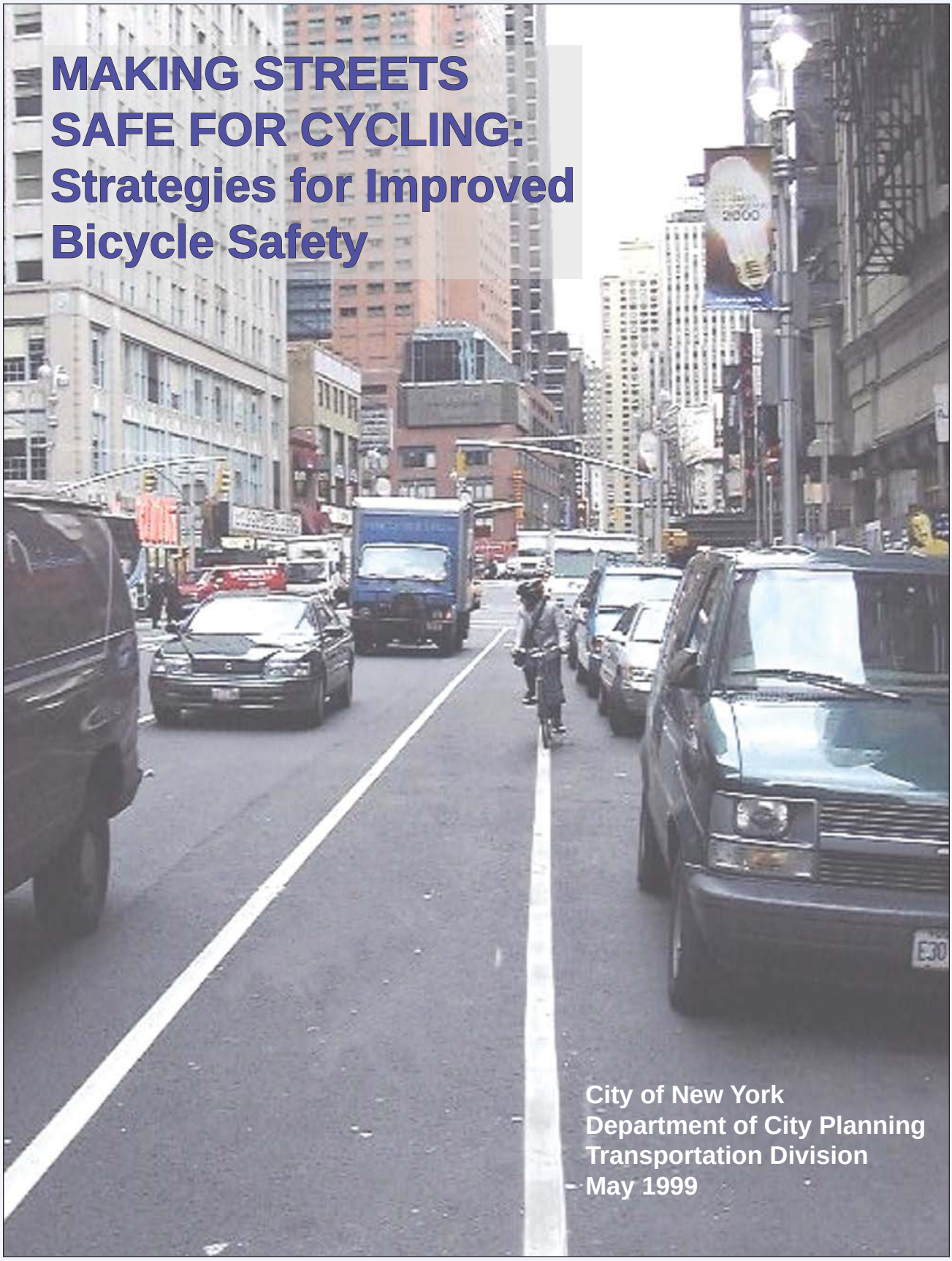
MAKING STREETS SAFE FOR CYCLING: Strategies for Improved Bicycle Safety



City of New York
Department of City Planning
Transportation Division
May 1999

MAKING STREETS SAFE FOR CYCLING:
Strategies for Improved Bicycle Safety

Final Report

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The City of New York

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May 1999

The preparation of this report was financed in part through funds from the U.S. Department of Transportation, Federal Highway Administration. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The contents of this report reflect the views of the author, who is responsible for the facts and accuracy of the data presented within. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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EXECUTIVE SUMMARY

This document is a compilation of three previous reports. The first, *Task 2: Literature Review*, provided an overview of bicycle facility research and implementation guides, followed by a selective case study survey of on-street cycling infrastructure implemented in both the United States and abroad (Appendix E). The second report, *Task 3: Existing Conditions*, contained a contextual review of New York City cycling data (including ridership and safety statistics) and on-street facilities, followed by a detailed review of Manhattan study area locations. The *Task 4: Recommendations* report drew on both of these documents to recommend innovative on-street cycling prototypes for evaluative testing in New York City.

Facility Recommendations

In this final report, eight facilities are recommended to improve safe cycling on New York City streets:

- ***Advanced Stop Box***
  Broadway at 17th Street
- ***Cycle Crossings***
  Lafayette Street/Fourth Avenue bicycle lane, at Astor Place
- ***Improved Lane Definition: color/texture***
  Fifth Avenue bicycle lane, 23rd to 7th Streets
- ***Improved Lane Definition: physical delineation***
  Broadway to Fifth Avenue, 24th to 23rd Streets
- ***Contra-Flow Bicycle Lane***
  West Broadway, Grand to Walker Streets
- ***Center-Median Bicycle Lane***
  17th Street, Broadway to Park Avenue
- ***Combined Bicycle/Bus Lane***
- ***Centerline Non-Compulsory Lane***

Cyclist on 17th Street near Union Square Park.

This report first describes a typical installation of each facility, then lists potential locations for testing in New York City. A specific pilot test is described for six facilities. The siting of pilot tests was informed by "critical (unsafe) locations" identified in the *Task 3: Existing Conditions* report. Recommendations in this document are based *first* on the selection of a facility type appropriate to New York City, and *second* on the selection of a location for successful implementation.

Associated Recommendations

Other associated recommendations address enforcement of on-street cycling facilities and the collection of cycling related safety/accident data. Consistent enforcement of on-street cycling facilities is as important to the success of implementation as proper engineering and placement. Systematic identification, collection and analysis of cycling-related safety data is critical to the successful evaluation of protoype facilities recommended in this report and future implementation efforts.

INTRODUCTION

New York City's first inter-agency coordinated bicycle program, the Bicycle Network Development Program (BND), was created in 1994 with a federal grant from the Intermodal Transportation Efficiency Act (ISTEA). The program began as a partnership between the NYC Departments of City Planning (NYCDCP) and Transportation (NYCDOT), and was joined by the Department of Parks and Recreation (NYCDPR) in 1996. Prior to this time, bicycle planning done by NYCDCP and NYCDPR had been largely incorporated with planning for off-street, greenway and recreational facilities. At NYCDOT, planning and implementation of on-street cycling facilities had been performed since the 1970's, although primarily in a project-specific context.[1]

The BND Program established the City's first coordinated on-street cycling program and bicycle policy, including suggestions for enforcement, encouragement and education programs for cycling. In addition, it identified a 550-mile citywide network of on-street cycling facilities which is gradually being implemented. These recommendations are contained within the *NYC Bicycle Master Plan*, released in 1997 by NYCDCP and NYCDOT.

The perception and reality, however, that New York City streets remain unsafe for cycling continues to discourage many potential cycling commuters. Difficulties in installing conventional[2] five-foot bike lanes on narrow and congested city streets are compounded by frequent double parking in existing bike lanes.

Focus on Facility Implementation

"Making Streets Safe for Cycling" is a targeted response to these problems which builds on the comprehensive bicycle agenda outlined by the BND program. Its focus is on-street facility implementation, a physical accommodation for cyclists using the roadway (e.g., Class II bikeways). For the purposes of this study, this definition includes specialized and standard bicycle lanes, various intersection treatments and traffic calming techniques. It excludes off-street paths (Class I bikeways), and bicycle routes identified by signs only (Class III bikeways).

Project Description

This study is based on research and analysis of prototype and existing on-street cycling facilities designed to minimize conflicts between cyclists and other roadway users. The final report recommends innovative on-street cycling design prototypes for evaluative testing, based on a study area defined as Manhattan and the major bridges that provide bicycle access to Manhattan from other boroughs.

At the same time, the study evaluates the effectiveness of New York Police Department (NYPD) bike patrols in reducing conflicts between cyclists and other mode users (pedestrians and cars). Detailed on-street facility recommendations are accompanied by broader recommendations to improve enforcement and create public awareness of on-street cycling facilities.

[1] "*Bikeway Planning and Policy Guidelines for New York City*," *released by the NYCDOT in 1978, established broad guidelines for bikeway planning but proposed implementation of only 23.5 miles of on-street (class II) bike lanes and little public outreach (i.e. encouragement, enforcement programs).*

[2] *Bike lanes which conform to guidelines identified by the American Association of State Highway and Transportation Officials (AASHTO) 1991 "Guide to the Development of Bicycle Facilities* ."

OVERVIEW:
Existing Conditions Review

The following is a contextual review of the current physical on-street cycling environment in the Manhattan study area, primarily through a detailed assessment of unsafe spot locations currently used by cyclists -- both those that do and do not support dedicated cycling facilities. This report also examines implementation, curbside regulation and enforcement issues to frame a discussion of how to implement cycling facility design prototypes.

Cycling Data and Statistics

In the past five years, overall increases in cycling ridership have been accompanied by increases in cycling accidents and injuries. In addition, the propensity to cycle can be linked to safety concerns about taxi and double-parked road users. However, a systematic identification of sites at which the greatest number of vehicular/bicycle accidents occur is not currently in place to guide on-street safety improvement efforts addressing these concerns.

On-Street Cycling Facilities

Portions of a planned network of on-street cycling facilities are currently in place, with plans for continued implementation in progress at the Departments of City Planning and Transportation. These plans provide opportunities for the strategic placement of innovative cycling facility prototypes to improve on-street safety.

Curbside parking regulations which affect cycling facilities may require modification to address future implementation of prototype facilities. Enforcement of both parking and moving regulations have been a focus of NYPD Traffic Control Division's bicycle patrol. A continued and increasingly focused enforcement effort is integral to ensuring that on-street facilities are accessible and safe.

Study Area Review

Ultimately, this report seeks to identify unsafe on-street locations currently used by cyclists for the implementation of prototype facilities (and new conventional bicycle lanes). Initial identification of these sites was based on the results of a questionnaire distributed to cyclists by the Department of City Planning.

A subset of ten roadways was identifed through analysis of questionnaire results. The chosen roadways reflect respondents' concern about north-south versus east-west roadways (approximately an 80/20 split). Specific study segments were identified on each roadway and reflect an overall concentration of responses below 59th St. In addition, respondents' concerns about poor bridge access prompted the addition of the Brooklyn and Queensboro Bridges entrances to the list of roadways, raising the number of selected study locations to a total of twelve.

Questionnaire results were then cross-referenced with NYCDOT Midtown Manhattan Bicycle Volumes (screenline counts) and NYPD vehicular Accident-Prone Location data, to confirm locations most heavily used by cyclists and most dangerous for roadway users, respectively. The results of this comparison were used to compile a final list of study locations as starting points for continued fieldwork and implementation recommendations. Maps are presented which illustrate recommended study segments and other locations critical to the network of existing facilities and recommended cycling routes.

NEW YORK CITY CYCLING DATA and STATISTICS

An overview of New York City's cycling environment provides an intital context in which to catalogue on-street physical conditions. This overview includes data on ridership levels and safety (injury and fatality) statistics, accompanied by a qualitative assessment of the greatest safety threats to on-street cyclists. Finally, safety research currently underway at the New York City Department of Transportation (NYCDOT) and federal agencies is reviewed.

Cycling Ridership

Since 1980, NYCDOT has been monitoring bicycle travel in selected locations. Bicycle volumes are recorded on the Staten Island Ferry, on three East River bridges on which Class I bicycle paths exist, and across 50th Street in Midtown Manhattan (Table 1).

Midtown Manhattan bicycle counts assess ridership levels on north-south avenues. These screenline counts are performed manually on a typical summer weekday between 7 am and 7 pm. In 1998, an additional screenline count on 23rd St. was performed to augment 50th St. screenline data. NYCDOT issues an annual report, *New York City Bicycle Statistics*, which compares annual statistics on cycling volumes, crashes, summons issuance, theft and theft recovery.

Table 1 is a three-year comparison of bicycle volumes (excluding 23rd St. counts) which reveals a slight decrease in ridership levels from 1996 to 1998, a difference of approximately 13% (2092 cyclists). This contradicts trends leading up to 1996, which saw an 8% increase in bicycle volumes in the Manhattan Central Business District in that year alone, and an increase of 142% since 1980.

Table 1
NYCDOT Average Daily Bicycle Volumes (50th Street Screenline, Bridge and Ferry)

Facility	1996	1997	1998
First Ave.	380	521	329
Second Ave.	874	933	879
Third Ave.	872	1311	1481
Lexington Ave.	640	855	927
Park Ave.	836	871	516
Madison Ave.	1030	1397	961
Fifth Ave.	1204	932	1098
Sixth Ave.	1506	1090	982
Seventh Ave.	820	666	730
Eighth Ave.	1345	856	1162
Broadway	875	956	410
Ninth Ave.	1090	1214	929
Tenth Ave.	341	298	241
Eleventh Ave.	113	136	160
Twelfth Ave.	35	31	62
Brooklyn Br.	1613	1698	1115
Queensboro Br.	1314	786	692
Williamsburg Br.	791	1022	966
Staten Island Ferry	387	318	335
Total	**16,066**	**15,891**	**13,974**

A preliminary look at 1998 data (23rd and 50th St. data only) shows overall higher numbers of cyclists near 50th St. in Midtown:

Table 2
1998 NYCDOT Average Daily Bicycle Volumes

Facility	23rd	50th	Total
First Ave.	1039	329	1368
Second Ave.	577	879	1456
Third Ave.	465	1481	1946
Lexington Ave.	434	927	1361
Park Ave.	1266	516	1782
Madison Ave.	143	961	1104
Fifth Ave.	1425	1098	2523
Sixth Ave.	134	982	1116
Seventh Ave.	799	730	1529
Eighth Ave.	1065	1162	2227
Broadway	0	410	410
Ninth Ave.	449	929	1378
Tenth Ave.	694	241	935
Eleventh Ave.	207	160	367
Twelfth Ave.	262	62	324
Total	**8,959**	**10,867**	

Accident Statistics

The City and State of New York compile data pertaining to every traffic accident (vehicular, pedestrian, cycling) that occurs within their boundaries. All data is derived from police reports written by the officer called to the scene of the accident. By definition, these reports are often highly imperfect; details may be vague or missing; judgements about the cause of accidents are often subjective. However, these on-site reports and summaries derived from them constitute the legal record of accidents in the City and State of New York.

Accident data can be reviewed both through an Interim Accident Summary Report and by individual location node. The summary data is compiled from individual police reports every six months, and offers a condensed view of nodes (by intersection) used to determine a pattern of accidents.

However, accident summary data refers only to vehicles and pedestrians specifically, not cyclists. Although accident data specific to cyclists is contained in individual accident reports, it can be primarily used only to review traffic patterns involving cyclists at pre-selected locations (not to initially identify a set of intersections continually problematic for cyclists).

General summary data are available, however, for the total number of bicycle/vehicular accidents in New York City. These are compiled by the New York Metropolitan Transportation Council (NYMTC), the Metropolitan Planning Organization (MPO) for the New York City region, and are based on New York State Department of Motor Vehicles data, available through 1996. This data shows a 43% overall increase in yearly accident totals since 1990 (Table 3):

Table 3
NYMTC Technical Notes Summary of Total NYC Vehicular/Bicycle Accidents

Year	Accidents
1990	3706
1991	4031
1992	4236
1993	4834
1994	4709
1995	5331
1996	5306
1997	N/A

Finally, current yearly summary data of citywide cycling injuries and fatalities is available from the New York Police Department (NYPD):

Table 4
NYPD[3] Total Bicycle Injuries and Fatalities

Year	Injuries	Fatalities
1996	5551	15
1997	5757	13

Table 5
NYPD Year-To-Date (YTD)[3] Bicycle Injuries and Fatalities

Year	Injuries	Fatalities
1997	5486	13
1998	4887	11

NYPD 1996 data shows higher cycling injury and fatality totals than NYMTC 1996 cycling accident totals (5566 versus 5306). Both 1996 and 1997 NYPD figures support a continued trend in decreased cycling safety seen since 1990, contrasting accident increases with concurrent decreases in the total number of cyclists recorded in NYCDOT bicycle counts (Table 1). NYPD 1998 figures reveal slight reductions in both the number and severity of cycling accidents, which are concurrent with decreased ridership levels recorded in 1998 NYCDOT bicycle counts.

[3] *Received (confirmed) from the Office of the Chief of Patrol. YTD: January 1 to November 23.*

Qualitative Safety Assessment

A qualitative assessment of on-street safety for cyclists was performed through a recent questionnaire distributed by the New York City Department of City Planning (DCP); (Appendix A). Bicycle safety questions were asked in addition to questions about bicycle travel habits and bicycle parking. From a total 1378 questionnaires returned, a majority of respondents (51.1%) resided in Manhattan:

Table 6
DCP Questionnaire
Borough Residence of Respondents

Borough	% Total
Manhattan	51.1%
Brooklyn	25.6%
Queens	12.1%
Staten Island	4.7%
Bronx	3.2%
outside NYC	3.2%
Total	**100%**

More than half (59.8%) of all respondents used their bicycle to commute to work, averaging 6.2 miles and 36 minutes per commute. Of questionnaire respondents who did not use their bicycle to commute to work, relative percentages of reasons given for not commuting by bicycle were well distributed among the top three categories:

Table 7
DCP Questionnaire
Reasons for Not Commuting by Bicycle

Reason	% Total
Nowhere to store my bike safely	29.2%
No shower/change facilities at work	25.7%
Fear of motorists	23.2%
Poor roadway surface conditions	12.7%
Work too far from home	9.2%
Total	**100%**

A question more specifically related to on-street safety asked cyclists the following:

Which roadway users are the greatest threats to your safety when riding in traffic?

For this question, survey respondents were asked to assign given categories with numbers from 1 to 5 (1-low to 5-high threat). To tabulate responses where no number was given, a zero was entered. With this correction, the question could be evaluated for 94.7 % of all surveys.

Results from this question are shown on Chart 1 (next page). Taxis and double-parked cars were ranked by respondents as the greatest roadway threats (4.1 and 3.7, respectively), followed by private passenger cars (3.5) and trucks (3.1).

A second question related specifically to on-street safety asked respondents to summarize accident information:

Have you been in an accident while riding in traffic? (check all that apply):

A police report was filed	*(_yes/_no)*
Someone was injured	*(_yes/_no)*
Someone was taken to the hospital	*(_yes/_no)*
I was doored	*(_ # times)*
I collided with a vehicle	*(_ # times)*
I collided with a person	*(_ # times)*

The results from this question are shown in Charts 2 and 3 (next page). A little more than half of all survey respondents (52.8 %) indicated that they had been involved in an accident by checking at least one of the given categories. In Chart 2, most responses were given from cyclists who had been doored, followed by collisions with vehicles.

Chart 3 shows a comparison of incidents of dooring, vehicle and pedestrian-related cycling accidents listed by number of occurences. Pedestrian-related accidents represented the greatest number of singular accidents; “dooring” and vehicular collisions represented the greatest number of multiple accidents, respectively.

Chart 1: Safety Threats in Traffic

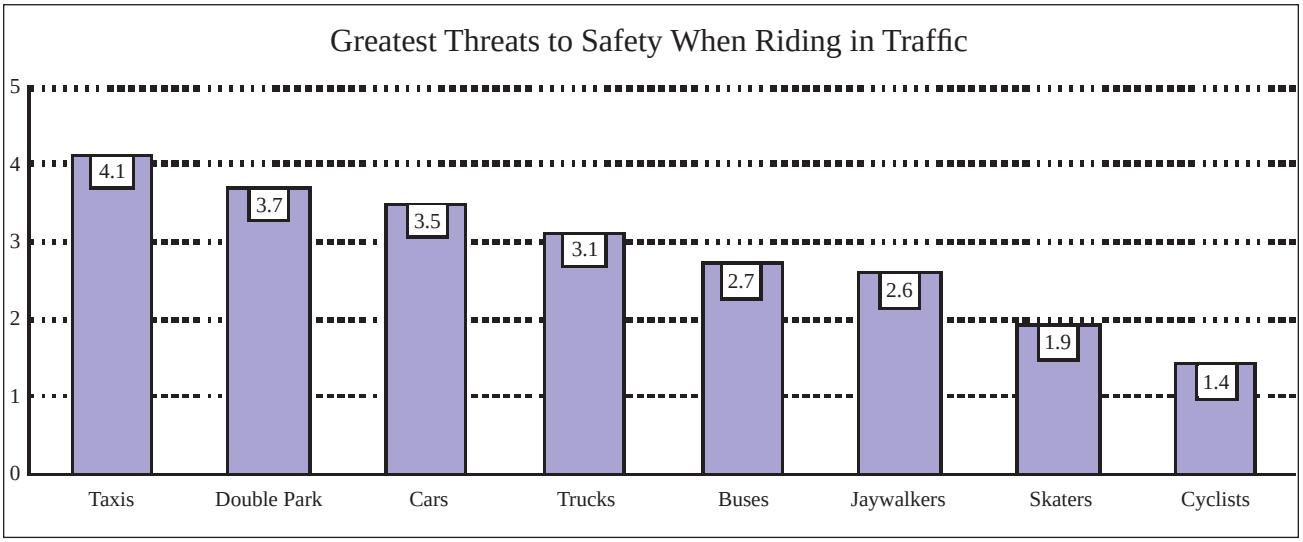


Chart 2: Accident Summary Information

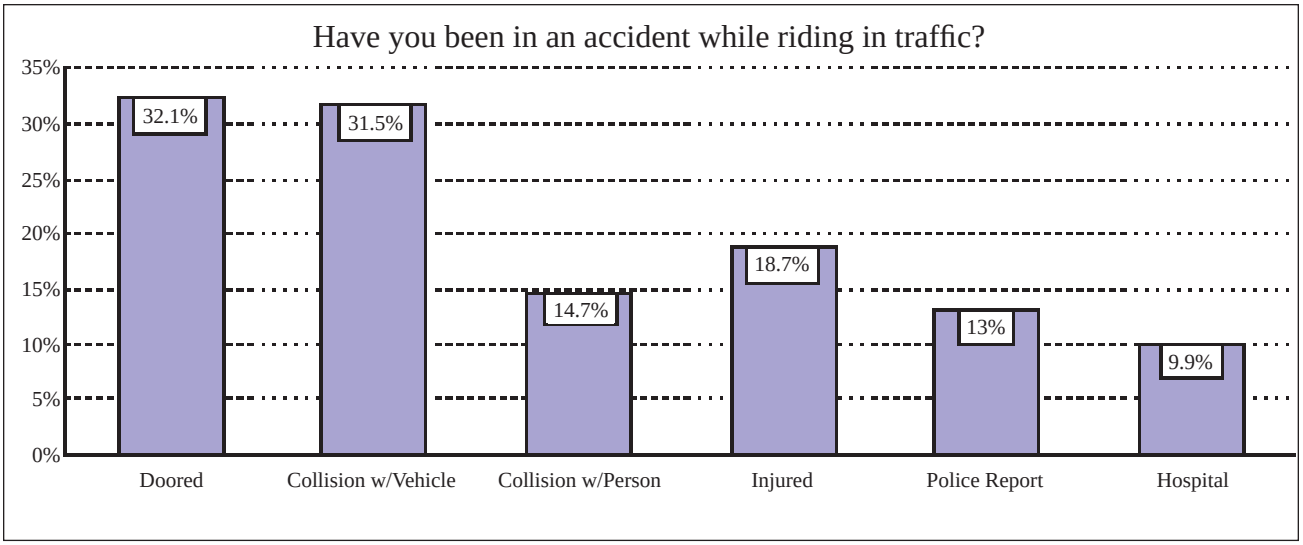
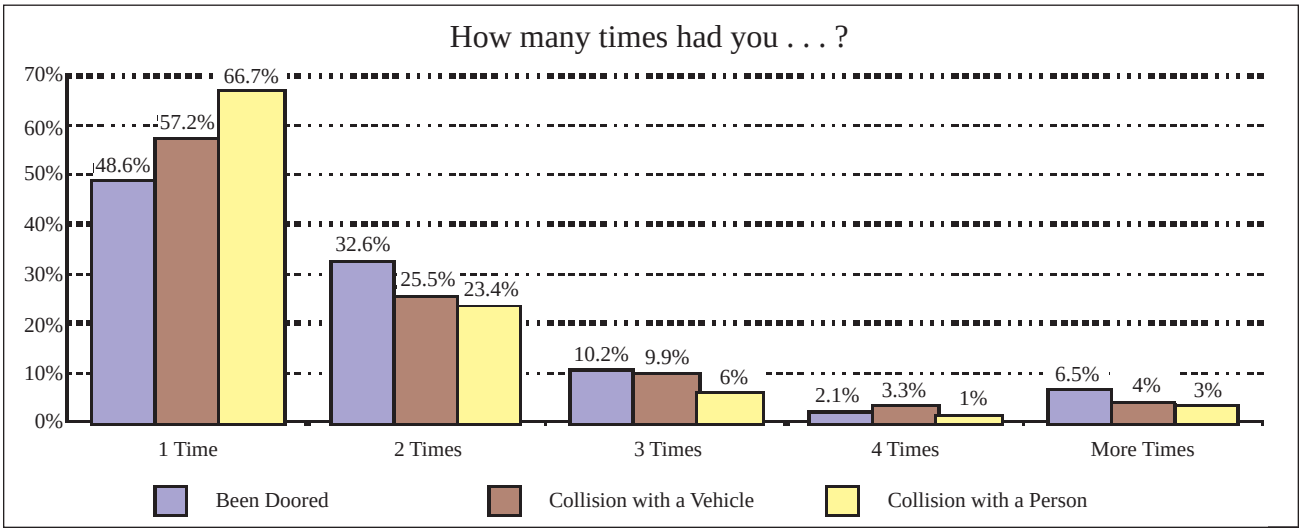


Chart 3: Accident Frequency Information



Safety Research

In a effort to provide a formulated approach to the analysis of safety and accident data, the Safety Division of NYCDOT is developing a Computer - Aided Safety Index for Urban Streets (CASIUS). CASIUS is an attempt to provide a safety index for New York City street links and nodes (intersections) based upon factors that affect accident experience.

Elements that comprise CASIUS are categorized into two basic areas: the first historical, the second predictive. Historical accident experience is necessary to examine the past safety perfomance of a location, focusing on accident severity and frequency. It indicates the presence or absence of particular problems through repeated occurrences of accident types.

The predictive category captures and analyzes the physical configuration, traffic congestion level, traffic markings and controls, pedestrian interaction and other information to determine the level of safety at a site. It also provides a means to evaluate remedial actions prior to implementation.

To date, CASIUS remains in developmental phases as research to define historical and predictive factors has yet to be completed. As a comprehensive, citywide tool, however, CASIUS may provide opportunities to develop increasingly systematic approaches to both quantitative and qualitative cycling safety research.

A related research effort is also currently in progress by federal agencies. A software program called the Pedestrian and Bicyclist Crash Analysis Tool (PBCAT) is currently being prepared under the sponsorship of the Federal Highway Administration and the National Highway Traffic Safety Administration. This tool, scheduled for availability in 1999, will automatically classify crashes, build a database and produce reports for use by a jurisdiction. Potential use of this tool for New York City will likely require improved summary tracking of cycling accidents.

Overall in the past five years, New York City has experienced growing numbers of on-street cyclists, accompanied by rising levels of cycling accidents. Most recently, slight decreases in cycling ridership have occurred, accompanied by similar decreases in the number of cycling injuries and fatalities. In the recent DCP effort to qualitatively assess on-street safety concerns of cyclists, the propensity to cycle was strongly linked to a “fear of motorists,” particularly taxi, car and double-parked road users. On-street facility improvements which address these concerns could help ensure a continued growth in cycling ridership without concurrent increases in accident rates.

NEW YORK CITY ON-STREET CYCLING FACILITIES

To begin cataloging the current physical on-street cycling environment in New York City (and Manhattan in particular), an overview of existing, past and planned bicycle facilities is given. This is accompanied by a description of the process used by NYCDOT to implement new cycling facilities, curbside regulation and NYPD enforcement affecting implemented facilities.

Existing and Planned Facilities

Existing bicycle lanes on New York City roadways generally conform to recommended standards established by the American Association of State Highway and Transportation Officials (AASHTO). These standards are presented in the *New York City Bicycle Master Plan*, and described in detail in the *Safe Streets Task 2 Literature Review* (pp.4-9).

In accordance with AASHTO recommendations, existing bicycle lanes are approximately five feet wide, marked with white thermoplastic striping, and cyclist and diamond stenciling. The Broadway, First, Fifth and Sixth Avenue lanes (Table 9) were implemented prior to the release of the AASHTO guidelines, and are approximately four feet wide.

The beginning of a five-foot bicycle lane, with six-foot buffer, on Lafayette St. (at Spring St.).

In contrast, several recently implemented lanes, including Lafayette, Hudson and Second Avenue lanes, have surpassed AASHTO recommended standards through inclusion of a six-foot striped buffer separating vehicle and bicycle travel. The width for each buffer was made possible through the reconfiguration or elimination of travel lanes.

To date, a total of 72.42 miles of on-street bicycle lanes have been implemented in four of five boroughs in New York City:

Table 8
Existing Citywide On-Street Bicycle Lanes

Borough	Total Miles (2-way)	%Total
Queens	21.40	29.55%
Manhattan	22.34	30.85%
Brooklyn	20.38	28.14%
Staten Island	8.30	11.46%
Total	**74.07**	**100%**

Within the Manhattan study area, 22.34 miles of lanes have been implemented in nine locations:

Table 9
Existing Manhattan On-Street Bicycle Lanes

Roadway	From	To	Miles
AC Powell Jr./ St. Nicholas	110th St.	168th St.	5.60
Broadway	59th St.	17th St.	2.60
Central Park	(drives)		6.24
First Ave.	72nd St.	125th St.	2.70
Hudson St./ Eighth Ave.	Dominick	14th St.	1.00
Lafayette St./ Fourth Ave.	Spring St.	14th St.	1.00
Second Ave.	14th St.	Houston	0.75
Fifth Ave.	23rd St.	7th St.	0.80
Sixth Ave.	8th St.	40th St.	1.65

An additional 39.5 miles of on-street (Class II) bicycle lanes outside of Manhattan are in the design stage at NYCDOT, the majority of which are planned for the Bronx (19.8 miles) and Brooklyn (15.1 miles).

Finally, approximately 90 miles of additional lanes are currently proposed for implementation during the next four years by the NYC Departments of City Planning and Transportation, including 50 miles in Manhattan and 10 miles in each of the four remaining boroughs.

Plans for continued on-street implementation provide opportunites for the strategic placement of innovative cycling facility prototypes which this study seeks to recommend. In making recommendations, however, it is important to note past and current attempts at innovative facility implementation in New York City.

Remnant of Sixth Ave. curb separated lane.

In 1980, a curb-separated bicycle lane was installed on Sixth Avenue in Manhattan, and removed within several months. Protected from motor vehicle traffic, the lane became a refuge for street vendors and pedestrians, and impassible for cyclists. A one-block (33th St. to 34th St.) portion of the lane and accompanying bicycle-traffic signal still exists at Herald Square.

A more recent cycling facility innovation is currently in place in Brooklyn. A red pigmented bicycle lane was implemented in November 1998 as part of a reconstruction of Adams Street by the New York City Economic Development Corporation (NYCEDC). The five-foot wide pigmented lane is bounded by granite pavers, and runs for approximately two blocks in both directions (from Tillary St. to Willoughby St.).

Pigmented bicycle lane on Adams Street.

The blocks adjacent to this newly installed lane contain several court buildings, a major post office, hotel and the New York City Techinical College. Cars accompanying these uses at times ignore the curbside parking prohibition that was implemented with the new lane, rendering it inaccessible to cyclists.

Finally, raised markings have been implemented by the New York State Department of Transportation (NYSDOT) on a recently constructed portion of the Route 9A Hudson River bicycle path in Manhattan's West Village. Series of raised markings are meant to alert cyclists at pedestrian intersections. Although these markings have been implemented on an off-street (Class I) path, the potential exists to use similar markings in conjunction with innovative on-street lane design through high-volume pedestrian areas.

Newly implemented bike path on Route 9A.

Bicycle Lane Implementation

NYCDOT is primarily reponsible for implementing on-street cycling facilities. The following steps are used to plan for the implementation of on-street bicycle lanes:

1. Identify specific alignment for consideration;
2. Measure width and ride to determine suitability, including stress level determination (a function of the number of lanes, curb lane width, traffic volume and vehicle speed);
3. Compile Automated Traffic Recorder (ATR) vehicle counts;
4. Compile vehicle turning counts, classification counts and signal timing diagrams;
5. Conduct capacity analysis using Highway Capacity Software (HCS) and above data;
6. Create an engineering design for lane implementation, including a diagram of proposed "typical" lane widths;
7. Present this design to community boards in which the lane is proposed;
8. Collect inventories of curb use, regulation and signage;
9. Write orders for sign implementation;
10. Inform the NYCDOT Borough Commissioner.

The feasibility of implementing recommended cycling facilities relies heavily on step 5: HCS analysis. HCS analysis allows the NYC DOT to determine the impact a proposed facility will have on existing traffic in a specific location, based primarily on the percentage change in vehicular traffic delay.

Change in the level of service (LOS) rating (A/best through F/worst) assigned to a location before and after proposed implementation is also used to determine traffic effects of a new cycling facility. Acceptable changes in LOS are in part dependent on existing levels of service (i.e., a change from LOS A to LOS D is more severe than a change from LOS C to LOS D).

If impacts are considered significant, lane implementation will be deemed infeasible, halting further work. In certain cases, however, a compelling need for a lane may outweigh traffic impacts, allowing the implementation process to continue.

Associated Curbside Regulation

Traffic rules, including curbside regulation, are outlined in the NYC Department of Transportation *Traffic Rules* manual. This document contains provisions both specifically and generally related to the operation of on-street bicycle facilities.

Regulations which specifically address bicycle lanes appear in Section 4-08 of the NYCDOT *Traffic Rules*. These include:

> (e) ***General No Stopping Zones*** (stopping, standing and parking prohibited in specified places). No person shall stop, stand or park a vehicle in any of the following places, unless otherwise indicated by posted signs, markings or other traffic control devices, or at the direction of a law enforcement officer:
>
> > (9) Bicycle lanes. Within a designated bicycle lane.

Double-parking, cited by DCP questionnaire respondents as the second highest roadway threat to cyclists (p.4), is addressed through regulation of standing vehicles. This section does not, however, address bicycle lanes as a specific subset, and mentions them only in relation to loading and unloading commericial vehicles. Language used for this purpose is somewhat unclear, indicating that commercial vehicles should stand on the "roadway side of bicycle lanes," without specifically stating that vehicles are prohibited from standing in bicycle lanes:

> (f) ***General No Standing Zones*** (standing and parking prohibited in specified places). No person shall stand or park a vehicle in any of the following places, unless otherwide indicated by posted signs, markings or other traffic control devices, or at the direction of a law enforcement officer:
>
> > (1) Double parking. On the roadway side of a vehicle stopped, standing or parked at the curb, except a person may stand a commercial vehicle alongside a vehicle parked at the curb at such locations and during such hours that stopping, standing, or parking is not prohibited, while expeditiously making

> pickups, deliveries or service calls, provided that there is no unoccupied parking space or designated loading zone on either side of the street within 100 feet that can be used for such standing...A person may stand a commercial vehicle *along the roadway side of a bicycle lane* provided all other conditions of this paragraph (1) are met.

NYCDOT's planned expansion of the city's network of cycling lanes will require increasingly explicit curbside regulation and signage to accompany new facilities. Double parking, identified by cyclists as a leading threat to on-street safety, should be a target of focused regulation.

In addition, future implementation of innovative on-street cycling facilities will require modified curbside regulations which address all relevant cycling facilities (not just bicycle lanes). New facilities should also be implemented in conjuction with improved signage to make delivery vehicles aware of loading/unloading regulations (outside of bicycle lanes), and to alert motorists to double-parking and standing regulations (outside of bicycle lanes). Regulation efforts need to be coordinated with effective enforcement, discussed below.

In addition, the ability of commercial vehicles, buses and taxis to use *designated curbside areas* also affects cyclists' safe use of clear bicycle lanes; bicycle lanes are often inadvertantly blocked by trucks, buses and taxis when illegally parked passenger cars prevent the use of these designated areas. These areas require explicit signage to identify regulations near new and existing cycling facilities, in addition to targeted enforcement efforts.

In addition to ticket issuance, Traffic Enforcement Agents are authorized by Section 4-08 of the *Traffic Rules* to affix a sticker to the rear side window of unattended stopped, standing or parked cars which violate parking regulations and interfere with the free flow of traffic. Finally, summons issuance by NYPD officers is a critical enforcement effort related to curbside use, and is discussed in the following section.

Enforcement

Uniformed Bicycle Patrols were initiated through a 1992 NYPD Community Policing Bicycle Patrol pilot program in the 24th Precinct. The objective of this pilot program was to provide each beat officer with a bicycle to be utilized as a "tool" to enhance patrol capacity, giving police officers increased mobility and community visibility.

After one year, the Community Policing Bicycle Patrol was deemed successful and ten additional precincts were equipped with bicycles. In 1995, increasing popularity of the Bicycle Patrols led to their expansion to approximately 59 precincts, an expansion funded by community donations channeled through the New York City Police Foundation. In 1997, the NYPD took over the funding of the Bicycle Patrol, expanding it to every Precinct,Task Force, the Traffic Control Division and the Housing Bureau.

Currently there are approximately 1700 marked police bicycles citywide. A smaller additional number of unmarked bicycles are also ultized by Anti-crime personnel and the Street Crime Unit.

Work performed by Bicycle Patrol officers generally falls into two categories: (1) community policing and (2) traffic enforcement (all traffic).

COMMUNITY POLICING

Bicycle Patrols have been primarily used to emphasize quality of life enforcement,[4] particularly at parks, playgrounds and housing developments. In most instances, officers use the bikes as a tool to address a wide variety of law enforcement issues, not only those that are specifically bicycle-related. Policy for the bike patrols is set at the precinct level, with direction from the Office of the Chief of Patrol. This policy reflects community concerns and prevalent local conditions and concerns.

Community police work which involves cyclists ranges from officers who target the use of bicycles for criminal activity (including robberies in which bicycles are used as a "get-away" and

drug dealers who use bicycles for quick relocation and as "look-outs" for police officers), to officers who target cyclists for moving offenses. Inspector John White, Office of the Chief of Patrol, has stated, however, that criminal enforcement is often prioritized over moving offense enforcement by precinct Bicycle Patrols.[4] Concern about drug activity in Washington Square Park, for example, has led bicycle patrol officers in that precinct to focus their work on suspected drug behavior in lieu of other offenses, including moving violations that involve cyclists.

In specific instances, however, community concern about cycling moving violations has led officers to focus their efforts on summons issuance. In recent months, for example, community complaints about speeding cyclists at entrances to the Brooklyn Bridge have prompted targeted summons efforts by patrol officers.

Summonses issued by the Bicycle Patrols are now tracked on a daily (v. weekly) basis by the Office of the Chief of Patrol.

TRAFFIC ENFORCEMENT

Overview

Traffic enforcement of cyclists has increased concurrently with expansion of the Bicycle Patrol Program, evident from the annual numbers of summons issued to cyclists. These numbers reflect NYPD totals, including but not limited to summonses issued by Bicycle Patrols:

Table 10
Citywide Bicycle Summonses Issued

Year	Total	Increase
1993	1794	N/A
1994	1961	9%
1995	2389	18%
1996	5966	150%
1997	N/A	N/A

These numbers show dramatic increases in summonses issued to cyclists in years immediately following major expansions of the Bicycle Patrol Program (described earlier). Most dramatic is a 150% increase in cycing summonses that occurred after the 1995 expansion of the Program. A second major Program expansion occurred in 1997, for which summary data is not available.

However, a comparison of 1997 and 1998 year-to-date (YTD) reports[5] of moving traffic summonses shows a 67% increase in the number of moving summonses issued to cyclists from 1997 (5,702 summons) to 1998 (9,532 summonses):

Table 11
Citywide YTD Moving Violations

1997 Moving Summonses	
Issued to Motor Vehicles	711,121
Issued to Cyclists	5,702
Issued to Pedestrians	9
Total	**716,832**
1998 Moving Summonses	
Issued to Motor Vehicles	830,724
Issued to Cyclists	9,532
Issued to Pedestrians	151
Total	**840,407**

This data also allows comparison between the relative percentage growth of traffic summonses issued to cyclists to those issued to motor vehicles. As a total percentage share, summonses issued to cyclists increased from 0.8% to 1.13%, or 0.33%. The percentage share of motor vehicle summonses decreased from 99.2% to 98.8%, or 0.4% (Table 3).

[4] *Interview with Inspector John White, Office of the Chief of Patrol, 9/30/98.*

[5] *January 1 to August 31, NYPD summary report which includes data for each precinct command; Housing, Transit, Port Authority, Highway and Traffic Control Division.*

Table 12
1997-1998 YTD Relative Percentage Change in Moving Violations Issuances

Issued to	Relative Change
Cyclists	+0.33%
Motor Vehicles	-0.4%

In summary, from 1997 to 1998, an increasing *total* number of cycling summonses reflects a rising *percentage* of cycling summonses relative to motor vehicle summonses. These results occurred in tandem with continual expansion of the NYPD Bicycle Patrol program. Based on these results, a preliminary conclusion can be drawn that, on the whole, an expanded Bicycle Patrol Program has resulted in greater emphasis on the enforcement of cyclists than of motor vehicles.

Traffic Control Division (TCD)

NYPD's Traffic Control Division contains a uniformed Bicycle Patrol whose primary function is to enforce parking regulations on bicycle lanes and double parking conditions generally in Patrol Borough Manhattan South[6] (below 59th St.)

The Bicycle Patrol is employed during day (8 am to 4 pm) and evening (4 pm to 12 am) tours of the TCD Enforcement Unit. Each shift is staffed by one sergeant and approximately nine police officers. Target areas covered by the TCD Bicycle Patrol fluctuate and are based on input from each precinct on problem areas requiring increased enforcement. These assignments are not currently influenced by the location of existing bicycle lanes. In addition to their regular assignments, Bicycle Patrol officers also cover major events (parade, presidential visit), civil disturbances (fire, building collapse) and other emergencies.

In 1998 (YTD), approximately half of all borough command summonses to cyclists were issued by the TCD Bicycle Patrol.[7] Summary data of all summons issued by the Patrol offers the most detailed profile of cycling-related enforcement activity. Through October 1998, the Patrol issued a total **10,674** summonses[8] (Table 13).

Table 13
TCD Bicycle Patrol
YTD Total Summonses

Moving Violations	6,834
Parking Violations	3,673
Criminal Court summonses	167
Total	**10,674**

Of these 10,674 total summonses, 4,608 (43.2%) were specifically related to cycling -- issued either directly to cyclists or to motor vehicles in bicycle lanes. A further analysis of cycling-related summonses reveals a 3:1 ratio of summonses issued to cyclists versus motor vehicles parked illegally in bicycle lanes: 3,441 (74.7%) were issued to cyclists; 1,167 (25.3%) were issued to motor vehicles (Table 14).

Table 14
TCD Bicycle Patrol
YTD Total Cycling Related Summonses

Summonses Issued to Cyclists	3,441
Summonses Issued to Motor Vehicles in Bicycle Lanes	1,167
Total	**4,608**

Further comparisons can be made among cycling-related summonses. The breakdown of the 1,167 summonses to motor vehicles included:

Parking in Bicycle Lane	1,160
Driving in Bicycle Lane	2
Other	5
Total	**1,167**

A breakdown of the 3,441 summonses issued directly to cyclists[9] included:

Disobeying Red Lights	1,088
Riding Wrong Way	1,185
Riding on the Sidewalk	509
Other[10]	659
Total	**3,441**

Finally, analysis of the total number of moving violation summonses issued to motor vehicles versus cyclists shows approximately a 3:2 ratio: 4052 (59%) were issued to motor vehicles; 2782 (41%) were issued to cyclists (Table 15).

Table 15
TCD Bicycle Patrol
YTD Total Moving Violations Summonses

Issued to Motor Vehicles	4,052
Issued to Cyclists	2,782
Total	**6,834**

Summary of TCD Analysis

Overall, work performed by the TCD Bicycle Patrol (both general traffic enforcement and enforcement specific to cycling) contributes to safer on-street conditions which benefit cyclists. However, as the only NYPD Patrol whose assignments *specifically* include enforcement of on-street cycling conditions, the TCD Bicycle Patrol is particularly important to the existence of bicycle facilities that remain clear and safe for cyclists' use.

Considering this, detailed analysis of summonses issued by the Bicycle Patrol related to cycling (43.2% of total summonses) was performed. This analysis showed a 3:1 ratio of summonses given to cyclists versus motor vehicles disrupting use of bicycle lanes. This figure contrasts sharply with DCP survey results discussed earlier in this report (p.4), which cited double-parked vehicles as the second greatest threat to cyclists riding in traffic. Overall, the TCD Bicycle Patrol issued summons to cyclists at a 2:3 ratio over the sum total issued to motor vehicles (for both cycling-related and non-cycling specific offenses).

With the continued expansion of the network of bicycle lanes, preliminary recommendations can be made for an (1) increased emphasis on motor vehicle enforcement *directly related* to on-street cyclists, and (2) specific targeting of locations where NYCDOT has installed cycling facilities to make these investments usable.

[6] *Text taken from "History of the Uniformed Bicycle Patrol," issued by the Office of the Chief of Patrol.*

[7] *TCD Bicycle Patrol issued 2457 of 4626 borough command summonses to cyclists. Office of the Chief of Patrol Bicycle Enforcement Report, reporting from January 1 thru September 21.*

[8] *Summary data is for evening tour only; the bike unit of the day tour was initiated 10/98 and data not yet available.*

[9] *See Appendix B for a summary listing of cycling infractions and associated fines.*

[10] *Includes criminal court summones to store owners who utilize bicycles for delivery and have not maintained proper records.*

STUDY AREA REVIEW

Ultimately, this report attempts to identify *unsafe* on-street locations *currently used by cyclists* for the implementation of prototype facilities (and new conventional bicycle lanes). A total of ten roadway locations and four bridge entrances were selected for preliminary field work based on these two criteria.

Initial Identification of Study Locations

As discussed earlier, the diffuse nature of New York City and State accident report data precluded its use to determine study locations (p.3). As an alternative, the questionnaire distributed to cyclists by the Department of City Planning (p.4) included two open-ended questions which asked respondents to list on-street locations they considered most dangerous, as well the reasons why:

- Along your typical routes, are there any particularly bad intersections or stretches of roadway? Describe the exact location;
- What is the nature of the problem?

Approximately 800 questionnaires were received. Multiple entries to the above questions resulted in 1361 location entries that were tabulated by borough:

Table 16
DCP Questionnaire
Problem Locations by Borough

Borough	# Entries	% Total
Manhattan	871	64.0%
Brooklyn	278	20.4%
Queens	110	8.1%
Staten Island	40	2.9%
New York[11]	34	2.5%
Bronx	28	2.1%
Total	**1361**	**100%**

In keeping with the scope of this study, however, only those locations within Manhattan and access points for bridges to Manhattan (in other boroughs) were analyzed. A "Manhattan subset" database that included **1022** entries was created to identify study locations (representing 76.1% of total responses).

Analysis
These 1022 locations were first classified as roadways (R), intersections (I) or bridges/points of bridge access (B). Totals for each classification were fairly evenly distributed:

Table 17
DCP Questionnaire -- Manhattan Subset
Classification of Problem Locations

Classification	# Entries	% Total
Roadway	409	38.7%
Intersection	343	32.5%
Bridge/Access	304	28.8%
Total	**1056**[12]	**100%**

Of roadways listed, the majority ran in a north-south direction (versus an east-west direction), approximately an 80/20 split:

Table 18
DCP Questionnaire -- Manhattan Subset
Problem Roadways by Direction

Roadway Direction	% Total
North-South	78%
East-West	22%

Problems at Manhattan subset locations were entered into the database and identified using 19 classification keywords based on typical responses. More than one keyword was generally used to describe each response; where applicable keyword descriptions overlapped, the most specific ones were used (descriptions of

[11] *34 responses were entered as "NY," denoting reference to a bridge/path between boroughs (not assigned to only one).*

[12] *34 entries were listed as "R, B" or "I, B" and appear twice.*

each keyword are contained in Appendix C). A list of keywords and the total number and percentage of each appears in the following table:

Table 19
DCP Questionnaire -- Manhattan Subset
Problem Keywords Given for Locations

Keyword	# Listed	% Listed
Poor bridge access	237	15.3%
Congestion	211	13.6%
Poor road condition	182	11.7%
No defined cycling space	168	10.8%
Double parked vehicles	107	6.9%
Conflicts w/ turning vehicles	86	5.6%
Vehicular speeds	77	5.0%
Intersection design	75	4.8%
Aggressive driving	69	4.5%
Pedestrians in cycle space	60	3.9%
Traffic signal problem	59	3.8%
Unlawful driving	53	3.4%
Stopping taxis	32	2.1%
Jaywalking	30	1.9%
Narrow roadway	30	1.9%
Merge problems	30	1.9%
Narrow bicycle lane	21	1.4%
Construction	12	0.8%
Unlawful cycling	10	0.6%
Total	**1549**[13]	**100%**

Finally, the 1022 total problem locations were queried to identify initial study locations for preliminary fieldwork. Locations with the highest concentrations are listed by roadway (includes references to associated intersections):

Table 20
DCP Questionnaire -- Manhattan Subset
Most Problematic Locations by Roadway

No.	Roadway	# Listed[14]
1.	Broadway	147
2.	Sixth Ave.	86
3.	Eighth Ave.	54
4.	59th St.	52
5.	Second Ave.	47
6.	Seventh Ave.	42
7.	34th St.	39
8.	Fifth Ave.	35
9.(1)	LafayetteSt./Fourth Ave.	32
9.(2)	42nd St.	32
11.	Houston St.	29
12.	Third Ave.	26
13.	Ninth Ave.	25
14.	Canal St.	23
15.	First Ave.	18

Of these 15 roadways, nine are located entirely in the southern half of Manhattan, below (including) 59th St. The remaining six north-south roadways were analyzed to determine general areas of concentration, north or south of (including) 59th St:[15]

Table 21
DCP Questionnaire -- Manhattan Subset
Problematic North-South Roadways;
Percent of Responses below/above 59th St.

Roadway	% below	% above
Broadway	86%	14%
Second Ave.	93%	7%
Fifth Ave.	90%	10%
Third Ave.	91%	9%
Ninth Ave.	100%	0%
First Ave.	71%	29%

Five of 15 roadways in Table 20 run in an east-west direction. A closer look at the total entries

[13] *Total has no relation to total number of entries; each entry was eligible for more than one keyword. Percentage given as a part of total number of keywords listed (not entries).*

[14] *Intersections references included in totals with each roadway.*

[15] *Area consistent with NYPD accident data.*

for each roadway[16] shows differences in the type of responses each received -- referenced either as roadway segments (a block or more), or in relation to specific intersections. Forty-second St. and 34th St., in particular, both ranked as top ten *Problematic Locations by Roadway* (Table 20) but were cited far more often in relation to discrete intersections than as roadway segments.

For this reason, 42nd St. and 34th St. are not included in a final list of study locations; problematic intersections on these roadways will be addressed as components of the roadways they intersect.[17]

Major intersection areas that were identified as problematic locations were catalogued and listed separately from roadways and other minor intersections. These areas are generally irregularly shaped or excessively large cross-roads.[18] Queries of these areas sought to establish concentrations of responses beyond those associated with discrete intersections or roadways. Major intersection areas most frequently cited by questionnaire respondents were traffic irregularities created by Broadway:

Table 22
DCP Questionnaire -- Manhattan Subset
Top Problematic Major Intersection Areas

Intersection area	# Listed
Herald Square	41
Columbus Circle	31
Times Square	18
Union Square	17
Madison Square	12

Finally, a query of all bridges to and from Manhattan from other boroughs was conducted, focusing on locations which provide immediate access to bridge entrances:

Table 23
DCP Questionnaire -- Manhattan Subset
Top Bridge /Access Recommendations

Bridge	Total[19]	Entrance
Brooklyn Bridge	173	
Manhattan Entrance		83
Brooklyn Entrance		81
Queensboro Bridge	85	
Manhattan Entrance		55
Queens Entrance		25
Williamsburg	19	
Manhattan Entrance		6
Brooklyn Entrance		12

Results

The total analysis of questionnaire results provides both specific location recommendations and overall guidelines to be used to determine a final list of study locations.

In Table 17, *Classification of Problem Locations*, the greatest number of respondents cited unsafe locations as roadway segments (R). Roadways, in combination with their associated intersections, provided the highest concentrations of responses in Table 20, *Most Problematic Locations by Roadway*, as well. As a result, roadways are used as the primary basis for the final selection of study sites in the continutation of this project.

Of the fifteen roadways listed in Table 20, ten will be targeted as study locations for preliminary field work. Based on Table 21 results, *Problematic North-South Roadways*, study segments of these roadways should be concentrated below (including) 59th St. Following the trend established by Table 18, *Problem Roadways by Direction*, eight of the ten roadways selected should run in a north-south direction. Using a

[16] *Excludes major intersection areas, which are listed in Table 23.*
[17] *Based on an assumption that roadways used as travel corridors would be primarily referenced by questionnaire respondents as roadways (R), versus a series of linked intersections (I).*
[18] *Major intersection areas are described in Appendix D.*
[19] *Bridge totals include general references (not specific to entrances or assigned to a specific borough).*

roadway-based approach, major intersections identified inTable 22 will be addressed as critical locations along appropriate roadways.

Bridge entrances (Table 19 and Table 23) cannot be adequately addressed as roadway components. In particular, the Brooklyn Bridge and Queensboro Bridge entrances should be addressed as unique study locations, in addition to the ten targeted roadway study locations.

Based upon questionnaire results, an initial identification of study locations for preliminary fieldwork follows:

Table 24
Initial Identification of Study Locations

No.	Roadway	Study Segment
1.	Broadway	Canal to 59th St.
2.	Sixth Ave.	9th to 59th St.
3.	Eighth Ave.	14th to 59th St.
4.	59th St.	First to Eighth Ave.
5.	Second Ave.	14th to 61st St.
6.	Seventh Ave.	8th to 59th St.
7.	Fifth Ave.	23rd to 59th St.
8.	Lafayette/Fourth	Spring to 14th St.
9.	Houston St.	A to Seventh Ave.
10.	Third Ave.	42nd to 60th St.
11.	Brooklyn Bridge	
	Manhattan and Brooklyn entrances	
12.	Queensboro Bridge	
	Manhattan and Queens entrances	

Table 24 reflects an 80/20 split between north-south and east-west roadways (Table 18); two east-west roadways appearing on the list show relatively high percentages of roadway segment versus intersection references. Study segments recommended for each roadway contain major intersection areas which were identified by questionnaire respondents (Table 22), and reflect the highest concentrations of total responses. These typically occurred south of 59th St., consistent with Table 21 results.

As a final note, safety problems used to classify Manhattan location entries (Table 19) were compared with the “safety threats to cyclists” identified by DCP questionniare respondents (pp.4-5). Problems related to road conditions, a lack of defined cycling space, turning conflicts at intersections, high vehicle speeds and aggressive driving were most commonly cited in Table 19, expanding the list of general safety concerns ranked earlier. Safety problems associated with buses, which ranked third on pp.4-5, did not appear in Table 19.

Additional Data Sources

Two additional data sources were referenced against Table 24, *Initial Identification of Study Locations*: (1) NYCDOT Screenline Counts and (2) NYPD vehicular Accident-Prone Locations. These sources were used to further clarify locations most heavily used by cyclists, and locations considered most dangerous for roadway users, respectively.

NYCDOT SCREENLINE COUNTS

NYCDOT Midtown Manhattan Bicycle Volumes recorded at 23rd and 50th Streets were compared with questionnaire results. These volumes are referenced in Table 2 (p.2) of this report, which lists avenues with the highest total ridership counts as:

Rank	Roadway	Total Volume
1.	Fifth Ave.	2523
2.	Eighth Ave.	2227
3.	Third Ave.	1946
4.	Park Ave.	1782
5.	Seventh Ave.	1529

Four of these roadways are listed in Table 24, *Initial Identification of Study Locations*. Park Avenue is not listed; however, it is not heavily referenced by survey respondents nor is it referenced on NYPD safety data (below). Several roadways are included on Table 24 despite lower NYCDOT ridership counts due to high survey response. Study segments identified for each roadway on Table 24 encompass NYCDOT peak ridership counts (p.2).

NYCDOT screenline data was also used to evaluate the relevance of NYPD vehicular accident-prone location data to cyclists (below).

NYPD ACCIDENT-PRONE LOCATIONS

Questionnaire Table 24 results were also compared with lists of vehicular accident-prone locations tabulated monthly by each of the 22 Manhattan NYPD precincts.

An Accident-Prone Location (APL) index is assigned to each location where accidents occurred in a given month (typically at intersections). This number equals the total number of accidents plus the number of injuries/deaths that occurred at each location. Individual precinct lists of top accident-prone locations are aggregated by Patrol Boroughs Manhattan South and North to identify the top ten accident-prone intersections in each jurisdiction, south and north of 59th St., respectively.

An analysis of NYPD data first ranked borough-wide accident-prone locations by total APL number for a six-month period. Intersections were included only if they appeared more than once during that time period, to focus on chronic locations:

Table 25
NYPD Accident-Prone Locations
Intersections with Ten Highest APL Totals

Intersection	APL Total
Second Ave. at 59th St.	78
Eighth Ave. at 34th St.	71
Seventh Ave. at 34th St.	69
Second Ave. at 36th St.	67
Amsterdam at 181st St.	67
Fifth Ave. at 34th St.	67
Eighth Ave. at 42nd St.	57
Eleventh Ave. at 42nd St.	52
Eighth Ave. at 23rd St.	50
65th St. Transverse Rd.	50
Seventh Ave. at 65th St.	50
Canal St. at Bowery	49
Second Ave. at 57th St.	48

Of Table 25 intersections, eight appear within roadway segments listed in Table 24, *Initial Identification of Study Locations*. These are noted as critical locations within appropriate roadway segments in a final list of study locations (p.18). The remaining four intersections are located outside of the identified study area focus (below 59th St.), or on roadways with low or no NYCDOT ridership counts available.

Further analysis of NYPD data ranked each roadway by the APL total of its individually listed locations, and by the total number of locations which appeared on precinct APL lists:[20]

Table 26
NYPD Accident-Prone Locations
Roadways with Ten Highest APL Totals

Roadway	# sites	APL Total
34th St.	7	294
23rd St.	7	245
42nd St.	7	243
57th St.	7	226
Eighth Ave.	4	215
Second Ave.	4	154
Twelfth Ave.	4	132
Tenth Ave.	4	127
Third Ave.	4	127
Canal St.	3	110
Sixth Ave.	3	93

Of these roadways, four (Eighth, Second, Third and Sixth Avenues) appear on Table 24, *Initial Identification of Study Locations*. Three of these roadways (excluding Sixth Avenue) were also among the top five NYCDOT recorded bicycle volumes, meeting both high ridership and poor safety criteria for this study.

[20] *Roadways shown were tabulated from Patrol Borough Manhattan South APL lists only (determined as the focus of the study area). APL Roadways in Manhattan North are listed in Appendix D.*

Final List of Study Locations

Final study locations were identified by referencing three sources of available data to identify locations both unsafe for and well-used by cyclists: (1) NYCDCP Questionnaire responses, (2) NYCDOT Midtown Manhattan Bicycle Volumes and (3) NYPD vehicular accident-prone location data. Critical locations identified within roadway study segments target both the highest concentrations of questionnaire responses and NYPD accident-prone locations.

Table 27
Final List of Study Locations for Preliminary Fieldwork

No.	Roadway	Study Segment	Critical Locations[21]
1.	Broadway	59th St. to Canal St.	Union Square area, 34th St. to 23rd St. Herald Square area (34th St.) Times Square area (44th St.)
2.	Sixth Ave.	9th St. to 59th St.	14-57th St. Herald Square area (34th St.)
3.	Eighth Ave.	14th St. to 59th St.	23rd St. intersection 34th St. intersection 34th St. to 42nd St. (40th to 42nd St.) 42nd St. intersection Columbus Circle
4.	59th St.	First Ave. to Eighth Ave.	Second Ave. intersection Columbus Circle
5.	Second Ave.	61st St. to 14th St.	36th St. intersection 42nd St. to 36th St. 57th St. intersection 59th St. intersection
6.	Seventh Ave.	59th St. to Greenwich Ave.	34th St. intersection 42nd St. intersection 59th St. to 42nd St.
7.	Fifth Ave.	59th St. to 23rd St.	23rd St. intersection 34th St. intersection 59th St. to 42nd St.
8.	Lafayette/Fourth	Spring St. to 14th St.	Astor Place/8th St. intersection 14th St. intersection
9.	Houston St.	Ave. A to Seventh Ave.	Sixth Ave. intersection
10.	Third Ave.	42nd St. to 60th St.	57th St. to 59th St.
11.	Brooklyn Bridge	Manhattan & Brooklyn entrances	
12.	Queensboro Bridge	Manhattan & Queens entrances	

[21] *Locations which overlap address cyclists travelling through an area, using specific roadways. Major intersection areas are defined in Appendix D.*

Study Location Maps

Maps identifying final roadway and bridge study area segments are presented in the following pages. Accompanying each is a description of typical roadway widths, lane configuration, associated bus routes and defining land use based on preliminary fieldwork. Roadway widths and traffic lanes indicated on each segment include both travel and parking lanes.

The maps also identify critical locations within study segments. These locations provide initial starting points for continued field work and, ultimately, recommendations for on-street innovative and conventional cycling facilitiy implementation (to be contained in a final Task 4 report, *On-Street Cycling Facility Recommendations)*.

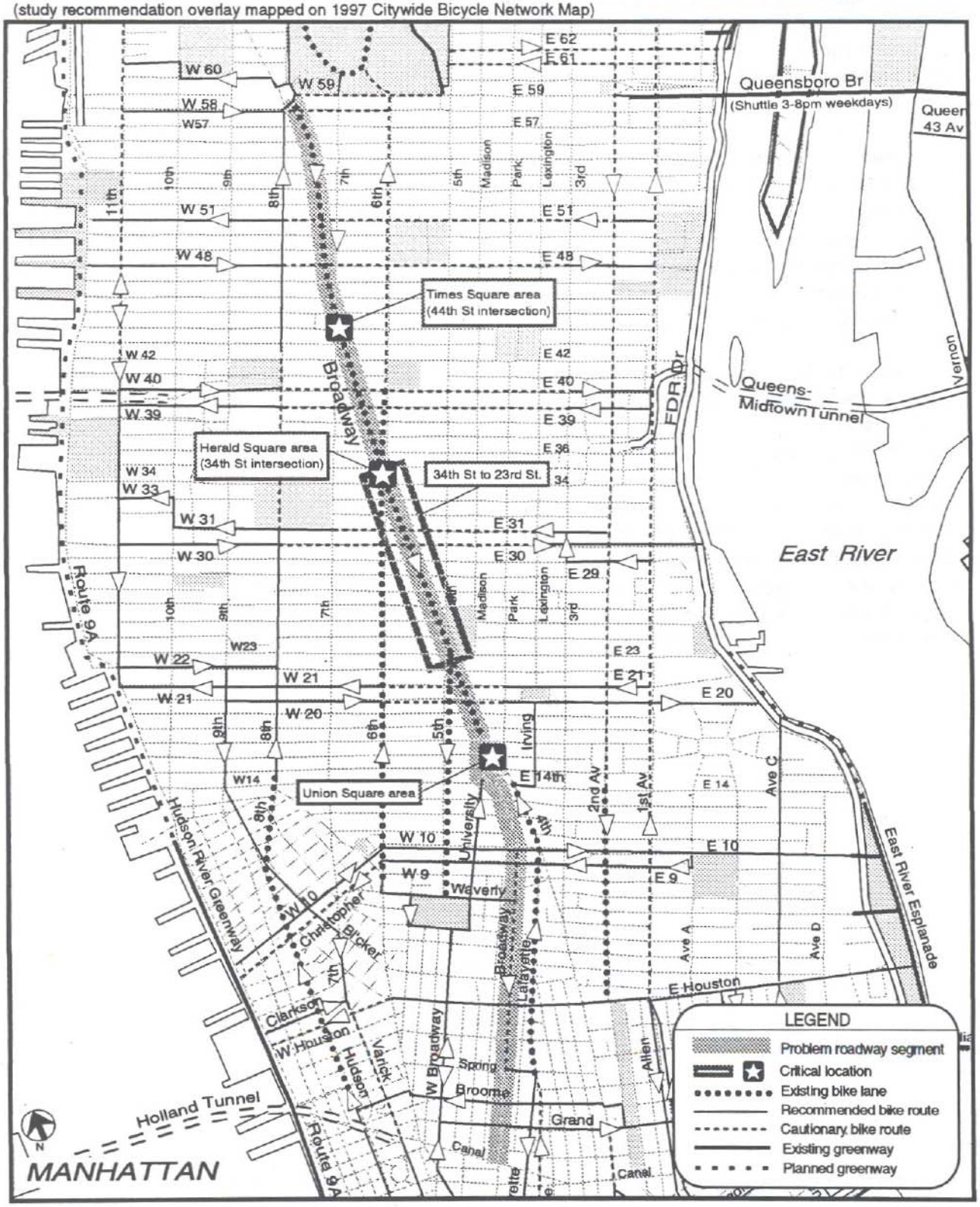
Most importantly, study segments and critical locations are mapped relative to the network of existing and proposed cycling travel routes illustrated in the *New York City Bicycle Master Plan* and Cycling Maps. Implementation recommendations made by this study will seek congruity with the recommended network, identifying opportunities to improve unsafe locations most heavily used by cyclists through the implementation of select innovative on-street facilities profiled in the Task 2 report, *Literature Search*.

Study Segment 1

Broadway: 59th St. to Canal St.

A major southbound arterial, Broadway runs diagonally through Midtown Manhattan creating irregularly shaped intersections, three of which appear as critical locations in this report. Roadway width varies throughout the study segment, from 34 to 60 feet. The M1, 5, 6, 7,10, 27, and 104 bus routes each use portions of this segment, often accommodated by a bus lane. A 4 to 5-foot bicycle lane exists from 59th to 17th

(study recommendation overlay mapped on 1997 Citywide Bicycle Network Map)

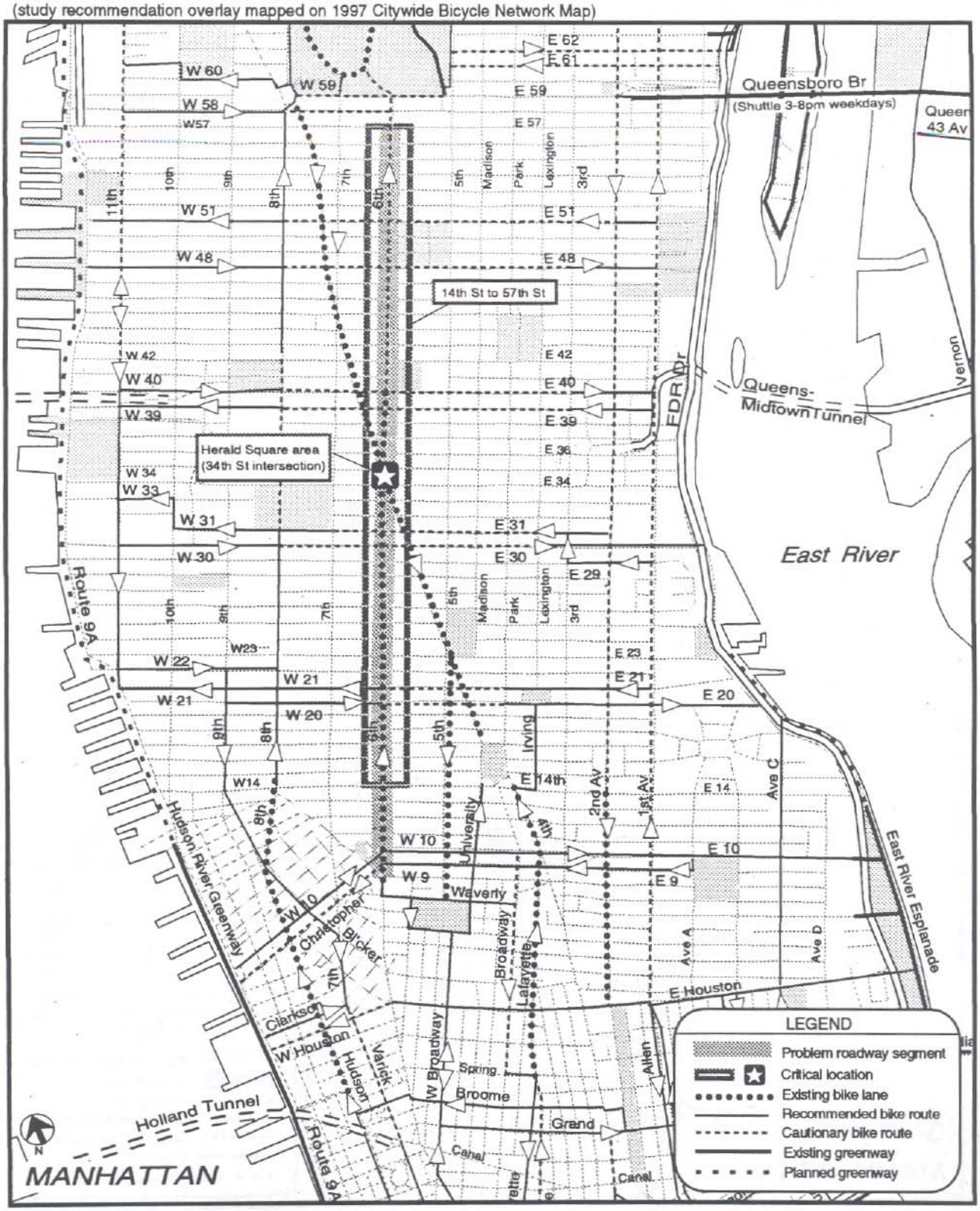


Study Segment 2

Sixth Ave: 9th St. to 59th St.

A major northbound arterial, Sixth Avenue has a roadway width of approximately 65 feet and accommodates seven traffic lanes. An atypical intersection exists where Sixth Ave. intersects Broadway, at 34th St. (Herald Square). The M5, 6, and 7 bus routes run along this study segment. A 4 to 5-foot bicycle lane exists from 9th St. to 40th St.

(study recommendation overlay mapped on 1997 Citywide Bicycle Network Map)

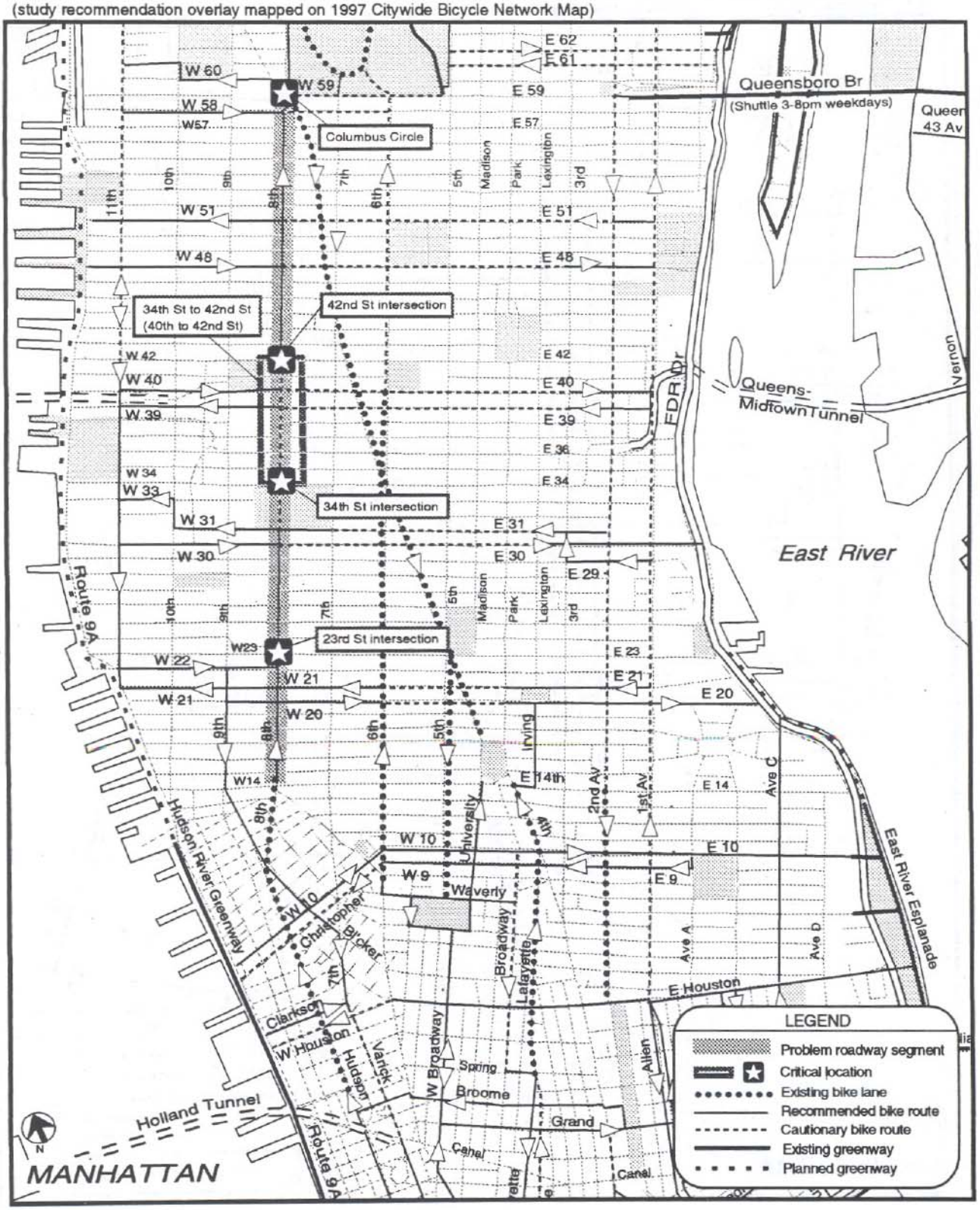


Study Segment 3

Eighth Ave: 14th St. to 59th St.

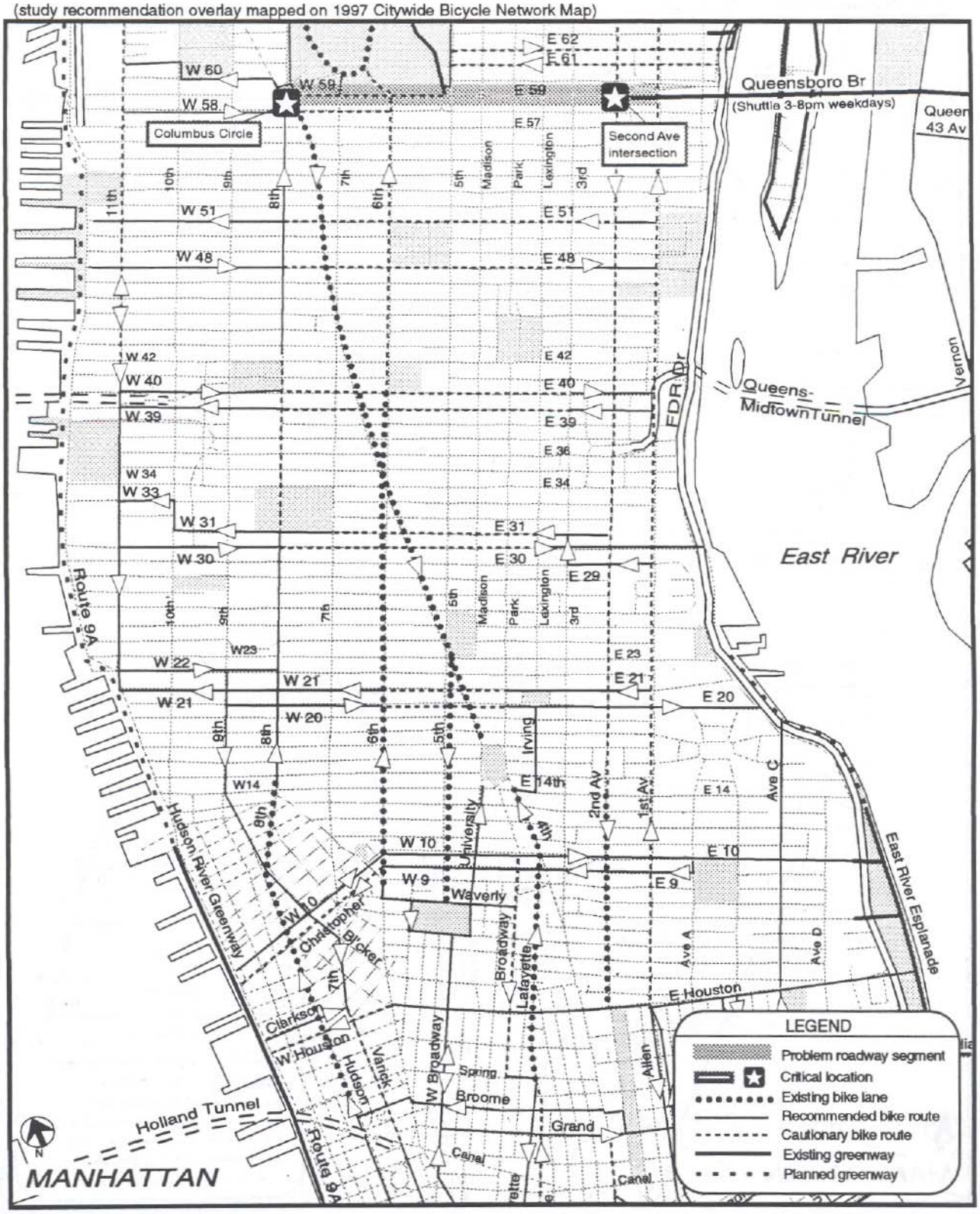
The Eighth Avenue study segment is typically 70 feet wide, accommodating six traffic lanes. Penn Station and the Port Authority Terminal, major facilities for bus, subway and rail transfer, are located along Eighth Ave. from 31st-33rd Sts. and 40th-42nd Sts., respectively. The M10, 16, 27, and 104 bus routes also use portions of the study segment. A 5 to 6-foot bicycle lane with buffer exists south of 14th St. (continued from the Hudson St. lane).

(study recommendation overlay mapped on 1997 Citywide Bicycle Network Map)



Study Segment 4

59th St: First Ave. to Eighth Ave.

Located at the southern edge of Central Park, 59th Street provides a major east-west connection across Manhattan. Roadway width varies widely throughout the study segment, from 33 feet (at Second Ave.) to 72 feet (at Columbus Circle), accommodating three to six lanes. 59th St. also changes from two-way to east-bound travel only, east of Fifth Ave. The M5, 6, 7 and Q32 bus routes use portions of this segment.

(study recommendation overlay mapped on 1997 Citywide Bicycle Network Map)