SUNNYSIDE YARD MASTER PLAN – TRANSPORTATION APPENDIX

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Contents

1. Introduction

This report includes supplementary information and analysis performed by *Sam Schwartz* in support of the transportation analysis for the Sunnyside Yard Master Plan. It is organized into three subsections:

1. Existing Conditions & Transportation Context
2. Flexible Transportation Model Methodology & Inputs
3. Future Transportation Conditions and Long-Term Strategy

The materials in this appendix are standalone data and analysis but should be read in conjunction with the Sunnyside Yard Master Plan to understand the full approach for transportation.

2. Existing Conditions & Transportation Context

The section describes existing conditions and summarizes key take-aways and assumptions from the 2017 Sunnyside Yard Feasibility Study. It describes a key challenge of the project: limited core transportation capacity, or capacity to handle the dominant westbound flow of people and vehicles to Manhattan from Queens (and points east) in the AM peak hour.

2.1 Existing Transportation Conditions

The existing transportation network in and around Sunnyside Yard is generally under or at capacity, with vehicle levels of services generally acceptable. However, limited core transportation capacity, or capacity to handle the dominant westbound flow of people and vehicles to Manhattan from Queens and points east in the AM peak (and in the reverse direction in the PM peak), is a key challenge today and could become an increasing challenge in the future. Roadway and transit capacity between Sunnyside Yard and Manhattan is a pinch point; absent transportation system enhancements and/or expansion, new core-bound residents – whether from overall growth in Queens and Long Island or from new development at Sunnyside Yard – could significantly strain already stressed roads and subways.

2.2.1 Driving

Major highways, bridges, and tunnels are located near the project site, including the Ed Koch Queensboro Bridge, the Queens Midtown Tunnel, the Brooklyn-Queens Expressway (I-278), and the Long Island Expressway (I-495). Key roads adjacent to the site include Jackson Avenue, Northern Boulevard, Skillman Avenue, 21st Street, Thomson Avenue, Queens Boulevard, Honeywell Street, 39th Street, and Hunters Point Avenue/49th Avenue.

The Feasibility Study conducted an analysis of existing vehicular traffic operations, based on traffic count data collected in 2015. The peak hours were determined to be 7:45–8:45 AM and 4:15–5:15 PM. The analyses were conducted per the 2000 Highway Capacity Manual (HCM) methodology, and calculations were performed using Highway Capacity Software (HCS+ 5.5). The results of the initial analysis can be found in the Feasibility Study, and included the following ten intersections:

1. 49th Ave @ Skillman Ave
2. 49th Ave @ 21st St
3. Jackson Ave @ 21st St
4. Jackson Ave @ Thomson Ave
5. Queens Blvd @ Jackson Ave/Northern Blvd
6. Northern Blvd @ Honeywell St/39th Ave
7. Northern Blvd @ 39th St/Steinway St
8. Skillman Ave @ Honeywell St/35th St
9. Queens Blvd @ Skillman Ave
10. Thomson Ave @ Skillman Ave

To reflect the most current roadway infrastructure and intersection operations in the study area, the following adjustments were made to the Feasibility Study analysis:

- Use of Synchro analysis software rather than HCM. Synchro can more accurately capture the effect of queuing and delay from one intersection on the operations of other nearby intersections in the roadway network.
- Updated all signal timings.
- Updated MTA bus stops/blockages and parking lanes/parking maneuvers.
- Added turn bay storage lengths and updated lane utilizations based on field observations conducted in June 2018.

As part of this project, a traffic capacity analysis was performed for ten key intersections in the vicinity of Sunnyside Yard. Field observations were conducted from 4:30 – 6:30 pm on Monday, June 25 2018 (Weekday PM Peak Period) and from 7:00 – 9:30 am on Tuesday, June 26 2018 (Weekday AM Peak Period).[1] The observations included notes on vehicular LOS, queuing, lane utilization, pedestrian/bicycle activity, special operations by enforcement agents, and any causes of delay including parking lane usage, parking/pick-up/drop-off maneuvers, bus stops, and downstream congestion.

The analyses completed as part of the Feasibility Study included calibration of traffic analysis parameters to better replicate field conditions. These calibration measures were generally carried through to the Synchro model. The following additional calibration of the Synchro models was completed based on June 2018 field observations:

- Adjustments to traffic flow to account for queue spillback in a turn lane.
- Adjustments to account for locations where the volume counted exceeded the capacity.
- Adjustments to account for locations where operations were observed to be significantly better or worse than initially calculated by the model. This includes approaches affected by queueing and downstream delay. The Synchro results were adjusted to be relatively close to the original HCS results unless field observations strongly indicated otherwise.

Most of the intersections in the study area experience minor to moderate delays due to congestion (see **Figures 1** and **2**). The limited number of possible routes spanning the railroad tracks at Sunnyside Yard results in high concentrations of vehicles at the intersections on either end of the crossings. Furthermore, heavy congestion to and from the Queensboro Bridge spills back onto the arterial roadways in the study area, especially Queens Boulevard and Northern Boulevard.

Due to downstream congestion which limits volume throughput along Queens Boulevard and Northern Boulevard, there are several critical lane groups which could not be fully calibrated to reflect field conditions. Additional baseline assumptions will need to be made when conducting future condition analyses regarding the heavy congestion at these locations.

[1] Note that these dates are not NYCDOT-approved traffic count data collection dates.

Figure 1: 2018 Baseline AM Peak Traffic Conditions

Figure 2: 2018 Baseline PM Peak Traffic Conditions

2.2.2 Parking

Parking in the area surrounding the project site was found to have low turnover (1 or 2 maneuvers per hour), with on-street parking close to 100 percent utilized on weekdays in Fall 2015. Multiple off-street parking facilities are located nearby and were found to have only slightly lower rates of utilization (96 percent and 84 percent during the AM and PM peak periods). Overall, the Feasibility Study deemed that there is "little or no surplus capacity to handle future growth.” No further parking data was collected for this effort. However, parking maneuvers for each intersection approach were included in the Synchro model, based on the original HCS files.

2.2.3 For-Hire Vehicles (FHVs), Taxis, and Carshare

The use of FHVs and taxis is not described in the Feasibility Study. However, the number of trips provided by transportation network companies (TNCs) like Uber and Lyft (a subset of the FHV family) continues to grow. TNC ridership in New York City tripled between the spring 2015 and the fall of 2016, from 4.3 million to 15 million monthly. [2] This coincided with falling yellow cab ridership (from 21.3 million to 17.2 million). Despite the option for pooled rides, and some more optimistic forecasts, TNCs have led to an increase in vehicle miles traveled in New York City, with implications for congestion in both the Manhattan core and surrounding areas like Western Queens. Planning for this type of mobility at the project site will be critical. This could include specified pick-up and drop-off zones, incentives for shared trips, etc. Taxi trips could be handled similarly.

Carshare use (ie Zipcar, Enterprise Carshare) was also not described in the Feasibility Study. Carshare offers members an alternative to private vehicle ownership and may help reduce the need for parking onsite. Launched in May 2018, NYCDOT is currently undertaking a two-year citywide Carshare Pilot program that designated carshare parking spaces for the use of specific participating carshare companies on-street in select neighborhoods, and in municipal parking facilities citywide. Though no spaces are currently within or adjacent to the project site, this effort could be expanded in the future.

2.2.4 Walking

As of 2015, pedestrian flow at the 10 critical intersections surrounding the project site was generally good from a capacity perspective (LOS A or B). Existing critical pedestrian pathways include the major roads identified for vehicles (above), as well as additional streets on the eastern edge of the site: 43rd Place, 36th Crescent, 42nd Place, 37th Avenue, and Barnett Avenue. While pedestrian crowding is not an issue, the quality of the walking environment in the vicinity of Sunnyside Yard is generally fair to poor, with high levels of noise and air pollution, narrow or cracked sidewalks, the presence of litter, and a lack of street trees.

Conditions noted in the Feasibility Study (e.g. crosswalk conditions, signal countdown clocks, sidewalk widths, etc.) largely remain the same, with some improvements.[3] Both Northern Boulevard and Queens Boulevard are designated as priority corridors under Vision Zero; a Vision Zero Priority Area encompasses the entire project site.

Pedestrian conditions surrounding Sunnyside Yard are illustrated in **Figure 3** and described in the following bullets:

- Much of Jackson Avenue and Northern Boulevard on the northern edge of the project site is characterized by multiple travel lanes, high traffic volumes, and vehicle-oriented land uses. However, Northern Boulevard between Honeywell and Broadway was subject to corridor safety improvements in 2017, including 14 new pedestrian safety islands.

[2] Schaller Consulting. Unsustainable? The Growth of App-Based Ride Services and Traffic, Travel and the Future of New York City. February 2017. www.schallerconsult.com/rideservices/unsustainable.pdf
[3] Per June 2018 site visit.

- The Queens Plaza Pedestrian and Bicycle Improvement Project, completed in Spring 2012, significantly enhanced pedestrian and bicycle facilities at the Queens Plaza intersection, including streetscape improvements and the Dutch Kills Green public open space (a former parking lot). However, Queens Boulevard and the intersection are still characterized by high vehicle volumes, complex intersections, and elevated vehicular and subway structures.
- Skillman Avenue between 39th Street and Queens Boulevard is notable for its back-in angled parking on the northern side, which often narrows the sidewalk width.
- Thomson Avenue between Skillman Avenue and Van Dam Street (adjacent to LaGuardia Community College) underwent a street improvement project in 2019, including new crosswalks and signals, ADA compliant curb ramps, signal adjustments, and widened sidewalks.

Skillman Avenue at Honeywell Street

Northern Boulevard at 39th Street

Honeywell Street, NB

Queens Plaza (Queens Boulevard at Jackson Avenue)

Figure 3: 2018 Pedestrian Conditions

2.2.5 Bicycling

Bicycle facilities in and around the project site are shown in **Figure 4** Key facilities include standard bike lanes on the Honeywell and 39th Street bridges, and protected lanes on Queens Boulevard and the Queensboro Bridge. Key regional bike connections include the Queensborough Bridge (to access Manhattan); the Pulaski and Greenpoint Avenue bridges (to access Brooklyn); 35th and 36th streets (to head north into Astoria); and Queens Boulevard, 34th Avenue and 31st Avenue (to access points east in Queens).

The Feasibility Study noted “gaps along Jackson Avenue, as well as along additional local north-south streets,” which is generally still the case.[4] However, since 2015, the lane on Honeywell Street was added, as well as shared lane markings (“sharrows”) on Greenpoint Avenue to the south of the site and a combination of lanes and sharrows on 31st Avenue to the north. The 2018 New York City Bike Map also identifies Jackson Avenue from 11th Street to Queens Boulevard as a potential future bike lane (shown as dotted in **Figure 4**). An NYCDOT proposal to upgrade the standard lanes on Skillman Avenue and 43rd Avenue to parking-protected lanes has moved forward. Multiple injuries and a bicyclist facility have occurred on those corridors.

Bikeshare is another key mobility resource. Since its launch in New York City in 2013, Citi Bike has expanded to Queens, with docks adjacent to the project site (see **Figure 5**). Future expansion geographies and timelines are unknown, but the project site is an obvious gap in the current network of docks. The city has also piloted dockless bikeshare in four locations outside of the Citi Bike network.

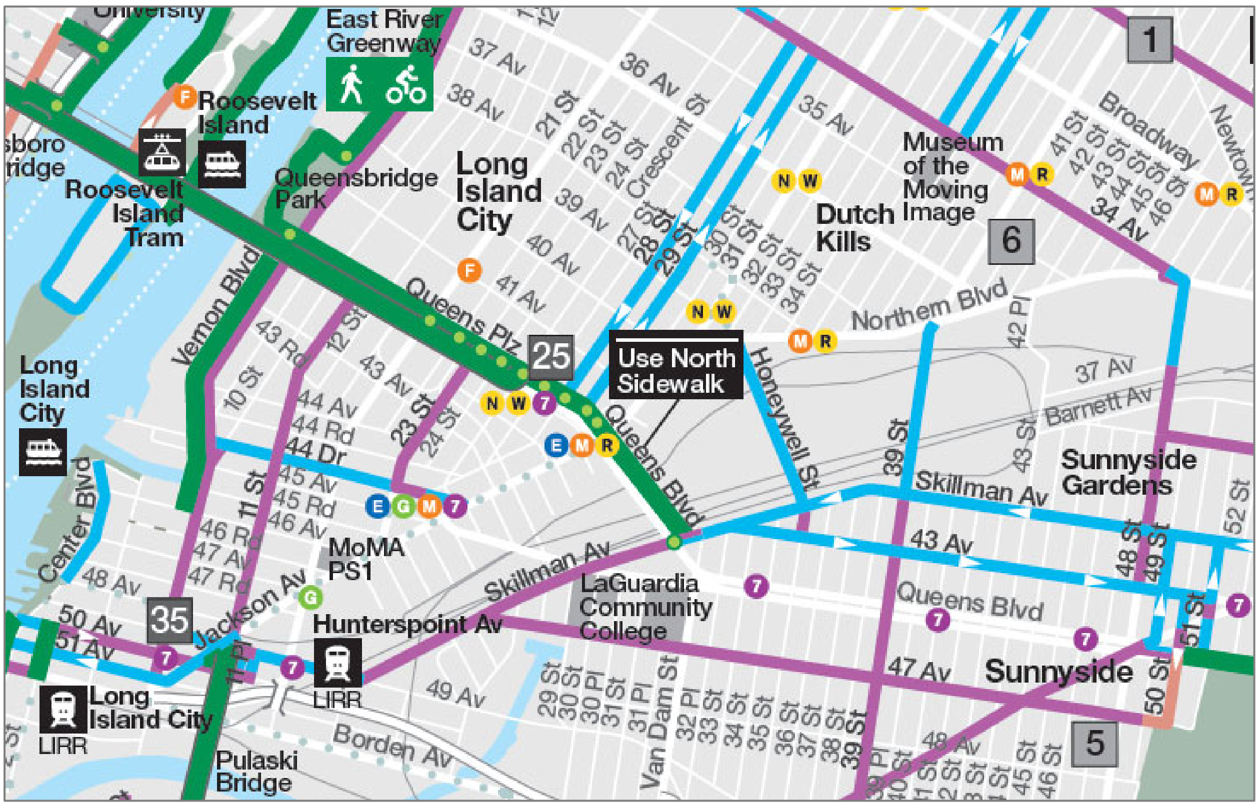


Figure 4: NYC Bike Map (2018)

[4] Per June 2018 site visit.

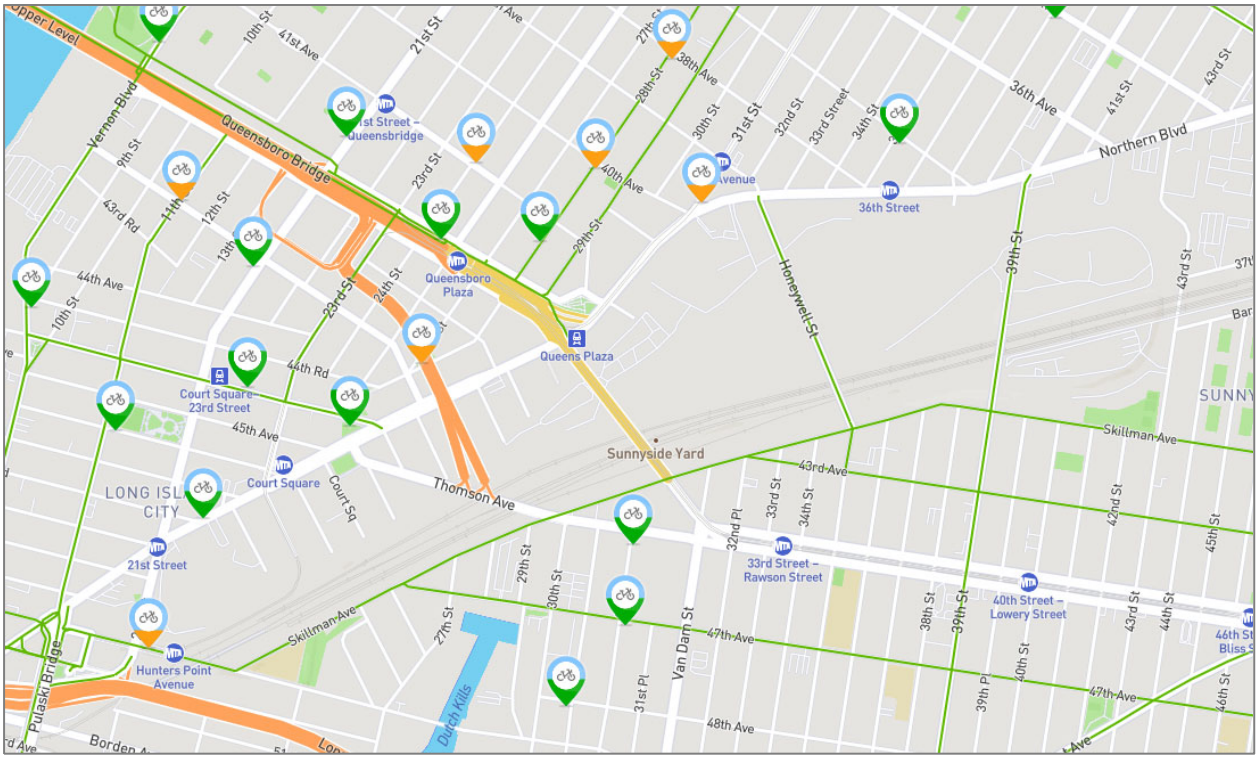


Figure 5: Citi Bike Map (Summer 2018)

Crashes

Bicycle and pedestrian crash data documented in the Feasibility Study (from January 2012 through December 2014) showed that only one intersection was identified as a "high-crash location," Queens Boulevard at Jackson Avenue/Northern Boulevard.[5] Other locations with high numbers of total crashes (and total injuries) included Queens Plaza at Crescent Street, Queens Boulevard at Skillman Avenue, Queens Boulevard at Van Dam Street, and Thomson Avenue at Van Dam Street. Crashes in the area that have occurred since those documented in the Feasibility Study are cataloged online via the City's publicly available Vision Zero View web interface.[6] In 2015, 2016, and 2017, the following locations within a half mile of the project site had either a pedestrian or bicycle fatality or five or more pedestrian or bicycle injuries:

Bicycle and Pedestrian Fatalities

- 34th Avenue at 28th Street
- Van Dam Street at Starr Avenue
- 21st Street at 36th Avenue
- 21st Street at 40th Avenue
- Vernon Blvd at 41st Avenue
- Queens Plaza North at 29th Street
- 12th Street at 36th Avenue

Bicycle and Pedestrian Injuries (5 or more)

- 21st Street at 41st Avenue
- 21st Street at 49th Avenue
- Northern Blvd at 48th Street

[5] New York City defines a high crash location as one where there were 48 or more total crashes or five or more pedestrian/bicycles injury crashes in any consecutive 12 months of the most recent 3-year period.
[6] Vison Zero View, accessed August 2018. https://www.nycvzv.info/

2.2.6 Subway

Multiple subway lines and stations surround Sunnyside Yard (**Figure 6**). **Table 1** details average weekday ridership, recent ridership trends, and station access. Overall, the system is most constrained during the AM peak period traveling westbound toward Manhattan. With the exception of the M, R, and 7 local, trains are operating at or near capacity during this time.

Even for those lines with additional capacity, subway riders often experience crowded service due to unreliability. Averaged over an hour and only including days without severe disruptions, reported crowding levels do not always capture what riders experience on specific trains. Therefore, even though 100% or lower volume to capacity (V/C) average loading is an industry guideline for acceptable service, typical and exceptional experiences of being on a train during an hour at capacity on average may be more crowded for many riders when service spacing is suboptimal. This suggests that reliability is a critical crowding metric as well.

As noted in the handbook, signaling and ADA related improvements outlined in the MTA's Fast Forward and Capital Plan promise to transform service in the vicinity of Sunnyside Yard.

Table 1: Existing MTA Subway Service

Line	Station	Avg Weekday Ridership (2017)	4 Year Change (2014-2017)	ADA Accessible?	No. of Entrances/Exits
G	21st St	1,863	47.3%	No	3
EMG7	Court Square	23,672	5.5%	7 only	9 (1 of 9 on 44th Dr. closed for construction)
F	21st St - Queensbridge	10,209	14.5%	Yes	3
EMR	Queens Plaza	11,369	12.3%	Yes	7
7NW	Queensboro Plaza	13,502	16.9%	No	2
NW	39th Ave	3,267	-6.8%	No	2
MR	36th St	4,786	4.1%	No	5
7	40th St	10,624	-5.2%	No	4
7	Hunters Point Ave	7,283	9.3%	No	3
7	33rd St - Rawson	12,429	-12.8%	No	6

Figure 6: Subway Map

Currently, the stations surrounding the project site have limited ADA accessibility, with a variety of improvements planned at multiple nearby stations. Development of Sunnyside Yard may require substantial additional station ingress/egress, mezzanine, and platform capacity improvements. These could be a considerable expense and require further analysis.

2.2.7 Buses

In addition to local buses, over thirty express buses pass the site but do not stop, accessing Manhattan via the Queens Midtown Tunnel and/or the Queensboro Bridge. Bus services may change in the future, as MTA NYCT launched a borough-wide Queens Bus Network Redesign in April 2019.[7]

Multiple MTA bus route pass near the project site (**Figure 7**). There are 11 local bus routes with stops within ½ mile of the project site, with the highest ridership volumes on the Q60 and Q66. However, almost all the routes have experienced ridership losses in recent years, echoing overall declining bus ridership citywide. MTA is undertaking a redesign of Queens Bus Network to look at changes to the routes to better optimize the network and grow ridership. This work was ongoing during this study and the final results were not determined at the completion of this report; therefore, the team was unable to incorporate these changes.

In addition to local buses, over thirty express buses pass the site but do not stop, accessing Manhattan via the Queens Midtown Tunnel (QMT) and/or the Queensboro Bridge. From 7AM to 10AM, westbound buses routed via the QMT use the contraflow HOV+3 tube. Select Bus Service (SBS), New York City's brand of Bus Rapid Transit (BRT) is another type of bus service that can improve speed and reliability through features like dedicated lanes, off-board fare payment, and stop spacing. No SBS routes currently exist near the study area, but Northern Boulevard has been identified as a potential corridor,

[7] https://new.mta.info/queensbusredesign

Table 2: Existing MTA Bus Service

Route	Routing	Weekday Frequency (AM Peak)	Avg Weekday Ridership (2017)	4 Year Change (2014-2017)
Q32	Jackson Heights – Penn Station	10 min	9,186	-13.5%
Q60	South Jamaica – East Midtown	8 min	13,977	-1.0%
Q66	Flushing – LIC	10 min	13,748	-2.5%
Q67	Ridgewood – LIC	12 min	2,498	-11.1%
Q69	Jackson Heights – LIC	7 min	9,613	-4.8%
Q100	LIC – Riker's Island	12 min	4,119	-1.9%
Q101	Steinway – East Midtown	14 min	3,538	2.7%
Q102	Astoria – Roosevelt Island	15 min	2,756	6.1%
Q104	Sunnyside - Ravenswood	20 min	2,237	-3.1%
B32	LIC – Williamsburg Bridge Plaza	30 min	849	30.0%
B62	LIC – Downtown Brooklyn	8 min	7,292	-23.9%

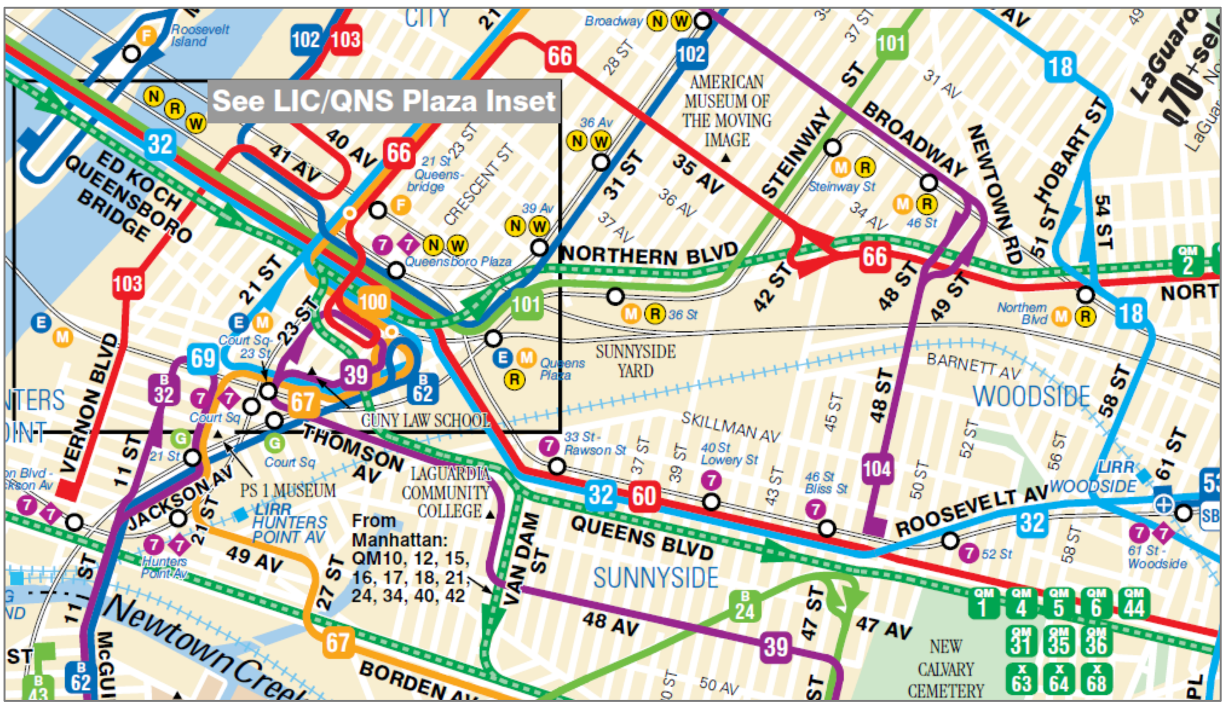


Figure 7: Queens Bus Map (May 2018)

2.2.8 Regional Rail

The Long Island Rail Road (LIRR) currently serves the project site via the Hunterspoint Avenue station and the Long Island City station to the west and the Woodside station to the east (see **Figure 8**). Part of the Long Island City spur, Hunterspoint has limited service (weekday peak direction only). Service to/from Manhattan requires a transfer to the 7 or a transfer to another LIRR branch at Jamaica. Woodside, though farther from the site, offers more frequent service, 26 AM peak period trips (6AM to 10AM) to

Penn Station.[8] **Table 3** shows average weekday daily arrivals and departures from Hunterspoint and Long Island City, as well as the two other west of Jamaica terminals.[9]

Table 3: LIRR Ridership West of Jamaica

2016	Weekday Daily Arrivals	Weekday Daily Departures
Hunterspoint & Long Island City	3,230	2,690
Atlantic Terminal	15,020	13,710
Penn Station	117,150	115,990

The proposed Sunnyside Station, developed as part of the East Side Access planning process, would be a new LIRR station between Woodside and Penn Station. As noted in the Feasibility Study, it was partially funded in the initial 2015-2019 MTA Capital Plan, and was scheduled to be completed post East Side Access, though those funds were pushed to an unfunded future capital plan along with other trailing East Side Access projects. With a tentative location adjacent to Queens Boulevard northwest of Skillman Avenue, its future service is still to be determined.

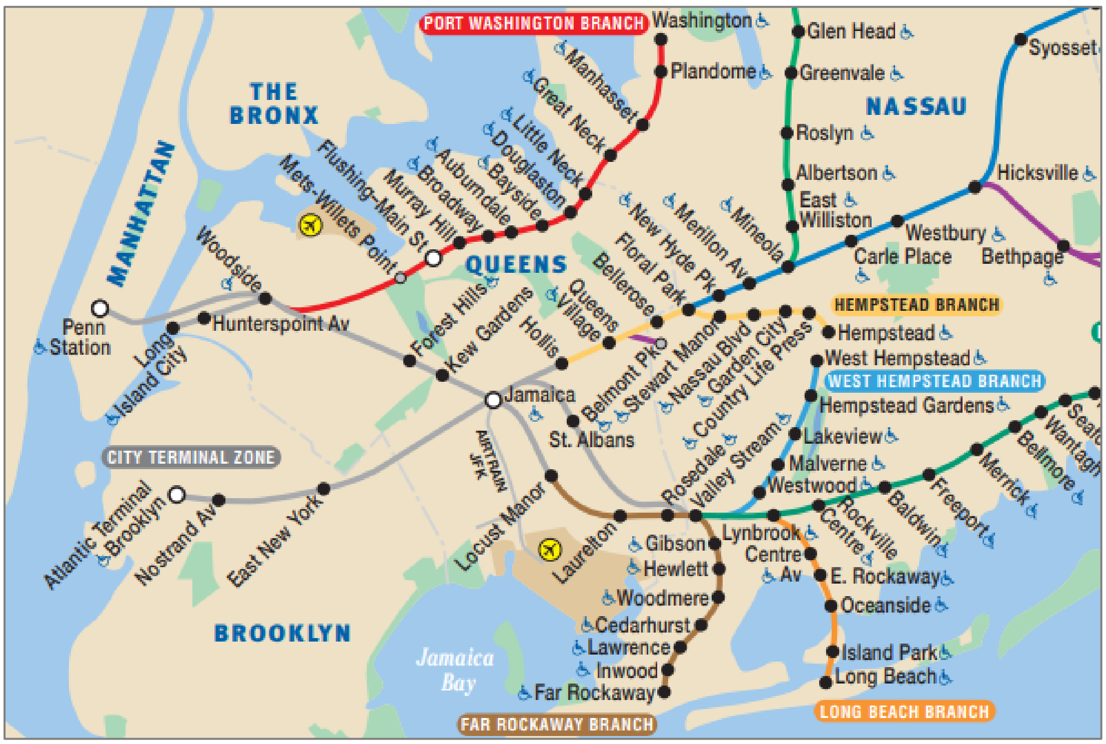


Figure 8: Long Island Rail Road Map

2.2.9 Ferry

NYC Ferry has three year-round routes that serve landings near the Yard: Hunters Point South and Long Island City/Gantry Plaza State Park. Frequencies are currently every 20-25 minutes during the AM peak, but more frequent service may be possible in the future. The City is also investing in new 350-passenger capacity vessels, up from the standard 149-passenger. Ferries can help address core capacity via service between Queens and the Manhattan landings (E. 34th Street and Wall Street Pier 11).

[8] LIRR City Terminal Branch Schedule, effective July 21 – September 3, 2018. http://web.mta.info/lirr/Timetable/Branch2/CityTerminalBranch.pdf
[9] LIRR 2016 Ridership Book. http://web.mta.info/mta/news/books/docs/2016%20LIRR%20Ridership%20Book.pdf

2.2 Transportation Context

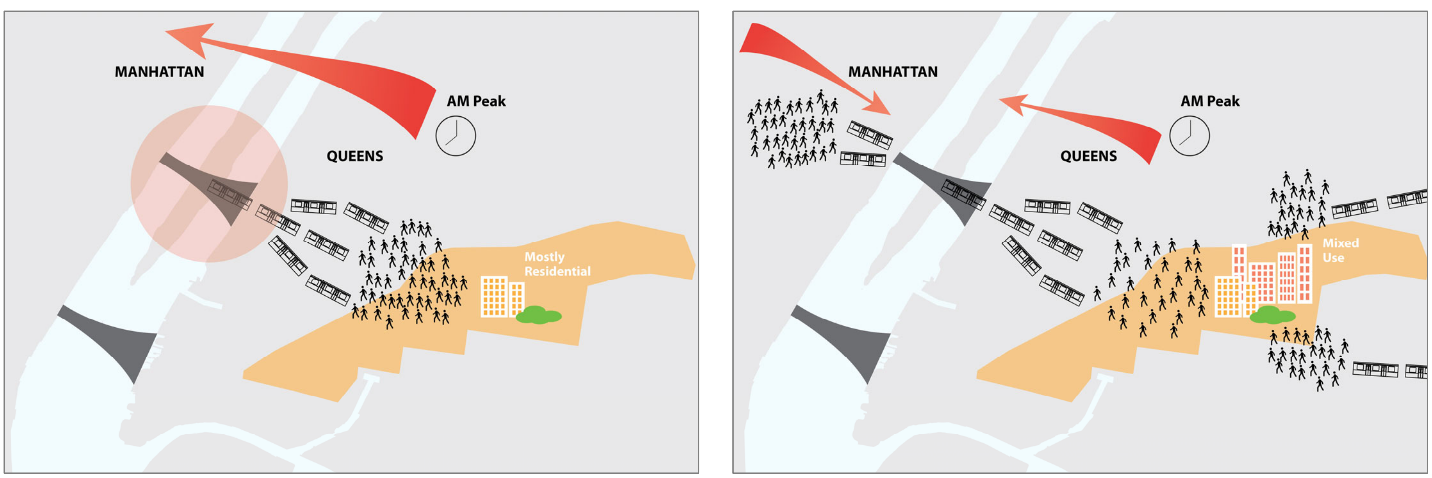
2.2.1 Mode Share and Core Capacity

Mode share is one piece of the puzzle in understanding and addressing the transportation challenges facing Western Queens. **Table 4** shows 2018 mode share for New York City as a whole and for the area surrounding the project site.[10] The aggregated New York City numbers vary by borough and by neighborhood. Auto mode share, for example, is highest in areas of eastern Queens farthest from Manhattan. Subway mode share is highest in Long Island City, Woodside, and the area surrounding Sunnyside Yard (~50%). This is higher than Manhattan, where there are more walk and bike trips.

Table 4: 2018 Mode Share (Origins) for All Trips

	Auto	Taxi	Rail	Subway	Bus	Walk	Bike	Ferry
New York City	19.5%	1.9%	0.9%	31.7%	5.2%	36.4%	4.3%	0.1%
Sunnyside, Woodside, and LIC	18.1%	0.9%	1.6%	50.1%	2.3%	21.7%	4.3%	1.0%

The City can ease core capacity congestion by increasing throughput on existing corridors (e.g. optimizing traffic signals, higher frequency subway service, prioritizing buses and high occupancy vehicles), or by adding new transportation options (e.g. new BRT routes, ferry expansion, subway construction). In addition to these transportation interventions, the City can shape the transportation future through land use strategies – transportation capacity and land use mix are inextricably linked. A balanced program of residential, commercial, and office uses in Sunnyside would promote more reverse-commuting workers in the off-peak direction, able to use existing subway capacity. In addition, workers from further east in Queens with destinations in Sunnyside Yard would be "intercepted," making room for those destined for Manhattan. The concept of core capacity, and the importance of land use as a complement to transportation interventions, is illustrated in **Figure 9**.



Travel Patterns with Residential Uses in Sunnyside Yard

Travel Patterns with Mixed Uses in Sunnyside Yard

Figure 9: Land Use and Core Capacity

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[10] New York Metropolitan Transportation Council Best Practice Model (NYMTC BPM); US Census Journey to Work.

3. The Flexible Transportation Model (FTM)

This section steps through the FTM process. Critical to taking a proactive approach to improving transportation conditions and managing the impacts of development, the FTM assesses future demand versus capacity in 2030 and 2050, in multiple no-build and build scenarios. This section inventories planned or potential future transportation projects and policies that could serve the project site and/or impact core transportation capacity on routes serving the project site. This appendix classifies the future transportation projects and policies by status and describes how each project and policy is operationalized in the FTM.

3.1 Overview

Multiple solutions will be needed across modes to both improve the existing local and regional transportation network and to ensure that Sunnyside Yard will not create undue additional demand. Approaching the project from another perspective, it is an opportunity to invest in and improve the transportation system, both through transportation improvements and the programming and design of the site. Expanding vehicular capacity is unrealistic, resulting in the need for interventions that encourage and incentivize multi-modal choices, which are the core of what the FTM is built to assess.

3.2 The Flexible Transportation Model - Methodology

The Sunnyside Yard Flexible Transportation Model (FTM) was developed to estimate and test transportation supply and demand over multiple timeframes. It is a spreadsheet model primarily based on the New York Best Practice Model (BPM) by the New York Metropolitan Transportation Council (NYMTC). The objective of the model is to accurately estimate trips moving through the Sunnyside Yard development area (the “core”) and predict how those trips change in the future with and without the development. The model is designed to be flexible enough to easily modify the base trips as needed to account for shifts in build years, various interventions, and potential mitigations.

The FTM was developed to understand and test transportation supply and demand in 2030 and 2050[11]. **Figure 10** depicts the FTM process. The FTM first accounts for background growth, or the regional growth expected by NYMTC assumptions and other projected developments. NYMTC is the Metropolitan Planning Organization for New York City, Long Island, and the lower Hudson Valley. NYMTC’s Best Practice Model (BPM) is the foundation for transportation planning and analysis for the region, encompassing travel patterns within NYMTC’s region as well as in Northern New Jersey. The FTM then incorporates potential future transportation projects and policies that will create additional capacity, may influence mode choice, or reflect future underlying trends or changes to our mobility ecosystem, and the associated government response (e.g. shared mobility).

Origin and Destination (OD) trips by mode were obtained from the BPM for all Traffic Analysis Zones (TAZs) in the New York metropolitan area. To simplify the analysis, the BPM trip data was aggregated

[11] *Note that the FTM reflects the best publicly available data at its time of creation. There were as several updates throughout the course of the project to incorporate changing information and public commitments, expertise, data, and professional judgement from the project team and agency partners. While other agencies provided input, the inputs and results should not be interpreted as consensus facts or plans beyond the Sunnyside Master Plan project team. In many cases, the team tested high and low potential impacts to reflect the range of possible outcomes based on best practices in the profession and available information. The FTM’s assumptions and conclusions are ultimately estimates used to understand future conditions and guide future investments reflecting the efforts and expertise primarily of the NYCEDC and the consultant team for Sunnyside Yard.*

down to 38 TAZs with greater granularity within the immediate area of the Sunnyside Yard development and lesser granularity outside of the core. Only the AM peak hour is modeled because observations of existing conditions show that it is the time period of most concentrated demand for the subway network which is potentially the most constrained in future build scenarios and because the subway has the most plausible potential future options to address future increased need. The BPM has a base year of 2010 and a forecast year of 2040. The data is provided for peak 4-hour periods. Additionally, the trip mode is broken down as follows: auto, taxi, truck, transit, and regional rail. As a result, the BPM output was manipulated to establish a current year baseline (2018), for the peak hour (8-9 AM), with more granularity on mode split (especially with regards to transit). Walk and bicycle trips are not accounted for in the BPM and were therefore estimated using an alternate method derived from a New York City Department of Transportation (NYCDOT) study using Census data.[12]

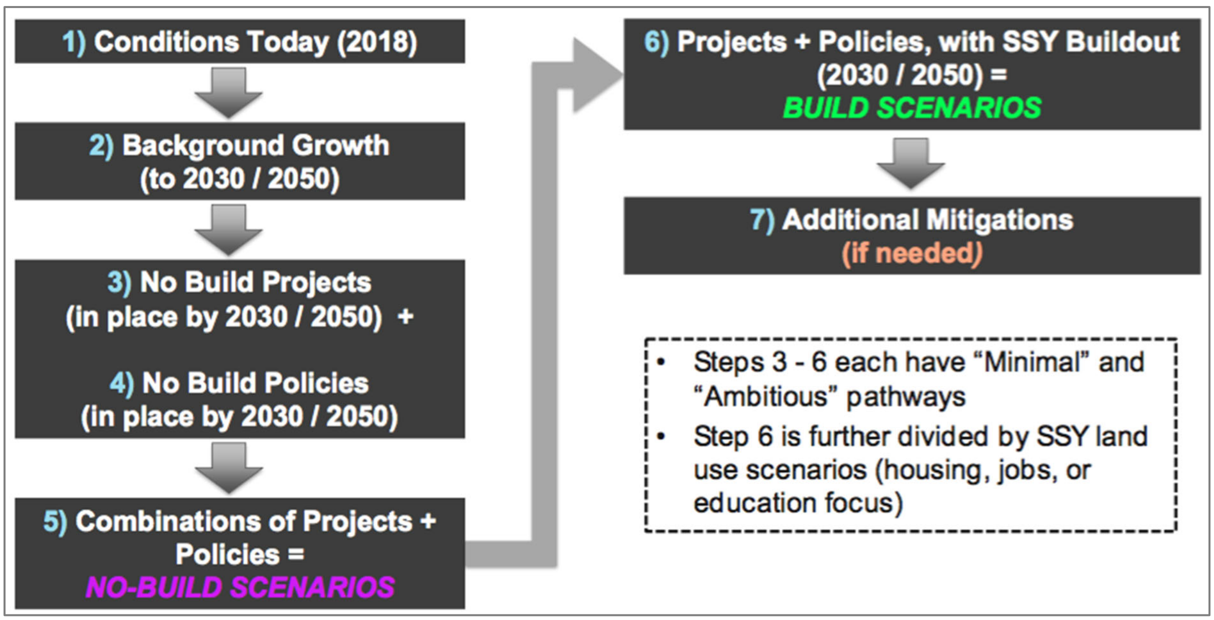

Figure 10: The FTM Process

Beginning with the 2010 BPM data, transit trips were split into further detail (subway, bus) based on the most recent 2016 US Census data for each TAZ. The percent of peak hour trips (occurring in 1 hour of the 4-hour period) for each mode/TAZ was also obtained from the Census, with the exception of trucks, which was obtained from a NYCDOT study.[13] The 2010 data was then grown forward to 2018 using Census data by mode/TAZ. Additionally, the surge in recent years of TNCs such as Uber and Lyft was accounted for by adjusting taxi trips.[14] A separate validation study of the BPM confirmed that the BPM was overestimating regional rail trips and underestimating subway trips in the region, so adjustment factors were applied to those modes. With a baseline 2018 matrix of OD trips, detailed analyses were further conducted for each of the individual modes, with the greatest attention to subway, regional rail, and vehicle.

A subway analysis was conducted for the lines passing through the core in the peak direction during the AM peak hour: 7 Local/Express, E, F, M, R, N, W, and G. The baseline BPM OD trip profile provided the number of trips entering/leaving each TAZ. The subway trips for each TAZ that had trips that enter the core were assigned to a subway line and station. This assignment was primarily based on the 4-hour turnstile data available publicly from the Metropolitan Transportation Authority (MTA). An accumulation

[12] Cycling in the City. NYCDOT. May 2018. www.nyc.gov/html/dot/downloads/pdf/cycling-in-the-city.pdf
[13] NYC Urban Freight. NYCDOT. March 2016. https://www.fhwa.dot.gov/Planning/freight_planning/talking_freight/march_2016/talkingfreight3_16_16sh.pdf
[14] NYC Mobility Report. NYCDOT. June 2018. www.nyc.gov/html/dot/downloads/pdf/mobility-report-2018-print.pdf

was set up for each subway line under study to create a line profile going through the core. At key transfer points, transfer rates were applied to move trips between lines. These transfer rates were based on professional judgement and input from the New York City Economic Development Corporation (NYCEDC) and New York City Transit Authority (NYCT). In addition to volumes, the capacity of each line during the AM peak hour in the peak direction was calculated using train car capacities and frequency. Volume-to-capacity ("V/C") ratios were calculated for the peak load points, both existing and at potential new peak load points based on future travel changes and growth.

For vehicle trips, the 2015 Existing Condition volumes for the ten intersections examined in the Sunnyside Yard Feasibility Study were used as the starting point of this analysis. The intersection volumes were then projected backwards to 2010 to align with original BPM data. The percentage change between the 2010 BPM and baseline 2018 OD trips was calculated for each origin TAZ. A special run of the BPM called a "Select Link Analysis" was performed to calculate the TAZ split for each approach by mode at each study intersection, which was used to split the 2010 intersection volumes. The 2010 to 2018 percent changes were then applied to the 2010 intersection volumes to obtain baseline 2018 intersection volumes.

The model also tests the impacts of future Sunnyside Yard land uses. For the purposes of the model, future build years of 2030 and 2050 were chosen to test potential partial and full build-out timeframes, though subsequent analysis indicated full build by 2050 is unlikely. In this sense, the capacity analyses at these time horizons are conservative in that they likely overestimate trips generated by a Sunnyside Yard development. For both the future build years, the same general methodology used to calculate the 2018 baseline numbers was applied with the 2040 BPM run as the starting point. The percent growth (backwards to 2030 and forwards to 2050) was calculated based on the differences in output in the 2010 and 2040 BPM runs. The transit split and AM peak hour percentages were made consistent with the 2018 assumptions.

A trip generation analysis was performed to calculate the projected number of trips that would be produced by the Sunnyside Yard development. The project site was divided into seven zones (A through G), each with its own set of land uses. As the development program was evolving, assumptions were made to split high-level land use categories (housing, commercial, institutional, and industrial); into more specific land uses. Multiple land use scenarios were tested, each with different mixes of land use categories, with special testing of plans with a housing focus, jobs focus, and education focus. Lastly, only a portion of the development was assumed to be completed by 2030 (Phase 1).

Trip generation methodologies were applied in accordance with rates and input values from the *New York City Environmental Quality Review Technical Manual (CEQR Technical Manual)* as well as other environmental traffic studies. Recognizing that CEQR assumptions are in large part based on historical trip-making, the FTM includes trip generation scenarios that reflect a less auto-oriented future for the city, and for Sunnyside Yard in particular. Mode splits were adjusted to more closely reflect the transportation characteristics of the site and projected changes in travel patterns of the site's residents, workers, and visitors in 2030 and 2050, corresponding to both site and citywide transportation policy goals. The calculated trips to/from the site were distributed to each TAZ based on existing percentages derived from Census data for trips going to/from the study area. Additional adjustments were made to distribute trips to each TAZ based on professional judgement to account for projected changes in and around Sunnyside Yard. These trips were added to the 2030/2050 No Build trips to create the 2030/2050 Future Build baselines.

Several interventions were incorporated into the model to account for potential changes to the transportation network in the future. These interventions are categorized into three groups: Projects, Citywide Policies, and Mitigations. Some interventions, like Communications Based Train Control (CBTC), only affect the supply side and available capacity. Other interventions, like Congestion Pricing, affect the demand side and have assumptions that shift trips between modes. Given the uncertainty of the transportation network in the future, a range of assumptions were defined regarding each intervention's magnitude, implementation speed, and overall impact. For each project or policy, an "ambitious" option uses the high end of the range while a "minimal" option uses the low end of the range.

Each intervention is applied in sequence to the Future Build baseline volumes and can be enabled or disabled as needed. Once all of the interventions are applied, a final modified set of OD trips is obtained which is processed through the individual mode analyses (in particular subway and vehicle).

The FTM comes with caveats and limitations. Its order of operations may impact results; interaction among all the interventions is linear, not dynamic. Most importantly, it is necessarily a work in progress, and the assumptions should be updated based on future data, input from City and State agencies, and research.

The following provides a detailed description of the model structure, components, and data sources.

Model Overview

- Excel workbook with approximately 200 sheets
- File size of approximately 150,000 KB
- Each OD trip table is a 50 x 50 cell matrix per mode

Model Inputs

- New York Best Practice Model Origin and Destination Trips (2010 and 2040)
- US Census Bureau, 2012 – 2016 American Community Survey 5-Year Estimates
- NYC DOT Citywide Mobility Survey (2017)
- NYC DOT Mobility Report (June 2018)
- NYC DOT Cycling in the City Report (2018)
- MTA 4-hour Turnstile Data (2017)
- FreightNYC Report (2018)
- Sunnyside Yard Feasibility Study
- 2010 Base Year Update and Validation of the NYMTC New York Best Practice Model Report (2014)
- 2014 New York City Environmental Quality Review Technical Manual (CEQR Technical Manual)
- NYC DOT NYC Urban Freight Presentation (2016)
- MTA Long Island Railroad 2016 Ridership Book
- MTA 2017 Annual Report
- New York City Bridge Traffic Volumes 2010
- 2016 New York City Bridge Traffic Volumes
- Queens Plaza Park Development
- Professional judgements based on industry and mode best practices and experience, and internal analyses

Model Outputs

- 2030 and 2050 Dashboards
  - Volume by mode
  - Vehicle volume at 10 Intersections
  - Mode share for NYC and Long Island City and Sunnyside Areas
  - Mode share without walk and bike trips for NYC and Long Island City and Sunnyside Areas
  - Mode share for Sunnyside Yard (SSY)
  - Subway Peak Load Points
  - Subway V/C Calculations by line and station
  - Subway V/C Charts by line and station showing baseline capacity and increases for interventions (subway car redesign, added cars, and CBTC)
  - Volume progression by mode for each project/policy analyzed

Model Elements

Transportation Modes Analyzed

- Vehicular
  - Auto
  - Taxi (includes TNCs / shared mobility)
  - Truck
- Regional Rail
- Subway
- Bus
- Bike
- Ferry
- Walk

Projects

- Subway - CBTC
- Subway - added cars
- Subway - car redesign
- Bike facilities and bikeshare expansion
- Additional ferry capacity
- Local bus service in and around Sunnyside Yard
- Regional rail changes or policy improvements
- LIRR East Side Access
- Freight improvements

Policies

- Congestion pricing
- Shared mobility - changes to mode share and occupancy
- Autonomous vehicles - changes to mode share and network efficiency

Mitigations

- Bus Rapid Transit (BRT)
- Sunnyside Station
- Channeling transit riders to under-capacity access points
- New Subway Line – Modelling a Queens Super Express route

Strengths/Weaknesses

- Strengths
  - Designed to be flexible to easily manipulate OD trips in the network
  - Easily tests different development scenarios and interventions
  - Relatively transparent and accessible compared to typical travel demand models
  - Provides greater insight beyond the BPM
- Weaknesses
  - Based on BPM which is intended for regional- (not neighborhood-) scale planning
  - Subway analysis based on incomplete data
  - BPM base year is 2010; several adjustments needed to bring to 2018
  - Future policies challenging to quantify and are inherently uncertain
  - Model order of operations slightly impacts volume progression results for each individual intervention

3.2.1 FTM Transportation Interventions – Projects, Policies, and Mitigations

Tables 5 and **6** list the transportation interventions currently incorporated into the FTM, distinguishing between discrete projects and broader background trends or policies. Some of the projects and policies will also be considered mitigations, or improvements specific to a build scenario. The projects and policies are classified as known and likely; probable; to be determined by the Sunnyside Yard Master Plan; planned with uncertain specifics, or unplanned and uncertain. Estimates of added core capacity are also documented.

Table 5: Inventory of Future Transportation Projects

Projects/Policy	Category	Added Core Capacity	Status Estimate
Subway CBTC	Subway	High	Known & Likely
Queens Super Express or Alternate Subway	Subway	High	Unplanned & Uncertain
Subway – added cars & car redesign	Subway	Medium	Unplanned & Uncertain
Sunnyside Station (mainline)	Rail	Medium	Known & Likely
BRT (SSY – Manhattan)	Bus	Medium	Unplanned & Uncertain
Channel riders to under-capacity transit	Site Design	Medium	TBD by SSY Master Plan
Regional rail changes/policy improvements	Rail	Medium	Unplanned & Uncertain
Freight efficiency improvements	Vehicles	Low	Probable
LIRR East Side Access	Rail	Low	Known & Likely
Local bus service in and around SSY	Bus	Low	Known & Likely
Bike facilities and bikeshare expansion	Bike	Low	Known & Likely
Additional ferry capacity	Ferry	Low	Known & Likely

Table 6: Inventory of Future Transportation Policies

Policies	Category	Added Core Capacity	Status Estimate
Congestion pricing and/or East River tolls	Vehicles, Bus	High	Planned, with Uncertain Specifics
Shared mobility (mode share & occupancy)	Vehicles	Medium	Unplanned & Uncertain
AVs (mode share & network efficiency)	Vehicles	Low	Probable

The following section documents each project and policy in detail, including a brief description, potential impact to core capacity, and 2030 and 2050 model assumptions. **Figure 11** illustrates the projects and policies that have spatial locations.

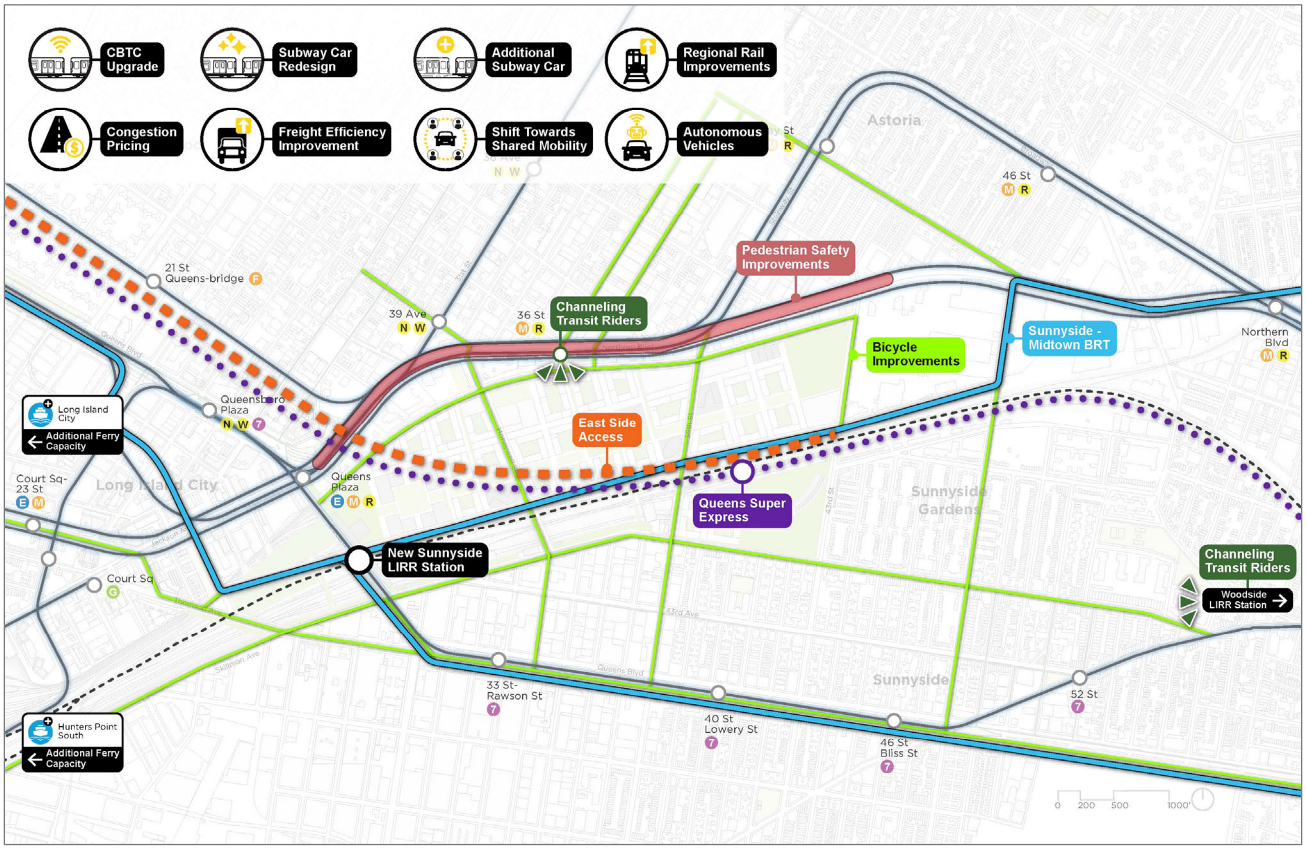

Figure 11: Future Transportation Improvements

Subway CBTC (7, E, F, M, R lines in progress; NW lines in capital plan; full system targeted by 2030's per Fast Forward Plan)

- *Added Core Capacity:* High
- *Status Estimate:* Known and Likely (to be completed in segments – exact timing to be determined)

CBTC allows for trains to run more closely spaced, increasing the number of trains per hour (TPH) and thus passenger capacity. It is a key feature of NYCT's 2018 Fast Forward Plan, and funding for most nearby line segments is included in MTA's 2015-2019 Capital Plan Amendment and 2020-2024 Capital Plan. CBTC could increase TPH by as much as 20% from currently scheduled service. Importantly, it could also increase service delivered (effective TPH) to 100 percent (scheduled TPH), which is equivalent to as much as 1 additional train per hour on some lines.

Capacity gains achievable through CBTC are limited by certain system chokepoints, such as tunnels. CBTC capacity gains could also be limited by terminal capacity (e.g. at Parsons/Archer and Ditmars Blvd). However, this analysis assumes that terminal improvements like crossovers and extended tail tracks will be implemented concurrently to enable CBTC efficiency gains where necessary. This analysis estimates increases up to 36 TPH, below international benchmarks, but most tested scenarios and current operating practices suggest more modest capacity gains. The uncertainty around TPH capacity gains achievable on the subway network via CBTC and other interventions is an opportunity for additional analysis.

Table 7: Additional Trains Per Hour (TPH) with CBTC

2030 "minimal"	*2030 "ambitious"*	*2050 "minimal"*	*2050 "ambitious"*
7 local +1 TPH *7 express +1 TPH* *E +2 TPH* *F +1 TPH* *MR +1 TPH* *NW + 1 TPH*	*7 local +1 TPH* *7 express +1 TPH* *E +3 TPH* *F +3 TPH* *MR +1 TPH* *NW +2 TPH*	*7 local +1 TPH* *7 express +1 TPH* *E +3 TPH* *F +3 TPH* *MR +1 TPH* *NW +1 TPH*	*7 local +1 TPH* *7 express +1 TPH* *E +3 TPH* *F +3 TPH* *MR +2 TPH* *NW +2 TPH*

New Subway Line

- *Added Core Capacity:* High
- *Status Estimate: Unplanned and Uncertain*

The concept of an extension/branching of the F was first described in detail in the 1968 Metropolitan Transportation Program for Action. A "super express" service was proposed from the 63rd Street tunnel to Forest Hills/71 Av but was abandoned due to lack of funding.[15] The line was to use the ROW of the LIRR Main Line, rejoining the Queens Boulevard Line at 71 Av. Other potential extensions continued eastward to Hollis or Laurelton. Several alternate proposals have been forwarded in the intervening decades.

The model assumes the completion of the Queens Super Express between Sunnyside Yard and Forest Hills/71st Av, with a station within or adjacent to Sunnyside Yard between 39th and 43rd streets with two tracks. This service would provide relief to other subway lines, particularly the EF, and could divert some number of current drivers between Eastern Queens and Long Island City or Manhattan. Although using the surface LIRR alignment could accelerate project implementation, there may be alignment width challenges and it is assumed it would not be completed before full build (2050). Substantial capacity gains could only be realized with the concurrent completion of Second Avenue Subway Phase 3 (63rd St – Houston St), so Super Express trains could travel via 2nd Avenue instead of the already constrained 6th Avenue, or with an alternate new Manhattan trunk line.

The model assumes that for 2050 build with mitigations, a percentage of EF and 7 riders in particular are diverted to the new service. The percentage varies by location and reflects the assumption of Super Express stops at Forest Hills/71st Av, Woodside, and Sunnyside Yard. The diversion is within the bounds of a new service capacity of 10 car trains with 145 passengers per car at 15 TPH, with a V/C of approximately 80%. Significant additional work would be necessary to establish a preferred alignment or strategy for taking advantage of excess tunnel capacity under the East River and the 63rd Street tunnel connection and to determine the effect of this alignment on demand for the borough's other subways.

Subway - Car Redesign and Added Cars

- *Added Core Capacity:* Medium
- *Status Estimate:* Unplanned and Uncertain

Both subway car redesign and added cars can increase capacity on existing lines. The MTA has already made an initial order of 440 R211 cars, for use on the B Division (lettered lines).[16] The R211s could allow for more passengers per car due to features like wider doors. Open gangways have more floor area,

[15] "Mysteries of the Queens Blvd Subway" www.vanshnookenraggen.com/_index/2015/09/mysteries-of-the-queens-boulevard-subway/; "MTA Program for Action" http://www.thejoekorner.com/lines/progforaction.htm
[16] "MTA Approves Purchase of Next Generation of Subway Cars." January 24, 2018. www.mta.info/news-nyc-transit/2018/01/24/mta-approves-purchase-next-generation-subway-cars

make it easier for passengers to distribute throughout the train, and can reduce dwell times by facilitating boarding and alighting. International precedent shows potential for 8 to 10% capacity increases over conventional train designs.[17]

The model assumes a more conservative estimate of capacity added due to car redesign:
2030 "minimal" – no capacity increase
2030 "ambitious" – no increase on the 7; +5% capacity on the EF, MR, and NW
2050 "minimal" – +3% capacity on the 7; +5% on other lines
2050 "ambitious" – +5% capacity on the 7; +10% capacity on other lines

Adding another car to each train could mean another roughly 10% capacity increase (with a minimum of 110 to 175 passengers per car). Platform length and interlocking layouts are limiting factors (especially on the NW), and a station-by-station assessment would be needed to determine the scope and magnitude of improvements necessary to add cars. Open gangway cars could provide a solution for boarding and alighting if the additional car extends past the useable platform and are only able to berth some doors.

The model assumes no additional cars per train would be in place until 2050, due to logistical challenges.
2050 "minimal" – no additional cars
2050 "ambitious" – 1 additional car per train on the 7, E and F lines

Sunnyside Station

- *Added Core Capacity:* Medium
- *Status Estimate:* Unplanned and Uncertain

Sunnyside Station was designed to a conceptual level as part of the East Side Access FEIS.[18] This new station would be located near Queens Boulevard at Skillman Avenue, west of Woodside on the LIRR Main Line. It would serve LIRR trains connecting to Penn Station but not to Grand Central Terminal. The potential of Sunnyside Station to add to core capacity is uncertain; as evaluated to date, it has primarily been identified as a destination station for suburban riders originating from the east, diverting some auto trips and trips from other LIRR branches. Sunnyside Station could be designed as the Yard's intermodal hub, but its impact on core capacity will depend on key variables including future service patterns and fare structures, and the potential of multiple operators serving the station is still under evaluation. Significant further analysis and policy decisions would improve the model's ability to represent impact.

The model assumes that Sunnyside Station is a build project. For 2050 build with mitigations, it assigns +700 trips to LIRR, with 12% diverted from auto and 88% diverted from other LIRR.

Sunnyside Yard Bus Rapid Transit (BRT)

- *Added Core Capacity:* Medium
- *Status Estimate:* Unplanned and Uncertain

The Queens Midtown Tunnel (QMT) and the Queensboro Bridge are key transit corridors that carry thousands of local and express bus riders between Manhattan and Queens every day. However, congestion often delays buses, increasing travel times and decreasing reliability. If implemented with dedicated, separated, and enforced ROW, BRT service between Sunnyside Yard and Midtown could

[17] London (New Tube for London, October 2014, http://content.tfl.gov.uk/ntfl-feasibility-report.pdf) and Toronto (NY Times, "A Subway Car With Few Doors, but More Ways Out" www.nytimes.com/2013/10/21/nyregion/no-doors-between-subway-cars-mta-may-consider-new-model.html?_r=0)
[18] http://web.mta.info/capital/esa_docs/feisfiles/02_project_alternatives.pdf

make bus service more convenient and appealing, diverting some riders that would have otherwise taken the subway or driven. Future BRT service could be distinguished from the City's existing SBS service by more robust priority treatments.

Articulated buses with a capacity of 100 passengers with headways of every 2-4 minutes equates to 1,500 to 3,000 peak direction trips per East River crossing. Two potential services could be implemented to/from Midtown: via the QMT and via the Queensboro Bridge. A QMT route could approach the tunnel at the far west corner of the Yard from a new street through the center of the site, or if that proves infeasible, along dedicated lanes on Skillman Avenue, 49th Avenue, and 21st Street. Dedicated lanes on 50th Avenue would lead to a bus queue jump to the tunnel entrance. A Queensboro Bridge route could use dedicated Thomson Avenue ramps to the bridge's upper level, a strategy considered in the 2011 Queensboro Bridge Bus Priority Study.

In Manhattan, the buses could follow similar routings to those of current express buses (34th St, 6th Ave, 57th St, etc.). This improvement assumes that streets on the Manhattan side would also provide a high level of bus priority (more robust than today) to allow for a truly rapid service. The existing dedicated lanes in Manhattan would also be made more robust. The FTM assumes costs for standard BRT infrastructure, as a completely new flyover ramp to the QMT contraflow HOV+3 tube would be unnecessary. Buses would use the westbound tube in the QMT after bypassing Long Island Expressway congestion via the dedicated lanes described above.

The model diverts 95% of the new BRT trips from the subway and 5% from auto in 2030; and the model diverts 90% of the new BRT trips from the subway, 5% from auto, and 5% from taxis in 2050.

2030 "ambitious" with mitigations +300 BRT trips per route
2050 "ambitious" with mitigations +1,200 BRT trips per route

Channeling Transit Riders

- *Added Core Capacity:* Medium
- *Status Estimate:* Contingent on Sunnyside Yard Master Plan

Sunnyside Yard site design, new shuttle services, and other incentives may be able to influence travel behavior, shifting riders from over-capacity to under-capacity subway lines, and to a lesser extent, to rail or bus. Specific improvements could be enhanced streetscapes within SSY and in surrounding neighborhoods, infrastructure providing more direct connections to certain stations (passageways, connected lobbies, etc.), or a (potentially free) shuttle service to certain stations.

The model assumes that riders are channeled from the subway to LIRR (Woodside, or possibly Sunnyside Station contingent on future service), and from more crowded subway lines to less crowded lines. In all scenarios, 3% of area subway riders currently using other lines are channeled to the MR, which has and will have the most capacity.

2030 & 2050 "minimal" no change in rail trips
2030 & 2050 "ambitious" with mitigations +1% rail trips replacing subway

Regional Rail Changes or Policy Improvements

- *Added Core Capacity:* Medium
- *Status Estimate:* Unplanned and Uncertain

Changes to regional rail have the potential to encourage use of LIRR and shift trips away from cars and subways. This could include LIRR-subway fare parity, fare payment integration, and through-running of LIRR, New Jersey Transit, and Metro North trains. The model replaces auto and subway trips with rail trips, with percentages based on location.

2030 "minimal" +10% rail trips (~7,000 trips)
2030 "ambitious" +18% rail trips (~13,000 trips)
2050 "minimal" +10% rail trips (~9,000 trips)
2050 "ambitious" +18% rail trips (~16,000 trips)

Freight Improvements

- *Added Core Capacity:* Low
- *Status Estimate:* Probable

Improvements in freight logistics citywide could reduce vehicular traffic (i.e. truck trips) in the future. Currently, 89% of freight moving through New York City is via truck, and absent changes, total freight could increase by 68% between 2012 and 2045.[19] Investing in rail and maritime modes could reduce freight's burden on the road network in the future, along with other strategies like last-mile consolidation centers, overnight delivery, and new delivery technologies. However, truck volumes may actually increase in the near-term due to more home deliveries and returns.

The model approaches freight from a citywide perspective and makes a percentage reduction in overall truck trips.

2030 "minimal" no reduction in truck trips
2030 "ambitious" -5% truck trips
2050 "minimal" -5% truck trips
2050 "ambitious" -35% truck trips

LIRR East Side Access

- *Added Core Capacity:* Low
- *Status Estimate:* Known and Likely

East Side Access will provide LIRR service to Grand Central Terminal, supplementing existing service to Penn Station and offering Long Island and Queens commuters a more direct trip to Manhattan's east side. Revenue service is forecasted for 2023.[20] East Side Access could divert a small number of subway trips (particularly the 7 train) and some existing vehicle trips. The 2001 FEIS calculated a diversion of 1,185 riders from the 7 train to LIRR in the AM peak hour, and 5,058 for the peak period (6-10am).[21] The model diverts subway trips to rail.

2030 "minimal" +1% rail trips
2030 "ambitious" +5% rail trips
2050 "minimal" +1% rail trips
2050 "ambitious" +5% rail trips

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[19] Freight NYC. NYCEDC. July 2018. www.nycedc.com/program/freight-nyc
[20] http://web.mta.info/capital/esa_alt.html
[21] http://web.mta.info/capital/esa_docs/feisfiles/09_transportation.pdf

Local Bus Service

- *Added Core Capacity:* Low
- *Status Estimate:* Known and Likely

Per MTA's Fast Forward Plan, all five boroughs will undergo a complete bus network redesign over the next several years. These redesigns could help reverse recent trends of declining local bus ridership and make local buses an attractive option for Sunnyside Yard residents and workers. Local bus service would not address core capacity directly as few local routes connect Western Queens to Manhattan, but new or adjusted routes could facilitate demand for north-south trips through the Yard serving local destinations that are not particularly subway accessible.

The model treats local bus separately from any future BRT service. It assumes the following:

Table 8: Modes replaced by local bus

2030 "minimal"	*2030 "ambitious"*	*2050 "minimal"*	*2050 "ambitious"*
+0% local bus trips	*+2% local bus trips Modes replaced by bus: Taxi 50% Walk 30% Bike 20%*	*+2% local bus trips Modes replaced by bus: Taxi 50% Walk 30% Bike 20%*	*+4% local bus trips Modes replaced by bus: Taxi 50% Walk 30% Bike 20%*

Bike Improvements

- *Added Core Capacity:* Low
- *Status Estimate:* Known and Likely

Bicycling in New York City has grown significantly over the past decade.[22] The gradual build-out of an all-ages and abilities bike network, expansion of Citi Bike, and the introduction of dockless bike and electric pedal-assist bike options citywide should continue to support this trend. The city is targeting an increase in biking mode share from 1% in 2018 to 10% in 2050.[23] International cities show what could be possible beyond this goal, with mode shares of 20% (Tokyo) and 35-40% (Copenhagen and Amsterdam).[24] Designing Sunnyside Yard with bicycling at the forefront (e.g. bike share integration, secure parking, and protected infrastructure) could help relieve demand on the road network and the transit system.

The model assumes the following regarding bicycle mode share and mode replacement:

Table 9: Modes replaced by bike

2030 "minimal"	*2030 "ambitious"*	*2050 "minimal"*	*2050 "ambitious"*
+1% bike trips Modes replaced by bike: Taxi 10% Subway 35% Bus 25% Walk 30%	*+8% bike trips Modes replaced by bike: Taxi 10% Subway 35% Bus 25% Walk 30%*	*+2% bike trips Modes replaced by bike: Taxi 10% Subway 35% Bus 25% Walk 30%*	*+15% bike trips Modes replaced by bike: Taxi 10% Subway 35% Bus 25% Walk 30%*

[22] Total daily cycling trips increased by 156% between 2006 and 2016. "Cycling in the City." NYCDOT. 2018. www.nyc.gov/html/dot/downloads/pdf/cycling-in-the-city.pdf
[23] "New York City's Roadmap to 80x50." https://www1.nyc.gov/site/sustainability/codes/80x50.page
[24] Cycling Mode Share Data for 700 Cities. http://www.cityclock.org/urban-cycling-mode-share/#.W5vXwOhKiUk

Ferry Capacity

- *Added Core Capacity:* Low
- *Status Estimate:* Known and Likely

Ferry service in New York has expanded significantly since 2017. NYC Ferry now has six year-round routes, three of which serve the study area via two landings: Hunters Point South and Long Island City/Gantry Plaza State Park. The City is estimating up to 9 million annual passengers by 2023, up from 3.7 million passengers in 2017.[25] Ferries address core capacity via service between Queens and the Manhattan landings (e.g. E. 34th St and Wall St Pier 11). Frequencies are currently every 20-25 minutes during the AM peak, but more frequent service may be possible in the future. The City is also investing in new 350-passenger capacity vessels, up from the standard 149-passenger. In the future, growth in ridership at existing landings could draw riders from nearby subway stations, reducing strain on those lines.

The model assumes that ferries draw from subway (75%) and buses (25%).

2030 "minimal" +3% ferry trips
2030 "ambitious" +10% ferry trips (~1,000 additional trips)
2050 "minimal" +6% ferry trips
2050 "ambitious" +20% ferry trips (~2,000 additional trips)

Road Pricing

- *Added Core Capacity:* High
- *Status Estimate:* Unplanned and Uncertain

The idea of road pricing or a congestion fee in New York City has a long history. Most recently, the 2015 Move NY and the 2017 Fix NYC plans have both put forward pricing schemes that charge vehicles entering the Manhattan Central Business District (below 60th Street) and subsequent legislation passed in 2019 put NYC on a path toward congestion pricing in 2021.[26] These plans address the City's worsening congestion and the need to identify revenue streams for transit. Road pricing could rebalance vehicle trips region-wide and reduce volumes in Manhattan and the vicinity (e.g. on the Queensboro Bridge).

The model replaces single occupancy vehicle (SOV) trips with transit (50%) and HOV trips (30%) and removes 20% of trips.

2030 "minimal" -20% to +3.0% change in VMT (varied by location)
2030 "ambitious" -20% to +3.0% change in VMT (varied by location)
2050 "minimal" -4.0% to 0.6% change in VMT (varied by location)
2050 "ambitious" -41% to 6.1% change in VMT (varied by location)

Shift Toward Shared Mobility

- *Added Core Capacity:* Medium
- *Status Estimate:* Unplanned and Uncertain

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[25] May 3, 2018. https://www1.nyc.gov/office-of-the-mayor/news/235-18/mayor-de-blasio-nyc-ferry-now-planning-9-million-annual-riders-growing-meet-demand#/0
[26] Fix NYC Advisory Panel Report. January 2018. http://www.hntb.com/HNTB/media/HNTBMediaLibrary/Home/Fix-NYC-Panel-Report.pdf

The trend towards shared mobility (shared cars, bikes, scooters, and rides) is part of an increased emphasis on mobility as a service, on-demand and as-needed. The relatively sudden ascendency of app-hailed for-hire vehicles is one element of shared mobility, though only a portion of rides are actually shared. In New York City, 22% of all Uber and Lyft trips are shared trip requests that are actually matched.[27]

Shared mobility impacts are complex because they depend on which modes shared trips are diverted from; the roadway network would benefit if shared trips were formerly SOV trips, but not if they were primarily transit, walk, or bike trips. Recent research suggests that, up to now (and absent potential policy to shape these travel decisions), shared rides add to traffic in New York City because most users are switching from non-auto modes and the vehicles travel without passengers for a portion of their trips.[28]

Average vehicle occupancy is another aspect of shared mobility. The model assumes that occupancy could range from 1 person to 3 people, compared to approximately 1.5 occupancy for FHVs and taxis today.[29] For the most ambitious, longer term scenario, it assumes the City could enact comprehensive FHV regulations that strongly incentivize shared rides. Potential interactions with policy, industry trends, and the potential of Autonomous Vehicles makes the long-term impact of this trend particularly uncertain.

2030 "minimal" 1 person shared trip occupancy
2030 "ambitious" 2 people shared trip occupancy
2050 "minimal" 2 people shared trip occupancy
2050 "ambitious" 3 people shared trip occupancy

Table 10: Modes replaced by shared trips

2030 "minimal"	*2030 "ambitious"*	*2050 "minimal"*	*2050 "ambitious"*
SOV 2%	*SOV 10%*	*SOV 5%*	*SOV 15%*
Rail 1%	*Rail 1%*	*Rail 2%*	*Rail 2%*
Subway 1%	*Subway 1%*	*Subway 2%*	*Subway 2%*
Bus 3%	*Bus 3%*	*Bus 4%*	*Bus 4%*
Walk 0%	*Walk 1%*	*Walk 0%*	*Walk 2%*
Bike 0%	*Bike 2%*	*Bike 0%*	*Bike 3%*

Autonomous Vehicles (AVs)

- *Added Core Capacity:* Low
- *Status Estimate:* Unplanned and Probable

Private firms and the public sector are already developing, investing in, and considering policies to address AV technology, which could remake the existing transportation system in many ways. Though the scope and level of automation in place in New York City in the future is unknown, widespread adoption of AVs in general is plausible within 15 to 20 years.[30] The AV future could be "heaven or hell" depending on whether AVs are primarily shared or personally owned, what kinds of shifts from other modes result, and the degree to which network efficiency gains can be realized. In the best case for the City's transportation system, AVs could reduce car ownership, prompt shifts from SOV trips to AV transit services, and make more efficient use of road space. Conversely, cheap AVs could encourage SOV trips and increase congestion, as well as shift trips from greener modes.

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[27] Schaller Consulting. "The New Automobility: Lyft, Uber and the Future of American Cities." July 2018. http://www.schallerconsult.com/rideservices/automobility.pdf
[28] Ibid.
[29] Calculated based on NYC Taxi & Limousine Commission passenger count data.
[30] "Driverless Future: A Policy Roadmap for City Leaders." https://driverlessfuture.webflow.io/

The model makes assumptions on both mode shift and network efficiency impacts, based on a survey of recent literature.[31] The “taxi” trip category is a proxy for FHVs that would be autonomous in the future. These trips are diverted from rail and subway, varied by location and based on current mode splits.

2030 “minimal” -10% network efficiency; +10% taxi trip increase
2030 “ambitious” +10% network efficiency; +2.5% taxi trip increase
2050 “minimal” +10% network efficiency; +20% taxi trip increase
2050 “ambitious” +25% network efficiency; +5% taxi trip increase

[31] World Economic Forum. “Reshaping Urban Mobility with Autonomous Vehicles.” June 2018.

4. Future Transportation Conditions

The Flexible Transportation Model (FTM) developed for this project assesses future transportation demand across modes over multiple timeframes in no-build and build scenarios. There is significant uncertainty in trying to estimate transportation conditions (and societal changes in general) over 30 years. Over the past 30 years (since 1990), some changes put this effort into perspective: mobile phones have proliferated, shared mobility services and apps were non-existent, New York City's population has grown by 15% and its economy has rebounded with 30% growth in jobs, and climate change and extreme weather events are accelerating. Given this uncertainty, the FTM looks at two future year scenarios, 2030 and 2050, that provide a reasonable range of possible future conditions in and around Sunnyside Yard that can inform the long-term transportation strategy. The focus of the work was more on the 2050 scenario as this served as a proxy for a build year. The 2030 scenario was used to evaluate potential project phasing.

Described in the prior section, a series of interventions were incorporated into the FTM to account for projected changes to the transportation network in the future. These interventions are categorized into three groups: Projects, Citywide Policies, and Mitigations. Some interventions, like CBTC, only affect the supply side and available capacity. Other interventions, like congestion pricing, affect the demand side and have assumptions that shift trips between modes. For each project or policy, an "ambitious" option uses a high end of a range of assumptions regarding the intervention's magnitude, implementation speed, and overall impact. A "minimal" option is the low end of the range.

Table 11: Transportation Intervention Impacts

Transportation Interventions		Scenario			
		No Build	Build	Minimal	Ambitious
Subway – CBTC	Project	X	X	Low Impact	High Impact
Subway – added cars	Project	X	X	Low Impact	High Impact
Subway – car redesign	Project	X	X	Low Impact	High Impact
Bike facilities and bikeshare expansion	Project	X	X	Low Impact	High Impact
Additional ferry capacity	Project	X	X	Low Impact	High Impact
Local bus service	Project	X	X	Low Impact	High Impact
Regional rail changes/policy improvements	Project		X	Low Impact	High Impact
LIRR East Side Access	Project	X	X	Low Impact	High Impact
Freight improvements	Project	X	X	Low Impact	High Impact
Congestion pricing	Policy	X	X	Low Impact	High Impact
Shift toward shared mobility – changes to mode share and occupancy	Policy	X	X	Low Impact	High Impact
AVs – changes to mode share	Policy	X	X	High Impact	Low Impact
AVs – changes to network efficiency	Policy	X	X	Low Impact	High Impact
Bus Rapid Transit (BRT)	Mitigation		X	Low Impact	High Impact
Sunnyside Station	Mitigation		X	High Impact	High Impact
Channeling transit riders to under capacity access points	Mitigation		X	Low Impact	High Impact
New Subway Line – Queens Super Express	Mitigation		X	High Impact	High Impact

The FTM was used to understand how the different transportation options (and in particular subway lines) passing through the project core would be impacted by each of these interventions, specifically for the AM peak period traveling westbound towards Manhattan. The subway lines that were analyzed in detail included the 7 Local. 7 Express, E, F, M, R, and N/W. The following section details how the subway lines and traffic volumes at 10 key intersections around the site are impacted under the different no-build and build scenarios along with the different intervention categories.

2050 Background Growth

Though a year 2050 scenario in which the transportation system remains the same and only background population and job growth occur is by its nature unrealistic given many planned changes, it is worth noting that a 2050 Background Growth scenario highlights how the impacts associated with a future Sunnyside Yard are marginal compared to the overall impacts of background growth. V/Cs on all lines would worsen without planned improvements. Motor vehicle volumes at the 10 study intersections increase by 52 percent compared to 2018 volumes. These trends reflect assumptions for regional growth embedded in the New York Best Practice Model (BPM) maintained by the New York Metropolitan Transportation Council (NYMTC).

2050 No Build – Minimal Projects and Policies

The 2050 No Build – Minimal Projects and Policies scenario considers a conservative set of assumptions for the projects and policies that are projected to change the transportation network in the future. These interventions, while conservative, would have a significant impact on the subway lines with the highest V/Cs. As compared to the 2050 Background Growth scenario, the V/Cs on the 7 Express, E, F, R, and N/W lines would greatly improve. The V/Cs on the 7 Local and the M lines would improve slightly as compared to the 2050 Background Growth scenario. This is primarily due to the implementation of CBTC on all the analyzed lines. Car redesign adds additional capacity to the system, and government measures related to shared mobility, autonomous vehicles, and regional rail policy also impact the transportation landscape. Vehicle volumes at the 10 study intersections increase by 39 percent as compared to 2018 volumes.

2050 No Build – Ambitious Projects and Policies

The 2050 No Build – Ambitious Projects and Policies scenario considers an ambitious set of assumptions for the projects and policies that are projected to change the transportation network in the future. These ambitious interventions would significantly improve the V/Cs on all of the subway lines, except the 7 Local, which would have a slight improvement in V/C. Again, this is primarily due to the implementation of CBTC on all the analyzed lines. Compared to the minimal scenario, CBTC would enable one additional train per hour on the M, R, and N/W lines. In the ambitious scenario, added subway cars is an additional intervention that adds capacity to the system. Vehicle volumes at the 10 study intersections decrease by five percent as compared to 2018 volumes. This can be attributed to more aggressive congestion pricing, a greater shift to shared mobility (e.g. higher vehicle occupancy), and efficiencies from autonomous vehicles.

2050 Build – Minimal Projects and Policies

The 2050 Build – Minimal Projects and Policies scenario considers the potential Sunnyside Yard development along with the same set of conservative policy and project assumptions as in the 2050 No Build – Minimal Projects and Policies scenario. While the proposed program would place additional trips onto the subway network, the implementation of the minimal policies and projects would have a similar impact on the V/Cs as in the 2050 No Build – Minimal Projects and Policies scenario. The V/Cs on the 7 Express, E, F, R, and N/W lines would improve greatly as compared to the 2050 No Build – Background Growth scenario. The V/C on the M would improve slightly as compared to the 2050 Background Growth. The 7 Local would be the only line that would have a V/C that tangibly degrades as a result of the increase in trips from the development. The 7 Local/Express, E, and N/W would be operating at or near capacity in this scenario. Vehicle volumes at the 10 study intersections increase by 50 percent as compared to 2018 volumes.

2050 Build – Ambitious Projects and Policies

The 2050 Build – Ambitious Projects and Policies scenario considers the potential Sunnyside Yard development along with the same set of ambitious policy and project assumptions as in the 2050 No Build – Ambitious Projects and Policies scenario. The ambitious policies and projects would improve the V/Cs on all the subway lines, with only the 7 Local operating near capacity in this scenario. Vehicle volumes at the 10 study intersections increase by one percent as compared to 2018 volumes.

2050 Build – Ambitious Projects and Policies and Mitigations
The 2050 Build – Ambitious Projects and Policies scenario considers the potential Sunnyside Yard development, the same set of ambitious policy and project assumptions, and additional mitigations. The additional mitigations would have the most impact on the V/Cs on the 7 Local/Express, E, and F lines. Specifically, the presence of a "Queens Super Express" subway line running parallel to the Queens Boulevard corridor would draw a significant number of passengers from the E and F lines. Vehicle volumes at the 10 study intersections increase by one percent as compared to 2018 volumes.
A range of transit capacity improvements is achievable and would continue to better the experience of transportation compared to the available transit capacity without any interventions.

This section includes two additional pertinent order of magnitude model outputs beyond those provided in the main Sunnyside Yard Master Plan report:

1) The below chart breaks down the relative subway volume that the FTM estimates the full development would create if built by 2050 for each subway line, at each respective line's peak load point, as well as the baseline volume:

Table 12: 2050 Estimated Subway Peak Load Point Volumes

Line	Station	2050 Estimated Volume	2050 Estimated SSY Volume
7 Loc	40 St-Lowery St	17,700	1,200
7 Exp	Vernon Blvd-Jackson Av	18,000	200
E	East of Jackson Hts	25,500	400
F	Jackson Hts-Roosevelt Av	21,500	<100
M	East of Jackson Hts	8,600	100
R	Queens Plaza	10,100	1,000
N, W	Queensboro Plaza	25,200	400

2) While the Sunnyside Yard Master Plan report illustrates the significant order of magnitude of opportunities to increase subway capacity, **Figure 12** indicates the relative scale that some of the major interventions could decrease subway demand at the system's most crowded points in one tested scenario.

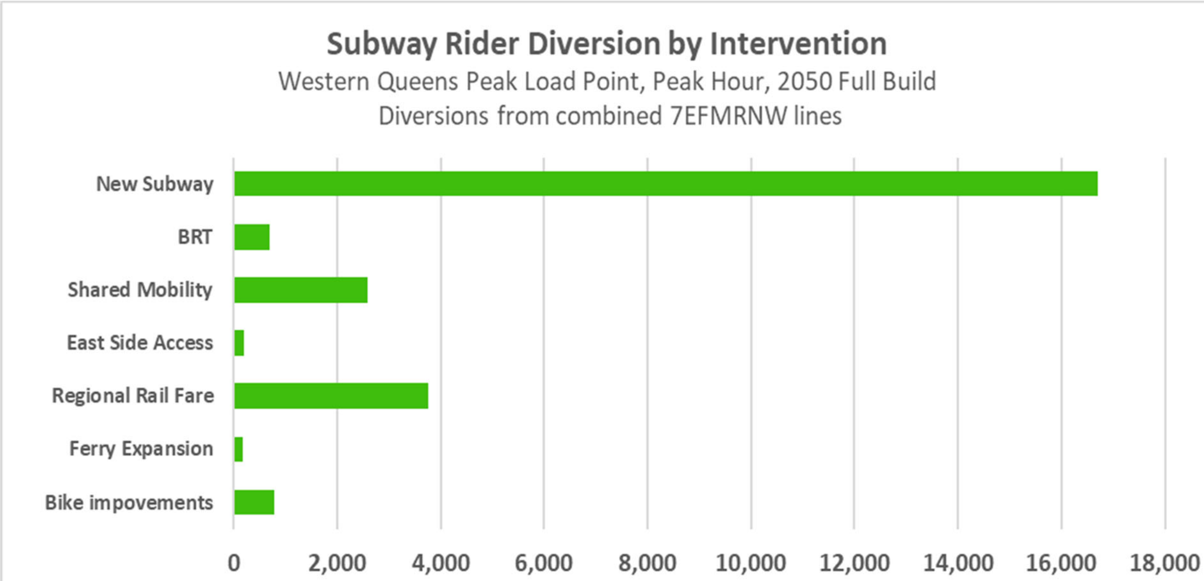

Figure 12: Subway Rider Diversion by Intervention

5. Transportation Strategies: Long-Term Build-Out

In the long-term, multiple solutions will be needed to both improve the existing local and regional transportation network and to ensure that Sunnyside Yard will not create excess additional demand on core capacity. From another perspective, it is an opportunity to invest in and improve the system, both through transportation improvements and the programming and design of the site. Expanding vehicular capacity is unrealistic, resulting in the need for interventions that encourage and incentivize multi-modal choices, either increasing throughput on existing corridors or by adding new transportation options.

The location and scale of Sunnyside Yard also presents a broader opportunity to help define what urban mobility can and should look like well into the future: convenient, efficient, reliable, equitable, sustainable, affordable, healthy; helping to unlock opportunities and supporting a strong quality of life for all New Yorkers; drawing from time-tested transportation policy, programmatic, and design practices while applying new mobility innovations that help achieve the desired goals.

The overarching transportation goal for Sunnyside Yard is to facilitate the highest possible non-automotive mode share: through minimal parking supply, convenient and enjoyable connections to nearby transit options (particularly those with excess capacity), walkable streets, a vibrant public realm, and targeted investments in new or increased transit capacity. Likewise, smart and clean approaches to freight and waste management, and sustainable design, are key elements to the transportation strategy for Sunnyside Yard.

The following sections describe site-specific elements of the transportation strategy as well as a suite of larger-scale transportation network investments that could address current and future transportation challenges in and around Sunnyside Yard and Western Queens.

5.1 Sunnyside Yard Site Design

Achieving the transportation vision and goals for Sunnyside Yard will require a range of strategies to help people get to, from, and around the site – by non-polluting or low-polluting modes to the greatest extent possible.

5.2.1 Multi-Modal Neighborhood Connections

The grade differences and – on the north side in particular – limited right-of-way connections between the Sunnyside Yard site and surrounding streets create physical constraints to providing access to the site and integrating the site's walking, transit, bicycling, and driving networks to the broader networks. This necessitates a thoughtful strategy to create convenient, comfortable multi-modal connections. It also necessitates creative solutions that draw inspiration from other neighborhoods around New York and around the world with significant grade changes.

For walking, priority connections are to nearby transit stations, including the E/M/R at Queens Plaza, M/R on Northern Boulevard, N/W on 31st Street, and 7 local and express on Queens Boulevard. In particular, because the M/R 36th Street station provides significant spare capacity, connecting Sunnyside Yard residents, workers, and visitors to and from that station is a key strategy for supporting transit use at Sunnyside Yard. At a minimum, this could include pedestrian safety and walkability improvements at the Northern Boulevard/38th Avenue/35th Street and Northern Boulevard/36th Street intersections to help pedestrians cross to and from the subway entrances on the north side of Northern Boulevard. Beyond that, access should ideally be created to the subway station from the south side of Northern Boulevard; the narrow sidewalk width currently makes it difficult to add new staircases without widening the sidewalk into the south curbside lane. Ideally, a direct pedestrian connection could be created between Sunnyside Yard and the subway station. The more direct and pleasant this connection is, the more Sunnyside Yard residents, workers, and visitors will utilize the 36th Street station.

Walkability and streetscape improvements could also be made to the Northern Boulevard/Honeywell Street/39th Avenue intersection, and 39th Avenue between Northern Boulevard and 31st Street, to facilitate pedestrian connections between Sunnyside Yard and the N/W trains. Likewise, improvements to the Skillman Avenue/43rd Avenue/33rd Street intersection (including enhancement of the traffic triangle into a pedestrian plaza) and along 33rd Street between Skillman Avenue and Queens Boulevard will facilitate pedestrian connections from Sunnyside Yard (via the proposed pedestrian bridge over the LIRR Mainline) to the 7 local and express trains at the 33rd Street station.

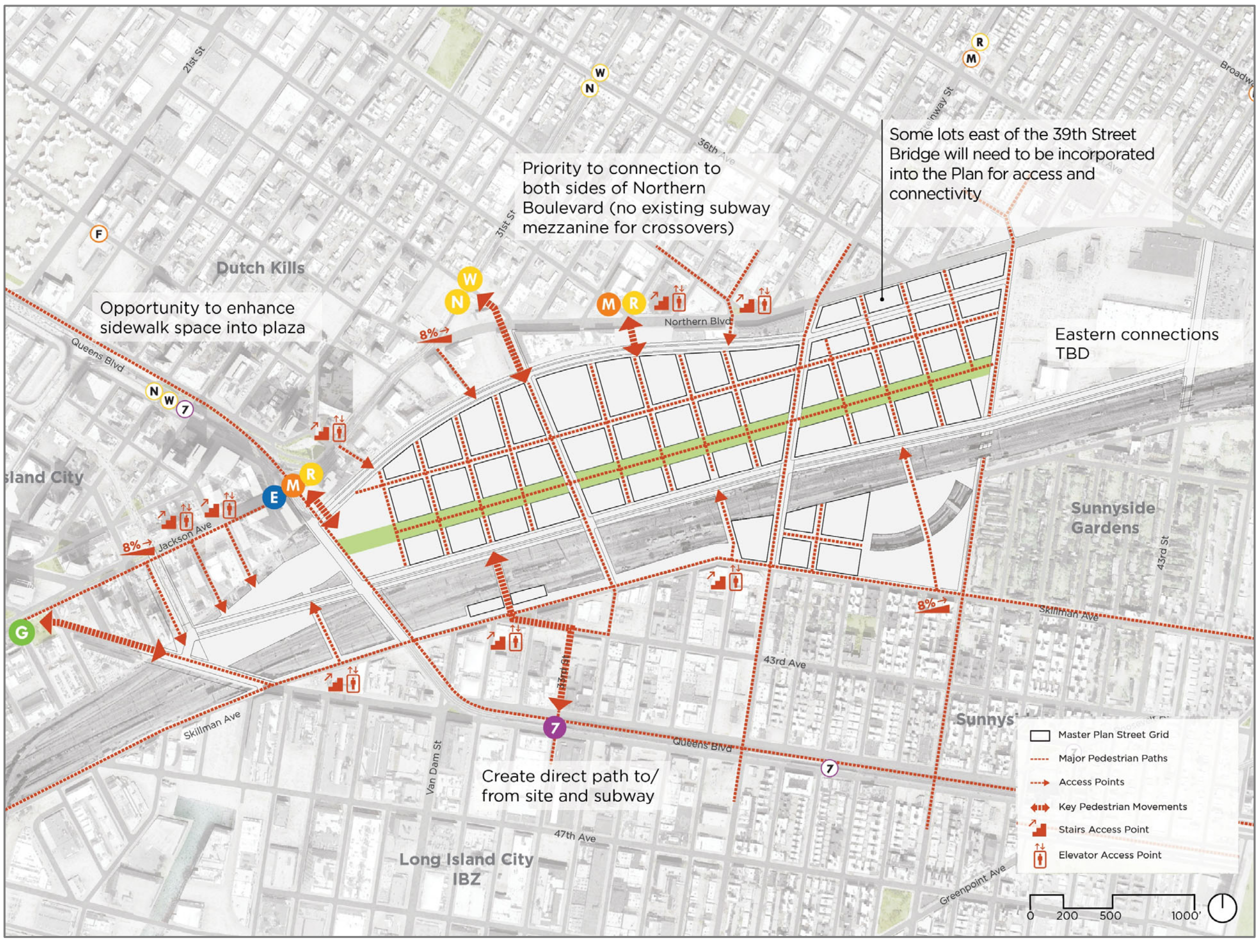

Figure 13: **Streetscape Improvements and Pedestrian Circulation**

For motor vehicles, the key routes remain largely the same as today, with the exception of the two new east-west corridors traversing the Sunnyside Yard site, both of which could be open to general traffic for some or all of the day. Interior streets, however, are proposed to be restricted to walking, biking/micromobility, service vehicles, and, eventually, shared autonomous vehicles making local pick-ups or drop-offs. Likewise, freight-priority routes remain largely the same as today, depending on the specific locations chosen for freight and waste consolidation centers and loading/unloading points.

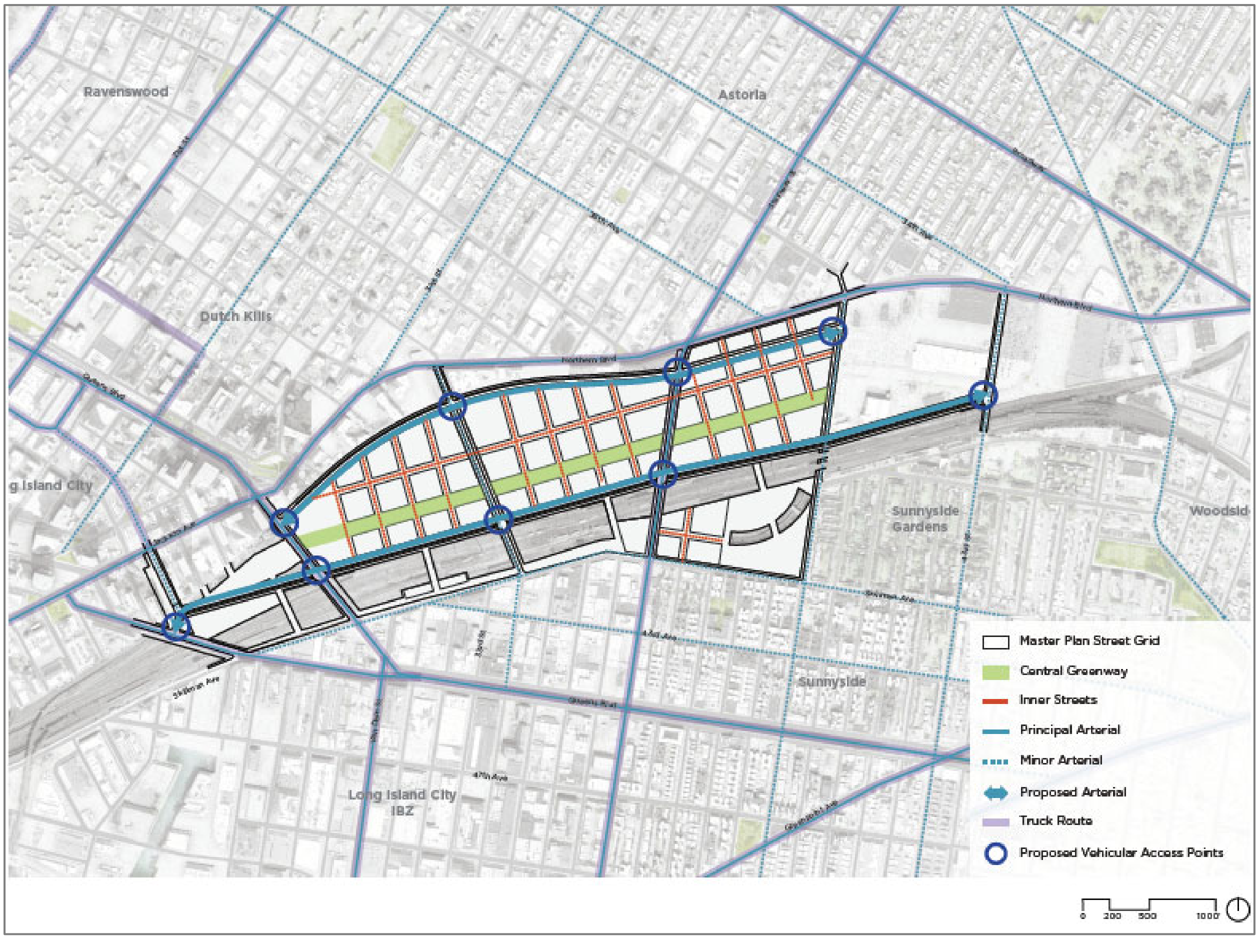

Figure 14: Sunnyside Yard Circulation and Access Points

The entirety of the Sunnyside Yard site is planned to be safe, comfortable, and convenient for bicycling and other sustainable micromobility modes, with key east-west bike paths on the northern and southern corridors that intersect with the existing routes on Queens Boulevard, Honeywell Street, 39th Street, and 48th Street, connecting to the broader network. In addition to the streets listed above, new or enhanced bicycle routes are proposed on Thomson Avenue, 36th Street, 35th Street, and 34th Avenue to create a more comprehensive and high-comfort bike network in Western Queens that also provides connections to Eastern Queens (via Queens Boulevard, 31st Avenue, and 34th Avenue), Manhattan (via the Queensboro Bridge), Roosevelt Island (via the Roosevelt Island Bridge), and Brooklyn (via the Pulaski Bridge, Greenpoint Avenue Bridge, and Kosciuszko Bridge).

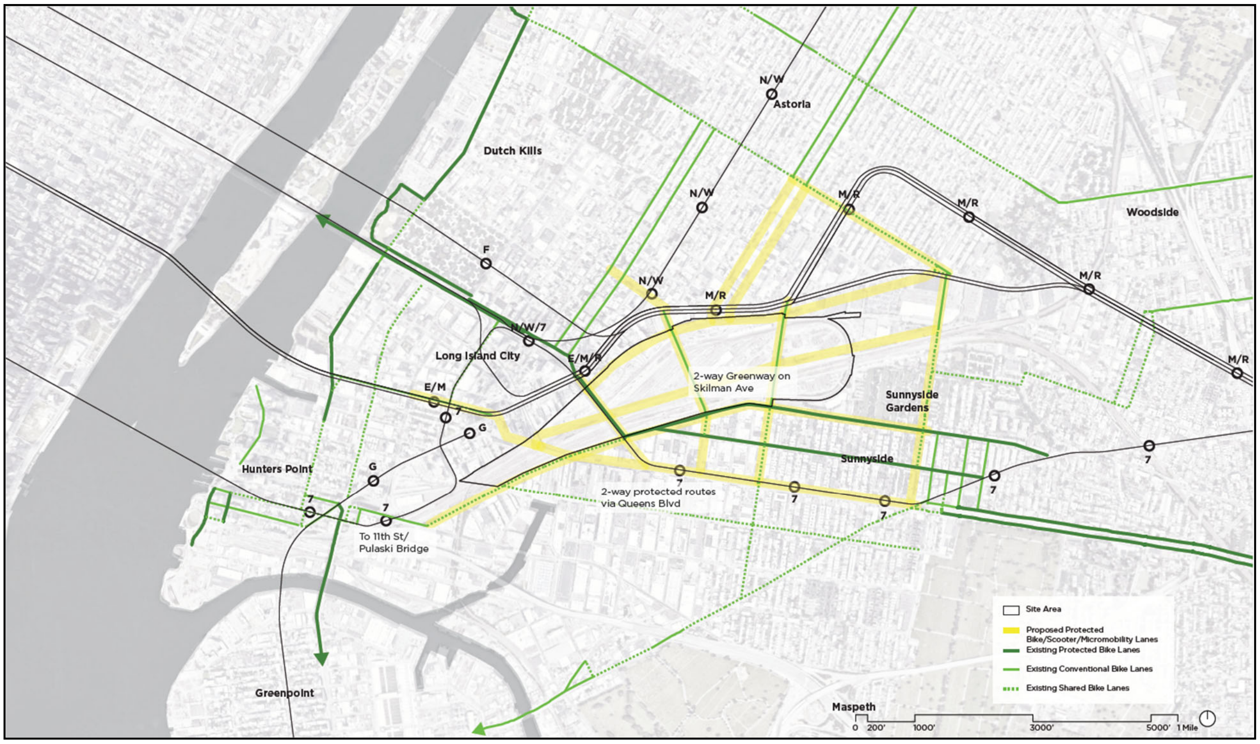

Figure 15: Existing and Proposed Bicycle Network

5.2.2 Micromobility

Micromobility (bike share, electric pedal-assist bikes, shared scooters, etc.) offers the potential to meet people's needs for shorter trips of generally one to five miles. When these trips are made by micromobility modes in lieu of car trips, they can help reduce traffic congestion and pollution; when they are made in lieu of transit trips, they can free up space on transit for other riders. Along with walking and traditional (fully human-powered) bicycling, Sunnyside Yard will support the use of micromobility to provide a range of convenient and affordable transportation options that minimize the need for automobile trips to and from the site. In particular, these modes provide one option for connecting residents, workers, and visitors the "first and last mile" to nearby transit stations, including those with more available capacity.

Sunnyside Yard's two new major east-west streets (the northern and southern corridors) will provide dedicated space for micromobility modes such as bikes, scooters and personal electric vehicles (PEVs). The wide greenway down the center of the site may also provide east-west connectivity. Micromobility will be welcome, too, on the internal streets, although dedicated space for these modes will be unnecessary due to the limited vehicle access and slow speeds, creating low-speed shared spaces.

This network of routes will be complemented by other policies and tools that facilitate the use of micromobility modes, including infrastructure and facilities in the form of charging stations for electric modes and indoor parking open to the public. In terms of policies, Transportation Demand Management (TDM) programs for residents and employees can promote the use of micromobility and other modes over driving, while the introduction of technologies like geofencing will help integrate these higher-speed modes into a public space heavily used by pedestrians.

Using E-bikes, E-scooters and other PEVs requires access to electricity at designated charging stations or parking areas. These facilities should be planned for in advance, as they require infrastructure in the form of electrical conduit traversing the neighborhood and outlets at potential charging-station locations.

Space is also a necessity for charging stations and allocating it in the site design phases is crucial. Another facility to be incorporated into plans is indoor parking garages. Be it personally owned or shared bikes and scooters, low-emission modes can be encouraged by providing users with comfortable, protected parking options that can be used in any weather, complemented with clothes changing facilities for cyclists using non-motorized bikes.

A broader TDM program would provide a package of incentives to use low-emission modes of transportation. Bundling together transit passes with reimbursement for subscriptions to shared micromobility systems can help commuters overcome the last-mile challenge in cases where public transportation does not provide full network coverage, particularly as integration of trip planning and payment options potentially enables a shift towards packages of shared mobility options. A resident of Sunnyside Yard could, for example, access the Cornell-Technion campus on Roosevelt Island using an electric pedal-assist bike or shared scooter – a trip that might otherwise be too long for a walk or not as practical for a personal bike trip. Or a resident of eastern Queens could take the LIRR to Woodside and utilize a micromobility mode to go the rest of the trip to eastern Sunnyside Yard.

5.2.3 Parking

Sunnyside Yard is one of the most transit-friendly locations in Queens and the city at large. In many cases, the streets in the neighborhoods surrounding Sunnyside Yard are highly utilized for (mostly free) on-street parking. Likewise, as discussed in the Existing Transportation Conditions section above, the major streets in and around Sunnyside Yard are operating at or close to capacity during peak times. Given the expected growth in the City and region – even without new development at Sunnyside Yard – the surrounding streets are expected to suffer from greater congestion in the future unless substantial policy interventions occur. Finally, trends in mobility services and technologies can make it easier for New Yorkers to avoid car ownership, relying instead on transit, walking, biking, and alternatives to car ownership like carshare, taxis, and app-based ridehail services.

For all of these reasons, and in furtherance of the City's goals to reduce greenhouse gas emissions 80% by 2050 and for Sunnyside Yard to serve as a model of sustainable and resilient design, the development will minimize the need for on-site parking through the provision of a range of attractive transportation choices and a suite of transportation demand management incentives. Therefore, minimal parking is proposed within Sunnyside Yard, including both on- and off-street, though individual buildings are not necessarily precluded from including parking by this masterplan, just discouraged via design. "Spillover" parking from Sunnyside Yard is not expected on the streets of surrounding neighborhoods because of the physical distance between the Sunnyside Yard site and those streets, and the relative convenience of other options vs. personal car ownership.

5.2.4 Emerging Mobility

The first two decades of the twenty-first century have seen innovations and disruption of the mobility services sector at an unprecedented scale. Emerging modes, such as microtransit, micromobility, ridesourcing (TNCs), carsharing, carpooling, and the evolution of autonomous, connected, and electric vehicles are increasingly impacting the day-to-day quality-of-life and well-being of many New Yorkers. Alongside traditional transportation modes – particularly New York City's extensive transit system – this new transportation marketplace may dramatically shape how people move and make transportation decisions, but the net benefit to society (and particularly lower-income populations) will depend on smart policy and regulation on the part of the public sector and well-structured public-private partnerships.

The timeframe of Sunnyside Yard is decades, and it is impossible to know exactly what the future holds as these trends and technologies go forward. Furthermore, many of these changes – such as the adoption of autonomous vehicles or road-user charging policies – will occur at a much larger scale than can be meaningfully steered through one neighborhood alone. The strategy around emerging mobility for Sunnyside Yard, therefore, is a mix of using currently available and emerging technologies to influence travel behavior towards sustainable options and designing flexibly enough to be able to harness the best of future innovations that we can't yet conceive.

Autonomous vehicle technology is maturing. Autonomous technology can potentially make both public- and privately-provided transit more financially viable by significantly reducing the costs of operation. At Sunnyside Yard, circulator shuttles are one option to connect people to subway and regional rail stations and external vehicle access points when walking, biking, and other micromobility options aren't viable (e.g. due to distance, weather, physical ability, or having things to carry) and those trips can't be served by traditional transit options such as local bus service. Autonomous shuttles may therefore play a role in the Sunnyside Yard neighborhood by creating seamless connectivity to, from, and within the site, particularly in light of the limited access to the site for general vehicle traffic.

The internal grid of Sunnyside Yard will be focused on supporting intense pedestrian activity and designed for dynamic, convertible uses over the course of the day, week, and year: commercial activities (green markets, produce stands, and food trucks), social (block parties, street fairs, performances, and art), and personal activities (paratransit, moving vans, or large sized deliveries). Where Sunnyside Yard interfaces with adjacent neighborhoods and higher capacity transportation options, this flexibility can also support movement of emergency vehicles and temporary travel demand management. That way, the transportation infrastructure on the community's edges could be dynamically transitioned to recreational uses at other times of day.

Eventually, advances in technologies paired with ubiquitous automated vehicles may allow for the dynamic management of street configuration rather than the traditional approach of fixed curb lines and traffic control devices such as regulatory signage and roadway markings. In other words, LED or other lighting embedded in the roadway could be changed to reallocate space between different modes or uses. "Old-fashioned" elements such as planters and seating could also be used and manually moved by maintenance staff to dynamically program street space. Through these approaches, vehicle access, the assignment of lanes, and the width of the sidewalk can be changed depending on needs, "reprogramming" the street based on the usage conditions. These types of approaches will be more practical from a cost and maintenance standpoint on the interior streets of Sunnyside Yard that have little to no traffic from heavy vehicles and are subjected to less wear-and-tear.

Another technology that can be incorporated in Sunnyside Yard is adaptive traffic signals. Adaptive signals can change their timing according to the user approaching the intersection to allow them more time to cross. While it might be most effective for pedestrians who walk slower than average, adjusting signals to account for the need of motorized and non-motorized cyclists can enhance their experience and encourage a safer and smoother ride.

5.2 Additional Considerations

5.2.1 Streets-focused interventions

A conceptual idea that the team explored as part of an intermodal strategy is an elevated infrastructure to connect the future Sunnyside Yard deck to the Queens Plaza Station (E/M/R) and Queensboro Plaza Station (7/N/W). This concept has the potential to strengthen the bike and pedestrian access between the Yard development and Long Island City transit hub. The elevated infrastructure builds on the existing 7 subway bridge structure and adds to it a protected walkway and possibly micromobility deck. In addition, a vertical connection to Queens Plaza station is proposed on the southeast corner of Northern Boulevard and Queens Boulevard. The team also looked at a new elevated connection between the Queens Boulevard Bridge deck to the Queensboro Plaza subway station (divided into two segments) to allow for direct transfers between the E/M/R and the 7/N/W. This new infrastructure could potentially be landscaped to invite people to Sunnyside Yard and shield the walkway from train-related noise.

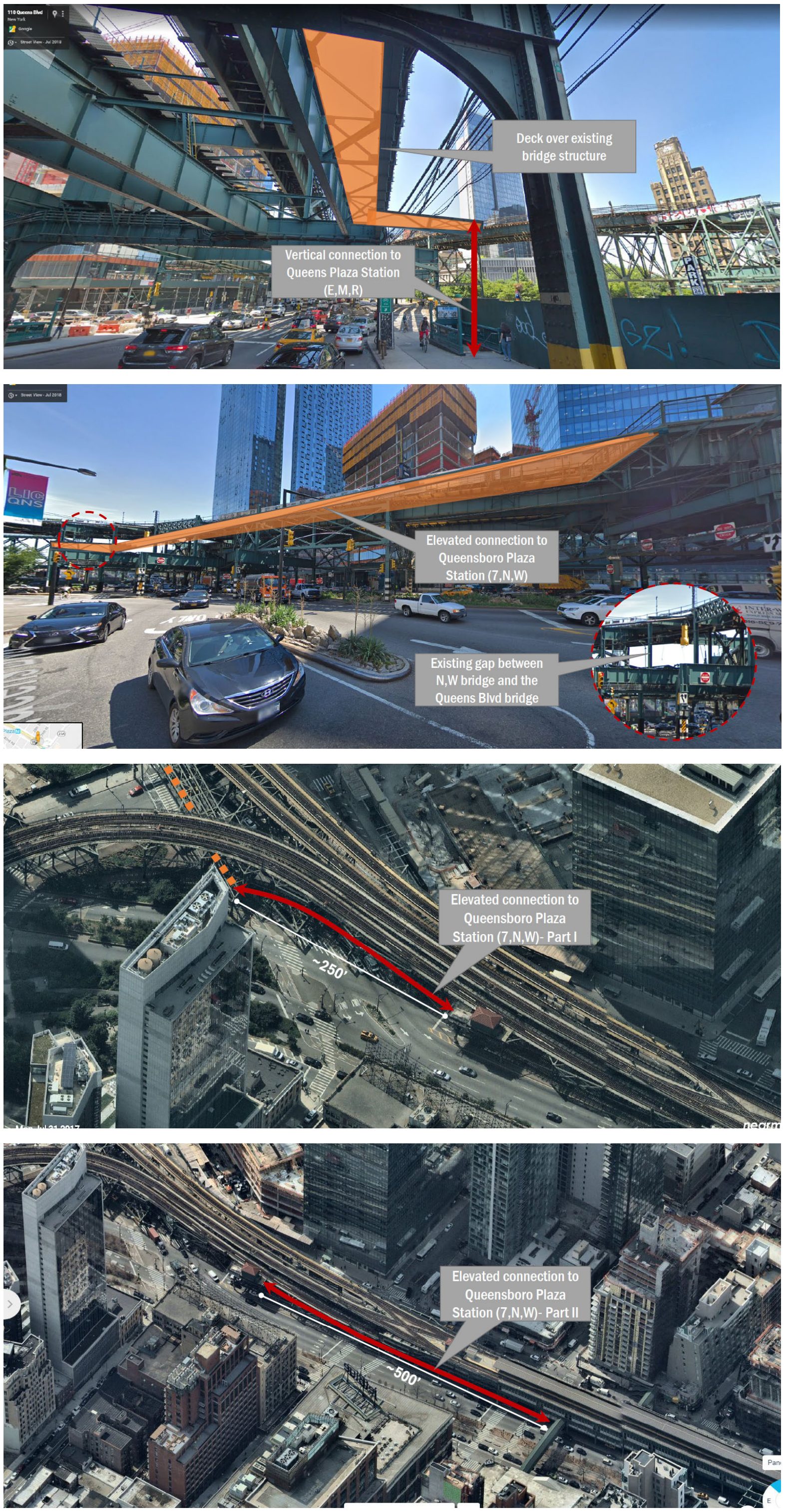

Figure 16: Elevated Infrastructure Concepts

5.3 Phasing Considerations

The phasing of the build-out of development at Sunnyside Yard impacts the timing of the range of transportation investments described above. For example, certain subway stations and lines will see increased demand based on the proximity of new development (although strategies to connect riders to under-capacity stations could still be implemented, e.g. micromobility modes or a transit circulator). Other investments, like new bus rapid transit route(s), may not see sufficient demand to justify their implementation until there has been a significant increase in the residential and employee populations.

In terms of the physical design of the site, the northern and southern corridors will be increasingly useful as through-routes (e.g. for buses and bicycling) as more of the plan is built out and the corridors create a continuous east-west connection that minimizes the need for complicating detours to and from parallel routes with constrained capacity like Northern Boulevard and Skillman Avenue. Running bus rapid transit or other rapid transit service along the southern corridor, for example, may not be practical until the corridor connects directly to the connections to Manhattan (i.e. the Queensboro Bridge ramps) on its western end and 39th Street on its eastern end.

Assuming west-to-east phasing, improvements at the Queens Plaza (E/M/R), 33rd Street-Rawson (7 Local/7 Express), and 39th Avenue (N/W) stations will provide the most benefit to early phases of the development. Improvements could include increased capacity (e.g. through new or expanded staircases), accessibility (33rd Street-Rawson is not currently ADA-accessible), and streetscape enhancements that make the stations more accessible (real or perceived) such as pedestrian safety improvements, street trees, public seating, public art, and pedestrian plazas. As development moves east across the site, access and capacity improvements to the 36th Street (M/R) station become critical to serving Sunnyside Yard's transportation demand.