# Review of the A and C Lines

New York City Transit

December 11, 2015

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# Executive Summary

The attached report provides a comprehensive review of operations on the A and C lines. Combined, the two lines serve 800,000 riders a day across three boroughs and connect to many of the most important intermodal hubs in New York City.

The A differs from most other New York City Transit subway lines in that its route splits three ways at its southern end in eastern Queens. It is also exceptionally long, at 32 miles between 207 St and Far Rockaway-Mott Av. Like many other subway lines, it merges several times with other lines. The combination of these traits tends to reduce reliability.

In contrast, the C is a shorter line scheduled to run less frequently than the A and many other lines. C service is relatively reliable, even though it has historically been assigned some of the oldest cars in the system.

This review has been prepared within the context of NYC Transit's service planning procedures, and all discussions of service levels take into account established guidelines for designing and scheduling service. NYC Transit determines how many trains run on a given line based on a number of factors, including line capacity, equipment availability, and the Rapid Transit Loading Guidelines. The Guidelines ensure that limited resources are equitably allocated throughout the system by establishing, by time of day, maximum passenger load levels and minimum service frequencies, where operationally feasible. The Guidelines are applied by evaluating average ridership levels at locations where trains are most heavily loaded ("peak load points") to develop recommended service frequencies, where operationally feasible. A and C loading is currently within 73% to 85%, on average, of those Guideline maximums during the AM peak at their peak load points, depending on line and direction, in contrast to more crowded lines like the 2,3,4,5,and E, which are more heavily loaded than Guideline maximums at their peak load points.

This review has also been prepared within the context of overall growth on the subway system. Ridership has been increasing on all subway lines in recent years, which has led to more crowding and delays systemwide than during lower ridership years.

This review identifies a number of opportunities to improve the customer experience on the A C lines, with recommendations chiefly intended to improve service management and reliability, station access and conditions, and customer communications.

***Key Issues and NYC Transit Actions:***

- **Issue: Service Frequency**

  While A C ridership has grown in recent years, average passenger loads and service frequencies are within, and are projected to remain within, NYC Transit's Rapid Transit Loading Guidelines during both peak and off-peak hours, with three exceptions:

  - Crowding on the Manhattan-bound A at Hoyt-Schermerhorn Sts during the latter part of the weekday morning rush hour, between 9:00 and 9:30 AM
  - Long scheduled headways on the C on early Sunday mornings
  - Long scheduled headways on the Far Rockaway A in the early midday on weekdays

**Actions:**

- By the end of 2015, adjust the schedule of peak A service to meet increased ridership demand in the late AM peak and to even out passenger loads on both the A and the C.
- By mid-2016, revise A timetables to make A headways consistent with frequency guidelines on the Far Rockaway branch, and revise C Sunday schedules to increase service frequencies in the early morning.

➢ **Issue: C Train Length**

At 480 feet long, C trains are shorter than the 600-foot-long A trains, which has prompted requests for longer trains on the C. The $100 million or larger investment necessary to procure cars to lengthen trainsets assigned to the C from 480 to 600 feet long cannot be justified because average loads on the C are within NYC Transit's Rapid Transit Loading Guidelines and are projected to remain so through 2035 with the scheduling of additional rush hour trips of 480-foot trains. NYC Transit continuously monitors ridership and loading. If loading on the C increases faster than projected, then NYC Transit will address the need for additional cars in a future capital plan.

**Action:** C trains will remain 480 feet long for the foreseeable future.

➢ **Issue: Reliability**

The A performs below the system average based on the key performance measures that NYCT reports on monthly, including Wait Assessment, while the C performs better than average. Unevenly spaced service on both lines, as measured by Wait Assessment, can cause crowding, delays, and reduced service.

Scheduled running times on both the A and C are shorter than actual measured running times at certain times of day, particularly during the AM peak, and only about three-quarters of scheduled departures from originating terminals leave within 30 seconds of schedule.

The opening of the South Channel Bridge south of the Broad Channel station to allow marine traffic to pass is a major cause of delays and major gaps in service on the A, as well as on Rockaway Park S trains. Currently, the US Coast Guard requires that the South Channel Bridge be opened for all marine traffic except during brief moratorium periods during the AM and PM peaks.

**Actions:** NYC Transit will implement a number of initiatives to improve reliability on the A C, including:

- By the end of 2015, revise the A C weekday timetables to better reflect actual running times in the AM peak and enable more even A train spacing.
- Facilitate on-time terminal dispatching through new internal communications tools and, by-mid-2016, expanding the number of crews on the A line so that when trains arrive at the terminals late, crews can more frequently leave for their return trips on time.
- In 2015, start working with the US Coast Guard to expand moratorium periods during which the South Channel Bridge is not opened for marine traffic.
- Reduce dwell times at Hoyt-Schermerhorn Sts in the AM peak by deploying platform conductors.
- By mid-2016, adjust the A C weekend timetables to better reflect actual running times.

- **Issue: Old Cars**

  The older cars that run on the A C (R32's built in 1964 on the C and R46's built in 1976 on the A) lack features found on newer cars that improve reliability and customer information. While older, these cars are still in a state of good repair and car problems are not a major cause of delay on either line. Nevertheless, the all-underground nature of the C line can adversely affect the reliability of the R32 air-conditioning system, due to the higher temperatures below ground. Both the R32 and R46 fleets are slated for replacement in the coming years.

  **Actions:** Continue with existing car fleet assignment and replacement plans, including:

  - As of May 2015, run approximately half of the C train fleet using relatively new R160's in place of the older R32's on an ongoing basis for operational and maintenance reasons.
  - Upon delivery of R179 cars, currently on order, replace the entire C fleet and a small portion of the A fleet with the new cars.
  - In the early 2020s, replace the remaining A R46 fleet with the new car order of R211's.

- **Issue: Customer Communication**

  The A C line lacks the communications infrastructure necessary to enable centralized service management and customer information delivery via next train countdown clocks on platforms. Long-term plans call for installation of an improved communications infrastructure on the A C line, pending capital funding.

  **Action:** Prioritize long-term implementation of planned communications upgrades, including implementation of train tracking and control technologies and installation of public address systems.

  Implement interim solutions that provide real-time train location information to improve service management, including on-time train dispatching, and to expand customer information on some sections of the A C.

- **Issue: Station Access**

  There are opportunities to improve entry/egress time, convenience, and accessibility at and around some A C stations.

  **Action:** On an ongoing basis, improve station access by reconfiguring entry and exit turnstile layouts, widening stairways, and opening new or currently closed entries and stairways, based on capacity needs, potential time savings, and the availability of limited capital funds.

  If funding is identified, reopen closed entrances at Franklin Av, 168 St, and 50 St (southbound), where existing Americans with Disabilities Act (ADA) compliance makes such work relatively cost-effective.

Many of these recommendations are dependent on identifying funding for either operating or capital expenses, while others are included in planned operating expenses or in the 2010-2014 or the 2015-2019 MTA Capital Programs.

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# Introduction

The A C Line Review is one of a series of New York City Transit studies that closely examine portions of the subway system in order to assess operational challenges and identify potential improvements to better customers' journeys.

This line review addresses two interrelated subway routes that share a corridor between Upper Manhattan and Brooklyn. The A runs between the northern tip of Manhattan in Inwood and the southeast edge of Queens in the Rockaways. The C, for its entire route between Washington Heights and Eastern Brooklyn, runs alongside or on the same tracks with the A. They share many challenges, and incidents on one line often affect the other. Therefore, NYC Transit investigated both lines together.

Each weekday, approximately 800,000 subway trips include the A or C – about 14% of all New York City subway trips. These trips, to school, work, airports, tourist attractions, home, recreation, and friends and family, are critical for New Yorkers and visitors alike, and demonstrate the mobility benefits provided by New York City's mass transit system. Ridership on the A C has grown in recent years, though it remains within NYC Transit's loading Guidelines. At the same time, service reliability has declined as measured by NYC Transit's "Wait Assessment" metric.

NYC Transit examined various aspects of the lines over recent months and has identified a number of opportunities for improvements.

This report is organized into seven sections plus appendices:

1. Service Design and Scheduling presents service history, service design, and timetable issues.

2. Train Frequency and Ridership examines the relationship between ridership, train frequency, and crowding.

3. Service Management addresses performance metrics, impediments to service regularity, and options for improving service regularity.


| | | |
|---|---|---|
| **Route miles:** | **A (207 St-Far Rockaway)** | **32** |
| | **C (168 St-Euclid Av)** | **19** |
| **Boroughs:** | | **Manhattan, Brooklyn, Queens** |
| **Average weekday trips on A or C:** | | **800,000** |
| **Average weekday trips on A:** | | **600,000** |
| **Average weekday trips on C:** | | **250,000** |
| **Average weekday trips on A and C:** | | **50,000** |
| **Share of subway system trips:** | | **14%** |
| **A train length:** | | **600 ft** |
| **C train length:** | | **480 ft** |
| **Stations:** | | **66** |
| **C local** | | **22** |
| **Fully ADA accessible** | | **17.5*** |

**Art installations in 25 stations**

**Multiple connections to regional transportation options plus every subway line except the 6**

***At 50 St, only the southbound platform is ADA accessible***

4. Stations and Station Access covers the customer experience before and after riding the train. About half of the average weekday subway trip is spent getting to the platform and waiting for the train.

5. Customer Communication reviews existing and future technologies and strategies for communicating with A C customers, including real time information, and options for clarifying JFK Airport access by better distinguishing the Lefferts Blvd and Rockaways branch services.

6. Infrastructure reports on the condition of A C infrastructure, recent and future work on the line, and the operational impact of this work.

7. Next Steps presents recommendations for improvements to the A C.

Finally, appendices provide additional information about the A C line.

# 1. Service Design and Scheduling

At 32 miles, the A is the longest line in the system, operating from Inwood along the west side of Manhattan, through central Brooklyn on the Fulton St corridor, to Lefferts Blvd and the Rockaways in Queens. Except overnight, when the C does not run, the A runs express between 168 St in Manhattan and Euclid Av in Brooklyn. The shorter C line operates during the day and evening between 168 St and Euclid Av along the same route, making all local stops. Together, the A and C operate along one of the most heavily travelled corridors in the subway system, connecting to every other subway line, except the 6, and most major regional transit centers and airports.

In Queens, the A splits twice, first between the Lefferts Blvd branch and the Rockaways branch, and again in the Rockaways branch between the Far Rockaway and Rockaway Park sub-branches. For most of the day, scheduled A service is evenly divided between the Lefferts Blvd and Rockaways branches and is determined by ridership and loading Guidelines. Aside from five peak direction-only A trains during the morning and evening peak periods, the Rockaway Park branch is served exclusively by the Rockaway Park S shuttle, which runs between Rockaway Park and Broad Channel, connecting with the Far Rockaway A train. The Lefferts Blvd A operates as a shuttle overnight between Lefferts Blvd and Euclid Av, while the full Far Rockaway A operates overnight, making local stops in place of the C, which does not run overnight.


The A, C, and S services each operate with different length trains. Almost all A trains are composed of eight 75-foot cars, for a total of 600 feet per train.[1] The C is composed of eight 60-foot cars, and totals 480 feet per train. The Rockaway Park S is generally 300 feet long, except during summer weekends when it runs with 600-foot trains.[2] Train length is determined based on platform length, car availability, and ridership demand.

[1] One PM peak A train is composed of ten 60-foot cars, which, at 600 feet long, is the same length as the rest of the A fleet.

[2] NYC Transit also has a contingency plan to run 600-foot Rockaway Park S trains during especially hot summer days, to accommodate high beach ridership.

This section discusses recent changes to A C service, scheduling, and transfers.

## Interlockings

In order to route trains properly in the subway, trains must change tracks at key locations known as "interlockings" – track and signal arrangements that allow trains to cross between tracks controlled by towers.[3] The routes operated by A and C trains are controlled by 30 interlockings, 16 of which are used in daily operations on the A C:

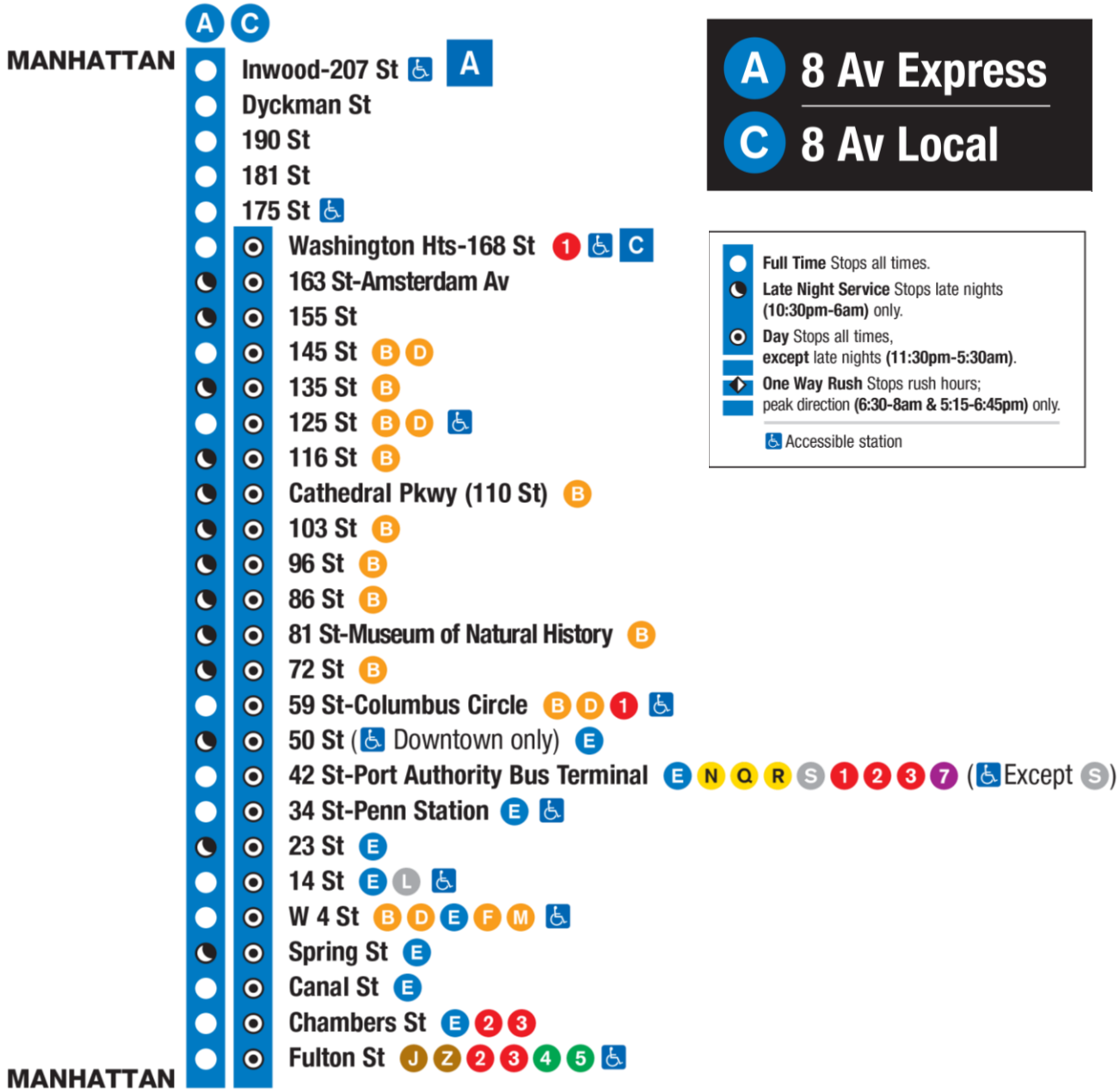
- Terminals: 207 St, 168 St, Euclid Av, Lefferts Blvd, Mott Av, and Rockaway Park
- Key merge locations: 145 St, 59 St, 42 St, Canal St, Hoyt-Schermerhorn Sts, Liberty Junction, and Hammels Wye
- Interlockings providing access to train storage locations: 207 St (207 St Yard), Euclid Av (Pitkin Yard), and Rockaway Park (Rockaway Park Yard)

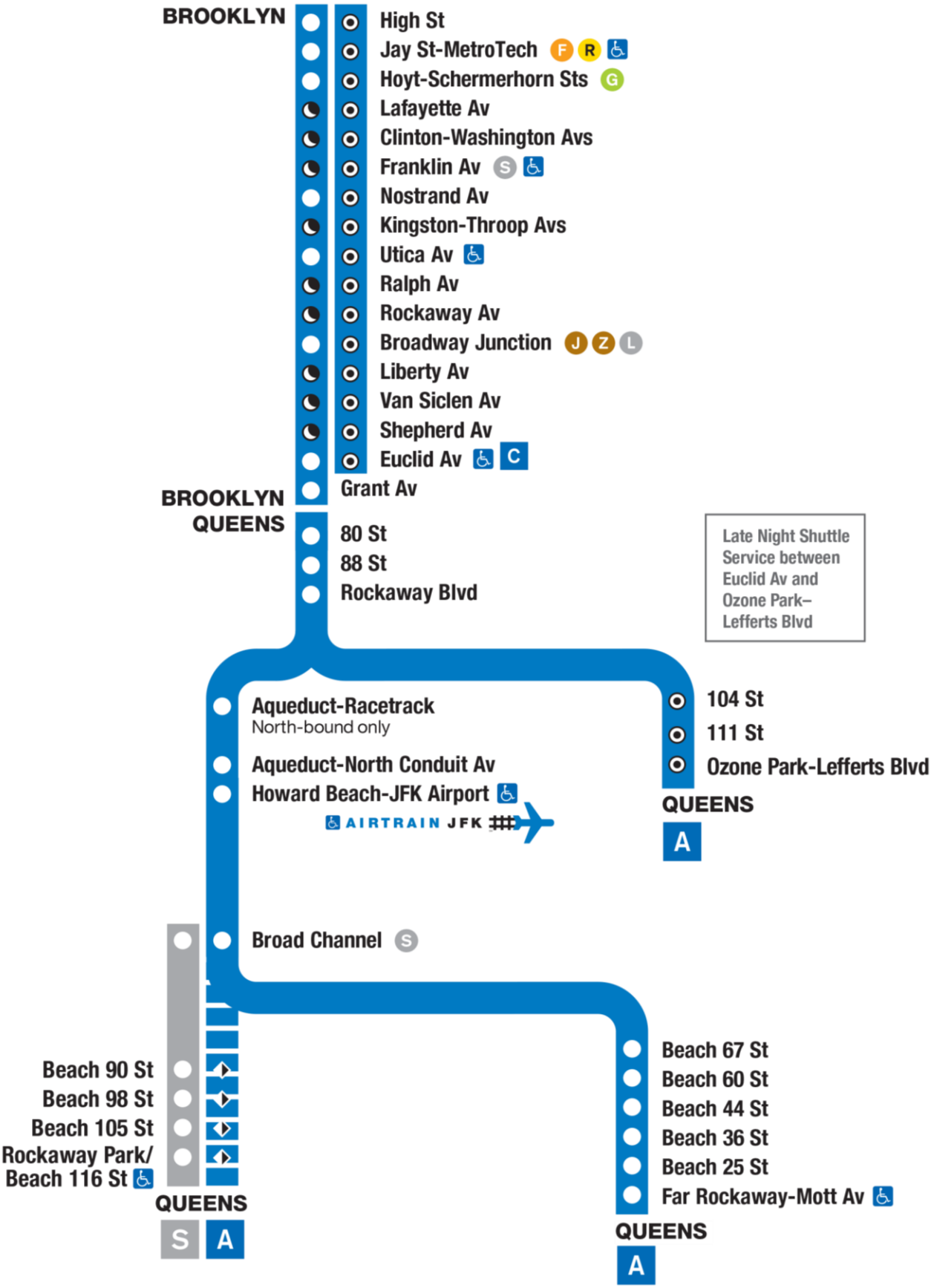
Other interlockings allow trains to be rerouted for planned or unplanned diversions, and all interlockings may be used by work trains and other non-revenue trains. See Appendix A for a list of all interlockings on the A C.

## A C Service Design

Since local and express service between 207 St and Chambers St began in 1932, dozens of service designs have operated on the lines on which the A C now operate. Other routes that have operated along the current A C include the AA, B, BB, CC, E, H, HH, and K. The service extended into Brooklyn and Queens over the course of the 1930s, 1940s, and 1950s, replacing, and, south (east) of Grant Av, incorporating the BMT Fulton St elevated. Service to the Lefferts Blvd and Rockaways branches began in 1956 when NYC Transit took over the Long Island Rail Road (LIRR) Rockaways lines. While full-time (except nights) express service has operated in Manhattan since 1932, express service in Brooklyn only ran during rush hours until 1988, and was not expanded to weekends and late evenings until 1999. The current A C service design, largely unchanged since 1999, is a complex design with several merges between the A, C, and other lines, and with A service branching to serve three southern terminals. The diagram on the next two pages shows the current service design.

[3] A tower is a field office where operating staff monitor and control train traffic on a section of one or more lines through one or more interlockings. While some towers operate automatically, staff in towers can manually route trains through interlockings when necessary.


A C
MANHATTAN
Inwood-207 St A
Dyckman St
190 St
181 St
175 St
Washington Hts-168 St 1 C
163 St-Amsterdam Av
155 St
145 St B D
135 St B
125 St B D
116 St B
Cathedral Pkwy (110 St) B
103 St B
96 St B
86 St B
81 St-Museum of Natural History B
72 St B
59 St-Columbus Circle B D 1
50 St (Downtown only) E
42 St-Port Authority Bus Terminal E N Q R S 1 2 3 7 (Except S)
34 St-Penn Station E
23 St E
14 St E L
W 4 St B D E F M
Spring St E
Canal St E
Chambers St E 2 3
Fulton St J Z 2 3 4 5
MANHATTAN
A 8 Av Express
C 8 Av Local
Full Time Stops all times.
Late Night Service Stops late nights (10:30pm-6am) only.
Day Stops all times, except late nights (11:30pm-5:30am).
One Way Rush Stops rush hours; peak direction (6:30-8am & 5:15-6:45pm) only.
Accessible station


BROOKLYN
High St
Jay St-MetroTech F R
Hoyt-Schermerhorn Sts G
Lafayette Av
Clinton-Washington Avs
Franklin Av S
Nostrand Av
Kingston-Throop Avs
Utica Av
Ralph Av
Rockaway Av
Broadway Junction J Z L
Liberty Av
Van Siclen Av
Shepherd Av
Euclid Av C
Grant Av
BROOKLYN
QUEENS
80 St
88 St
Rockaway Blvd
Late Night Shuttle Service between Euclid Av and Ozone Park–Lefferts Blvd
Aqueduct-Racetrack
North-bound only
Aqueduct-North Conduit Av
Howard Beach-JFK Airport
AIRTRAIN JFK
104 St
111 St
Ozone Park-Lefferts Blvd
QUEENS
A
Broad Channel S
Beach 90 St
Beach 98 St
Beach 105 St
Rockaway Park/
Beach 116 St
QUEENS
S A
Beach 67 St
Beach 60 St
Beach 44 St
Beach 36 St
Beach 25 St
Far Rockaway-Mott Av
QUEENS
A

The merge of the A C onto the shared two-track segment between the interlocking south of Hoyt-Schermerhorn Sts in Brooklyn and the Canal St interlocking in Manhattan is a major constraint on combined A C capacity. No more than 26 trains per hour (tph) can reliably traverse this section due to the current signal and interlocking design, and irregular service can reduce actual service to less than 26 tph through this segment.

Throughout the subway system, trains are generally scheduled to arrive at merge points no closer than two minutes apart. However, in practice, train arrivals at merges can rarely be timed perfectly, and the congestion that results from bunched arrivals can lead to delayed trains or reduced levels of service.

In a two-month sample of train performance data collected in Fall 2014, the northbound A C at Hoyt-Schermerhorn Sts achieved the scheduled AM peak combined schedule of 26 tph on only 34% of weekdays; at least 25 tph was achieved on 60% of weekdays. This merge congestion led to median running times increasing by 45 seconds for northbound C trains between Lafayette Av and the Hoyt St interlocking during the AM peak, and average station dwell times[4] increasing by 20 seconds for both southbound A and C trains at Canal St during the PM peak. These delays contribute to irregularity and gaps in service.

In addition to the capacity limitations posed by the Hoyt-Schermerhorn Sts interlocking and the shared A C segment, the current service pattern poses several other challenges to efficient and reliable service. The exceptional length of the A line is an operational challenge. The branching nature of the A in Queens and limited terminal capacity lead to less operational flexibility. The many merges for both the A and C can cause delays and reduce reliability.

**Alternative Service Designs**

A number of alternative service designs that address challenges of the current service design were considered as part of this review, but none is preferable at this time given ridership patterns, capacity constraints at interlockings, limited subway car availability, operating budget limitations, and the need to maintain and inspect infrastructure and the car fleet during off-peak hours. Several of these alternatives are discussed below.

One alternate service design that could simplify the branching A service extends the C to one of the A branch terminals. This option would result in longer end-to-end running time for the C train, which in turn would require more C trainsets and crews to maintain current operating frequencies. NYC Transit lacks available train cars necessary to operate this service design at this time. There would be terminal capacity constraints if both A and C trains shared a terminal in Queens; any extension of the C to a current A terminal would consequently require a reduction or elimination of most A service to that terminal. Therefore, extending the C to a current A terminal may require that branch's customers to take the local C in Brooklyn, or transfer to or from an express A, lengthening their trips.

Another service design issue related to the branched A is the balance of service between the Lefferts Blvd and Rockaways branches. In the current schedule, service is divided roughly equally between the two branches at most times of day. Fall 2014 northbound ridership surveys at Broadway Junction during the AM peak indicate that this division is appropriate, as loads from

[4] Dwell time is the length of time a train is stopped in a station.

Lefferts Blvd and the Rockaways were comparable and little overcrowding was observed on any A trains operating from either branch. Off-peak, Rockaways ridership is heavier than Lefferts ridership, but still within guidelines, and minimum service levels are maintained per Guidelines on each branch, as discussed in Section 2, "Train Frequency and Ridership."

The merges of the southbound A C and of the northbound C E at Canal St could be eliminated by a service design in which the C would operate local between 168 St and World Trade Center and the E would operate express on the 8 Av Line and local in Brooklyn to Euclid Av. While this alternate service design would eliminate delays caused by the northbound and southbound Canal St merges, it would introduce a new, high-frequency A E southbound merge at 42 St. It would also introduce PM congestion to the northbound merge at Hoyt-Schermerhorn Sts, which is already congested in the AM, since the PM peak northbound E must be scheduled for more service than the C due to ridership in midtown and Queens. In addition, since AM southbound E service would have to be maintained at 15 tph to adequately serve Queens Blvd riders, extending the E to Euclid Av would require the acquisition of many additional trainsets for operation.

### Train Length

There have been periodic requests for the operation of full-length 600-foot trains on the C in lieu of the current 480-foot trains. This would increase C trainset capacity by 25 percent, create more consistency for customers at platforms shared with most other lines, and ease cross-platform transfers with other 600-foot trains. However, based on projections for C ridership incorporating regional employment, population, and transportation forecasts, NYC Transit projects that C loading with 480-foot trains at current frequencies will remain within NYC Transit Rapid Transit Loading Guideline levels[5] into the 2020s. These preliminary projections further indicate that the addition of one northbound AM peak C trip, which is feasible with the acquisition of additional cars, will enable C loading with 480-foot trains to remain within Guidelines through 2035.

Full-length C trains would require an additional 44 cars at a cost of over $100 million. Currently, the cars necessary for 600-foot C trains are not included in the MTA Capital Program. Increasing C trains to 600 feet using existing rolling stock would be an inefficient use of NYC Transit resources because other lines with higher ridership would be required to operate the 480-foot-long trains[6] currently assigned to the C, resulting in heavier crowding on those lines.

While longer C trains may have operational benefits during peak hours and would provide capacity for future growth along the A C line, longer trains are not needed to accommodate current or forecasted ridership. Given that C loading remains within guideline levels, the considerable expense of acquiring additional train cars to lengthen the train is not warranted at this time. In the long run, NYC Transit will monitor C line ridership levels and adjust fleet plans if necessary and feasible. Procurement of additional cars would be evaluated in the context of

[5] Guidelines are explained in Section 2, "Train Frequency and Ridership."

[6] The older R32 cars assigned to the C are configured as permanently coupled pairs; four such pairs comprise a 480-foot long C train. However, most of the rest of the B Division car fleet is comprised of cars configured into half-length consists, such that two consists make up a train – either two 240 foot long consists for a 480-foot train or two 300 foot long consists for a 600-foot train. (For instance, on the A train, two 300-foot consists of R46 cars make up a 600-foot train.) Thus, there is relatively little flexibility in exchanging cars between trains of different length.

limited available funds, competing capital priorities, and the potential for operating additional scheduled service with 480-foot C trains to maintain loading within NYC Transit's Guidelines.

## Timetables

As of the June 2015 timetables, NYC Transit schedules 166 round trips on the A on weekdays, 144 on Saturdays, and 117 on Sundays. There are 100 round trips scheduled on the C on weekdays, 91 on Saturdays, and 79 on Sundays. Full timetables can be found at www.mta.info/schedules. Terminal-to-terminal running times for Lefferts Blvd trains are roughly 75 minutes per direction, Far Rockaway train running times are generally closer to 95 minutes, and C train running times are 65 minutes or slightly more. All subway running times vary by time of day to account for variations in dwell times, interlocking and train congestion, routine maintenance, and changes to stopping patterns.

The A C timetables are based on running times between key stations and the need to accommodate multiple merges:

- The A and D merge northbound at 59 St and southbound at 145 St, as do the B and the C. The pattern of A B C D service at 59 St is so fundamental to operating service on the 6 Av and 8 Av Lines, in both directions, that the A C schedules must be developed around this location. All A C schedule adjustments are calculated backward or forward from 59 St.
- The A and C merge northbound at Hoyt-Schermerhorn Sts and southbound at Canal St.
- The C and the E merge northbound at Canal St and southbound at 42 St.
- Lefferts Blvd and Rockaways A trains merge northbound at Rockaway Blvd.
- The Far Rockaway A, the Rockaway Park A, and the Rockaway Park S shuttle merge at Broad Channel in both directions.

Weekend timetables require the same merges, except for the B and Rockaway Park A, which do not operate on weekends.

### Running Times and Schedule Changes

NYC Transit reviewed running times across most of the subway system in 2014. For many lines, including for the A C, these were the first comprehensive running time reviews since the 1990s. Running times throughout the system have trended longer in recent years due to a number of factors:

- Rapidly increasing ridership, which can affect dwell times.
- The installation of new signal systems and the modification of older signal systems to improve operational safety.
- An increase in the average number of slow speed zones due to more maintenance work along the right of way.
- More stringent safety rules to improve protection for track workers[7] at work sites.

Inadequate or inaccurately distributed running time can contribute to uneven service and lead to scheduled trip cancellations because trains or crews arrive at terminals too late to make subsequent scheduled return trips. Additional running time requires extra train crews and cars,

[7] Slow speed zones, where train speeds are temporarily limited to 10 mph, are established on tracks where work is taking place as well as on tracks adjacent to work zones.

while too much running time can raise costs and lead to delays at merges and entering terminals.

The 2014 running time analyses, distilled from large samples of electronic data,[8] indicated that the A C is largely scheduled with appropriate running times at most times of day, which enable trains dispatched on time to consistently arrive at merges and terminals on time to complete subsequent trips, barring unusual delays. Nevertheless, during peak periods and evenings actual running times were found to be slightly longer than scheduled running times. As a result, NYC Transit preliminarily adjusted the A C timetables in December 2014 to better reflect the actual running times. These changes will be further refined for the AM peak period in the December 2015 timetable to distribute the appropriate additional running time along the Fulton St corridor in Brooklyn and in Upper Manhattan to better match measured intermediate running times. Middays, NYC Transit put additional running time into the timetables in 2014 to compensate for slow speed operation necessitated by system maintenance. Overnight running times were found to be adequate.

Independent of the running time analyses, about five minutes of "recovery time" was added to the C schedule, at the Euclid Av terminal, in the summer of 2014. This added time enables arriving southbound trains to relay[9] and depart on time for their northbound trips, even if they arrive late, leading to more regular service in both directions.

### Coordination of Transfers with Other Lines

The Far Rockaway A and Rockaway Park S timetables are written to coordinate passenger transfers, to the extent practical, and to prevent the two services from interfering with each other where they share tracks at Broad Channel. Since most S riders come from or are destined for the A, the northbound shuttle ideally arrives shortly before the northbound A, and the southbound S ideally departs shortly after the southbound A at Broad Channel. During late nights in particular, when A and S trains are scheduled at the same frequency, the Rockaway Park S is scheduled to connect with A trains in both directions, minimizing the time passengers must wait to transfer between trains. During other times of day, differences in scheduled frequencies and less reliable service can result in inconsistent connections. However, S dispatchers generally attempt to hold back scheduled Rockaway Park-bound shuttles to directly follow Far Rockaway-bound A trains when doing so will not negatively affect subsequent Broad Channel-bound trips.

Scheduling connections between the A C and other lines is not feasible in most cases. The A C connects with every line in the system, except the 6, and has cross-platform connections with the B D E F G. Each subway line is scheduled at different frequencies that change across the day, based on loading guidelines and operational requirements. Therefore, the A C cannot be timed for deliberate transfers at most stations, at most times of day. NYC Transit policy directs conductors and train operators to hold trains for cross-platform connections during off-

[8] Throughout much of the B Division (lettered lines), this electronic data consists of manual entries in train arrival/departure logs at key stations. In limited sections of the B Division, and on the 1 2 3 4 5 6 lines, train tracking data is automatically collected, allowing for more detailed analysis of station-to-station running times.

[9] "Relay" refers to a train changing direction on tracks that extend beyond a terminal station. A train enters the terminal on an arrival track, discharges its passengers, and moves to the tracks beyond the terminal. The operating crew then changes directions and brings the train back into the terminal on a departure track. Both the 168 St and Euclid Av terminals of the C are relay terminals. In contrast, the 207 St, Lefferts Blvd, Far Rockaway, and Rockaway Park terminals of the A are not relay terminals; A trains change directions while dwelling at the terminal platform.

peak times when doing so does not adversely affect on-time operation. During rush hours, however, holding for cross-platform connections is discouraged to avoid delaying following trains since most lines are scheduled at higher frequencies.

In addition, the A C connects with numerous local buses, regional and intercity bus services at the Port Authority Bus Terminal and the George Washington Bridge Bus Station, and with regional and intercity rail services of the Long Island Rail Road (LIRR), New Jersey Transit, PATH, JFK AirTrain, and Amtrak.

## Service Design and Scheduling: Issues and Actions[10]

- Some running times in the A and C timetables do not yet fully reflect running times measured in 2014, and inaccurate running times can result in delays, uneven service, and reduced service.
  - NYC Transit will adjust running times in the timetables on both weekdays and weekends.
- The Rockaway Park S does not always connect for transfers with the Far Rockaway A.
  - NYC Transit will establish dispatching guidelines to improve these connections.

[10] Issues and Actions are those for which NYC Transit is making a recommendation in the Next Steps section of this report.

# 2. Train Frequency and Ridership

The NYC Transit Rapid Transit Loading Guidelines establish service levels, where operationally feasible, based on the average observed number of riders on the train at a line's peak load point. A and C trains carry heavy ridership in some locations during the AM peak, although they are generally less crowded than the subway's most crowded lines such as the 2, 4, 5, 7, L, E, and F. While A C ridership has grown in recent years, loading surveys indicate that it has not outgrown the Guideline capacity provided at current scheduled frequencies, with one exception as described at the end of this section.

## Train Frequency: Based on Guidelines, Ridership, and Feasibility

The NYC Transit Rapid Transit Loading Guidelines are used to develop and maintain comprehensive, cost-efficient, and equitable transit service that meets the needs of those who live, work, and travel in New York City. These guidelines provide a structure for consistent and fair evaluation of existing and proposed services by determining when, where, and how frequently service should be offered.

The Guidelines, which apply to all lines in the system, stipulate that train frequency, when feasible, should be based on two factors:

1. Minimum service frequencies, which vary by time of day and day of week.
2. Maximum average loads, which vary depending on service frequency during peak hours. Lower maximum passenger loads are allowed on lines with less frequent service.

***1. Minimum Service Frequency***

| Time of Day / Day of Week | Trips Per Hour | Average Headway (Time Between Trains) |
|---|---|---|
| Weekday Daytimes and Saturdays | **6** | **10 Minutes** |
| Weekday Evenings and Sundays | **5** | **12 Minutes** |
| Overnight All Days and A Branches Past Rockaway Blvd Split, Weekday Daytimes and Saturdays | **3** | **20 Minutes** |
| A Branches Past Rockaway Blvd Split, Weekday Evenings and Sundays | **2.5** | **24 Minutes** |

Minimum frequencies in the Guidelines recommend a base frequency. The daytime minimum frequencies of 6 and 5 tph only apply to the combined A north of the merge of the Lefferts Blvd and Rockaways branches at Rockaway Blvd, because of the unique branching characteristics of the A in Queens. The minimum frequencies on the Lefferts Blvd and Far Rockaway branches are half of the standard minimum frequency. They also do not apply to the Rockaway Park S.

If loading is high enough, the Guidelines recommend more frequent service than the minimum frequencies, if operationally feasible, based on the number of riders on board trains at the peak load points, which vary by direction and time of day. The guidelines recommend adjusting train frequency based on loading levels compared to capacity, if feasible, so that average loads are no greater than the following levels:

***2. Maximum Average Loads***

| Time of Day/Day of Week | Passengers Per 60' Car | Passengers Per 75' Car |
|---|---|---|
| Weekday Peaks[11] | 145 | 175 |
| Weekday Off-peaks, Saturdays, and Sundays | 54 | 88 |

Service frequencies and loading sometimes cannot conform to Guideline levels due to operational constraints such as track capacity, car availability, and the need to accommodate maintenance and construction work.

**Weekday Service**

Weekday peak loads, and therefore peak frequencies, are generally headed toward the Manhattan business districts in the AM peak, the time of heaviest ridership, and away from the Manhattan core in the longer, less concentrated PM peak. On the A C, the peak load points[12] are leaving Hoyt-Schermerhorn Sts (A C) northbound and 125 St (A) and 72 St (C) southbound in the AM peak and leaving 14 St (A) and 59 St (A C) northbound and Jay St-MetroTech (A C) southbound during the PM peak.

Based on current scheduled frequencies at these points, the maximum average loads defined by the guidelines vary by location and time of day. The guidelines specify a maximum rush hour average of 1,400 passengers per 600-foot A train at peak load points, and 1,160 passengers per 480-foot C train, if operationally feasible.[13]

The charts on the following page show currently scheduled A C service frequency at West 4 St, by clock face hour in each direction, and illustrate how service increases to match increased ridership during the AM and PM peaks. During the combined AM peak northbound hour of roughly 8:00 to 9:00 AM, a total of 26 A and C trains are scheduled to pass through the peak load point in Downtown Brooklyn, heading towards Manhattan.

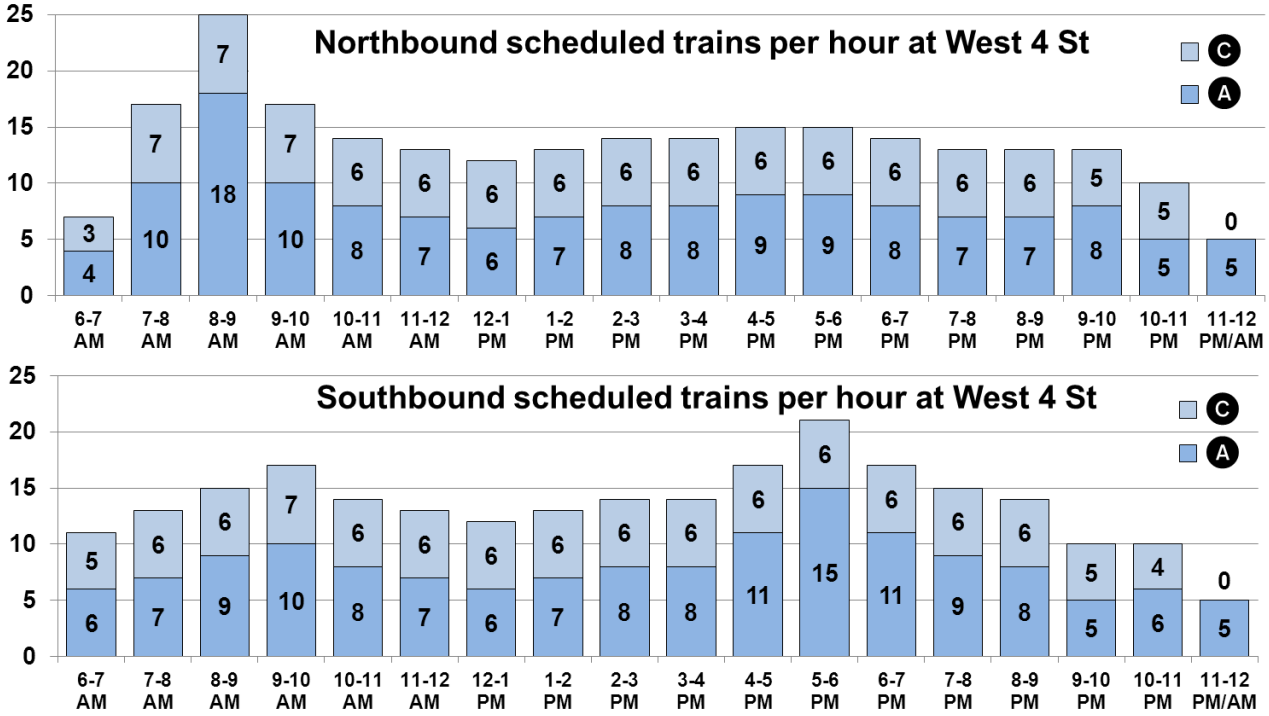
[11] The peak-period maximum frequency loading guideline is based on three square feet per standing passenger and all seats occupied. For locations with less than 15 tph, loading guidelines recommend slightly fewer passengers per car.

[12] The peak load point is the station at which trains, upon departure, are most heavily loaded on a line.

[13] At the A C peak load points, the maximum guidelines apply to the average loading of the combined A and C at Hoyt-Schermerhorn Sts northbound in the AM and to the combined A D leaving 59 St northbound in the PM. Lower frequency-based guidelines apply to the combined A D at 125 St and the combined B C at 72 St southbound in the AM as well as to the combined B C northbound at 59 St and to the A and C separately at Jay St-MetroTech southbound in the PM.

The C generally runs at 6 trains per hour (tph), the minimum weekday Guideline frequency, except during the AM peak, when it runs at up to 8 tph, and the PM peak, when it runs at 7 tph during the peak hour.[14] The A varies from 6 to 18 tph, depending on time and direction.

Southbound, the A is scheduled at 11 tph during the AM peak hour at 125 St, the peak load point. The D is scheduled at 9 tph during the same period at 125 St, while the C and B at 72 St are scheduled at 7 tph each, for a total of 20 and 14 tph on each shared corridor.




Overnight, when the C does not run, the Far Rockaway A, the Lefferts Blvd shuttle, and the Rockaway Park S each run at 3 tph for most of the period, per the guidelines. The Rockaway Park S runs at 4 tph most of the day, generally matching the frequency of the Far Rockaway A.

NYC Transit schedules roughly the same A service frequency on the Lefferts Blvd and Rockaways branches during most periods of the day, except the rush hours, when the Rockaways branch has slightly more frequent peak direction service than the Lefferts branch, due to the five peak direction Rockaway Park A trains. There is approximately equal ridership on the two branches during peaks. In off-peak periods, when Rockaways branch ridership is higher than Lefferts branch ridership, minimum frequency guidelines apply to both Lefferts Blvd and Far Rockaway service because loading is within guidelines on both branches.

Service must be balanced at all times among the three primary A train terminals and with C local service during the daytime, while maintaining headways (time periods between trains) that both meet minimum service frequencies and prevent excessive average loads. Although recent

[14] The peak frequencies of 8 northbound C trains in the AM peak and 7 southbound C trains in the PM peak do not pass W 4 St on a clock face hour such as 8-9AM, but are rather measured in the peak hour at Downtown Brooklyn northbound and 72 St southbound. Thus, they are not visible on the clock face hour graphic at W 4 St above.

ridership surveys indicate that additional service is not required at this time, should ridership eventually require additional service, options for increasing AM peak capacity on the A C are constrained by its track and signal layout and by limited rolling stock availability. It is not currently practical to schedule more than 26 tph per direction through the shared two-track corridor between the interlocking just south of Hoyt-Schermerhorn Sts and the interlocking at Canal St due to limited signal and track capacity. Future signaling and interlocking replacements to enable Communications-Based Train Control (see "Infrastructure") are planned to increase the track and signal capacity, but these are not expected to be fully installed until the late 2020s or 2030s.

Even if there were demand for additional A C service during rush hours and the signal capacity to allow for greater frequency, additional cars would need to be acquired and traction power capacity would need to be studied prior to increasing service on the A and C during the AM peak, in either direction.[15] PM peak service currently carries loads that are within Guidelines, but increasing PM service would also require acquiring additional cars.

Based on current ridership levels and operational reasons, midday and evening service is largely scheduled at or more frequently than the minimum frequency called for by the guidelines. For instance, combined A service is scheduled at between 6 and 8 tph during weekday middays when guidelines call for a minimum of 6 tph. Due to the limited availability of trains, the split in A service in Queens, and the high number of northbound trains required by weekday AM peak ridership, there are some extended scheduled headways to and from Far Rockaway in the early midday that are longer than the average of 20 minutes called for by the Guidelines. Some of these longer headways can be reduced with schedule adjustments, while others may require additional trains. NYC Transit will reduce these extended headways in 2016, where feasible.

### Weekend Service

Weekend ridership does not lead to the extreme peak periods of concentrated service that occur on weekdays. Also, service frequencies are constrained by the need to accommodate maintenance work along the right of way, much of which occurs on weekends. Thus, on Saturday the A is scheduled at 8 tph for much of the day and the C is largely scheduled at the guideline minimum frequency of 6 tph. On Sunday, ridership levels require that the A and C are each scheduled at 6 tph during the midday, which is more frequent than the guideline minimum frequency of 5 tph for Sundays.

C service begins leaving the terminals shortly before 6:00 AM on Saturdays and around 7:00 AM on Sundays, as the A shifts from overnight local service to daytime express service. On Saturdays, the C transitions to a 10-minute headway (6 tph) by about 7:30 AM. On Sundays, however, C headways are not consistently shorter than 15 minutes until after 10:00 AM. These Sunday morning AM local headways are longer than those on comparable corridors, and in fact the first three C headways are actually longer, at 20 minutes, than the last three A local

[15] In general, NYC Transit has very few spare trains during peak periods, and acquiring additional trains involves significant capital expenditure and generally takes at least five years between the start of procurement and the start of passenger service. Therefore, the only way to add trains to A C service during peak periods in the short term is to reassign trains from other lines, which is logistically challenging to schedule and requires that the transferred trainsets be from lines that would continue to operate within guidelines with fewer trains. NYC Transit regularly forecasts growth to anticipate necessary train fleet expansion. Given limited capital resources and manifold capital needs, fleet expansion to accommodate the potential for higher than forecasted growth is generally not the best use of those limited resources.

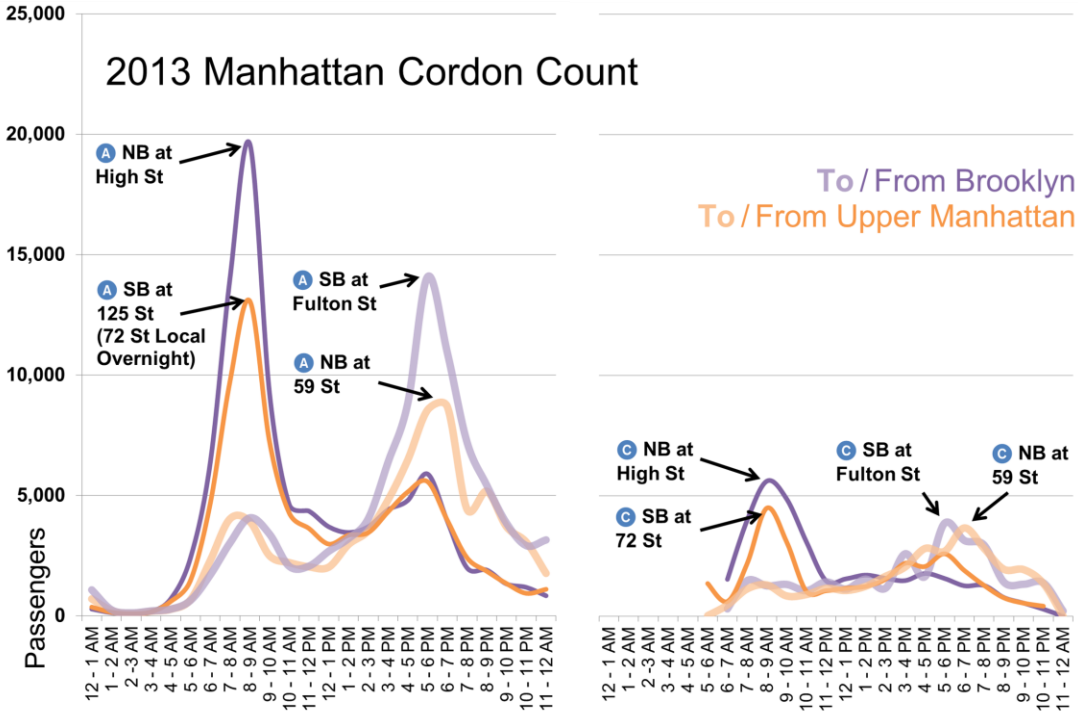
headways (15 minutes) immediately prior to the start of C service. NYC Transit will increase local service during this period in 2016.

Due to service changes and diversions necessary for maintenance and construction, weekend riders generally face longer headways and less regular service than weekday peak riders. As discussed in the "Infrastructure" section, NYC Transit performs necessary construction and maintenance work on the subway during off-peak hours, when the system is relatively less busy. Off-peak frequencies are sometimes reduced below Guideline recommendations in order to accommodate essential capital and maintenance work. Such reduced frequencies on the C, for instance, can lead to loads above guidelines along Central Park West, where the B does not operate on weekends.

In summer, trips to the beaches in the Rockaways can significantly increase ridership on the A and Rockaway S, especially on weekends and exceptionally hot days. NYC Transit analyzed ridership levels to and from the Rockaways in summer 2015 and is investigating options to reduce crowding in summer 2016.

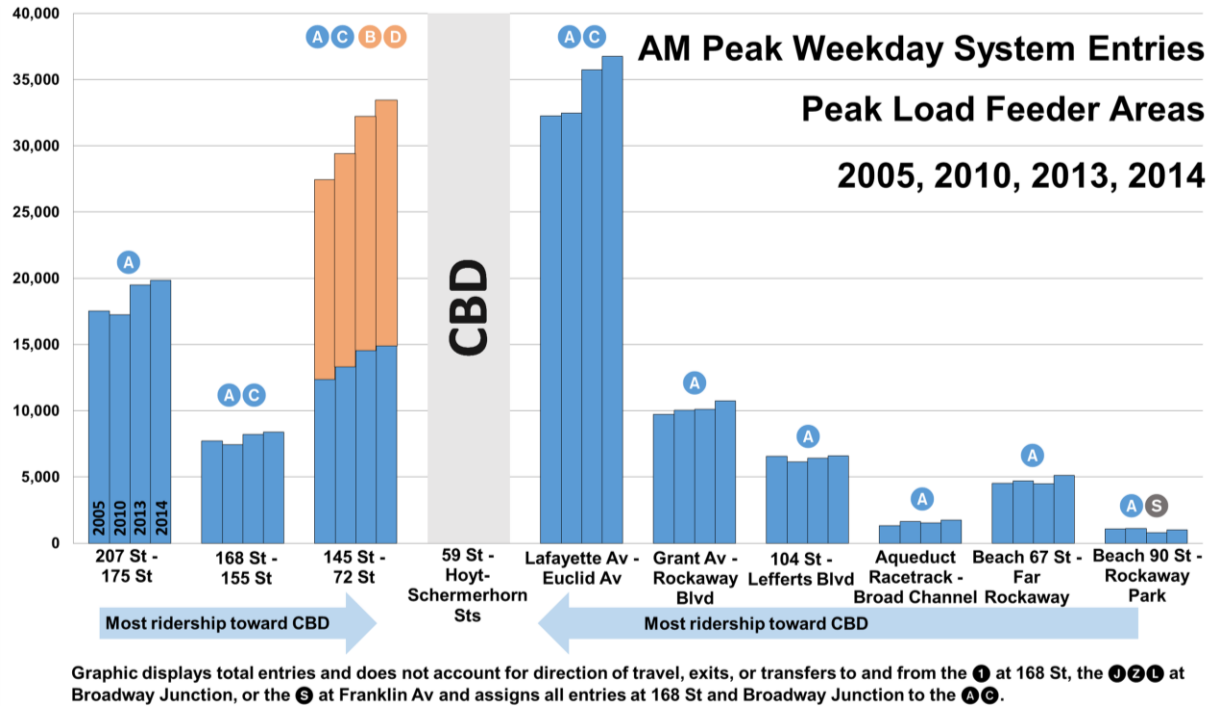
## Ridership on the A C Line

Out of an average 5.6 million weekday subway trips, approximately 800,000 trips – more than the total daily ridership of the Washington Metro (the second busiest rail system in the United States) – are taken, in whole or in part, on the A C. The line plays such a sizable role in the system in part because the A C offers transfer opportunities to all other subway lines, except the 6, as well as connections to regional transportation services as outlined in "Service Design and Scheduling." Because the line passes through the Central Business District (CBD),[16] it has AM peak traffic in two directions: southbound out of upper Manhattan and northbound out of Queens and Brooklyn. The northbound peak direction has the higher cumulative peak ridership.




[16] New York City's CBD in this case includes all of Manhattan south of 60th St as well as Downtown Brooklyn.

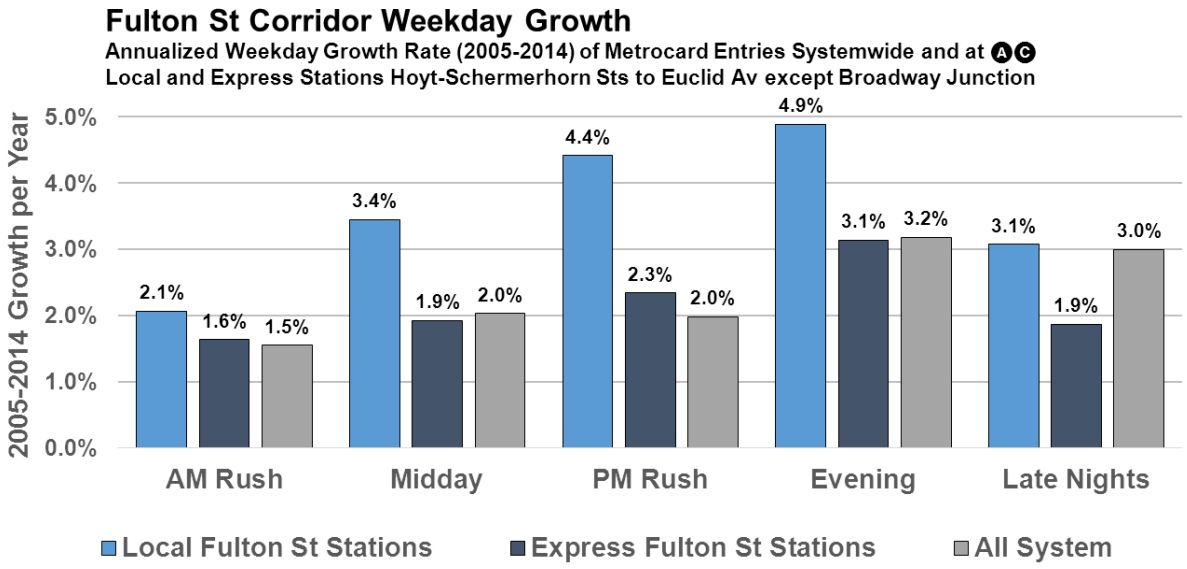
Subway ridership has grown rapidly in recent years. Ridership across the whole subway network increased 2.6% from 2013 to 2014, with ridership growing faster in Brooklyn and Manhattan than in Queens and the Bronx. A C ridership has also grown substantially in recent years, with notable AM peak growth where the A C runs in Inwood, Washington Heights, Harlem and the Upper West Side in Manhattan, and at many of its local-only stations along the Fulton St corridor in Brooklyn. Although there has been ridership growth in both AM peak directions, much of the southbound growth in Harlem and the Upper West Side has been absorbed by the B D as shown below.



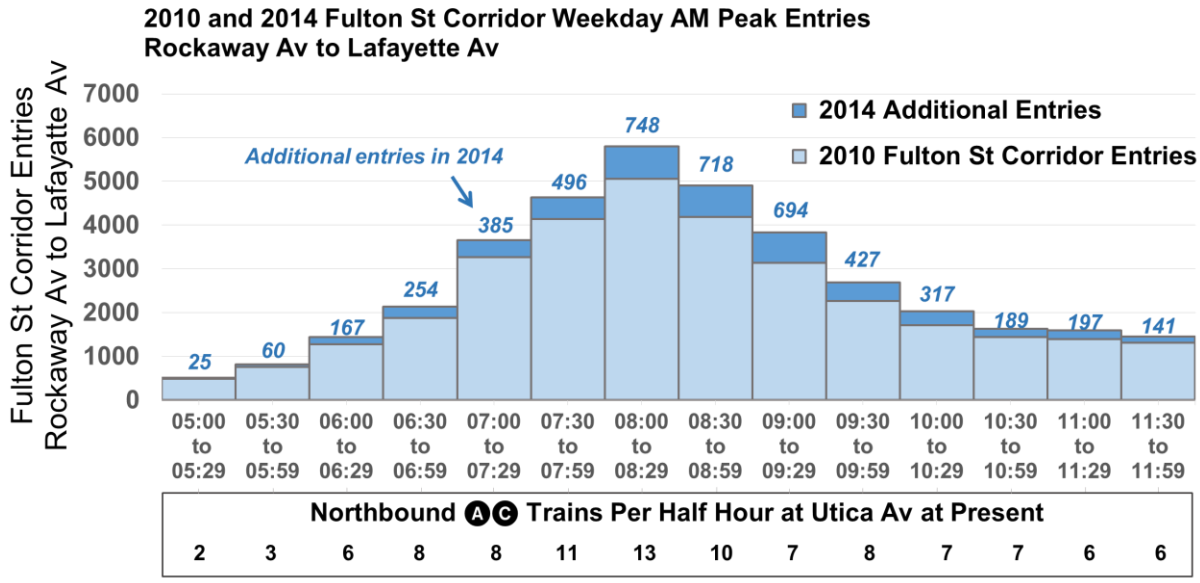

Graphic displays total entries and does not account for direction of travel, exits, or transfers to and from the 1 at 168 St, the J Z L at Broadway Junction, or the S at Franklin Av and assigns all entries at 168 St and Broadway Junction to the A C.

Along the Fulton St corridor in Brooklyn, where A C ridership has increased the most and AM peak A C service is scheduled at its peak frequency of 26 tph, average annual A C ridership growth since 2005 has outpaced full system growth.[17] As shown in the first chart below, however, the two lines have not borne equal shares of this growth: express A ridership has grown at approximately the same pace as the full system, while local C ridership has significantly outpaced the system.

[17] The chart on this page and the two on the next page incorporate fall non-holiday weekday station entries from 2005, 2010, 2013, and 2014 analyzed for this study. Fall was chosen because it is the peak ridership period.




Although this growth has been distributed across the day, the greatest ridership growth by volume has occurred during the AM peak in recent years, with pronounced growth toward the latter end of the AM peak when scheduled train service transitions from peak hour frequencies to less frequent midday levels. Comparing average weekday ridership on the Fulton St corridor (between Rockaway Av to Lafayette Av) in 2014 and 2010, nearly as many additional riders in 2014 boarded between 9:00 and 9:30 (694) as between 8:00 and 8:30 (748), but riders in the later half-hour period were distributed amongst 7 rather than 13 A C trains. Ridership growth by station is detailed in Appendix B.




### Ridership Growth in Context

Ridership growth alone does not translate into a need for increased service if there is still available train capacity at current frequencies, per guidelines. Recent measurements indicate

that average loads at the peak load points are within guideline levels during the morning and evening peak ridership hours as shown in the below table.[18]

**Recent A C Peak Loads[19] vs. Practical Capacity**

| Period | Dir | Route | Station | Peak Ridership Hour | Passenger Volume / Capacity |
|---|---|---|---|---|---|
| AM Peak | SB | A | 125 St | 8:07-9:06 | 85% |
| | | C | 72 St | 8:06-9:05 | 75% |
| | NB | A | Hoyt - Schermerhorn Sts | 7:54-8:53 | 73% |
| | | C | Hoyt - Schermerhorn Sts | 8:20-9:19 | 81% |
| PM Peak | NB | A | 14 St | 16:51-17:50 | 59% |
| | | A | 59 St - Columbus Circle | 17:20-18:19 | 56% |
| | | C | 59 St - Columbus Circle | 17:36-18:35 | 50% |
| | SB | A | Jay St - MetroTech | 17:03-18:02 | 63% |
| | | C | Jay St - MetroTech | 18:02-19:01 | 55% |

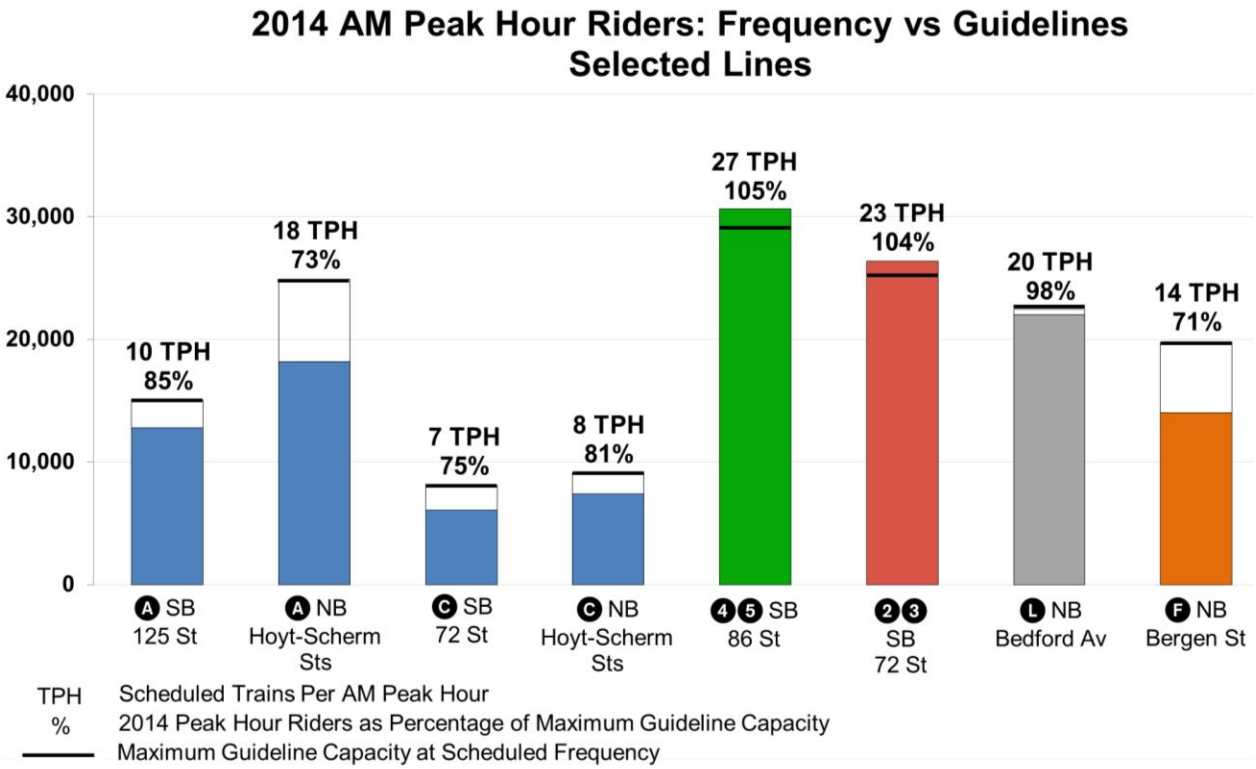
Although overall ridership is up across much of the system, AM peak hour ridership for the A is below historic highs in both directions. The southbound A had higher peak hour ridership prior to the recession in 2008 than in 2014, and the northbound A in Downtown Brooklyn in 2014 had only about 90% as many riders as it did from 1998-2008. However, AM peak C ridership is now slightly higher in both directions than in any year since the current service design began in 1999.

NYC Transit preliminary projections indicate that both lines' ridership will remain within peak guidelines for the foreseeable future, resulting in 2035 AM peak passenger volume to capacity ratios of 77% to 91%, depending on the line and direction.[20] While the A and C are more crowded in the AM peak compared to the past several years, this is the case on most lines in the system and the A C are still less crowded than many other lines, as shown below.

[18] These capacities reflect guidelines per combined corridor frequencies in many cases. For instance, northbound at Hoyt-Schermerhorn Sts, the A and C guideline loading levels reflect their combined frequencies, as most customers will board the train that comes first rather than wait for one over the other.

[19] Note: Cordon count ridership above does not correspond to the peak hour ridership counts that drive service frequency due to different locations, years, and the use of hourly clock-face counts rather than the peak 60 minutes.

[20] These AM peak projections, which indicate that loading will remain below guidelines at all A and C peak load points through 2030 at existing frequencies, are based on regional employment, transportation, and population forecasts. If train loading increases above guideline levels, NYC Transit will endeavor to add service, where and when feasible, given limited train cars and track capacity. The 2035 projected ratios of 77% to 91% assume that one additional AM peak southbound A 600' train and one additional AM peak northbound C 480' train will be added as loading on these services reaches guideline levels.




**The 4 5 and 2 3 are above guidelines during the peak hour when no additional service can be added due to operational constraints. The Second Avenue Subway should mitigate crowding on the 4 5.*
***The A at 125 St SB shares many riders with the D and the C at 72 St SB shares many riders with the B.*

### Loading Irregularities and Crowding Above Guidelines

While A C ridership during peak hours is within guidelines on average, irregular service can result in loading levels above guidelines on some trains or portions of trains. Even when train loading is within guidelines on average during a 60-minute period, there are often individual trains or cars that are above guidelines and thus a significant portion of riders will experience crowded conditions.

For instance, the C has historically been much less crowded than most other lines, and this remains true outside of the AM peak. However, as ridership has grown, occasional crowding has become much more common during the AM peak. Although average C loads leaving Hoyt-Schermerhorn Sts during the AM peak hour are at 81% of guidelines per recent load checks, 11% of these trains, on average, have loads exceeding 120% of guidelines.

| Route | Station | Dir | AM Peak Hour | Trains > 120% of Guideline Capacity |
|---|---|---|---|---|
| A | Hoyt - Schermerhorn Sts | NB | 7:54-8:53 | 2% |
| C | Hoyt - Schermerhorn Sts | NB | 8:20-9:19 | 11% |
| A | 125 St | SB | 8:07-9:06 | 7% |
| C | 72 St | SB | 8:06-9:05 | 9% |

At certain points along the line, loading tends to be concentrated on one or more cars, often toward an end of the train, while other cars are relatively lightly loaded. For instance, southbound C trains in the PM in Downtown Brooklyn tend to be much more crowded in the first cars, as passengers place themselves toward southern station exits at Lafayette Av, Clinton-Washington Avs, Franklin Av, and Nostrand Av, such that there are about 120 riders in the first car leaving Jay St and only 70 in each of the last three cars, on average, in the PM peak period. Riders also tend to congregate in the southern portion of trains leaving and arriving at 34 St-Penn Station for quicker access to regional transportation. Northbound AM peak C trains departing 34 St-Penn Station have about three times as many passengers in the rear car as the front car, on average.

Although C trains are generally far less crowded than trains on most other lines, the occasional very crowded train or car may lead to a perception of overcrowding not reflected by loading on the average train on the line, since proportionally more riders experience the crowded train or car than the relatively less crowded one. Similarly, uneven loading within and between A trains may contribute to dissatisfaction with crowding on the line. In many cases, less crowded conditions can be found in other portions of the train or by waiting for subsequent trains.

While some crowding is the result of service irregularity or rider preferences, in other cases crowding is due to an increase in ridership or changing ridership patterns. NYC Transit makes periodic schedule adjustments to better fit service frequency to passenger loads.

## Recent Changes in A C Frequency

In 2010, off-peak guidelines were revised to allow for less frequent service and greater loading during middays, evenings, and weekends to reduce costs following the 2008 financial crisis. On the A, scheduled weekday service was reduced by four round trips in the midday and two round trips in the evening, and minor changes were made on weekends. C service frequency was not significantly affected by these revisions.

As with all subway lines, passenger loading on the A C is regularly measured to ensure that the line is scheduled within loading guidelines. Like most lines in the system, the A and C are most crowded in the AM peak, when the most frequent service is scheduled. As off-peak ridership has grown systemwide, however, schedule adjustments are increasingly justified in the early or late “shoulders” of peak periods, or during middays and evenings. Adjustments are more likely to be implemented outside of the peaks as additional peak service is often restricted by insufficient cars or service that already operates at track and signaling capacity.

Ridership surveys in 2013 led to the summer 2014 implementation of three additional weekday A round trips in the late PM peak and early evening, including two new round trips plus one trip that was shifted from the early PM rush hour, when loading is below guideline loads.

Recent ridership surveys indicated that, although combined A C ridership is currently within guidelines, A and C service is not ideally distributed to match current ridership northbound in the AM peak: the A operated with average loads over guideline levels from 9:00-9:30 AM because the scheduled frequency of A service dropped off much faster than ridership during this period. Ridership has grown faster during the latter part of the peak (9:00-10:00 AM out of Brooklyn) than the earlier part (7:30-8:30 AM), and as a result, shifting one A train leaving Hoyt-Schermerhorn Sts northbound from the 8:00-8:30 half hour to the 9:00-9:30 half hour

would create a better match between customer demand and train capacity supplied and bring the A within loading guidelines between 9:00 and 9:30.

This schedule change should create more even loading at the peak load point on average, not only on the A but also on the C, onto which A riders sometimes divert due to long wait times or crowding (common at Utica Av and Nostrand Av), or because they have no preference between the A and C (common at Hoyt-Schermerhorn Sts). The table below shows how this change will create more even projected loading across the peak. By shifting this trip out of the peak hour, a slot will become available to add a peak hour A or C train in the future should ridership warrant and if an additional trainset becomes available. However, in the meantime, service tends to be more reliable when scheduled to operate below the peak track and signaling capacity, and when loading is within guidelines.

**A C Northbound at Hoyt-Schermerhorn Sts**

| | Before Train Shift | | After Train Shift | |
|---|---|---|---|---|
| | Sch. # Trains | Actual V/C (max) | Sch. # Trains | Projected V/C (max) |
| 06:00-06:29 | 5 | 52% | 5 | 52% |
| 06:30-06:59 | 7 | 51% | 7 | 51% |
| 07:00-07:29 | 8 | 61% | 8 | 61% |
| 07:30-07:59 | 10 | 73% | 10 | 73% |
| **08:00-08:29** | **13** | **70%** | **12** | **77%** |
| 08:30-08:59 | 12 | 77% | 12 | 77% |
| **09:00-09:29** | **7** | **83%** | **8** | **73%** |
| 09:30-09:59 | 8 | 73% | 8 | 73% |
| 10:00-10:29 | 7 | 49% | 7 | 49% |

When average passenger loads are within guidelines but loading above guidelines exists on some trains, NYC Transit can improve service comfort and reliability by evening out loading between trains. This can be accomplished either by redistributing trains to better match demand, as described above, or by better managing service to minimize headway variation as described in the next section.

## Train Frequency and Ridership: Issues and Actions

- Uneven headways between trains lead to long waits on platforms and uneven loading on trains. Uneven loading is a particular problem in the AM peak on the C. Although train loading is within guidelines over the full peak hour, a minority of trains are significantly over guidelines.
  - ➢ NYC Transit will take steps to provide more even service as described in Section 3, “Service Management,” and will shift one A trip to the 9:00 to 9:30 AM half hour in the timetable.
- In the AM peak, northbound A and C service does not reflect changes in ridership distribution, and northbound A customers at Hoyt-Schermerhorn currently experience loading above guideline levels, on average, between 9:00 and 9:30 AM.
  - ➢ NYC Transit will shift one A train to the 9:00 to 9:30 AM half hour in the timetable.
- If a need for more service arises in the future, there would be insufficient cars available to add A C service during peak periods without reducing service elsewhere.

Additionally, no more than 26 trains per hour can reliably pass through the current Hoyt-Schermerhorn Sts interlocking in Brooklyn.
  - NYC Transit would acquire additional cars if necessary and if funds are available, and plans to upgrade the Hoyt-Schermerhorn Sts interlocking beyond the 2015-2019 Capital Program. By shifting one A trip to outside of the peak hour, there will be capacity for one additional A or C trip in the future, should loading warrant it and a trainset be available.

- The A has unusually long headways to and from Far Rockaway in the early midday period on weekdays.
  - NYC Transit will shift or add trips in the timetable, where feasible.
- The C has unusually long headways in the early AM on Sunday.
  - NYC Transit will add trips in the timetable.

# 3. Service Management

The successful daily operations of the A and C are enabled by the dedication of over 2,100 NYC Transit employees operating, announcing, dispatching, inspecting, maintaining, and cleaning the A C's trains, stations, and infrastructure. Collectively, NYC Transit is challenged to provide reliable, safe, comfortable, and efficient service for its customers with a system strained by record ridership and aging infrastructure.

Subway riders benefit from regularly spaced train arrivals that equalize the average wait time and loading from train to train. Regular headways also allow for more efficient allocation of limited NYC Transit resources. However, in practice, some service irregularity is inevitably introduced into subway schedules due to the need for lines to merge onto shared tracks and other operational concerns, and even more irregularity arises from unscheduled incidents such as a sick passenger or signal problem occurring during the course of a train's run. Irregular service, in turn, can cause excessive wait times, delays, and crowding.

This section quantifies service irregularity on the A C by summarizing performance indicators,[21] describes some challenges to regular service on the A C, presents existing strategies for preventing and correcting irregular service, and identifies opportunities for improvement.

## Operational Performance

NYC Transit assesses service operations using several measures:

- Wait Assessment (WA) compares actual headways with scheduled headways, and is the primary measure of service quality for customers.
- On-Time Performance (OTP) compares actual arrival times at terminals with scheduled arrival times, and is predominantly useful as an internal measure for scheduling.
- Mean Distance Between Failure (MDBF) measures the reliability of train cars in service.

By several operational measures, the A underperforms compared to the B Division[22] average, due in part to its exceptional length and complexity.

### Wait Assessment

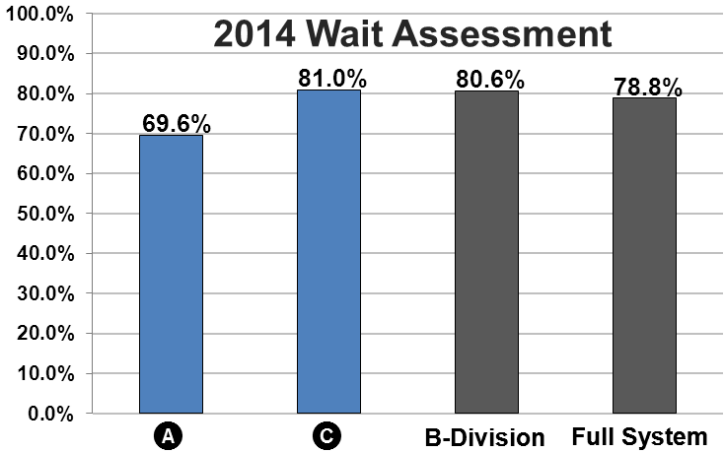
Wait Assessment (WA) measures the percentage of trains that arrive at stations within 25% of the scheduled wait time between trains, and thus provides an assessment of average customer experience.[23]

[21] Performance Indicators are standard measures that New York City Transit uses to report monthly on the quality and regularity of subway and bus operations.

[22] The B Division is composed of the "letter" lines, whereas the A Division is the "number" lines and the 42 St S.

[23] WA is measured weekdays between 6:00 AM and midnight and is defined as the percentage of actual intervals between trains that are no greater than the scheduled interval plus 25%. Results on the B Division are based on 12-month rolling sample data, collected manually in field surveys. Although Wait Assessment provides a better picture of wait time, and therefore the evenness of loading between subsequent trains on the same line or corridor, it is easier

There are significant challenges to maintaining headway regularity on the A, as discussed on the following pages. As of December 2014, its 12-month rolling average Wait Assessment was 69.6% compared to 81.5% on the C, 80.6% on the B Division and 78.8% system wide.




### On-Time Performance

On-Time Performance (OTP) measures how many trains arrive at their terminals no more than 5 minutes after their scheduled arrival times.[24] While OTP is a useful management tool, it has limited utility in measuring the quality of service that customers experience as they wait for trains at mid-line stations. Given the frequency of subway service, riders typically do not consult a schedule before riding the train; they simply wait for the next train and care about the evenness of service and train frequency, which determine their average wait time and can affect the average level of crowding on the train.

A and C OTP has mirrored the slight downward B Division trend in recent years. As of December, 2014, the 12-month rolling OTP on the A was 72.5%, on the C was 83.7%, on the B Division was 78.1% and systemwide was 74.0%. OTP on the C is thus well above both the full system and B Division averages. Although OTP on the A is below these averages, the length and complexity of the line are partially responsible, as discussed later in this section.

### Mean Distance Between Failure

Mean Distance Between Failure (MDBF) is the average number of miles a subway car travels in service before a mechanical failure occurs that causes the train to arrive at its terminal more than five minutes late. In December 2014, the A and C 12-month rolling MDBF were 89,211 and 66,379 miles respectively, compared to a systemwide MDBF of 139,863 miles. While these were the two lowest mean distances between failure of any line, the MDBF has relatively little impact on service reliability as measured by WA and OTP, because relatively few delays – roughly 6% of A C delays in 2014 – are caused by car failures. The R46 cars assigned to the A and the R32 cars assigned to the C are among the oldest in the system: the R46's entered service in 1976 and the R32's entered service in 1964. Both fleets are in a state of good repair, but they lack some of the modern amenities of newer fleets, like automated announcements. Both fleets are planned for replacement by the early 2020s. In recent summers, a number of the R32's on the C have been replaced by R160's because the air conditioning systems on the R32's perform better on outdoor lines than on lines, like the C, that are entirely underground.

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for lines that run less frequently to pass. For instance, when the C is scheduled at a ten-minute headway, a gap of more than 12.5 minutes between trains would result in a WA failure, giving trains 2½ minutes of leeway. In contrast, when the A is scheduled at a four-minute headway, it has only a one-minute (25%) allowance and will fail the measurement if the actual headway is more than five minutes.

[24] Trains are "late" if they arrive at the terminal five or more minutes after the scheduled arrival time. The schedule used for OTP is the schedule that is in effect, either the permanent schedule or a "supplement" timetable prepared for construction work, a special event, or other operational reasons. Trains that skip any scheduled station stop are also not considered on-time.

## Causes of Irregular Headways and Delays on the A C

There is no single cause for disruptions of scheduled service, so there is no single solution. A number of factors contribute to delays and uneven service on the A and C, some of which are unique to the lines while others apply throughout the subway system.

Types of incidents that affect all lines in the system include signal malfunctions, track fires, sick passengers, police activity, track work, and long station dwell times due to high ridership, cross-platform transfers, and/or gaps in service. Longer lines that carry large numbers of customers, like the A, are simply more likely to encounter more of these issues on any given trip than shorter lines, making it more difficult to return to scheduled service.

The A and the F are two of the longest lines in the system and serve the most customer miles per the NYC Transit ridership model. Along such lines, small delays at the beginning of a train run may lead to much larger delays as the train proceeds to pick up a larger-than-usual share of passengers waiting at stations, thereby leading to an increase in the gap in service ahead of it. Unevenness and lateness can cascade, as trains and crews arriving very late at the terminal may then be dispatched late for their next scheduled runs, or trips may be cancelled entirely.

Delays on one service can also cause crowding and delays on parallel services. For instance, a major delay in A express service northbound in the AM peak in Brooklyn will often prompt riders to divert to the parallel C local service, contributing to delays and crowding on that line as well.

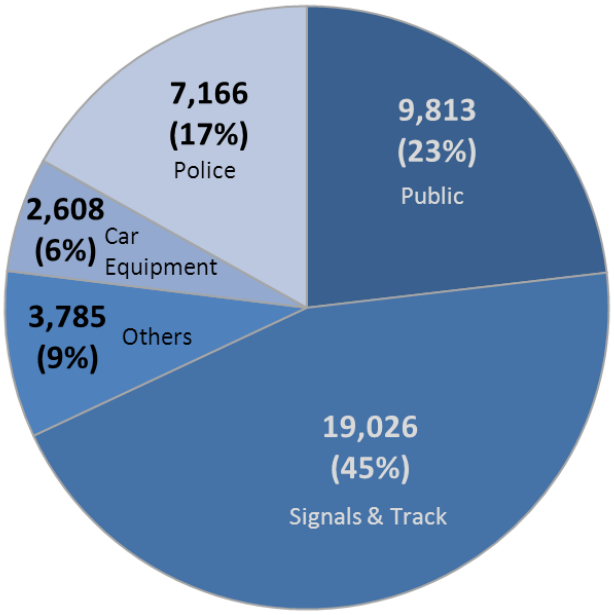
In 2014, 7,244 delay-causing incidents were reported by A and C crews, resulting in 42,398 delayed trains.[25] This is a 26% increase in incidents and a 77% increase in train delays over 2011; systemwide, the growth in incidents and delays over the same period was 62% and 97%.

An incident's impact on service depends greatly on the type of incident, location, and volume of train traffic potentially affected: an incident such as a midday door problem may result in only one delayed train, while a fire or smoke condition during the morning rush may result in dozens of delayed trains.

As noted in the previous section, car equipment failures that result in delays accounted for about 6% of all A C delays in 2014. The most common car equipment problems are related to doors, which are prone to malfunction as obstructions frequently interfere with their proper operation.

For incidents involving police notification, the greatest number of train delays were caused by sick or injured customers

**Causes of 2014 A C Train Delays**




42,398 total train delays, as reported by A C trains. Does not include delays reported for other lines that affected A C trains.

[25] Each train delay represents one train arriving at its terminal five or more minutes late.

The greatest increase in delays was in the "Public" category, which saw 150% more trains delayed in 2014 than in 2011. "Public" delays are delays external to NYCT (except Police actions) that affect operations, like bad weather, or a water main break. The most common source of public delays was the South Channel Bridge, which cuts off service to and from the Rockaways when it is opened to maritime traffic. The South Channel Bridge is discussed in greater detail later in this section. Door-holding is another frequently cited public source of train delays.

While the greatest growth in delays stemmed from public incidents, the category with by far the most per-incident effect on service is track and signal delays. During peak periods, a single broken rail or malfunctioning signal or switch incident can result in more than 100 delayed trains. An analysis of delays caused by signals shows that signals installed when the subway lines over which the A C operate were originally constructed in the 1930s, 1940s, and 1950s in Brooklyn and Queens malfunction about twice as frequently and cause more than five times as many delayed trains as the much newer replacement signals installed in parts of Manhattan in the 1990s and 2000s. Work on the right-of-way, generally restricted to off-peak hours when of a non-emergency nature, can also cause significant delays.[26] Some of the causes of delay on the A C are described in further detail below.

### Dispatching

On-time terminal departures are critical to minimizing the chances of uneven and delayed service. Early departures from terminals are sometimes necessary to provide track space for arriving trains and customers, and late departures are sometimes unavoidable because of train and crew delays, but in either case corrective action should be taken at subsequent stations to hold early trains to schedule or to even out spacing ahead of late trains.

A review of operations on the A C shows that trains are sometimes dispatched early or late from their terminals without an evident reason and without corrective action further down the line. Over 17% of A and C trains in Fall 2014 were dispatched more than one minute late, and over 2% were dispatched more than 30 seconds early. These early and late dispatches included trains coming into service directly from the yard at Rockaway Park, which should generally be dispatched on time regardless of incidents elsewhere. While the resulting gaps often caused no major problems, they sometimes led to large service gaps, which increase wait times and crowding for riders. Improving dispatching adherence would improve service regularity. Manual entry of train dispatch data and manual service management tools used on the A C make proper dispatching of trains challenging and impede effective dispatching supervision.

### Communications

The relatively dispersed nature of the supervisory communications system on the B Division can similarly impede timely and comprehensive corrective action in response to an incident on the A C, as tower staff are unable to view train locations across the full line or review the effects of their actions in detail. With the exception of recently modernized master towers at 207 St, 59 St, and World Trade Center that control relatively long portions of the line, most supervisory towers can observe and control only small, localized sections of the railroad. This sometimes means that tower staff do not obtain timely information about delays elsewhere on the line, preventing

[26] Work-related delays on outdoor segments are concentrated during middays and weekend daylight hours, because non-emergency work is restricted to daylight hours on elevated and other outdoor segments. Underground work-related delays are concentrated during the overnights and weekends.

them from adjusting service to benefit customers by evening out A C headways. This situation is common to all line segments with original signal systems installed prior to the 1960s.

### Merges

As noted previously, merges can cause delays when one train has to wait for another to cross in front. A northbound A from Far Rockaway could potentially be delayed by a merge six times:

- Rockaway Park A or S at Broad Channel
- Lefferts Blvd A at Rockaway Blvd
- C at Hoyt-Schermerhorn Sts
- E at Canal St, merging ahead of the C
- D at 59 St
- B at 145 St, merging ahead of the D, during the AM peak only

For the A and C together, perhaps the greatest risk of delay is at their northbound merge south of Hoyt-Schermerhorn Sts, where combined capacity is constrained to the currently scheduled 26 trains per hour during the AM peak hour. Small delays and uneven gaps between trains can lead to a backup of service, an effect that occurs to some degree at all regular merge points, but it is generally more likely and severe when trains merge at higher frequencies. At Hoyt-Schermerhorn Sts, northbound A C station dwell times increase by a median of more than 10 seconds in the AM peak hour compared to the midday, which increases the likelihood that trains are held behind the interlocking south of the station. When long dwells are combined with uneven service, multiple trains can bunch up behind the interlocking causing significant delays.

The median C running time between leaving Lafayette Av and entering the interlocking south of Hoyt-Schermerhorn Sts is 2:01 in the AM peak hour, an increase of 45 seconds over the midday running time of 1:16, indicating the significance of this merge delay at Hoyt-Schermerhorn Sts. This additional running time is not evenly distributed between trains: one-fifth of AM peak trains had an average running time of 4:56, indicating significant congestion and delay for some trains and smooth operations for others. This variation means that the additional running time due to the merge delay cannot be entirely accounted for in schedules, and some degree of unevenness and late service will occur.

Similar train congestion often occurs at merges throughout the system and elsewhere on the A C when dwell times increase following service gaps. Congestion is particularly acute where dwells increase in front of interlockings during periods of frequent service.

### Transfers

A “surge” of riders transferring from another line can also cause uneven loading and longer dwells, leading to uneven headways. On the A C, this problem is particularly acute at Hoyt-Schermerhorn Sts in the AM peak hour, when about 2,000 southbound G train riders transfer across the platform to the Manhattan-bound A or C. This transfer occurs at the peak load point for the A and C, where the trains are already highly loaded. These transfer surges from the G lead to uneven and greater dwell times for A and C trains at Hoyt-Schermerhorn Sts.

The following table below shows the extent of the delay north of the merge at Hoyt-Schermerhorn Sts, including in-station dwell times, during the AM peak.

**Median Northbound Running Times between Hoyt-Schermerhorn Sts Interlocking and Departure from Hoyt-Schermerhorn Sts Station**

| Route | Midday | AM Peak Hour | Longest 20% During the AM Peak Hour |
|---|---|---|---|
| A | 0:52 | 1:08 | 1:36 |
| C | 1:03[27] | 1:14 | 1:41 |

Like the A and C, G ridership has grown substantially in recent years. Since there are 26 A and C trains and 9 G trains scheduled during the peak hour, about a third of the departing A C trains pick up the approximately 200 riders transferring from the average G train and become significantly more crowded than those that do not.

The differences in train length can exacerbate the dwell time issues at Hoyt-Schermerhorn Sts. G trains are 300 feet long, while, as noted previously, A trains are 600 feet long and C trains are 480 feet long. The 480-foot C trains can be more affected by a G transfer surge than the 600-foot A trains because there is less space to distribute the additional riders. In addition to extended station dwells, which can delay following trains, this transfer sometimes causes passenger loads above guidelines on trains absorbing the transferring riders.

Other locations where irregular transfers lead to particularly variable loading and dwell times include Jay St (transfers from the F), 59 St (B and D), and 125 St (B and D). Adding platform conductors during the AM or PM peak periods to facilitate quick boarding and door closing may help to alleviate transfer- and interlocking-related delays by reducing dwell times.

### Car Class Age and Train Length

As noted in the “Operational Performance” section, the A and C primarily operate with some of the subway’s oldest cars, which experience mechanical failures more often than the system average, though fleet-related delays are a relatively small proportion of total delays. These older cars must be assigned to active service until planned replacements arrive because NYC Transit does not have a sufficient number of newer cars to provide service if the older R32 and/or R46 cars were to be retired prior to the arrival of their replacements.

Introducing newer cars on the lines would reduce delays associated with car age and introduce modern features, such as digital information displays and local door recycling, [28] which could improve customer communications and reduce dwells, improving headway regularity.

The R46 cars assigned to the A are planned to be primarily replaced in the early 2020’s by cars in the R211 car order. These cars are currently in the design phase and will be ordered as part of the 2015-2019 MTA Capital Program. The R211’s are expected to come into service in the early 2020’s.

[27] Longer times on the C than on the A are likely caused by relatively slow C movement over the interlocking.

[28] Local door recycling is a feature on newer railcars that allows the conductor to reopen and close individual doors, when there is customer holding a door or an object blocking a door. On older cars, the conductor must reopen all doors on either the front or rear half of the train and thus risk a possible second blockage at another door.

C trains are currently 480 feet long, consisting of eight 60-foot-long R32 cars, the oldest regularly operating car class in the subway, or eight 60-foot-long R160 cars, the newest car class in the subway. As mentioned in "Operational Performance" above, some 480-foot-long trains of R160's have been assigned to operate on the C during the summer months because moving some R32's to other lines with outdoor sections[29] is better for the reliability of the cars' air conditioners. Currently, about half of all C trains are made of R160's. New 480-foot trains for the C are part of the R179 car order, which was funded in the 2010-2014 Capital Program. The R179 cars are currently under construction.


R32


R160

The C train's relatively short length is also a factor that can contribute to uneven loading. The C train stops at platforms designed for longer trains, so regardless of where the train stops, at least one end of the train will always be 60 feet or more from the end of the platform. Where stairs are located at ends of the platform or where there are cross-platform transfers with 600-foot trains, some passengers necessarily find themselves positioned to most easily board the first or last car, contributing to end-car crowding and extended dwell times. This issue can be mitigated at low cost by optimizing the position where the train stops on the platform relative to stairs and entrances and by notifying customers of that position with signage. Stopping position changes are addressed in "Stations and Station Access."

### Crossing Jamaica Bay

Trains on the Rockaways branch cross Jamaica Bay. To the south of Broad Channel, the South Channel Bridge,[30] which both the Rockaways A trains and the Rockaway Park S must cross, is a swing bridge that can open to allow for the passage of maritime traffic. NYC Transit must open the bridge on signal from a commercial or recreational sea vessel during most hours of the day, per federal law and US Coast Guard rules. Whenever NYC Transit opens the bridge, service to and from the Rockaways is typically disrupted for ten to fifteen minutes. Though Rockaways customers are most inconvenienced by South Channel Bridge openings, disruptions in service propagate down the line and resulting delays in both directions that can affect service for all A customers for hours.

In an effort to reduce service disruptions during peak commuting periods, NYC Transit worked with the US Coast Guard to establish a peak period moratorium on opening the South Channel Bridge. The rule change went into effect in November 2006, allowing the bridge to remain closed during the morning and afternoon commuter rush hour periods, from 6:45 AM to 8:20 AM and from 5:00 PM to 6:45 PM, Monday through Friday, except Federal holidays.[31]

[29] The C line is entirely underground, which adversely affects the reliability of its air-conditioning system, due to the higher temperatures underground.

[30] Also known as the Beach Channel railroad bridge, and referred to as such in USCG rules.

[31] Federal Register, Vol. 71, No. 203, October 20, 2006.

NYC Transit analyzed bridge opening delays during a two-year period between 2012 and 2014 and concluded that the bridge remained closed per the moratorium rule with reasonable consistency. However, the data show predictable spikes in bridge openings immediately after the AM and PM peak moratorium periods, reflecting pent-up demand for marine passage through the channel.[32] The AM spike, at 8:20, directly affects northbound trains toward the end of the peak hour of service, and the PM spike occurs on the late "shoulder" of the peak period, when service is transitioning from peak frequencies. Both spikes occur when peak-direction ridership is not only still relatively high but has been growing.

Bridge openings also sometimes cause delays just before the AM and PM peaks, and these delays tend to disrupt service well into the peak. A line ridership has increased at the early and late shoulders of the peak periods, and reliability of operations during the shoulders has consequently become a more critical issue. Early AM bridge openings are particularly problematic, as they can delay southbound trips heading to Far Rockaway to operate in peak service northbound. In addition to early morning A trains coming from Manhattan that provide northbound peak service, three morning A trains out of Far Rockaway are stored overnight in Pitkin Yard in Brooklyn and thus must cross the South Channel Bridge southbound in order to make their morning northbound trips into Manhattan.

The South Channel Bridge opening moratorium windows, as they currently stand, appear insufficient to protect the full peak period commuter service on the A.

## Service Flexibility and Delay Management

When a train is significantly delayed, whether northbound or southbound, the gap in service sometimes continues in the other direction, as subsequent trips for that train or crew are either late or eliminated entirely. Crews require sufficiently long breaks between trips, known as crew recovery time, to ensure that they are ready to make their return trips; given the length of the A line, adequate crew recovery time is critical, while inadequate crew recovery can exacerbate the effect of delays. In extreme circumstances, service disruptions can proliferate and continue to cause irregular service for hours after the initial incident has been resolved.

NYC Transit manages service to minimize delays' negative effects on customers. To recover from unplanned delays, NYC Transit can deploy a variety of strategies, including holding trains in stations ahead of service gaps to even out headways, rerouting trains from other lines to fill gaps in service, terminating trains prior to their regular terminals to reverse direction and fill gaps in the opposite direction, and directing trains to skip stations. Skipping stations can produce a number of benefits: it allows the skipping train to shorten a large service gap ahead and reach its terminal in time to make a prompt return trip, and it reduces congestion, enabling following trains to serve the accumulated crowds in a more timely manner. Terminal dispatchers can also dynamically adjust service to evenly distribute the time between departures when earlier incidents have resulted in too few trains arriving at terminals to make scheduled departures.

[32] Over the two-year analysis period, these spikes accounted for 66 bridge opening incidents in the half hour following the AM moratorium, or approximately one opening every seven weekdays, and 82 bridge opening incidents in the half hour following the PM moratorium, or approximately one opening every six weekdays. While South Channel Bridge openings do not disrupt shoulder service on a daily basis, occasional disruptions are still costly in terms of customer travel time. Each bridge opening delays three trains, on average, which means that hundreds of commuters on the affected trains are delayed by up to 15 minutes and thousands more waiting at downstream stations also experience gaps in service.

Trains are sometimes held to their scheduled station departure time in mid-route stations to ensure that early trains do not cause long gaps in service. A variation on this strategy is to specifically monitor and hold trains “to time” at key locations prior to entering the CBD, called a “gateway-in” hold. When combined with scheduled holds at these locations, this strategy enables trains to be evened out mid-route and recover from small delays, keeping small headway variations from becoming major delays.

The A C operates over a relatively flexible track layout that enables many dynamic delay management strategies. The corridor has four tracks for most of the shared portion where the A and C both run, with the significant exception of the two-track segment between Hoyt-Schermerhorn Sts and Canal St. Where the A runs alone, it runs primarily on two- and three-track segments. In three- and four-track segments, trains can be rerouted between the local and the express tracks at various interlockings to even out headways, to run around incidents, or to accommodate work on the tracks. There are also several locations with interlockings and spur tracks that allow trains to terminate and reverse direction mid-route, though this is rarely used during regularly scheduled service due to limited staffing and to avoid the interruptions and delays caused by mid-route reversing time.

Although the segment of the line between Canal St and Hoyt-Schermerhorn Sts is only two tracks, much of the segment can be bypassed during major work or unplanned incidents that impede service by running A C trains along the F train’s route via the Rutgers Tube between Jay St and West 4 St, at non-peak frequencies. Similarly, F trains can be rerouted along the A C route via the Cranberry St Tube between those two stations, at non-peak frequencies. During rush hours, however, the total number of A C and F trains scheduled greatly exceeds the maximum capacity of either the Cranberry or Rutgers Tubes, making such reroutes infeasible or subject to significant congestion.

The branched nature of the A poses a difficulty for service management: Lefferts Blvd-bound service can be regular during a period of disruption in Far Rockaway-bound service, for example, but rerouting trains from Lefferts Blvd service to Far Rockaway service may be impractical because trains and crews are assigned to begin and end their shifts at a specific terminal, and the route is so long that few other options exist for quickly restoring regular service to the Far Rockaway branch. Gaps in service to Far Rockaway thus often reverberate as gaps in northbound service.

Between terminals, the A and C are monitored and controlled at many locations. NYC Transit’s Rail Control Center monitors and manages system-wide conditions, though until the full roll-out of ISIM-B (Integrated Service Information and Management – B Division),[33] supervision and service management for the B Division at the Rail Control Center are limited. Master towers at 207 St and 59 St manage considerable portions of A and C operations in Manhattan and are staffed at all hours. Staff at 207 St Master Tower can observe operations between the 207 St terminal and 155 St, and they can control interlockings from 207 St to 168 St; staff at 59 St Master Tower can observe operations between 163 St and 23 St (and up to 161 St on the B D Concourse Line), and they can control interlockings from 145 St to 59 St. In addition, there are staffed towers at other locations that have more limited monitoring and control capabilities, but nonetheless are capable of taking corrective action when necessary. A number of other towers

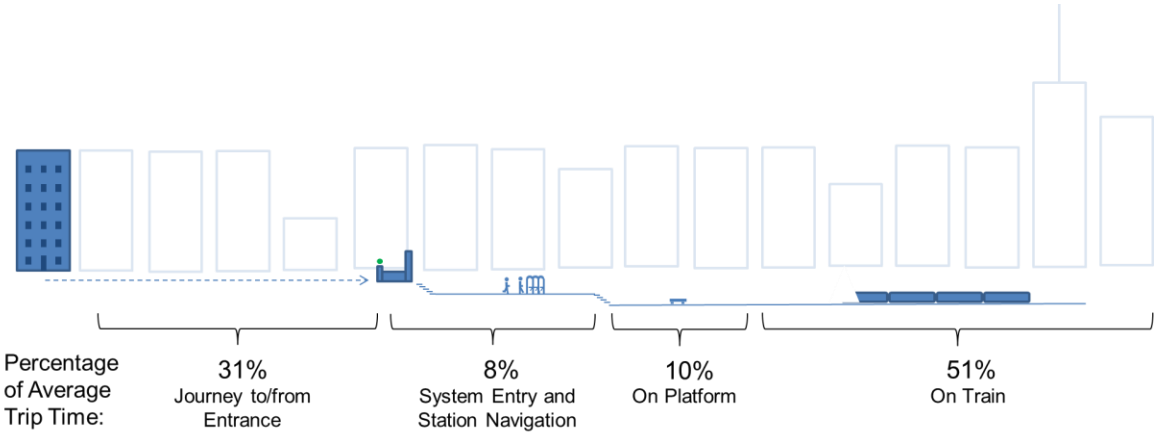
[33] ISIM-B, which is primarily a communications upgrade to support rail system management, is still under development and is included in the 2015-2019 MTA Capital Program. When introduced, it will allow for centralized control and full-line view of service conditions for all B Division lines at the Rail Control Center. ISIM-B is addressed in greater detail in Section 5, “Customer Communication.”

exist but are typically de-staffed, with interlockings operating semi-automatically or “fleeted” so that the switches cannot be moved until a tower operator is assigned to staff the tower.

To mitigate delays caused by off-peak track maintenance and inspections, extra running time can be added in the timetable to enable trains to make subsequent trips on time. Timetable adjustments are summarized in the “Service Design and Scheduling” section of this report, and track work is further discussed in the “Infrastructure” section below.

## Service Management: Issues and Actions

- The A performs below the system average by the measures of OTP and WA, while the C has room for improvement. The length and branching nature of the A train, unnecessary early and late dispatching, the lack of centralized control and communication, merges, transfer volumes, extended dwells, car class age, and the opening of the South Channel Bridge all reduce A C service reliability.
  - NYC Transit will introduce new electronic tools to assist line supervision and management to better monitor service and evaluate incident responses. Terminal departure schedule adherence could be particularly improved via these tools.
  - NYC Transit will introduce holds in the schedules at Euclid Av northbound and 145 St southbound, when feasible, to help even out service, and will add recovery time for midday work on the Rockaway branch at Euclid Av rather than near the terminal in Manhattan, when feasible, to help improve the A C merge at Hoyt-Schermerhorn Sts.
  - NYC Transit will add additional crews to the A Line, when feasible, to improve reliability by increasing crew recovery time at terminals and ensure the availability of crews for train departures.
  - NYC Transit will pursue an expanded rush hour moratorium on opening the South Channel Bridge.
  - NYC Transit will deploy platform conductors to reduce dwell times, pending funding.
  - NYC Transit will update schedules to better reflect running times and ridership demand as described in “Service Design and Scheduling” and ”Train Frequency and Ridership.”
  - NYC Transit will reposition in-station train stopping positions and benches to reduce dwell times (see “Stations and Station Access”).
  - NYC Transit will improve customer communications to reduce station dwell times and speed up incident recovery (See “Customer Communication”).
- Both the A and C have lower MDBF than the system average, reflecting the age of the cars assigned to the lines.
  - NYC Transit plans to assign newer cars with better communications technology and more reliability to the A and C.

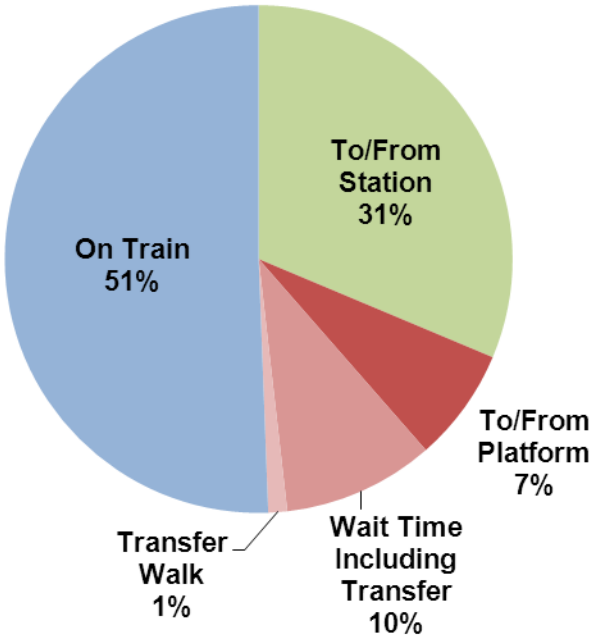



# 4. Stations and Station Access

A C passengers, like all subway riders, spend a large portion of each trip not on the train, but rather getting from their origin point to the station entrance, accessing and waiting on the platform, and exiting the station and navigating to their destination. Approximately half of the average weekday subway-exclusive trip is spent outside of the train.[34] This section discusses the many opportunities for improving the quality, convenience, and safety of these portions of A C trips.

**Weekday Trip Breakdown, System Average**

(Subway only trips, no other mode connections)




## In Station

As part of the A C Line Review, NYC Transit staff surveyed all 66 stations on the lines, focusing on the station environment, waiting conditions, train stopping positions, station areas, and customer communications infrastructure (discussed in Section 5 – "Customer Communication").

### Stopping Positions

All A and C station platforms are longer than the 480-foot-long C trains, and many are longer than the 600-foot-long A trains. The position where the train stops on the platform affects both customer convenience and service performance, as suboptimal stopping positions can cause longer walking time to/from the street or other trains and can consequently extend dwell time. NYC Transit reviewed every regular stopping position on the A C and found a number of opportunities for improvement, described in detail in Appendix C.

[34] The estimates of each component of the average trip are from a NYC Transit analysis incorporating system ridership model data and 2009 origin/destination phone survey data that only includes subway trips without bus or regional rail connections.

For example, on the northbound local platform at 34 St-Penn Station, which serves the E and the C during daytime hours, many customers use whichever train comes first. The 600-foot-long E stops in front of all entrances, whereas the C stops in the center of the platform such that it is an equal distance from the north entrances at West 35th Street, which only serve 18% of customers, and the southern entrances that serve Penn Station and 66% of customers (see below photo of a stopped C train distant from the south end of the northbound platform). This can lead to significant congestion in the relatively narrow portion of the platform adjacent to the south end of a stopped C, which in turn impedes platform circulation and extends boarding and alighting times in the southern C cars, thereby extending dwell times and delaying trains.

**34 St-Penn Station: Rear of stopped C train on left and high-use entrance on right**

In many cases, trains stop some distance from an end-of-platform entrance and the platforms lack signage regarding where trains will stop. This can cause customer inconvenience and lengthen dwell times as customers may not realize that they are standing beyond the train until the train is stopped.

Adjustments to train stopping locations require operational and engineering analysis to ensure that sight lines remain adequate for door operations, to relocate CCTV cameras and monitors to aid door operations if necessary, and to determine whether the changes in location affect signal operations.

### Benches


While many station platforms and mezzanines on the A C have an adequate number of benches, others have too few or none at all. The presence of a sufficient number of benches, and their appropriate distribution on the platform and mezzanine, are important for customer comfort. Poorly placed benches can also reduce platform capacity or extend dwell times by constricting customer movement. The aforementioned survey identified opportunities to add 18 new benches at 11 stations, as well as to relocate 12 benches within 7 stations, as detailed in Appendix D.

### Heaters

Most outdoor A stations in Queens have some form of weather protection and heating for customer comfort in winter, largely on mezzanines, with automated next train annunciators that provide notice, by track, for customers to move to the platform for an approaching train. Although many mezzanines are heated, the heated temperature is generally well below typical indoor temperatures. Additionally, there are customer-activated outdoor heaters at Broad Channel. However, the heated mezzanine at Broad Channel is warmer than the outdoor heaters.

NYC Transit investigated opportunities for improved heating at some of these stations as part of this study, but no funding has been identified for improvements.

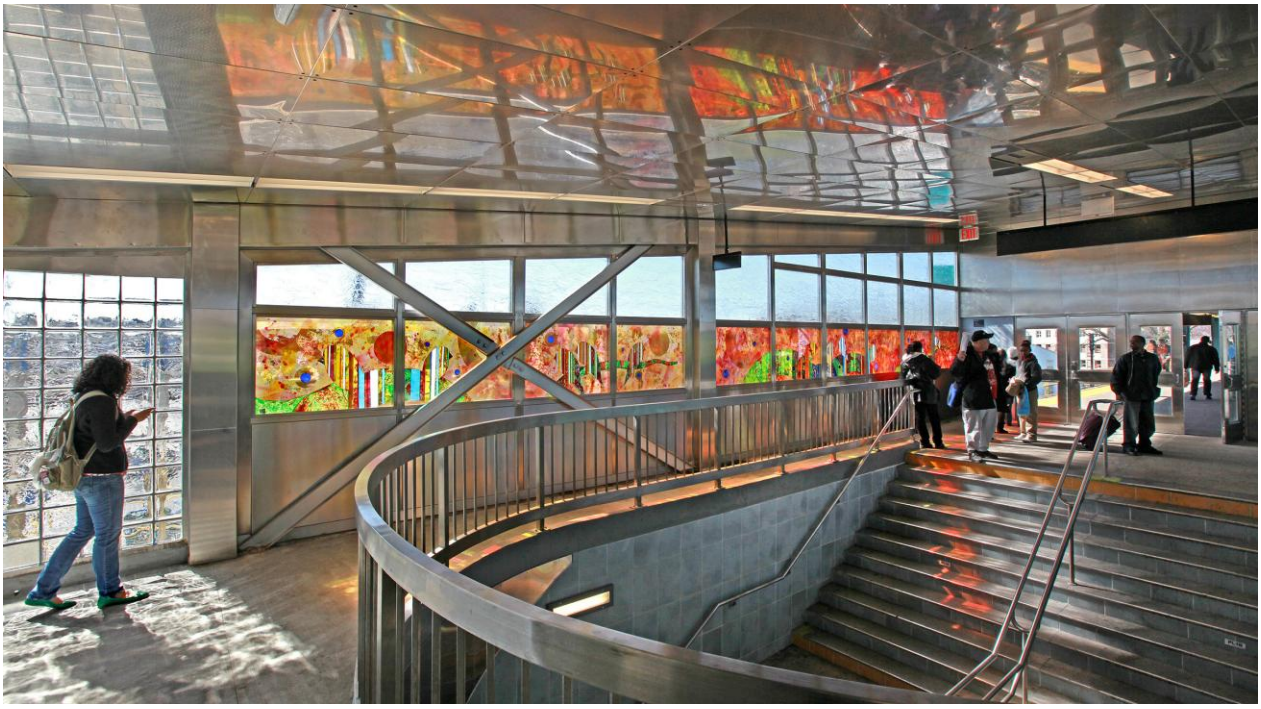
### Passenger Environment Survey

Improving the passenger environment throughout the system is a priority for NYC Transit. The Passenger Environment Survey (PES) provides an assessment of the conditions that subway riders encounter in stations and onboard trains, in terms of cleanliness, climate control, and the like. PES statistics are based on regular observations at stations throughout the subway system and onboard trains.

As recorded by the PES, riders on the A and C experience a pre-AM peak station environment comparable to stations throughout the system in terms of cleanliness and comfort. From July to December 2014, PES statistics show that stations served by the A C were within 1% of the system average for floor and seat cleanliness and for presence of litter in mezzanines, passageways, stairways, and on platforms before the morning rush. By the time of surveys taken after the AM peak, however, A C stations performed 7% worse than the system average for floor and seat cleanliness and 9% worse for presence of litter. See Appendix E for more detailed station and subway car PES results.

### MTA Arts & Design

There are many opportunities to create a better environment for customers at A C stations; MTA Arts & Design improves and enlivens customers' experiences within stations and on trains through permanent artwork, Music Under New York, and other programs. The A C line has arts installations in 25 stations, described in further detail in Appendix F. Another five projects are currently being installed during station rehabilitations at 80 St, 88 St, Rockaway Blvd, 104 St, and 111 St in Queens. Music Under New York brings live music to A C riders at 34 St-Penn Station, 125 St, 42 St-Port Authority, 59 St-Columbus Circle and at the Fulton Center.



*Respite* (2011) © Jason Rohlf, NYC Transit Far Rockaway-Mott Avenue. Commissioned by MTA Arts & Design. Photo: Rob Wilson.

## Station Access

About a third of the time of the average AM peak trip is spent traveling between the customer's origin/destination and the subway platform; there are many opportunities to improve access to A C stations via better connectivity with other travel modes and by improving entrances to the station and platform.

### Elevator Access and the Americans with Disabilities Act

As part of the MTA's ongoing efforts to improve station accessibility in compliance with the Americans with Disabilities Act (ADA), 17 of the 66 stations on the A and C lines plus the southbound platform at 50 St have been upgraded with elevators and other infrastructure to facilitate use by customers who use wheelchairs or who otherwise need or prefer elevator access. Most recently, elevators at Utica Av and Fulton St were opened for public use in 2014. Four additional stations have same-platform transfer accessibility. The Lefferts Blvd station is planned for full ADA accessibility with multiple elevators, with substantial completion scheduled for 2016.


No additional A C stations are slated to receive ADA accessibility upgrades in the 2015-2019 MTA Capital Program.

### Opening New and Closed Stairways

Many A C stations have stairways to the street that are closed to the public.[35] Some were decommissioned in the 1980s due to low ridership and high crime, while others have been closed much longer. In some cases, reopening these stairways could provide significant benefits to customers. There are also many stations where stairway widening or entirely new entrances could provide benefits. New or expanded entry/exit locations can reduce passenger trip time, both by minimizing walking time to and from the station and by reducing in-station congestion.

Under recent Federal Transit Administration interpretation of the ADA, the opening of a de-commissioned station stairway at a station or platform that is not ADA accessible would require that MTA NYC Transit also provide ADA-compliant elevators or ramps to allow for use of the same part of the station by customers who use wheelchairs. This requirement increases the threshold at which the benefits of re-opening stairs at non-ADA-compliant stations outweigh the cost of upgrading the station. At an average cost of $17 million to bring a station into compliance, on top of any other improvement costs, reopening stairways at non-ADA-compliant

[35] See Appendix G for a list of closed entrances at nineteen stations on the A C and a case study at Nostrand Av.

stations requires significantly more potential benefit to justify the expense, and no such stairway openings are planned at this time.[36]


Only six of the nineteen A C stations with closed stairways listed in Appendix G are currently ADA compliant. Of those six, reopening closed entrances at Franklin Av, 50 St southbound, and 168 St would particularly improve station operations and customer convenience. Many closed stairway reopenings require substantial construction and the relocation of critical equipment or facilities, while others require relatively little construction. Preliminary cost estimates for construction to reopen entrances at Franklin Av, 50 St southbound, and 168 St range from $2.7 million to $10.6 million for each station, depending on location and scope.

In the long term, opening many of the closed entrances at many non-accessible stations would be beneficial. However, opening any closed entrance of a currently non-ADA-accessible station would be particularly expensive. With additional capital funding, or a change in the interpretation of ADA back to its earlier, more flexible administration, reopening closed entrances at non-ADA-accessible stations such as Hoyt-Schermerhorn Sts, Nostrand Av, Spring St, and many stations along Central Park West would become more feasible.

In some cases, real estate developers and other stakeholders have paid for and/or constructed new entries, including elevators, in exchange for zoning bonuses and to serve their future tenants. There are other stations where not only reopening closed entrances but also constructing brand new entrances may make sense to support development, improve safety, or ease pedestrian congestion in the station and on the street. For instance, Hoyt-Schermerhorn Sts currently has limited entrances, and both the station's existing customers and new customers attracted by the considerable upcoming commercial and residential development in the area would be well served by new entrances, elevators, and reconfigured turnstile layouts.


Canal St Before


Canal St After

### Turnstiles, Entrance Layouts, and Transfers

NYC Transit reconfigures the layouts of turnstiles and emergency exits on an ongoing basis to improve access in and out of stations' paid areas. Improvements include converting "high-wheel" entries to low turnstiles (see Canal St photos), adding entry/exit devices of either type, and converting "exit-only" areas to entry/exits. This process requires significant staff resources and entry device availability; therefore, these improvements are planned for gradual implementation over a multi-year timeframe. Mezzanines and entrance areas are also sometimes expanded to improve capacity as part of nearby building development.

[36] While $17 million is the average cost of ADA compliant construction per station, the actual cost at any given station may be higher or lower depending on the land use, station configuration, the number of elevators and/or ramps needed to achieve compliance, and other engineering considerations.

A C stations with recent improvements include:

- Canal St: Three low turnstiles were added to the one high wheel entry at each side of the north entrance.
- Clinton-Washington Avs: Two high wheels were converted to three low turnstiles at the Manhattan-bound Washington Av entrance in Spring 2015 and an exit-only area was converted to entry/exit with additional high wheels at the Euclid Av-bound entry at Clinton Av in 2013.
- 42 St-Port Authority: A street elevator on the southwest corner of 44th Street and 8th Avenue recently opened as part of a real estate development.
- Chambers St: High wheels were added to intermediate street stairs at Warren Street and Murray Street in 2014.
- Fulton St: Escalators, elevators, improved entries and improved transfers were built as part of the Fulton Center project which opened in 2014.

Additionally, the internal layouts of stations are sometimes improved as part of major capital work. Recent A C examples include improved transfers at the Fulton Center and the completion of the transfer between the R at MetroTech and the A C F at Jay St.

### Intermodal Connections

Roughly 70,000 A C riders a day transfer from and to dozens of bus routes, particularly in central Brooklyn and Queens, where subway service is less dense than in much of the city. A C riders benefit from many of the improvements to New York City bus service implemented in the past several years, including the introduction of MTA Bus Time for real-time bus location information on all routes and the expansion of Select Bus Service (SBS) for quicker bus trips. SBS routes intersecting the A C include the Bx12 at 207 St, M60 at 125 St, M86 at 86 St, M34/M34A at 34 St-Penn Station, and B44 at Nostrand Av. The planned Utica Avenue and Woodhaven/Cross Bay Boulevards SBS routes will further improve bus access to the A C at Utica Av and Rockaway Blvd.

The A C provide a number of intermodal connections, as follows:

| Type of Service | Provider | A C Station | Connecting Facility |
|---|---|---|---|
| Intercity and Commuter Bus | NJ Transit, Greyhound, Trailways, etc. | 42 St- PABT | Port Authority Bus Terminal |
| | | 175 St | George Washington Bridge Bus Terminal |
| Interstate Rapid Transit Service | PATH | Fulton St<br>Chambers St-WTC | World Trade Center |
| | | W 4 St | 9 St |
| Intercity and Commuter Rail | Long Island Rail Road, NJ Transit, Amtrak | 34 St-Penn Station | Penn Station |
| | Long Island Rail Road | Lafayette Av | Atlantic Terminal |
| | | Nostrand Av | Nostrand Av |
| | | Broadway Jct | East New York |
| | | Far Rockaway-Mott Av | Far Rockaway |
| Airport Rail Service | JFK AirTrain | Howard Beach-JFK | JFK Airport |
| | NJ Transit and Amtrak to Newark AirTrain | 34 St-Penn Station | Penn Station |

| | | | |
|---|---|---|---|
| Airport Bus Service | NYCT | 125 St | M60 SBS to LaGuardia Airport |
| | MTA Bus | Lefferts Blvd | Q10 to JFK Airport |
| | Newark Airport Express | 42 St- PABT | Port Authority Bus Terminal |

In many of these cases, there are opportunities to improve the pedestrian connections and environment between transportation modes to improve the quality and speed of A C riders' full trips via better wayfinding, more direct connections, or safer street crossings.

### Station Area Connectivity and Wayfinding

Although New York City's streets are outside of NYC Transit's jurisdiction, the quality and safety of pedestrian infrastructure near bus stops and train stations greatly affects NYC Transit customers' trips. In this context, the NYC Department of Transportation (NYC DOT) has recently made or is planning to soon make improvements to intersections and streets adjacent to A C station entrances, some of which are part of Select Bus Service (SBS) expansion in collaboration with NYC Transit:

- Broadway Junction – Bus and taxi connection street enhancements are under construction.
- 190 St – A midblock pedestrian crossing has been installed on Bennett Avenue adjacent to the station as part of a neighborhood slow zone.
- Utica Av – NYC DOT has proposed intersection improvements to improve safe transfers and crossings at Utica Avenue and Fulton Street, in part for the upcoming B46 SBS.
- Rockaway Blvd – NYC DOT has made improvements at Rockaway Boulevard and Liberty Avenue and is investigating further improvements in conjunction with the Woodhaven Blvd SBS.
- Several Stations in the Rockaways – Pedestrian infrastructure like crosswalks is less robust than in many other parts of the city, which may be an impediment to convenient and safe subway access. NYC DOT is investigating pedestrian improvements in the Rockaways, and, in collaboration with MTA Bus Company and Nassau Inter-County Express (NICE) bus, is evaluating improvements to intermodal transfers around the Far Rockaway-Mott Av station.

There may be other opportunities to improve the convenience and safety of the pedestrian street environment used by A and C riders as part of their journeys. Pedestrian crossings providing access to station entrances throughout the city are particularly common opportunities for pedestrian infrastructure improvements. There are also opportunities for interagency cooperation to improve wayfinding at intermodal connections, like between the subway and LIRR at Broadway Junction, Nostrand Av, and Lafayette Av stations, and to major area attractions, like the Brooklyn Bridge and Brooklyn Bridge Park at High St. In many cases, there is some wayfinding information in stations but little at street level to help customers find their destinations. NYC DOT has a street level wayfinding program that is installed in cooperation with funding partners around the city.

## Stations and Station Access: Issues and Actions

- Suboptimal train stopping positions cause customer inconvenience and operational delay on some platforms.
  - ➢ NYC Transit will adjust train stopping positions where doing so will improve customer convenience and/or train operations, where feasible.
- Signage does not generally indicate the location on the platform where the 480-foot C train stops.
  - ➢ NYC Transit will add such signage at selected stations.
- Customers at many platforms have need for additional benches where they can be accommodated without impeding platform circulation or extending dwell times. Some benches are placed in inconvenient locations or in locations that can lead to extended train dwell times.
  - ➢ NYC Transit will reposition and add benches.
- Many stations have closed stairways and entrances that, if reopened, would improve station circulation and safety and reduce trip times. Some stations could also be improved with new entrances or expanded entrances.
  - ➢ NYC Transit will reopen and add stairways and expand existing entrances, consistent with the Americans With Disabilities Act, where necessary funding is identified.
- Many station entry areas lack sufficient capacity for current customer volumes or could otherwise be redesigned for customer convenience.
  - ➢ NYC Transit will continue to redesign or expand entry areas.
- Many outdoor stations have heated or weather insulated areas that are still generally cold in winter.
  - ➢ NYC Transit currently has no plans to better heat or insulate station mezzanines on the A C lines.
- While NYC Transit has renovated a number of stations to be ADA compliant in recent years, a majority of stations on the line, and in the overall subway system, are still ADA inaccessible and lack elevators.
  - ➢ NYC Transit plans to install elevators at Lefferts Blvd. Additional stations will be made ADA compliant, but no further stations on the A C are currently planned for ADA improvements.
- While some pedestrian infrastructure near A C stations has been upgraded in recent years, there are many locations where improvements could increase the convenience and safety of getting to and from stations.
  - ➢ NYC Transit will continue to work with outside organizations, including NYC DOT, to improve this infrastructure.


# 5. Customer Communication

Clear, accurate, and timely service information improves customers' journeys by enabling them to make informed routing decisions. When riders choose to take alternate routes during a service disruption, passenger congestion is reduced on the affected line, which helps to accelerate the resumption of regular service.

Many lines lack state of the art information-delivery systems. Like stations on the B D E F G J M N Q R Z lines, A C stations are not equipped with comprehensive real-time communication infrastructure like that which is installed on the 1 2 3 4 5 6 and L lines. However, some A C stations in upper Manhattan have audio and digital display announcements that indicate approaching trains by local/express service, and there are mezzanine- or platform-based next train annunciators and digital next train arrival indicator displays that specify train direction at most stations south of Clinton-Washington Avs in Brooklyn and Queens. Additionally, dedicated announcers at the 59 St and Jay St Master Towers provide service information at nearby stations during most rush periods.

Wi-Fi and cell phone service is planned for implementation at all underground stations by 2017, enabling individuals to access train service information directly on their personal devices. Currently, Wi-Fi and cell phone service is available at A C stations between 14 St and 207 St, and at the Fulton Center.

## Service Advisory Postings and Signage

The A C is included in all of NYC Transit's regular communications to riders regarding upcoming and current service changes, such as printed posters on platforms, audio announcements on trains and on platforms with public address systems, online updates at mta.info, and advisories via text, email, and social media.

Service design information is posted online, in stations and on train, indicating train destinations, hours of service, and connections via signs and maps. Field surveys for this report identified several opportunities for improved signage, including for JFK service, described below, and a number of miscellaneous issues which have already been addressed. A separate field survey revealed that despite existing signage indicating that the B runs only on weekdays, some weekend customers at Central Park West stations, especially at the tourist-heavy 72 St and 81 St stations, let the C pass. NYC Transit will install supplemental signage to better serve these customers.

## Real-Time Service Information

On the 1 2 3 4 5 6 and L lines, automatic monitoring of train locations enables delivery of real-time information via "countdown clocks" and other PA/CIS (Public Address/Customer

Information Screen) messages. Currently, many A C stations lack Public Address systems and, as with most other B Division (lettered) lines, A C train locations are not centrally tracked. Technology upgrades planned over the coming years are expected to improve real-time information for the A C and throughout the system, funding permitting.

In 2014, NYCT activated a train tracking system, I-TRAC, at control towers and terminals on the B Division. I-TRAC is the digitalization of the prior paper-based system of train arrival/departure logs. It enables better line oversight and more timely communication of service conditions in some situations. Improvements to this system are currently being implemented. However, I-TRAC's reliability and coverage for both service management and supervision purposes is dependent on staff, as it is a manual-entry system rather than a fully automated train tracking system.

In the coming years, ISIM-B (Integrated Service Information and Management – B Division) is slated for installation throughout the B Division, under the 2015-2019 MTA Capital Program. ISIM-B, which is still in development, would be first and foremost a rail system management project that would facilitate centralized supervision of B Division lines, including the A C, with the added benefit of enabling improved customer communications. Together with PA/CIS installations, ISIM-B would enable communication of "next train" status on platforms and via the Internet, similar to that currently on the 1 2 3 4 5 6 L, and further support supervision and dynamic service management. The implementation of ISIM-B will likely occur over a period of several years, into the 2020s.

A number of signals on the B Division have been equipped with Programmable Logic Controllers (PLCs) that broadcast the state of the signals for maintenance purposes. On the A C, PLCs are installed between 207 St and 23 St, and between Canal St and Lafayette Av. NYC Transit is integrating automatic PLC signal data with manually entered I-TRAC data to provide better real-time information to NYC Transit supervisory staff, and "next train" information for some locations will be made available to customers in the near future. This would be an incremental improvement, given that the timeline for fully centralized system-wide train tracking is not finalized. However, this technology is not a viable alternative to ISIM-B for tracking and communicating train location information for the full B Division, or even any full B Division line.

Many stations have PA systems for live or automated announcements. Some newer PA installations are connected to the Rail Control Center, while others are solely connected to local towers. As part of the 2010-2014 MTA Capital Program, public address systems are planned to be installed at 29 additional A C stations by 2017. A dedicated announcer is generally assigned to the 59 St Master Tower during rush periods to make announcements at nearby stations. A dedicated announcer is also frequently assigned to Jay St Tower but is often moved to other locations in the AM peak due to insufficient staffing. Each announcer can make announcements at a number of adjacent stations but often lacks specific information about the state of service in segments of the system far from his or her location. Equipping announcers with more complete information would enable better announcements and improve customers' journeys.

On The Go! Travel Station Kiosks have been added to many A C platforms, transfer corridors, and mezzanines. These kiosks provide riders with interactive maps and other information.

There are no automated visual or audio announcements on the R32 and R46 car classes assigned to the C and A trains. Onboard announcements are made exclusively by conductors.

The Second Half 2014 Passenger Environment Survey found that the A and C are less likely to have audible public address announcements than most other lines, with 86% of potential announcements actually made on the A and 81% on the C, compared to 91% systemwide. By this measure, the A C compare favorably with other lines lacking automated announcements, for which the average was 80% of announcements made. This issue is mitigated on the C by the newer R160's now assigned to about half of its fleet. R160's have automated audio and visual next station information and 99% of R160 cars in service were found to have functional public address systems. Long-term, on-train communications on the A and C will improve substantially with the introduction of new cars.

## JFK Airport Connection via AirTrain at Howard Beach

The number of A train riders connecting to John F. Kennedy Airport at Howard Beach has increased substantially over the past decade, following the opening of the JFK AirTrain in 2003. This increase in ridership reflects heavy use by airport workers, as well as fliers. Service from JFK AirTrain to the subway is relatively intuitive for customers, but service to JFK AirTrain poses special challenges for customers who are unfamiliar with the A, like tourists, because only trains destined for Far Rockaway or Rockaway Park stop at Howard Beach-JFK Airport. A trains to Lefferts Blvd do not stop at Howard Beach-JFK Airport. About 6.5% of A riders are destined for stations between the A split at Rockaway Blvd and the Queens terminals, and therefore must board an A train for the correct branch. Only about one half of one percent of all A riders are destined for the JFK AirTrain at Howard Beach.

Currently, all southbound A train conductors make audio announcements regarding their train's destination from Euclid Av to Rockaway Blvd, where the line splits, and the distinction is noted on platform edge signs and columns, as well as on the system map. However, not all customers easily navigate to the airport. Some JFK-bound customers mistakenly take Ozone Park-Lefferts Blvd destined A trains, and others take C trains. Reasons may include malfunctioning on-board PA announcements, insufficiently clear signage, and language barriers.

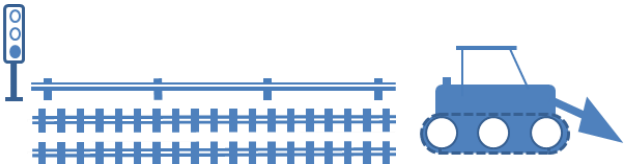
This study explored several possibilities for reducing customer confusion about the branching A:

- Rebrand the Lefferts Blvd branch with another letter. While rebranding would clearly benefit the relatively small number of infrequent riders bound for Howard Beach-JFK Airport, it would not benefit northbound riders or southbound riders between 207 St and Rockaway Blvd, and the complexity it would introduce could create confusion for tourists and others who may not realize that the two 8th Avenue express services were effectively the same within Manhattan and Brooklyn. Rebranding one branch would also create operational challenges at 207 St, as the current southbound A trains often alternate between destinations and end car route signs would need to be manually adjusted. This adjustment would be easier with the newer cars planned for the line in the early 2020s. Rebranding would also require significant changes to the system's map and signage.
- Improve signage in stations and add dedicated signage on trains incorporating graphical elements and explanations in multiple languages to decrease confusion.
- Expand on-train destination announcement procedures to give customers more opportunities to confirm that they are on the correct train and to help boarding customers identify the train's destination branch. Currently, Queens-bound A conductors are only required to announce the train's destination terminal at Euclid Av and in Queens.

- Ensure that future next-train destination information in stations indicates whether the A train is going to Howard Beach-JFK Airport.
- Install signage at Lefferts Blvd explaining JFK travel options to customers who accidentally take the wrong branch. Customers at Lefferts Blvd can backride to Rockaway Blvd to switch branches, take the Q10 bus, or use private transportation such as taxis.

## Customer Communication: Issues and Actions

- Some customers at Central Park West local stations, especially at 72 St and 81 St, are unaware that the B does not run on weekends and therefore erroneously let the C pass.
  - ➢ NYC Transit will install supplemental signage at these stations to better serve these customers.
- Stations lack comprehensive communications infrastructure, including PAs and electronic real-time next train information.
  - ➢ NYC Transit will continue its ongoing programs to install new communications infrastructure and train-tracking systems.
- Jay St Tower does not have a dedicated announcer staffed during all peak periods.
  - ➢ NYC Transit will add staff.
- A and C cars are less likely to have functioning public address systems than other lines in the system and they lack automated next stop information.
  - ➢ NYC Transit will acquire new R179 cars for use on the A and C upon delivery and has temporarily assigned some newer R160 cars to the C in the interim.
- Some JFK-destined customers have difficulty determining the correct A train to board to get to Howard Beach-JFK Airport.
  - ➢ NYC Transit will implement improved customer information regarding airport access.



# 6. Infrastructure

Much of the infrastructure in the subway system dates to the first half of the 20th century. Considering that the "hard" infrastructure on the A C – including much of the tracks, interlockings, and signal system – largely dates to the period of its original construction in the 1930s through the 1950s, it is still largely in good condition. There are, however, a number of recent and ongoing infrastructure challenges on the A C, including damage caused by Superstorm Sandy and an original signal system that on some portions of the A C is over 80 years old. Infrastructure work, whether to improve storm resilience or to obtain a "state of good repair" to minimize unplanned disruptions, is critical to maintain and improve the services' reliability.

## Infrastructure Conditions

The infrastructure required for a rail system includes a vast array of assets – tracks, signals systems, stations, tunnel structures, elevated structures, at-grade structures, tunnel lighting systems, fan plants, pumps, electrical and communications systems, storage yards, maintenance shops, and more. All assets degrade over time, necessitating their maintenance and eventual replacement.

### Age of Interlockings and Signals

The A C, like much of the system, runs on tracks with interlockings and a signal system dating, in part, to the original construction of the line. In the A C line's case, that means much of its infrastructure dates to the 1930s, 1940s, and 1950s. Old systems can cause unexpected service disruptions due to malfunctions and repair work, and in many cases spare parts for older signals are no longer manufactured, requiring NYCT to recondition critical overage components. However, while many of the A C systems are old, they are safe and highly functional.

Some of the A C line's infrastructure is new, including sections reconstructed after Superstorm Sandy. Signal systems that have already been modernized on the A C include the segments between 207 St and 59 St, between Canal St and Chambers St, and parts of the Rockaways branches. The West 4 St interlocking, which also serves the B D E F M lines, is scheduled to be modernized with funding allocated in the 2010-2014 MTA Capital Program, with substantial completion planned for 2018.

Three other interlockings that are original to the line's construction are planned to be modernized under the 2015-2019 MTA Capital Program:

- Hoyt-Schermerhorn Sts interlocking, where the A and C merge/diverge in Brooklyn (this construction is not yet scheduled)[37]
- 42 St North interlocking, where the C and E trains merge/diverge (planned for completion in 2023 or later)

[37] The current interlocking restricts combined A C frequency to 26 tph. The modernized interlocking, which is not yet designed, may enable additional frequency once Communications-Based Train Control is installed.

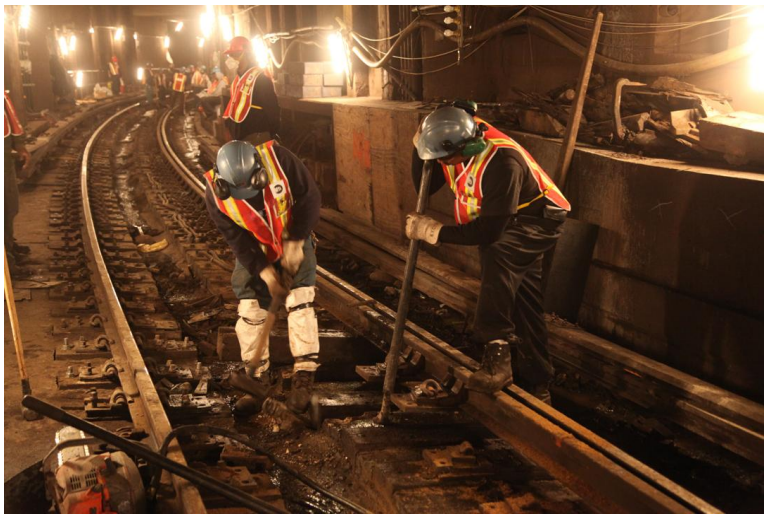
- 30 St interlocking, which is used for planned and unplanned reroutes (planned for completion in 2023 or later)

In addition, signal systems in the Cranberry Tube (the East River crossing between Brooklyn and Lower Manhattan), at Rockaway Park Yard, and around the 207 St terminal and train yard will be upgraded in coming years as part of Superstorm Sandy reconstruction work.

NYC Transit is in the long term process of upgrading all signals and interlockings systemwide for Communications-Based Train Control (CBTC). These are major investments, which are prioritized by system design, the cumulative customer benefit provided, and the logistical challenges of scheduling service-altering construction in multiple locations simultaneously. A C signals still operate safely, and those on the 8 Av and Fulton St corridors, between 42 St and Euclid Av, are slated to be replaced in the coming ten to twenty years under the current CBTC rollout plan. The 2015-2019 MTA Capital Program includes design of CBTC on the 8 Av corridor from south of 59 St-Columbus Circle to Jay St. Installation of CBTC on this segment would be funded in the 2020-24 Capital Program.

### Station Component Conditions

All NYC Transit infrastructure assets are evaluated in terms of condition. The most recent comprehensive evaluation of station assets was the 2012 Station Condition Survey. Excluding six stations on the Liberty Av Line that are currently undergoing component rehabilitation,[38] the survey found that the percentage of components at each station considered deficient ranged from a low of 0% to a high of 73%. Many stations throughout the system, including on the A and C, have old components that would benefit from renovation or replacement.



NYC Transit endeavors to achieve a state of good repair and prioritizes the most critical improvements based on available funding. Ongoing and recent renovations of A C stations in Queens specifically address a number of deteriorated stations components. Many of the A C stations with the highest percentage of deficient components are slated for component rehabilitation, including:

- Aqueduct-North Conduit Av (39% of components rated as deficient), 103 St (29%), 110 St (34%), 145 St (45%), and 168 St (48%) stations (*construction start in 2015/2016*), as part of the 2010-2014 MTA Capital Program;
- 50 St (37%), 23 St (40%), and Spring St (31%) stations (*construction start TBD*), as part of the 2010-2014 MTA Capital Program; and

[38] The 80 St, 88 St, Rockaway Blvd, 104 St, 111 St, and Lefferts Blvd stations had between 42% and 63% deficient components at the time of the 2012 survey, and these deficiencies are being addressed through MTA Capital Program work. In conjunction with this rehabilitation work, the Lefferts Blvd station is also being upgraded to provide full ADA (Americans with Disabilities Act) accessibility.

- Dyckman St (54%), 175 St (73%), 116 St (46%), Clinton-Washington Avs (41%), and Kingston-Throop Avs (54%) stations, are planned as part of the 2015-2019 MTA Capital Program.

NYC Transit performs similar analyses for other asset classes such as electrical, structures, track, and lighting, and all inform the development of capital projects.

## The Necessity of Work on the Subway

Maintenance and other construction throughout the subway system are necessary to provide safe and reliable service, and to keep infrastructure in a state of good repair. Some disruption of service is often necessary to complete routine maintenance or repair work, as trains sometimes have to be rerouted or are required to operate more slowly past work zones. There is a balance between the conflicting goals of completing the work quickly and in a cost-effective manner and of minimizing the impact on customers.

Whenever routine maintenance or capital construction work is necessary, NYC Transit makes every effort to minimize the impact during peak travel periods by scheduling the work during off-peak hours. Some construction and maintenance work on the A C takes place during middays and overnight. All maintenance on outdoor segments of track is completed during daytime hours and often causes significant delays on the A in Queens, where the A is entirely outside. Weekend work from late Friday night through early Monday morning usually allows about 53 hours of uninterrupted work and tends to be the most efficient means of accomplishing repair and construction work along the right-of-way. Ridership is lower on Saturdays and Sundays than on weekdays. Accordingly, NYC Transit will continue to concentrate work on weekends as much as possible, on the A C line and elsewhere.

A major cause of delays during construction work is the need to slow trains when they pass work zones where track and other maintenance and inspection work is taking place. This “flagging” process is used to protect the safety of workers in areas where trains are operating. In recent years, the length of the slow zone, and thus the duration of the delay, has increased to enhance worker safety. NYC Transit has taken proactive measures to mitigate maintenance-related delays, including restricting the number of track gangs (work crews) that can work along the line at any one time and increasing terminal recovery time during off-peak hours. NYC Transit is continuing to refine procedures that balance maintenance and passenger service systemwide.

In order to complete basic maintenance on the A C line, along with Superstorm Sandy Recovery and Resiliency work, interlocking replacement projects, and other capital work, there will be service changes on the A C for the majority of weekends in coming years. To ensure that customers still have travel alternatives and to avoid overwhelming those alternatives, work is coordinated when possible so that alternate train lines are not under construction when A C service is unavailable, and shuttle buses are operated along line segments with no train service at all and no nearby alternatives.

## Superstorm Sandy and Upcoming Related Service Changes

In October 2012, Superstorm Sandy damaged the A C lines in several key locations – including Rockaway Park-Beach 116 St Terminal, the Cranberry Tube between Manhattan and Brooklyn, the Rockaway Line between Howard Beach and Hammels Wye (where the Far Rockaway and Rockaway Park branches split), the upper 8 Av Line between Dyckman St and

207 St Terminal, and both the 207 Street and Rockaway Park Yards. The Cranberry Tube alone was inundated with approximately 1.5 million gallons of floodwater during the storm, and full A train service to and from the Rockaways was not restored until May 2013.

NYC Transit has made major capital investments to repair Sandy damage along the A C lines, simultaneously upgrading and/or modernizing many assets in the process. A $90 million emergency repair effort restored the washed-out Rockaway Line to service within seven months of the storm and provided partial flood protection for critical locations. Rehabilitation of the Cranberry Tube and the right-of-way between Dyckman St and 207 St are currently ongoing, while a major rehabilitation of the 207 Street Yard is planned for the coming years. In sum, these investments will replace damaged track, signals, tunnel lighting, power cables, and communications infrastructure, and rehabilitate flooded pump rooms, fan plants, substations, circuit breaker houses, and stations. These projects total approximately $765 million, primarily funded via the Federal Transportation Administration's Emergency Relief Fund.

NYC Transit is also taking significant steps to prevent similar flood damage from occurring in the future. Focusing on system vulnerabilities in the Category 2 flood zone, NYC Transit has instituted a multi-billion dollar resiliency program to protect the subway system from flooding and improve its emergency response capabilities. Various resiliency initiatives will affect the A C lines, including:

- Sealing all street-level water ingress points, including station stairways, vent bays, manholes, hatches, and fan plants
- Installing flood barriers to protect critical exposed right-of-way, including the Rockaway Line between Howard Beach and Hammels Wye, Rockaway Park Yard, and 207 Street Yard
- Hardening and/or relocating critical equipment in pump rooms, signal rooms, substations, and circuit breaker houses
- Providing augmented pumping capacity at critical locations, including West 4 Street Interlocking
- Protecting critical rooms within vulnerable stations, such as Howard Beach, Broad Channel, and Beach 116 St-Rockaway Park
- Upgrading the Emergency Booth Communications System (EBCS) systemwide

Over the next several years, construction related to Sandy repairs and resiliency improvements will continue to affect the A C lines. Repairs to the Upper 8 Av Line and the Cranberry Tube will require service diversions through 2016 and 2017, respectively. 207 St Yard will undergo major construction beginning in 2016, while the Rockaway Line will likely require extensive service changes for flood mitigation work currently in design, although a timeline for construction has not yet been established.

## Summary of Recent Capital Projects

A number of important capital projects were completed along the A C line in recent years, some of which presented short-term operating challenges that contributed to delays and off-peak service disruptions while supporting longer-term service quality and efficiency along the route. These projects include:

- Station renewals at all ten stations in the Rockaways
- The rebuilding of two miles of track on Broad Channel Island and the North Channel Bridge through Jamaica Bay, including the installation of a storm protection sea wall following Superstorm Sandy damage
- Signal repairs at the Rockaway Park interlocking and yard, Hammels Wye interlocking, Broad Channel interlocking and flats, and Howard Beach interlocking
- Elevator installation and ADA access at Utica Av
- Renovation of Jay St station and completion of the transfer passageway to the R at Jay St-MetroTech
- Completion of the Fulton Center, with improved transfers, communications, elevators, and ADA access
- Reconstruction of mainline track in places throughout the A and C routes, including installation of Continuous Welded Rail on portions of the 8 Av Line

In addition, the previous and current MTA Capital Programs devote significant resources to renewing key assets along the A C.

## Other Major Ongoing and Planned Capital Projects

The 2010-2014 and 2015-2019 MTA Capital Programs include projects that will make improvements to stations, structures, communications, power, and signals along the A and C lines that will improve reliability, the customer experience, and, in the long-term, capacity. Typical work ranges from rehabilitation of street stairs or ventilator grating to full station rehabs or major interlocking and signal system improvements. Major ongoing or planned capital projects include the following:

- Complete station renewals at 80 St, 88 St, Rockaway Blvd, 104 St, 111 St, and Lefferts Blvd, including elevators and full ADA accessibility at Lefferts Blvd station (*substantial completion in 2016*)
- Component rehabilitation at many stations, as listed in Station Component Conditions above
- CBTC-ready interlocking modernizations at West 4 St (*substantial completion planned for 2018*), Jay St (*construction not yet scheduled*), Hoyt-Schermerhorn Sts (*construction not yet scheduled*), 30 St (*award planned for2018*), and 42 St North (*award planned 2018*)
- Acquisition of new cars for C (*in service upon delivery*) and the A (*in service in early 2020s*)
- Rehabilitation of the Washington Heights Substation and replacement of equipment at three substations on the Fulton St line to ensure adequate supply and reliability of the electrical system that powers the subway (*award in 2018*)
- Replacement of escalators and elevators at 207 St, 190 St, 181 St, 175 St, and Broadway Junction stations (*in 2015-2019 Capital Program*)
- Sandy recovery and resiliency work in the Rockaways, Inwood, the Cranberry Tube
- Continued work on the ISIM-B Communications System (*in 2015-2019 Capital Program*)

Additionally, the LIRR plans to improve the Nostrand Av LIRR station in the 2015-2019 MTA Capital Program, and the Port Authority of New York and New Jersey is currently renovating the George Washington Bridge bus terminal and has proposed a major upgrade to the Port Authority Bus Terminal, each of which will benefit customers transferring between suburban and long distance bus services and the A C.

## Infrastructure: Issues and Actions

- Much of the infrastructure of the subway system, including the A C lines, is in need of repair or replacement. Planning these improvements is particularly challenging in the uncertain funding environment, with tremendous recovery and resiliency work necessitated by Superstorm Sandy.
  - ➢ NYC Transit will continue to implement improvements as funding allows.
- Balancing service needs and capital maintenance and improvement needs is an ongoing challenge.
  - ➢ NYC Transit will improve its planning and distribution of work along the right-of-way, and will continue to accommodate necessary work in the schedules where feasible and cost-effective.

# 7. Next Steps

The A C is a part of about 800,000 subway trips every day, and is thus a crucial part of New York City's economy and residents' and visitors' quality of life. This review identifies areas for improvement in A C line operations, including:

- Service regularity
- Customer communications
- Station access and conditions

NYC Transit analyzed a number of options to address issues in these areas for improvement, and the recommendations below often address issues identified in multiple sections of this report that address multiple areas for improvement. Many improvements were planned independent of this line review, while others were developed as part of this study. Some recommendations are unfunded or are planned as part of the 2015-2019 MTA Capital Program.

## Summary of Recommendations

| | |
|---|---|
| **Service and Loading Regularity** | • Adjust schedules<br>• Improve A-S connections<br>• Reduce peak period openings of the South Channel Bridge<br>• Deploy platform conductors<br>• Improve dispatching adherence<br>• Integrate new service management tools<br>• Upgrade service infrastructure<br>• Minimize conflict between service and system work<br>• Add and adjust benches<br>• Adjust stopping positions<br>• Install platform signage indicating train stopping positions<br>• Introduce new train cars<br>• Upgrade communications technology on the line<br>• Provide interim real-time next train arrival improvements<br>• Improve information regarding the branching A and JFK service<br>• Add dedicated announcers to Jay St |
| **Station Access and Conditions** | • Add and adjust benches<br>• Adjust stopping positions<br>• Improve access to and from platforms<br>• Upgrade stations infrastructure<br>• Reopen closed station entrances<br>• Upgrade communications technology on the line<br>• Provide interim real-time next train arrival improvements<br>• Add dedicated announcers to Jay St |
| **Customer Communications** | • Install platform signage indicating train stopping positions<br>• Better indicate lack of weekend B service at 72 St and 81 St<br>• Introduce new train cars to improve on-train customer information<br>• Upgrade communications technology on the line<br>• Provide interim real-time next train arrival improvements<br>• Improve information regarding the branching A and JFK service<br>• Add dedicated announcers to Jay St |

**Adjust the Weekday Schedules to Reflect Changes in Running Times on the A C:**

Issue**:** The A and C schedules do not reflect actual running times at certain times of day.

Recommendation: Adjust the A and C schedules to better reflect the actual observed running times of these trains in the AM peak and on weekends. These changes are refinements on top of adjustments already implemented in 2014 for both directions in the AM peak, middays, PM peak, and evenings as well as an increase in crew "recovery time" on the C.

Implementation: December 2015

**Adjust the Weekday AM Schedule to Reflect Shifting Ridership on the A:**

Issue: Ridership has grown in the late AM peak and northbound A service could better match demand during the 9:00-9:30 half hour in Downtown Brooklyn. The current scheduled service leads to relatively heavy loading on both the A and C and loading above guidelines on the A during this period.

Recommendation: Reschedule one northbound A train from the 8:00-8:30 half hour at Hoyt-Schermerhorn Sts, when there is more A service than ridership necessitates, to the 9:00-9:30 half hour to better match rider demand and bring passenger loading within guidelines for the full AM peak.

Implementation: December 2015

**Adjust the Weekday Schedule to Implement Holds for Evenness on the A:**

Issue: A service is relatively uneven compared to the schedule, particularly northbound.

Recommendation: Adjust the northbound A schedule at all times on weekdays to implement a short in-station "gateway-in" hold at Euclid Av. Trains that arrive early at Euclid Av will be held to scheduled departure time and trains that are slightly delayed between the Queens terminals and Euclid Av will be able to catch up to their scheduled departure time. Having dispatchers hold trains until their scheduled departure time will result in more even A train spacing, which will in turn decrease average wait times, even out loading between trains, improve the ability of the service to recover from delays, and help balance C train performance and loading by reducing ridership diverted from uneven A service.

In the long term, investigate the feasibility of implementing short "gateway-in" holds southbound at 145 St and better distributing existing midday holds across the line.

Implementation: Short northbound holds at Euclid Av will take effect in December 2015.

**Adjust the Midday A Schedule to Eliminate Long Headways to and from Far Rockaway-Mott Av:**

Issue: Early midday service to and from Far Rockaway includes some extended scheduled headways that are not consistent with the frequency guidelines.

Recommendation: Adjust the A schedule to shorten these headways by shifting trains or adding service.

Implementation: Planned for summer 2016.

**Adjust the Schedule to Increase C Service Frequency on Sunday Mornings:**

Issue: Sunday morning C headways are longer than those on comparable services.

Recommendation: Increase service on the C on Sunday mornings to reduce wait times at local stations prior to 10:30 AM. This will require an earlier start-up of C service in the morning, and hence an earlier start of A express service. Concurrent with these changes would be changes to weekend running times to better reflect actual performance.

Implementation: Planned for summer 2016.

**Increase Crew Recovery Time to Improve On-Time Departures:**

Issue: A trains are often significantly delayed in the late evening and early overnight period by track gangs setting up for overnight track work.

Recommendation: Add additional crews to the A Line, when feasible, to improve reliability by increasing crew recovery time at terminals and ensure the availability of crews for train departures.

Implementation: Summer 2016.

**Establish Guidelines to Improve A-S Connections:**

Issue**:** The Rockaway Park S does not always connect for transfers with the Far Rockaway A.

Recommendation: Establish guidelines that will allow dispatchers some latitude in dispatching Rockaway Park S shuttles to facilitate A connections, as long as holding the trains does not negatively impact subsequent trips.

Implementation: March 2016.

**Pursue an Expanded Moratorium on South Channel Bridge Openings:**

Issue: The opening of the South Channel Bridge causes major delays and gaps in service on the A and Rockaway Park S trains.

Recommendation: Pursue an amendment to the 2006 US Coast Guard rule that established a moratorium on AM and PM peak period bridge openings. Whereas the current rule discourages bridge openings from 6:45 AM to 8:20 AM and from 5:00 PM to 6:45 PM, a recent analysis suggests that the AM period should run from 6:00 to 9:30, and the PM period from 4:00 to 7:30.

Implementation: Began process in 2015, implementation dependent on concurrence by the US Coast Guard.

**Deploy Platform Conductors to Reduce Station Dwell Times:**

Issue: Long and variable station dwell times lead to irregular spacing between trains, uneven passenger loading, extended trip times, and train delays. This problem is particularly acute at Hoyt-Schermerhorn Sts northbound in the AM peak.

Recommendation: Deploy platform conductors at Hoyt-Schermerhorn Sts in the AM peak to reduce extended train dwell times caused by riders.

Implementation: Platform conductors began AM peak operations at Hoyt-Schermerhorn Sts on the northbound platform in Fall 2015.

**Reduce Unnecessary Early and Late Train Dispatches:**

Issue: Some trains are unnecessarily dispatched early or late throughout the system, including on the A C, which sometimes leads to uneven service.

Recommendation: Improve dispatching adherence by developing new electronic service management tools to provide better information about train locations.

Continue to improve the manual terminal departure reporting in the I-TRAC train tracking system and eventually reduce the reporting responsibilities of dispatchers through automated departure time information via Programmable Logic Controllers (PLCs), Integrated Service Information and Management – B Division (ISIM-B) and/or Communications-Based Train Control (CBTC).

Implementation: Ongoing.

**Integrate New Electronic Service Management Tools:**

Issue: Line management and dedicated announcers on the B Division, including the A C, lack a complete view of the line's operations, which impedes comprehensive and effective service management and customer communications.

Recommendation: With the timeline for implementation of ISIM-B uncertain, rapidly develop new interim I-TRAC- and PLC-based service management tools to provide more complete and useful information to field personnel prior to the implementation of ISIM-B.

Implementation: Pending further feasibility analysis.

**Upgrade Infrastructure on the A C Lines:**

Issue: Much of the infrastructure on the A and C lines, like much of the system, is in need of replacement or upgrade to maintain and improve service.

Recommendation: Continue plans to upgrade infrastructure across the A and C lines in coming years to repair damage from Superstorm Sandy, improve resilience against future flooding and other damaging events, maintain a reliable system in a state of good repair, including stations, and prepare for the implementation of CBTC.

Implementation: Ongoing, subject to funding availability and system-wide priorities.

**Minimize Conflict between Passenger Service and System Work**

Issue: Necessary maintenance and capital work can cause delays and interrupt passenger service throughout the system.

Recommendation:

- Continue to concentrate inspections and track work during lower-ridership periods: middays, overnights, and weekends.

- Continue system-wide efforts to better plan and manage interruptions caused by routine maintenance and work.
- In the long term, move northbound A running time that was added to account for off-peak flagging delays from the end of the line to Euclid Av during middays to better accommodate outdoor work in Queens and maintain more even A headways. This change refines midday running time increases implemented in 2014.

Implementation: As the last item requires a major schedule revision, the timeline is not yet determined. It will be partially implemented through gateway-in holds in December, 2015.

**Add and Adjust Platform Benches**:

Issue: Customers at some station platforms would benefit from additional or differently placed benches. Some existing benches are inconveniently located or their location on the platform contributes to crowding in certain subway cars or on the platform, leading to extended dwells.

Recommendation: NYC Transit identified 18 new benches to install at 11 stations and 12 benches to relocate at 7 stations to provide more convenient waiting locations and to minimize train dwell times. New bench locations under consideration can be found in Appendix D.

Implementation: March 2016.

**Adjust Train Stopping Positions**:

Issue: Some train stopping positions on the A and C are inconvenient for customers, leading to unnecessary on-platform walking, localized platform crowding, uneven loading on end cars, and extended dwell times.

Recommendation: Improve A C stopping positions at 17 stations, as preliminarily described in Appendix C. New stopping positions were identified using turnstile entrance data, analysis of station layouts, and field observations.

Implementation: NYC Transit will complete most recommended adjustments by the end of Summer, 2016. Adjustments that require infrastructure changes such as new CCTVs will be completed by the end of 2016. Some adjustments may be modified or eliminated pending further analysis.

**Install Platform Signage Indicating Train Stopping Positions on Select Platforms:**

Issue: Some customers do not know where trains stop on some platforms, which can lead to customer confusion and extended dwell times.

Recommendation: Adjust station signage to indicate train stopping positions at stations where trains stop far from end-of-platform entrances.

Implementation: In parallel with stopping position changes, NYC Transit will install a first round of signage by Summer, 2016, and a second round by the end of 2016.

**Improve Access to and from Platforms:**

Issue: There are many opportunities to improve station entry/egress time, convenience, and accessibility at and around A C stations.

Recommendation: Continue to improve station access through reconfigured entry and exit turnstile layouts, widened stairways, and new or reopened entries and stairways, where it would benefit customers, in the context of limited funds:

- Implement a number of planned entry/exit improvements in the coming years. These include:
  - 175 St: Additional turnstiles will be installed at the northern entrance serving George Washington Bridge Bus Station.
  - 181 St: New low turnstiles will be installed at the northern entrance.
  - 86 St: Turnstile capacity will be increased at 86th Street.
  - 50 St: Entry/exit design will be improved in both directions.
  - 34 St-Penn Station:
    The northbound local platform may be widened as part of the Penn Plaza project.
    The southbound local platform street stair at 33rd Street and 8th Avenue will be widened as part of the Moynihan Station project.
    The entrance at the south end will be rationalized to better serve all entry areas as part of the Moynihan Station project.
  - Jay St: Easement entrances on the east side of Jay Street will be rebuilt as part of the 370 Jay Street project.
  - Nostrand Av: Additional high wheel exit-only turnstiles will be installed for the northbound platform.
  - Rockaway Av: The southbound southern exit-only high wheel will be converted to also provide entry access.
- Continue to improve ADA accessibility throughout the subway system.
- Continue to collaborate with NYC DOT to improve surface level infrastructure for intermodal transfers and pedestrian access to the subway.

Implementation:

- Entry/exit improvements are implemented on an ongoing basis commensurate with availability of staff resources or as part of larger real estate construction timelines.
- ADA accessibility improvements are part of the capital planning process, and require lengthy planning.
- NYC DOT is working on a number of A C station areas with varying implementation timelines.

**Re-open Closed Station Entrances**:

Issue: Customers would benefit from the reopening of a number of closed entrances at A C stations. However, current interpretation of ADA legislation requires that the affected platforms be made fully ADA compliant, with costly elevator access. Reopening closed entrances requires a significant capital investment.

Recommendation: Reopen the closed Classon Avenue entrance at the Franklin Av station, the 167th Street entrance at 168 St, and the southbound 51st Street entrance at 50 St, as these closed entrances are at already ADA accessible stations and would have significant customer benefits.

Implementation: After further refining costs for reopening the three recommended entrances, NYC Transit will work with government partners and other stakeholders to identify funding. No funding has been identified at this time to reopen the recommended entrances or to install new elevators at A C stations besides Lefferts Blvd, which is currently undergoing station renewal.

**Introduce New Train Cars:**

Issue: R32's assigned to the C line and R46's assigned to the A line lack reliable audio and visual customer communications systems and have relatively poor reliability as measured by MDBF.

Recommendation: In the near term, and on an ongoing basis, exchange approximately half of the C train fleet of R32 cars for newer R160's from the J Z line, for maintenance and operational reasons. In the long term, replace the C and A car fleets with new cars.

Implementation: R160's were reassigned to some C trains in May 2015.

The C fleet and a small part of the A fleet is planned for replacement with the new car order of R179's, and the rest of the A fleet is planned for replacement with the new car order of R211's in the early 2020s.

**Upgrade Communications Technology on the Line to Support Service Management and Customer Communications**:

Issue: Existing communications technology does not provide a full view of A C operations to support service management or customer communications.

Recommendation: Continue plans to implement a progression of technology upgrades to the A C over the coming years to improve line oversight and deliver better real-time information to customers. These upgrades include:

- Underground Wi-Fi/cell service, for delivery of service information directly to customers
- Public Address systems, for delivery of live service information in stations
- I-TRAC improvements, for better train tracking and service management
- ISIM-B, for comprehensive A C line and B Division service management
- CBTC, for improved service regularity and management, as well as potential capacity increases

Implementation: NYC Transit plans to implement real-time information upgrades to the A C line and throughout the system as quickly as feasible. Wi-Fi is planned for implementation by 2017. CBTC on the full line is not planned for implementation until the 2040s, though this timeline is not finalized and CBTC on a portion of the A C in Manhattan is planned to be completed earlier. Public address systems, ISIM-B development, and interlocking replacements necessary for CBTC are part of the 2015-2019 MTA Capital Program.

**Implement Interim Real-Time Next Train Arrival System Improvements**:

Issue: Most B Division lines, including the A C, lack the accurate and specific next train information that is announced on platforms for the 1 2 3 4 5 6 and L trains.

Recommendation: Integrate I-TRAC- and PLC-based improvements to support the public delivery of real-time information in some locations prior to introduction of ISIM-B.

Implementation: NYC Transit plans to introduce improved public next train arrival information on part of the A C in 2016 via the internet and Subway Time app. The initial roll-out is planned to include at least the portion between 59 St and 135 St, and to subsequently include 145 St to 207 St.

**Emphasize that the C is the only service on weekends at 72 St and 81 St**

Issue: Some customers, especially at 72 St and 81 St, are unaware that the B does not run on weekends and erroneously let the C pass.

Recommendation: Install supplemental signage at these stations to better serve these customers.

Implementation: NYC Transit will install supplemental signage at 72 St and 81 St by Summer 2016.

**Improve On-Train Customer Information**:

Issue: There is no automated customer information on the R32 and R46 trains assigned to the A and C lines, and less than 90% of potential conductor announcements on these lines are audible.

Recommendation: Replace the existing A C fleets of R46's and R32's with new technology train cars to introduce more reliable automated visual and audio announcements.

Implementation: R160's were reassigned to some C trains in May 2015.

The C fleet and a small part of the A fleet is planned for replacement with the new car order of R179's when they are delivered, and the rest of the A fleet is planned for replacement with the new car order of R211's in the early 2020s.

**Improve Customer Information Regarding the Branching A and JFK Airport Service:**

Issue: Many customers have difficulty understanding branching A service or have difficulty using the A train to reach the JFK AirTrain at Howard Beach.

Recommendation:

- Improve the on-train announcement procedure to require conductors to announce the terminal destination of all southbound A trains at all Brooklyn and Queens stations between Jay St-MetroTech and Rockaway Blvd, rather than just from Euclid Av to Rockaway Blvd.
- Explore the installation of permanent signage in each car of all A trains to provide better information about the branching service and JFK connections.
- Install signage at Lefferts Blvd station to inform customers about their travel options to JFK if they inadvertently take the Lefferts Blvd A train to its terminal. This signage would be implemented after the renewal of the station is completed in 2016 and would include information about using the Q10 bus or private transportation from Lefferts Blvd as well as backriding to the AirTrain via Rockaway Blvd.
- Ensure future improvements to next train information on the line will also specify the train's destination and highlight the airport connection, where possible.

Implementation: Improved on-train announcement procedures will be implemented and improved signage will be installed in 2016.

**Add AM Dedicated Announcers to Ensure that Jay St Tower is Staffed:**

Issue: Jay St Tower often lacks a dedicated announcer in the AM peak.

Recommendation: Hire additional dedicated announcers in the AM peak to ensure that Jay St Tower is more regularly staffed and service announcements are more regularly provided at Jay St-MetroTech and other nearby A C stations.

Implementation: Pending identification of funding

# Appendix A – Interlockings

Sixteen interlockings are used in daily operations on the A C. They are listed below, with a summary of their primary functions.

- 207 St interlocking serves the 207 St terminal and provides access to the 207 St Yard.
- 200 St interlocking is used for trains entering and leaving service from the 207 St Yard.
- 168 St interlocking serves the 168 St terminal and enables C train "relays" (changing directions) beyond the platforms.
- 145 St, 135 St and 59 St interlockings process the merge/diverge with the B and D.
- 42 St interlocking processes the merge/diverge with the E.
- Canal St interlocking processes the merge/diverge with the E and of the A and C.
- Hoyt-Schermerhorn Sts interlocking processes the merge/diverge of the A and C.
- Euclid Av interlocking serves the Euclid Av terminal and C train and Lefferts Shuttle relays. It also provides access to Pitkin Yard.
- Liberty Junction interlocking controls the merge/diverge of the Rockaway A and Lefferts Blvd A services.
- Lefferts Blvd interlocking serves the Lefferts Blvd terminal.
- Broad Channel interlocking serves the Rockaway Park S terminal and S shuttle relays.
- Hammels Wye interlocking controls the merge/diverge of the Far Rockaway A and Rockaway Park A and S services.
- Rockaway Park interlocking serves Rockaway Park terminal and provides access to the Rockaway Park Yard.
- Mott Av interlocking serves the Far Rockaway terminal.

Fourteen additional interlockings allow trains to be rerouted and terminated short of their regular terminals when required by scheduled work or service disruptions, and/or provide access to yards and spur tracks. These interlockings are also used by work trains when necessary.

- 181 St
- 174 St
- 125 St
- 81 St
- 72 St
- 30 St
- W 4 St
- Chambers St
- Jay St-MetroTech
- Lafayette Av
- Utica Av
- Broadway Junction
- Pitkin Yard
- Howard Beach

# Appendix B – Ridership

This station entry data differs from the regularly published annual data in that it only includes entries for non-holiday fall weekdays, a relatively high and consistent ridership period.

## AVERAGE FALL WEEKDAY STATION ENTRIES

| Station | 2005 | 2014 | % Increase | A C 2014 Entry Rank | A C % Increase Rank |
|---|---|---|---|---|---|
| Inwood-207 St (A) | 8,680 | 10,010 | 15% | 26 | 48 |
| Dyckman St (A) | 6,140 | 7,140 | 16% | 34 | 45 |
| 190 St (A) | 4,070 | 4,770 | 17% | 46 | 43 |
| 181 St (A) | 9,820 | 11,650 | 19% | 22 | 40 |
| 175 St (A) | 12,670 | 13,910 | 10% | 18 | 55 |
| 168 St (A C 1) | 22,190 | 27,240 | 23% | 11 | 34 |
| 163 St-Amsterdam Av (C) | 3,530 | 4,550 | 29% | 47 | 26 |
| 155 St (C) | 2,220 | 2,730 | 23% | 52 | 33 |
| 145 St (A B C D) | 18,860 | 26,350 | 40% | 12 | 10 |
| 135 St (B C) | 4,420 | 6,320 | 43% | 38 | 8 |
| 125 St (A B C D) | 21,780 | 30,370 | 39% | 9 | 11 |
| 116 St (B C) | 5,040 | 7,470 | 48% | 32 | 6 |
| Cathedral Pkwy-110 St (B C) | 5,740 | 7,520 | 31% | 31 | 24 |
| 103 St (B C) | 4,710 | 5,050 | 7% | 45 | 56 |
| 96 St (B C) | 7,940 | 10,900 | 37% | 23 | 15 |
| 86 St (B C) | 10,910 | 12,510 | 15% | 20 | 51 |
| 81 St-Museum of Natural History (B C) | 10,280 | 13,500 | 31% | 19 | 23 |
| 72 St (B C) | 7,450 | 9,710 | 30% | 27 | 25 |
| 59 St-Columbus Circle (A B C D 1) | 66,170 | 82,820 | 25% | 3 | 28 |
| 50 St (C E) | 17,860 | 22,020 | 23% | 13 | 32 |
| Times Sq-42 St (N Q R S 1 2 3 7)/ 42 St (A C E) | 172,720 | 210,230 | 22% | 1 | 37 |
| 34 St-Penn Station (A C E) | 79,190 | 89,600 | 13% | 2 | 53 |
| 23 St (C E) | 21,530 | 27,750 | 29% | 10 | 27 |
| 14 St (A C E)/8 Av (L) | 32,840 | 46,910 | 43% | 7 | 9 |
| West 4 St-Washington Sq (A B C D E F M) | 36,330 | 45,050 | 24% | 8 | 30 |
| Spring St (C E) | 10,300 | 14,090 | 37% | 17 | 16 |
| Canal St (A C E) | 17,840 | 21,110 | 18% | 14 | 42 |
| Chambers St (A, C)/WTC (E)/Park Place (2 3) | 50,170 | 61,410 | 22% | 5 | 35 |
| Fulton St (A C J Z 2 3 4 5) | 65,500 | 75,220 | 15% | 4 | 50 |
| High St (A C) | 5,410 | 8,870 | 64% | 29 | 2 |
| Jay St-MetroTech (A C F R) | 33,880 | 49,460 | 46% | 6 | 7 |
| Hoyt-Schermerhorn Sts (A C G) | 9,130 | 10,550 | 16% | 24 | 47 |
| Lafayette Av (C) | 4,140 | 5,450 | 32% | 42 | 22 |
| Clinton-Washington Avs (C) | 4,860 | 7,360 | 51% | 33 | 5 |

## AVERAGE FALL WEEKDAY STATION ENTRIES

| Station | 2005 | 2014 | % Increase | A C 2014 Entry Rank | A C % Increase Rank |
|---|---|---|---|---|---|
| Franklin Av (C S) | 4,440 | 7,070 | 59% | 35 | 4 |
| Nostrand Av (A C) | 14,930 | 18,420 | 23% | 15 | 31 |
| Kingston-Throop Avs (C) | 4,770 | 6,590 | 38% | 37 | 13 |
| Utica Av (A C) | 13,950 | 16,520 | 18% | 16 | 41 |
| Ralph Av (C) | 4,390 | 5,950 | 36% | 39 | 17 |
| Rockaway Av (C) | 4,750 | 5,650 | 19% | 40 | 39 |
| Broadway Junction (A C J L Z) | 10,610 | 10,280 | -3% | 25 | 60 |
| Liberty Av (C) | 3,260 | 2,930 | -10% | 51 | 63 |
| Van Siclen Av (C) | 2,520 | 3,360 | 33% | 49 | 19 |
| Shepherd Av (C) | 2,860 | 3,550 | 24% | 48 | 29 |
| Euclid Av (A C) | 9,730 | 11,670 | 20% | 21 | 38 |
| Grant Av (A) | 6,090 | 7,010 | 15% | 36 | 49 |
| 80 St (A) | 3,910 | 5,250* | 34% | 43 | 18 |
| 88 St (A) | 2,640 | 2,600* | -2% | 54 | 59 |
| Rockaway Blvd (A) | 7,120 | 9,440* | 33% | 28 | 20 |
| 104 St (A) | 1,860 | 1,770* | -5% | 57 | 61 |
| 111 St (A) | 2,790 | 3,110* | 11% | 50 | 54 |
| Ozone Park-Lefferts Blvd (A) | 8,070 | 8,460 | 5% | 30 | 57 |
| Aqueduct Racetrack (A) | NA | 1,670 | NA | 58 | NA |
| Aqueduct-North Conduit Av (A) | 890 | 1,240 | 39% | 59 | 12 |
| Howard Beach-JFK Airport (A) | 1,680 | 5,470 | 226% | 41 | 1 |
| Broad Channel (A S) | 360 | 320 | -11% | 66 | 64 |
| Beach 67 St-Arverne By The Sea (A) | 1,790 | 2,470 | 38% | 55 | 14 |
| Beach 60 St (A) | 2,310 | 2,690 | 16% | 53 | 44 |
| Beach 44 St (A) | 410 | 670 | 63% | 63 | 3 |
| Beach 36 St (A) | 810 | 990 | 22% | 60 | 36 |
| Beach 25 St (A) | 1,760 | 2,000 | 14% | 56 | 52 |
| Far Rockaway-Mott Av (A) | 4,470 | 5,170 | 16% | 44 | 46 |
| Beach 90 St (A S) | 970 | 970 | 0% | 61 | 58 |
| Beach 98 St (A S) | 1,170 | 650 | -44% | 64 | 65 |
| Beach 105 St (A S) | 250 | 330 | 32% | 65 | 21 |
| Rockaway Park-Beach 116 St (A S) | 820 | 750 | -9% | 62 | 62 |
| **AVERAGE** | 14,164 | 17,342 | | | |
| **MEDIAN** | 5,414 | 7,248 | | | |

* Platforms at 88 St and 104 St were closed for portions of fall 2014, suppressing average ridership at these stations, and possibly elevating average ridership at 80 St, Rockaway Blvd, and 111 St.

# Appendix C – Stopping Position Changes

| Station (Direction) | Proposed Adjustments* |
|---|---|
| 163 St (NB) | Move the 480' train south ~60' so that the rear car stops just south of the P2 staircase. |
| 163 St (SB) | Move the 480' train south ~60' so that the front car lines up with the 600' train stop marker. |
| 135 St (SB) | Move the 480' train south ~50' so that the front car lines up with the 600' train stop marker. |
| 116 St (NB) | Move the 480' train south ~60' so the rear car is close to the south end of the platform. |
| 116 St (SB) | Move the 480' train south ~60' so that the front car lines up with the 600' train stop marker. |
| 110 St (NB) | Move the 480' train south ~60' so that the rear car lines up with the south end of the platform. |
| 110 St (SB) | Move the 480' train south ~60' so that the front car lines up with the 600' train stop marker. |
| 96 St (NB) | Move the 480' train north ~60' so that the front car lines up with the 600' train stop marker. |
| 96 St (SB) | Move the 480' train north ~60' so that the rear car lines up with the north end of the platform. |
| 50 St (NB) | Move the 480' train south ~60' so that the rear car lines up with the south end of the platform. |
| 34 St-Penn Station (NB) | Move the 480' train south ~60' so that the rear car lines up with the southern entry area. |
| 34 St-Penn Station (SB) | Move the 480' train south ~60' so that the front car lines up with the 600' train stop marker. |
| Spring St (SB) | Move the 480' train south ~50' so that the front car is 10' north of the 600' train stop marker. |
| Chambers St (NB) | Move the 600' train south ~50' so that the rear car stops 30' north of the P18 staircase. |
| Chambers St (NB) | Move the 480' train south ~50' so that it remains centered on the 600' train. |
| Fulton St (NB) | Move the 600' train north ~10' so that the front car lines up with the north end of the platform. |
| Fulton St (SB) | Move the 600' train north ~15' so that the rear car lines up with the north end of the platform. |
| Fulton St (NB) | Move the 480' train north ~65' so that the front car lines up with the north end of the platform. |
| Fulton St (SB) | Move the 480' train north ~55' so that the rear car lines up with the north end of the platform. |
| High St (NB) | Move the 480' train south ~50' so that the rear car lines up with the south end of the platform. |
| High St (SB) | Move the 480' train south ~80' so that the front car lines up about ten feet in front of the 600' train stop marker. |
| High St (SB) | Move the 600' train south ~10' so that it is closer to the southern exit and consistent with the 480' train. |
| Lafayette Av (NB) | Move the 480' train south ~40' so that it is centered on the platform stairs. |
| Lafayette Av (SB) | Move the 480' train south ~90' so that the front car lines up with the 600' train stop marker. |
| Clinton-Washington Avs (NB) | Move the 480' train south ~60' so that it is centered between the north and south exits. |
| Franklin Av (NB) | Move the 600' train south ~30' so that the rear car lines up with the south end of the platform. |
| Franklin Av (NB) | Move the 480' train south ~25' so that the rear car lines up with the south end of the platform. |

| | |
|---|---|
| Nostrand Av (SB) | Move the 480’ train south ~50’ so that the front car lines up with the 600’ train stop marker. |
| Nostrand Av (NB) | Move the 480’ train south ~105’ on the express tracks so that rear car lines up with the rear of the 600’ train. |
| Nostrand Av (SB) | Move the 480’ train south ~60’ on the express track so that the front car lines up with the 600’ train stop marker. |
| Broadway Junction (SB) | Move the 480’ train south ~60’ so that the front car lines up with the 600’ train stop marker. |
| Broadway Junction (SB) | Move the 480’ train south ~60’ on the express track so that the front car lines up with the 600’ train stop marker. |
| Aqueduct-North Conduit Av (NB) | Move the 600’ train south ~35’ so that the rear car lines up with the south end of the platform. |

*Some adjustments may be modified or eliminated pending further analysis.

# Appendix D – Proposed Bench Changes

## A C Bench Additions

| Station | Action | Benches |
|---|---|---|
| 103 St | Add one additional bench to southbound platform | 1 |
| 50 St | Add three benches (total of three benches in each direction) | 3 |
| Spring St | Add two benches northbound and three benches southbound | 5 |
| Clinton-Washington Avs | Add one bench on the south end of the northbound platform | 1 |
| Franklin Av | Add one bench to the northbound platform | 1 |
| Nostrand Av | Add one bench toward the middle of the northbound express platform near the stairway, such that it can be used to wait for service on the upstairs or downstairs track | 1 |
| Broadway Junction | Add one bench toward the north end of the northbound platform | 1 |
| Grant Av | Add one additional bench to the mezzanine, space permitting | 1 |
| Aqueduct-North Conduit Av | Add one bench to the northbound platform | 1 |
| Howard Beach | Add one bench to the northbound platform | 1 |
| Broad Channel | Add one additional bench to each platform | 2 |

## A C Bench Moves

| Station | Action | Benches |
|---|---|---|
| 163 St | Relocate one bench from the northbound platform to the mezzanine | 1 |
| 135 St | Spread two benches so that one on each platform serves the northern entrance | 2 |
| 125 St | Spread four benches to enable easier platform circulation by stairways and for cross-platform transfers | 4 |
| 72 St | Spread one bench on each platform to serve the southern entrance | 2 |
| 23 St | Move southernmost bench on the northbound platform north to serve the northern entrance. | 1 |
| Lafayette Av | Move the north-most bench on the northbound platform back toward the stairs. | 1 |
| Kingston-Throop Avs | Spread one bench from the northbound entrance | 1 |

# Appendix E – Passenger Environment Survey

## Passenger Environment Survey
Second Half 2014

| Station Results | | | A C | | System-wide | | Diff (%None & Light) | |
|---|---|---|---|---|---|---|---|---|
| | | | Surveyed Before Morning Peak | Surveyed After Morning Peak | Surveyed Before Morning Peak | Surveyed After Morning Peak | Surveyed Before Morning Peak | Surveyed After Morning Peak |
| Litter Condition in Stations | | None | 2% | 5% | 1% | 5% | -4% | -8% |
| *Presence of Litter* | *Includes trackbed component* | Light | 66% | 52% | 71% | 61% | | |
| | | Moderate | 31% | 36% | 26% | 30% | | |
| Includes all components of station: mezzanine, passageway, platform, stairways and trackbed | | Heavy | 1% | 6% | 2% | 4% | | |
| | *Measured without trackbed component* | None | 37% | 27% | 38% | 33% | -1% | -9% |
| | | Light | 47% | 43% | 47% | 46% | | |
| | | Moderate | 15% | 26% | 13% | 18% | | |
| | | Heavy | 1% | 5% | 2% | 3% | | |
| Floor and Seat Cleanliness Conditions in Stations | | None | 43% | 48% | 47% | 53% | -1% | -7% |
| | | Light | 40% | 27% | 37% | 30% | | |
| *Degree of Dirtiness* | | Moderate | 16% | 19% | 14% | 14% | | |
| | | Heavy | 1% | 5% | 2% | 3% | | |
| Graffiti Conditions in Stations | | None | 79% | | 81% | | 0% | |
| *Presence of Graffiti* | | Light | 20% | | 18% | | | |
| | | Moderate | 1% | | 1% | | | |
| | | Heavy | 0% | | 0% | | | |

Note: Difference greater than ±6% is considered statistically significant

# Passenger Environment Survey

Second Half 2014

| Subway Car Results | | A C at Terminal | A C in Service | System-wide at Terminal | System-wide in Service | Diff (%None & Light) at Terminal | Diff (%None & Light) in Service |
|---|---|---|---|---|---|---|---|
| Litter Condition in Cars | None | 96% | 70% | 90% | 65% | **1%** | **1%** |
| *Presence of Litter* | Light | 3% | 23% | 8% | 27% | | |
| | Moderate | 0.5% | 1% | 0% | 0% | | |
| | Heavy | 0.5% | 6% | 2% | 8% | | |
| Cleanliness of Car Floors and Seats | None | 96% | 83% | 92% | 82% | **1%** | **2%** |
| *Degree of Dirtiness* | Light | 3% | 11% | 6% | 10% | | |
| | Moderate | 0.5% | 0% | 0% | 0% | | |
| | Heavy | 0.5% | 6% | 2% | 8% | | |
| No Interior Graffiti | | 97% | | 99% | | **-2%** | |
| No Scratchitied Windows | | 85% | | 90% | | **-5%** | |
| Cars with Public Address Announcements | | | | 91% | | | |
| *- Automated Announcements* | | n/a | | *99%* | | | |
| *- Conductor Announcements* | | *84%* | | *80%* | | ***4%*** | |
| *Actual # of announcements made vs total potential announcements* | | | | | | | |
| Climate Control Conditions in Cars | | 92% | | 96% | | **-4%** | |
| *% of cars with average interior temp. between 58F and 78F* | | | | | | | |

Note: Difference greater than ±6% is considered statistically significant

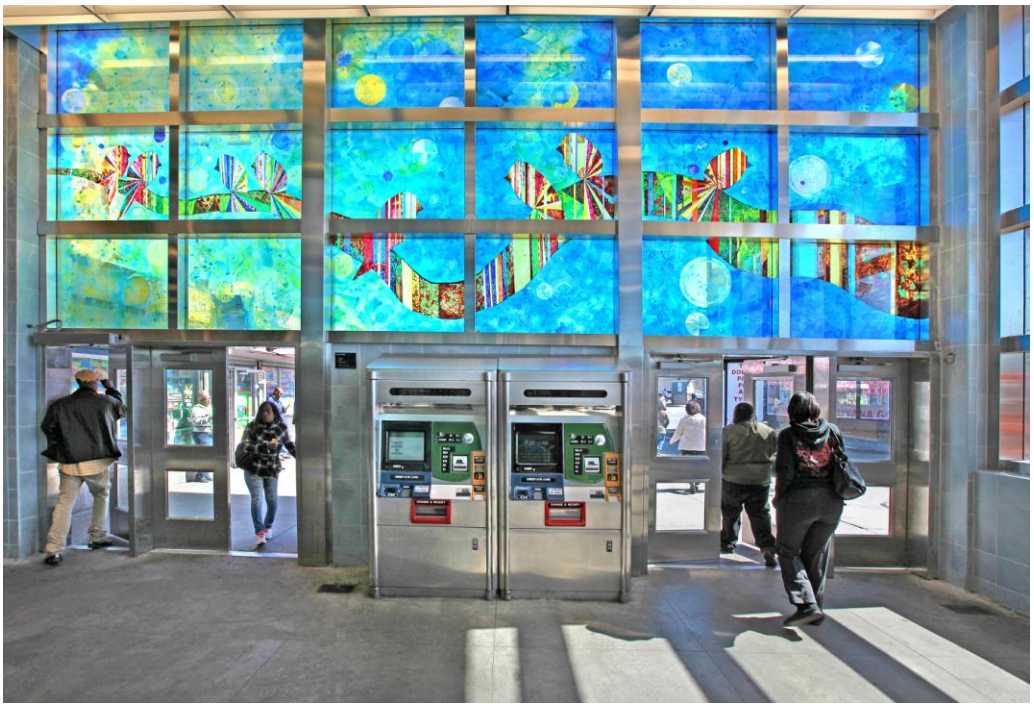
# Appendix F – MTA Arts & Design Installations

MTA Arts & Design has overseen art installations at 25 A C stations, listed below. Another five projects are currently being installed during station rehabilitations in Queens at 80 St, 88 St, Rockaway Blvd, 104 St, and 111 St.

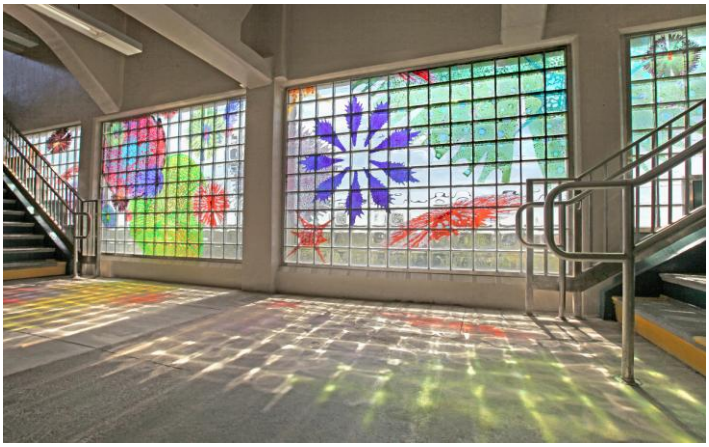
| STATION | ARTIST | TITLE |
|---|---|---|
| Inwood-207 St | Sheila Levrant de Bretteville | *At the Start... At Long Last, 1999* |
| Cathedral Pkwy (110 Street) | Christopher Wynter | *Migrations, 1999* |
| 81 St-Museum of Natural History | Arts For Transit Collaborative | *For Want of a Nail, 2000* |
| 59 St-Columbus Circle | Sol LeWitt | *Whirls and twirls (MTA), 2009* |
| 50 St | Matt Mullican | *Untitled, 1989* |
| 42 St-Port Authority Bus Terminal | Lisa Dinhofer | *Losing my Marbles, 2003* |
| Times Sq-42 St | Max Neuhaus | *Times Square, 1977-1992, 2002-present* |
| Times Sq-42 St | Roy Lichtenstein | *Times Square Mural, 2002 (Collage 1990, fabricated 1994)* |
| 34 St-Penn Station | Eric Fischl | *The Garden of Circus Delights, 2001* |
| 14 Street/8 Av | Tom Otterness | *Life Underground, 2001* |
| Canal St | Walter Martin and Paloma Muñoz | *A Gathering, 2001* |
| Chambers St/Park Place | Andrew Ginzel & Kristin Jones | *Oculus, 1998* |
| Fulton Center | James Carpenter Design Associates, Grimshaw Architects, ARUP | *Sky Reflector-Net, 2014* |
| Fulton St/William St | Frederick Dana Marsh | *Marine Grill Murals, ca. 1913; installed 2000; relocated 2011* |
| Jay St-MetroTech | Ben Snead | *Departures and Arrivals, 2009* |
| Franklin Av | Eric Pryor | *Life and Continued Growth, 1999* |
| Utica Av | Jimmy James Greene | *Children's Cathedral, 1996* |
| Broadway Junction | Al Loving | *Brooklyn, New Morning, 2001* |
| Far Rockaway-Mott Av | Jason Rohlf | *Respite, 2011* |
| Beach 25 St | Mauricio Lopez | *Past/Present/Future, 2011* |
| Beach 36 St | George Bates | *Symphonic Convergence 1&2, 2011* |
| Beach 44 St | Jill Parisi | *Coom Barooom, 2011* |
| Beach 60 St | Simon Levenson | *The Beaches of New York City,* |

| | | |
|---|---|---|
| | | *2011* |
| Beach 67 St | Ingo Fast | *On and Off the Boardwalk, 2011* |
| Beach 90 St | Michael Miller | *Surf Station 90, 2011* |
| Beach 98 St | Duke Riley | *Be Good or Be Gone, 2011* |
| Beach 105 St | Callie Hirsch | *Vast, 2011* |
| Rockaway Park-Beach 116 St | K K Kozik | *First on the Beach and Wednesday Night Fireworks, 2008* |


*For Want of a Nail* (2000) © Arts for Transit Collaborative, NYCT 81 St-Museum of Natural History station. Commissioned by MTA Arts & Design. Photo: Rob Wilson.



*Respite* (2011) © Jason Rohlf, NYCT Far Rockaway-Mott Avenue. Commissioned by Metropolitan Transportation Authority Arts & Design. Photo: Rob Wilson.



*(***Above***)* *Coom Barooom* (2011) © Jill Parisi. NYCT Beach 44 St station. Commissioned by Metropolitan Transportation Authority Arts & Design. Photo: Rob Wilson.

(**Right**) *Whirls and Twirls (MTA)* (2009) © Sol LeWitt, NYCT 59 St-Columbus Circle station. Commissioned by Metropolitan Transportation Authority Arts & Design. Photo: Vanni Archive Architectural Photography.

*Departures and Arrivals* (2009) © Ben Snead, NYCT Jay St-Metro Tech station. Commissioned by Metropolitan Transportation Authority Arts & Design. Photo: Collin LaFleche.

# Appendix G – Selected Closed Entrances

| Closed A C Station Entrances | | |
|---|---|---|
| **Station** | **Entrance** | **Station ADA Accessible** |
| 168 St | s/e corner of 167th St and St. Nicholas Av<br>west side of St. Nicholas Av at 167th St | Yes |
| 163 St | s/e corner of 163rd St and St. Nicholas Av<br>s/w corner of 163rd St and St. Nicholas Av | |
| 155 St | s/e corner of 153rd St and St. Nicholas Av<br>s/w corner of 153rd St and St. Nicholas Av | |
| 125 St | s/e corner of 124th St and St. Nicholas Av<br>n/w corner of 124th St and St. Nicholas Av<br>s/e corner of 126th St and St. Nicholas Av<br>n/w corner of 126th St and St. Nicholas Av | Yes |
| 116 St | n/e corner of 118th St and 8th Av<br>n/w corner of 118th St and 8th Av | |
| 110 St | n/e corner of 111th St and 8th Av<br>n/w corner of 111th St and 8th Av<br>n/e corner of 110th St and 8th Av | |
| 103 St | n/w corner of 104th St and Central Park West<br>s/w corner of 104th St and Central Park West<br>s/w corner of 102nd St and Central Park West | |
| 96 St | n/w corner of 95th St and Central Park West<br>s/w corner of 95th St and Central Park West | |
| 72 St | s/w corner of 71st St and Central Park West | |
| 59 St | n/w corner of 61st St and Central Park West | Yes |
| 50 St | n/e corner of 52nd St and 8th Av<br>s/e corner of 52nd St and 8th Av<br>s/e corner of 49th St and 8th Av | Yes (southbound/ west entrances only) |
| | s/w corner of 52nd St and 8th Av<br>s/w corner of 51st St and 8th Av<br>n/w corner of 52nd St and 8th Av | |
| W 4 St | s/e corner of Washington Pl and 6th Av<br>s/w corner of Washington Pl and 6th Av<br>s/e corner of W 4th St and 6th Av<br>n/w corner of W 4th St and 6th Av | Yes |
| Spring St | s/e corner of Prince St and MacDougal St<br>n/e corner of Prince St and 6th Av<br>s/e corner of Charlton St and 6th Av<br>n/e corner of Charlton St and 6th Av | |
| Hoyt-Schermerhorn Sts | n/w corner of Schermerhorn St and Hoyt St<br>s/w corner of Schermerhorn St and Hoyt St | |

| Closed A C Station Entrances | | |
|---|---|---|
| **Station** | **Entrance** | **Station ADA Accessible** |
| Franklin Av | n/e corner of Fulton St and Classon Av<br>s/e corner of Fulton St and Classon Av | Yes |
| Nostrand Av | n/e corner of Fulton St and Bedford Av<br>s/e corner of Fulton St and Bedford Av<br>n/e corner of Fulton St and Arlington Pl<br>s/e corner of Fulton St and Arlington Pl | |
| Ralph Av | n/w corner of Fulton St and Howard Av<br>s/w corner of Fulton St and Howard Av | |
| 88 St | n/e corner of Liberty Av and 86th St<br>s/e corner of Liberty Av and 86th St | |
| 104 St | n/w corner of Liberty Av and 102nd St<br>s/w corner of Liberty Av and 102nd St | |

Note: The above table is not a comprehensive list of all closed street stairs, but rather closed street stairs that lead to closed entry areas. Closed entry areas and stairs exist at additional stations, but have not been included due to their limited potential utility. The above closed entrances represent varying levels of opportunity for expanding access to the paid area of stations. Some of these stairs/entry areas could be reopened at relatively low cost, by uncovering a stair, rehabilitating the area, and installing fare control devices; reopening others would require considerable construction and capital expenditure due to changing land use, the need to relocate NYC Transit infrastructure present in the closed area, or the need to substantially redesign the closed area for various reasons. ADA elevator access would also be required at non-ADA accessible stations under the current FTA interpretation of ADA

### Case Study: Closed Entrances at Nostrand Av

Nostrand Av has two sets of closed entrances and constrained, often crowded entrances and exits at Nostrand Av and Fulton St. One set of closed entrances is on the northeast and southeast corners of Bedford Av and Fulton St. These stairways connect to a long-closed mezzanine area and two passageways to the northbound and southbound platforms. Opening the closed Bedford Avenue entrance at the Nostrand Av station would ease congestion at the current entrances and stairways at Nostrand Avenue, and at street level, as well as reduce uneven loading on the A and C trains that results from all customers accessing and departing the station via the Nostrand Av entrance. Customers going to and from areas west of Nostrand Avenue, including those making bus connections with the B26, B44, B44 SBS, and B49 at Bedford Avenue, would save over 600 feet of walking distance. The second set of closed stairways is at a closed entrance exclusively serving the northbound platform at Fulton Street and Arlington Place. Reopening solely this entrance could achieve many of the same benefits as reopening the Bedford Av entrances in one direction, at lower cost. Capital funding has not been identified for these projects, which would require elevators for accessibility.