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## Appendix F: Ridership Forecasts



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# 1 Introduction

This document describes the forecasts of transit ridership for the Staten Island North Shore Bus Rapid Transit (BRT) Project (the Proposed Project). These forecasts have been prepared in support of the Environmental Impact Statement for the project now being developed by the Metropolitan Transportation Authority (MTA) in accordance with New York's State Environmental Quality Review Act (SEQRA).

## Project Overview

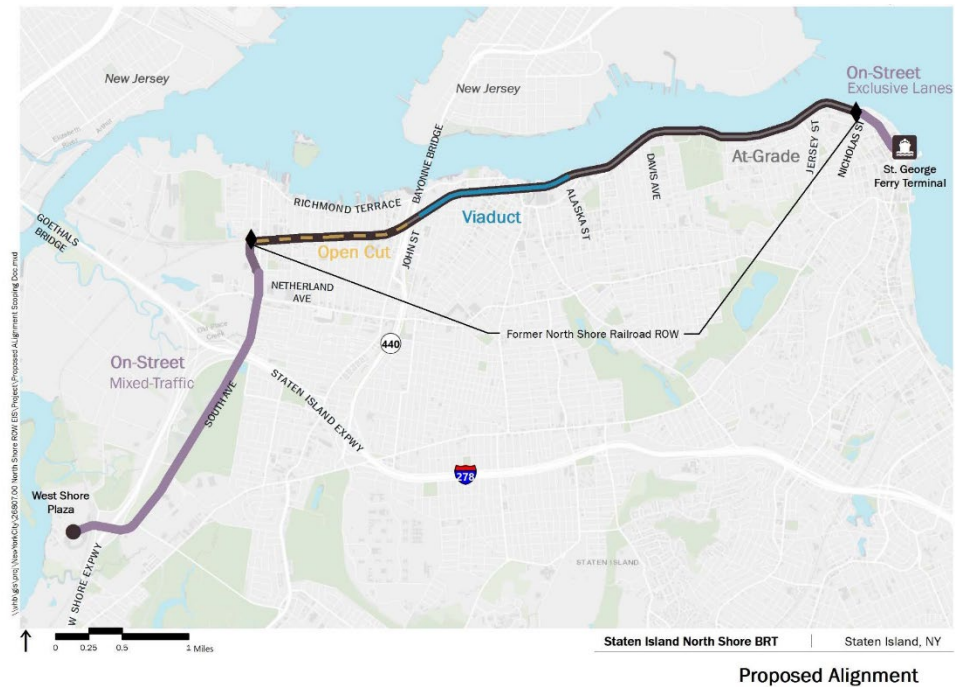
### Study Area

The Proposed Project involves the implementation of new and enhanced public transit service along the North and West Shores of Staten Island (see Figure 1) between South Avenue (West Shore Plaza, located near the intersection of South Avenue and Chelsea Road) and St. George (St. George Terminal, located near the intersection of Richmond Terrace and Bay Street) in Richmond County, New York. The approximately 8-mile proposed alignment would be comprised of approximately 5.3 miles of right-of-way (ROW) from the former North Shore Railroad and approximately 2.7 miles of City roadways such as Richmond Terrace and South Avenue. As shown in Figure 1, the proposed alignment includes at-grade, elevated viaduct, and below grade open-cut sections, with street-running portions along South Avenue (mixed-traffic) and Richmond Terrace (exclusive two-lane median busway).



## STATEN ISLAND NORTH SHORE BUS RAPID TRANSIT

Figure 1 Project Alignment



## Demographic Characteristics

The current population of the socioeconomic study area is 58,571, according to the 2017-2021 ACS.<sup>1</sup> The study area for the Proposed Project is approximately 74.5 percent non-white and 32.1 percent low income, which is higher than in Staten Island Community District 1 and in Staten Island as a whole. Nearly all of the block groups that comprise the study area meet two of the criteria for a Potential Environmental Justice Area (PEJA) due to a high minority-identifying population and at least 22.8 percent with a household income below the federal poverty level.<sup>2</sup> The median annual household income for the study area is estimated at \$82,109 in 2021—ranging from \$60,744 in the Viaduct section to \$104,173 in the South Avenue section. Median household income is \$103,825 on Staten Island and \$82,040 in New York City as a whole. Between 2010 and 2021, the median household income for the study area increased by 8.9 percent after adjusting for inflation. Median household income on Staten Island expanded by 5.9 percent during this period, while in New York City as a whole it increased by 18.3 percent.<sup>3</sup>

<sup>1</sup> US Census Bureau. *American Community Survey*. 2017-2021 American Community Survey 5-year Estimates. Accessed from <https://data.census.gov/>. Accessed on April 2, 2023.

<sup>2</sup> <https://www.dec.ny.gov/public/911.html>. Accessed on May 11, 2023.

<sup>3</sup> US Census Bureau. *American Community Survey*. 2006-2010 and 2017-2021 American Community Survey 5-year Estimates. Accessed from <https://data.census.gov/>. Accessed on April 2, 2023.



## Transit network

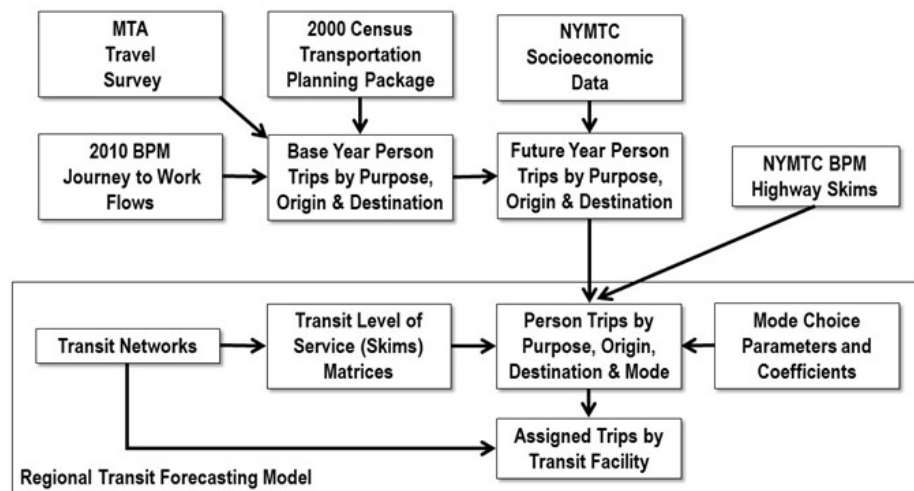
MTA-NYCT operates an extensive network of local and limited bus routes that serve the entire borough (<http://web.mta.info/nyct/maps/bussi.pdf>). The four primary local/limited bus routes that link the North Shore with the St. George Terminal are the S40/90, S44/94, S46/96, and S48/98. The terminal is currently served by 22 NYCT bus routes and provides connections to lower Manhattan via the Staten Island Ferry and both Battery Park City and Midtown West by NYC Ferry, and the MTA Staten Island Railway (SIR), which is the borough's only passenger rail line, serving communities between St. George and Tottenville.



## 2 Regional Transit Forecasting Model Overview

Forecasts for the Staten Island North Shore Bus Rapid Transit project were prepared using the MTA’s Regional Transit Forecasting Model (RTFM). The RTFM, which is built on Caliper’s Transcad platform, is a variant of the 4-step ridership forecasting methodology of trip generation, distribution, mode choice, and assignment. It is used to forecast changes in ridership on the various modes, resulting from changes in population, employment, and other socioeconomic factors, as well as changes in the transportation network. [Figure 2](#) below details the structure of the model.

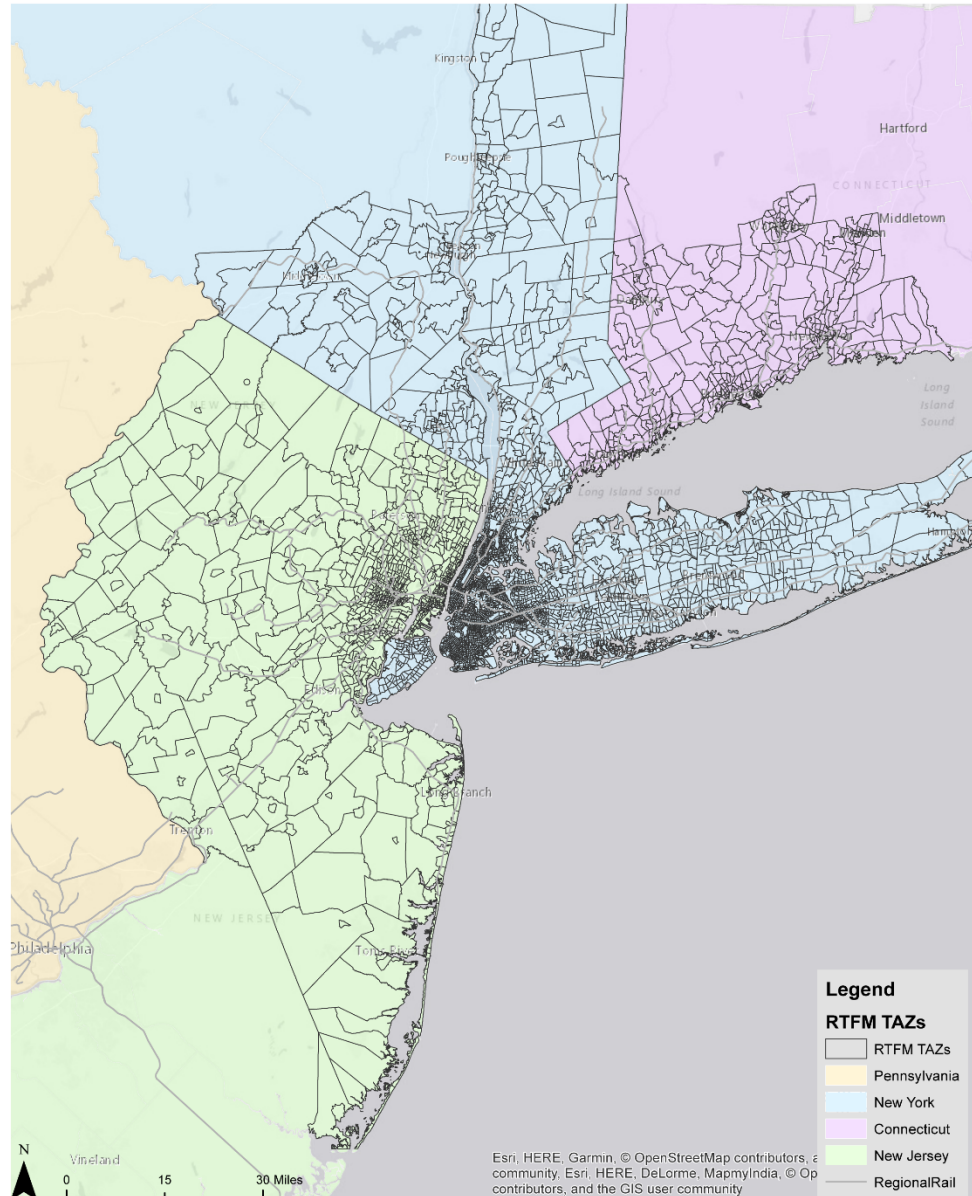
**Figure 2 Regional Transit Forecasting Model Overview**



The model estimates travel by mode and route within 3,586 travel analysis zones (TAZs) in a 28-county area covering New York City and its suburbs, northern New Jersey, and southeastern Connecticut. [Figure 3](#) below depicts the zonal system.



Figure 3 Regional View of the RTFM Zonal (TAZ) System



Source: RTFM

The RTFM was updated to TransCAD v6 in the context of recent studies, including the Long Island Railroad Network Strategies Study, NYCT Utica Avenue Corridor Study, NYMTA Bay Ridge Connector (BRC) Feasibility and Alternatives Analysis Study, and NYMTA East Side Access and Penn Station Access Travel Demand Forecast Update and Integrated Operations Simulation (ESA/PSA).

The RTFM processes data from a variety of sources to describe how current transit customers use the transit system. After calibration to current conditions, it then represents the changes in transit ridership that can be expected from both demographic growth in the region and from transit service improvements



associated with the project. The resulting estimates of transit demand are assigned to individual transit routes and stops based on detailed region-wide transit schedules and the most convenient routing to travel from each trip’s origin to destination regarding travel time and out-of-pocket costs.

The calibration year for the model is 2019 and for this project, ridership forecasts have been developed for the year 2035.

Demographic forecasts are based on adopted Traffic Analysis Zone (TAZ) projections available from the New York Metropolitan Transportation Council (NYMTC). These projections are available in five-year increments between 2010 and 2055.

## Model Calibration and Validation Comparisons

This section describes the model calibration and compares the validation results updating the RTFM to 2019 conditions, including a list of the sources and data used for calibration and validation and a description of how the model TAZs were aggregated for analysis. In addition, the trip table results and the screenlines that were developed for validation, as well as the updates that were made to the transit networks are included. Finally, the mode choice adjustments and the validation comparisons respectively are included at the end of this section.

### Data Sources

**Table 1** below list the sources of data and how the data was used for the calibration and validation of the model.

Table 1 Data Sources

**Table 1** Date Sources

<b>Agency</b>	<b>Data</b>	<b>Use</b>
<b>LIRR</b>	2013 Origin-Destination (OD) Survey	Scaled to 2019 for on off and Screenline comparisons
	2019 Ridership Book	Scale OD Survey to 2019 based on terminal ridership growth
<b>MNR</b>	2014-2017 East of Hudson Survey	Linked Trip Comparisons
	Spring 2019 Harlem, Hudson, New Haven, West of Hudson Line Counts	On off and Screenline comparisons
<b>NYCT</b>	2019 HUB Bound Volumes	Screenline comparisons
	2019 24-Hr Model Screenline Volumes	Screenline comparisons
	2019 Demand Model Screenline Volumes	Screenline comparisons
	2019 Number Trips Model Screenline Volumes	Screenline comparisons





**Table 1 Date Sources**

<b>Agency</b>	<b>Data</b>	<b>Use</b>
MTA	2018 New York City Travel Survey	Linked Trip Comparisons
NYMTC	2011 Regional Household Travel Survey	Linked Trip Comparisons
	2012 BPM SE Data and Model Outputs for 2019 and 2045 Conformity Runs	Person Trip Tables and Highway Skims
Replica	2019 Average Weekday Synthetic Travel	Linked Trip Comparisons
<b>Abbreviations</b>		
LIRR	Long Island Railroad	
MNR	Metro North Railroad	
NYCT	New York City Transit	
MTA	Metropolitan Transportation Authority	
NYMTC	New York Metropolitan Transportation Council	

Source: MTA

Ridership counts for 2019 from LIRR was used to scale the LIRR 2013 Origin-Destination surveys to 2019 baseline conditions. Similarly, surveys and counts from MNR, NYCT, MTA, and Replica data were used to provide the 2019 baseline for comparisons to model output. The RTFM Person Trip Tables and Highway Skims were developed using data supplied by NYMTC from their model.

### Person Trip Tables

The 2019 Person Trip were built in several steps. First, socioeconomic data from the NYMTC’s Best Practice Model (BPM) and the American Community Survey (ACS) were used to update the previous 2015 Base Year trip tables to 2019 Baseline conditions. These updated trip tables were then validated to trip distribution information from the MTA’s 2018 New York City (NYC) travel survey, NYMTC’s 2011 Household Survey and Replica’s 2019 data.

To generate person trips for the RTFM person trip table, the BPM journeys from the 2019 Conformity model run were extracted and converted to person trips by separating each stop on each journey into home-based work, home-based other, and non-home-based trips. New Jersey and West of Hudson based trips were then replaced with trips from the North Jersey Travel Demand Forecasting Model (NJTDFM) for the base year calibration to use its survey-based trips as done previously for the West of Hudson project. The 2012-2016 ACS was then used to adjust Home Based Work trips to match observed travel patterns. [Table 2](#) shows the 2019 total daily person trips used for the RTFM base year calibration.



**Table 2 2019 RTFM Daily Person Trips**

<b>Home-Based Work Trips</b>	<b>Home-Based Other Trips</b>	<b>Non-Home-Based Trips</b>	<b>Total Person Trips</b>
15,500,003	31,775,959	13,847,608	61,123,770

Source: RTFM

### Transit Network

The RTFM Transit Network coded in the model was updated to represent 2019 service levels. For NYCT Subways, Metro-North, and Long Island Rail Road services the 2019 scheduled headways were checked against model headway and stopping patterns with updates to match schedules. For the NYC Buses, a more detailed update was performed as previous updates to the RTFM did not focus on buses in New York City. These changes included replacing local services with Select Bus Services (SBS), adding new routes, removing routes that no longer operate, and renaming routes where necessary.

### Transit Fares and Value of Time

Fares in the model are in 2005-year dollars:

- » NYCT fares are \$2.25 for subway and \$5.94 for express buses.
- » Commuter rail use monthly zone to zone pass pricing in 2005-year dollars assuming 40 trips per month with no free transfer assumed to NYCT.
- » Ferry fares one-way 2005-year dollar fares.
- » New projects used existing service fares for NYCT bus/ subway or commuter rail fare zones.
- » The attached Value of Time in RTFM e-mail discusses the differing values of times in the commuter rail and other transit modes. For the metric spreadsheet we are using a value of \$17 per hour in 2019 dollars for metric calculations.

**Table 3** below indicates the values of time used in the RTFM, as well as the equivalent values (\$/hr) in 2019 and current dollars.



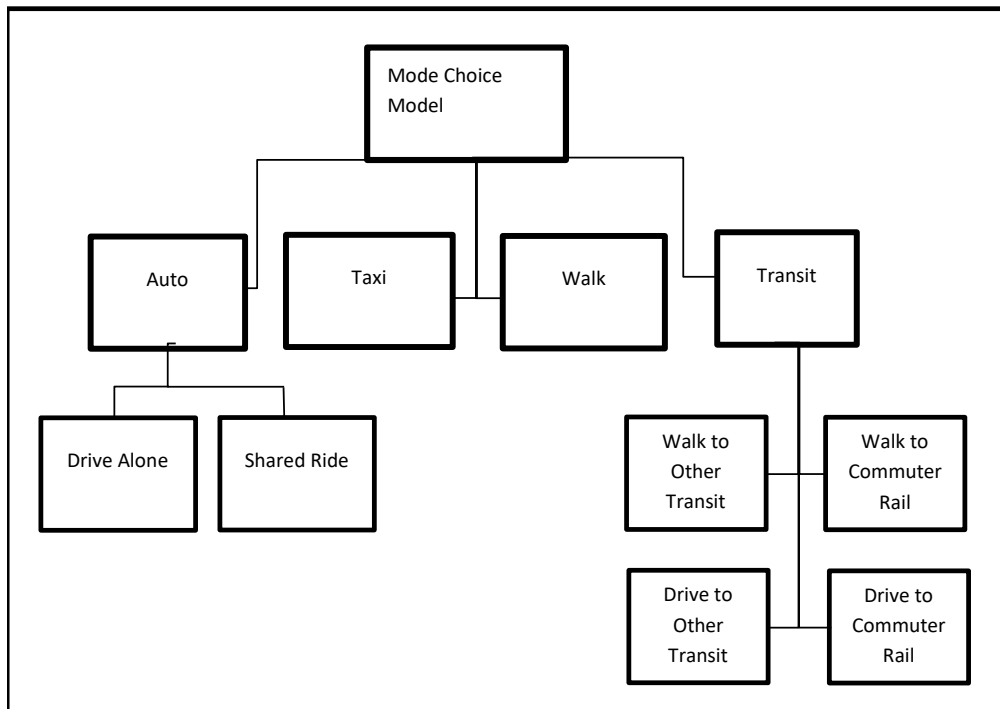
**Table 3 Value of Time**

Mode	Value of Time (\$/min) 2005	Equivalent Value of Time (\$/hr)	
		2019 dollars	2022 dollars
Subway/Bus	0.22	\$17.30	\$19.80
Commuter Rail	0.18	\$14.15	\$16.20

**Mode Choice Adjustments**

The RTFM Mode Choice model consists of four primary nests including Auto, Taxi/ TNC, Walk/Non-Motorized, and Transit. Within the Auto nest there are two sub modes including Drive Alone and Shared Ride. Within the Transit nest there are four sub modes including Walk to Commuter Rail, Drive to Commuter Rail, Walk to Other Transit, and Drive to Other Transit. Within the Transit nest if any leg of the trip is on commuter rail it falls within one of the Commuter Rail nests, while if it only uses bus, subway, ferry, or other non-commuter rail legs it falls within one of the Other Transit nest. For the RTFM there are coefficients for in-vehicle travel time, walk time, drive time, wait times, and costs as well as mode specific constants for each mode and sub mode by geography of the trip origin and destination. Figure 4 shows the RTFM Mode Choice Diagram with hierarchy of nests within the mode choice model.

**Figure 4 RTFM Mode Choice Diagram**



Source: RTFM



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The calibration effort involved the adjustment and update of Mode Choice constants for various market segments and modes in the region. These adjustments were performed in order to more closely match targets that were developed based on 2019 BPM trip tables and observed data. See [Table 4](#).

**Table 4 2019 Mode Choice Daily Trips compared with Targets**

	2019 Targets			
	Home-Based Work Trips	Home-Based Other Trips	Non-Home Based Trips	Total
Drive Alone	9,398,499	9,324,712	5,488,955	24,212,166
Share Ride	2,006,653	15,750,050	5,923,393	23,680,097
Walk-Rail	242,209	45,022	48,712	335,943
Drive-Rail	376,546	60,675	51,049	488,270
Walk-Train	2,379,236	2,734,771	1,395,578	6,509,586
Drive-Train	298,537	134,001	16,744	449,282
Taxi	292,877	359,647	505,357	1,157,881
Walk	554,602	3,239,460	390,098	4,184,160
<b>Total</b>	<b>15,549,160</b>	<b>31,648,338</b>	<b>13,819,887</b>	<b>61,017,384</b>
<b>2019 Base Model Mode Choice Results</b>				
Drive Alone	9,291,487	9,759,639	5,499,426	24,550,552
Share Ride	2,009,983	15,090,082	5,877,077	22,977,142
Walk-Rail	235,064	42,400	47,212	324,676
Drive-Rail	383,832	62,391	48,499	494,723
Walk-Train	2,424,623	2,921,995	1,412,531	6,759,149
Drive-Train	328,906	129,622	16,488	475,016
Taxi	294,756	367,693	542,336	1,204,785
Walk	531,353	3,402,132	404,033	4,337,518
<b>Total</b>	<b>15,500,003</b>	<b>31,775,956</b>	<b>13,847,601</b>	<b>61,123,561</b>

Source: RTFM

**Validation Comparisons – Transit Boardings in the Study Area**

Table 5 through Table 7 presents a comparison of results for Staten Island transit boardings by route in the study area. As shown in [Table 5](#), the aggregate weekday boardings of bus routes along the proposed BRT corridor obtained in the model is 6% less than the weekday counts provided by NYCT. Boardings at bus routes intersect with the corridor are 12% higher in the model (see [Table 6](#)) than the actual counts provided by NYCT. The most significant mismatch is with the results obtained for the Staten Island Ferry (see [Table 7](#)); the SI Ferry actual



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ridership is 29% less than the ridership results in the model. However, as results obtains with the aggregate model results for the bus routes along the proposed BRT corridor closely match the 2019 counts, we consider that the model reflects well the transit ridership in the study area.

**Table 5 Comparison of Observed and Estimated Weekday 2019 Boardings of Local and Express Bus Routes Along the BRT Corridor**

<b>Bus routes along the proposed BRT corridor</b>	<b>2019 Weekday Counts</b>	<b>2019 RTFM Results</b>
S40/S90	7,052	7,052
S44/S94	8,583	10,351
S46/S96	10,405	6,027
S48/S98	10,406	10,784
<b>Total</b>	<b>36,446</b>	<b>34,215</b>

**Table 6 Comparison of Observed and Estimated Weekday 2019 Boardings for Local Buses that Intersect with the Corridor**

<b>Bus routes that intersect with the proposed BRT corridor</b>	<b>Observed</b>	<b>2019 RTFM Results</b>
S53	2,724(*)	2,621(*)
S54	1,931	1,948
S57	1,836	1,719
<b>Total</b>	<b>6,491</b>	<b>7,388</b>

(\*) Boardings southbound and Alightings Northbound in the bus stops of the Port Richmond Terminal and Broadway/Clover Rd segment.

**Table 7 Comparison of Observed and Estimated AM Peak 2019 Boardings for the Staten Island Ferry**

<b>Ferry</b>	<b>Observed</b>	<b>2019 RTFM Results</b>
Staten Island Ferry to Manhattan	15,160	20,318
Staten Island Ferry to Staten Island	2,384	4,232
<b>Total Fixed Guideway</b>	<b>17,544</b>	<b>24,550</b>



## 3 Future Scenario

### The Project Definition

#### Overview

The project under study is a Bus Rapid Transit (BRT) route approximately 5.3 miles long of exclusive busway between St. George and Arlington in Staten Island, plus 2.7 miles of exclusive busway along Richmond Terrace and in mixed-traffic operation along South Ave between Arlington Station and West Shore Plaza.

The bus service for the Proposed Project includes two new BRT lines (routes S1 and S2) together with changes to existing Staten Island bus services designed to eliminate duplicative routes and to take advantage of the new guideway in situations where existing routes could benefit from an extension of service on the new BRT roadway to reach major destinations such as St. George or Arlington station.

Characteristics of two new BRT lines (S1 and S2) are summarized in [Table 8](#) and compared to four existing “close peer” routes.



**Table 8 BRT Coding for New BRT Routes (S1 and S2) Compared to Existing Routes (S40, S90, S46 and S96)**

Route	S1	S2	S40	S90	S46	S96
Type	BRT	BRT	Local Bus	Ltd. Bus	Local Bus	Ltd. Bus
Operates in No-Build	No	No	Yes	Yes	Yes	Yes
Operates in Build	Yes	Yes	Yes	No	Yes	No
Peak Headway	10	5	10	12	10	12
Mid-Day Headway	10	15	20	--	124	--
Route Type	0	0	3	3	3	3
Station	Time from Origin (hh:mm:ss)	Time from Origin (hh:mm:ss)	Time from Origin (hh:mm:ss)	Time from Origin (hh:mm:ss)	Time from Origin (hh:mm:ss)	Time from Origin (hh:mm:ss)
BRT - West Shore Plaza	0:00:00				0:00	0:00
BRT – Teleport	0:03:00					
BRT – Goethals	0:07:00					
BRT - Forest Av	0:08:00					
BRT Arlington	0:09:00	0:00:00	0:00	0:00		
BRT-Mariners	0:12:00	0:02:00	< - Existing Bus Service -> <sup>5</sup>			
BRT-Elm Park (Morningstar)	0:13:00	0:04:00				
BRT-Port Richmond	0:16:00	0:06:00	0:14	0:14	0:30	0:24
BRT-West Brighton (Broadway)	0:18:00	0:08:00	< - Existing Bus Service ->			
BRT-Livingston	0:20:00	0:10:00				
BRT-New Brighton	0:22:00	0:12:00				
BRT – St. George	0:27:00	0:17:00	0:34	0:29	0:54	0:45

The two new BRT routes – S1 and S2 – would operate together with other existing routes (currently S53, S54, and S57, extended along the proposed corridor) that would use the busway for part of their route. S2 would operate fully on the busway and S1 would operate on the busway plus the South Avenue extension to West Shore Plaza. The existing S46 route would be cut back to terminate at Teleport and would not serve West Shore Plaza.

The modifications of the 2019 bus routes include the following:

Deletions:

<sup>4</sup> In the midday, half of S46 trips serve Teleport and the other half serve West Shore Plaza

<sup>5</sup> Times provided at selected bus stops to facilitate an approximate comparison to BRT travel times. Actual bus stops located on city streets served by each route that are approximately parallel to the BRT alignment.



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- » Route S90 and S96. These routes are the limited-stop routes that parallel local routes S40 and S46. These services duplicate the BRT and are eliminated with the introduction of BRT services.

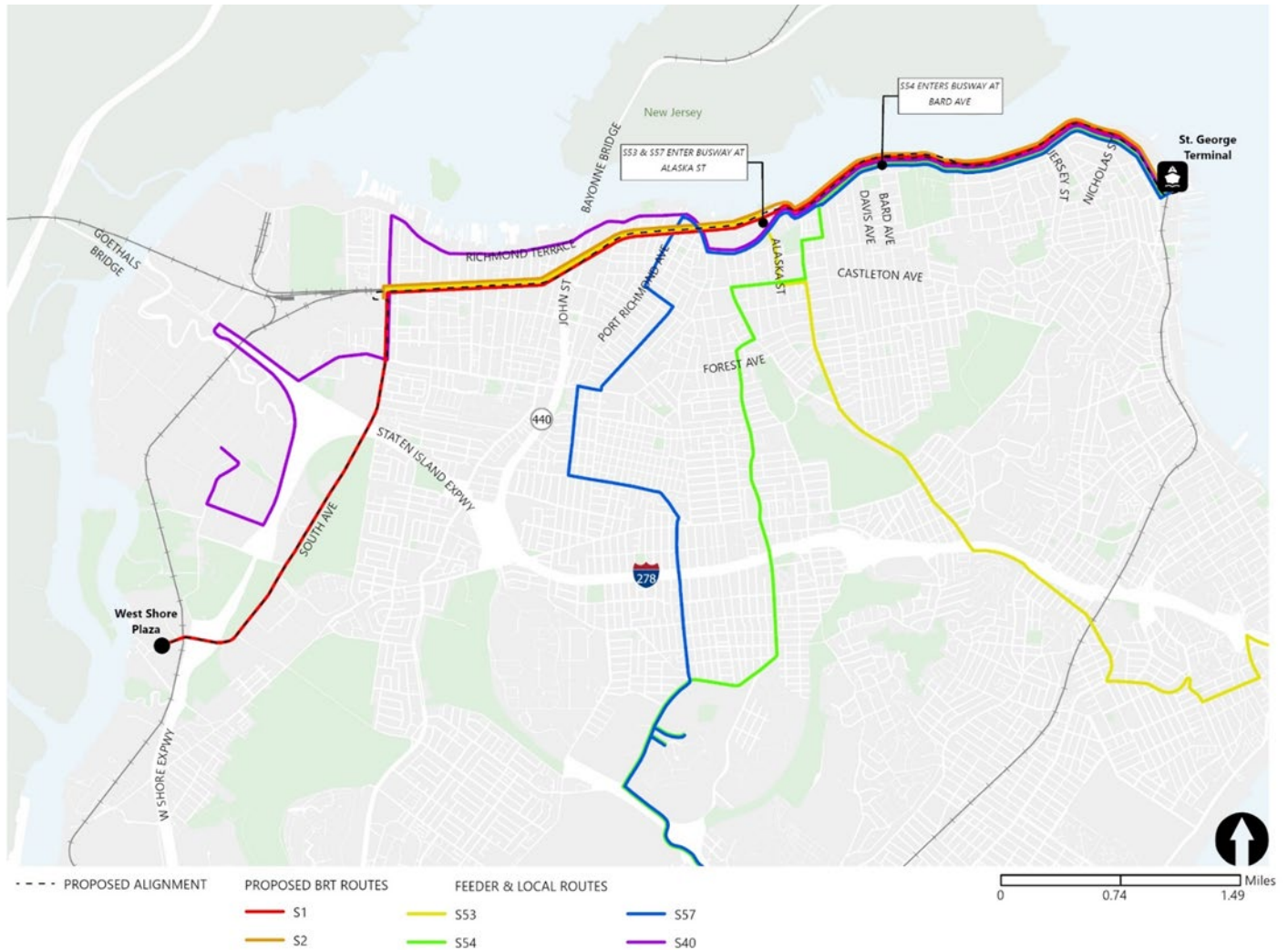
### Extensions:

- » S53 extended on the guideway to serve BRT stations between Port Richmond (its current terminus) and Arlington
- » S54 extended on the guideway to serve BRT stations between Livingston (its current terminus) and St. George
- » S57 extended on the guideway to serve BRT stations between West Brighton (its current terminus) and St. George





Figure 5 BRT Alignment and Modifications of the Existing Bus Network



### Stations

The BRT system, as currently defined, has seven project stations<sup>6</sup> along the right-of-way of former North Shore Railroad. The stations and their locations (latitudes and longitudes) are as follows:

- » BRT-St. George – 40.643637,-74.073882
- » BRT-New Brighton – 40.644860,-74.098666
- » BRT-Livingston – 40.645144,-74.108732
- » BRT-West Brighton (Broadway) – 40.641220,-74.118329

<sup>6</sup> Trips that board, alight or pass through the station on board a transit vehicle are considered trips-on-project for FTA project evaluation purposes.



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- » BRT-Port Richmond – 40.638956, -74.132617
- » BRT-Elm Park (Morningstar) – 40.635522,-74.145098
- » BRT-Mariners – 40.633943,-74.153492
- » BRT Arlington – 40.633046,-74.167136

Four additional stops are served by one of the two main BRT Routes (S1) along South Avenue between the right-of-way of the former North Shore Railroad and West Shore Plaza. These stations are not identified as “project” stations by the FTA. Trips that both board and alight at one of these stations are not treated as Trips-on-Project for FTA evaluation purposes. However, trips boarding and alighting at these locations are presented in the summaries of station and route boardings and alightings to support analysis of traffic and pedestrian impacts. These four stops are located at:

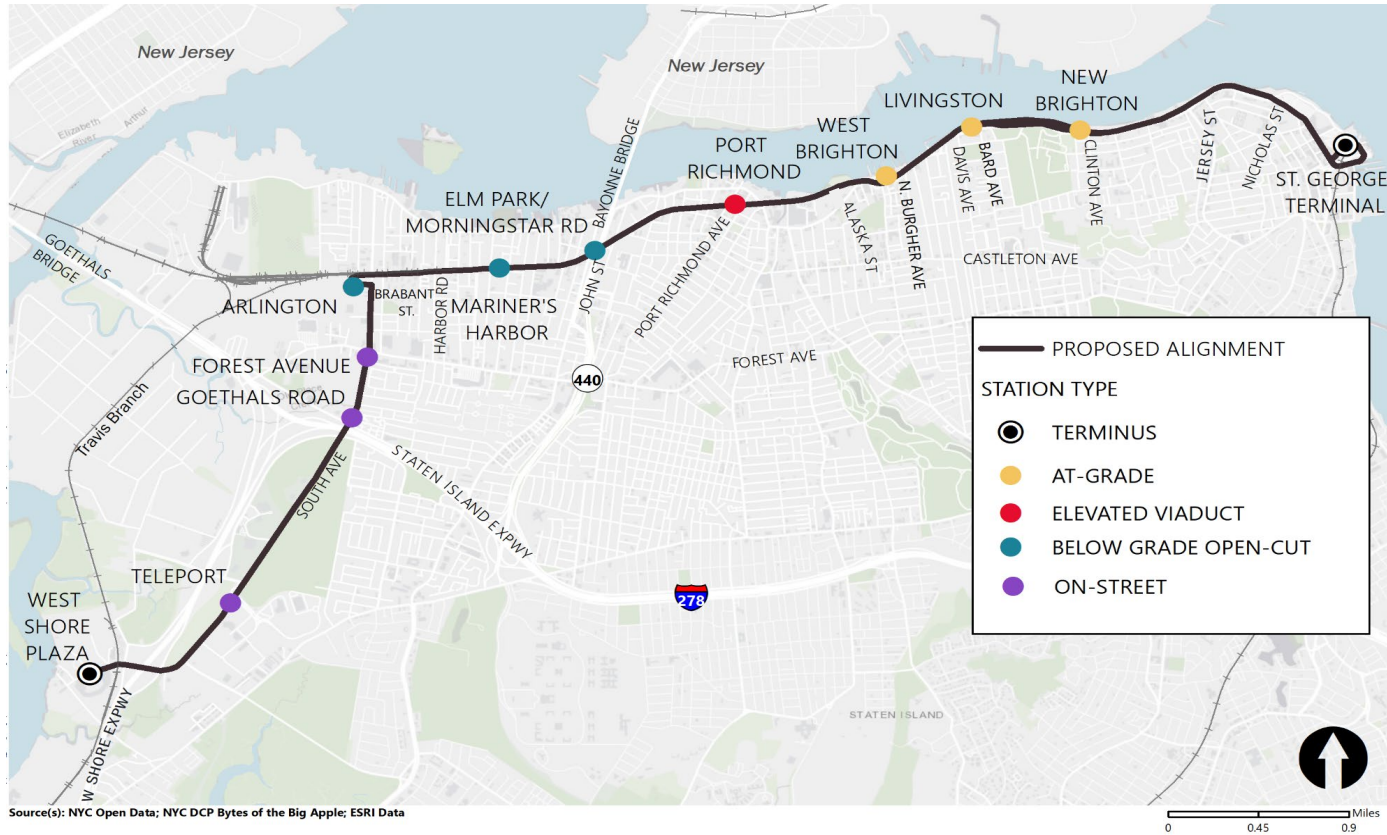
- » BRT-Forest Av – 40.627592, -74.166418
- » BRT-Goethals Rd – 40.621698, -74.168498
- » BRT-Teleport – 40.608228, -74.178788
- » BRT-West Shore Plaza – 40.601971, -74.191329

Both types of station are shown in the map below in [Figure 6](#).



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Figure 6 Staten Island North Shore Station Locations





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Table 9 and Table 10 provide the travel distance and travel time between each of the proposed BRT stations for the westbound and eastbound directions.

**Table 9 Length and travel Time Between Stations - Westbound**

			<b>Proposed BRT Alternative</b>	<b>Proposed BRT Alternative Travel Time</b>
	<b>Westbound</b>		<b>Length (ft)</b>	<b>Time (mins)</b>
Richmond Terrace and Busway ROW	St. George Terminal	New Brighton	300	0.98
			2430	1.85
			3444	0.98
			843	0.64
			1311	1.12
		Dwell Time		0.50
	New Brighton	Livingston	2918	0.83
		Dwell Time		0.50
	Livingston	West Brighton	2462	0.70
		Dwell Time		0.50
	West Brighton	Port Richmond	4378	1.55
		Dwell Time		0.50
	Port Richmond	Elm Park/Morning Start	4008	1.14
		Dwell Time		0.50
	Elm Park/Morning Star	Mariners Harbor	2699	0.77
		Dwell Time		0.50
Mariners Harbor	Arlington Terminal	3676	1.31	
	Dwell Time		0.50	
Along South Ave	Arlington Terminal	Forest Ave	2629	1.20
		Dwell Time		0.50
	Forest Ave	Goethals Rd	2042	0.93
		Dwell Time		0.50
	Goethals Road	Bloomfield	2604	1.18
		Dwell Time		0.50
	Bloomfield	Lois Lane	1510	0.69
		Dwell Time		0.50
	Lois Lane	Teleport	1705	0.78
		Dwell Time		0.50
Teleport	West Shore Plaza Terminal	4368	1.99	
			<b>TOTAL</b>	<b>24.62</b>



**Table 10 Length and travel time between stations - Eastbound**

	<b>Eastbound</b>		<b>Length (ft)</b>	<b>Time (minutes)</b>	
Along South Ave	West Shore Plaza Terminal	Teleport	4368	1.99	
		Dwell Time		0.50	
	Teleport	Lois Lane	1705	0.78	
		Dwell Time		0.50	
	Lois Lane	Bloomfield	1510	0.69	
		Dwell Time		0.50	
	Bloomfield	Goethals Rad	2604	1.18	
		Dwell Time		0.50	
	Goethals Road	Forest Ave	2042	0.93	
		Dwell Time		0.50	
	Forest Ave	Arlington Terminal	2717	1.24	
		Dwell Time		0.50	
	Richmond Terrace and Busway ROW	Arlington Terminal	Mariners Harbor	3829	1.74
			Dwell Time		0.50
Mariners Harbor		Elm Park/Morning Start	2527	0.72	
		Dwell Time		0.50	
Elm Park/Morning Star		Port Richmond	3649	1.04	
		Dwell Time		0.50	
Port Richmond		West Brighton	4750	1.35	
		Dwell Time		0.50	
West Brighton		Livingston	2450	0.87	
		Dwell Time		0.50	
Livingston		New Brighton	2938	0.83	
		Dwell Time		0.50	
New Brighton		St. George Terminal		300	0.98
				2430	1.10
			3444	1.73	
			843	0.64	
			1311	1.12	
			<b>TOTAL</b>	<b>24.91</b>	

Table 11 provides an overview of the BRT and feeder route service frequencies, transfer opportunities, fare, and vehicle capacity. Additionally, parking is provided



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at three stations: 72 spaces at Livingston Station, 71 spaces at Arlington Station, and 100 spaces at West Shore Plaza Station. All parking is assumed to cost \$3.00 per day (\$1.50 per trip).

**Table 11 BRT Vehicles, Schedules, and Fare**

<b>Item</b>	<b>Description</b>
Service frequency or headway	24-hour service AM Peak frequencies: <ul style="list-style-type: none"> <li>› 10 minutes (S1)</li> <li>› 9.3 mins (S2)</li> <li>› 7 minutes (S53)</li> <li>› 15 minutes (S54)</li> <li>› 15 minutes (S57)</li> </ul>
Station-to-station transfers opportunities & Time required for transfers	Transfers available at St. George Ferry Terminal to SI Ferry, NYC Ferry and other bus routes; and at Arlington Station to S40 serving the Matrix development.
Fare for this mode	NYCT standard fare (\$2.75 in 2020)
Vehicle capacity/consist, including # of customers able to be accommodated under guideline loads per vehicle	Standard 40' bus (maximum avg. load of 54 passengers per bus in the peaks)



## 4 Forecast Results

### Overview

#### Forecasted Ridership by Scenario

- » 2019 Build: 2019 network with the project and 2019 matrices
- » 2035 No Build: 2035 network and 2035 matrices
- » 2035 Build: 2035 network with the project and 2035 matrices

#### Projected Population, Labor Force, and Employment

Zone-level population and employment New York Metropolitan Transportation Commission (NYMTC) sociodemographic (SED) projections as well as from the planned developments for this horizon in the study area were used to project the 2019 trip tables to 2035 trip tables.<sup>7,8</sup> NYMTC revised their 2020 SED by delaying their initial employment projections by 5 years to reflect the impact of Covid-19.

**Table 13** provides county-level summary of current and forecast year population, employment, and employed labor force for the years 2020 and 2035. The population and labor force for Staten Island is expected to grow less than the regional average, but employment percent growth is projected to be higher than the average of the region (see **Table 13**). However, the study area (one-mile buffer around the project), is expected to grow at the same rate or a higher rate as the region as a whole (see **Table 13** and **Table 14**):

- » Population in the St. George area of Staten Island is projected to grow significantly, around 27%, between 2020 and 2035 (See Figure 7). Many of

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<sup>7</sup> NYMTC is a regional council of governments that is the metropolitan planning organization for New York City, Long Island and the lower Hudson Valley. Socioeconomic and demographic forecasts are produced in response to mandated federal requirements and are crucial components in the development of regional transportation plans, transportation conformity analysis, congestion management process, and decision-making on the use of these funds. Forecasts are updated every 4 years for counties in New York City; Long Island; Mid-Hudson; New Jersey (14 counties); and Connecticut (3 counties).

<sup>8</sup> <https://www.nymtc.org/en-us/Data-and-Modeling/Socioeconomic-and-Demographic-SED-Forecasts/2055-Forecasts>



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these customers are sufficiently near the ferry that they can walk, use the Staten Island Railway, or use conventional local bus and are less likely to be customers of the BRT.

- » Between 2020 and 2035, population in the Port Richmond area is expected to grow by 9% and population in Elm Park and Mariners Harbor areas is expected to grow moderately, by 4%-5%, while the remainder of the corridor will experience little to no growth (see Figure 7).
- » Employment is expected to grow significantly at the end points of the BRT line between 2020 and 2035 with St. George and Northwest Staten Island growing by 16% and 24%, respectively. In the middle of the corridor employment the growth will be between 4% and 10% (see Figure 8).
- » The highest growth in Employed Labor Force is projected in St. George (14 percent) and in Port Richmond (8%), between 2020 and 2035 (see Figure 9).
- » Overall Manhattan employment (a key destination for Staten Island residents) is expected to grow by 5% between 2020 and 2035. While this is a modest percentage, Manhattan remains the major employment center in the region with more employees than residents. As such, travel from all parts of the region (including Staten Island’s North Shore) to Manhattan will continue to witness stronger growth than would be predicted by population growth alone.

**Table 13 Population, Employment, and Employed Labor force Forecasts for the Modeling Region by County**

County	Population 2020	Employment 2020	Employed Labor Force 2020	Population 2035	Employment 2035	Employed Labor Force 2035
Bronx	1,454,816	394,406	590,394	1,573,786	452,857	662,319
Kings	2,647,112	894,383	1,167,569	2,860,506	1,050,613	1,294,274
New York	1,668,548	2,650,527	879,351	1,754,534	2,781,900	958,178
Queens	2,349,324	749,661	1,124,569	2,483,716	914,161	1,208,776
<b>Richmond</b>	<b>484,897</b>	<b>134,126</b>	<b>212,328</b>	<b>498,769</b>	<b>150,247</b>	<b>217,358</b>
<i>Change (Richmond)</i>				3%	12%	2%
Bergen	929,861	432,432	473,818	997,118	462,467	501,658
Dutchess	298,978	117,891	151,010	311,939	122,674	147,265
Essex	800,276	371,547	380,516	856,747	402,119	409,722
Fairfield	944,219	465,191	478,015	1,007,001	499,112	498,395
Hudson	675,060	291,710	355,159	760,716	327,784	402,705
Hunterdon	126,922	53,294	68,425	130,230	57,372	65,260
Mercer	387,645	228,777	194,673	405,455	252,633	196,783
Middlesex	837,396	386,228	410,834	896,183	408,201	433,349





**Table 13 Population, Employment, and Employed Labor force Forecasts for the Modeling Region by County**

County	Population 2020	Employment 2020	Employed Labor Force 2020	Population 2035	Employment 2035	Employed Labor Force 2035
Monmouth	630,213	264,896	316,910	645,951	280,548	312,877
Morris	500,829	290,195	267,887	513,852	308,601	263,478
Nassau	1,354,852	573,980	674,027	1,440,708	628,150	725,919
New Haven	858,979	387,159	426,775	897,440	414,367	431,834
Ocean	597,539	181,718	256,760	663,764	192,364	279,247
Orange	382,922	148,561	176,114	433,295	157,751	192,144
Passaic	515,029	184,492	242,369	558,963	198,590	260,895
Putnam	98,919	26,927	50,272	104,221	28,866	50,093
Rockland	21,338	121,606	148,816	360,101	132,534	167,453
Somerset	336,521	186,759	178,664	353,811	197,944	182,092
Suffolk	1,500,734	633,405	747,548	1,593,636	669,460	763,538
Sussex	146,004	43,431	77,199	149,705	46,554	73,128
Union	554,212	238,740	279,698	595,930	258,558	297,972
Warren	109,717	35,722	57,470	113,886	39,215	56,259
Westchester	968,823	439,344	474,395	995,611	464,609	484,578
<b>Grand Total</b>	<b>22,481,684</b>	<b>10,927,110</b>	<b>10,861,566</b>	<b>23,957,572</b>	<b>11,900,250</b>	<b>11,537,550</b>
<i>Entire Region Change</i>				7%	9%	6%

Source: NYMTC 2055 Socioeconomic and Demographic Forecasts

**Table 14 Population, Employment, and Employed Labor force Forecasts for Staten Island**

Area	Population 2020	Employment 2020	Employed Labor Force 2020	Population 2035	Employment 2035	Employed Labor Force 2035
Study Area	131,031	51,113	54,855	139,697	57,906	58,297
<i>Change (%)</i>				7%	13%	6%
<i>Change (Absolute)</i>				8,666	6,793	3,442
Rest of Staten Island	353,866	83,013	157,473	359,072	92,341	159,061
<i>Change</i>				1%	11%	1%
<i>Change (Absolute)</i>				5,206	9,328	1,588



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## Figure 7 Projected Population Percent Growth 2020-2035

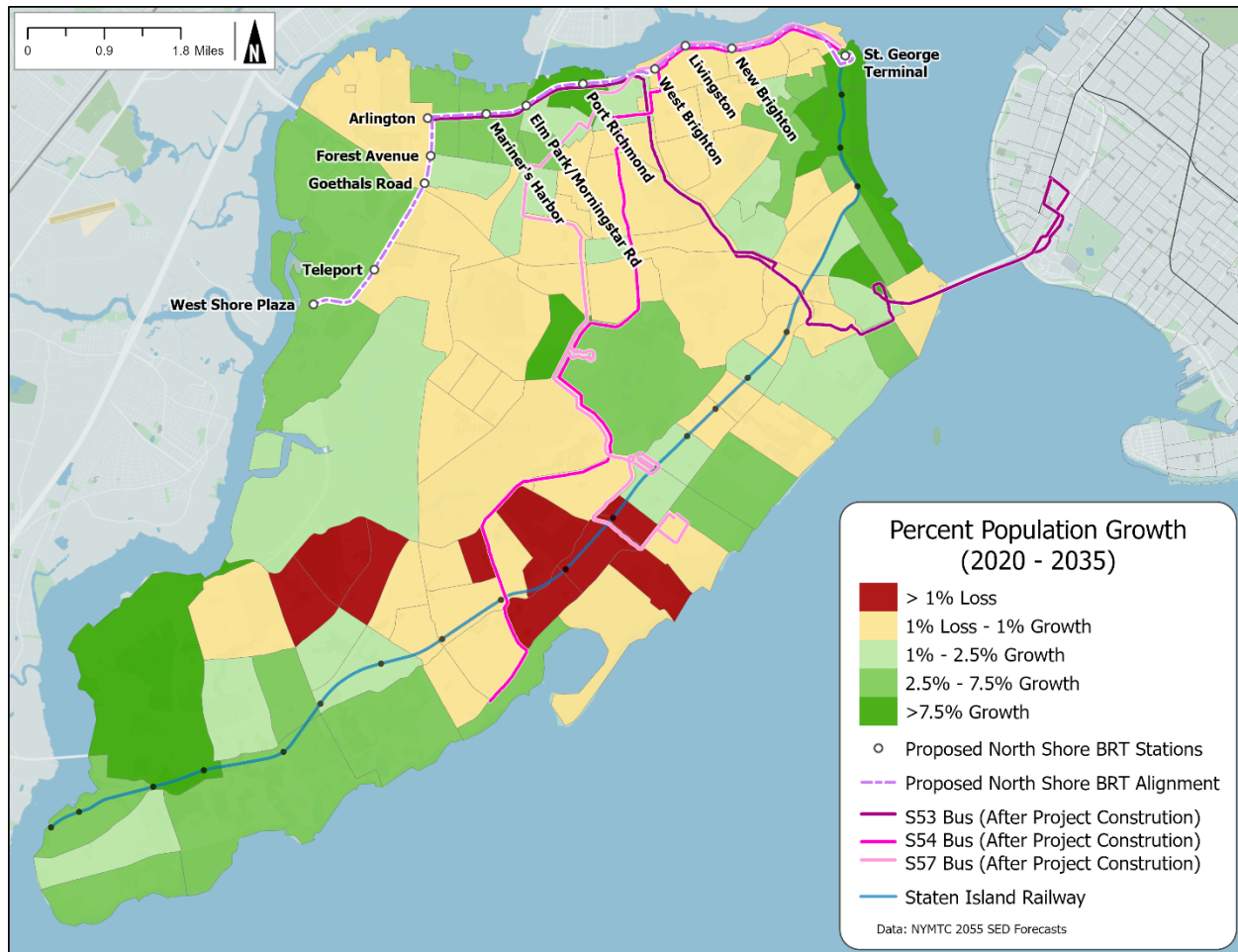




Figure 8 Projected Employment Percent Growth 2020-2035

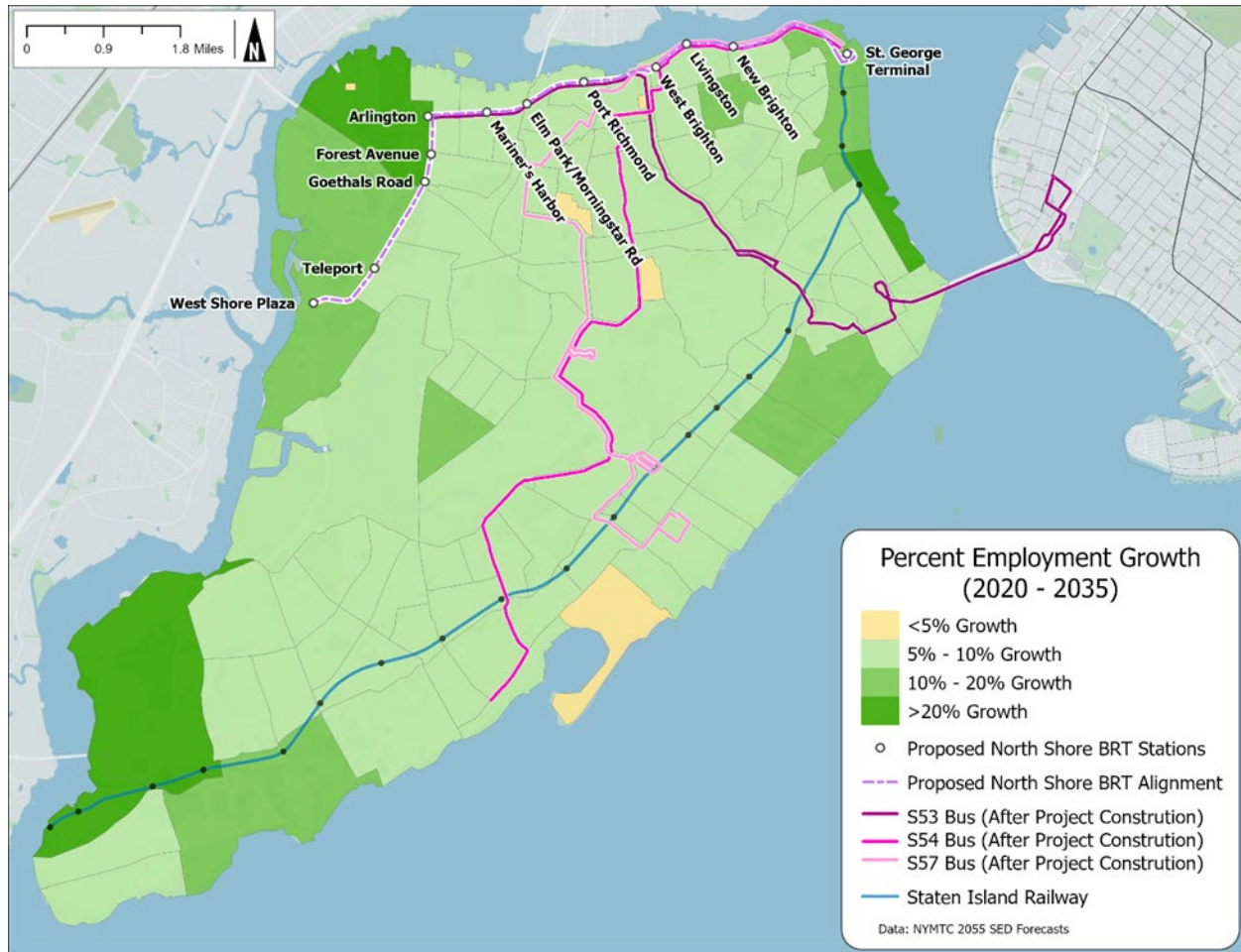
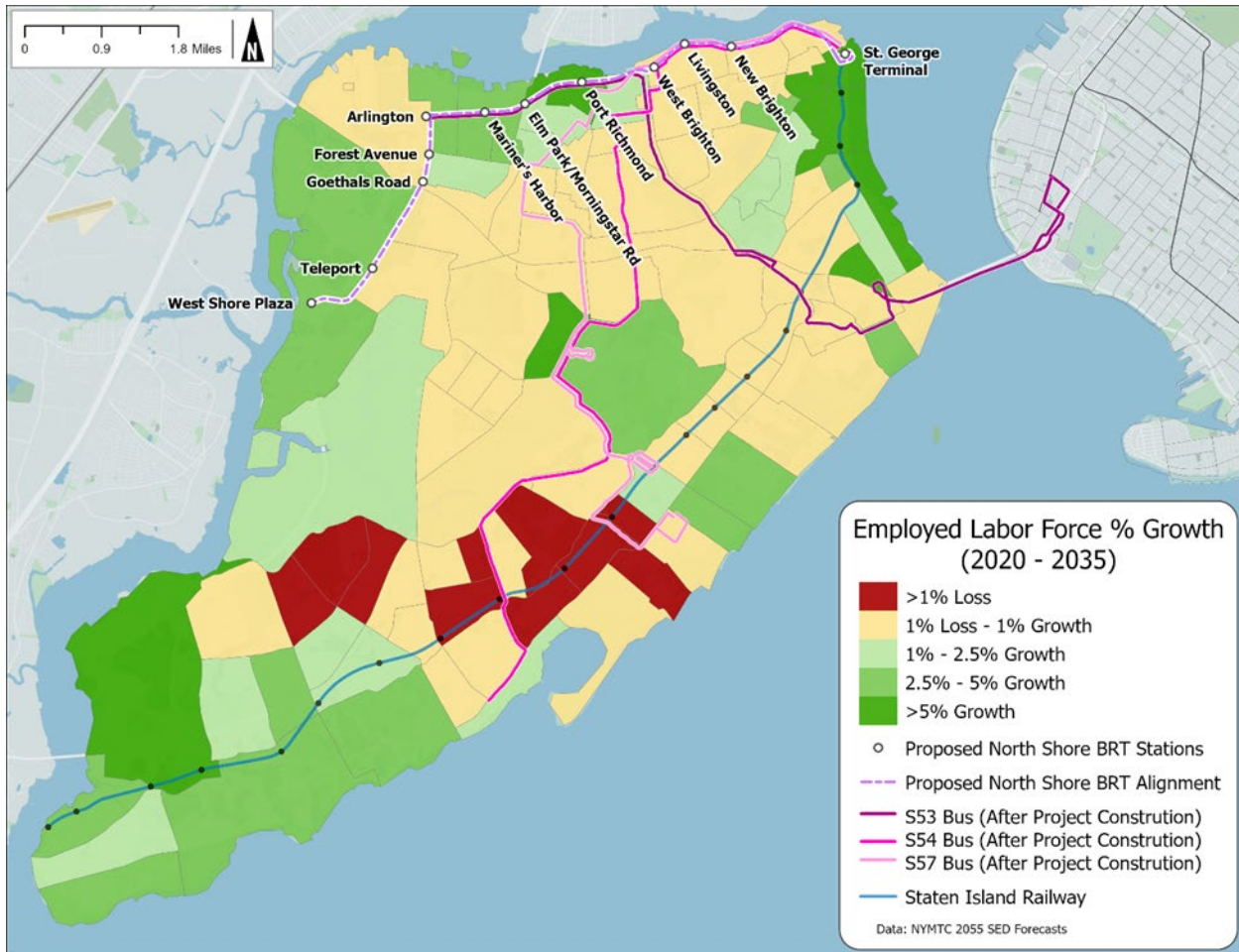




Figure 8 Projected Labor Force Percent Growth 2020-2035



Source: TAZ level forecasts prepared for NYMTC Best Practice Model and consistent with NYMTC 2055 Socioeconomic and Demographic Forecasts

### Transportation Network – 2035 No-Build Scenario

Below is a list of major transportation projects that are currently operating or planned to be implemented by 2035, but that were not operating in 2019.

#### Commuter and Regional Rail Network

- » LIRR Grand Central Madison: includes 87 inbound to Penn, 60 inbound to GCT, 23 outbound from Penn, 20 outbound from GCT.
- » Penn Station Access: from PSNYX EIS (12 inbound trains to Penn, 47 inbound to GCT, 12 outbound from Penn, 15 outbound from GCT).
- » LIRR Modernization:
  - Assumes all Huntington trains continue to Port Jefferson
- » Gateway Program: Includes 8 inbound trains to PSNY from Pascack Valley and 8 inbound trains to PSNY from Port Jervis Line.



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- » Connect NEC 2035<sup>9</sup>
- » LIRR Yaphank Station Relocation
- » Elmont-UBS Arena: all trains in the Hempstead branch are planned to stop at Station.

### Ferry Network

- » Ferry connecting St. George with the World Financial Center and West Midtown, which started operating in 2021.<sup>10</sup>

### Subway Network

- » CBTC: all lines under construction or planned for construction, plus all north-south trunk lines.
- » 2nd Ave Subway Phase 2

### Bus Network

- » Bronx Bus Network redesign, which went into effect in 2022.

### Road Network

- » Congestion Pricing - NYMTC's conformity assumptions and legislative toll scenario (See Table 15).

**Table 15 NYMTC's Conformity Assumptions and Legislative Toll Scenario**

Legislative Alternative Toll Rates in Cents (2010 dollar year)				
NYMTC Conformity BPM	Time Period	Autos	Medium Trucks	Heavy Trucks
	AM through PM	654	1746	2619
	NT	381	1017	1526

### Planned Developments in the Study Area

The study area is defined as the 1-mile buffer from the project under study. Table 16 shows all of the developments planned to occur in the study area before the build-year of 2035.

<sup>9</sup> [CONNECT NEC 2035 | Northeast Corridor Commission \(nec-commission.com\). https://nec-sommission.com/connect-nec-2035/.](https://nec-sommission.com/connect-nec-2035/) Accessed August 14, 2023.

<sup>10</sup> [St. George - New York City Ferry Service. https://www.ferry.nyc/routes-and-schedules/route/st-george/.](https://www.ferry.nyc/routes-and-schedules/route/st-george/) Accessed August 14, 2023.



**Table 16 Planned Developments in the Study Area**

<b>Project Name</b>	<b>Location</b>	<b>Development Summary</b>
Bay Street Corridor	20-block area in Downtown Staten Island	Residential: 2,557 units Commercial: 275,348 sf Community Facility: 46,799 sf Parking Facility: 1,290 spaces
St. George Waterfront Redevelopment [includes NY Wheel (Warehouse) & Empire Outlets (Office)]	Richmond Terrace between Bay Street and Nicholas Street	Commercial: 95,100 sf (Warehouse)+490,000 sf (Office) Parking Facility: 962 spaces (Warehouse)+1,250 spaces (Office)
Lighthouse Point	Richmond Terrace and Bay Street	Residential: 109 units Commercial: 259,800 sf Parking Facility: 345 spaces
2111 Richmond Terrace Storage Facility	Richmond Terrace and Maple Avenue	Warehouse: 305,076 sf
110 Port Richmond Avenue Housing Development	Port Richmond Avenue between Ann and Bennet Streets	Residential: 77 units
221 Port Richmond Avenue Housing Development	Port Richmond Avenue between Castleton and Anderson Avenues	Residential: 48 units
Forest Avenue & South Avenue Cross Access Retail	Forest Avenue and South Avenue	Commercial: 300,000 sf (approximately)
South Avenue Retail Development	Forest Avenue and South Avenue	Retail + Restaurant: 226,000 sf Parking Facility: 838 spaces
Matrix Development	656 Gulf Avenue	Warehouse: 2,400,000 sf
1441 South Avenue Office Development	South Avenue between Teleport Drive and Travis Avenue	Office: 325,000 sf Parking Facility: 672 spaces
River North	Richmond Terrace, Stuyvesant Place, and Hamilton Avenue	568 housing units Residential: 669,785 sf Commercial: 30,489 sf
160 Richmond Terrace	Richmond Terrace, Stuyvesant Place, and Hamilton Avenue	77 housing units
40 Bay Street	Bay Street between Hyatt Street and Victory Blvd	53 housing units Residential: 39,665.65 sf Commercial or community facility: 6,546 sq ft



**Table 17 2019 and 2035 Daily Person Trips**

	<b>Home-Based Work Trips</b>	<b>Home-Based Other Trips</b>	<b>Non-Home-Based Trips</b>	<b>Total Person Trips</b>
<b>2019</b>	15,500,002	31,775,954	13,847,606	61,123,562
<b>2035</b>	16,718,887	33,920,563	15,157,455	65,796,904
<b>Change</b>	8%	7%	9%	8%



## 5 Ridership Results by Scenario

This section presents scenario-specific forecast results for the Proposed Project. Each set of forecast results is presented in two tables, Table 17 and Table 18—the first represents forecasted ridership if the project had been in operation in 2019 and the second represents ridership in Year 2035 (Opening Year).

### Ridership Results by Route

The first set of results are presented in Table 18 and Table 19 and show project and total ridership for corridor routes. Project ridership on a route is defined as any trip that travels on the stated route and boards, alights, or passes through a project station (i.e., any station on the North Shore Railway right-of-way between Arlington and St. George). The total of all project riders by route is slightly higher than FTA’s definition of linked transit Trips-on-Project since a small number of projects linked trips will transfer between these routes and therefore be double-counted. As shown in Table 19, Year 2019 project route boardings are 25,416 weekday trips.

**Table 18 Year 2019 Weekday Project and Total Route-Level Boardings by Scenario (Unlinked Trips)**

	<b>Observed</b>	<b>2019 Model</b>	<b>2019 Model - Build</b>
S1			12,594
S2			8,207
S53(*)			833
S54(*)			2,095
S57(*)			1,686
<b>Subtotal</b>			<b>25,416</b>
S40/S90	7,052	7,052	1,917
S44/S94	8,583	10,351	5,964





**Table 18 Year 2019 Weekday Project and Total Route-Level Boardings by Scenario (Unlinked Trips)**

	<b>Observed</b>	<b>2019 Model</b>	<b>2019 Model - Build</b>
S46/S96	10,405	6,027	1,659
S48/S98	10,406	10,784	8,014
<b>Subtotal</b>	<b>36,446</b>	<b>34,215</b>	<b>17,555</b>
<b>Total</b>	<b>36,446</b>		<b>42,971</b>

(\*) Boardings on the stops in the Rapid Transit Corridor

**Table 19 Year 2035 Weekday Project and Total Route-Level Boardings by Scenario (Unlinked Trips)**

	<b>2035 No-Build</b>	<b>2035 - Build</b>
S1		13,630
S2		8,873
S53(*)		1,450
S54(*)		2,369
S57(*)		1,826
<b>Subtotal</b>		<b>28,148</b>
S40/S90	7,907	2,516
S44/S94	10,853	6,171
S46/S96	6,937	1,906
S48/S98	12,765	9,448
<b>Subtotal</b>	<b>38,462</b>	<b>20,041</b>
<b>Total</b>		<b>48,809</b>

(\*) Boardings southbound and Alightings Northbound in the bus stops of the Port Richmond Terminal and Broadway/Clover Rd segment

### Ridership Results by Station

Table 20 through Table 23 present daily boardings at each BRT station for different combinations of access mode and forecast year. These tables include both project stations (i.e., those on the exclusive fixed guideway facility between St George and Arlington, inclusive) and stops used by the S1 along South Avenue. The number of boardings shown on these tables are slightly lower than route level project boardings reported above since S53, S54, and S57 receive boarding passengers who count as project riders but do not board at one of the BRT stops presented in this table. The station ridership tables are organized as follows:



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- » **Table 20** presents daily boardings made by travelers accessing the stations by walk access for years 2019 and 2035, respectively. Except for St. George station, many travelers access the BRT system by walking to the nearest station. Walk access accounts for approximately 35 percent of all trips using the BRT system in 2035.
- » **Table 21** presents daily boardings made by travelers accessing the stations by driving; utilizing the park-and-ride lots, at stations that have them or by being dropped off at stations. The drive access mode accounts for around 10 percent of all BRT trips and reflects the limited parking capacity at each lot serving the line in 2035. The number of drive access boardings is similar to the number of cars parking in these lots each day, particularly if the vehicle occupancy of the park-and-ride access trip is close to one (i.e., driver only).
- » **Table 22** presents daily boardings made by travelers accessing BRT stations by transferring from another transit service. The majority of these transfers occur at the St. George Station where many customers transfer from the Staten Island Ferry to the BRT system. Transfers account for approximately 55 percent of all BRT boardings.
- » **Table 23** presents total (all access mode) daily boardings for each BRT station. St. George has the highest ridership boardings of all stations, accounting for 43% of all boardings.

As shown in **Table 20**, weekday project boardings are expected to grow modestly into the future. Over the 16-year period between 2019 and 2035 ridership is expected to grow from 25,416 in 2019 to 28,148 in 2035, an increase of 10%. This outcome is the result of several changes expected for the corridor between 2020 and 2035 including:

- » Population in the North Shore Corridor is expected to grow from 131,031 to 139,697, a change of 8,666 or around 7%.
- » Employment in those same locations is expected to grow from 51,113 to 57,906, an increase of 6,793 jobs or 13%.
- » The total employed labor force in the area will also grow from 54,855 to 58,297, an increase of 3,443 in the local labor force or 6%. This growth will lead working adults to seek job opportunities in places with stronger growth (by numbers) including Manhattan which will grow by 131,373 jobs between 2020 and 2035.

Key outcomes are from model:

- » All S2 riders and nearly all S1 riders are project riders. The S1 riders that are not project riders are a very small number of trips that both board and alight the route along South Avenue and never travel along the guideway portion of the line. Given the relatively undeveloped nature of land uses along South Avenue, this outcome appears to be plausible.



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- » When compared to the no-build scenario, all S90 and S96 riders must use different routes since neither route operates in competition with the BRT. Although other parallel routes continue to operate since they provide important transit services to the communities they serve, most parallel routes show noticeable declines in ridership as riders shift from local routes to the BRT line.

Together, these station summaries show that St. George Station will be the most heavily used station in the system. This station will account for 43% of all boardings. This is consistent with the demand patterns described above, which show a large portion of transit trips on the North Shore of Staten Island involve travel to or from Manhattan. The BRT serves as an effective connector to the Staten Island Ferry and the NYC Ferry providing a new and highly effective transit option for the Staten Island to-Manhattan Market.

The next most-used station is New Brighton, which accounts for 4,649 boardings, about 17 percent of total boardings. A large portion of boardings at this station, 44 percent is accounted for by riders transferring from another bus route. The other station with demand over 4,000 boardings is Arlington Station at 4,041 boardings (14 percent of total boardings). Arlington Station is also expected to have the highest growth in number of boardings between 2019 and the 2035 build year, an additional 1,304 boardings. Half of the boardings are accounted for by those walking to the station. It is expected that the area around Arlington Station will have an employment growth of over 20 percent between 2019-2035, which helps to explain the projected growth in boardings between the 2019 Build year and 2035 Build year.

At the other end of the scale, Forest Ave, Goethals Rd, and Teleport station stops attract fewer than 300 riders per day in 2035 and each of these stops only account for 1 percent or less of station boardings. This is most likely attributed to the fact that there is limited residential development within walking distance of these stations and although some workers are destined for these station stops and may choose to use the BRT, the largest market for the project (residents traveling to work in Manhattan) is not a material contributor to ridership demand at these stations.

**Table 20 Year 2019 and 2035 BRT Weekday Walk Boardings by Station**

BRT routes		2019 Build	2035 Build
S1/S2	St George Terminal	2	2
S1/S2	New Brighton	2,305	2,590
S1/S2	Livingston	794	589
S1/S2	West Brighton	383	829
S1/S2	Port Richmond	1,356	1,420
S1/S2	Elm Park/Morningstar Rd	592	624
S1/S2	Mariner's Harbor	824	1,097
S1/S2	Arlington Station	1,480	2,019



**Table 20 Year 2019 and 2035 BRT Weekday Walk Boardings by Station**

BRT routes		2019 Build	2035 Build
S1	Forest Ave	4	5
S1	Goethals Road	58	63
S1	Teleport	351	273
S1	West Shore Plaza	396	466
	<b>Total</b>	<b>8,545</b>	<b>9,976</b>

**Table 21 Year 2019 and 2035 BRT Weekday Driving Boardings by Station**

BRT routes		2019 Build	2035 Build
S1/S2	St George Terminal	569	654
S1/S2	New Brighton	-	-
S1/S2	Livingston	617	623
S1/S2	West Brighton	-	-
S1/S2	Port Richmond	-	-
S1/S2	Elm Park/ Morningstar Rd	-	-
S1/S2	Mariner's Harbor	-	-
S1/S2	Arlington Station	813	1,447
S1	Forest Ave	-	-
S1	Goethals Road	4	4
S1	Teleport	-	-
S1	West Shore Plaza	49	36
	<b>Total</b>	<b>2,052</b>	<b>2,763</b>

**Table 22 Year 2019 and 2035 BRT Weekday Transfer Boardings by Station**

BRT routes	Station	2019 Build	2035 Build
S1/S2	St George Terminal	11,252	11,416
S1/S2	New Brighton	1,852	2,059
S1/S2	Livingston	3	3
S1/S2	West Brighton	389	432
S1/S2	Port Richmond	661	664
S1/S2	Elm Park/Morningstar Rd	17	5
S1/S2	Mariner's Harbor	2	1
S1/S2	Arlington Station	443	576
S1	Forest Ave	69	82



**Table 22 Year 2019 and 2035 BRT Weekday Transfer Boardings by Station**

BRT routes	Station	2019 Build	2035 Build
S1	Goethals Road	130	172
S1	Teleport	-	-
S1	West Shore Plaza	-	-
	<b>Total</b>	<b>14,818</b>	<b>15,408</b>

**Table 23 Year 2019 and 2035 BRT Weekday All-Access Modes Boardings by Station**

BRT routes		2019 Build	2035 Build
S1/S2	St George Terminal	11,822	12,072
S1/S2	New Brighton	4,158	4,649
S1/S2	Livingston	1,413	1,215
S1/S2	West Brighton	772	1,261
S1/S2	Port Richmond	2,018	2,084
S1/S2	Elm Park/ Morningstar Rd.	608	629
S1/S2	Mariner's Harbor	825	1,098
S1/S2	Arlington Station	2,737	4,041
S1	Forest Ave	73	86
S1	Goethals Road	193	239
S1	Teleport	351	273
S1	West Shore Plaza	446	502
	<b>Total</b>	<b>25,416</b>	<b>28,148</b>

Table 24 and Table 25 show the purpose trip of riders using the BRT. In Table 24, if the project build year was 2019, home-based work trips, meaning trips originating at home, with the destination of work, was a slightly larger proportion, 42% of all trips, than home-based other trips, which are trips originating at home for purposes other than work, which accounted for 39% of all trips. The largest trip purpose is home-based other trips, meaning trips originating from home, that are for all other purposes aside from work. However, for the Build Year 2035, this breakdown switches. See Table 25. Home-based other trips become the largest share of trips, at 43% and home-based work trips drop to 38% of the total transit trips.



**Table 24 Year 2019 Weekday Linked Transit Trips by Purpose**

	<b>2019 No Build</b>	<b>2019 Build</b>	<b>Growth Increment</b>
Home-Based Other Trips	3,156,408	3,157,858	1,450
Home-Based Work Trips	3,372,425	3,373,801	1,376
Non-Home Based Trips	1,524,730	1,525,599	869
<b>Total</b>	<b>8,053,564</b>	<b>8,057,258</b>	<b>3,694</b>

**Table 25 Year 2035 Weekday Linked Transit Trips by Purpose**

	<b>2035 No-Build</b>	<b>2035 Build</b>	<b>Growth Increment</b>
Home-Based Other Trips	3,997,947	4,000,604	2,657
Home-Based Work Trips	3,482,903	3,484,841	1,939
Non-Home-Based Trips	1,775,093	1,776,628	1,535
<b>Total</b>	<b>9,255,943</b>	<b>9,262,073</b>	<b>6,130</b>

The forecasted ridership for the BRT project presented in this document represent a modest evolution over current ridership patterns rather than a wholesale change from patterns that are seen today. This fact suggests that the forecasts are plausible and have a good chance of being realized in a form similar to what is described above. These observations suggest that the projections of North Shore BRT ridership presented in this document are a useful estimate of the benefits that the Proposed Project will provide to the travelling public.