

Project Identification

Nostrand Avenue is a heavily traveled north-south arterial corridor in Brooklyn, NY, that currently suffers from slow and unreliable bus service. The New York City Department of Transportation (NYCDOT) and MTA New York City Transit (NYCT) are working together to improve the speed and reliability of bus service on key corridors throughout New York City, including Nostrand Avenue.

The Nostrand Avenue Bus Rapid Transit (BRT) service will be a 9.3 mile route replacing the existing NYCT B44 Limited-Stop bus route, which serves 17,000 customers on an average weekday. (The B44 local route serves an additional 24,000 customers.) This BRT project will provide fast and reliable bus service along a key north-south route in Brooklyn, connecting densely-populated residential areas with multiple subway lines, bus routes, shopping areas, two colleges, and two major hospitals. (See the attached map.) Nostrand Avenue provides an excellent opportunity to demonstrate the impact of low-cost BRT solutions along an existing high ridership corridor located in a dense residential and commercial area. Nostrand Avenue is already the fourth busiest bus route in New York City, with 13.6 million annual riders, and ridership on the route is expected to grow once BRT service is implemented as a result of improved speed and reliability, as well as increased frequency and longer hours of service.

Setting

Brooklyn is one of the five boroughs of New York City, and is coterminous with Kings County. Located at the southwest tip of Long Island and immediately to the southeast of Manhattan, Brooklyn is New York City's most populous borough, with over 2.5 million residents and a population density of over 35,000 residents per square mile. Downtown Brooklyn is the third largest Central Business District in New York City (after Midtown and Lower Manhattan), and there are approximately 460,000 jobs located within Brooklyn, a number that has been increasing steadily over the past several years.

The Nostrand Avenue BRT corridor will extend from Sheepshead Bay in southern Brooklyn to the Williamsburg Bridge / Washington Plaza bus terminal in northern Brooklyn. This heavily-used transit corridor serves the following major trip generators and transit hubs, providing transfers to 33 bus routes, 9 subway routes, and a commuter rail line:

- Brooklyn College, part of the City University of New York (CUNY) with 16,000 students and 1,300 faculty and staff.
- Medgar Evers College, a division of CUNY, with over 5,500 students and 750 faculty and staff.
- The Junction retail district and bus transfer hub located at Flatbush Avenue. The Junction's role as a retail destination has been reinforced recently by the opening of a Target store in March 2008.
- Fulton Street, a major pedestrian-oriented retail corridor.
- The Nostrand Avenue retail corridor, another major pedestrian shopping area.
- The State University of New York (SUNY) Downstate Medical Center, with 4,800 employees, 2,500 students and medical residents, and 400 beds at the University Hospital of Brooklyn.
- Kings County Hospital Center, with 600 beds and 4,700 employees.
- The Flatbush Avenue transit hub (The Junction), with 2,300 daily passengers transferring between the B44 and the B6, B11, B41, B103, and Q35 bus routes and 1,450 daily

Nostrand Avenue Bus Rapid Transit – Making the Case

passengers transferring from the B44 to the 2/5 subway lines, which connect to the CBDs in Downtown Brooklyn, Lower Manhattan, and Midtown Manhattan.

- The B12 and B35 major east-west bus routes, serving numerous residential and commercial areas in central Brooklyn, with 2,150 weekday transfers from the B44.
- The Nostrand Avenue Long Island Rail Road (LIRR) station, with 850 weekday boardings and alightings, largely by reverse commuters to the Long Island suburbs.
- The Nostrand Avenue A/C subway station, with 2,150 weekday transfers from the B44. These subway routes serve the CBDs in downtown Brooklyn, Lower Manhattan, and Midtown Manhattan, as well as JFK Airport.
- The Bedford-Nostrand Avenue G subway station, with 200 weekday transfers, providing service to Downtown Brooklyn and Queens.
- The Marcy Avenue J/M/Z subway station, which is one stop from Manhattan.

Purpose of the Project

The purpose of this project is to use innovative methods to improve the reliability and speed of bus service on the Nostrand Avenue corridor. BRT is a new service approach being implemented in New York City to improve bus service on congested corridors with a high demand for transit. This project will serve the 17,000 daily riders on the B44 Limited and will attract additional riders who currently avoid bus service on the Nostrand Avenue corridor due to slow speeds and a lack of reliability.

Within a 1/4 mile of the Nostrand Avenue corridor, there are 300,000 residents, according to the 2000 Census. Sixty-two percent of households within 1/4 mile do not own a car, and 28% percent live below the poverty line. Sixty percent of residents commuting from this zone travel by transit, including 15% primarily by bus.

Current Conditions

Along the Nostrand Avenue corridor, traffic congestion and long boarding times lead to slow and unreliable bus service. The corridor is densely developed, and the lack of subway service along most of the route adds to the need for improved bus operations to serve the largely transit-dependent population.

Traffic Congestion. During significant portions of the day, the Nostrand Avenue corridor is heavily congested, with commuters, shoppers, and delivery vehicles competing for road space. Initial traffic observations indicate several intersections along the corridor operating at a poor Level of Service, with volumes at or close to the capacity of the roadway. Delivery activity by commercial vehicles and double parking by private vehicles further reduces the capacity of the roadway, exacerbating congested conditions. Recent speed runs show general traffic operating at approximately 10-12 mph, despite a posted speed limit of 30 mph.

Slow Boarding Due to Heavy Ridership. High ridership levels in the corridor (17,000 Limited and 24,000 local riders on an average weekday) result in slow boarding and increased travel time. Under current conditions, delays increase as crowded buses wait while large numbers of passengers enter the bus and pay their fare at a single farebox. This increases the dwell time and exacerbates passenger crowding and bus bunching. The passenger congestion increases travel times and reduces reliability. Running time surveys have found that 24% of B44 Limited travel time is consumed by dwell time at stops; in some locations, buses spend over three minutes stopped while passengers board.

Nostrand Avenue Bus Rapid Transit – Making the Case

Result: Slow Overall Bus Speeds. Together, traffic congestion and slow boarding reduce average bus speeds and overall service reliability, making bus transit less competitive compared to traveling by private car or taxi. The B44 Limited currently takes from 68 to 82 minutes to travel end-to-end during weekday hours, at an average trip speed of 7-8 mph (in the most congested portion of the corridor, average bus speeds are as slow as 4-5 mph). The B44 local is even slower, taking from 71 to 91 minutes to travel the corridor, at an average speed of 6-8 mph. In the middle of the night, when there is no traffic congestion, the B44 local is allocated 50 minutes to cover the same distance, at an average speed of 11.5 mph, indicating that there is room for significant improvement.

The Subway Serves a Small Portion of the Nostrand Avenue Corridor. For 2.4 miles in the center of the corridor, the 2/5 trains operate along Nostrand Avenue, with six stations between Flatbush Avenue and President Street. Beyond President Street, these lines travel toward the Brooklyn and Manhattan CBDs. In this area, the B44 Limited competes poorly with subway, taking about 19 minutes to travel from President Street to Flatbush Avenue (with the B44 local taking about 27 minutes), while the subway covers the same segment in 10 minutes.

For the 3 miles north of President Street, there are opportunities to transfer to intersecting east-west subway lines, including the A/C at Fulton Street, the G at Lafayette Street, and the J/M/Z at the northern terminal. However, there is no rapid transit option for travel along the Nostrand Avenue corridor in this segment, leaving the B44 Limited as the fastest north-south transit mode, although it is much slower than a subway line.

In the 3.8 miles south of the 2/5 terminal at Flatbush Avenue, the lack of subway service is particularly acute, with no parallel or intersecting subway service available within the Nostrand Avenue travel shed. The nearest parallel subway line is the B/Q, which is located 3/4 mile to the west, well beyond walking distance. In the absence of a subway line, the B44 Limited functions as the closest equivalent, although without nearly comparable speed or reliability.

Case for the Project

Proposed Approach

For the 3.8 miles of the route between Flatbush Avenue and Sheepshead Bay, the route will operate in both directions on Nostrand Avenue, with a one-way terminal loop along Shore Parkway and Emmons Avenue. For the 5.5 miles to the north of Flatbush Avenue, one-way street patterns will lead the route to operate northbound on Rogers and Bedford Avenues, and southbound on Lee and Nostrand Avenues. (See the attached map.)

The features described below will result in reduced running times, shorter trip duration, and improved reliability on the Nostrand Avenue corridor.

- “Interior” (not curb) bus lanes for 4.6 miles of the route, between Flatbush and Flushing Avenues. Interior bus lanes will not conflict with parking, deliveries, and right turns, therefore offering better performance than a curb bus lane, with fewer impacts. (This will result in time savings of 4.6 minutes per trip due to the 4.6 miles of bus lanes, at a rate of 1 minute per mile.)
- Where there are bus lanes, “bus bulbs” allowing the stations to extend into the curb lane, so buses do not have to pull to the curb. (See the attached schematic drawing of bus bulbs and lanes.) These also provide room for customers to queue out of the flow of

Nostrand Avenue Bus Rapid Transit – Making the Case

pedestrian traffic, and space to accommodate shelters, fare collection machines, and passenger information including maps and real-time bus arrival displays. (Time savings of 1.2 minutes per trip due to the bus bulbs, at a rate of 10 seconds per bulb.)

- Transit signal priority for the southern 3.8 miles of the route, south of Flatbush Avenue, where signal priority would not be complicated by one-way streets. (Time savings of 2 minutes per trip due to the 3.8 miles of transit signal priority, at the rate of 0.5 minute per mile (observed time savings for the Victory Blvd signal priority project on Staten Island).)
- Off-board fare collection, with fare collection machines at BRT stations. (Time savings of 9.3 minutes per trip due to prepaid boarding, assuming a 50% reduction in dwell time (a more conservative reduction than is used in the TRB “Transit Capacity and Quality of Service Manual”).)
- Fewer stops than the existing Limited service: an average of 15 stops in each direction, compared with an average of 37 on the current B44 Limited. The Limited currently makes all stops at northern and southern extremities of route, while local trips short-turn before reaching these areas. Under both the proposed approach and the low-cost alternative, local trips will be extended to the full route length, allowing BRT service to stop only at major intersections for the entire length of the trip. (Time savings of 7.33 minutes per trip due to the elimination of an average of 22 stops in each direction, based on a 20 second maneuvering time savings per stop.)
- Increased frequency compared with the current B44 Limited. BRT trips will operate every 3 minutes in the peak and every 7 minutes off-peak, compared with current Limited service every 4 to 6 minutes in the peak and every 8.5 minutes off-peak. (This offers a 0.5 to 1.5 minutes reduction in average wait time at peak hours, and 0.75 minutes off-peak, due to the increase in frequency over existing Limited service.)
- Longer span of service than the current B44 Limited. The BRT will operate on weekdays from 5:30 AM to 10 PM, compared to the current span of 6:00 AM to 8:30 PM. BRT service will operate 7 days per week, as does the existing Limited service.

Added up without adjustments, these measures will save 25 minutes per full-length trip, or 33% of travel time. If this percentage is conservatively adjusted to 25%, the savings per trip will be 19 minutes. This will save customers 4.4 minutes per average 2.3 mile trip. With 17,000 riders on the route, the average daily travel time savings will be 74,800 minutes per day. In addition, customers on B44 local buses will experience time savings from some of the BRT elements, particularly the interior bus lanes.

The combination of bus lanes and signal priority will greatly reduce the variability that congestion imposes on bus service. Prepaid boarding will substantially lessen passenger queues and dwell times at each stop. These BRT measures designed to speed service will also improve schedule reliability, thereby improving overall transit quality. Expanded hours of BRT operation will improve the overall attractiveness of the route, since customers will know that at most times they will have access to a fast transit service.

The combination of faster travel, improved reliability and frequency, and longer span of service will lead to increased ridership. The BRT service will be seen as a better transit option and will be more competitive with automobile travel. It will attract additional riders bound for the transit-oriented shopping districts and other trip generators along the route. Trips involving a transfer to another bus, subway, or to the LIRR will have shorter and more predictable overall travel times, leading to increased ridership on those routes as well.

Nostrand Avenue Bus Rapid Transit – Making the Case

By addressing the problems of traffic congestion, slow boarding, and overall slow travel times, the proposed Nostrand Avenue BRT will achieve the goal of providing a faster, more dependable and more attractive transit option. By achieving a time savings of 4.4 minutes per customer trip with \$44.7 million in capital costs and \$6.7 million in additional annual operating costs, the proposed approach is a very cost-effective solution for the heavily-used Nostrand Avenue transit corridor.

Low-Cost Alternative

The low-cost alternative would involve increasing the frequency of buses on the B44 Limited route, and reducing the number of Limited stops. However, these measures by themselves would not represent a major improvement for transit customers.

The B44 Limited currently operates in the morning peak every 4-5 minutes southbound and every 6 minutes northbound. Reducing the headway by 1 minute, a roughly 20% increase in service, would reduce the average wait time and therefore the average trip time by only 30 seconds. Maintaining this increase in frequency would be operationally difficult, given the very short combined Limited and local frequencies that already exist – as many as 35 southbound buses in the morning peak hour. Without a dedicated bus lane, an even higher density of buses than there is now on the corridor could lead to increased congestion for all road users.

As described above, both the proposed approach and the low-cost alternative involve extending local service to the outer terminals at all times, so that the stop spacing on Limited or BRT service can be standardized for the entire length of the corridor. In addition, some existing Limited stops with close spacing would be eliminated. If these service and stop changes were made for the low-cost alternative (requiring a 32% lengthening the local trips), then the number of Limited stops would be reduced to 15 northbound and 14 southbound. This reduction in the number of Limited stops would reduce the travel time for a full trip by 7.33 minutes, assuming a time savings of 20 seconds per eliminated stop.

With fewer Limited stops, the travel time for the average B44 Limited customer trip of 2.3 miles would be reduced by 1.7 minutes. Together with the increase in frequency described above, the low-cost alternative would reduce the average customer trip time from 17.4 to 15.2 minutes. The operating cost for these improvements would be approximately \$3 million annually (there would be little or no capital expenditure).

While the low-cost alternative would reduce travel times, it would not ameliorate the major problems that detract from the customer experience on the B44 Limited: traffic congestion on the route and slow boarding due to heavy ridership. Therefore, it would not sufficiently improve travel times or bus reliability. The travel time savings of the low-cost alternative would be half of the savings of the proposed approach, as detailed above. Furthermore, the low-cost alternative would not improve bus schedule reliability, which is a function of buses delayed by traffic congestion and long passenger boarding times. Without additional measures to improve bus service, the improvements would not be cost-effective compared to current Limited-stop service, and would not attract additional transit customers to this corridor.

Risk

Uncertainties in the Costs

The project scope includes 14 “bus bulb” extensions of the sidewalk at BRT stations. NYCDOT is in the process of determining the design of these bus bulbs. It is expected that they would be created from prefabricated parts in order to reduce the time and cost of installation. Because the final design of the prefabricated bus bulbs is to be determined, the costs could change. However, the project cost estimate used a conservative assumption in this area to minimize the risk that the cost of this item will increase.

A second major cost item is the increment of new buses required for the increase in frequency over current Limited service and the lengthening of local trips. These will be low-floor articulated buses, which NYCT does not yet have a contract to purchase. Given the competitiveness of the bus industry at this time, there are cost and schedule uncertainties associated with this item.

Uncertainties in the Benefits

Two of the proposed BRT measures have some uncertainty in the benefits they will deliver. The effectiveness of the bus lanes will be somewhat determined by the degree of police enforcement. If New York City is permitted by the State Legislature to enforce bus lanes with video cameras, the need to rely on police resources will be reduced. Meanwhile, the time savings from prepaid boarding will vary based on the degree of customer education and compliance with this fare collection system, since it differs from NYCT’s practice for non-BRT bus routes. However, the experience to date with the off-board fare collection system implemented on the BRT service on Fordham Road in the Bronx has been quite promising.

Summary

The goal of the Nostrand Avenue BRT project is to speed bus service for the 17,000 daily customers who ride the existing B44 Limited route, which will be replaced by the BRT. New riders will also be attracted to the BRT service due to the improvements in speed, reliability, frequency, and hours of service. The existing B44 Limited suffers from traffic congestion, long dwell times due to heavy ridership, and overall slow travel speed. Without operational improvements this route will continue to provide slow and unreliable service. Riders on the B44 local will also benefit from some of the project improvements, particularly the bus lanes.

The proposed BRT project will provide twice the travel time savings of the low-cost alternative and will improve transit reliability, effectively addressing the problems associated with current transit service. The low-cost alternative would lead to some travel time savings, but with a significant annual operational and capital cost due to added bus service. In contrast, the proposed approach has the potential to greatly improve transit service and attract new riders to a heavily-used travel corridor, with significant mobility and economic development benefits.



Manhattan

Queens

East River

Williamsburg Bridge

**Williamsburg Bridge Plaza Station/
Bus Transfer Hub** J M Z

ROEBLING ST

TAYLOR ST

Lee/Taylor Stations

Flushing Stations

LEE AV
NOSTRAND AV

Downtown
Brooklyn

BEDFORD AV

Lafayette Stations G

Fulton St
Shopping Corridor

Fulton Stations A C

Long Island RR
Nostrand Av

St. John's Place Stations 3

Medgar Evers College



Empire Blvd Stations 2 5

Prospect
Park

2 5 Kings County Hospital

Clarkson Stations

ROGERS AV

2 5 **Church Stations**

Southbound
on
Nostrand Av

Northbound
on
Rogers Av

2 5

2 5

Brooklyn

Brooklyn College



**Flatbush Av/
Brooklyn College Station** 2 5

The Junction Retail District
& Bus Transfer Hub

FLATBUSH AV

Kings Highway Station

NOSTRAND AV

Marine
Park

**Avenue U
Station**

**Avenue X
Station**

**Emmons St
Station**

**Emmons St/
Knapp St Station**

SHORE PKWY
Sheepshead Bay