0	38	10	372	81
6-6:15 AM	385	67	0	45	18	515	130
6:15-6:30AM	374	79	1	50	25	529	154
6:30-6:45AM	354	107	5	50	13	529	170
6:45-7 AM	348	113	2	44	19	526	176
7-7:15 AM	415	122	6	53	13	609	188
7:15-7:30AM	428	178	8	69	17	700	264
7:30-7:45AM	408	155	3	74	16	656	245
7:45-8 AM	452	177	9	85	15	738	277
8-8:15 AM	494	239	4	82	24	843	345
8:15-8:30AM	317	219	2	65	17	620	301
8:30-8:45AM	386	189	1	63	22	661	274
8:45-9 AM	360	233	2	93	24	712	350
9-9:15 AM	333	173	9	66	21	602	260
9:15-9:30AM	384	150	1	56	17	608	223
9:30-9:45AM	426	136	5	68	15	650	219
9:45-10 AM	484	181	8	67	15	755	263
10-10:15 AM	433	152	7	64	15	671	231
10:15-10:30	288	143	8	69	24	532	236
10:30-10:45	284	138	6	58	17	503	213
10:45-11 AM	349	138	4	67	15	573	220
11-11:15 AM	268	113	1	75	28	485	216
11:15-11:30	243	121	2	63	26	455	210
11:30-11:45	233	85	3	54	32	407	171
11:45-12 PM	197	114	4	70	29	414	213
	9,792	3,713	101	1,728	560	15,894	6,001

Survey Date: 10-12-89

Table 4.5: NYCDCP Classification Counts (Excerpt)

COMMERCIAL VEHICLE SURVEY

The New York City Department of City Planning is conducting a study to improve goods-movement within New York City. As part of this study we are interested in obtaining information on your trip today. Please take a few moments to answer the following questions. When you have completed the survey, JUST DROP THE POSTAGE PAID FORM IN ANY MAILBOX. Your answers will be strictly confidential. Your cooperation is essential to the success of this study and much appreciated.

1. Where did you start your trip today?
   ____
   Address or nearest intersection
   ________ ________ |_|_|_|_|_|
   County State Zip Code

2. At what type of facility did you start your trip today?
   01|_| Truck Terminal 04|_| Pier
   02|_| Warehouse 05|_| Factory
   03|_| Piggy-back Fac. 06|_| Office
   |_| Other (specify) ____________

3. What type of vehicle are you driving?
   1|_| Van/Pick-up
   2|_| Single Unit Truck
   3|_| Tractor Trailer

4. How many axles do you have?
   1|_| 2 axles 5|_| 6 axles
   2|_| 3 axles 6|_| 7 axles
   3|_| 4 axles 7|_| 8 axles
   4|_| 5 axles |_| other____

5. What type of trailer do you have?
   01|_| Utility 04|_| Container
   02|_| Flatbed 05|_| Auto
   03|_| Double Trailer 06|_| Tanker
   |_| Other (specify)____________

6. What commodity do you normally carry?
   01|_| Food/Farm Products
   02|_| Oil/Fuel 05|_| Paper
   03|_| Furniture 06|_| Apparel
   04|_| Metal Products 07|_| Chemicals
   |_| Other (specify)____________

7. Is your vehicle 1|_| Full
   2|_| Partially Full 3|_| Empty

8. What is the purpose of your trip?
   1|_| Delivery only
   2|_| Pickup only
   3|_| Pickup and Delivery
   4|_| Installation/Maintenance/Repair

9. What is your major destination?
   ____
   Address or nearest intersection
   ________ ________ |_|_|_|_|_|
   County State Zip Code

10. What type of facility is this?
    01|_| Truck Terminal 04|_| Pier
    02|_| Warehouse 05|_| Factory
    03|_| Piggy-back Fac. 06|_| Office
    |_| Other (specify) ____________

11. How often do you typically make this trip?
    1|_| More than once a day
    2|_| Daily
    3|_| More than once a week
    4|_| Weekly
    |_| Other (specify)____________

THE FOLLOWING QUESTIONS PERTAIN TO THE PORTION OF YOUR TRIP WITHIN MANHATTAN

12. How many stops will you make in Manhattan today?
    1|_| I will not stop in Manhattan
    2|_| 1 or 2
    3|_| 3 or 4
    4|_| 5 or more

13. Will you use a bridge or tunnel to leave Manhattan today?
    |_| NO, I will stay in Manhattan today.
    |_| YES, I will use ____________
    Bridge or Tunnel

14. If you answered YES to Question 13 what time will you leave Manhattan? ____ : ____ |_| AM |_| PM
    HOUR MIN

15. When you leave Manhattan will your vehicle be
    1|_| Full 2|_| Partially Full 3|_| Empty

16. Were you also interviewed today?
    1|_| NO
    2|_| YES, at this facility
    3|_| YES, at another facility

THANK YOU FOR COMPLETING THE SURVEY. PLEASE DROP THE POSTAGE PAID FORM IN ANY MAILBOX.

Figure 4.3: Survey Form, East River Truck Crossings Survey

24 HOUR VEHICULAR VOLUMES

Stillwell Avenue Bridge
10/82

Hour	N/B Autos	N/B Trucks	N/B Buses	N/B Total	S/B Autos	S/B Trucks	S/B Buses	S/B Total	Sum Totals
12- 1 am	69	1	0	70	56	3	0	59	129
1- 2 am	33	5	4	42	28	8	5	41	83
2- 3 am	37	3	0	40	29	3	0	32	72
3- 4 am	16	3	3	22	23	0	1	24	46
4- 5 am	20	2	4	26	20	3	6	29	55
5- 6 am	23	5	9	37	40	4	8	52	89
6- 7 am	30	4	20	54	78	2	13	93	147
7- 8 am	129	21	12	162	156	11	34	201	363
8- 9 am	184	34	25	243	207	16	27	250	493
9-10 am	142	26	22	190	138	61	13	212	402
10-11 am	130	32	20	182	140	39	15	194	376
11-12 am	148	41	8	197	161	30	10	201	398
12- 1 pm	195	71	13	279	195	34	14	243	522
1- 2 pm	170	63	19	252	211	61	18	290	542
2- 3 pm	210	58	25	293	197	82	23	302	595
3- 4 pm	223	35	30	288	264	43	17	324	612
4- 5 pm	223	36	30	289	230	37	17	284	573
5- 6 pm	217	15	17	249	227	25	14	266	515
6- 7 pm	158	8	17	183	151	7	14	172	355
7- 8 pm	127	7	3	137	124	6	2	132	269
8- 9 pm	122	6	1	129	133	2	2	137	266
9-10 pm	112	5	1	118	122	6	1	129	247
10-11 pm	107	6	0	113	98	5	0	103	216
11-12 pm	85	4	0	89	84	3	0	87	176
Totals	2,910	491	283	3,684	3,112	491	254	3,857	7,541
7-10 am	455	81	59	595	501	88	74	663	1,258
10- 1 pm	473	144	41	658	496	103	39	638	1,296
1- 4 pm	603	156	74	833	672	186	58	916	1,749
4- 7 pm	598	59	64	721	608	69	45	722	1,443

Table 4.6: NYCDOT Classification Counts (Example)

Avenue and Broadway, Atlantic Avenue and Utica Avenue, and Flatbush Avenue and Bergen Street (see Table 4.7). The same truck definition pertains.

Table 4.7: Classification Counts for Selected Locations in Brooklyn

CLASSIFICATION COUNTS PERFORMED AT SELECTED INTERSECTIONS IN NORTH BROOKLYN FOR THE BROOKLYN TRUCK ROUTE STUDY

		Distribution of Trucks by Class (% of All Trucks)			
Location	% Trucks In Total Traffic	2 Axle-4 Tire	2 Axle-6 Tire	3 Axle-Single Unit	Tractor Trailer
Greenpoint Ave. McGuinness Blvd.	31.7	36.3	41.3	9.9	12.5
Meeker Ave. & Vandervoort Ave.	37.0	36.1	39.4	7.6	16.9
Myrtle Ave. & Broadway	28.7	47.9	40.9	4.6	6.6
Atlantic Ave. & Utica Ave.	21.6	49.3	33.2	6.3	11.2
Flatbush Ave. & Bergen Street	14.7	59.7	30.7	4.0	5.6

In the late 1980's Urbitran conducted a Brooklyn Truck Route Study. As Figure 4.4 shows, it provides 1985-1986 daytime (12-hour), 2-way counts of truck volumes at selected locations along Metropolitan Avenue, Grand Street, Flushing Avenue, Myrtle Avenue, Atlantic Avenue, Flatbush Avenue, Linden Boulevard, and Flatlands Avenue. The definition of a truck is the same as that used by NYCDOT - a vehicle with six or more tires and/or three or more axles.

The Port Authority of New York and New Jersey (PANYNJ) provided traffic flows for the Verrazano Narrows Bridge, an OD survey of easbound trips, breaking down

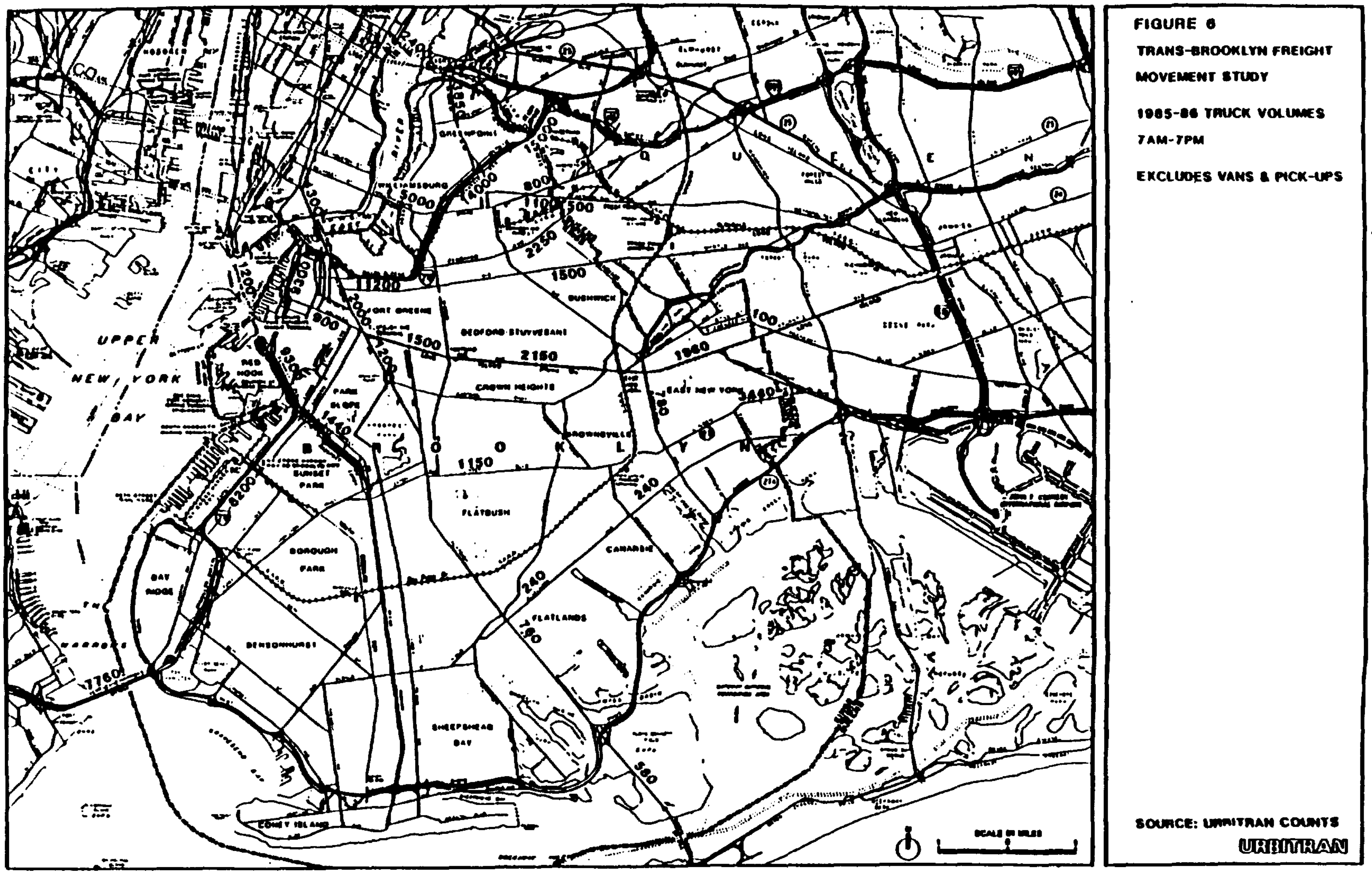


Figure 4.4: Truck Volumes from the Brooklyn Truck Route Study

destinations into upper and lower Brooklyn, Manhattan, and points north and east of the network, and counts of trucks by truck type into and out of air cargo facilities at JFK International Airport. The data for the Verrazano Narrows Bridge parallels that presented in Chapter 3 for the George Washington bridge - breakdowns of vehicles by vehicle class, both in terms of interviewed vehicles and totals. The data for truck trips near JFK airport shows truck and van arivals, by 15-minute time period, coming into the terminal from the Van Wyck Expressway (see Table 4.8).

From New York State Department of Transportation (NYSDOT) we obtained two major items. The first are factors for estimating traffic volumes by time period and truck class from AADT statistics, as was explained in Chapter 3 and presented in Tables 3.4 and 3.5. NYSDOT also provided AADTs for several locations on the Gowanus Expressway and on Linden Boulevard.

4.3 Creating the Constraints

Based on the data collected from the various sources, the next task is to create the OD, OT, and LV constraints from which the flow matrix estimates are developed. This section addresses that process and illustrates how several of the constraints are developed.

4.3.1 OD Constraints

Table 4.9 shows an excerpt from the 69 OD constraints pertaining to the AM period analysis. (There are 70 for the midday time period and 50 for the PM peak as can be found in Appendix B.) Eight of the constraints are derived from the 1984 PANYNJ OD

DATE: 11/4/85 LOCATION: VanWyck—Inbound

TIME ENDING	TRUCKS Freight	TRUCKS Service	VANS Freight	VANS Service	TIME ENDING	TRUCK Freight	TRUCK Service	VAN Freight	VAN Service
6:15 A	4	2	2	2	3:45	3	5	7	11
6:30	2	1	2	3	4:00	3	5	4	4
6:45	1	2	2	2	415	1	5	0	2
7:00	4	5	1	1	430	3	1	0	7
7:15	2	4	2	5	445	0	1	0	2
7:30	2	8	0	2	500	3	4	2	6
7:45	5	6	1	6	515	3	2	2	4
8:00	11	8	2	9	5:30	0	2	2	8
8:15	5	3	2	3	5:45	0	1	2	5
8:30	4	3	2	2	6:00	4	2	1	2
8:45	13	4	4	5	6:15	1	0	0	4
9:00	11	5	3	3	6:30	3	3	2	3
9:15	5	5	2	5	6:45	2	1	2	4
9:30	8	8	2	4	7:00	2	2	0	1
9:45	7	13	2	2	7:15	3	1	2	2
10 00	5	6	0	4	7:30	1	2	1	5
10:15	10	5	0	2	7:45	2	1	2	4
10:30	11	7	1	2	8:00	1	0	0	6
10:45	5	6	2	4	815	2	1	0	2
11:00	7	7	4	4	830	3	0	0	3
11:15	9	4	8	13	845	0	0	0	0
11:30	12	7	1	2	9:00	1	3	0	1
11:45	6	5	1	8	915	0	2	0	1
12:00	3	5	2	5	930	0	2	0	1
12:15 P	6	8	3	3	9:45	0	3	0	3
12:30	1	8	6	3	10:00	0	2	0	1
12:45	9	14	2	7	10:15	1	3	0	1
1:00	2	11	2	4	10:30	0	2	0	1
1:15	6	3	4	2	1045	1	3	0	3
1:30	5	8	1	4	11:00	0	1	0	1
1:45	6	7	3	7	11:15	0	2	0	2
2:00	7	6	2	3	1130	1	0	0	0
2:15	13	8	2	2	11:45	0	0	0	2
2:30	4	5	3	4	12:00	0	2	0	1
2:45	5	8	6	2	1215A	0	1	1	3
3:00	4	3	4	4	1230	0	2	0	2
3:15	5	6	3	4	1245	1	2	1	3
3:30	2	5	0	9	1:00	0	1	0	1
					TOTAL	267	301	114	264

Table 4.8: JFK Air Cargo Study Data (Excerpt)

Table 4.9: OD Constraints Excerpt - AM Time Period

1 Verrazano Bridge	Bklyn - S	1984 PA counts - 2&3 axles	1.0	3.0	30	240	0	1	0	0	239
2 Verrazano Bridge	Bklyn - S	1984 PA counts - >3 axles	1.0	3.0	33	340	0	0	0	1	332
3 Verrazano Bridge	Bklyn - N	1984 PA counts - 2&3 axles	1.0	3.0	30	160	0	1	0	0	157
4 Verrazano Bridge	Bklyn - N	1984 PA counts - >3 axles	1.0	3.0	30	220	0	0	0	1	217
5 Verrazano Bridge	BQE	1984 PA counts - 2&3 axles	1.0	3.0	30	220	0	1	0	0	218
6 Verrazano Bridge	BQE	1984 PA counts - >3 axles	1.0	3.0	30	310	0	0	0	1	303
7 Verrazano Bridge	All Manhattan	1984 PA counts - 2&3 axles	1.0	3.0	30	50	0	1	0	0	42
8 Verrazano Bridge	All Manhattan	1984 PA counts - >3 axles	1.0	3.0	30	60	0	0	0	1	58
9 BQE	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	156	1560	1	0	0	0	1556
10 BQE	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	60	600	0	1	0	0	625
12 BQE	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	140	0	0	0	1	130
13 Verrazano Bridge	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	110	1	0	0	0	104
14 Verrazano Bridge	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	120	0	1	0	0	125
16 Verrazano Bridge	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	90	0	0	0	1	89
17 Zone 4701	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	110	1	0	0	0	104
18 Zone 4701	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	14
19 Zone 4702	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	35
20 Zone 4703	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	35
21 Zone 4705	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	70	1	0	0	0	69
22 Zone 4705	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	30	0	1	0	0	28
24 Zone 4705	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	7
25 Zone 4706	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	35
26 Zone 4706	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	28

survey conducted at the Verrazano Bridge and the remaining 61 are derived from the East River Truck Crossing Survey conducted by NYCDCP. Using the first line as an example, each constraint indicates the origin-destination locations to which the observation pertains (Verrazano Narrows Bridge, eastbound, to the southern portion of Brooklyn), a description of the observation's source (the 1984 Port Authority counts, for 2- and 3-axle trucks), the weights attached to small (1.0) and large (3.0) deviations from the observed value, the limits, below (30) and above (240) the observed value (of 239) at which the secondary, larger weights (3.0) take effect, the truck classes to which the observation pertains (0=no and 1=yes, and TC1=commercial vans, TC2=single unit trucks, and TC4=trucks with four or more axles), and the observed value (239). (TC3 is reserved for three-axle trucks when it is possible to distinguish between two and three axle trucks.)

To illustrate how the OD constraints are developed, let us use the East River Crossing Survey observations as an example. Recall from the discussion of data sources that the New York City Department of City Planning (NYCDCP) had developed two sets of data during the survey process. The first was vehicle classification counts for the Williamsburg and Manhattan Bridges, the Midtown Tunnel and the Queensboro Bridge and the second was a dataset containing OD data from interviews conducted for trips traveling westbound into Manhattan across these facilities.

As was shown in Table 4.5, the classification data show inbound vehicle flows by vehicle class, each quarter-hour between 4:00 AM and 8:00 PM. The vehicles have been classified as passenger cars, vans and pickups, buses, single-unit trucks, and combination trucks. The vans and pickups category includes just commercial vehicles, not private vans, as the latter have been counted as passenger cars.

The origin-destination data contain 15 data items for each record, including origin, number of axles, and vehicle type, as was shown in Figure 4.3. There are 3,067 records in the data file, 2,910 of which are complete enough to be used. Of these, 1,191 pertained to the Manhattan Bridge; 863 to the Queensboro Bridge; 722 to the Queens-Midtown Tunnel; and 291 to the Williamsburg Bridge. Origin and destination locations have been coded as "Port Authority Zones," which are based on ward boundaries within the City. Figure 4.5 shows the delineation of these zones within Brooklyn.

The first processing step is to aggregate the survey data by origin (Port Authority Zone) and destination (in this instance, the bridge or tunnel employed). Then the data can be divided into two groups, those trips destined to Lower Manhattan via the Manhattan or Williamsburg Bridges, and those destined to the Queensboro Bridge and the Queens-Midtown tunnel. The latter trips exit the study network via the BQE.

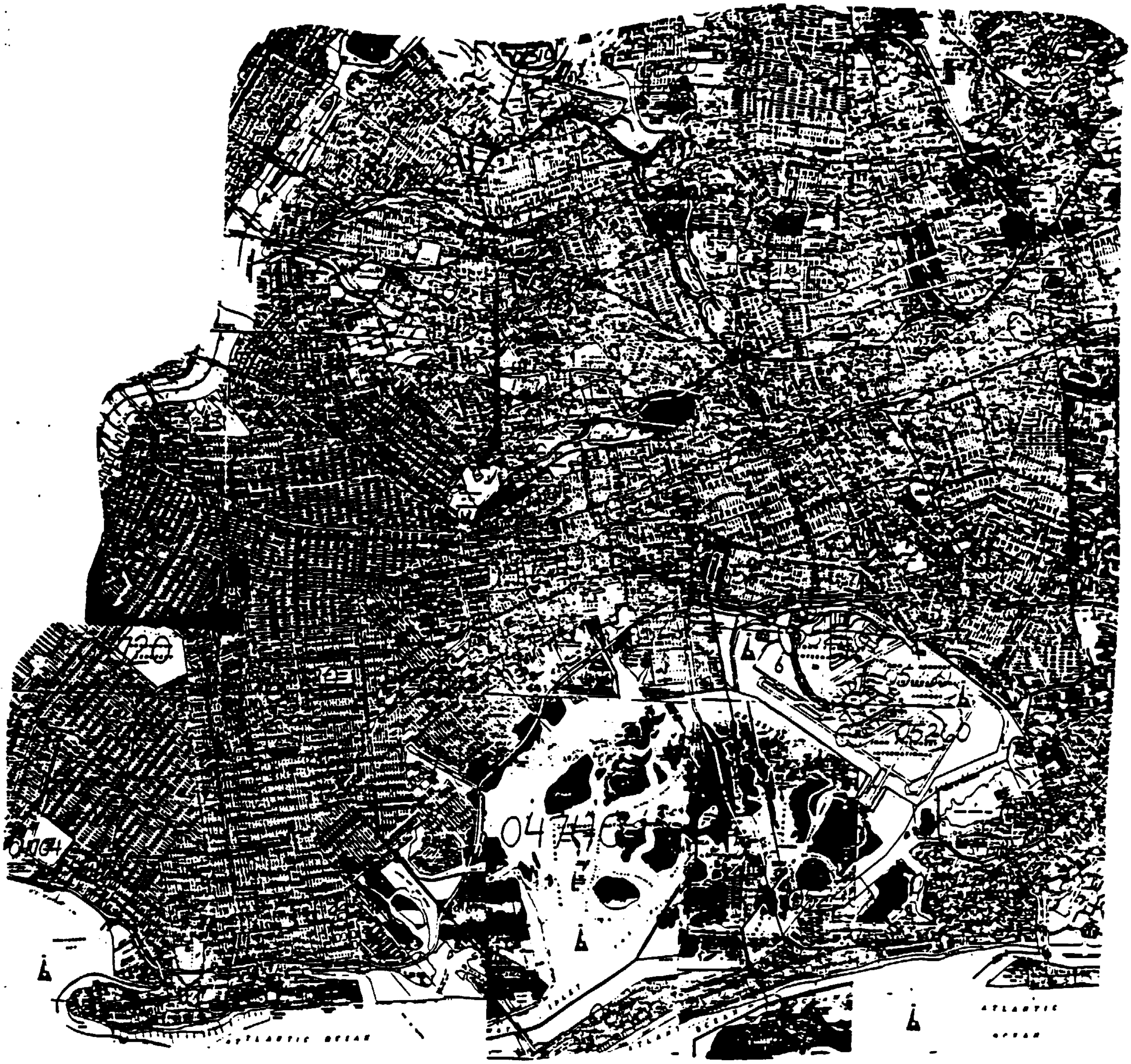


Figure 4.5: Port Authority Zones in Brooklyn

Records for the Manhattan and Williamsburg Bridges must subsequently be processed to generate a distribution of trips from certain zones within the network (e.g., a set of zipcodes within Brooklyn) to Lower Manhattan (external Zone 100). Each cluster of zones within Brooklyn corresponds to a given Port Authority Zone. In similar fashion, the records for the Queensboro Bridge and Queens-Midtown Tunnel are used to generate a distribution of trips to external zone 103, the BQE.

Finally these trip distributions must be combined with the truck counts by time period and truck class to develop lower bounds for truck flows by truck class from clusters of zones within the study network to external zone 100 and 103. The breakdown of surveys among trip origins is used to estimate, within a given truck class, the percentage of trips coming from Port Authority Zones (and, implicitly, clusters of our own network zones) to a given bridge or tunnel. Next, these percentages are applied to the total truck flows by truck class, from the classification counts, to estimate total truck trips from a given origin to a given facility. Finally, the resulting volumes for the Williamsburg and Manhattan bridges are summed to create lower bounds on trips to Lower Manhattan; and the same process is followed for the Queensboro Bridge and the Queens-Midtown Tunnel to produce lower bounds for trips to the BQE.

4.3.2 OT Constraints

Table 4.10 shows the 6 OT constraints that have been developed for the AM period analysis. (There are six similar OT constraints for the midday and PM peak time periods, respectively, as can be found in Appendix B.) Two are from the 1991 TBTA toll counts

Table 4.10: OT Dataset Excerpt - AM Time Period

OT	1 All Origins	Verrazano Bridge	1991 TBTA toll counts WB	1.0	3.0	50	50	0	1	0	0	507
OT	2 All Origins	Verrazano Bridge	1991 TBTA toll counts WB	1.0	3.0	50	50	0	0	0	1	446
OT	3 All Origins	JFK - Linden Ave	1985 JFK Air Cargo Study	1.0	3.0	0	30	1	0	0	0	86
OT	4 All Origins	JFK - Linden Ave	1985 JFK Air Cargo Study	1.0	3.0	0	30	0	1	0	1	173
OT	5 JFK - Linden Ave	All Destinations	1985 JFK Air Cargo Study	1.0	3.0	0	30	1	0	0	0	92
OT	6 JFK - Linden Ave	All Destinations	1985 JFK Air Cargo Study	1.0	3.0	0	30	0	1	0	1	91

westbound on the Verrazano Narrows Bridge. The remaining four are derived from the 1985 JFK air cargo study conducted by the PANYNJ. Using the first line as an example, each constraint indicates the location from which the trips originate (all locations), the destination (the Verrazano Narrows Bridge, westbound), the observation's source (1991 TBTA toll count data), the weights attached to small (1.0) and large (3.0) deviations from the observed value, the limits, below (50) and above (50) the observed value (of 507) at which the secondary, larger weights (3.0) take effect, the truck classes to which the observation pertains (0=no and 1=yes, and TC1=commercial vans, TC2=single unit trucks, and TC4=trucks with four or more axles), and the observed value (507).

Using the data from the Verrazano Narrows bridge as an example, we can illustrate how the OT constraint data are prepared. Similar to Tables 4.3 and 4.4 presented earlier, the TBTA has collected toll plaza data for the Verrazano Narrows Bridge. Taking the data from the equivalent of Table 4.3 it is possible to estimate weekday trips by time period and direction during the day. In addition, by joining these data with the breakdowns of bridge crossings by vehicle type (the equivalent of Table 4.4) it is possible to estimate truck trips by vehicle type for each time period. Implicit assumptions involved in creating these estimates are 1) that the data are representative of a typical day for this facility and 2) the

APPENDIX A

INPUT DATASETS FOR THE BRONX CASE STUDY

OD Dataset, AM Time Period

00	1	GW Bridge - EB	Lower Manhattan	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	134
00	2	GW Bridge - EB	Lower Manhattan	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	20	20	0	0	0	1	45
00	3	GW Bridge - EB	Manhattan 1420	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	7
00	4	GW Bridge - EB	Manhattan 1420	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	6
00	5	GW Bridge - EB	Manhattan 1430	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	18
00	6	GW Bridge - EB	Manhattan 1441	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	3
00	7	GW Bridge - EB	Manhattan 1442	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	28
00	8	GW Bridge - EB	Bronx - General	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	187
00	9	GW Bridge - EB	Bronx - General	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	136
00	10	GW Bridge - EB	Bronx 2510	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	81
00	11	GW Bridge - EB	Bronx 2510	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	101
00	12	GW Bridge - EB	Bronx 2520	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	53
00	13	GW Bridge - EB	Bronx 2520	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	20	20	0	0	0	1	22
00	14	GW Bridge - EB	Bronx 2530	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	18
00	15	GW Bridge - EB	Bronx 2530	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	10
00	16	GW Bridge - EB	Bronx 2540	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	18
00	17	GW Bridge - EB	Bronx 2540	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	9
00	18	GW Bridge - EB	Bronx 2550	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	7
00	19	GW Bridge - EB	Bronx 2550	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	6
00	20	GW Bridge - EB	Bronx 2560	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	7
00	21	GW Bridge - EB	Westchester - NE	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	316
00	22	GW Bridge - EB	Westchester - NE	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	689
00	23	GW Bridge - EB	Triborough Br.	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	119
00	24	GW Bridge - EB	Triborough Br.	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	147
00	25	GW Bridge - EB	Bronx-Whitestone	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	113
00	26	GW Bridge - EB	Bronx-Whitestone	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	133
00	27	GW Bridge - EB	Throgs Neck Br.	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	327
00	28	GW Bridge - EB	Throgs Neck Br.	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	481
00	29	Westchester - I87	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	130
00	30	GW Bridge - EB	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	180
00	31	Bronx - General	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	360
00	32	N. Manhattan	Triborough Br.	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	162
00	33	N. Manhattan	Triborough Br.	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	10
00	34	Others	Triborough Br.	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	694
00	35	Others	Triborough Br.	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	195
00	36	Triborough Br.	N. Manhattan	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	201
00	37	Triborough Br.	N. Manhattan	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	12
00	38	Triborough Br.	Others	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	833
00	39	Triborough Br.	Others	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	234
00	40	Westchester - I87	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	130
00	41	Manhattan - general	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	20	20	0	1	0	1	60
00	42	GW Bridge - EB	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	250
00	43	Bronx - General	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	250
00	44	Westchester - I87	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	140
00	45	GW Bridge - EB	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	390
00	46	Manhattan - general	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	20	30	0	1	0	1	60
00	47	Bronx - General	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	140

OD Dataset, Midday Time Period

00	1	GW Bridge - EB	Lower Manhattan	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	86
00	2	GW Bridge - EB	Lower Manhattan	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	20	20	0	0	0	1	60
00	3	GW Bridge - EB	Manhattan 1420	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	6
00	4	GW Bridge - EB	Manhattan 1420	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	6

OD	5 GW Bridge - EB	Manhattan 1442	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	19
OD	6 GW Bridge - EB	Manhattan 1442	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	3
OD	7 GW Bridge - EB	Bronx - General	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	151
OD	8 GW Bridge - EB	Bronx - General	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	91
OD	9 GW Bridge - EB	Bronx 2510	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	115
OD	10 GW Bridge - EB	Bronx 2510	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	106
OD	11 GW Bridge - EB	Bronx 2520	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	39
OD	12 GW Bridge - EB	Bronx 2520	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	20	20	0	0	0	1	16
OD	13 GW Bridge - EB	Bronx 2530	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	19
OD	14 GW Bridge - EB	Bronx 2530	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	6
OD	15 GW Bridge - EB	Bronx 2540	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	12
OD	16 GW Bridge - EB	Bronx 2540	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	6
OD	17 GW Bridge - EB	Bronx 2550	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	12
OD	18 GW Bridge - EB	Bronx 2550	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	13
OD	19 GW Bridge - EB	Bronx 2560	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	9
OD	20 GW Bridge - EB	Bronx 2560	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	3
OD	21 GW Bridge - EB	Westchester - NE	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	430
OD	22 GW Bridge - EB	Westchester - NE	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	1120
OD	23 GW Bridge - EB	Triborough Br.	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	158
OD	24 GW Bridge - EB	Triborough Br.	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	130
OD	25 GW Bridge - EB	Bronx-Whitestone	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	117
OD	26 GW Bridge - EB	Bronx-Whitestone	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	97
OD	27 GW Bridge - EB	Throgs Neck Br.	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	220
OD	28 GW Bridge - EB	Throgs Neck Br.	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	381
OD	29 Westchester - I87	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	140
OD	30 GW Bridge - EB	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	190
OD	31 Bronx - General	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	390
OD	32 N. Manhattan	Triborough Br.	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	190
OD	33 N. Manhattan	Triborough Br.	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	12
OD	34 Others	Triborough Br.	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	743
OD	35 Others	Triborough Br.	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	209
OD	36 Triborough Br.	N. Manhattan	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	209
OD	37 Triborough Br.	N. Manhattan	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	13
OD	38 Triborough Br.	Others	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	825
OD	39 Triborough Br.	Others	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	232
OD	40 Westchester - I87	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	130
OD	41 Manhattan - general	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	20	20	0	1	0	1	60
OD	42 GW Bridge - EB	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	260
OD	43 Bronx - General	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	260
OD	44 Westchester - I87	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	180
OD	45 GW Bridge - EB	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	500
OD	46 Manhattan - general	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	20	30	0	1	0	1	80
OD	47 Bronx - General	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	180

OD Dataset, PM Time Period

OD	1 GW Bridge - EB	Lower Manhattan	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	25
OD	2 GW Bridge - EB	Lower Manhattan	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	20	20	0	0	0	1	22
OD	3 GW Bridge - EB	Manhattan 1420	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	2
OD	4 GW Bridge - EB	Manhattan 1420	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	2
OD	5 GW Bridge - EB	Manhattan 1430	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	2
OD	6 GW Bridge - EB	Manhattan 1443	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	2
OD	7 GW Bridge - EB	Bronx - General	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	37
OD	8 GW Bridge - EB	Bronx - General	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	31
OD	9 GW Bridge - EB	Bronx 2510	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	103
OD	10 GW Bridge - EB	Bronx 2510	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	145
OD	11 GW Bridge - EB	Bronx 2520	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	12
OD	12 GW Bridge - EB	Bronx 2530	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	20	20	0	1	0	0	12
OD	13 GW Bridge - EB	Bronx 2530	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	3
OD	14 GW Bridge - EB	Bronx 2540	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	7
OD	15 GW Bridge - EB	Bronx 2550	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	9
OD	16 GW Bridge - EB	Bronx 2550	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	0	20	0	0	0	1	6
OD	17 GW Bridge - EB	Bronx 2560	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	0	20	0	1	0	0	2
OD	18 GW Bridge - EB	Westchester - NE	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	158
OD	19 GW Bridge - EB	Westchester - NE	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	852
OD	20 GW Bridge - EB	Triborough Br.	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	54
OD	21 GW Bridge - EB	Triborough Br.	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	62
OD	22 GW Bridge - EB	Bronx-Whitestone	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	30	30	0	1	0	0	130

OD	23	GW Bridge - EB	Bronx-Whitestone	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	30	30	0	0	0	1	51
OD	24	GW Bridge - EB	Throgs Neck Br.	1991 PA Cmdty Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	150
OD	25	GW Bridge - EB	Throgs Neck Br.	1991 PA Cmdty Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	190
OD	26	Westchester - I87	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	190
OD	27	GW Bridge - EB	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	250
OD	28	Bronx - General	Triborough Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	510
OD	29	N. Manhattan	Triborough Br.	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	243
OD	30	N. Manhattan	Triborough Br.	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	15
OD	31	Others	Triborough Br.	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	977
OD	32	Others	Triborough Br.	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	275
OD	33	Triborough Br.	N. Manhattan	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	271
OD	34	Triborough Br.	N. Manhattan	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	17
OD	35	Triborough Br.	Others	1988 TBTA Trk Surv - 2&3 axles	1.0	3.0	50	50	0	1	0	0	951
OD	36	Triborough Br.	Others	1988 TBTA Trk Surv - 4+ axles	1.0	3.0	50	50	0	0	0	1	267
OD	37	Westchester - I87	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	210
OD	38	Manhattan - general	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	20	20	0	1	0	1	100
OD	39	GW Bridge - EB	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	400
OD	40	Bronx - General	Bronx-Whitestone	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	400
OD	41	Westchester - I87	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	270
OD	42	GW Bridge - EB	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	50	50	0	1	0	1	760
OD	43	Manhattan - general	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	20	30	0	1	0	1	120
OD	44	Bronx - General	Throgs Neck Br.	1988 TBTA Trk Surv - 2&3,4+axle	1.0	3.0	30	50	0	1	0	1	270

OT Dataset, AM Time Period

OT	1	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - vans	1.0	3.0	40	40	1	0	0	0	150
OT	2	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	549
OT	3	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - 4+ axles	1.0	3.0	20	20	0	0	0	1	301
OT	4	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - vans	1.0	3.0	40	40	1	0	0	0	100
OT	5	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	476
OT	6	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - 4+ axles	1.0	3.0	40	40	0	0	0	1	534
OT	7	Bronx-Whitestone	All Destinations	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	615
OT	8	Bronx-Whitestone	All Destinations	TBTA toll data 8/91 - 4+ axles	1.0	3.0	30	30	0	0	0	1	337
OT	9	Throgs Neck Br.	All Destinations	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	60	60	0	1	0	0	750
OT	10	Throgs Neck Br.	All Destinations	TBTA toll data 8/91 - 4+ axles	1.0	3.0	60	60	0	0	0	1	841
OT	11	All Origins	Hunt's Point	Hunt's Point Access Study	1.0	3.0	150	150	1	1	0	0	1500
OT	12	Hunt's Point	All Destinations	Hunt's Point Access Study	1.0	3.0	150	150	1	1	0	0	1500
OT	13	Zone 1-10458,63,68,71	All Destinations	Bronx Truck Route Study	1.0	3.0	50	50	0	1	0	1	680
OT	14	Zone 2-10466,67,69,70	All Destinations	Bronx Truck Route Study	1.0	3.0	40	40	0	1	0	1	1100
OT	15	Zone 3 - 10464,75	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	80
OT	16	Zone 6 - 10453	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	750
OT	17	Zone 7 - 10457	All Destinations	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1060
OT	18	Zone 8 - 10460	All Destinations	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	920
OT	19	Zone 9 - 10462	All Destinations	Bronx Truck Route Study	1.0	3.0	70	70	0	1	0	1	250
OT	20	Zone 10 - 10461	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	300
OT	21	Zone 11 - 10465	All Destinations	Bronx Truck Route Study	1.0	3.0	30	30	0	1	0	1	80
OT	22	Zone 12 - 10452	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	400
OT	23	Zone 13 - 10456	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	750
OT	24	Zone 14 - 10459	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	320
OT	25	Zone 15 - 10472	All Destinations	Bronx Truck Route Study	1.0	3.0	100	100	0	1	0	1	600
OT	26	Zone 16 - 10451	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	750
OT	27	Zone 17 - 10455	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	400
OT	28	Zone 19 - 10473	All Destinations	Bronx Truck Route Study	1.0	3.0	130	130	0	1	0	1	710
OT	29	Zone 20 - 10454	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	400
OT	30	All Origins	Zone 1-10458,63,68,71	Bronx Truck Route Study	1.0	3.0	50	50	0	1	0	1	680
OT	31	All Origins	Zone 2-10466,67,69,70	Bronx Truck Route Study	1.0	3.0	40	40	0	1	0	1	1100
OT	32	All Origins	Zone 3 - 10464,75	Bronx Truck Route Study	1.0	3.0	20	40	0	1	0	1	80
OT	33	All Origins	Zone 6 - 10453	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	750
OT	34	All Origins	Zone 7 - 10457	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1060
OT	35	All Origins	Zone 8 - 10460	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	920
OT	36	All Origins	Zone 9 - 10462	Bronx Truck Route Study	1.0	3.0	70	70	0	1	0	1	250
OT	37	All Origins	Zone 10 - 10461	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	300
OT	38	All Origins	Zone 11 - 10465	Bronx Truck Route Study	1.0	3.0	30	30	0	1	0	1	80
OT	39	All Origins	Zone 12 - 10452	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	400
OT	40	All Origins	Zone 13 - 10456	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	750
OT	41	All Origins	Zone 14 - 10459	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	320
OT	42	All Origins	Zone 15 - 10472	Bronx Truck Route Study	1.0	3.0	100	100	0	1	0	1	600

OT	43	All Origins	Zone 16 - 10451	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	750
OT	44	All Origins	Zone 17 - 10455	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	400
OT	45	All Origins	Zone 19 - 10473	Bronx Truck Route Study	1.0	3.0	130	130	0	1	0	1	710
OT	46	All Origins	Zone 20 - 10454	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	400
OT	47	All Origins	NE Thruway	NYS THROUGHWAY DATA	1.0	3.0	37	37	0	1	0	0	618
OT	48	All Origins	NE Thruway	NYS THROUGHWAY DATA	1.0	3.0	44	44	0	0	0	1	784
OT	49	All Origins	Hunt's Point	Sense of Heavy Flows	1.0	3.0	0	200	0	0	0	1	0
OT	50	Hunt's Point	All Destinations	Sense of Heavy Flows	1.0	3.0	0	200	0	0	0	1	0
OT	51	All Origins	N. Manhattan	Intuition about truck flows	1.0	3.0	0	200	0	1	0	1	0
OT	52	N. Manhattan	All Destinations	Intuition about truck flows	1.0	3.0	0	200	0	1	0	1	0

OT Dataset, Midday Time Period

OT	1	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - vans	1.0	3.0	40	40	1	0	0	0	160
OT	2	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	580
OT	3	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - 4+ axles	1.0	3.0	20	20	0	0	0	1	318
OT	4	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - vans	1.0	3.0	40	40	1	0	0	0	130
OT	5	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	609
OT	6	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - 4+ axles	1.0	3.0	40	40	0	0	0	1	684
OT	7	Bronx-Whitestone	All Destinations	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	528
OT	8	Bronx-Whitestone	All Destinations	TBTA toll data 8/91 - 4+ axles	1.0	3.0	30	30	0	0	0	1	290
OT	9	Throgs Neck Br.	All Destinations	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	60	60	0	1	0	0	607
OT	10	Throgs Neck Br.	All Destinations	TBTA toll data 8/91 - 4+ axles	1.0	3.0	60	60	0	0	0	1	681
OT	11	All Origins	Hunt's Point	Hunt's Point Access Study	1.0	3.0	150	150	1	1	0	0	2240
OT	12	Hunt's Point	All Destinations	Hunt's Point Access Study	1.0	3.0	150	150	1	1	0	0	2240
OT	13	Zone 1-10458,63,68,71	All Destinations	Bronx Truck Route Study	1.0	3.0	50	50	0	1	0	1	1090
OT	14	Zone 2-10466,67,69,70	All Destinations	Bronx Truck Route Study	1.0	3.0	40	40	0	1	0	1	1760
OT	15	Zone 3 - 10464,75	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	130
OT	16	Zone 6 - 10453	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1200
OT	17	Zone 7 - 10457	All Destinations	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1700
OT	18	Zone 8 - 10460	All Destinations	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1470
OT	19	Zone 9 - 10462	All Destinations	Bronx Truck Route Study	1.0	3.0	70	70	0	1	0	1	400
OT	20	Zone 10 - 10461	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	480
OT	21	Zone 11 - 10465	All Destinations	Bronx Truck Route Study	1.0	3.0	30	30	0	1	0	1	130
OT	22	Zone 12 - 10452	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	640
OT	23	Zone 13 - 10456	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1200
OT	24	Zone 14 - 10459	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	510
OT	25	Zone 15 - 10472	All Destinations	Bronx Truck Route Study	1.0	3.0	100	100	0	1	0	1	960
OT	26	Zone 16 - 10451	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1200
OT	27	Zone 17 - 10455	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	640
OT	28	Zone 19 - 10473	All Destinations	Bronx Truck Route Study	1.0	3.0	130	130	0	1	0	1	1140
OT	29	Zone 20 - 10454	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	640
OT	30	All Origins	Zone 1-10458,63,68,71	Bronx Truck Route Study	1.0	3.0	50	50	0	1	0	1	1090
OT	31	All Origins	Zone 2-10466,67,69,70	Bronx Truck Route Study	1.0	3.0	40	40	0	1	0	1	1760
OT	32	All Origins	Zone 3 - 10464,75	Bronx Truck Route Study	1.0	3.0	20	40	0	1	0	1	130
OT	33	All Origins	Zone 6 - 10453	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1200
OT	34	All Origins	Zone 7 - 10457	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1700
OT	35	All Origins	Zone 8 - 10460	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1470
OT	36	All Origins	Zone 9 - 10462	Bronx Truck Route Study	1.0	3.0	70	70	0	1	0	1	400
OT	37	All Origins	Zone 10 - 10461	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	480
OT	38	All Origins	Zone 11 - 10465	Bronx Truck Route Study	1.0	3.0	30	30	0	1	0	1	130
OT	39	All Origins	Zone 12 - 10452	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	640
OT	40	All Origins	Zone 13 - 10456	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1200
OT	41	All Origins	Zone 14 - 10459	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	510
OT	42	All Origins	Zone 15 - 10472	Bronx Truck Route Study	1.0	3.0	100	100	0	1	0	1	960
OT	43	All Origins	Zone 16 - 10451	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1200
OT	44	All Origins	Zone 17 - 10455	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	640
OT	45	All Origins	Zone 19 - 10473	Bronx Truck Route Study	1.0	3.0	130	130	0	1	0	1	1140
OT	46	All Origins	Zone 20 - 10454	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	640
OT	47	All Origins	NE Thruway	NYS THROUGHWAY DATA	1.0	3.0	52	52	0	1	0	0	852
OT	48	All Origins	NE Thruway	NYS THROUGHWAY DATA	1.0	3.0	81	81	0	0	0	1	1118
OT	49	All Origins	Hunt's Point	Sense of Heavy Flows	1.0	3.0	0	200	0	0	0	1	0
OT	50	Hunt's Point	All Destinations	Sense of Heavy Flows	1.0	3.0	0	200	0	0	0	1	0
OT	51	All Origins	N. Manhattan	Intuition about truck flows	1.0	3.0	0	200	0	1	0	1	0
OT	52	N. Manhattan	All Destinations	Intuition about truck flows	1.0	3.0	0	200	0	1	0	1	0

OT Dataset, PM Time Period

OT	1	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - vans	1.0	3.0	40	40	1	0	0	0	250
OT	2	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	899
OT	3	All Origins	Bronx-Whitestone	TBTA toll data 8/91 - 4+ axles	1.0	3.0	20	20	0	0	0	1	493
OT	4	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - vans	1.0	3.0	40	40	1	0	0	0	190
OT	5	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	913
OT	6	All Origins	Throgs Neck Br.	TBTA toll data 8/91 - 4+ axles	1.0	3.0	40	40	0	0	0	1	1024
OT	7	Bronx-Whitestone	All Destinations	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	40	40	0	1	0	0	681
OT	8	Bronx-Whitestone	All Destinations	TBTA toll data 8/91 - 4+ axles	1.0	3.0	30	30	0	0	0	1	374
OT	9	Throgs Neck Br.	All Destinations	TBTA toll data 8/91 - 2&3 axle	1.0	3.0	60	60	0	1	0	0	668
OT	10	Throgs Neck Br.	All Destinations	TBTA toll data 8/91 - 4+ axles	1.0	3.0	60	60	0	0	0	1	749
OT	11	All Origins	Hunt's Point	Hunt's Point Access Study	1.0	3.0	150	150	1	1	0	0	2380
OT	12	Hunt's Point	All Destinations	Hunt's Point Access Study	1.0	3.0	150	150	1	1	0	0	2380
OT	13	Zone 1-10458,63,68,71	All Destinations	Bronx Truck Route Study	1.0	3.0	50	50	0	1	0	1	1160
OT	14	Zone 2-10466,67,69,70	All Destinations	Bronx Truck Route Study	1.0	3.0	40	40	0	1	0	1	1870
OT	15	Zone 3 - 10464,75	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	140
OT	16	Zone 6 - 10453	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1280
OT	17	Zone 7 - 10457	All Destinations	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1800
OT	18	Zone 8 - 10460	All Destinations	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1560
OT	19	Zone 9 - 10462	All Destinations	Bronx Truck Route Study	1.0	3.0	70	70	0	1	0	1	430
OT	20	Zone 10 - 10461	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	510
OT	21	Zone 11 - 10465	All Destinations	Bronx Truck Route Study	1.0	3.0	30	30	0	1	0	1	140
OT	22	Zone 12 - 10452	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	680
OT	23	Zone 13 - 10456	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1280
OT	24	Zone 14 - 10459	All Destinations	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	540
OT	25	Zone 15 - 10472	All Destinations	Bronx Truck Route Study	1.0	3.0	100	100	0	1	0	1	1020
OT	26	Zone 16 - 10451	All Destinations	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1280
OT	27	Zone 17 - 10455	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	680
OT	28	Zone 19 - 10473	All Destinations	Bronx Truck Route Study	1.0	3.0	130	130	0	1	0	1	1210
OT	29	Zone 20 - 10454	All Destinations	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	680
OT	30	All Origins	Zone 1-10458,63,68,71	Bronx Truck Route Study	1.0	3.0	50	50	0	1	0	1	1160
OT	31	All Origins	Zone 2-10466,67,69,70	Bronx Truck Route Study	1.0	3.0	40	40	0	1	0	1	1870
OT	32	All Origins	Zone 3 - 10464,75	Bronx Truck Route Study	1.0	3.0	20	40	0	1	0	1	140
OT	33	All Origins	Zone 6 - 10453	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1280
OT	34	All Origins	Zone 7 - 10457	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1800
OT	35	All Origins	Zone 8 - 10460	Bronx Truck Route Study	1.0	3.0	200	200	0	1	0	1	1560
OT	36	All Origins	Zone 9 - 10462	Bronx Truck Route Study	1.0	3.0	70	70	0	1	0	1	430
OT	37	All Origins	Zone 10 - 10461	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	510
OT	38	All Origins	Zone 11 - 10465	Bronx Truck Route Study	1.0	3.0	30	30	0	1	0	1	140
OT	39	All Origins	Zone 12 - 10452	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	680
OT	40	All Origins	Zone 13 - 10456	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1280
OT	41	All Origins	Zone 14 - 10459	Bronx Truck Route Study	1.0	3.0	80	80	0	1	0	1	540
OT	42	All Origins	Zone 15 - 10472	Bronx Truck Route Study	1.0	3.0	100	100	0	1	0	1	1020
OT	43	All Origins	Zone 16 - 10451	Bronx Truck Route Study	1.0	3.0	150	150	0	1	0	1	1280
OT	44	All Origins	Zone 17 - 10455	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	680
OT	45	All Origins	Zone 19 - 10473	Bronx Truck Route Study	1.0	3.0	130	130	0	1	0	1	1210
OT	46	All Origins	Zone 20 - 10454	Bronx Truck Route Study	1.0	3.0	90	90	0	1	0	1	680
OT	47	All Origins	NE Thruway	NYS THROUGHWAY DATA	1.0	3.0	22	22	0	1	0	0	458
OT	48	All Origins	NE Thruway	NYS THROUGHWAY DATA	1.0	3.0	106	106	0	0	0	1	787
OT	49	All Origins	Hunt's Point	Sense of Heavy Flows	1.0	3.0	0	200	0	0	0	1	0
OT	50	Hunt's Point	All Destinations	Sense of Heavy Flows	1.0	3.0	0	200	0	0	0	1	0
OT	51	All Origins	N. Manhattan	Intuition about truck flows	1.0	3.0	0	200	0	1	0	1	0
OT	52	N. Manhattan	All Destinations	Intuition about truck flows	1.0	3.0	0	200	0	1	0	1	0

LV Dataset, AM Time Period

LV	1	48831	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	180
LV	2	48831	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	130
LV	3	-48831	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	180
LV	4	-48831	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	130
LV	5	10520	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	170
LV	6	10520	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	120
LV	7	-10520	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	170
LV	8	-10520	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	120
LV	17	10180	Bronx Cnty traffic count - vans	1.0	3.0	80	80	1	0	0	0	780
LV	18	10180	Bronx Cnty traffic count-others	1.0	3.0	60	60	0	1	0	1	550

LV	19	-10180	Bronx Cnty traffic count - vans	1.0	3.0	80	80	1	0	0	0	780
LV	20	-10180	Bronx Cnty traffic count-others	1.0	3.0	60	60	0	1	0	1	550
LV	21	10190	Bronx Cnty traffic count - vans	1.0	3.0	90	90	1	0	0	0	880
LV	22	10190	Bronx Cnty traffic count-others	1.0	3.0	60	60	0	1	0	1	620
LV	23	-10190	Bronx Cnty traffic count - vans	1.0	3.0	90	90	1	0	0	0	880
LV	24	-10190	Bronx Cnty traffic count-others	1.0	3.0	60	60	0	1	0	1	620
LV	25	10240	Bronx Cnty traffic count - vans	1.0	3.0	100	100	1	0	0	0	950
LV	26	10240	Bronx Cnty traffic count-others	1.0	3.0	70	70	0	1	0	1	670
LV	27	-10240	Bronx Cnty traffic count - vans	1.0	3.0	100	100	1	0	0	0	950
LV	28	-10240	Bronx Cnty traffic count-others	1.0	3.0	70	70	0	1	0	1	670
LV	29	10930	Bronx Cnty traffic count - vans	1.0	3.0	110	110	1	0	0	0	1080
LV	30	10930	Bronx Cnty traffic count-others	1.0	3.0	80	80	0	1	0	1	760
LV	31	-10930	Bronx Cnty traffic count - vans	1.0	3.0	110	110	1	0	0	0	1080
LV	32	-10930	Bronx Cnty traffic count-others	1.0	3.0	80	80	0	1	0	1	760
LV	33	18900	Bronx Cnty traffic count - vans	1.0	3.0	90	90	1	0	0	0	890
LV	34	18900	Bronx Cnty traffic count-others	1.0	3.0	60	60	0	1	0	1	630
LV	35	-18900	Bronx Cnty traffic count - vans	1.0	3.0	90	90	1	0	0	0	890
LV	36	-18900	Bronx Cnty traffic count-others	1.0	3.0	60	60	0	1	0	1	630
LV	97	11860	Bronx Cnty traffic count - vans	1.0	3.0	50	50	1	0	0	0	550
LV	98	11860	Bronx Cnty traffic count-others	1.0	3.0	340	340	0	1	0	1	3390
LV	99	-11860	Bronx Cnty traffic count - vans	1.0	3.0	80	80	1	0	0	0	750
LV	100	-11860	Bronx Cnty traffic count-others	1.0	3.0	220	220	0	1	0	1	2170
LV	101	8820	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	120
LV	102	8820	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	140
LV	103	-8820	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	130
LV	104	-8820	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	130
LV	105	48590	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	190
LV	106	48590	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	140
LV	107	-48590	Bronx Cnty traffic count - vans	1.0	3.0	60	60	1	0	0	0	550
LV	108	-48590	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	280
LV	109	49560	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	140
LV	110	49560	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	160
LV	111	-49560	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	320
LV	112	-49560	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	240
LV	113	50131	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	210
LV	114	50131	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	190
LV	115	-50131	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	340
LV	116	-50131	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	150
LV	117	10380	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	280
LV	118	10380	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	200
LV	119	-10380	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	80
LV	120	-10380	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	120
LV	121	9810	Bronx Cnty traffic count - vans	1.0	3.0	70	70	1	0	0	0	670
LV	122	9810	Bronx Cnty traffic count-others	1.0	3.0	70	70	0	1	0	0	700
LV	123	9312	Bronx Cnty traffic count - vans	1.0	3.0	170	170	1	0	0	0	1680
LV	124	9312	Bronx Cnty traffic count-others	1.0	3.0	190	190	0	1	0	0	1890
LV	125	-49610	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	50
LV	126	-49610	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	130
LV	127	49610	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	170
LV	128	49610	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	100
LV	143	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	50	50	1	0	0	0	510
LV	144	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	60	60	0	1	0	0	550
LV	145	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	90	90	0	0	0	1	910
LV	146	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	40	40	1	0	0	0	440
LV	147	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	30	30	0	1	0	0	160
LV	148	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	30	30	0	0	0	1	190
LV	149	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	70	70	1	0	0	0	670
LV	150	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	60	60	0	1	0	0	560
LV	151	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	40	40	0	0	0	1	370
LV	152	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	90	90	1	0	0	0	930
LV	153	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	60	60	0	1	0	0	610
LV	154	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	30	30	0	0	0	1	180
LV	155	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	1	0	0	0	50
LV	156	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	0	1	0	0	150
LV	157	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	0	0	0	1	60
LV	158	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	40	40	1	0	0	0	440
LV	159	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	30	30	0	1	0	0	230
LV	160	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	30	30	0	0	0	1	160
LV	161	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	30	30	1	0	0	0	40

V	162	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	30	30	0	1	0	0	180
LV	163	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	30	30	0	0	0	1	200
LV	164	-11962	NYSDOT S1 WB -CBE Extension	1.0	3.0	30	30	0	1	0	0	280
V	165	-11962	NYSDOT S1 WB -CBE Extension	1.0	3.0	30	30	0	0	0	1	310
V	166	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	70	70	1	0	0	0	740
V	167	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	110	110	0	1	0	0	1080
LV	168	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	200	200	0	0	0	1	950
LV	169	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	50	50	1	0	0	0	450
V	170	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	80	80	0	1	0	0	790
V	171	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	70	70	0	0	0	1	740
LV	178	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	70	70	1	0	0	0	690
LV	179	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	100	100	0	1	0	0	1010
V	180	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	200	200	0	0	0	1	930
V	181	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	40	40	1	0	0	0	420
V	182	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	70	70	0	1	0	0	730
LV	183	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	70	70	0	0	0	1	700

LV Dataset, Midday Time Period

LV	1	48831	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290
V	2	48831	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	210
V	3	-48831	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290
V	4	-48831	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	210
LV	5	10520	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	280
LV	6	10520	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	190
V	7	-10520	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	280
V	8	-10520	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	190
LV	17	10180	Bronx Cnty traffic count - vans	1.0	3.0	130	130	1	0	0	0	1260
LV	18	10180	Bronx Cnty traffic count-others	1.0	3.0	90	90	0	1	0	1	880
V	19	-10180	Bronx Cnty traffic count - vans	1.0	3.0	130	130	1	0	0	0	1260
V	20	-10180	Bronx Cnty traffic count-others	1.0	3.0	90	90	0	1	0	1	880
V	21	10190	Bronx Cnty traffic count - vans	1.0	3.0	140	140	1	0	0	0	1420
LV	22	10190	Bronx Cnty traffic count-others	1.0	3.0	100	100	0	1	0	1	990
LV	23	-10190	Bronx Cnty traffic count - vans	1.0	3.0	140	140	1	0	0	0	1420
LV	24	-10190	Bronx Cnty traffic count-others	1.0	3.0	100	100	0	1	0	1	990
LV	25	10240	Bronx Cnty traffic count - vans	1.0	3.0	150	150	1	0	0	0	1540
LV	26	10240	Bronx Cnty traffic count-others	1.0	3.0	110	110	0	1	0	1	1080
LV	27	-10240	Bronx Cnty traffic count - vans	1.0	3.0	150	150	1	0	0	0	1540
LV	28	-10240	Bronx Cnty traffic count-others	1.0	3.0	110	110	0	1	0	1	1080
LV	29	10930	Bronx Cnty traffic count - vans	1.0	3.0	180	180	1	0	0	0	1750
LV	30	10930	Bronx Cnty traffic count-others	1.0	3.0	120	120	0	1	0	1	1220
LV	31	-10930	Bronx Cnty traffic count - vans	1.0	3.0	180	180	1	0	0	0	1750
LV	32	-10930	Bronx Cnty traffic count-others	1.0	3.0	120	120	0	1	0	1	1220
LV	33	18900	Bronx Cnty traffic count - vans	1.0	3.0	150	150	1	0	0	0	1450
LV	34	18900	Bronx Cnty traffic count-others	1.0	3.0	100	100	0	1	0	1	1010
LV	35	-18900	Bronx Cnty traffic count - vans	1.0	3.0	150	150	1	0	0	0	1450
LV	36	-18900	Bronx Cnty traffic count-others	1.0	3.0	100	100	0	1	0	1	1010
LV	97	11860	Bronx Cnty traffic count - vans	1.0	3.0	40	40	1	0	0	0	400
LV	98	11860	Bronx Cnty traffic count-others	1.0	3.0	300	300	0	1	0	1	3000
LV	99	-11860	Bronx Cnty traffic count - vans	1.0	3.0	100	100	1	0	0	0	970
LV	100	-11860	Bronx Cnty traffic count-others	1.0	3.0	380	380	0	1	0	1	3780
LV	101	8820	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	200
LV	102	8820	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	150
LV	103	-8820	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	100
LV	104	-8820	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	150
LV	105	48590	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290
LV	106	48590	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	250
LV	107	-48590	Bronx Cnty traffic count - vans	1.0	3.0	40	40	1	0	0	0	390
LV	108	-48590	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	230
LV	109	49560	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290
LV	110	49560	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	290
LV	111	-49560	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	260
LV	112	-49560	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	130
LV	113	50131	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	180
LV	114	50131	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	240
LV	115	-50131	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	330
LV	116	-50131	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	180
LV	117	10380	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290

LV	118	10380	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	210
LV	119	-10380	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	120
LV	120	-10380	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	140
LV	121	9810	Bronx Cnty traffic count - vans	1.0	3.0	110	110	1	0	0	0	1090
LV	122	9810	Bronx Cnty traffic count-others	1.0	3.0	110	110	0	1	0	0	1140
LV	123	9312	Bronx Cnty traffic count - vans	1.0	3.0	110	110	1	0	0	0	1140
LV	124	9312	Bronx Cnty traffic count-others	1.0	3.0	120	120	0	1	0	0	1190
LV	125	-49610	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	120
LV	126	-49610	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	210
LV	127	49610	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	140
LV	128	49610	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	100
LV	143	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	50	50	1	0	0	0	460
LV	144	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	100	100	0	1	0	0	960
LV	145	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	170	170	0	0	0	1	1670
LV	146	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	60	60	1	0	0	0	640
LV	147	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	70	70	0	1	0	0	740
LV	148	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	220	220	0	0	0	1	2170
LV	149	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	140	140	1	0	0	0	1420
LV	150	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	90	90	0	1	0	0	880
LV	151	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	40	40	0	0	0	1	390
LV	152	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	110	110	1	0	0	0	1140
LV	153	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	120	120	0	1	0	0	1200
LV	154	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	140	140	0	0	0	1	1420
LV	155	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	1	0	0	0	230
LV	156	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	0	1	0	0	280
LV	157	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	0	0	0	1	260
LV	158	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	50	50	1	0	0	0	490
LV	159	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	30	30	0	1	0	0	330
LV	160	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	30	30	0	0	0	1	180
LV	161	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	30	30	1	0	0	0	50
LV	162	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	30	30	0	1	0	0	220
LV	163	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	30	30	0	0	0	1	250
LV	164	-11962	NYSDOT S1 WB -CBE Extension	1.0	3.0	30	30	0	1	0	0	220
LV	165	-11962	NYSDOT S1 WB -CBE Extension	1.0	3.0	30	30	0	0	0	1	250
LV	166	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	120	120	1	0	0	0	1230
LV	167	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	190	190	0	1	0	0	1920
LV	168	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	160	160	0	0	0	1	1580
LV	169	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	120	120	1	0	0	0	1160
LV	170	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	170	170	0	1	0	0	1710
LV	171	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	320	320	0	0	0	1	3190
LV	178	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	120	120	1	0	0	0	1150
LV	179	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	180	180	0	1	0	0	1800
LV	180	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	150	150	0	0	0	1	1480
LV	181	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	110	110	1	0	0	0	1080
LV	182	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	160	160	0	1	0	0	1600
LV	183	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	300	300	0	0	0	1	2980

LV Dataset, PM Time Period

LV	1	48831	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	310
LV	2	48831	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	220
LV	3	-48831	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	310
LV	4	-48831	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	220
LV	5	10520	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	300
LV	6	10520	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	210
LV	7	-10520	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290
LV	8	-10520	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	210
LV	17	10180	Bronx Cnty traffic count - vans	1.0	3.0	140	140	1	0	0	0	1350
LV	18	10180	Bronx Cnty traffic count-others	1.0	3.0	100	100	0	1	0	1	950
LV	19	-10180	Bronx Cnty traffic count - vans	1.0	3.0	140	140	1	0	0	0	1350
LV	20	-10180	Bronx Cnty traffic count-others	1.0	3.0	100	100	0	1	0	1	950
LV	21	10190	Bronx Cnty traffic count - vans	1.0	3.0	150	150	1	0	0	0	1520
LV	22	10190	Bronx Cnty traffic count-others	1.0	3.0	110	110	0	1	0	1	1060
LV	23	-10190	Bronx Cnty traffic count - vans	1.0	3.0	150	150	1	0	0	0	1520
LV	24	-10190	Bronx Cnty traffic count-others	1.0	3.0	110	110	0	1	0	1	1060
LV	25	10240	Bronx Cnty traffic count - vans	1.0	3.0	170	170	1	0	0	0	1650
LV	26	10240	Bronx Cnty traffic count-others	1.0	3.0	120	120	0	1	0	1	1160

LV	27	-10240	Bronx Cnty traffic count - vans	1.0	3.0	170	170	1	0	0	0	1650
LV	28	-10240	Bronx Cnty traffic count-others	1.0	3.0	120	120	0	1	0	1	1160
V	29	10930	Bronx Cnty traffic count - vans	1.0	3.0	190	190	1	0	0	0	1870
V	30	10930	Bronx Cnty traffic count-others	1.0	3.0	130	130	0	1	0	1	1310
.V	31	-10930	Bronx Cnty traffic count - vans	1.0	3.0	190	190	1	0	0	0	1870
LV	32	-10930	Bronx Cnty traffic count-others	1.0	3.0	130	130	0	1	0	1	1310
LV	33	18900	Bronx Cnty traffic count - vans	1.0	3.0	160	160	1	0	0	0	1550
V	34	18900	Bronx Cnty traffic count-others	1.0	3.0	110	110	0	1	0	1	1080
V	35	-18900	Bronx Cnty traffic count - vans	1.0	3.0	160	160	1	0	0	0	1550
LV	36	-18900	Bronx Cnty traffic count-others	1.0	3.0	110	110	0	1	0	1	1080
LV	97	11860	Bronx Cnty traffic count - vans	1.0	3.0	50	50	1	0	0	0	500
V	98	11860	Bronx Cnty traffic count-others	1.0	3.0	220	220	0	1	0	1	2180
V	99	-11860	Bronx Cnty traffic count - vans	1.0	3.0	70	70	1	0	0	0	740
.V	100	-11860	Bronx Cnty traffic count-others	1.0	3.0	330	330	0	1	0	1	3310
LV	101	8820	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290
LV	102	8820	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	70
V	103	-8820	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	80
V	104	-8820	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	100
LV	105	48590	Bronx Cnty traffic count - vans	1.0	3.0	40	40	1	0	0	0	420
LV	106	48590	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	210
.V	107	-48590	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290
.V	108	-48590	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	120
.V	109	49560	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	280
LV	110	49560	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	260
LV	111	-49560	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	130
.V	112	-49560	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	80
.V	113	50131	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	210
LV	114	50131	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	160
LV	115	-50131	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	290
.V	116	-50131	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	80
.V	117	10380	Bronx Cnty traffic count - vans	1.0	3.0	40	40	1	0	0	0	420
.V	118	10380	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	150
LV	119	-10380	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	130
LV	120	-10380	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	170
.V	121	9810	Bronx Cnty traffic count - vans	1.0	3.0	150	150	1	0	0	0	1530
.V	122	9810	Bronx Cnty traffic count-others	1.0	3.0	90	90	0	1	0	0	930
LV	123	9312	Bronx Cnty traffic count - vans	1.0	3.0	50	50	1	0	0	0	540
LV	124	9312	Bronx Cnty traffic count-others	1.0	3.0	50	50	0	1	0	0	540
.V	125	-49610	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	150
.V	126	-49610	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	190
.V	127	49610	Bronx Cnty traffic count - vans	1.0	3.0	30	30	1	0	0	0	60
LV	128	49610	Bronx Cnty traffic count-others	1.0	3.0	30	30	0	1	0	1	30
LV	143	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	40	40	1	0	0	0	410
LV	144	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	40	40	0	1	0	0	400
LV	145	11930	CBE grnd cnts-Beach/Taylor EB	1.0	3.0	100	100	0	0	0	1	1000
LV	146	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	40	40	1	0	0	0	430
LV	147	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	50	50	0	1	0	0	500
LV	148	-11930	CBE grnd cnts-Beach/Taylor WB	1.0	3.0	120	120	0	0	0	1	1200
LV	149	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	120	120	1	0	0	0	1170
LV	150	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	40	40	0	1	0	0	420
LV	151	10850	Hunts Point Stdy -Bruckner EB	1.0	3.0	30	30	0	0	0	1	160
LV	152	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	80	80	1	0	0	0	750
LV	153	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	70	70	0	1	0	0	650
LV	154	-10850	Hunts Point Stdy -Bruckner WB	1.0	3.0	30	30	0	0	0	1	170
LV	155	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	1	0	0	0	330
LV	156	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	0	1	0	0	100
LV	157	11020	Hunts Point Stdy -Sheridan NB	1.0	3.0	30	30	0	0	0	1	80
LV	158	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	30	30	1	0	0	0	210
LV	159	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	30	30	0	1	0	0	80
LV	160	-11020	Hunts Point Stdy -Sheridan SB	1.0	3.0	30	30	0	0	0	1	60
LV	161	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	30	30	1	0	0	0	70
LV	162	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	30	30	0	1	0	0	340
LV	163	11962	NYSDOT S1 EB -CBE Extension	1.0	3.0	40	40	0	0	0	1	380
LV	164	-11962	NYSDOT S1 WB -CBE Extension	1.0	3.0	30	30	0	1	0	0	250
LV	165	-11962	NYSDOT S1 WB -CBE Extension	1.0	3.0	30	30	0	0	0	1	280
LV	166	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	110	110	1	0	0	0	1060
LV	167	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	90	90	0	1	0	0	860
LV	168	11890	NYSDOT S1 EB -Jerome/Webster	1.0	3.0	200	200	0	0	0	1	710
LV	169	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	90	90	1	0	0	0	940

170	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	90	90	0	1	0	0	910
171	-11890	NYSDOT S1 WB -Jerome/Webster	1.0	3.0	150	150	0	0	0	1	1530
178	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	100	100	1	0	0	0	990
179	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	80	80	0	1	0	0	810
180	11900	NYSDOT S1 EB -Crotona/Sheridan	1.0	3.0	200	200	0	0	0	1	670
181	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	90	90	1	0	0	0	880
182	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	90	90	0	1	0	0	850
183	-11900	NYSDOT S1 WB -Crotona/Sheridan	1.0	3.0	140	140	0	0	0	1	1440

APPENDIX B

INPUT DATASETS FOR THE BROOKLYN CASE STUDY

OD Dataset, AM Time Period

1	Verrazano Bridge	Bklyn - S	1984 PA counts - 2&3 axles	1.0	3.0	30	240	0	1	0	0	239
2	Verrazano Bridge	Bklyn - S	1984 PA counts - >3 axles	1.0	3.0	33	340	0	0	0	1	332
3	Verrazano Bridge	Bklyn - N	1984 PA counts - 2&3 axles	1.0	3.0	30	160	0	1	0	0	157
4	Verrazano Bridge	Bklyn - N	1984 PA counts - >3 axles	1.0	3.0	30	220	0	0	0	1	217
5	Verrazano Bridge	BQE	1984 PA counts - 2&3 axles	1.0	3.0	30	220	0	1	0	0	218
6	Verrazano Bridge	BQE	1984 PA counts - >3 axles	1.0	3.0	30	310	0	0	0	1	303
7	Verrazano Bridge	All Manhattan	1984 PA counts - 2&3 axles	1.0	3.0	30	50	0	1	0	0	42
8	Verrazano Bridge	All Manhattan	1984 PA counts - >3 axles	1.0	3.0	30	60	0	0	0	1	58
9	BQE	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	156	1560	1	0	0	0	1556
10	BQE	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	60	600	0	1	0	0	625
12	BQE	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	140	0	0	0	1	130
13	Verrazano Bridge	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	110	1	0	0	0	104
14	Verrazano Bridge	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	120	0	1	0	0	125
16	Verrazano Bridge	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	90	0	0	0	1	89
17	Zone 4701	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	110	1	0	0	0	104
18	Zone 4701	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	14
19	Zone 4702	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	35
20	Zone 4703	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	35
21	Zone 4705	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	70	1	0	0	0	69
22	Zone 4705	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	30	0	1	0	0	28
24	Zone 4705	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	7
25	Zone 4706	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	35
26	Zone 4706	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	28
27	Zone 4707	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	70	1	0	0	0	69
28	Zone 4707	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	60	0	1	0	0	70
30	Zone 4708	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	210	1	0	0	0	208
31	Zone 4708	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	14
32	Zone 4709	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	35
33	Zone 4709	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	28
34	Zone 4710	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	250	1	0	0	0	242
35	Zone 4710	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	50	0	1	0	0	42
36	Zone 4710	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	7
37	Zone 4720	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	48	490	1	0	0	0	484
38	Zone 4720	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	160	0	1	0	0	167
40	Zone 4720	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	50	0	0	0	1	48
41	Zone 4730	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	55	560	1	0	0	0	553
42	Zone 4730	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	190	0	1	0	0	194
44	Zone 4730	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	21
45	Zone 4740	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	180	1	0	0	0	173
46	Zone 4740	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	120	0	1	0	0	139
48	Zone 4740	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	21
49	Zone 4800	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	35	350	1	0	0	0	346
50	Zone 4800	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	260	0	1	0	0	306
52	Zone 4800	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	40	0	0	0	1	34
53	Zone 4810	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	35	350	1	0	0	0	346
54	Zone 4810	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	100	0	1	0	0	139
56	Zone 4810	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	7
57	Zone 4820	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	70	1	0	0	0	69
58	Zone 4820	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	70	0	1	0	0	83
60	Zone 4820	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	21
61	Zone 4830	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	45	460	1	0	0	0	450
62	Zone 4830	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	190	0	1	0	0	208
64	Zone 4830	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	60	0	0	0	1	55
65	Zone 4840	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	41	420	1	0	0	0	415
66	Zone 4840	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	280	0	1	0	0	306

OD	68 Zone 4840	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	70	0	0	0	1	62
OD	69 Verrazano Bridge	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	13
OD	70 Zone 4710	BQE	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	30	0	1	0	0	14
OD	72 Zone 4720	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	25
OD	73 Zone 4720	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	7
OD	74 Zone 4730	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	13
OD	75 Zone 4740	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	13
OD	76 Zone 4740	BQE	1989 E. Rvr Cross - 3 axles	1.0	3.0	30	30	0	1	0	0	26
OD	77 Zone 4800	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	13
OD	78 Zone 4810	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	13
OD	79 Zone 4810	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	13
OD	80 Zone 4820	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	20
OD	81 Zone 4840	BQE	1989 E. River Crossings - vans	1.0	3.0	30	220	1	0	0	0	216
OD	82 Zone 4840	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	150	0	1	0	0	143

OD Dataset, Midday Time Period

OD	1 Verrazano Bridge	Bklyn - S	1984 PA counts - 2&3 axles	1.0	3.0	30	270	0	1	0	0	269
OD	2 Verrazano Bridge	Bklyn - S	1984 PA counts - >3 axles	1.0	3.0	37	380	0	0	0	1	373
OD	3 Verrazano Bridge	Bklyn - N	1984 PA counts - 2&3 axles	1.0	3.0	30	180	0	1	0	0	176
OD	4 Verrazano Bridge	Bklyn - N	1984 PA counts - >3 axles	1.0	3.0	30	250	0	0	0	1	244
OD	5 Verrazano Bridge	BQE	1984 PA counts - 2&3 axles	1.0	3.0	30	250	0	1	0	0	246
OD	6 Verrazano Bridge	BQE	1984 PA counts - >3 axles	1.0	3.0	34	350	0	0	0	1	341
OD	7 Verrazano Bridge	All Manhattan	1984 PA counts - 2&3 axles	1.0	3.0	30	50	0	1	0	0	47
OD	8 Verrazano Bridge	All Manhattan	1984 PA counts - >3 axles	1.0	3.0	30	70	0	0	0	1	65
OD	9 BQE	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	72	730	1	0	0	0	721
OD	10 BQE	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	71	710	0	1	0	0	795
OD	12 BQE	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	290	0	0	0	1	286
OD	13 Verrazano Bridge	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	33	330	1	0	0	0	328
OD	14 Verrazano Bridge	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	29
OD	15 Verrazano Bridge	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	60	0	0	0	1	59
OD	16 Zone 4701	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	22
OD	17 Zone 4702	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	90	1	0	0	0	87
OD	18 Zone 4702	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
OD	19 Zone 4703	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	50	1	0	0	0	44
OD	20 Zone 4703	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	19
OD	21 Zone 4705	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
OD	22 Zone 4707	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	70	1	0	0	0	66
OD	23 Zone 4707	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
OD	24 Zone 4708	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	90	1	0	0	0	87
OD	25 Zone 4708	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	30	0	1	0	0	39
OD	27 Zone 4708	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	8
OD	28 Zone 4709	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	70	1	0	0	0	66
OD	29 Zone 4709	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	29
OD	30 Zone 4710	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	140	1	0	0	0	131
OD	31 Zone 4710	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	30	0	1	0	0	29
OD	33 Zone 4720	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	41	420	1	0	0	0	415
OD	34 Zone 4720	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	100	0	1	0	0	116
OD	36 Zone 4720	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	40	0	0	0	1	34
OD	37 Zone 4730	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	35	350	1	0	0	0	349
OD	38 Zone 4730	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	110	0	1	0	0	117
OD	40 Zone 4730	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	60	0	0	0	1	50
OD	41 Zone 4740	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	140	1	0	0	0	131
OD	42 Zone 4740	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	60	0	1	0	0	58
OD	43 Zone 4740	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	8
OD	44 Zone 4800	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	200	1	0	0	0	197
OD	45 Zone 4800	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	170	0	1	0	0	194
OD	47 Zone 4800	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	120	0	0	0	1	118
OD	48 Zone 4810	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	250	1	0	0	0	240
OD	49 Zone 4810	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	80	0	1	0	0	78
OD	50 Zone 4810	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	25
OD	51 Zone 4820	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	250	1	0	0	0	240
OD	52 Zone 4820	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	50	0	1	0	0	59
OD	54 Zone 4820	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	17
OD	55 Zone 4830	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	44	440	1	0	0	0	437
OD	56 Zone 4830	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	230	0	1	0	0	242
OD	58 Zone 4830	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	50	0	0	0	1	42
OD	59 Zone 4840	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	52	530	1	0	0	0	524

60 Zone 4840	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	260	0	1	0	0	310
62 Zone 4840	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	110	0	0	0	1	101
63 Verrazano Bridge	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
64 Verrazano Bridge	BQE	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	24
65 Zone 4709	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	5
66 Zone 4720	BQE	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	35
67 Zone 4720	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	5
68 Zone 4730	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	24
69 Zone 4730	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
70 Zone 4740	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	5
71 Zone 4800	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
72 Zone 4810	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	12
73 Zone 4810	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
74 Zone 4820	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	12
75 Zone 4820	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
76 Zone 4830	BQE	1989 E. River Crossings - vans	1.0	3.0	30	30	1	0	0	0	12
77 Zone 4830	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	10
78 Zone 4840	BQE	1989 E. River Crossings - vans	1.0	3.0	30	190	1	0	0	0	189
79 Zone 4840	BQE	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	90	0	1	0	0	94

OD Dataset, PM Time Period

1 Verrazano Bridge	Bklyn - S	1984 PA counts - 2&3 axles	1.0	3.0	30	130	0	1	0	0	122
2 Verrazano Bridge	Bklyn - S	1984 PA counts - >3 axles	1.0	3.0	30	170	0	0	0	1	169
3 Verrazano Bridge	Bklyn - N	1984 PA counts - 2&3 axles	1.0	3.0	30	90	0	1	0	0	80
4 Verrazano Bridge	Bklyn - N	1984 PA counts - >3 axles	1.0	3.0	30	120	0	0	0	1	111
5 Verrazano Bridge	BQE	1984 PA counts - 2&3 axles	1.0	3.0	30	120	0	1	0	0	112
6 Verrazano Bridge	BQE	1984 PA counts - >3 axles	1.0	3.0	30	160	0	0	0	1	155
7 Verrazano Bridge	All Manhattan	1984 PA counts - 2&3 axles	1.0	3.0	30	30	0	1	0	0	21
8 Verrazano Bridge	All Manhattan	1984 PA counts - >3 axles	1.0	3.0	30	40	0	0	0	1	30
9 BQE	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	37	370	1	0	0	0	368
10 BQE	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	310	0	1	0	0	364
12 BQE	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	100	0	0	0	1	96
13 Verrazano Bridge	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	110	1	0	0	0	100
14 Verrazano Bridge	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	40	0	1	0	0	47
16 Verrazano Bridge	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	12
17 Zone 4701	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	12
18 Zone 4702	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	12
19 Zone 4703	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	23
20 Zone 4705	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	33
21 Zone 4707	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	33
22 Zone 4707	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	12
23 Zone 4707	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	12
24 Zone 4708	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	33
25 Zone 4709	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	33
26 Zone 4710	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	70	1	0	0	0	67
27 Zone 4710	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	50	0	1	0	0	47
28 Zone 4710	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	12
29 Zone 4720	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	310	1	0	0	0	301
30 Zone 4720	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	80	0	1	0	0	70
31 Zone 4720	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	24
32 Zone 4730	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	210	1	0	0	0	201
33 Zone 4730	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	80	0	1	0	0	70
34 Zone 4740	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	40	1	0	0	0	33
35 Zone 4740	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	40	0	1	0	0	35
36 Zone 4740	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	12
37 Zone 4800	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	240	1	0	0	0	234
38 Zone 4800	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	150	0	1	0	0	153
40 Zone 4800	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	90	0	0	0	1	84
41 Zone 4810	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	140	1	0	0	0	134
42 Zone 4810	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	30	0	1	0	0	24
44 Zone 4820	Lower Manhattan	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	12
45 Zone 4820	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	12
46 Zone 4830	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	30	270	1	0	0	0	267
47 Zone 4830	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	150	0	1	0	0	176
49 Zone 4830	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	50	0	0	0	1	48
50 Zone 4840	Lower Manhattan	1989 E. River Crossings - vans	1.0	3.0	63	640	1	0	0	0	635
51 Zone 4840	Lower Manhattan	1989 E. Rvr Cross - 2&3 axles	1.0	3.0	30	160	0	1	0	0	165

[illegible]	53 Zone 4840	Lower Manhattan	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	80	0	0	0	1	72
[illegible]	54 Zone 4840	BQE	1989 E. River Crossings - vans	1.0	3.0	30	60	1	0	0	0	58
[illegible]	55 Zone 4840	BQE	1989 E. Rvr Cross - 2 axles	1.0	3.0	30	30	0	1	0	0	12
[illegible]	56 Zone 4840	BQE	1989 E. Rvr Cross - >3 axles	1.0	3.0	30	30	0	0	0	1	8

OT Dataset, AM Time Period

OT	1 All Origins	Verrazano Bridge	1991 TBTA toll counts WB	1.0	3.0	50	50	0	1	0	0	507
OT	2 All Origins	Verrazano Bridge	1991 TBTA toll counts WB	1.0	3.0	50	50	0	0	0	1	446
T	3 All Origins	JFK - Linden Ave	1985 JFK Air Cargo Study	1.0	3.0	0	30	1	0	0	0	86
T	4 All Origins	JFK - Linden Ave	1985 JFK Air Cargo Study	1.0	3.0	0	30	0	1	0	1	173
OT	5 JFK - Linden Ave	All Destinations	1985 JFK Air Cargo Study	1.0	3.0	0	30	1	0	0	0	92
OT	6 JFK - Linden Ave	All Destinations	1985 JFK Air Cargo Study	1.0	3.0	0	30	0	1	0	1	91

OT Dataset, Midday Time Period

OT	1 All Origins	Verrazano Bridge	1991 TBTA toll counts WB	1.0	3.0	50	50	0	1	0	0	690
OT	2 All Origins	Verrazano Bridge	1991 TBTA toll counts WB	1.0	3.0	50	50	0	0	0	1	607
OT	3 All Origins	JFK - Linden Ave	1985 JFK Air Cargo Study	1.0	3.0	0	30	1	0	0	0	132
OT	4 All Origins	JFK - Linden Ave	1985 JFK Air Cargo Study	1.0	3.0	0	30	0	1	0	1	261
OT	5 JFK - Linden Ave	All Destinations	1985 JFK Air Cargo Study	1.0	3.0	0	30	1	0	0	0	134
OT	6 JFK - Linden Ave	All Destinations	1985 JFK Air Cargo Study	1.0	3.0	0	30	0	1	0	1	261

OT Dataset, PM Time Period

OT	1 All Origins	Verrazano Bridge	1991 TBTA toll counts WB	1.0	3.0	50	50	0	1	0	0	1066
OT	2 All Origins	Verrazano Bridge	1991 TBTA toll counts WB	1.0	3.0	50	50	0	0	0	1	937
OT	3 All Origins	JFK - Linden Ave	1985 JFK Air Cargo Study	1.0	3.0	0	30	1	0	0	0	126
OT	4 All Origins	JFK - Linden Ave	1985 JFK Air Cargo Study	1.0	3.0	0	30	0	1	0	1	92
OT	5 JFK - Linden Ave	All Destinations	1985 JFK Air Cargo Study	1.0	3.0	0	30	1	0	0	0	98
OT	6 JFK - Linden Ave	All Destinations	1985 JFK Air Cargo Study	1.0	3.0	0	30	0	1	0	1	108

LV Dataset, AM Time Period

LV	1	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - vans	1.0	3.0	370	370	1	0	0	0	1265
LV	2	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - 2axle	1.0	3.0	60	60	0	1	0	0	211
LV	3	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - >=2axle	1.0	3.0	190	190	0	1	0	1	843
LV	4	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - vans	1.0	3.0	280	280	1	0	0	0	949
LV	5	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - 2axle	1.0	3.0	160	160	0	1	0	0	527
LV	6	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - >=2axle	1.0	3.0	160	160	0	1	0	1	1054
LV	7	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - vans	1.0	3.0	30	30	1	0	0	0	48
LV	8	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - 2&3axle	1.0	3.0	30	30	0	1	0	0	66
LV	10	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - >3axle	1.0	3.0	30	30	0	0	0	1	3
LV	11	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - vans	1.0	3.0	30	30	1	0	0	0	295
LV	12	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - 2&3axle	1.0	3.0	30	30	0	1	0	0	406
LV	14	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - >3axle	1.0	3.0	30	30	0	0	0	1	19
LV	15	-11090	Gowanus G-3	Gowanus ground count - vans	1.0	3.0	90	90	1	0	0	0	865
LV	16	-11090	Gowanus G-3	Gowanus ground count - 2axle	1.0	3.0	50	50	0	1	0	0	481
LV	17	-11090	Gowanus G-3	Gowanus groundcount - >=2axle	1.0	3.0	50	50	0	1	0	1	962
LV	18	11090	Gowanus G-4	Gowanus ground count - vans	1.0	3.0	120	120	1	0	0	0	1210
LV	19	11090	Gowanus G-4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	202
LV	20	11090	Gowanus G-4	Gowanus groundcount - >=2axle	1.0	3.0	60	60	0	1	0	1	807
LV	21	12320	Gowanus G-8	Gowanus ground count - vans	1.0	3.0	40	40	1	0	0	0	440
LV	22	12320	Gowanus G-8	Gowanus ground count - 2axle	1.0	3.0	50	50	0	1	0	0	529
LV	23	12320	Gowanus G-8	Gowanus groundcount - >=2axle	1.0	3.0	40	40	0	1	0	1	969
LV	24	-12320	Gowanus G-9/G-18	Gowanus ground count - vans	1.0	3.0	140	140	1	0	0	0	1410
LV	25	-12320	Gowanus G-9/G-18	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	157
LV	26	-12320	Gowanus G-9/G-18	Gowanus groundcount - >=2axle	1.0	3.0	60	60	0	1	0	1	784
LV	27	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	110	110	1	0	0	0	1133
LV	28	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	40	40	0	1	0	0	426
LV	29	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	40	40	0	1	0	1	849
LV	30	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	30	30	1	0	0	0	152

V	31	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	50	50	0	1	0	0	453
LV	32	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	60	60	0	1	0	1	1012
LV	33	933445	Verrazano Br - WBD	91 Toll Data & GowClass - vans	1.0	3.0	90	90	1	0	0	0	434
V	34	933445	Verrazano Br - WBD	91 Toll Data - 2&3axle	1.0	3.0	80	80	0	1	0	0	508
V	36	933445	Verrazano Br - WBD	91 Toll Data - >3axle	1.0	3.0	90	90	0	0	0	1	447
LV	37	51600	4th Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	50	50	1	0	0	0	480
LV	38	51600	4th Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	64
V	39	51600	4th Avenue - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	70
V	40	-51600	4th Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	64
V	41	-51600	4th Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	45
LV	42	-51600	4th Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	48
LV	43	51670	5th Avenue - Loc 2b	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	43
V	44	51670	5th Avenue - Loc 2b	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	8
V	45	51670	5th Avenue - Loc 2b	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	33
LV	46	-51670	5th Avenue - Loc 2a	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	13
LV	47	-51670	5th Avenue - Loc 2a	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	13
V	48	-51670	5th Avenue - Loc 2a	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	13
V	49	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	150
V	50	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	96
LV	51	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	139
LV	52	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	148
V	53	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	27
V	54	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	54
LV	55	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	315
LV	56	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	102
LV	57	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	173
LV	58	912540	Ocean Pkwy - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	55
LV	59	912540	Ocean Pkwy - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	10
LV	60	912540	Ocean Pkwy - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	10
LV	61	52150	Coney Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	76
LV	62	52150	Coney Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	12
LV	63	52150	Coney Avenue - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	21
LV	64	-52150	Coney Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	279
LV	65	-52150	Coney Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	83
LV	66	-52150	Coney Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	112
LV	67	52380	Ocean Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	169
LV	68	52380	Ocean Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	46
LV	69	52380	Ocean Avenue - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	66
LV	70	-52380	Ocean Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	14
LV	71	-52380	Ocean Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	6
LV	72	-52380	Ocean Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	12
LV	73	12220	Flatbush Ave - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	239
LV	74	12220	Flatbush Ave - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	107
LV	75	12220	Flatbush Ave - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	235
LV	76	-12220	Flatbush Ave - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	59
LV	77	-12220	Flatbush Ave - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	15
LV	78	-12220	Flatbush Ave - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	26
LV	79	14920	Linden Ave @ Caton	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	73
LV	80	-14920	Linden Ave @ Caton	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	73
LV	81	14960	Linden @ Kings Hwy	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	135
LV	82	-14960	Linden @ Kings Hwy	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	135
LV	83	14981	Linden @ Penna Ave	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	106
LV	84	-14981	Linden @ Penna Ave	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	106
LV	95	-57310	Union St.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	192
LV	98	51960	Stillwell Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	85
LV	99	-51960	Stillwell Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	90
LV	100	-58690	Crospey Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	333
LV	101	58690	Crospey Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	288
LV	102	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	80	80	1	0	0	0	805
LV	103	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	468
LV	105	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	75
LV	106	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	80	80	1	0	0	0	805
LV	107	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	468
LV	109	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	75
LV	110	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	50	50	1	0	0	0	483
LV	111	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	280
LV	113	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	45
LV	114	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	50	50	1	0	0	0	483
LV	115	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	280

V	117	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	45
LV	118	12240	Flatbush Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	206
V	119	-12240	Flatbush Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	206
V	120	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	1	0	0	0	238
V	121	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	190
LV	123	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	54
LV	124	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	1	0	0	0	238
V	125	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	190
V	127	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	54
V	128	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	396
LV	129	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	318
V	131	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	90
V	132	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	396
V	133	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	318
LV	135	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	90
LV	136	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	60	60	1	0	0	0	568
V	137	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	455
V	139	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	129
V	140	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	60	60	1	0	0	0	568
LV	141	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	455
V	143	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	129
V	144	58910	Flatlands Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	65
V	145	-58910	Flatlands Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	65
LV	146	58960	Flatlands Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	65
LV	147	-58960	Flatlands Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	65
V	148	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	375
V	149	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	356
V	151	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	52
LV	152	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	375
V	153	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	356
V	155	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	52
V	156	56510	Flushing Ave	Brooklyn Truck Route Study	1.0	3.0	60	60	0	1	0	1	611
LV	157	-56510	Flushing Ave	Brooklyn Truck Route Study	1.0	3.0	60	60	0	1	0	1	611
LV	158	56130	Metropolitan Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	299
V	159	-56130	Metropolitan Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	299
V	160	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s v&p	1.0	3.0	600	600	1	0	0	0	3111
V	161	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s sut	1.0	3.0	300	300	0	1	0	0	1536
LV	162	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s comb	1.0	3.0	90	90	0	0	0	1	440
V	163	11206	Manhattan Bridge	91 TBTA Survey - vans&pickups	1.0	3.0	250	250	1	0	0	0	2518
V	164	11206	Manhattan Bridge	91 TBTA Survey - SU Trucks	1.0	3.0	100	100	0	1	0	0	1030
V	165	11206	Manhattan Bridge	91 TBTA Survey - Comb. Trucks	1.0	3.0	30	30	0	0	0	1	291
LV	166	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s v&p	1.0	3.0	350	350	1	0	0	0	1743
LV	167	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s sut	1.0	3.0	170	170	0	1	0	0	860
V	168	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s comb	1.0	3.0	50	50	0	0	0	1	247
V	169	11236	Williamsburg Bridge	91 TBTA Survey - vans&pickups	1.0	3.0	250	250	1	0	0	0	2513
V	170	11236	Williamsburg Bridge	91 TBTA Survey - SU Trucks	1.0	3.0	140	140	0	1	0	0	1367
LV	171	11236	Williamsburg Bridge	91 TBTA Survey - Comb. Trucks	1.0	3.0	30	30	0	0	0	1	191

LV Dataset, Midday Time Period

LV	1	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - vans	1.0	3.0	350	350	1	0	0	0	1196
V	2	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - 2axle	1.0	3.0	300	300	0	1	0	0	1025
V	3	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - >=2axle	1.0	3.0	150	150	0	1	0	1	1537
LV	4	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - vans	1.0	3.0	400	400	1	0	0	0	1366
LV	5	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - 2axle	1.0	3.0	100	100	0	1	0	0	342
V	6	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - >=2axle	1.0	3.0	150	150	0	1	0	1	854
V	7	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - vans	1.0	3.0	30	30	1	0	0	0	117
V	8	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - 2&3axle	1.0	3.0	30	30	0	1	0	0	161
LV	10	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - >3axle	1.0	3.0	30	30	0	0	0	1	7
LV	11	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - vans	1.0	3.0	30	30	1	0	0	0	182
V	12	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - 2&3axle	1.0	3.0	30	30	0	1	0	0	251
V	14	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - >3axle	1.0	3.0	30	30	0	0	0	1	11
LV	15	-11090	Gowanus G-3	Gowanus ground count - vans	1.0	3.0	50	50	1	0	0	0	541
LV	16	-11090	Gowanus G-3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	135
V	17	-11090	Gowanus G-3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	338
V	18	11090	Gowanus G-4	Gowanus ground count - vans	1.0	3.0	50	50	1	0	0	0	546
V	19	11090	Gowanus G-4	Gowanus ground count - 2axle	1.0	3.0	50	50	0	1	0	0	468
LV	20	11090	Gowanus G-4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	702

V	21	12320	Gowanus G-8	Gowanus ground count - vans	1.0	3.0	80	80	1	0	0	0	842
LV	22	12320	Gowanus G-8	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	316
LV	23	12320	Gowanus G-8	Gowanus ground count - >=2axle	1.0	3.0	40	40	0	1	0	1	737
.V	24	-12320	Gowanus G-9/G-18	Gowanus ground count - vans	1.0	3.0	100	100	1	0	0	0	1046
.V	25	-12320	Gowanus G-9/G-18	Gowanus ground count - 2axle	1.0	3.0	70	70	0	1	0	0	697
.V	26	-12320	Gowanus G-9/G-18	Gowanus ground count - >=2axle	1.0	3.0	50	50	0	1	0	1	1220
LV	27	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	70	70	1	0	0	0	693
V	28	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	80	80	0	1	0	0	759
.V	29	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	110	110	0	1	0	1	1815
V	30	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	60	60	1	0	0	0	646
LV	31	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	60	60	0	1	0	0	575
LV	32	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	90	90	0	1	0	1	1476
.V	33	933445	Verrazano Br - WBD	91 Toll Data & GowClass - vans	1.0	3.0	300	300	1	0	0	0	1485
.V	34	933445	Verrazano Br - WBD	91 Toll Data - 2&3axle	1.0	3.0	110	110	0	1	0	0	692
.V	36	933445	Verrazano Br - WBD	91 Toll Data - >3axle	1.0	3.0	120	120	0	0	0	1	608
LV	37	51600	4th Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	282
.V	38	51600	4th Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	110
.V	39	51600	4th Avenue - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	117
.V	40	-51600	4th Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	344
LV	41	-51600	4th Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	130
LV	42	-51600	4th Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	171
.V	43	51670	5th Avenue - Loc 2b	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	165
.V	44	51670	5th Avenue - Loc 2b	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	82
.V	45	51670	5th Avenue - Loc 2b	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	95
LV	46	-51670	5th Avenue - Loc 2a	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	82
.V	47	-51670	5th Avenue - Loc 2a	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	17
.V	48	-51670	5th Avenue - Loc 2a	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	39
.V	49	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	93
LV	50	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	47
LV	51	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	68
.V	52	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	260
.V	53	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	94
.V	54	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	170
LV	55	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	57
.V	56	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	17
.V	57	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	23
.V	58	912540	Ocean Pkwy - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	155
LV	59	912540	Ocean Pkwy - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	49
LV	60	912540	Ocean Pkwy - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	56
.V	61	52150	Coney Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	40	40	1	0	0	0	383
.V	62	52150	Coney Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	89
.V	63	52150	Coney Avenue - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	118
LV	64	-52150	Coney Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	40	40	1	0	0	0	401
.V	65	-52150	Coney Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	180
.V	66	-52150	Coney Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	228
.V	67	52380	Ocean Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	200
LV	68	52380	Ocean Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	111
LV	69	52380	Ocean Avenue - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	127
.V	70	-52380	Ocean Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	44
.V	71	-52380	Ocean Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	74
.V	72	-52380	Ocean Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	129
LV	73	12220	Flatbush Ave - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	201
.V	74	12220	Flatbush Ave - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	96
.V	75	12220	Flatbush Ave - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	110
.V	76	-12220	Flatbush Ave - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	104
LV	77	-12220	Flatbush Ave - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	22
LV	78	-12220	Flatbush Ave - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	47
.V	79	14920	Linden Ave @ Caton	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	119
.V	80	14920	Linden Ave @ Caton	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	119
.V	81	14960	Linden @ Kings Hwy	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	219
LV	82	14960	Linden @ Kings Hwy	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	219
.V	83	14981	Linden @ Penna Ave	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	172
.V	84	14981	Linden @ Penna Ave	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	172
.V	95	-57310	Union St.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	341
LV	98	51960	Stillwell Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	265
LV	99	-51960	Stillwell Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	246
.V	100	-58690	Crospey Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	60	60	0	1	0	1	617
.V	101	58690	Crospey Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	60	60	0	1	0	1	561
.V	102	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	140	140	1	0	0	0	1418

LV	103	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	70	70	0	1	0	0	824
LV	105	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	133
LV	106	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	140	140	1	0	0	0	1418
LV	107	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	70	70	0	1	0	0	824
LV	109	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	133
LV	110	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	90	90	1	0	0	0	851
LV	111	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	495
LV	113	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	80
LV	114	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	90	90	1	0	0	0	851
LV	115	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	495
LV	117	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	80
LV	118	12240	Flatbush Ave - 3	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	1	364
LV	119	-12240	Flatbush Ave - 3	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	1	364
LV	120	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	419
LV	121	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	336
LV	123	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	95
LV	124	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	419
LV	125	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	336
LV	127	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	95
LV	128	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	70	70	1	0	0	0	698
LV	129	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	50	50	0	1	0	0	559
LV	131	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	159
LV	132	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	70	70	1	0	0	0	698
LV	133	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	50	50	0	1	0	0	559
LV	135	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	159
LV	136	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	100	100	1	0	0	0	1001
LV	137	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	70	70	0	1	0	0	802
LV	139	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	227
LV	140	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	100	100	1	0	0	0	1001
LV	141	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	70	70	0	1	0	0	802
LV	143	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	227
LV	144	58910	Flatlands Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	115
LV	145	-58910	Flatlands Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	115
LV	146	58960	Flatlands Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	115
LV	147	-58960	Flatlands Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	115
LV	148	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	70	70	1	0	0	0	660
LV	149	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	60	60	0	1	0	0	627
LV	151	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	91
LV	152	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	70	70	1	0	0	0	660
LV	153	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	60	60	0	1	0	0	627
LV	155	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	91
LV	156	56510	Flushing Ave	Brooklyn Truck Route Study	1.0	3.0	110	110	0	1	0	1	1077
LV	157	-56510	Flushing Ave	Brooklyn Truck Route Study	1.0	3.0	110	110	0	1	0	1	1077
LV	158	56130	Metropolitan Ave	Brooklyn Truck Route Study	1.0	3.0	50	50	0	1	0	1	527
LV	159	-56130	Metropolitan Ave	Brooklyn Truck Route Study	1.0	3.0	50	50	0	1	0	1	527
LV	160	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s v&p	1.0	3.0	1100	1100	1	0	0	0	5654
LV	161	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s sut	1.0	3.0	600	600	0	1	0	0	2791
LV	162	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s comb	1.0	3.0	160	160	0	0	0	1	800
LV	163	11206	Manhattan Bridge	91 TBTA Survey - vans&pickups	1.0	3.0	200	200	1	0	0	0	2010
LV	164	11206	Manhattan Bridge	91 TBTA Survey - SU Trucks	1.0	3.0	110	110	0	1	0	0	1107
LV	165	11206	Manhattan Bridge	91 TBTA Survey - Comb. Trucks	1.0	3.0	40	40	0	0	0	1	425
LV	166	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s v&p	1.0	3.0	600	600	1	0	0	0	2958
LV	167	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s sut	1.0	3.0	300	300	0	1	0	0	1460
LV	168	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s comb	1.0	3.0	80	80	0	0	0	1	419
LV	169	11236	Williamsburg Bridge	91 TBTA Survey - vans&pickups	1.0	3.0	190	190	1	0	0	0	1891
LV	170	11236	Williamsburg Bridge	91 TBTA Survey - SU Trucks	1.0	3.0	100	100	0	1	0	0	1039
LV	171	11236	Williamsburg Bridge	91 TBTA Survey - Comb. Trucks	1.0	3.0	30	30	0	0	0	1	312

LV Dataset, PM Time Period

LV	1	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - vans	1.0	3.0	320	320	1	0	0	0	1096
LV	2	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - 2axle	1.0	3.0	210	210	0	1	0	0	731
LV	3	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - >=2axle	1.0	3.0	160	160	0	1	0	1	1279
LV	4	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - vans	1.0	3.0	430	430	1	0	0	0	1462
LV	5	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - 2axle	1.0	3.0	110	110	0	1	0	0	365
LV	6	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - >=2axle	1.0	3.0	160	160	0	1	0	1	913
LV	7	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - vans	1.0	3.0	30	30	1	0	0	0	236

V	8	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - 2&3axle	1.0	3.0	30	30	0	1	0	0	324
LV	10	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - >3axle	1.0	3.0	30	30	0	0	0	1	15
LV	11	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - vans	1.0	3.0	30	30	1	0	0	0	152
V	12	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - 2&3axle	1.0	3.0	30	30	0	1	0	0	209
V	14	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - >3axle	1.0	3.0	30	30	0	0	0	1	10
LV	15	-11090	Gowanus G-3	Gowanus ground count - vans	1.0	3.0	90	90	1	0	0	0	949
LV	16	-11090	Gowanus G-3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	237
V	17	-11090	Gowanus G-3	Gowanus ground count - >=2axle	1.0	3.0	40	40	0	1	0	1	593
V	18	11090	Gowanus G-4	Gowanus ground count - vans	1.0	3.0	60	60	1	0	0	0	623
V	19	11090	Gowanus G-4	Gowanus ground count - 2axle	1.0	3.0	40	40	0	1	0	0	416
LV	20	11090	Gowanus G-4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	728
LV	21	12320	Gowanus G-8	Gowanus ground count - vans	1.0	3.0	120	120	1	0	0	0	1181
V	22	12320	Gowanus G-8	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	338
V	23	12320	Gowanus G-8	Gowanus ground count - >=2axle	1.0	3.0	50	50	0	1	0	1	844
LV	24	-12320	Gowanus G-9/G-18	Gowanus ground count - vans	1.0	3.0	90	90	1	0	0	0	878
LV	25	-12320	Gowanus G-9/G-18	Gowanus ground count - 2axle	1.0	3.0	50	50	0	1	0	0	527
V	26	-12320	Gowanus G-9/G-18	Gowanus ground count - >=2axle	1.0	3.0	40	40	0	1	0	1	878
V	27	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	60	60	1	0	0	0	629
V	28	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	50	50	0	1	0	0	530
LV	29	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	50	50	0	1	0	1	1027
LV	30	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	130	130	1	0	0	0	1267
.V	31	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	50	50	0	1	0	0	474
.V	32	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	70	70	0	1	0	1	1126
LV	33	933445	Verrazano Br - WBD	91 Toll Data & GowClass - vans	1.0	3.0	560	560	1	0	0	0	2804
LV	34	933445	Verrazano Br - WBD	91 Toll Data - 2&3axle	1.0	3.0	160	160	0	1	0	0	1065
.V	36	933445	Verrazano Br - WBD	91 Toll Data - >3axle	1.0	3.0	190	190	0	0	0	1	937
.V	37	51600	4th Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	195
.V	38	51600	4th Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	44
LV	39	51600	4th Avenue - Loc 4	Gowanus groundcount - >=2axle	1.0	3.0	30	30	0	1	0	1	44
LV	40	-51600	4th Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	40	40	1	0	0	0	417
.V	41	-51600	4th Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	69
.V	42	-51600	4th Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	69
LV	43	51670	5th Avenue - Loc 2b	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	60
LV	44	51670	5th Avenue - Loc 2b	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	4
.V	45	51670	5th Avenue - Loc 2b	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	4
.V	46	-51670	5th Avenue - Loc 2a	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	26
.V	47	-51670	5th Avenue - Loc 2a	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	19
LV	48	-51670	5th Avenue - Loc 2a	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	19
LV	49	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	34
.V	50	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	27
.V	51	14850	Ft. Ham. Pkwy - 1b	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	38
LV	52	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	286
LV	53	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	26
.V	54	-14850	Ft. Ham. Pkwy - 1a	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	72
.V	55	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	35
.V	56	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	10
LV	57	-912540	Ocean Pkwy - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	10
LV	58	912540	Ocean Pkwy - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	125
.V	59	912540	Ocean Pkwy - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	36
.V	60	912540	Ocean Pkwy - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	36
LV	61	52150	Coney Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	227
LV	62	52150	Coney Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	53
.V	63	52150	Coney Avenue - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	72
.V	64	-52150	Coney Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	50	50	1	0	0	0	450
.V	65	-52150	Coney Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	90
LV	66	-52150	Coney Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	97
LV	67	52380	Ocean Avenue - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	137
.V	68	52380	Ocean Avenue - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	24
.V	69	52380	Ocean Avenue - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	26
LV	70	-52380	Ocean Avenue - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	19
LV	71	-52380	Ocean Avenue - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	71
.V	72	-52380	Ocean Avenue - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	71
.V	73	12220	Flatbush Ave - Loc 4	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	114
.V	74	12220	Flatbush Ave - Loc 4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	45
LV	75	12220	Flatbush Ave - Loc 4	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	62
LV	76	-12220	Flatbush Ave - Loc 3	Gowanus ground count - vans	1.0	3.0	30	30	1	0	0	0	121
.V	77	-12220	Flatbush Ave - Loc 3	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	28
.V	78	-12220	Flatbush Ave - Loc 3	Gowanus ground count - >=2axle	1.0	3.0	30	30	0	1	0	1	50
LV	79	14920	Linden Ave @ Caton	51 Data with multipliers	1.0	3.0	30	30	0	1	0	1	127

V	80	14920	Linden Ave @ Caton	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	127
LV	81	14960	Linden @ Kings Hwy	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	234
V	82	14960	Linden @ Kings Hwy	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	234
V	83	14981	Linden @ Penna Ave	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	184
V	84	14981	Linden @ Penna Ave	S1 Data with multipliers	1.0	3.0	30	30	0	1	0	1	184
LV	95	-57310	Union St.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	40	40	0	1	0	1	397
LV	98	51960	Stillwell Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	101
V	99	-51960	Stillwell Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	118
V	100	-58690	Crospey Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	291
V	101	58690	Crospey Ave.	NYCDOT Bridge Report - 1988 Cts	1.0	3.0	30	30	0	1	0	1	221
LV	102	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	90	90	1	0	0	0	888
V	103	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	50	50	0	1	0	0	516
V	105	12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	83
V	106	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	90	90	1	0	0	0	888
LV	107	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	50	50	0	1	0	0	516
LV	109	-12110	Flatbush Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	83
V	110	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	50	50	1	0	0	0	533
V	111	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	310
V	113	12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	50
LV	114	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	50	50	1	0	0	0	533
V	115	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	310
V	117	-12120	Flatbush Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	50
V	118	12240	Flatbush Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	228
LV	119	-12240	Flatbush Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	228
LV	120	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	1	0	0	0	262
V	121	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	211
V	123	14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	60
V	124	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	1	0	0	0	262
LV	125	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	211
V	127	-14480	Atlantic Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	60
V	128	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	437
V	129	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	350
LV	131	14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	99
LV	132	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	437
V	133	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	0	350
V	135	-14510	Atlantic Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	99
V	136	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	60	60	1	0	0	0	626
LV	137	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	502
V	139	14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	142
V	140	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	60	60	1	0	0	0	626
V	141	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	502
LV	143	-14550	Atlantic Ave - 3	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	142
LV	144	58910	Flatlands Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	72
V	145	-58910	Flatlands Ave - 1	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	72
V	146	58960	Flatlands Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	72
V	147	-58960	Flatlands Ave - 2	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	72
LV	148	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	413
V	149	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	393
V	151	56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	57
V	152	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	40	40	1	0	0	0	413
LV	153	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	40	40	0	1	0	0	393
LV	155	-56720	Myrtle Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	0	0	1	57
V	156	56510	Flushing Ave	Brooklyn Truck Route Study	1.0	3.0	70	70	0	1	0	1	674
V	157	-56510	Flushing Ave	Brooklyn Truck Route Study	1.0	3.0	70	70	0	1	0	1	674
V	158	56130	Metropolitan Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	330
LV	159	-56130	Metropolitan Ave	Brooklyn Truck Route Study	1.0	3.0	30	30	0	1	0	1	330
V	160	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s v&p	1.0	3.0	900	900	1	0	0	0	4566
V	161	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s sut	1.0	3.0	500	500	0	1	0	0	2254
V	162	11203	Manhattan Bridge	1988 NYCDOT & NYCDCP %'s comb	1.0	3.0	140	140	0	0	0	1	646
LV	163	11206	Manhattan Bridge	91 TBTA Survey - vans&pickups	1.0	3.0	120	120	1	0	0	0	1161
LV	164	11206	Manhattan Bridge	91 TBTA Survey - SU Trucks	1.0	3.0	50	50	0	1	0	0	496
V	165	11206	Manhattan Bridge	91 TBTA Survey - Comb. Trucks	1.0	3.0	30	30	0	0	0	1	253
V	166	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s v&p	1.0	3.0	600	600	1	0	0	0	2887
V	167	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s sut	1.0	3.0	300	300	0	1	0	0	1425
LV	168	11233	Williamsburg Bridge	1988 NYCDOT & NYCDCP %'s comb	1.0	3.0	80	80	0	0	0	1	409
V	169	11236	Williamsburg Bridge	91 TBTA Survey - vans&pickups	1.0	3.0	120	120	1	0	0	0	1161
V	170	11236	Williamsburg Bridge	91 TBTA Survey - SU Trucks	1.0	3.0	50	50	0	1	0	0	516
V	171	11236	Williamsburg Bridge	91 TBTA Survey - Comb. Trucks	1.0	3.0	30	30	0	0	0	1	121

breakdown of vehicle types by time of day does not deviate substantially from those that pertain to the day as a whole.

4.3.3 LV Constraints

Table 4.11 shows an excerpt from the 144 constraints pertaining to the AM period analysis. (There are 144 similar LV constraints for the midday and PM peak time periods, respectively, as can be found in Appendix B.) They break down, categorically into:

- 6 observations for the BQE that are combinations of data from the S-1 Highway Sufficiency File kept by NYSDOT and classification counts taken by the engineering consultant for the Gowanus project;

- 6 more S-1 based observations for Linden Boulevard, taken in combination with NYSDOT's default parameters for the distribution of traffic by time-of-day and vehicle class;

- 6 observations for the Brooklyn Battery Tunnel, 6 for the Williamsburg Bridge and 6 more for the Manhattan Bridge based on a combination of the NYCDCP survey data and 1991 TBTA toll plaza data;

- 60 observations based on data collected by the Gowanus project engineering consultant;

- o 3 observations from the Verrazano Bridge westbound toll data;
- o 5 observations based on the NYCDOT bridge report; and
- o 46 observations based on the 1985-1986 Brookly Truck Route Study (see Figure 4.4).

Table 4.11: LV Dataset Excerpt - AM Time Period

1	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - vans	1.0	3.0	370	370	1	0	0	0	1265
2	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - 2axle	1.0	3.0	60	60	0	1	0	0	211
3	933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - >=2axle	1.0	3.0	190	190	0	1	0	1	843
4	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - vans	1.0	3.0	280	280	1	0	0	0	949
5	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - 2axle	1.0	3.0	160	160	0	1	0	0	527
6	-933683	BQE - N of WillBr	S-1 & Gow Cls Cnts - >=2axle	1.0	3.0	160	160	0	1	0	1	1054
7	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - vans	1.0	3.0	30	30	1	0	0	0	48
8	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - 2&3axle	1.0	3.0	30	30	0	1	0	0	66
10	9837	Bklyn Batt Tun - SBD	91 TBTA Surv/May Toll - >3axle	1.0	3.0	30	30	0	0	0	1	3
11	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - vans	1.0	3.0	30	30	1	0	0	0	295
12	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - 2&3axle	1.0	3.0	30	30	0	1	0	0	406
14	9830	Bklyn Batt Tun - NBD	91 TBTA Surv/May Toll - >3axle	1.0	3.0	30	30	0	0	0	1	19
15	-11090	Gowanus G-3	Gowanus ground count - vans	1.0	3.0	90	90	1	0	0	0	865
16	-11090	Gowanus G-3	Gowanus ground count - 2axle	1.0	3.0	50	50	0	1	0	0	481
17	-11090	Gowanus G-3	Gowanus groundcount - >=2axle	1.0	3.0	50	50	0	1	0	1	962
18	11090	Gowanus G-4	Gowanus ground count - vans	1.0	3.0	120	120	1	0	0	0	1210
19	11090	Gowanus G-4	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	202
20	11090	Gowanus G-4	Gowanus groundcount - >=2axle	1.0	3.0	60	60	0	1	0	1	807
21	12320	Gowanus G-8	Gowanus ground count - vans	1.0	3.0	40	40	1	0	0	0	440
22	12320	Gowanus G-8	Gowanus ground count - 2axle	1.0	3.0	50	50	0	1	0	0	529
23	12320	Gowanus G-8	Gowanus groundcount - >=2axle	1.0	3.0	40	40	0	1	0	1	969
24	-12320	Gowanus G-9/G-18	Gowanus ground count - vans	1.0	3.0	140	140	1	0	0	0	1410
25	-12320	Gowanus G-9/G-18	Gowanus ground count - 2axle	1.0	3.0	30	30	0	1	0	0	157
26	-12320	Gowanus G-9/G-18	Gowanus groundcount - >=2axle	1.0	3.0	60	60	0	1	0	1	784
27	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	110	110	1	0	0	0	1133
28	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	40	40	0	1	0	0	426
29	-933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	40	40	0	1	0	1	849
30	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	30	30	1	0	0	0	152
31	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	50	50	0	1	0	0	453
32	933390	Gowanus S of ShrPkwy	Gowanus Fght Report - July 1992	1.0	3.0	60	60	0	1	0	1	1012
33	933445	Verrazano Br - WBD	91 Toll Data & GowClass - vans	1.0	3.0	90	90	1	0	0	0	434
34	933445	Verrazano Br - WBD	91 Toll Data - 2&3axle	1.0	3.0	80	80	0	1	0	0	508
36	933445	Verrazano Br - WBD	91 Toll Data - >3axle	1.0	3.0	90	90	0	0	0	1	447

Using the first line as an example, each constraint indicates the network link number and direction (+ or -) to which the observation pertains (933683), a description of the location (BQE - North of the Williamsburg Bridge), the source of the observation (S-1 data from NYSDOT plus Gowanus project classification counts), the weights attached to small (1.0) and large (3.0) deviations from the observed value, the limits, below (350) and above (350) the observed value (of 1265) at which the secondary, larger weights (3.0) take effect, the truck classes to which the observation pertains (0=no and 1=yes, and TC1=commercial vans, TC2=single unit trucks, and TC4=trucks with four or more axles), and the observed value (1265).

Before considering how these observations are developed, it is useful to discuss the default factors developed by NYSDOT for converting AADT's into hourly volumes by vehicle class. As was shown in Chapter 3, Table 3.4, the first set of these data shows a breakdown (percentage) of total daily traffic by hour. For example, the percent of daily traffic that occurs between 6AM and 10AM is 19.5%, being the total of 2.8%, 5.8%, 5.8%, and 5.1%. These data can be used to estimate total traffic in two directions within a given time period, or to establish factors that allow peak hour counts, within a given time period, to be expanded into an estimated total count for that time period (e.g., 3.36=.195/.058 for the 6-10 timeframe). The second set of data, presented in Chapter 3, Table 3.5, show breakdowns of total traffic for autos, vans, and trucks for typical urban freeways. When multiplied together, these two sets of data provide default estimates of the percent of daily vehicle trips, by vehicle class, occuring within a given time period. For example, the factor for vans during the AM peak is 0.0195, which implies that 1.95% of all daily vehicle trips are van trips that occur during the hours between 6AM and 10AM.

Turning back to the development of LV observations, several illustrations seem appropriate. First, let us consider the observations derived from the S-1 data and Gowanus study classification counts (LV constraints 1-8). In this instance, the baseline data are Sufficiency File observations of AADT's for the BQE. These have been converted into volumes by truck class and direction using the classification count done just south of this location, on the BQE just north of the Gowanus (see Table 4.2). As a second example, development of observations from the TBTA toll plaza surveys (e.g., LV constraints 7-14) are straightforward, involving aggregation of the toll plaza data into time periods (e.g., from Table 4.3) and subsequent postmultiplication by the percentage distributions of vehicles by vehicle class (e.g., from Table 4.4).

From the Gowanus Corridor Project, many link volume observations can be developed. As was shown in Table 4.2, these data present peak hour volumes and vehicle classification breakdowns for several locations within Brooklyn, The truck classes employed are light, medium, and heavy, meaning 1) commercial vans with two axles and four tires, 2) two-axle-six-tire trucks and 3) all other trucks (more than 6 tires and/or 2 axles). Table 4.2 shows four locations which volume and vehicle classification data have been collected. The first is between the Brooklyn Battery Tunnel and the BQE merge; the second is on the BQE between Rapelye Street and the merge point with the Gowanus. Each quadrant of the table shows the hourly volumes for the peak hour within each time period and the classification breakdown by vehicle types. The peak hour volumes and classification breakdowns, in combination with the time period expansion factors derived from the NYSDOT data just described above, are used to estimate total truck trips by location (direction) and truck class for each of the three time periods analyzed. Such estimates exist for three locations (two directions each) on the Gowanus expressway, and one location each (both directions) on Fourth Avenue, Fifth Avenue, Fort Hamilton Parkway, Ocean Parkway, Coney Avenue, Ocean Avenue, and Flatbush Avenue.

From the 1988 New York City Bridge Traffic Volumes Report, prepared by the New York City Department of Transportation (NYCDOT), truck volumes by hour and direction are available for several bridges in the network (see Table 4.6). These data are used to create total truck LV observations by direction, time period. Two exceptions are that the westbound classification counts for the Williamsburg and Manhattan Bridges, which break down the truck types in greater detail, are better data than those reported by the NYCDOT bridge report, and hence should be used in place of the NYCDOT data.

The 1984 Brooklyn Truck Route Study (see Figure 4.4) provides truck volume estimates for many of the arterials within Brooklyn. These are AADTs (Average Annual Daily Traffic values) for trucks alone (e.g., 2150 trucks in both directions, between 7:00 AM and 7:00 PM, for Atlantic Avenue between Bedford Avenue and Eastern Parkway). These counts on the arterials are the most valuable, since they are the only volumes available for those facilities. In conjunction with the NYSDOT default parameters for breakdowns of traffic volumes by time of day for urban arterials, these AADTs can be used to generate estimates of total truck volumes by time period. Moreover, through the use of NYCDOT's truck classification percentages, shown in Table 4.7, some of the truck AADTs shown in Figure 4.4 are expandable into truck flow estimates by truck class. For example, estimates along Flatbush Avenue can be developed based on the classification breakdowns from Flatbush Avenue and Bergen Street. Such estimates have been prepared for three locations on Flatbush Avenue, three on Atlantic Avenue, two on Flatlands Avenue, and one each on Myrtle Avenue, Flushing Avenue, and Metropolitan Avenue.

4.4 Findings

Of greatest interest from the case study are the OD matrices themselves and the network flow patterns they produce. Table 4.12 presents an excerpt from the AM peak period OD matrix and Figure 4.6 shows the corresponding flow pattern for all trucks combined. The pervasiveness of truck movements throughout the borough is quite evident. Flows are heavier along the Gowanus Expressway, along north-south arterials in the middle of the network, and east-west across the northern portion of the network.

Figures 4.7, 4.8, and 4.9 present truck-class specific AM flow patterns for light, medium, and heavy trucks, respectively (light=2-axle, 4-tire; medium=single unit trucks; and heavy=4 or more axles). One notices immediately the heavy van flows; flows that may well be in excess of those actually occurring. This result is due to the absence of good data for the vans; the implication being that if van flows and their management is of interest, far more data need to be collected if reasonable trip matrices are to be produced.

Midday and PM Peak flow patterns for all trucks are presented in Figures 4.10 and 4.11. One notices the increased density of truck trips within the borough and the shifts in directional proportions, particularly for the Verrazano Narrows Bridge. In the AM peak, flows are more evenly balanced whereas in the PM peak, they are predominantly westbound.

XH001005	104.428574	XH104101	100.000000	XM105003	84.141968
XH001015	42.185905	XH104103	273.000000	XM105008	181.985626
XH001101	89.000000	XH105004	135.624435	XM105018	450.792908
XH002006	642.857117	XH105018	129.000000	XV001008	842.857117
XH002008	374.509796	XH105027	299.000000	XV001014	380.769226
XH002025	13.768182	XH106102	91.000000	XV001015	101.642174
XH002101	17.000000	XM001020	94.194962	XV001100	104.000000
XH002103	126.000000	XM001025	23.691128	XV001104	423.160004
XH003014	27.272728	XM001101	14.000000	XV002025	890.615356
XH003023	389.461548	XM002101	28.000000	XV002101	39.000000
XH003100	7.000000	XM003014	187.995621	XV003023	5002.846191
XH004009	181.818176	XM003023	3195.884766	XV003102	35.000000
XH004010	9.000000	XM004027	140.018860	XV004009	1536.363647
XH005001	259.865723	XM004102	28.000000	XV004010	47.020000
XH006002	172.571442	XM005102	70.000000	XV004101	69.000000
XH006025	494.777740	XM006015	15.773586	XV004106	86.000000
XH006102	59.000000	XM006025	133.333328	XV005014	330.769257
XH006103	35.000000	XM006102	100.282143	XV006102	576.000000
XH008002	204.016708	XM006104	507.000000	XV006103	318.000000
XH008017	183.023514	XM007100	14.000000	XV007101	178.000000
XH009004	54.545456	XM007103	53.000000	XV008001	3414.285645
XH009017	5.551084	XM007105	171.052628	XV009004	127.272728
XH009020	158.764709	XM008010	192.361298	XV009100	191.000000
XH009021	1387.640503	XM008105	176.097473	XV010004	279.000000
XH009105	44.205814	XM009100	73.467857	XV012105	2469.565186
XH014024	90.000000	XM010008	28.301888	XV014001	33.999996
XH015103	21.000000	XM012102	375.250000	XV014005	100.000000
XH016101	7.000000	XM014005	100.000000	XV014018	2828.571533
XH016104	27.000000	XM014024	318.000000	XV014026	2917.029297
XH017008	202.206146	XM015001	8.999999	XV015001	130.000000
XH017009	853.333313	XM015100	42.000000	XV015102	242.000000
XH017101	48.000000	XM016102	167.000000	XV016102	484.000000
XH018100	12.000000	XM017103	178.000000	XV016103	450.000000
XH018101	9.000000	XM018101	306.000000	XV017102	553.000000
XH018105	129.000000	XM018105	455.000000	XV018020	2016.166626
XH019020	69.051285	XM019020	717.948730	XV018101	346.000000
XH020102	84.321556	XM019102	139.000000	XV019102	173.000000
XH021009	670.399048	XM019103	40.000000	XV019105	415.000000
XH021013	5.172414	XM020019	368.672150	XV020018	2683.333252
XH021019	26.357141	XM021019	83.214287	XV021001	378.160004
XH021023	71.071426	XM021023	255.357147	XV021022	301.265808
XH021101	21.000000	XM021101	194.000000	XV021101	657.000000
XH021103	55.000000	XM021104	1.000000	XV022012	5750.000000
XH022012	190.501694	XM022012	2328.860596	XV022021	301.265808
XH022021	65.012657	XM022021	240.506317	XV024104	10.840000
XH026102	34.000000	XM022101	328.000000	XV026014	2544.117676
XH026104	1.000000	XM023013	14.999998	XV026102	346.000000
XH027102	7.000000	XM026002	467.000000	XV027103	13.000000
XH027103	62.000000	XM027005	47.583336	XV100009	48.000000
XH027105	299.000000	XM027102	139.000000	XV101021	3111.000000
XH100009	3.000000	XM100006	1.000000	XV102003	1743.000000
XH101001	107.827583	XM100101	65.000000	XV103101	1229.000000
XH101004	69.047623	XM101004	196.309525	XV104102	104.000000
XH101021	263.124786	XM101021	1339.690430	XV104103	69.000000
XH102006	74.000000	XM102006	860.000000	XV105012	2469.565186
XH102106	173.000000	XM103100	276.332135	XV106004	92.000000
XH103014	94.321556	XM103102	348.467865		
XH103104	334.678436	XM104001	239.000000		
XH104001	332.000000	XM104013	157.000000		
XH104013	217.000000	XM104101	95.000000		

Key: XCOOODDD

X: Variable
C=V: Van
C=M: Single Unit Truck
C=H: Heavy Truck (4+ axles)
OOO: Origin Zone Number
DDD: Destination Zone Number

Table 4.12: OD Flow Matrix Results - Brooklyn Case Study

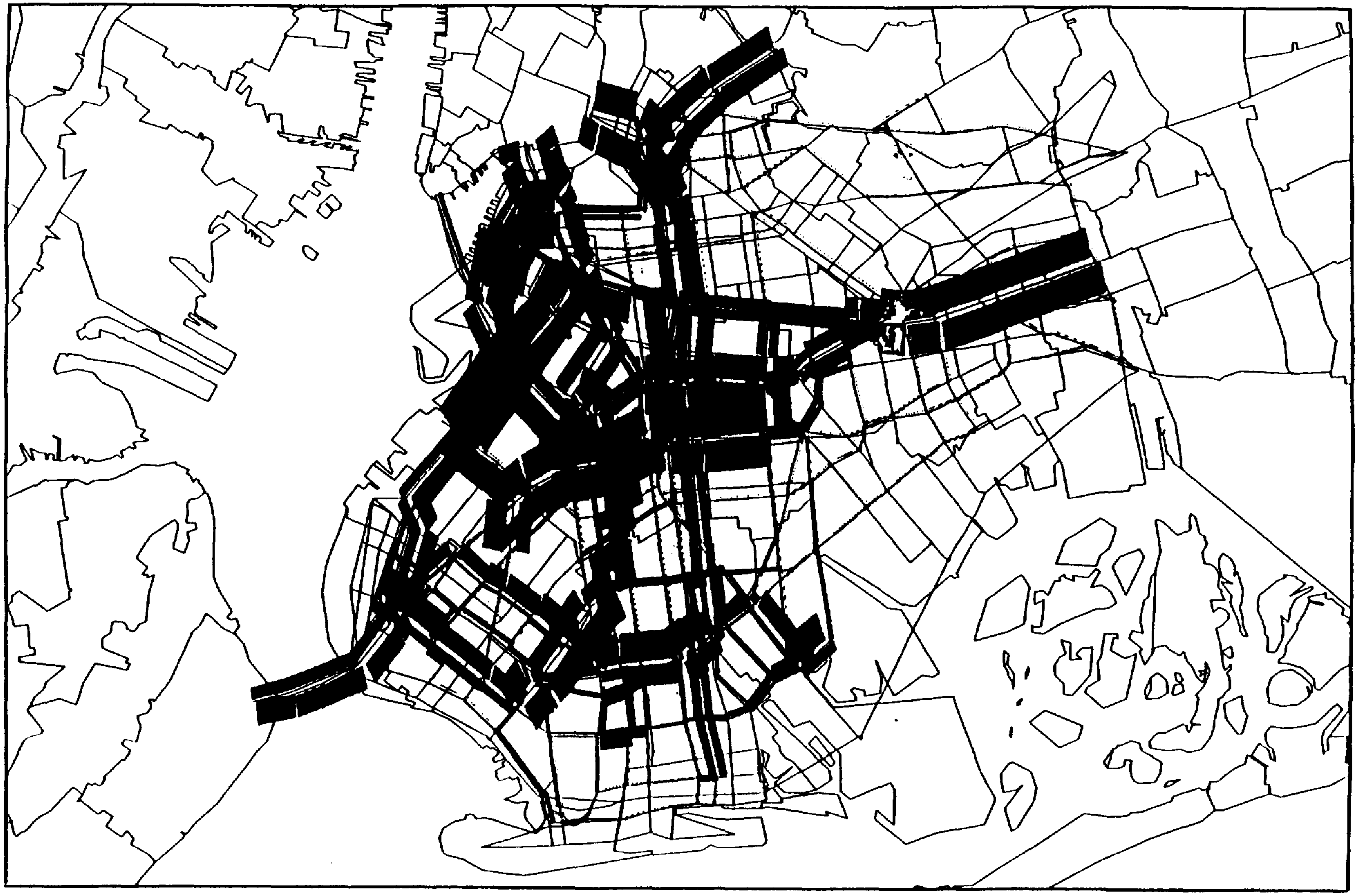


Figure 4.6: All Trucks, AM Period

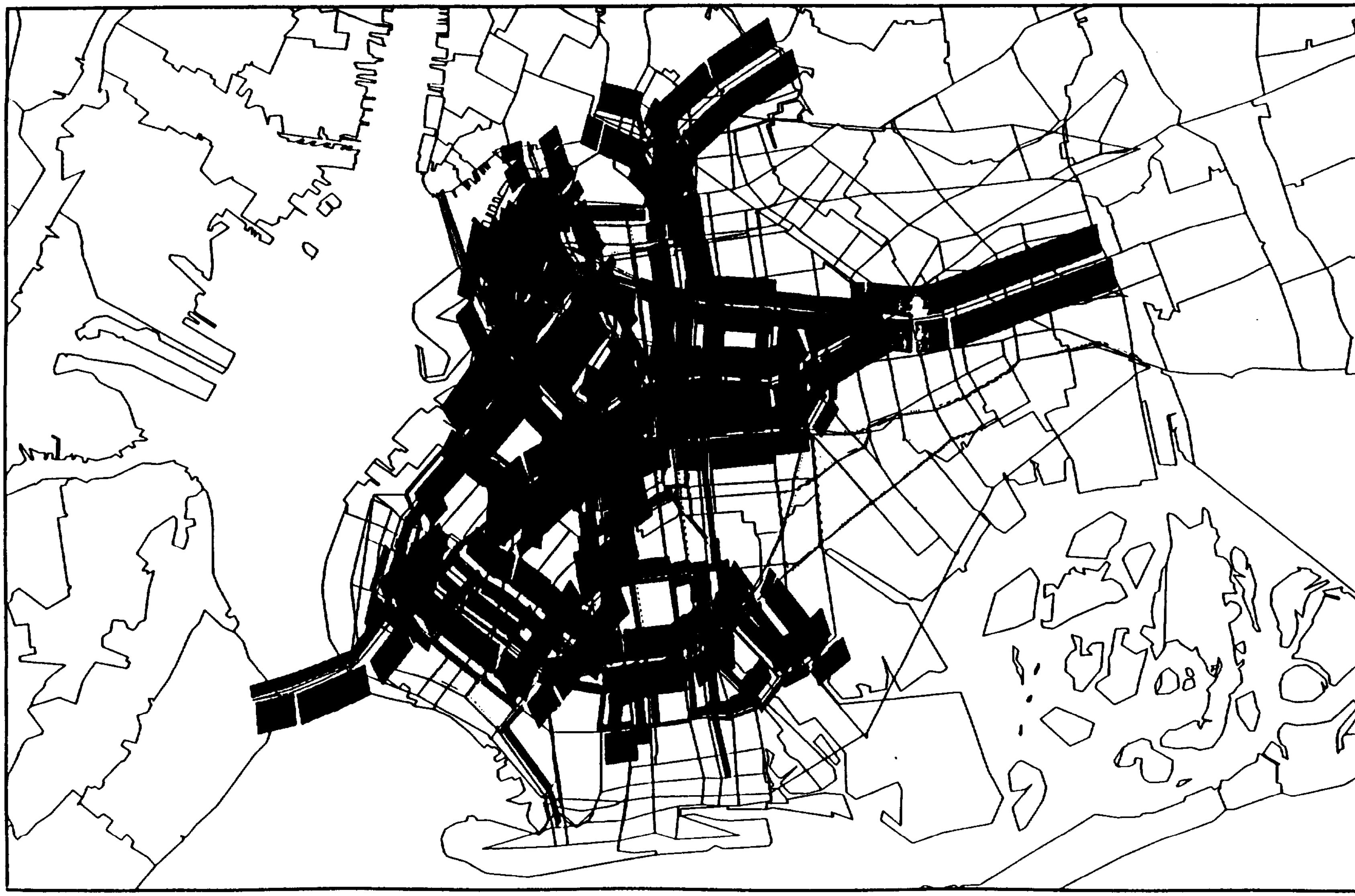


Figure 4.7: Van Flows, AM Period

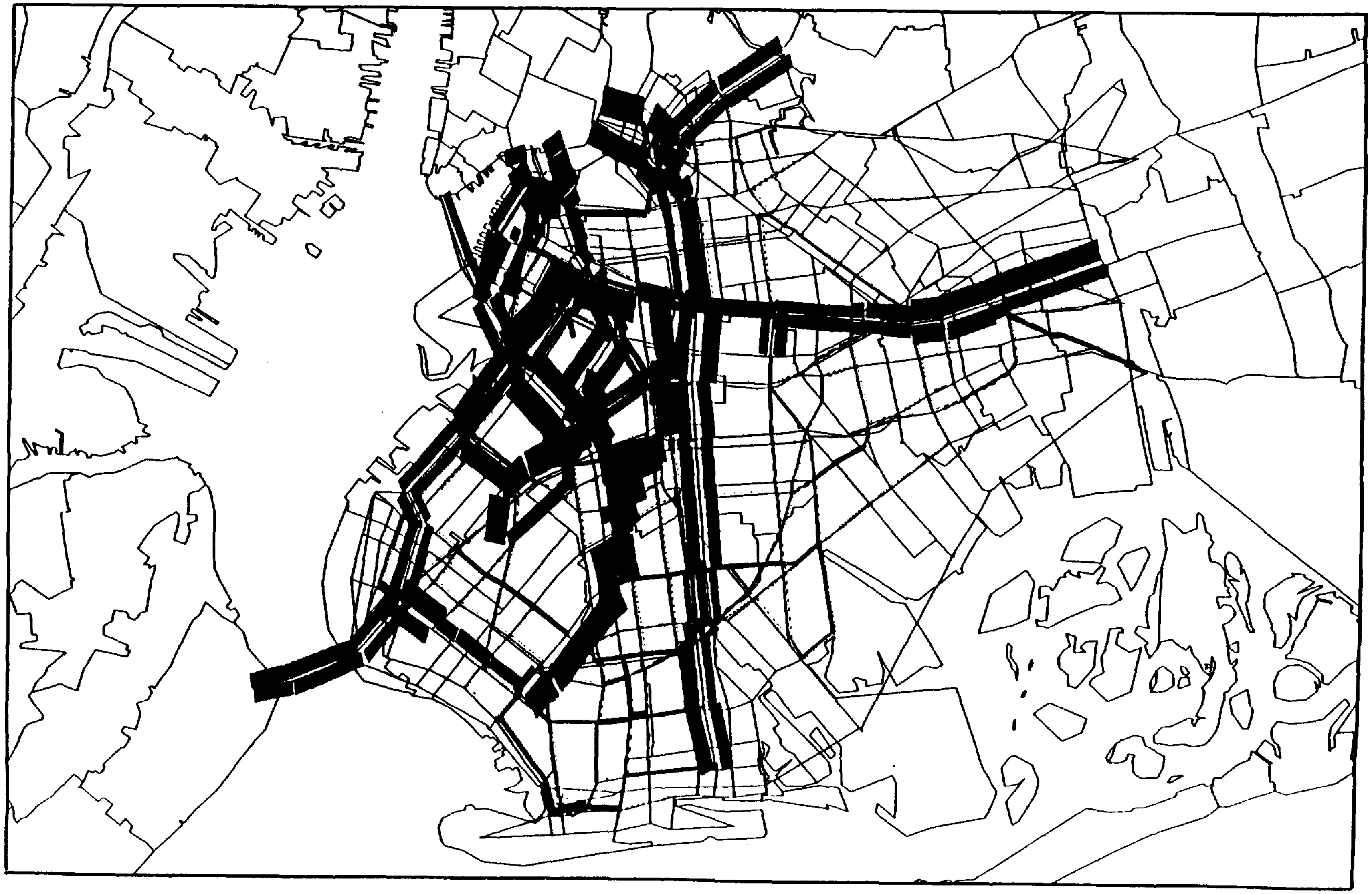


Figure 4.8: Medium Truck Flows, AM Period

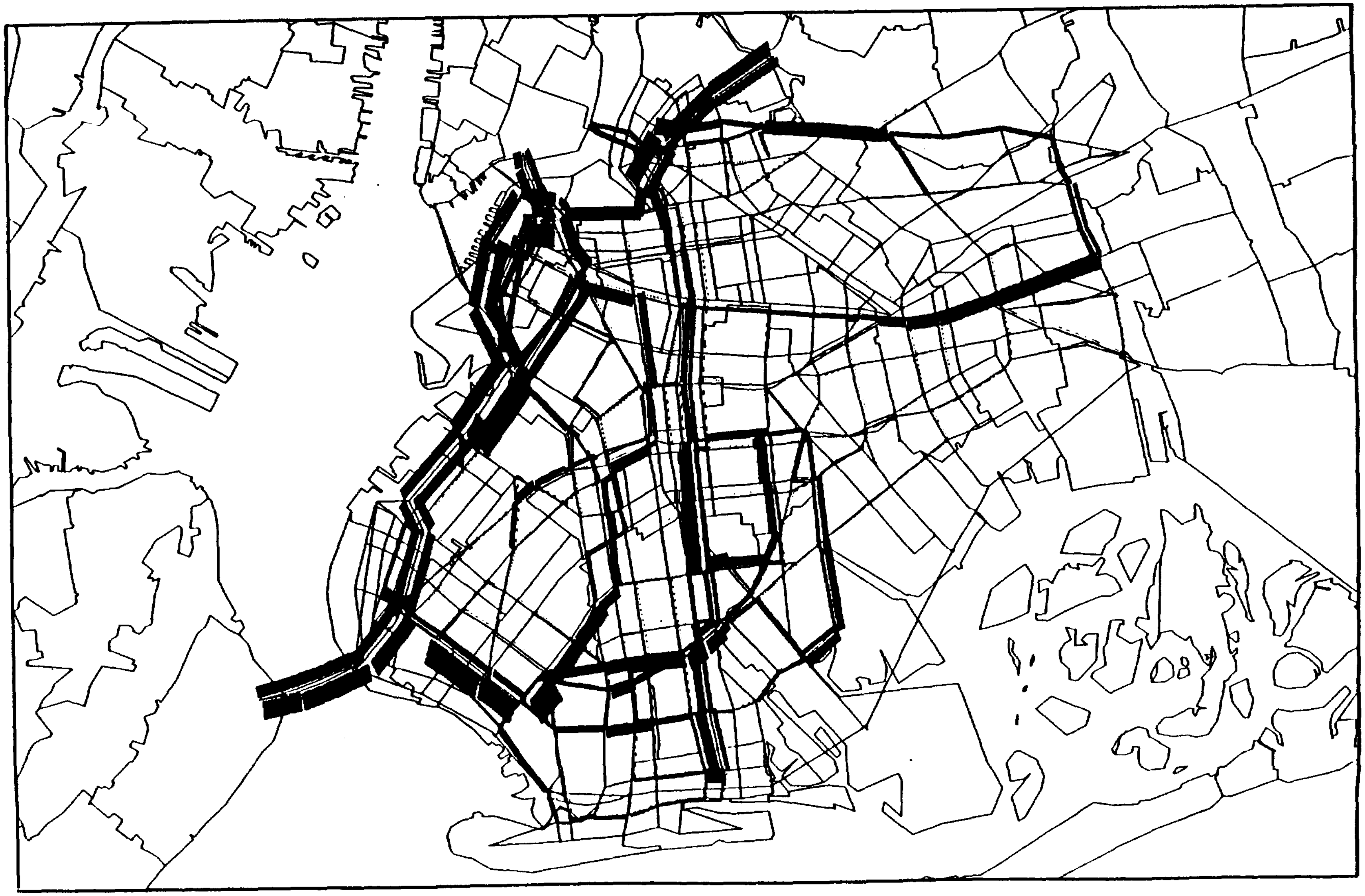


Figure 4.9: Heavy Truck Flows, AM Period

Figure 4.10: All Trucks, Midday Period

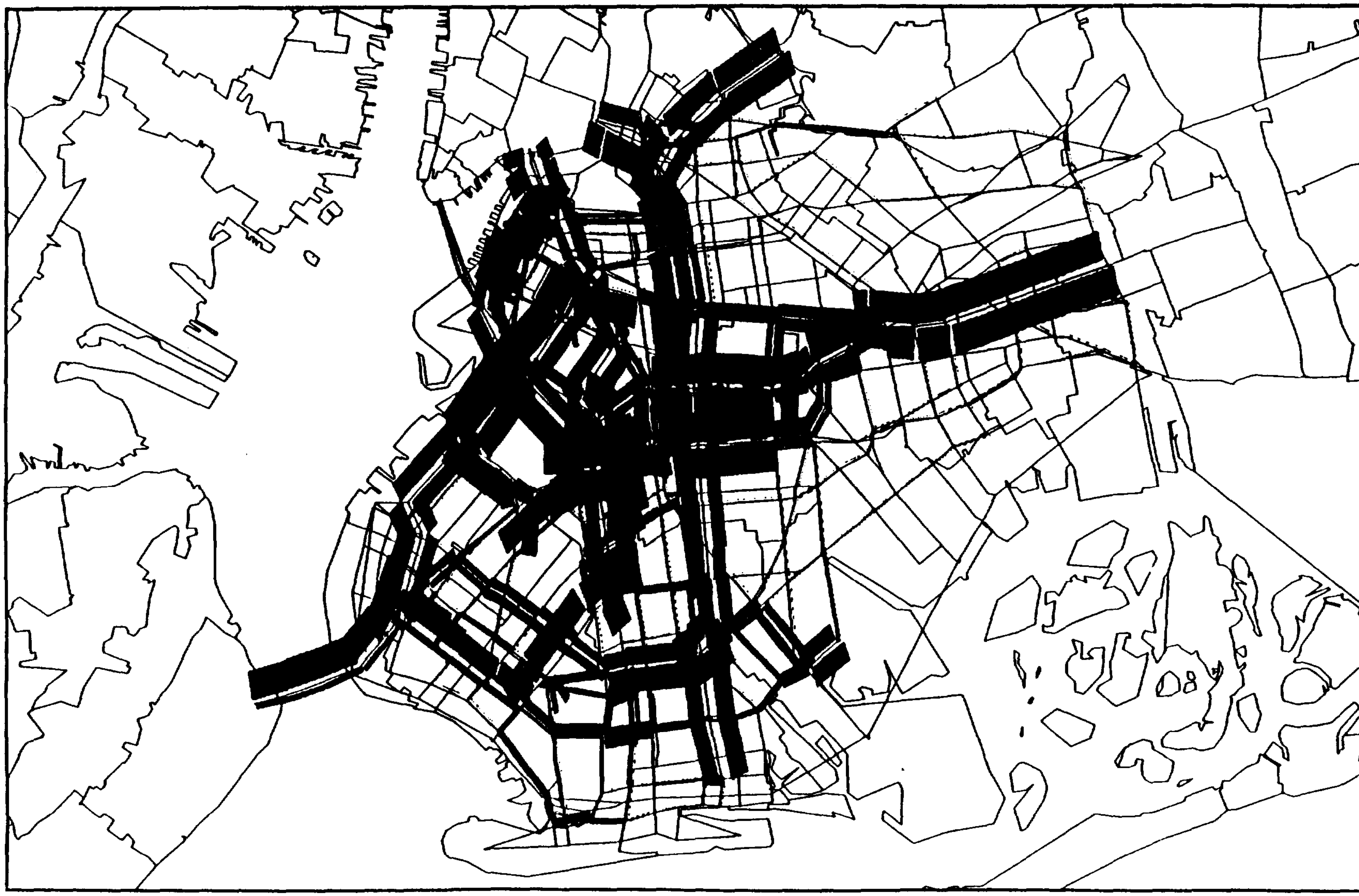


Figure 4.11: All Trucks, PM Period

4.5 Insights

Many insights can be derived from these results, some of which are observations about current trends in the truck flow patterns. Others relate to instances where further data need to be collected to improve the quality of the estimates.

For example, one significant weakness in the existing data is information about flows on the Prospect Expressway. No good counts exist. This major branch off the Gowanus Expressway probably carries many trucks, but there is no way to determine precisely how many. Classification counts need to be taken.

On the Gowanus Expressway there are similar problems, in spite of the extensive data collection that has already taken place. For example, the existing data do not provide information about flows between the Verrazano Narrows Bridge and the interchange with the Shore Parkway.

Throughout the borough there is a lack of information about van flows. Since several people have suggested potential use of the parkways for commercial vans, particularly during off-peak hours, it is important to increase dramatically the amount of information regarding van trips. Important places to collect this information include locations on Third Avenue, near the Gowanus Expressway, on Atlantic Avenue, within the arterial subnetwork near the Manhattan bridge, and along Linden Boulevard.

Link volume data, in general, would be helpful at the periphery of the network (e.g., at the Brooklyn/Queens border on Atlantic Avenue, Metropolitan Avenue, Myrtle Avenue, Linden Boulevard, and Flatlands Avenue). Also valuable would be observations of flows along north-south arterials like Bedford Avenue and Utica Avenue, and on east-west facilities like Kings Highway, Empire Boulevard, East New York Avenue, Fulton Street, Lafayette Avenue and DeKalb Avenue.

Newer OD data would be beneficial for truck trips entering and/or exiting the network at specific locations. These would include the Verrazano Narrows Bridge, the bridges and tunnels from Manhattan (eastbound), and trips going to/from the BQE. For example, the data from the 1984 Verrazano Narrows OD survey are nine years old at this juncture and may be misrepresenting current travel patterns.

CHAPTER 5

SUMMARY AND CONCLUSIONS

5.1 Introduction

This project has been undertaken to create and test methods for synthesizing truck flow patterns from partial and fragmentary observations. To accomplish this goal, the project has focused on assembling all available data on truck flows in a particular urban area (New York City), developing a useable database from these separate data sets, and using the database to support a modeling effort aimed at estimating both origin-destination patterns and link flows.

Increasing levels of congestion is the motivating factor. Gone is the option of building highway capacity fast enough to keep pace with the growth in demand. In addition, what capacity we do have is in need of repair, much of it having been built in the 1960's and 1970's. Network rehabilitation is a key focal point of current planning efforts.

Air quality is another issue driving the focus on goods movement. There is an interest in reducing the freight-related emissions, particularly nitrous oxides (NO_x) and particulates (PM_{10}) from diesel trucks. Lower travel times, achieved through higher average speeds and less delay, translate into smaller quantities of fuel consumed and lower emissions, even without changing the distribution of trips among truck classes, or among modes.

To address these issues, a sense of the flow patterns is needed. It is necessary to develop OD matrices, by truck class and time period, so that diversion studies can be performed, and so that the impacts of changes to the network's characteristics can be assessed. For example, if commercial vans are allowed to use auto-only parkways, during off-peak hours, what would be the impact? How would trips be diverted? If a major expressway is taken out of service, in whole or in part, for reconstruction and rehabilitation, what changes in truck flow patterns will result? Will certain businesses be forced to close? Will their transport costs increase dramatically? How will the overall network flow patterns be affected? Questions like these can only be answered if flow matrices are available.

Moreover, if one is to develop such matrices, from data currently available, how can the quality of the flow estimates be improved? Where should data be collected next? What types of data would be most helpful? Link classification counts? A partial OD survey? Answering these questions is a complex problem. It takes carefully designed methods and analysis tools to sift through the existing data and determine what additional data would have the greatest value.

Other problems complicate the situation. Often, the data are collected and kept by different agencies, the sampling bases are different (e.g., include/exclude vans, westbound flows only, tolled facilities only), different definitions are used for the items being collected (e.g., heavy truck, medium truck), and different time frames (e.g., different years, seasons, starting and ending times during the day). This suggests a need for an analysis tool that is tolerant of differences in the input data and robust in its estimation of flows.

5.2 The Methodology

In response to this need for better truck flow analysis tools, the purpose of this research project has been to develop a way to estimate OD trip matrices from data typically available: link volumes, classification counts, cordon counts of trucks entering and/or exiting the study area, and partial observations of the OD flows themselves. As described in Chapter 2, a method is developed that:

- o makes maximum possible use of existing information;
- o works with many different types of data and combinations of data;
- o deals effectively and efficiently with new types of data, and new forms of information;
- o generates multi-truck class OD flow matrices;
- o deals with multi-time period problems; and
- o accommodates network use restrictions (e.g, no trucks or no heavy trucks) and changes in those restrictions.

This new battery of software can help transportation planners estimate multi-class truck trip matrices for a given network and time period. These matrices and the associated link flows can be displayed using a Geographic Information System (GIS) platform. This contributes to rapid understanding of the results from a large, complex model.

5.3 Bronx Case Study

Chapter 3 presents an application of the methods described in Chapter 2 focusing on the Bronx, the northernmost of the five boroughs which make up New York City. The area is of particular interest for two reasons. First, the Cross-Bronx Expressway is scheduled for a major rehabilitation, requiring sections of it to be closed for extended periods. This will require that traffic be diverted to other routes, and the ability to predict flows for diversion studies is of considerable importance. Second, this area has a very high concentration of truck traffic. In addition, the Hunt's Point area (south of the interchange between the Bruckner Expressway and the Sheridan Expressway -- I-895) is the location of the major fresh meat and produce wholesale markets for New York City, generating approximately 15,000 truck trips per day [NYSDOT, 1985].

The primary purpose of the Bronx case study is to test the methods developed in Chapter 2, in order to understand how well they work, and to identify both strengths and weaknesses in the approach and its results. To accomplish this, available data on truck flows in this area is assembled to create model constraints, and then estimate truck origin-destination (OD) matrices, by time-of-day and vehicle class. These resulting trip matrices are the basis for conclusions regarding the nature of truck flows in the area, and identification of "holes" in the available data -- additional pieces of information which would be most helpful in building more precise estimates of truck flows. They also provide an important set of inputs for analyses of how such flows might change under specific changes in the network (such as closing the Cross-Bronx Exprssway), although that sort of diversion study is not included here.

The analysis includes three separate time periods and three truck classes. The time periods defined are 6-10 AM (AM Peak), 10 AM - 3 PM (Midday), and 3-8 PM (PM Peak). Separate OD matrices are estimated for each time period, based on data pertaining to that time period. The analysis does not include the nighttime hours between 8 PM and 6 AM. The three truck classes used are VANS (light-duty trucks with two axles and four tires), MEDIUM (two-axle and three-axle single unit trucks), and HEAVY (trucks with four or more axles, and all tractor-trailer units).

The combination of vehicle classes and time periods means that a total of nine separate OD matrices are estimated, in three separate analyses. The three truck classes are estimated together for each time period, but the time periods are done as separate analyses.

As part of the analysis of truck flows in this case study, we want to pay special attention to separating flows of local, originating, terminating and overhead trips, defined as follows:

Local: trips whose origin and destination are both internal to the study area;

Originating: trips whose origin is internal, but whose destination is outside the study area;

Terminating: trips whose origin is outside, but whose destination is inside the study area;

Overhead: trips which pass through the study area, but whose origin and destination are both outside.

The reason for this separation is that there is evidence of large overhead flows in the Cross-Bronx corridor, particularly of heavy trucks moving from New Jersey to New England and Long Island. One of the objectives of the case study is to provide additional insight into the nature of these movements, by time-of-day, and to differentiate the temporal patterns of the overhead movements from those of local, originating and terminating traffic.

The first major conclusion from this case study is that the methods developed in the project function as intended. Data have been taken from nine different sources, collected in different ways and at different times, and synthesized into a coherent database. This database is represented as a set of constraints for a linear programming problem which finds a set of trip tables. In this case study we have demonstrated the ability to find trip tables for three truck classes and three separate time periods during the day.

The analysis produces very plausible link flows over the network. The link flow results of the analysis are likely to be more reliable than the OD tables themselves. As described in the previous section, the OD tables have a relatively small number of non-zero entries, and those entries tend to be quite large. It is likely that a better solution would have more, and smaller, non-zero entries in the OD tables. This result is evidence of lack of data in a few crucial areas.

By looking carefully at both the OD tables and the link flows, we can identify several important "holes" in the input data. The three most important of these are:

1) the paucity of data on van movements;

2) the lack of survey data on westbound movements; and

3) the need for more complete ground counts over more of the network.

The lack of van data is particularly troubling, because of the large amount of anecdotal evidence that vans form a major element of the goods movement system within New York City. We have created OD tables for vans, but these would benefit greatly from additional data. Ideally, this additional data should include survey data on origins and destinations as well as ground counts on network links.

The truck survey data which do exist in this area are all for eastbound movements, because that is the direction in which tolls are collected at the major bridges. The result is that we have relatively little confidence in the estimates of westbound truck trips. Since surveying truck in the westbound direction is difficult, additional ground counts on the arterials as well as the expressways would help greatly.

In general, there is little link volume data in this case study. What exists is mostly on the expressways. We have almost no information on truck flows on the arterial streets.

When there is little link volume data, the results are very sensitive to the estimated link-utilization coefficients on the facilities which do have counts. This is particularly noticeable on the bridges crossing the Harlem River. The fact that we have counts on those bridges, and on virtually no streets in their vicinity, gives those bridge counts enormous leverage on estimated OD volumes for local trips. Additional vehicle classification counts, particularly on the arterial streets, would be most helpful to improve the reliability of the results.

5.4 Brooklyn Case Study

Chapter 4 describes the Brooklyn case study, the primary focus of which is on the area surrounding the Gowanus expressway. NYSDOT is in the process of rehabiliting that facility through a multi-year, multi-million dollar highway reconstruction project. The case study has three main purposes. The first is to test the methodology, and learn about its strengths and weaknesses. The second is to develop trip matrices for the network, using the methodology, and compare them with other known information about flow patterns in the area. The third is to identify holes in the data used to generate the matrices and identify ways to fill those holes.

Brooklyn was a natural choice because the Gowanus Expressway study has generated a rich set of truck-related data. Truck movements are heavy on the Gowanus, and many truck-based activites lie within the Gowanus corridor, so the engineering consultant has collected considerable traffic data, much of it focusing on truck flows.

Three truck classes are considered: 1) commercial vans, 2) single unit trucks (primarily two-axle-six-tire or three axle), and 3) trucks with four or more axles. In some instances, it is possible to distinguish between two and three-axle trucks, but neither of the two primary data sources available do so. The data collected by the engineering consultant classify trucks as either light (two-axle, four tire), medium (two-axle, six tire) or heavy (all other) and the data collected by the New York City Department of City Planning categorizes them as being either vans and pckups, single unit trucks, or combination trucks.

The scheme chosen matches that used in the Bronx case study, and helps delineate between trucks used for local deliveries as opposed to long-haul movements.

Three time periods are considered: an AM peak (from 6-10 AM), the midday (from 10AM to 3PM), and a PM peak (from 3-8 PM). These time periods match those commonly used to analyze traffic flows within the New York metropolitan area.

Of greatest interest from the case study are the OD matrices themselves and the network flow patterns they produce. The pervasiveness of truck movements throughout the borough is quite evident. Flows are heavier along the Gowanus Expressway, along north-south arterials in the middle of the network, and east-west across the northern portion of the network. Midday and PM Peak flow patterns for all trucks show the increased density of truck trips within the borough and the shifts in directional proportions, particularly for the Verrazano Narrows Bridge. In the AM peak, flows are more evenly balanced whereas in the PM peak, they are predominantly westbound.

One also notices the heavy van flows; flows that may well be in excess of those actually occurring. This result is due to the absence of good data for the vans; the implication being that if van flows and their management is of interest, far more data need to be collected if reasonable trip matrices are to be produced.

One apparent weakness in the existing data is information about flows on the Prospect Expressway. This major branch off the Gowanus Expressway probably carries many trucks, but there is no way to determine precisely how many. Classification counts need to be taken.

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