

Bus Network Redesign for a Multimodal City: A Case Study of Staten Island-to-Manhattan Express Bus Service in New York City

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Why?

Staten Island is the only borough of New York City without a rail connection into Manhattan, and on an average weekday nearly 36,000 rides are taken on express buses between the two boroughs.

Much of the express bus network has evolved through piecemeal changes over several decades. As traffic congestion (particularly in Manhattan) has progressively worsened, express bus performance has suffered, and riders frequently complain of poor reliability and long travel times.

The Issues: Before the Redesign

Network Complexity

There are 26 different express bus route variants, and though the intent of express service is to connect Staten Islanders to the Manhattan business districts and transit network, the routes function almost like local transit within Manhattan, branching out onto many different streets and making frequent stops.

Frequency

Given fixed resources, more routes means less frequent service per route. Many riders leaving Manhattan have multiple routes that travel near their home, but must choose in advance which street to wait for the bus on in Manhattan, reducing the effective service frequency available to them.

Tour of Manhattan

Nearly half of riders use routes that serve both Downtown and Midtown Manhattan on the same trip. Traffic in Manhattan has increased dramatically since the express bus lines were created. On some routes, up to 50% of running time is spent on congested Manhattan streets, often operating more than three times slower than the subways below.

Route	Manhattan Routing	Average SB Travel Time (minutes)	Average SB Travel Speed (mph)
X2	Midtown	80	15.9
X3	Downtown	63	14.3
X9	Midtown/Downtown	103	11.4

Stop Spacing

On average, Staten Island express routes have 27 stops before even leaving Staten Island. 83% of ridership is concentrated at 50% of the bus stops, while the bottom 20% of stops are estimated to have only 2% of ridership.



WHAT WE DID

Methodology

- Express buses travel through three distinct areas with different characteristics. Each one was evaluated separately:
 - Staten Island section: Review ridership by corridor, consolidate under-utilized stops, and straighten the route.
 - Non-stop section: Aim to maximize time on the expressway, use HOV infrastructure where possible.
 - Manhattan section: Review ridership by corridor (Downtown, In-between, Midtown) and area (West Side, Broadway/Church Avenues, East Side) to provide more direct rides for more customers. Minimize travel time on local streets.
- Develop route alternatives, comparing relative performance to other factors (such as walk time):
 - Speeds on Fifth Ave versus Lexington Ave
 - Speeds on 34 St versus 42 St
- Fine-tune alternatives based on additional public feedback.
- Re-analyze the proposed segments together and join them for higher-level review.

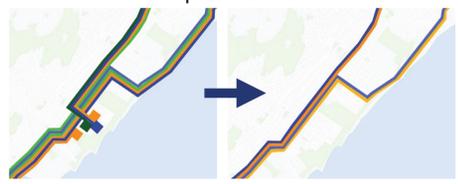
Redesign Goals

Avoid Manhattan Traffic



- Nearly 96% of riders go to Midtown or Downtown.
- In the redesigned network, 11 routes travel to Midtown Manhattan, 8 to Downtown, and 2 to Greenwich Village/Union Square, providing free transfers to the subway and local bus network in Manhattan for trips to other destinations.
- The average route mileage used on congested Manhattan streets is cut in half, meaning faster trips and improved reliability.

Simpler Network



- Simplifying the network in Manhattan allows for a more logical network on Staten Island, with fewer route variants each providing more frequent service.
- Today's network has 26 routes while the redesign has 21, but with no reduction in the overall number of trips (in fact, an increase).

More Direct Routing



- In the redesign, service was made more logical and direct, reducing the number of turns by 35% and increasing the percent of route mileage spent running non-stop on highways by 9%.
- Changes are most notable on Staten Island's South Shore.

Less Stopping



- Bus stops have been re-spaced, increasing the average distance between stops from the existing quarter-mile to slightly under a half-mile, similar to many of the MTA's popular Select Bus Service routes.
- Stop re-spacing and other improvements allowed for a reduction in average scheduled route running time and an increase in span on 11 routes.
- 70% of riders can use the same stop they do today.

SERVICE LAUNCH

What We Accomplished

- Compared to the old network, there are:
- More trips! 68 more on weekdays; 62 more on Saturdays; 60 more on Sundays.
 - 4 off-peak routes instead of 3.
 - Shorter avg. scheduled route travel times: 11% reduction.
 - 11 more routes that operate until 7 pm or later (20 vs 9).

The new network went live on August 19, 2018. More than 100 staff members supported the launch in the field in the first two weeks. We continue to evaluate traffic patterns and ridership and respond to customer concerns:

- Management reviews daily reports on On-Time Performance, Wait Assessment, Service Delivered, and Avg. Speed
- Extra trips added to alleviate crowding.
- Schedules updated with higher frequency.
- Adjustments made to mitigate delays due to pedestrian crowding in Midtown Manhattan.

What's Next?

This redesign serves as a template for bus redesigns in the rest of the city under the Fast Forward corporate plan. One of the four plan priorities is to Redesign the Bus Network to:

- Give buses greater priority in traffic.
- Enhance the fleet
- Redesign all routes in all five boroughs in three years, and
- Manage for reliability by being more data driven in our approach to maintenance.



New York City Transit President Andy Byford greets customers on the first day of the service launch.

**Fast Forward:
The Plan to Modernize
New York City Transit**

How?

Public outreach was a critical element of the study, including:

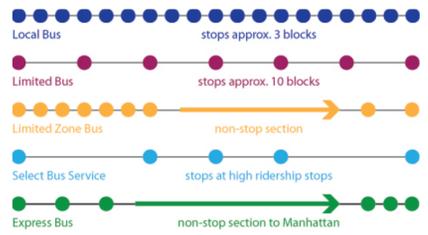
- On-board surveys of over 2,000 express bus riders
- Three public workshops with over 100 participants
- A bus hackathon event which tasked participants to propose bus network redesigns using data sets provided by New York City Transit
- Online feedback
- Two rounds of open houses, presenting the initial plan and then the revised plan
- Customer outreach at bus stops in weeks leading up to the launch

To make substantial improvements to rider concerns, a comprehensive examination of the network as a whole was required. To analyze travel patterns, a ridership model of bus stop origins and destinations was used, estimating rider trip information based on GPS and fare payment data. Staten Island express corridors and neighborhoods were examined in detail to understand where riders were going in Manhattan, and the entire express bus network was reassembled with a focus on speed and reliability.

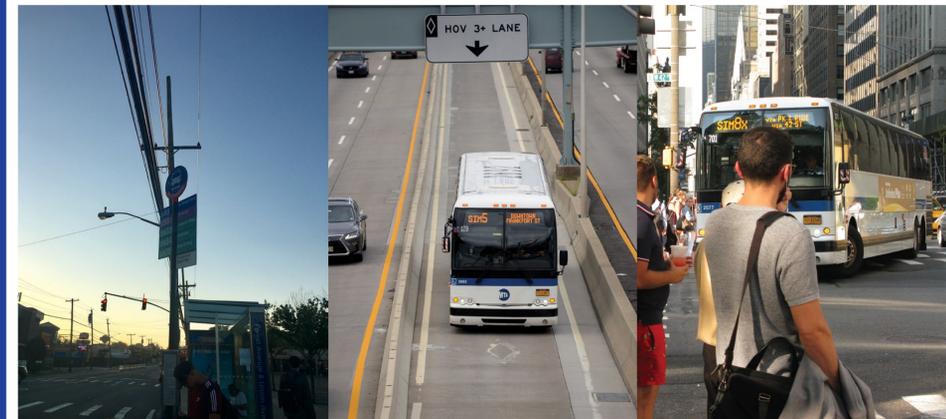


What is an Express Bus?

In New York City, an express bus refers to a premium-fare coach commuter bus that runs between an outer borough (typically in an area without adequate subway service coverage) and the Central Business District. Many routes operate at peak hours in the peak direction only.



Express bus service design must account for bus stops in suburban locations, expressway operating segments, and CBD congestion.



Public buses share the street with cars and trucks; private commuter buses, tour buses, ferry buses, and airport buses; emergency vehicles; people on bicycles; For Hire Vehicles; vendors setting up or hitching food carts; and pedestrian traffic at crosswalks.

