University Transportation Research Center
RFP Cover Sheet

Title: Pedestrian Fatality and Severe Injury Accidents in New York City
Proposal Number: NYC-07-01
Sponsors: NYCDOT
Date Issued: June 27, 2007; revised July 27, 2007

Pre-Proposal Meeting Date: None
Draft Budget Due at UTRC: August 22, 2007 (send to ckamga@utrc2.org)
Final Proposal Due at UTRC: August 23, 2007 (send to ckamga@utrc2.org, cc: ethor@utrc2.org)
RFP Closing Date: August 24, 2007

If you plan to apply:
Please contact Ellen Thorson at ethor@utrc2.org to let us know you are planning to submit a proposal. We will make sure you receive any additional information that becomes available about this proposal.

Proposal submission guidelines:
Please submit your proposal electronically to UTRC. We will confirm that the proposals make comparable budget assumptions and we will deliver the proposals to the sponsoring agency by the closing date.

Funding available:
Up to $350,000 is available from NYCDOT. To the extent possible, we request that PIs identify sources of in-kind matching funds from their home institution (e.g., tuition waiver/reductions, overhead cost-sharing, faculty release time, etc.).

For questions about this proposal, please contact:
Seth Berman at 212-676-1688 or Ann Marie Doherty at 212-676-1682

For questions about budget preparation, please contact:
Camille Kamga, 212-650-8087, ckamga@utrc2.org

Pedestrian Fatality and Severe Injury Accidents in New York City

NYC-07-01 *(revised July 27, 2007)*

Goals & Objectives

The goals of this study are to identify priority locations for pedestrian safety engineering treatments and to identify priority treatments by location type. These locations and treatments will be chosen through the analysis methods outlined below.

The first objective of this study is to analyze all pedestrian fatalities and severe injury accidents, for the most current five years, within the five boroughs. A comprehensive review of available data is an important step toward identifying priority locations for pedestrian safety engineering, as well as determining effective mitigation measures at locations where high numbers of pedestrian accidents occur. The report will summarize important information on factors that played a role in pedestrian deaths and severe injuries such as contributing factors, collision type, vehicle type, involved pedestrian and motorist action before the crash, age, land use, time of crash, location, etc. [These potential causes of a crash will be referred to as "crash factors."]

The second objective of this study is to identify locations (intersections and corridors) with outlying crash rates. Using crash data and traffic and pedestrian volume data that will be provided by the Department, the research team will identify intersections and corridors with above-average crash rates for their street types.

The third objective of this study is to correlate intersection and corridor types to crash types, using data compiled in the first objective.

The fourth objective is to identify controllable (engineering and education) factors that may account for variation in crash rates among comparable roadways or intersections. The researchers will group crashes into corridors, classify these corridors according to a typology developed in coordination with the Department, identify statistical outliers, and correlate roadway characteristics or engineering conditions with crash rates. Based upon the findings from these two objectives, recommendations will be developed for pedestrian safety improvements suited to specific intersection types. These findings will provide information useful for targeting engineering and education efforts.

Introduction

Pedestrian safety and mobility are high priorities for the New York City Department of Transportation (NYCDOT) because of the fatalities and injuries from automobile related crashes every year. New York City (NYC) is a unique urban environment. Of all major U.S. cities, NYC has one of the highest proportions of residents who walk for basic transportation purposes. According to the Census journey to work data, the level of walking in NYC is above the normal average. In 2005, 10% of NYC residents walked or biked to work compared to only 3% of Americans overall. Even when compared to residents of similar cities such as Chicago or Los Angeles where only 6% and 4%, respectively walked or biked to work, NYC ranks higher (American Community Survey, 2005). In the sixteen years between 1990 and 2005, annual

subway ridership increased by 41%, thereby generating more pedestrian activity as people walk to and from the subway as part of their journey to work. During this same period, pedestrian fatalities declined by 54.7%.

The Federal Highway Administration (FHWA) has recognized the importance of pedestrian safety and has selected cities and states from across the nation as focus areas for the development of strategies to reduce pedestrian fatalities and injuries. New York City was selected as a "Focus" city because of the high number of fatalities, although, based upon the dense population and the high number of trips made by walking, the rate of pedestrian fatalities is low compared to other cities.

Over the last decade the New York City Department of Transportation has actively accelerated its efforts to improve pedestrian and traffic safety by instituting a proactive and systematic approach to the identification of locations throughout the city where innovative safety mitigation measures can be implemented. Each year, NYCDOT publishes a Safety Report that highlights these improvements. There is no greater testament to the City's efforts than the decline of both pedestrian and vehicular fatalities over the past sixteen years. Some of the most remarkable strides have been made over the past two years, as the Department has seen fatalities reach historic lows. Pedestrian fatalities account for 50% of all types of traffic-related fatalities that occur annually in NYC, and while these fatalities have decreased by 55%, to 162 in 2006 from 366 in 1990, NYC plans to continue improving pedestrian safety and maintaining this downward trend.

This proposal for the Study of Pedestrian Fatalities and Severe Injuries in NYC will build on these current initiates and countermeasures and provide useful data and analysis to further reduce pedestrian accidents in the NYC region.

Methodology

In order to promote and ensure a safe environment for pedestrians, a comprehensive analysis of fatal pedestrian crashes and severe injury crashes of pedestrians is necessary. The study will review pedestrian, motorist and vehicle characteristics, crash locations, and mitigation measures. The study will summarize important information on factors that played a role in the deaths of approximately 475 pedestrians and more than 4,000 severe injuries in the most recent five years of available data.

A comprehensive review of available data is necessary for improving pedestrian safety and attempting to reduce the number of accidents resulting in severe injury. Conclusions will be drawn based on an understanding of the strengths and limitations of the data source. The following outline summarizes the proposed statistical methodology for analyzing crash data.

Task 1: Compile Data

Deliverables: Amended crash database
Roadway/intersection characteristics database
All other datasets compiled

The following sources will be used to compile pedestrian fatality and severe injury information, and roadway characteristics:

Fatalities

To describe traffic-related pedestrian fatalities, all New York Police Department (NYPD) MV-104 reports and Accident Investigation Squad (AIS) reports will be reviewed in addition to the Safe Team data and reports by NYCDOT's Safety Education Division, and all known pedestrian deaths will be included. The primary data source for the pedestrian fatality data will be NYC DOT's fatality database.

For this study, reconciled deaths from 2002 to 2006 will be cross-referenced with death certificates maintained by the Department of Health and Mental Hygiene to confirm the cause of deaths and to identify any additional traffic-related fatalities. All fatalities with an underlying cause of death indicating that the person was a pedestrian will be included based on International Classification of Disease (ICD) codes.

Severe Injuries

Information on Pedestrian severe crashes will be obtained from the New York State Department of Transportation (NYSDOT) Safety Information Management System (SMS), which compiles data from AIS reports submitted to the NYS Department of Motor Vehicles (NYSDMV) by NYPD. For this study, severe pedestrian injuries for the most recent five years of available data will be analyzed. Severe (but not fatal) pedestrian injuries are defined by NYSDMV as injuries that require the pedestrian to be taken to a hospital. Severe injuries include amputations, concussions, internal bleeding, severe burns, fractures and dislocation. NYSDMV only stores information on severe pedestrian injuries that are associated with a motor vehicle or bicycle crash.

Roadway Characteristics

Roadway/intersection characteristic data will be compiled from multiple sources, including existing NYCDOT traffic volumes, aerial photographs, field visits, EIS reports, and other available data sources. This data will be compiled into a database containing all relevant characteristics for each intersection/roadway involved in a crash as well as a stratified sample of non-crash intersections. See Appendix I for a suggested list of roadway characteristics. A final list of roadway characteristics will be developed by NYCDOT in conjunction with the research team.

Task 2: Analysis

Deliverables: Tables: frequency of accident types by crash factors
Tables/matrices: frequency of accident types by intersection type
GIS maps to explain findings, incl. crashes by type and age
GIS maps of high-crash locations, by type, age and other crash factors
Expanded datasets

To develop a correlation between accident type and intersection type/corridor type, the team will conduct a comprehensive analysis of factors contributing to pedestrian crashes.

The crash data to be analyzed shall include the cause of collisions, descriptive information of pedestrian victims and drivers, detailed roadway characteristics, location, and time of day, and season in which each crash occurred. This information, drawn from the datasets compiled in Task #1, will include graphs, charts, accident diagrams and detailed GIS maps to determine trends and correlations, which will be produced and included in the final report. All databases and datasets produced will be submitted to DOT.

In addition to the traffic-related factors that contributed to the accidents, contributing behavioral and land use factors will be examined. Contributing factors could include environmental causes, vehicular malfunctions, or human errors such as driver or pedestrian inattention, alcohol level of the driver or pedestrian, failure to yield, speeding, disregard for traffic controls by the driver or pedestrian, or crossing into the path of a pedestrian. Pedestrian behavior will also be examined and factors such as time of day or month of the year will be analyzed.

GIS maps will be produced to determine if "accident clusters" or specific accident types occur in the vicinity of specific uses such as schools, senior centers, public facilities, transit terminals or high activity generators. The GIS analysis should be performed both on a corridor (linear) and area/radius (circular) basis. High accident locations (citywide and by borough) will be identified and mapped as shown in attached examples. Locations of specific crash types and injuries with specific causes will be mapped as needed to explain findings. For high-crash locations, maps will also address the time of day of crashes, age of victims, and other crash factors.

Traffic data and pedestrian volumes will be collected to determine accident rates based on the level of activity at selected locations. The Department will assemble its current reports and other data that it has collected and provide this information to the consultant. Any additional data collection required for the study shall be submitted to the Department and if approved, the plan will be funded by the Department.

Roadway characteristics, specifically at these high accident locations, will be examined as well. Functional classification, roadway width, one- or two-way streets, vehicle volume, traffic controls, and curbside regulation will all be analyzed to determine contributing factors at the specific locations. If sufficient data is available, the statistical significance and magnitude of these contributing factors will be assessed to develop citywide estimates for contributing factor magnitudes. This analysis will be performed by intersection type, since the magnitude of crash factors may vary by intersection type.

The factors to be evaluated are in the categories are enumerated in further detail in Appendix I. A final list of roadway characteristics will be developed by NYCDOT in conjunction with the research team.

The analysis will examine the accident tables from the fatal database and MV-104 police reports to determine "contributing factors" associated with the driver, the pedestrian or both the driver and pedestrian involved in the accident In cases where "contributing factors" are unknown or not indicated by the police officer, in the "contributing factors" field or the "pedestrian action" field, the narrative of the MV-104 and the AIS reports will be examined to determine the causes of the fatality. Information that can be obtained about the pedestrian and driver (such as age, gender, address, and in the case of motorists, driving history and previous violations) should be used to see if there are any patterns that can help inform the department's education and outreach efforts".

Task 3: Crash Cause Modeling

Deliverables: Graphs, incl. crash frequency by intersection
List of outlying intersections and corridors
Explanatory value of each crash factor by intersection type
Explanatory value of each crash factor by corridor type
Table: Crash type frequency by corridor type
All datasets produced

This task will provide the Department with technical analysis evaluating the effectiveness of programs and countermeasures designed for pedestrian safety. Using the crash type and crash factor data compiled for Task #1, the research team will develop a regression or other statistical model to explain variation in the crash rate among intersections and corridors.

Characteristics (volume, width, functional classification, vehicle classification) of roadways vary widely and the frequency and severity of accidents is expected to vary accordingly. However, within a group of similar roads or intersections, crash rates are expected to vary based on controllable characteristics relevant to the Department's engineering and education efforts, as well as other characteristics outside the Department's control. .

The researchers will model the crash rate for each intersection type on the basis of factors obtained from Task #1. These factors will be grouped into engineering factors, education factors, and other factors based on the relevance of each factor to engineering or education efforts. Other variables (e.g. demographics) will also be included in the analysis. Each input factor will explain some portion of the variation among similar intersections. The explanatory value of each factor, and each group of factors, will be reported for each intersection type. The outlying members of each dataset will also be reported. (e.g. among two-way streets meeting one-way streets, engineering factors such as road width accounted for x% of the variation, while education factors such as red-light running or crossing against the signal accounted for y%, and the remaining variation was due to other variables outside the Department's control. The Department will use this information to focus its efforts on relevant efforts for each intersection type.)

Due to the low number of severe injury crashes per intersection, corridor crash rates will also be modeled. The research team will group crashes into corridors, producing a new dataset of crashes per corridor. The team will model the crash rate for each corridor type (categories described in Appendix I), based on factors (including characteristics of each corridor type) derived from information gathered in Task 1. For each corridor type, the analysis will explain crash rates based on engineering and education-related factors. This model will yield a crash type frequency for each corridor type, a measure of the explanatory power of each crash factor and each group of crash factors and a list of outliers (corridors with a higher-than-average crash rate for each corridor type).

Progress Meetings

Progress meetings between the consultant and the Project Manager will be convened on a monthly basis. In addition, meetings will be held with key NYCDOT staff after completion (and prior to finalization) of the deliverable items listed in this document.

Because of the need for a timely completion of this project, it is anticipated that work on these various deliverables will need to run concurrently. The research team should propose an appropriate timeline for the project within the 12 month timeframe.

Proposal Instructions

Proposals should be submitted electronically. They should include:

- Approach
- Methodology
- Statements of the qualifications of research team relevant to this topic;
- A budget, timeline and personnel for each task (total project timeline should not exceed 12 months).
- An overall budget that specifies level of effort for each member of the research team, as well as other direct and indirect costs (total project budget should not exceed $350,000 in funding from NYCDOT.

Questions should be directed to Seth Berman at 212-676-1688 or Ann Marie Doherty at 212-676-1682.

Additional Materials Relevant to This Project

Bicycle Fatality Report and other NYCDOT publications:
http://www.nyc.gov/html/dot/html/about/dotlibrary.html

NYC Child Fatality Report:
http://home2.nyc.gov/html/doh/html/pr2007/pr041-07.shtml

APPENDIX I

Analysis Section for Ped Fatality Proposal: ITEMS

1 Crash Locations
- By Borough
- High accident locations (Map)

2 Demographics of the Victim and driver (pedestrian, driver, passenger, bicyclist, motorcyclist)
- Age
- Sex
- Ethnicity
- Employment Level
- Income Level

3 Street Type where fatality occurred
- Intersection or midblock

4 Time of Crash
- Time of day
- Day of week
- Month of year

5 Roadway Conditions
- Wet
- Dry

6 Types of Injuries
- Body region injured in the crash (e.g., head torso, internal bleeding)

7 Death by type of vehicle
- Large or Small
- Auto, SUV, bus, truck, bicycle, motorcycle, taxi, tractor trailer, van, ambulance

8 Pedestrian deaths and serious injuries (Type A) as percent of total accidents

9 Motor vehicle operator characteristics/Contributing Factors/Type of Accident
- Alcohol/drugs involved?
- Medical reasons
- Human: Driver or Pedestrian
  - Inattention
  - Unspecified error
  - Failure to yield
  - Speeding
  - Disregarding traffic controls
  - Crossing into vehicle/pedestrian path

Unsafe lane changing
Emerging from behind parked vehicle
Environment (e.g., snow rain, view obstructed, sun glare)
Previous Violations
Vehicular (e.g., brake, steering defective)

10 Roadway Characteristics
Functional Classification
Roadway Width
One-Way Or Two-Way
Vehicle Volume
Traffic Controls
Curbside Regulation

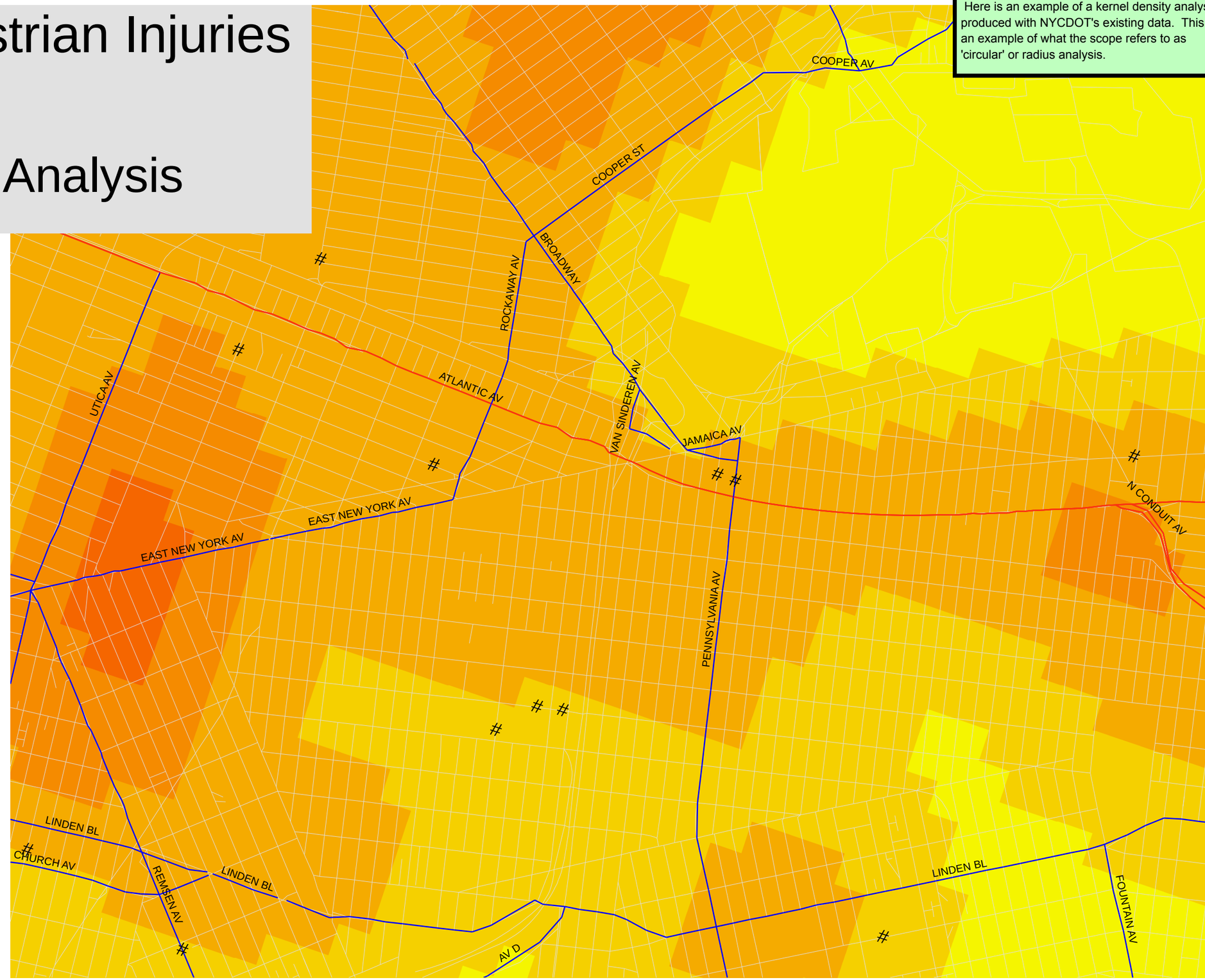
11 Land Use
School
Senior Center
Public Facility
Transit Terminal
Activity Generator

12 Geographic/Administrative boundaries
Census Tract
Community Board

Selected Pedestrian Injuries 2001- 2005

Kernel Density Analysis

Here is an example of a kernel density analysis produced with NYCDOT's existing data. This is an example of what the scope refers to as 'circular' or radius analysis.



Legend

KernelD_Seve1

<VALUE>

- 0.000000196 - 0.000006406
- 0.000006406 - 0.000012616
- 0.000012616 - 0.000018826
- 0.000018826 - 0.000025036
- 0.000025036 - 0.000031247
- 0.000031247 - 0.000037457
- 0.000037457 - 0.000043667
- 0.000043667 - 0.000049877

Truck Routes

- Limited Local
- Local
- Local and Through
- Through
- # Senior Center

0 0.25 0.5 Miles