100 Days and 100 Nights

From Astoria to Lower Manhattan and Back

March 2019

NYCTRC
NEW YORK CITY TRANSIT RIDERS COUNCIL


Lexington Av–59 St
5532

NYCTRC

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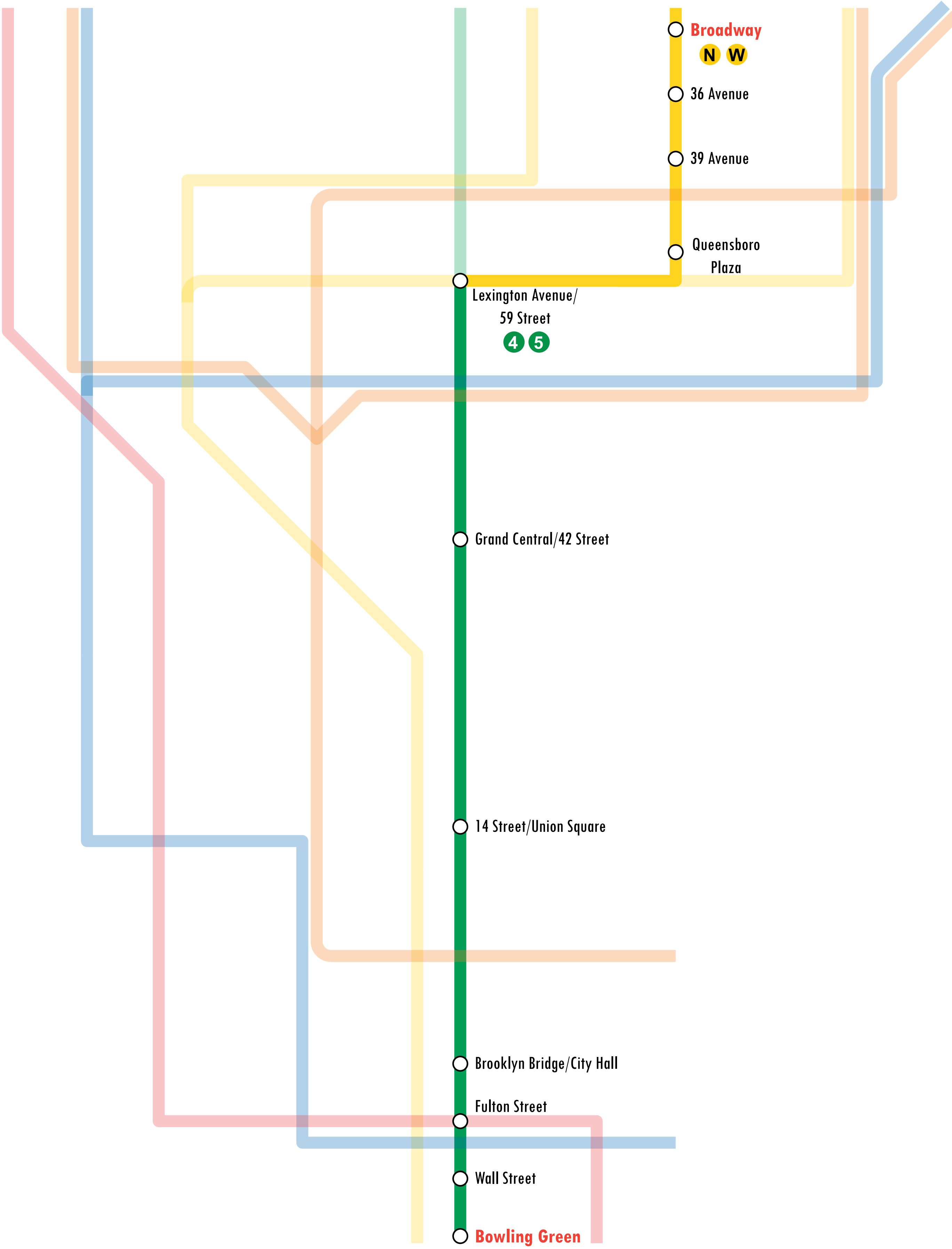

EXECUTIVE SUMMARY

Long Island City's (LIC) rapid growth and the physical constraints at the Lexington Av/59 St station have focused the attention of the New York City Transit Riders Council (NYCTRC) on several related rider concerns, including slow track speeds, and overcrowding onboard trains, on station platforms and in stairwells. LIC is currently adding more than 11,000 residential units, in addition to the 16,000 plus units completed since 2006. This growth can be felt at the Lex/59 St station during the PM peak as Queens-bound riders transfer from the 4/5/6 lines to the N/R/W lines, the stairwells can be blocked by N/R/W platform crowds, bringing the flow to a standstill. In this report, *100 Days and 100 Nights*, the Council conducted an in-depth study of this heavily traveled subway route to gain insight into the rider experience, identify the problems, and advance implementable solutions, largely within the context of New York City Transit's (NYC Transit) Fast Forward plan.

The trip begins in the AM peak from the N/W Broadway station in Astoria, transferring at the Lexington Av/59 St station to the southbound 4/5 lines, and terminating at lower Manhattan's Bowling Green station. This geographically diverse route includes riders from Queens, the Bronx, the Upper East Side, and Brooklyn (PM commute). The performance of the N/W and 4/5 lines creates crowding conditions that significantly impacts the rider experience, as well as the route's reliability and resiliency. These issues are not necessarily unique to this route, as riders can relate on a system-wide basis.

Several factors affecting the trip were measured and analyzed. These factors included: total trip durations; trip segment durations; track speeds; station dwell times; platform wait times; transfer times; station crowding; onboard crowding; and stairwell crowding. A rider logged each of these trip aspects over a seven month period, from September 2017 through mid-March 2018, during 111 AM peak and 100 PM peak trips.

The report recognizes that, in July 2017, NYC Transit began its Subway Action Plan (SAP) to stabilize the declining performance of the system. Keeping this in mind, the Council sought to understand the broader rider experience along this route by incorporating NYC Transit's peak hour real-time General Transit Feed Specification (GTFS) data and schedule data to identify performance changes. Our analysis showed that NYC Transit adjusted the 4/5 line schedules to better reflect the actual run-times, in an effort to provide a more reliable trip. We also found that after the first year of the SAP, the 4/5 line major delays declined by 38%.

From this in-depth study, the Council realizes that for this route to improve, investments must be made for both quick-win and longer-term scenarios. In addition to NYC Transit's SAP, Andy Byford's Fast Forward plan proposes to modernize the system beyond infrastructure investments. Some of the elements include the need to *upgrade critical infrastructure; review potential route changes to reduce reliance on critical interlockings; revitalize the station experience; accelerate accessibility; and give buses greater priority in the face of traffic*. Each of these initiatives, if applied to this route, has the potential to improve commutes for thousands of New Yorkers.

Several elements have already been implemented including the “Speed Unit”, to speed up trains throughout the system. So far, 24 locations have seen increased speed limits, with 44 more in the pipeline. Some of the speed improvements will have direct impacts to our surveyed route by increasing 4/5 train speeds south of 14 St/Union Square and doubling N/W train speeds in and out of the Ditmars Boulevard terminal in Astoria. For this work to fully advance, it is imperative that reliable and sustainable funding be identified. This report details additional possibilities for this route if the funding is applied. Substantial improvements could make this route faster, less crowded, and much more reliable for riders, giving special attention to the complexities at the Lex/59 St station.

AM PEAK FINDINGS

- **Broadway Station:** Platform and onboard crowding during service delays.
- **Queensboro Plaza:** Frequent onboard crowding.
- **Lex/59 St Station:** Significant stairwell crowding.
- **Lex/59 St to 14 St/Union Square:** Slow track speeds.
- **Queensboro Plaza, Grand Central/42 St, and 14 St/Union Square:** Extended dwell times.

PM PEAK FINDINGS

- **Lexington Avenue Line:** Frequent onboard crowding.
- **Lex/59 St Station's N/R/W platform:** Excessive crowding during service delays.
- **Lex/59 St Station:** Long transfer times.
- **14 St/Union Square, Grand Central/42 St, and Queensboro Plaza:** Extended dwell times.

FAST FORWARD: PRINCIPLES APPLIED

1. **Maximize N/R/W line capacity and reliability.**
   a. Reconfigure the Astoria-Ditmars Boulevard terminal tracks to increase AM peak Manhattan-bound train frequency and reliability, boosting potential capacity from 14 trains per hour (tph) to 19-24 tph.
   b. Reroute the N/R lines and de-interline (route-simplify) the Manhattan Broadway Line to increase train frequency and reliability, while reducing the Lex/59 St station crowding problem.

2. **Maximize 4/5 express line capacity and reliability.**
   a. Ensure 4/5/6 line Communications Based Train Control (CBTC) is installed within five years of implementation of Fast Forward to improve reliability, resiliency, track speeds, and crowding.
   b. Continue track speed and signal timer adjustments to improve train speed and throughput.
   c. Evaluate moving the southbound 4/5 platform at 14 St/Union Square station north to the straight track area, thus eliminating the need for the gap fillers and subsequent delays.
   d. Reroute the Brooklyn termini 2/3/4/5 lines to eliminate Nostrand Junction train conflicts that disrupt train spacing and interferes with the lines' reliability.

3. **Improve traffic flow and reduce crowding at Lex/59 St station.**
   a. Conduct a detailed capacity study of the station similar to the one conducted for Grand Central station to understand the short and long-term improvements that must be made to the station.
   b. Establish a Lex/59 St station crowd control mitigation plan staffed with additional platform controllers.
   c. Conduct regular table-top exercises to address Lex/59 St station crowding situations.
   d. Create station passenger-based crowding metrics to better inform NYC Transit of when to implement station-specific crowd-control measures.
   e. Implement and enforce a two-lane Lexington Avenue dedicated busway during Lexington Line CBTC installation, and apply Transit Signal Priority (TSP) as soon as possible to speed up buses.

INTRODUCTION

When New York City Transit's Subway Action Plan (SAP) was announced in late July 2017, the New York City Transit Riders Council (NYCTRC) was in the midst of conducting system reliability surveys to identify poor performing lines and their station and onboard impacts. As a result of these initial surveys, the Council identified a specific route on which to conduct an AM and PM peak hour deep dive analysis. This route is a representation of what riders system-wide endure in their everyday journeys. The route starts in the AM peak from the Astoria, Queens N/W Broadway station, transferring at the Lexington Av/59 St station to the 4/5 lines and terminates at Lower Manhattan's Bowling Green station; it does the reverse for the PM commute. This geographically diverse route includes riders from Queens, the Bronx, the Upper East Side, and Brooklyn (PM commute), traveling through the N line's AM peak load point at Queensboro Plaza[1] and several high volume stations along the 4/5 lines. The Council sought to capture travel speed issues as well as increasing crowding issues and station complexity at the Lex/59 St station, as it is a major transfer point for Queens riders.

Queens's growth impacts the route

From 2010 to 2017, Queens's population grew by 5.7%, adding 127,860 residents.[2] This growth, especially in Long Island City (LIC), has an impact on Queensboro Plaza station's ridership and transfers at Lex/59 St. Queensboro Plaza station's weekday ridership increased by 41% from 2011 to 2017[3], adding nearly 4,000 daily riders, and is expected to continue to increase with the expansion of the LIC core: LIC is currently adding more than 11,000 residential units, in addition to the 16,000 plus units completed since 2006.[4] This growth can be felt at the Lex/59 St station during the PM peak as Queens-bound riders transfer from the 4/5/6 lines to the N/R/W lines, the stairwells can be blocked by N/R/W platform crowds, bringing the flow to a standstill. The N/R/W platform at Lex/59 St is a complex shuffle[5], becoming excessively overcrowded even with the smallest N/R/W service delay. The station was not originally built to accommodate express 4/5 line service, providing transfers to the narrow, bi-directional center N/R/W platform. The station's physical constraints create unbearable crowding conditions that will worsen with Queens's continued rapid growth.[6]

4/5 express line performance affects the route

From July 2016 to June 2017, the 4/5 lines had 156 major delays where 50 trains or more were delayed. Meaningful improvements have occurred since the SAP was first introduced and Andy Byford took the helm of NYC Transit and proposed his Fast Forward plan in May 2018 to modernize and improve the system beyond the SAP's stabilization efforts.[7] From July 2017 to June 2018, major delays were reduced by 37% to 98 incidents, and they are on track for matching or beating this record for the 2018 to 2019 period.[8]

An early impactful initiative of the Fast Forward plan is the "Speed Unit", tasked with safely improving train speeds and assessing subway grade time signals to identify those that are incorrectly calibrated. Under this initiative, speed improvements were implemented at 24 locations with 44 more in the pipeline, totaling 68 faster areas across the system. Additionally, 320 inaccurate timer signals, which cause train operators to go slower than the posted track speed, have been identified as inaccurate and 59 have been recalibrated to-date.[9]

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1 MTA-NYCT, *NYCT Subway Performance Presentation*, May 2015, Date accessed: July 10, 2017, http://web.mta.info/mta/news/books/docs/150518_SubwayPerformance.pdf.

2 New York City Department of City Planning, *Current Estimates of New York City's Population for July 2017*, Date accessed: June 18, 2018, http://www1.nyc.gov/site/planning/data-maps/nyc-population/current-future-populations.page.

3 New York City Transit, *NYCT Average Weekday Subway Ridership*, Date accessed: July 18, 2018, http://web.mta.info/nyct/facts/ridership/ridership_sub.htm.

4 Long Island City Partnership, *LIC Neighborhood Snapshot*, Date accessed: July 20, 2018, https://longislandcityqueens.com/media/filer_public/f5/23/f523c1f0-8bef-4689-ae11-8cfb923115b7/2018reb_lic_85x11_4418b_nobleed.pdf

5 Riders have to choose between the N/W or R line depending on their destination. When extreme platform crowding occurs it is difficult for them to navigate and access the trains for boarding.

6 Additional LIC and Lex/59 St information can be found in Appendix A.

7 MTA-NYCT, *Fast Forward: The Plan to Modernize New York City Transit*, Date accessed: February 6, 2019, https://fastforward.mta.info/ .

8 MTA website, *MTA Subway Performance Metrics Dashboard*, Date accessed: February 20, 2019, http://dashboard.mta.info/.

9 MTA-NYCT, *MTA New York City Transit Announces Progress in Campaign to Safely Speed up Trains*, Date accessed: January 23, 2019, http://www.mta.info/press-release/nyc-transit/mta-new-york-city-transit-announces-progress-campaign-safely-speed-trains.

While this work is system-wide, it has direct impacts to our surveyed route, increasing 4/5 line southbound train speeds from Union Square to Bleecker Street by 19 MPH, and doubling train speeds approaching and departing Ditmars Boulevard on the N/W lines. These much-needed adjustments will have a positive impact on the AM peak southbound route. Trains will get out of the gate much faster in Astoria, and riders will enjoy a speedier trip south of Union Square to Bowling Green.

While important gains are being made, there is still significant work to be accomplished. Overall, our analysis found significant rider stresses along the course of the route, making it particularly difficult and demanding in both directions. The Council has been working closely with the team at NYC Transit by shedding light on the bottlenecks and overcrowding issues for both the AM and PM peak commutes. It is our hope that progress can continue and additional advancements can be made to improve the rider experience. Identifying and securing sustainable funding is crucial to continue current initiatives and implement Fast Forward proposals that will benefit this route and so many more throughout the system. This is but one example of what riders across the system face every day, making apparent the great need for a more reliable and fully-funded transit network.

METHODOLOGY

The Council initially surveyed eight stations. The selection was based on peak load points and stations that intersected main trunk lines in all boroughs. Station visits were conducted during the morning peak between 7:30 and 9:30 AM, with four-to-five visits per station.

These stations included:

- 59 Street - Brooklyn (N/R)
- 72 Street (1/2/3)
- Atlantic Av/Barclays Ctr (D/N/R)
- 86 Street (4/5)
- East 180 Street (2/5)
- Franklin Avenue (2/3/4/5)
- Kingsbridge Rd (4)
- Lexington Av/59 Street (N/R/W)

This preliminary survey work captured:

- Station level train throughput
- Directional onboard signage
- Station dwell times
- Arrival and departure onboard crowds
- Whether or not the platforms cleared after each train departed[10]

From this initial analysis, the Council selected the N/W to the express 4/5 route between Astoria's Broadway (N/W) station and the Bowling Green (4/5) station in Lower Manhattan, with the Lex/59 St transfer station as a focal point. N/W and 4/5 stations along the route included: Broadway; 36 Av[11]; 39 Av; Queensboro Plaza; Lexington Av/59 St; Grand Central/42 St; 14 St/Union Square; Brooklyn Bridge/City Hall; Fulton St; Wall St; and Bowling Green. This route was also chosen for the reason that it encompasses four subway lines, riders from four boroughs, an overcapacity subway station, and includes the busiest subway line in the system.

At the Broadway station, Manhattan-bound riders have choices: our surveyed route; W trains making all local stops to Whitehall St.; and N trains with a cross-platform transfer at 14 St/Union Square to local R/W service to Whitehall St.

The quantitative and qualitative journey elements were captured through 111 AM peak and 100 PM peak weekday trips, and detailed in daily logs from September 2017 through mid-March 2018. The daily logs were conducted by a PCAC staff member, who recorded real-time route observations through the lens of an everyday rider. Assumptions were not made if observations could not be accurately recorded. For example, if crowd size could not be accurately determined in its entirety, it was not recorded to reflect an area of concern.

Survey elements included:

- Platform wait times
- Station dwell times
- Travel times
- Transfer times
- Track speeds
- Station crowding
- Stairwell crowding
- Onboard crowding
- Trains too full to board
- Conductor announcements

10 Initial station survey forms can be found in Appendix D.

11 The closure of 36 Av could have had an impact on Broadway platform crowding levels. It is assumed that 36 Av riders would be using either Broadway or the 39 Av stations during this closure. In 2017, the 36 Av station's weekday ridership was 5,525, compared to Broadway's 13,242 weekday riders for the same year.

Summary of Calculation Methods

Scheduled travel time was gathered from the NYC Transit scheduled static data feeds and organized to capture scheduled trip times along the route and averaged for each peak hour between 6-10 AM and 4-8 PM.

Actual travel time was gathered from the NYC Transit real-time data feeds, then coded and converted into CSV files. The data collected included 4/5 actual train travel times for the trips' length and for specific route segments. This data was then organized to capture the average travel times for each peak hour between 6-10 AM and 4-8 PM. Inconsistencies in the B Division (lettered lines) real-time data made it unreliable to accurately capture the N/W portion of the route. Therefore, real-time data is not used for this segment.

Survey travel time was recorded from the moment an N/W train left the Broadway station, included the transfer at the Lex/59 St station, and when the connecting 4/5 train arrived at the Bowling Green station in Lower Manhattan (The opposite order was applied to the PM travel time).

Average track speeds were calculated from the route surveys by recording when a train left the station to when it stopped at the next station. Google Maps was used to obtain the distances from one station to the next. The distance was then divided by the time to calculate the train speeds between stations.

Dwell times were recorded at each station from when the train came to a complete stop until it started moving again.

Transfer times were recorded at Lex/59 St for the AM and PM peak trips. The transfer times include when the train stopped at the station, the walk to the other platform, and when the next boarded train started moving.

95th percentile was calculated for the total trip duration to understand how long most trips took by excluding the outlying trips.[12]

Buffer time (cushion time) was calculated using the 95th percentile and the average trip time to understand how much extra time needs to be added to ensure on-time arrivals. This calculation determines how much time is needed to have a more reliable trip.[13]

$$\textit{Buffer index (\%)} = \frac{\textit{95th percentile travel time (minutes) - Average travel time (minutes)}}{\textit{Average travel time (minutes)}}$$

Station level train counts (throughput) were gathered from the NYC Transit real-time data feeds. The average peak hour train count at the station level was calculated and compared to the NYC Transit scheduled static data feeds to determine the number of trains actually running, compared to the average number of trains scheduled from 6-10 AM and 4-8 PM.

Peak hour headways were calculated using the static scheduled data from the MTA General Transit Feed Specification (GTFS) feeds and was compared to the MTA website's Trip Planner and Google Maps to ensure consistency.

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12 *The 95th percentile says that 95% of the time, the usage is below this amount. Conversely of course, 5% of the time, usage is above that amount. The 95th percentile is a good number to use for planning so you can ensure you have the needed bandwidth at least 95% of the time. Source:* http://www2.arnes.si/~gljsentvid10/pct.html.

13 Buffer time was calculated using the Federal Highway Administration's Travel Time Reliability equation. US Department of Transportation, Federal Highway Administration, *Travel Time Reliability: Making It There On Time, All The Time*, Date accessed: July, 15, 2017, https://ops.fhwa.dot.gov/publications/tt_reliability/TTR_Report.htm

Station crowding was observed and recorded at the platform level while waiting for the arriving train. Crowding was organized using low, medium, full, and packed levels.

- **Low:** Platform edge not lined with riders, plenty of room to move around on the platform.
- **Medium:** Platform edge lined with riders, some room to move around on the platform.
- **Full:** Platform edge solidly lined with riders, minimal room to move around on the platform.
- **Packed:** Platform edge and entire platform solid with riders, barely any room to move.

Stairwell crowding was observed and recorded as the surveyor moved through the Lex/59 St station stairwells. Crowding was organized using low, medium, full, and packed levels.

- **Low:** Stairwells sparsely populated with free-flow conditions.
- **Medium:** Stairwells moderately populated with free-flow conditions.
- **Full:** Stairwells heavily populated with slow free-flow conditions.
- **Packed:** Stairwells extremely populated with queues forming at the platform level.

Onboard crowding was observed by the surveyor in a single car, in the middle of the train, while looking into the adjacent cars to help determine crowding levels. From the Council's initial surveys, it was found that the majority of train cars were the same in regards to crowding levels, with the end cars being less crowded than the others. Crowding was organized using level indicators: 1; 2; 3; and 4 to crush-load.

- **Level 1:** Plenty of seats and standing area available.
- **Level 2:** Seats are full, but there is ample standing space available.
- **Level 3:** Seats are full and there is standing space available away from the car doors.
- **Level 4 to crush-load:** Seats are full and no standing space is available, often preventing riders from boarding.

Additional Information

95th percentile statistic vs average is used in this report when we believed it is the method that best represents the rider daily experience, and/or the capabilities of the system.

Extremely difficult commutes were captured in the surveys (Appendix B) and became case studies to illustrate particular rider experiences that stood out from the typical commute.

Background research was conducted on Long Island City's (LIC) growth and the history of the Lex/59 St station to better understand events impacting this transit route.

MTA's General Transit Feed Specification (GTFS) was used to look beyond our single surveyed trip and to capture an overall picture for the AM/PM peak periods. The comparisons are visualized in the report to gain a better understanding of the service being provided to riders.

Glossary of Terms

De-interline (Route Simplification): Reduces subway merge points so that trains are not crossing in front of each other. When trains are crossing other lines it slows down service and leaves segments of lines underutilized, limiting capacity.

Headway: Timing intervals between trains at the station level.

Peak load-point: Onboard capacity measured where trains carry the heaviest load in the peak hour.

Throughput (train counts): How many trains serve a given station by the hour.

AM/PM PEAK FINDINGS

AM RIDER EXPERIENCE

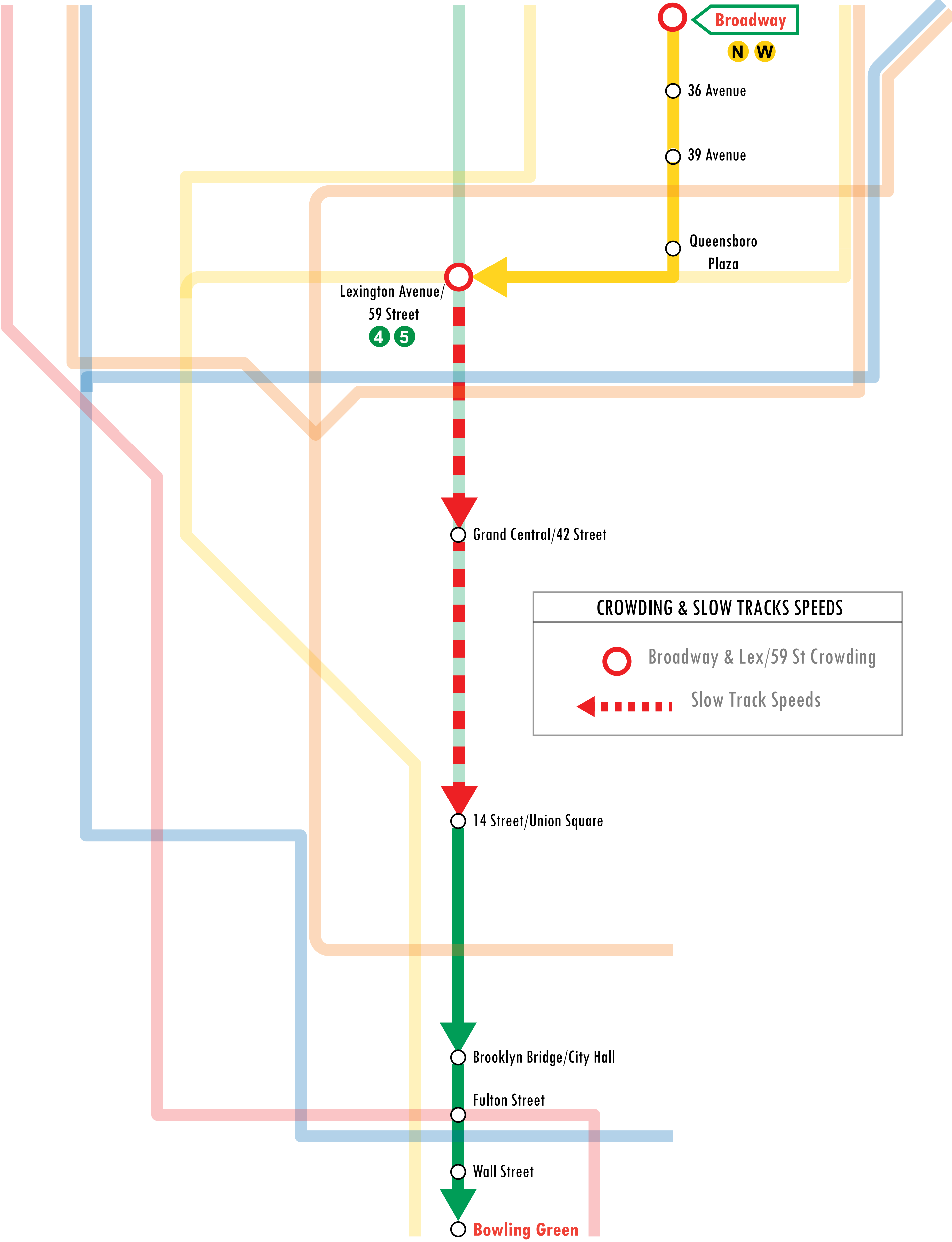
N W to 4 5 **111 weekday surveys starting between 8:15 – 8:30 AM**

The following AM rider experience highlights the route's southbound trip duration and problem areas. Extreme Broadway platform crowding and Queensboro Plaza onboard crowding were issues from the onset. After the Lex/59 St transfer, riders endured slow track speeds to 14 St/Union Square. Long dwell times were the highest at Queensboro Plaza, Grand Central/42 St, and 14 St/Union Square, increasing the total trip time. A total of four days were considered extreme commutes due to travel time lengths and other factors, which are detailed in Appendix B. Data visualizations detail the route surveys and real-time data feeds on the following pages.

Lexington Av/59 St Station Notes

Riders from the N/R/W trains disperse to the station's west-end portals for transfers to the 4/5/6 trains. The 4/5/6 trains are served by four platforms compared to the one, narrow, bi-directional platform for N/R/W service (see page 16).

AM SURVEY MAP



TRIP DURATION

Broadway Station to Bowling Green

Adding nearly ten minutes to the scheduled trip time is needed to ensure an on-time arrival.

39:00 Average *Scheduled* travel time

47:35 95th percentile travel time

09:21 Buffer time to arrive ontime

48:21 Most reliable travel time (Scheduled + Buffer Time)

BROADWAY STATION CROWDING

N W **Average weekday station entries = 13,242**

Extreme platform and onboard crowding occured during service delays.

16% Platform did not clear due to onboard crowding

15% N/W trains left the station full-to crush-load

7% Extreme platform crowding

QUEENSBORO PLAZA ONBOARD CROWDING

Average weekday station entries = 13,502 N W

The N/W/7 lines converge at Queensboro Plaza, where ridership has increased 41% since 2011. When trains were full, conductors ask riders to wait for the next train.

61% *N/W trains left the station full-to crush-load*

17% Platform did not clear due to onboard crowding

LEX/59 ST STATION TRANSFER CROWDING

N W 4 5 **Average weekday station entries = 58,467**

The Lex/59 St station is a major transfer point for Queens riders.

61% N/W trains arrived at the station full-to crush-load

67% *Extreme stairwell crowding*

46% 4/5 trains left the station full-to crush-load

LEX/59 ST TO 14 ST/UNION SQ SLOW SPEEDS

4 5

Slow track speeds from Lex/59 St to 14 St/Union Square created long travel times.

08:30 Average *Scheduled* travel time **(18 MPH)**

15:47 Average *Actual travel time* ***(9 MPH)***

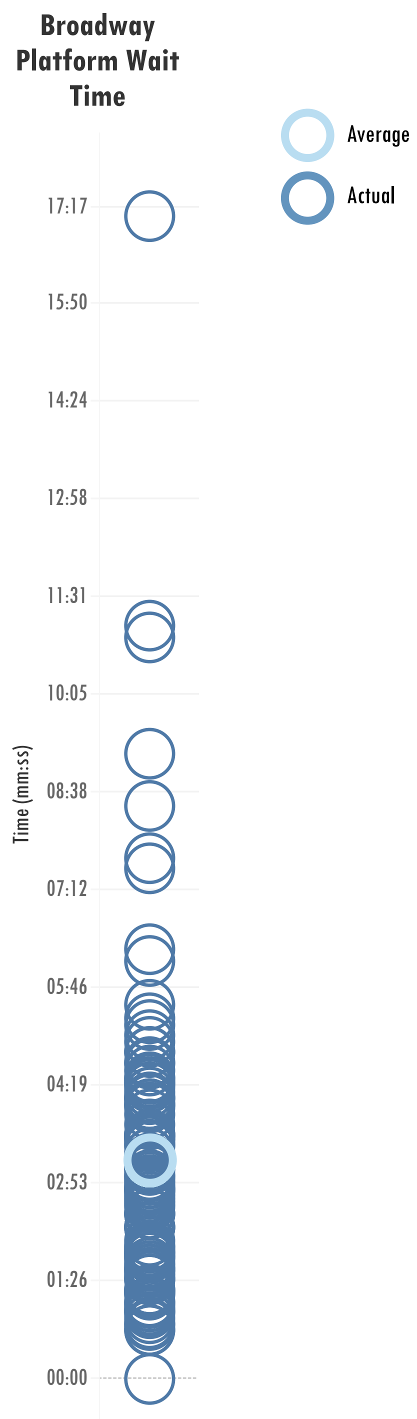
AM RIDER EXPERIENCE: IDENTIFIED COMMUTING ISSUES

1. Broadway station had severe platform and onboard crowding during service delays.
2. Queensboro Plaza had frequent severe onboard crowding.
3. Lex/59 St station had significant stairwell crowding.
4. Lex/59 St to 14 St/Union Square had slow track speeds.
5. Extended dwell times occured at Queensboro Plaza, Grand Central/42 St, and 14 St/Union Square.

AM RIDER EXPERIENCE: BROADWAY PLATFORM WAIT TIME

1 Broadway station had severe platform and onboard crowding during service delays.

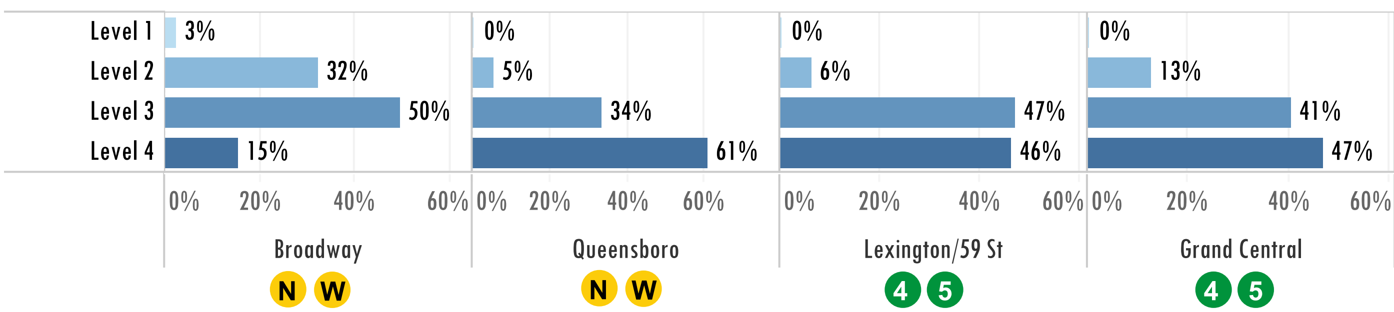
During service delays, platform waits quickly created extreme crowding conditions 7% of the time, which were further exacerbated 16% of the time when full trains arrived without room to accommodate the platform crowds. (Note: On 2/20/18, the Broadway platform wait time was 27 minutes. This unrepresentative wait time was excluded from the graph below due to scaling reasons.)



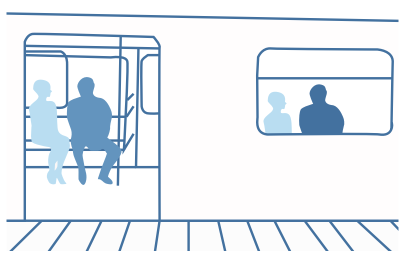
2 Queensboro Plaza had frequent severe onboard crowding.

Queensboro Plaza to Grand Central/42 St, via Lex/59 St, N/W and 4/5 trains were typically more crowded when leaving stations. Queensboro Plaza stands out the most, with 61% of trains leaving the station full-to-crush load (Level 4), preventing riders from boarding 17% of the time.

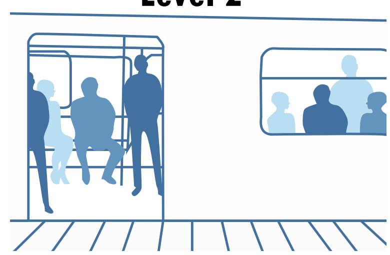
AM Onboard Crowding



Level 1



Level 2

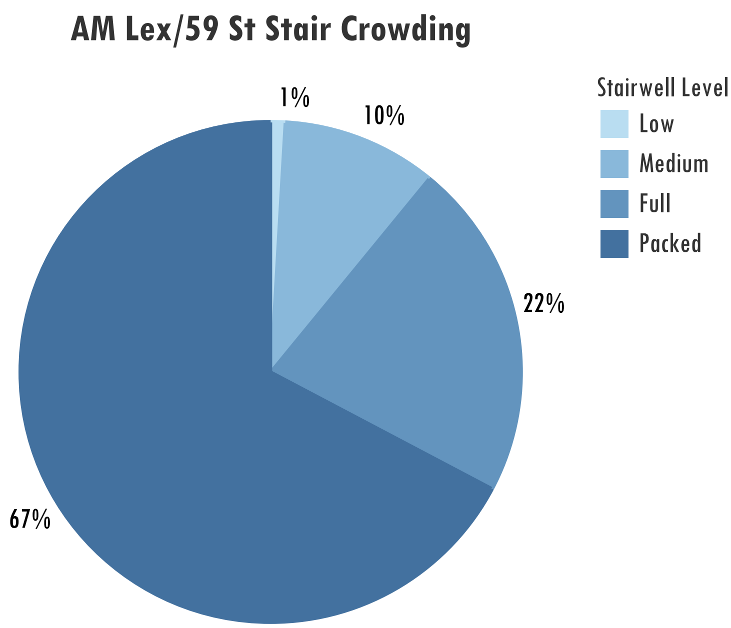


Level 3

Level 4

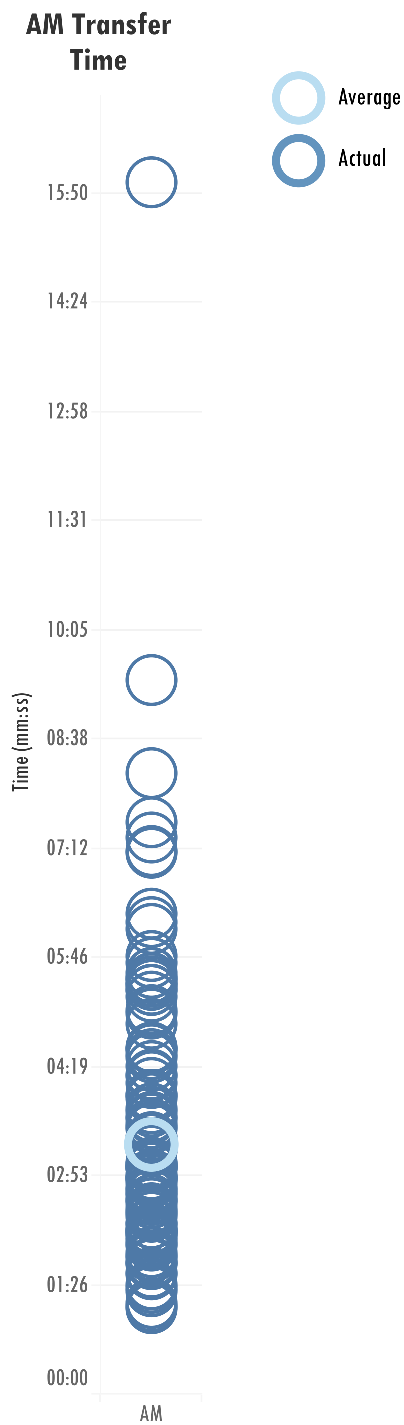
3 Lex/59 St station had significant stairwell crowding.

When transferring from the N/W to the 4/5 express trains, stairwells were packed 67% of the time with a near standstill queue to get down the stairs to the southbound express platform. This was further affected by arriving 4/5 riders ascending the same stairs that N/W riders are descending.



TRANSFER TIMES

During the AM commute, many Queens passengers transferred to the 4/5 lines at the Lex/59 St station. The stairwells were often packed, which affected transfer times. The average transfer time was 3:18 minutes, while the highest AM transfer time recorded was 16 minutes.



AM PEAK LEX/59 ST STATION RIDER FLOWS AND PINCH-POINTS

The diagram below illustrates how N/R/W riders transfer to either the 4/5 lines downstairs or to the 6 line upstairs, or exit the station. In the AM peak, N/R/W riders transfer from the single, narrow, bi-directional N/R/W platform to the four 4/5/6 line uptown and downtown platforms. Pinch-points often occur at the entrances of and on stairwells.

Lex/59 St Station Diagram

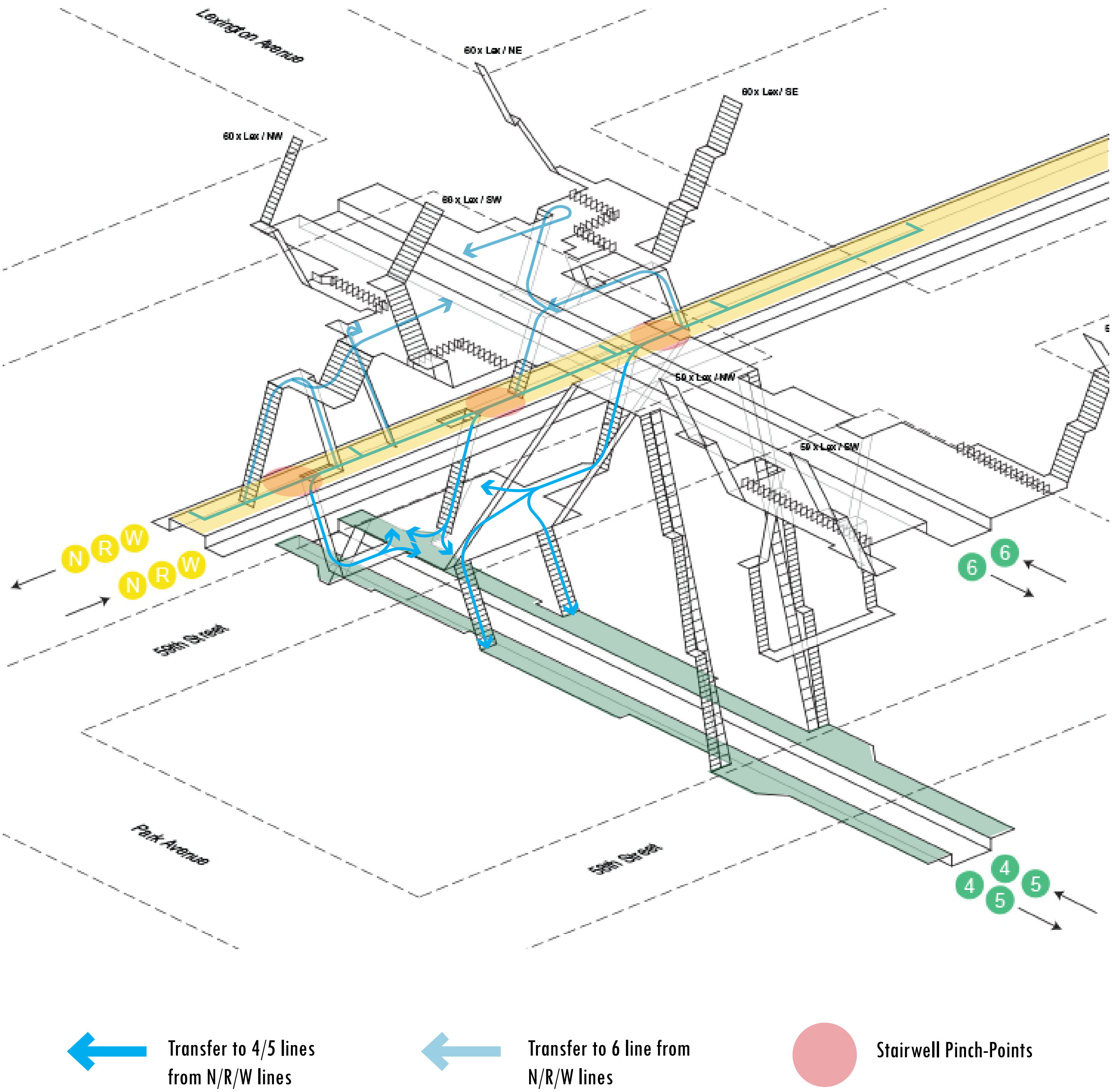
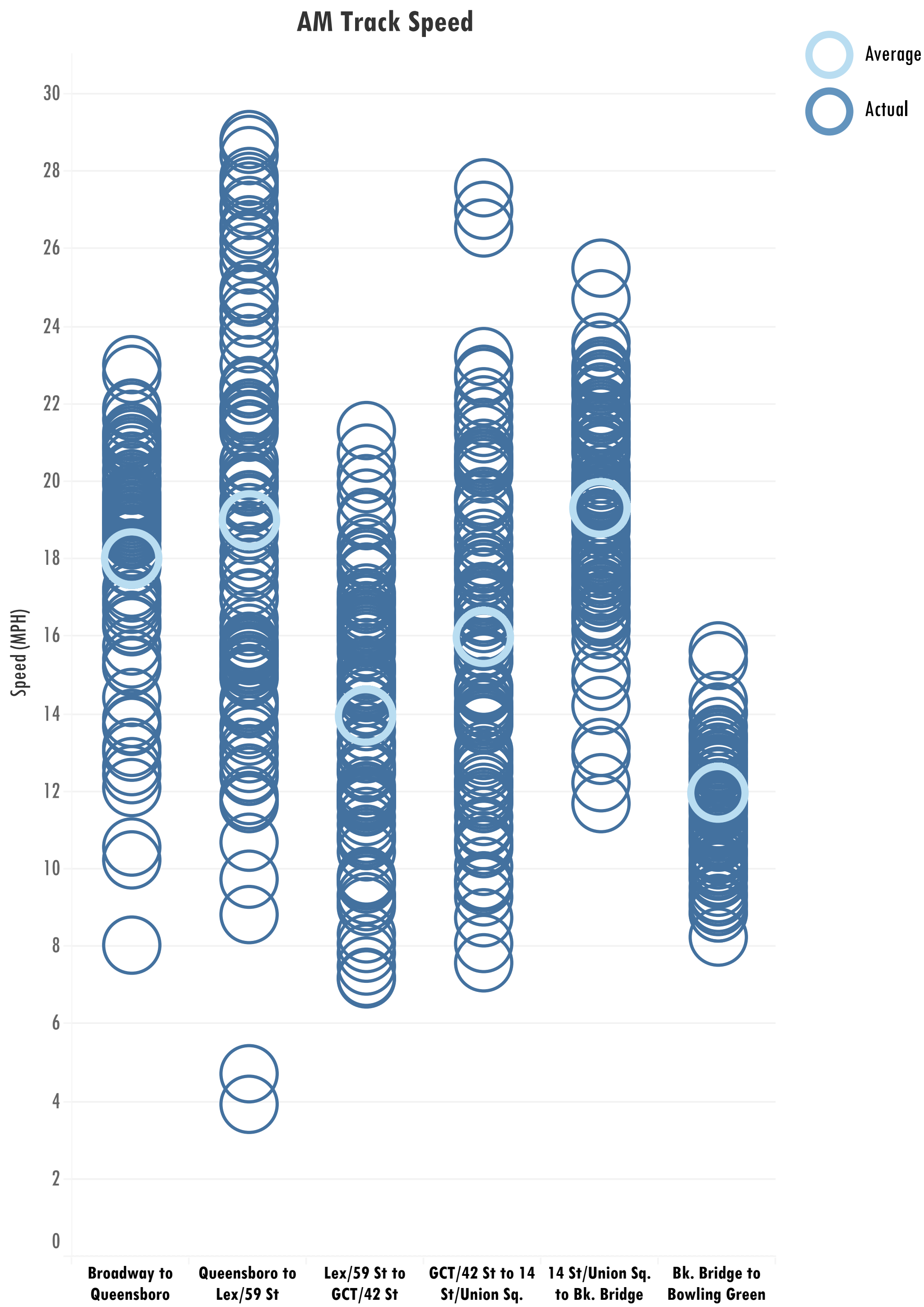


Diagram source: Candy Chan, [Project Subway NYC]

TRACK SPEEDS

4 Lex/59 St to 14 St/Union Square had slow track speeds.

During the AM commute, track speeds were slowest from Lexington Av/59 St to 14 St/Union Square (average = 15 MPH), and from Brooklyn Bridge/City Hall to Bowling Green (average = 12 MPH).



5 Extended dwell times occured at Queensboro Plaza, Grand Central/42 St, and 14 St/Union Square.

Queensboro Plaza

00:56 Average dwell time

04:35 Highest dwell time

Grand Central/42 St

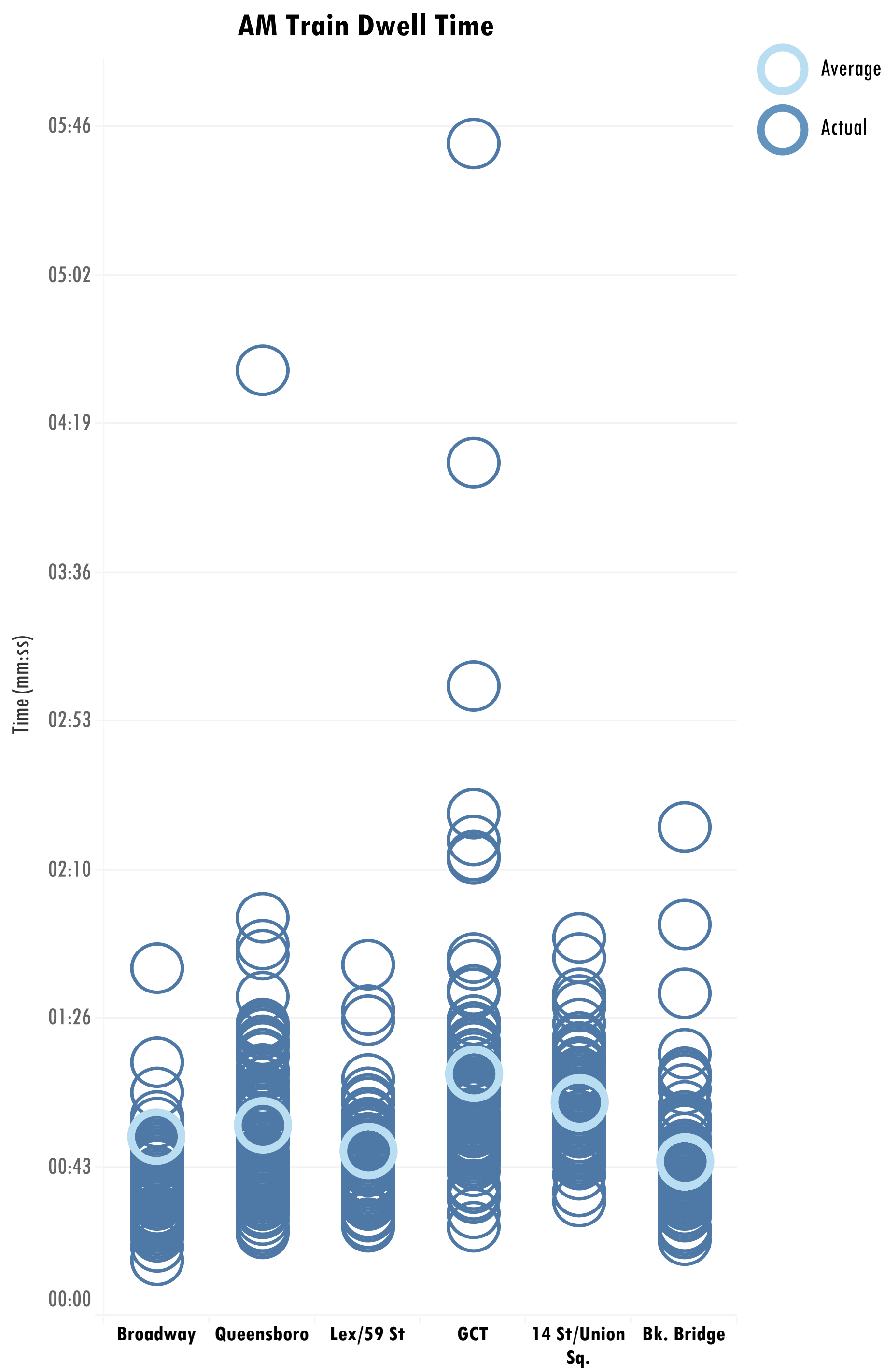
01:10 Average dwell time

05:41 Highest dwell time

14 St/Union Square

01:01 Average dwell time

01:50 Highest dwell time



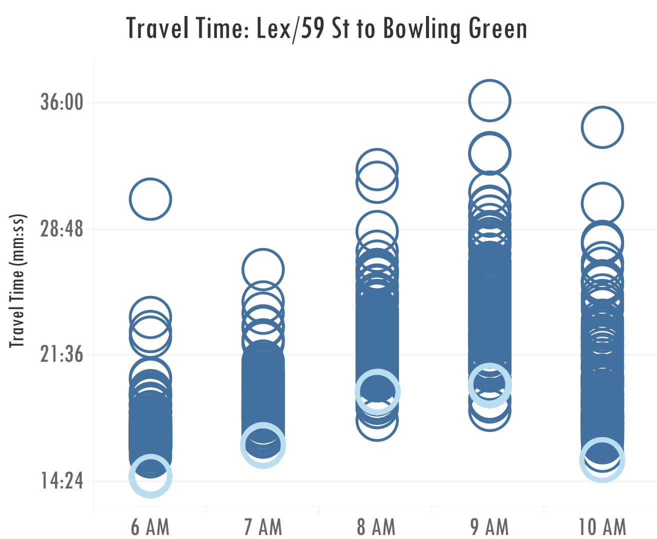
AM RIDER EXPERIENCE: REAL-TIME DATA

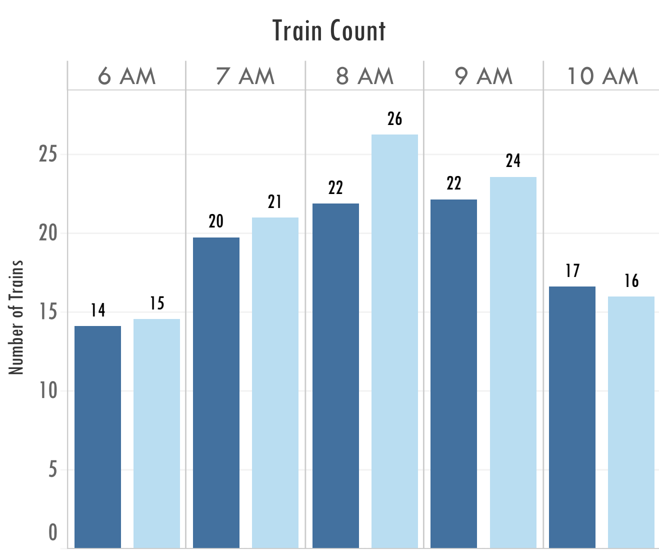
AM REAL-TIME DATA

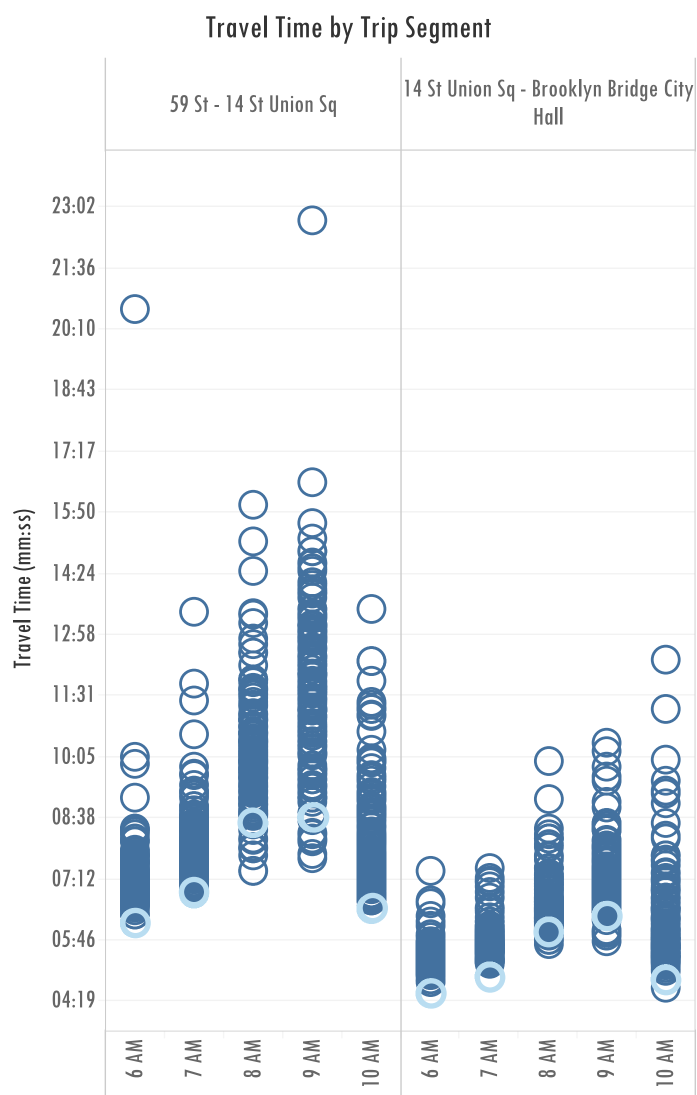
The MTA's GTFS real-time data demonstrates a major discrepancy between the scheduled and actual trip times. The graphics below correlate with the rider survey time period and show that almost all 4/5 trips from Lex/59 St took longer than the scheduled time to arrive at the Bowling Green station. The impact of these longer travel times resulted in less throughput. At the 8 AM hour, only an average of 22 trains went through the corridor, instead of the 26 scheduled trains. The breakdown of the 8 AM hour in 15 minutes segments can be found in Appendix C.

8 AM Peak Travel Times

Segment	Scheduled Time	% of Days When Avg.Trips Take Longer than Scheduled Time
Lex/59 St to Bowling Green	19:29	94%
Lex/59 St to 14 St/Union Sq.	8:30	92%
14 St/Union Sq. to Brooklyn Br.	5:58	93%



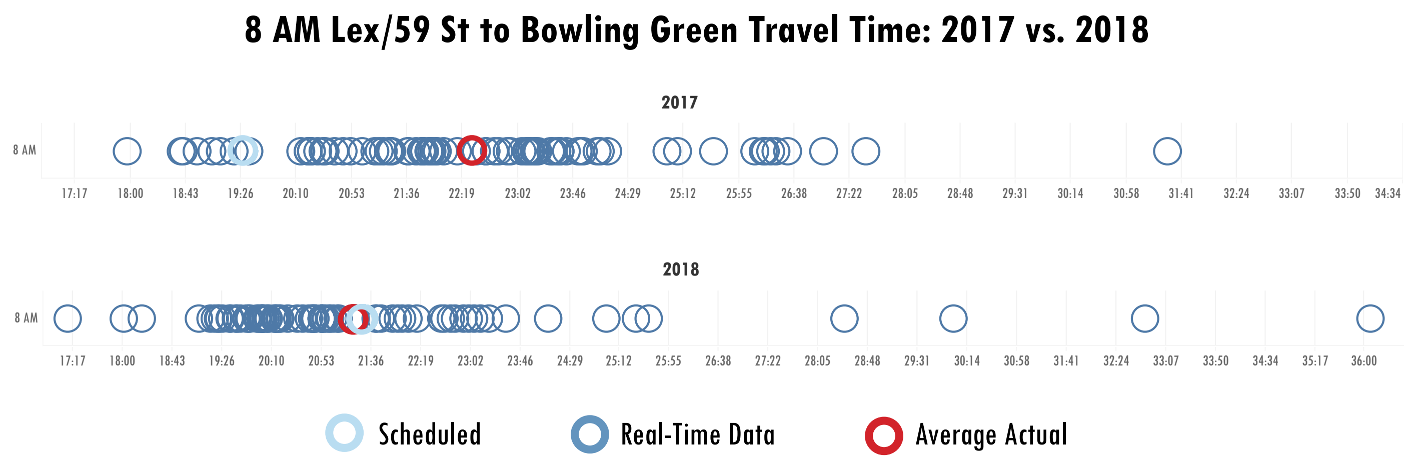




Scheduled Real-Time Data

AM REAL-TIME DATA 2017 vs. 2018

A year after the implementation of the SAP, the Council reviewed data to see if any service improvements were accomplished on 4/5 trips between Lex/59 St and Bowling Green stations. During that time, the 8 AM hour average scheduled travel time between Lex/59 St and Bowling Green was adjusted from 19:29 to 21:30 minutes. This adjustment resulted in more trains meeting the scheduled run time for this segment – between September and December 2017 only 20% made the scheduled run time, and for the same time period in 2018, this climbed to 61%. Additionally, when comparing the scheduled trip time to the rider survey, the rider's average travel time in this segment was 23:02 minutes, which is more aligned with the most recent schedule adjustment to 21:30 minutes. However, despite this on-time performance (OTP) improvement, there is still more that can be done. The graph below shows that not only are schedules becoming more realistic, but travel times are starting to improve as well.



2017: During the 8 AM hour, the average actual travel time was **22:24** minutes, ranging between 17:58 and 31:30 minutes.

2018: During the 8 AM hour, the average actual travel time was **21:28** minutes, ranging between 17:12 and 36:05 minutes.

PM RIDER EXPERIENCE

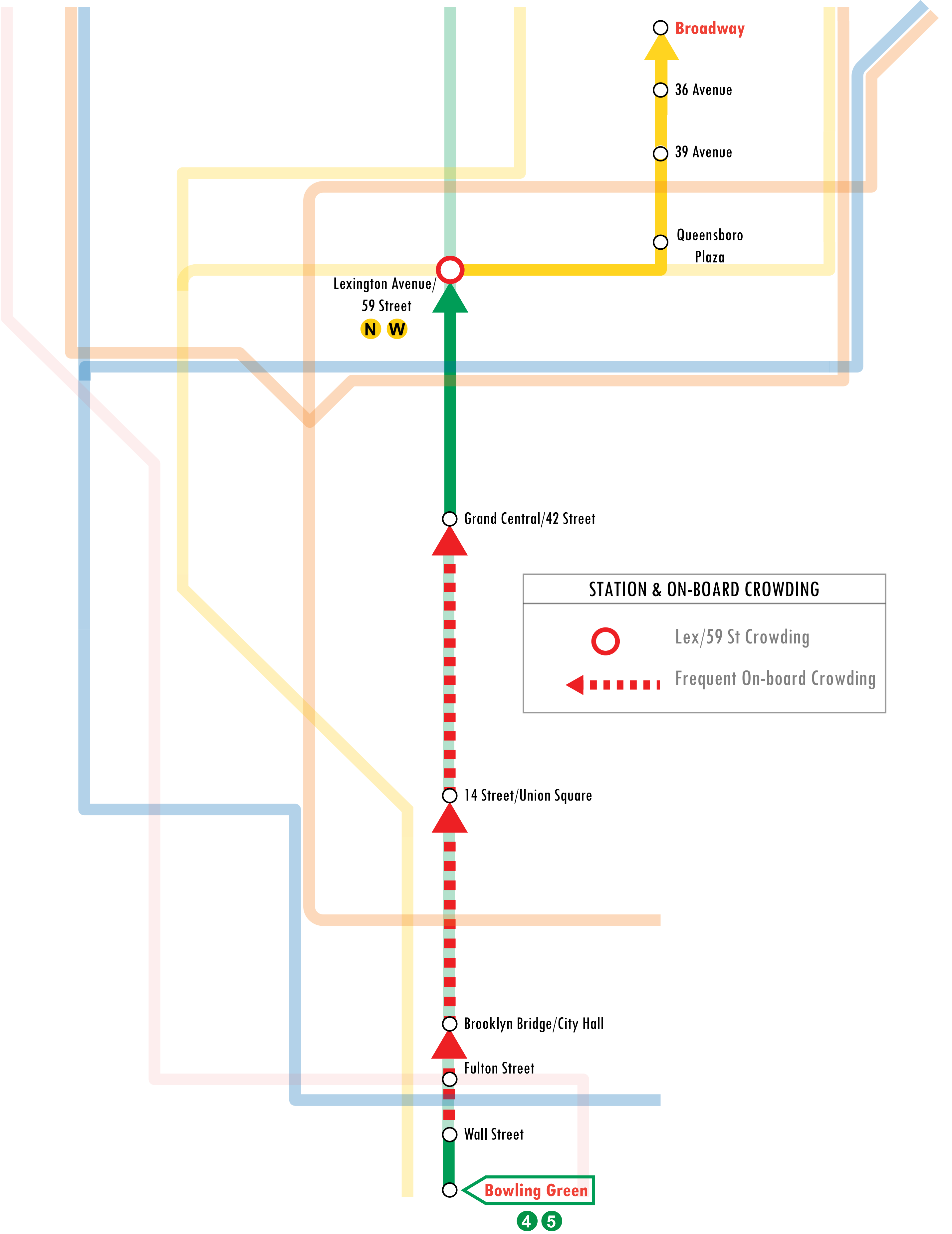
4 5 to N W — **100 weekday surveys starting between 5:00 – 5:30 PM**

The following PM rider experience highlights the route's northbound trip duration and problem areas. Extreme onboard crowding from Fulton St to Grand Central/42 St often left riders on the platforms. Crowding peaked at the Lex/59 St station, where N/R/W platform crowds were untenable 20% of the time, with long transfer times 34% of the time. Long dwell times were the highest at 14 St/Union Square, Grand Central/42 St, and Queensboro Plaza, increasing the total trip time. A total of three days were considered extreme commutes due to long transfer times (up to 36 minutes) and crowding at Lex/59 St station, which are detailed in Appendix B. Data visualizations detail the route surveys and real-time data feeds on the following pages.

Lexington Av/59 St Station Notes

In the PM, a preponderance of riders transfer from the 4/5/6 trains via four platforms to a single, narrow, bi-directional N/R/W platform. With all these Queens-bound riders transferring to the N/R/W lines, the platform and stairwells are frequently overcrowded (see page 30).

PM SURVEY MAP



September 2017 - March 2018

TRIP DURATION

Bowling Green to Broadway Station

Nearly nine minutes needed to be added to the scheduled time to ensure an on-time arrival.

38:00 Average *Scheduled* travel time

44:43 95th percentile travel time

08:52 Buffer time to arrive on-time

46:52 *Most reliable travel time (Scheduled + Buffer Time)*

LEXINGTON AVENUE ONBOARD CROWDING

4 5

Extreme crowding in the PM commute was a common occurrence. Trains frequently arrived at stations full-to crush-load, preventing riders from boarding. When trains were full, conductors asked riders to wait for the next train.

Riders not able to board due to onboard overcrowding frequency:

27% *Fulton*

17% Brooklyn Bridge/City Hall

20% *14 St/Union Square*

13% Grand Central/42 St

14 ST/UNION SQ to LEX/59 ST TRACK SPEEDS

4 5

From 14 St/Union Square to Lex/59 St PM travel times and track speeds were 50% faster than the AM commute.

07:16 Average *Scheduled* travel time **(22 MPH)**

08:21 Average *Actual* travel time **(18 MPH)**

LEX/59 ST STATION TRANSFER CROWDING

N W 4 5

Extreme crowding at the Lex/59 St station's Queens-bound platform is problematic during the PM commute. Irregular service and delays caused transfer times to be as high as 36 minutes.

37% *Packed stairs*

34% *Longer than average platform wait times*

20% *Extreme platform crowding*

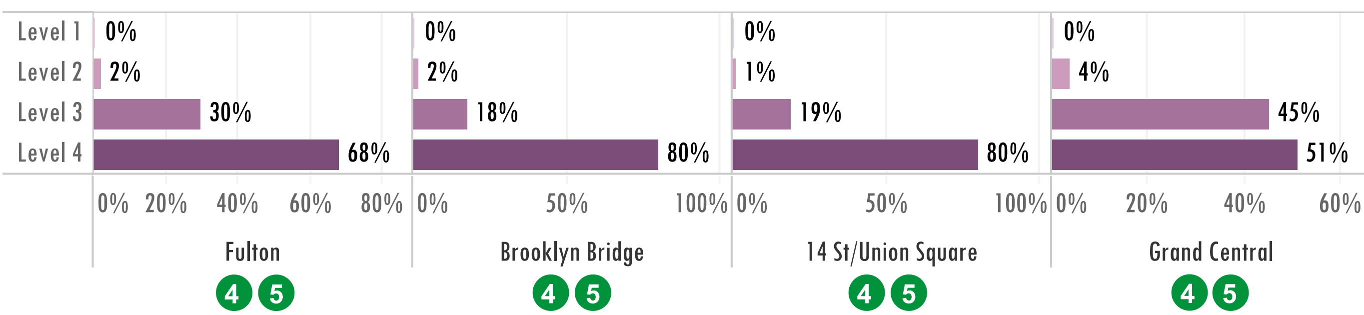
PM RIDER EXPERIENCE: IDENTIFIED COMMUTING ISSUES

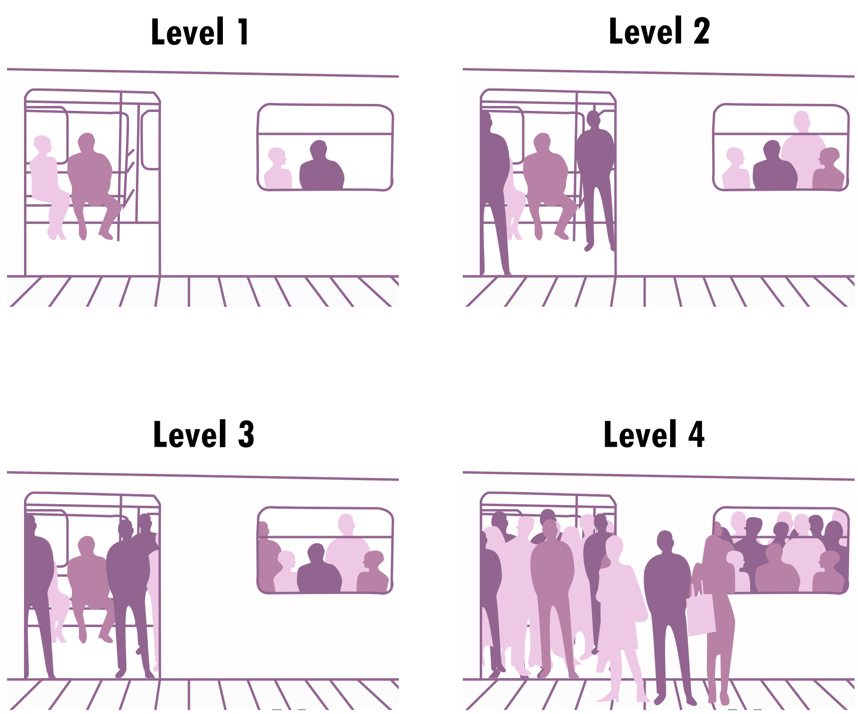
1. Lexington Avenue Express Line onboard crowding was frequent.
2. Lex/59 St station's N/R/W platform had excessive crowding.
3. Lex/59 St station's long transfer times were frequent.
4. Extended dwell times occured at 14 St/Union Square, Grand Central/42 St, and Queensboro Plaza.

1 Lexington Avenue Express Line onboard crowding was frequent.

During the PM commute, 4/5 Lexington Avenue Line onboard crowding was extreme. From the lower Manhattan stations (Fulton St and Brooklyn Bridge/City Hall) to 14 St/Union Square, train cars were often full-to-crush load (Level 4) 68%, 80%, and 80% of the time respectively, preventing riders from boarding across the entire length of the platforms. At Fulton St, riders were unable to board 27% of the time due to onboard crowds.

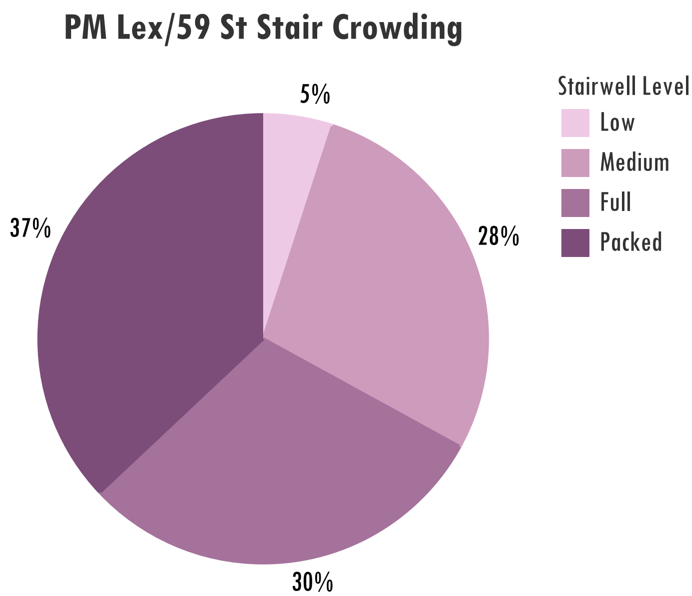
PM Onboard Crowding





STAIRWELL CROWDING

When transferring from the express 4/5 trains to the N/W lines, stairwells were packed 37% of the time, and could get backed-up when the platform above was packed – leaving riders trapped in the stairwells.

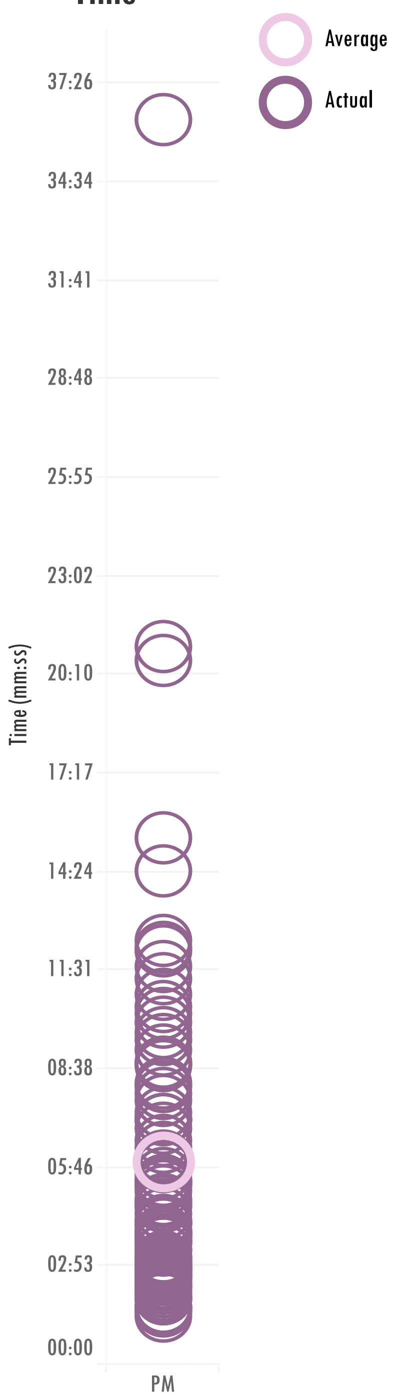


2 Lex/59 St station's N/R/W platform had excessive crowding.

3 Lex/59 St station's long transfer times were frequent.

Irregular N/R/W service caused lengthy Lex/59 St station transfer times, with the longest transfer time taking 36 minutes. The northbound 4/5 trains come into the station approximately every two minutes, with many riders transferring to the N/R/W line, adding substantially to the platform crowds that occur with frequent service disruptions. This lengthy Lex/59 St station PM transfer is an extreme stress point for riders.

PM Transfer Time



PLATFORM CROWDING DURING LONG TRANSFER TIMES

When a 3 + minute service delay occurred, the N/R/W platform became uncomfortably crowded. During times of extreme delays lasting well above 3+ minutes, multiple 4/5/6 trains arrived at the station, resulting in extreme crowding conditions that overwhelmed the N/R/W platform with Queens-bound riders. On 2/28/2018, the most extreme event, a total of 18 4/5/6 trains arrived with no N/R/W trains for over 19 minutes.

3+ Minute Observed N/R/W Queens Bound Headways & Platform Crowding

Date	Observed N/R/W Headways 3+ Minutes	# of 4,5,6 Trains	Platform Crowd
9/15/2017	7:39	8	5-6 ppl deep
9/27/2017	5:15	3	3-4 ppl deep
10/12/2017	5:11	5	3-4 ppl deep
10/26/2017	3:59	3	5-7 ppl deep
1/24/2018	4:06	5	5-7 ppl deep
1/25/2018	13:32	14	5-7 ppl deep
2/21/2018	3:20	1	7-9 ppl deep
2/26/2018	3:05	3	3-4 ppl deep
2/27/2018	4:41	6	4-5 ppl deep
2/28/2018	19:39	18	7-9 ppl deep

ppl = people

Table Notes:

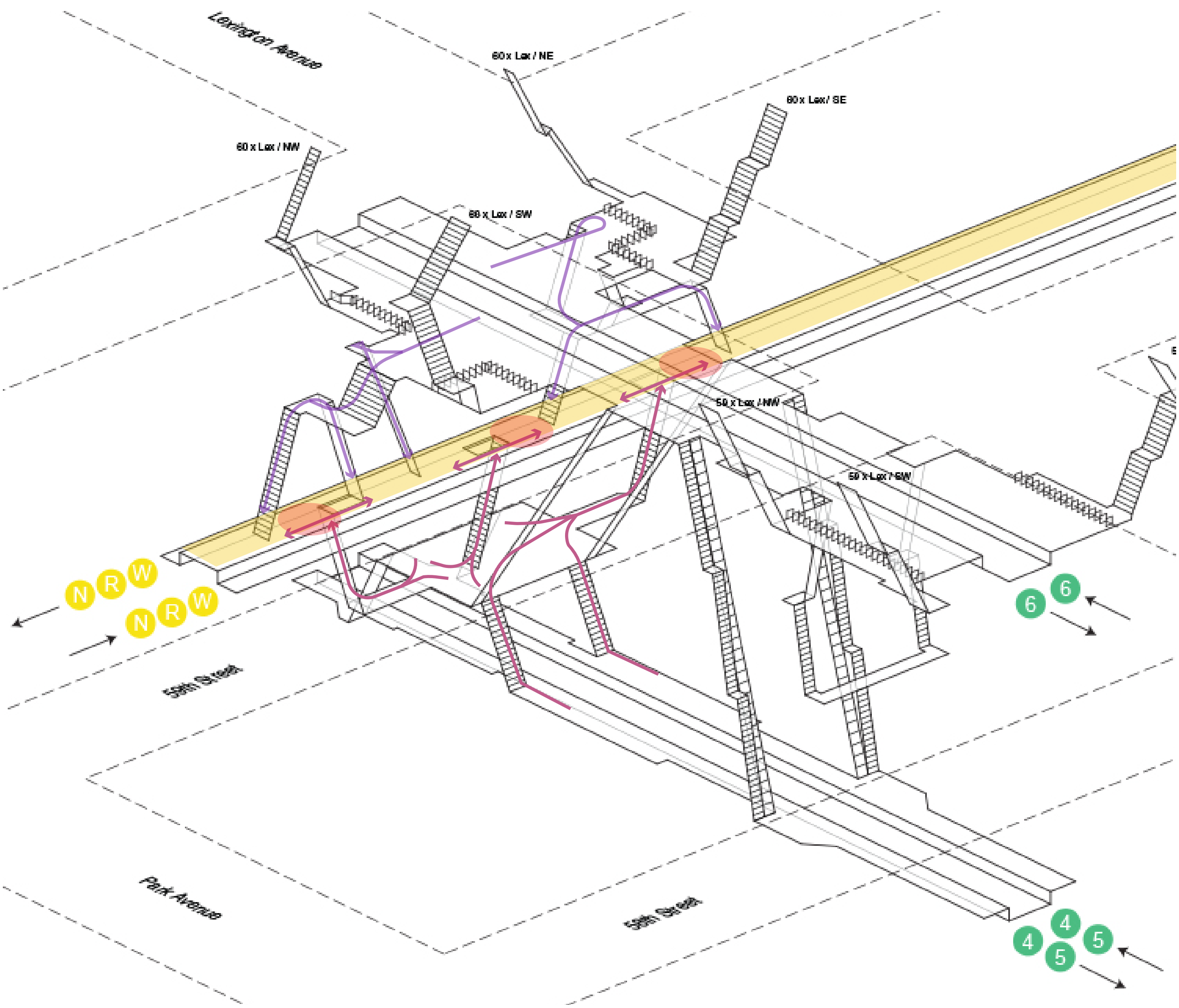
Observed headways were recorded when the surveyor could denote the time one train left and when the next train arrived. When the surveyor reached the platform without a train present, headways could not be recorded.

Platform crowds were not necessarily indicative of observed headways; it often depended on prior service throughput before the surveyor arrived at the platform. However, when recorded headways were extreme, Queens-bound platform crowds overwhelmed the platform (7-9 people deep), and consumed the entire width of the platform.

PM PEAK LEX/59 ST STATION RIDER FLOWS AND PINCH-POINTS

The diagram below illustrates how 4/5/6 riders transfer to the N/R/W lines from both downstairs and upstairs platforms. In the PM peak, 4/5/6 riders transfer from a total of four platforms to the single, narrow, bi-directional N/R/W platform. Pinch-points often occur on the stairwells leading to the N/R/W platforms and can become extreme when the Queens-bound side of the platform is overcrowded.

Lex/59 St Station Diagram



Transfer to N/R/W lines from 4/5 lines

Transfer to N/R/W lines from 6 line

Stairwell Pinch-Points

Diagram source: Candy Chan, [Project Subway NYC]

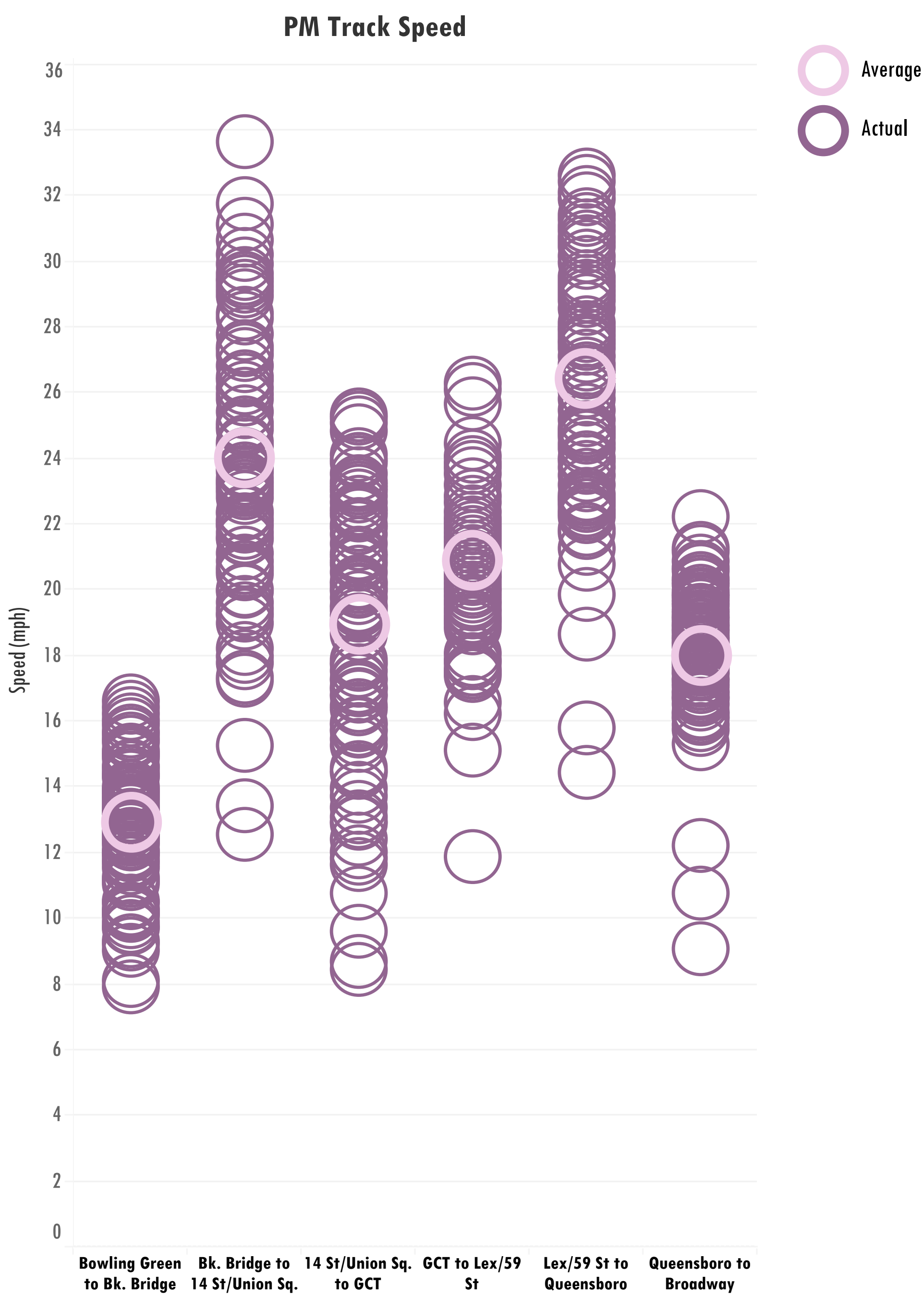
TRACK SPEEDS

PM track speeds were faster compared to the AM commute.

24 MPH Average between Brooklyn Bridge and 14 St/Union Square (AM = 19 MPH)

21 MPH Average between Grand Central/42 St and Lex/59 St (AM = 14 MPH)

26 MPH Average between Lex/59 St and Queensboro Plaza (AM = 19 MPH)



4 Extended dwell times occured at 14 St/Union Square, Grand Central/42 St, and Queensboro Plaza.

14 St/Union Square

01:01 Average dwell time

05:30 Highest dwell time

Grand Central/42 St

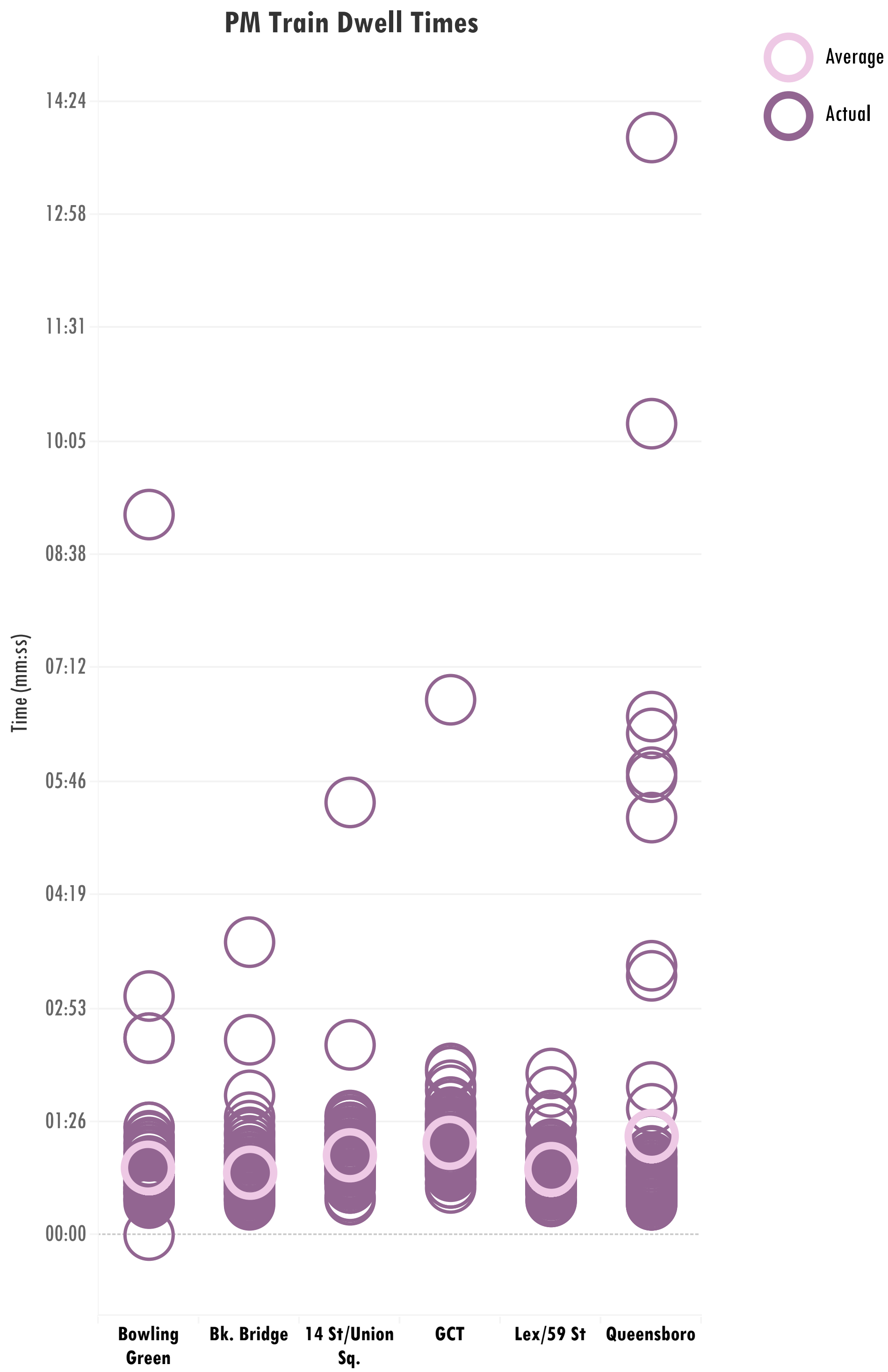
01:11 Average dwell time

06:48 Highest dwell time

Queensboro Plaza

01:14 Average dwell time

13:57 Highest dwell time



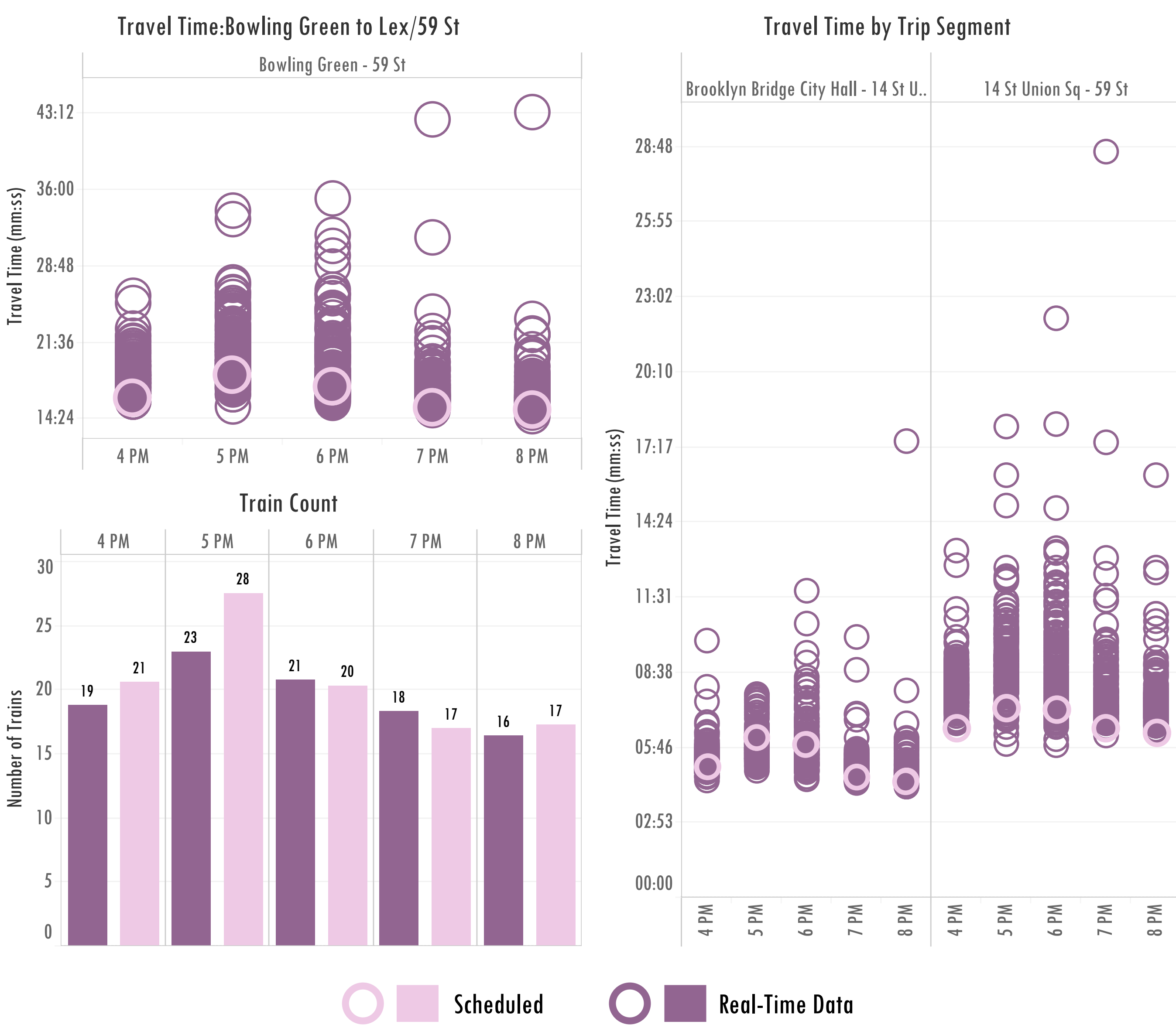
PM RIDER EXPERIENCE: REAL-TIME DATA

PM RIDER EXPERIENCE: REAL-TIME DATA

The MTA's GTFS real-time data demonstrates a major discrepancy between the scheduled and actual trip times. The graphics below correlate with the rider survey time period and show that almost all trips from Bowling Green on the 4/5 took longer than the scheduled time to arrive at the Lex/59 St station. The impact of these longer travel times resulted in less throughput. At the 5 PM hour, only an average of 23 trains went through the corridor, instead of the 28 scheduled trains. The breakdown of the 5 PM hour in 15 minutes segments can be found in Appendix C.

5 PM Peak Travel Times

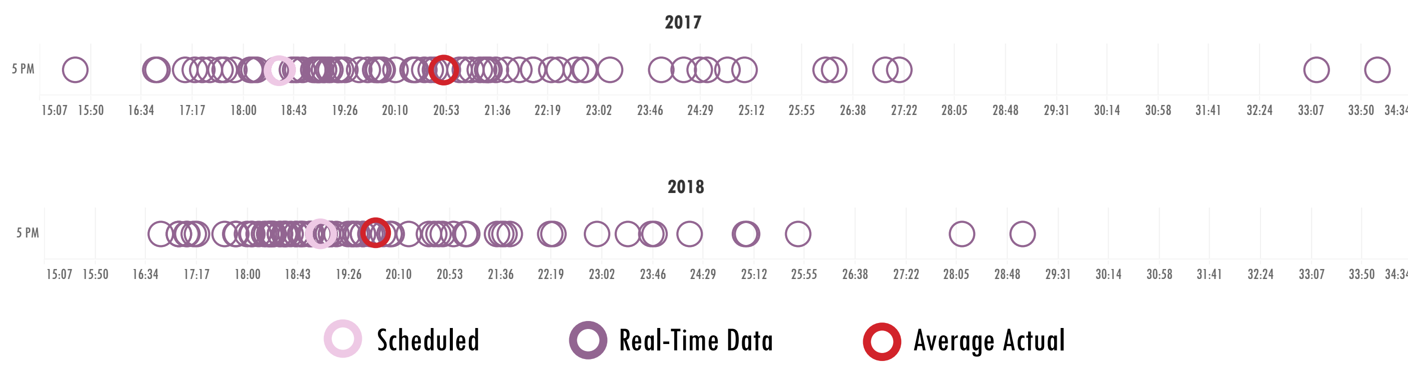
Segment	Scheduled Time	% of Days When Avg.Trips Take Longer than Scheduled Time
Bowling Green to Lex/59 St	18:21	85%
Brooklyn Br. to 14 St/Union Sq.	6:05	28%
14 St/Union Sq. to Lex/59 St	7:16	91%



PM REAL-TIME DATA 2017 vs. 2018

A year after the implementation of the SAP, the Council reviewed data to see if any service improvements were accomplished on the 4/5 trips between Bowling Green and Lex/59 St stations. During this time, the 5 PM scheduled travel time between Bowling Green and Lex/59 St was adjusted from 18:33 to 19:05 minutes. This adjustment resulted in more trains meeting the scheduled run time for this segment – in 2017 only 27% made the scheduled run time, and in 2018 this 5 PM percentage climbed to 47%. Additionally, when comparing the scheduled trip time to the rider survey data, the rider average travel time in this segment was 19:52 minutes, which is more aligned with the most recent schedule adjustment to 19:05 minutes. However, despite this on-time performance (OTP) improvement, there is still more that can be done. The graph below shows that not only are schedules becoming more realistic, but travel times are starting to improve as well.

5 PM Bowling Green to Lex/59 St Travel Time: 2017 vs. 2018



2017: During the 5 PM hour, the average actual travel time was **20:51** minutes, ranging between 15:38 and 34:03 minutes.

2018: During the 5 PM hour, the average actual travel time was **19:50** minutes, ranging between 16:46 and 29:01 minutes.

AM vs. PM COMMUTES

During the PM commute, track speeds were faster compared to the AM commute. For both the AM and PM commutes, train speeds can go much faster, as evident from the visuals below. The following three segments had the largest difference between AM and PM track speeds.

Average speed between Queensboro & Lex/59 St

AM: 19 MPH

PM: 26 MPH

+7 MPH in PM

Average speed between Lex/59 St & Grand Central/42 St

AM: 14 MPH

PM: 21 MPH

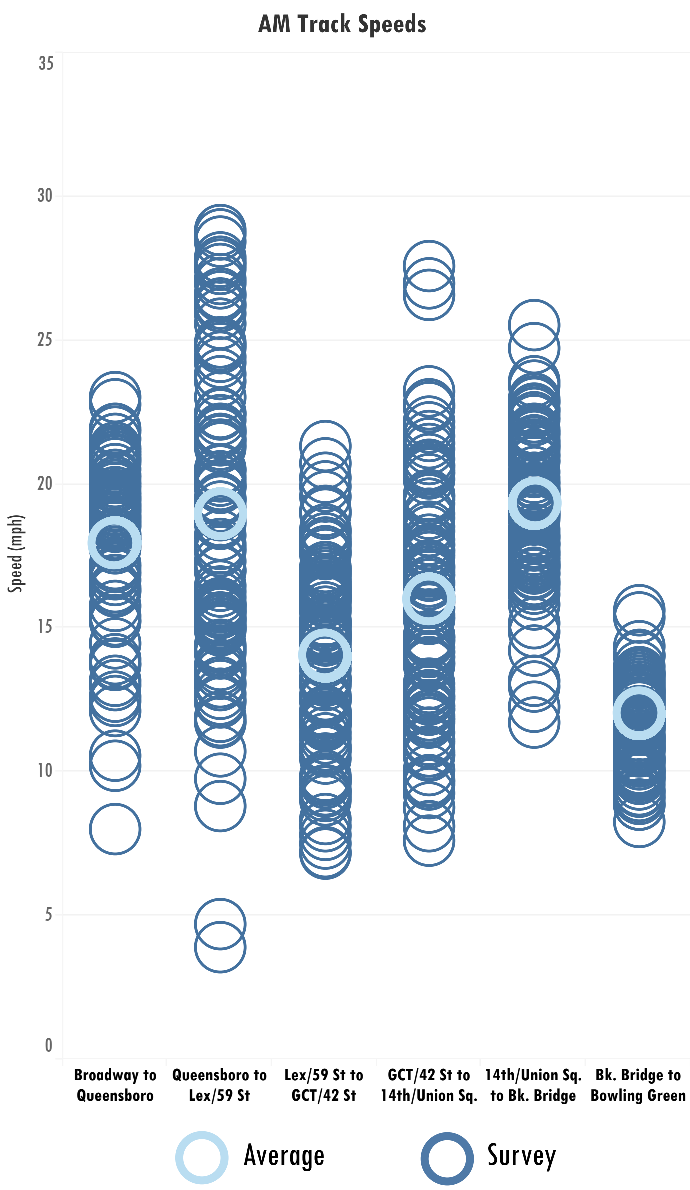
+7 MPH in PM

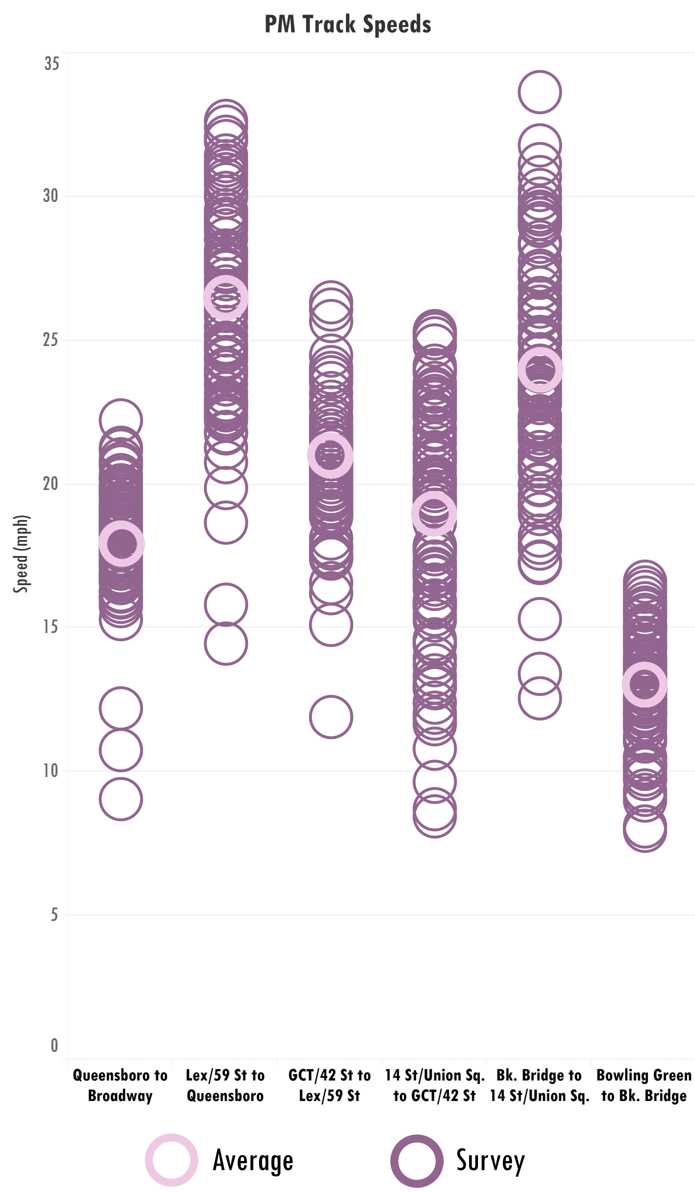
Average speed between 14 St/ Union Sq. & Brooklyn Bridge

AM: 19 MPH

PM: 24 MPH

+5 MPH in PM





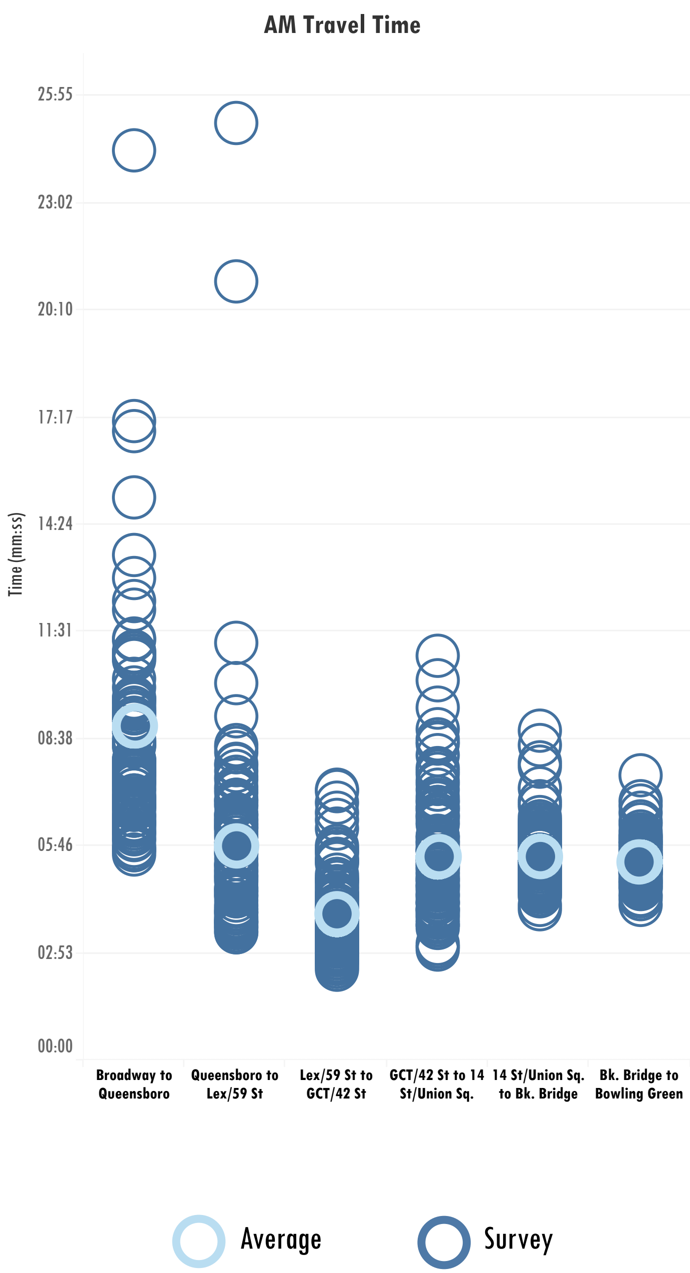
Since track speeds were faster during the PM commute, so were train travel times as compared to the AM commute.

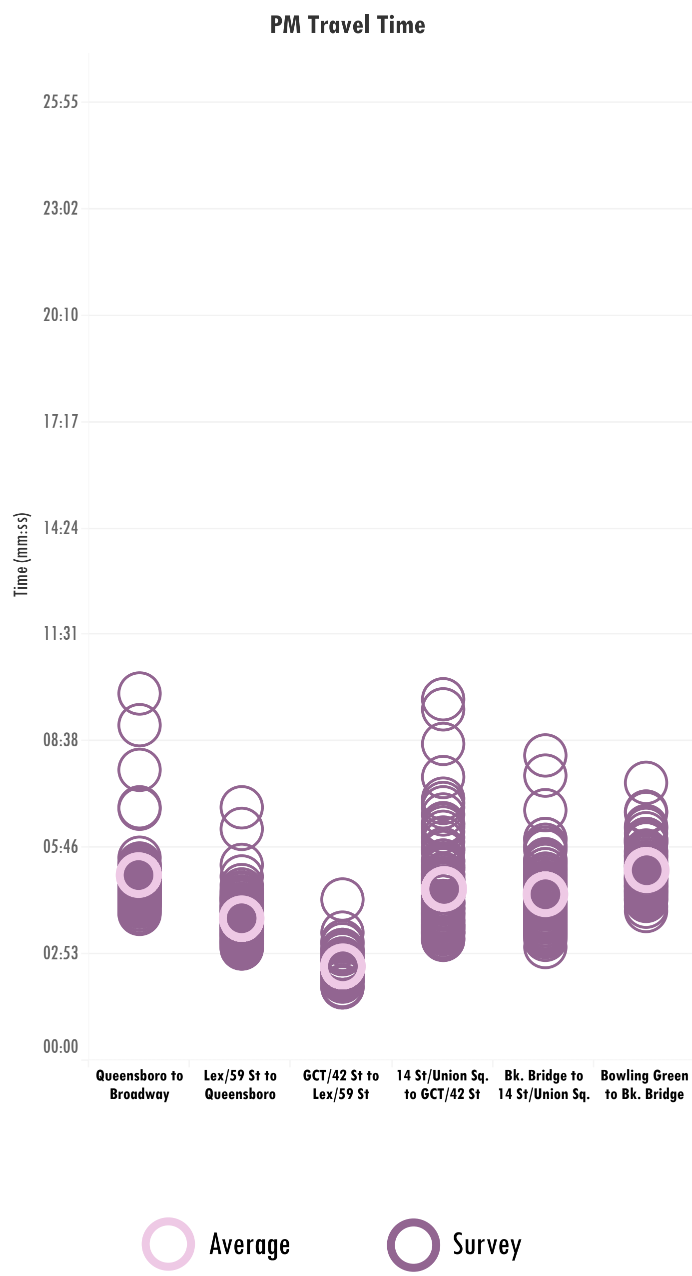
03:55 AM average travel time between Lex/59 St and Grand Central/42 St.

02:32 PM average travel time between Grand Central/42 St and Lex/59 St.

05:28 AM average travel time between Grand Central/42 St and 14 St/Union Square.

04:38 PM average travel time between 14 St/Union Square and Grand Central/42 St.





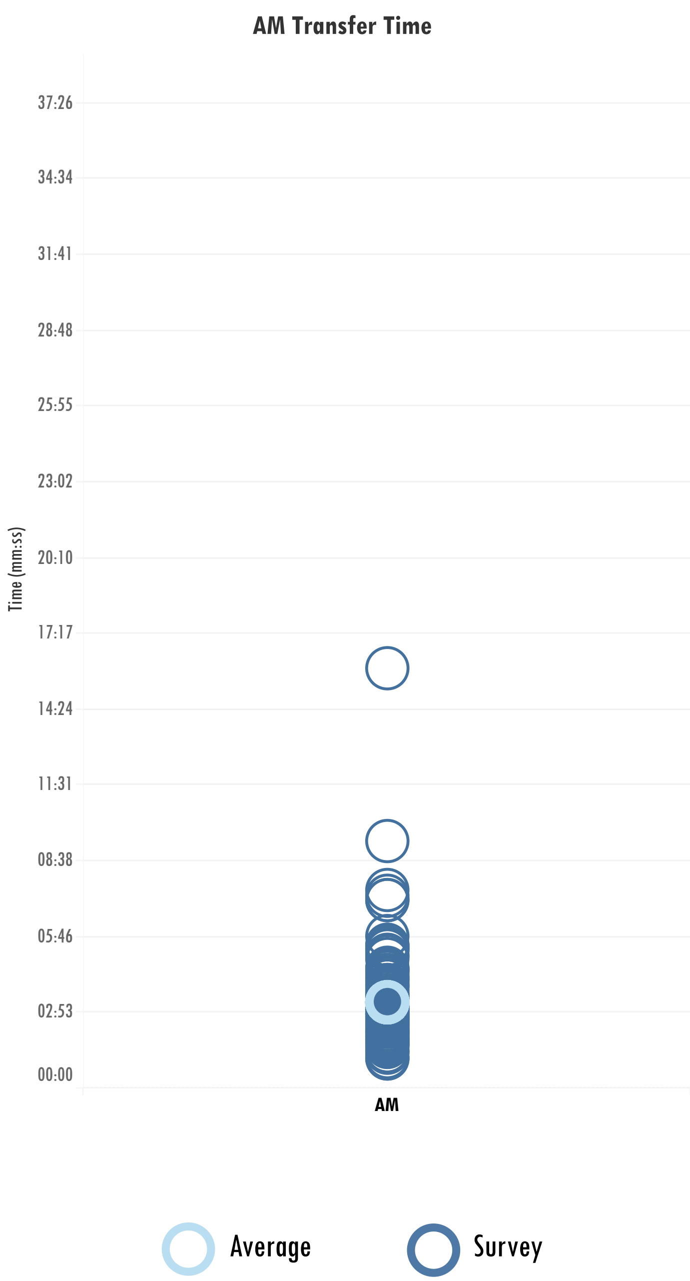
Transfer times during the PM commute at Lex/59 St were considerably longer than AM commute transfer times.

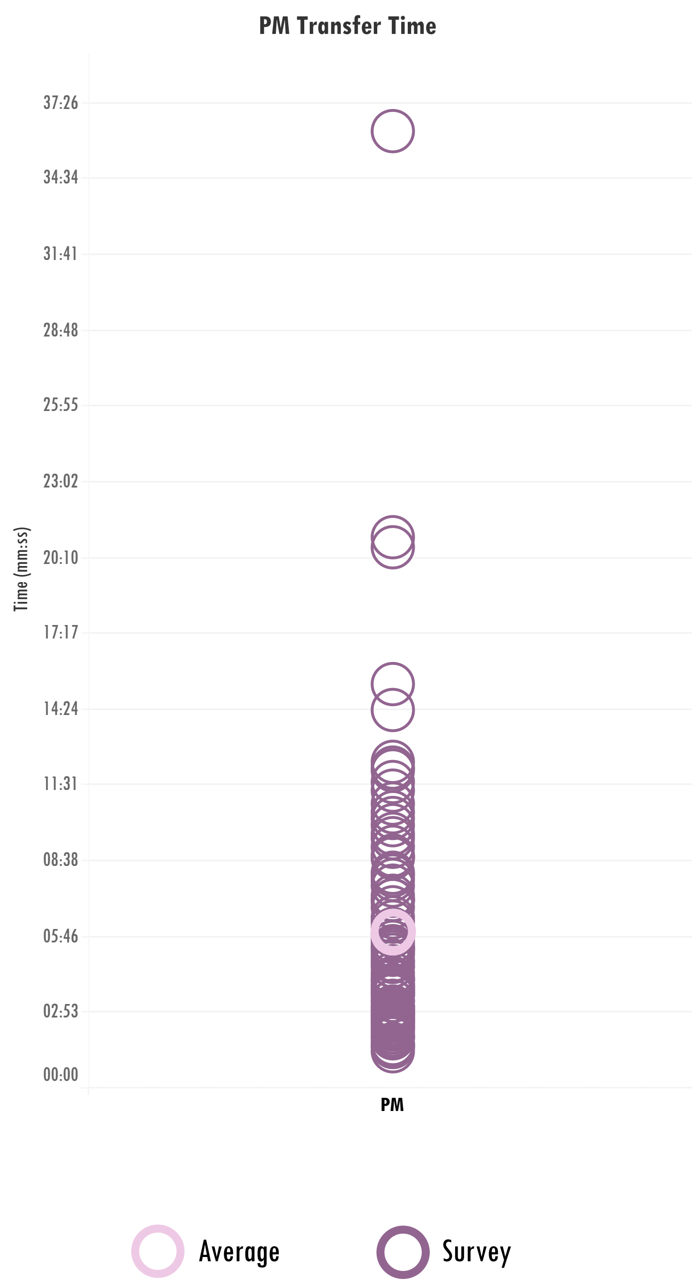
03:18 AM average transfer time

05:54 PM average transfer time

16:00 AM longest transfer time

36:00 PM longest transfer time





CONCLUSION

For more than 100 days and nights, from Astoria, Queens to Lower Manhattan and back, we encountered difficult and unreliable commutes, as many riders do all too often on this route and many more throughout the system. The study found that morning riders encountered overcrowding at the N/W Broadway station, onboard crowding at Queensboro Plaza, packed stairwells at the Lex/59 St station, and slow track speeds on the 4/5 lines. These matters make it difficult to arrive at a destination on time. During this study, our rider found that nine minutes must be added to the scheduled time, extending the trip from the scheduled 39 minutes to over 48 minutes. In the PM commute, the 4/5 from Fulton St to Grand Central/42 St had serious onboard overcrowding, so much so that riders were unable to board the train at least 27% of the time at the Fulton St station. In addition, the Lex/59 St station's frequent overcrowding substantially slowed the transfer times with even a slight service delay. The station has clearly reached its overcrowding threshold.

Queens's continued growth and the physical limitations of the Lex/59 St station are difficult pairings. The two factors are magnified further when delays occur, increasing overcrowding at all levels. Adding major delays to this equation, riders find themselves traveling into a state of hopeless chaos all too often. These memories stand out in riders minds, affecting their overall perceptions of the system. As more demand is put on this station, substantive measures must be planned and implemented to improve these conditions.

Components of the report's real-time data reflects the survey time period. Our survey shows that the AM southbound 4/5 trips between Lex/59 St and Bowling Green, took 23:02 minutes on average (average departure time was 8:46 AM), and the real-time data for this time period ranged between 23:37 and 24:32 minutes; at that time the scheduled trip time ranged between 20:53 and 21:38 minutes – a nearly 3 minute difference. Thus, NYC Transit made the decision to increase the run times to better reflect the trip realities, until greater trip time savings are gained.

The more recent 8 AM hour real-time data, September to December 2018, the average actual travel time was 21:28 minutes, and almost exactly matches the average scheduled trip time of 21:30 minutes. The SAP and "Save Safe Seconds Campaign" have been able to shave off minutes and seconds, which is just the beginning of what can be accomplished. NYC Transit knows how to improve this route and the system, and it's exciting to think about what the commute could be by implementing the much-needed investments identified in this report.

Funding the Fast Forward Plan will further this work to address the route's reliability, crowding conditions, and overall rider experience. Applying both quick-win and longer-term solutions will help create a more seamless, comfortable, and less stress-inducing ride. Fast Forward lays out the need to *upgrade critical infrastructure; review potential route changes to reduce reliance on critical interlockings; revitalize the station experience; accelerate accessibility; and give buses greater priority in the face of traffic*. Each of these initiatives, if applied to this route, has the potential to improve commutes for thousands of New Yorkers. In the following sections, we identify various issues and offer solutions we would like to see included in the details of a fully-funded and implemented Fast Forward plan. It will require New York State, the City of New York, NYC Department of Transportation, and MTA-NYC Transit working together to realize these full benefits, which will address:

- Broadway station and onboard N/W crowding (AM);
- Lexington line 4/5 slow track speeds and severe overcrowding (AM/PM); and
- Lex Av/59 St station service reliability and severe overcrowding (PM).

Our hope is that this report conveys the urgent need to find funding to address the problems on this route and the many other routes throughout the system. Providing these much-needed investments will improve the rider experience and perceptions of the system, and return our subway network to being the envy of the world once again.

IDENTIFIED ISSUES REQUIRING SOLUTIONS

Infrastructure issues:

- **The Astoria-Ditmars Boulevard terminal's track configuration limits AM peak service into Manhattan,** and creates service gaps that lead to station and onboard N/W line crowding. The long, slow movements through the interlocking create opposing train movement conflicts. During the AM peak, only 14 trains per hour (tph) can be turned.
- **The 4/5 lines have antiquated signals and slow track speeds** - the most heavily traveled line in the system suffers from poor reliability and resiliency, slow track speeds, and overcrowding issues. Without Communications Based Train Control (CBTC), the lines will continue to have reduced capacity, inconsistent train speeds, and the inability to identify a train's location precisely, which slows incident recoveries.
- **Overall, infrastructure short-comings negatively affect service on the 4/5 lines.** There is a need to examine various 4/5 infrastructure components such as the route's signal timers, 14 St/Union Square gap fillers, and merge points like Nostrand Junction in Brooklyn.

Crowding issues:

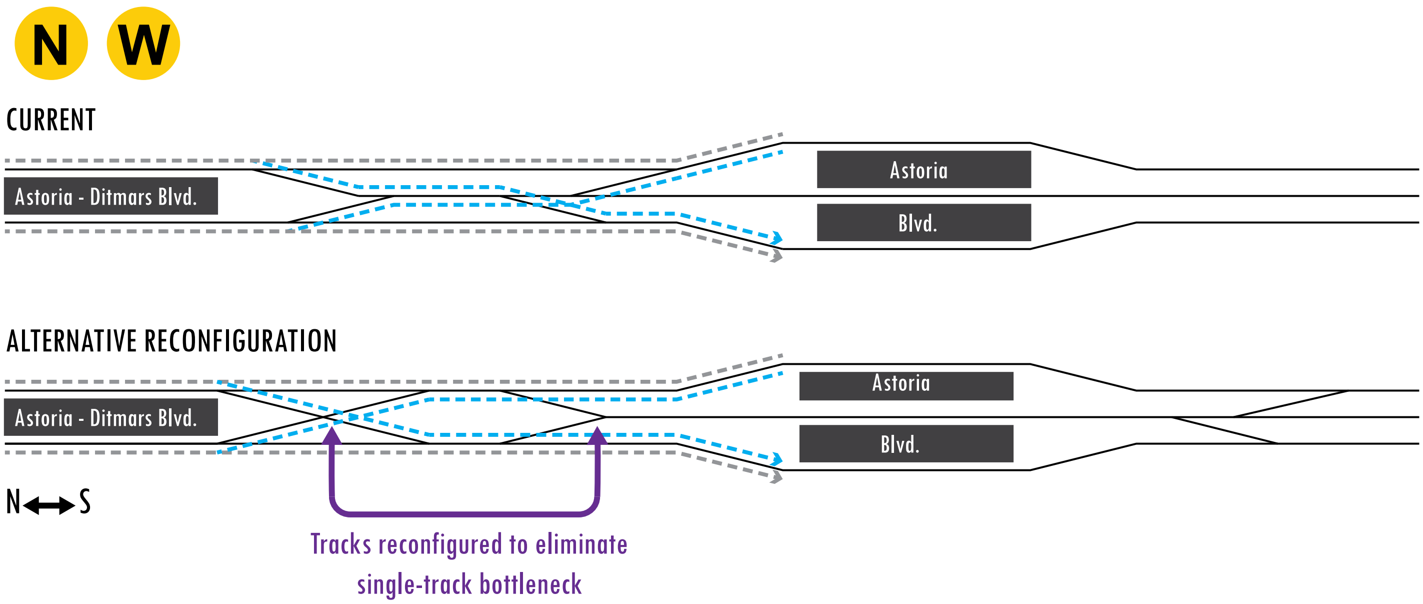
- **The Lex/59 St station frequently reaches extreme crowding in the PM peak during N/R/W service delays.** Three lines with two different destinations at the station help to create crowding problems. The N/R/W platform was not designed to accommodate three lines on a narrow, bi-directional platform, made more difficult as Queens continues to rapidly grow. Riders must choose between the N/W lines or the R line depending on their final Queens destination. This creates flow constraints on:
    - A very overcrowded platform.
    - A platform where many columns, staircases, and people create bottlenecks.
    - A platform where riders compete for space to access the trains (the platform shuffle).

- **NYC Transit lacks a robust crowd mitigation effort to address extreme crowding conditions,** like that of the London Underground (see Appendix E). During peak hours for the Lex Av/59 St station, platform crowding during the PM commute can become so extreme that it is difficult to exit and board trains, stairwells become backed up, and riders become frustrated when unable to access and board Queens-bound trains. Due to these issues, PM transfer times can be long, causing overall longer travel times.
- **NYC Transit does not have a crowding metric indicating which stations are under extreme stress from overcrowding.** At the Lex/59 station, Queens-bound riders regularly face dreadful commutes and severe overcrowding. During N/R/W Queens-bound PM commutes, stairwell and platform crowds increase as 4/5/6 trains continuously enter the station, and riders transfer to the often less frequent N/R/W trains.
- **Riders don't want to take slow buses, so they crowd the subway.** Lexington Avenue bus speeds are slow due to congestion, deliveries, and parking.

FAST FORWARD: PRINCIPLES APPLIED

1 MAXIMIZE N/R/W LINE CAPACITY AND RELIABILITY

(A) Reconfigure the Astoria-Ditmars Boulevard terminal tracks to increase AM peak Manhattan-bound train frequency and reliability. The Astoria-Ditmars terminal's track configuration limits AM peak service into Manhattan, and creates service gaps that lead to station and onboard N/W line crowding.

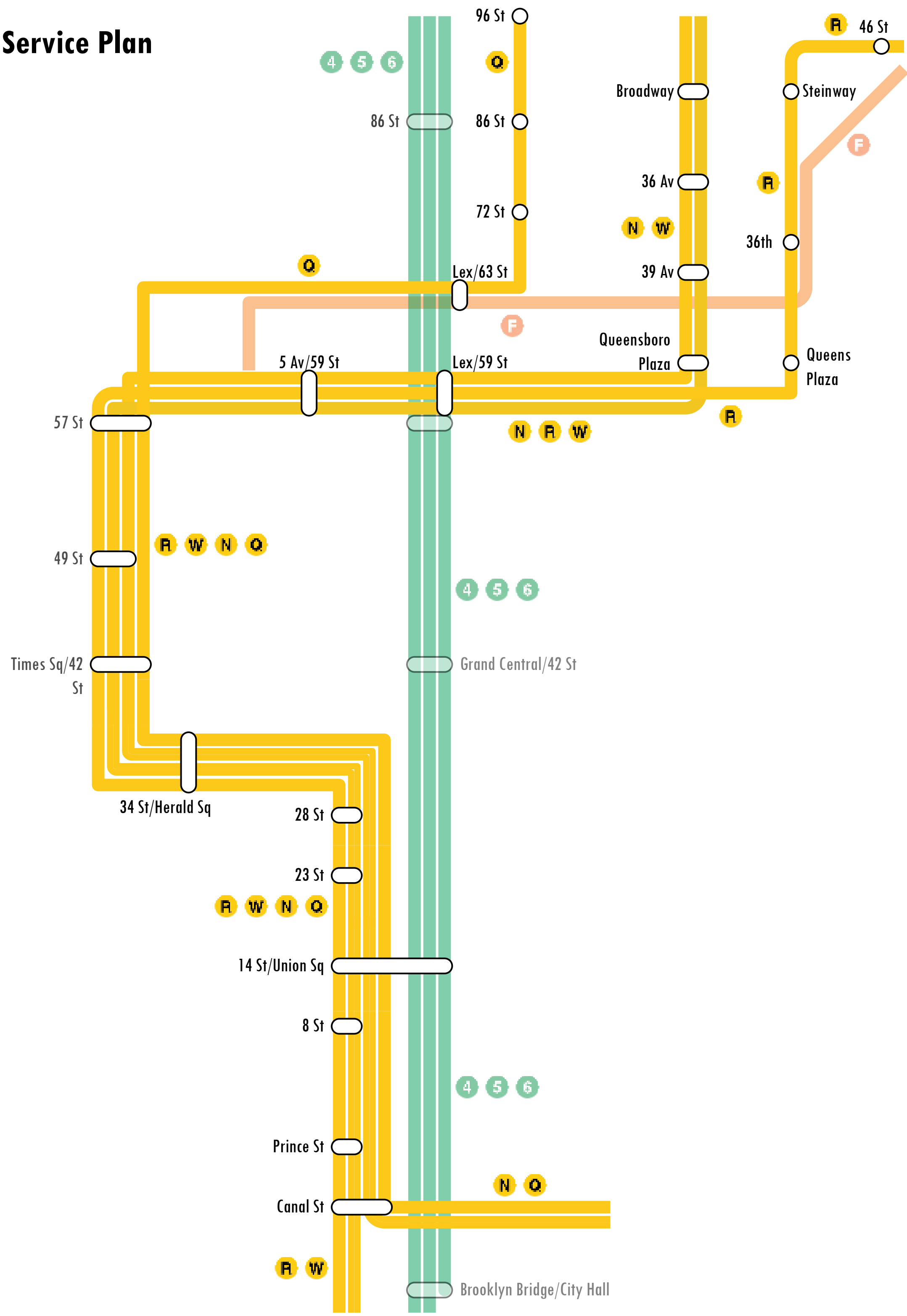


Benefits:

- Reconfigured tracks can improve trains per hour (tph) from 14 to 19-24 (Similar to the terminal configuration at South Ferry).
- Improves reliability and reduces service gaps.
- Increases AM service frequency and line capacity.
- Reduces station crowding at Astoria branch stations and Queensboro Plaza.

B Reroute the N/R lines and de-interline (route-simplify) the Manhattan Broadway Line to increase train frequency and reliability, while reducing the Lex/59 St station crowding problem. Undertake an in-depth comprehensive route review: model the following conceptual reroutes and line simplifications.

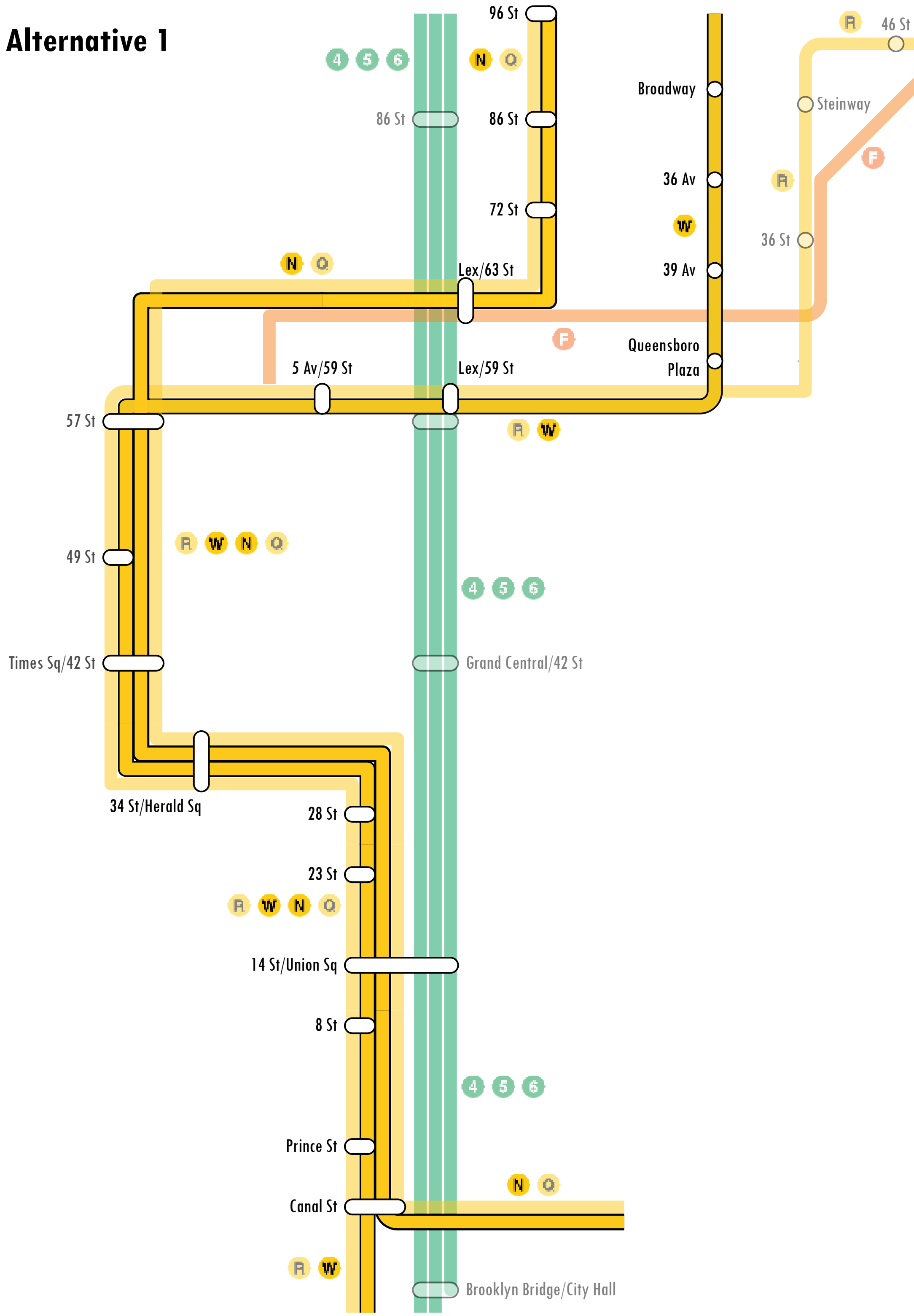
Current Service Plan



Reroute the N line to follow the Q line to 96th Street.

- Double W service frequency to cover the loss of N service to Astoria during weekdays, and run W service to Astoria on the weekends.
- Extend a portion of W trips to a Brooklyn terminus to reduce terminal delays at Whitehall Street.
- Educate riders on service changes and alternatives.

Reroute Alternative 1

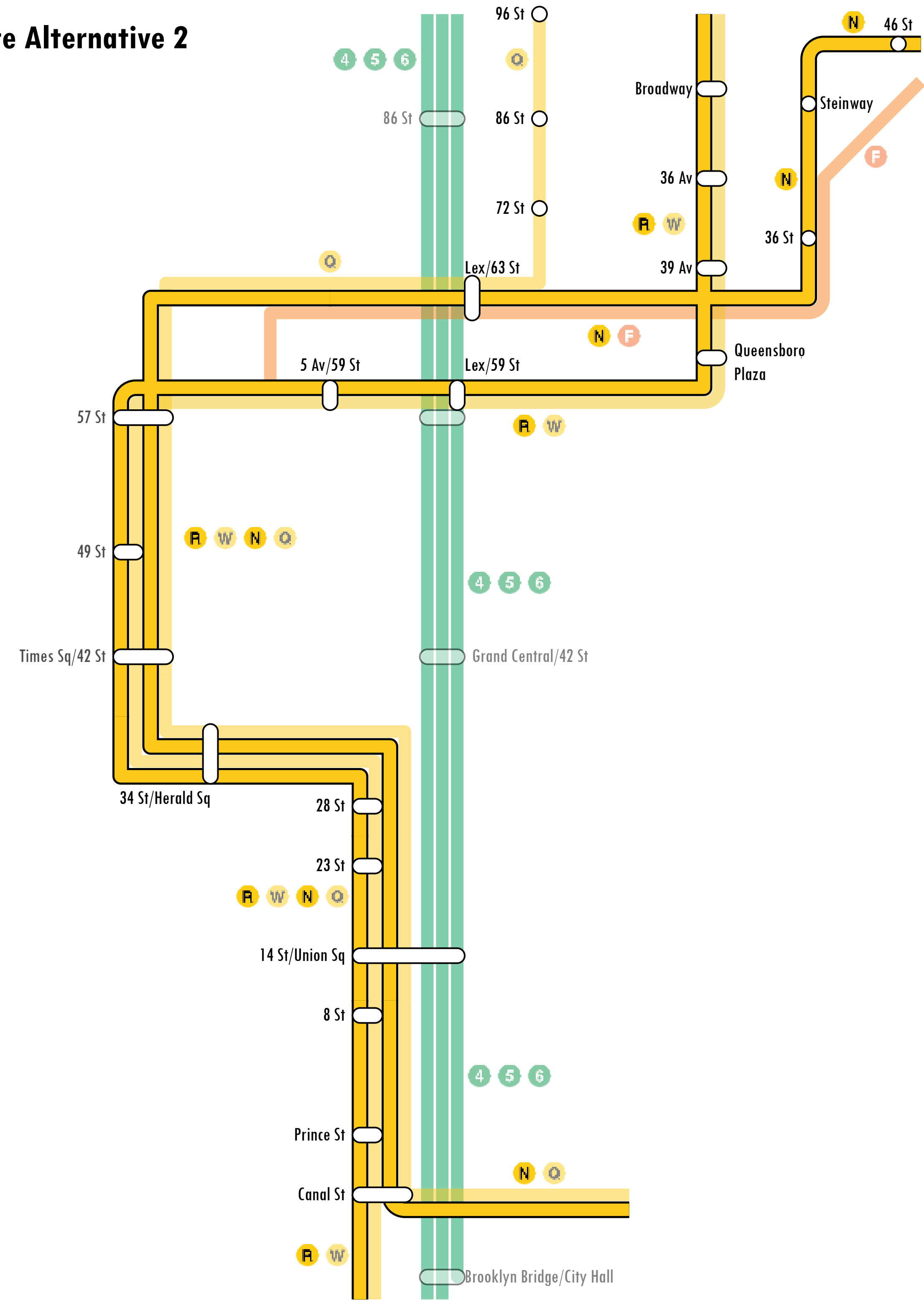


Reroute the R line to join the W line through the Lexington Av/59 St station to Ditmars Blvd. in Astoria.

Reroute the N line to join the F line through the Lexington Av/63 St station to Forest Hills.

- Increase frequency on the M line.
- Educate riders on service changes and alternatives.

Reroute Alternative 2



Benefits: Alternatives 1 & 2

- **Alternatives 1 & 2:** De-interlines (simplifies) the Broadway line to improve reliability by reducing interlocking delays.
- **Alternatives 1 & 2:** Reduces Lex/59 St station crowding and reduces the platform shuffle by having only two lines (R/W) arriving at the platform instead of three (N/R/W).
- **Alternative 1:** Eliminates merges at 34th Street (Manhattan) to speed up trains, allowing for more train throughput.
- **Alternative 2:** Eliminates merges at 34th Street (Manhattan) and Queensboro Plaza (Queens) to speed up trains, allowing for more train throughput.
- **Alternative 2:** Reduces crowding on Queens Boulevard express E service since riders can stay on the N line for express service in Manhattan.
- **Alternative 1:** Adds service to the Second Avenue line, addressing ridership needs on the corridor, while making the new line a more attractive alternative.

2 MAXIMIZE 4/5 LINE CAPACITY AND RELIABILITY

A **Ensure 4/5/6 line CBTC is installed within five years of Fast Forward implementation to improve reliability, resiliency, track speeds, and crowding. NYC Transit's Fast Forward Plan has prioritized 4/5/6 CBTC installation from 149 St/Grand Concourse to Nevins St.**

Benefits:

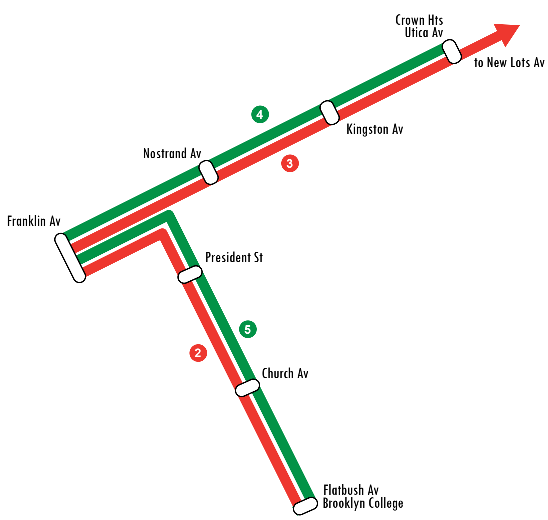
- Maximizes 4/5 capacity: CBTC safely shortens the distance between trains and efficiently manages traffic and speed.
- Improves 4/5 reliability and resiliency: CBTC identifies precise train locations, which speeds up incident recovery, while the current system only identifies a broad area for train locations.
- Provides 4/5 speed supervision: CBTC manages train speed. The current signaling system relies on train operators to maintain the posted speeds and can result in train operators going excessively slow.

B **Continue track speed and signal timer adjustments to improve train speed and throughput.**

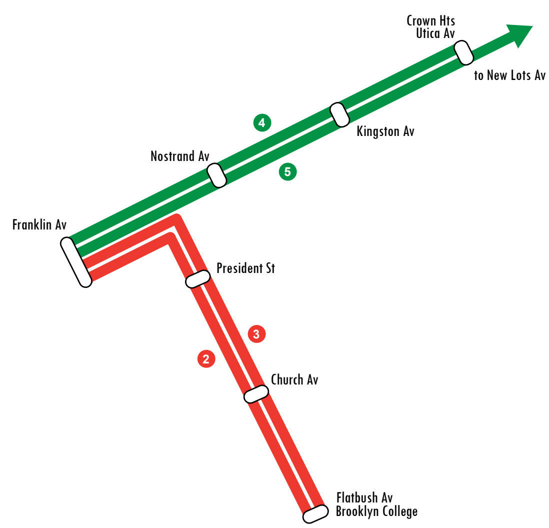
C **Evaluate moving the southbound 4/5 platform at 14 St/Union Square station north to the straight track area, thus eliminating the need for the gap fillers and subsequent delays.**

D **Reroute the Brooklyn termini 2/3/4/5 lines to eliminate Nostrand Junction train conflicts. The proposed reroute would require new crossovers. Undertake an in-depth comprehensive route review: model the following conceptual reroute, and determine the feasibility to expand capacity at the Flatbush Avenue terminal.**

Current Service Plan



Proposed Reroute



Benefits:

- Improves 4/5 line reliability, resiliency, and capacity.
- Improves track speeds in both directions.

3 IMPROVE TRAFFIC FLOW AND REDUCE CROWDING AT LEX/59 ST STATION

A Apply the methodology and resources that were applied to Grand Central station to Lex/59 St crowding and levels of service issues. In the future, look toward incorporating requirements for developers for value capture opportunities and other potential investments to apply such methodologies and resources.

Benefits:

- Improves mezzanine, platform, and staircase circulation.
- Provides more platform space by removing bulky stair casings and columns where feasible.
- Improves station access by reopening and providing new station entrances.
- Provides the opportunity to make the station ADA accessible.

B Establish a Lex/59 St station crowd control mitigation plan staffed with additional platform controllers. NYC Transit lacks a robust crowd mitigation effort to address extreme crowding conditions. During peak hours for the Lex/59 St station, platform crowding during the PM commute can become so extreme that it is difficult to exit and board trains, stairwells become backed up, severely limiting platform movement.

C Conduct regular table-top exercises to address Lex/59 St station crowding situations.

Benefits:

- Defines how to measure when the station becomes congested.
- Staff is trained to identify that once free movement along the back of a platform is lost, crowd control procedures are put into place.
- Station is equipped with a dedicated station control room to facilitate crowd control operations.

D Create station passenger-based crowding metrics, to better inform NYC Transit of when to implement station-specific crowd-control measures. NYC Transit does not have a crowding metric indicating which stations are under extreme stress from overcrowding. Riders waiting for the Queens-bound N/R/W service in the PM peak face large stairwell and platform crowds as 4/5/6 trains bring more riders to the station seeking to transfer to less frequent N/R/W service.

Benefits:

- Addressing station overcrowding through operational adjustments.
- Coordinates efforts with NYPD Transit police to provide attention and presence at stations that have overcrowding safety issues.
- The metric can inform and support capital investment needs for improved capacity and expansion efforts.

E Implement and enforce a two-lane Lexington Avenue dedicated busway during Lexington Line CBTC installation, and apply Transit Signal Priority (TSP) as soon as possible to speed up buses. Riders don't want to take slow buses, so they crowd the subway. Lexington Avenue bus speeds are slow due to congestion, deliveries, and double parking. Enforcement and creation of an additional dedicated bus lane will be crucial when CBTC is being installed.

Benefits:

- Bus travel is prioritized in the corridor, which increases bus speeds and frequencies.
- Frees up subway capacity, with more Lexington line subway riders taking buses for short distance trips.

LONG ISLAND CITY AND QUEENSBORO PLAZA

Queensboro Plaza, perched high above Long Island City (LIC), provides access to the heavily traveled N, W, and 7 lines. Approaching the station, one can see the new shiny glass towers being erected to house those wishing to be close to Manhattan's core. Becoming its own core, LIC will be adding more than 11,000 residential units in addition to the 16,000 plus units already completed since 2006.[14] What will this mean for Queensboro Plaza and the other nearby stations? Will all those new riders fit onto the already packed rush-hour morning trains? Will expansion be needed? How will NYC Transit's Fast Forward Plan improve the commute for thousands of Queens riders?

Once an industrial and manufacturing hub, in 2001, 37 blocks were rezoned in LIC, which is now experiencing sky-rocketing growth and the City wants to rezone again.[15] In fact, it's fast-developing urban core saw the most rental housing construction in the nation between 2010 and 2016, with Los Angeles's downtown coming in a distant second.[16] As with the new and proposed development in the area, the 2001 rezoning was designed to take advantage of LIC's mass transit access and its supply of large underdeveloped land parcels and foster investment in the community. Since then, LIC's skyline has clearly taken shape, with thousands of units already completed and more on the way.

Planned Growth by 2020:

- 4 million square feet of commercial and industrial development
- 11,000 + residential units in the pipeline
- 5,200 + hotel rooms will be completed with the addition of 36 new hotels
- 411,000 square feet of retail development[17]

LIC's rapid development is impacting nearby stations like Queensboro Plaza. From 2011 to 2017, the station's ridership increased by 41%.[18] With more people and businesses moving to the area, ridership will continue to climb, which will require the MTA to look at ways to expand system capacity.

Source: Long Island City Partnership

Clearly, LIC's rapid growth warrants investment in its transit infrastructure to ensure it can keep up with demand. NYC Transit's Fast Forward plan has emerged as the best option for the City's aging transit system. It has the potential to improve the lives of those who live, work and play in LIC, and those who travel through. The Plan will upgrade many of the tracks, signals, stations and structures required to run the system effectively and improve the ride for millions, with potential route changes and revisions to improve running times. Now is the time to make investments to ensure the area thrives as an attractive place to live and work.

14 Long Island City Partnership, *LIC Neighborhood Snapshot*, Date accessed: July 20, 2018, https://longislandcityqueens.com/media/filer_public/26/42/26423f44-6221-4549-8b58-9f624772f251/lic_neighborhood_snapshot_june_2018.pdf

15 City of New York, *Long Island City Rezoning,* Date accessed: June 18, 2017, https://www1.nyc.gov/assets/planning/download/pdf/plans/long-island-city-mixed-use/lic.pdf

16 Rent Café Blog, *Top U.S. Neighborhoods that Got the Most Apartments After the Recession*, Date accessed: June 6, 2017, https://www.rentcafe.com/blog/rental-market/real-estate-news/top-20-neighborhoods-with-most-apartments-post-recession/

17 Long Island City Partnership, *LIC Neighborhood Snapshot*, Date accessed: July 20, 2018, https://longislandcityqueens.com/media/filer_public/26/42/26423f44-6221-4549-8b58-9f624772f251/lic_neighborhood_snapshot_june_2018.pdf

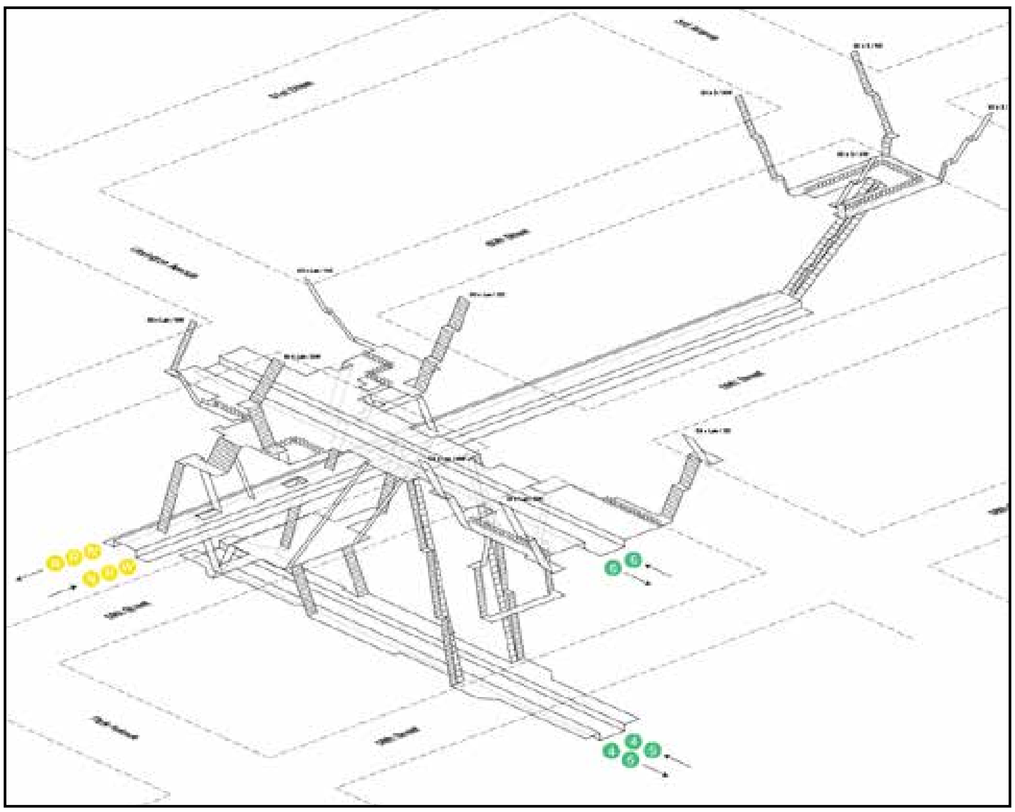
18 MTA, *Average Weekday Subway Ridership,* Date accessed: June 22, 2017, http://web.mta.info/nyct/facts/ridership/ridership_sub.htm

LEXINGTON AV/59 ST STATION

The popularity of the city-run subway literally brought down Manhattan's once-popular elevated train tracks in the 1940s and 50s, with the last - the Third Avenue "El" shutting down service in 1955. The year before, it carried more than 25,000,000 people.[19] Until the Second Avenue Subway began service in 2016, the Lexington Avenue subway was the only line serving the increasingly populous Upper East Side and East Midtown.

In 1959, development and population growth along the Lexington Avenue Line led the Transit Authority to undertake a $130 million modernization program to enhance stations and lengthen platforms and trains to accomodate greater ridership.[20] This modernization plan included making the Lex/59 St station an express stop on the 4/5 lines.

Lex/59 St Station Layout



Source: Candy Chan, [Project Subway NYC]

Lex/59 St originally housed only local train service, with express 4/5 trains going directly from 86 Street to Grand Central/42 Street. Serving an estimated 10 million riders a year in 1959, the New York City Transit Authority began a three year project to allow the express service stop deeply below 59th Street.[21] By expanding express service to the station, the Transit Authority expected the following benefits:

- Reduce Grand Central congestion due to local and express transfers at Lex/59 St
- Reduce Grand Central Shuttle congestion by providing N, R, or W service to the West Side

19 Stelter, Lawrence, *The Rise and Decline of New York City's Third Avenue Elevated Train Line*, The Gotham Center For New York City History (March 8, 2008), Date accessed: March 23, 2018, https://www.gothamcenter.org/blog/the-rise-and-decline-of-new-york-citys-third-avenue-elevated-train-line

20 Grutzner, Charles, *New Platform for IRT Locals At Brooklyn Bridge to End Jams*, New York Times (September 1, 1962), Date accessed: March 22, 2018, https://timesmachine.nytimes.com/timesmachine/1962/09/01/83515455.html.

21 Levey, Stanley, *East Side Subway to Get Express Stop at 59th St*, NY Times, (April 8, 1959), Date accessed: March 22, 2018, https://timesmachine.nytimes.com/times-machine/1959/04/08/89177710.html.

- Provide convenient N, R, and W transfers for Queens riders to Lexington line 4/5 express trains
- Eliminate the need for express riders to transfer to local service

Today, the 4/5/6 Lexington Avenue line is the most heavily traveled corridor in the NYC Transit subway system and as a result, trains are often overcrowded and stations along the route are congested. Among these stations stands Lex/59 St, a major transfer point for riders traveling between Manhattan and Queens. By 2017, the station's ridership had climbed to over 17 million, almost double than in 1959. The increase in riders entering the station has been compounded by greater numbers of transfers occurring there. Population growth in Queens to upwards of 2.3 million people, as well as continued job growth in Midtown and Downtown Manhattan, has helped to increase transfers at this station.[22]

The N/R/W platform at Lex/59 St is bi-directional and narrow, which causes portions of it to get dangerously congested. With six lines (4/5/6/N/R/W) stopping at the station, combined with a walking F/Q line transfer from Lex/63 St station, transfers can be problematic due to the limitations of the narrow N/R/W platform, often resulting in stairwell and platform crowding. The perpendicular shape of the station causes all transfers between trains to occur at one end of the platform, resulting in pinch-points and stairwell crowding.

As population and subway ridership continues to grow, it is critical to adequately address crowding issues. The recent rezoning of East Midtown in 2017 will expand development rights in exchange for widening of staircases between the Lex/59 St mezzanine and the N/R/W platforms, but not until a proximate project is identified and gets underway.[23] While these solutions have the potential to alleviate some of the rider flow issues that plague the station, more needs to be done to address crowding issues.

NYC Transit's Subway Action Plan (SAP), instituted in 2017, has garnered some positive results in reducing crowding due to delays along each line, which contribute to congested platforms and subway cars. The Fast Forward plan will go further to address the station's geometry and other issues that cause delays across the lines that converge at Lex/59 St. Fast Forward includes the need to *upgrade critical infrastructure; review potential route changes to reduce reliance on critical interlockings; and revitalize the station experience*. Once these actions are implemented, riders using and transferring at the station will see more reliable service and less crowding.

22 U.S. Census Bureau, American Fact Finder, *2016 ACS 5-Year Population Estimate*, Date accessed: March 25, 2018, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml.

23 City of New York, *Greater East Midtown*, Date accessed: March 22, 2018, https://www1.nyc.gov/site/planning/plans/greater-east-midtown/greater-east-midtown.page

APPENDIX B: EXTREME COMMUTES

AM EXTREME COMMUTES

Three of the surveyed AM trips exceeded an hour, with one taking an hour and forty-five minutes due to signal problems at the 5 Av/59 St station. During the AM commute trip, reliability was impacted by sick passengers, signal problems, NYPD investigations, and mechanical failures. The survey period consisted of seven sick passengers, three major signal delays, three NYPD investigations, and two trains mechanical problems, according to MTA Alerts.

9/19/2017 Signal problems at 39 Av and sick passenger at 14 St/Union Square

- **Trip time** was 58:32 (39:00 scheduled travel time).
- **Slow train travel** between Queens N/W stations, with an 11 minute (average 5:46) travel time between Queensboro Plaza and Lex/59 St.
- **Slow track speeds** dipped to 9 MPH between 39 Av and Queensboro Plaza, and between Queensboro Plaza and Lex/59 St (average 14, 19 MPH respectively).
- **Slow track speeds** dipped to a low of 11 MPH between Grand Central and 14 St/Union Square (average 16 MPH).

10/6/2017 NYPD Investigation at Lex/59 St

- **Trip time** was 1:03:09 (39:00 scheduled travel time).
- **Broadway** the first N train was too full to board.
- **Slow speeds** between Queensboro Plaza and Lex/59 St, with multiple long stops between stations.
- **Slow train travel** through the tunnel between Queensboro Plaza and Lex/59 St took 25:13 minutes (average 5:46).
- **Long stops** in the tunnel totaled 16:18 minutes.

2/20/2018 Signal problems at 5 Av/59 St

- **Trip time** was 1:45:59 (39:00 scheduled travel time).
- **Held at Queens N/W stations** for long periods (27 minute dwell time at Broadway).
- **Riders abandoned the train** at 39 Av and had to walk to Queensboro Plaza to take the 7 train to Grand Central/42 St as an alternative.
- **4/5 lines rerouted** at Grand Central/42 St on the local 6 line track, compounding the already bad situation.
- **Trip was almost an hour longer** than the most reliable travel time of 48 minutes (Scheduled + Buffer Time).

2/26/2018 Sick passenger at Lex/59 St

- **Trip time** was 1:10:16 (39:00 scheduled travel time).
- **Broadway** the first N train was too full to board.
- **Held at Queensboro Plaza** (4:35 Minutes).
- **Slow travel** between Queensboro Plaza and Lex/59 St due to sick passenger.
- **Slow train travel** through the tunnel between Queensboro Plaza and Lex/59 St took 20:57 minutes (average 5:46).
- **Long stops** in the tunnel totaled 9:47 minutes.
- **Slow track speeds** between Queensboro Plaza and Lex/59 St was 5 MPH (average 19 MPH).

PM EXTREME COMMUTES

Despite 40% of trips taking longer than the average, only one trip exceeded an hour. While the overall trip time was shorter in the PM than in the AM, transfer times at Lex/59 St were longer, impacting the total trip travel time. Three particular days stand out the most when Lex/59 St transfer times were 20 to 36 minutes. However, MTA Alerts only shows the 36 minute transfer time most likely affected by switch problems at 34th St, with no obvious reason for the other two long transfer times.

10/17/2017 Total Lexington transfer time was 20:58 minutes

- **Station platform** was full to the other side of the platform (7-9 people deep).
- **Platform crowds** caused stairwell backups.
- **Trains** left at crush loads.
- **First train** was too full to board at Lex/59 St.

1/25/2018 Total Lexington transfer time was 20:35 minutes

- **Station platform** was mostly full (5-7 people deep).
- **Platform crowds** caused stairwell backups.
- **Trains** left at crush loads.
- **First train** was too full to board at Lex/59 St.

2/28/2018 Total Lexington transfer time was 36:24 minutes due to signal problems at 34th St

- **N/R/W platform** was full to the other side of the platform (7-9 people deep).
- **Platform crowds** caused stairwell backups.
- **Six station announcements:** Major Uptown delays due to switch problems at 34th St.

APPENDIX C: 8 AM/5 PM REAL-TIME DATA 15 MIN. SEGMENTS

- Between 8:16 - 8:30 AM, an average of two fewer trains ran compared to what was scheduled.
- Between 8:46 - 9:00 AM, trains took almost three minutes longer than what was scheduled.

Lex/59 St to Bowling Green AM: Train Counts & Travel Time

AM Time Segment	Actual Train Count	Scheduled Train Count	Count Difference	Actual Time	Scheduled Time	Time Difference
8:00 - 8:15	5.52	6.48	-0.96	20:56	19:02	+1:54
8:16 - 8:30	5.16	7.00	-1.84	21:53	20:33	+1:21
8:31 - 8:45	5.25	6.48	-1.23	23:37	20:53	+2:44
8:46 - 9:00	4.81	6.00	-1.19	24:32	21:38	+2:55

Note: The average rider survey depature time from Lex/59 St was at 8:46 AM.

- Between 5:16 - 5:30 PM, an average of two fewer trains ran compared to what was scheduled.
- Between 5:16 - 5:30 PM, trains took over two minutes longer than what was scheduled.

Bowling Green to Lex/59 St PM: Train Counts & Travel Time

PM Time Segment	Actual Train Count	Scheduled Train Count	Count Difference	Actual Time	Scheduled Time	Time Difference
5:00 - 5:15	5.26	7.00	-1.74	20:22	18:10	+2:13
5:16 - 5:30	5.06	6.90	-1.83	21:19	18:44	+2:36
5:31 - 5:45	5.12	6.43	-1.32	21:38	19:05	+2:33
5:46 - 6:00	5.26	7.00	-1.74	21:33	19:16	+2:17

Note: The average rider survey depature time from Bowling Green was at 5:14 PM.

APPENDIX D: INITIAL SURVEY FORMS

Line ______ Car # ______

Correct Signage ☐ yes ☐ no

Time Doors Open ______

Time Train Starts to Leave ______

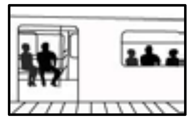
Notes

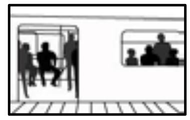
Doors held? Is the platform uncomfortably crowded?

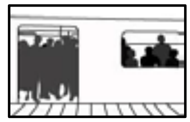
people left on platform

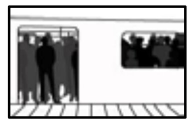
Train Crowd Level

Arrive **Depart**

☐  ☐ Everyone is able to sit.

☐  ☐ All seats are full. Lots of room to stand.

☐  ☐ Crowded, but still room for more.

☐  ☐ Very crowded. Can only squeeze on.

☐ Cleared ☐ Not cleared

Line ______ Car # ______

Correct Signage ☐ yes ☐ no

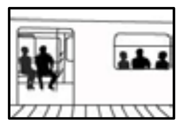
Time Doors Open ______

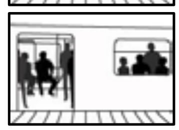
Time Train Starts to Leave ______

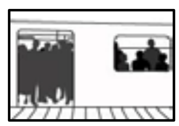
Notes

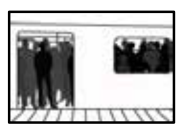
Train Crowd Level

Arrive **Depart**

☐  ☐ Everyone is able to sit.

☐  ☐ All seats are full. Lots of room to stand.

☐  ☐ Crowded, but still room for more.

☐  ☐ Very crowded. Can only squeeze on.

☐ Cleared ☐ Not cleared

Line ______ Car # ______

Correct Signage ☐ yes ☐ no

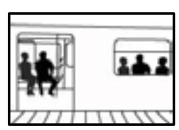
Time Doors Open ______

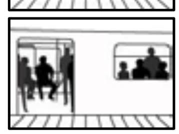
Time Train Starts to Leave ______

Notes

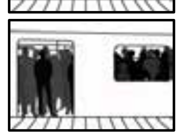
Train Crowd Level

Arrive **Depart**

☐  ☐ Everyone is able to sit.

☐  ☐ All seats are full. Lots of room to stand.

☐  ☐ Crowded, but still room for more.

☐  ☐ Very crowded. Can only squeeze on.

☐ Cleared ☐ Not cleared

APPENDIX E: LONDON UNDERGROUND CROWD CONTROL

Crowds at the Lex/59 St Station are not an anomaly. Subway platform crowding has become a critical problem in many subway stations, leading to safety and operational challenges and system-wide delays.

Fortunately, New York City can look to other systems for possible solutions. In 2003, the London Underground created a transit crowding memorandum with the British Parliament, which is still in effect today. The memorandum details safety risks and operational management of crowding.

London Underground Stations: Safety Managing Crowding

- Each station has an emergency and congestion plan.
  - Identifies station pinch points.
  - Defines how to measure when a specific station becomes congested.

- Operational rulebook crowd control procedures are initiated when congestion occurs.
  - Cordoning off or evacuating stations.

- Staff are trained to identify that once free movement along back of a platform is lost, crowd control procedures are put into place.
  - Staff may take an escalator out of use to slow peoples' approach to a platform.
  - Ticket gates may be reversed to favor exiting flows and slow the flow into a station.
  - If necessary, staff will close parts of a station, or some or all of the entrances.
  - Closures are supported by station announcements and detail alternate routes.

- Many stations are equipped with dedicated station control rooms to facilitate crowd control operations.
  - Station Assistant Train Services (SATS): Station platform staff who manage the boarding and alighting of trains and encourage customers to use full length of platform to avoid crowding.
  - SATS are supported by radio based public address (PA) systems allowing them to make announcements and move along the platforms freely.

- Crowd control procedures are implemented daily at many stations, with specific station experienced staff.
  - Staff are able to predict the build-up of congestion and can proactively take steps to slow the build-up.

- Refresher training is administered periodically, especially for less experienced staff.

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NYCTRC

NEW YORK CITY TRANSIT
RIDERS COUNCIL


Exit
Downtown
Local 6
24 hr booth
Lex Av-
59 St
CAUTION DO NOT ENTER

"A predictable, reliable subway ride can only occur when the infrastructure and signal system are properly cared for. Funding *Fast Forward* is an important and vital step in that direction - and will result in faster, smoother, and more predictable subway trips for this route and all New Yorkers."

- Andrew Albert (NYCTRC Chair)

NYCTRC
NEW YORK CITY TRANSIT RIDERS COUNCIL