Feasibility and Analysis of F Express Service in Brooklyn

May 2016

(With April 2019 Update)

New York City Transit

Preface

This report on potential F Express service in Brooklyn was originally released in May of 2016. It recommended that F service in Brooklyn be evenly divided into "local" and "express" services, with the express running between Church Av and Jay St during peak hours. The report acknowledged that there would be trade-offs between faster run times for customers at express stations, and longer waits for customers at local stations. After the release, further evaluation and planning for any potential F Express was deferred until after the end of the planned 15-month L Tunnel 24/7 shutdown, which would have had indirect operational effects conflicting with the operation of an F express. The revised L Tunnel plan, announced in January 2019, would no longer affect weekday rush hour service, thus eliminating those operational conflicts.

In the years since 2016, there have been some changes in conditions along the F corridor, as well as in agency-wide capital plan priorities. MTA New York City Transit is now re-issuing this report with an addendum describing those changes, including an analysis of an additional option of running the "Coney Island Flyer," a more limited express service with two express F trains northbound from Coney Island during the AM peak period and two express F trains southbound from Coney Island during the PM peak period. NYCT projects that 2,100 riders may opt for Coney Island Flyer express service during the morning rush hour and 1,800 during the afternoon rush hour; for the limited span of the Coney Island Flyer operation, the share of affected riders who would benefit is projected to be 53% as compared to 45% of riders benefitting with the evenly divided "local" and "express" service, as riders adjust their trips to take advantage of the express operation.

NYCT recommends introducing operation of these Coney Island Flyers as a pilot starting in September 2019.

Brooklyn Ⓕ Express Study

Table of Contents

List of Figures

List of Tables

Executive Summary

NYCT has prepared this study of F express service on the Culver line in Brooklyn. The focus of the study is to develop and analyze an express F service that: 1) would meet current ridership demand consistent with NYCT Rapid Transit Service and Loading Guidelines and: 2) could reliably operate given the existing car fleet, track capacity, switch locations and station constraints.

An addendum to this study updates the analysis to 2019 and introduces the concept of the "Coney Island Flyer," a more limited express service, with two express F trains northbound from Coney Island during the AM peak period and two express F trains southbound from Coney Island during the PM peak period. NYCT recommends introducing operation of the Coney Island Flyer trains in September 2019.

Proposed Service Plan

The option analyzed in detail for this report is a two-way peak period express service between Church Av and Jay St-MetroTech, with half of the F trains operating express during rush hours and half of the F trains, along with the G trains, operating local. Other configurations are not feasible at this time, nor is it possible to meaningfully add overall F service, making reductions in local service inevitable.

The proposed Coney Island Flyer trains discussed in the 2019 addendum would operate express between Church Av and Jay St-MetroTech.

Current Infeasibility of Express between Kings Hwy and Church Av

A one-way peak direction express service between Kings Hwy and Church Av, with locals generally originating or terminating at Kings Hwy and expresses operating through from or to Coney Island-Stillwell Av, is not feasible given the current track and switch layout at Kings Hwy. Modernization of the Kings Highway interlocking has been programmed in the current capital plan, and is planned to include the additional switches required to allow for smooth operation of a one-way express service on this segment upon completion after 2019. However, the marginal impacts of this express segment would lead to approximately equal numbers of passengers losing time (from longer waits) and gaining time. Moreover, nearly all of the benefitting passengers would board at stations between Stillwell Av and Kings Hwy, where most passengers already have nearby access to alternative express services to Manhattan. Most of the passengers between Kings Hwy and Church Av, who are more dependent on the Culver line, would only have local service and therefore longer waits.

Constraints on Adding Total F Service

Due to rolling stock and track capacity limitations, any F express scenario will lead to reductions in service at Brooklyn local stations between Church Av and Jay St-

MetroTech, as the existing level of Ⓕ service in Brooklyn would have to be split between the express and local operations. Even if more trains become available and ridership grew to justify a significant increase in service, current limitations in available track capacity along the route of the Ⓕ in Manhattan and Queens would limit increases to only one or two additional trains per hour.

Operational Improvements and Impacts

Operationally, an express service could lead to some improvements, as southbound Ⓕ express trains would no longer be delayed by terminating Ⓖ trains discharging at Church Av, and to a lesser extent, by Ⓖ trains originating at Church Av. However, an additional train merge and diverge between expresses and locals would be added in each direction, which could reduce the benefit of some of these operational improvements.

Note that major service diversions on the Ⓕ line in Brooklyn are scheduled from Summer 2016 through Summer 2017 in connection with ongoing reconstruction work at nine Culver line stations. If the Ⓕ Express were operated during this timeframe, it would be susceptible to decreased reliability and frequency because the construction limits the ability to turn trains at optimal locations. Express service would also likely be limited to the peak direction (northbound in the morning, and southbound in the evening), with some express trains originating or terminating at Church Av, thus negating many of the time benefits for passengers south of Church.

Travel Time Savings

Analysis of travel times shows that express riders during the AM peak hour would save on average 3.4 minutes due to faster running times and local riders would lose on average 1.3 minutes mainly due to longer waits for local trains.[1] The maximum running time savings would be 7.3 minutes northbound and 6.2 minutes southbound, while the maximum additional travel time from longer waits would be 5.0 minutes. There would be a net travel time benefit of 27,000 minutes, or 1.0 minutes per affected passenger during an average weekday AM peak hour.[2] However, given the heavier ridership at local stations between Church Av and Jay St-MetroTech, more riders would experience longer travel times – 13,700 (or 52% of riders) versus 12,900 (or 48%) who would have shorter travel times.

[1] Additional average waiting time for Ⓕ trains at local stations would be 2.1 minutes, but that would be mitigated for some riders by the presence of the Ⓖ train, and in the case of riders at 15 St and Ft Hamilton Pkwy, the possibility of transferring to an Ⓕ express at 7 Av.

[2] If the express were implemented prior to Fall 2017, net time savings would be reduced, because the station reconstruction project would require some express trains to begin their northbound trips at Church Av.

During the AM shoulder periods positive impacts would be slightly lower and negative impacts would be slightly higher because the relative increase in wait times would be higher. During the PM peak hour net travel savings would only be 13,000 minutes, or 0.7 minutes per affected passenger; northbound local times are slower relative to express times due to signal constraints, as a result southbound travel time savings are not as great as northbound travel time savings.

Crowding Impacts

Ⓕ express trains would, on average, be slightly more crowded than current Ⓕ trains, while the Ⓕ locals would be less crowded. Both trains would continue to operate well within NYCT loading guidelines. However, PM peak hour express service would also lead to much larger exit surges from less frequent local Ⓕ trains at the Bergen St and Carroll St stations, leading to significant congestion at one street stair at Bergen St, and moderate congestion at one street stair at Carroll St. Mitigating these impacts by widening the stairs and installing the ADA-required elevators would cost approximately $10 million per station. These mitigations are not included in the proposed 2015-2019 Capital Program.

Recommendation

Due to the overall net passenger travel time savings and potential operational benefits, the original version of this report recommended that an Ⓕ express service be implemented after the Culver station project, early Fall 2017. The proposed service plan would have resulted in a net travel time benefit of 27,000 minutes during the weekday AM peak hour and 13,000 minutes during the PM peak hour. Ⓕ express trains would not be delayed by Ⓖ train operations and would have faster run times. While Ⓕ riders at local stations would experience longer wait times, this service change would help Ⓕ riders in South Brooklyn with the longest commutes.

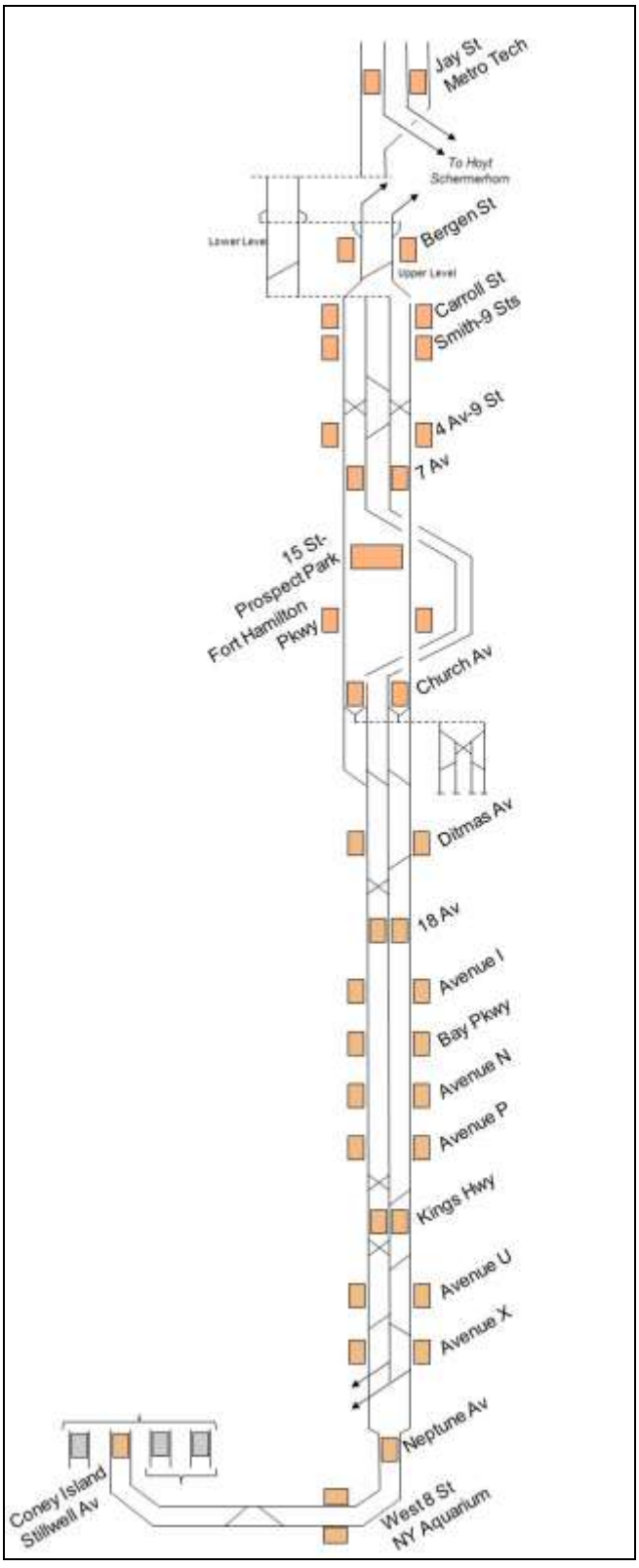
The addendum recommends a more limited “Coney Island Flyer” Ⓕ express operation, discussed in more detail in Section VII.

I. Introduction

Riders on the Culver line experience some of the longest trips in the system without an express or skip-stop option – the stretch from Neptune Av to Broadway-Lafayette St is 43 minutes – and runs through neighborhoods showing high growth rates. The focus of the study is to develop express F service options that would meet current ridership demand consistent with the NYCT Rapid Transit Service and Loading Guidelines and could feasibly operate given existing constraints in rolling stock, track capacity, switch locations and stations, as well as to analyze its potential benefits and drawbacks.

The F train operates between Coney Island in Brooklyn and 179 St–Jamaica in Queens, via the Culver line in Brooklyn, the 6th Avenue local in Manhattan and the Queens Boulevard express tracks in Queens. While it currently runs local along the full length of the Culver line, there are three tracks from Kings Highway to Church Av, and four tracks from Church Av to Jay St-MetroTech. The three-track section can in principle carry a one-way express service, while the four-track section can carry a two-way express service. The express tracks serve Kings Highway, 18 Av, Church Av, 7 Av, and Jay St-MetroTech. Express service operated in various configurations along the Culver line beginning in 1968, but was suspended in 1987 due to major structural work and has not been restored. As explained below, restoration of express service over the three-track section is not currently operationally feasible due to the track and switch layout at Kings. This report analyzes in detail restoration of a two-way express service over the four-track section.

Figure 1 – Culver Line Track Configuration



II. Population and Ridership

Ridership patterns along the Culver line are largely the product of the land use and demographic profiles of the areas it serves. The areas south of Church Avenue differ in significant ways from the areas north of Church Avenue, which has important implications for the benefits and disadvantages of any potential Ⓕ express service.

South of Church Av, the Ⓕ corridor serves the neighborhoods of Kensington, Borough Park, Ocean Parkway, Midwood, Gravesend, and Coney Island. The neighborhoods between the 18 Av and Neptune Av stations are generally characterized by a mix of row homes, detached houses, and low-rise multi-family apartment buildings. These neighborhoods have substantially lower population densities than other neighborhoods north of Church Av, such as Windsor Terrace, Park Slope, Carroll Gardens, Cobble Hill and Boerum Hill. (There are some notable exceptions – parts of Kensington, Borough Park and Coney Island do have densities comparable to the northern neighborhoods).

Similarly, the southern Culver corridor as a whole shows lower densities than the areas along parallel Brooklyn corridors such as the Brighton, Sea Beach, and West End lines (see Figure 2).

Several other demographic and employment factors affect ridership patterns. The percentage of residents who are members of the labor force is 44% south of Church Av and 64% to the north of Church Av. This is true even of the higher density neighborhoods of Kensington, Borough Park and Coney Island (see Figure 3). Even more distinct is the location of employment; approximately 35% of workers at Church Av and to the south work in Manhattan while approximately 60% of workers north of Church Av work in Manhattan.[3]

---

[3] Sources:

Population and demographic data from US Census 2011 ACS 5-Year Estimates.

Employment data from US Census 2011 Longitudinal Employer Household Dynamics Origin-Destination Employment Statistics (LODES).

Ⓕ Corridor defined as census tracts within 1 mile of line.

Figure 2 – Population Density, Ⓕ Corridor

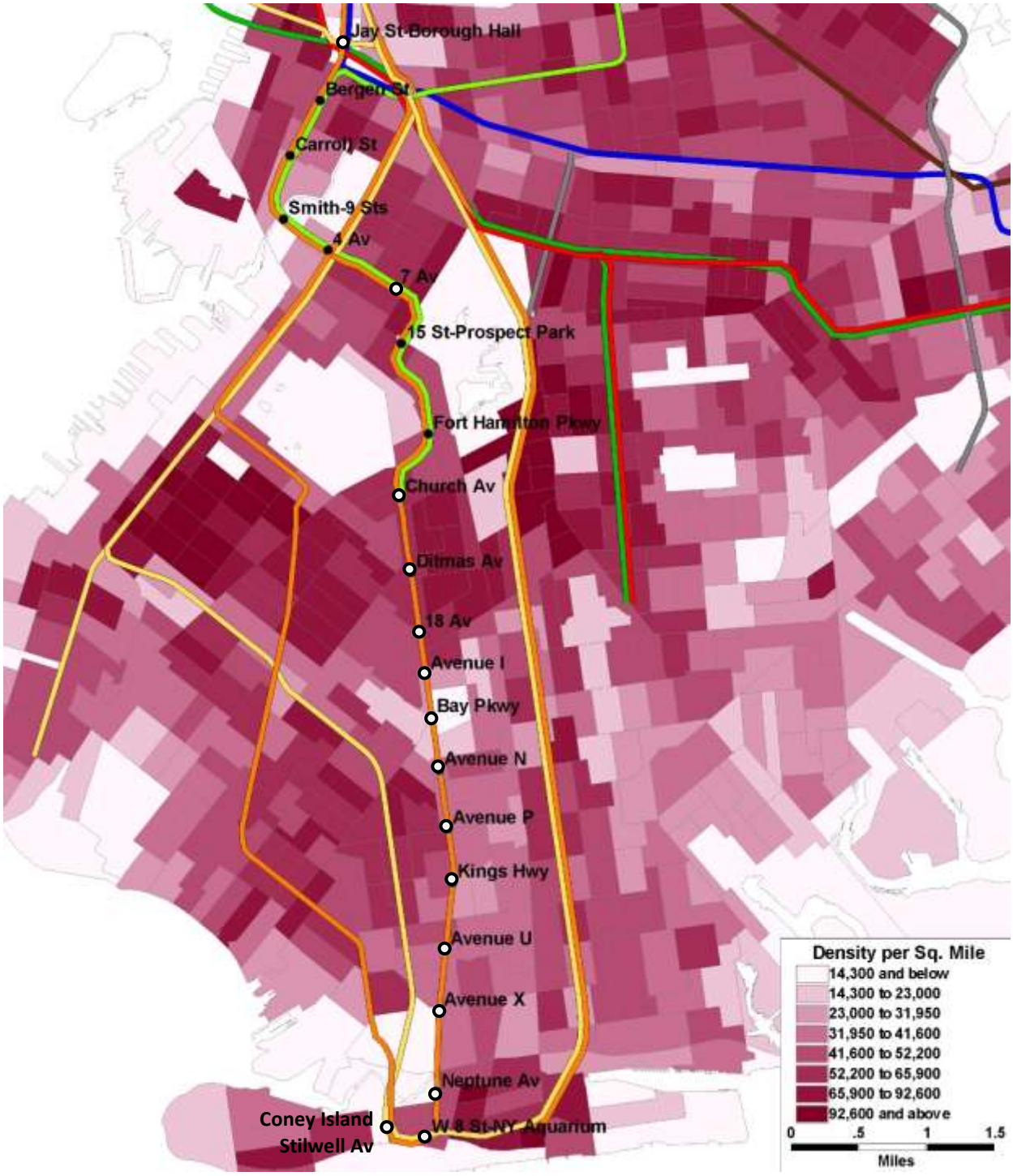
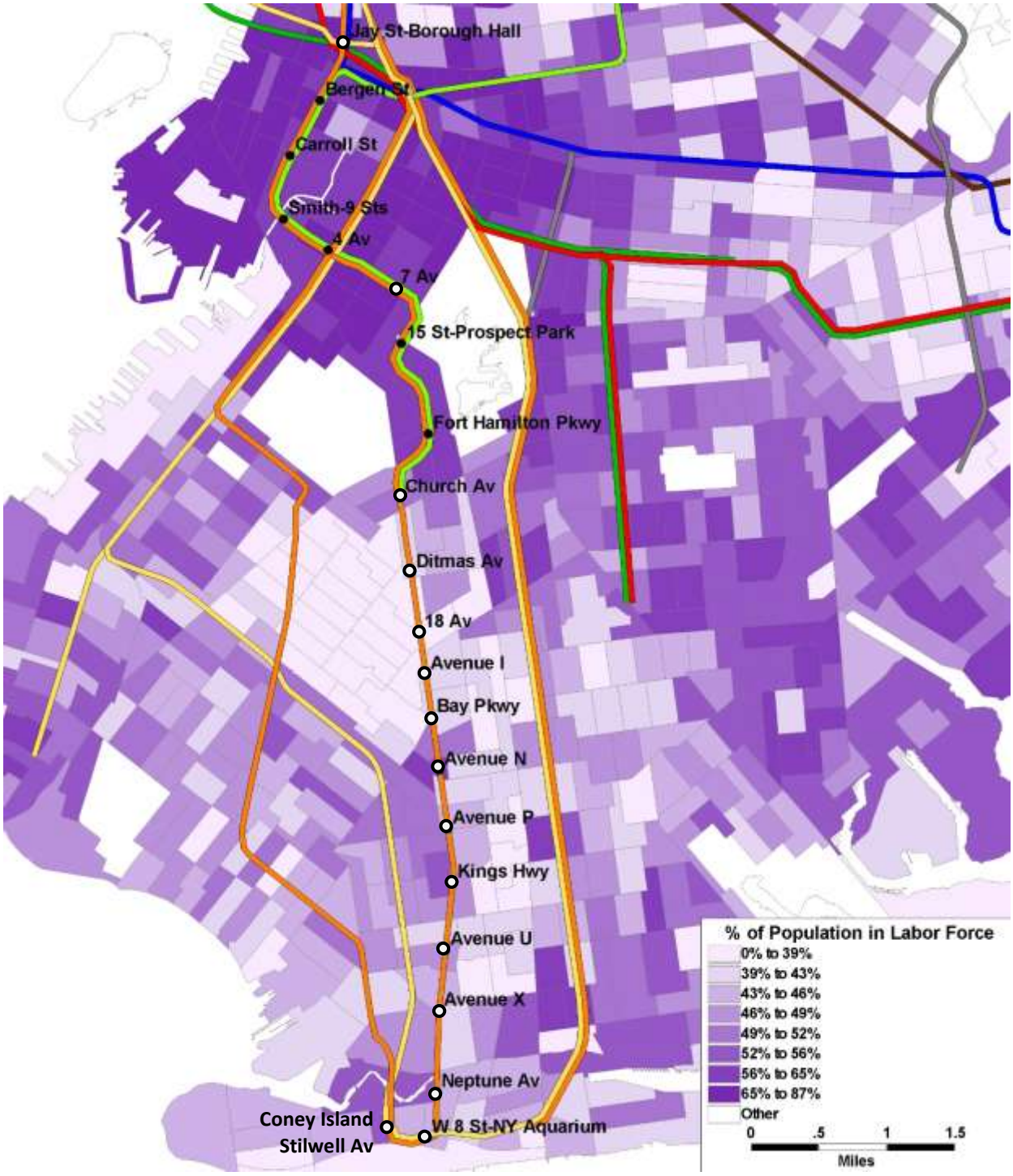


Figure 3 – Labor Force as % of Population, Ⓕ Corridor



As a result of this demographic background, AM northbound ridership on the (F) builds slowly between Coney Island and Ditmas Av, with an average of roughly 400-500 boardings per station in the AM peak hour. Ridership per station increases beginning at Church Av, with an average of about 1,400 boardings per station through Bergen St. Five of the seven Culver line stations with the most (F) boardings are local stops north of Church Av. Riders at these stops would not benefit from (F) express service in any scenario, as will be detailed in Section IV, because they will unavoidably experience longer waits in any feasible scenario.

Table 1 summarizes (F) ridership in the AM peak hour for a typical weekday in 2014.

Table 1 – Northbound AM Peak Hour Ridership Profile

Proposed Local Stop
Proposed Express Stop

Station	On	Off	Leave Load Volume	% of Guideline
Coney Island-Stillwell Av	450	-	450	4%
W 8 St-NY Aquarium	150	10	590	5%
Neptune Av	250	30	810	7%
Avenue X	520	30	1,300	7%
Avenue U	400	50	1,650	9%
Kings Hwy	650	70	2,230	11%
Avenue P	550	30	2,750	14%
Avenue N	600	60	3,290	17%
Bay Pkwy	210	60	3,440	17%
Avenue I	250	70	3,620	18%
18 Av	500	120	4,000	20%
Ditmas Av	700	120	4,580	23%
Church Av	1,400	110	5,870	30%
Fort Hamilton Pkwy	1,200	50	7,020	35%
15 St-Prospect Park	1,300	80	8,240	41%
7 Av	1,900	250	9,890	50%
4 Av	1,400	400	10,890	55%
Smith-9 Sts	350	90	11,150	56%
Carroll St	1,900	600	12,450	63%
Bergen St	1,800	250	14,000	71%
Jay St-MetroTech	3,700	4,000	13,700	68%

Traditionally, Bergen St has been the peak load point on the northbound (F) during the morning rush hour – meaning the (F) is at its most crowded between Bergen St and Jay

St.[4] NYCT determines peak hour service levels of each route by measuring demand at the peak load points. If loads are above loading guidelines[5], NYCT will add service if possible (in some cases track capacity or other physical constraints prevent additional service). Loading on the (F) between Brooklyn and Manhattan is currently well within guideline loads in both the morning and evening peaks, as shown in Table 2. As such, increasing the number of rush hour trains to and from Brooklyn is not warranted by ridership levels.

Table 2 –2014 Average (F) Peak Hour Passenger Volume and Percent of Guideline Capacity

Period	Station at Peak Load Point	Passenger Volumes	Trains per Hour	% Guideline Capacity	% Trains over Guideline
AM Peak	Bergen St (northbound)	14,000	13.8	71%	13%
PM Peak	Jay St-MetroTech (southbound)	11,300	13.9	56%	11%

Sources: NYCT Traffic Checks, 2013 and 2014

Recent Trends in Ridership

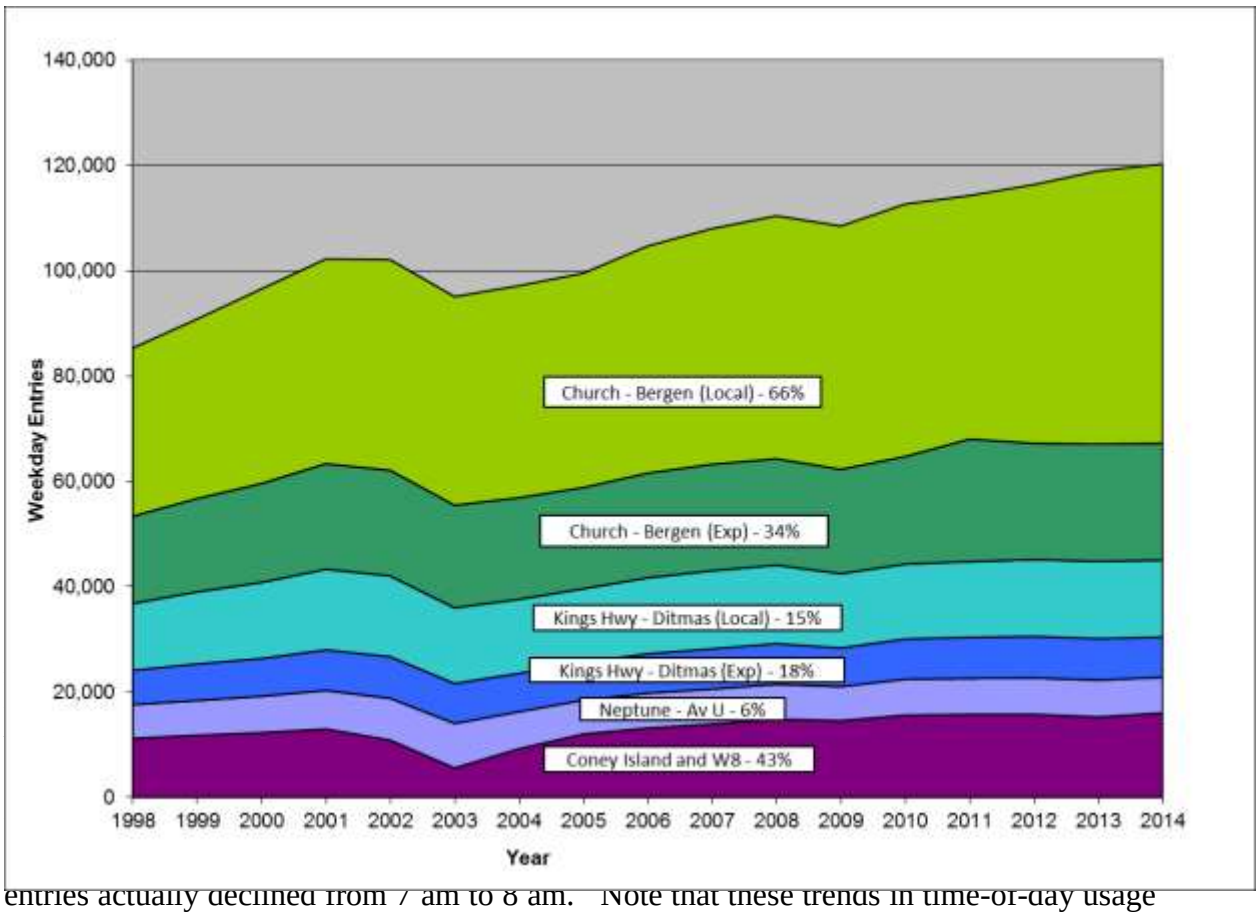
Ridership growth on the Culver line has outpaced systemwide growth in recent years, though it has been comparable to overall growth in Brooklyn. This is in part due to continued population growth in neighborhoods served by the (F) in northern Brooklyn (DUMBO, Downtown Brooklyn, Carroll Gardens, Gowanus and Park Slope) as well as Chinatown and the Lower East Side. Figure 4 shows Culver line weekday station entries, which in total grew by 44% from 1998 to 2014. This is lower than overall Brooklyn growth (52%) but higher than systemwide growth (41%) during the same period.

However, that growth has been highest at the local stations between Church Av and Bergen St (66%). Growth at express stops (i.e., Church Av and 7 Av) was 34% - slightly below the system average. Meanwhile, ridership growth at stations south of Church Av, both express and local stops, has been considerably lower (18% and 15% respectively).

[4] Recent service changes and demographic patterns have altered northbound (F) ridership demand so that Bergen St in Brooklyn and 2 Av in Manhattan are now roughly equal in demand, and either location may be the peak load point in any given year.

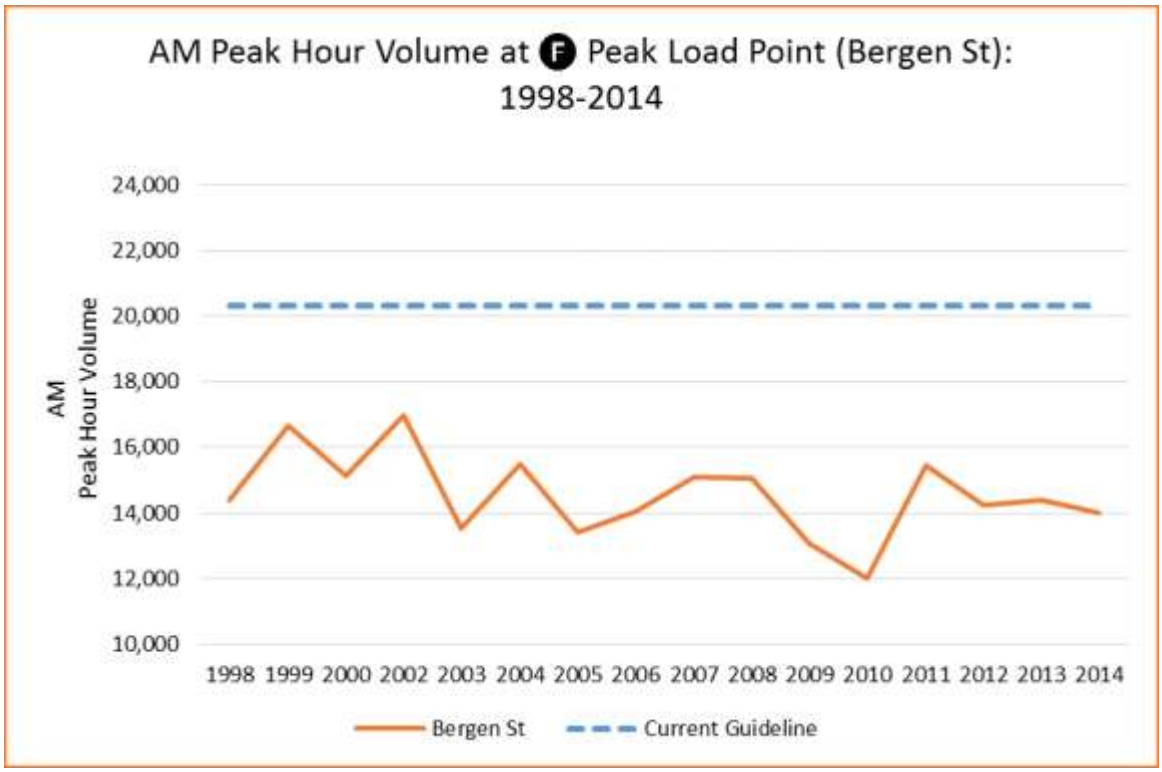
[5] The peak-period guideline capacity is based on 3 square feet per standing passenger and all seats occupied. Note that the policy maximum weekday headway is 10 minutes (except late evenings and overnights) even if ridership does not warrant more frequent service.

Figure 4 – Ⓕ Line Station Weekday Entries and Growth by Segment, 1998-2014



entries actually declined from 7 am to 8 am. Note that these trends in time-of-day usage are not unique to the Culver line and have been experienced throughout the system.

Figure 5 – Ⓕ Line Peak Hour Load Trend



Source: NYCT observations

Table 3 –Change in Weekday Entries by Hour, 2007-2014, (F) Corridor[6]

Hour	2007	2014	% Change
12a-1a	308	392	27%
1a-2a	137	173	27%
2a-3a	92	113	23%
3a-4a	110	132	20%
4a-5a	360	421	17%
5a-6a	1,400	1,334	-5%
6a-7a	4,132	4,208	2%
7a-8a	11,174	11,102	-1%
8a-9a	14,938	15,407	3%
9a-10a	7,937	8,543	8%
10a-11a	4,065	4,312	6%
11a-12p	3,213	3,508	9%
12p-1p	3,128	3,435	10%
1p-2p	3,180	3,524	11%
2p-3p	3,809	4,295	13%
3p-4p	4,742	5,257	11%
4p-5p	4,665	5,440	17%
5p-6p	4,743	5,659	19%
6p-7p	3,714	4,682	26%
7p-8p	2,681	3,140	17%
8p-9p	1,989	2,281	15%
9p-10p	1,421	1,700	20%
10p-11p	1,170	1,429	22%
11p-12a	797	949	19%
Total	**85,914**	**93,450**	**9%**

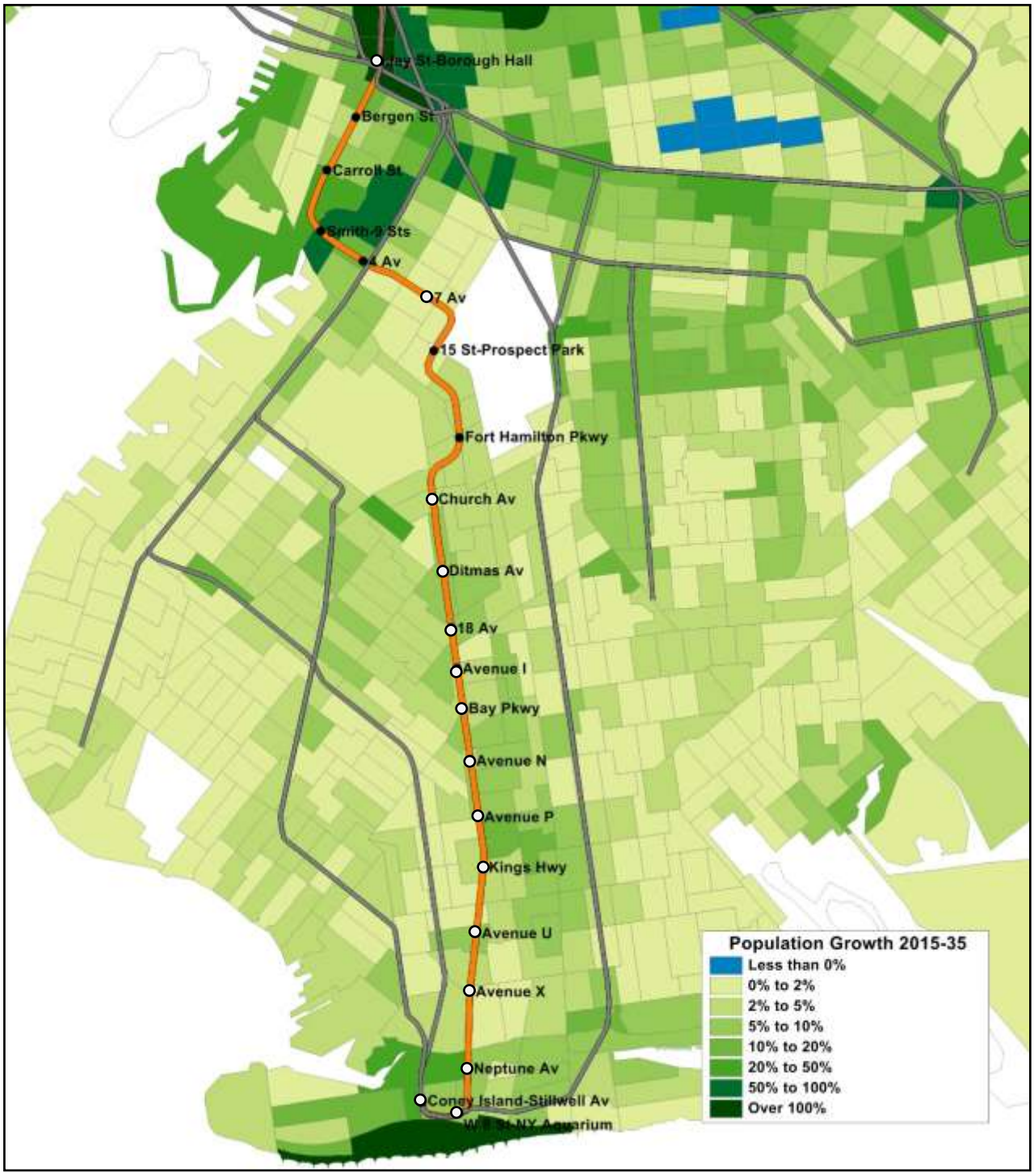
[6] Hourly MetroCard data by station is not available for years prior to 2007.

Projected Future Growth in Corridor

The latest sub-county level 2035 forecasts available from the New York Metropolitan Transportation Council (NYMTC) and the NYC Department of City Planning, illustrated in Figure 6, show that Brooklyn growth is expected to be concentrated in the northern portions of the borough. However, the Culver corridor is expected to experience growth slightly higher than much of the rest of South Brooklyn, generally in the range of 3% to 7%, with some high growth pockets in Coney Island, Gowanus and Carroll Gardens. Coney Island residents could benefit marginally from an F express (other express services are available at Stillwell Av), while the higher growth sections in Gowanus and Carroll Gardens would only be served by local stations. The population growth is expected to lead to increases in peak demand of 9% at Bergen St and 7% at 2 Av.

These forecasts incorporate known large-scale real estate projects or rezonings under development. However, the current mayoral administration is actively seeking to promote housing development to accommodate projected population increases throughout the city, and it is possible that some neighborhoods in South Brooklyn, including the F corridor, could be targeted for additional rezonings or large-scale projects not currently captured in the forecasts.

Figure 6 – Projected Population Growth, 2015-2035



III. History of Brooklyn F Express

The F in Brooklyn operates over two segments built in different eras. South of Church Av, the F operates on a mostly three-track elevated structure built primarily in the 1910s as part of the BMT Culver Line. From Church Av north, the F operates on a mostly-four track line that opened in 1933 as part of the IND subway. The two lines were combined in 1954, with BMT trains rerouted via a connector between the Ditmas Av and Church Av stations onto the IND into Manhattan.

The IND portion of the Culver line between Jay St and Church Av was designed in the 1920s with the concept that express tracks would lead to Manhattan via the 6th Avenue Line, while local tracks would serve Brooklyn/Queens destinations via the Crosstown and Queens Boulevard Lines. As originally conceived, the availability of direct service to Manhattan and the CBD would have been limited to just those stations with express platforms – Church Av, 7 Av, and, originally, Bergen St. However, when the IND Culver Line opened, direct local service to/from Manhattan was provided from the outset; indeed, no express service was operated for more than 34 years after the IND Culver line was completed in 1933, and 14 years after the IND and BMT portions of the Culver line were connected. Moreover, with the exception of a few months in the 1970s, in practice Manhattan service was always provided at local stations.

Express service was first introduced on the Culver line in 1968 and ran in some form until 1987, as shown in Figure 7. During that time, F express service operated in two distinct phases.

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 Hwy and Church Av and in both directions between Church Av and Jay St.

- 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 Av and Kings Hwy.

- During the hours of F express operation, some F trains also made all local stops in both directions between Kings Hwy and Jay St.

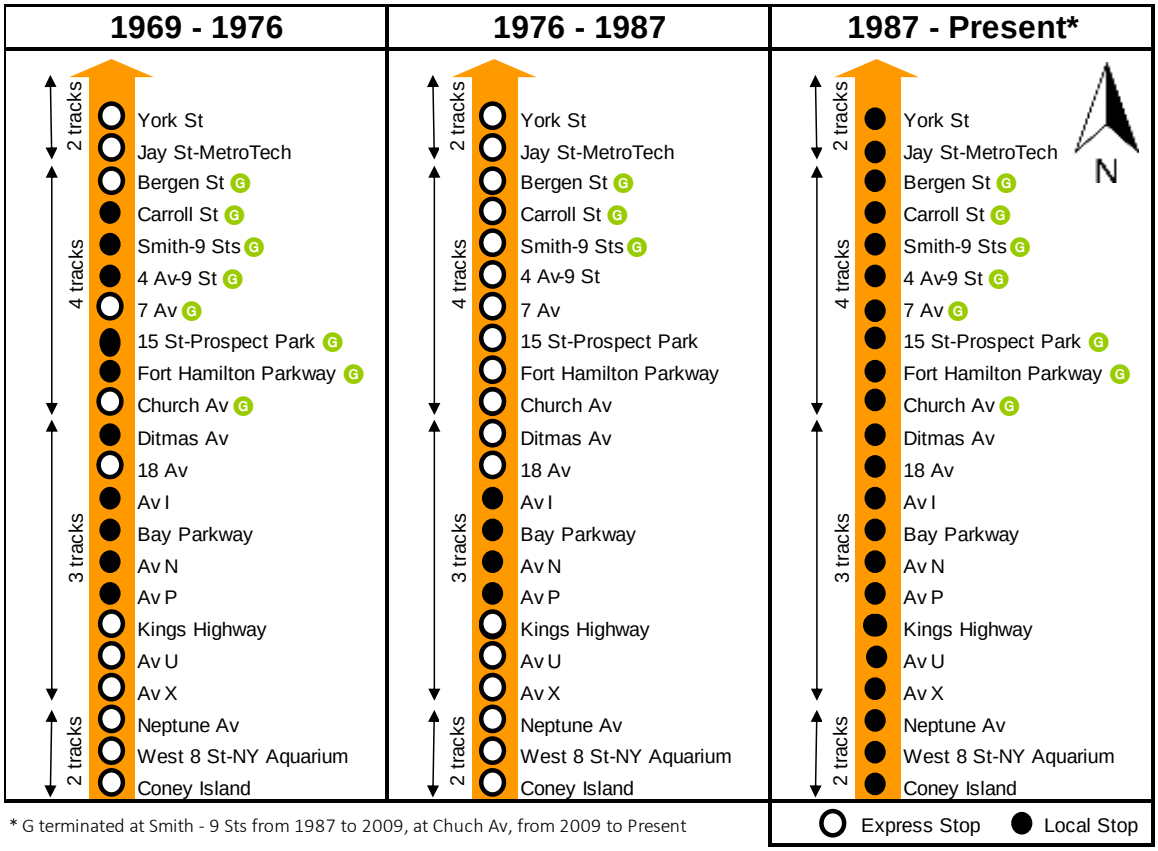
- G trains making all local stops supplemented F local trains in both directions between Church Av and Jay St during rush hours.

From 1976 to 1987, peak-direction rush hour Brooklyn F express service operated between Kings Hwy 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. During the hours of F

express operation, some (F) trains also made all local stops in both directions between Kings Hwy and Jay St. All (F) trains made all local stops between 18 Av and Jay St.

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.

Figure 7 – History of (F) Train Service Patterns



In 1987, express service was suspended for structural work on the elevated portion between Kings Hwy and 18 Av. From 1989 to 1993, various plans to restore express service, including between Church Av and Jay St, were proposed but were not implemented. This was due to budget constraints at the time and opposition from residents and elected officials in Carroll Gardens because Bergen St and Carroll St stations are local stations.[7]

[7] Bergen St was originally an express station, but is now a local-only station. This is discussed in greater detail later in this report.

In 1999, damage resulting from a fire in the relay room for the track switches and signals near the Bergen St station precluded implementation of express service. Although temporary repairs allowed full F and G local service to operate, between 1999 and the reconstruction of the signal relay room in Fall 2008, the express tracks were not available for service. In 2009, the Culver Viaduct rehabilitation project began which also precluded express service, as the project removed two of the four tracks on the viaduct from service continuously until 2012. Completion of that project now makes all tracks, including the express tracks, available for service between Church Av and Jay St.

Comparisons to Other Express Corridors

While the Brooklyn F corridor is one of the longer subway corridors without express or skip-stop service, when compared to similar corridors it is among the least likely to benefit from an express. The most relevant comparison is to other corridors where express trains must merge with local trains before entering the central business district. The requirement that all local and express trains merge onto a single track constrains total combined local and express service to the capacity of the single track. Other corridors where local and express tracks do not merge – such as Queens Boulevard (E F M R) or the Manhattan IRT corridors (1 2 3 and 4 5 6) – are not comparable because the local tracks alone cannot accommodate the number of trains needed to meet demand.

Table 4 shows relevant characteristics of comparable corridors; the 6 express/local in the Bronx, the 7 express/local in Queens, the A C express/local in Brooklyn, and the Brighton line (B Q express/local) which parallels the F. (The B Q represent a slightly different service pattern because while the B and Q share the same tracks between Prospect Park and DeKalb Av, they serve different corridors in Manhattan).

In all of these corridors it is technically feasible to run all scheduled trains on the local track and still meet ridership demand within the NYCT Rapid Transit Loading Guidelines, meaning that there are trade-offs in running express/local service similar to the trade-offs involved in F express service. All of these corridors serve a higher level of passenger demand than the F corridor, and therefore can justify more frequent total service than the F. This in turn means that provision of express service has a smaller impact on average wait times at local stations. Moreover, the population patterns in those corridors are more compatible with express service in that there are greater concentrations of riders around express stations. As a result, in these cases more riders save time from the express than lose time.

Table 4 – Comparison of Selected Express/Local Corridors (AM Peak Hour)

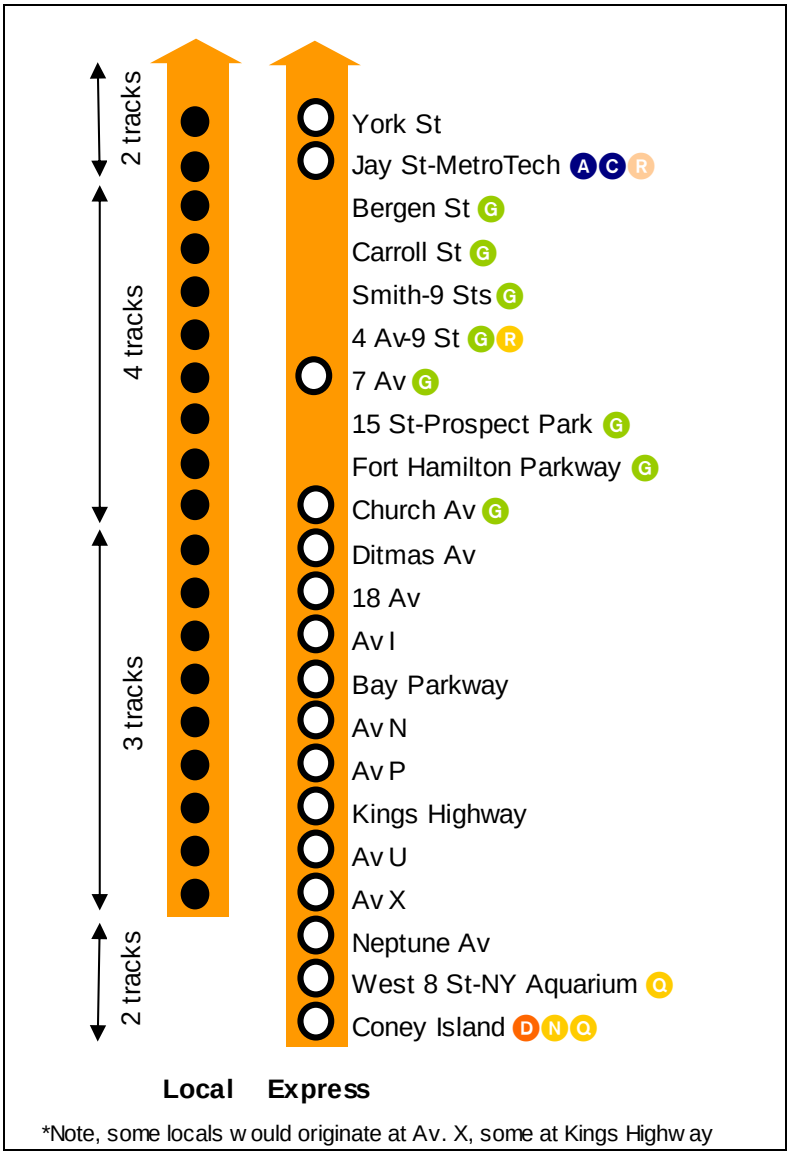
	6	7	A C	B Q	F
Express Riders	70%	50%	73%	56%	48%
Local-Only Riders	30%	50%	27%	44%	52%
Stops Skipped	9	10	9	8	6
End-to-End Running Time Savings of Express vs. Local	6.5	5.5	5.5	6.5	7
Combined Volume at Peak Load Point	24,200	30,700	27,000	20,900	14,000
Combined Frequency (Trains per Hour)	22	27	26	20	14
Frequency at Local Stations (Trains per Hour)	10	13.5	8	10	7
Extra Average Wait at Local Stops (Mins) vs. All-Local Service Pattern	1.63	1.1	2.59	1.5	2.14

IV. Current Express Options

Proposed Express Service Pattern

The two-way express would run along the four-track section between Church Av and Jay St-MetroTech in both directions during the AM and PM peak periods. Northbound, the express would bypass Ft. Hamilton Parkway and 15 St-Prospect Park before stopping at 7 Av. It would skip four additional local stops: 4 Av-9 St (missing the transfer to (R) service), Smith-9 Sts, Carroll St and Bergen St. It would merge again with (F) local service between Bergen St and Jay St. The same pattern would hold in the southbound direction. See Figure 8.

Figure 8 – Proposed (F) Express Pattern



Potential "Zone Express" with local (F) Service Terminating at Church Av

A variant on this option could be a "zone express" in which local trains would use Church Av as a terminal and most trains to and from Coney Island and Kings Highway would run express north of Church Av. (Local trains going from and to the (F) train storage yard near the Avenue X station would also operate in service south of Church Av.) While this option would reduce service south of Church Av, it may allow for some operational improvements and marginally reduce fleet requirements. The ability of Church Av to operate as a terminal for 7 (F) trains in addition to all (G) trains (currently, 9

trains in the peak hour) would need to be investigated, as a recent signal and track modernization project changed the track configuration of the "tail tracks" where G trains currently terminate south of Church Av and where local F trains would also terminate. However, because this configuration would require an extra transfer for passengers traveling between stations south of Church Av and local stations north of Church Av and possibly lead to uneven loading, it was not studied as part of this report.

Potential Kings Highway Express Option

NYCT did look at the feasibility of an express option that included a one-way service between Kings Hwy and Jay St-MetroTech. The marginal impacts of this express segment would lead to approximately equal numbers of passengers losing time (from longer waits) and gaining time. Moreover, nearly all of the benefitting passengers would come from stations between Stillwell Av and Kings Hwy, where passengers already have nearby access to alternative express services to Manhattan (i.e, the D N Q at Stillwell Av, and the N at Av X, Av U and Kings Hwy). Most of the passengers between Kings Hwy and Church Av, who are more dependent on the Culver line, would have longer waits.

However, this option is currently infeasible, because the required track switches to support this operation are not in place. In the early 1990s, the switches at Kings Hwy that had been used to route trains to the express track were in need of replacement based on age and condition. They were removed because the expense of replacement could not be justified as they were no longer in use. They would need to be reinstalled to allow express service to operate without being delayed by local trains terminating at Kings Hwy. The interlocking (track switches and signals) at Kings Highway is slated to be modernized as part of the next capital plan, with completion scheduled for some time after 2020; the modernization could include reinstallation of the necessary track switches.[8]

Because of these capital projects, the Kings Highway express option has been dropped from further consideration at this time. A future study could examine the additional benefits of the Kings Highway to Church Av express segment as an extension of, or in lieu of, a Jay St to Church Av express.

[8] Note that even if these switches were in place today, this express service could not begin operation until at least 2018, due to an ongoing major station reconstruction project at nine stations south of Church Av. That project will require F service to run on the express track between 18 Av and Neptune Av for six months in each direction while the local tracks are taken out of service. From south to north, the stations included in this project are Av X, Av U, Kings Highway, Av P, Av N, Bay Parkway, Av I, 18 Av, and Ditmas Av.

Potential of Restoring Bergen St Lower Level Service

Some observers have suggested that NYCT restore the lower level of Bergen St. which had originally been a bi-level express station before it was removed from service in the 1990s.[9] Conceptually it would be possible to restore the lower level and allow express trains to stop there, thus mostly eliminating the negative impacts at one of the most heavily used local stations.

However, restoring the lower level for use would require significant and costly reconstruction, including the following:

- Accessibility upgrades (elevators, boarding areas, and platform edges) per the Americans with Disabilities Act (ADA),
- Reconstruction of platform stairs,
- Water proofing and concrete repairs,
- Lighting/communications, and
- Across-the-board replacement of architectural finishes (floors, wall, ceilings, paint, etc.).
- Relocation of signal cable chases to provide adequate headroom on the lower level platforms.
- Restoration of two staircases between the upper and lower levels that had been removed after the lower level platforms were decommissioned.
- Potential modifications to the express track signals to accommodate a station stop that may not have been included in the modernized signal system installed after the Bergen Street Fire.

A comprehensive engineering review may find additional elements in need of repair. This work is estimated to cost in excess of $75 million.

[9] Local platforms were on the upper level with express platforms on the lower level. This bi-level design led to awkward customer service, because northbound customers would often wait in stairwells between levels in order to see where the next Manhattan-bound train would arrive.

Figure 9 – Current Conditions at Bergen St Lower Level

Express Run Times

In December, 2014, NYCT conducted a number of test train runs on the express tracks to estimate potential run-time savings versus current local service. The tests determined that express trains could save over 7 minutes northbound and over 6 minutes southbound compared to local service, as shown in Table 5. The different run time savings are due mainly to varying signal constraints by direction.

Table 5 – Test Train Travel Times (Minutes)

	Segment	Current	Express	Difference
Northbound	Church Av - 7 Av	6.3	3.7	2.6
	7 Av - Jay St	9.7	5.0	4.7
	TOTAL	**16.0**	**8.7**	**7.3**
Southbound	Jay St - 7 Av	9.5	5.4	4.1
	7 Av - Church Av	6.8	4.7	2.1
	TOTAL	**16.3**	**10.1**	**6.2**

In practice, these run times would be subject to operational delays, as the express and local services would still need to merge north of Bergen St in the northbound direction and south of Church Av in the southbound direction. On the other hand, running half of all F trains on the express track would reduce conflicts with the G train, which are particularly problematic at Church Av where terminating G trains can delay following southbound F trains while passengers are discharged, and originating G trains conflict with following northbound F trains. Also, northbound F express trains would avoid restrictive signals on the local track entering Bergen St upper level, which are necessary for safe train operations but can delay service on the local track.

Note that major service diversions on the F line in Brooklyn are scheduled from Summer 2016 through Summer 2017 in connection with the Culver stations reconstruction project. If the F Express were operated during this timeframe, it would be susceptible to decreased reliability and frequency because the construction limits the ability due to turn trains at optimal locations. During this project, the express track between Neptune Av and 18 Av will be used to bypass stations. As a result Kings Highway cannot be used to turn trains. Due to limits on car equipment availability, this means that some F trains will need to be turned at Church Av, which would cause conflicts with use of the express track north of Church Av. Due to those same constraints express service would also likely be limited to the peak direction (northbound in the morning, and southbound in the evening), with some express trains originating or terminating at Church Av, thus negating many of the time benefits for passengers south of Church Av.

Proposed Frequencies and Limits on Total F Service

For the purpose of this report, it is assumed F service would be split evenly between local and express routes to make the merge between those services as smooth as possible. This is the practice on most, but not all, comparable segments of the subway system where local and express services must merge. In theory an uneven ratio might slightly reduce the wait time impacts at local stations, but the merge would be much more likely to lead to delays and uneven service along the shared segment north of Bergen St, negating some of the wait-time benefits at local stations.

With that service design, there would be 7 express trains and 7 local trains during the AM peak hour, evenly splitting the current 14 trains per hour. During shoulder periods and the PM peak periods there would be 6 express trains per hour and 6 local trains per hour (the minimum policy frequency), evenly splitting the current 12 local F trains per hour.

The F express service plan and service frequencies that could be provided in any practical option are constrained by a number of factors. This means that in all scenarios, express F service would lead to reductions in service at local stations and longer wait times.

In the immediate future, NYCT does not have enough rolling stock to add any F service in the AM peak period. The next fleet of cars, the R-179 order will be delivered in the coming years. At that time it may be possible to expand F service by one additional train in the peak hour to 15 trains per hour if warranted by ridership and competing system demands.

However, even with an unlimited fleet, practical track capacity would constrain total F service to the same 15 trains per hour for the foreseeable future. The Queens Boulevard express tracks where the F and the E operate is limited to 30 trains per hour (or 15 tph on each line) in each direction. It would be physically possible to run an additional two

F trains per hour along the 6th Avenue local track and then the Queens Boulevard local track.[10] However, both of those tracks are shared with the M service from Brooklyn, which is currently at 90% of NYCT's loading guidelines during the AM peak (compared to 71% on the F). In recent years M ridership has been growing very rapidly, and it is expected that this trend will continue. To meet that demand, NYCT expects it will be necessary to increase peak M service from 8 tph to 10 tph. (Note that M service will increase to 9 tph in June 2016). This would preclude adding more than one northbound F train, even after future expansions of the car fleet.[11]

Limits on Span of F Express

NYCT Rapid Transit Service and Loading Guidelines require a maximum of 10-minute headways, on average, on each service during weekdays.[12] This limits the potential span of Brooklyn express service to times when the F is currently scheduled for a maximum of 5-minute headways or a minimum of 12 trains per hour. Currently those times are roughly 7:15 am to 9:00 am and 5:00 pm to 8:00 pm at Church Av. During most of the midday period the F is scheduled at 8 trains per hour. Ridership demand does not justify increasing off-peak service beyond that level at this time or in the near future.

In sum, these constraints limit the extent of F express service to peak hours, between Church Av and Jay St, with no increase in service to mitigate loss of service at local stations at present, and at most an increase of one train per hour on peak hour F service upon delivery of the R-179 order.

V. Express Ridership and Travel Time Savings

Table 6 illustrates travel time savings for selected pairs of origin and destination stations, including wait times. Times from express stops generally decrease by over 5 minutes, but note that on average passengers at express stations will wait longer for their express train, somewhat reducing the in-vehicle time savings of over 6 minutes. Some riders boarding at express stations would be negatively affected, because they have local destinations. Trips beginning or ending at local stations between Church Av and Jay St-

[10] Capacity on the 6th Avenue local tracks is 25 trains per hour – 14 F trains and 8 M trains are currently scheduled in the northbound direction in the AM peak hour. Capacity on the Queens Boulevard local tracks is effectively 20 trains per hour, 10 R trains and 8 M trains are currently scheduled in the northbound direction.

[11] Signal and traction power investments on the Queens Blvd and 6 Av lines may allow for a slight increase in capacity on these lines, but not until the 2020s.

[12] There are limited exceptions to the guideline maximum headway, for branching services at the outer extremities of the subway system. These would not apply to the F train.

MetroTech would be served by only 7 trains per hour compared to the current 14 trains per hour. This translates to an average wait of 4.3 minutes instead of 2.1 minutes. For certain destinations, such as W4 St, the additional wait time is marginally reduced at local stations because some customers may choose to board a (G) train if it arrives first and ride to Hoyt-Schermherhorn Sts where they can transfer to an (A) or (C) train.

Table 6 – Travel Time Impacts Between Selected Station Pairs, AM Peak*

From	To	Base Scenario	Church Express Scenario		Time Savings
		(F)	Via (F) Express	Via (F) Local	
Kings Hwy	Bergen St	27.5	-	29.7	-2.1
Kings Hwy	34 St - Herald Sq	46.3	40.9		5.4
Bay Pkwy	7 Av	15.1	14.8		0.3
Fort Hamilton Pkwy	34 St - Herald Sq	33.1	-	35.3	-2.1
7 Av	34 St - Herald Sq	28.7	25.7		3
Carroll St	W4 St	18	-	19.8	-1.8
Bergen St	34 St - Herald Sq	20.9	-	23	-2.1
2 Av (Manhattan)	Bergen St	12.9	-	14.9	-2
2 Av (Manhattan)	7 Av	20.3	18.9		1.4

*Includes Wait Time

Table 7 shows the aggregate impacts to all affected riders, broken down by the magnitude of their change in travel time. Because the local stations between Church Av and Jay St accommodate more riders than other stations along the (F) in Brooklyn, the number of negatively affected riders outnumbers positively affected riders – 13,700 vs. 12,900 on an average weekday AM peak hour (or 52% vs. 48%). Most riders at express stations (i.e, 7 Av, and stations from Church Av south) would benefit. On average, benefitting riders save 3.4 minutes, while the inconvenienced riders lose on average 1.3 minutes. Because express riders generally save more time than local riders lose, the total impact to all affected passengers combined would be a net travel time reduction, with a net average savings of 1.0 minutes per affected passenger.

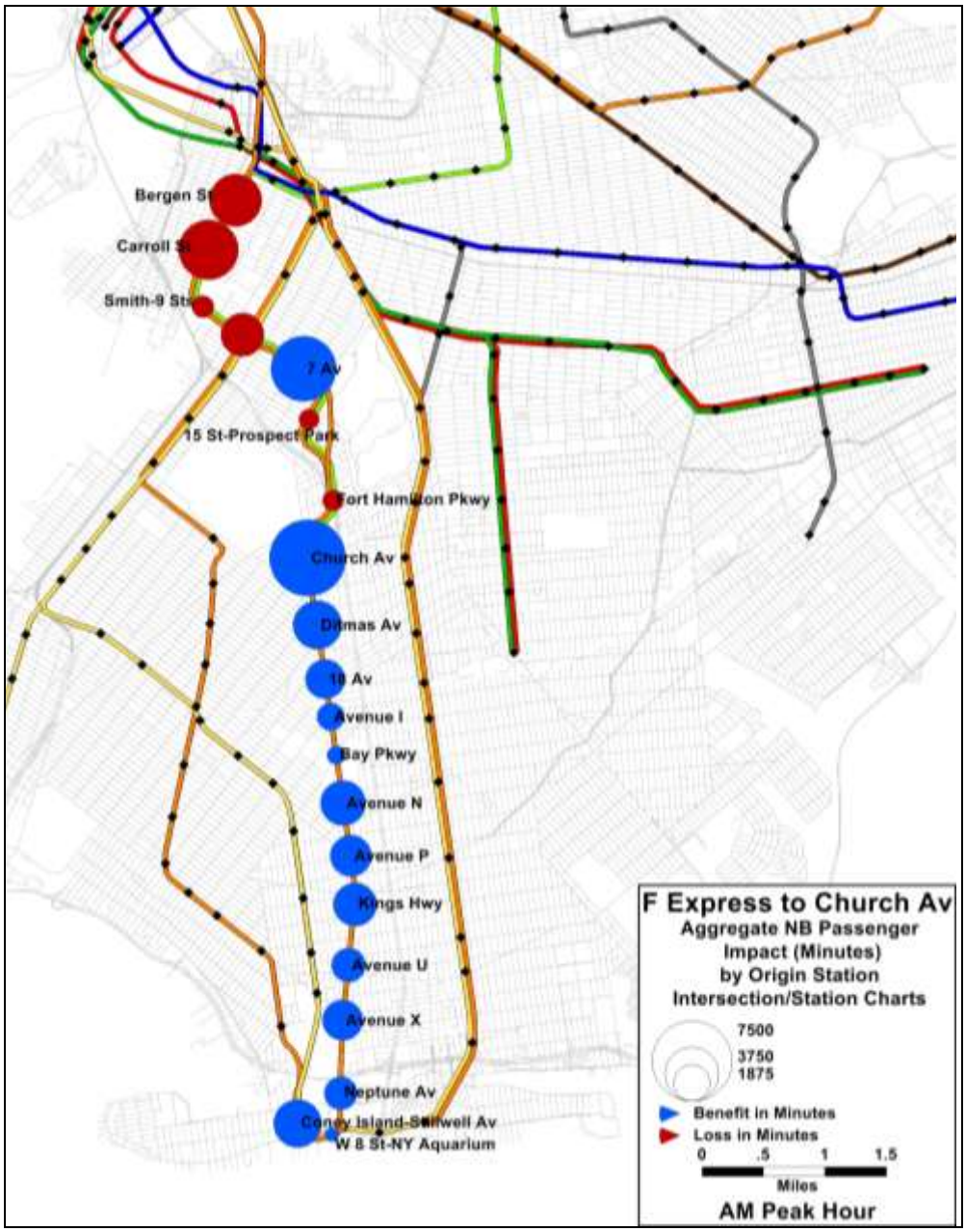
Table 7 – Impacts to Riders by Magnitude of Travel Time Impact, Jay St to Church Av Express, AM Peak Hour

	Minutes Saved	Riders	Share	Total Mins	Avg Mins
Benefitting Riders	Over 5	1,400	5%	(8,100)	(5.8)
	4-5	4,600	17%	(22,300)	(4.8)
	3-4	900	3%	(3,300)	(3.6)
	2-3	2,700	10%	(6,800)	(2.5)
	1-2	1,600	6%	(2,800)	(1.7)
	0-1	1,700	6%	(980)	(0.6)
	TOTAL	**12,900**	**48%**	**(44,280)**	**(3.4)**
	Minutes Lost	Riders	Share	Total Mins	Avg Mins
Inconvenienced Riders	0-1	6,500	24%	3,200	0.5
	1-2	3,200	12%	3,800	1.2
	2-3	4,000	15%	10,200	2.6
	3-4	-	0%	-	-
	4-5	-	0%	-	-
	Over 5	-	0%	-	-
	TOTAL	**13,700**	**52%**	**17,200**	**1.3**
	NET TOTAL	**26,600**	**100%**	**(27,080)**	**(1.0)**

Figure 10 illustrates the aggregate travel time impact by origin station (where passengers enter the system).[13] This shows that even though the average impact at local stations would be lower than the average savings at express stations, because those are much busier stations, the typical local station shows a total loss of time comparable to the total saved time at express stations. Nevertheless, because most passengers from Church Av south would benefit, the total overall impact would be a net savings of 26,600 passenger-minutes in the peak hour.

[13] Aggregate impact is equal to the sum of all time impacts to riders who enter each station.

Figure 10 – AM Travel Time Savings by Entry Station, Church Av to Jay St Express



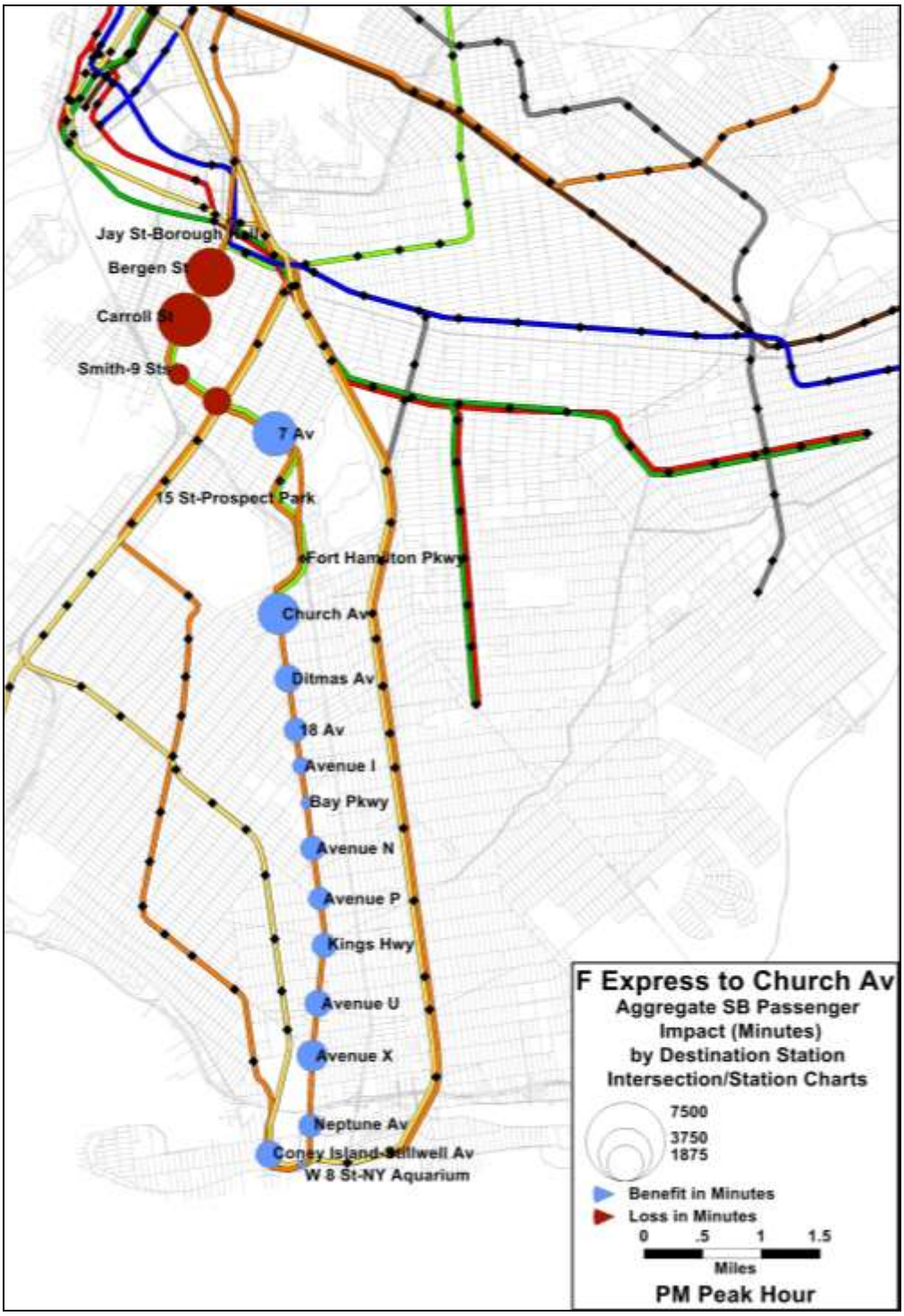
In the evening, the positive impacts will be lower, mainly because the express savings is lower in the southbound direction, as shown previously in Table 5, due to signal constraints. The ratio of benefitting passengers to inconvenienced passengers is 49% to 51%. Benefitting passengers gain on average 2.8 minutes, while inconvenienced passengers lose 1.3 minutes, for a net impact of 0.7 minutes of savings per affected rider. Table 8 shows the share of riders by the magnitude of their change in travel time for the AM peak hour. Figure 11 shows the aggregate impacts by destination station; showing

that the total loss at Bergen St and Carroll St stations is greater than the total savings at any single express station.

Table 8 – Impacts to Riders by Magnitude of Travel Time Impact, Jay St to Church Av Express, PM Peak Hour

	Minutes Saved	Riders	Share	Total Mins	Avg Mins
Benefitting Riders	Over 5	900	4%	(5,200)	(5.6)
	4-5	1,300	6%	(5,900)	(4.7)
	3-4	1,000	5%	(3,200)	(3.2)
	2-3	3,000	15%	(8,400)	(2.8)
	1-2	2,500	12%	(4,500)	(1.8)
	0-1	1,500	7%	(1,300)	(0.9)
	TOTAL	**10,200**	**49%**	**(28,500)**	**(2.8)**
	Minutes Lost	Riders	Share	Total Mins	Avg Mins
Inconvenienced Riders	0-1	4,700	23%	1,600	0.3
	1-2	1,900	9%	2,500	1.3
	2-3	3,900	19%	9,100	2.4
	3-4	-	0%	100	3.2
	4-5	-	0%	-	-
	Over 5	-	0%	-	-
	TOTAL	**10,500**	**51%**	**13,300**	**1.3**
	NET TOTAL	**20,700**	**100%**	**(15,200)**	**(0.7)**

Figure 11 – PM Travel Time Savings by Exit Station, Church Av to Jay St Express



Potential Shift from Other Corridors

One plausible explanation for low ridership on the southern portion of the Culver line is that it may be a direct result of its relatively slow local service. Riders living close to the Culver line may prefer the parallel Sea Beach (N), West End (D) or Brighton (B Q) lines, even if the those lines are farther away from their homes, because express service is available. If that is the case then a new Culver express would divert some riders from the parallel corridors to the Culver line. However, the demographic profile illustrated earlier in Section II is likely the main driver of lower ridership on the Culver line versus parallel lines.

To further examine this potential shift, NYCT conducted an analysis allocating Culver, Brighton, Sea Beach and West End line station entries to surrounding blocks based on population data. A ridership demand model was then run to estimate potential corridor shifts. The results show that accounting for such potential shifts could attract about 900 additional riders onto northbound Culver service in the AM peak hour. This represents about 13% of loads leaving Church Av[14]. However, the marginal increase explained by corridor shifts would only be about 5% by the peak load point at Bergen St.

Loading Impacts

Given current ridership patterns, loads on the (F) express would be higher than on the (F) local. At the peak load point of the express (leaving 7 Av) crowding is estimated to be about 80% of the guideline load during the AM peak hour, while the local (F) would only be at 58% of the guideline load (see Table 10) [15]. These compare to the current average (F) loading of 71%.

[14] The benefits accrued by these passenger have been included in the above time benefits analysis.

[15] Despite the corridor shifts discussed above, the total volume of (F) riders would only increase by about 100 riders per hour at Bergen St, because some riders at local stations would board (G) trains if a (G) arrives before an (F) local. As noted above, including the (G), the total number of northbound riders departing Bergen St increases 5%.

Table 9 – Current and Projected Northbound Departing Loads by Station, AM Peak Hour

Proposed Local Stop
Proposed Express Stop

STATION	Current (F)		With (F) Express			
	Load	% of Guideline	(F) Local	% of Guideline	(F) Express	% of Guideline
Coney Island-Stillwell Av	450	4%	20	1%	900	9%
W 8 St-NY Aquarium	590	5%	30	2%	1,100	11%
Neptune Av	810	7%	30	2%	1,300	13%
Avenue X	1,300	7%	80	2%	1,900	19%
Avenue U	1,650	9%	110	3%	2,200	22%
Kings Hwy	2,230	11%	210	2%	3,000	30%
Avenue P	2,750	14%	770	8%	2,900	29%
Avenue N	3,290	17%	990	10%	3,700	36%
Bay Pkwy	3,440	17%	980	10%	3,700	36%
Avenue I	3,620	18%	1,050	10%	3,900	38%
18 Av	4,000	20%	1,170	12%	4,400	43%
Ditmas Av	4,580	23%	1,270	13%	4,900	48%
Church Av	5,870	30%	1,600	16%	5,900	58%
Fort Hamilton Pkwy	7,020	35%	2,100	21%	5,900	58%
15 St-Prospect Park	8,240	41%	2,600	26%	5,900	58%
7 Av	9,890	50%	3,100	31%	8,100	80%
4 Av	10,890	55%	3,600	35%	8,100	80%
Smith-9 Sts	11,150	56%	3,800	37%	8,100	80%
Carroll St	12,450	63%	4,900	48%	8,100	80%
Bergen St	14,000	71%	5,900	58%	8,100	80%

Station Impacts

The proposed Culver Express will exacerbate circulation congestion at one stair each at both the Bergen St and Carroll St stations during the PM peak hour.

Bergen St Station

The southbound platform at the Bergen St station has control areas at Bergen Street and at Warren Street. The northbound platform also has separate control areas at Bergen and Warren Streets. Based on morning entries on the northbound platform, Warren Street is more heavily used than Bergen Street, yet the outbound fare control area has only one street stair versus two stairs at Bergen Street. The express F option would reduce local service by 50%, nearly doubling the number of passenger exiting per train at local stations. Currently, a queue forms at the bottom of the Warren Street stair when a train discharges. NYCT evaluates queues based on the 80th percentile surge. The average passenger in that surge must wait on line about 9 seconds. If F express service were implemented the average passenger would be forced to wait 42 seconds to reach the stair. This does not account for the modest amount of counter-flow that currently exists, which would further delay exiting riders. Operation of F express would exacerbate queuing and increase riders' exiting time.[16] The cost of mitigating this impact would be approximately $10 million, which would cover the cost of widening the stair and installing an ADA-required elevator between the street and the southbound platform.

Carroll St Station

A similar but less severe situation exists at the Carroll St station. Based on morning entry volumes, the President St. fare control areas are busier than the 2nd Place control area, yet the outbound control area at President St. has a single two lane street stair. At the President St. stair, the average wait in in the 80th percentile surge would increase from 5 seconds to 15 seconds with the F express operation. The cost of mitigating this impact would also be approximately $10 million, which would cover the cost of widening the stair and installing an ADA-required elevator between the street and the southbound platform. Note that the mitigation projects at both stations are not included in the proposed MTA 2015-2019 Capital Program.

No other station impacts are foreseen resulting from a Culver express. Smith-9 Sts, 4 Av-9 St, 15 St - Prospect Park and Ft Hamilton Pkwy stations all have lower ridership as well as more capacity.

[16] This extra queueing time for southbound riders in the PM peak hour has not been factored into the travel time analysis presented above.

VI. Recommendations

Due to the overall net passenger travel time savings and potential operational benefits, NYCT recommends that an F express service be implemented after the Culver stations project, early Fall 2017. Implementing this service will result in a net travel time benefit of 27,000 minutes during the weekday AM peak hour and 13,000 minutes during the PM peak hour. F express trains will not be delayed by G train operations and will have faster run times. While F riders at local stations would experience longer wait times, this service change will help those riders along the F train in South Brooklyn with the longest commutes.

VII. 2019 Update

After this report was initially issued in 2016, further evaluation and planning for any potential F Express was deferred until after the end of the planned 15-month L Tunnel 24/7 shutdown, during which the planned increased G service on weekdays as part of the Alternate Service Plan would have conflicted with the operation of an F express. The revised L Tunnel plan, announced in January 2019, would no longer affect weekday rush hour service, and thus no longer require weekday G service increases that would preclude operation of an F Express.

In the years since 2016, there have been some changes along the F corridor, affecting ridership patterns, understanding of operating conditions, and agency-wide capital plan priorities.

This update also includes consideration of a more limited variant of the F express concept, the "Coney Island Flyer." Under this variant, fewer express trips would be scheduled than with an even express/local split, with the rush hour trips specifically scheduled and advertised. In this way, they would be similar to the A Line "Rockaway Park Specials" which provide limited, precisely scheduled rush hour trips from and to Rockaway Park-Beach 116 St. Operationally feasible, the "Coney Island Flyers" would benefit a small number of rush hour riders from the southern portion of the F line in Brooklyn without inconveniencing a large number of local riders on the northern portion of the F in Brooklyn.

Ridership Trends

Since 2014, average October weekday ridership (station entries) has decreased by 7% at express stops (generally at the south end of the line below Church Av) and by 1% at local stops north of Church Av, compared to a systemwide average weekday decline of 2.7%. This shift means that the number of potential "losers" from an F Express has held relatively steady while the number of potential "winners" has declined.

The sharper declines south of Church Av may be due to slow service intensified by the recently completed multi-year Culver stations projects; those riders disproportionally may be choosing other lines and modes, particularly For Hire Vehicles (FHV's). FHV usage has increased greatly along the F in Brooklyn, especially between Church Ave and Coney Island (+1519% in the AM Peak Hour from May 2015 to May 2018).

NB AM peak hour F service currently operates 14 tph, with loads now at 83% of headway-based guidelines (15,700 during the peak hour). While this is higher than the average loads observed in 2014, adding rush hour trains along the F in Brooklyn would still not be warranted by pure ridership considerations.

As a result of the changes in ridership, under an evenly split service plan with 7 trains per hour on both the local (F) and the express (F), there are relatively fewer riders who would save time under this plan, and relatively more riders who would have longer waits; the ratio is now estimated to be 55%/45%. (This accounts for riders who currently use other lines, but might shift to the (F) if an express were available). However, because the riders who save time on average save more time than the inconvenienced riders lose, there would still be a net aggregate passenger time savings of 16,700 minutes in the AM peak hour, an average of 0.9 minutes per affected rider.

Table 10 - Impacts to Riders by Magnitude of Travel Time Impact, Jay St to Church Av Express, AM Peak Hour (Updated to 2019 Conditions)

	Minutes Saved	Riders	Total Minutes	Avg. Minutes	Share
Benefitting Riders	5+	-			0%
	4-5	4,900	(22,000)	(4.5)	21%
	3-4	890	(3,300)	(3.7)	4%
	2-3	2,100	(4,900)	(2.3)	9%
	1-2	1,600	(2,500)	(1.6)	7%
	0-1	1,100	(600)	(0.5)	5%
	Total	10,590	(33,300)	(3.1)	45%
	Minutes Lost	**Riders**	**Total Minutes**	**Avg. Minutes**	**Share**
Inconvenienced Riders	0-1	7,100	3,900	0.5	30%
	1-2	2,000	3,000	1.5	9%
	2-3	3,700	9,600	2.6	16%
	3-4	-	-		0%
	4-5	-	-		0%
	5+	-	-		0%
	Total	12,800	16,600	1.3	55%
	Grand Total	23,400	(16,700)	(0.7)	100%

Operational Considerations

Subway operations simulations undertaken since the 2016 report have shown that the projected maximum track capacity on the 6 Av local tracks is 28 trains per hour (tph) with current signals, as opposed to 25 tph as estimated in 2016. While this allows for an overall increase in (F) service, that would be limited because of growing (M) train ridership, which may trigger a need for more (M) service along 6 Av.

The (M) train from Williamsburg continues to see substantial growth. Currently scheduled at 10 tph in the AM peak, the (M) will likely need to go to 12 tph to meet near-term loading needs. With 14 (F)'s scheduled in the AM peak, (M) growth would leave capacity

for two more Ⓕ trains along the shared 6 Av segment. Were Ⓕ express to operate, 16 tph on the Ⓕ would allow for an even split at 8 tph for each of the express and local.

Fast Forward (CBTC) running time improvements plus the reduction in running time associated with express operation should allow the existing Ⓕ fleet to make one to two additional peak-period trips, allowing for more service without adding to the fleet size.

Bergen St
Reopening lower level of Bergen St station as an express stop would reduce the number of local riders who would "lose" from this service plan by about 2,500 during the AM peak hour, but would also reduce the travel time savings for express riders by adding an additional station stop and associated dwell time.

In order to reopen the lower level, substantial renovations will be needed, including 4 elevators required under the Americans with Disabilities Act (ADA). Preliminary planning for Fast Forward does not identify this station as an ADA priority because Jay St-MetroTech is immediately to the north on the Ⓕ train and is ADA accessible. Jay St, Church Avenue, and Coney Island-Stillwell Avenue are the only stations along this line segment that are ADA accessible. Preliminary planning for Fast Forward has identified 7 Av as a candidate for ADA access. No other stations along the Culver line have been identified as ADA access candidates yet, although at least 2 will likely be needed between Coney Island and Church Av.

Potential "Coney Island Flyer" Service

As an alternative to a 50/50 express/local split, NYCT is exploring the possibility of operating a limited number of well-advertised one-way express trips serving the Coney Island/southern Culver Line market on a pilot basis. This would allow riders who are able to adjust their schedules to take advantage of the express service, while limiting the affected local riders to relatively short spans of time. This approach would also allow for the application of scheduling techniques to reduce, but not eliminate, the additional waiting time local riders would incur.

Operational, Scheduling, and Cost Implications

As envisioned, there would be two one-way express trips northbound from Coney Island during the AM rush hour and two express trips southbound to Coney Island in the PM rush hour, skipping local stops between Church Av and Jay St-MetroTech. The two trips would operate 30 to 40 minutes apart:

- In the morning, the two trips would leave Coney Island between approximately 7:00 a.m. and 7:30 a.m. and reach midtown at 34 St-Herald Square between approximately 7:55 a.m. and 8:25 a.m.
- In the evening, the two trips would leave midtown at 34 St-Herald Square between approximately 5:00 p.m. and 5:40 p.m. and would reach Coney Island between approximately 6:00 p.m. and 6:40 p.m.

The exact times of these express trips would depend upon development of final timetables. NYCT Operations Planning is currently developing draft schedules.

To ensure reliable operation at the advertised times, the expresses would be scheduled to go directly into service from storage tracks northbound at Coney Island in the morning and southbound at Jamaica-179 St in the afternoon. Using these "put-ins" from storage tracks would ensure the availability of trains and crews for the express service to run when advertised. The trips selected to be converted to express operation in Brooklyn would be covered by existing put-in trains.

Because these express trips would be conversions of existing local trips in Brooklyn, the interval between trains serving the local stations between Church Av and Jay St-MetroTech will necessarily increase to provide for a scheduling "window" for the express trains. Adjustments to the scheduled times of local trains adjacent to the express trips can even out waiting times (and associated passenger loads) between local trains. Note that these sort of adjustments are possible with a scheme with fewer expresses, but would not be possible with a 50/50 express/local split.

Because the F shares tracks with other routes (G, M, and E), the schedules need to be coordinated with these other routes, particularly on the Brooklyn segment shared with the G. NYCT Operations Planning recommends that implementation of any express operation be undertaken via supplement schedules on the F, as well as the G, if necessary.

This plan should not change the number of crews or trains required, although there may be changes in pay hours as crews change assigned trips. Additional operating costs would most likely be minimal.

There would be implementation costs, including outreach, marketing, and signage. Outreach to affected communities would be required in the weeks prior to implementation.

Ridership Impacts

With only two express trips per peak, the absolute number of affected riders – both benefitting and inconvenienced – would naturally be much lower than with the 50/50 plan, as there would be no change in service for most of the rush hour. However, compared to the 50/50 plan, it is likely that relatively more riders would benefit. With accurate information some riders would shift their travel times to board these expresses. Similar short spikes in ridership can be observed at stations with infrequent special service, such as the aforementioned "Rockaway Park Specials" on the (A) line. Based on patterns observed on the (A) line, it is estimated that the share of affected riders that would benefit from this operation could rise from 45% in the 50/50 plan to 53%. Timed arrivals would allow express riders to enjoy the full benefits of faster run times (approximately 7 minutes northbound and 6 minutes of southbound), without the offsetting additional waiting time under the 50/50 plan. For local riders the schedule adjustments could reduce the maximum waiting time impacts from an additional 4 minutes on average to an additional 2-3 minutes (with additional average waits dropping from 2 minutes to 1-1.5 minutes). It is expected that the 7:00 train would carry 900 riders (63% of guideline capacity) at its peak load point (between 7 Av and Jay St-MetroTech), while the 7:30 train would carry 1,200 passengers; the total number of morning express riders would be approximately 2,100. In the afternoon, the expected load would be about 900 riders on both of the express trains, for a total of 1,800.

Implementation and Evaluation

NYCT recommends implementing "Coney Island Flyer" as a pilot, possibly in September 2019. Once in operation, the service plan should be operated for a period of several weeks or months, to evaluate performance. Evaluation criteria would include:

- Ridership – overall passenger loads on expresses and locals, as well as net travel time impacts. If ridership approaches the levels noted above (900 on the 7:00 train and the afternoon trains, 1,200 on the 7:30 trains), NYCT would deem the pilot to be successful in terms of demand.
- Public response – market research of express and local riders.
- Performance metrics – running times of expresses and locals, journey time metrics, train performance, adherence to advertised times, etc.