# Review of the G Line

New York City Transit

July 10, 2013

# Executive Summary

The attached report provides a comprehensive review of operations on the G line. Based on NYC Transit's standard measures of On-Time Performance and Wait Assessment, the G performs well relative to the average subway line.

At the same time, the G differs from other NYC Transit subway lines because the route is relatively short and never enters Manhattan, and thus serves primarily as a feeder/distributor with most riders transferring at least once before reaching their destinations.

This review identifies a number of opportunities to improve operations on the G line, with recommendations chiefly intended to provide more even train headways and passenger loading, as well as to improve customer communication.

**Key Findings:**

- While G ridership has grown significantly in recent years, it still remains relatively low compared to the rest of the system, and average passenger loads on the G are within service guidelines during both peak and off-peak hours.
- Scheduling the G train around the busier and more frequent F train causes uneven headways and passenger loads on the G, most significantly during the afternoon peak period, when G service is scheduled at the minimum guideline frequency of 6 trains per hour (an average 10-minute headway).
- G riders make twice as many transfers as the average subway rider; this high transfer rate is inconvenient for customers who must wait for multiple trains.
- Trains shorter than the platform length cause uncertainty about where the G train stops, contributing to uneven passenger loads.

**Key Recommendations:**

- By mid-2014, increase the frequency of G service during the afternoon peak period from 6 to 7½ trains per hour between approximately 3:00 p.m. and 9:00 p.m., contingent on funding. By reducing average headways from 10 minutes to 8 minutes, the G timetable will mesh more effectively with the F timetable, evening out wait times and passenger loads.
- By mid-2014, revise the G timetable to provide more even headways between Hoyt-Schermerhorn Sts and Court Square, and implement more effective mid-route supervision. This will provide for more consistent wait times and more even passenger loads.
- By the end of 2013, adjust selected train stopping positions to better accommodate the short G trains, to make weekday and weekend stopping positions uniform, and to encourage more even passenger loads throughout the trains. Adjust additional stopping positions requiring infrastructure changes by mid-2014.
- By the end of 2013, install signs on G platforms to better communicate train stopping positions to customers.

# Introduction

The G operates on the Crosstown Line north of Bergen St between Brooklyn and Queens and shares tracks with the F in South Brooklyn. Ridership on the G has increased rapidly in recent years, in part because it provides access to many fast-growing neighborhoods, including Williamsburg and Greenpoint. While the G line's ridership is high compared to lines in many other systems nationally, it remains among the least traveled lines in New York City. On the Culver Line, where the G must share tracks with the busier, more crowded F train between Bergen St and Church Av, the F takes precedence and the less frequent G must be scheduled around the more frequent F.

The G functions as a feeder/distributor line, with many riders transferring to and from other lines to complete their trips; its riders make twice as many transfers as the system average. Due to the high transfer rate, G riders experience longer wait times when scheduled train frequencies are low.

This report is organized into five sections followed by options and recommendations for changes:

- Service Design and Scheduling addresses recent and potential changes to the service, operational issues that affect scheduling and delay management, and transfers.
- Train Frequency and Ridership examines the relationship between ridership, train frequency, crowding, and train length.
- Operational Performance evaluates indicators such as wait times and on-time performance.
- Customer Communication reviews existing and future communications systems along the line.
- Infrastructure reports on the condition of the G line's infrastructure, recent and future work on the line, and the operational impact of this work.
- Next Steps presents options to improve the line's performance.

Finally, appendices provide additional information about the G line.

## G Vitals

| | |
|---|---|
| **Route Miles:** | **11.4** |
| **Stations:** | **21** |
| **Stations without Transfers:** | **10** |
| **Transfer Opportunities** | |
| **In-Station (8 lines):** | **11 Stations** |
| **Cross-Platform (2 lines):** | **1 Station** |
| **G Trips with 1+ transfers:** | **76%** |
| **AM Peak Trains Per Hour:** | **9** |
| **PM Peak Trains Per Hour:** | **6** |
| **Average Weekday Riders:** | **125,000** |
| **Total Annual Riders:** | **40 Million** |
| **Share of Subway System Trips:** | **2.4%** |
| **Share of Subway Turnstile Registrations:** | **1.4%** |
| **Boroughs:** | **Brooklyn, Queens** |
| **Neighborhoods:** | **Kensington, Windsor Terrace, Park Slope, Gowanus, Carroll Gardens/Red Hook, Cobble Hill, Downtown Brooklyn, Ft. Greene, Clinton Hill, Bedford-Stuyvesant, Williamsburg, Greenpoint, and Long Island City** |

# Service Design and Scheduling


The G line connects Brooklyn and Queens and, built as the "Crosstown Line," is the only New York City Subway line, other than two shuttles, that does not serve Manhattan.

The G line's service design and schedule have changed a number of times since the 1990's. This section discusses recent changes to G service, the flexibility of the line's infrastructure, scheduling issues, and transfers.

## Recent Changes in G Service

### Service to Forest Hills and Improved Court Square Transfers

Prior to 1997, the G train operated between between Smith-9 Sts and Forest Hills-71 Av weekdays (including evenings), 179 St late nights, and Court Sq on weekends. From 1997 to 2001, G trains operated only between Smith-9 Sts and Court Square on nights and weekends due to construction on the 63 Street Connector; at those times, the G did not operate to Forest Hills-71 Av.

With the opening of the 63 Street Connector in October 2001, the Queens weekday terminus of the G train was changed to Court Square to provide capacity along the Queens Blvd line for the new Queens–Manhattan V (now M) service. At the same time, G service along the Queens Blvd line to Forest Hills-71 Av was restored late evenings, nights and weekends, when local track capacity was available. However, because of limited terminal capacity in Queens, late evening G trains could only run every 15 minutes over the entire length of the line; this was less service than called for by NYC Transit service guidelines.

As part of this service change, improvements were made to ease transfers at Court Square, including a free MetroCard walking transfer to the 7 and a moving walkway between the G and the EV (now EM) services.[1] In addition, G service frequency was increased from 6 trains per hour (tph) to 9 tph in the morning rush and to 8 tph in the evening rush. To provide the increased frequency, G trains were necessarily shortened from six to four cars. Running four-car trains every 6.5-minutes (the "headway") maintained the same peak capacity as the prior service design of six cars on 10-minute headways. Fewer riders per train also reduced platform and stairwell crowding at major transfers.

In the following years, construction frequently required the G to be suspended between Court Square and Forest Hills-71 Av on weekends. In 2010, late evening, overnight and weekend G service was permanently rescheduled to terminate at Court Square. Because ongoing construction activity will limit weekend capacity on the Queens Boulevard tracks for the

[1] In 2011, the MetroCard walking transfer to the 7 at Court Square was converted to an in-system transfer with an enclosed escalator and an elevator between mezzanines to improve G riders' access to the 7 to Manhattan and Queens.

foreseeable future, G service to Forest Hills cannot be restored without reducing service between Queens and Manhattan.

### Permanent Extension to Church Av

Beginning in July 2009, the G was extended by five stops at its south end from Smith-9 Sts to Church Av. This extension, which costs approximately $2 million annually to operate, was initially implemented to accommodate the rehabilitation of the Culver Viaduct over the Gowanus Canal.

The extension to Church Av, made permanent in 2012, improves connectivity between northern and southern Brooklyn and provides a direct transfer between the G and R trains at 4 Av-9 St. Additionally, because Church Av has better facilities for terminating trains and accommodating operating crews, the extension improves terminal operations and limits the potential for delays associated with relaying trains.[2]

### Weekend Service

On weekends, service currently runs with One Person Train Operation (OPTO), and at some stations trains stop at different locations than on weekdays due to sightline considerations.

## Interlockings and Service Changes

The G train's route includes six interlockings – track and signal arrangements that allow trains to cross between tracks controlled by towers.[3] Three of them are critical to daily operations on the G:

- Court Square interlocking serves the north terminal.
- Bergen St interlocking processes the merge/diverge with the F.
- Church Av interlocking serves the south terminal.

Additional interlockings located at Nassau Av, Bedford-Nostrand Avs, and 4 Av-9 St allow trains to be rerouted and terminated short of their regular terminals when required by scheduled work or service disruptions.

While the G and A C run side-by-side at Hoyt-Schermerhorn Sts, there is no G interlocking at that location, either connecting the two G tracks or connecting the G with the A C tracks, because the grades and curves on either side of the station preclude the installation of track switches.

See full track and interlocking diagram for the G in Appendix D.

[2] A relay is a series of movements that reverse a train's direction when it does not change directions at a platform. For example, a southbound train relaying at Church Av would a) discharge passengers on the southbound local tracks, b) move south of the terminal, c) have its train operator walk from the south operating cab to the north cab, and d) move back into the terminal station on the northbound local track to pick up passengers.

[3] A tower is a field office where operating staff control train traffic on a section of one or more lines through one or more interlockings. Some towers control a single interlocking, as is the case for most interlockings on the G.

During construction for the Culver Viaduct rehabilitation and, prior to that, the Bergen St interlocking modernization, scheduled outages on the southern portion of the line were fairly common. Now that these projects have been completed, customers riding on the G south of Bedford-Nostrand Avs should expect fewer planned outages than in the recent past. However, as detailed in the Infrastructure section of this report, major work to repair systems damaged by Superstorm Sandy will necessitate tunnel closures between Nassau Av and Court Square for 12 weekends during the summer 2013 and for a full five-week period during summer 2014.

## Service Flexibility and Delay Management

When unplanned delays occur, NYC Transit can deploy a variety of recovery strategies, including holding trains in stations to even out headways, terminating trains prior to their regular terminals to fill gaps in the opposite direction, rerouting trains from other lines to compensate for delayed service, and directing train crews to skip stations in order to reach their final terminals in time to make return trips.

As noted above, the G operates over a mostly two-track railroad with a relatively inflexible track layout. This has delay management implications, as some of the techniques used to mitigate delays on other lines are not possible on the G: along most of the line there are no parallel express tracks that can be used for rerouting trains, and there are few places to short-turn trains.

Between its two terminals, the G is monitored and controlled at two locations:

- Tower operators are assigned to Hoyt-Schermerhorn Sts at all times except late nights. While they can monitor G trains and hold them at the station, they primarily manage the operation of the A and C trains at that location.
- Tower operators are assigned to Bedford-Nostrand Avs during weekday peak and midday periods, as well as during planned off-peak service changes for construction requiring use of the middle track. This staffing allows for some delay management actions; when there are disruptions on one half of the line, trains can be short-turned at Bedford-Nostrand Avs so that the other half of the line may be served.

While delay management options on the G are limited by its track layout, the line's relatively long headways and short route make returning trains to their schedule relatively easy at the terminals, minimizing delays in the opposite direction.

## Timetables

The G timetable is based on running times between key stations and the need to integrate with the F train's schedule between Church Av and Bergen St.

### Running Time Performance

NYC Transit studied G terminal operations and found them to be satisfactory. Departures from Court Square and Church Av are generally on-time, and an analysis of running times during the spring of 2013 indicates that the G is scheduled with adequate time between stations and terminals.

### Uneven Scheduled Headways

G trains entering service at Church Av during the peak hours are scheduled around the more frequent and heavily loaded F trains that travel on the same tracks. The F train is scheduled at 14 tph during the a.m. peak, and northbound F headways must be as even as possible to accommodate merges, first with M trains in Manhattan and then with E trains in Queens. Accommodating the higher-ridership F on the shared tracks causes uneven scheduled G service during rush hours. In the a.m. peak, G scheduled headways range from five to ten minutes, and in the p.m. peak scheduled headways range from 7½ to 12½ minutes.

**Sample F and G a.m. Scheduled Departures at Bergen St**

| Line | Departure | Headway |
|---|---|---|
| F | 7:40:30 a.m. | 5:00 |
| G | 7:42:30 a.m. | **9:00** |
| F | 7:45:30 a.m. | 5:00 |
| G | 7:48:30 a.m. | **6:00** |
| F | 7:50:30 a.m. | 5:00 |
| F | 7:55:30 a.m. | 5:00 |
| G | 7:57:30 a.m. | **9:00** |
| F | 8:00:30 a.m. | 5:00 |
| G | 8:02:30 a.m. | **5:00** |
| F | 8:05:30 a.m. | 5:00 |
| G | 8:08:30 a.m. | **6:00** |
| F | 8:10:30 a.m. | 5:00 |
| F | 8:15:30 a.m. | 5:00 |
| G | 8:17:30 a.m. | **9:00** |
| F | 8:19:30 a.m. | 4:00 |
| F | 8:23:30 a.m. | 4:00 |
| G | 8:25:30 a.m. | **8:00** |
| F | 8:27:30 a.m. | 4:00 |
| F | 8:31:30 a.m. | 4:00 |
| G | 8:33:30 a.m. | **8:00** |
| F | 8:35:30 a.m. | 4:00 |
| F | 8:39:30 a.m. | 4:00 |
| G | 8:41:30 a.m. | **8:00** |
| F | 8:44:30 a.m. | 5:00 |
| G | 8:47:30 a.m. | **6:00** |
| F | 8:49:30 a.m. | 5:00 |
| F | 8:54:30 a.m. | 5:00 |
| G | 8:56:30 a.m. | **9:00** |
| F | 8:59:30 a.m. | 5:00 |
| F | 9:04:30 a.m. | 5:00 |
| G | 9:06:30 a.m. | **10:00** |
| F | 9:09:30 a.m. | 5:00 |

Uneven scheduled service can result in uneven loading, which, in turn, makes service even more uneven as longer scheduled gaps between trains tend to widen along the line and shorter gaps tend to narrow. Ridership checks performed in the spring of 2013 found that northbound G trains with passenger loads above guidelines often followed a long gap in service, while trains following relatively short headways tended to carry light loads. (See Train Frequency and Ridership section for more discussion.) This dynamic can lead to the perception of lower than scheduled train frequency.

In the p.m. peak, increasing G frequency from 6 to 7.5 tph, resulting in an 8-minute headway, would significantly improve G service regularity by better integrating with the F train's 4-minute headway during this period. This change in service would increase NYC Transit annual operating costs by an estimated $700,000.

### Holds

Throughout the day, a strategy for evening out uneven headways in the timetable is to implement train "holds" northbound at Hoyt-Schermerhorn Sts. Holds are accomplished via holding lights, operated by staff in the tower, which instruct train crews to wait in the station. Scheduled holds are typically no longer than two minutes. Southbound, holds are intended to fit the G trains between the F trains in the schedule. Northbound, holds can help even out headways, so that waits and passenger loads are more regular over the Crosstown Line, which has heavier ridership than the shared Culver Line segment.

A limited number of "holds" are scheduled in the timetable for G trains at Hoyt-Schermerhorn Sts. Currently, however, holds are rarely implemented as scheduled at Hoyt-Schermerhorn Sts because of limited staff resources at the tower focused mainly on A and C service, and holds

in the timetable that emphasize the southbound merge with the F instead of evening out headways northbound.

### Coordination of Transfers with Other Lines

Despite the importance of transfers to G riders, scheduling connections between lines is generally not feasible. NYC Transit's general policy directs conductors and train operators to hold trains for cross-platform connections during off-peak times when doing so would not adversely affect on-time operations. During rush hours, however, holding for cross-platform connections is discouraged to avoid delaying following trains or causing uneven loads onboard trains. On the G, this policy applies to the A C transfer at Hoyt-Schermerhorn Sts, the only location on the line that offers cross-platform transfers to other lines.

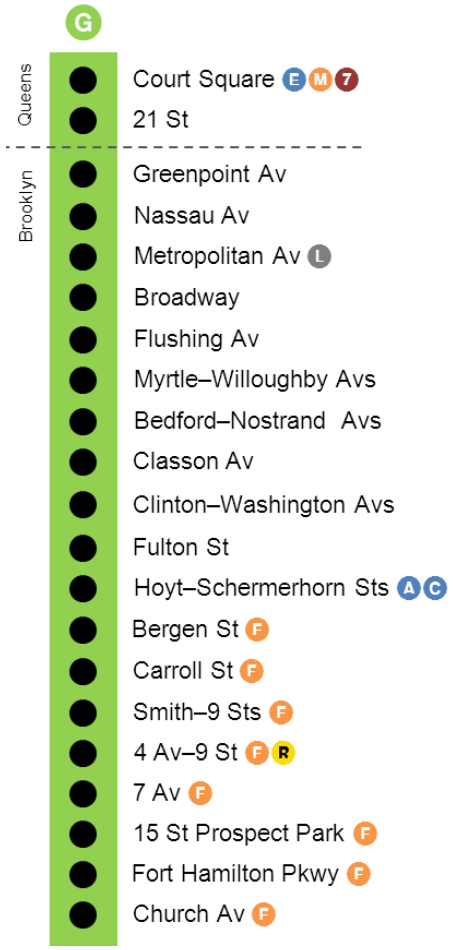
## Transfers

### Feeder/Distributor Role and the Need to Transfer

For most passengers, the G serves as a "feeder/distributor" that helps riders travel to and from lines connecting with Manhattan. According to NYC Transit's ridership model, G riders make an average of 1.0 in-system subway-to-subway transfer per trip – more than riders of any other line (excluding the three shuttles) and more than double the systemwide average of 0.45 transfers per trip.

| Transfers | System | G |
|---|---|---|
| 0 | 59.5% | 24.1% |
| 1 | 35.9% | 54.9% |
| 2 | 4.3% | 19.4% |
| 3+ | 0.3% | 1.6% |
| **Average Transfers** | **0.45** | **1.00** |

G riders are more than four times as likely as the average system rider to make multiple transfers in a trip. With over 20% of riders making two or more transfers, the G also has substantially more multiple-transfer riders than other lines that do not serve both midtown and lower Manhattan. On the L, which reaches neither lower Manhattan nor midtown, fewer than 11% of riders must make two or more transfers, while on the J, which does not go to midtown, 12.6% must make two or more transfers. On the D, which does not go to lower Manhattan, 10% of riders must make two or more transfers. The need to transfer on the G can lead to longer travel times and to less reliable door-to-door trips.




### In-Station Transfers

Riders on the G train are currently able to transfer to trains on other lines at four locations, plus along the shared segment with the F:

- Court Square has passageways to/from the 7, E, and M trains, providing service to Manhattan and further into Queens.
- Metropolitan Av has a passageway to/from the Lorimer St L station, providing access to Manhattan and along the Canarsie Line in Brooklyn.

- Hoyt-Schermerhorn Sts has transfers to/from the A C trains, with cross-platform transfers for the most common transfer moves.
- Between Bergen St and Church Av, where the G shares tracks with the F train, riders can transfer to/from the F at any shared station.
- 4 Av-9 St has transfers to/from the R (and late at night to/from the D and N) via stairs.

**Out-of-System "Walking" Transfers**

There have been requests for MetroCard walking transfers between the G and other nearby stations. These transfers would benefit only pay-per-ride MetroCard customers, as unlimited ride MetroCard customers can already make these transfers at no additional cost. Over 49% of NYC Transit subway customers currently use unlimited ride passes.

Under NYC Transit policy, MetroCard walking transfers between subways are established only to mitigate permanent or temporary service changes. The only permanent MetroCard walking transfer currently in the system is between the Lexington Av-63 St F station and the 59 St 4 5 6/Lexington Av N Q R station; this was established to maintain a connection between the F and the Lexington Av Line when the F was rerouted from the 53 St Line to the 63 St Line in 2001. Walking transfers cannot be implemented on the G without modifying NYC Transit policy systemwide.

The two most commonly requested MetroCard walking transfers are between the Broadway and Lorimer St stations and between the Fulton St and Atlantic Av-Barclays Center stations.

*Broadway G – Lorimer St J M*

The G crosses below the elevated Jamaica Line, but there is no physical transfer connection between the two lines. The Broadway G station is located approximately 600 feet from the nearest Lorimer St J M station entrance. An out-of-system MetroCard walking transfer between Broadway and Lorimer St was temporarily established in 1999 as mitigation for the Williamsburg Bridge closure, which suspended J M Z service between Brooklyn and Manhattan for four months while the bridge was under construction.

Adding the Broadway-Lorimer St walking transfer would provide network benefits by shortening some trips and providing an additional route to Manhattan for G riders. An analysis of recent data showed that currently 2,300 riders per average weekday make a Broadway-Lorimer St transfer. Slightly over half of these riders use unlimited ride MetroCards. Converting the pay-per-ride fares to free transfers would result in an annual revenue loss of approximately $770,000, assuming reasonable restrictions to limit, though not eliminate, multiple trips for the price of one entry. Without these restrictions, annual revenue loss would increase to $1.1 million.

*Fulton St G – Atlantic Av-Barclays Center B D N Q R 2 3 4 5*

While a walking transfer between Fulton St on the G and the Atlantic Av-Barclays Center station complex may be useful for certain trips, the distance between the closest entrances is over 1,200 feet, significantly greater than any in-system transfer distance. The most direct route between the stations requires up to seven minutes to walk. This transfer would largely benefit trips within Brooklyn, since most trips to/from Manhattan would be faster by transferring to/from the A C at Hoyt-Schermerhorn Sts.

Given current ridership patterns, an estimated 4,000 trips per weekday would be eligible for a MetroCard walking transfer, slightly under half of which use pay-per-ride MetroCards, which would result in an estimated annual revenue loss of $1.34 million with restrictions to reduce multiple trips for the price of one entry, and $7 million without these restrictions. Given the density of subway stations in Downtown Brooklyn and the heavy commercial activity in the area, restrictions would not clearly distinguish between transfers that improve connectivity and entries for a second trip that use the walking transfer to avoid paying a second fare. A significant portion of these "transfers" would likely be stop-overs by riders who travel to the area and then, within the MetroCard two-hour time limit, re-enter the subway at Fulton St once they are done with their activities.

## Addressable Issues Identified in Service Design and Scheduling[4]

- Integration with F train headways causes uneven service and loading.
- Control and monitoring of the G is limited.
- Scheduled holds are not functioning as designed.
- G riders make twice as many transfers per trip as riders in the full system.

[4] Addressable issues are those issues for which NYC Transit is making a recommendation in the Next Steps section of this report.

# Operational Performance

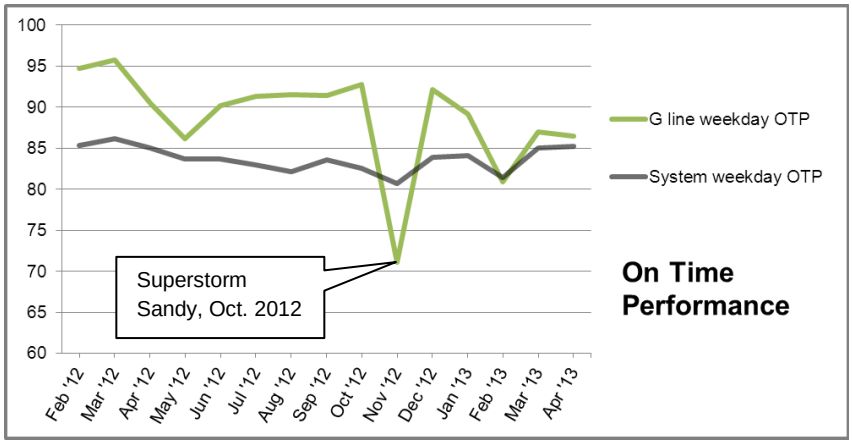
NYC Transit assesses operations and system conditions using several measures described in this section:

- On-Time Performance (OTP) compares actual arrival times at terminals with scheduled arrival times.
- Wait Assessment (WA) compares actual headways with scheduled headways.
- Mean Distance Between Failure (MDBF) measures the reliability of train cars in service.
- The Passenger Environment Survey (PES) assesses station and car conditions.

## On-Time Performance

On-Time Performance (OTP) measures how many trains arrive at their terminals within five minutes of their scheduled arrival times.[5] With a 12-month terminal OTP typically around 90%, the G has historically performed better than the average line in the system.

The figure below shows monthly OTP statistics for the G line from February 2012 to April 2013. The sharp decrease in November 2012 is due to Superstorm Sandy and its aftermath, before subway operations returned to normal. Preliminary 2013 statistics show the G dropping to around 86% OTP year-to-date, which reflects the ongoing effects of Sandy damage to electrical and signal infrastructure essential to train operations. Nevertheless, OTP on the G remains above systemwide levels.

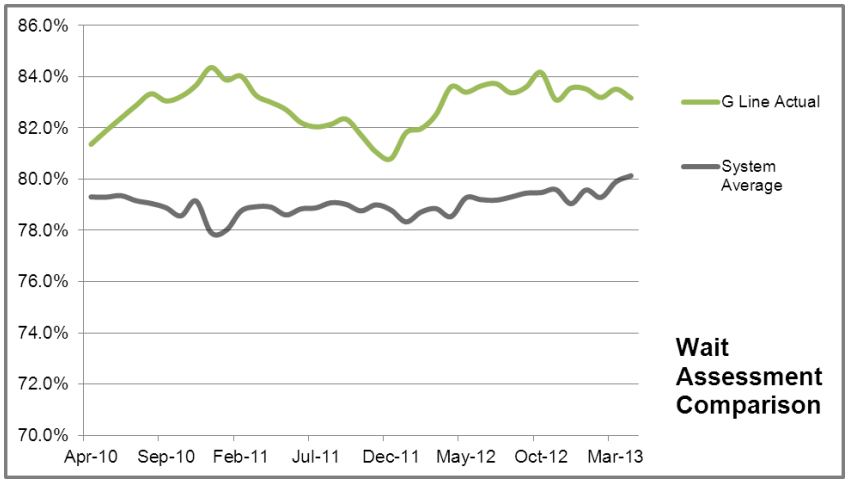



OTP is a good indicator of operational efficiency, but it has limited utility in measuring the quality of service that customers experience as they wait for trains at mid-line stations. For example, the G runs on an average scheduled headway of about 7 minutes during the a.m. peak. A train on that headway arriving 1 minute early followed by a train arriving 4 minutes and 59 seconds late results in an actual headway of nearly 13 minutes – a very long rush hour wait, especially for commuters who need to transfer to another line before reaching their destinations. By the OTP measure at the terminal, though, both trains would be considered "on time."

[5] 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 or a special event. Trains that skip any scheduled station stop are not considered on-time.

## Wait Assessment

Wait Assessment (WA) measures the percentage of trains that arrive at stations within 25% of the scheduled wait time, and thus provides a better picture of average customer experience.[6] WA on the G line has improved somewhat over a three year period, rising from 81.4% in April 2010 to 83.2% in April 2013, and it is consistently above the systemwide WA average of around 79%. The G has the best WA results of all lines, excluding the shuttle lines.




The G line's strong showing on OTP and WA, compared with the rest of the subway system, can be attributed in part to its short line length. At 11.4 miles from terminal to terminal, the G line is about half the system's average line length, and shorter lines tend to accumulate fewer delays. For the 7.1-mile Crosstown section of the line, the G does not share tracks with other lines, so operations on the Crosstown segment are generally less affected by delays that occur on other lines.

However, OTP and WA do not fully explain G train riders' experiences. For example, during the p.m. rush G trains are scheduled to run every 10 minutes on average. Due to irregular headways built into the G timetable to accommodate F trains running on the shared Culver line tracks, a number of northbound G trains are scheduled at a 12-minute headway during this period. If one of these trains runs three minutes behind schedule, then passengers who just missed the prior train would have a 15-minute wait. Despite this large gap in service, the train would pass both OTP and WA measures. This quirk of performance measurement can occur anywhere in the system, but the adverse effect on rider experience is amplified on the G line due to uneven, and relatively long, scheduled headways. For this reason, the OTP and WA performance indicators may mask irregularities in headways, loading, and customer experience, which are discussed further in the Train Frequency and Ridership section of this report.

## Mean Distance Between Failure

Mean Distance Between Failure (MDBF), which is tracked by car class, 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 5 minutes late. In March 2013, the combined average MDBF

[6] WA is measured weekdays between 6:00 a.m. and midnight and is defined as the percent of actual intervals between trains that are no greater than the scheduled interval plus 25%. Results are based on 12-month rolling sample data.

for R68 and R68A car classes – the two car classes operating on the G line – was 129,230 miles, compared to a systemwide average of 163,739.

While the cars assigned to the G have somewhat lower MDBF than the average NYC Transit subway car, this does not appear to affect service on the G line as measured by other key performance indicators: On-Time Performance and Wait Assessment are both relatively high, as discussed above.

## Passenger Environment Survey

The Passenger Environment Survey (PES) provides an assessment of the conditions that subway riders encounter in stations and on board 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.

Riders on the G experience a relatively clean and comfortable environment, as recorded by the PES. From July to December 2012, PES statistics show that the G outperformed the system average by 17% for litter in stations measured after the a.m. peak; it performed 6% better than the system average for floor and seat cleanliness in stations measured after the a.m. peak; and 100% of G trains fall in the acceptable range (58°-78°F) for subway car interior temperature. See Appendix B for more detailed PES results.

# Train Frequency and Ridership

New York City Transit loading and frequency guidelines establish service levels, where operationally feasible, based on the average number of riders at a line's most heavily loaded point. G ridership is relatively light, which accounts for its comparatively infrequent service. Although G ridership has grown in recent years, loading surveys confirm that it has not outgrown the capacity provided by its trains at current scheduled frequencies. This section also addresses the ramifications of increasing train length.

## Train Frequency: Based on Service Guidelines

NYC Transit Service 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:

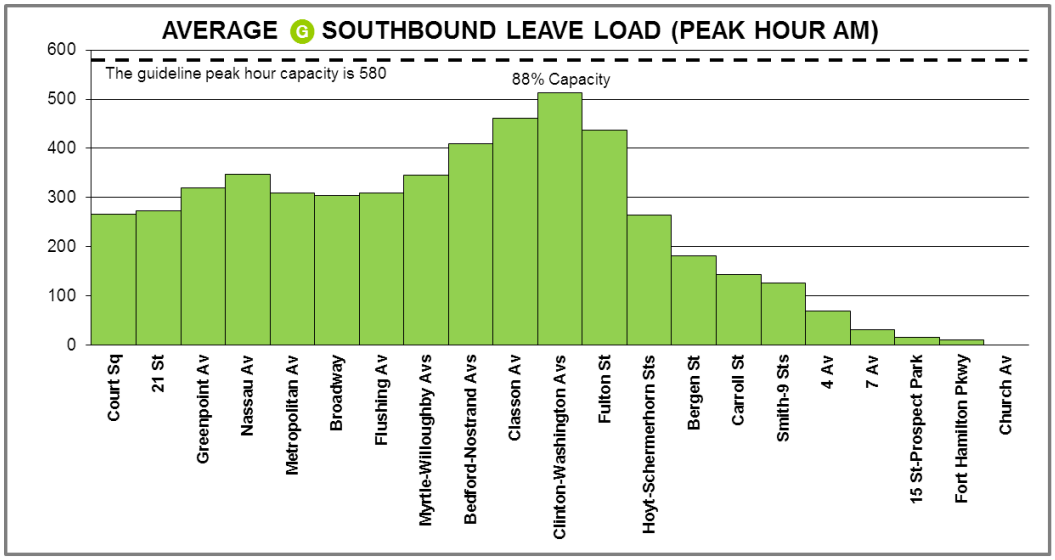
1. Minimum service frequencies, which vary by time of day and day of week.
2. Maximum average loads, which vary depending on service frequency during peak hours. Lower maximum passenger loads are allowed on lines with less frequent service.

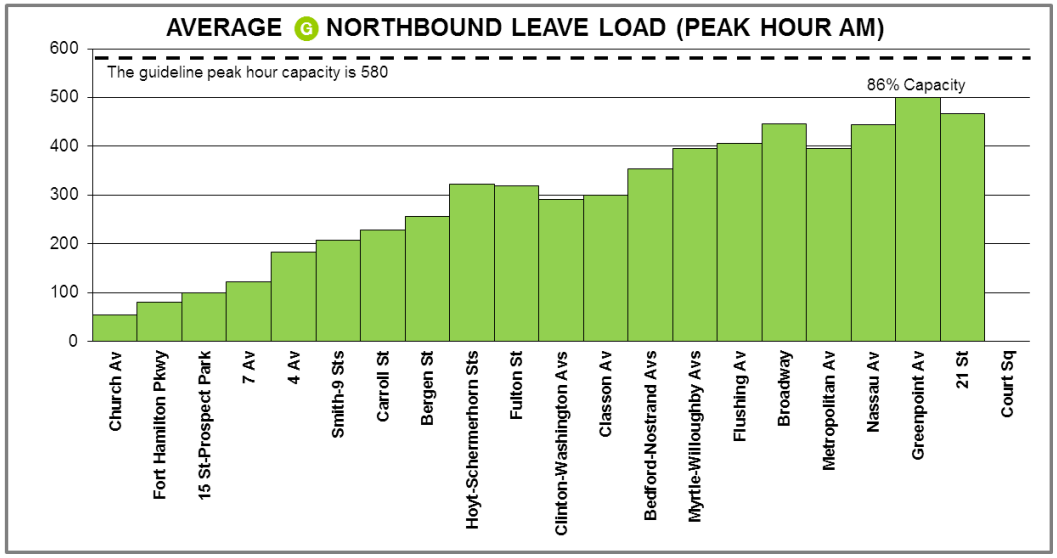
Service frequencies and loading sometimes cannot conform to guideline levels due to operational constraints such as track capacity, car availability, and the need to accommodate construction work.

Service frequencies established by the loading guidelines are based on the number of riders where trains are most crowded during the highest ridership hour – at a line's "peak load point." On the G, the northbound and southbound peak load points are, respectively, at Greenpoint Av and Clinton-Washington Avs in the morning peak and at Fulton St and 21 St during the evening peak. Based on current scheduled frequencies at these points, the maximum average loads defined by the guidelines are 580 passengers per train during the a.m. peak hour and 560 passengers per train during the p.m. peak hour, if operationally feasible.[7]

[7] For comparison, at frequencies of 15 tph and above, the loading guidelines define a maximum average of 700 passengers per train, if operationally feasible, on cars used by the G. This peak-period maximum frequency loading guideline is based on three square feet per standing passenger and all seats occupied.

The below charts show the average passenger loads on a typical morning rush hour G train as it leaves each station: [8]




As with all subway lines, ridership on the G is periodically measured to ensure that the line is scheduled within service guidelines, when feasible. Due to relatively light ridership compared with other lines, the G line's scheduled service is based on the minimum guideline frequencies[9] at all times except during the a.m. peak hour and Sundays. During weekday a.m. periods, current G ridership levels justify a peak hour scheduled frequency of 9 tph (a 6½-minute headway), which is 3 tph above the minimum guideline frequency. Sunday service is scheduled slightly above the minimum guideline frequency at 6 tph (10-minute headway).

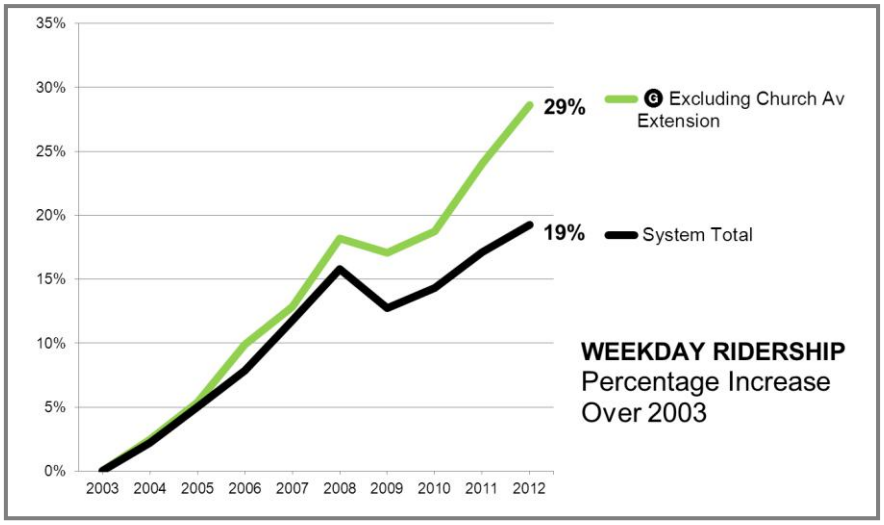
[8] The passenger loads shown in these charts are averages calculated by NYC Transit's ridership model; the results are calibrated based on actual counts from loading surveys at peak load points and other key stations. Charts are not shown for the p.m. peak because hourly ridership is lower in the evening.

[9] Minimum frequencies are 6 tph (10-minute headway) on weekdays and Saturdays, 5 tph (12-minute headway) on evenings and Sundays, and 3 tph (20-minute headway) during late nights.

While running the G at minimum service frequencies, including during the p.m. rush, is appropriate based on current NYC Transit Service Guidelines, this service frequency results in significant waits for the majority of G riders who make one or more subway-to-subway transfers per trip. Especially during the p.m. rush, when scheduled G headways can be as long as 12.5 minutes, riders transferring to or from the G can expect added time and uncertainty in their commutes.

## Ridership on the G Line

Although G ridership has grown at a faster pace than the full system in recent years, it nevertheless accounts for only about 1.4% of the system's total MetroCard entries and 2.3% of all subway trips, once transfers are taken into account. As noted above, average loading on G trains remains within NYC Transit's loading guidelines.[10]




As outlined in the Service Design section of this report, a number of changes to G service were made between 2001 and 2012, all of which affected the line's total ridership. Service changes related to construction, such as the closure of Smith-9 Sts from mid-2011 to early 2013, also adversely affected ridership. Despite these impacts, ridership has grown at all times of the day and week in recent years.

### Ridership Growth in Context

Between 2003 and 2012, G ridership rose from an estimated 1.1% to 1.4% of total recorded MetroCard entries to the system. However, much of that increase was due to the new riders on the Church Avenue extension. Absent those riders, G system entries only increased 0.15 percentage points (to 1.25%) as a proportion of total system entries.

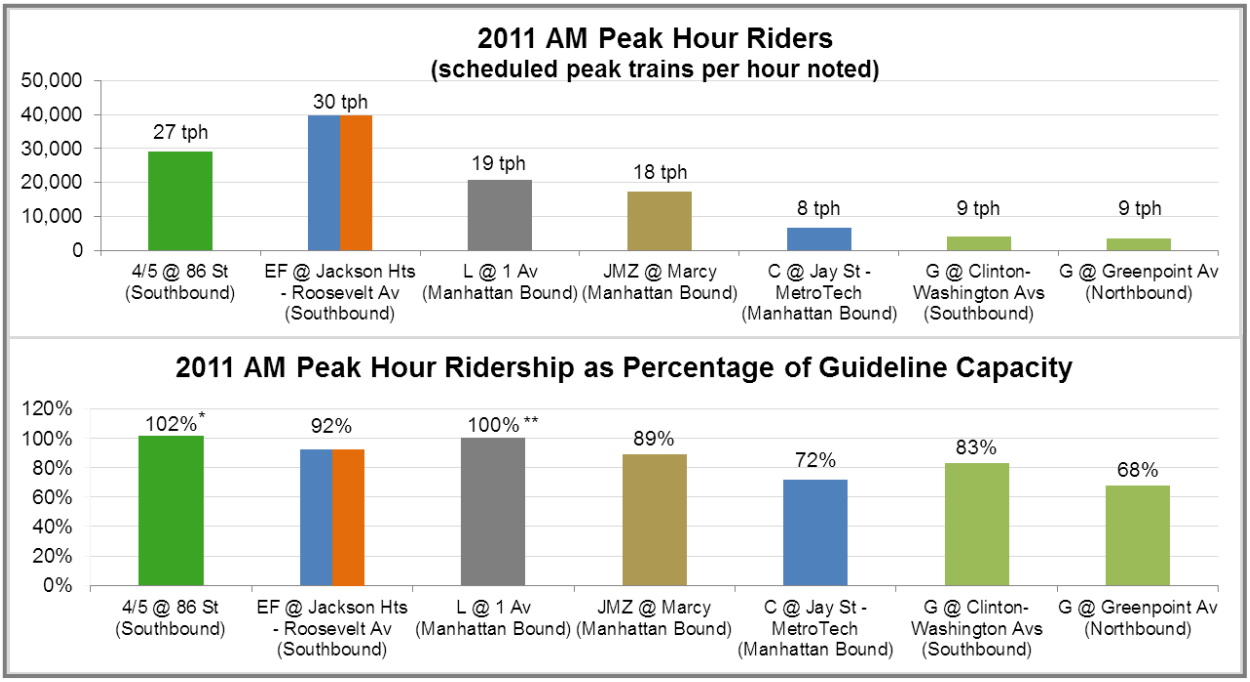
Ridership growth alone does not translate into a need for increased service if there is still available train capacity at current frequencies, per guidelines, or if other constraints limit more frequent service. Between 2010 and 2013, average loads at the peak points have remained well within guideline levels during the morning and evening rush hours as shown in the below table.

[10] Unless otherwise noted, ridership statistics in this section are based on MetroCard station entries for the entire G line, and include estimated shares of entries at G stations serving multiple lines, such as Carroll St and Court Square. Passenger loading estimates are based on actual counts in the field.

| Station | Direction and Time | 2010 Guideline Percentage | 2011 Guideline Percentage | 2012 Guideline Percentage | Preliminary 2013 Guideline Percentage |
|---|---|---|---|---|---|
| Clinton-Washington Avs | SB a.m. | 87% | 83% | 77% | 88% |
| Greenpoint Av | NB a.m. | 78% | 68% | 74% | 86% |
| 21 St (Court Sq 2013)* | SB p.m. | 61% | 71% | 75% | 72% |
| Fulton St (Hoyt 2013)* | NB p.m. | 73% | 70% | 73% | 74% |

** Preliminary 2013 figures are based on surveys conducted for this report, while 2010-2012 figures are from larger year-round samples. Since the 2013 surveys did not include the usual p.m. peak load points, Court Square and Hoyt-Schermerhorn are used here as proxies for 21 St and Fulton St.*

G peak hour ridership is low compared with other lines in the system. As the chart below illustrates, the relative infrequency of G service, in scheduled trains per hour, is roughly proportional to its ridership, given that G trains are half the length of most other trains. Even at relatively low frequencies, however, G trains run well within guideline passenger capacity, so G riders are more likely than riders on more frequently run lines to have seats on the train.

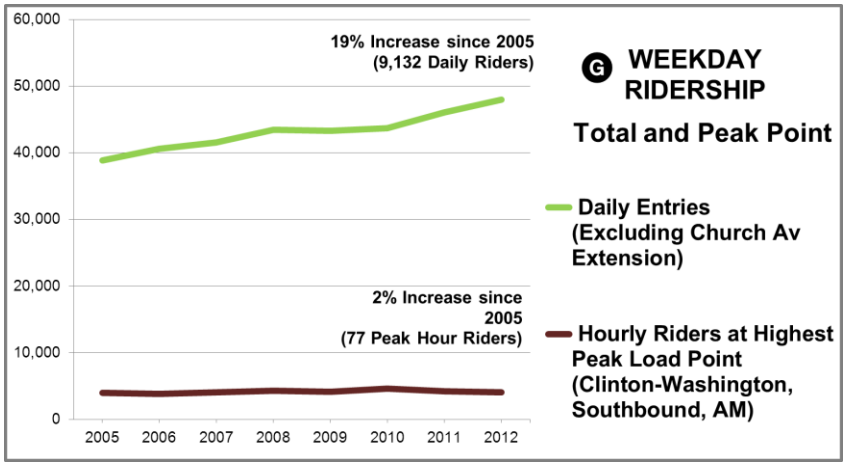



** 4 5 a.m. peak service cannot be scheduled more frequently due to track capacity constraints. The Second Av subway should relieve some congestion on the Lexington Av line.*
***The chart shows 2011 data for all lines except the L, which is 2012 data. More L trains are on order for delivery by 2016 in order to further increase peak frequencies.*
*Note: These charts show selected lines in order to compare ridership on the G with that on lines that run through the same neighborhoods (L, J M Z, C) as well as busier lines elsewhere in the system (4 5, E F).*

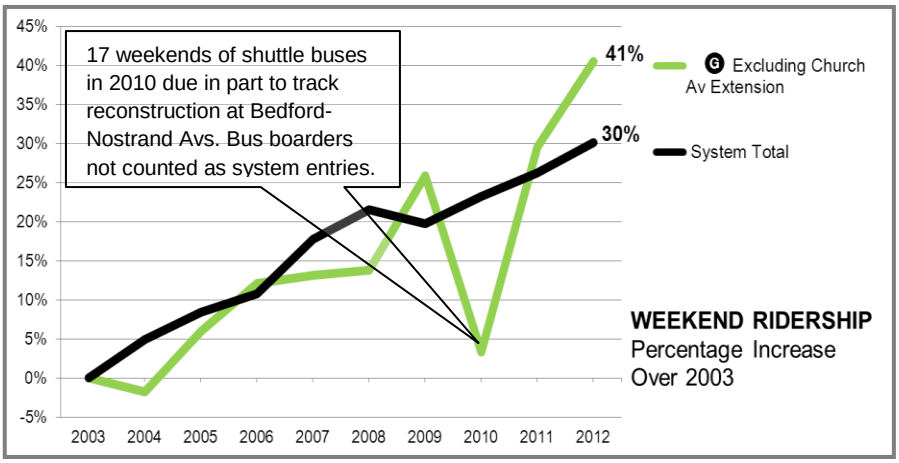
### Off-Peak Ridership

Ridership on the G has grown more slowly at the peak load points, which drive service frequency, than on the line as a whole. The G line saw a 19% increase in daily station entries at all stations between 2005 and 2012, while peak hour ridership at its busiest peak load point

(Clinton-Washington, southbound in the a.m.) increased negligibly during the same period. This suggests that most of the recent growth is outside of peak hours and peak load points.




Weekend ridership systemwide has risen in recent years, and the G has a higher proportion of weekend to weekday ridership than other lines as well as an increasing number of weekend late night riders. Nevertheless, weekend loading surveys on the G have shown that train loading is within guidelines. In 2012, systemwide weekend ridership was only 53% of weekday ridership.[11] For the full G line, this ratio was 57%, and for stations on the Crosstown section between Fulton St and 21 St, the ratio was 61%.




Due to service changes and diversions necessary for construction, weekend riders generally face longer headways and less regular service than weekday peak riders. As discussed in the Infrastructure section, it is necessary to perform construction and maintenance work on the subway during off-peak hours, when the system is relatively less busy. Off-peak passenger loads are permitted to rise above guideline levels in order to accommodate essential work.

## Loading Irregularities and Crowding

While G ridership during peak hours is within guidelines on average, at all stations and all times of day, irregular headways can result in crowding on some trains and increase the time trains dwell in stations. Loading surveys in the spring of 2013 frequently recorded train bunching, in which a late, relatively crowded train was closely followed by an early, lightly loaded train. Of 64 peak hour G trains observed, 11 trains (17.2%) carried above-guideline loads at the observed peak load points. In keeping with the pattern of irregular loading, three of the 64 trains were recorded below the full seated load level of 280 riders per train.

[11] Weekend ridership in this report refers to the average ridership per weekend day. This differs from other NYC Transit publications in which weekend ridership refers to the two day sum of average Saturday plus average Sunday ridership.

On the G, irregular loading is not only a problem between one train and the next. Similar to the findings of the F study in 2009 and the L study in 2011, G loading during the peak period also varies among cars, and even within cars. The short (300-foot) four-car length of the train exacerbates these imbalances in end cars when gaps in service occur during peak periods.

For example, the table below shows loading skewed toward the front of the train for all trains departing Broadway northbound during a typical a.m. peak hour. Car 1, the northernmost car, is more heavily loaded in each of the nine trains surveyed, and Car 4 nearly always has the lightest load. Headways are uneven, and after a long headway, Car 1 can be loaded above guidelines. If headways were even, so that the same total number of riders were divided evenly among trains (but not cars), the distribution would resemble the "peak hour average" in the bottom line of the table. The passenger load is still uneven across cars, but no car is over the guideline load of 145 passengers per car and there is significant unused capacity (about 30%) in Cars 3 and 4.

**Peak hour G trains departing Broadway northbound, March 19, 2013**

| Arrival | Departure | Headway | Car 1 | Car 2 | Car 3 | Car 4 | Train total | V/C* |
|---|---|---|---|---|---|---|---|---|
| 8:11:40 | 8:12:06 | 12:31 | 190 | 170 | 160 | 120 | 640 | 1.10 |
| 8:14:27 | 8:14:50 | 02:44 | 70 | 60 | 50 | 50 | 230 | 0.40 |
| 8:21:59 | 8:22:30 | 07:40 | 130 | 90 | 90 | 100 | 410 | 0.71 |
| 8:30:28 | 8:31:20 | 08:50 | 190 | 180 | 150 | 150 | 670 | 1.16 |
| 8:37:40 | 8:38:05 | 06:45 | 150 | 120 | 90 | 110 | 470 | 0.81 |
| 8:47:25 | 8:47:55 | 09:50 | 210 | 170 | 130 | 130 | 640 | 1.10 |
| 8:54:08 | 8:54:26 | 06:31 | 140 | 120 | 80 | 80 | 420 | 0.72 |
| 8:57:53 | 8:58:10 | 03:44 | 60 | 40 | 60 | 40 | 200 | 0.34 |
| 9:09:59 | 9:10:20 | 12:10 | 160 | 160 | 130 | 100 | 550 | 0.95 |
| **Guideline Load**** | | | **145** | **145** | **145** | **145** | **580** | **1.00** |
| **Peak Hour Average** | | | **144** | **123** | **104** | **98** | **470** | **0.81** |

**V/C (volume-to-capacity ratio) is the ratio of passenger load to guideline capacity.*
***On lines with heavier ridership, guideline loads reach 175 passengers per car.*

While 17.2% of 64 peak hour trains carried above-guideline loads at the observed peak load points, 22.2% of *individual cars* had loads above guideline. There is a clear tendency for rider volumes on G trains to be unevenly distributed, most often skewed toward the end cars. Due to uneven train spacing and uneven loading a significant number of riders on any given day experience crowding on trains that have ample room in other cars. Appendix F summarizes peak hour loading by car at surveyed stations.

### Contributors to Irregular Loading

There is a clear connection between irregular headways and uneven loading between trains. Some uneven loading between cars on a single train, however, is unavoidable as people choose which train car to board based on the locations of exits and transfers at the ends of their G trips, which are at the ends of platforms at many stations. A surge of passengers transferring from another line to the G can also cause uneven loading, for similar reasons: only two stairs bring riders transferring from the L to either G platform at Metropolitan Av, for example, and both stairs provide easiest access to the northernmost cars.

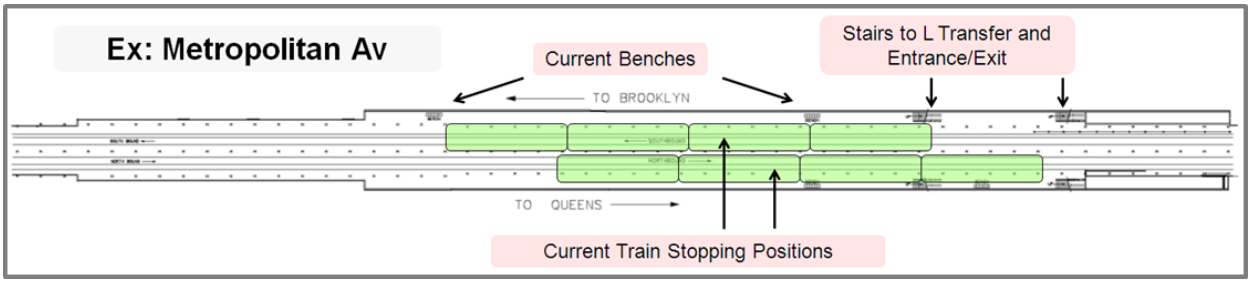
A major factor contributing to uneven loading is the G train's four-car length. The G train stops at platforms designed for longer trains, so regardless of where the train stops, one end of the train will always be at least 150 feet (and sometimes as far as 300 feet) from the end of the

platform. Where stairs are located at ends of the platform, some passengers necessarily find themselves positioned to most easily board one of the two end cars, resulting in end-car crowding. At several stations the G train stops at one location weekdays (operating with a train operator and a conductor) and at a different location on weekends (operating solely with a train operator),[12] which can cause some confusion.

Another contributor to uneven loading related to short train length is the lack of visual cues informing riders where the train will stop. Daily commuters and other routine G riders most often know where on the platform to wait for the train, but infrequent riders sometimes wait beyond the end of the train when it stops at the station, and thus board the nearest end car.

Additionally, in some stations, benches are situated outside of the train's stopping position, or at the first or last car, which can exacerbate loading issues and be inconvenient for customers.

The illustration below shows some of the issues caused by current train stopping positions and bench placements. Southbound trains stop a car length past the stairwell nearest to the L transfer and station entrance, forcing customers to walk farther than they would if the train stopped at the northernmost stairwell, and contributing to crowded rear cars in the afternoon rush. Additionally, one of the two benches on the southbound platform is located beyond the first car, leading to an unnecessarily long walk for waiting customers and further exacerbating front-car loading during the morning rush.




Terminal procedures can also contribute to uneven loading. In order for crews to change ends at terminal stations where trains change directions while stopped at the platform, standard NYC Transit procedure involves closing all but one door on each car when the train stops at a terminal, before reopening all doors prior to departure for the return trip. As a result, riders boarding the G train at Court Square have a tendency to gather near each car's open door. During peak periods, the end cars grow so congested at the open door that some riders choose to wait on the platform for other doors to open rather than squeeze into a crowded entry. Individual cars often end up unevenly loaded and uncomfortable to board. That uneven loading, and the delays it causes as riders try to board and exit through crowded corners of the cars, continue down the line.

## Train Length

As noted above, G trains are currently 300 feet long,[13] consisting of four 75-foot-long R68/R68A cars, and are always shorter than the platforms where they stop. This can lead to customers

[12] In some cases this is due to sightline issues at curved station platforms. At some stations, CCTV monitors serve as visibility aids at the conductor's position, at the train operator's position, or both. See Appendix C for a full list of stopping position issues.
[13] The "Service Design and Scheduling" section explains that G trains were shortened to four cars in order to increase frequency of service.

waiting at the wrong section of the platform and to extended station dwell times, as train operators and conductors sometimes delay the train's departure as a courtesy to customers coming from platforms areas outside of the train's stopping position. These inconveniences have led to occasional requests for full length, 600-foot G trains. However, longer trains would require more cars, cost more to operate, and most likely trigger reduced service frequency per guidelines, with adverse impacts on transfer flows. Longer trains would also be loaded far below guideline capacity at all times of day.

The R68 cars are linked into four-car units, so operation of five-, six-, or seven-car trains is not feasible. Expanding to 600-foot trains would require the acquisition of new cars at an approximate cost of $10 million per train (or $130 million for the full G fleet), and cars for longer G trains are not included in the capital program. Once purchased, each car also increases operating costs due to maintenance and power consumption.

Longer trains run at current frequencies would lead to a considerable reduction in loads carried per car. If trains were lengthened to eight cars at the current frequency, the average car at the morning peak load point of Clinton-Washington Avs would hold only 64 riders, less than a seated load and only 44% of guideline load. By NYC Transit guidelines, this light load would trigger frequency reductions in the morning rush hour from 9 tph to 6 tph, for an average headway of 10 minutes or a 33% reduction in service.

Given that increasing the length of G trains to 600 feet at current ridership levels would be a misallocation of NYC Transit resources and could lead to reduced service frequency and crowded transfers, other means were examined to address concerns associated with short trains, as discussed in the Next Steps section.

## Addressable Issues Identified in Train Frequency and Ridership

- G riders make twice as many transfers as the average NYC subway rider, but service guidelines do not account for the customer impacts of higher than average transfer rates.
- Uneven headways between trains lead to long waits and uneven loading.
- Trains shorter than platform length cause uncertainty about stopping position and uneven loading.
- Some stopping positions and benches are not optimally located, causing uneven loading and customer inconvenience. Adding to the inconvenience, weekday and weekend stopping positions differ at some stations.
- Trains waiting to depart Court Square terminal frequently leave most doors closed until just before departure, causing customer inconvenience and uneven loading within cars.

# Customer Communication

Many G stations lack much of the real-time communication infrastructure that benefits riders on other lines in the system. Few G stations have public address systems and, at present none have electronic dynamic messaging signs. However, stations on the line are slated for a number of technology improvements in the coming years. Additionally, a platform signage trial is underway to better indicate the G train stopping positions on the platform.

## Service Advisory Postings

The G 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 PA systems, online updates at mta.info, and advisories via text, email, and social media.

## Real-Time Information

On the 1 through 6 and L lines, automatic monitoring of train locations enables delivery of real-time information via "countdown clocks" and other PA/CIS (Public Address and Customer Information Screen) messages. Currently, most G Crosstown stations lack Public Address systems and, as with most other B Division (lettered) lines, precise G train locations are not centrally tracked. A progression of planned technology upgrades is planned over the coming years, each of which should improve real-time information delivered to customers on the G and throughout the system. Although a timeline for completion has not yet been set, a train tracking system known as I-TRAC is currently being implemented at select control towers on the B Division. This will enable better line oversight and timely communication of service conditions where customer communication infrastructure is in place. A contract to install PA/CIS systems at 87 stations not currently equipped with such systems, including 12 G stations[14], is scheduled for award later in 2013, with substantial completion forecast for 2016.

In several years, ISIM-B (Integrated Service Information and Management – B Division) is slated for installation throughout the B Division. Together with PA/CIS installations, ISIM-B will enable communication of "next train" status on platforms and via the Internet, similar to that currently on the A Division (the numbered lines), and further bolster oversight and dynamic service adjustments. ISIM-B, which is still in development, will be first and foremost a rail system management project which will facilitate centralized supervision of the G line, with the added benefit of enabling improved customer communications. No timetable has been set for the roll-out of ISIM-B.

NYC Transit is also expanding the pilot On The Go! Travel Stations to more of the system, and is in the early stages of pursuing their installation in G stations. These On The Go! Travel Stations can provide real-time transit information, interactive maps, TripPlanner+, and other information to users.

## Stopping Position Signage

Routine G train riders most often know where the train will stop at their station, but only select stations have signs that inform occasional riders where the train will stop. Some G stations

[14] Ten stations are on the Crosstown line and two are on the shared portion of the line.

have signs indicating that trains “stop at the center of platform,” but some stations lack stopping position signage entirely and “center” is not an accurate description in every case. As a result, customers sometimes wait for the G train where the train does not stop.

NYC Transit is committed to improving station signage. To study the impact of platform signs that indicate the stopping positions of trains, NYC Transit installed trial signage at Clinton-Washington Avs and Bedford-Nostrand Avs in May 2013. In addition to better communicating stopping positions, NYC Transit expects that stopping position signage can result in more even loading between cars on each G train, as customers will better position themselves to take advantage of the relatively empty middle cars.

## Addressable Issues Identified in Customer Communication

- Stations lack communications infrastructure, including PAs and electronic real-time information signage.
- Stopping positions are not always clear to passengers.

# Infrastructure

Considering that the "hard" infrastructure on the G – the tracks, some of the interlockings, and the signal system – largely dates to the period of its original construction, much of it is still in good condition. There are, however, a number of ongoing infrastructure challenges on the G including electrical and signal equipment damage caused by Superstorm Sandy in the Greenpoint Tubes between Brooklyn and Queens.

## 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 G, like much of the system, runs on tracks with interlockings and a signal system dating to the original construction of the line. In the G line's case, that means that much of its infrastructure dates to the 1930's. Old systems can cause unexpected service disruptions due to malfunctions and repair work. However, while many of the G systems are old, they are safe and highly functional.

Some of the G line's infrastructure is new. Reconstruction of the Culver Viaduct between Carroll St and to 4 Av-9 St is substantially complete. Four of the six interlockings on the G line have been or are currently being modernized:[15]

- The Court Square interlocking was modernized in 1998.
- The Bergen St interlocking was modernized in 2008.
- The 4 Av interlocking was modernized in 2012, in conjunction with the Culver Viaduct rehabilitation.
- The Church Av interlocking is currently undergoing modernization, with expected completion in 2014.

The remaining two interlockings are original to the line's construction, dating to the 1930s; they are scheduled to be modernized in the 2015-2019 Capital Program, subject to funding availability. In addition, systems in the Greenpoint Tubes will be upgraded during Superstorm Sandy flooding repair work in the near future.

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 and the cumulative customer benefit provided. G signals still operate safely and are not slated to be replaced for more than a decade, as CBTC is being installed first on higher-ridership line segments with signal systems and other infrastructure of similar vintage.

[15] Dates are for substantial completion of the project.

### Component Conditions

All infrastructure assets are evaluated in terms of condition. G station conditions from the 2012 Station Condition Survey are presented in Appendix E. The percentage of components considered deficient ranges from a low of 0% to a high of 33%[16]. Similar analyses are undertaken for other asset classes and inform the development of capital projects.

## The Necessity of Work on the Subway

Maintenance and other construction are necessary throughout the subway system 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. There is a balance between the conflicting goals of completing the work quickly and in a cost-effective manner and 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 G takes place during middays and overnight. 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. 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 G 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. NYC Transit has taken proactive measures to mitigate maintenance-related delays, including restricting the number of track gangs (work crews) that can be working along the line at any one time.

In order to complete basic maintenance on the G line, an estimated ten or more weekends of work affect service annually, on top of service changes required for capital projects. To ensure that customers still have travel alternatives and to avoid overwhelming those alternatives, work is coordinated when possible so that nearby train lines, such as the J and L, are not under construction when G service is unavailable, and shuttle buses are operated along line segments with no train service at all.

[16] Of all 21 G stations, 5 had 0% deficient scores, representing good component conditions. Four of these stations were on the Crosstown Line section. At the time of the 2012 survey, Smith-9 Sts station was closed for station rehabilitation, and it was thus excluded. The most deficient station was 21 St, which is scheduled for repair work on mezzanine components as well as platform columns, ceilings and walls in 2013.

## Summary of Recent Capital Projects

A number of important capital projects have been completed along the G line in recent years, some presenting short-term operating challenges that have contributed to delays and off-peak service disruptions while ensuring longer-term safety and efficiency along the route. These projects have included:

- Ongoing reconstruction of the four-track Culver Viaduct over the Gowanus Canal in Brooklyn, including complete rehabilitation of Smith-9 Sts station and substantial work at 4 Av-9 St, including removal and replacement of all tracks and signals on the viaduct.
- Completion of an enclosed transfer to the 7 in 2011 with an enclosed escalator between G and 7 mezzanines at Court Square.
- Installation of an elevator at Church Av station in 2008, bringing the station into ADA compliance.
- Modernization (ongoing) of the Church Av interlocking.

In addition, the previous and current Capital Programs devote significant resources to renewing key assets along the G, particularly structures, stations, and signals on the Culver Line segment; and communications infrastructure and mainline track replacement on the Crosstown Line.

## Major Upcoming Work

The flooding of the Greenpoint Tubes between the Greenpoint Av and 21 St stations during Superstorm Sandy significantly damaged electrical and signal systems. Repairs are necessary for the continued safe and reliable operation of G service. Repair work requires 12 full weekend closures in 2013. Further work will require complete around-the-clock closure of the G line between Court Square and Nassau Av, for five full weeks during the summer of 2014.


During these Greenpoint Tubes closures, the G will terminate at Nassau Av, and a shuttle bus will carry passengers from there to Court Square via Manhattan Avenue, stopping at stations in-between. A second shuttle bus will carry passengers from Lorimer St. (L) to Court Square via McGuinness Boulevard, stopping where McGuiness Boulevard crosses Nassau Avenue and Greenpoint Avenue, and at 21 St.

The 2010-2014 capital program includes station component work at 21 St, Broadway, Myrtle-Willoughby Avs, Clinton-Washington Avs, and 7 Av. Work on 21 St and Greenpoint Av will be awarded in 2013 in order to complete work during Sandy-related tunnel closures. 7 Av is also scheduled for award in 2013, and the remaining work is scheduled for award in 2014. Additionally, Greenpoint Av is scheduled to be made ADA-compliant in the 2015-2019 Capital Program.

# Next Steps

This review has identified areas for improvement in G line operations, including:

- A schedule adversely affected by integration with the F, resulting in uneven headways and lower p.m. frequency
- Uneven passenger loading
- Challenges to effective line supervision
- Infrastructure in need of modernization

NYC Transit has analyzed a number of options to address these issues. Potential improvements often address issues from multiple sections of this report, and are divided below into recommended improvements and changes that are not recommend at this time.

## Recommended

- **Increase PM Peak Service Frequency**: To remedy G service irregularities resulting from the merge with the F, NYC Transit recommends an increase in weekday evening peak G service from the current 6 tph to 7.5 tph, between the hours of approximately 3 p.m. and 9 p.m., funding permitting. This increase is consistent with other service increases based on operational considerations. Increasing p.m. peak service from a 10-minute headway to an 8-minute headway would lead to significantly improved service regularity by improving schedule compatibility with the F, which operates on a 4-minute headway during much of this period. If funded, this service frequency increase would take place in mid-2014, the next opportunity to implement revised permanent schedules. This recommendation is contingent on the identification of funding for its cost of approximately $700,000 annually.

- **Add and Implement Holds**: Scheduled holds at Hoyt-Schermerhorn Sts should be adjusted to achieve more regular headways for northbound trains at all times of day, and subsequently reduce long waits and uneven loading. Line supervision will be coordinated to ensure the holds are implemented once revisions are provided. This recommendation could be implemented in mid-2014, in conjunction with increased p.m. peak service frequency.

- **Open Train Doors Longer at Court Square Terminal**: Often G trains depart Court Square unevenly loaded as a result of only one door per car being open while the train is in the station prior to its southbound departure. To alleviate some of the load imbalance originating at Court Square, NYC Transit recommends that train crews board the train at least two minutes prior to scheduled departure and immediately open all train doors. This recommendation could be implemented in the near future.

- **Upgrade Communications Technology on the Line**: NYC Transit has prioritized the planned installation of PA/CIS at 12 G stations that currently lack public address systems. This will allow service announcements and other messages to be heard and viewed on the platform. As discussed in the Customer Communications section, installation of PA/CIS on the G line is scheduled for substantial completion in 2016. A progression of technology upgrades to the G is also planned over the coming years, each of which should improve line oversight as well as deliver better real-time

information to customers. NYC Transit commits to implementing real-time information upgrades to the G line as quickly as feasible.

- **Adjust Train Stopping Positions**: NYC Transit has comprehensively reviewed train stopping positions along the G line using entrance and exit data and an analysis of station layouts. NYC Transit recommends adjusting the following stopping positions to maximize customer convenience, to reduce uneven loading on end cars, and to make weekend and weekday stopping positions consistent. NYC Transit will complete most recommended adjustments by the end of 2013. Adjustments that require infrastructure changes will be completed by mid-2014.

| **Recommended Stopping Position** (See Appendix C for Diagrams and Full Discussion) | | |
|---|---|---|
| **Station** | **Southbound Change: Primary Reason** | **Northbound Change: Primary Reason** |
| **21 St** | Exit/Entrance Alignment | *Exit/Entrance Alignment |
| **Greenpoint Av** | No change. | Weekday/Weekend Consistency |
| **Nassau St** | Better Serve North Entrance | No change. |
| **Metropolitan Av** | Exit/Entrance and Transfer Alignment | No change. |
| **Broadway** | Weekday/Weekend Consistency | * Exit/Entrance Alignment and Weekday/Weekend Consistency |
| **Flushing Av** | * Exit/Entrance Alignment and Weekday/Weekend Consistency | Exit/Entrance Alignment and Weekday/Weekend Consistency |
| **Myrtle-Willoughby Avs** | Exit/Entrance Alignment | No change. |
| **Bedford-Nostrand Avs** | Cross-Platform Consistency | Cross-Platform Consistency |
| **Classon Av** | Exit/Entrance Alignment | Exit/Entrance Alignment |
| **Fulton St** | No change. | *Better serve exit/entrance with majority of users |
| **Hoyt-Schermerhorn Sts** | No change. | Reduce uneven loading and dwell time |
| **Bergen St** | Weekday/Weekend Consistency | No change. |
| **4 Av-9 St** | Exit/Entrance and Transfer Alignment | Exit/Entrance and Transfer Alignment |
| **7 Av** | Weekday/Weekend Consistency | No change. |
| **Ft Hamilton Pkwy** | No change. | Weekday/Weekend Consistency |

**Requires infrastructure changes that have additional costs.*

- **Adjust Platform Bench Locations**: Platform benches, as places where people wait for trains, provide an important cue to the train's stopping position. NYC Transit reviewed bench locations at all G stations and identified six benches at five stations for near-term relocation to provide more convenient waiting locations and, by extension, to minimize train dwell times in-station. Some of these benches will also lead people toward the center of trains where they are likely to find less crowded cars. A complete list of new bench locations that are under consideration can be found in Appendix C**.**

- **Improve Stopping Position Signage**: Clearly identifying the stop location of the G train, so that customers know where on the platform to wait for trains, promises to result in more even passenger distribution among train cars, thus reducing end-car crowding. NYC Transit is exploring options for improved signage, which will be installed at G stations following implementation of planned changes in train stopping positions and the identification of funding.

## Not Recommended

- **Lengthen the Trains**: The G trains should remain their current length because longer trains are costly, would result in less frequent service, and would be loaded far under capacity at all times of day at all stations. At current or even reduced frequencies, increasing G trains to 600 feet would be a misallocation of NYC Transit resources.

- **Increase a.m. Peak Service Frequency**: Increasing service beyond the current 9 tph in the a.m. peak hour is not recommended because peak loading surveys have shown rider loads to be within guidelines. Individual trains and cars are less likely to be crowded following the implementation of recommendations that will improve service regularity and loading. NYC Transit should continue to closely monitor loading on the line, and be prepared to increase service frequency in the future, if feasible, if ridership levels exceed guidelines.

- **Increase Off-Peak Service Frequency**: Increasing service beyond guidelines on weekends and other off-peak hours is not recommended because of relatively low ridership and the need to perform maintenance, capital construction, and Superstorm Sandy recovery work. Regular future off-peak loading checks will ensure that the G remains within guidelines whenever feasible.

- **Provide Out-of-System Walking Transfers at Broadway G – Lorimer St J M and/or at Fulton St G – Atlantic Av-Barclays Center B D N Q R 2 3 4 5**: Although these proposed transfers would provide some network benefits, NYC Transit does not recommend adding free MetroCard walking transfers at any location along the G, because of the existing policy which establishes MetroCard walking transfers only to mitigate changes in service. Changing this policy would have revenue impacts beyond the G line.