Bicycle Parking System Assessment

There are a large number of bicycle parking systems on the market today, each asserting that they are the best product. After extensive research, the following designs were selected because they met the basic safety standards set by CDOT and they were practical and implementable in New York City. Each selected design provides users with the opportunity to lock their bicycles to the rack at multiple points. They are constructed of durable, high quality materials and they are not easily compromised by pipe cutters and other hand tools. The cost of a product is also an important determining factor regarding implementation. However, this study looks at the rack design and not specific brands or manufacturers to determine feasibility. Many of the manufacturers provided price lists based upon the number of units purchased. In most cases, the greater the number of units purchased, the less expensive the cost per unit is.

The Bicycle Parking Systems evaluated were:

1. Inverted “U” Rack
2. Wave Rack
3. Multiple “U” Rack
4. X-Type Tree Guard
5. Spacepod Racks
6. Parking Meter Retrofitted Bicycle Racks
7. 2-Tier Racks
8. Bike Lockers
9. Curb Extensions & On-Street Bicycle Racks

Inverted "U" Rack

The inverted "U" rack became popular in the 1980's and remains one of the most widely used racks by cyclists today. The standard inverted "U" rack design is a minimum of 30 inches long and 36 inches in length. Smaller dimensions would not provide sufficient support to the bicycle. Typically, two bikes can be parked on opposite sides of the rack and will not create a problem for either the bicycle or its users. The inverted "U" rack provides sufficient stability to prevent the bicycle from tipping over, and allows the front and rear wheels to be locked separately or together to the rack using a U-lock or chain. Placement of the inverted "U" racks should provide easy and independent access to the bicycle. The inverted "U" is widely recommended as the standard rack in areas where space is limited. Because of its narrow design, the inverted "U" rack is ideal for sidewalk placements where bicycles can be parked securely in a uniform fashion and not impede pedestrian traffic. The rack should be placed along routes where they are clearly visible. The site should be frequented by moderate to heavy foot traffic to discourage theft and minimize vandalism. The most secure method of installation is in-ground where the rack is embedded into the surface and secured using metal bolts and concrete.

City Racks Inverted "U" rack located on a Manhattan sidewalk

CityRacks Inverted "U" rack located at the 7th Avenue subway station in Brooklyn

Wave Rack

The wave rack is designed to hold a large number of bicycles. The number of bicycles that each rack can accommodate depends on the specific dimensions. On average each wave rack can hold at least four bicycles. While the wave rack can feasibly accommodate at least four bicycles, the rack does not adequately support the bike frame and allows for only one wheel to be locked. Because the wave rack does not support the frame of the bicycle properly, many users have resorted to locking their bikes parallel to the wave rack as if it were an inverted "U" rather than perpendicular, thereby reducing the overall number of bikes each rack can hold.

The wave rack can be made with 2" square steel tubing to help reduce the possibility of theft unlike the round tubing. Many cycling organizations have complained that the wave rack does not accommodate as many bicycles as manufacturers claim, (five bikes on the standard wave rack). Despite misuse, the wave rack remains popular among municipalities because it is relatively inexpensive and require very little maintenance.

CityRacks Wave rack located at City Hall subway station in Manhattan

Wave rack located at the Douglaston LIRR station in Queens

Multiple "U" Rack

The multiple "U" rack is a series of inverted "U" racks fitted together along two parallel rails to provide parking for multiple bicycles in the same space. This "ganged" design is highly recommended because it accommodates several bikes and provides two points of contact for the bike to be locked. The rack offers protection and stability to the bicycle's frame and wheels. Multiple "U" racks can accommodate more bicycles per square foot than many other racks in an efficient manner.

There are two ways to install this rack, the surface mount and the in-ground mounting. The surface mount allows the rack to be secured to the surface to the using an anchor that is fastened using tamper resistant screws into cement. The in-ground installation is available in concrete, asphalt, or brick. The rack's tubing, depending on the manufacturer, can be either round or square. The rack is durable, inexpensive and requires little maintenance.

Welle Series Multiple "U" rack manufactured by Bikeparking.com

A Multiple "U" rack provided by DCAS for New York City employee use

The X-Type Tree Guard

In response to an international design competition sponsored by Trees New York to create a bicycle rack whose function was not only to store bicycles but to serve as a tree guard, the X-Type tree guard was invented in 1999. Created by James G. Smith, the X-Type tree guard was designed to offer both protection to the tree and provide bicycle parking on three of the four sides of a tree pit. The X-Type bicycle rack is made of steel and finished with a black powder coat to ensure that it can withstand heavy use and variable weather conditions. The rack promotes environmental responsibility by eliminating contact made with the tree by bicycles.

The X-Type rack is a simple arching form that can accommodate the commonly used U-lock of a chain. The base can be ordered with flanges that accommodate three drive screws, or without flanges (to be sunk into concrete footings). The X-Type tree guard is an innovative design that fits form and function. The drawback to this rack system is the required customization. Because the size of a tree pit may vary, it requires the unit to be made to fit each individual pit, resulting higher manufacturing costs. Because of the higher production costs, the manufacturer encourages bulk orders to control costs and maximize productivity.

Left: Front view of the X-Type Tree Guard rack;

Right: Side view of the X-Type Tree Guard rack

Vertical Bicycle Parking

Vertical bike parking is an innovative design that allows bicycles to be secured between a 70 and 90 degree angle depending on the model. This design is ideal for areas with limited available space and high demand for bicycle parking. The key concept of this bicycle parking system is to both support the bicycles vertically allowing bicycles to be stored in awkward or underutilized areas and making the best possible use of space. Depending on the manufacturer, bicycles locked vertically can be supported by its rear wheel or the frame of the bicycle. Most vertical bicycle parking systems can accommodate the U-lock or a chain. For proper installation vertical bicycle parking systems require a solid level concrete base of in-ground installation. If in ground installation is not available, some models can be wall mounted, requiring a structurally sound supporting wall.

The downside to vertically parking bicycles is having to lift the bicycle onto the rack. Many manufacturers have circumvented this issue by designing their racks with a lever system to raise the bicycle onto the rack or have designed the rack with a ramp allowing users to roll the bicycle into position. The vertical bicycle rack is a novel idea that would work well in New York City where space is limited. Regrettably, preparing locations for installation and the necessary maintenance of the racks make this system costly for widespread use.

Spacepod manufactured by Cyclepod:
www.cyclepods.co.uk/wallpods.htm

The Ultra Space Saver manufactured by Dero:
www.dero.com

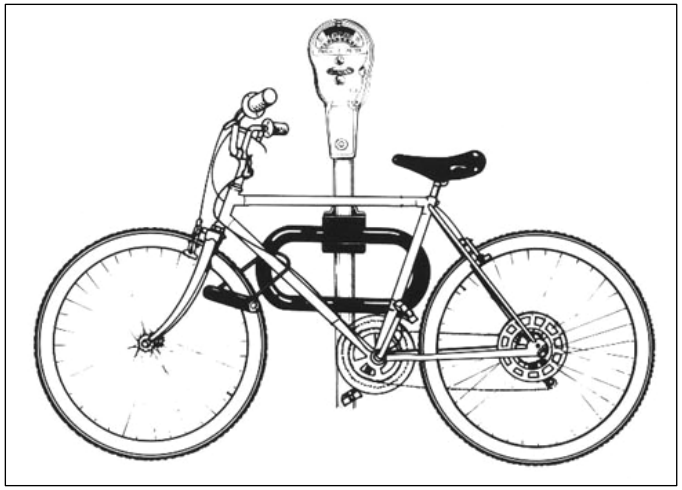
Parking Meter Retrofitted Bicycle Rack

Currently, New York is in the process of removing manual parking meters in neighborhoods throughout the city. The manual meter is being replaced by an electronic meter that accepts credit cards and requires one meter for multiple parking spaces.

Once the manual meters are out of service it is presumed that they will be removed from the sidewalk and disposed of. The parking meter bike rack reuses the post from the manual meter, and with minor alterations transforms an old parking meter into a bicycle rack. The concept of retrofitting a parking meter into a bicycle rack is innovative and makes use of existing street furniture. Each converted meter can accommodate two bicycles using a U-lock or chain. They are designed to allow clearance for car doors and should not obstruct the normal flow of pedestrian activity. Retrofitted parking meters are a fairly inexpensive option. According to a report from the City of Oakland, a retrofitted parking meter pole/bicycle rack costs about as much as installing a new, inverted "U" rack. It also requires little to no maintenance and should remain in working condition for at least 10 years.

Despite the feasibility of the converted parking meter, manufacturers are designing the bicycle racks with round tubing making the rack susceptible to pipe cutters. The alternative is to design the racks using square tubing, thereby increasing its security and compatibility to the CDOT *CityRacks* standards.

Meter Hitch manufactured by Dero: www.dero.com



Oval-Lok manufactured by Sunshine U-Lok Corporation

2 Tiered Rack Systems

The 2-tiered bicycle rack design is a feasible option when demand for bicycle parking is high, space is limited and there is ample height clearance. The major advantage to this rack is its space saving potential because the bicycles are stored in a bi-level system. This system is ideal for transit locations where high density bicycle parking is needed. There is little to no maintenance required. The ease of use depends on the cyclist's ability to lift the bicycle on to the rack to store it securely. Some designs come equipped with a lever that comes down to ground level. The bicycle is then rolled on to the lever and lever is pushed back into place. Other designs require users to lift the bicycle without any assistance, limiting the number of users who can utilize the parking. Another possible drawback of this design is that users can bump their heads on the upper racks. Once in place the user can lock the bicycle in place using a u-lock or chain.

The ideal placement for the double decker system is an indoor location, such as inside a subway station or in a covered area. These racks must be installed on a level, high-quality concrete floor/pavement, using expansion bolts. The 2 tiered bicycle system has been successfully installed in the Chicago Bikestation as well as the Seattle Bikestation.

Left: The Josta 2-Tiered bicycle parking system used for indoor bicycle parking: www.josta.de

Right: A 2-Tiered hydraulic bicycle rack at a transit station in Taipei, China: www.trtc.com.tw

Bicycle Lockers

Bike lockers are stand-alone enclosures, generally designed to hold one bicycle per unit. Bicycle lockers generally come in two types of configurations: horizontal and vertical. Lockers are possibly the most secure option for long-term bicycle parking and storage. Bicycle lockers are usually constructed of metal and/or high-strength plastic resin to protect bicycles from inclement weather conditions and vandalism. Users will not have to worry about returning to a wet seat, or a stolen bicycle after their commute. It also takes less time to place a bicycle in a locker than it does to lock a bicycle to a rack. One shortcoming of the locker system is that since it generally stores one or two bicycles, it is less efficient at saving space than other bicycle parking options.

Square shaped opaque bicycle locker

Due to growing security concerns, municipalities have become hesitant to install bicycle lockers. In some cases homeless people have been found sleeping inside of the lockers. Manufacturers as a result, have designed new bicycle lockers with transparent sides to allow security personnel to easily view the locker's contents and minimize security threats.

There are two types of bicycle lockers. There are coin operated lockers that are rented on a daily basis, and there are digital lockers that use a smart card and require a membership. Though reasonably secure, coin operated lockers can become a target of theft. Video surveillance can be installed at locker locations to mitigate this problem, but that would further increase the cost to maintain the lockers. When using a digital locker, the cost of locker is automatically debited from the card, eliminating the need for cash. The digital system is easier to use and has lower administrative costs because all repairs and servicing are done off site.

Wedge shaped See-Thru bicycle locker

Curb Extensions and On-Street Bicycle Racks

Curb extensions generally consist of widening an existing sidewalk at an intersection, which will reduce the roadway width and calm traffic while at the same time providing space for the installation of bicycle racks. Construction costs for curb extensions are rather high, ranging from $5,000 to $25,000 depending on the design and the need to reconfigure sewer drains and other infrastructure to accommodate the extended curb. An economical alternative to the curb extension is the on-street bicycle rack (bike oasis/corral) that is installed adjacent to the curb. This option uses the same concept as the curb extension but does not require major construction. To create a bike corral, a few on-street parking spaces are removed and replaced with bicycle racks. Bumpers, bollards/barriers, or even paint can be used to block off the designated on-street area for bicycles. This requires minimal construction and maintenance. Relocating drainage is no longer a concern, further minimizing the cost. The total cost for the installation of bike corral varies depending on the materials used as a buffer on the roadway. This concept has been used in several cities in California, including Berkeley and San Francisco.

Bicycle Oasis in Munich, Germany

Bike Oasis in Portland, Or.

In 2007, the L subway station at Bedford Avenue (and North 7th Street) became the first place in New York City where parking spaces were removed and the curb extended to accommodate bicycle racks. The Bedford Avenue station has become a popular park-and-ride location for numerous bike commuters in recent years. The bicycle rack curb extension at the Bedford Avenue L subway station was originally proposed in the 1999 *NYCDCP New York City Bicycle Parking Needs* report. In 2004, the city received numerous complaints of bicycles blocking the crowded, narrow sidewalks in Williamsburg. In addition, there were also numerous reports of bicycles being seized from street furniture by NYPD. The sidewalk on North 7th Street at the southeastern station entrance had limited circulation space for pedestrians. There were about 10 existing bicycle racks that lined the sidewalk on North 7th Street between Bedford and Driggs Avenues, but they were insufficient at meeting the demand for bicycle parking in the Williamsburg area.

In response, CDOT preformed a streetscape renovation and extended a 76' section of sidewalk by five feet and installed nine *CityRacks* at the southeast corner of the Bedford Avenue and North 7th Street. With the elimination of two or three parking spaces, the new racks created enough space to accommodate 32 bicycles and the racks are always full. There was little community opposition over the loss of the parking spaces. The entire project cost about $32,000.

Above & Below: Curb Extensions at Bedford Avenue (L) subway station in Brooklyn

Bicycle Parking Possibilities in NYC

The bicycle parking described in this section are innovative bicycle parking systems that can accommodate a large number of bicycles with integrated environmentally-friendly technology. These bicycle parking systems are practical and can be put to use in New York City as the popularity of cycling increases. The cost of each system varies based upon the type of installation and the needed maintenance. The following bicycle parking systems are intended for long term implementation with the potential to pay for itself over time.

Bicycle Cages

The bicycle cage is not a new concept, however in New York City where space is limited installing this type of bicycle parking can prove to be a very challenging task. The bicycle cage is a customizable bicycle parking enclosure designed to fit within the provided space. The number of bicycles and the type of bicycle parking that a cage can accommodate is dependent on the allowable space. Users simply access the cage using a smart card or key fob. Once inside the bicycle can be locked to an available rack using a standard U-lock or chain.

One of the first bicycle cages installed in the United States was at the Alewife Station in Cambridge, Massachusetts in the Fall of 2008. The bicycle cages can accommodate a total of 300 bicycles. The cage provides high security, sheltered bicycle parking all while remaining unattended. Equipped with closed circuit cameras, proper lighting, high security chain link fence and locks, users are made to feel confident that when they return their bicycle will still be there. To enter the cage users tap their Bike Charlie Carda card, similar the Metro card in New York City on a magnetic plate on the door. Payment is not required to enter the bicycle cage. However, once money is added to the Bike Charlie Card it doubles as a transit pass to access the subway station.

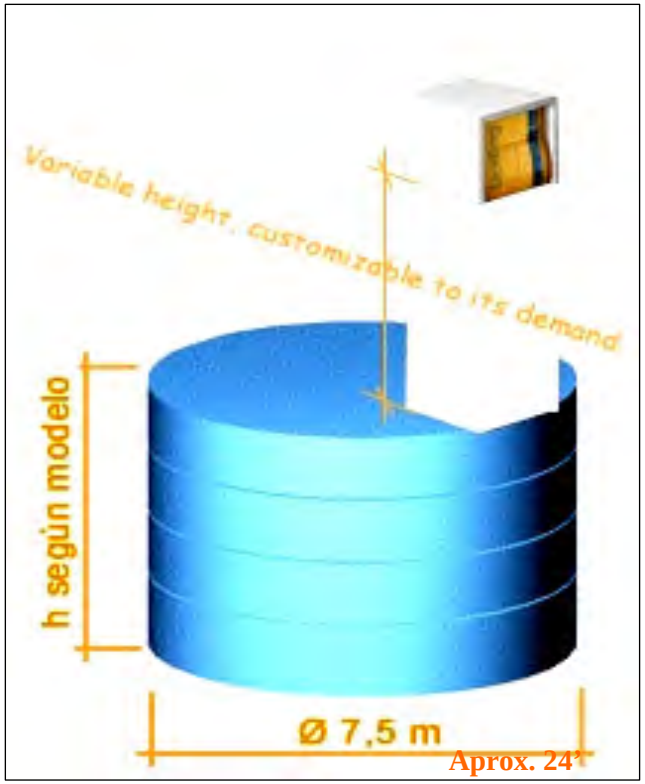
The advantage to the bicycle cage is that it requires very little maintenance and the turnover time between design and installation is very short. The disadvantage to the bicycle cage is the amount of space needed to get the maximum use. Although the bicycle cage is customized to fit any given space, the ultimate goal is to be able to store a large number of bicycles. If the size of the cage is not large enough, the cost of installation and land space will greatly outweigh the benefit of provide bicycle parking.

Above: The Alewife Station bicycle cage
Right: The *Bike Charlie Card* used to access the bicycle cage
(both images courtesy of www.MBTA.com)

Biceberg

The Biceberg is an underground automated bicycle parking system currently used in Barcelona, Amsterdam, and Copenhagen. The *Biceberg* is approximately 24ft in diameter and can accommodate up to 92 bicycles. The *Biceberg* is composed of disc shaped compartments, each designed to store 23 bicycles. Depending on the available space and the number of bicycles needed to be stored, the compartments are stacked on top of each other up to a maximum of four compartments. The *Biceberg* that holds up to 92 bicycles occupies the equivalent to about four car parking spaces on two floors. The advantage to the *Biceberg* being placed underground is that it occupies very little sidewalk space and minimizing potential conflicts with pedestrian traffic.

It takes less time to place a bicycle into Biceberg than locking a bicycle on a standard inverted "U" rack. A smart chip card is used to operate the *Biceberg.* All of the user's information and bicycle location is recorded and stored on the card eliminating the need to remember a password. After the user swipes the card, the door opens, the bicycle is placed into the *Biceberg*, the door then closes immediately and places the bicycle onto a lift, which lowers and places the bicycle in a storage compartment. The bicycle is then later retrieved by swiping the smart-chip card. It takes only 30 seconds for *Biceberg* to retrieve the bicycle. Bicycles are completely protected from vandalism, as well as poor weather conditions. *Biceberg* can also store additional items like helmets and backpacks.



Dimensions of the Biceberg; The height of the unit varies upon the available space and the number bicycles needed to accommodate

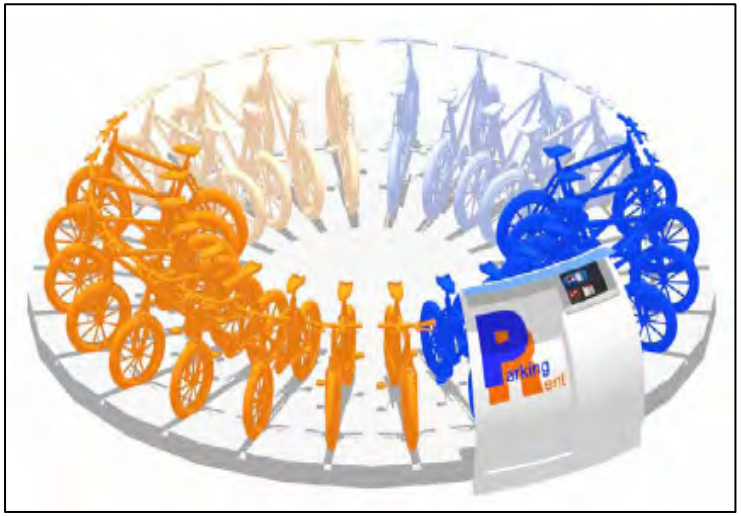
To install the *Biceberg,* excavation is needed to house each compartment and its electrical components. Once in place, the compartments are covered with soil and the surface is returned to it previous condition. The bicycle receiving room, similar to an elevator is installed at street level and the *Biceberg* is ready for use. The excavation process and the electrical connections are the most costly components of the Biceberg installation. The system could pay for itself in the long-term, since users would pay to store their bicycles. Biceberg can also be funded through advertisements on the surface infrastructure. Biceberg is one of the most secure options for future, long-term bicycle parking and storage. The cost of operation and maintenance on the *Biceberg* would minimal with proper use particularly since the system is completely automated. The drawback to this long-term option is the high installation costs.

In the long term the Biceberg would be considered to be a viable bicycle parking system in New York City because it occupies a minimum amount of sidewalk space while maintaining a high capacity of bicycle storage. The under utilized mezzanine space found in many subway stations throughout the city would be an ideal site to place the Biceberg. Because the space is already hollowed out, excavation would be limited. A transparent cover could be built to store the pods and passengers could watch as users on the street level deposit and retrieve their bicycles. If installed in New York City sufficient signage and educational campaigns would be needed for the successful implementation of this bicycle parking system.

Street view of the Biceberg

Bigloo

Bigloo is a sustainable, secure parking and rental system for bicycles. It is an automated system, similar to *Biceberg* and is in use in several European cities. Like *Biceberg*, the system is very easy to use, but in the United States may not be easily recognized as bicycle parking. Adequate signage and education campaigns would be needed for successful implementation of this option. It takes even less time to deposit and retrieve a bicycle from *Bigloo* than *Biceberg*. *Bigloo* can store and return bikes to street level in under 10 seconds. One of the advantages of the *Bigloo* is that the user does not need to remember where they parked their bicycle. *Bigloo* is an intelligent system that also uses a smart chip card that stores user's information. The system is equipped with a radar systems and artificial vision which it uses to park and retrieve bicycles. Bicycles are protected from vandalism, and inclement weather conditions. Additional items like helmets can also be stored in the *Bigloo*.



Above: Interior view of the B-igloo

Below: Exterior view of the B-igloo

The disadvantages of *Bigloo* are that it occupies a great deal of space and it is very expensive. *Bigloo* can be equipped with components that allow it to use solar and wind energy, making it one of the most sustainable and secure bicycle parking systems. This sustainable technology will also help minimize operational costs. In addition, the *Bigloo* can also be funded through advertisements. The *Bigloo* can store up to 24 bicycles. The basic dimensions of the installation are 23ft in diameter and a maximum height of 6.2ft. The access space and the level floor of the platform allow bicycles of up to 4ft in height and handlebars of 3ft wide to be parked.

Case Studies – Existing Conditions & Recommendations

In order to convey the benefits of using site specific bicycle parking to meet the needs of its users within variable conditions, this report includes nine case studies to help visualize the existing conditions and see how the space would look and function with the recommended bicycle parking. These nine cases studies were selected from the 239 transit station surveyed for this study. In some cases, few changes were needed to meet existing bicycle parking needs. There were some locations that provided opportunities for more innovative and creative approaches to bicycle parking within the constraints of subway station structures. In addition to the recommended bicycle parking systems, each station should be outfitted with signs directing cyclists to the parking location, an illustration showing how to properly use each bicycle parking system, and signage that absolves the managing agency from litigation in the event a bicycle is damaged or stolen. Where possible, the stations recommended for indoor bicycle parking should also be equipped with cameras that are linked to the MTA's existing security system for the monitoring of the bicycle parking areas. Signs should be posted to reassure users that their property is safe. Finally, at the Spuyten Duyvil station along the Metro North in the Bronx where cyclists will be sharing the road with drivers, "Share the Road" signs should be posted to make drivers more aware of cyclists' presence. *(See Appendix E)*

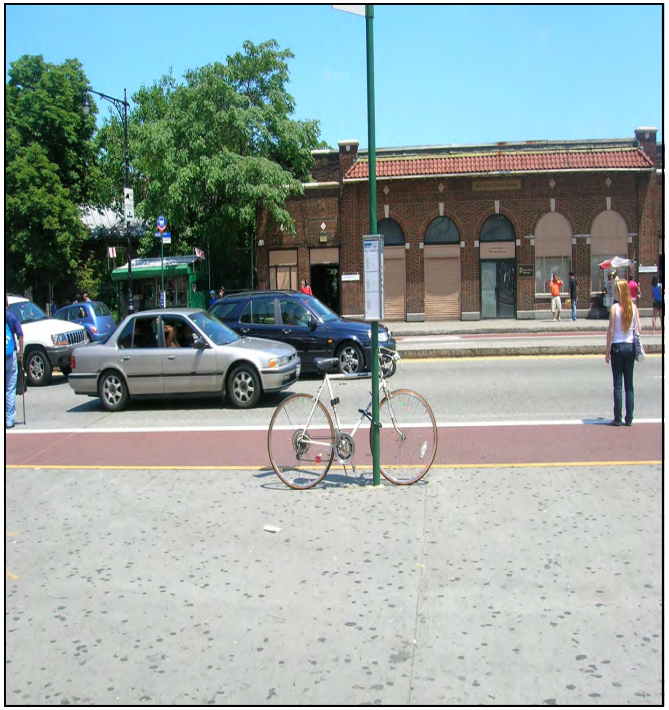
*The drawings used in this section are to illustrate the placement of each bicycle parking system and are not to scale

Fordham Station, Metro North, The Bronx - The Multiple "U" Rack

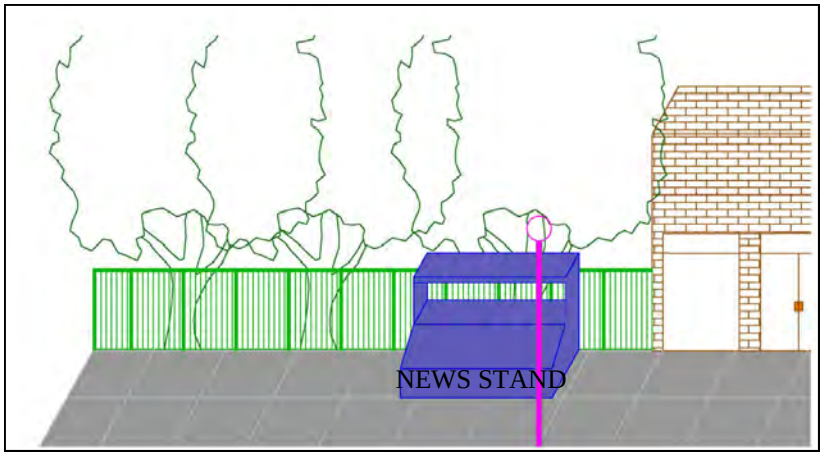
Fordham, a Metro North station in The Bronx, was chosen as a candidate for the installation of a Multiple "U" Rack. This location had three parked bicycles present during the field visit. The station is adjacent to a bus depot and a public plaza with vendors and heavy pedestrian traffic. Outside of the station, the westbound side of Fordham Road can accommodate bicycle racks on the left side of the newspaper stand to avoid conflict with passengers waiting for the bus at the bus stop. The Multiple "U" rack is proposed for this station because there isn't any bicycle parking available to meet the existing demand. There is also sufficient space to install the rack without interfering with the flow of pedestrian traffic. Installing a Multiple "U" rack that holds at least six bicycles at this station will not only meet the needs of the existing cyclists, it will encourage other cyclists to commute to the rail station via bicycle.

Above: Vacant space to the left of a newspaper stand at the Fordham station;

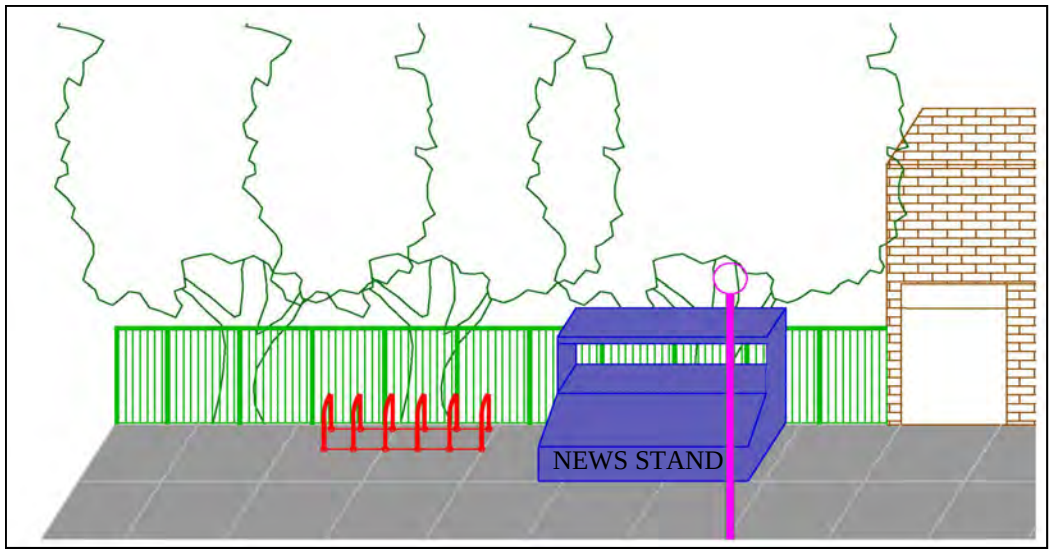
Right: An example of a Multiple "U" rack proposed for this station



A bicycle chained to the bus stop at the Fordham station



Existing Fordham Station without bicycle parking

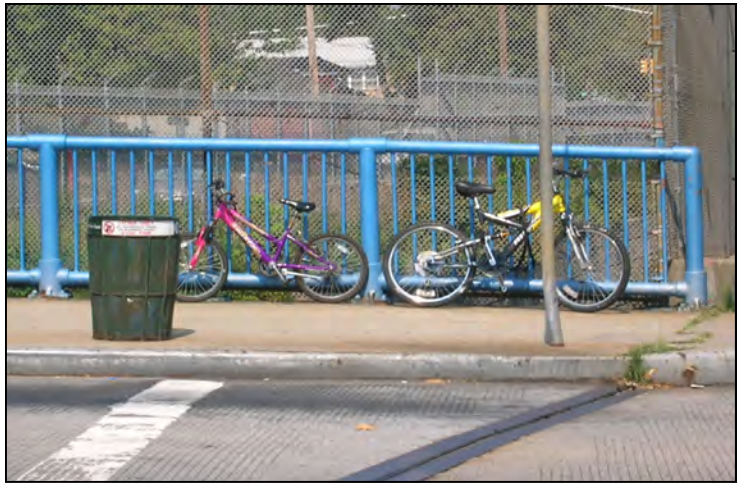


Fordham Station after Inverted "U" racks are installed

Grant City, Staten Island Rail Road, Staten Island - Inverted "U" Rack (CityRack)

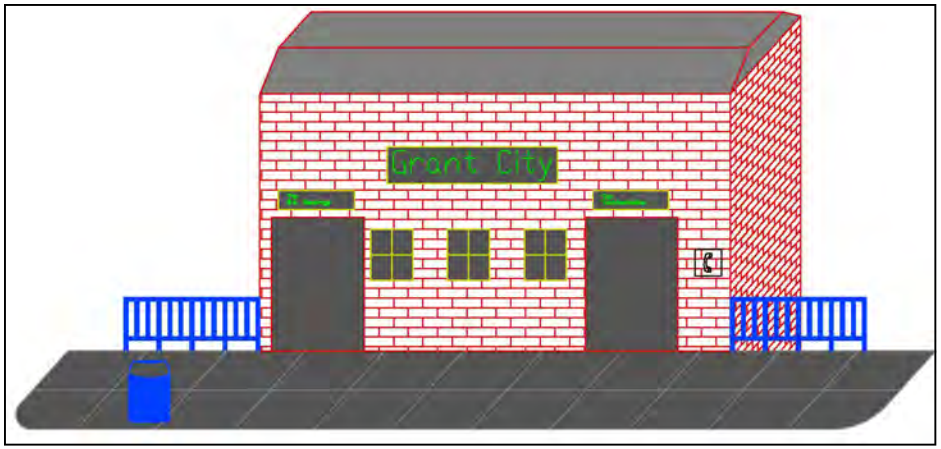
The Grant City station, along the Staten Island Railway, lacks bicycle parking. The station is along a neighborhood commercial corridor in a primarily residential area. During the field visit, four bicycles were locked to a railing across the street from the Staten Island Railway entrance at a bus stop.

Two inverted "U" racks are being proposed for this station to accommodate existing bicycle users and encourage cycling as an alternate mode of transportation. The waiting area at the station was under consideration for use as covered bicycle parking, but the space is too narrow to park bicycles and provide safe access to the platform. The alternative is to install the bicycle racks on the sidewalk directly in front of the station at opposite corners to ensure that MTA staff has access to the station for maintenance. The sidewalks were recently re-built therefore, no additional construction is needed to ensure proper installation of the racks.

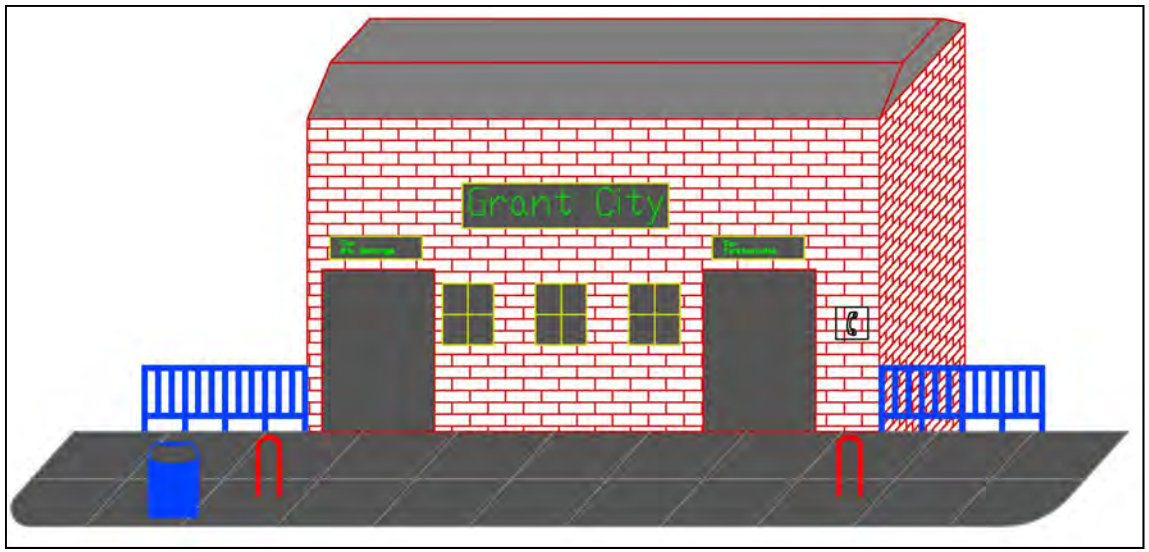


Bicycles found locked at the bus stop across from the Grant City rail station

Available space in front of the Grant City rail station to accommodate bicycle parking Grant City rail station



Existing Grant City station without bicycle parking



Grant City station after inverted "U" racks are installed

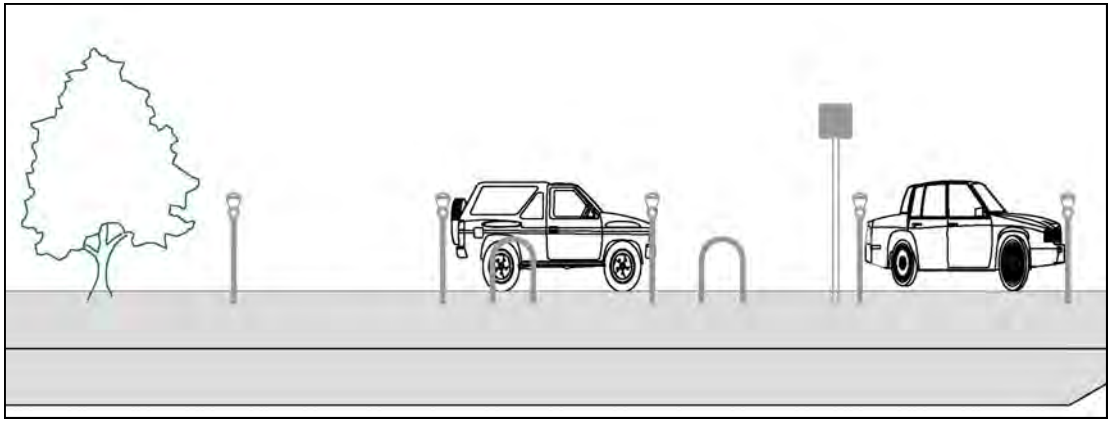
Graham Avenue Station, L, Brooklyn - Retrofitted Parking Meters

The Graham Avenue station is located along the (L) subway line in Brooklyn. There were over 25 bicycles found parked in the vicinity of the Graham Avenue station, with only a few inverted "U" racks to lock them to. Most of the racks held more bicycles than they could support and additional bicycles were locked to adjacent bus stop posts and parking meters.

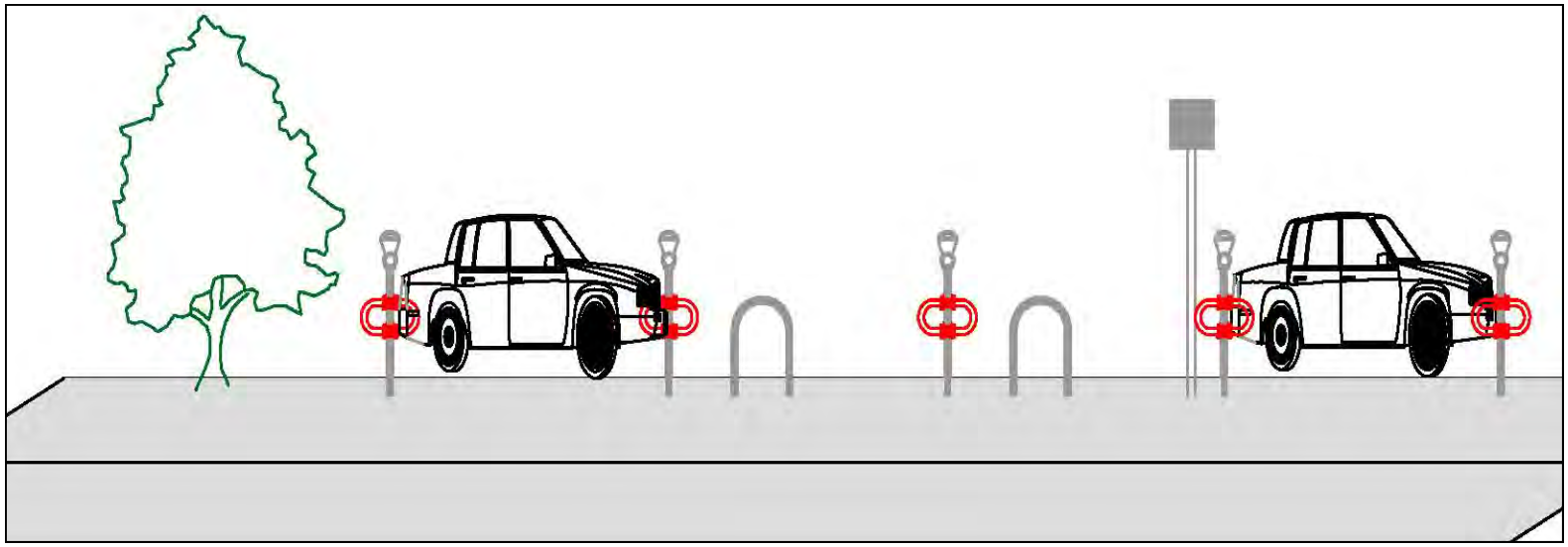
To meet this high demand for bicycle parking, the suggested site specific solution to the bicycle parking shortage is the retrofitted parking meter. There are many parking meters that can be retrofitted to double as bicycle parking in the area. This treatment was chosen to maximize sidewalk space and use existing street furniture. While many bicycles are already being locked to parking meters, retrofitting the meters will formalize an existing informal activity and will encourage proper bicycle parking technique. The image on the bottom right shows a bicycle locked to a parking meter facing perpendicular to the street. Bicycles should be locked parallel to the street for the safety of the cyclists and drivers. In the future, if the manual meters are replaced by electronic Muni-Meters, the heads of the meters can be removed and replaced by a sign illustrating how to properly lock a bicycle to the rack.

Bicycle locked to a parking meter perpendicular to the sidewalk creating a hazard

Bicycle locked to a parking meter parallel to the sidewalk



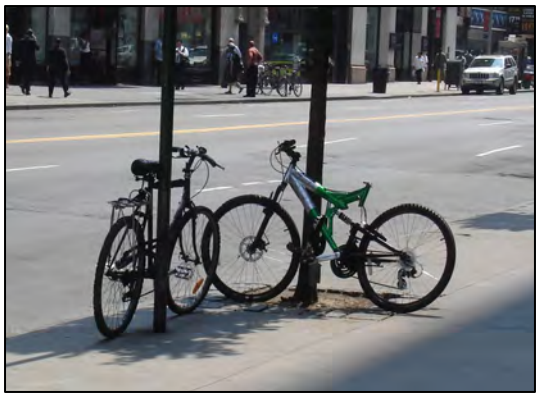
Existing Graham Avenue station with CityRacks and parking meters



Graham Avenue station with existing CityRacks and parking meter converted bicycle racks

X-Type Tree Guard Racks proposed at the 23rd Street, F,V, Manhattan

The 23rd Street station along the F, V line in Manhattan had approximately 27 bicycles with 8 wave racks on the first field visit. On the second visit, a Cemusa bicycle shelter was installed at the southeast corner, next to the PATH station entrance. It also appears that traditional tree guards were installed around tree pits to protect the trees from bicycles being locked to them as seen in the picture below taken on the first visit.



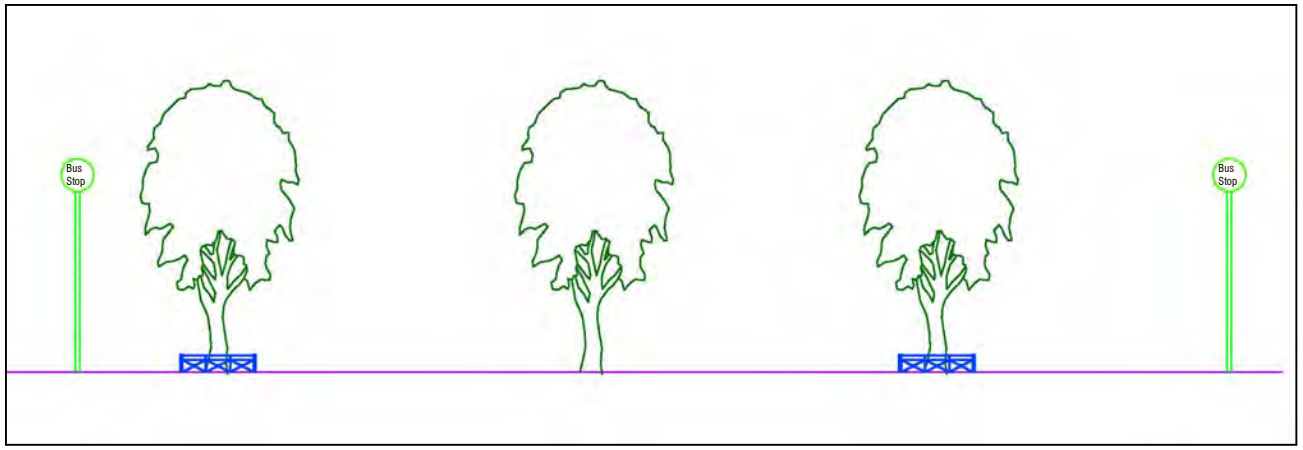
Bicycles locked to a tree and a bus stop at 23rd Street station

Despite the newly installed bicycle parking, some cyclists have continued to lock their bicycles to trees and tree guards. Traditional tree guards are inappropriate for bicycle parking because they do not have the proper height to adequately support the weight and size of a bicycle.

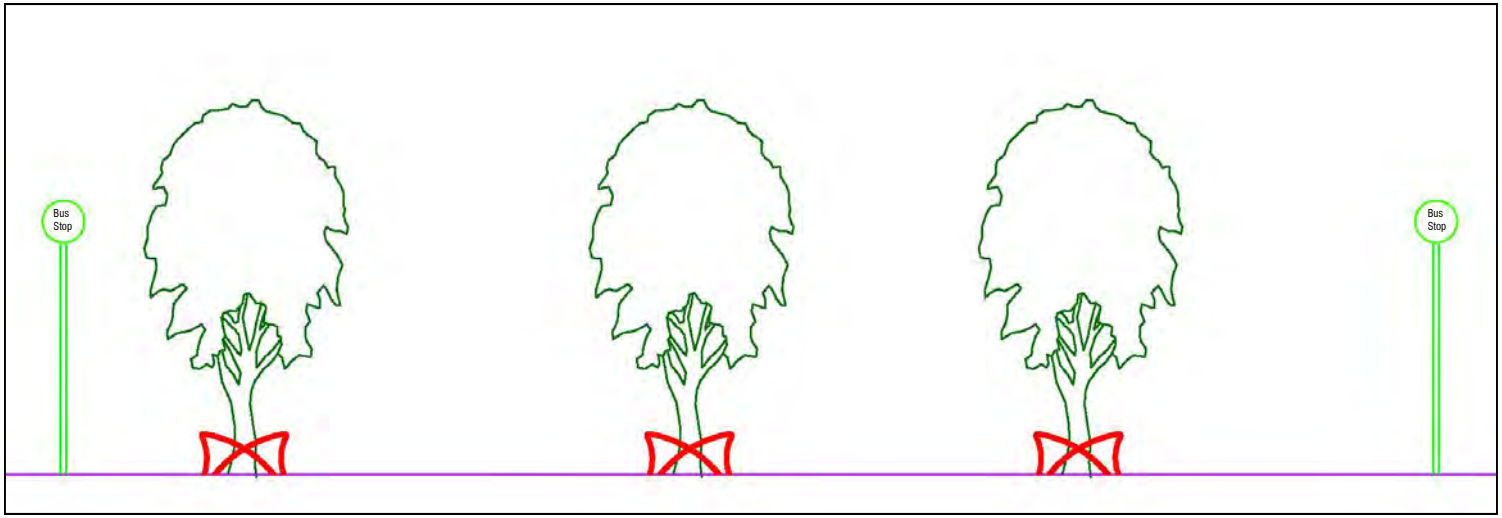
The suggested site specific bicycle parking system for this location is the X-Type Tree Guard bicycle rack. This bicycle parking system fits in with the existing environment and does not occupy any additional sidewalk space. It protects the street trees while at the same time meets the need for additional bicycle parking in the area. The trees that are proposed to receive the X-Type Tree Guard are located near the M23 bus stop at the south-east corner of 23rd Street between 5th Avenue and 6th Avenue. There was an initial concern that any bicycles locked to a proposed tree pits would block passengers from entering and exiting the bus. However, after monitoring three buses load and unload passengers, it was observed that the tree pit bicycle racks will not impede bus traffic because the bus doors open between the tree pits.

Above: A bicycle found chained to a tree on the second field visit

Right: A bicycle chained to a bus stop post



Existing tree guard not designed to accommodate bicycles



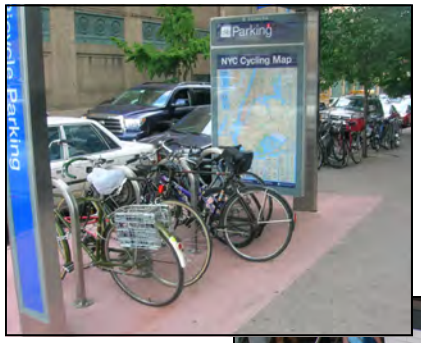
The X-Type Tree Guard installed to protect both the tree and park bicycles

DeKalb Avenue, B,Q,R,M, Brooklyn - Vertical Bicycle Parking

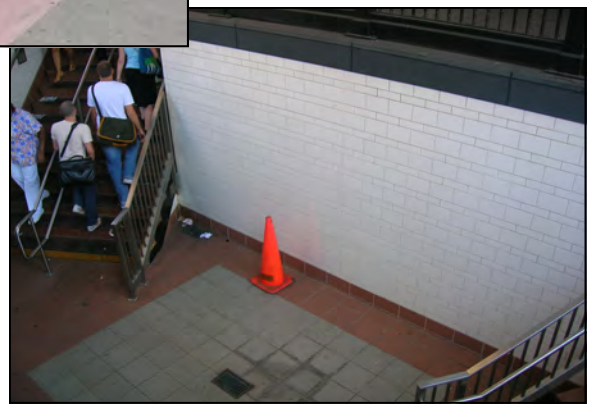
The DeKalb Avenue station in Brooklyn has a high demand for bicycle parking. There are 4 wave racks and a Cemusa bicycle shelter near the station's entrance, all of which are at maximum capacity. Cyclists have resorted to chaining their bicycles to the subway entrance railing because there is no additional space to park a bicycle. At the time of the field visit, 30 bicycles were parked near this station. To create more bicycle parking in an area with little available sidewalk space, it is recommended that a vertical bicycle parking system be used at this subway station. The proposed location for the rack placement is on the open mezzanine area of the station. This area is sheltered from variable weather conditions and utilizes unused space. The available area provides adequate space for the installation of a minimum of 7 bicycle parking spaces depending on the model chosen.

The rack would be securely anchored to the wall and the floor of the proposed area. This bicycle parking system stores the bicycles vertically, thereby occupying a smaller footprint and reducing possible pedestrian circulation conflicts. The rack would be placed out of the way of the drains found at both sides of the staircases to minimize any future flooding concerns. In addition to the vertical rack, the installation of a bike rail is proposed for the inside of both staircases that lead to the mezzanine area. This will allow cyclists to safely roll their bicycles along the stairs without causing injury to other passengers entering or exiting the station. The bike rail is approximately four inches in width depending on the model selected and will have minimal impact on pedestrian traffic along the stairs.

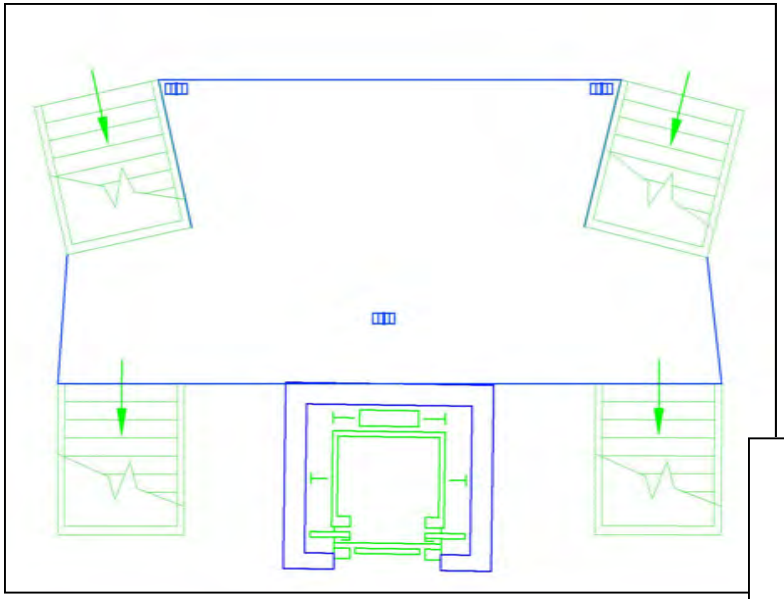
The recommendation for indoor bicycle parking does not comply with the MTA's current policy. However, proposed indoor bicycle parking may be kept under consideration by the MTA if the selected station exhibits a high enough demand for parking and the proposed parking system met their specifications.



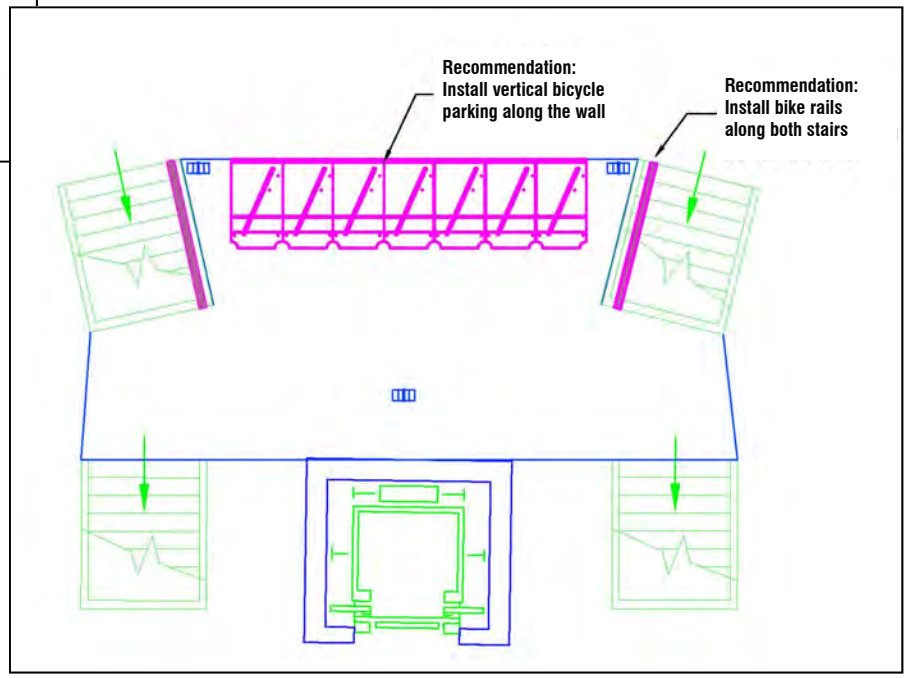
Left: Cemusa bicycle shelter, DeKalb Avenue station at maximum capacity



Right: Available space for additional bicycle parking on the mezzanine level of DeKalb Avenue station



Left: An example of a bike rail in use.



Above: Drawing of the existing layout of the mezzanine area of the station;

Right: Drawing of the mezzanine area with Vertical racks installed and the bike rails installed on both staircases.

Spuyten Duyvil, Metro North, The Bronx - Bike Lockers

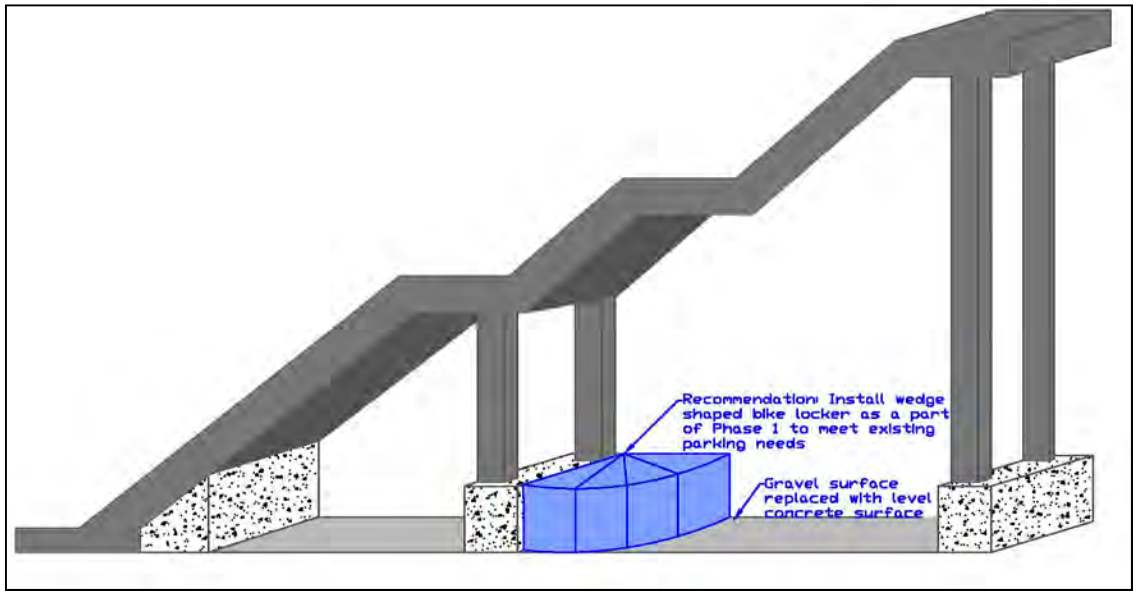
The Spuyten Duyvil Metro North station is located in the Riverdale section of The Bronx. Most of the passengers at this station park their cars in the station parking lot or along the road leading to the stations elevated entrance and take the commuter train into New York City. At the time of the field visit, there were three bicycles found parked at the station. Because bicycle parking is not available at this station, the bicycles were locked to rails at the top of the stairway near the station entrance and inside of the station's waiting area. This station has an abundance of space, unlike many of the stations found in other parts of the city. The available space provides the opportunity to explore non-traditional methods of bicycle parking. The site specific bicycle parking system selected for this station is the bicycle locker, to be located in the unutilized space beneath the station stairs. There is currently a demand for bicycle parking, therefore ensuring that the lockers will be used immediately after installation. Compared to some of the stations within the city, the number of bicycles found at the Spuyten Duyvil station was low. The placement of the lockers will encourage others to use cycling as a viable mode of transportation.

Bike lockers are a costly investment, particularly at locations that do not demonstrate a very high demand for bicycle parking. With this in mind, a phasing process is proposed in which four lockers are immediately installed as a part of the initial phase. Post-installation analysis is recommended 6 months to a year after installation to determine if the demand has increased or remained the same. If the demand for bicycle parking increases, during the second phase additional lockers would be installed within the same space to meet the growing and future demand for bicycle parking.

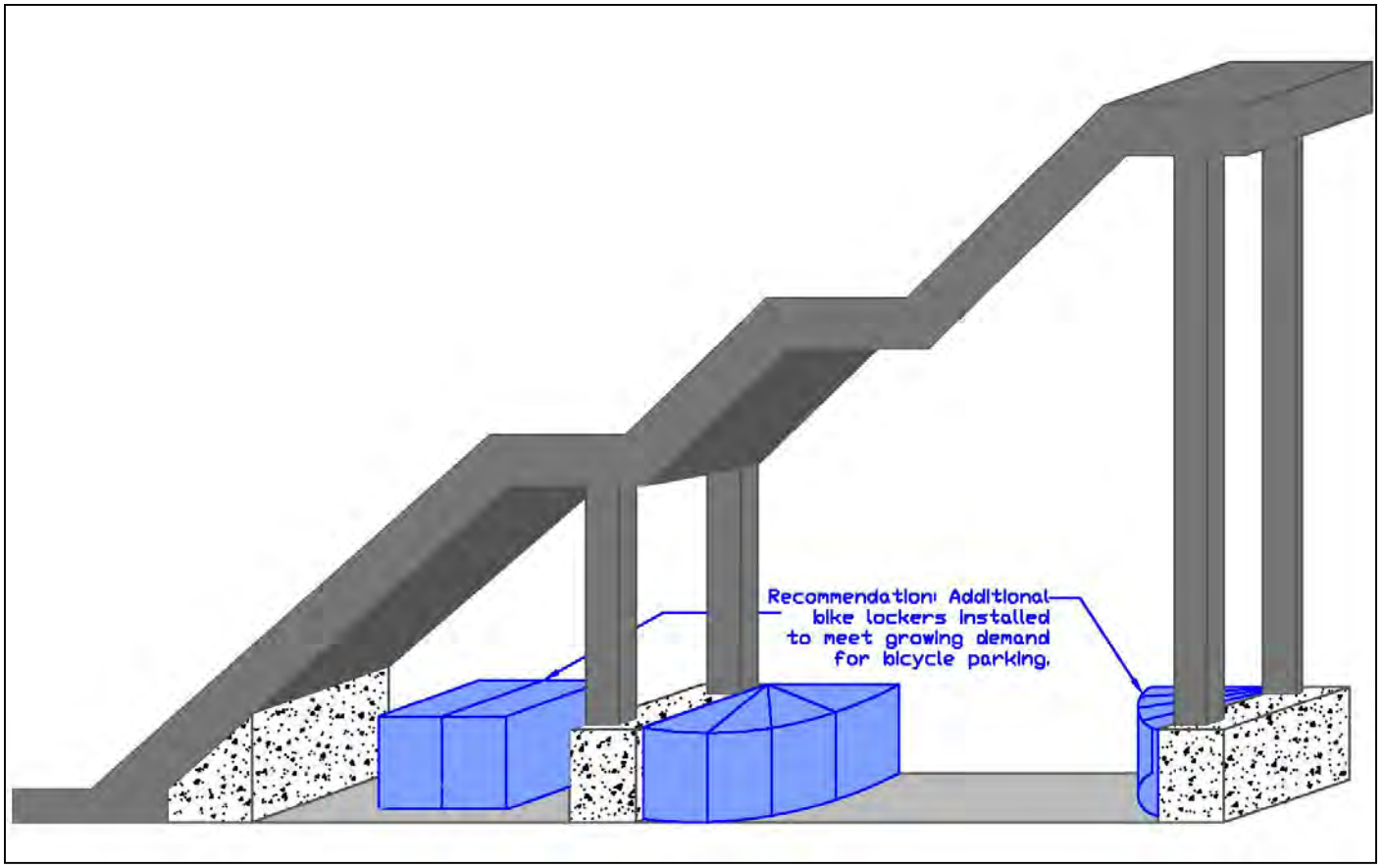
The bicycle lockers come in various shapes and sizes to best fit the available space. The wedge configuration of bicycle lockers provides a flexible arrangement for the area underneath stairs and can be easily adjusted or expanded upon as demand for bicycle parking increases. Minimal construction is needed for the installation of the bicycle lockers. The existing space has a gravel base, that will require resurfacing with a solid concrete slab to properly secure the bicycle lockers.

Above: Bicycles found locked to the railings inside and outside of the Spuyten Duyvil, Metro North Rail station

Existing Spuyten Duyvil station with available space beneath the stairs for bicycle parking



Phase I of the bicycle locker installation beneath the station stairs



The final phase of bicycle parking installation as the demand for parking increases

2-Tier Bicycle Rack proposed at the Brooklyn Bridge/City Hall, 4,5,6, Manhattan

The Brooklyn Bridge/City Hall station in lower Manhattan has 4 entrances. At the time of the field visit, there were a total of 33 bicycles parked in close proximity to the station. Many bicycles were locked to the railing of the subway entrances or locked to nearby posts. Two extended wave racks and a "wheel bender" rack that only supports the bicycle by the front wheel were found at the station entrance of the Municipal Building. This area is completely covered, providing sheltered bicycle parking. The bike racks were installed by the Department of Citywide Administrative Services (DCAS) and were intended primarily for city employee use, but are now available to the public. At the time of the first field visit, the existing demand was being met by the offered bicycle parking, however the configuration of the racks did not allow for the most efficient use of the space. DCAS, with the help of CDOT, has since reconfigured the area to increase the capacity from 24 to 52 bicycle parking spaces using inverted "U" racks and multiple "U" racks.

During the first field visit prior to the reconfiguration, this station's existing conditions were well suited for the installation of a 2-tiered bicycle rack. The available height clearance and the unobstructed wall space of the covered area made this station an ideal candidate for the proposed bicycle parking system. The recommended location for the rack would be along the wall away from pedestrian traffic. This will allow users to raise and lower their bicycles without possible injury to other cyclists or passengers. The constant presence of security and pedestrians around the perimeter of the building reduces the possibility of bicycle theft.

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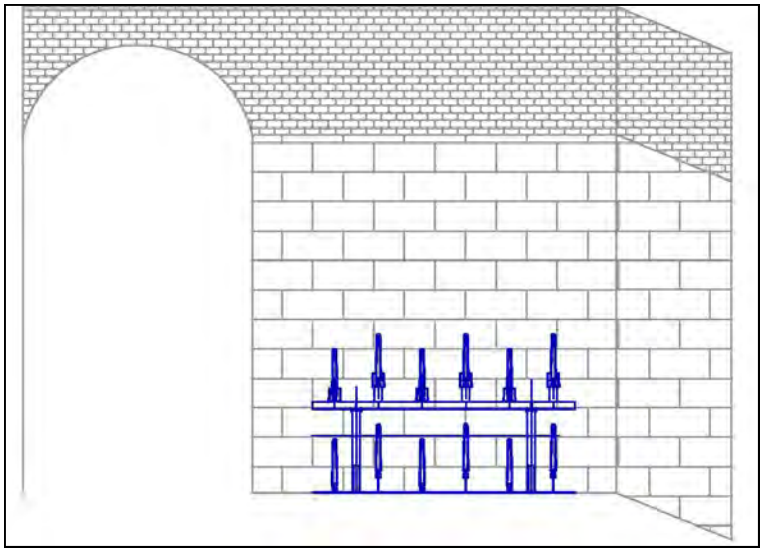
The original configuration of the bicycle parking area at the Municipal Building

A snap shot of the reconfigured bicycle parking area at the Municipal Building



Above Left: Covered space at the Brooklyn Bridge/City Hall station available for 2-tiered bicycle parking;
Above Right: Drawing of 2-tiered bicycle parking at the Brooklyn Bridge/City Hall station;
Right: Example of the a 2-tiered bicycle rack in a space similar to the Brooklyn Bridge/City Hall station

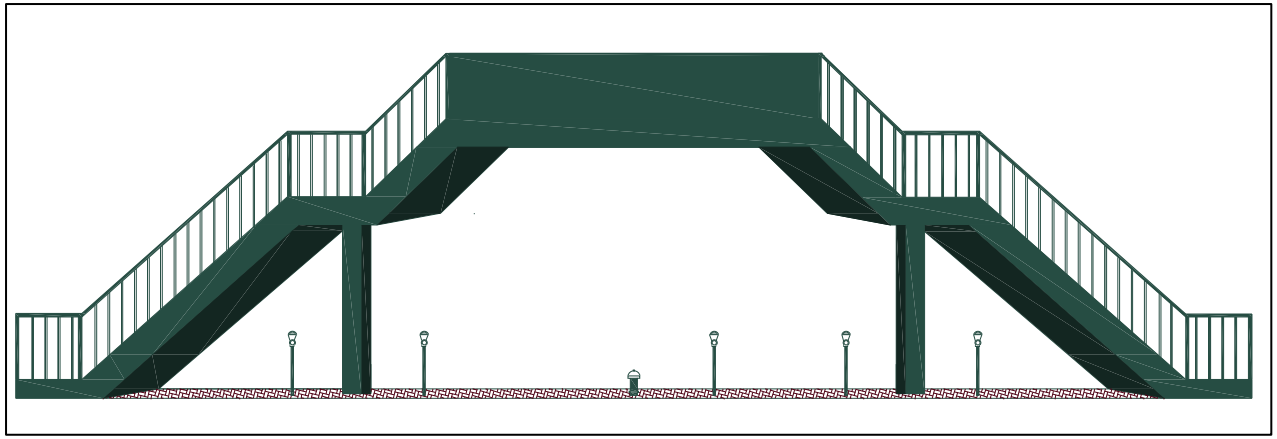
Multiple "U" Racks proposed at the Astoria-Ditmars Boulevard, N, W, Queens

The Astoria-Ditmars Boulevard station is along the (N, W) lines in Queens. At the time of the field visit, there were 35 bicycles in the vicinity of the station, and only 2 bicycle racks; a wave rack and a "wheel bender" bike rack that only supports the bicycle by the front wheel. At over 20 feet wide on either side, the sidewalks are wide enough to accommodate additional bicycle racks. There is a high demand for bicycle parking and limited placement options due to significant pedestrian traffic.

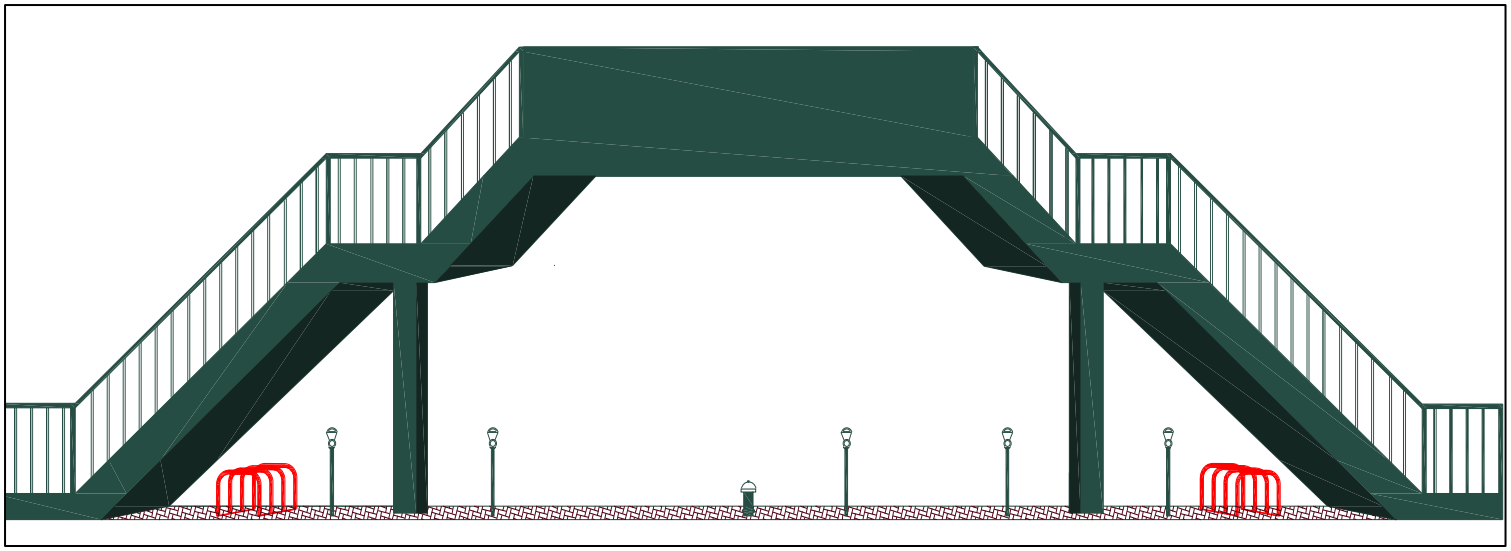
The subway station is elevated and the space underneath the stairs is not being utilized. The multiple "U" rack is the site specific bicycle parking system recommended for this station. Located beneath the stairs, the bicycle racks will be protected from the weather and they will be positioned away from pedestrian traffic. With the Multiple "U" racks in place, bicycles can be parked in an organized manner. The drawback to the installation of the multiple "U" racks at this station is that some of the bricks embedded into the sidewalk would have to be removed to allow for proper in-ground installation. To offset this concern, it is also recommended that the concrete used during the installation be dyed the color of the existing brick in order to maintain the appearance of continuity.

Because the demand for bicycle parking is so high in this area, a phasing component is suggested to allow for additional bicycle parking if demand increases. After the multiple "U" racks have been installed post-installation analysis should be conduct with six months to determine whether demand has increased or remained the same. If demand increases, phase II of this project would retrofit the parking meters that are in close proximity to the subway entrances with bicycle racks. Phase II will increase the amount of available bicycle parking for the future.

Left: Bicycles locked to parking meters along the sidewalk
Right: Sidewalk view of the available space beneath the subway entrance stairs;



Drawing of the existing area beneath the subway entrance stairs



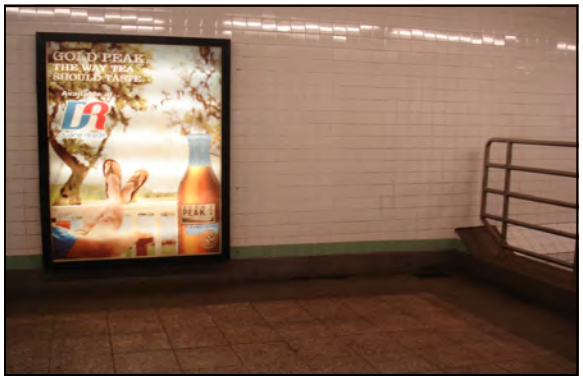
Drawing of the area beneath the subway entrance stairs fitted with bicycle parking

Metropolitan Avenue, G, Brooklyn - Indoor Multiple "U" Racks

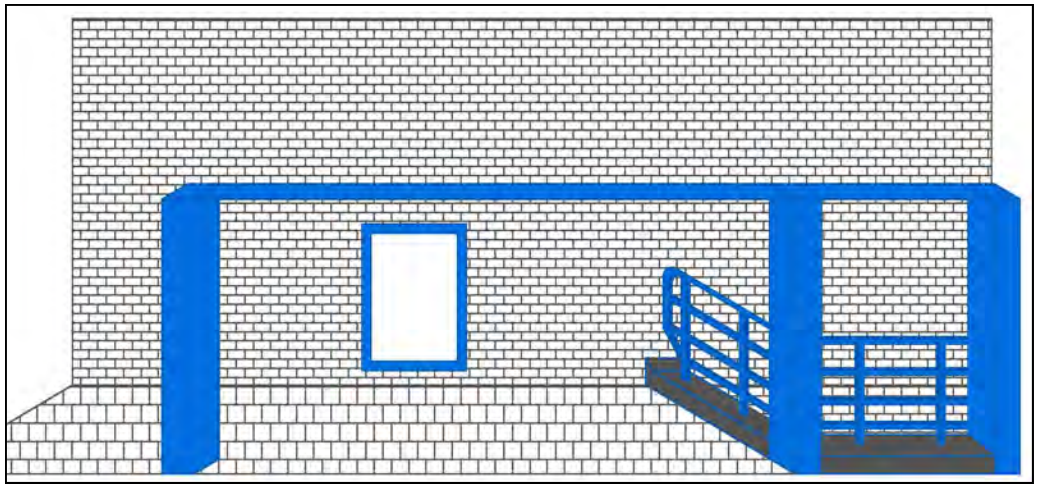
The Metropolitan Avenue station on the (G) line in Brooklyn, has a reasonably high demand for bicycle parking with limited space on the street level at the station's entrances. At the time of the field visit, 16 bicycles were locked to one wave rack and two inverted "U" racks. A few bicycles were also attached to nearby utility posts. With limited sidewalk space, alternative methods of bicycle parking were explored when deciding on a site appropriate design for bicycle parking. The vast amount of space on the mezzanine level of the subway station provides an opportunity for indoor bicycle parking.

Bicycles will be protected from inclement weather and the otherwise underutilized space in the station will serve a function. In addition to the bicycle racks, a bike rail is also proposed to be installed at the access points closest to the location of the racks to allow cyclists to safely roll bicycles along the stairs without causing injury to other passengers entering or leaving the station. In the event demand for indoor parking increases beyond the capacity of the multiple "U" rack, it is recommended that the racks be removed and replaced with a 2-tier rack system to meet increased demand. The height and available space within the station can easily accommodate the changes.

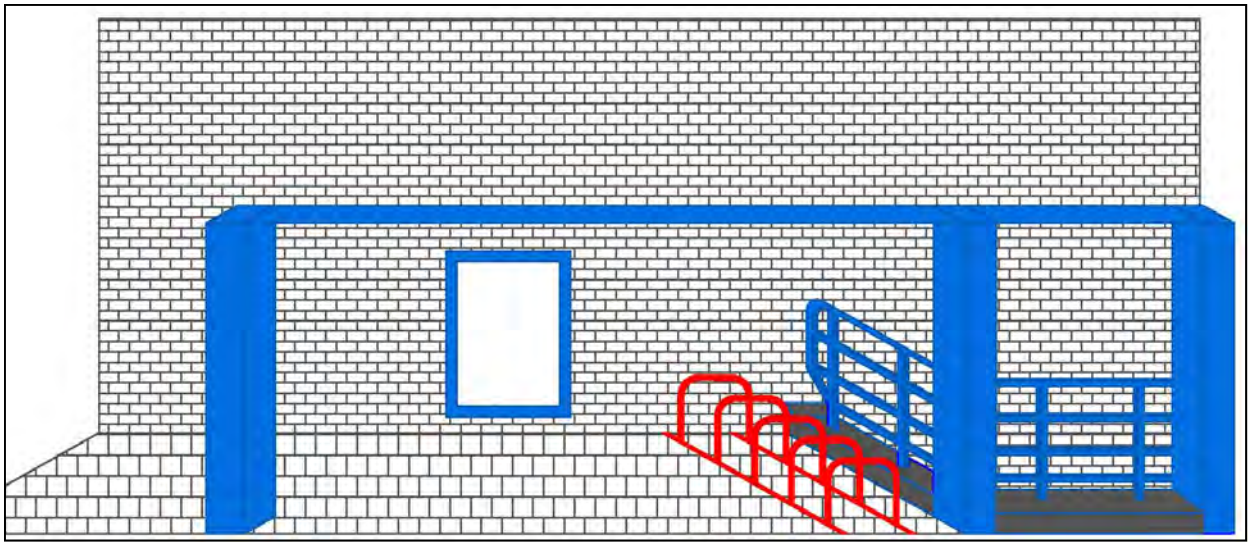
Above: Inside the paid zone of the Metropolitan Avenue subway station on the mezzanine level



Above: Area on the mezzanine level available for bicycle parking avoiding pedestrian conflicts



Drawing of area proposed for indoor bicycle parking



Drawing of area proposed for indoor bicycle parking after the bicycle racks are installed

Post-installation Management

Once installed, it is important that a management program be put in place to monitor the usage and condition of the bicycle racks regardless to the type of rack used. An integral part of a bicycle parking management program is controlling the number of abandoned bicycles left locked to racks. With an increase in bicycle parking citywide, abandoned bicycles are going to become a larger concern for the *CityRacks* program. Not only are abandoned bicycles an eyesore, they occupy bicycle parking spaces and prevent others from making use of the bicycle racks. This was the case when conducting a field visit to the Bedford Avenue station along the (L) line in Brooklyn. Abandoned bicycles and bicycle parts were chained to a *CityRack* preventing the proper parking of two bicycles. To control the abandoned bicycle problem, the agency responsible for maintaining the bicycle racks could implement a maintenance system in order to better track the usage of the racks. Currently, various agencies including the Police, Sanitation and Parks Departments periodically clip abandoned bicycles without notice (occasionally confusing them with legitimately locked bicycles).

In 2006, the City Council introduced legislation (Int.234) to amend New York City Administrative Code section 16-122 to include non-motorized vehicles as the definition of an abandoned bicycle and the procedure by which a violation can be issued and responded to prior to the disposal of the abandoned bicycle. This legislation was not passed into law and bicycles continue to be seized without clear guidance from the law.

In addition to managing the quality of bicycle parking, it is important to keep the public informed on where bicycle parking is located and allow them to locate bicycle parking along major routes and near points of interest.

Abandoned bicycle and bicycle parts found at Bedford Avenue Station (L) in Brooklyn

Abandoned bicycles chained to a post near the Clinton- Washington Station (G) in Brooklyn

CityRacks Tracking and Maintenance System

The first step in maintaining *CityRacks* would be to create an inventory tracking system. Currently, CDOT maintains a database of *CityRacks* that are identified by location (i.e. the northeast corner of 59th Street and 8th Avenue, with an "in front of" address). This system can be confusing when there are several *CityRacks* in one location. Alternatively, each *CityRack* could be assigned GPS coordinates to simplify the process of identifying individual racks. This should be done during the installation process. Under this proposal, each rack would also be assigned an ID number to be used to track it throughout the entire process, from installation to maintenance.

As part of this new program, regular maintenance would need to be scheduled, either by borough, neighborhood or community board. Additionally, under this program, requests for maintenance or removal of abandoned bicycles could be made based on calls to 311 or from the community boards. As part of the program, rack usage should be documented and analyzed. During maintenance, it should be noted whether the racks are being used, if there are enough racks to meet the demand, and requests should be submitted if additional racks are needed. The condition of the racks should also be documented and notes made indicating whether the racks are in need of repair and if there were any abandoned bicycles found locked to the racks. A notification system could be added to the maintenance regimen to inform owners of bicycles that appear to be abandoned that their bicycles will be removed within a pre-determined amount of time if the bicycle is not claimed. This is currently the practice in Copenhagen and on many college campuses including New York University. In Copenhagen, a bright colored tape is wrapped around part of the bicycle. If the tape is not broken after a certain period of time, the bike is presumed abandoned and will be removed. In the case that bicycles are removed in error, they should be kept for a two week period at a storage facility where users could go to retrieve them. A storage facility could be located in each borough for easy retrieval. This proposed maintenance program is an essential component to maintaining a successful *CityRacks* program. It ensures that all cyclists will have access to secure bicycle parking.

Interactive Website for Bicycle Parking Users

Working towards an efficient and comprehensive citywide bicycle parking program, the CDOT has launched a mapping application on their website that allows cyclists to locate the CityRack nearest to where they are going. This new application allows users to zoom-in and select the bicycle icon closest to their destination. Once selected, a pop-up box is displayed with the address of the rack, the type of rack and the number of racks available at that location.

Building off the CDOT bicycle parking locator website, the NYCDCP/TD in collaboration with CDOT is in the process of creating an interactive website that will provide cyclists in NYC with a step-by-step bicycle routing and bicycle parking location query ability. The purpose of the project is to make available to cyclists a comprehensive trip planning website that includes up-to-date bicycle facility data and a routing application, together with information on the location of safe and secure bicycle parking. The website would include: a search page with options to search by address, intersection, point of interest, or a user-defined point on a citywide map; a dynamic map of the search results for routing and parking; and the tabular information associated with the bicycle parking facilities shown on the map. The routing feature will include step-by-step written instructions that corresponds to a map displaying the route. Information would include streets, bicycle routes and public transportation facilities.

In addition to allowing users to view current information relating to the locations and types of bicycle parking facilities throughout the city, the application would also allow users to provide feedback such as data errors, report damaged racks, additional bicycle parking facilities not in the database, and potential sites where a bicycle parking facility is desired to the planning and operating agencies. This will allow users to communicate up-to-date information on problematic bicycle parking conditions with city agencies responsible for maintaining them.

Recommended Next Steps

This study lays the groundwork for the development of a comprehensive bicycle parking network. The 239 stations surveyed during this study represents a portion of the total transit stations citywide. Following the methodology used for this study a complete matrix can be created to include all transit stations citywide to determine the bicycle parking demand as well as the type and number of racks needed to meet the demand for each station. In the long term, it is suggested that a study be conducted for each borough to evaluate each transit station on an individual basis and analysis be conducted to determine the appropriate bicycle parking for current and future demand.

Interagency Coordination

There are many agencies involved in the implementation process of bicycle parking at transit stations. With improved coordination between agencies, data collection and implementation can be processed quickly and more efficiently producing a high quality bicycle parking network. With coordinated efforts between NYCDCP/TD and CDOT, recommendations for *CityRacks* placement generated by this study have been provided to CDOT for immediate and future installation. The data collected regarding the stations in Queens along the (7) subway line is now being used by CDOT to site bicycle parking for immediate installation of *CityRacks*. At the same time, the other stations surveyed in this study are being evaluated for future bicycle parking installation. The information gathered during this study could be very useful to the MTA to incorporate bicycle parking when planning station improvements and renovations. Continued collaborative efforts among agencies are recommended to ensure a comprehensive network for bicycle parking and other bicycle related initiatives, particularly at intermodal transportation hubs and stations located within future growth areas. Open communication among agencies allows for data sharing and reduces redundancy in planning and data collection.

Public Education

The next step in developing a bicycle parking network is educating the public on how to properly use the provided bicycle racks. While this study highlights different types of bicycle parking systems, one commonality is the need for user education. To ensure the public is being made aware of proper bike locking technique, a picture diagram could be included on a panel of the Cemusa bicycle shelters. Similar to the “LOOK” campaign designed by CDOT to make drivers more aware of cyclists on the road, a campaign can be created to educate existing and potential cyclists on how to properly use *CityRacks*. With correct use of *CityRacks*, the number of bicycle thefts citywide will decrease.

Conclusion

The bicycle parking systems highlighted in this study showcase the many possibilities available when considering bicycle parking at transit stations. Using a standard inverted "U" bicycle rack is the most cost effective approach when considering bicycle parking. It provides a uniform and cohesive streetscape with little maintenance required. This works well when all stations are the same and have equal demand. The case studies show that all stations are not alike and that demand is not equal across the city. Special situations will arise when a standard system will not yield the most efficient use of the available space. For certain locations, standard *CityRacks* are not sufficient, and site-specific solutions must be created. Fieldwork conducted in this study shows the citywide need for increased bicycle parking near transit, and describes a methodology for selecting locations for specific bike parking systems. This study shows that secure bicycle parking can be provided at any transit station regardless of its location or available space whether it is to meet existing demand, or to encourage cycling to transit as a viable mode of transportation.