APT.D-1523

HEAVY DUTY VEHICLE

DRIVING PATTERN AND USE SURVEY

FINAL REPORT

PART I

NEW YORK CITY

Prepared For

ENVIRONMENTAL PROTECTION AGENCY

AND

COORDINATING RESEARCH COUNCIL, INC.

APRAC CAPE 21–71

By

Wilbur Smith and Associates

May, 1973

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May 1973

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Material contained in this report is partially based upon the 1963 Truck Origin-Destination Survey conducted by the Tri-State Reginal Planning Commission. The Commission made these survey records available to Wilbur Smith and Associates for their subsequent reprocessing and use. The latter organization is solely responsible for the analyses and interpretations derived therefrom and used in this report.

Office of Air and Water Programs Publication Number APTD - 1523

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Chapter 1

INTRODUCTION

This report presents data collated from various sources which identify the composition, function and travel behavior of urban truck travel in New York City. From the data, various stratifications have been organized to permit the characterization of mission, function and use patterns of trucks operating over urban streets. These stratifications will be employed to develop representative truck-use patterns for development of emission tests.

The study was Phase I of a two-phase program jointly undertaken by the Environmental Protection Agency and the Coordinating Research Council, Inc., under contract CRC APRAC Project No. CAPE-21-71 (1-72). The study objective was to assemble these data for both the Los Angeles Basin and New York City areas from existing data sources. However, data related to the Los Angeles Basin proved to be inconclusive and additional survey activity has been recommended to permit comparative stratifications between both areas. Because of the pressing need for data to proceed with Phase II of the program, it has been decided to publish the final report in two parts. Part I, represented by this document, reports the truck pattern and use data related to New York City. Part II, relating to the Los Angeles Basin, will be published subsequently when supplemental studies in that area have been completed.

Phase II of the program will be undertaken as a separate contract. This element will select and stratify heavy-duty vehicles, over 10,000 pounds gross vehicle weight. An economical sample of trucks representative of the total population in each area will be instrumented and operated in normal fashion to collect detailed operating profile data of truck operation not now available

in existing data. The data will include the recording of engine speed, vehicle speed and per cent of rated engine torque, plus other data. Processing of these data will provide truck operating profile data required to develop emission testing procedures, including a representative engine test cycle for emission control measure qualification of new engine designs.

The Work Program

The work program was divided into four tasks:

Task 1. Orientation and Available Information - This effort was the identification and collection of available information on urban trucks and truck usage from existing literature, vehicle registration records, urban truck weight (loadometer) studies, comprehensive urban area transportation planning studies, fleet operator statistics and other available data sources for the Los Angeles and New York City areas.

Task 2. Analysis of Vehicle Characteristics and Truck Use Variables - Meaningful characteristics of the urban truck population were assembled from the information derived in Task 1 by detailed stratification and analysis to reduce and simplify the number of categories of trucks and the kinds of travel they perform.

Task 3. Analysis of Truck-Use Patterns - The travel performed by each of the major classes of vehicles defined in Task 2 were examined in relation to place and time and extent of use, type of street traveled, place and length of time at rest, vehicle miles of travel by geographic unit of area and street type, and land-use traversed. Two general sets of data resulted--the general characteristics of truck use and the spatial patterns of truck use on the street network.

Task 4. Data Deficiences and Requirements - In the process of assembly and analysis of available data, additional information was identified as needed to improve the analysis.

Data Sources for the New York City Area

The New York City area is geographically unique in that natural barriers practically surround it, forcing most external traffic to cross one of the bridges or pass through tunnels under rivers. Since these facilities, for the most part, charge tolls, very good statistical data on the nature and frequency of truck traffic was available. Within the area, three islands contain four of the five boroughs. Interchange of traffic between these boroughs is accomplished by strategic bridge and tunnel crossings, tending to channelize inter-borough travel.

An important data base for the study was a Truck-Taxi Survey conducted in 1963 by the Tri-State Transportation Committee (the forerunner of the Tri-State Regional Planning Commission). The geographical area covered by the Truck-Taxi Survey, termed the Cordon Area, includes the areas surrounding New York City in the three states of New York, New Jersey and Connecticut. A three percent random sampling of trucks and taxis registered within the defined cordon area was designed and conducted for that study. The sample was selected in three independent subsamples of 1 percent each with varying degrees of preliminary geographic stratification.* A total of 14,623 interviews were assigned. Completed truck interviews totaled 10,510, for a completion of the entire survey of 72 percent. After adjusting for 1,275 out-of-scope sample units never assigned to interviewers, the completion rate was computed to be 78 percent. The survey total trips reported was 74,031, with an average number of trips per interview of 7.04. Of the completed interviews, 3,505 truck owners reported no trips.

* A summary of sample selection methods is given in TRUCK-TAXI FIELD OPERATIONS REPORT, August 1965, Tri-State Transportation Committee; with a treatment in greater detail in Technical Report #4005-2273, Tri-State Transportation Committee.

Since the objectives of the CAPE 21-71 Study was the New York City area, a special sort of these data was obtained from the Tri-State Regional Planning Commission. This sort selected only trucks reporting trips with either origin, destination or both orgin and destination within New York City. This compression of data resulted in data on 1,047 trucks making 10,665 internal trips and 643 trips with one trip end (internal-external) within New York City.

To obtain registration data for the study, a sample of 1971 truck registrations by county for the 9-county area was obtained from R. L. Polk and Company. Polk processes data for the New York State Department of Motor Vehicles under contract and is the sole source for these data. Nineteen Hundred Seventy-one was the earliest year available. Trucks of the last 10 model years are included. A random sort was performed of every 10th truck over 6,001 pounds GVW. A total of 7,547 trucks in the 9-county area resulted.

Another important data source was the traffic count data taken at approximately 275 cordon points during the period of 6 A.M. to 8 P.M. or 2 P.M. to 8 P.M. for a typical weekday in 1962-63. Since these cordon points were associated with expressways, parkways and principal urban arterials, and were dispersed strategically throughout the area, these volumes were assigned to a network of these facilities and used to estimate vehicle miles of travel by vehicle type performed on these categories of roadways.

Average travel speed from the Tri-State street inventory and land-use planning data were associated with this network to present the nature of the travel in various zones within the city.

A summary of study data source, information available and use in the study is given in Table 1.

Table 1

DATA SOURCE SUMMARY

NEW YORK AREA

DATA SOURCE	INFORMATION AVAILABLE	USE IN STUDY
1. Origin-Destination Truck Surveys		
a) Tri-State 1963 Truck-Taxi Survey (Tri-State Regional Planning Commission)	Sample interview surveys for all trucks over 6,000 pounds registered in the three-state planning region. Truck data: axles and weights, type of industry, owned or rented vehicle. Trip data: origin-destination, land use, commodity type, density, weight, trip time, trip elapsed time, and trip air-line distance.	This source provided the basis for determining the essential characteristics of truck use. Data were sorted for all trucks whose origins and/or destinations relate to N.Y.C. Relationships developed can be applied to the present truck population.
b) Trans-Hudson Vehicular Origin-Destination Survey - 1970	O-D data for trucks and trailers by percentage for 18 zones west of the Hudson and 15 zones east of the Hudson River. (George Washington, Lincoln, and Holland Crossings)	This source supplemented the nature and volume of external truck trips at the Hudson River screenline.
c) Staten Island Bridges - 1968 Vehicular Origin/Destination Survey	O-D data for trucks and trailers by percentage for 13 zones north and 12 zones south of Kill Van Kull. (Goethals, Bayonne, and Outerbridge Crossings.)	This source supplemented the nature and volume of external trips between the Staten Island/New Jersey screenline.
2. Motor Vehicle Registration Files		
a) 1971 New York Metro Area Truck Registration File (R. L. Polk & Co.)	10 percent sample of trucks over 6,000 pounds registered in the nine-county New York area with model years within ten years.	Provided an analysis of truck characteristics within present truck population in New York area, vehicle type, licensed gross weight, body style and county location.

Table 1 (Cont'd)

DATA SOURCE	INFORMATION AVAILABLE	USE IN STUDY
3. Roadside Vehicle Classification Surveys		
a) "Comparison of Bridge Traffic", City of New York, Division of Bridges. 1965-1970 Annual	24-hour bi-directional counts on 55 bridge crossings, giving number of autos, trucks, and buses.	Provided truck volumes by time of day for major bridge crossings in N.Y.C.--principally used to determine screenline volumes between the five boroughs of the city.
b) Average Daily Vehicular Crossing at Hudson River, Staten Island, and Port Authority Bridges. 1968-1971	Average counts for total trucks, trucks and tractor trailers for weekdays, Saturdays, Sundays, and Holidays.	Provided truck volumes for Hudson River, East River and Staten Island/New Jersey screenlines. (Port Authority Bridges)
c) Traffic Counts for 1964 and 1972 - Triborough Bridge and Tunnel Authority	Sample classification counts by nine vehicle classes for the Triborough, Bronx-Whitestone, Throg Neck Bridges and the Queens-Midtown Tunnel.	Provided truck volume samples for East River Crossings (Triborough bridges)
d) 1966 Truck Weight Study (New York State Department of Transportation)	Statewide study of truck weights by vehicle classes, estimated annual travel by each truck type, estimated ton-miles of cargo carried by highways, trends in axle weight and gross weight frequencies on highways.	Of limited application in study. Only three cordon points located near N.Y.C. screenlines--none in N.Y.C.
e) Vehicle Classification and Vehicle Occupancy Report, 1962-63	Bi-directional hourly volume counts for single unit and tractor trailer categories at approximately 275 cordon points. Counts run from 6 A.M. - 8 P.M. or 1 P.M. - 8 P.M.	A primary data source for determining traffic volumes and vehicle miles of travel on urban expressways and principal arterials in N.Y.C. The expansion of these data to a 24-hour period and assignment to these urban street systems provides detailed insight into truck movements.

Applicability of 1963 Survey Data

The primary objective of this study is to provide data for use to develop a stratified sampling plan to be employed in Phase II of the program. The collection and processing of all available data on heavy truck use has been accomplished to fulfill this objective.

Much of the data used in this study was obtained as early as 1963. Many changes have occurred within the study area which could affect the truck driving patterns and use since that time. Comparisons between survey data taken in 1963 with more recent data indicate that certain patterns have changed little in the intervening years. One such comparison is made in times of bridge crossings in Chapter 4.

It is recognized that patterns of through-trips by trucks have changed due to such influences as the development and industrialization of Nassau and Suffolk Counties and the relocation of motor freight terminals. Through-trucks were not contained in the Tri-State survey material because that sample was based upon trucks registered in the area. A majority of through trucks are not registered locally. These trips were made on well defined routes at reasonably efficient speeds. Therefore, it is felt that VMT generated by through trucks are not a major contributor to motor vehicle emissions in the urban area and their omission in Phase II is reasonable.

Conclusions drawn from Phase I data are tentative and need to be in rough order of magnitude only. The information will be used to intelligently sample the truck population in New York City during the Phase II Survey. It is expected that any significant shifts in truck driving pattern and use will be reflected in that data.

Chapter 2

TRENDS IN TRUCK REGISTRATIONS

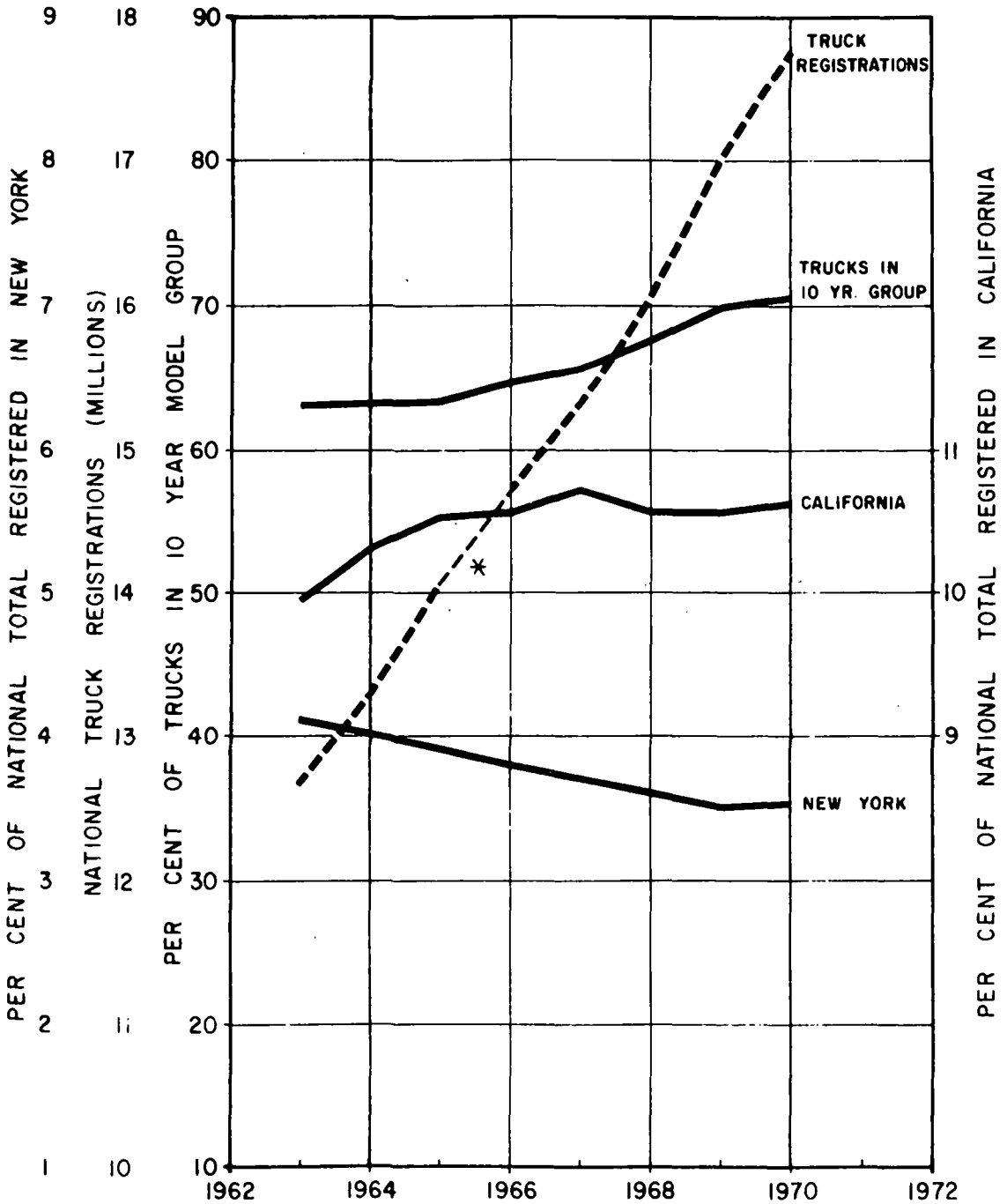
The two selected study areas can be anticipated to differ in some degree in truck use patterns because of differences in many characteristics. Los Angeles typifies the younger city, whose major growth occurred after motor vehicle use was fairly well established. Its street and freeway network has therefore developed with this growth and is more responsive to traffic demands.

On the other hand, the New York City area was well established before the advent of the motor vehicle. Its street network was principally organized before the motor vehicle was developed. Network update to widen streets and to build limited access expressways has been costly and has not kept up with traffic demand. As a result truck travel in the area is difficult and facilities are congested. This has influenced the patterns of truck use in the area when compared to travel in most of the Los Angeles Basin.

Some preliminary insights into area differences might be inferred from trends in truck registrations in California and New York against national totals, in the share of state registrations of trucks in the Los Angeles County and New York City, in the age distribution of trucks in these two areas, and in the per capita truck registrations.

State Registrations to National Totals

In Figure 1, national truck registrations have grown from about 13 million in 1962 to over 17.6 million in 1970. The percent share of this total truck population registered in



* Beginning in 1966, Certain Vehicles Formerly Classified as Passenger Cars Are Counted as Trucks.

TRENDS IN TRUCK REGISTRATIONS NATIONWIDE AND IN THE STATES OF CALIFORNIA AND NEW YORK

Source: MOTOR TRUCK FACTS, 1965, 1968, 1971, AMA.

Wilbur Smith and Associates

FIGURE 1

California has risen from a little less than 10 percent to about 10.6 percent, being stable at this approximate range over the last six years. Truck registrations in New York State have declined steadily from a little over 4 percent to about 3.5 percent, over the 8-year period.

About 63 percent of the national total of trucks were less than 10 years old in 1963. In the 8-year period, the national truck population has progressively become younger. In 1970, over 70 percent of the nation's truck population was less than 10 years old. The significance of this will be noted shortly.

Study Areas Registrations to State Registrations

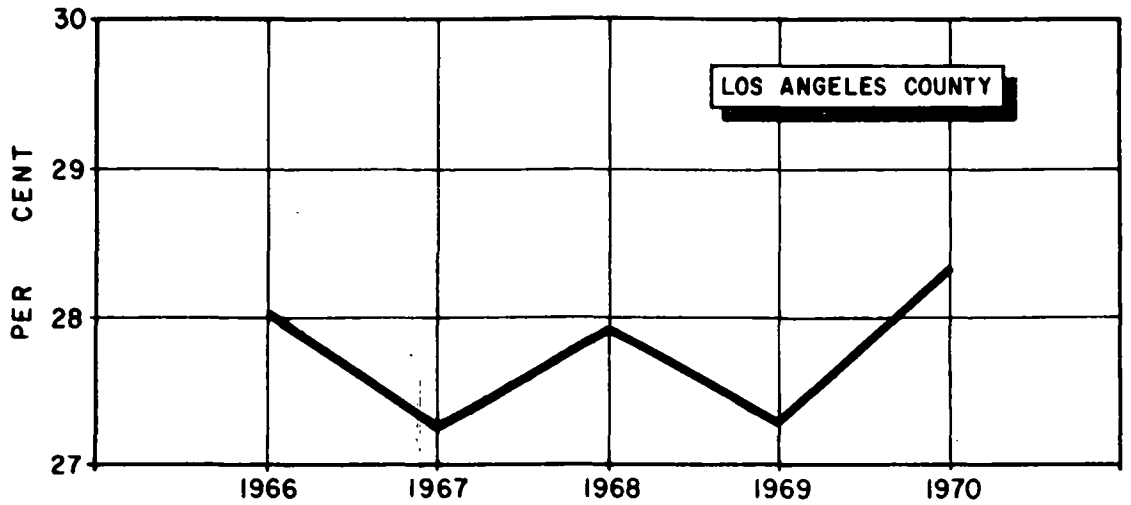
The trend in the share of total state registrations for both study areas is illustrated in Figure 2. Los Angeles County has about 27.8 percent of California truck registrations and has remained fairly constant at this level over the period from 1966 to 1970. Meanwhile truck registrations in New York City as compared to total state registrations have declined almost 4 percent to a share of about 17.5 percent of the total in 1970.

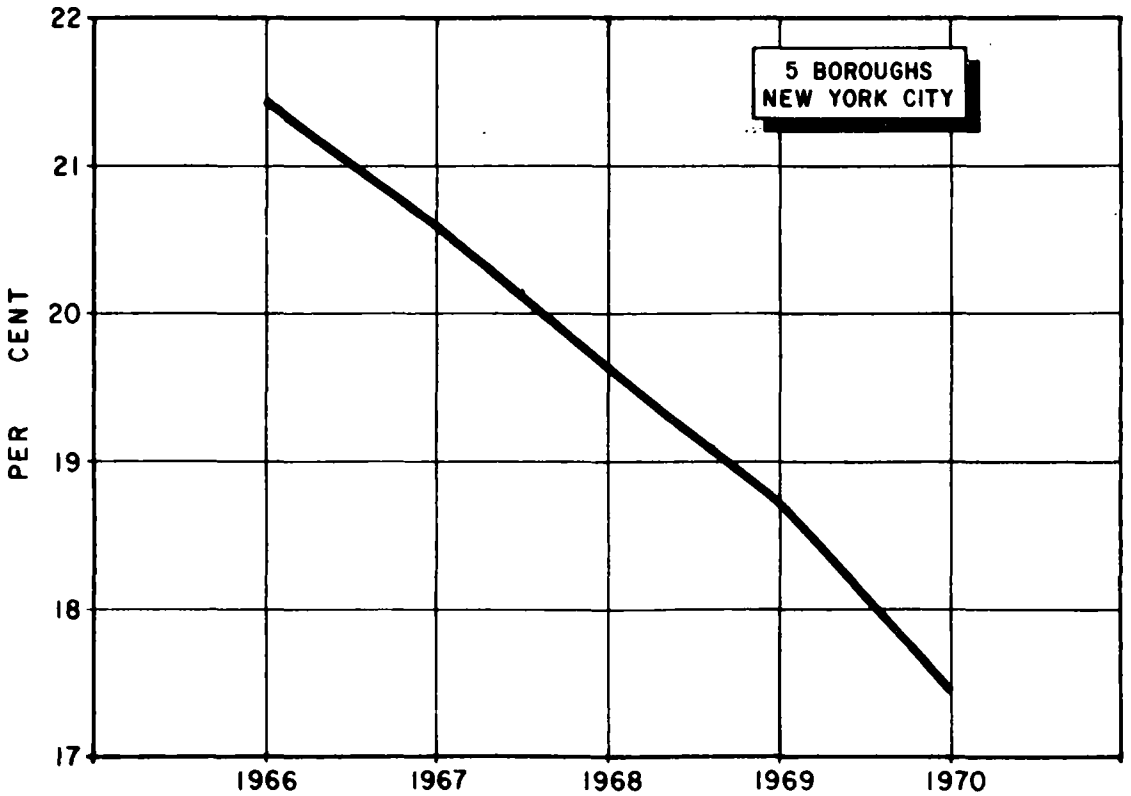
Age Distribution of Truck Population

The distribution of the national average age of trucks from 1967 to 1970 is compared with the age distribution of trucks registered in the nine-county New York area from 1971 registration files is shown in Figure 3. The trend illustrated here shows that the trucks in the 10-year model group tend to contain a higher percentage of older models than the national average.

Per Capita Truck Registrations

Another comparison may be made between per capita truck registrations in the two study areas. Trends in these relationships are shown in Figure 4. In Los Angeles, the number of persons per truck has declined steadily and was about 13 residents



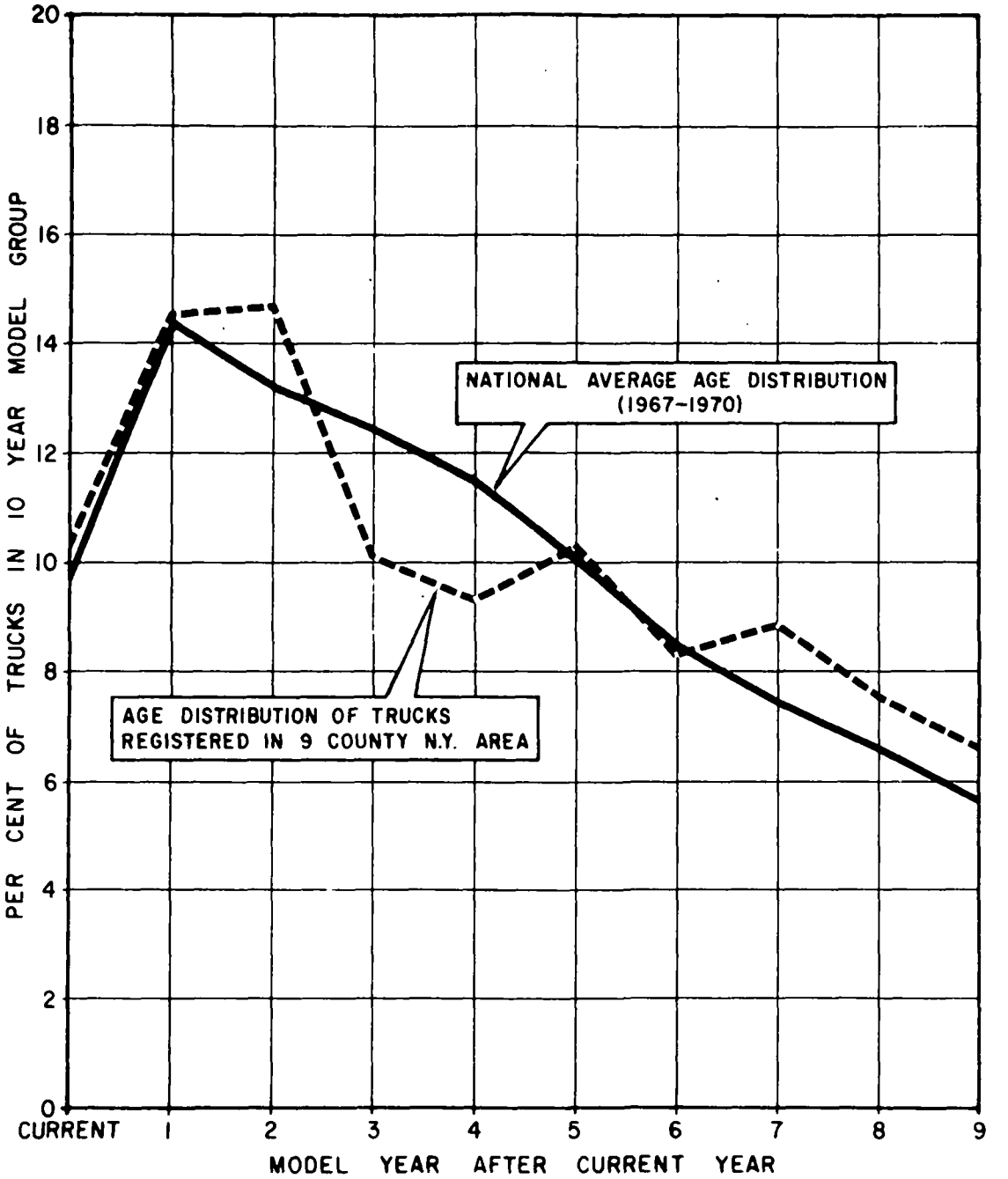


TRENDS IN TRUCK REGISTRATIONS IN LOS ANGELES COUNTY AND NEW YORK CITY VERSUS RESPECTIVE STATE TOTAL TRUCK REGISTRATIONS

Source: MOTOR TRUCK FACTS, 1968 – 1970.

Wilbur Smith and Associates

FIGURE 2



DISTRIBUTION OF TRUCK AGE IN NEW YORK AREA COMPARED WITH NATIONAL AVERAGE

Source: MOTOR TRUCK FACTS.

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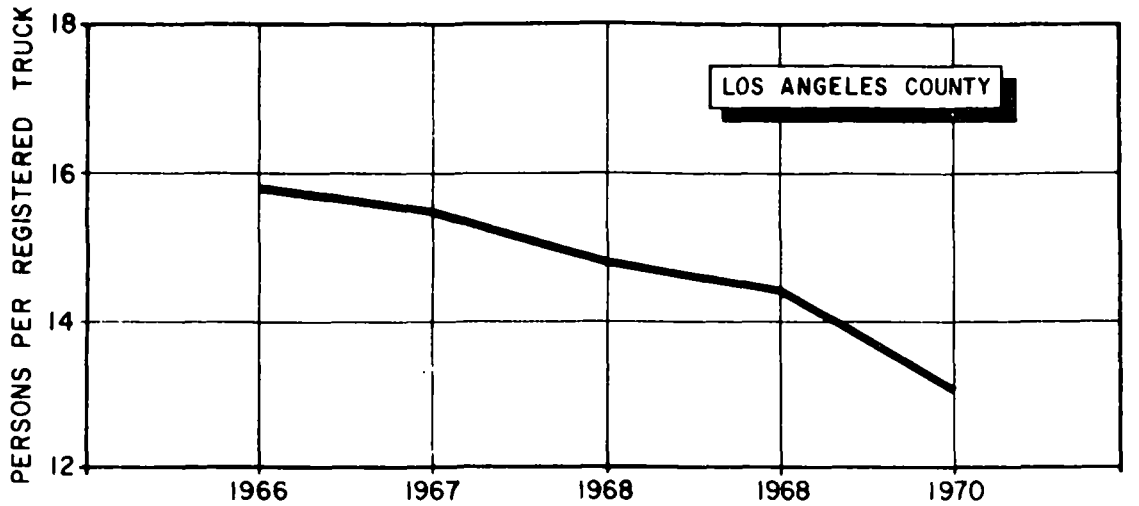
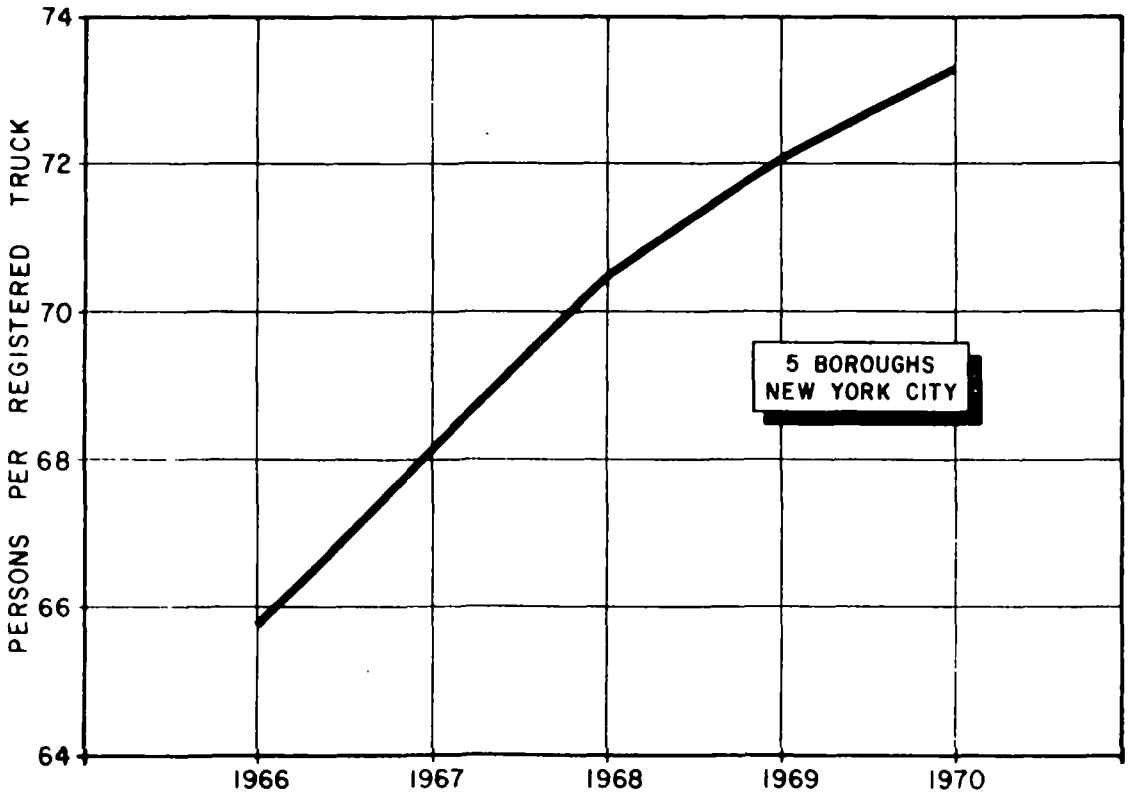
FIGURE 3





TRENDS IN PER CAPITA TRUCK REGISTRATIONS – LOS ANGELES COUNTY AND NEW YORK CITY

Source: MOTOR TRUCK FACTS.

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FIGURE 4

per registered truck. During the same period, in New York City, this ratio is substantially larger and has increased from a little less than 66 persons per truck to over 73 persons per truck.

Trends in Truck Registrations in the 3-State Area to New York City

Trends in motor truck registrations in the 3-state area of New York, Connecticut and New Jersey are compared with the registrations in the 5 boroughs of New York City in Table 2 These data are significant in that the upward trend of the 3-state area is not matched with truck registrations solely in New York City. There are several possible explanations for this trend. Among other factors it is known that truck freight terminals have been relocated from the environs of the city to outlying counties. Large truck loads are broken down here and distributed to other destinations, including New York City, by smaller vehicles.

Interpretation of Trend Data

While no attempt is to be made here to explain these variances, for there are many factors involved, it is clear that truck populations are substantially different in the two study areas. It must therefore be anticipated that truck use, extent of truck travel and the number of trips and other factors are likewise in variance in these two study areas.

One purpose of this study was to further identify these differences as well as the similarities of the truck use profiles by comparative means. Data sources, previous study methods and procedures vary in relation to these areas. Care must be exercised in comparisons and use of registration data. It has been observed that registration data often overstate actual population because transfer of ownership of a vehicle does not always require the purging of the previous licensee from the records. Vehicles are registered by the location of the owner's home or commercial operations. The record does not indicate the locale

Table 2

TRENDS IN MOTOR TRUCK REGISTRATIONS
NEW YORK, CONNECTICUT AND NEW JERSEY
5 BOROUGHS OF NEW YORK CITY

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Connecticut (1)	121,117	125,356	129,180	140,850	147,124	151,058	155,194	163,101	168,858	177,453
New Jersey (1)	259,957	268,403	272,580	281,353	292,676	299,251	300,040	305,873	312,873	318,284
New York (1)	502,659	515,697	523,874	539,148	550,568	567,844	570,946	580,809	597,300	631,678
5-Boroughs N. Y. C. (2)	112,321*	120,635	124,260	112,059	117,086	121,715	117,805	114,051	112,033	110,270

* Includes only Kings, Queens, Bronx and New York Counties for 1961.

SOURCES: (1) MOTOR TRUCK FACTS, AMA, Various annual editions, from U. S. Department of Transportat, Federal Highway Administration (Table MV-1)

(2) R. L. Polk & Co., permission for further use must be obtained from R. L. Polk & Co.

of the vehicle use. With these and other limitations, the results of the study have accomplished its objectives.

Chapter 3

CHARACTERISTICS OF TRUCK POPULATION - NEW YORK CITY

In the analysis of the truck population, the characteristics of trucks must be delineated under defined categories. The selection of these parameters is first limited by the organization of the data source. If two or more sources are used, or if comparisons are to be drawn between two or more areas, care must be exercised to remove any differences which might arise due to definitions, terms, and local practices.

Gross Vehicle Weight

One commonly applied parameter often used to segregate trucks is Gross Vehicle Weight (GVW). This parameter can be found in registration data in those states where licensing is accomplished against this parameter, such as New York State. Thirty six other states also employ this practice. Empty weight is the taxation parameter in 7 states as of July 1971, while a combination of GVW and Empty weight is employed in the remaining 6 states.

Gross vehicle weight has been divided in this study into 7 weight categories.*

6-10,000 pounds
10-14,000 pounds
14-16,000 pounds
16-19,500 pounds
19.5-26,000 pounds
26-33,000 pounds.
Over 33,000 pounds.

Vehicle Type

Vehicle type is another common characteristic. There are several prevailing definitions of vehicle type. The definition used

* For a calculation of stratum boundaries for GVW related to Tri-State Survey distributions, see Appendix A.

in this study, matching both registration data and truck survey data is as follows:

2-axle/single rear tires
2-axle/dual rear tires
3-axle/dual rear tires
3-axle/combination tractor-trailer
4-axle/combination tractor-trailer
5-axle/combination tractor-trailer
Other

The first three categories are single-unit trucks while the remaining are tractor-trailer combinations (no full trailer operation is permitted on public highways in New York.)

Body Type

A truck characteristic used in some stratifications is that of body type. Variations between registration data definitions and survey data do occur but are relatively minor, as indicated below:

Registration Data	Survey Data
Compact Van	Single Unit
Dump	Panel
Flat-bed	Pick-up
Panel	Step-in Delivery
Pick-up	Tank
Refrigerator	Van
Stake body	Stake
Tank	Dump
Tractor	Other
Van	Combination
Wrecker	Van
	Dump
	Flat-bed
	Other

One difference appears in the above listing. Registration data indicate the tractor as a separate element not associated with a specific semitrailer, whereas, survey data includes both elements as a combination.

Type of Fuel

Type of fuel is a characteristic often included in registration data. In the case of the Tri-State Survey, this information was not included.

Truck User Characteristics

Another set of categories of truck characteristics relate to those of its user. While these are not readily obtainable from registration data, they were collected in the Tri-State Survey. Fleet size can be implied from the number of vehicles garaged at the same address included in that data. Eleven broad categories of types of industry in which the user was engaged were coded as follows:

Code Descriptor	Code Descriptor
0 Agricultural	6 Finance
1 Construction	7 Professional
2 Manufacturing	8 Repair
3 Utility, Communication, Transportation	9 Entertainment and Recreation
4 Wholesale	X Public Administration
5 Retail	

A more detailed definition within these categories is given in Appendix B.

Overview of Truck Population

To generate a general profile of truck population in New York City, the data from the R. L. Polk and Company 10 percent Sample and the Tri-State Truck-Taxi Survey were processed,

collating truck characteristics in various combinations to provide matrix relationships. In the remaining part of this report, these sources will be referred to as "registration" and "survey" data, respectively. The results of these stratifications are presented and discussed in the paragraphs to follow.

Distribution of Trucks by Body and Fuel Type - From registration data, almost 85 percent of the total population is represented by 7 body types: van, pick-up, dump, panel, stake, body, tractor and compact van. Over 90 percent use gasoline engines. Predominant among the 9.7 percent of population which are diesel powered trucks are tractors which represent about 3.9 percent of the total. About 3.75 percent of diesels have van type bodies. Table 3 provides the distribution of 1971 registrations in the 9-county New York City area by body type and fuel type.

Distribution of Trucks by Body Type- The survey contained trucks over 6,000 pounds GVW but were not segregated by fuel type. If the truck population in the survey were separated by single unit and tractor trailer combinations, the numbers and distributions would be as shown in Table 4.

Registration data lists tractors without association to type of semi-trailer which it might be pulling. The survey indicates the combination and classifies that group by the type of tractor. Even though there was an 8-year span between registration data and survey data, a comparison between type of truck body contained in both sets was made after dropping out tractors and miscellaneous from the registration data. The classifications of body type and percent of the total 6,723 vehicles remaining is shown in Table 5.

In a similar vein, the survey data relating body styles of the 1047 trucks is also shown. This comparison indicates fair agreement when the time difference is considered. (Recall

Table 3

NINE COUNTY NEW YORK AREA
1971 MOTOR VEHICLE REGISTRATION
DISTRIBUTION OF TRUCKS BY BODY TYPE
AND FUEL TYPE

BODY TYPE	GASOLINE PERCENT	DIESEL PERCENT	TOTAL PERCENT
Compact Van	7.4	0	6.6
Dump	9.9	17.0	10.6
Flat-bed	3.6	3.1	3.6
Panel	9.9	2.6	9.1
Pickup	17.3	0	15.5
Refrigerator	1.5	2.2	1.6
Stake Body	9.7	1.4	8.9
Tank	3.1	12.9	4.1
Tractor	4.3	45.8	8.5
Van	27.0	14.6	25.7
Wrecker	2.7	0.4	2.5
Miscellaneous	3.6	0.0	3.3
	100.0	100.0	100.0
SAMPLE SIZE			
TOTAL CLASSIFIED	6,296	701	6,997
TOTAL UNKNOWN	508	33	541
TOTAL REGISTERED	6,804	734	7,538
PERCENT OF TOTAL SAMPLE UNKNOWN	7.5	4.5	7.2

* Miscellaneous includes buses, house cars, motor homes, van campers, station buses, wagons and other multipurpose vehicles.

SOURCE: R. L. Polk & Co.

Table 4

STRATIFICATION OF TRUCKS OVER 6,000 GVW
BY
TYPE OF BODY FOR SU AND TT TRUCKS

SINGLE UNIT TRUCKS	NUMBER OF TRUCKS	PER CENT OF TRUCKS
Panel	39	4.1
Pick-up	6	0.6
Step-in Delivery	38	3.9
Tank	33	3.4
Van	484	50.3
Stake	109	11.3
Dump	79	8.2
Other	175	18.2
Subtotal	963	100.0
TRACTOR TRAILOR TRUCKS		
Van	46	54.8
Dump	5	5.9
Flat Bed	29	34.5
Other	4	4.8
Subtotal	84	100.0
TOTAL	1,047	

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

Table 5

COMPARISONS OF BODY TYPE

New York City Area

REGISTRATION DATA (1)			SURVEY DATA		
BODY TYPE DESCRIPTOR	NUMBER	% TOTAL	BODY TYPE DESCRIPTOR	NUMBER	% TOTAL
Compact Van	463	6.9	Step-In Delivery	38	3.6
Panel	638	9.5	Panel	39	3.7
Pick-Up	1,088	16.2	Pick-up	6	0.6
Van	1,805	26.8	Van	530	50.6
Tank Truck	288	4.2	Tank Truck	33	3.2
Stake Body	622	9.2	Stake Body	109	10.4
Flat Bed	251	3.7	Flat Bed	29	2.8
Dump	741	11.2	Dump	84	8.0
Wrecker	173	2.6			
Refrigerator	110	1.6			
			Other	179	17.1
Unknown	544	8.1			
	6,723	100.0		1,047	100.0

SOURCE:

(1) R. L. Polk & Company 10 per cent sample of 1971 Registration Data - 9 County N.Y.C. Data - Permission for further use must be obtained from R. L. Polk & Co.

(2) Tri-State Truck-Taxi Survey - 1963

that 1971 registrations were the earliest available for New York City). It dramatically illustrates the effect of interpretation of body type descriptors between two data sources. Generally good agreement was maintained between tank, stake, and dump trucks.

However, four descriptors appear to describe similar body styles. Registration data descriptors of compact-van, panel, pick-up, and van trucks could be describing the same grouping as collectively described by the survey data descriptors of step-in delivery, panel, pick-up and van, for each group respectively contain 59.4 percent and 58.5 percent of the total population. When comparisons are made between what appears to be the same body style within each aggregated group indicates large disagreement.

Another possible source of the disparity is that trucks registered in an area are not always used to a great extent in that area. The survey data indicates only trucks reporting qualified trips in the area.

The disparity between survey data and registration data is not important in the final analysis. Registration data was the principal source of distribution of fuel type among truck stratifications. With this exception, 1971 registration data were not employed except for comparative purposes.

Distribution of NYC Registrations by Fuel Type, Vehicle Type and GVW - The 1971 registration data for the nine-county area was sorted for fuel type, vehicle type and GVW. There were 4,464 vehicles in these records. The percent distribution of fuel type is shown in Table 6.

Table 6

PERCENT OF TOTAL NYC REGISTRATIONS
BY FUEL TYPE, VEHICLE TYPE, & GVW

	VEHICLE TYPE					
	2-Axle		3-Axle		Tractor-Trailer	
GVW CLASS	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline
10-14,000	0*	2.9	-	-	-	0.5
14-16,000	0.5	15.9	-	-	0*	1.5
16-19,500	0*	15.1	-	-	0.8	2.8
19.5-26,000	1.5	26.3	-	-	0.5	5.0
26-33,000	3.2	5.0	0*	-	2.5	1.9
33,000+	1.0	1.7	2.4	2.0	3.4	3.1
	7.2	66.9	2.4	2.0	7.2	14.8

0* Less than 0.1%.
\- None in sample.

SOURCE: R. L. Polk & Co. - Permission for further use must be obtained from R. L. Polk & Co.

With the 2-axle category, 91.3 percent of the total sample of 3,278 vehicles were gasoline powered. The 3-axle category was more equally divided, with 54.5 percent diesel and 45.5 gasoline powered out of a total of 200 vehicles in the sample. In the case of 995 tractor-trailer combinations, about one third were diesel; two thirds were gasoline.

Distributions of Trucks by Vehicle Type and GVW from Survey - The survey data yields what is considered a better profile of truck distributions by vehicle type and GVW, as shown in Table 7. Note that the 2-axle truck is still dominant with a total of 87.5 percent of all trucks in the survey in this class. The 3-axle category divides between single unit and combination, with 4.0 percent and 3.4 percent, respectively. Only 5.1 percent of all trucks in the survey were combinations with greater than 3 axles and "other".

Distribution of Trucks by County and Gross Vehicle Weight - The distribution of trucks registered by county and vehicle weight is indicated in Table 8. Of interest in this analysis is the observation that the distribution of trucks by weight in the Bronx is a good proxy candidate for total truck weight distribution in the 5 boroughs of New York City. The distribution of trucks weighing 10,000 pounds or less is concentrated primarily in the four counties of Nassau, Suffolk, Rockland and Westchester with 61.5 percent of this category there. Otherwise, heavier trucks are predominant in the New York City area with 53.0 to 54.8 percent of the trucks registered in these categories.

Table 7

NEW YORK CITY TRUCK POPULATION
BY GVW AND TYPE OF TRUCK

	2-AXLE TRUCK				3-AXLE TRUCK		TRACTOR TRAILER COMBINATION									
	Single Rear Tire		Dual Rear Tire		Dual Rear Tire		3-AXLE		4-AXLE		5-AXLE		OTHER		GRAND TOTAL	
CATEGORY	Number	Total	Number	Total	Number	Total	Number	Total	Number	Total	Number	Total	Number	Total	Number	Total
6-10,000	26	2.4	31	2.9	1	0.1	1	0.1	1	0.1			1	0.1	61	5.7
10-14,000	43	4.1	140	13.3					1	0.1					184	17.5
14-16,000	19	1.8	87	8.3	3	0.3									109	10.4
16-19,500	36	3.4	228	21.7	2	0.2	3	0.3	2	0.2			1	0.1	272	25.9
19.5-26,000	13	1.2	112	10.7	4	0.4	4	0.4							133	12.7
26-33,000	11	1.0	88	8.3	3	0.3	7	0.7	2	0.2			1	0.1	112	10.6
Over 33,000	4	0.4	84	8.0	29	2.7	20	1.9	32	3.0	12	1.2			181	17.2
TOTALS	152	14.3	770	73.2	42	4.0	35	3.4	38	3.6	12	1.2	3	0.3	1,052	100.0

SOURCE: 1963 Truck-Taxi Survey, Tri-State Regional Planning Commission.

Table 8

Nine-County New York Area
1971 MOTOR VEHICLE REGISTRATIONS
By County and Vehicle Weight

	WEIGHT								TOTAL	
	10,000 or less		10,001 - 19,500		19,501 - 26,000		Over 26,001			
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
New York City Bronx	5,835	62.6 14.1	1,432	15.4 14.6	1,157	12.4 13.2	893	9.6 14.1	9,317	100.0 14.0
Kings	11,481	56.4 27.7	3,355	16.5 34.2	3,209	15.7 36.6	2,326	11.4 36.7	20,371	100.0 30.7
Queens	8,042	63.6 19.4	1,811	14.3 18.4	1,712	13.5 19.5	1,090	8.6 17.2	12,655	100.0 19.1
New York	13,161	65.6 31.8	2,790	13.9 28.4	2,425	12.1 27.7	1,691	8.4 26.7	20,067	100.0 30.3
Richmond	2,886	73.7 7.0	429	11.0 4.4	261	6.7 3.0	339	8.6 5.3	3,915	100.0 5.9
Subtotal	41,405	62.4 100.0	9,817	14.8 100.0	8,764	13.2 100.0	6,339	9.6 100.0	66,325	100.0 100.0
New York Area Nassau	20,399	70.5 19.0	3,377	11.7 18.2	2,949	10.2 18.5	2,219	7.6 18.5	28,944	100.0 18.7
Suffolk	27,192	80.4 25.3	2,819	8.3 15.2	2,272	6.7 14.2	1,572	4.6 13.1	33,855	100.0 22.0
Rockland	14,329	73.8 13.3	2,080	10.7 11.2	1,563	8.0 9.8	1,452	7.5 12.1	19,424	100.0 12.6
Westchester	4,153	76.9 3.9	437	8.1 2.4	427	7.9 2.7	384	7.1 3.2	5,401	100.0 3.5
TOTAL	107,478	69.8	18,530	12.0	15,975	10.4	11,966	7.8	153,949	100.0 100.0

SOURCE: R. L. Polk & Co.

Distribution of Truck Population by Fuel Type and Model Year - A little over 90 per cent of trucks registered in the 9-county area are gasoline powered. How the truck population is distributed by model year is shown in Table 9. Note that the percent of trucks registered in 1971 by model year that are diesel increased slightly over the norm for the 1967 to 1970 model years. This share reduced for 1971 models. Again, these are total truck registrations in the 9-county region. The indications are that these are principally over-the-road vehicles, for few large diesels operate in the congested New York City area except as through-trucks on selected routes.

Truck Ownership by Industry Type - The survey provides information on truck ownership for trucks in the New York City area. Almost 18 percent of the trucks are rented. Three categories of industries--Manufacturing, Utilities/Communications/Transportation, and Wholesale--operate about 76 percent of the trucks in the New York City area. Almost 20 percent of these vehicles are rented by these industries, with this practice more prevalent in Manufacturing and Wholesale industries than in the remaining category. Table 10 indicates this distribution.

Distribution of Trucks by Vehicle Type and Industry Type - The survey data also provides visibility into the types of vehicles operated by the 11 industry categories. About 72.5 percent of all vehicles operated are the 2-axle, dual-rear-tire type. Almost 87 percent are 2-axle vehicles. Of this group, almost 76 percent of the 2-axle vehicles are operated by the three categories of industries--Manufacturing, Utilities/Communications/Transportation, and Wholesale. Almost 60 percent of the 3-axle single unit trucks are operated by these industries. Table 11 presents this stratification for all industry categories and all vehicle types in the survey.

TABLE 9

NINE COUNTY NEW YORK CITY AREA

NUMBER OF VEHICLES REGISTERED BY MODEL YEAR AND FUEL TYPE
10% SAMPLE OF LAST 10 YEARS MODELS

1971

MODEL YEAR	TYPE FUEL						TOTAL
	DIESEL		GASOLINE		UNKNOWN		
	NUMBER	% OF TOTAL	NUMBER	% OF TOTAL	NUMBER	% OF TOTAL	
1962	33	6.6	466	93.4			499
1963	28	4.9	538	95.1			566
1964	59	9.7	602	90.3	6		667
1965	42	6.7	584	93.3			626
1966	68	8.7	714	91.2	1	0.1	783
1967	97	13.8	607	86.2			704
1968	84	10.9	684	89.1			768
1969	120	10.9	988	89.0	2	0.2	1,110
1970	131	12.0	964	88.0			1,095
1971	72	9.9	657	90.1			729
TOTAL	734	9.7	6,804	90.2	9	0.1	7,547

Data Source: R. L. Polk & Co. Permission for further use must be obtained from R. L. Polk & Co.

TABLE 10

NEW YORK CITY DATA

ANALYSIS OF TRUCK OWNERSHIP BY INDUSTRY TYPE

BUSI/ INDUST	OWN	RENT	TOTAL
- PUBLIC ADMINISTRATION	33	1	34
0 AGRICULTURAL	6	-	6
1 CONSTRUCTION	57	3	57
2 MANUFACTURING	164	57	221
3 UTIL., COMM., TRANS.	289	38	327
4 WHOLESALE	190	63	253
5 RETAIL	80	16	96
6 FINANCE	3	-	3
7 PROFESSIONAL	4	1	5
8 REPAIR	38	8	46
TOTAL	864	187	1,051
%	82.1%	17.9%	

SOURCE: 1963 Truck-Taxi Survey, Tri-State Regional Planning Commission

TABLE 11

NEW YORK CITY DATA

NUMBER OF TRUCKS OVER 6,000 POUND GVW
BY VEHICLE TYPE AND TYPE OF INDUSTRY

VEH TYPE	TYPE OF INDUSTRY 0	1	2	3	4	5	6	7	8	9	X	TOTAL
2 Axle - Single Rear Tires	1	7	26	49	41	12	2	1	10		3	152
2 Axle - Dual Rear Tires	5	39	174	214	194	76	1	4	32		27	766
3 Axle - Dual Rear Tires		11	7	10	8	3			1		2	42
3 Axle - Combination		1	8	19	4				3			35
4 Axle - Combination		1	3	26	4	3						37
5 Axle - Combination			1	9		2						12
Other		1									2	3
TOTAL	6	60	219	327	251	96	3	5	46		34	1047
PERCENT OF TOTAL	0.6	5.7	20.9	31.3	24.0	9.2	0.3	0.5	4.4	-	3.3	

TYPE OF INDUSTRY CODE

0 - Agricultural
1 - Construction
2 - Manufacturing
3 - Utility, Communication, Transportation
4 - Wholesale
5 - Retail
6 - Finance
7 - Professional
8 - Repair
9 - Entertainment and Recreation
X - Public Administration

Data Source: 1963 Truck-Taxi Survey, Tri-State Regional Planning Commission

Distribution of Single-Unit and Tractor-Trailer Combinations by Industry Type and GVW - Table 12 expands the distribution by GVW categories. Among the single-unit trucks, approximately 58 percent weigh between 6,000 and 19,500 pounds GVW. Of this percentage, 44 percent are operated by the three-industry group previously cited. A little over 8 percent of the vehicles in use are tractor-trailer combinations, with over 62.5 percent of all combinations being operated by the Utilities/Communications/ Transportation category of industry. The three categories of industry operate about 86 percent of all combinations.

Fleet Size - An indication of truck fleet operations by type of industry can be gained from survey data in Table 13 Of all interviewees in the survey, about 80 percent of those reporting 51 or more trucks garaged at the same address were in the three-industry group. Manufacturers were the dominant industry within this group, reporting about 28 percent of their trucks were garaged with 50 or more trucks in the same place.

Correlation of GVW and Empty Weight - New York registers trucks by GVW. California registers them by empty weight. To examine these two parameters for possible correlation, a linear regression analysis using the least squares method was performed on the Tri-State truck data shown in Table 14. For each of the 1,047 trucks in the sample, the truck's GVW and EVW were introduced into a linear regression computer program. The program treated the GVW as the dependent variable and the EVW as the independent variable. The analysis results in linear equation:

$$GVW = 1.84\ EVW + 856\ \text{lbs.}$$

The correlation coefficient for the analysis was 0.84, which lies in the poor to fair range. Given the truck's EVW, the equation predicts the GVW with approximately 70 percent confidence. Converting the EVW categories used in the Los Angeles data to GVW yields the following results:

TABLE 12

NEW YORK CITY DATA

DISTRIBUTION OF TRUCKS OVER 6,000 POUNDS GVW
BY SINGLE UNIT/TRACTOR-TRAILER INDUSTRY TYPE AND GVW
CATEGORY

VEH TYPE	BUSI/ INDUS	6,000 10,000	PERC/ TOTAL	10,001 14,000	PERC/ TOTAL	14,001 16,000	PERC/ TOTAL	16,001 19,500	PERC/ TOTAL	19,501 26,000	PERC/ TOTAL	26,001 33,000	PERC/ TOTAL	33,001 AND UP	PERC/ TOTAL
	2	12	1.14	39	3.72	26	2.48	55	5.24	35	3.34	26	2.48	15	1.43
	3	5	.48	42	4.00	33	3.15	89	8.48	46	4.39	28	2.67	30	2.86
SU	4	16	1.53	43	4.10	30	2.86	73	6.96	31	2.96	24	2.29	28	2.67
	5	6	.57	22	2.10	8	.76	19	1.81	7	.67	6	.57	23	2.19
	9	18	1.72	37	3.53	12	1.14	30	2.86	10	.95	18	1.72	21	2.00
Subtotal		57	5.43	183	17.45	109	10.39	266	25.36	129	12.30	102	9.72	117	11.15
	2											3	.29	9	.86
	3			1	.10			5	.48	4	.38	4	.38	40	3.81
TT	4	1	.10									1	.10	6	.57
	5													5	.48
	9							1	.10			2	.19	4	.38
Subtotal		1	.10	1	.10			6	.57	4	.38	10	.95	64	6.10
TOTAL		58	5.53	184	17.54	109	10.39	272	25.93	133	12.68	112	10.68	181	17.25

INDUSTRY CODE

2 - Manufacturing

3 - Utility, Communications and Transportation

4 - Wholesale

5 - Retail

9 - All Other

Data Source: 1963 Truck-Taxi Survey, Tri-State Regional Planning Commission

TABLE 13

NEW YORK CITY DATA

TRUCK OPERATORS REPORTING NUMBER OF TRUCKS GARAGED AT SAME ADDRESS BY INDUSTRY TYPE

BUSI/ INDUST	NO. OF TRUCKS GARAGED AT SAME ADDRESS 0-1	2-4	5-10	10-25	26-50	51-100	101-200	201-500	500-UP	TOTAL
-	1	1	4	6	2	6	8	3		31
0	1	3	2							6
1	10	23	10	5		5	1			54
2	24	40	34	26	26	25	19	14		208
3	34	79	65	50	33	28	16	15	2	322
4	35	78	47	39	16	16	3	2		236
5	15	34	15	15	6	3	1	1		90
6			1							1
7			1	3						4
8	3	8	9	7	4	2	3	3		39
TOTAL	123	266	188	151	87	35	51	38	2	991

BUSINESS/INDUSTRY CODE

- - Public Administration
0 - Agriculture
1 - Construction
2 - Manufacturing
3 - Utilities, Communication and Transportation
4 - Wholesale
5 - Retail
6 - Finance
7 - Professional
8 - Repair
9 - Entertainment and Recreation

SOURCE: 1963 Truck-Taxi Survey, Tri-State Regional Planning Commission

TABLE 14

NEW YORK CITY DATA

CORRELATION STUDY BETWEEN GROSS VEHICLE WEIGHT AND EMPTY WEIGHT OF TRUCKS

	EMPTY VEHICLE WEIGHT													
GVW	0 2000	2001 4000	4001 6000	6001 8000	8001 10000	10001 12000	12001 14000	14001 16000	16001 18000	18001 20000	20001 22000	22001 24000	24001 26000	26001 & UP
01			1											1
03			3	8										
04			1	16										
05			4	22	4									
06			1	40	9	1								
07				22	11	3								
08				18	19	3								
09				21	31	5								
10			1	13	28	7	1							
11				11	32	15	1							
12				12	22	8	1							
13				29	99	37	4	2						
14				2	20	16	1			2				
15				1	11	5								
16				3	9	3			1					
17					8	4	1	1						
18				2	15	5	3	2			1			
19					5	6	3	2		1				
20				3	8	9	4	2						
21				1	1	3	5	1	3					
22					6	7	4		1					
23				1	5	1	1	2	2	3				
24				1	3	7	6	1		2				
25				1	1	5	2	2						1
26				1	2	2	6	6	1	6				
27						4	1	4	1	1				1
28				1		6	3	1	3		1			
29					2	1	7	2	1					1
30					2	3	5	2	1					
31				1			2	6	1	1				
32						6	6	7		1				
33					1	3	4		2					
34				1				1	1	2				
35							1							
36					1	1		1		1	4			
37				2	10	31	12	6	5	11	11	6	2	17
TOTAL			11	233	365	207	84	51	23	31	17	6	2	21

GVW CODE

01	6- 7,000	20	23-24,000	11	15-16,000	29	32-33,000
03	7- 8,000	21	24-25,000	12	16-17,000	30	33-34,000
04	8- 9,000	22	25-26,000	13	17-18,000	31	34-35,000
05	9-10,000	23	26-27,000	14	18-19,000	32	35-36,000
06	10-11,000	24	27-28,000	15	19-19,500	33	36-37,000
07	11-12,000	25	28-29,000	16	19.5-20,000	34	37-38,000
08	12-13,000	26	29-30,000	17	20-21,000	35	38-39,000
09	13-14,000	27	30-31,000	18	21-22,000	36	39-40,000
10	14-15,000	28	31-32,000	19	22-23,000	37	Over 40,000

L. A. EVW Categories	Equivalent GVW Categories
6,000 - 9,999	11,856 - 19,256
10,000 - 14,999	19,256 - 28,456
15,000 - 19,999	28,456 - 37,756
20,000 - 24,999	37,756 - 46,856
25,000 - 29,999	46,856 - 56,056
30,000 - 34,999	56,056 - 65,256
35,000 +	65,256 +

The confidence in this predictive model was so low that it was rejected as a means to correlate the Los Angeles data to GVW.

Omission of Certain Vehicles in Data

Certain vehicle types are not included in these data. Representative of this class are the recreational vehicles such as camper/pick-up combinations, motor homes, etc. There were no vehicles of this type appearing in the Tri-State survey data, apparently due to the small number in the total population. They are also not considered by owners and others as "trucks" in their use patterns. The omission is not considered significant since only the very largest and more luxurious motor homes exceed 10,000 pounds GVW. Annual production of this type vehicle is less than 100,000.

Chapter 4

PATTERNS OF TRUCK USAGE

From a study and analysis of the survey trip data, it was possible to generate an understanding of the patterns of truck usage. These survey data had already been processed to contain only truck data which made a "qualified" trip within New York City. A "qualified" trip was one which had either origin, destination or both within the city limits during the survey period. Number of trips, county of origin, county of destination, airline trip mileage, elapsed trip time and other trip information was contained in these data. Various correlation studies were run to obtain a pattern of usage.

The definition of an internal-external trip was given to a trip which had exclusively an origin or destination within the city. An internal-internal trip was one in which both had origin and destination within the city.

Number of Trips by Industry Type and Vehicle Type

The Truck-Taxi Survey contained data on a total of 11,283 trips performed during the survey period which were "qualified". The manner in which these trips distribute among 4 industry groups by vehicle type is shown in Table 15. This table is a compression of a more extensive stratification, given in Table C-1 in Appendix C . The category of "all other" includes 7 industry types, when combined, forms a group of comparable size to Manufacturing, Utility/Communications/Transportation, and Wholesale industries, with the share of total trips being 21.6, 25.8, 27.4, and 25.2 percent respectively. These data pertain to vehicles with GVW greater than 6000 pounds.

Table 15

NEW YORK CITY DATA

NUMBER OF REPORTED TRIPS
BY INDUSTRY TYPE AND VEHICLE TYPE
FOR ALL VEHICLES OVER 6000 POUND GVW

	SINGLE UNIT TRUCKS			TRACTOR-TRAILER COMBINATIONS				
VEHICLE TYPE	2-AXLE SINGLE REAR TIRE	2-AXLE DUAL REAR TIRE	3-AXLE DUAL REAR TIRE	3-AXLE	4-AXLE	5-AXLE	OTHER	TOTAL
Manufacturing	514	2310	38	33	13	2		2910
Utility/Communications/ Transportation	527	2293	72	78	88	29		3087
Wholesale	396	2393	69	19	11			2853
All Other	418	1797	156	18	18	19	7	2433
Total	1855	8758	335	148	130	50	7	11283

SOURCE: 1963 TRUCK-TAXI SURVEY, Tri-State Regional Planning Commission

Approximately 78 percent of all trips were reported by operators of the single unit, 2-axle, dual-rear-tire trucks. The single unit, 2-axle, single-rear-tire trucks had about a 16.5 percent share, so that the combined grouping accounts for about 94.5 percent of all trips. Approximately 3 percent of total trips were reported for the 3-axle, dual-rear-tire trucks. Therefore, the single unit trucks in the area perform almost 97.5 percent of trips. The remainder are assigned to all types of tractor-trailer combinations.

About 25.7 percent of the travel is performed by trucks who made 17 or more daily trips, as shown in Table 16. Predominant in this grouping is the 2-axle, dual-rear-tire truck. The single unit, 2-axle trucks performed almost all trips in this category.

At the other end of the scale, 92 percent of all tractor-trailer combinations and "other" vehicle types performed between 1 and 6 daily trips.

Trip Characteristics by Vehicle Type

The survey data recorded trip distance by airline mileage between planning network nodes. The relationships between number of trips performed and the mileage were associated with both the vehicle type and the vehicle GVW. These were stratified by internal-internal and internal-external type trips.

Trips and Mileage by Vehicle Type - Table 17 presents a summary of these data by vehicles over 6000 pounds GVW. The 2-axle, dual-rear-tire truck dominates in both generating about 77.7 percent of the total trips and 70.5 percent of total airline survey miles. This travel is divided between internal-internal trips, which accounted for 60 percent of the total number of trips and about 47.1 percent of the total airline mileage. Another 23.4 percent of total trip mileage was traveled in performing internal-external trips. Table 18 summarizes the average trip

Table 16

NUMBER OF DAILY TRIPS REPORTED
BY VEHICLE-TYPE AND INDUSTRY TYPE
FOR TRUCKS OVER 6,000 POUNDS GVW

New York City Data

VEHICLE TYPE	INDUSTRY TYPE	NUMBER OF TRUCK-TRIPS REPORTED									
		1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17+	TOTAL
2-Axle Single Rear Tires	Manufacturing	52	45	40	37	34	30	28	26	222	514
	Utility/Communications/Transport	98	89	74	65	52	45	31	25	48	527
	Wholesale	82	63	50	40	31	28	20	16	66	396
	All Other Industry Types	71	45	39	29	19	14	12	10	179	418
	Subtotals	303	242	203	171	136	117	91	77	515	1,855
2-Axle Dual Rear Tires	Manufacturing	345	288	247	204	174	144	125	115	688	2,310
	Utility/Communications/Transport	425	333	243	181	147	130	110	93	631	2,293
	Wholesale	386	307	248	210	193	167	145	129	573	2,358
	All Other Industry Types	362	262	196	150	126	102	78	59	462	1,797
	Subtotals	1,518	1,190	934	745	640	543	458	396	2,334	8,758
3-Axle Dual Rear Tires	Manufacturing	14	13	6	3	2					38
	Utility/Communications/Transport	20	12	6	4	4	4	2	2	18	72
	Wholesale	16	13	12	9	6	6	2	2	3	69
	All Other Industry Types	33	22	18	16	15	12	9	7	24	156
	Subtotals	83	60	42	32	27	22	13	11	45	335
3-Axle Tractor-Trailer Combinations	Manufacturing	16	8	6	2	1					33
	Utility/Communications/Transport	38	23	8	3	2	2	2			78
	Wholesale	8	7	4							19
	All Other Industry Types	8	5	4	1						18
	Subtotals	70	43	22	6	3	2	2			148
5-Axle T-T Combinations	Manufacturing	2									2
	Utility/Communications/Transport	18	7	4							29
	All Other (No Wholesale)	4	2	2	2	2	2	2	2	1	19
	Subtotals	24	9	6	2	2	2	2	2	1	50
Other Types	Agricultural	4	2	1							7
GRAND TOTALS		2,075	1,589	1,219	959	808	686	566	486	2,896	11,283

SOURCE: 1963 Truck-Taxi Survey, Tri-State Regional Planning Commission.

Table 17

NEW YORK CITY DATA

Trip Characteristics By Vehicle Type Over 6,000 Pounds GVW

VEHICLE TYPE	INTERNAL - INTERNAL Number Trips	INTERNAL - INTERNAL Total Airline Miles	INTERNAL - EXTERNAL Number Trips	INTERNAL - EXTERNAL Total Airline Mileage	TOTAL Number Trips	TOTAL Total Airline Mileage
1. 2-Axle, single rear tire	1,784	2,175	71	1,042	1,855	3,217
2. 2-Axle, dual rear tire	8,371	12,097	412	6,019	8,783	18,116
3. 3-Axle, dual rear tire	309	786	26	372	335	1,158
4. 3-Axle, T.-T. Combination	94	332	54	1,406	148	1,738
5. 4-Axle, T.-T. Combination	65	242	65	824	130	1,066
6. 5-Axle, T.-T. Combination	36	98	14	350	50	448
7. Other	6	15	1	13	7	28
	10,665	15,745	643	10,026	11,308	25,771

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

Table 18

NEW YORK CITY DATA

AVERAGE AIRLINE MILES AND PER CENT OF TOTAL INTERNAL-INTERNAL AND INTERNAL-EXTERNAL TRIPS
By Vehicle Type

VEHICLE TYPE	Internal - Internal Trip		Internal - External Trip	
	Average Airline Miles Per Trip	Per Cent Total Miles (Int.-Int.)	Average Airline Miles Per Trip	Per Cent Total Miles (Int-Ext.)
1. 2-axle, single rear tire	1.21	13.8	14.67	10.4
2. 2-axle, dual rear tire	1.44	76.7	14.60	60.0
3. 3-axle, dual rear tire	2.53	5.0	14.26	3.7
4. 3-axle, combination	3.52	2.1	26.04	14.1
5. 4-axle, Combination	3.72	1.5	12.67	8.2
6. 5-axle, combination	2.73	0.6	24.92	3.5
7. Other	2.49	0.1	13.38	0.1

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

airline miles and the percentage of total miles traveled by types of vehicles in performing internal-internal and internal-external trips.

The distribution of airline trip distance by vehicle type for the two trip types is shown in Table 19.

Travel distance in a rectangular network can be estimated from airline distance by multiplying the later by the factor 1.21.

Trip Elapsed Time by Vehicle Type - Survey trip data included estimated elapsed time for each reported trip. These times have been organized by vehicle type for all vehicles over 6000 pounds GVW, in Table 20. Shown here are the elapsed trip time increment distributions for internal-internal and internal-external type trips. Standing alone, these data have little meaning except to provide a rough travel time estimate by vehicle type. However, when associated with each trip distance, a more accurate estimate of average speed can be made. Association with trip end and trip start times of contiguous trips provides the ability to estimate soak-time of engines. These will be discussed later in this chapter.

Travel Characteristics of Trucks over 6000 Pounds GVW - A summary of travel characteristics of trucks over 6000 pounds GVW is presented in Table 21. Once again, the 2-axle, dual-rear-tire truck is shown to generate about 70 percent of the total truck vehicle traveled (VMT). All single unit trucks account for 87.3 percent of the truck VMT. The average speed for single unit trucks was approximately 8.5 mph. Combinations averaged the high speed of 13.7 mph, due, most likely to the fact that little travel was performed on narrow, congested local streets.

The 2-axle, single-rear-tire truck averaged more daily trips while the 3-axle, dual-rear-tire truck had the lowest number of daily trips of the single unit truck category.

Table 19

NUMBER OF TRIPS AND AIRLINE MILEAGE OF
TRUCK-TRIPS FOR TRUCKS OVER 6,000 POUNDS GVM
BY VEHICLE TYPE

New York City Data

INTERNAL-INTERNAL TRIPS

VEHICLE TYPE	AIRLINE DISTANCE 0-0.5	0.5-1	1.1-1.5	1.6-2	3-4	5-6	7-8	9-10	11-12	13-15	16-Up	TOTAL TRIPS	TOTAL MILES
1	1,019	245	126	189	105	49	29	15	3	1	3	1,784	2,174.87
2	4,488	1,068	608	930	661	305	157	86	36	18	14	8,371	12,097.07
3	53	34	38	79	68	25	7	2	3			309	784.60
4	27	11	4	6	20	18	2	2		2	2	94	331.84
5	6	5	1	9	30	9	5					65	241.87
6	11	1	4	5	7	8						36	98.27
7	2		1	1	1	1						6	14.94
TOTAL	5,600	1,364	782	1,219	892	415	200	105	42	21	19	10,665	15,743.46

INTERNAL-EXTERNAL TRIPS

VEHICLE TYPE	0-2	3-4	5-6	7-8	9-10	11-12	13-15	16-UP	TOTAL TRIPS	TOTAL MILES
1	4	10	8	3	7	8	5	26	71	1,042.41
2	33	43	41	49	40	27	34	145	412	6,018.56
3	4	3		4			1	14	26	371.86
4	1		3	4	7	2	4	33	54	1,406.37
5	10	5	1	6	13	3	3	24	65	824.37
6	1	2		1	2	2	2	4	14	349.81
7							1		1	13.38
TOTAL	53	63	53	67	69	42	50	246	643	10,026.76
% OF TOTAL	8.2	9.8	8.2	10.4	10.7	6.5	7.8	38.3		

VEHICLE CODE:
1. 2-axle, single rear tire
2. 2-axle, dual rear tire
3. 3-axle, dual rear tire
4. 3-axle, tractor-trailer combination
5. 4-axle, tractor-trailer combination
6. 5-axle, tractor-trailer combination
7. Other

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 20

NEW YORK CITY DATA

TRIP ELAPSED TIME IN MINUTES FOR TRUCKS
OVER 6,000 POUNDS GVW BY VEHICLE TYPE

TABLE 3A

INTERNAL-INTERNAL TRIPS ONLY

TRIP ELAPSED TIME-MINUTES

VEH TYPE	0-5	6-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-UP	TOTAL
1	694	389	370	170	43	36	51	4	7	12	13	7	1784
2	3573	1573	1576	890	179	232	197	23	40	37	40	46	8371
3	17	96	79	60	19	10	15	2	7			4	309
4	9	10	19	20	3	5	21	3	1	2	2	1	94
5	3	2	6	20	2	15	11			4	4	2	65
6	2	6	6	11	2	4	4	1					36
7			3	1			1		1				6
TOTAL	4298	2075	2061	1172	248	302	300	33	56	55	59	60	10665
% OF TOTAL	40.3	19.6	19.3	11.0	2.3	2.8	2.8	0.3	0.5	0.6	0.6	0.6	100%

TABLE 3B

INTERNAL-EXTERNAL OF EXTERNAL-INTERNAL TRIPS
TRIP ELAPSED TIME-MINUTES

VEH TYPE	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101 UP	TOTAL
1	3	13	12	3	6	13	3	3	5	2	8	71
2	14	26	59	37	40	97	19	30	50	7	31	412
3		2	8	2	2	8	1		1		2	26
4	2		5	1	5	8	2		16	2	13	54
5		2	7	4	6	22	6	6	5		7	65
6	1		1		1	6			3		2	14
7						1						1
TOTAL	20	45	92	47	60	155	31	39	80	11	63	643
% OF TOTAL	3.1	7.0	14.3	7.3	9.3	24.2	4.8	6.1	12.4	1.7	9.8	100%

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 21

NEW YORK CITY DATA

SUMMARY OF URBAN TRUCK
TRAVEL CHARACTERISTICS BY VEHICLE TYPE
ALL TRUCKS OVER 6,000 POUNDS GVW

	TYPE OF VEHICLE								
	1	2	3	SU	4	5	6	7	TT
VEHICLE MILES									
% Int.-Int.	13.8	76.8	5.0	95.6	2.1	1.5	0.6	0.1	4.3
% Int.-Ext.	10.4	60.0	3.7	74.1	14.1	8.2	3.5	0.1	25.9
% OF TOTAL	12.5	70.3	4.5	87.3	6.7	4.0	1.7	0.1	12.5
TRUCK TRIPS									
% OF TOTAL	16.5	77.5	3.0	97.0	1.3	1.2	0.4	0.1	3.0
TRUCK POPULATION									
% OF TOTAL									
TRI-STATE SURVEY	14.5	73.3	4.0	91.8	3.3	3.5	1.1	0.3	8.2
AVG. MILES PER TRIP									
(MILES)	2.1	2.5	4.2	2.4	14.2	9.9	10.8	5.3	11.6
AVG. MILES PER TRUCK									
(MILES)	25.6	28.5	33.8	27.8	60.1	34.9	45.2	15.9	45.8
AVG. TRIP SPEED									
(MPH)	7.6	8.7	9.5	8.5	15.7	11.2	16.3	8.7	13.7
AVG. NUMBER TRIPS PER TRUCK PER DAY	12.2	11.4	8.1	11.4	4.2	3.5	4.2	3.0	3.9

Trips by combinations averaged almost five times longer than the single unit truck category but there were almost three-fourths fewer average daily trips.

A statistical analysis of trip characteristics was conducted to compare the aggregations of trucks above 6,000 pounds GVW and the aggregation above 10,000 pounds GVW. Table 22 indicates the results of these analyses. Eliminating the trucks between 6,000 and 10,000 pounds GVW affected the trip characteristics of only the 2-axle, single-rear-tire truck. The average number of daily trips for this truck type decreased for the higher weight aggregation and the number of miles per day tended to increase. Otherwise, the characteristics of the two aggregations remained the same.

The average daily hot soak time ranged from a little over 55 minutes to about 93 minutes for vehicles with GVW of 10,000 pounds and over as shown in Table 22. The number of trips in which the soak time exceeded 90 minutes is shown in the last column of this tabulation.

Trip Types for Trucks Over 10,000 Pounds GVW - An analysis of truck trips of this aggregation was performed. As shown in Table 23, internal-internal trips in all 5 boroughs were mostly performed by the single unit truck, accounting for over 98 percent of all trips of this nature. There were variations in the distribution of these trips among each of the boroughs. Much higher percentage of use of the 2-axle, dual-rear-tire truck was reported in Brooklyn and a lower than average use in Manhattan. In Manhattan, there was a significant increase in share of internal-internal travel by the smaller 2-axle, single-rear-tire truck.

One trend is worthy of note. No trips were reported by combinations in Richmond in the 1963 survey. The survey was conducted prior to the opening of the Verrazano Narrows Bridge and the resulting development and change in traffic patterns this facility has caused. It could be reasonable that the share of total internal-internal truck trips might approach that of other boroughs.

Table 22

NEW YORK CITY DATA

STATISTICAL ANALYSIS OF TRIP CHARACTERISTICS BY VEHICLE TYPE

VEH.	NO. TRIPS PER DAY AVG.	NO. TRIPS PER DAY DEV.	NO. MILES PER TRIP AVG.	NO. MILES PER TRIP DEV.	NO MILES PER TRUCK AVG.	NO MILES PER TRUCK DEV.	SPEED(MPH) AVG.	SPEED(MPH) DEV.	DAILY SOAK-TIME PER TRUCK AVG.	DAILY SOAK-TIME PER TRUCK DEV.	NO. TRIPS > 90 MIN. SOAK TIME
VEHICLES OVER 10,000 POUNDS GVW											
1	10.8	09.0	02.4	08.0	26.4	20.4	07.7	09.6	78.2	60.4	73
2	11.4	14.3	02.5	10.2	28.5	24.0	08.8	07.0	62.1	62.8	415
3	08.1	07.6	04.2	07.8	33.8	29.2	09.5	18.8	55.4	87.2	28
4	04.2	02.6	14.3	28.4	59.9	74.3	15.8	10.9	92.8	98.7	37
5	03.5	01.6	09.9	08.6	34.9	34.7	11.2	06.2	51.2	59.0	35
6	04.2	04.3	10.8	15.3	45.2	74.1	16.3	11.2	57.5	84.0	12
7	03.0	02.8	05.3	11.1	15.9	00.4	08.7	08.0	72.5	02.5	
VEHICLES OVER 6,000 POUNDS GVW											
1	12.2	13.6	02.1	08.2	25.6	20.1	07.6	09.4	67.7	63.1	84
2	11.4	14.2	02.5	10.0	28.5	24.0	08.7	07.0	61.6	62.8	431
3	08.1	07.6	04.2	07.8	33.8	29.2	09.5	18.8	55.4	87.2	28
4	04.2	02.5	14.2	28.4	60.1	74.2	15.7	11.0	92.8	98.7	38
5	03.5	01.6	09.9	08.6	34.9	34.7	11.2	06.2	51.2	59.0	35
6	04.2	04.3	10.8	15.3	45.2	74.1	16.3	11.2	57.5	84.0	12
7	03.0	02.8	05.3	11.1	15.9	00.4	08.7	08.0	72.5	02.5	

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 23

NEW YORK CITY DATA

STATISTICAL ANALYSIS OF TRIP CHARACTERISTICS
OF INTERNAL TRUCK-TRIPS BY VEHICLE TYPE
FOR TRUCKS OVER 10,000 POUNDS GVW

BOROUGH	VEHICLE TYPE 1	2	3	SU	4	5	6	TT	% OF TOTAL INTERNAL TRIPS
BRONX									10.7
% OF INTERNAL BRONX TRIPS	17.6	80.4	0.6	98.6	1.1	0.3	-	1.4	
BROOKLYN									32.0
% OF INTERNAL BROOKLYN TRIPS	6.6	89.9	1.9	98.4	0.9	0.4	0.3	1.6	
MANHATTAN									39.8
% OF INTERNAL MANHATTAN TRIPS	28.4	69.1	1.4	98.9	0.5	0.2	0.4	1.1	
QUEENS									15.9
% OF INTERNAL QUEENS TRIPS	12.6	81.0	4.6	98.2	0.4	0.9	0.5	1.8	
RICHMOND									1.6
% OF INTERNAL RICHMOND TRIPS	14.9	83.6	1.5	100.0	-	-	-	-	
TOTAL INTERNAL TRIPS	17.6	79.1	2.0	98.7	0.6	0.4	0.3	1.3	100.0

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 24

NEW YORK CITY DATA

STATISTICAL ANALYSIS OF TRIP CHARACTERISTICS
OF EXTERNAL TRUCK-TRIPS BY VEHICLE TYPE
TRUCKS OVER 10,000 POUNDS GVW

BOROUGH	VEHICLE TYPE 1	2	3	SU	4	5	6	TT	% OF TOTAL EXTERNAL TRIPS
BRONX									17.5
% OF EXTERNAL BRONX TRIPS	14.3	75.5	7.1	97.9	-	3.1	-	3.1	
BROOKLYN									20.9
% OF EXTERNAL BROOKLYN TRIPS	6.0	76.1	2.5	84.6	9.4	4.3	1.7	15.4	
MANHATTAN									27.3
% OF EXTERNAL MANHATTAN TRIPS	9.2	59.5	1.3	70.0	5.9	21.5	2.6	30.0	
QUEENS									30.9
% OF EXTERNAL QUEENS TRIPS	11.6	61.8	2.3	75.7	13.3	8.7	2.3	24.3	
RICHMOND									3.4
% OF EXTERNAL RICHMOND TRIPS	15.8	15.8	10.5	42.1	47.4	10.5	-	57.9	
TOTAL EXTERNAL TRIPS	10.4	65.0	3.2	78.6	7.7	11.6	2.1	21.4	100.0

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

Table 24 shows a significantly different trip pattern trend against vehicle type. The prominence of the single unit truck performing internal-external trips in the Bronx reduced slightly. However, significant shifts of this type trip were reported in the other boroughs. In Richmond, a higher percentage of internal-external trips was performed by the larger tractor-trailer combinations than by single unit trucks.

The characteristics of the internal-internal trips between the 5 New York City boroughs were analyzed and are presented in Table 25. Trips in both directions on linkages between boroughs as a percentage of total interborough trips by vehicle type are shown. For the proper interpretation of these data, Table 26 indicates the division of total trips by borough which fall under the following categories: Internal - those totally with the borough; External - One trip-end in the city associated with the specific borough and the other external to the city; and Interborough - internal-internal trips between boroughs.

Trip Characteristics by Single-Unit and Tractor-Trailer Combination Aggregations

To explore if a meaningful set of trip characteristics could be assembled from the survey data by the single unit/combination aggregation, a series of analyses were run.

Distribution of Trips by GVW and Industry Type - Table 27 shows the results of this processing of reported trips. The percentage of trips among the various sizes of single unit trucks contains two peaks. The largest occurs with trucks of GVW in the range from 16,001 to 19,500 pounds with about 26 percent of total trips. The smaller peak appears to relate to the 10,001 to 14,000 pound GVW category. As expected, tractor-trailer trips were largely performed by vehicles of greater than 33,000 pounds GVW.

Distribution of Expanded* Truck-Miles by Industry Type and GVW - The stratification of survey data for expanded* truck-miles

* Expanded truck-miles equals airline distance times 1.21.

TABLE 25

NEW YORK CITY DATA

STATISTICAL ANALYSIS OF INTERBOROUGH TRIP CHARACTERISTICS
BY VEHICLE TYPE
FOR TRUCKS OVER 10,000 POUNDS GVW

LINKAGES (BOTH DIRECTIONS)	VEHICLE TYPE 1	2	3	SU	4	5	6	TT	% OF TOTAL INTERBOROUGH TRIPS
	%	%	%	%	%	%	%	%	
BRONX-BROOKLYN	11.0	73.4	2.2	87.6	13.4	-	-	13.4	4.3
BRONX-MANHATTAN	15.0	78.1	2.3	95.4	1.1	3.5	-	4.6	16.7
BRONX-QUEENS	14.8	64.8	7.4	87.0	11.1	1.9	-	13.0	5.2
BRONX-RICHMOND	-	100.0	-	100.0	-	-	-	-	0.1
BROOKLYN-MANHATTAN	16.6	71.3	3.1	91.0	2.8	4.1	2.1	9.0	27.7
BROOKLYN-QUEENS	9.1	85.5	2.3	96.9	1.0	0.7	1.4	3.1	28.6
BROOKLYN-RICHMOND	33.3	66.7	-	100.0	-	-	-	-	0.3
MANHATTAN-QUEENS	16.8	75.1	4.0	95.9	0.7	3.5	-	4.0	16.6
MANHATTAN-RICHMOND	-	66.7	-	66.7	-	33.3	-	33.3	0.3
QUEENS-RICHMOND	-	-	-	100.0	-	-	-	-	0.2
TOTAL INTERBOROUGH TRIPS	13.8	76.8	3.1	93.7	2.7	2.7	0.9	6.3	100.0

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 26

NEW YORK CITY DATA

SUMMARY OF STATISTICAL ANALYSIS
OF TRIP CHARACTERISTICS
FOR TRUCKS OVER 10,000 POUNDS GVW

	INTERNAL % OF TOTAL TRIPS	EXTERNAL % OF TOTAL TRIPS	INTERBOROUGH % OF TOTAL TRIPS HAVING ONE TRIP-END IN BOROUGH
BRONX	9.0	1.0	2.72
BROOKLYN	26.9	1.2	6.31
MANHATTAN	33.4	1.5	6.35
QUEENS	13.4	1.7	5.23
RICHMOND	1.3	0.2	0.09
TOTAL TRIPS	84.0	5.6	10.4

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 27

NEW YORK CITY DATA

DISTRIBUTION OF TRUCK-TRIPS BY SINGLE UNIT AND TRACTOR-TRAILER, INDUSTRY TYPE AND GROSS VEHICLE WEIGHT CATEGORY

VEH YPE	BUSI/ INDUS	6,000 10,000	PERC/ TOTAL	10,001 14,000	PERC/ TOTAL	14,001 16,000	PERC/ TOTAL	16,001 19,500	PERC/ TOTAL	19,501 26,000	PERC/ TOTAL	26,001 33,000	PERC/ TOTAL	33,001 AND UP	PERC/ TOTAL
	2	250	2.21	608	5.38	304	2.69	896	7.93	526	4.65	188	1.66	107	.95
	3	88	.78	552	4.88	372	3.29	772	6.83	582	5.15	348	3.08	178	1.57
SU	4	195	1.73	514	4.55	451	3.99	944	8.35	370	3.27	155	1.37	198	1.75
	5	210	1.86	240	2.12	113	1.00	165	1.46	145	1.28	58	.51	249	2.20
	9	132	1.17	232	2.05	111	.98	167	1.48	64	.57	357	3.16	128	1.13
Subtotal		875	7.74	2146	18.99	1351	11.95	2944	26.05	1687	14.93	1106	9.79	860	7.61
	2											10	.09	38	.34
	3			4	.04			20	.18	13	.12	24	.21	134	1.19
TT	4	1	.01									5	.04	24	.21
	5													35	.31
	9							5	.04			4	.04	17	.15
Subtotal		1	.01	4	.04			25	.22	13	.12	43	.38	248	2.19
TOTAL		876	7.75	2150	19.02	1351	11.95	2969	26.27	1700	15.04	1149	10.17	1108	9.80

INDUSTRY CODE

2 - Manufacturing

3 - Utility, Communications and Transportation

4 - Wholesale

5 - Retail

9 - All Other

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

by industry type and GVW stratums is shown in Table 28. The distribution indicated here followed the previous presented patterns.

Statistical Analysis of Truck-Trips - An analysis of truck-trips was performed on the single unit/combination aggregation by industry type. This analysis, summarized in Table 29, failed to show recognizable relationships which could be used to simplify and collect trip characteristics into smaller cells.

Trip Characteristics by GVW Stratums

An analysis of travel characteristics by GVW categories, similar to those performed by vehicle type (Table 21, for example). The results is given in Table 30. When compared to the analyses performed by vehicle type, the trip characteristics are about equally distributed in all GVW stratums with little apparent trends or patterns evident.

Time Distribution of Truck Trips

The mid-point time of all trips reported in the survey were collated as shown in Table 31. This collation was made against type of industry within each vehicle type. The total truck trips are distributed such that about 89.6 percent of all trips have their mid-point time within the hours of 6 A.M. and 6 P.M. A plot of this distribution is shown in Figure 5. The major activity between midnight and 6 A.M. are trips performed by the manufacturing industry trucks. Wholesale industry trucks begin their trips around 2 A.M. whereas the Utility/Communications/ Transportation reports their earlier moves starting about 4 A.M. Most of this movement is the familar 2-axle, dual-rear-tire truck.

To demonstrate any dramatic shifts in time distribution of trips, data of bridge crossings in 1964 and 1971 made by the New York City Department of Public Works were overlaid on the survey data. There appears to be slight shifts in night truck trips in both the 1964 and 1971 bridge crossings. The peak hour activity at the

TABLE 28

NEW YORK CITY DATA

DISTRIBUTION OF EXPANDED* TRUCK-MILES
BY SINGLE UNIT AND TRACTOR-TRAILER, INDUSTRY TYPE
AND GROSS VEHICLE WEIGHT CATEGORY

VEH TYPE	BUSI/ INDUS	6,000 10,000	PERC/ TOTAL	10,001 14,000	PERC/ TOTAL	14,001 16,000	PERC/ TOTAL	16,001 19,500	PERC/ TOTAL	19,501 26,000	PERC/ TOTAL	26,001 33,000	PERC/ TOTAL	33,001 AND UP	PERC/ TOTAL
	2	261.59	.84	1065.60	3.42	654.75	2.10	1967.92	6.31	919.83	2.95	821.72	2.64	390.92	1.25
	3	139.11	.45	981.54	3.15	704.92	2.26	2723.75	8.74	1312.61	4.21	611.46	1.96	844.96	2.71
SU	4	408.00	1.31	1305.94	4.19	903.19	2.90	2065.05	6.63	1033.93	3.32	778.44	2.50	820.39	2.63
	5	232.28	.75	487.82	1.57	321.95	1.03	674.50	2.16	165.02	.53	173.35	.56	607.67	1.95
	9	405.58	1.30	821.86	2.64	315.28	1.01	763.54	2.45	215.50	.69	616.69	1.98	683.76	2.19
Subtotal		1446.56	4.64	4662.76	14.96	2900.09	9.31	8194.76	26.29	3646.89	11.70	3001.66	9.63	3347.70	10.74
	2											486.09	1.56	908.82	2.92
	3			17.69	.06			260.14	.83	181.32	.58	138.18	.44	1240.18	3.98
TT	4	7.20	.02									23.56	.08	254.02	.82
	5													237.20	.76
	9							15.62	.05			25.98	.08	171.36	.55
Subtotal		7.20	.02	17.69	.06			275.76	.88	181.32	.58	673.81	2.16	2811.58	9.02
TOTAL		1453.76	4.66	4680.45	15.02	2900.09	9.31	8470.52	27.18	3828.21	12.28	3675.47	11.79	6159.28	19.76

INDUSTRY CODE

2 - Manufacturing

3 - Utility, Communications and Transportation

4 - Wholesale

5 - Retail

9 - All Other

* NOTE: EXPANDED TRUCK-MILES EQUALS AIRLINE DISTANCE TIMES 1.21.

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 29

NEW YORK CITY DATA

STATISTICAL ANALYSIS OF TRUCK-TRIPS BY SINGLE UNIT AND TRACTOR-TRAILER COMBINATIONS BY INDUSTRY

Average and Deviation of Number of Trips & Miles, Speed, and Daily Soak-Time, and Number of Trips Where Soak-Time Exceeded 90 Minutes

GVW	IND	NO. TRIPS PER DAY AVG.	NO. TRIPS PER DAY DEV.	NO-MILES PER TRIP AVG.	NO-MILES PER TRIP DEV.	NO-MILES PER TRUCK AVG.	NO-MILES PER TRUCK DEV.	SPEED(MPH) AVG.	SPEED(MPH) DEV.	DAILY SOAK-TIME PER TRUCK AVG.	DAILY SOAK-TIME PER TRUCK DEV.	NO. TRIPS >90 MIN. SOAK TIME
SINGLE UNIT TRUCKS												
10-14.000	2	15.6	12.2	01.8	03.8	27.3	12.4	07.3	05.5	30.6	34.2	18
	3	13.1	11.1	01.8	05.4	23.4	14.8	07.8	05.1	96.1	72.2	20
	4	12.0	09.9	02.5	12.1	30.4	24.6	10.3	08.4	62.0	64.4	16
	5	10.9	11.9	02.0	10.5	22.2	21.8	07.4	10.4	63.6	70.3	11
	9	06.3	05.7	03.5	09.8	22.2	19.8	08.3	11.2	90.4	93.5	30
14-16,000	2	11.7	11.4	02.2	07.2	25.2	15.8	08.3	03.9	88.8	72.7	12
	3	11.3	09.3	01.9	03.1	21.4	14.2	06.0	03.3	68.5	58.8	23
	4	15.0	11.6	02.0	05.8	30.1	20.9	08.2	09.2	90.3	54.8	12
	5	14.1	15.3	02.8	05.6	40.2	27.8	11.4	06.9	62.5	39.3	3
	9	09.3	09.1	02.8	05.9	26.3	16.5	07.8	04.8	54.9	81.5	7
16-19,500	2	16.3	20.5	02.2	21.7	35.8	24.9	09.5	06.5	74.9	58.9	22
	3	08.7	07.3	03.5	07.2	30.6	33.4	09.4	08.0	51.6	61.5	73
	4	12.9	12.7	02.2	10.9	28.3	21.1	09.0	15.5	68.2	74.1	33
	5	08.7	08.4	04.1	08.2	35.5	26.0	12.4	17.3	91.7	95.9	4
	9	05.6	05.8	04.6	18.7	25.5	25.2	09.0	07.1	93.5	21.1	24
19.5-26,000	2	15.0	16.9	01.8	07.1	27.2	16.6	08.0	03.9	81.1	57.5	19
	3	14.4	32.0	01.5	08.5	21.4	13.8	06.4	05.7	54.7	59.6	26
	4	12.2	10.8	02.8	07.5	33.6	24.4	09.6	09.9	78.0	63.5	14
	5	19.3	17.9	01.3	01.7	24.4	13.6	07.7	02.3	98.0	81.1	1
	9	06.3	05.4	03.6	07.1	22.8	11.0	09.6	05.1	12.3	78.0	7
26-33,000	2	07.8	06.9	03.9	08.6	30.2	27.5	10.4	07.7	28.4	59.2	18
	3	11.1	13.9	02.7	07.8	29.7	37.5	09.1	07.4	42.1	58.9	34
	4	06.4	04.5	05.1	09.3	32.2	18.4	10.0	05.4	37.3	42.8	12
	5	12.4	09.7	02.2	02.2	27.4	18.3	07.6	02.6	23.9	47.1	2
	9	19.2	33.1	01.7	06.9	33.0	31.5	07.9	04.6	08.8	44.0	10
Over 33,000	2	07.1	04.2	03.7	03.1	26.1	18.2	07.9	05.3	47.4	39.2	5
	3	05.9	04.7	04.7	09.6	28.2	25.0	07.3	05.7	22.4	58.5	26
	4	07.1	04.6	04.1	04.6	29.3	21.2	07.7	04.0	82.9	59.4	16
	5	10.8	06.7	02.4	01.9	26.4	17.4	08.5	04.4	15.8	41.6	8
	9	06.1	07.3	05.3	07.5	32.6	36.3	11.1	07.5	28.0	73.1	10
TRACTOR-TRAILER COMBINATIONS												
16-19,500	3	04.0	01.4	13.0	12.2	52.0	51.4	14.4	08.0	56.8	59.2	4
19.5-26,000	3	03.3	02.5	13.9	12.2	45.3	23.8	16.1	15.8	68.8	90.9	4
26-33,000	2	03.3	02.3	48.6	15.9	62.0	86.2	26.8	03.0	53.3	92.4	3
	3	06.0	05.7	05.8	15.9	34.5	27.5	10.6	07.2	77.5	98.4	5
	9	02.0	01.4	06.5	10.2	13.0	04.5	07.8	09.1	00.0	00.0	2
Over 33,000	2	04.2	02.3	23.9	49.4	01.0	39.5	18.9	09.0	08.3	35.4	5
	3	03.4	01.5	09.3	10.0	31.0	47.3	11.6	09.3	48.1	63.7	46
	4	03.4	01.6	10.6	04.9	36.3	33.7	13.9	05.6	94.3	96.4	5
	5	07.0	06.0	06.8	11.0	47.4	33.2	10.8	09.2	40.0	51.2	2
	9	04.3	02.6	10.1	04.7	42.8	38.5	10.2	03.5	33.8	98.4	2

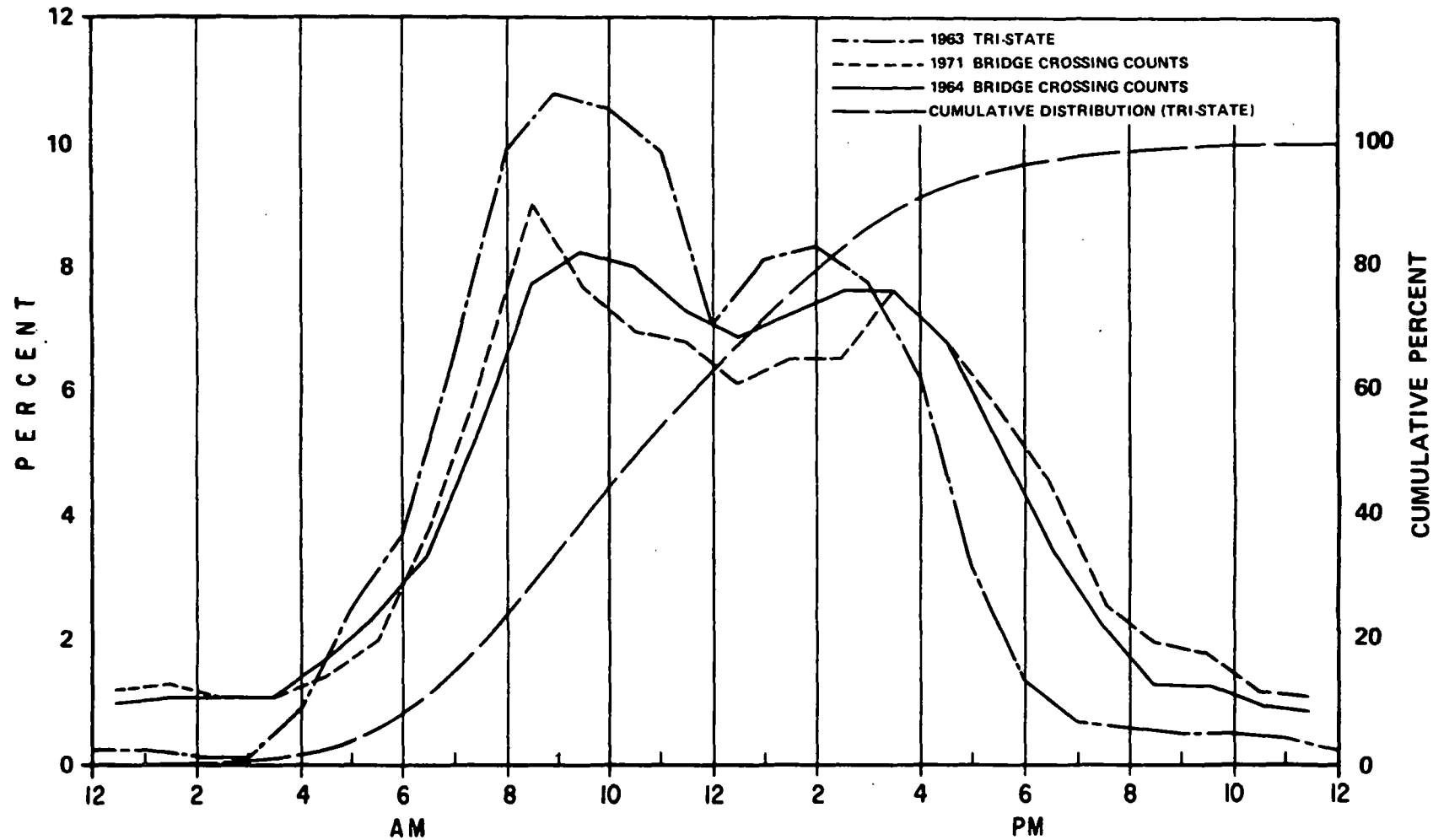
Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 30

NEW YORK CITY DATA

SUMMARY OF URBAN TRUCK TRAVEL CHARACTERISTICS BY GVW CATEGORY

	GROSS VEHICLE WEIGHT CATEGORY						
	6,000 10,000	10,000 14,000	14,000 16,000	16,000 19,500	19,500 26,000	26,000 33,000	Over 33,000
VEHICLE MILES % OF TOTAL	4.6	15.0	9.3	27.2	12.3	11.8	19.8
% OF TOTAL DAILY TRUCK-TRIPS	7.0	19.0	11.9	26.3	15.0	10.2	9.8
TRUCK POPULATION % OF TOTAL TRI-STATE SURVEY	5.5	17.5	10.4	25.9	12.7	10.7	17.3
AVG. MILES PER TRIP (MILES)	1.62	2.18	2.14	2.85	2.26	3.20	5.56
AVG. MILES PER TRUCK (MILES)	25.1	25.4	26.8	31.2	28.8	32.8	34.1
AVG. TRIP SPEED (MPH)	7.5	8.5	8.0	9.7	8.3	6.9	10.4
AVG. NUMBER TRIPS PER TRUCK PER DAY	15.1	11.7	12.4	10.8	12.8	10.2	6.1



COMPARISON OF TIME DISTRIBUTION OF TRUCK TRIPS
BETWEEN 1963-4 AND 1971

Wilbur Smith and Associates

FIGURE 5

TABLE 31

NEW YORK CITY DATA

TIME DISTRIBUTION OF TRUCK-TRIPS FOR TRUCKS OVER 10,000 POUNDS GVW BY VEHICLE TYPE AND INDUSTRY TYPE

VEH TYPE	BUSI/ INDUST	MID-POINT TIME (AM) 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1	-							1	2			2	1	6
1	0								1					1
1	1								2					2
1	2				1	17	28	28	28	37	39	26	24	228
1	3	2		2			1	13	32	37	45	41	36	209
1	4					13	15	21	26	36	38	34	32	215
1	5	1					1	6	8	9	8	6	5	44
1	8						1	5	10	10	9	7	3	45
Subtotal		3		2	1	30	46	74	109	129	139	116	101	750
2	-							45	67	41	35	31	41	260
2	0						2	1	2	1	2	2		10
2	1						4	16	21	20	12	14	10	97
2	2	11	6	1	27	100	148	169	223	228	230	203	149	1495
2	3				41	68	73	109	229	240	249	244	163	1416
2	4		2	3	12	58	99	143	222	280	243	243	147	1452
2	5	1	1	1	6	5	11	52	80	93	107	94	71	522
2	6									1		1		2
2	7							1	2	2	1	2		8
2	8	3	1	4	3	1	2	15	18	15	18	19	16	115
Subtotal		15	10	9	89	232	339	551	864	921	897	853	597	5377
3	-	1	1		2	1	1	1	1	1	2	1	1	13
3	1							9	5	7	7	6	3	37
3	2							2	2	5	2	6	4	21
3	3							2	7	8	6	7	5	35
3	4						1	3	6	9	8	9	3	39
3	5							3	2	4	4	5	4	22
3	8								4	3	3	2		12
Subtotal		1	1		2	1	2	20	27	37	32	36	20	179
4	1							1						1
4	2					1	1	4	6	1	3	2	2	20
4	3						2	6	5	7	9	6	1	36
4	4							1	2	3		3		9
4	8				1		1		1	1		1	1	6
Subtotal					1	1	4	12	14	12	12	12	4	72
5	1										1			1
5	2							1		1	2	1	2	7
5	3	2		1	1	1	3	11	11	9	6	5	6	56
5	4							1		1	1	1	2	6
5	5							2	2	1	3	2	2	12
Subtotal		2		1	1	1	3	15	13	12	13	9	12	82
6	2									1		1		2
6	3					1	1	3	4	2	5	4	1	21
6	5						1	3	2	2	3	1	1	13
Subtotal						1	2	6	6	5	8	6	2	36
7	-								1	2	1			4
TOTAL		21	11	12	94	266	396	678	1034	1118	1102	1032	736	6500
% IN HOUR TO TOTAL		0.2	0.1	0.1	0.9	2.5	3.7	6.5	9.9	10.8	10.5	9.9	7.1	
CUMULATIVE %		0.2	0.3	0.4	1.3	3.8	7.5	14.0	23.9	34.7	45.3	55.2	62.3	

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE 31 (CONTINUED)

NEW YORK CITY DATA

TIME DISTRIBUTION OF TRUCK-TRIPS FOR TRUCKS OVER 10,000 POUNDS GVW
BY VEHICLE TYPE AND INDUSTRY TYPE

VEH TYPE	BUSI/ INDUST	MID-POINT TIME (PM) 13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	-		1	2										3
1	0				1									1
1	1			2										2
1	2	28	10	24	10	7	5	3					1	88
1	3	54	63	63	64	30	11	5	2	1				293
1	4	37	29	26	30	23	11	5			1			162
1	5	8	9	7	8	1	2	1				1	1	38
1	8	6	9	7	4	2		1						29
Subtotal		133	121	131	117	63	29	15	2	1	1	1	2	616
2	-	43	32	14	32	12	14	10	7	6	8	1		179
2	0		2	3	2									7
2	1	11	18	19	15	3	2				1			69
2	2	170	164	141	106	49	15	19	35	25	21	26	13	784
2	3	156	189	191	151	77	37	9	2	2				814
2	4	174	180	152	113	63	19	6	8	6	7	3	3	734
2	5	85	84	68	42	24	13	4	1	1	1	1	1	325
2	6	1		1	1	1		1		1	1			7
2	7	1	2	4										7
2	8	16	15	11	14	10	7	2	3	3	4	5	4	94
Subtotal		657	686	604	476	239	107	51	56	44	43	36	21	3020
3	-	1	1	1		1	1	1	1	1	1		2	11
3	1	8	5	7	8	1		1						30
3	2	2	4	3	3		1							13
3	3	6	8	8	10	4	1							37
3	4	10	4	8	3	2	2	1						30
3	5	4	6	3	3	3								19
3	8	3	3	3	3									12
Subtotal		34	31	33	30	11	5	3	1	1	1		2	152
4	1			1										1
4	2	2	1	3	2	2	1		1		1			13
4	3	7	5	10	7	2	4	1	2	1	2	1		42
4	4	2	1	2	3			1						9
4	5	2	2	1	1	3	1							10
Subtotal		13	9	17	13	7	6	2	3	1	3	1		75
5	1			1										1
5	2		3	1		2								6
5	3	4	9	7	9			3						32
5	4	2		1	1	1								5
5	5		1	2		1								4
Subtotal		6	13	12	10	4		3						48
6	3	2	1	2	2	1								8
6	5	2	1	2	1									6
Subtotal		4	2	4	3	1								14
7	-	1												1
7	1			1										1
Subtotal		1		1										2
TOTAL		844	852	802	649	325	147	74	62	47	48	38	25	3927
% IN HOUR TO TOTAL		8.7	8.3	7.7	6.2	3.1	1.4	0.7	0.6	0.5	0.5	0.4	0.2	
CUMULATIVE %		70.4	78.7	86.4	92.6	95.7	97.1	97.8	98.4	98.9	99.4	99.8	100.0	

bridge does not coincide in magnitude or time with survey trips. There are two factors worthy of consideration here. One is the fact that Tri-State survey data shown here covers all trips, not those related to bridge crossings only. Secondly, 1964 and 1971 bridge crossings tract each other reasonably well, thus substantiating the fact that truck travel patterns have not shifted significantly since 1964. It is not likely that patterns shifted between the 1963 Truck-Taxi Survey and 1964.

Chapter 5

ROADWAY TYPES USED IN TRUCK TRAVEL

Intensity of truck travel is indicated in terms of vehicle miles of travel (VMT). These data have been related to vehicle type, user industry type, and other truck and trip characteristics in Chapters 2,3, and 4. The intensity of truck travel by type of roadway was not indicated in the basic Tri-State Truck-Taxi Survey. The desirability of estimating these relationships to relative highway emissions is obvious.

Phase II of the program will instrument trucks and record data to define trip patterns by three categories of roadways--Expressways, Arterials, and Local Streets. A preliminary insight into the fraction of truck VMT committed on these three roadway types was developed through a combination of data from a variety of sources.

The methodology employed in developing this estimate was to generate a network of expressways and arterials. Using volume counts obtained for these linkages, daily truck VMT by these facilities were estimated. Next, an estimate of total daily truck VMT was made from other source data. The difference between the total VMT and that assigned to expressways and arterials was assumed to be that truck travel on local streets.

Estimation of Truck VMT on Arterials and Expressways

The network shown in Figure 5-1 was assumed, based upon both judgment and cordon count locations contained in the

PAGE NOT

AVAILABLE

DIGITALLY

1963 "Vehicle Classification and Vehicle Occupancy Report".* The network comprises about 445.5 miles of roadways identified therein as Arterials and about 106.6 miles identified as Expressways.

This network was divided into short analysis segments. The length of each segment was scaled. A direct truck volume count was available for about 35 percent of these segments from the classification report. Volumes for the remaining segments were estimated by association with these counts and extensions of these data to continuous portions of a given facility. VMT estimates were obtained from the product of truck volumes on each segment and segment length. The estimates derived by these means is given in Table 32.

Table 32

TRUCK MILEAGE BY TYPE OF ROADWAY

	URBAN ARTERIALS		EXPRESSWAYS	
	Miles	Truck-Miles	Miles	Truck-Miles
Brooklyn	96.3	278,400	24.8	134,700
Queens	141.9	331,700	33.4	353,100
Bronx	74.2	101,000	31.2	216,900
Manhattan	90.8	408,900	0	0
Staten Island	42.3	44,200	17.2	27,100
TOTAL	445.5	1,164,200	106.6	731,800

An average of about 1,164,200 daily vehicle miles of truck travel are performed on urban arterials, and about 731,800 vehicle miles on expressways in New York City.

*These were annual counts taken by the New York State Department of Highways.

Estimation of Total VMT

Bridge volumes for 18 major bridges* indicate that about 175,000 trucks crossed in a typical day. This volume included through trucks. The Port of New York Authority estimated during a comparable period that about 21.3 percent of trucks crossing Staten Island and Trans-Hudson bridges were performing through trips. Applying this factor to the total daily volume of 175,000 trucks produces an estimate of about 137,500 trucks engaged in travel internal to the Metropolitan area.

In the sorted data for trucks performing "eligible" trips in New York City derived from the Tri-State Truck-Taxi Survey, 1,047 trucks reported a total daily travel of 25,771 airline miles. Based upon Bureau of Census estimates that over-the-road mileage is 21 per cent higher than airline miles, the total daily travel in the sample expands to 31,180 roadway miles.

This selected data sample was processed to determine the number of trucks reporting trips which crossed the same 18 bridges. The results indicated that 1,135 trucks made trips involving these bridges.

By comparing these 1,135 trucks in the selected sample to the total daily counts of 137,500 trucks performing internal metropolitan trips, provides an expansion factor for estimation purposes of 0.0083. Applying this factor to the 31,180 truck miles reported in the sample data set, results in a total VMT

*Derived from data in the 1963-64 "Comparison of Bridge Traffic" made by the New York City Department of Public Works.

estimate of about 3,757,000 vehicle miles daily. One can arrive at an estimate that about 19.5 percent of truck VMT is committed on the portion of the network identified as Expressways, about 31 per cent on those network facilities identified as Arterials, with the remaining 49.5 percent of truck travel committed on facilities not included in the network and therefore termed Local Streets.

Chapter 6

CONCLUSIONS

A major objective of Phase II of the program is to develop a profile of engine operation variables employed in urban truck population use. As has been cited, the two study areas are the Los Angeles Basin and New York City. A sample plan design will be based upon data assembled in Phase I, and 50 trucks in each area will be instrumented. An instrumental survey will be conducted to accumulate up to 172 truck-days of data in each area by monitoring truck trips performing their usual trip patterns and normal use. Any given truck will be monitored from 1 to 5 days, depending upon the sample plan.

Parameters to be recorded include engine rpm, percent of maximum developed torque and vehicle speed against time in increments of less than 1 data set per second.

The sampling plan should statistically subdivide the truck population into as small a number of strata as are feasible due to the small number of trucks in the survey. Each strata should represent a segment of the population which has similar patterns of travel and use and the smallest variation of travel characteristics.

Subject to the restrictions in sample size and total truck-days of data to be assembled, the objective of the sample plan is to determine the distribution of trucks and days assigned to each strata which minimizes the variation of the estimated and the actual use profile in intensity of travel performed (VMT).

Intensity of travel performed by trucks within a given stratum is a basic emission characteristic since the magnitude of emission components produced by a vehicle, all other things remaing constant, depends upon distance traveled.

Potential Stratification Parameters

The data contained in this report should be analyzed to develop desirable stratification parameters. Comparisons should be made between truck, user and engine characteristics to aggregate data such that travel characteristics and use patterns are compartmentalized into meaningful and related groupings.

Enginer Fuel Type - An obvious dimension, determined by the differenced in levels and composition of emissions, is that of fuel type. Two types of fuel predominate--gasoline and diesel. While the trip-making characteristics on this simple delineation can not be easily identified, this parameter must certainly be expected in any reasonable stratified sample.

User Industry Type - Eleven industry types were identified in the survey data. When considering the distribution of the fraction of total VMT generated, three user industry groups commit about equal travel intensity in New York City, and their total is a little over 75 percent of all truck VMT. These are: Wholesale Utilities/Communication/Transportation, and Manufacturing. Combining the remaining user industry types under a category of Other results in four industry groups that generate about equal VMT in the urban area. The basic three industry group travel characteristics, while varying even within each group to some extent, can be considered as somewhat similar because of truck usage and trip purpose.

Truck Characteristics - Within the eight strata suggested above, travel characteristics vary according to truck characteristics. Two aggregations of travel characteristics were performed in the data analysis of this study.

One aggregation was based upon vehicle type which employed number of axles as a parameter to more grossly separated vehicle type into single-unit trucks and tractor-trailer combinations.

The second aggregation was based upon the vehicle's gross vehicle weight, which was divided into seven weight intervals or classes.

A third possible aggregation, that which might have employed body type is a set of parameters, was not extensively employed in the data analysis. This was justified on two bases; the number of body types was large, with twelve categories defining the survey; and the apparent discrepant definition of body types between survey data and registration data.

Recommended Stratification Parameters

It is recommended that the two engine fuel types--gasoline and diesel--be employed as basic parameters within the sample plan. Likewise, the aggregation of four user industry types discussed above in the sample plan design would parametrically divide total VMT by approximately equal groupings. Thus, a matrix of 2 x 4 has been formed thus far.

There remains a task of selecting between vehicle type and gross vehicle weight for a set of truck characteristics parameters to be included.

Aggregating by Vehicle Type - One dominant vehicle type consistently emerged in the study data processing. This vehicle type was the 2-axle, dual rear tire truck. This dominance was found regardless of whether the population included the 6-10,000 pound GVW class or not. This vehicle type represented about 73 percent of the total population of trucks over 6,000 pounds GVW. This type generates about 70 percent of the total truck VMT in performing about 78 percent of total truck trips. Their trips accounted for over 76 percent of all internal-internal trips and in so doing accumulated about 47 percent of internal-internal trip mileage. In the internal-external trip category, this type traveled about 23 percent of that category mileage and made about 60 percent

of the trips. The same pattern exist even when the 6-10,000 pound GVW class is dropped from the data.

Combining the 2-axle, single rear tire truck statistics with those of the 2-axles dual results in a group representing about 87 percent of the total population. When including all trucks over 6,000 pounds GVW, this grouping would account for about 94 percent of all truck trips and would generate about 84 percent of all truck WMT.

About 4 percent of the truck population is the 3-axle dual rear tire truck. This category accounts for about 5 percent of internal-internal trip mileage and about 4 percent of internal-external trip mileage.

The remainder of the VMT is generated by tractor-trailer combinations of all types.

An analysis of variance between various pairings of vehicle types and their travel characteristics of trip speed, number of trips per day, and miles per trip was conducted. These tests employed the following procedures:(*)

Let:

α = significance level of text - 0.05

$\bar{X}_A$ = mean of variable for vehicle type A

$\bar{X}_B$ = mean of variable for vehicle type B

S_A^2 = standard deviation of variable for vehicle type A

S_B^2 = standard deviation of variable for vehicle type B

n_A = number of measurements of variable for vehicle type A

n_B = number of measurements of variable for vehicle type B

Then compute:

$$V_A = \frac{S_A^2}{n_A} = \text{variance of } \bar{X}_A$$

$$V_B = \frac{S_B^2}{n_B} = \text{variance of } \bar{X}_B$$

Compute "effective number of degrees of freedom", thus:

$$F = \frac{(V_A + V_B)^2}{\frac{A^2}{n_A + 1} + \frac{B^2}{n_B + 1}} - 2$$

From a table of "student t" distributions, obtain

$$t_{(1-\frac{\alpha}{2}} \cdot$$

Compute:

$$u = t(1 - \frac{\alpha}{2}) \sqrt{V_A + V_B}$$

If:

$|\bar{X}_A - \bar{X}_B| > \mu$, decide that there is a significant difference in average performance of A and B; otherwise, decide that there is no reason to believe that A & B differ in average performance.

(*) For illustration of this method, see National Bureau of Standard Handbook 91, "Experimental Statistics" by Mary Gibbons Natrelle, August 1, 1963, pp. 3-26 through 3-30.

Table 33 shows the results of the above test procedure applied to statistical data of vehicle types as regard to trip speed, number of trips per day, and miles per trip.

Note that the 2-axle truck types indicate no significant travel characteristic difference. Thus, these types could be aggregated into one stratum parameter without affecting the travel characteristics of the combination (Types 1 and 2).

The test indicates only a significant difference in miles per trip between the 2-axle single rear tire group (Type I) travel and the 3-axle dual group (Type 3) travel. However, the 2-axle dual rear tire (Type 2) travel shows significant differences in both number of trips per day and miles per trip when compared to the 3-axle dual group (Type 3). The conclusion from this test is that the Type 3 vehicle group should probably remain separate from the combined 2-axle group.

With these two single unit truck type groups generating over 90 percent of all truck VMT, it would appear logical to group all tractor-trailer combinations into a third group. Refer again to Table 33 to see what are the travel characteristic variances of such a combination.

Note that in most cases, the tractor-trailer combinations (Types 4, 5 and 6) travel characteristics are significantly different from the single unit trucks (Types 1, 2 and 3). There is no significant variance between type 4 and 6 or between types 5 and 6 within the tractor-trailer group. There is some variance indicated between type 4 and 5 in trip speed and miles per trip. This variance can be discounted when the small fraction of travel is accounted to the type 4 combinations.

Using vehicle type as a stratification parameter, a 2 x 4 x 3 matrix would be evident. Thus, 24 strata would be

Table 33

RESULTS OF VARIBILITY TESTS BETWEEN VEHICLE TYPES AND THEIR TRAVEL CHARACTERISTICS

Comparison Between			TRAVEL CHARACTERISTICS								
			Trip Speed			No. Trips per Day			Miles/Trip		
Vehicle Type A	and	Vehicle Type B	$\bar{X}_A - \bar{X}_B$	μ	Different ?	$\bar{X}_A - \bar{X}_B$	μ	Different ?	$\bar{X}_A - \bar{X}_B$	μ	Different ?
1		2	1.1	1.5	No	0.6	1.8	No	0.1	0.4	No
1		3	1.8	2.2	No	2.7	2.8	No	1.8	1.4	Yes
1		4	8.1	2.3	Yes	6.6	1.7	Yes	11.9	1.0	Yes
1		5	3.5	1.6	Yes	7.3	1.6	Yes	7.5	2.1	Yes
1		6	8.6	3.8	Yes	6.6	2.8	Yes	8.4	16.4	No
2		3	0.7	2.1	No	3.3	2.6	Yes	1.7	0.9	Yes
2		4	7.0	2.3	Yes	7.2	1.4	Yes	11.8	1.9	Yes
2		5	2.4	1.5	Yes	7.9	1.2	Yes	7.4	2.1	Yes
2		6	7.5	3.7	Yes	7.2	2.7	Yes	8.3	16.0	No
3		4	6.3	3.0	Yes	3.9	1.5	Yes	10.1	2.1	Yes
3		5	1.7	2.5	No	4.6	2.4	Yes	5.7	2.3	Yes
3		6	6.8	4.3	Yes	3.9	3.4	Yes	6.6	16.0	No
4		5	4.6	2.8	Yes	0.7	1.0	No	4.4	2.8	Yes
4		6	0.5	4.4	No	0.0	2.6	No	3.5	16.0	No
5		6	4.1	4.1	No	0.7	2.5	No	0.9	16.0	No

VEHICLE TYPE CODE

Single Unit	1.	2-axle, single rear tire
	2.	2-axle, dual rear tire
	3.	3-axle, dual rear tire
Tractor Trailer	4.	3-axle, tractor-trailer
	5.	4-axle, tractor-trailer
	6.	5-axle, tractor-trailer

contained in the basic sample plan configuration.

Aggregating by GVW - With 6 GVW classes basically contained in the data, obtained by dropping the light truck category (6-10,000 pounds GVW), it would be required to combine these classes in some meaningful manner to reduce the total number of stratum levels in the basic sample plan configuration. If these strata cannot be reduced to 3 or less without combining strata with significantly different travel characteristics into the combinations, the aggregation by vehicle type appears the preferred strata parameter. Without such a combination, the basic sample matrix would have 48 strata into which only 50 trucks could be divided. This would appear to be an insufficient sample size which would result in inconclusive sample results.

Upon examination of data, no significant combinations of GVW classes appeared reasonable. It is therefore recommended the GVW not be applied as a strata parameter in a sample plan utilizing only a 50-truck sample size.

APPENDIX A

Calculation And Selection Of Stratum Boundaries For Gross Vehicle Weight

APPENDIX A

CALCULATION AND SELECTION OF STRATUM BOUNDARIES FOR GROSS VEHICLE WEIGHT (GVW) TRUCK CHARACTERISTICS

The problem is to select the best possible divisions or categories for the GVW characteristic. The lower limit is set by the requirements of the Phase II RFP at 10,000 lbs. From this point, there are two different sets of stratum boundaries that are candidates for selection.

The first set of boundaries are defined by prior usage. Their main advantage is that the results of any stratification using these conventional boundaries could be compared directly to other studies.

The second method of selecting the stratum boundaries is based solely on the statistical characteristics of the distribution of GVW in the Tri-State data.

The statistical method utilized is called the CUM $\sqrt{f(y)}$ RULE and is based on the work by Dalenius (1957) in determining the best stratum boundaries under proportional and Neyman allocation.

Conventional Boundaries - Listed below are the GVW stratum boundaries that are most commonly used:

GVW in Thousands
10 - 14
14 - 16
16 - 19.5
19.5 - 26
26 - 33
33+

Statistical Boundaries - Generally, the method used in the CUM $\sqrt{f(y)}$ RULE is to record the number of trucks that fall in GVW categories ranging from 10,000 lbs to 40,000+ lbs. in 1,000 lbs. increments. These values constitute the f(y) function. Next the cumulative of $\sqrt{f(y)}$ distribution is determined. The stratum boundaries are then determined by dividing the CUM $\sqrt{f(y)}$ distribution into six equal increments. The Tri-State data were analyzed in this fashion and the following stratum boundaries were derived:

GVW in Thousands
10 - 13.5
13.5 - 17.0
17.0 - 20.4
20.4 - 26.5
26.5 - 33.9
33.9 +

Conclusions - The results of selecting the stratum boundaries by two different means are remarkably similar. Because there is no serious discrepancy between the "statistically best" stratum boundaries and the stratum boundaries that are currently in use, the currently used stratum boundaries will be used in this study.

Table A-1

NEW YORK CITY DATA

CALCULATION OF STRATUM BOUNDARIES FOR GVW TRUCK CHARACTERISTICS

GVW	TOTAL NUMBER F(GVW)	F(GVW)	CUM F(GVW)
10 - 11,000	51	7.1	7.1
11 - 12,000	36	6.0	13.1
12 - 13,000	40	6.3	19.4
13 - 14,000	57	7.6	27.0
14 - 15,000	50	7.1	34.1
15 - 16,000	59	7.7	41.8
16 - 17,000	43	6.6	48.4
17 - 18,000	171	13.1	61.5
18 - 19,000	41	6.4	67.9
19 - 19,500	17	4.1	72.0
19.5 - 20,000	16	4.0	76.0
20 - 21,000	14	3.7	79.7
21 - 22,000	28	5.3	85.0
22 - 23,000	17	4.1	89.1
23 - 24,000	26	5.1	94.2
24 - 25,000	14	3.7	97.9
25 - 26,000	18	4.2	102.1
26 - 27,000	15	3.9	106.0
27 - 28,000	20	4.5	110.5
28 - 29,000	12	3.5	114.0
29 - 30,000	24	4.9	118.9
30 - 31,000	12	3.5	121.4
31 - 32,000	15	3.9	125.3
32 - 33,000	14	3.7	129.0
33 - 34,000	13	3.6	132.6
34 - 35,000	11	3.3	135.9
35 - 36,000	20	4.5	140.4
36 - 37,000	10	3.2	143.6
37 - 38,000	5	2.2	145.8
38 - 39,000	1	1.0	146.8
39 - 40,000	8	2.8	149.6
Over 40,000	113	10.6	160.2

To divide GVW into 6 strata:

$$\frac{160.2}{6} = 26.6$$

Taking increments at : 26.6; 53.2; 79.8; 106.4; 133.3

on CUM f(GVW) produces increments:

10 - 13.5
13.5 - 17.0
17.0 - 20.4
20.4 - 26.5
26.5 - 33.9
33.9+

APPENDIX B

1963 Truck-Taxi Survey
Business Or Industry Codes

APPENDIX B

1963 TRUCK-TAXI SURVEY

BUSINESS OR INDUSTRY CODES

0 - AGRICULTURE, FORESTRY, FISHERIES, AND MINING

Agriculture
Forestry
Fisheries
Coal Mining
Crude Petroleum and Natural Gas Extraction
Metal Mining
Non-metallic mining and quarrying, except fuel

1 - CONSTRUCTION

Airport Construction
Bricklaying
Building Construction
Building Wrecking
Cement Paving
Painting
Paperhanging
Street Repair

2 - MANUFACTURING

Aircraft and Parts
Apparel and Accessories
Bakery Products
Beverage Industries
Canning and Preserving Fruits, Vegetables and Sea Food
Confectionary and Related Products
Dairy Products
Drugs and Medicines
Electrical Machinery, Equipment and Supplies
Farm Machinery and Equipment
Flood Coverings, Except Hard Surfaces
Furniture and Fixtures
Glass and Glass Products
Grain - Mill Products
Knitting Mills
Lumber and Wood Products
Meat Products
Motor Vehicles and Motor Vehicle Equipment
Office, Computing and Accounting Machine
Paints, Varnishes and Related Products
Paperboard Containers and Boxes
Petroleum Refining
Photographic Equipment and Supplies (Continued on next page)

BUSINESS OR INDUSTRY CODES

Printing, Publishing and Allied Industries, Except Newspapers
Professional Equipment and Supplies
Pulp, Paper, and Paperboard Mills
Rubber and Plastic Products
Ship and Boat Building and Repairing
Synthetic Fibers
Tobacco Manufactures
Yarn, Thread and Fabric Mills

3 or C - UTILITIES, COMMUNICATIONS AND TRANSPORTATION

3=
Electric light and power
Electric - gas utilities
Gas and Steam Supply Systems
Petroleum and Gasoline Pipe Lines
Sanitary Services
Water Supply

Radio Broadcasting and Television
Telephone (wire & radio)
Telegraph (wire & radio)

Air Transportation
Railroads and Railway Express Service (If the vehicles are not used in freight service)
Street Railways and Bus Lines
Subways
Taxicab Service
Water Transportation
C=
Railroads and Railway Express Service (If the vehicles are used in freight service)
Trucking Service
United Parcel Service
Moving and Storage

4 - WHOLESALE TRADE

Drugs, Chemicals and Allied Products
Dry Goods and Apparel
Electrical Goods, Hardware, and Plumbing Equipment
Farm Products - raw material
Food and related products
Machinery, Equipment and Supplies
Motor Vehicles and Equipment
Petroleum Products
Miscellaneous Wholesale Trade
Not specified wholesale trade

5 - RETAIL TRADE

Apparel and accessory stores, except shoe stores
Dairy Products, Stores and milk retailing
Drug Stores
Eating and drinking places (Continued on next page)

BUSINESS OR INDUSTRY CODES

Food Stores, except dairy products
Fuel and Ice Dealers
Furniture and Housefurnishings Stores
Gasoline Service Stations
General Merchandise Retailing
Hardware and Farm Equipment Stores
Household Appliance, T. V. and Radio Stores
Jewelry Stores
Limited Price Variety Stores
Liquor Stores
Lumber and Building Material Retailing
Motor Vehicles and Accessories Retailing
Retail Florist
Shoe Stores
Miscellaneous Retail Stores
Not specified Retail Trade

6 - FINANCE, INSURANCE, REAL ESTATE, PROFESSIONAL, AND RELATED SERVICES

Banking and Credit Agencies
Insurance
Law Offices
Real Estate
Security and Commodity Brokerage and Investment Companies

7 - PROFESSIONAL AND RELATED SERVICES

Accounting, Auditing & Bookkeeping Services
Educational Services
Engineering & Architectural Services
Hospitals
Medical and other Health Services
Nonprofit Membership Services
Welfare and Religious Services
Miscellaneous Professional and Related Services

8 - BUSINESS, REPAIR, AND PERSONAL SERVICES

Advertising
Miscellaneous Business Services

Automobile Repair Services and Garages
Shoe Repair
Miscellaneous Repair Services

Barber and Beauty Shops
Dressmaking Shops
Hotels and Lodging Places
Laundering, Cleaning and Dyeing Services
Private Households

BUSINESS OR INDUSTRY CODES

9 - ENTERTAINMENT AND RECREATION SERVICES

Bowling Alleys, Billiard and Pool Parlors
Theaters and Motion Pictures
Miscellaneous Entertainment and Recreation Services

(-)- PUBLIC ADMINISTRATION

Federal Public Administration
International Public Administration
Local Public Administration
Postal Service
State Public Administration

APPENDIX C

Supplemental Tabulations

TABLE C-1

NEW YORK CITY DATA

NUMBER OF DAILY TRUCK-TRIPS OF
TRUCKS OVER 6,000 POUNDS GVW
BY VEHICLE TYPE AND INDUSTRY TYPE

VEH TYPE	INDUST	TRUCK TRIPS 1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-UP	TOTAL
1	-	6	4	3	1						14
1	0	2									2
1	1	13	2	2							17
1	2	52	45	40	37	34	30	28	26	222	514
1	3	98	89	74	65	52	45	31	25	48	527
1	4	82	63	50	40	31	28	20	16	66	396
1	5	24	23	20	16	9	6	6	6	149	259
1	6	4	2	2	2						10
1	7	2	2	2	2	2	2	2	2	21	37
1	8	20	12	10	8	8	6	4	2	9	79
Subtotal		303	242	203	171	136	117	91	77	515	1855
2	-	54	42	31	24	19	17	14	13	227	441
2	0	9	4	3	1						17
2	1	76	42	24	13	7	3	2	1		168
2	2	345	288	247	204	174	144	125	115	668	2310
2	3	425	333	243	181	147	130	110	93	631	2293
2	4	386	307	248	210	193	167	145	129	573	2358
2	5	150	122	99	88	80	66	48	37	190	880
2	6	2	2	2	2	1					9
2	7	8	6	1							15
2	8	63	44	36	22	19	16	14	8	45	267
Subtotal		1518	1190	934	745	640	543	458	396	2334	8758
3	-	4	2	2	2	2	2	2	2	6	24
3	1	21	12	10	8	7	5	3	1		67
3	2	14	13	6	3	2					38
3	3	20	12	6	4	4	4	2	2	18	72
3	4	16	13	12	9	6	6	2	2	3	69
3	5	6	6	4	4	4	3	2	2	10	41
3	8	2	2	2	2	2	2	2	2	8	24
Subtotal		83	60	42	32	27	22	13	11	45	335
4	1	2									2
4	2	16	8	6	2	1					33
4	3	38	23	8	3	2	2	2			78
4	4	8	7	4							19
4	8	6	5	4	1						16
Subtotal		70	43	22	6	3	2	2			148
5	1	2									2
5	2	6	6	1							13
5	3	51	28	8	1						88
5	4	8	3								11
5	5	6	6	2	2						16
Subtotal		73	43	11	3						130
6	2	2									2
6	3	18	7	4							29
6	5	4	2	2	2	2	2	2	2	1	19
Subtotal		24	9	6	2	2	2	2	2	1	50
7	-	3	2	1							6
7	1	1									1
Subtotal		4	2	1							7
TOTAL		2075	1589	1219	959	808	686	566	486	2895	11283

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE C-2

NEW YORK CITY DATA

NUMBER OF TRUCKS BY GROSS VEHICLE WEIGHT AND VEHICLE TYPE

GVW	VEHICLE TYPE 1	2	3	4	5	6	7	TOTAL
01			1				1	2
03	7	4						11
04	14	3						17
05	5	24		1				30
06	16	34			1			51
07	5	31						36
08	10	30						40
09	12	45						57
10	9	39	2					50
11	10	48	1					59
12	7	34		2				43
13	22	145	1	1	2			171
14	5	34	1				1	41
15	2	15						17
16	2	13	1					16
17	3	11						14
18	1	26		1				28
19	2	13	2					17
20	3	20		3				26
21		14						14
22	2	15	1					18
23		12		2	1			15
24	2	17		1				20
25	1	9		1			1	12
26	3	20		1				24
27	1	9	2					12
28	3	10	1	1				15
29	1	11		1	1			14
30		11		1	1			13
31		10		1				11
32	3	16	1					20
33		9			1			10
34		4			1			5
35		1						1
36		4	2	1	1			8
37	1	29	26	17	28	12		113
TOTAL	152	770	42	35	37	12	3	1051

GVW CODE

01	6- 7,000	20	23-24,000
03	7- 8,000	21	24-25,000
04	8- 9,000	22	25-26,000
05	9-10,000	23	26-27,000
06	10-11,000	24	27-28,000
07	11-12,000	25	28-29,000
08	12-13,000	26	29-30,000
09	13-14,000	27	30-31,000
10	14-15,000	28	31-32,000
11	15-16,000	29	32-33,000
12	16-17,000	30	33-34,000
13	17-18,000	31	34-35,000
14	18-19,000	32	35-36,000
15	19-19,500	33	36-37,000
16	19.5-20,000	34	37-38,000
17	20-21,000	35	38-39,000
18	21-22,000	36	39-40,000
19	22-23,000	37	Over 40,000

VEHICLE TYPE CODE

1 - 2 Axle - Single Rear Tires

2 - 2 Axle - Dual Rear Tires

3 - 3 Axle - Dual Rear Tires

4 - 3 Axle - Combination

5 - 4 Axle - Combination

6 - 5 Axle - Combination

7 - Other

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE C-3

NEW YORK CITY DATA

STATISTICAL ANALYSIS OF INTERNAL AND EXTERNAL
TRIPS BY BOROUGH AND GVW CATEGORY

BOROUGH	GROSS VEHICLE WEIGHT 10,001-14,000 INT.	10,001-14,000 EXT.	14,001-16,000 INT.	14,001-16,000 EXT.	16,001-19,500 INT.	16,001-19,500 EXT.	19,501-26,000 INT.	19,501-26,000 EXT.	26,001-33,000 INT.	26,001-33,000 EXT.	33,001 AND UP INT.	33,001 AND UP EXT.	% OF TRIPS TOTAL INTERNAL	% OF TRIPS TOTAL EXTERNAL
BRONX													10.7	17.5
% OF BRONX TRIPS	49.2	25.0	0.00	8.3	18.2	14.5	22.2	16.7	3.1	16.7	6.7	18.8		
BROOKLYN													32.0	20.9
% OF BROOKLYN TRIPS	42.3	20.9	12.8	11.9	22.7	16.4	16.7	28.4	2.9	6.0	2.7	16.4		
MANHATTAN													39.8	27.3
% OF MANHATTAN TRIPS	48.5	12.0	6.8	6.7	20.4	10.7	14.9	22.7	4.1	10.7	5.2	37.3		
QUEENS													15.9	30.9
% OF QUEENS TRIP	44.5	22.1	18.0	16.3	6.8	4.8	16.4	15.4	7.7	25.0	6.6	16.4		
RICHMOND													1.6	3.4
% OF RICHMOND TRIPS	28.6	6.2	-	-	-	-	35.0	25.0	16.9	-	19.5	68.8		
TOTAL TRIPS	44.8	19.7	10.7	11.3	17.3	10.3	17.2	21.4	4.8	12.0	5.2	25.3		

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE C-4

NEW YORK CITY DATA

STATISTICAL ANALYSIS OF INTERBOROUGH
TRIPS BY LINKAGES AND GVW CATEGORIES

LINKAGES (BOTH DIRECTIONS)	GROSS VEHICLE WEIGHT 10,000 14,000	14,001- 16,000	16,001- 19,500	19,501- 26,000	26,001- 33,000	33,000 AND OVER	% OF TOTAL INTERBOROUGH TRIPS
	%	%	%	%	%	%	
BRONX-BROOKLYN	46.2	7.7	15.4	7.7	-	23.0	4.3
BRONX-MANHATTAN	31.2	3.1	20.4	20.4	3.1	21.8	16.7
BRONX-QUEENS	18.8	-	25.0	25.0	12.4	18.8	5.2
BRONX-RICHMOND	33.3	-	-	-	66.7	-	0.1
BROOKLYN-MANHATTAN	27.2	1.8	18.4	27.9	6.1	20.2	27.7
BROOKLYN-QUEENS	27.8	6.9	22.9	25.7	2.8	13.9	28.6
BROOKLYN-RICHMOND	-	-	-	100.0	-	-	0.3
MANHATTAN-QUEENS	27.8	9.1	18.2	24.2	7.6	12.1	16.6
MANHATTAN-RICHMOND	-	-	-	-	-	100.0	0.3
QUEENS-RICHMOND	-	-	100.0	-	-	-	0.2
% OF TOTAL	28.8	5.0	20.6	23.5	5.0	17.1	

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE C-5

NEW YORK CITY DATA

STATISTICAL ANALYSIS OF INTERNAL-INTERNAL TRIP CHARACTERISTICS BY BOROUGH

BOROUGH	NO. TRIPS PER DAY		NO. MILES PER TRIP		NO. MILES PER TRUCK		SPEED (MPH)		DAILY SOAK-TIME PER TRUCK		NO. TRIPS >90 MIN. SOAK TIME
	AVG.	DEV.	AVG.	DEV.	AVG.	DEV.	AVG.	DEV.	AVG.	DEV.	
Bronx	08.8	10.1	01.0	01.9	09.0	08.4	05.4	05.4	15.9	68.1	44
Brooklyn	10.7	16.1	01.3	02.3	13.6	12.5	06.2	05.5	18.9	60.5	118
Manhattan	09.2	12.7	00.9	01.3	08.4	07.2	04.4	06.3	26.4	55.9	141
Queens	07.7	09.2	01.8	02.5	13.8	11.9	07.7	06.3	03.7	53.0	63
Richmond	09.5	08.5	03.1	03.0	29.6	28.2	11.5	05.6	68.8	54.5	4

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE C-6

NEW YORK CITY DATA

AVERAGE NETWORK SPEEDS BY ROADWAY TYPE FROM TRI-STATE TRAFFIC MODEL

COUNTY	ANALYSIS AREA NUMBER	AVERAGE SPEED - MPH EXPRESSWAY	ARTERIAL	LOCAL
Manhattan	001	27.7*	14.9	12.0
	002	29.0	15.7	12.5
	003	31.3	17.2	13.5
Bronx	004	32.1	17.2	13.8
	005	39.7	20.6	16.7
	006	37.6	19.9	16.1
	007	40.9	21.4	17.5
Kings	008	32.3	18.1	13.9
	009	----**	20.2	14.7
	010	33.8	19.0	14.5
	011	35.8	20.2	15.4
Queens	012	----**	29.4	20.7
	013	34.4	19.8	14.8
	014	37.3	21.6	16.0
	015	37.6	21.0	16.1
Richmond	016	52.8	29.7	22.2
	017	41.2	25.2	18.6
	018	60.0	33.5	25.0

* No trucks permitted on Manhattan Expressways.

** No expressways in analysis area.

Data Source: 1963 Truck-Taxi Survey Tri-State Regional Planning Commission

TABLE C-7

NINE COUNTY NEW YORK CITY AREA

1971 Truck Registrations
Last 10 Years Models

COUNTY	GROSS VEHICLE WEIGHT - LBS				
	10,000 or less	10,001-19,500	19,501-26,000	over 26,000	TOTAL
BRONX	5,835	1,432	1,157	893	9,317
KINGS	11,481	3,355	3,209	2,326	20,371
QUEENS	8,042	1,811	1,712	1,090	12,655
NEW YORK	13,161	2,790	2,425	1,691	20,067
RICHMOND	2,886	429	261	339	3,915
N.Y.C. Sub-Total	41,405	9,817	8,764	6,339	66,325
NASSAU	20,399	3,377	2,949	2,219	28,944
SUFFOLK	27,192	2,819	2,272	1,572	33,855
ROCKLAND	14,329	2,080	1,563	1,452	19,424
WESTCHESTER	4,153	437	427	384	5,401
TOTAL	107,478	18,530	15,975	11,966	153,949

SOURCE: R. L. POLK & CO.
Permission for further use must be obtained from R. L. Polk & Co.

Table C-8

NINE-COUNTY NEW YORK CITY AREA

NUMBER OF VEHICLES REGISTERED BY BODY STYLE, WHEEL CODE, AND FUEL TYPE
10% SAMPLE OF LAST 10 YEARS MODELS - 1971

BODY STYLE	WHEEL CODE										TOTAL	
	42 2-AXLE/REAR DRIVE		44 2-AXLE/4 WD		49 2-AXLE/UNKNOWN		64 3-AXLE DUAL		99 UNKNOWN			
	GASOLINE	DIESEL	GASOLINE	DIESEL	GASOLINE	DIESEL	GASOLINE	DIESEL	GASOLINE	DIESEL	GASOLINE	DIESEL
BUS	112	1									112	1
COMPACT VAN	463										463	
DUMP	361	16	6	1	2		53	37	200	65	622	119
FLAT-BED	149	6			3	1	2	6	75	9	229	22
HOUSE CAR	2								13		15	
MOTOR HOME	4										4	
PANEL	608	18	6		6						620	18
PICK-UP	780		273		3				32		1,088	
REGRIGERATOR	62	6			5			2	28	7	95	15
STATION-BUS	20		7		1						28	
STAKE BED	484	7	13		1		2		111	3	611	10
STATION WAGON	65		3								68	
TANK	85	14					8	15	105	61	198	90
TRACTOR	155	107			2		13	45	102	169	272	321
VAN	1,662	102	2		28		8				1,700	102
VAN-CAMPER	1										1	
WRECKER	148	1	8		1				13	2	170	3
UNKNOWN	392	8	17	1	4		5	4	90	20	508	33
SUB-TOTAL	5,553	286	335	2	56	1	91	109	769	336	6,804	734
TOTAL	5,839		337		57		200		1,105		7,538	
UNKNOWN FUEL												
STAKE									1		1	
TRACTOR									2		2	
VAN		3									3	
UNKNOWN									3		3	
TOTAL	5,842		337		57		200		1,111		7,547	

SOURCE: R. L. POLK & CO.

Permission for further use must be obtained from R. L. Polk & Co.

Table C-9

NINE-COUNTY NEW YORK CITY AREA

NUMBER OF VEHICLES REGISTERED BY BODY STYLE, GROSS VEHICLE WEIGHT AND FUEL TYPE

10% SAMPLE OF LAST 10 YEARS MODELS - 1971

BODY STYLE	GROSS VEHICLE WEIGHT - POUNDS (G - GASOLINE, D - DIESEL)														TOTAL	
	6,000-10,000		10,001-14,000		14,001-16,000		16,001-19,500		19,501-26,000		26,001-33,000		over 33,001			
	G	D	G	D	G	D	G	D	G	D	G	D	G	D	G	D
BUS	16				8		12		76	1					122	1
COMPACT VAN	463														463	
DUMP	128	1	6		33		109	1	210	25	29	9	107	83	622	119
FLAT-BED	42		5		15		46		97	4	17	7	7	11	229	22
HOUSE-CAR	12		3												15	
MOTOR-HOME	4														4	
PANEL	372	5	54		41		50		82	2	11	10	10	1	620	18
PICK-UP	1,069		1		13		3				1		1		1,088	
REFRIGERATOR	9		4		2		30	2	43	2	5	9	2	2	95	15
STATION BUS	28															28
STAKE BODY	237		19		138	1	101		106	6	5	3	5		611	10
STATION WAGON	62		1		2		2		1						68	
TANK	2		1		5		61	35	30	3	44	15	55	37	198	90
TRACTOR							13		64	9	129	156	66	156	272	321
VAN	261		52	2	462	22	266		572	38	50	33	37	7	1,700	102
VAN-CAMPER	1														1	
WRECKER	128				13		13		13	1	2	2	1		170	3
UNKNOWN	234		7		45		92		104	2	15	16	11	15	508	33
SUB-TOTAL	3,068	6	153	2	777	23	798	38	1,398	93	308	260	302	312	6,804	734
TOTAL	3,074		155		800		836		1,491		568		614		7,538	
UNKNOWN FUEL																
STAKE							1									1
TRACTOR											1		1			2
UNKNOWN										1			2			3
VAN					3											3
TOTAL	3,074		155		803		837		1,492		569		617		7,547	

SOURCE: R. L. POLK & CO.

Permission for further use must be obtained from R. L. Polk & Co.

Table C-10

NINE-COUNTY NEW YORK CITY AREA

NUMBER OF VEHICLES REGISTERED BY WHEEL CODE, GROSS VEHICLE WEIGHT, AND FUEL TYPE
10% SAMPLE OF LAST 10 YEARS MODELS

WHEEL CODE	GROSS VEHICLE WEIGHT - POUNDS (FUEL TYPE: G - GASOLINE, D - DIESEL)														TOTAL	
	6,001-10,000		10,001-14,000		14,000-16,000		16,001 19,500		19,501-26,000		26,001 33,000		OVER 33,000			
	G	D	G	D	G	D	G	D	G	D	G	D	G	D	G	D
42 2-AXLE/2 WHEEL DRIVE	2,621	5	129	2	712	22	673	1	1,121	67	223	144	74	45	5,553	286
44 2-AXLE/4 WHEEL DRIVE	334	1					1			1					335	2
49 2-AXLE/UNKNOWN	4								52	1					56	1
SUB-TOTAL 2-AXLE TRUCKS	2,959	6	129	2	712	22	674	1	1,173	69	223	144	74	45	5,944	289
64 3-AXLE/4 WHEEL DRIVE												3	91	106	91	109
69 3-AXLE/UNKNOWN														1		1
SUB-TOTAL 3-AXLE TRUCKS												3	91	107	91	110
99 UNKNOWN	109		24		65	1	124	37	225	24	85	113	137	160	769	335
SUB-TOTAL	3,068	6	153	2	777	23	798	38	1,398	93	308	260	302	312	6,804	734
TOTAL	3,074		155		800		836		1,491		568		614		7,538	
UNKNOWN FUEL 42 2-AXLE/2 WHEEL DRIVE					3											3
[illegible] UNKNOWN							1		1		1		1			1
TOTAL	3,074		155		803		837		1,492		569		617		7,547	

SOURCE: R. L. POLK & CO.