MTA New York City Transit

October 7, 2009

Review of F Line Operations, Ridership, and Infrastructure

Executive Summary

The F line operates between Coney Island, Brooklyn, and Jamaica, Queens, via 6th Avenue in Manhattan. It is the second longest line in the subway system at just over 27 miles, and it shares tracks with three other lines along the way (the E, G, and V), requiring multiple merges and diverges. Moreover, it is one of the busiest lines in the system, as it – along with the E – serves the heavily traveled Queens Boulevard express corridor, where trains operate every two minutes during rush hours. The combination of great length, operational complexity, and heavy ridership volume makes the F line particularly prone to delays in service.

Because of the susceptibility of the F line to delay, MTA New York City Transit has undertaken a review of its operations, ridership, and infrastructure. The review shows that the F lags behind other routes in many performance measures and that the older parts of its infrastructure, some of which are 90 years old, can affect service reliability.

Reliability of the F, as on all other lines in the subway, is affected by infrastructure condition, maintenance and renewal; in the case of the F, the need to renew key assets in the coming years is becoming critical, due to their age and condition. As assets age, they become more prone to breakdown, thus adversely affecting reliability.

The relationship between routine maintenance and infrastructure renewal work on the one hand and operational reliability on the other hand is a complex one. Work of this sort is critical for ensuring that the railroad is in a state of good repair, but the work itself can interfere with service and cause delays. Not undertaking or severely restricting such work, however, while reducing delays in the short run, can lead to a greater risk of breakdown and more serious delays in the long run. As a result, NYCT tries to schedule routine maintenance and infrastructure renewal work when feasible.

This report identifies strategies for improving operations, some of which have been or are being implemented and others of which require further development. These strategies include:

- Reorganizing line management, to provide greater accountability over multiple disciplines (July 2009).
- Establishing a task force of senior managers to review F line operations and develop strategies for improvements (Fall 2009).
- Reviewing the schedules and service design of the F to assess potential operational and service changes, including modifications to Queens/Manhattan service (underway) and express service in Brooklyn (to be undertaken prior to the completion in 2013 of the ongoing Culver Viaduct project).

- Undertaking a train load analysis to provide line management with critical information for evening out train loads (underway).

- Assigning more reliable cars to the F (July 2009), reducing the number of separate car classes operating on the F from 5 to 2 (July 2009), assigning a dedicated car maintenance manager to the F (September 2009), and continuing to place new cars into F service (underway).

- Modifying delay management strategies to reduce reliance on skipping stations (July 2009).

- Renewing aging infrastructure, including, but not limited to, reconstructing the Culver Viaduct (underway), rehabilitating key stations like Jay Street (underway), and modernizing critical components of the signal system (planned for the 2010-14 Capital Program).

- Developing strategies to reduce the impact of maintenance and infrastructure renewal work on operations (underway), including coordinating previously separate maintenance activities, establishing a "Scheduled Maintenance System" for signal repairs and heavy maintenance gangs for track repairs, and installing track barriers during long-term projects to reduce the need to slow down when passing work zones.

In addition to these strategies, a recent change in service is expected to improve F operations – the extension of the G from its former southern terminal at Smith-9 Streets station to the Church Avenue station. Although this change, which occurred in early July 2009, was made to accommodate the Culver Viaduct reconstruction project, it has a positive side-benefit of relocating the G terminal operations in Brooklyn to a better location from an operational perspective, with more tracks available for G trains to change directions. This should reduce the number of F trains delayed by terminating G trains. Also, extending G service to Church Av provides alternative service and capacity options for another five stations along the F route in Brooklyn. Another potential service change that may improve the F – the operation of an F express in Brooklyn – cannot be considered until completion of the ongoing Culver Viaduct reconstruction project in 2013.

New York City Transit

October 1, 2009

Review of F Line Operations, Ridership, and Infrastructure

Introduction

Because of the susceptibility of the F line to delay, MTA New York City Transit has undertaken a review of its operations, ridership, and infrastructure. This report documents the complexity of the F line's service design, the large number of riders the F carries, key performance measures, the state of the infrastructure that the F line operates along, and the impact that maintenance and renewal projects have on operations. Finally, this report identifies current and planned strategies for improving reliability and renewing the F infrastructure.

Schedules, Service Design, and Shared Trackage

Over its 27-mile route length, the F operates both as an express and as a local, and it normally shares tracks with three other routes (E, V, and G) on three different line segments. The complexity of its schedule and service design can affect performance and reliability.

The length of a route can affect reliability. Longer routes like the F tend to be more prone to delay than shorter routes, because there are more opportunities for incidents to occur and because once the trains reach their final terminals at the end of long routes they may not have sufficient time to recover from delays in order to make their return trips.

Aspects of the weekday F schedules and service design warrants analysis of possible changes, including running times, Queens/Manhattan service and potential Brooklyn express service.

Interlockings and Merge/Diverge Points

All locations where trains switch tracks, merge, or diverge hold the potential for delay. In order to ensure safe separation of trains and to ensure that the movable track components of switches are locked (do not move) while trains pass over them, these merge/diverge points, or interlockings, have specialized signal systems that place limitations on when track switches can move once they are locked in place and once trains have passed over them.[1]

[1] Limitations on switch movement timing vary by interlocking, due to differences in track layout.

The F merges with and diverges from the E, G, and V at the following interlockings:

- E – Weekdays in Queens, the F shares the Queens Boulevard Line express tracks with the E between the 75th Avenue interlocking and the 36th Street interlocking. During rush hours, 15 E and 15 F trains per hour are scheduled to operate on this segment in the peak direction, for a combined frequency of 30 trains per hour, or an average of one train every two minutes. This is the highest scheduled frequency on a single track segment in the entire subway system. Evenings and weekends, the E and F share tracks between the Van Wyck Boulevard interlocking and the 36th Street interlocking.

- V – In Manhattan, the F shares the 6th Avenue Line local tracks with the V between the 50th Street interlocking and the 2nd Avenue interlocking, weekdays and evenings. During rush hours, 15 F and 10 V trains are scheduled to operate on this segment in the peak direction, for a combined frequency of 25 trains per hour, or an average of one train every 2.4 minutes.

- G – In Brooklyn, the F shares the Culver Line local tracks with the G between the Bergen Street interlocking and the Church Avenue interlocking, at all times. During the morning rush hour, 14 F and 9 G trains are scheduled to operate in the peak, northbound direction on this segment, for a combined frequency of 23 trains per hour, or an average of one train every 2.6 minutes. Before the G was extended to Church Avenue in July 2009, it terminated at the Smith-9 Streets station in Brooklyn and relayed (changed directions) on one of the express tracks within the 4th Avenue interlocking. The Smith-9 Sts/4th Avenue terminal operation often delayed F service, because of the time needed to clear G trains of passengers before moving to the relay positions, the slow speeds required, and the availability of only one track for G relays. The new Church Avenue terminal of the G provides for faster moves into and out of multiple relay locations and is less likely to delay following F trains as a result.

In addition to the merge/diverge points outlined above, several other interlockings are critical to F operations, including those at terminal stations (Jamaica-179 St in Queens and Coney Island, Avenue X, and Kings Highway in Brooklyn) and at access points to storage yards (Union Turnpike in Queens, and Avenue X and Coney Island in Brooklyn).

Schedules

While NYCT periodically updates timetables for all its routes to reflect changes in ridership, the base F timetables, including station-to-station running times, have not been reviewed and revised since 2001, when the 63rd Street Connector service plan was implemented. Since then, increases in ridership and changes in operating practices may have rendered the base F timetables out-of-date. On-time performance (discussed later in this document) on the F has been declining in recent years, and the schedules are due for a thorough review to ensure they more accurately reflect current operating conditions.

Queens/Manhattan Service

In 2001, NYCT revised service on the F in conjunction with the opening of the 63rd Street Connector between the 36 St station on the Queens Boulevard Line and 21 St-Queensbridge on the 63rd Street Line. At the time, the F was rerouted off its traditional 53rd Street path onto the 63rd Street Line, the new V Queens Boulevard Local was routed via the 53rd Street Line, and the G was short-turned at Long Island City-Court Square weekdays. E and R routes were unchanged. This service change resulted in lower levels of crowding on the EF Queens Boulevard express, particularly on the F.

The 63rd Street service plan, however, is highly complex and challenging to operate, requiring multiple merges and diverges because of the need to interweave V service with E, F, and R trains. The service plan also matches a long 6th Avenue local route (F) with a short 6th Avenue local route (V). Terminal operations for the V at the Lower East Side-2 Av station can also affect F service. If southbound V trains are delayed entering the terminal in the middle tracks at Lower East Side-2 Av, following southbound F trains can also be delayed.

Now that the service plan has been in operation for over eight years, NYCT is reviewing its operation and ridership to determine whether any modifications are warranted.

Potential F Express in Brooklyn

The F currently runs express at all times between the Forest Hills-71 Av station and the 36 St interlocking in Queens; elsewhere it runs local, including along the 6th Avenue Line in Manhattan and the Culver Line in Brooklyn. Between 1968 and 1987, the F also provided rush hour express service in Brooklyn,[2] and political leaders and community advocates have in recent years called for restoration of such F express service.

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[2] The rush hour Brooklyn F express service operated in two distinct phases – from 1968 to 1976 between Kings Highway and Jay St-Borough Hall and from 1976 to 1987 between Kings Highway and 18 Av only.

From 1968 to 1976, rush hour Brooklyn F express service operated as follows:

- From approximately 6:30 to 9:00 a.m, F express trains operated in the peak direction to Manhattan between Kings Highway and Church Avenue and in both directions between Church Avenue and Jay Street
- From approximately 4:00 to 6:15 p.m.. F express trains operated in both directions between Jay Street and Church Avenue and in the peak direction from Manhattan between Church Avenue and Kings Highway.
- From 1968 to 1976, G trains making all local stops supplemented F local trains in both directions between Church Avenue and Jay Street during rush hours.

From 1976 to 1987, peak-direction rush hour Brooklyn F express service operated between Kings Highway and 18 Av only, from approximately 6:30 to 9:00 a.m. to Manhattan and from approximately 4:00 to 6:00 p.m. from Manhattan. All F trains made all local stops between 18 Av and Jay Street.

In the timetable effective November 17, 1986, peak-direction Brooklyn F express trains operated every 9 to 10 minutes during morning rush hour and every 9 to 12 minutes during the evening rush hour. When F expresses operated, peak-direction F local trains also ran every 9 to 10 minutes during morning rush hour and every 9 to 12 minutes during the evening rush hour.

While express service on the F line in Brooklyn may have potential benefits for riders, it will not be possible until after the completion of the Culver Viaduct Rehabilitation project in 2013 (discussed later in this report), because this vital project requires temporarily removing from service two of the four tracks on the structure. NYCT will examine the demand for F express service, including the option of extending the V to Brooklyn as a local, for possible implementation after the completion of the viaduct rehabilitation.

Evaluation of a possible F express in Brooklyn would have to take into account load factors, ridership patterns, train availability, and operating cost. Currently, rush hour F service operates within NYCT loading guidelines, although individual trains and cars can be crowded. Approximately two-thirds of F riders in Brooklyn are on the northern segment of the Culver Line, between Church Avenue and Bergen Street, and two of the busiest stations on the line – Bergen Street and Carroll Street – are local stops.[3] F express trains would also skip the transfer station to the M and R trains at 4 Av-9 St, which may inconvenience some passengers. Operating the F express and extending the V to Brooklyn as a local would require additional trains and cars; such a service increase would increase operating costs.

Operational Performance of the F

NYCT assesses operations and conditions with several measures, including:

- On-Time Performance (OTP) – The percentage of trains arriving at terminal destinations within five minutes of their scheduled arrival times.
- Wait Assessment – A measure of the actual time interval between trains against the scheduled interval.[4]
- Mean Distance Between Failure (MDBF) – Revenue car miles divided by the number of delay incidents attributed to car-related causes.
- Passenger Environment Survey (PES) – Station and car cleanliness measures.

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[3] The Bergen Street station had originally been a bi-level express station, with local platforms on the upper level and express platforms on the lower level. This bi-level design led to awkward customer service because customers would often wait in stairwells between levels in order to see which level the next Manhattan-bound train would arrive at. When the station was rehabilitated in the 1990's, the lower level express platforms were removed from service and support facilities were built on the platforms. Enabling the station to operate as an express stop would require major capital investment.

[4] Wait Assessment is measured weekdays between 6:00 a.m. and Midnight, when service is relatively frequent. It is defined as the percentage of actual intervals that are no more than the scheduled interval plus 2 minutes during peak hours (6 a.m. – 9 a.m., 4 p.m. – 7 p.m.) and plus 4 minutes during off-peak hours (9 a.m. – 4 p.m., 7 p.m. – Midnight). Data is collected based on a sampling methodology.

On-Time Performance and Wait Assessment

On-time performance itself is divided into two measures:

- Absolute OTP, which measures terminal arrivals against the published timetable.
- Controllable OTP, which measures terminal arrivals against whatever schedule is in effect, either the regular published timetable or a schedule supplement or General Order (G.O.)[5] that has been the subject of a service advisory posted on the MTA Website. G.O.'s and supplements are issued for temporary service changes as the result of planned repair work, as well as for other reasons, like special events. Controllable OTP also excludes delays over which NYCT management has no immediate control – sick customers, police or fire department activity, vandalism, trespassing, opening of movable bridges for maritime traffic, and the loss of outside electrical power.

Absolute and Controllable OTP statistics are based on records maintained at all terminals for all subway trips and are analyzed centrally by the Department of Subways at the Rail Control Center. Wait Assessment statistics are compiled by the Division of Operations Planning, based on observations at key stations by traffic checkers.

A review of F performance indicators shows that it lags behind other routes in on-time performance and wait assessment, ranking near the bottom for all lines. In May 2009, for instance, in all three measures, the F ranked next-to-last among all subway lines.[6]

The Wait Assessment measures for the F do not lag behind the systemwide averages by as large a degree as the OTP measures. This apparent discrepancy reflects the high service frequency of the F, with trains scheduled to operate every 8 minutes or less during most off-peak hours and every four minutes during rush hours. Thus, from a customer service perspective, even though trains themselves may not be operating on time for much of their trips, most passengers, on average, do not have to wait longer than the scheduled waiting time.

Table 1 summarizes F and systemwide OTP and wait assessment measures.

[5] A schedule supplement is a temporary schedule that changes or modifies the base, permanent timetable. A General Order is a planned, temporary service change. G.O.'s can be implemented with or without temporary schedule supplements.

[6] A different line was ranked last for each of the indicators in May 2009: the Q for Absolute OTP, the E for Controllable OTP, and the 5 for Wait Assessment. In each case, the indicator for the F was only slightly higher than that for the other lines.

Table 1
F Line and Systemwide Performance Measures
January – May 2009

	Jan. 2009	Feb. 2009	Mar. 2009[7]	Apr. 2009	May 2009	June 2009	July 2009
Absolute Weekday OTP							
F	65.5%	65.5%	50.6%	49.4%	46.9%	53.4%	50.8%
System	80.2%	79.5%	74.4%	77.7%	75.8%	75.8%	74.4%
Difference	-14.7%	-14.0%	-23.8%	-28.3%	-28.9%	-22.4%	-23.6%
Controllable Weekday OTP							
F	74.6%	80.5%	66.5%	64.8%	59.1%	64.6%	62.1%
System	87.6%	87.1%	85.6%	88.3%	87.2%	87.6%	87.4%
Difference	-13.0%	-6.6%	-19.1%	-23.5%	-28.1%	-23.0%	-25.3%
Weekday Wait Assessment							
F	83.1%	82.6%	82.6%	82.4%	82.6%	n/a	83.1%
System	86.8%	87.0%	87.2%	87.5%	87.7%	n/a	88.3%
Difference	-3.7%	-4.4%	-4.6%	-5.1%	-5.1%	n/a	-5.2%

Sources: NYCT Committee Agendas, March – September, 2009

Mean Distance Between Failure

One key aspect of operational performance is the reliability of the cars that operate in train service. This is measured by Mean Distance Between Failure (MDBF). Prior to May 2009, MDBF was not tracked by route, but rather by car type. In May 2009, NYCT began tracking MDBF by both line and car class.

In the case of the F, five different car classes were used in daily service during the first five months of the year – R32, R40, R42, R46, and R160. The three older car classes, R32, R40, and R42, representing more than one-quarter of the F fleet in April 2009, are being replaced by new cars. Of the other two car classes, the R46, accounting for over 60% of the F fleet, is due for Scheduled Maintenance System (SMS) work starting in 2010, while the R160, comprising about 10% of the F fleet, is newly built. As more new R160's are delivered, the number of new cars on the F will increase.

In May 2009, the combined average MDBF for all the cars specifically assigned to F service was 146,115 miles, compared to a systemwide average of 185,485. In July 2009, after the older car classes were replaced by newer car classes in F service, the average MDBF on the F exceeded the systemwide average – 158,847 vs. 134,384.

Table 2 summarizes the MDBF of all the car classes used in F service in January through July of 2009.

[7] A refinement of the Absolute OTP methodology starting in March 2009, in which trains skipping scheduled station stops were more accurately categorized as not being on time, caused a drop in the statistics. As described in the "Delay Management Strategies" section, the F had a comparatively high frequency of trains skipping stops, which may partly explain why the drop in Absolute OTP statistics on the F was steeper than the drop systemwide.

Table 2
Mean Distance Between Failure for Car Classes in F Service (Miles)
January – May 2009

Car Class	Year Built	Car Age	Cars on F[8]	% of F Fleet[8]	Jan. 2009	Feb. 2009	Mar. 2009*
R32[9]	1964-65	43-44	50	12.8%	51,749	41,469	50,332
R40[9]	1968-69	40-41	40	10.3%	113,084	79,152	100,705
R42[9]	1969-70	39-40	20	5.1%	93,444	84,378	124,179
R46[10]	1975-78	31-34	240	61.5%	87,821	93,080	125,125
R160	2005-09	0-4	40	10.3%	346,228	1,175,410	798,045
Total F			390	100.0%	---	---	---
System			6,359	---	132,340	138,178	150,126

Car Class	Year Built	Car Age	Cars on F[8]	% of F Fleet[8]	Apr. 2009	May 2009	July 2009
R32	1964-65	43-44	50	12.8%	69,995	108,220	---
R40	1968-69	40-41	40	10.3%	118,441	127,813	---
R42	1969-70	39-40	20	5.1%	58,852	112,936	---
R46	1975-78	31-34	240	61.5%	91,830	132,485	96,528
R160	2005-09	0-4	40	10.3%	714,432	932,354	556,524
Total F			390	100.0%	---	146,115	158,847
System			6,359	---	147,167	185,485	134,384

Sources: NYCT Committee Agendas, March – September, 2009
NYCT Car Assignment, April 2009
Note: June 2009 data is not published in NYCT Committee Agendas.

Except for the new R160 cars, all of the cars assigned to the F as of April 2009 are less reliable than the average NYCT subway car, as measured by MDBF. Since each failure measured by MDBF is based on a delay in service, the lower MDBF statistics reflect a higher propensity to car fleet-related delays on the F than on other lines. As noted above, in July 2009, three older classes were taken out of F service, which improved overall car fleet reliability for the F.

Delay Management Strategies

When delays do occur, NYCT can mitigate their impact with a variety of strategies, including holding trains in stations to even out intervals, short-turning trains to fill gaps in the opposite direction, rerouting trains from other lines to compensate for delayed services, and having trains skip stations to get to their final terminals in time to make their return trips.

[8] As of April 2009; does not include spares.

[9] Scheduled for retirement in 2009-2010.

[10] Undergoing Scheduled Maintenance System (SMS) work in 2009-2010.

This last strategy – station skipping – is one that needs to be undertaken with care. Station skipping is undertaken during major train delays in order to even out both the intervals between trains and the passenger loads among trains. Skips are generally less disruptive when trains are closely bunched, so that a following train can make all the stops that the delayed train skips. During peak travel times, skips are also generally more productive when they occur in the pick-up direction – that is, the direction in which more passengers are boarding than alighting. When trains skip in the pick-up direction, they are less likely to be delayed by the need for, and associated confusion of, passengers traveling to skipped stations to get off the train. When trains skip in the discharge direction, it does not improve the evenness of loading or customer wait times; the loads are already imbalanced and customers have already waited. Thus, skipping in the discharge direction generally benefits relatively few groups of customers.

Anecdotal reports indicated that the strategy of having late trains skip stations to hasten arrival at the terminal has been occurring frequently on the southbound F in Brooklyn during the afternoon and evening periods – that is, in the discharge direction, at stations where more riders are alighting than boarding. A review of Train Register Sheets (records maintained at terminals) for March through June of 2009 indicated that skips between 3:00 and 9:00 p.m. on weekdays accounted for 3% to 5% of all trips; between those hours, 66 southbound F trains are scheduled to operate to Brooklyn each weekday:

Table 3
Unscheduled Station Skips – Southbound F, 3pm – 9pm (Weekdays)
March – June 2009

	All Skips			Skips North of Church Av	
Month	**Total Skips**	**Average Skips/Day**	**% of Daily Trips**	**Number**	**% of Total Skips**
March	34	2.0	3.0%	3	8.8%
April	61	3.2	4.9%	15	24.6%
May	39	2.4	3.7%	6	15.4%
June	44	2.3	3.5%	5	11.4%
March – June	**178**	**2.5**	**3.8%**	**29**	**16.3%**

Sources: NYCT Train Register Sheets, Coney Island and Kings Highway terminals, March – June, 2009

The frequency of unscheduled station skips in the Brooklyn-bound direction during the afternoon/evening period, while enabling trains to hasten their trips to their terminals, can adversely affect passengers' trips, since these skips occur in the discharge direction. Thus, at the start of the skip, there is a tendency to delay a train further, as passengers going to the skipped station(s) get off the train to wait for an all-stop train.

Passenger Environment Survey

The Passenger Environment Survey (PES), while not a direct measure of train operations and delays, does provide 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 compiled by the Division of Operations Planning, based on a sample of observations at stations throughout the subway system and on_board trains by traffic checkers.

From January 2008 through March 2009, PES statistics for the F closely tracked those of the system as a whole, as shown in Table 4.

The differences between the F and the system as a whole for most PES measures were so close as to be statistically insignificant. (Based on the sample sizes, differences of less than +/-6% are considered statistically insignificant.) The only measurable difference was for the cleanliness measure for floors and seats on subway cars in service, where the F lagged behind the system average by ten percentage points.

Appendix A provides more detail on the first quarter 2009 PES.

Table 4
Key Passenger Environment Survey Statistics – F
January – March, 2009

	F		**System**		**Difference**	
Station Results	**Survey Before AM Peak**	**Surveyed After AM Peak**	**Survey Before AM Peak**	**Surveyed After AM Peak**	**Survey Before AM Peak**	**Surveyed After AM Peak**
Litter – None or Light	74%	61%	77%	57%	-3%	+4%
Floor/Seat Dirt – None or Light	87%	73%	85%	75%	+2%	-2%
Graffiti – None or Light	100%		100%		0%	

	F		**System**		**Difference**	
Subway Car Results	**At Terminal**	**In Service**	**At Terminal**	**In Service**	**At Terminal**	**In Service**
Litter – None or Light	95%	87%	97%	91%	-2%	-4%
Floor/Seat Dirt – None or Light	93%	81%	97%	91%	-3%	-10%
Temperature – % between 58º and 78º F	99%		97%		+2%	

Source: NYCT Passenger Environment Survey, First Quarter 2009

F Ridership

Weekday and overall F ridership has grown significantly over the past 5 years; however, ridership at stations served only by the F has not kept pace with systemwide ridership growth. Ridership at transfer stations served by the F as well as other routes has exceeded systemwide growth; however, it is not clear how much of that growth is attributable to the F. Table 5 shows growth in F ridership and systemwide ridership relative to 2004. Annual F ridership has grown every year except 2004-2005, with nearly an 8% overall increase since 2004, and weekday F ridership has grown every year since 2004, with an overall increase of more than 8% since 2004.

Table 5
Cumulative Change in Subway Ridership since 2004

Year	Weekday Only - % Change			Total - % Change (including Holidays)		
	F Only Stations	F Shared Stations	System-wide	F Only Stations	F Shared Stations	System-wide
2005	0.2%	3.1%	2.7%	-0.9%	2.1%	1.6%
2006	4.0%	6.6%	5.5%	2.8%	6.6%	5.1%
2007	5.8%	11.6%	9.3%	5.0%	12.2%	9.6%
2008	8.3%	14.4%	13.3%	7.6%	15.2%	13.9%

Sources: NYCT Turnstile Registrations, 2005, 2006, 2007, and 2008

Despite increasing ridership on the F, its ridership remains below NYCT's passenger loading guidelines at the peak load points in both directions, suggesting that most growth has occurred off-peak and during the shoulders of the peaks.[11] Table 6 shows 2008 F ridership and volume-to-capacity ratios (V/C) at the stations at which F trains are most crowded – the peak load points.[12] The ridership data indicate possible uneven loading and reliability issues in the evening peak on the F line in Brooklyn, as more trains exceed guideline capacity in the PM peak hour than in the AM peak hour, even though the AM peak hour has a higher overall V/C.

Table 6
2008 Average F Peak Hour Volume and V/C

Period	Station at Peak Load Point	Volume	Actual Trains per Hour	V/C: Volume/ Guideline Capacity	% Trains over Guideline	Avg. Trains over Guideline
AM Peak Hour	Bergen St (northbound)	15,049	14.4	0.75	10%	1.4
	Roosevelt Island (southbound)	16,600	14.4	0.82	26%	3.7
PM Peak Hour	Jay St-Borough Hall (southbound)	10,645	12.3	0.62	12%	1.5
	Lexington Av/63 St (northbound)	15,247	15.0	0.73	15%	2.3

Sources: NYCT Traffic Checks, 2007 and 2008

Although loading on the F line on average falls within guideline capacity, individual trains may exceed guideline capacity. For example, Table 6 shows that 26% of southbound trains at Roosevelt Island in the AM peak hour exceed guidelines with V/C's greater than 1.0

In addition, certain cars may exceed guideline levels even on trains with V/C's of less than 1.0. A car-by-car analysis of the F line at the peak load points showed that southbound trains at Roosevelt Island tend to be more heavily loaded at the south (front)

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[11] The peak-period guideline capacity is based on 3 square feet per standing passenger and all seats occupied.

[12] A V/C ratio of 1.0 indicates trains are fully loaded per the guideline capacity, on average, over the peak hour.

end of the train – that is, the front 2 cars are twice as likely to exceed guideline loads compared with the rest of the train. Loading is relatively even on Queens-bound F trains at the peak load point during the evening peak period.

Brooklyn F trains tend to be more heavily loaded at the front and back, which reflects the location of platform stairs along the F in Brooklyn. Passenger volumes in the end cars are twice as likely to exceed guideline capacity, compared with the middle cars, during the morning peak period (6am to10am) and three times as likely during the evening peak period (3pm to 7pm). The relatively uneven loading within trains may contribute to the perception of the line as overcrowded, since proportionately more riders are in the crowded sections of the train.

F Infrastructure

Capital investment – and the need for capital investment – affects reliable train operations in multiple ways. Assets in need of replacement or reconstruction require more maintenance and may be more prone to fail; both routine, preventative maintenance and repairs in response to failure can disrupt service and cause delays. Similarly, the work to replace or rebuild assets can also disrupt service and cause delays, as trains may have to be rerouted or may be required to operate more slowly. Whenever routine maintenance or capital reconstruction/replacement work is scheduled, NYCT makes every effort to minimize the impact during peak travel periods, but during off-peak hours, particularly nights and weekends, this type of work can, and does, lead to delays and disruptions.

The F operates on numerous line segments that are many decades old, and many of the infrastructure assets on these segments are original and due for modernization. As a result, the current Capital Program, as well as upcoming Capital Programs, directs a considerable amount of investment towards renewing the infrastructure of the subway lines over which the F operates.

The F, however, does not operate on the oldest lines in the subway system. Most IRT (numbered) routes, for instance, operate on lines that predate most of the lines over which the F runs.[13] Since the modern era of MTA Capital Programs began in 1982, much of the focus on renewing capital assets has been on lines older than the F that had more deteriorated assets. With much of the critical renewal work completed on those older lines, current and upcoming Capital Programs are now devoting relatively more resources to the F.

Infrastructure Conditions

The infrastructure required for a rail system includes a vast number of assets – tracks, signals systems, stations, tunnel structures, elevated structures, at-grade structures, tunnel lighting systems, fan plants, pumps, electrical and communications systems,

[13] As noted in Table 7, one segment of the F in Brooklyn is 90 years old. This segment, the Culver Line south of Church Avenue, is of the same vintage as much of the IRT.

storage yards, maintenance shops, etc. Each of these assets (including their various subcomponents) has a useful life – the period during which, with proper maintenance, the asset can be expected to perform as designed before it needs to be replaced or rebuilt. Useful lives differ from asset to asset, and many assets can continue to work as designed well beyond the end of their nominal useful lives, with proper, albeit increasingly expensive, maintenance. The availability of replacement parts is a concern as assets age.

Over its 27-mile route length, the F operates on two of the newest pieces of subway infrastructure in the system, the rebuilt Stillwell Terminal in Coney Island, which opened in 2004, and the 63rd Street Connector in Queens, which opened in 2001. The F also operates along one of the oldest rail lines in the system, the southern portion of the Culver Line in Brooklyn, which dates from 1919-20. The bulk of the infrastructure for the F dates from 1940 or earlier, and 16% of its route length dates from 1920 or earlier. Table 7 summarizes when the various segments of the F opened for service.

Table 7
Construction Dates of Line Segments Served by the F
From North to South

Line	Line Segment (From – To)	Miles	% F Route	Year Built	Age (Years)
Queens Blvd Line	Jamaica-179 St – 169 St	0.54	2.0%	1950	59
	169 St – Union Turnpike-Kew Gardens	2.36	8.7%	1937	72
	Union Turnpike-Kew Gardens – 36 St	6.05	22.3%	1936	73
63rd St Line	36 St – 21 St-Queensbridge	0.81	3.0%	2001	8
	21 St-Queensbridge – 57 St	2.17	8.0%	1989	20
6th Av Line	57 St – 47-50 Sts-Rockefeller Center	0.43	1.6%	1968	41
	47-50 Sts-Rockefeller Center – W 4 St	2.05	7.6%	1940	69
	W 4 St – Jay St	3.32	12.2%	1936	73
Culver Line	Jay St – Church Av	4.28	15.8%	1933	76
	Church Av – Ditmas Av	0.55	2.0%	1954	55
	Ditmas Av – Av X	3.25	12.0%	1919	90
	Av X – South of W 8 St	1.08	4.0%	1920	89
	South of W 8 St – Coney Island[14]	0.25	0.9%	2004	5
Total F Line		**27.14**	**100.0%**	**Weighted Avg. Age**	**67.8**
Constructed 1940 and Earlier		*22.39*	*82.5%*		
Constructed 1919-1920		*4.33*	*16.0%*		

Sources: Distance and Maximum Running Time Between Stations, NYCT Operations Planning, 2007
New York Subways Historical Map, Quail Map Co., 1993

As noted above, the emphasis in earlier capital programs was on subway lines that were older than most of the F line. Since much of the route of the F had been built in the 1930's, at the start of the MTA Capital Program in 1982, it was by and large in better condition than many of the lines built in the first three decades of the 20th century.

[14] Stillwell Terminal at Coney Island serves four subway lines: the West End (D), Culver (F), Sea Beach (N), and Brighton (Q). The capital project to modernize the terminal entailed completely demolishing the old structure (station, viaduct, tracks, signals, etc.) and building an entirely new facility.

Nevertheless, the F has not been neglected in terms of capital investment since the 1980's. Considerable investment has been undertaken along the line, including the construction of the new 63rd Street Line and the 63rd Street Connector, as well as rehabilitation of much of the track structure and of the signals at the Bergen Street Interlocking, where the F and G merge and where a fire in 1999 required the complete replacement of the signals at that location. Now, however, the F requires significant capital investment to ensure its long-term reliability, given that over 80% of its route dates from 1940 or earlier and many of the components on those segments have not been modernized. Certain asset categories – particularly signal systems, the Culver Viaduct over the Gowanus Canal in Brooklyn, and many stations – are at the point where modernization and reconstruction are required.

All infrastructure assets are evaluated in terms of condition. The following tables address station conditions as an example. Table 8 lists the component categories evaluated at each station, on a scale of 1 to 5, with 1 being the best and 5 the worst, while Table 9 summarizes the percentage of station components rated as sub-par – a rating of 3.5 or higher – for 9 representative F stations in Manhattan and Brooklyn. Appendix B contains a list of recent, current, and upcoming projects at those stations.

Table 8
Station Components

Component	Component
Street Stairs	Platform Edges
Interior Stairs	Windscreen
Mezzanine Areas & Platform Areas:	Canopy
• Ceilings & walls • Through-Spans	Vents
• Floors • Columns	Other

Source: Component Condition Rating Distribution by Station, NYCT Capital Planning and Budget, 2009

Table 9
Component Condition Ratings at Selected Stations Served by the F

Line	Station	Total Components	% Rated 3.5 or Worse
6th Avenue Line	Broadway-Lafayette	37	8%
	Lower East Side-2 Av	28	0%
	Delancey St	33	0%
	East Broadway	31	3%
	York St	11	0%
	Jay St[15]	86	0%
Culver Line	Bergen St	46	2%
	Carroll St	37	14%
	Smith-9 Sts	20	65%

Source: Component Condition Rating Distribution by Station, NYCT Capital Planning and Budget, 2009

[15] The Jay Street station is currently undergoing a complete station modernization, including the construction of a new transfer passageway to the Lawrence Street-MetroTech station, which will benefit F riders transferring to/from M and R trains. As a result, all component conditions are rated as "Under Construction," rather than by a numerical rating.

For the 9 stations summarized above, the percentage of components considered sub-par ranges from a low of 0% at several stations, including Delancey St, which was completely rehabilitated in 2004, to a high of 65% at Smith-9 Sts, which is an outdoor station slated for rehabilitation in conjunction with the project to rebuild the Culver Viaduct over the Gowanus Canal.

Similar analyses have been undertaken for other asset classes, which inform the development of capital projects.

Recent and Ongoing Infrastructure Projects

Over the past few months, several important capital reconstruction projects along the F line have presented short-term operating challenges that have contributed to delays, while ensuring longer-term safety and efficiency along the route. These projects have included:

- Reconstruction of a segment of one of the express tracks in Queens near the Grand Avenue station. This work required slower speed operation at all times (even when construction was not underway), reduced train frequencies during rush hours, and necessitated reroutes via the local track during off-peak hours. This work began in early March 2009 and was completed at the end of July 2009.

- Flood mitigation projects along the Queens Boulevard and 6th Avenue corridors.

- Installation of security equipment in the tunnel between Queens and Manhattan.

- Construction of a free transfer passageway between the Sixth Avenue B D F V line and the northbound Lexington Avenue 6 line at the Broadway-Lafayette Street/Bleecker Street station complex. This project corrects the anomaly of a transfer available in one direction only; currently B D F V riders can only transfer to/from the southbound 6 at this station complex. Once the transfer opens, riders will be able to transfer to/from the 6 in both directions. The new transfer, when opened, will benefit Brooklyn F customers in particular, as Broadway-Lafayette Street/Bleecker Street is the first opportunity for Brooklyn F to transfer to/from the Lexington Avenue Line. (Brooklyn B D riders can transfer to/from the 4 5 Lexington Avenue Line at Atlantic Avenue-Pacific Street.)

- Reconstruction of the Jay Street station, including the addition of a passageway that will provide a free connection for customers between the M R line at Lawrence Street and A C F service at Jay Street.

- Lighting improvements in the tunnel between Manhattan and Brooklyn.

- The start of the reconstruction of the Culver Viaduct over the Gowanus Canal in Brooklyn.

Construction on other lines also often has an impact on the F, as other lines must be re-routed onto the F line in order to accommodate work elsewhere in the system. For instance, on weekends the F must often share its route between Jay St and West 4 St with the A line in order to allow for necessary ongoing rehabilitation of signals at Chambers Street-World Trade Center station complex (A C E).

Although NYCT has made an effort to schedule much of this work during late night, midday or weekend hours when ridership and service frequency are lowest, this work often requires that trains run more slowly and/or less frequently, particularly during off-peak periods. As a result, such work adds significantly to the number of delays experienced by F riders. In addition, at times this work can affect peak travel periods, causing congestion and significantly delaying service. For example, track reconstruction work requires the use of temporary track structures for several weeks or months while the work is underway. The temporary nature of these track structures requires that trains run at reduced speeds at all times, even when no work is being undertaken, such as during rush hours.

Maintenance and Inspection Work and Adjacent Track Flagging

In addition to the capital reconstruction projects underway or recently completed along the F line, routine track and other maintenance can also affect service reliability. Unlike much of the capital reconstruction work, which is focused on specific locations, maintenance and inspection work varies by location on a daily basis. As a result, delays vary by location, as well.

A major cause of delay when track and other maintenance and inspection work takes place is the need to slow down while trains pass work zones. In January 2009, for example, there were 1,232 delayed F trains due to preventative maintenance and inspection work and unscheduled repairs along the right of way, or an average of nearly 40 delays a day.

Prior to a change in work rules in 2007, only the trains along the track that was being worked on had to slow down; under the current rules, trains on tracks adjacent to the work zone must slow down, as well. This is called “Adjacent Track Flagging,” in reference to the “flagging” process used to protect the safety of workers in areas where trains are operating.[16] The adoption of Adjacent Track Flagging rules took place in response to the death of two track maintainers in the Spring of 2007.[17]

The adoption of Adjacent Track Flagging rules has led to a substantial increase in delays, since trains on tracks adjacent to work zones never had to slow down previously.

[16] Along outdoor line segments during daylight hours, work crews use colored flags to identify their locations to passing trains – hence the term “flagging.” Underground, and outdoors after dark, work crews use colored lights for the same purpose.

[17] Following the death of the track maintainers in 2007, NYCT imposed a moratorium on track work in order to re-evaluate flagging and other procedures that protect the safety of crews in work zones where trains operate. This resulted in an increased level of work throughout the system once the moratorium was lifted for much of 2008 and into 2009.

The impact of Adjacent Track Flagging has been felt not only in routine maintenance and inspection work, but also in capital projects.

NYCT has taken proactive measures to mitigate maintenance-related delays, including restricting, where possible, work on the tracks to nighttime hours only, as well as restricting the number of track gangs (work crews) that can be working along the line at any one time. Another mitigating measure, undertaken by NYCT in conjunction with the Transport Workers Union, is the installation of barriers between the tracks where work is taking place and the tracks on which trains operate. With barriers in place, adjacent track flagging is no longer necessary except when workers must cross the active running tracks. This approach is only practical for long-term capital reconstruction projects where tracks are taken out of service for extended periods of time.

Even with these mitigating measures, work on the tracks affects reliability of train operations. While much of the capital reconstruction and maintenance work is scheduled to take place overnight, some of the work must take place during the day because for safety reasons non-emergency outdoor work is only permitted to be performed during daylight hours. Even the overnight work significantly affects service. Delays after midnight along the F are a particular concern, with trains routinely arriving at their terminals 15 or more minutes later than scheduled. When trains are that late, trains and crews can arrive at their terminals too late to make their next scheduled trip, compounding the delays.

Number of Planned Diversions and Slow Orders Due to Capital and Maintenance Work

The combination of capital work and routine maintenance and inspection work leads to a large number of planned diversions affecting the F, in which F trains are routed onto tracks they do not normally use or trains on other lines are routed onto F tracks, as well as slow-speed orders. These planned diversions and/or slow-speed orders are implemented by General Order; some also require supplement schedules. Many of these diversions/slow speed orders were associated with work on the right of way, which required flagging, including adjacent track flagging.

A review of a 17-week period in March through June of 2009 shows that a total of 248 separate planned diversions and/or slow speed orders affected F service, for an average of 14.6 per week. Most of these planned diversions/slow speed orders covered multiple days in each week, with each individual day the diversion takes place referred to as an "occasion." For instance a midday diversion might work all 5 weekday middays per week (5 occasions) or a weekend diversion might be in effect through both weekend days. As a result, the 248 diversions/slow-speed orders affecting F service over a 17 week period actually reflects 828 occasions in which work affected F service, or an average of 48.7 occasions per week. These diversions and occasions covered several projects and disciplines, including (but not limited to) track and switch reconstruction, rehabilitation of substations and electrical systems, signal modernization, installation of tunnel and emergency lighting, station rehabilitation, installation of security systems, cable and conduit installation, repair of drainage and ventilation systems, installation of radio system antennas, and cleaning of tracks and tunnels.

Most of these diversions and occasions occurred during the late night period (roughly 11:00 p.m. – 5:00 a.m. weekdays) or during weekends. Table 10 summarizes diversions and occasions for this 17-week period, while Appendix C provides a week by week summary.

Table 10
Diversions and Occasions Affecting the Ⓕ
March – June 2009 (17 Weeks)

	Total for 17 Weeks		**Average per Week**	
Time Period	**Diversions**	**Occasions**	**Diversions**	**Occasions**
All Times	15	105	0.88	6.18
Weekdays				
Middays Only	29	141	1.71	8.29
Late Nights Only	97	374	5.71	22.00
Weekends				
½ Days to Noon	10	10	0.59	0.59
Daytimes Only	4	4	0.24	0.24
Late Nights Only	7	21	0.41	1.24
24 Hours	86	173	5.06	10.18
Total	**248**	**828**	**14.59**	**48.71**

Source: Diversions Affecting 'F' Train Service, March – June 2009, NYCT Operations Planning

Major Ongoing and Upcoming Reconstruction Projects

As noted above, the current and upcoming Capital Programs devote considerable resources to renewing key assets along the Ⓕ, particularly structures, stations, and signals. This section highlights two areas in particular that are, or will be, the subject of major investment in the coming years – the reconstruction of the Culver Viaduct in Brooklyn and modernization of signal systems at various locations along the Ⓕ. In addition, this section identifies other projects that address the condition of other parts of the Ⓕ infrastructure.

The four-track Culver Viaduct over the Gowanus Canal is one major asset along the Ⓕ that must be rebuilt. Built in the early 1930's, this concrete and steel structure takes the Ⓕ and Ⓖ over the Gowanus Canal. The Smith-9 Streets station at its apex is the highest station in the subway system, in terms of elevation above the street. The concrete on the viaduct is cracking and chipping, and as a temporary measure, NYCT has wrapped the exterior of the structure in protective netting.

Reconstruction of the viaduct is the only solution to its structural problems. The reconstruction, including improvements to the drainage system, requires replacing the concrete decking, which in turn requires removing and replacing all of the tracks and signals on the viaduct. Reconstruction of the Smith-9 Streets station will also take place over the course of the Culver Viaduct project.

The work, which began this year, requires taking two tracks out of service at a time and as a result will lead to major service changes at all times, including rush hours, for the next four years. The first major service change, as noted above, was the extension of the G train to Church Avenue, because reconstruction work at the 4th Avenue station makes its traditional relay track at the 4th Avenue interlocking unavailable. Appendix D outlines all of the planned service changes required for the Culver Viaduct project, although these plans are subject to modification as the project progresses.

To mitigate the impact of ongoing work on the tracks of the Culver Viaduct, NYCT has installed track barriers between the tracks that are out of service for reconstruction and the tracks that are in service, to reduce the need for adjacent track flagging and thereby reduce project-related train delays.

In addition to the Culver Viaduct, one other major asset along the F is slated for major investment in the proposed 2010-14 Capital Program: the signal system. Except for the relatively short segment via the 63rd Street Line between the 50th Street interlocking in Manhattan and the 36th Street interlocking in Queens, as well as at two other interlockings (Bergen Street in Brooklyn and Van Wyck Boulevard in Queens) and at Coney Island, all of the signals along the route of the F are essentially original and have been in continual service for 60 to 90 years. They are therefore due for modernization. While these signals continue to operate as designed, their maintenance becomes increasingly expensive, and the reliability of the signals will increasingly become an issue. The 1999 fire at the Bergen Street interlocking, which led to a project to replace and modernize the signals at that location, highlighted the need to modernize aging signal systems.

Signal modernization projects are complex undertakings, as they must be designed to ensure safe train operations in all cases. Not only do signal modernization projects require the installation of a large number of components and an extensive amount of cabling, but they also require that the old signals must remain in operation until the new signals have been fully tested and are ready to be placed into service.

Because of the large number of signals that must be replaced, modernization of the signal system along the F is being divided into several projects spread out over many years, well into the 2020's, starting first with the modernization of the signal systems at interlockings. In Queens and Manhattan, the modernization projects are planned to include Communications-Based Train Control (CBTC), the new technology signal system that is currently in operation on the L line. In Brooklyn, the modernization is slated to entail new conventional signals that would be compatible with a CBTC overlay in the future.

The volume of signal work alone will dictate a significant number of off-peak service changes to accommodate the work for each project.

Table 11 summarizes the signal modernization work along the F line proposed for the 2010-2014 Capital Program. Of the more than $2.2 billion that NYCT proposes to spend on subway signal modernization projects in the next Capital Program, nearly $1.6 billion – or almost 70% - will be to modernize signal systems along the route of the F.

As indicated above, additional signal modernization work along the F will be programmed in later Capital Programs, through the 2020's.

Table 11
Signal Modernization Projects on the F
Proposed 2010-2014 MTA Capital Program

Project	**Line**	**Proposed Budget** ($ Millions)	**Year of Award**	**Projected Year of Completion**
Queens				
Union Turnpike Interlocking	Queens Blvd	171.4	2011	2015
Forest Hills-71 Av Interlocking	Queens Blvd	191.4	2011	2015
Roosevelt Av Interlocking	Queens Blvd	115.5	2012	2015
Queens Blvd CBTC Phase I[18]	Queens Blvd	125.0	2013	2018
Manhattan				
34 St Interlocking	6 Av	221.9	2012	2017
West 4 St Interlocking	6 Av	230.6	2012	2016
Brooklyn				
Jay St Interlocking	6 Av	199.6	2014	2019
CBTC Test Track	Culver	84.6	2011	2015
Church Av Interlocking	Culver	$246.1	2010	2014
Total for F, 2010-14		**$1,586.1**		**n/a**
Total for All Signal Projects, 2010-14		**$2,268.1**		**n/a**
Percent for F, 2010-14		*69.9%*		*n/a*

Source: Proposed MTA Capital Program 2010-14 – Draft, August 2009

The proposed 2010-14 Capital Program includes several other significant projects to improve the infrastructure of the rail lines used by the F, including tunnel lighting, ventilation, and structures. To the extent feasible, the tunnel lighting and ventilation projects will be coordinated with the Culver Viaduct and Queens Boulevard Line Signal Interlocking modernization projects, to minimize customer impacts.

Table 12 summarizes some of these other projects:

[18] CBTC Phase I on the Queens Boulevard Line will also include portions of the E and V along 53rd Street in Manhattan.

Table 12
Selected Other Capital Projects on the F
Proposed 2010-2014 MTA Capital Program

Project	Line	Proposed Budget ($ Millions)	Year of Award	Projected Year of Completion
Queens				
Tunnel Lighting - Roosevelt Av to 36 St	Queens Blvd	$76.4	2012	2015
Upgrade Emergency Ventilation (46 St)	Queens Blvd	$90.4	2012	2015
Brooklyn				
Tunnel Lighting - 4 Av to Church Av	Culver	$36.8	2010	2013
Paint Structure: Church Av to W 8 St	Culver	$51.4	2013	2016

Source: Proposed MTA Capital Program 2010-14 – Draft, August 2009

Strategies for Improving Reliability

This review has identified a number of factors contributing to below average reliability on the F, including:

- A long, complex route shared with several other lines.
- Heavy ridership and uneven loading.
- Poor performance of the car fleet.
- Poor application of delay management strategies.
- Aging infrastructure.
- Delays due to work on the tracks, particularly during the midnights.

NYCT has identified a number of strategies for improving operation of the F, including:

- Line General Management – Fundamental to any operational improvement is closer cooperation between those responsible for delivering service to customers and those responsible for maintaining the car fleet and infrastructure. To accomplish this, NYCT restructured its Department of Subways. In July 2009, NYC Transit's Line General Manager Program, already in place in the IRT (numbered lines) since the end of 2008, expanded to the BMT and IND lines (lettered lines, including the F). The Line General Manager concept provides for a dedicated management team to evaluate, monitor and manage the operations of each individual subway line, with the aim of improving customer satisfaction with the service provided on that line. NYCT has experienced success with this initiative in improving on-time performance on several of the IRT lines and believes that the challenges faced by the F line will be more effectively addressed with this new management structure in place.

- Senior Management Oversight – At the direction of President Roberts, a task force of senior managers from key departments is being established to review F line operations and to develop strategies for improvements. This effort began in October 2009. A similar multi-departmental exercise that began in 2008 focused on the 4 Lexington Avenue express and has succeeded in improving performance while also introducing service innovations. Innovations on the 4 include extending midday 5 service to Brooklyn to alleviate delays on the 4, adjusting 4 schedules to accommodate trackwork and to provide for gap trains to protect service in case of delays, and piloting morning rush hour 4 express service in the Bronx.

- Schedule and Service Design – The complexity of the F line and the heavy loads it carries warrant reviewing the service design of the F to assess potential operational and service changes, including:
  - Surveys of running times from end to end on the F to determine whether and how schedules should be modified, both peak and off-peak. This effort is currently underway.
  - An analysis of the 63rd Street Connector service plan between Queens and Manhattan, which rerouted the F onto the 63rd Street Line from the 53rd Street Line. This effort is currently underway.
  - An evaluation of potential F express service in Brooklyn. This review is slated to be undertaken during the Culver Viaduct reconstruction project, which will be completed in 2013.
  - An assessment of how midnight hour service design is affected by maintenance and capital work (see discussion of delays due to trackwork below). This effort is currently underway.
- Managing Loads – With a car-by-car analysis of train loads, F line general management will work with Customer Communications and the Rail Control Center to encourage more even loading of trains to reduce crowding in individuals cars. This effort can include targeted station announcements, staff on platforms, and posters and brochures. The Division of Operations Planning is currently undertaking this car-by-car analysis.
- Improving the Car Fleet Performance – NYCT has undertaken several changes in the F line fleet and how it is managed, including:
  - Changing the car assignments in July 2009 for all lines that operate along the Queens Boulevard Line (EFGRV) so that cars due for retirement are by and large not assigned to long lines with heavy ridership, like the F. This new strategy removed the oldest cars with the lowest reliability from the F, reducing the number of car classes assigned to the F from 5 to 2, and should help improve operational performance. The two car fleets assigned to the F are the R46 cars, built in the mid- to late 1970s and the R160 cars, currently being delivered.
  - Targeting the R46 car fleet assigned to the F for reliability improvements, including undertaking Scheduled Maintenance System (SMS) work in 2009-10, which replaces or overhauls key components, and undertaking

an engineering analysis of the R46 fleet to identify major causes of failure.

- Assigning a dedicated car maintenance manager for the cars assigned to the F.
- Continuing the assignment of new R160 cars to the F, as they are delivered and placed into service. Most F trains will eventually consist of R160 cars; however, some trains of R46's are expected to remain in F service until they come due for replacement by the end of the next decade.

- Delay Management Strategies – As noted above, F trains skipping stations in the Brooklyn-bound (discharge) direction afternoons and evenings has been a common response to delays in service. In July 2009, the F Line General Manager instructed field supervision to stop skipping stations in the discharge direction during the PM periods as a delay management strategy, so as not to inconvenience passengers. Line management and the Division of Operations Planning will develop new delay management strategies for the F line in the near future.

- Aging Infrastructure – Numerous reconstruction projects are underway, or are planned, along the F, including (but not limited to) the Culver Viaduct reconstruction, station modernization efforts, and a signal modernization program. Without reconstruction, the infrastructure will deteriorate as it ages and grow increasingly unreliable. Given the impact that reconstruction work can have on delays, as discussed in the next paragraph, NYCT will coordinate the work to minimize delays.

- Delays Due to Work on the Tracks – NYCT is undertaking a number of initiatives to address delays due to work on the tracks, for both maintenance and capital work. These are still under development for the F, but can include:

    - Providing additional running time in the timetables during off-peak hours, particularly middays and midnights. While this will not make service faster, this will help trains and crews reach their terminals with sufficient time to make their next scheduled trips, and it should reduce the incidence of large gaps in service due to trackwork delays.
    - Scheduling regular track outages on certain line segments to facilitate maintenance and inspection, allowing formerly separate routine maintenance activities to occur at the same time.
    - Revising service patterns off-peak, including the possibility of splitting midnight-hour F service into two, more manageable segments with guaranteed connections between the segments mid-route.

- o Monitoring service more closely and directing work crews to stop work and vacate the track area if there is an excessive build-up in congestion.
- o Establishing a Scheduled Maintenance System (SMS) for preventive signal repairs, similar to the SMS cycles established for car maintenance.
- o Establishing heavy maintenance rail gangs for track repairs.
- o Installing, where feasible, track barriers for long-term projects, to allow work to proceed without requiring delay-inducing adjacent track flagging.

Conclusion

The F is one of the longest routes in the subway system, and one of the most complex to operate. Operating over some of the oldest, and some of the youngest, line segments in the system, it carries a large number of riders, in some cases in trains that are loaded above NYCT's loading guidelines.

This report has shown that F performance statistics have lagged behind system averages and that many assets of the F infrastructure are old and in need of modernization. This report has also shown that NYCT is proactively seeking to correct the situation. Through a new managerial structure, creative operational strategies, and increased capital investment, NYCT is committed to improving the performance and condition of the F.