OVERVIEW: *Recommendations*

The following recommendations are divided into three components: Facility Recommendations, Enforcement Recommendations and Data Recommendations. Eight facilities are recommended for test implementation, six of which are linked to specific locations. Enforcement recommendations apply to all existing and proposed on-street cycling facilities. Data recommendations apply to accident data currently available from NYPD, NYDMV and NYSDOT, and document research efforts for this study to assist future planning work.

Prototypical Cycling Facilities

Eight facilities are recommended to improve safe cycling on New York City streets:

- Advanced Stop Box
- Cycle Crossings
- Improved Lane Definition: color/texture
- Improved Lane Definition: physical delineation
- Contra-Flow Bicycle Lane
- Center-Median Bicycle Lane
- Combined Bicycle/Bus Lane
- Centerline Non-Compulsory Lane

The 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 location of pilot tests was informed by "critical locations" listed in the *Task 3: Existing Conditions* report; however, 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.

***Facility Pilot Test Locations*:**

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 Sts.

Improved Lane Definition: physical delineation
Broadway to Fifth Ave, 24th to 23rd Sts.

Contra-Flow Bicycle Lane:
West Broadway, Grand to Walker Streets

Center-Median Bicycle Lane:
17th Street, Broadway to Park Avenue

Associated Recommendations

Consistent enforcement of on-street cycling facilities is as important to the success of implementation as proper engineering and placement. A series of enforcement recommendations are described, with emphasis on a "zero tolerance" intiative -- a targeted approach to ticketing motor vehicles unlawfully occupying bicycle lanes. Other recommendations include revisions to the parking summons form, use of a "public awareness summons form" to regularly distribute safe cycling information and changes to the traffic code.

Finally, a description of existing bicycle-safety data sources is provided, as well as recommendations to facilitate access to location-specific cycling accident information. 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.

FACILITY RECOMMENDATIONS

Eight facilities are recommended for prototype testing to improve safety for on-street cyclists, based on research contained in the Appendix E*: Literature Review*:

- ***Advanced Stop Box***
- ***Cycle Crossings***
- ***Improved Lane Definition: color/texture***
- ***Improved Lane Definition: physical delineation***
- ***Contra-Flow Bicycle Lane***
- ***Center-Median Bicycle Lane***
- ***Combined Bicycle/Bus Lane***
- ***Centerline Non-Compulsory Lane***

Recommendations are based first on the selection of facility type, and second on the selection of appropriate locations for successful implementation. Potential locations are listed for each facility type; for facilities, a recommended pilot test location is also described. Both potential and pilot test locations generally target unsafe areas identified in the *Task 3 Existing Conditions Report*. However, several recommendations encompass other areas -- particularly where improved roadway conditions are likely to facilitate route connections between segments of the City's proposed bicycle network (*see New York City Bicycle Master Plan*).

Prototype installation of some recommended facilities will require further capacity analysis (HCS described in *Task 3*) to determine feasibility. Potential locations are listed in addition to "pilot test" locations in the event that a location is deemed infeasible through HCS analysis.

In some cases, several prototypical facilities are recommended for use simultaneously. For example, techniques to improve conventional lane definition are recommended in conjuntion with improved cycle crossings; flexible bollards (or other physical separators) are recommended in conjunction with center-median and contra-flow bicycle lanes.

Finally, successful evaluation of each prototype facility requires site-specific analysis *before* and *after* implementation. Analysis should be conducted by the implementing agency.

To help analysis efforts, City agencies are encouraged to foster partnerships with research organizations, following an example set by the Florida State Department of Transportation (FLDOT), and the cities of Portland and Eugene, Oregon. Each recently partnered with the University of North Carolina (UNC) Highway Safety Research Center (HSRC), studying bikeway safety issues and techniques around the country (discussed in Task 2 *Literature Review*). HSRC's research efforts are currently funded through a grant by the Federal Highway Administration.

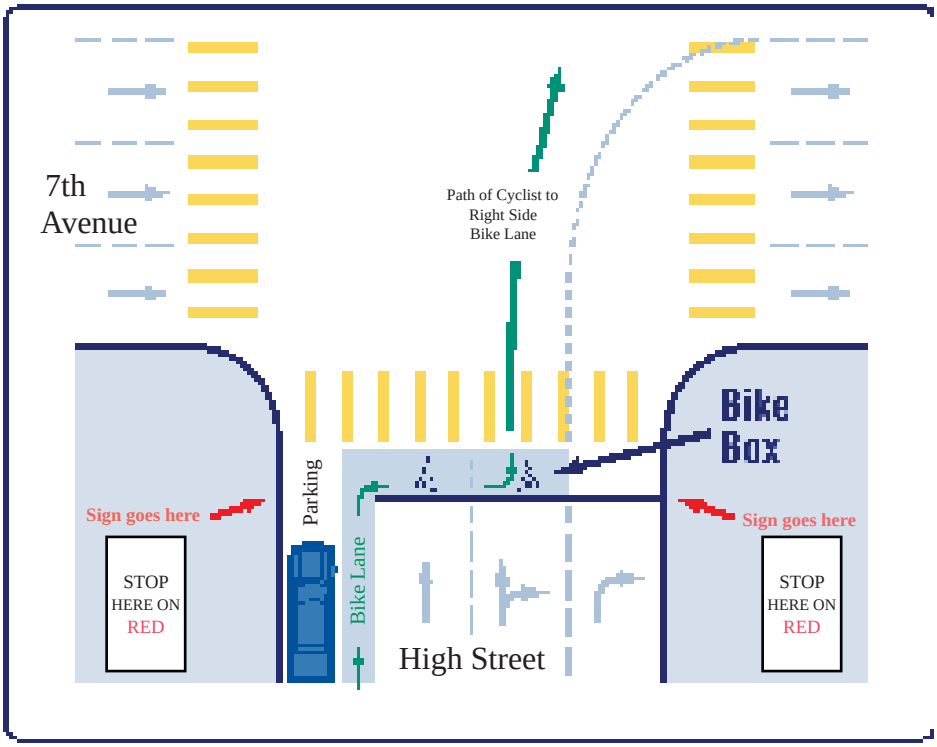
Ultimately, the following pilot tests are intended to provide starting points for continued future implementation of innovative cycling facilities -- provided that they can be shown to improve safey for cyclists in accord with other roadway users.

Advanced Stop Box: *Nearside approach*

Description

Advanced stop boxes are placed in front of motor vehicles to allow cyclists to move ahead of traffic at signalized intersections. At a red traffic signal, advanced stop boxes allow cyclists to make safe lane changes at an intersection (across a roadway), make turning movements ahead of motor vehicles, and avoid conflicts with turning vehicles. These facilities also provide additional queuing space at high-volume intersections. (Note: stop boxes do not affect traffic movements at a green signal.)

Advanced stop boxes are typically six to ten feet wide, pigmented and stenciled, with eight-inch wide edge line striping. The boxes should span the width of the roadway, behind and adjacent to striped crosswalks, to limit conflicts with crossing pedestrians. The box should include a cycle lane approach located either (1) nearside (near a curb) or (2) as a center lane approach (see Appendix E: *Literature Review* for more details).



Bicycle box design at High Street, Eugene OR:

11-foot crosswalk
9-foot bicycle box
8-foot parking lane
5-foot bicycle lane
11/10/11-foot travel lanes

Source: City of Eugene web site

Potential Test Locations: Lafayette Street at Houston Street
Fourth Avenue at 14th Street
Broadway at 17th Street
Sixth Avenue at 42nd Street
(with extension of the bicycle lane from 40th Street).

Pilot Test 1: *Advanced Stop Box (nearside approach)*
Broadway at 17th Street

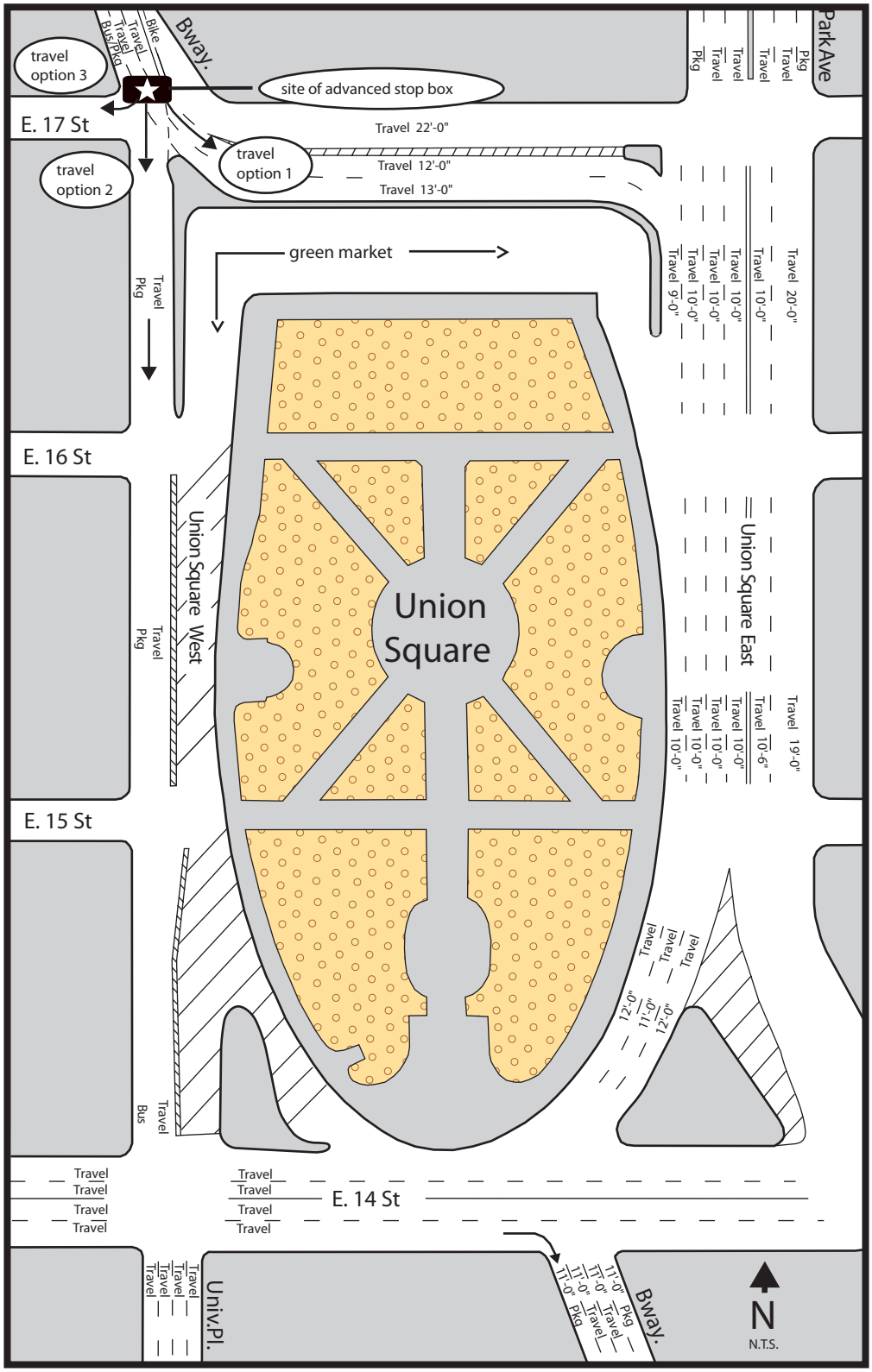
A cyclist stopped with traffic on Broadway, at 17th Street intersection. The 2.6-mile bicycle lane on Broadway begins at 59th Street and ends at this location. The existing crosswalk is approximately 18 feet wide.

The southbound Broadway bicycle lane ends at 17th Street (the northwest corner of Union Square), with no further provision to accommodate cyclists. From this point, motor vehicles may proceed in one of three directions (see diagram): (1) traffic making a left turn onto east-bound 17th Street (center and east-side lanes);(2) traffic continuing southbound on Union Square West, a low-volume single lane roadway with parking (west-side and center lanes); or (3) traffic turning right to travel westbound on 17th Street towards Fifth Avenue.

Implementation of an advanced stop box would allow cyclists to move safely across motor vehicle traffic stopped at a red light, to access Union Square West to continue traveling in a southbound direction (Travel Option 2) or to turn right and head west on 17th Street (Travel Option 3). The stop box would have no affect when the traffic signal is green -- cyclists wishing to access Union Square West would either need to wait for the red signal to use the stop box, attempt to change lanes while riding during breaks in traffic before the intersection, or wait and cross with pedestrians.

A stop box at this location would be most helpful for less experienced cyclists unwilling to cross multiple lanes while riding in traffic. The box would also help keep cyclists clear of pedestrian traffic. Pedestrian volumes at this intersection are heavy,[22] particularly on days during which the “green market” located along the north and west sides of Union Square Park is in operation. Additionally, a well-used pedestrian corridor is striped along the entire west side of the park, encouraging frequent pedestrian crossings on Union Square West from 17th to 14th Streets. Accommodating cycle travel southbound ahead of vehicle traffic should help reduce conflicts between pedestrians and cyclists at this busy intersection, and also reinforce a clear a right-of-way for cyclists on Union Square West.

[22] *Pedestrian volumes and crosswalk levels of service (LOS) for this intersection are cited in the 14th Street Transportation Study, Department of City Planning, 1998.*

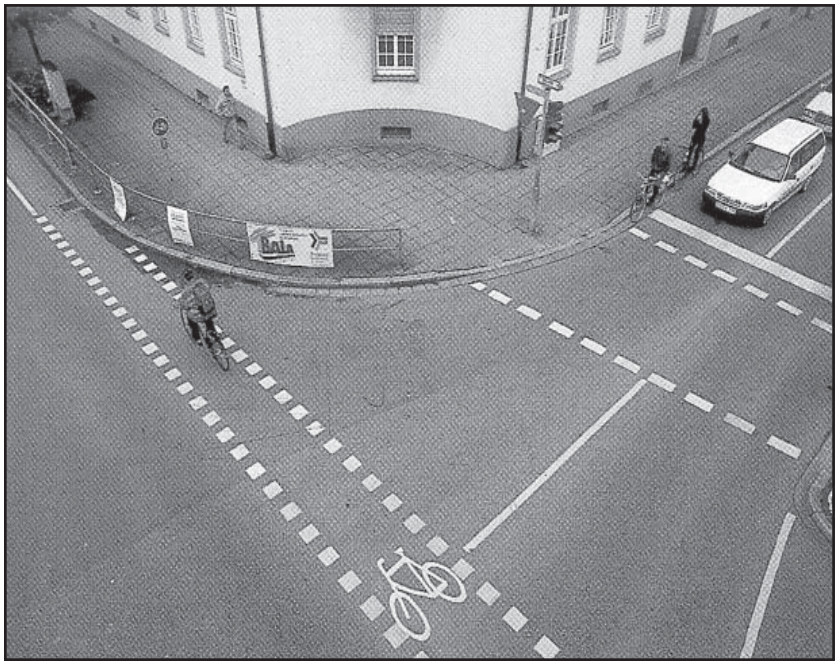


Plan view at Union Square. Location of proposed advanced stop box shown on Broadway, at (north of) 17th Street intersection. Travel Option 1 shows the route of cyclists traveling with traffic onto eastbound 17th Street, where no dedicated cycling facility currently exists (see p.18); Travel Options 2 and 3 show the route of cyclists continuing southbound on Union Square West or westbound on 17th Street (respectively). An advanced stop box would facilitate travel for cyclists following route 2 or 3.

Cycle Crossings: ***Pigmented, Pegga-tracked crossing; Bollards with accompanying signage***

Description

Pigmentation, pegga-tracked (dashed) markings and changes in pavement material (e.g. pavers, concrete) can be used to extend a cycle lane through an intersection, to provide continuity for cyclists and to heighten driver and pedestrian awareness of cyclists in an intersection[23] (especially for turning vehicles). At high-volume pedestrian intersections, bollards placed at the curb edge (with accompanying signage) can also alert pedestrians to the presence of cyclists passing through a crosswalk in a marked bicycle lane.



Left: Pegga-tracked (broken line) cycle crossing in Freiburg (Germany). Above: Yellow bollard with attached blue sign denotes a bicycle lane traveling through a crosswalk. Source: Cities Make Room for Cyclists.

Potential Test Locations:

Cycle crossing markings are recommended at intersections throughout the on-street bicycle network. Additionally, bollards (with accompanying signage) are recommended at high-volume pedestrian crossings. High-volume pedestrian areas (Lafayette St. bicycle lane at Astor Place), and wide or irregularly shaped intersections (Madison Square, Herald Square) should be targeted for priority implementation.

[23] *Note: Implementation of pigmented pavement and/or pavers generally requires an additional expense, and is not part of the normal implementation process of roadway (re)construction. See also Pilot Test 3, p. 9, pigmented bicycle lane.*

Pilot Test 2: Pigmented, pegga tracked cycle crossing, with bollards Lafayette Street/Fourth Avenue bicycle lane, at Astor Place

Northbound view from the bicycle lane of pedestrians waiting on and off the curb to cross Lafayette Street, at Eighth Street. The bicycle lane passes close to the curb through this area and is often blocked by pedestrians.

Cycle crossing improvements are recommended on Lafayette Street/Fourth Avenue, at the Astor Place and 8th Street (consecutive, south to north) intersections where cycle paths are frequently blocked by pedestrians standing on and off the curb. Existing travel lane widths are wide and vary throughout this roadway segment as it curves northbound from Lafayette to Fourth Avenue (lanes listed west to east):

Approaching Astor Place intersection:		*South side; 8th Street intersection: (pictured above)*		*North side; 8th Street intersection: (pictured above)*	
parking	*9'*	*buffer*	*5'*		
bicycle lane	*5'*	*bicycle lane*	*6'*	*buffer*	*3'*
buffer	*6.5'*	*buffer*	*5.5'*	*bicycle lane*	*5'*
travel lane	*11.5'*	*travel lane*	*12.8'*	*travel lane*	*14.5'*
travel lane	*12'*	*travel lane*	*12.8'*	*travel lane*	*12'*
parking/bus	*11.5'*	*buffer*	*14.5'*	*buffer*	*14.5'*
TOTAL	*55.5'*	*TOTAL*	*56.6'*	*TOTAL*	*49'*

Specific recommendations for 8th Street and Astor Place intersections include:

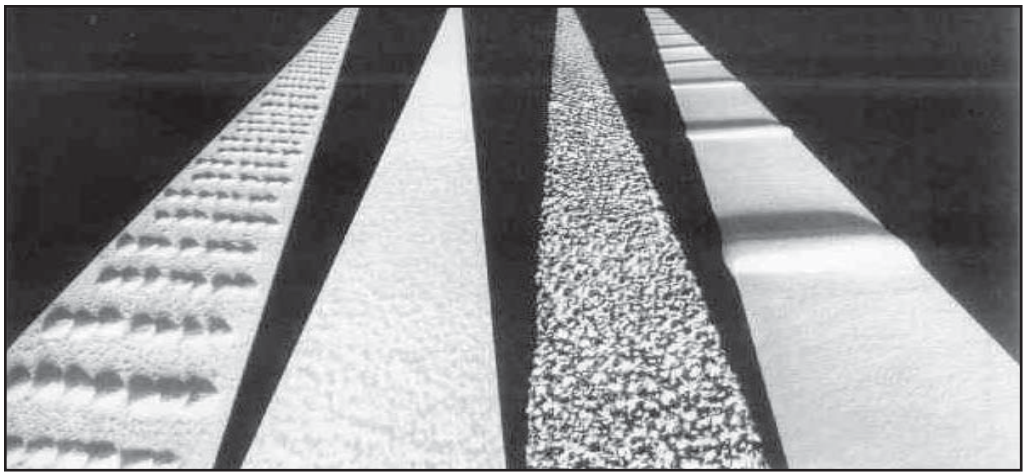
(1) Blue pigmented and pegga-tracked extensions of the bicycle lane through currently unmarked areas (consistent with pigmentation recommended in Pilot Test 3, p. 9);
(2) Bollards with accompanying signage placed on the sidewalk at the curbline at the northwest corner of the 8th Street intersection, to identify the presence of a bicycle lane to pedestrians: "Bike lane, stand clear" (see bollard/sign example on previous page);
(3) An eastward shift of existing lanes (or a narrowing of existing travel lanes or buffers) to create a minimum 5 ft buffer between the curb and bicycle lane at the 8th St intersection, northwest corner (pictured above). To maintain proper alignment, lanes south of this intersection may need to be shifted. Pegga-track markings should be kept to visually connect new alignments.

Improved Lane Definition: Color/Texture
Pigmented lanes, Profiled markings

Description

Improved marking techniques can be used to more clearly identify bicycle lanes for both cyclists and motor vehicles, particularly in locations where vehicles regularly drive, stand or park in the lanes. Blue-colored pigmented lanes are recommended, based on research and successful testing and implementation of these lanes by the City of Portland. Profiled markings should be slightly raised to attract the attention of drivers, but suitable for cyclists entering and exiting a lane.

Blue pigmented bicycle lane in Portland, OR, at the east end of the Broadway Bridge. Portland's efforts to reduce conflicts between cyclists and motorists using pigmented lanes are based on research of European techniques. Preliminary evaluation of the lanes has found them to be effective.
Source: City of Portland Bicycle web site.



Examples of profiled markings manufactured by Agomer GmbH. Additional manufacturers of profiled markings are listed at the end of this document.

Potential Test Locations:
Pigmented cycle lanes are recommended throughout the on-street bicycle network; profiled marking is recommended on the Broadway, Fifth and Sixth Avenue bicycle lanes.

Pilot Test 3: Pigmented bicycle lane, with profiled marking
Fifth Avenue bicycle lane, 23rd Street to 7th Street (Washington Square North)

Existing pavement markings for bicycle lanes consist solely of white, reflective thermoplastic, which wears quickly on high-volume roadways and makes it difficult for motorists to identify exclusive right-of-ways for cyclists. Worn pavement markings can also undermine police officers' attempts to enforce clear bicycle lanes to motorists.

A recommendation for testing of improved lane markings on Fifth Avenue has two components:

(1) *Blue pigmentation of the existing bicycle lane, with identifying signage (see photo previous page).* To speed implementation, pigmentation should occur initially as a paint overlay, or as colored concrete if reconstruction of the roadway occurs. Pigmentation will help *visually* define the presence of the bicycle lane, distinguishing its striping from other roadway markings. Pigmented lanes are recommended in conjuction with pigmented intersection crossings described in Pilot Test 2 (p. 7). As cited in the *Task 3: Existing Conditions* report, a red pigmented lane was recently installed on Adams Street, in Brooklyn. No formal evaluation of this lane has been performed.

(2) *Profiled marking to define the existing bicycle lane*. The use of profiled marking along the bicycle lane will help *physically* define its presence to motor vehicles; raised texture should offer enough to be felt by motorists travelling at both high and low speeds, yet be slight enough for cyclists to move in and out of the lane without difficulty. Several examples of profiled markings are shown on the previous page. In addition, the Arizona Department of Transportation (ADOT) has been testing profile thermoplasic as a pavement marking system. From ADOT's experience, profiled markings have proven to be durable, and perform as a longitudinal rumble strip for both edge and lane lines. Other, less expensive options which could be investigated include ground-in or rolled-in rumble strips.

Temporary (simulated) tests of profiled marking on Fifth Avenue could also be performed using "Quick Stripe," or a similar installation. Rubber panels are folded onto the pavement and can be easily installed or removed, before a more permanent striping test is implemented.

A cyclist on the Fifth Avenue bicycle lane, near 21st Street.

Improved Lane Definition: Physical delineation
Rubberized curbs, Beveled-edge reflectors, Flexible bollards

Description

Raised markings physically define cycle travel lane apart from motor vehicle travel lanes. Installation must ensure that raised curbs and reflectors are not able to deflect a bicycle wheel, causing cyclists to lose control. Equipment, and size and spacing of marking must allow vehicles to access curbside parking (where existing). In addition, implementation of raised markings requires coordination with snow removal operations.

In Paris (pictured right), rubberized curbs and flexible bollards have been used to define 33 km (of 101 km) of on-street lanes (1997 implementation status). This design is mainly used when no parking exists along the curbside. Preliminary testing has found this treatment to significantly improve on-street safety for cyclists. However, problems associated with these lanes include parked or stopped vehicles in locations where parking demands are high, and pedestrians who stand in the cycle lane at intersections waiting to cross the roadway.

As pictured right, the curbs are 5 cm high, 0.12 m (0.4 feet) wide and anchored into the street pavement with 12 cm deep bolts (pavement in Paris has a superficial bituminous layer of 5 cm and a 20 cm thick layer of concrete; the 12 cm depth was chosen to keep the pavement water tight). The curbs are spaced approximately 3 m (10 feet) apart.

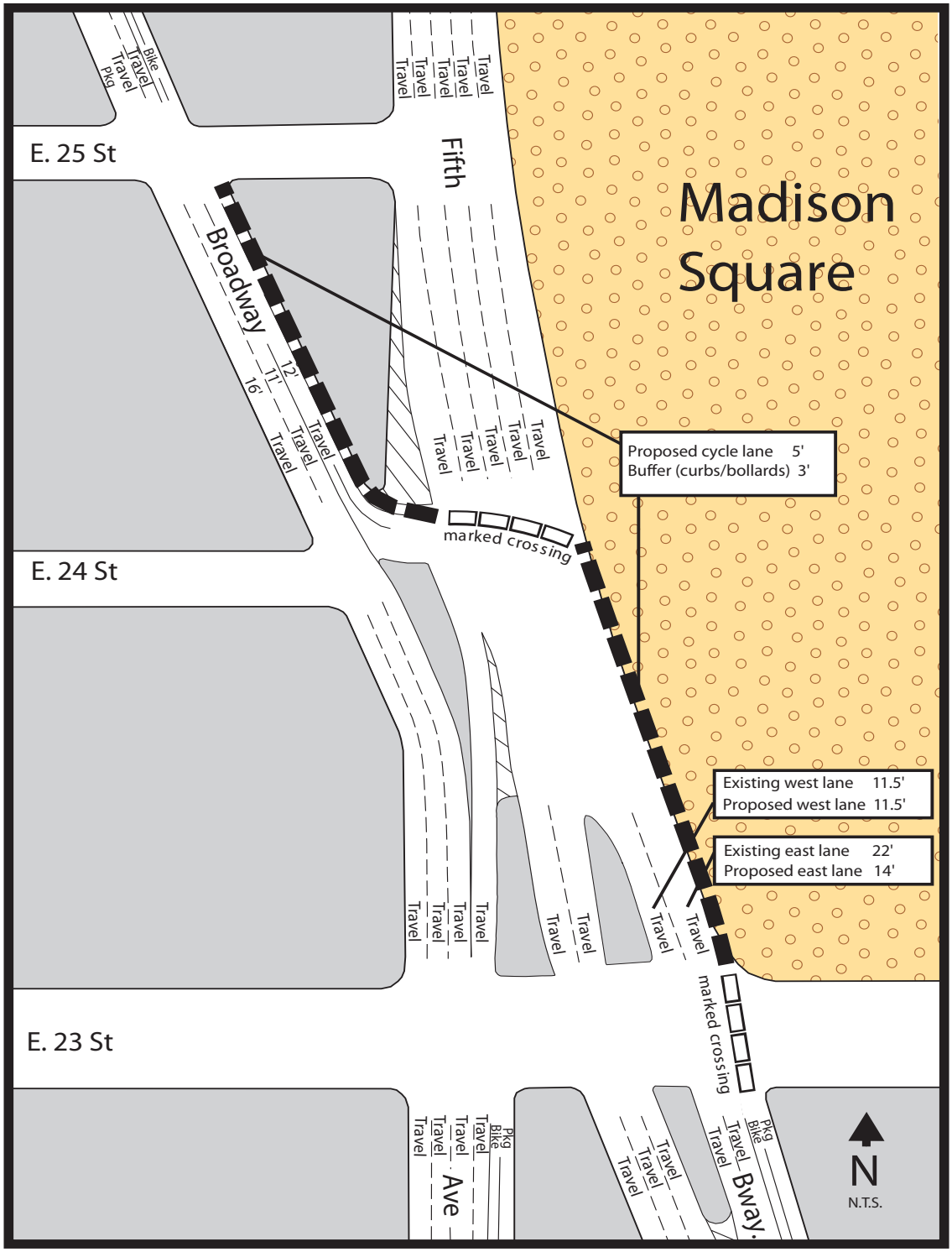
Flexible bollards are approximately 75 cm (30 inches) high with a 20 cm (8 inches) diameter, placed at the ends of the lane.

Rubberized curbs (with reflective strips) and flexible bollards used on a bike lane in Paris.

Potential Test Locations: High-volume bicycle lanes, including Broadway, Fifth and Sixth Avenue bicycle lanes.

Adam Clayton Powell Blvd.

Pilot Test 4: Bicycle lane with rubberized curbs and flexible bollards Broadway to Fifth Avenue, from 25th to 23rd Streets



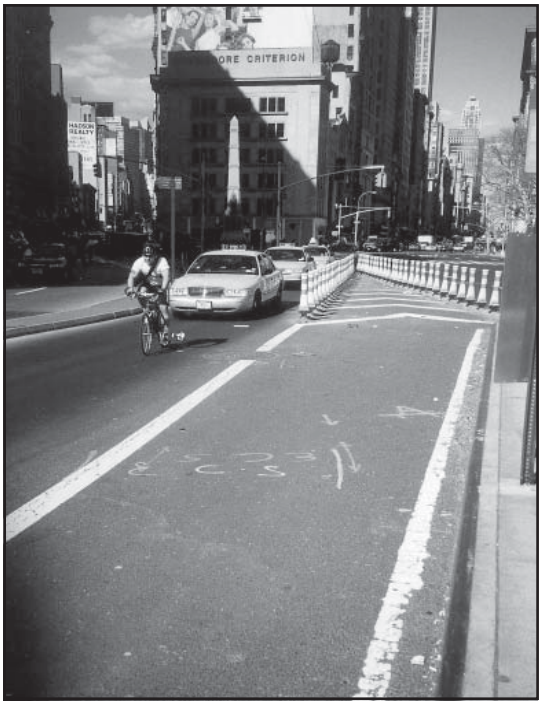
Plan view west of Madison Square Park. Location of proposed bicycle lane with rubberized curbs and flexible bollards shown beginning on Broadway, south of 25th Street. A marked cycle crossing is proposed to connect this portion of the lane to its southbound continuation along the west side of Madison Square Park, from 24th Street to 23rd Street. The proposed lane is 5 feet, with a 3-foot buffer containing curbs and bollards. This design assumes a narrowing of an existing east travel lane from 22 feet to 14 feet (south of 24th St.) to accommodate the new facility. See p.12 for further description.

As seen on the diagram on the previous page, a physically delineated bicycle lane on Broadway is proposed south of 25th Street (occupying one edge of an existing traffic island for one block). Wide travel lanes on Fifth Avenue (leading to Broadway) from 24th to 23rd Streets permit the continuation of this exclusive bicycle lane adjacent to the park: a 22-foot wide east-side travel lane could be narrowed to 14-feet, allowing space for a 5-foot bicycle lane with 3-foot buffer (containing curbs and bollards).

A pilot test of a “Paris-style” bicycle lane (using rubber curbs and flexible bollards) is particularly appropriate for this location: no vehicular parking exists along the curb, and pedestrian crossings are restricted by metal barriers. This space is sometimes occupied by charter buses; however, private bus standing could be accommodated north of 24th Street.

Rubberized curbs are recommended at 10-foot intervals (similar to Paris the installation described on the previous page). Bollards are recommended throughout the length of this proposed facility (in addition to marking the ends of the lane), supplementing the curbs at 5-foot intervals. Continuous placement of bollards will help (1) keep the lane definition within the vertical sightline of cyclists, and (2) define an exclusive space for cyclists for motorists, particularly approaching the 23rd Street intersection where left-turning vehicles will conflict with cyclists traveling from the end of the proposed facility through the intersection (to access an existing east-side bicycle lane south of 23rd Street). The proposed “Paris-style” implementation should also occur in conjunction with a marked cycle crossing through the 23rd Street intersection (see Cycle Crossings, p.6).

A plan for maintenance will be required to keep the exclusive bicycle lane clear of road debris.



Left: A cyclist riding southbound on Fifth Avenue (leading to Broadway) approaching 23rd Street, adjacent to Madison Square Park where the propsed facility will be located. Above: Flexible bollards used to direct traffic block a portion of the existing bicycle lane on Broadway (leading to Fifth Avenue, south of 25th Street). This same type of bollard could be used to define the proposed cycle lane along Madison Square Park.

Contra-Flow Bicycle Lane

Description

Contra-flow lanes permit bicycle travel against the flow of motor vehicle traffic. Successful installations in other cities have used the lanes, in short lengths of one to three blocks, as connectors between cycling facilities and destinations. Contra-flow lanes are recommended for use on streets with limited on-street parking and a minimum number of driveway crossings. Additional signage may be needed to alert vehicles making left turns to look in two directions. The contra-flow lane may also be raised to provide better visual identification of cyclists to motorists.

A contra-flow bicycle lane in Minneapolis places cyclists between northbound vehicles lanes and a southbound bus-only lane on Hennepin Avenue, a major commercial arterial.

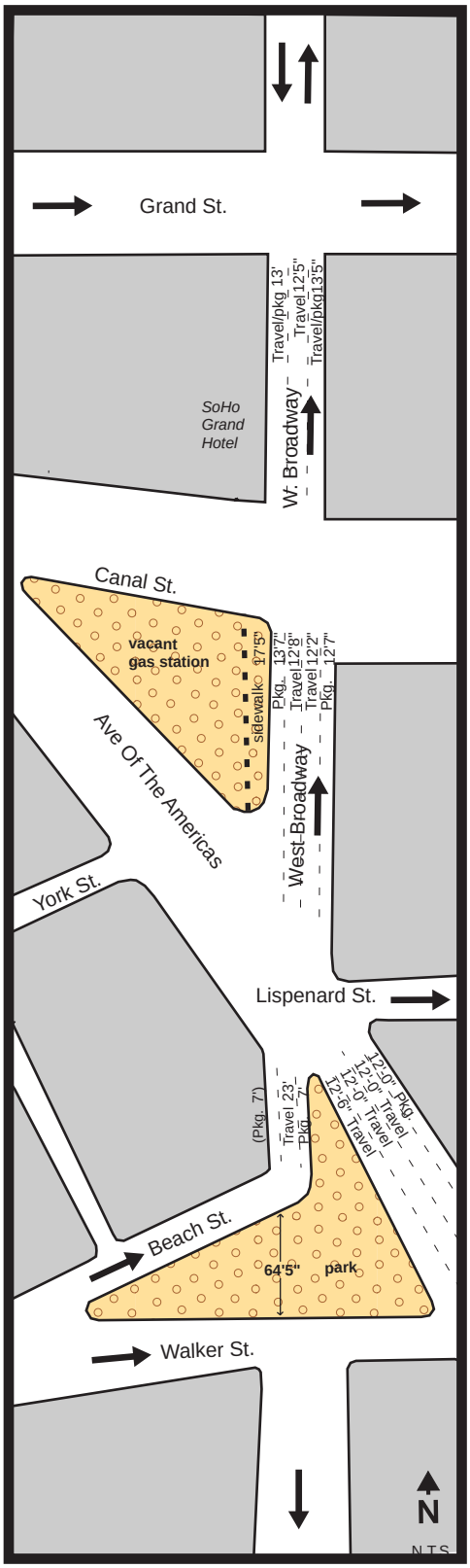
Potential Test Locations: West Broadway, from Grand Street to Walker Street.

Queensboro Bridge (dependent on the completed construction of the Bridge pedestrian/bicycle paths):

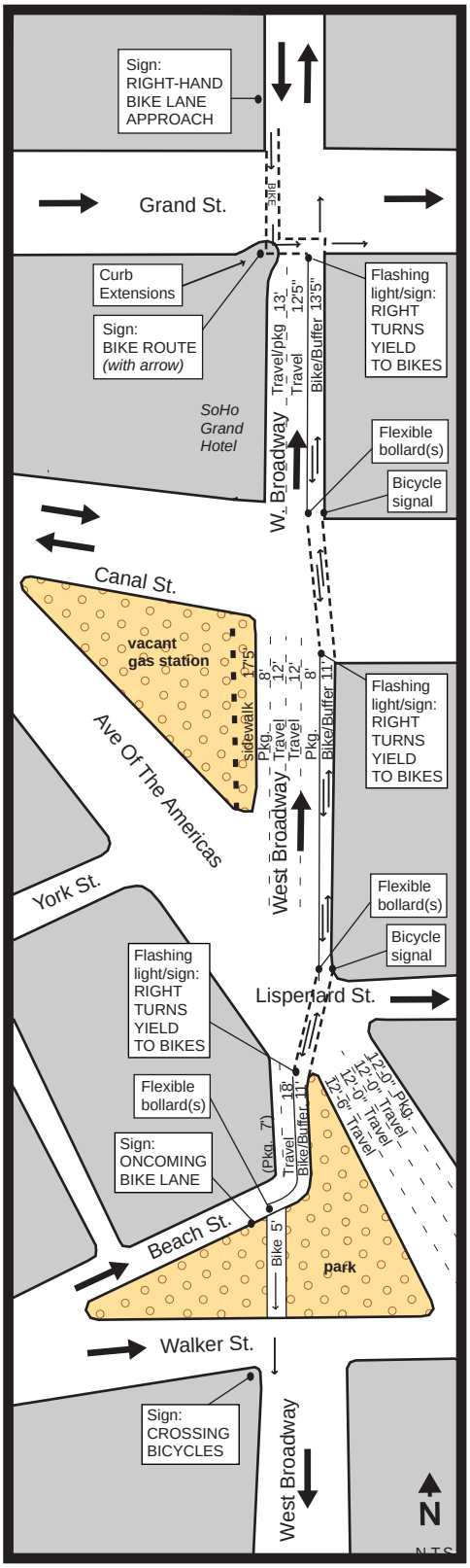
Second Avenue, from 60th to 59th Streets -- to accommodate cyclists exiting a *southside* Queensboro Bridge bicycle path (allowing cyclists to continue north).

60th Street, from First to Second Avenues -- to accommodate cyclists using a *northside* Queensboro Bridge bicycle path (allowing exiting cyclists to continue to Second Avenue, and providing eastside access from 60th Street).

Pilot Test 5: Contra-flow bicycle lane (bi-directional) West Broadway, Grand Street to Walker Street



Plan view of West Broadway, existing conditions.



Plan view of West Broadway, with proposed bi-directional contra-flow bicycle lane.

The proposed contra-flow bicycle lane on West Broadway (from Grand to Walker Street) would facilitate a southbound route between previously unconnected segments of the *New York City bicycle network* (see maps, Task 3 report). A signed and striped west-side approach to the lane would begin north of Grand Street. Having crossed Grand, signage would direct cyclists to cross with pedestrians to safely access the lane. The lane would continue south of Grand Street adjacent to the east curb, to avoid conflicts with delivery and passenger vehicles in front of the SoHo Grand Hotel (between Grand and Canal Streets). The lane is proposed (typically) as eight feet wide, with a three-foot buffer lined continuously with flexible bollards to differentiate the lane from vehicular traffic, particularly at intersections. Signage is recommended at all driveway exits to alert motorists to cycle traffic in two directions.

(a) Segment 1. North view from Canal St. (to Grand St.).

(b) Segment 2. North view from Lispenard St. (to Canal St.).

Segment 1: Canal St. to Grand St.

Existing conditions: West Broadway is one-way northbound between Canal and Grand Streets. Traffic originates from either Canal Street or West Broadway, south of Canal Street. Curbside parking is restricted from 8am to 6pm on both curbsides, but cars, trucks and taxis use the curbside space continuously to access the SoHo Grand Hotel (on the west side of the street).

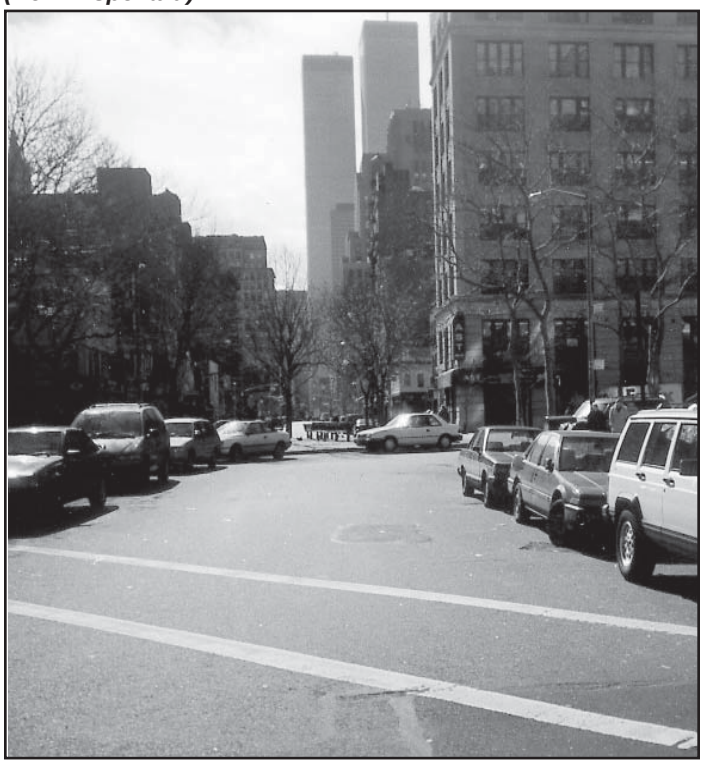
Proposed facility: An eight-foot contra-flow bicycle lane with a five and 1/2-foot buffer is proposed on the east side of the street. The roadway would be limited to one travel lane and one travel/parking lane against the west curb. Curb extensions would be required at the southwest intersection of West Broadway and Grand Street to protect crossing cyclists from on-coming northbound vehicles.[24] A flashing light and/or signage would be required to direct right-turning motorists to yield to through cyclists, south of the intersection of West Broadway with Grand Street.

Segment 2: Lispenard St. to Canal St.

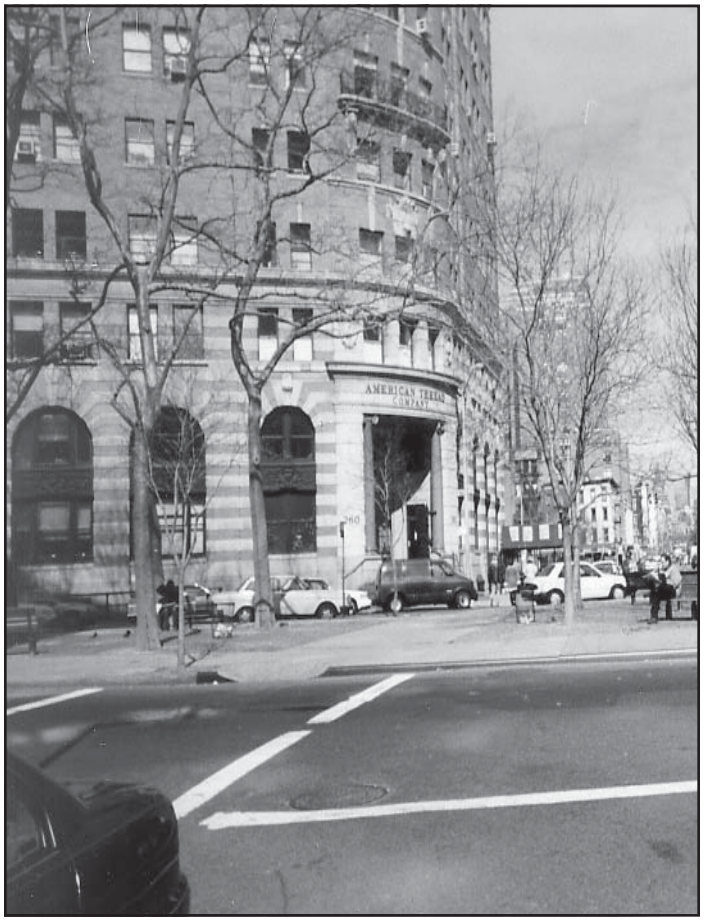
Existing conditions: West Broadway is one-way northbound. Traffic enters this one block segment of West Broadway from Sixth Avenue (to the south). Parking exists on both sides of the street. A vacant gas station with a wide sidewalk occupies the west-side block.

[24] *Northbound vehicle travel at this intersection would be limited to one lane; however, traffic is currently forced to merge right to a single lane north of Grand Street (to accommodate southbound (two-way) traffic). There are no left turns. As with other recommendations, LOS analysis is required.*

(c) Segment 3. South view along Beach Street to park (from Lispenard).



(d) Segment 3. North view from Walker St. (south of park).



Proposed facility: An eight-foot contra-flow bicycle lane with a three-foot buffer is proposed on the east side of the street. Existing vehicular lanes would be retained but would be narrowed to eight-foot parking and 11-foot travel lanes. A bicycle signal would be needed north of the intersection with Lispenard, to direct crossing southbound cyclists. A flashing light and/or signage would also be required south of the intersection to direct right-turning motorists to yield to through cyclists before the intersection of West Broadway with Lispenard Street and Sixth Avenue.

Segment 3: Walker St. to Lispenard St.

Existing conditions: South of Lispenard Street, West Broadway transitions to Beach Street (adjacent to a small park). There is parking on both sides of the street, and no marked travel lanes exist. The park has trees and benches on its east end; the west end has no street furniture. From Beach Street, an access ramp leads to a walkway through the park, which cyclists currently use to cross through the park to continue southbound on West Broadway.

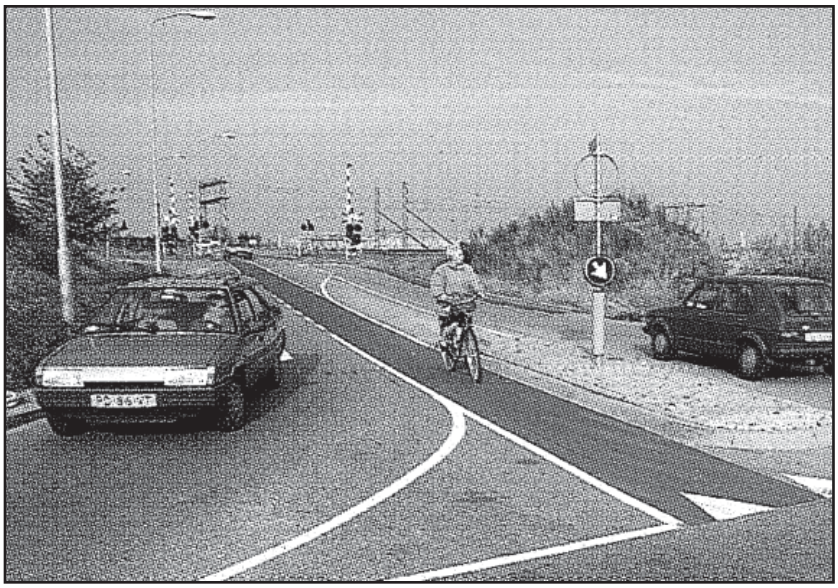
Proposed facility: An eight-foot contra-flow bicycle lane with a three-foot buffer is proposed on the east side of the street (adjacent to the park). The roadway would be limited to one eight-foot parking lane and one 18-foot travel lane for one-half block. The contra-flow lane would end as cyclists continue to travel southbound through the park, towards Walker Street. Cyclists turning southwest at the bend on Beach Street (moving toward the park entrance) should be protected from oncoming vehicles by the presence of parked vehicles (or implementation of a buffer) along the south side of the roadway, west of the park entrance.

A flashing light and/or signage would be required to direct right-turning motorists to yield to through cyclists, south of the intersection of West Broadway with Lispenard Street. Signage would also be required to warn motorists of the start of the oncoming (contraflow) bicycle lane near the entrance to the park, and as cyclists exit the park at the intersection of Walker Street and West Broadway.

Center-Median Bicycle Lane

Description

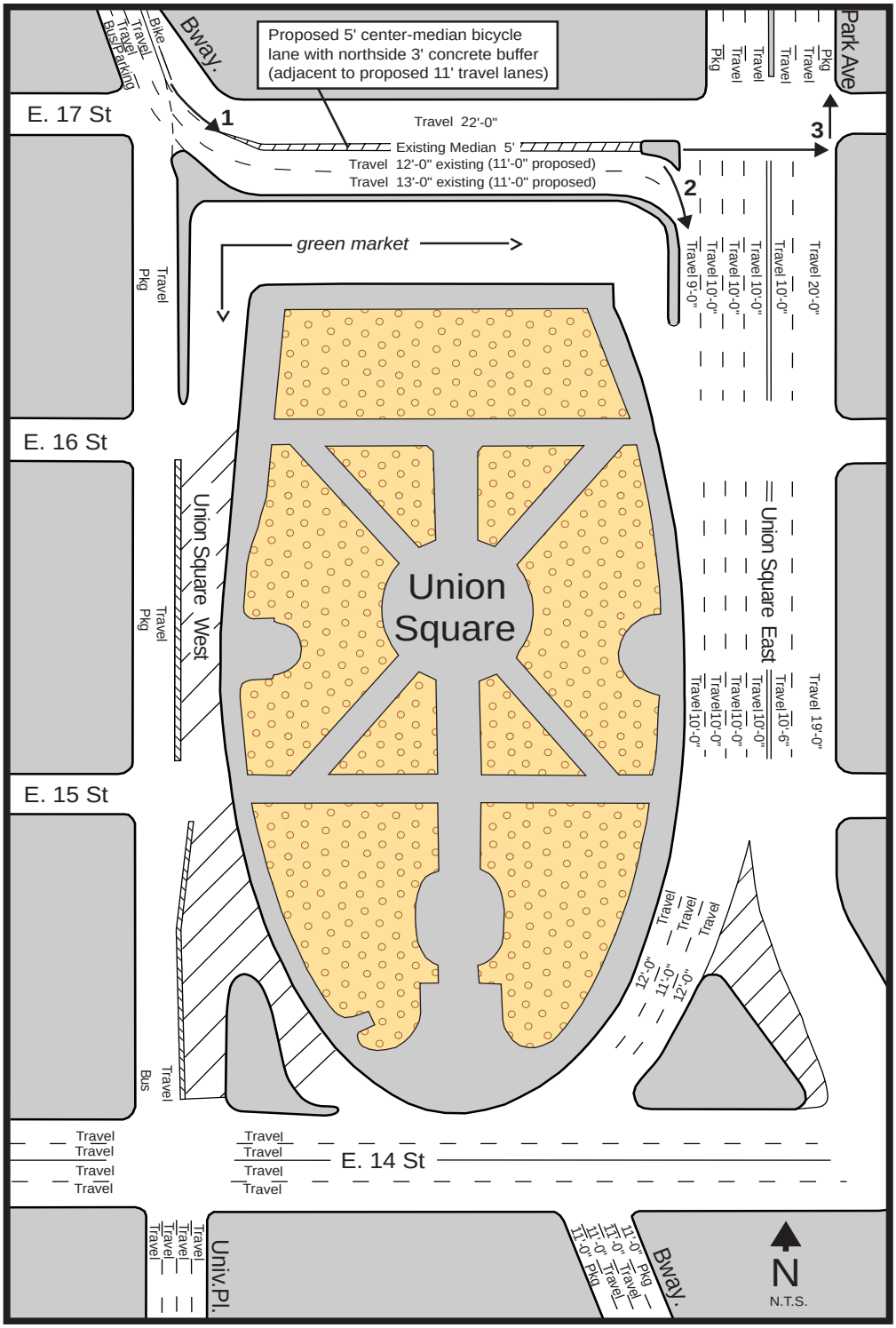
Center-median bicycle lanes provide a cycling space against (or within) the center median of a roadway, and are recommended for use on continuous roadways with few turning movements. A recent installation of a center-median lane can be found in Minneapolis, where bi-directional cycling traffic is accommodated between motor vehicle lanes and a bus-only lane. Center-median lanes have also been successfully implemented in Seattle, WA. Intersections where motor vehicles make left turns through the median should be designed similarly to intersections where cyclists using a right-side bicycle lane face right-turning traffic (AASHTO recommended treatment).



A cycle lane adjacent to an intersection center-median in Apeldoorn, The Netherlands. The lane has a bright red pigment with white markings, highly visible on the roadway. Source: Cities Make Room for Cyclists.

Potential Test Locations: 17th Street, from Broadway to Park Avenue.
Park Avenue, from 14th to 17th Streets.

Pilot Test 6: Center-median bicycle lane (with flexible bollards) 17th Street, Broadway to Park Avenue



Plan view at Union Square. Location of proposed center-median bicycle lane shown on 17th Street, between Broadway and Park Avenue. Arrow #1 shows cyclists traveling with traffic onto eastbound 17th Street from the Broadway bicycle lane. From the east end of 17th Street segment, Arrows #2 and #3 show the potential routes of cyclists as they continue southbound on Union Square East or northbound on Park Avenue (respectively). Implementation of the new lane should include an eastward shift of the vehicle stop line on the northside of 17th St. (for westbound traffic), to facilitate cyclists' clear access to the lane through the intersection.

The proposed one-way (eastbound) center-median lane would extend from the Broadway bicycle lane, allowing cyclists to safely continue traveling with the flow of vehicular traffic onto eastbound 17th Street. Currently, eastbound cyclists moving alongside traffic from the Broadway bicycle lane confront on-coming traffic as they make the turn onto 17th Street.

The new lane would replace an existing five-foot painted median (pictured left) with a five-foot blue pigmented lane adjacent to a three-foot, northside concrete median buffer. The additional three feet required for the buffer could be obtained by creating two 11-foot westbound travel lanes.

The lane would end at Union Square East (see diagram), where cyclists could safely continue north or south. If possible, plans to reconstruct Union Square Park and the surrounding roadways should accommodate an extension of this facility southbound on Union Square East.

A pegga-tracked cycle crossing connecting the end of the existing Broadway bicycle lane to the proposed center-median lane would be required to alert turning motorists to the presence of cyclists in the intersection (see p.6).

Top: Cyclist using the existing unprotected, painted median on 17th Street to travel eastbound to Union Square West.

Left: Southeast view from 17th Street, at Union Square West, where the proposed center-median lane would end. From this point, cyclists using the lane would move along the traffic island to continue traveling southbound (arrow #2) or northbound (arrow #3).

Combined Bicycle/Bus Lane

Description

These lanes provide an exclusive travel lane for both cyclists and buses, during continual or restricted (peak-traffic) hours. Successful implementation of these lanes may require additional training for bus drivers, to educate them about operating safely with cyclists. These lanes are recommended on routes using compressed natural gas buses.

Potential Test Locations:

Tests of combined bicycle/bus lanes are recommended for existing city-wide priority bus lanes, particularly on roadways with double lanes (e.g. Madison Avenue). However, successful implementation of the lanes will require a dedicated enforcement effort to keep them clear of motor vehicles for cycle and bus use. One model for improved enforcement of priority bus lanes was pilot tested by the Metropolitan Transportation Authority (MTA) in 1994. This study was developed as a follow-up to an MTA September 1994 report, *Faster Than Walking?: Street congestion and New York City Transit Buses*, which questioned the cost-effectiveness of bus lane enforcement and recommended the implementation of self-enforcing bus lane designs.

During a three-month period, the MTA New York City Transit and NYCDOT implemented a program of sustained enforcement of bus lane regulations. Evaluation of this program showed a nearly “break-even” result from revenue alone, and a potential positive cost/benefit of over $70,000 per quarter from reduced running time.

A similar, coordinated and targeted effort would be required in conjunction with prototype testing of bicycle/bus lanes, to keep the lanes clear of motor vehicles to allow predictable (and safe) travel movements by both users.

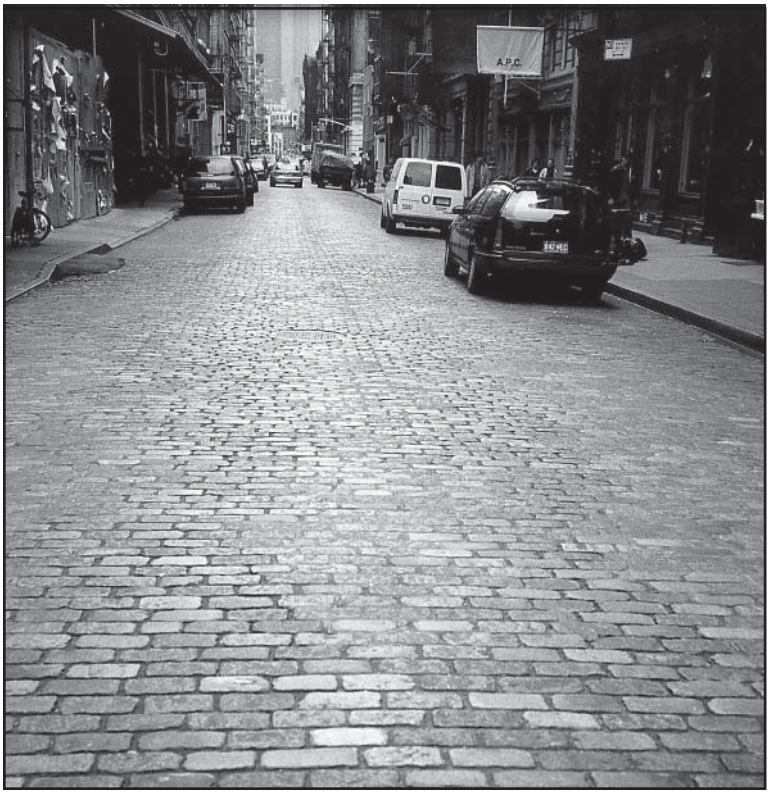
Left: A southbound cyclist using the bus lane on Broadway (south of Houston). Despite frequent bus scheduling, cyclists can be observed using the lane during hours restricted to bus-only travel.
Below: A delivery truck standing illegally at a bus stop on Broadway (below Canal).

Centerline Non-Compulsory Lane

Description

A limited width, unmarked centerline lane may be used to improve comfort and safety levels for cyclists on rough or cobbled roadways, and reduce motor vehicle speeds by visually narrowing the roadway surface. These lanes can be used to facilitate travel connections within the bicycle network on roadways with poor cycling surfaces. Surface treatments for a non-compulsory lane include: leveled cobbles, pavers, brick, concrete and asphalt.

Pavers line a cobbled street, to facilitate pedestrian and bicycle traffic. Source: An Improved Traffic Environment, Report 106, Denmark Ministry of Transport.



Potential Test Locations:
Citywide streets with surfaces unsuitable for cycling, particularly those which facilitate route connections in the *New York City Bicycle Master Plan*. One roadway for test implementation is Varick St. south of Canal St., to connect southbound cyclists on Seventh Avenue to West Broadway.

Mercer Street (pictured left, south view from Prince Street) in SoHo provides a safe, low-volume, though somewhat bumpy southbound route for cyclists.

ENFORCEMENT RECOMMENDATIONS

The successful implementation of cycling facilities depends as much on enforcement as proper engineering and placement. To help ensure that new facilities are available for use by cyclists and not occupied by motor vehicles, a series of enforcement recommendations are listed below.

Curbside Regulation

In addition to enforcing curbside regulations that typically accompany traditional bicycle lanes, enforcement of newly implemented on-street cycling facilities will (in some cases) require modified curbside regulations, particularly where protoypical improvements are recommended. Double parking, identified by cyclists as a leading threat to their safety, should be a target of focused regulation. An improved definition of on-street cycling space and its associated regulations (through signage, striping and other prototypical measures) may assist enforcement efforts by clarifying usage of these areas for other roadway users.

Ultimately, however, consistent enforcement of curbside and traffic regulations provides the clearest definition of their applicability to on-street bicycle facilities. NYPD-based recommendations include increased motor vehicle enforcement directly related to on-street cyclists (i.e., parking in bike lane, driving in bike lane, failing to yield right of way to cyclists) and targeted enforcement of bicycle facilities, such as a “zero tolerance” program.

Zero Tolerance Enforcement Program

Following the example of initiatives currently in place for speed, seat belt and bus lane enforcement, a targeted approach to ticketing motor vehicles unlawfully occupying bicycle lanes is recommended. This type of initiative would be most effective occurring at least once a month, in coordination with public relations efforts to provide publicity (including, but not limited to, *National Bike Month* and local *Bike-to-Work Week* activities). Public awareness of targeted enforcement of cycling lanes is critical to the success of a non-continuous program.

As with other NYPD zero tolerance initiatives, data on enforcement activity should be collected from each precinct after a target day and tabulated by the Office of the Chief of Patrol. An evaluation of this data could be used to aid future planning and enforcement efforts.

This initiative is anticipated to affect a greater number of precincts as new portions of the planned 550-mile on-street bicycle network are implemented over the next five years.

“Public Awareness” Summons Form

Safety information currently distributed by the NYPD (in conjunction with NYCDOT) has a limited and targeted circulation. To improve distribution, revision of both parking and moving summons forms to include traffic safety information (on the back of the copy of forms given to traffic violators) is recommended. Information printed on summons forms could provide a broad, routinized form of outreach for safe cycling and “Share the Road” information for motor vehicles, in addition to providing information about seat belt use, speeding, child safety seats, and hazards of driving under the influence of alcohol or drugs (DUI).

Revised Parking Summons Form

In particular, minor revision to the parking summons form currently used by NYPD would allow officers to more accurately track and ticket motor vehicles unlawfully parked in bicycle lanes. The form lists a number of common violations which officers can quickly check without having to reference code or fine information, including *double parking* and *no parking* violations. These violations are more easily referenced, and often checked in placed of, *parking in bicycle lane*, which is not readily listed.

A space on the form for officers to identify the type of violation as *bicycle lane-related*, or the addition of a line specific to *parking in a bike*

lane, would allow officers to more easily record cycling-related enforcement information, and provide better data to assist on-street cycling improvement efforts by other City agencies.

Amended Traffic Code

In addition to on-street enforcement efforts, revision of the *New York City Traffic Rules and Regulations* is recommended to institutionalize the protection of existing on-street bicycle facilities. A revision could be based, in part, on language found in the San Francisco Traffic Code:

> ***San Francisco Traffic Code. Article 5B. Section 110. Protection of Existing Bicycle Facilities.***
> (a) the following activities are prohibited unless the Board of Supervisors expressly grants prior approval:
> (1) the narrowing of right hand travel lanes with parking, including turn lanes to less than twenty-two (22) feet or the narrowing of right hand travel lanes without parking, including turn lanes to less than fourteen (14) feet;
> (2) the narrowing or elimination of any bicycle lanes;
> (3) the narrowing or removal of bicycle paths; or
> (4) the addition of traffic lanes, except where such lanes consist of left or right turn pockets.
> (b) This Section only applies to the streets, lanes and paths on the City's official bicycle route system as defined in the most recent update of the Transportation Element of the S.F. Master Plan.

DATA RECOMMENDATIONS

To effectively plan and locate on-street cycling facilities, regular and systematic collection of cycling data is needed. Detailed accident data, in particular, is needed to continue to identify unsafe locations which should be addressed as priorities for facility improvement.

Existing Data Sources

Accident data is presently available through a number of different State and City agencies: the New York Police Department (NYPD), the New York Department of Motor Vehicles (NYDMV), and the New York State Department of Transportation (NYSDOT).

The **NYPD** provides a primary source of accident data for all road users through police report. From this information, NYPD is able to produce current yearly summary data of citywide cycling injuries and fatalities. This data does not, however, identify locations dangerous for cyclists.

The **NYDMV** receives data directly from the police reports. Using that information, they produce a summary report of New York City motor vehicle accidents and a report on New York City bicycle accidents. The reports have a variety of details, including the time of day accidents occurred; age and sex of accident victims; a distinction between injuries or deaths resulting from accidents; details about the severity of injuries; and information about pre-accident bicycle action/movements. These reports, however, do not cite specific locations where accidents occurred.

In addition, the NYDMV has the ability to produce special reports, by request, referring specifically to cyclists. The information is updated as far as June 1998, and can be sorted by borough, precinct, year, and accidents specific to cyclists. These reports cannot provide location information more specific than precinct-level, and the process to receive information is time consuming.

The **NYSDOT** receives the accident data that has been coded by the NYDMV. NYSDOT's current safety management system consists of two components: SASS (state accident surveillance system) a program with the capacity to compile accident summary reports on roadways under the jurisdiction of the state; and CLASS (centralized local accident surveillance system) a program with the capacity to show local crash statistics by summary and by individual node.

Both of these systems are being integrated into one automated Safety Management System (SMS) that would make queries easier and allow agencies direct access to all of the information. SASS has already been incorporated into SMS, but plans for the incorporation of CLASS (which is what would be required for local system bike data in NYC) have been held up indefinitely.

Using SASS data accessed via the SMS, NYSDOT was able to disseminate summaries of bicycle and pedestrian accidents that occurred on the state highway system between 1990 to 1993, in a 1995 report. However, this report contained no detailed information for local accident sites.

Within the current CLASS system there are two reports that are regularly produced, the Interim Summary Report, and the Local Accident Surveillance Reports:

- The Interim Summary Report, compiled every six months, has data that refers to vehicle and pedestrian accidents; however, there are no statistics in the summary report referring to cycling accidents.

- Cycling accident data is available in the Local Accident Surveillance Reports (individual police reports compiled by node), but they are compiled with vehicular and pedestrian accidents, making it necessary to sort through piles of impertinent information to find individual bicycle reports. Even once the reports are sorted this data is only useful when the dangerous location has already been identified.

Although cycling data is not included in the standard issue reports, NYSDOT is able to accommodate individual requests for cycling accident data. NYSDOT, similar to NYDMV, can produce a limited number of reports -- including a list of bicycle accident prone locations in New York City. Unfortunately the availability of this service is not well-publicized, and the preparation of such reports can be very time consuming.

Recommendations

Accident data needed for effective bicycle facility planning is not currently readily available. In order to begin "making streets safe for cyclists," accident prone locations for cyclists need to be regularly and systematically identified, showing precisely where and how accidents occurred.

Given NYSDOT's ability to sort information by location, specific recommendations are that:

- NYSDOT include bicycle accident data in their Local Accident Surveillance Summary.

- NYSDOT produce an annual report identifying the most dangerous locations for cyclists in New York City.

APPENDIX A:
Department of City Planning Bicycle Questionnaire

The City of New York / Department of City Planning, Transportation Division
Bicycle Questionnaire

№ 5827

Please answer the following questions as completely as possible - thank you!

The Bicycle Program at the Department of City Planning, Transportation Division has been very active in providing better cycling conditions in New York City. This survey will help our continued planning efforts, which include studies and implementation projects to improve bicycle parking and safety. Thanks for your help!

I. BICYCLE TRAVEL HABITS

Do you ever use your bicycle to commute to work? ____ **yes** ____ **no**
(If no, go directly to part B)

A. *If yes*:
Describe the route of your typical commute:
(i.e. Park Slope, Brooklyn to Midtown Manhattan)
Begins at_____
and ends at_____

The streets that I typically use are:_____
_____
_____

How long have you been commuting to work? ____ **years**

Approximately how far is your commute? ____ **miles**

How long does it usually take you? ____ **hrs.** ____ **min.**

I commute:

(choose one)
- ☐ once a week
- ☐ twice a week
- ☐ 3 or more times a week
- ☐ once a month
- ☐ twice a month

(choose one)
- ☐ year round
- ☐ seasonally

B. *If no*:
What is(are) your primary reason(s) for not commuting by bicycle?
(check all that apply)
- ☐ I work too far from home
- ☐ Fear of motorists
- ☐ Roadway surface conditions are poor
- ☐ Nowhere to store my bike safely
- ☐ No shower/change facilities at work

C. Please tell us a little about yourself *(optional)*.
What is your age? ☐ Under 21 ☐ 21-40 ☐ 41-62 ☐ Over 62
Are you ☐ Male ☐ Female

Please fold here

II. BICYCLE SAFETY (all trips)

Which roadway users are the greatest threats to your safety when riding in traffic?
(Please assign numbers 1-5 to each category (1 if low threat - 5 if high threat)

- ____ taxi cab drivers
- ____ private passenger car drivers
- ____ bus drivers
- ____ truck drivers
- ____ double parked cars
- ____ jaywalking pedestrians
- ____ in-line skaters
- ____ other cyclists

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? _____
_____
_____

If you have been in an accident while riding in traffic: *(check all that apply)*
- ☐ a police report was filed
- ☐ someone was injured
- ☐ someone was taken to the hospital
- ☐ I was doored (# ___ times)
- ☐ I collided with a vehicle (# ___ times)
- ☐ I collided with a person (# ___ times)

III. BICYCLE PARKING (all trips)

Where would you like racks, lockers, etc.: ***(please be site specific)***

A) Bike Racks *(including lots and garages)* **B) Bike Lockers**
_____ _____
_____ _____

C) Additional Bike Racks *(where facilities are available but more are needed)*
_____
_____

D) Bike Service Station *(including guarded bike parking, repairs, bike rental, coffee, snacks, and a nice atmosphere)*
_____
_____

If safe and secure bike parking were available (such as indoor and/ or guarded facilities), how much would you be willing to pay?

$_____ an hour $_____ per day

THANK YOU for your time and effort! Please fold here > use seal provided (no staples), and mail. No postage necessary.

APPENDIX B:
Summary Listing of Cycling/Skating Summonses and Associated Fine Structure for New York City

Law Code	Description	Plea Fine 1st occurance	Plea Fine 2nd occurrance	Plea Fine 3rd occurrance
1111D1B	Red light violation	50	100	250
1111D1C/ 30C1B	NYC red light	100	200	500
1230A	Parent or guardian allows child to violate regulations	40	40	40
1232A/ 412P1	Improper operation (off seat or pedals)	40	40	40
1232B	Too many riding on bike	40	40	40
12331	Clinging to moving vehicle	40	40	40
12332	Attach self to moving vehicle	40	40	40
12333	Permit clinging to moving vehicle	40	40	40
1234A	Failure to keep right	40	40	40
1234B	More than 2 abreast	40	40	40
1234C	Riding on path	40	40	40
1234D	Failure to stop before entering a roadway (from driveway, etc).	40	40	40
1235	Carry articles (without one hand on steering wheel)	40	40	40
12336A	Inadequate light/reflectors	40	40	40
1236C	Inadequate brake	40	40	40
1236D/ 1236E/ 1238.10	No/improper reflectors (afer sunset)	40	40	40
1238	Parent or guardian allows child under 14 to bike/skate without helmet	40	40	40
1229AB	Non-motorized on exp/hwy	40	40	40
407C31	Ride/skate on sidewalk	40	40	40

APPENDIX C:
Description of problem keywords applied to DCP questionnaire responses (listed in order as appear on Table 19)

Poor bridge access: applied generally to bridge entrance references; additional keywords listed as appropriate.

Congestion: refers to “crowded” conditions, “too many cars,” etc.

Poor road condition: roadway surface and related conditions, including lighting.

No defined cycling space: applied generally to complaints about a lack of exclusive cycling space and poor design/ indication of space meant to be exclusive.

Double parked vehicles: includes mention of loading and unloading delivery trucks.

Conflicts w/ turning vehicles: primarily at intersections.

Vehicular speeds: specific category of *unlawful driving* (see below).

Intersection design: applied generally to references about overall design, including “too many roads come together,” “intersection too wide,” and “confusion” at locations where roadways intersect.

Aggressive driving: applied to driving behavior that is aggressive but not necessarily in violation of traffic laws, i.e. “crazy drivers,” “cut off.”

Pedestrians in cycle space: applied to general references about pedestrians in roadway/cycling space, particularly at intersections (see *jaywalking* below).

Traffic signal problem: applied to references about signal timing, crossing difficulty at signalized intersections, and traffic phase confusion.

Unlawful driving: applied generally to references about illegal driving except speeding (see *vehicular speeds*, above), i.e. “running a red light,” “driving in the bike lane,”vehicles not staying in a lane.”

Stopping taxis: generally applied to each reference; includes livery vehicles.

Jaywalking: specific to illegal pedestrian crossings, i.e. against a light, in the middle of a roadway (see *pedestrians in cycle space*, above).

Narrow roadway: specific to roadway widths (for *congestion*, see above).

Merge problems: applied to references about converging lanes, or the ability to cross moving traffic lanes at locations other than intersections.

Narrow bicycle lane: specific to width references (see *no defined cycle space*, above).

Construction: as stated.

Unlawful cycling: includes on-street and cycling on bridge paths.

APPENDIX D:

(1) Major Intersection Area Search Locations

Herald Square
Including Greeley Square, this area is defined by the intersection of Broadway and Sixth Avenue, from 32nd St. to 36th St.

Columbus Circle
This area currently operates as a traffic circle at the intersection of Broadway and Eighth Avenue, at the southwest corner (Merchants' Gate Entrance) of Central Park.

Times Square
Including Duffy Square, this area is defined by the intersection of Broadway and Seventh Avenue, from 43rd St. to 47th St.

Union Square
This area encompasses Union Square Park, bounded by Park Avenue (Union Square East) and Broadway (Union Square West), from 14th St. to 17th St.

Madison Square
Including Worth Square, this area is defined by the intersection of Broadway, Fifth and Madison Avenues, from 22nd St. to 26th St, immediately west of Madison Square Park.

(2) NYPD Accident Prone Locations, Patrol Borough Manhattan North, Roadways with Highest Accident-Prone Location (APL) Totals

Roadway	# sites	APL Total
Broadway	7	294
125th St.	7	245
Second Ave.	7	243
Amsterdam Ave.	7	226
Seventh Ave.	4	215