University Transportation Research Center
RFP Cover Sheet

Title: Effectiveness of Traffic Calming Measures
Proposal Number: NYC-08-01
Sponsors: NYCDOT
Date Issued: February 6, 2008 *(Revised February 26, 2008)*
Draft Budget Due at UTRC: March 11, 2008 (send to peickemeyer@utrc2.org, cc: ethor@utrc2.org)
Final Proposal Due at UTRC: March 13, 2008 (send to peickemeyer@utrc2.org, cc: ethor@utrc2.org)
RFP Closing Date: March 14, 2008

If you plan to apply:
Please contact Penny Eickemeyer at peickemeyer@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:
NYCDOT has specified a maximum budget of $350,000 for this project (including a 7.75% CUNY-RF fee). The project should be completed within 9 months.

To the extent possible, UTRC requests 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.).

Other Notes:

1. This RFP makes reference to another NYCDOT-funded project, "Pedestrian Fatality and Severe Injury Accidents in NYC." NYSDOT's scope for that project is attached at the end of this RFP. The final scope for that project appears on the UTRC website at http://www.utrc2.org/research/projects.php?viewid=158.

2. NYCDOT requests that no private consultants (for-profit businesses) participate on any teams submitting proposals in response to this RFP.

For questions about this RFP, 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

Effectiveness of Traffic Calming Measures
NYC-08-01

Introduction

Traffic calming and related safety improvement measures can reduce the impact of motorized traffic in urban areas through design and operational changes to roadways. The New York City Department of Transportation (DOT) has implemented numerous traffic calming measures throughout the City. These measures, as well as other treatments in the design and operation of City streets, provide a data set from which to analyze their impacts on traffic safety. To ensure continued success in its effort to reduce traffic fatalities and injuries, DOT requires the ability to obtain greater understanding of the impacts of existing measures and to select the most effective and appropriate measures for future implementation.

Goals and Objectives

The goals of this study are to:

1) develop enhanced analytic tools for use by DOT to identify and evaluate safety issues in problematic locations

2) determine the safety impacts of recently implemented and new candidate traffic calming measures.

Together, this study will allow DOT to proactively evaluate and address safety conditions in the City.

The first goal will be accomplished by producing enhanced tools for DOT to analyze available crash and traffic data to better identify trends and safety issues in the City. These tools will include a user-friendly methodology for investigating safety issues, by type, mode and other attributes at problematic locations. It will also provide DOT with the ability to present findings in accessible formats.

The second goal will be accomplished by performing an in-depth evaluation to determine the effectiveness of various roadway design and operational measures, including traffic calming and safety measures implemented by DOT in recent years. This study will provide insight into crash histories at various locations where improvements have been made, and at comparable locations without improvements. Conclusions will be drawn about the effectiveness of traffic calming and other safety measures, and the potential benefits of the implementation of new measures.

Tasks

1. Literature Review

A review of existing traffic calming and safety literature will be undertaken to identify roadway design and operational characteristics that have been linked to an improvement in safety for all road users. Jurisdictions with advanced traffic calming programs that may be applicable to this study include London, Copenhagen, Paris, Cambridge (MA), and Portland (OR), as well as many other U.S. and international examples. This task will assist in the identification of roadway characteristics and traffic calming measures for study.

2. Identification of Enhanced Analytical Tools

The study will compile a summary of available sources of data for traffic crashes, traffic operations and implemented traffic calming and related safety measures. It will assess the ability of existing analytical tools utilized by DOT to identify safety issues, as well as build upon proposed analytical tools currently being developed by DOT through an effort currently underway. The study will review DOT’s tools used to evaluate and propose new measures to improve safety.

DOT maintains a Traffic Fatality Database whereby DOT is notified by the Accident Investigation Squad (AIS) of the NYPD when all traffic fatalities occur within the City. We receive both the AIS and MV-104 reports for each of these fatality crashes. This data is maintained in an Access database with most of the information contained on these reports included in the database. These statistics are reconciled on a monthly basis with NYPD to ensure that both data sets are consistent.

In addition, DOT receives accident data from NYPD daily, but the fields and information is very limited.

The other source of accident data that is also stored in an Access database is the State's accident data. It is current through 2006. The data is more detailed than the daily NYPD data, but there are still many fields of information not included in the database.

Some of the other tools DOT is currently using are GIS based mapping of crashes and kernel density analysis performed using ARCGIS spatial analyst. This is used to identify clusters of particular types of crashes.

The study will recommend enhancements to DOT’s analytical tools. It will recommend a “best practice” method of assessing the safety issues at a given location. These methods should be applicable broadly to intersections, roadways and street networks in New York City. It will identify supplemental sources of data (e.g., *On Star* reports). It should lead to improving DOT’s ability to efficiently describe and respond to safety issues, and to assess the safety impacts of proposed measures at a specific location.

In producing analytical tools and collecting information, the study will be coordinated with the Pedestrian Severe Injury and Fatality Study, which is examining all pedestrian severe injury and fatality crashes in New York City for a five-year period, and will be performed for DOT by a research team lead by Dr. Allison de Cerreño ***(see attached scope).*** The Pedestrian Severe Injury and Fatality study will yield a detailed database of pedestrian severe injury and fatality crashes, with roadway characteristics for crash locations, and will model crash causes, and provide mitigation recommendations.

3. Information Collection

The study will assemble crash, traffic, and roadway characteristic data needed to utilize the recommended enhanced analytical tools. Traffic data to be considered for identifying critical safety issues and effectiveness of traffic calming measures include traffic volume and speed, pedestrian activity and population, truck/bus routes, street operation (one-way/two-way), lane widths and dedicated turn lanes, traffic controls (signals, 2-way and multi-way stops, uncontrolled intersections), distance or time between safe pedestrian crossings, 3-legged to 4-legged or multi-legged intersections, trees/street furnishing, lighting and state of repair.

4. Performance Evaluation of Traffic Calming Measures

Drawing from locations where traffic calming measures have been implemented by DOT and from locations with similar characteristics without having such measures, the study will evaluate the relative effectiveness of various roadway design and operational treatments. The study will recommend the most effective traffic calming measures for minimizing crash rates for various roadway types.

Recent traffic calming measures to be evaluated include but are not limited to:

- separated cycle lanes (9th Avenue Complete Street between W.14th and W.23rd Streets in Manhattan)
- road diets (Ninth Street Road Diet in Park Slope, Brooklyn)
- signal progression calming (Court Street, 8th Avenue and Prospect Park West in Brooklyn)
- permitted/protected left turns (Ocean Parkway)
- leading pedestrian intervals (LPIs)
- complex-intersection safety improvements (Herald Square, Columbus Circle, Frederick Douglass Circle, Brooklyn's Grand Army Plaza)
- roadway narrowing (actual and effective)
- lane narrowing/channelization
- on-street bicycle lanes
- share-the-road bicycle lane markings
- pedestrian refuges (Queens Boulevard)
- bulbouts/neckdowns
- speed reducers.

A statistically rigorous and comprehensive analysis will study the safety effects of changes in a broad array of roadway characteristics through studies of roadways altered by traffic calming measures. The evaluation of traffic calming measures will be based on crash rates, normalized by appropriate factors such as vehicle or person-miles traveled, exposure rates and total conflicts. Roadway characteristics to be evaluated should include not only those directly related to traffic calming but to other roadway characteristics which may vary among otherwise comparable streets. Possible trip diversions that may affect safety performance might require evaluation of segments of the street network beyond individual roadways.

This comprehensive analysis should include various statistical tests, such as the t-test, F-test, Chi-square test, and linear and non-linear regression models, as appropriate, to measure significant variation, linearity, and effectiveness of the studied characteristics. Where a statistical model is constructed, it should include statistical components that test whether the observed variations in crash rate, due to operational and design characteristics, are statistically significant.

Using an annual or monthly time-series set of crash data, the study will construct "before" and "after" comparisons of crash rates for appropriate periods. These "before" and "after" crash histories will be analyzed by mode, type and severity of injury, contributing factors, roadway characteristics, land use and any other relevant characteristics. Historical patterns will be identified, tested and summarized. Traffic calming could be evaluated against the performance of other roadways with similar characteristics, but lacking the safety measure under study.

These evaluations should answer the following questions:

1. Which types and modes of crashes can be reduced with each improvement type, and which contributing factors are mitigated by each measure?

2. How effective is each type of traffic calming measure at reducing fatality crashes, severe injury crashes, total injury crashes and total crashes, normalized as appropriate?

The evaluation of traffic calming measures will be based on variation among roadways. Performance of the study facility may be compared to the performance of other roadways with similar characteristics, but lacking the safety measure under study. One varying characteristic will be used to evaluate the safety effects of the varying characteristic. For example, one-way and two-way streets of comparable width, modes, vehicular and pedestrian volume and surrounding land use may be selected to test the safety effects of operational direction.

Appropriate statistical models will be constructed to explain variation in crash histories in terms of varying operational and design characteristics, among roadways with otherwise similar characteristics.

This evaluation should answer the following questions. Among similar roadways with a variety of configurations, which is the safest? Which types of crashes, with victims in which mode, are reduced or increased by each roadway design or operational characteristic?

Some implementation types can be studied by both of the methods outlined above - comparison of "after" to "before" conditions, and comparison to similar roadways without the characteristic under study.

The evaluation of some traffic calming measures may require the evaluation of a portion of the network beyond the location in question. For example, it may be desirable to evaluate the safety effects of a left-turn restriction by including crash histories of adjacent roadways or intersections on which left turns are expected to shift.

Specific traffic calming measures, such as speed reducers and roadway characteristics such as lane width, have hundreds of potential study locations. Such measures should be assessed on the largest scale practical.

4. *Final Products*

This study will produce a software package or set of tools with which DOT can analyze the safety effects of its traffic calming measures in the future. This software package should be simple, user-friendly and compatible with an updatable crash history database. It will allow DOT to efficiently analyze the safety performance of a facility, project, or program.

A geocoded crash history database with key crash attributes will be compatible with existing data sources, future TRACS implementation and other applicable data sources. An attractive, easily comprehensible software interface will be programmed to allow the public to access this database and generate simple visual displays of safety information, as through maps, graphs or charts and made accessible to the public via the DOT website.

A final report and/or presentation will explain all methods, findings, and recommendations, including the most effective traffic calming measures for various roadway characteristics, and the safety evaluation tools described above.

5. *Evaluation Criteria*

An evaluation committee will review and score all proposals pursuant to the criteria described below. DOT reserves the right to interview proposers and visit their offices for the purpose of clarifying their proposals, after which their initial scores may be re-evaluated. Proposers will be ranked in accordance with their scores, and the proposer with the highest score will be awarded the project.

The Evaluation Criteria shall be as follows:

1. Quality & Relevance of Prior Experience (Weighted 40%)

    a. Proposed Staff: Demonstrated experience and qualification in traffic engineering, traffic calming, statistical analysis and presentation of findings.

2. Quality of Proposal (Weighted 55%)

    a. Overall Project: Understanding reasonableness and coherence of overall approach including understanding of project scope and requirements reflected in the work plan

    b. Approach: Clearly defined functions of all project staff members. Reasonable and coherent work plan or schedule detailing how the approach that will be taken to achieve the project objective. Consistency in the supporting documentation.

    c. Innovation: Utilization of innovative techniques to address the project issues and advance analytical capabilities.

3. Workload-Staff Availability (Weighted 5%)

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 9 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.

Pedestrian Fatality and Severe Injury Accidents in New York City
NYC-07-01

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:

<u>Fatalities</u>

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.

<u>Severe Injuries</u>

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.

<u>Roadway Characteristics</u>

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).

Task 4: Database Development and Recommendations

Deliverable

Usable Database System for Crash Analysis and Recommendations

Upon conclusion of the analysis and modeling, a comprehensive database will be developed to enable the Department to perform analysis and query the current data (and future data) in a user-friendly format.

Several agency goals should be taken into account in the preparation of operational, engineering, design, education and policy recommendations. These recommendations should include pursuing the creation of "complete streets" principles (or streets that take into account the provision of safe space for all users) whenever possible. Finally, recommendations should reflect the Department's evolving mission and its jurisdictional and programmatic boundaries.