1. INTRODUCTION

The Subway-Sidewalk Interface Project is a joint project sponsored by the New York City Department of City Planning (NYCDCP) and the New York City Department of Transportation (NYCDOT). The project is funded through a matching city-federal grant under the Transportation Equity Act for the 21st Century (TEA-21), Congestion Mitigation and Air Quality (CMAQ) program.

Pedestrian circulation improvements linked to mass transit access offer the opportunity to reduce vehicular congestion and improve air quality. The Subway-Sidewalk Interface Project focuses on the areas where the subways meet the street, the nexus of the surface and subsurface circulation systems. The project aims to improve pedestrian and vehicular circulation around the entrances to subway stations in order to encourage mass transit use. The project will implement improvements that relieve congestion and improve security and safety. The type of improvements that may be implemented include signage, lighting, signal timing adjustments, pavement markings, corner clearances, and curb line changes where necessary. Thirty sites throughout the Bronx, Brooklyn and Queens have been selected.

Subway Stations Selected for the Subway-Sidewalk Interface Project

The Bronx	**Brooklyn**	**Queens**
231st Street (1)	7th Avenue (Q)	30th Avenue (N-W)
233rd Street (2-5)	36th Street (M-N-R-W)	33rd Street (7)
Burnside Avenue (4)	Bay Parkway (M-W)	40th Street (7)
Fordham Road (B-D)	Bedford Avenue (L)	71st/Continental Avenues (E-F-G-R-V)
Gun Hill Road (5)	Church Avenue (2-5)	90th Street (7)
Gun Hill Road (2-5)	Jay Street Borough Hall (A-C-F)	179th Street/Jamaica (F)
Parkchester/East 177th Street (6)	Kings Highway (Q)	Metropolitan Avenue (M)
Pelham Parkway (5)	Myrtle/Wyckoff Avenues (M-L)	Rockaway Park/Beach 116 (A-S)
Pelham Parkway (2-5)	Nostrand Avenue (A-C)	Ozone Park/Lefferts Boulevard (A)
Third Avenue/149th Street (2-5)	Sheepshead Bay (Q)	Woodhaven Boulevard (G-R-V)
	Utica Avenue (3-4)	

1.1 THE RECOMMENDATIONS TECHNICAL MEMORANDUM

Technical Memorandum V, Recommendations, is the latest in a series of technical documents that have been released to the public via the Technical Advisory Committee.

The recommendations contained in this document are suggested methods for addressing the issues, and taking advantage of the opportunities, that were presented in *Technical Memorandum IV, Issues and Opportunities.* Issues were identified through field observations, on-site meetings with community board district managers, discussions with the Technical Advisory Committee, and data analysis. Recommendations may or may not address all of the issues at each station, and may require further analysis to determine feasibility. The objective of this memorandum is to suggest improvement techniques for discussion and further study.

Some of the recommendations proposed in this report do not fall under the jurisdiction of NYCDOT and will require coordination with other operational agencies, such as NYC Transit and the NYC Department of Parks and Recreation. Any recommendations for improvements to property that is not under the jurisdiction of NYCDOT is subject to approval by the relevant agencies and would be maintained by those agencies.

The report is arranged in the following manner: Section one is the introduction to the report; section two lists the recommendations that may be implemented system-wide and by station type; section three presents the coordination and implementation issues; section four lists the techniques and treatments recommended at the specific sites, some of which are currently used by New York City; section five presents the site-specific recommendations at each of the project sites.

2. SYSTEM-WIDE AND STATION TYPE RECOMMENDATIONS

While many recommended techniques are proposed on a site-specific basis, other recommendations have been considered at all stations or at all stations of a certain type. The following sections provide standard sets of recommendations for each type of station, although not every listed technique is appropriate for all stations of that type.

2.1 SYSTEM-WIDE

The following set of recommendations involves standard concepts for all thirty subway stations. Subway stations are areas of high pedestrian activity. These recommendations are intended to facilitate circulation by providing pedestrians with appropriate orientation signage and safer, clutter-free routes. Some recommendations are intended to alert motorists to the heavy pedestrian activity and encourage them to use caution.

- Install subway signs surrounding each station,
- Highlight concrete risers near subway stairwells with orange or yellow thermoplastic,
- Install bicycle parking at stations that are heavily used by cyclists and which are located along bicycle routes,
- Install Light Emitting Diode (LED)
- Install universal pedestrian signals.

Subsequent to the release of the Issues and Opportunities report, NYCDOT installed LED lighting and universal pedestrian signals throughout Brooklyn and New York City.

2.2 ELEVATED STATIONS

Most of the elevated stations, with the exception of the 33rd and 40th Street stations, share issues related to the elevated structures such as blocked visibility, drainage, insufficient lighting, and sanitation. The following recommendations are aimed at reducing the negative impacts of the elevated structures:

- Improve lighting beneath the elevated structures,
- Paint columns a light, reflective color,

231st Street. Passengers load onto the bus beneath the elevated structure.

- Install netting or non-toxic bird repellent to prevent sanitation problems that result from birds perching in the elevated structure,
- Widen crosswalks that have columns embedded within them where geometry permits in order to improve safety and the sightline of motorists,
- Drain run-off directly into the storm sewer system, and
- Develop treatments to address passengers loading onto buses in the street.

2.3 INTERMODAL STATIONS

Intermodal stations, which provide connections to commuter trains and numerous bus lines, are often heavily used and located in commercial areas. The following recommendations aim to make the congestion at these stations more manageable, reduce confusion, and properly direct pedestrians to their destinations.

Myrtle/Wyckoff Avenues. Buses and livery cars load and unload passengers on Palmetto Street.

- Install bus signage within the stations to direct subway passengers to the correct exits and the appropriate bus stops on the street level,
- Display subway, bicycle, and neighborhood maps on bus shelters,
- Install concrete bus pads that delineate bus stops,
- Explore and implement bus actuated signals if feasible at appropriate locations, and
- Assign appropriate curb use for taxis and passenger loading, and install appropriate signage for such uses where warranted and feasible.

2.4 STATIONS WITH ENTRANCES IN BUILDINGS OR ON TRAFFIC ISLANDS


Beach 116th Street. The entrance is located within a building and can be difficult for unfamiliar passengers to find.

Many of the stations located within buildings or on traffic islands have irregular street geometry, which results in particular issues at individual stations. It is therefore difficult to recommend standard treatments for these types of stations. However, the following recommendations are applicable to most of these stations due to the recurrence of certain issues:

- Provide crosswalks and traffic controls at all crossing points leading to the stations entrances, if warranted, and
- Provide landscaping or other amenity upgrades at traffic islands as funding permits. Any landscaping, amenities, special pavement treatments or other upgraded elements on property under NYCDOT jurisdiction must be made through NYCDPR's Greenstreets Program or under a maintenance agreement with a local community organization.

Stations	System-wide	Elevated	Intermodal	Building/ Island	Additional Design		Major Design
					Traffic Control Devices and Signals	Curb Realignments	
7th Avenue (Q)*	X			X		X	
36th Street (M-N-R-W)**	X		X		X		
Bay Parkway (M-W)	X	X	X			X	
Bedford Avenue (L)	X					X	
Church Avenue (2-5)	X		X				
Jay Street, Borough Hall (A-C-F)	X		X				
Kings Highway (Q)	X	X	X			X	
Nostrand Avenue (A-C)	X		X				
Sheepshead Bay (Q)	X	X	X	X	X		
Myrtle/Wyckoff Avenues (M-L)	X	X	X	X			X

* The 7th Avenue subway station does not have any entrances located on traffic islands, however, there are traffic islands nearby station entrances and many of the issues at this type of station exist at 7th Avenue.

** The 36th Street subway station is not an intermodal station, however, due to limited visibility of nearby bus stops it exhibits many of the same issues as an intermodal station. We believe that the intermodal recommendations would greatly improve this station as well.

2.5 ADDITIONAL RECOMMENDATIONS

Some of the stations require additional recommendations that are not included in the standard sets of recommendations by station type. These recommendations involve curb realignments, signal timing changes, or some other type of innovative technique or treatment.

In Brooklyn, the Myrtle/Wykoff station will require major redesign work in order to improve it. Recommendations may include channelizing traffic differently, creating a bus terminal, or implementing an enforcement program to control traffic violations. The Myrtle/Wyckoff site is an intermodal station, located at the intersection of two commercial streets which generate a heavy amount of pedestrian activity. The chart on page four outlines the different types of recommendations listed for each of the stations in this report.

3. COORDINATION AND IMPLEMENTATION ISSUES

The following section describes coordination and implementation issues that have affected station recommendations. Section 3.1 describes implementation issues caused by ongoing projects, while section 3.2 lists the current policies that should be enforced in targeted areas.

3.1 ONGOING PROJECTS

This report does not make recommendations for two stations due to other projects that supercede the Subway Sidewalk Interface Project. In the Bronx, NYC Transit is conducting the Gun Hill Road Intermodal Study at the Gun Hill Road, White Plains Road station. Plans for the project include a reconstruction of the station, park, and roadway, and bus improvements. In Brooklyn, the Weeksville, Utica Avenue Transportation Study, recently released by NYCDOT has recommended numerous improvements at the Utica Avenue station. In addition, at NYCDOT's request, the Bay Parkway station replaced the Utica Avenue station.

NYCDOT is conducting overlapping projects at some other stations; however, these projects will not completely supercede the work of this Project. These study areas would benefit from the broad improvements that have been recommended for the different station types. The following is a list of those study areas and projects:

Bronx:

- Pelham Parkway, Dyre, reconstruction of Pelham Parkway
- Pelham Parkway, WPR, reconstruction of Pelham Parkway

Queens:

- 71st and Continental Avenues, Queens Boulevard Pedestrian Safety Study, Phase I
- Woodhaven Boulevard, Queens Boulevard Pedestrian Safety Study, Phase II
- 33rd Street, Queens Boulevard Pedestrian Safety Study, Phase II
- 40th Street, Queens Boulevard Pedestrian Safety Study, Phase II

Brooklyn:

- Jay Street/Borough Hall, Downtown Brooklyn Traffic Calming Project
- Jay Street/Borough Hall, Marriott Expansion

3.2 ENFORCEMENT OF CURRENT POLICY

Currently, policies are in effect in New York City which could significantly improve the streets and sidewalks for pedestrians. Targeted enforcement of these policies in specific locations where violations are egregious would significantly improve circulation for pedestrians and motorists. This report highlights some of those locations and recommends programs that would assist officials with enforcement. The following is a list of current policies recommended for system-wide enforcement:

- Enforcement of vendor rules
- Enforcement of traffic rules
- Enforcement of Local Law 23, a new policy regulating the placement of newspaper boxes
- Enforcement of clear corner policy

4. TECHNIQUES AND TREATMENTS

This section describes the techniques and treatments recommended to improve individual sites analyzed in this report. This section may be used as a glossary of terms for the station reports since a brief explanation of each technique and treatment is provided.

Amenities Upgrade

Landscaping:

Well-maintained trees, shrubs and other plants, alone or combined with specialized urban design treatments, may improve pedestrian circulation as well as improve the environment for pedestrians. Improved landscaping is recommended at many of the traffic islands within the study areas when a maintenance agreement between a community group or NYCDPR's Greenstreets Program and NYCDOT is feasible.

Street Furniture:

Well-designed and appropriately-placed street furniture amenities, such as benches and trash cans, improve pedestrian circulation and conditions. In some cases, upgrades from the standard city designs are recommended when a maintenance agreement between a local community group and NYCDOT is feasible.

Bicycle Facilities

Bicycle Lanes:

A bicycle lane is an on-street path indicated by striping, pavement markings and signs. It is also referred to as a Class II bicycle riding facility and is used by cyclists for commuting, commercial delivery and recreational purposes. The following AASHTO (American Association of State Highway Transportation Officials) guidelines are often used when implementing on-street bicycle lanes:

- It is recommended that bicycle lanes adjacent to parking lanes be a minimum of five feet wide.
- A bicycle lane should be placed between the parking lane and the travel lane. It should not be placed between the curb and the parking lane where visibility is reduced, particularly at intersections.
- A buffer between the bicycle lane and the travel lane is recommended in order to provide greater protection from motor vehicles.

Bicycle lanes are only recommended on streets that are included as recommended routes in the *New York City Bicycle Master Plan*.

Bicycle Parking:
NYCDOT's current standard for bicycle parking is a rack constructed of unpainted, galvanized steel and formed into a continuous curve. The rack, an inverted (upside-down) U, can accommodate two bicycles or a double loop for five bicycles. NYCDOT has implemented the installation of these racks through the City Racks Program. A new bicycle rack design was approved in 2002. The new design has a square-tube pipe instead of the current round tube pipe, with a black finish instead of the current galvanized unpainted finish. These new racks are the same size as the existing "U" city racks. Bicycle parking is recommended at locations heavily used by cyclists and on streets included in the *New York City Bicycle Master Plan*.


Bicycle Parking.

Channelization

Lane Arrow Markings:
Lane arrow markings are used to help the road user select the appropriate lane in advance of reaching a queue of waiting vehicles. Arrow markings may be used to convey either guidance or mandatory messages.

Lane Line Markings:
Lane line markings define the channelization of a roadway and guide motorists to the appropriate traffic lanes. The following list describes the different types of lane line markings and how they are used.

- A solid white line prohibits or discourages crossing.
- A double yellow line consists of two solid lines separated by a discernible space. A double line indicates maximum or special restrictions.
- A broken line consists of normal line segments separated by gaps. A broken line indicates a permissive condition.
- A dotted line consists of noticeably shorter line segments separated by shorter gaps than used for a broken line. The width of a dotted line shall be at least the same as the width of the line it extends. A dotted line provides guidance. (Manual on Uniform Traffic Control Devices [MUTCD], pps. 3A-3, 3A-4)

Speed Humps:
Speed humps are carefully profiled humps creating vertical constraints on speed. They are commonly placed at intervals ranging from 80 to 130 meters along the street (ITE Journal, *Traffic Calming*, August 1997, p. 37). This traffic calming device is recommended at locations where motorists should drive at a slow speed due to high volumes of pedestrian activity.

Speed Tables:
Speed tables are similar to speed humps but are constructed with a flat top which typically doubles as

a pedestrian crosswalk. This technique is typically used in heavily trafficked pedestrian areas (ITE Journal, *Traffic Calming*, August 1997, p. 37). This traffic calming device is recommended in locations where motorists should drive at a slow speed due to high volumes of pedestrian activity.

Stop Lines:
Stop lines are solid white lines extending across approach lanes, indicating the point at which a vehicular stop is intended or required to be made (MUTCD, p 3B-32). Stop lines should be used to indicate the point behind which vehicles are required to stop in compliance with a STOP sign, traffic control signal, or some other traffic control device (MUTCD, p. 3B-34).

Traffic Flow:
In order to improve vehicular circulation in some study areas, a change in traffic flow is recommended either by closing a street and rerouting traffic, prohibiting a turn, or changing the direction of traffic. Peg-a-tracking, a series of dotted lines that guide traffic through an intersection, is also recommended in some locations to improve the traffic flow through an intersection.

Tubular Markers:
Primarily orange, tubular markers are similar to bollards but are made of a material that may be struck without causing damage to the impacting vehicle. They are typically a temporary traffic control device and may be used effectively to divide lanes of traffic and delineate the edge of a pavement drop-off where the use of larger objects is not possible (MUTCD, p. 6F-45). This channelization device is recommended to divide bicycle lanes from other traffic lanes.

Vehicular Signage Upgrade:
Vehicular signage providing directional information to motorists may need to be upgraded at some locations where the signage is presently unclear or misleading.

Crosswalks

Bike Box:
Bike boxes involve striping a bicycle lane through a crosswalk, thereby permitting cyclists to queue in, or adjacent to, the crosswalk at a red light. This technique:

- Gives cyclists a head start at signalized intersections,
- Increases the feeling of safety among cyclists,
- Eliminates nuisance from exhaust fumes while cars are stationary, and
- Reduces conflict between cyclists and motorists prior to, and during crossing an intersection.

This technique is recommended at locations along streets that are heavily used by cyclists and included in the *New York City Bicycle Master Plan*.

Crosswalk Design:
In some instances, a different crosswalk design may be recommended in place of the current design. The following is a list of the different crosswalk designs:

- *Standard Crosswalks*: The standard crosswalk is defined by two parallel lines that run perpendicular to the curb.
- *High Visibility Crosswalks:* The pedestrian area of a high visibility crosswalk is defined by lines which are painted perpendicular to the direction of pedestrian movement.
- *Ladder Crosswalks:* This is a combination of the standard and high visibility crosswalks,

where lines running from curb to curb are connected by perpendicular lines. This configuration is sometimes called a "school" crosswalk.

- *Barnes Dance Crosswalk:* This type of crosswalk is designed in the pattern of an "X" and permits pedestrians to cross a street on a diagonal. This crosswalk will only be installed where the signal timing has an all-pedestrian phase.
- *Colored Thermoplastic:* Tinting the thermoplastic indicates to motorists that the area they are approaching is unique and they must proceed with caution. This technique is used in Europe.

Crosswalk Widening:
This report will recommend widening crosswalks where additional capacity is needed at locations with high volumes of pedestrian activity.

New Crosswalk:
In some locations, field observations prompted the recommendation for a warrant analysis in order to examine the need for a crosswalk at locations where no traffic controls exist.

**It is the policy of NYCDOT that wherever crosswalks are upgraded or newly installed, the white crosswalk markings extend from the building line to 1-2 feet inside the curb line. Stop lines are placed 4 feet behind the crosswalk.

Curb Realignment
Pedestrian Ramps:
Pedestrian ramps provide access to the sidewalk and street for wheelchair-bound people and people with strollers and carriages. Every street corner by law must have a pedestrian ramp in order to improve access to the sidewalk network for all users.

Neckdowns:
In order to increase effective sidewalk width, a neckdown extends the sidewalk area into the roadbed, typically into a parking lane. Neckdowns add pedestrian space for bus stops, subway stairs and elevators, queuing capacity for waiting pedestrians, pedestrian ramps, street furniture and fire hydrant access. Neckdowns also slow vehicular turning movements, decrease the pedestrian crossing distance, and prevent vehicles from loading and unloading passengers in the crosswalk (Mixed-Use Zone, NYCDOT, 1995). The following types of neckdowns are recommended:


Neckdown.

- *Transit Neckdowns* increase pedestrian queuing space around subway entrances.
- *Bus Neckdowns* allow buses to load and unload passengers in the travel lane.
- *Mid-block Neckdowns* shorten the crossing distance for pedestrians.
- *Bike Parking Neckdowns* provide additional space for bicycle parking.

Sidewalk Network Connection:
Building a sidewalk where none exists helps to improve the pedestrian network.

Sidewalk Widening:
Widening a sidewalk increases pedestrian queuing space and improves the level of service along the sidewalk. Additional pedestrian queuing space is typically needed in areas adjacent to subway entrances where pedestrian volumes are observed to be high. If there is excess roadbed adjacent to the sidewalk it may be widened without conducting a traffic analysis. A traffic analysis is necessary when removing a travel or parking lane in order to widen the sidewalk.

Increase Radius:
Increasing the radius of a corner may sometimes facilitate improved traffic flow, particularly for buses. This is recommended where buses have difficulty turning only if ample sidewalk space is available and pedestrian levels of service are not compromised as a result of the reduced sidewalk space.

Curb Use

For Hire Vehicles (FHV) Stands and Signs:
A FHV stand provides dedicated curb space for luxury limousine, black cars or livery vehicles to pick up and drop off passengers. These stands would relieve vehicular congestion because FHVs commonly occupy travel lanes while waiting for passengers. NYCDCP has investigated the feasibility of installing FHV stands at locations throughout Brooklyn, however, at the printing of this report has not reached a consensus as to the proper utilization of them with our partner agencies.

Currently, there are no NYCDOT signs that indicate FHV-only stands. There is an ongoing test on West 41st Street between Sixth and Seventh avenues that offers a staging area for FHVs, announced by regulatory signs prohibiting other vehicles from parking in these spots.

Parking Regulations Change:
Changes in parking regulations are recommended in locations where parked vehicles block pedestrian circulation and visibility, or where current regulations are inappropriate.

Passenger Loading Zone:
Passenger loading zones, also known as Kiss-n-Ride zones, are popular throughout the U.S., providing easily-accessed short-term standing zones for loading and unloading passengers. These zones are typically located near transit facilities where passengers are dropped off or picked up by drivers.

Taxi Stands and Signs:
Taxi stands and signs provide direction for pedestrians and taxi drivers alike, indicating the curbs dedicated for hailing cabs. Taxi stands are an identifiable, orderly, efficient, and quick means of securing a taxi that benefit both the driver and the passenger. Improving the effectiveness of taxi stands should reduce congestion and pedestrian-vehicular conflicts, while improving convenience and safety for passengers and taxi drivers. This report recommends the establishment of taxi stands at stations that have high volumes of passengers loading and unloading from taxis.

Truck Loading Zone:
Stations located in commercial areas with heavy truck loading activity require zones specifically assigned to the purpose of loading and unloading merchandise from trucks. This report recommends establishing truck loading zones, or changing the regulations of existing loading zones, at some of

these stations. Standard NYCDOT policy has been used to determine where these truck loading zones should be located.

Enforcement

Clear Corners:

According to Executive Order No. 22 of 1995, "Sidewalk Corner Clearance," structures and objects should not be placed in the corner (area created by extending the building lines to the curb) and corner quadrant (area ten feet from either side of the corner). As each agency replaces structures or objects under city ownership, such structures should be moved outside of the corner and corner quadrant. This report identifies specific locations where this policy should be implemented or enforced.

Local Law 23:

Local Law 23 legislates the placement of newsracks. The law states that newsracks may not be placed within 15 feet of a fire hydrant, in a driveway, within two feet of a curbcut, within close proximity to a subway station entrance, within a bus stop, within a crosswalk area, in or within five feet of a corner area, or on any sidewalk with less than eight feet of unobstructed pedestrian passage. This report recommends the application of these policies where corners are cluttered with street furniture.

Traffic Laws:

NYCDOT has very detailed guidelines for compliance with traffic rules (NYCDOT Traffic Rules, 10-6-00). In some locations pedestrian and vehicular circulation may be dramatically improved through strict enforcement of existing traffic laws.

Vendor Rules:

According to the Rules of the City of New York (RCNY), sidewalk stands may not extend farther than one-third of the width of the sidewalk. A sidewalk stand license application may be denied if pedestrian movement, public safety or convenience would be significantly impeded by the presence of the stand (2952 RCNY, 7-31-99). These guidelines have been developed to ensure that, while serving the public, newsstands do not unduly interfere with pedestrian circulation or unduly conflict with street furniture or the design relationship with their surroundings (2953 RCNY, 7-31-99).

Lighting Upgrade

Beneath Elevated Structure:

The cobra head luminaire is in use beneath many of the elevated structures throughout the city. The lighting may be improved by using a higher wattage or by reducing the space between the luminaires. According to NYCDOT's *Catalogue of Street Lighting Equipment*, the Brooklyn Bridge (BB) luminaire is the most appropriate for elevated structures.

Pedestrian Scale Lighting:

At some locations standard cobra head luminaires facing the street do not provide sufficient lighting for the sidewalks. At these locations pedestrian scale lighting is recommended to increase the lighting for pedestrians. Such lighting is a cobra head attached to existing lampposts that face the sidewalk and are placed lower than the standard cobra head luminaire. Any program to develop pedestrian scale lighting would have to involve a maintenance agreement with local Business Improvement Districts (BIDs).

Medians/Islands

Channelization Median:

Such medians are often painted and are either located in the middle of the roadway or adjacent to a sidewalk. If the median delineates excess roadbed and is adjacent to a sidewalk, it may be recommended that a curb be constructed in order to increase pedestrian queuing space.

Pedestrian Refuge Island:

These islands provide an area for pedestrian refuge within the roadway. They may be painted or raised; however, raised pedestrian refuge islands provide safety benefits that painted islands may not. This report recommends that such medians be extended into the crosswalk to maximize pedestrian refuge space.

NYCT Subway Operations

Drainage:

At many elevated stations stormwater run-off drains from the elevated structure onto the street accumulates and ponds, creating obstructions for pedestrians and motorists. This report recommends that the run-off be drained directly into the sewer system from the elevated structure. This effort may be accomplished as NYCT plans their station rehabilitations and major capital improvements.

Globe Placement:

An illuminated sphere is sometimes displayed outside a subway entrance to make the entrance visibly recognizable to pedestrians and transit users. Illuminated green globes mark entrances that are open 24 hours a day, and illuminated red globes mark entrances with limited access. It is recommended that some additional entrances be marked with globes.

Concrete Riser.

Highlight Concrete Riser:

The concrete riser at the top or base of subway stairwells should be highlighted with bright orange or yellow thermoplastic, or with a concrete coloring additive. It is important for pedestrians to pay attention to these objects while entering or exiting the subway. NYC Transit is currently testing the use of a coloring additive on concrete risers.

Netting or Bird Repellent:

Netting is sometimes placed beneath elevated structures to prevent birds from perching within the structure and creating sanitation problems on the street below. An alternative to the installation of netting is the application of a non-toxic bird repellent gel directly to the elevated structure. The gel must be reapplied once a year; however, it is less costly than the netting. A third option is to use a low-voltage electronic bird repellent. This option is currently being used at some stations and is included in station renovation projects.

Operation Hours:

The institution of the Metrocard now allows station entrances to be open longer hours without much additional cost to the MTA. In some locations this report recommends the installation of high wheel entrances at subway stations to allow Metrocard access into the stations at all hours.

Paint Elevated Structure:
The elevated structures should be painted a light, reflective color in order to reflect the light and reduce shadows.

Station Entrance Placement:
At some locations the entrance of the station is not placed in the optimal location. This report identifies a very few sites where it is recommended to move the entrances. This type of recommendation is very capital intensive and has only been suggested if an opportunity exists to do it with little difficulty.

NYCT Bus Operations
Bus Pad:
This device is distinctively paved and is used to mark the bus stop in the roadway. Usually concrete is used along the curb lane at the bus stop.

Bus Shelters:
Shelters provide a waiting area, as well as weather protection, for bus passengers and serve as visible indicators of bus stops. It is recommended that narrow shelters recently adopted by DOT be installed in some cases, to ensure that pedestrian traffic is not impeded on the sidewalks.

Bus Stop Relocation:
It is recommended that some bus stops be relocated to reduce pedestrian and vehicular traffic movements from interfering with each other and improve the flow of traffic.

Bus Terminal:
Intermodal stations frequently provide connections to numerous bus lines; however, many of those buses are located in scattered locations around the station, making intermodal transfers difficult for pedestrians. A bus terminal would provide a central location for all buses to queue so that pedestrians may locate their buses quickly and easily. Bus terminals are recommended at only non-centralized intermodal sites that have heavy bus usage.

Standard Bus Signage:
New circular, reflective signs that list the routes servicing the bus stop have been installed. It is recommended that these new signs be installed in additional locations.

Standard Bus Signage.

Orientation Signage
Destination Orientation:
Some of the stations within this study are located in close proximity to tourist sites or other major destinations that attract people who are unfamiliar with the station. These pedestrians, unlike the regular commuter, are not familiar with the local area and would benefit from destination orientation signage.

Transit Orientation:
Some subway stations have signs near their exits that indicate the locations of bus stops. This signage

is important for pedestrians making intermodal trips because they help pedestrians locate the appropriate exit, thereby limiting their contact with vehicles. This report recommends additional locations for this type of signage.

Additionally, in order to ease transfers at intermodal stations, subway, bicycle, and neighborhood maps should be installed at bus shelters near large intermodal subway stations. The neighborhood maps are especially beneficial since they indicate the exact location of all subway entrances.

Subway Signs:
This report recommends the installation of signs that will offer information about the location of subway entrances in the area. This trailblazing signage would be placed within a specified radius of subway entrances. The design and placement of these signs would be subject to MTA review and must involve a maintainance agreement with a BID or local community group.

Traffic Control Signals
All Pedestrian Phase:
This signal timing technique allows pedestrians from all intersection approaches to cross the street at the same time. During this phase vehicular traffic is completely stopped. This type of signal cycle is recommended at locations that have very heavy pedestrian congestion.

Bus-Actuated Signal:
There are several possibilities for achieving signal priority for buses. A bus approaching a traffic signal may extend or advance the cycle to green, through transponders or other electronic communications, to proceed through the intersection if needed to maintain the bus schedule. Another option is for a bus equipped with an automatic vehicle location (AVL) system and advanced radio communications to allow an operations center to determine bus adherence to the schedule and trigger traffic signals when needed. Bus-actuated signals are recommended for certain large intermodal stations or along bus routes that have heavy vehicular congestion, in order to help buses run more efficiently.

Computerized Signal:
Computerizing traffic signals allows the signal timing to be changed from a central location as opposed to dispatching a technician on-site. In addition to allowing variable phasing throughout the day at complicated intersections with numerous approaches, computerized signals allow the timing to be calculated more accurately, thereby providing optimal traffic flow through the intersection. This report recommends that these signals be installed at locations with numerous signals and heavy vehicular congestion.

Cyclist Signal:
If signals are installed where visibility is low, a separate signal may be used for cyclists (MUTCD, pg. 9D.02). At junctions with bike lanes, a separate cyclist signal may be established in order to give cyclists a pre-green signal before vehicles. This would help reduce the number of accidents between motorists and cyclists. Separate cyclist signals may also be used to reduce the green time for cyclists in order to facilitate the flow of turning vehicles (Collection of Cycle Concepts, pg. 86). Cyclist signals are only recommended at intersections along streets included in the *New York City Bicycle Master Plan,* or at locations with a high incidence of bicycle accidents.

Extended Pedestrian Crossing Time:
This technique gives pedestrians additional time during the WALK phase to cross the street after vehicles have stopped. This provides an extended RED phase for vehicles at the end of the signal cycle (as opposed to LPI's, which provide an extended RED phase at the beginning of the signal cycle.) This technique also reduces the pedestrian-vehicular conflict at intersections. This report recommends that pedestrian crossing time be extended at locations that have been identified as having insufficient signal timing for pedestrians.

LED Lighting:
Signals using "Light Emitting Diodes (LED)" are brighter and longer-lasting than signals using regular incandescent bulbs. LED lighting makes the signal much easier to see for pedestrians and motorists. Furthermore, LED lights are energy efficient, consuming 90 to 95 percent less power than regular incandescent bulbs. In addition, this lighting method is cost effective due to its ten-year-average life span, which significantly reduces all labor and operating costs. In accordance with this department's recommendations, NYCDOT has installed this type of lighting at all traffic signals in new York City, including Brooklyn.

Leading Pedestrian Interval:
Signals with a Leading Pedestrian Interval (LPI) have a signal split so that the pedestrian WALK phase precedes the vehicular GREEN phase by a few seconds. The extended RED phase for motorists gives pedestrians a chance to establish themselves in the crosswalk before vehicles turn. This significantly reduces the pedestrian-vehicular conflict that consistently occurs in the crosswalks when pedestrians and vehicles compete for the right-of-way. This report recommends LPIs at locations that have heavy pedestrian congestion and if the signal timing permits.

Signal Placement/New Signal:
In some locations field observations prompted the recommendation for a warrant analysis to determine the need for a new signal where none currently exists.

Universal Pedestrian Signal:
Such signals use illuminated symbols of a walking person (symbolizing WALK) and an upraised hand (symbolizing DON'T WALK) (MUTCD, pg. 4E.01). In accordance with this department's recommendations, NYCDOT has installed universal pedestrian signals throughout New York City, including Brooklyn.

Universal Pedestrian Signal.