

# RETHINKING BOLLARDS

HOW BOLLARDS CAN SAVE LIVES,  
PREVENT INJURIES AND RELIEVE  
TRAFFIC CONGESTION IN NEW YORK CITY



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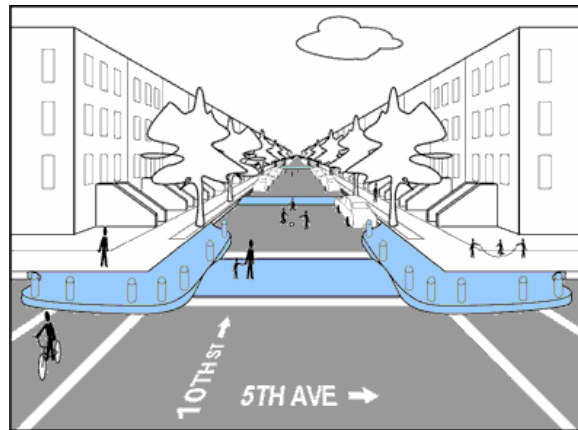
**July 2007**

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## Executive Summary

Each year thousands of pedestrians are injured and hundreds are killed by motorists on New York City streets. As the population of the City increases, and especially as the number of senior citizens increases, there is no better time to implement basic engineering improvements that are proven to calm traffic and prevent crashes. While it may not be possible to put bollards on every block, there are many sensible places that could become standard locations to install them. Areas with high pedestrian volumes, high crash locations, high populations of senior citizens and along bus and truck routes should be prioritized.



*A rendering of a traffic-calmed intersection at 10<sup>th</sup> Street and 5<sup>th</sup> Avenue in Park Slope, Brooklyn. The diagram demonstrates the potential of bollards for defining pedestrian space and protecting pedestrians.*

Like speed humps and sidewalk extensions, bollards are an effective way to calm traffic and protect pedestrians. Though bollards are ubiquitous in other dense pedestrian-oriented cities, they are rarely deployed on the streets of New York. This report presents examples of how bollards are working at a few select locations in New York City, and makes recommendations for a citywide policy to expand the deployment of bollards and other vertical deflectors to protect all street users. Recommendations for bollard use include the following:

- **Experimentation with innovative pedestrian-friendly street designs**
- **Designation of exclusive pedestrian and bicycle areas**
- **Preventative safety measures to manage vehicular flow and calm traffic**
- **Implementation of Bus Rapid Transit (BRT)**
- **Securing bike lanes, paths & greenways**
- **Security for government and financial institutions**
- **Prevention of parking on sidewalks**

While bollards have demonstrated efficacy in these and other applications, New York City has been conservative in their use. Currently, the DOT does not have a set policy to guide their prescription, installation or maintenance. A clearly defined city policy and community support for bollards will help the city and local neighborhood interests move forward in installing them. The use of bollards as a preventative safety measure on the City's streets and sidewalks could dramatically reduce the number of people injured and killed by errant motorists.

## Introduction

New York is known for its walkability and vibrant street life. Yet the threat of traffic and dangerous road conditions are a daily reality for pedestrians and one of the reasons why many New Yorkers choose to drive for short distance trips that could easily be made on foot (22% of citywide driving trips are 1 mile or less in length.) The PlaNYC initiative provides new opportunities to make our streets more inviting for pedestrians and reduce short distance driving. Basic traffic calming measures like speed humps, corner curb extensions and bollards are ideal tools to improve public space and are proven to prevent injuries.

Bollards have a variety of designs and uses. Though their application in New York City is limited, there are several successful examples of their use: three-foot tall metal or cement posts stand on sidewalks protecting infrastructures such as fire hydrants, municipal (Muni) parking meters and phone booths. Elsewhere in the city, bollards manage and direct traffic flow, separate bike lanes from traffic, mark off taxi queuing areas, protect pedestrian space, draw driver's attention to traffic calming measures, prevent vehicles from parking on sidewalks, test roadway redesign and sidewalk widenings and guard against potential terrorist threats. Bollards can be constructed of almost any material and range from the fluorescent orange flexible columns used to direct traffic to large cement planters used to prevent cars from entering an area.

While bollards have demonstrated efficacy in these and other applications, New York City has been conservative in their use. Throughout the world, cities make standard practice of using bollards to narrow turning radii, reduce speeds, widen sidewalks and prevent parking on sidewalks, making their deployment the rule, not the exception. Currently, the DOT does not have a set policy to guide their prescription, installation or maintenance. A clearly defined city policy and community support for bollards will help the city and local neighborhood interests move forward in installing them.



*Stylized bollards on Broadway secure buildings, protect pedestrians and serve as seating. Photo courtesy of Project for Public Spaces.*

Despite their limited use, the following report outlines the different types and applications for bollards at New York City locations which provide us with best practice standards. It also addresses the current needs for bollard installation and the effects these instruments have on the street environment. This report is intended for planning practitioners, urban designers, landscape architects, city agencies, property owners, developers, community groups and anyone interested in safer and more livable cities.

# Bollard Design

A **bollard** is a fixed or flexible object used to delineate an area, prevent vehicles from entering an area or protect an area. Depending on their function, bollards can be designed to give way on minimum impact, or withstand heavy forces. There are as many different types of bollards as there are uses for them.

## Permanent Bollards

**Fixed bollard** (also called *static, architectural or permanent bollards*): Fixed bollards are primarily made of concrete, wood or metal. Its position cannot be adjusted. Fixed bollards are surface mounted or built into the ground.



**Rising bollard** (also called a *retractable bollard*): A rising bollard rises and retracts into the ground automatically when activated by a hand-held remote, a swipe card, or other type of controller. Rising bollards can be electronically, hydraulically or pneumatically driven. Rising bollards allow quick access to emergency or delivery vehicles, or conversely, immediate access restriction in a security emergency.

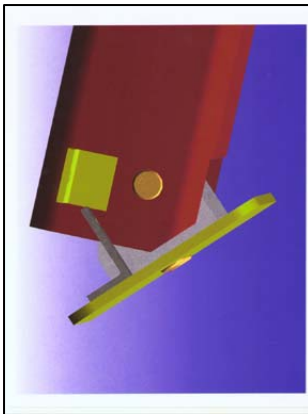
**Security Bollard:** Security bollard are used as anti-terrorism and anti-crime measures and engineered to withstand heavy impacts. They can be fixed or rising.



**Removable bollard:** Removable bollards can be manually lifted out of the ground when unlocked with a key, but have a base that is permanently fixed to the ground.



**Telescopic bollard:** Telescopic bollards 'telescope' in length, and can be manually retracted to street level when unlocked with a key.



**Lay-flat bollard** (also called a *fold-down* or *collapsible bollard*): Lay-flat bollards can be manually dropped to the ground ('lay flat') when unlocked with a key.



**Bell Bollard:** A bell bollard is a short, bell shaped bollard. The bell's slope allows a vehicle's wheel to hit and roll around the bollard, and is useful in areas with frequent U-turns or other tight turning radii.

# Temporary & Flexible Bollards

**Flexible bollard:** A plastic bollard that is bolted to the roadway, but bends and returns to its original position when hit. Flexible bollards are used to test curb line changes, sidewalk widenings, new medians, and channelize traffic. In Europe, permanent flexible bollards are lit inside by recessed bulbs to mark traffic islands and roundabouts.



**Qwick Kurb:** Qwick Kurb is a brand name of a temporary device made of many plastic bollards or paddles strung together into a plastic curb.



**Breakaway bollard:** A bollard or post designed to give way on impact. Intended to deter access, but allow vehicles through in an emergency.

**Planters:** Large planters can also physically demarcate a street, widen sidewalks, and restrict access for motor vehicles. With proper management and funding for maintenance, planters can improve the aesthetics of an area, helping to foster community acceptance of the new curb line or median.



## The Benefits of Bollards

Bollards are widely used throughout Europe, Australia and the United States as a simple, effective, inexpensive way to tame and separate traffic, protect pedestrians, limit vehicle access and test roadway design.

## Opportunities for Great Public Spaces

New York City agencies use bollards to experiment with new street designs. While temporary bollards or planters will not protect pedestrians from wayward vehicles, they are a powerful tool for testing and demonstrating innovative designs, and ultimately making streets safer for pedestrians and cyclists.



In the summer of 2006, the DOT transformed a poorly managed area of Downtown Brooklyn into a pedestrian-only plaza on Willoughby between Pearl and Adams Streets. **The two-block stretch was mainly used as an illegal parking lot for police and court officers' cars**, and these streets carried very few cars as compared to pedestrians. Planters were used to define the space, protect seating areas and enhance the plaza with greenery. This experimental street closure proved to be a huge success and is a prime example of how opportunities for prioritizing pedestrians can work throughout the city.



***Before and After:** Willoughby Street in Downtown Brooklyn has been transformed from an illegal parking lot into a comfortable and inviting public space with tables and chairs, umbrellas and surrounding greenery.*

## Other Examples of Street Redesign Bollards and planters in NYC:

- Times and Herald Square (photo, right) make use of flexible bollards to delineate traffic flow.
- Flexible plastic bollards at Madison Square in Manhattan help to rationalize and improve traffic flow.
- Plastic bollards/posts tested the DOT's Mulry Square redesign.
- DUMBO's Pearl Street pedestrian plaza



## Livable Streets

As a thriving, world-class city, New York's streets should be safe and friendly to all users, including bicyclists, pedestrians, children, seniors and motorists. One way bollards can help make our streets safer is by designating pedestrian and bicycle-only areas and calming traffic.

Bollards are a simple engineering tool to protect pedestrians and cyclists from vehicles, and designate pedestrian areas by blocking vehicular access while allowing pedestrians and cyclists to enter freely between each bollard. Bollards enforce and manage traffic flow 24 hours a day.

In Times Square, pedestrian volumes often force people to spill onto the streets. Stripping the road to extend the sidewalk gives pedestrians more room as they wait for the light, but does not protect them from turning trucks (photo, top right). The addition of plastic bollards offers some protection from wayward vehicles, as evidenced from the scuff marks on the bollards (bottom right). This temporary sidewalk extension is also an example of an inexpensive way to test pedestrian friendly designs. A final build-out of the sidewalk may be complimented by permanent, well-designed bollards.





In Manhattan's West Village, permanent bollards demarcate a pedestrian zone and create the feeling of a small plaza and refuge where several streets converge. By narrowing the roadway, vehicles slow down through the residential area (photo, top left).



Retractable bollards or manually adjustable bollards can be used where it is necessary to allow temporary access. Automatic retractable bollards are the most convenient, but they are also the most expensive and require more maintenance. A bollard system can also use a timer to allow access at certain times of the day. Emergency vehicles may override the timer. Retractable bollards are used at the entrance to Columbia University's campus (photo, bottom left).

### Other Examples of Livable Streets in NYC:

- In Chelsea, the Fashion Institute of Technology (FIT) has created a day-time pedestrian plaza at the center of its campus on West 27<sup>th</sup> Street by installing a barrier at the road's entrance. While any vehicle may still drive through upon request, the barrier serves as a strong deterrent for most drivers. This area serves as a safe and relaxing atmosphere for students to study and socialize.
- Fulton Street in lower Manhattan has been a pedestrian mall during lunch hours for over ten years. The local business improvement organization designed special signs at the street's entrance to designate the area car-free.
- Operable barriers, such as rising bollards, were recommended in the City's 1997 "Lower Manhattan Pedestrian Study" to replace the typical wooden horse or trash can used to close streets to vehicular traffic at midday.

## Traffic Safety & Calming

The most basic and important use of permanent bollards is to provide a physical barrier to protect pedestrians from encroaching vehicles. But they can also be used as a preventative measure to manage vehicular flow and calm traffic. Used in conjunction with neck downs (a.k.a. bulbouts or sidewalk extensions) and other traffic calming measures, bollards alert drivers to the narrowed roadway, and prevent vehicles from mounting the sidewalk and injuring pedestrians.

The DOT installed permanent bollards at this pedestrian island at Grand Army Plaza, Brooklyn shortly before this driver lost control of their vehicle (photo, right). The island is heavily used as a pedestrian refuge by families with young children and seniors accessing Prospect Park, the Brooklyn Library, Museum and other nearby attractions.



Likewise, cement barriers have been installed on pedestrian medians along Broadway on the Upper West Side to protect pedestrians as they wait to finishing crossing the avenue. In the fall of 2006, a taxi driver slammed into a median barrier across the street from the entrance to Columbia University (photo, right). These treatments are proven to save lives and prevent injuries, and should be applied to any areas with high pedestrian volumes, a high rate of vehicle crashes, areas with high concentrations of senior citizens and areas along bus routes.



On Restaurant Row in West Midtown, bollards on neckdowns alert drivers to the curbline change. Together, these treatments calm traffic while giving pedestrians a shorter crossing distance. Because building out sidewalk corners sometimes requires major drainage work, neckdowns can be prohibitively expensive. As a cost-saving measure, bollards can be used alone to physically delineate pedestrian space or to narrow a lane without affecting drainage.

## Other Examples of Traffic Calming & Safety Improvements in NYC:

**Top:** Bollards top new neckdowns at Mulry Square in Manhattan. (Photo courtesy of Project For Public Spaces)

**Middle:** Bell bollards highlight the Houston Street medians and protect pedestrians

**Bottom:** Bollards delineate the tips of the median (pedestrian refuge) on the West Side Highway.

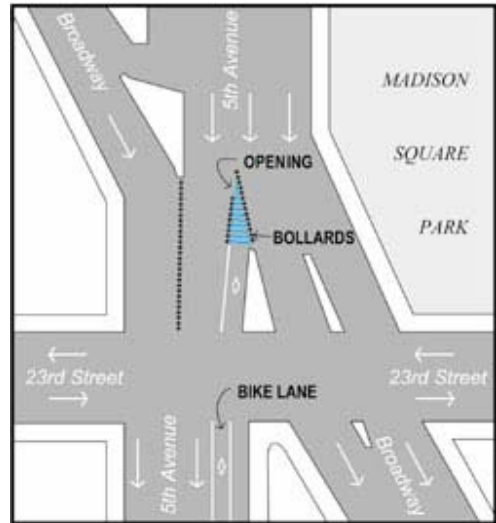


## Traffic Management

Both temporary and permanent bollards can serve several functions in traffic management. Temporary bollards can test channeling, traffic diversions, closures and semi-closures designed to improve the safety and flow of traffic. If those changes prove acceptable, permanent bollards that are more aesthetically appealing can be installed. Flexible bollards are also used widely to create AM/PM contra-flow lanes on bridges and separate lanes of traffic to prevent dangerous maneuvers.

Test bollards and the bollards separating lanes of traffic are generally made from plastic or “Quick Kurb”. Drivers can hit and even drive over them with minimal damage to vehicles. At Madison Square, bollards rationalize traffic at the complex intersection of Fifth Avenue, Broadway and 23<sup>rd</sup> Street (photos, right). They improve traffic flow by channeling cars and reducing confusion, and provide a larger refuge area for pedestrians crossing the seven lanes of oncoming traffic.

Throughout the city, flexible bollards are used at bridge and tunnel access points and to separate turn lanes from through traffic. Local through traffic can continue flowing while drivers waiting to access a bridge, tunnel or turn may queue separately. Examples include Manhattan access to the Queensboro Bridge around 59<sup>th</sup> Street (photo, bottom left) and the Seventh Avenue entrance to Holland Tunnel. Quick Kurb is also used to define a taxi queuing stand at 32<sup>nd</sup> and 7<sup>th</sup> Ave outside Penn Station.



*A photo simulation of Houston Street with a buffered bike lane demonstrates how flexible bollards can be used to delineate different street uses. Separating cyclists from motorists offers an extra level of protection from conflicts.*

## Bus Lanes

Many cities, including Paris, Bogota and Vancouver have implemented Bus Rapid Transit (BRT), a high speed bus system operated within a segregated, dedicated travel lane. These priority bus lanes can use bollards to selectively restrict traffic. If the lane is sectioned off from normal traffic (for example, with plastic bollards or Qwick Kurb), then a retractable bollard placed at the top of the lane will allow only buses and other selected vehicles to use the lane.



*A Priority Bus Lane in Europe*

### **Bus Rapid Transit in New York City**

A Bus Rapid Transit (BRT) pilot program will be tested along five different corridors in New York City. Implementation for the first two routes is slated to begin in the fall of 2007, and in 2008 for the other three corridors. According to the Metropolitan Transportation Authority (MTA), these demonstration corridors will be evaluated on the impact of BRT on general traffic and other bus operations, curb parking restrictions, effects on retail and commercial businesses, station spacing and required street improvements. Flexible bollards or Qwick Kurb should play a key role in testing BRT in New York City.



*Rouen, France*

## Bike Lanes, Paths & Greenways

For cyclists, bollards are an invaluable tool to prevent cars from encroaching on bike lanes, separated paths and greenways. Bollards can also alert and slow cyclists and drivers as they approach a hazardous intersection.

Manhattan's **Hudson River Greenway** is the most heavily used greenway in an urban area in the U.S. and runs adjacent to an eight-lane highway. The greenway's proximity to a major arterial and multiple intersections for vehicles to access riverfront facilities pose a major safety challenge.

*Flexible reflective bollards caution drivers and path users that an intersection is approaching and are a preventative measure against cars entering the path (photo, right). Emergency vehicles are still able to enter the path.*



The styles and specifications of the bollards differ along the Hudson River Greenway and makes for an excellent study area. The use of bollards as both a design and safety feature can be seen throughout the length of the greenway. Flexible plastic bollards are used on the inside of the path, while permanent steel bollards have been installed at path entrances and along the highway median.

After two cyclists were hit and killed on the Hudson River Greenway in the summer and fall of 2006, a task force of agencies was formed to consider permanent bollards on the path to increase the level of safety for cyclists and pedestrians, and at any location where cars cross the greenway.



*At the Intrepid Museum, attractive steel bollards protect the plaza from turning tourist coaches and wayward vehicles, while a flexible bollard alerts users to the path entrance (photo, above left). In Lower Manhattan, the Greenway features permanent steel bollards on both sides to protect path users and secure office buildings (photo, below left).*

### Other examples of Bike Lanes, Paths and Greenways in NYC:

- The Tillary Street bike lane in Downtown Brooklyn is one of the few contra-flow bike lanes in New York City; there is a two-way bike lane on one side of the street. This DOT pilot project has been tested with jersey barriers, and will soon be made permanent with attractive bollards and planters (photo, above right).
- A 1999 Department of City Planning report, *Making Streets Safe ForCycling*, discusses at length the use of flexible plastic bollards in bike lane design.
- In Bronx Park, bollards are used on the Bronx River Greenway as it passes over the Burke Bridge (photo, below right). This bridge has become an important place for people to pause and look at the river that flows beneath it. On a typical summer day there are regular users of the greenway and also those that sit on the benches to read and have their lunch. The bollards were installed so security and maintenance vehicles (which utilize the greenway path) stay clear of people who are sitting on the benches. These bollards also keep people safe by encouraging greenway users (cyclists, roller bladders or runners) to stay on the path while those stopping to enjoy the bridge stay toward the edges that are distinguished as a pedestrian area.



Bollards are an indispensable security device. They can stop a truck at high speeds, and for this reason, they are used at nuclear power plants, embassies, courthouses, the State Department headquarters, the US Supreme Court and military bases around the world.

Since 2001, bollards, barriers and planters have been used extensively throughout New York City to secure government and private institutions. Rows of permanent steel bollards envelop courthouses in Downtown Brooklyn and lower Manhattan, while large cement planters are routinely placed at the entrance to major office buildings. The rapid proliferation of security bollards after September 11<sup>th</sup> demonstrates the ease of installing them. They City could easily make bollards a standard feature for pedestrian safety, which would respond to another daily threat to public safety.



*Security bollards line the sidewalks of Centre Street in Lower Manhattan.*

### **Examples of Security Bollards in NYC:**

- The Downtown Brooklyn Courthouse is surrounded by cement and stainless steel bollards (photo, right). A simple directive from the DOT to install the steel bollards closer to the curb's corner could potentially save a life or prevent injury.
- Part of the Brooklyn Museum's façade redesign includes sleek stainless steel bollards (photo, below right). However, in 2005 five pedestrians were hit by a car on the sidewalk in front of the bollards. Again, with some forethought, security bollards can be installed with pedestrian safety in mind.



## Parking on Sidewalks

Since building owners are responsible for the repair of sidewalks abutting their property, they often request bollards in front of their buildings to prevent vehicles from parking on their sidewalks and guard against the damage caused by the weight of cars and trucks. Sidewalk parking is illegal and a significant problem in New York City, taking away scarce space from pedestrians. Rather than waiting for property owners to request sidewalk bollards, the City should pro-actively seek locations to place bollards at locations where sidewalk parking is prevalent.



*Bollards should be set more narrowly than they are here to prevent drivers from illegally parking on the sidewalk.*

Transportation Alternatives recently released a study on permit parking abuse titled, *Above The Law*, which demonstrated the extent of illegally parked cars with government placards. The greatest obstacle to solving this problem is a lack of enforcement by the New York Police Department. Bollards are an affordable, 24-hour enforcement measure that is preventive rather than punitive.

## Other Uses

The most common use of bollards in New York City is for property protection, such as telephone booths, utility boxes, Muni Meters and fire hydrants. Bollards also protect building corners from cars.

Bollards are also used in commercial parking lots in lieu of an entrance/exit swing arm and in work zones. Brightly colored temporary bollards serve as warning to all types of traffic in construction or utility work zones.



*Bollards protect a Muni Meter and a utility box in Manhattan.*

## Common Concerns

Complaints about bollards are few. Most of the problems people find with them are easily solved. Here are some commonly heard complaints and their solutions:

### 1. Bollards impede people with visual and mobility impairments.

Bollards can and should be spaced so that wheelchairs may pass but vehicles can not. Visually impaired pedestrians are, in most cases, equipped with a method of detecting obstacles, such as a guide dog or cane, and are prepared to encounter a bollard. Bollards should be tall enough to prevent a tripping hazard.



### 2. Bollards interfere with snow plowing.

Countries with heavy snowfall such as Canada, Denmark, Norway and Sweden routinely use bollards both on sidewalks and streets. Proper management of areas sectioned off by bollards should be determined and implemented.



### 3. Permanent steel bollards cause damage to vehicles

While bollards are a boon for pedestrian safety, DOT engineers have limited bollard installation because they perceive them as dangerous to vehicles and their drivers. The DOT's stated fear is that a driver hitting a bollard could cause damage to the car, or even cause injury or death, and the City could be held liable.



**Top:** Bollards are spaced to prevent vehicles, but allow access for the disabled.

**Middle:** When installed correctly, bollards do not interfere with snow plowing.

**Bottom:** Bollards absorb impacts that otherwise might have been meant for pedestrians.

As this report demonstrates, there are dozens of successful examples of safe, common sense applications for bollards in New York City. Bollards are no different than street lights, posts or trees that already line our streets. Cars will only come in contact with bollards if they waver out of their lane. Thus, if a bollard is hit, it is preventing injuries and saving lives.

Cars mounting sidewalks is a widely publicized problem in New York City, injuring and killing scores of people each year (see Appendix for articles), and bollards are a proven solution to this problem. According to records kept by the NY State Department of Motor Vehicles, about 10% of New York City pedestrians struck by cars are actually hit off road on the sidewalk or inside their homes.

Reflectors or lights on bollards alert and warn drivers of bollards' location. If a car collides with a fixed bollard, drivers are protected by thousands of pounds of steel. Potential injury to passengers and drivers is much less severe than potential injury to unprotected pedestrians and cyclists who would be struck if there were no bollard.

Where pedestrian safety is not the primary goal of bollard use (such as in lane separation or testing street redesign), plastic bollards, which cause little or no damage to vehicles and their drivers, are used.

#### **4. Retractable bollards cause damage to vehicles.**

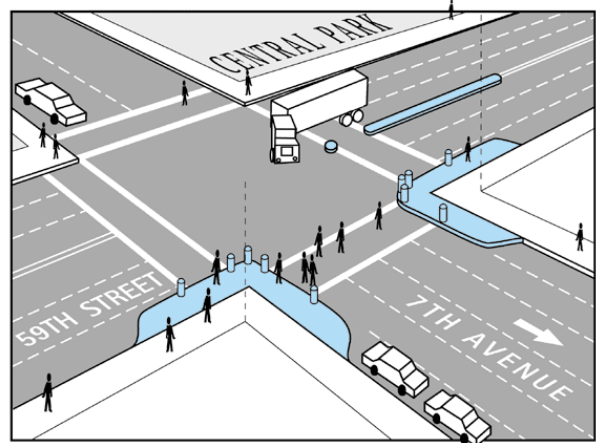
Retractable bollards can cause damage to a vehicle if it passes over the bollard as it rises from the ground. However, the simple installation of an inductive loop in the road prevents a bollard from rising with a vehicle overhead. The coil of wire is embedded in the street surface to detect the presence of a driver above. In addition, the City should also clearly indicate the presence of the bollard, post the time bollards rise if they are set to a timer, and install lights to alert drivers when bollards are about to rise.



*The traffic light in the upper right hand corner warns drivers when these retractable bollards rise.*

## Towards Uniform Bollard Policy in NYC

Bollards have been used most extensively in New York City, especially post September 11<sup>th</sup>, as a security measure. Security bollards are now an integrated part of the urban landscape in this new security conscious era. The potential to deploy bollards to protect pedestrians and enhance our public spaces, however, remains severely underexploited. The City DOT, in partnership with property owners, developers and professional planners should take the opportunity to improve pedestrian safety and public space throughout New York, using bollards to test and implement progressive street and intersection re-design techniques.



*Above: A T.A.-backed plan for neckdowns with bollards at 59<sup>th</sup> St. and 5<sup>th</sup> Ave. in Manhattan where two elderly women were killed simultaneously.*

Without an existing city policy, there is no consensus among stakeholders on what is or is not possible or acceptable, and this information vacuum leaves individual engineers and planners free to make up their own policy on an ad hoc basis, or dismiss bollard use because there is no guiding document. Residents will often be told that what has been done in another area of the city is impossible in their neighborhood, simply because the project has a different engineer or planner who has a different idea as to the purpose and appropriateness of bollards.

In regards to policy, engineers and planners usually reference The American Association of Highway Transportation Officials' (AASHTO) *A Policy on Geometric Design of Highways and Streets*. However, these design guidelines are most often aimed at suburban and limited access highway conditions, and AASHTO's *Roadside Design Guidelines* readily admits this weakness. Rather than follow guidelines meant for lower density suburban areas, NYC DOT should consider developing a policy appropriate for New York City's highly pedestrianized, urban environment.

In formulating a bollard policy, the City DOT must take the needs of New York City's walking majority into account, along with the needs of all street users. Millions of pedestrians rely on those who design and maintain the streets to ensure that a journey by foot is as safe as one by car. As the PlaNYC initiatives on pedestrian plazas and other walking-oriented transportation projects gain momentum, there has never been a better time to integrate a cohesive citywide bollard policy.

## Appendix A: Links

### **Bollard Systems and Best Practices:**

Slide Show about a variety of bollards, their uses and how they work from German company Elektro-Elektronik Pranjic:

[http://www.eep.de/Englisch/Intern/Projekte\\_Verkehr.htm](http://www.eep.de/Englisch/Intern/Projekte_Verkehr.htm)

The Institute of Transportation Engineers (ITE) neighborhood traffic management book:

<http://www.ite.org/traffic/soartm/Chapter5.pdf>

Federal Highway Administration (FHWA) discussion of bollards as temporary traffic calming treatment:

<http://ntl.bts.gov/DOCS/bikeped.html>

U.K. Department of Transport, Rising Bollards:

<http://www.dft.gov.uk/pgr/roads/tpm/tal/signsandsignals/risingbollards>

### **Examples of Bollard Types:**

Assortment of bollard types from Wausau Tile:

<http://www.wausautile.com/index.cfm/choice/TerraForm/page/Bollards/family/6/product/y/id/29>

Gallery of security bollards and barriers from Brigham Scully:

<http://www.brighamscully.com/photos/pde.html>

Examples of gourmet fixed bollards from Urban Accessories:

<http://www.urbanaccessories.com/bollards1.htm>

Examples of plastic flexible posts from Qwick Kurb:

<http://www.qwickkurb.com/index.htm>

Examples of bollards designed for pedestrianization schemes and bus priority from Access Control:

<http://www.access-control.co.uk/retracta.htm>

Examples of collapsible bollards from Traffic Guard:

<http://www.trafficguard.net/collapsible/index.html>

Examples of bollards for lighting from Illuminator Wholesaler:

<http://www.illuminatorwholesaler.com/bollards.html>

## **Bollards at Work:**

Berkeley, California.. Bollards as traffic calming devices:

<http://www.ci.berkeley.ca.us/transportation/TrafficCalming/TCinBerkeley.html>

High Wycombe, England (ATG company website). Bus Priority and Pedestrianization:

<http://www.atg-access.com/bus.htm>

Nottinghamshire, England. Pedestrianization scheme using automatic rising bollards (search for 'bollards' on the home page):

<http://utc.nottscc.gov.uk/ttisarb.htm>

Covent Garden, London, England. Bollards in town plan:

<http://www.cgareatrust.org.uk/PDF/07%20Space%20Between%20Buildings.pdf>

Swords, Ireland. Bollards to prevent parking on footpaths:

<http://www.fingalcoco.ie/minutes/1999/fr/1208/fr19990717.htm>

Portland, Oregon. Trail Intersection Improvements:

[http://www.walkinginfo.org/pedsafe/casestudy.cfm?CS\\_NUM=32](http://www.walkinginfo.org/pedsafe/casestudy.cfm?CS_NUM=32)

## Appendix B: Bollard Vendors

### Security bollards

*Delta Scientific – Security Bollards*

Eastern Region U.S.A.

7902 A, Hill Park Court

Lorton, VA 22079

Phone (703) 541-9114

Email: [info@DeltaScientific.com](mailto:info@DeltaScientific.com)

Web: [deltascientific.com/](http://deltascientific.com/)

### Temporary curbing

**QWICK KURB<sup>®</sup>, INC.**

1916 US 41 South

Ruskin, FL 33570

Phone: 800-324-8734

Email: [qwickkurb@ithink.net](mailto:qwickkurb@ithink.net)

Web: [qwickkurb.com/](http://qwickkurb.com/)

### Rising bollards with AVI technology

*ATG Access*

Automation House

Lowton Business Park

Newton Road, Lowton St. Mary's

Warrington WA3 2AP, England

Phone: 01942 685522

Email: [sales.access@atgholdings.com](mailto:sales.access@atgholdings.com)

Web: [atg-access.com/](http://atg-access.com/)

### Rising bollards with AVI technology

*Elektro Elektronik Pranjic*

Hauptstrasse 380

D - 44649 Herne

Phone.: +49 23 25 - 79 11 67

Email: [info@eep.de](mailto:info@eep.de)

Web: [eep.de/Englisch/Intern/Projekte\\_Verkehr.htm](http://eep.de/Englisch/Intern/Projekte_Verkehr.htm)

### Classic Style Bollards (including bell bollards)

100% Recyclable Cast Iron Bollards

*Furnitubes*

Meridian House, Royal Hill

Greenwich, London [SE10.8RD](http://SE10.8RD)

Phone: 020 8378 3200

Email: [sales@furnitubes.com](mailto:sales@furnitubes.com)

Web: [furnitubes.com/bollards-cast-iron-aluminium.php](http://furnitubes.com/bollards-cast-iron-aluminium.php)

### Fixed and Removable Security Bollards

*American Anti Ram*

541 Eastpark Court

Sandston, VA 23150

Phone: (804) 737-1825

Email: [sales@americanantiram.com](mailto:sales@americanantiram.com)

Web: [americanantiram.com/](http://americanantiram.com/)

### Bollards and Planters

*Wausau Tile, Inc.*

PO Box 1520 Wausau, WI 54402-1520

Phone: (715) 359-3121

Toll Free: (800) 388-8728

Email: [wtile@wausautile.com](mailto:wtile@wausautile.com)

Web: [wausautile.com](http://wausautile.com)

### Bollard varieties

*Creative Pipe, Inc.*

P.O. Box 2458 | Rancho Mirage, California

92270-1087 USA

Toll Free: 1.800.644.8467 | Telephone:

760.340.5555 | Fax: 760.340.5883

Email: [sales@creativepipe.com](mailto:sales@creativepipe.com)

Web: [creativepipe.com/](http://creativepipe.com/)

## Appendix C: Sample NYC Bollard Locations

Location	Borough	Type/Use
The United States Courthouse at Foley Square	Manhattan	Permanent bollards
Times Square	Manhattan	Bollards mark bike lane
Madison Square	Manhattan	Qwick Kurb
Herald Square	Manhattan	Bollards and planters mark bike lane
Greeley Square	Manhattan	Planters widen sidewalk
Hudson River Greenway	Manhattan	Plastic bollards slow bikes at intersections
Jane Street	Manhattan	Permanent bollards close street and force turns
East River Esplanade	Manhattan	Permanent bollards
Ericsson Place (Hudson Street and Hubert Street)	Manhattan	Permanent bollards define pedestrian space at Tribeca park edge
Varick Street and Broome Street	Manhattan	Flexible bollards separate traffic for Holland Tunnel entrance
59 <sup>th</sup> Street and 3rd Avenue	Manhattan	Flexible bollards separate right hand turn lanes
Columbus Circle	Manhattan	Permanent bollards protect sidewalk
50 <sup>th</sup> Street (6 <sup>th</sup> & 7 <sup>th</sup> Ave)	Manhattan	Permanent planters within set back
Mulry Square	Manhattan	Permanent, marking neckdown
Rockefeller Center	Manhattan	Removable bollards block Rockefeller Plaza from vehicles
Fulton Street, South Street Seaport	Manhattan	Permanent and manual bollards mark off pedestrian mall
City Hall	Manhattan	Retractable bollards at gates
Sunnyside	Queens	Pedestrian space
Ditmas Park Historic District, E. 17 <sup>th</sup> Street	Brooklyn	Permanent bollards line landscaped medians
DUMBO Pearl Street Pedestrian Plaza	Brooklyn	Planters surround new pedestrian plaza
Fulton Mall	Brooklyn	Permanent bollards at different set backs on sidewalk separate delivery vehicles and pedestrians
Tillary St. median at Adams Street	Brooklyn	Bollard on new expanded median
Willoughby Plaza at Adams Street	Brooklyn	Planters surround pedestrian plaza
Fordham Plaza	Bronx	Permanent bollards separate bus and pedestrian traffic
Westchester Square	Bronx	Permanent bollards protect the park edge