Regional Plan Association

Overlooked Boroughs

Where New York City's Transit Falls Short and How to Fix It

Technical Report | February 2015

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Relationship to Regional Plan Association's Fourth Regional Plan

RPA began to work on the foundations of what will become the Fourth Regional Plan in the history of the region more or less simultaneously with the research and analyses in this report. As with previous plans, transportation will be a key part of the 4RP. And it stands to reason that the work in this report on mobility of the more than 7 million people living in the boroughs will be integrated into the 4RP work, addressing the mobility needs of all 23 million people living in the metropolitan region.

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Figure 1: Transit Systems in New York City

Source: MTA

Introduction and Approach

To many outsiders, "New York City" refers to Manhattan south of 125th Street. Yet, not only do nearly 90 percent of the city's 8.2 million city residents live outside this part of Manhattan, but the Bronx, Brooklyn, Queens and Staten Island are also home to more than half of the city's jobs, and have experienced job growth twice as fast as Manhattan's during the past two decades. This report uses "the boroughs" to refer to where nearly 90 percent of the city's population lives – the Bronx, Brooklyn, Queens, Staten Island and northern Manhattan – and "CBD" or central business district to refer to Manhattan south of 60th street. The focus of this report is transit-based mobility for access to jobs and other activities in the boroughs, increasingly vital to the city and state economy, and the well-being of its residents.

Built mostly in the first third of the 20th century, New York City's subway system was designed to open up the rapidly growing City to residential development beyond lower Manhattan and improve transportation capacity to job concentrations in the CBD. This was accomplished remarkably well, but today the transit system is not meeting the travel needs of the boroughs, which have outgrown our Manhattan-oriented transit network.

For instance, of the 26 distinct subway routes, 24 converge on Manhattan's core, only incidentally offering service for travel within the other boroughs. And Staten Island has no subway at all, but rather one rail line; the 14-mile, 22 station Staten Island Railway (SIR) service that terminates at the ferry terminal in St. George. Express buses attempt to fill in this radial pattern for service to Manhattan, albeit with less frequent service than the subway system, fewer Manhattan destinations, and more limited off-peak and weekend schedules. Nor do the express buses operate to serve travelers moving among the boroughs. Figure 1 depicts the subway routes, the express bus routes and the SIR.

The 228 local bus routes that operate within the five boroughs serve residents seeking transit for shorter trips within their own or nearby boroughs. These routes tend to be slow, though limited-stop routes can increase speeds. In recent years the NYCDOT and the MTA have initiated Select Bus Service (SBS) along 6 corridors. SBS services require off-vehicle fare purchases, have fewer stops and designated rights-of-way, all intended to speed service. The region's three commuter rail networks provide limited service to and from the boroughs to either Manhattan or to the suburbs surrounding the City, since their primary purpose is to speed suburban residents to the Manhattan core. They represent an untapped resource for residents in the boroughs. There is also a limited ferry network that operates within New York City. The iconic Staten Island Ferry operates from St. George to Lower Manhattan and is the most important transit lifeline between the often neglected borough and the region's commercial core. In addition, in recent years the city has experimented with various ferry services either in response to 9/11 or the Sandy storm. Currently, there is the East River ferry route that connects one point in Queens with four in Brooklyn and two in Manhattan and a service from Red Hook to Lower Manhattan subsidized by IKEA. There is also an experimental route from the Rockaways, a barrier peninsula in southeast Queens, to Lower Manhattan, stopping at Pier 11 and at 34th Street on the East River. The service costs only $2 and operates only on weekdays during peak periods. These routes require short-term subsidies that must be renewed periodically. The NYC Economic Development Corporation is considering the initiation of other routes.

Figure 1 shows the subway, commuter rail and ferry network and Figure 2 shows the local bus network.

A well-functioning transit system is especially important for both low- and average income New Yorkers, the majority of whom who do not own a car. Not only does the system put them in reach of millions of jobs, but it enables them to get to schools, hospitals, cultural facilities, parks and services. This helps mitigate New York's high cost of housing, and it is part of the reason that low-income New Yorkers have a better chance of getting ahead than residents of many other U.S. regions.

This report pursues several parallel paths to gain an understanding of the transit needs in the boroughs of New York City. These include:

- Understanding current travel patterns using US Census travel to work data. Trips to and from work constitute half of all trips made on the New York City subway system and almost one-third of all the trips made on local buses. Although work trips are only part of the travel picture, these data help to understand the relative size, geographic orientation, and mode choices of the travel markets in the City.

- Identifying areas of the city where good transit is especially important because auto ownership is low. This analysis also identifies areas of high auto ownership as areas where shift to transit would be more problematic.

- Using these data to formulate statistical models that recognize factors other than transit service that explain why people use transit, including land use densities in residential and work locations, the cost of auto use (including parking and tolls), and income (which mitigates the high cost of auto use for some trips). This analysis helps to identify the markets in the city where transit use is poor after accounting for non-transit-service factors.

Figure 2: Local Bus Network in New York City

Source: MTA

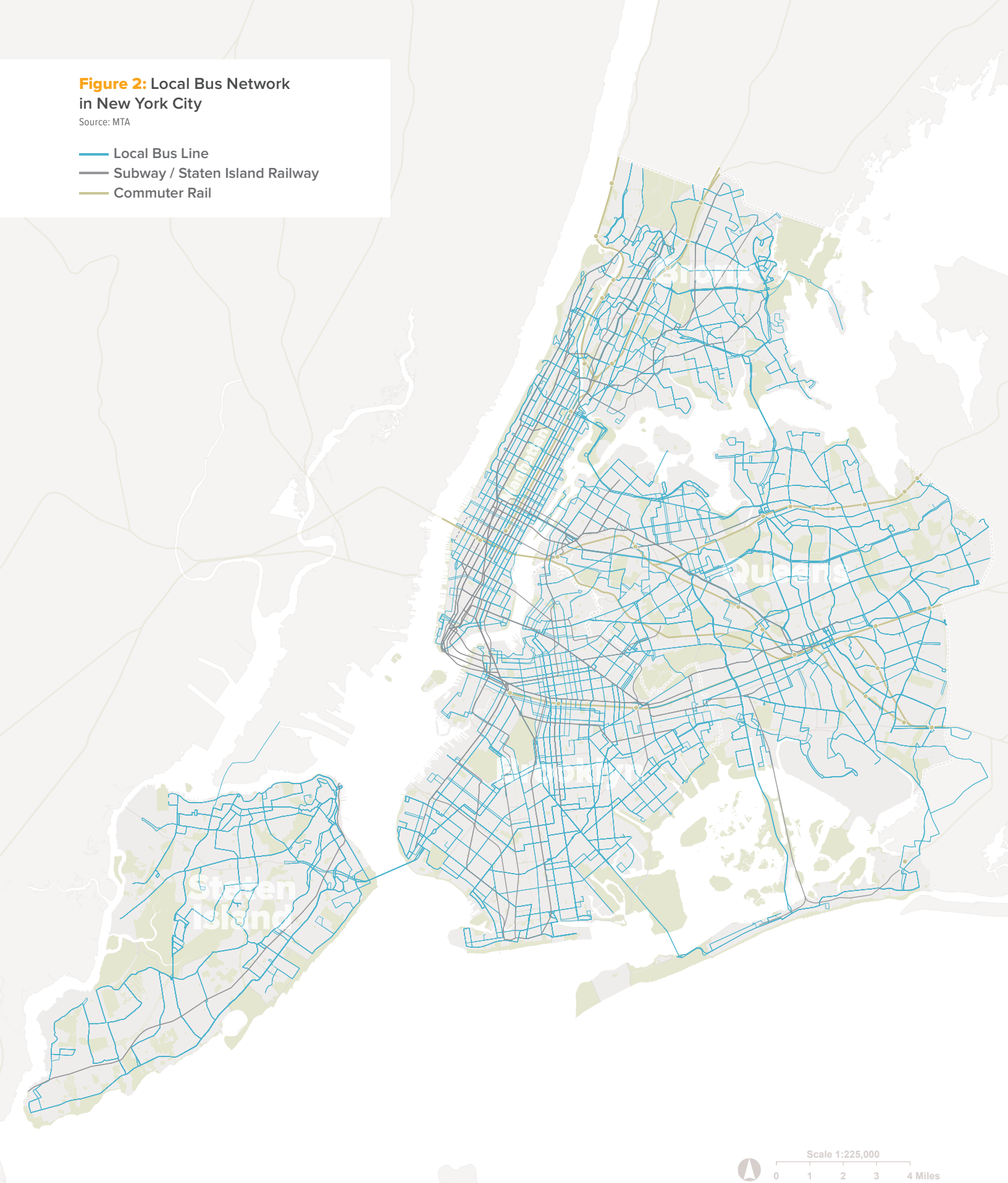
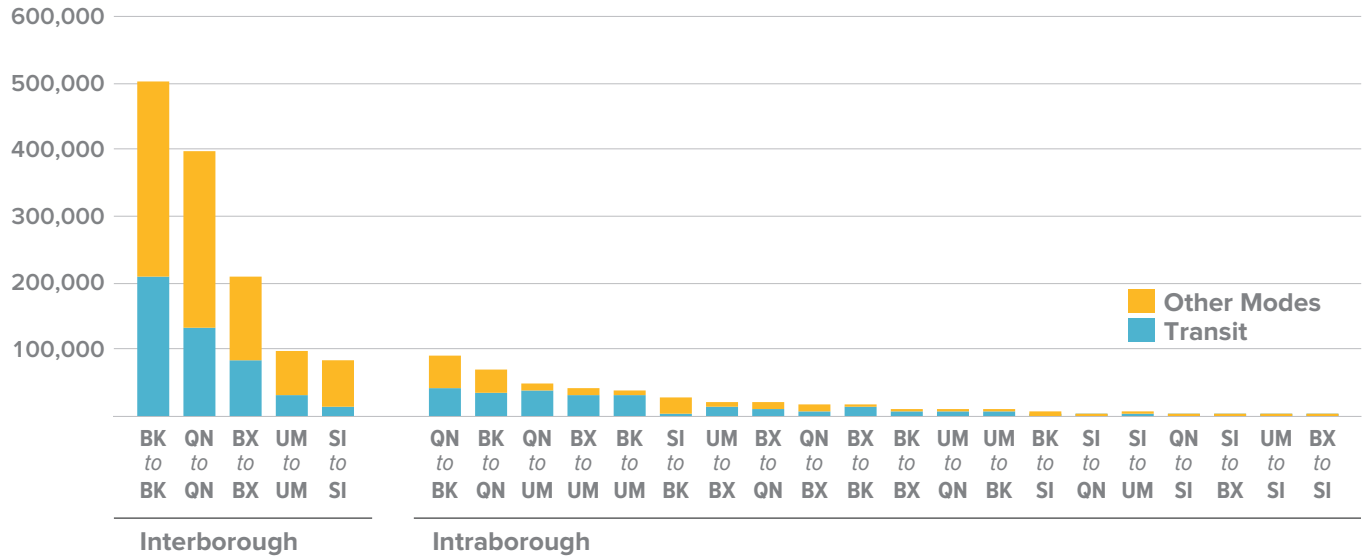


Figure 3: Borough to Borough Trips to Work



- Understanding public priorities. On the proposition that people who live and work in an area are most familiar with the shortcomings of the transit system, RPA met with five community boards, one per borough, to discuss their transit needs. Although no single community board can be representative of an entire borough, much less the city, this process helped identify some transit service characteristics that attract people to transit and areas in the boroughs where service is lacking. This was done by prompting the attendees to discuss the nine factors that attract riders, presented in the form of questions, as follows:

In addition to community board outreach, RPA established an advisory committee consisting of representatives of transportation advocacy groups with deep local transit knowledge, and transit operators who would be responsible for implementing recommendations. The composition of this committee is provided in the Acknowledgements.

The recommendations in this report are based on the investigations of the transit deficiencies and the feedback from the outreach process. These recommendations may be generic, i.e. applicable to the entire transit system and the entire city, or geographically specific within a borough or a neighborhood, a subway line or a bus route. The agencies responsible for implementation are then identified.

Patterns of Travel to Work: Borough Demands and Transit Shares

Residents of the city, and people everywhere for that matter, need the transportation system to get to and from work, and to carry out their other normal daily activities – shop, visit others, go to school, and to reach various recreation venues. This report initially focuses on gaining a better understanding of work trip patterns for the boroughs' residents, and how the transit system serves them today. There are a number of reasons for doing this.

- The work trip is taken daily and making improvements to it can have a greater quality of life impact;
- Work trips are more often made during peak times when transit service is more essential because road traffic is more congested;
- Work trips tend to made alone making transit more economical, while non-work trips are often made by family members traveling together making auto travel more economical;
- Work trips tend to be made to centers of economic activity, such as major central business districts;
- Getting to work is critical to economic well-being of New Yorkers;
- Work trip data is available in great detail from US Census surveys while data for non-work trips are gathered more sporadically and less universally.

Recent work trip data is available through the American Community Survey which surveyed households annually from 2006 to 2010. When combined for those five years the sample

Table 1: Borough to Borough Work Trips by Mode: 2010

	Residence	The Bronx	Brooklyn	Manhattan	Queens	Staten Island	TOTAL
Work Location	**The Bronx**	226,315	19,960	191,620	21,565	615	460,075
	Brooklyn	13,535	533,685	391,010	69,680	6,695	1,014,605
	Manhattan	27,180	23,905	696,080	20,085	1,420	768,670
	Queens	21,040	84,985	370,245	430,250	2,080	908,600
	Staten Island	1,580	29,970	52,940	5,700	95,780	185,970
	TOTAL	**289,650**	**692,505**	**1,701,895**	**547,280**	**106,590**	**3,337,920**
Percent by Transit	**The Bronx**	40.2	78.8	83.8	59.4	64.2	61.0
	Brooklyn	56.6	42.3	90.2	49.7	35.7	61.5
	Manhattan	69.2	75.6	58.2	68.9	47.2	59.4
	Queens	37.1	41.2	85.5	33.0	23.3	55.2
	Staten Island	12.3	19.0	75.1	16.9	16.3	33.4
	TOTAL	**43.3**	**43.4**	**74.9**	**37.3**	**18.3**	**57.7**
Percent by Subway	**The Bronx**	13.9	67.7	68.6	45.8	27.6	40.5
	Brooklyn	52.0	24.6	83.6	38.3	17.0	48.6
	Manhattan	44.4	70.3	47.9	60.4	31.3	48.8
	Queens	29.4	31.4	72.6	16.0	19.2	40.8
	Staten Island	4.4	2.1	7.2	3.4	0.8	3.0
	TOTAL	**19.6**	**27.3**	**62.6**	**21.5**	**2.8**	**42.9**
Percent by Bus	**The Bronx**	25.5	7.8	11.2	10.8	10.6	18.1
	Brooklyn	2.6	16.9	4.6	9.8	12.8	11.5
	Manhattan	22.0	3.0	8.9	5.6	9.2	9.1
	Queens	6.4	7.5	7.6	16.3	3.6	11.7
	Staten Island	5.7	14.5	54.0	9.8	14.2	25.4
	TOTAL	**22.6**	**14.9**	**9.3**	**14.8**	**13.8**	**12.7**
Percent by Auto	**The Bronx**	36.1	20.5	15.1	39.9	30.9	26.8
	Brooklyn	41.1	31.7	8.3	46.9	60.5	24.0
	Manhattan	27.6	18.6	8.0	26.6	43.0	9.6
	Queens	62.0	57.1	13.6	47.1	76.0	34.8
	Staten Island	83.5	80.2	23.9	82.3	73.2	60.7
	TOTAL	**37.7**	**36.2**	**10.6**	**46.4**	**71.8**	**26.1**

Source: U.S. Census Bureau, American Community Survey 2006 to 2010

rate includes over 8 percent of households, an adequate sample unless dealing with very small areas with low volumes of trips.[1]

The overall pattern and modal shares of travel within and between the boroughs is shown in Table 1. Over 3.3 million daily work trips are represented in Table 1. This is the sum of all trips taken for work purposes within the five boroughs. As might be expected, the number of people who travel to Manhattan is high and the share that uses transit from the other boroughs to Manhattan is also high, from 75 percent for Staten Islanders to 90 percent for Brooklyn residents. Note the Manhattan to Manhattan anomaly with only 58 percent using transit, a result of the high share of these trips made on foot.

Inter and Intra Borough Travel

The high volume of trips made within each of the non-Manhattan boroughs is significant. If not working in Manhattan, New Yorkers are likely to work closer to home. Approximately half of the workers living in each of the four non-Manhattan boroughs also work in their own borough. For all of these trips, less than half use transit – 40 percent for the Bronx, 42 percent for Brooklyn, 33 percent for Queens and barely one in six for Staten Island. For the intra-Bronx trips, buses are used twice as much at the subway while in Brooklyn substantially more ride the subway. The Queens trips are split evenly between the two transit modes, and the Staten Island trips are almost exclusively by bus, since there is no subway service there; the Staten Island Railway is barely used at all for trips within that borough.

There is also substantial travel between the boroughs. By far the largest are the flows in each direction between Brooklyn and Queens, the only borough pairs that are contiguous, i.e. not separate by a major water body. Eighty-five thousand people travel from Queens to Brooklyn jobs and another 70,000 make the trip from Brooklyn to Queens' job sites. Over half of the Queens-Brooklyn flow is made by car, as is 47 percent of the flow in the other direction. Among those using transit in each direction, most ride the subway rather than buses.

The other inter-borough flows are much lower. Staten Island to Brooklyn, with 30,000, is the highest but only 19 percent use transit. In contrast, other notable borough pairs have higher transit shares – the Bronx to Queens and to Brooklyn are 58 percent and 79 percent transit use, respectively, and Queens to the Bronx at 37 percent. Most of these longer distance trips are by subway. Since these trips tend to be longer than those within

1 Data recorded includes the dominant mode of trip, estimated travel times, and time of departure. The home origin of the trip is organized by census tract and census block level. The work trips destination, i.e. the work site is established by the work address from the survey and is coded to enable aggregation by various units of geography, including census block, census tract, zip code, municipality or county, or as often used by transportation planners, by specialized Transportation Analysis Zones (TAZ).

Table 2: Work Trips From the Boroughs to the Suburbs: 2010

	Residence	Work Location	Total	Transit	Percent Transit	Likely Transit Option
To New Jersey	**Manhattan**	**Bergen**	6,760	530	7.8	Subway to bus
	Bronx	**Bergen**	3,590	485	13.5	Bus to GWBBS to Bus
	Queens	**Bergen**	3,265	385	11.8	Subway to Bus
	Brooklyn	**Bergen**	2,200	245	11.1	Subway to Bus
	Manhattan	**Essex**	4,040	1,940	**48.0**	Subway to Bus or NJT
	Brooklyn	**Essex**	2,965	1,425	**48.1**	Subway to NJT
	Queens	**Essex**	2,075	765	**36.9**	Subway to NJT
	Staten Island	**Essex**	2,025	55	2.7	Bus
	Brooklyn	**Hudson**	7,245	4,980	**68.7**	Subway to PATH
	Manhattan	**Hudson**	6,820	5,455	**80.0**	Subway and PATH
	Queens	**Hudson**	5,665	3,545	**62.6**	Subway to Bus or PATH
	Staten Island	**Hudson**	4,245	770	18.1	Bus, LRT, PATH
	Bronx	**Hudson**	2,585	1,245	**48.2**	Subway and PATH
	Staten Island	**Middlesex**	3,180	40	1.3	None
	Brooklyn	**Middlesex**	2,250	300	13.3	NJT to Subway
To Long Island	**Queens**	**Nassau**	75,025	13,130	17.5	Subway to LIRR or Bus
	Brooklyn	**Nassau**	11,000	3,185	**29.0**	Subway to LIRR or Bus
	Manhattan	**Nassau**	4,340	1,410	**32.5**	Subway to LIRR
	Bronx	**Nassau**	2,590	620	23.9	Subway to LIRR
	Queens	**Suffolk**	13,815	1,545	11.2	Subway to LIRR
	Brooklyn	**Suffolk**	2,720	555	20.4	Subway to LIRR
	Manhattan	**Suffolk**	2,345	810	**34.5**	Subway to LIRR
Hudson Valley and Connecticut	**Bronx**	**Westchester**	37,585	11,725	**31.2**	Subway to Bus or Metro North
	Manhattan	**Westchester**	9,415	3,655	**38.8**	Subway to Metro North
	Queens	**Westchester**	8,670	1,275	14.7	Subway to Metro North
	Brooklyn	**Westchester**	3,135	1,260	**40.2**	Subway to Metro North
	Manhattan	**Fairfield**	4,570	2,775	**60.7**	Subway to Metro North
	Bronx	**Fairfield**	2,495	490	19.6	Subway or Bus to Metro North
	Queens	**Fairfield**	2,300	285	12.4	Subway to Metro North

Source: U.S. Census Bureau, American Community Survey 2006 to 2010
Note: Deficient routes shaded.

boroughs, the faster subway becomes a more likely transit option, and direct subway service becomes more relevant. Of course, in the absence of a subway at all, as with Staten Island, transit is considerably less attractive.

For trips from Manhattan to the boroughs of the Bronx, Queens or Brooklyn, each with 20,000 or more trips, the transit share is higher, mostly by subway.

Comparisons of these data with the earlier US Census produce some welcome findings. Almost all the borough-to-borough work trip flows have become more transit oriented. The total number of work trips has also grown substantially from 2.9 to over 3.3 million, paralleling the growth in the city's population.

Travel Between Boroughs and Suburbs

Many borough residents work outside the city. In Table 2 the work trips data for travel from the boroughs to nearby suburban counties is presented for those county-to-county markets that exceed 2,000 work trips a day. Twenty-nine pairs meet that threshold, totaling 239,000 trips. Not surprisingly, the highest volumes are from boroughs to contiguous suburban counties – Queens to Nassau and the Bronx to Westchester. Other high volume pairings are from Queens to Suffolk and Manhattan to Westchester. The trip-making to New Jersey counties are more defused with Brooklyn to nearby Hudson County leading the pack.

The service and fare policies of Metro-North and Long Island Rail Road are generally not designed to attract those living and working within New York City. However, the growth in commutation on Metro-North from New York City to the suburbs shows what is possible. There has been a doubling of reverse commuting from Manhattan and the Bronx to the northern suburbs since 1995, fueled largely by the job growth in White Plains and Stamford and new track capacity that permitted additional reverse service. The LIRR hasn't experienced similar growth, due to insufficient capacity for rush-hour reverse service and few large job concentrations near suburban stations.

The transit modal share collectively for the trips in Table 2 is 27 percent; the pairs exceeding 30 percent are highlighted in gray. The transit shares vary widely by market. These markets either have direct commuter rail service, or have it combined with subway or bus and destined for either the nearby counties of New Jersey with rail service to other suburban counties adjacent to the city. The exceptions are the two Manhattan to Long Island markets which exceed 30 percent transit. There are only two markets that fall below 30 percent that have New Jersey or Hudson Valley destinations – Brooklyn/Middlesex and Queens/

Table 3: Work Trips from the Suburbs to the Boroughs: 2010

	Residence	Work Location	Total	Transit	Percent Transit	Likely Transit Option
From New Jersey	Bergen	Bronx	6,515	420	6.4	Bus via GWBBS and Bus
	Bergen	Brooklyn	2,740	975	35.6	Bus to Subway
	Bergen	Queens	4,230	935	22.1	Bus to Subway
	Essex	Brooklyn	2,470	1,275	51.6	NJT or Bus to NYC and Subway
	Hudson	Brooklyn	3,430	2,135	62.2	LRT/PATH to Subway
	Hudson	Queens	2,270	1,235	54.4	LRT/PATH or Bus to Subway
	Middlesex	Brooklyn	3,155	795	25.2	NJT to Subway
	Middlesex	Staten Island	3,035	59	1.9	None
	Monmouth	Brooklyn	3,550	710	20.0	Rail and PATH to Subway
	Monmouth	Staten Island	3,585	95	2.6	None
From Long Island	Nassau	Bronx	6,335	395	6.2	Bus or LIRR to Subway
	Nassau	Brooklyn	25,255	4,355	17.2	Bus or LIRR to Subway
	Nassau	Queens	70,435	6,365	9.0	Bus or LIRR to Subway
	Suffolk	Bronx	3,565	385	10.8	LIRR to Subway
	Suffolk	Brooklyn	10,250	2,535	24.7	LIRR to Subway
	Suffolk	Queens	25,050	3,595	14.4	LIRR to Subway
From Hudson Valley	Orange	Bronx	3,980	234	5.9	None
	Rockland	Bronx	5,680	84	1.5	Bus to GWBBS and Bus
	Westchester	Bronx	29,910	3,345	11.2	Metro North or Bus to Subway
	Westchester	Brooklyn	3,820	1,730	45.3	Metro North to Subway
	Westchester	Queens	5,450	755	13.9	Metro North to Subway

Source: U.S. Census Bureau, American Community Survey 2006 to 2010.
Note: Deficient routes shaded.

Fairfield; in both those cases the auto trip is much more direct than the transit option.

The major county-to-county commutes from the surrounding, mostly suburban counties to the boroughs is of somewhat less interest in this report, since the focus is on mobility improvements for borough residents. Nevertheless, better access to jobs in the boroughs builds their economic strength and is worthy of mention here. The suburb-to-city work trip travel is presented in Table 3 and shows all markets of more than 2,000 work trips.

There are 225,000 trips represented in Table 3, but only 14 percent use transit. High auto ownership levels among suburban residents undoubtedly explain some of this low share, compared to the 27 percent for the borough-to-suburb transit share. The highest transit shares are found among those pairs that are close in suburban counties and that involve Brooklyn and Queens. The transit shares tend to be higher where a trip would involve traveling to and through Manhattan, where the transit network is more robust and travel by car is more onerous. Westchester to Brooklyn is a good example.

From the three preceding tables of work trip flows in the New York region, a number of key points relevant for borough work trip mobility stand out.

- There are 1.7 million borough residents that work in Manhattan (Table 1). With most, 1.4 million, working below 96th Street on the east side and 125th Street on the west side.
- An almost equal number of borough residents, 1.6 million, work in the other boroughs.
- Of these, by far the largest travel flows are internal to each borough; less than half of these flows are made by transit. Reliance on buses is high in these boroughs, especially where the subway is not oriented toward many trips as in the Bronx and Queens or where a subway is totally absent as on Staten Island.
- Travel between the adjacent borough of Queens and Brooklyn is also significant. Car use for these trips is high. Subway use far exceeds bus use for these trips, in part a consequence of poor direct bus service between the two boroughs.
- The volumes of trips to suburban counties are much lower than travel within the boroughs. By far the highest volumes are: from Queens and to a lesser extent Brooklyn to Nassau County, from Brooklyn, Manhattan and Queens to Hudson County, and from the Bronx and Manhattan to Westchester. Where rail transit is available, it is well used. Where buses are the major transit option, transit shares are lower.
- Suburbs-to-boroughs transit shares are highest where the city transit system can aid the trip, lowest where the system is not available or not especially robust.

Up to now the emphasis has been work trips. These trips are important for obvious reasons, but they are in the minority. Over the course of a week about half of all trips made on the NYC subway and about 70 percent of all trips made on buses are for purposes other than going to or from work.[2] Recently, the MTA has made available raw survey data they have collected for all their trips, but the effort to organize and compile these data for non-work trips has not been undertaken in this report, given the extensive tasks required. Instead, the discussion of non-work trips is addressed through other types of analyses.

2 NYMYC-NJTPA 2010-2011 Regional Household Travel Survey

Determinants of Transit Use Other Than Transit Service Quality

The county level work travel patterns summarized above mask the key factors that determine the share of work trips made by transit. By looking in greater geographic detail at the community board level, it is possible to ferret out those factors that explain in large part why some people opt to travel by car and others by transit. Many make the choice because they are affected by the areas they work or live in. For instance: dense areas are more congested and road traffic tends to be greater; the cost of owning a car is higher; and, transit service tends to be more robust. At low densities, driving tends to be cheaper and easier, and transit service more sparse. Additionally, higher incomes indirectly produce a lower share of transit users. Higher income households tend to own more cars, all else being equal, and with a car affordable, may choose to own it and use it.

Auto Availability

The relationships between auto availability, and transit use is a complex one – the more cars that are owned, the less transit is used, the more transit is available the fewer the cars that are owned. Further complicating the matter is that people with higher incomes, those living at lower densities or households with more people of driving age all tend to be associated with more car ownership, independent of the quality of the transit service.[1]

Table 4 shows the distribution of auto availability[2] by household in the five boroughs. Manhattan, not surprisingly has the highest share of households without a car, with very few owning two. The Bronx and Brooklyn have similar distributions, over half own none, and only about one in ten households own two or more. Queens is more car-oriented and Staten Island still more so, with only about one in six households owning none, similar to suburban county averages. In Staten Island almost half of the households have at least two autos available to them.

Table 4: Household Auto Availability in New York City by Borough: 2010

Borough	Zero Cars	One Car	Two or More
Bronx	58.8	30.5	10.7
Brooklyn	56.5	33.0	10.6
Manhattan	77.7	19.8	2.5
Queens	36.3	40.2	23.4
Staten Island	15.7	37.0	47.3
New York City	54.6	31.5	13.9

Source: U.S. Census Bureau, American Community Survey 2006 to 2010

1 For a more complete discussion of these relationships see Pushkarev and Zupan, *Public Transportation and Land Use Policy*, Chapter 2, Indiana University Press 1977.

2 The Census Bureau asks respondents how many vehicles are available in the household, rather than how many are owned. In this report the two terms are used interchangeably, if imprecisely.

The analysis of borough level work trip patterns and auto ownership, while instructive in providing a picture for the City and for the individual boroughs can mask details that are best understood at a finer geographic level.

The importance of these data can be thought of in two ways. First, the absence of cars in a household, whether for reasons of income, lifestyle choices, transit quality, parking availability or density, translates into reliance on public transit for mobility. Therefore, it is particularly important that transit service be available in areas with high concentrations of households without cars. Figure 4 shows the density of carless households in New York City, highlighting the areas of below average income. Most of the areas that stand out also have nearby subways, which can take the sting out of being carless. But there are exceptions – neighborhoods with high concentrations of households without cars and poor access to the subway network. These include the Third Avenue corridor in Morrisania and East Tremont and Soundview/Castle Hill in the Bronx, parts of East Harlem in Manhattan, Elmhurst and Corona in Queens, and the neighborhoods of Bedford/Stuyvesant, Bushwick, East New York, Sunset Park and Flatlands in Brooklyn. Second, the presence of two or more cars in a household makes it much more unlikely that for most trips there will be an inclination to travel by transit, the exception being mostly for trips into Manhattan where the cost of using the car will inhibit car use.

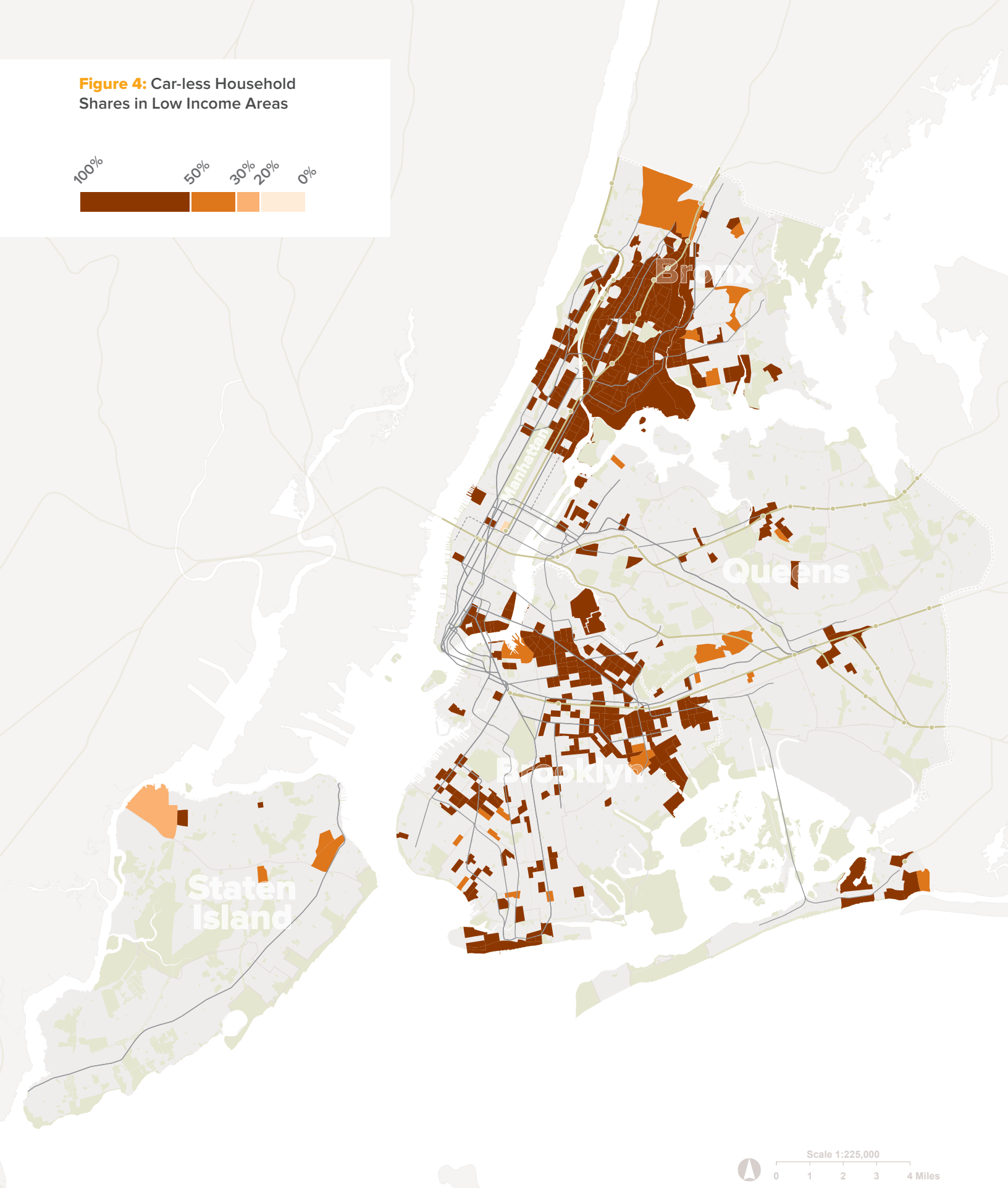
The availability of a car in a household is a prime determinant of modal choice. Without one the choice of transit is an obvious one; the traveler is "captive." And with little choice, if the transit service is deficient, the traveler is stuck without a decent alternative. That lack of adequate transit service for this person is a matter of equity, with society limiting his or her mobility and economic and social well-being. For those with a car available, the traveler has a choice and any deficiencies in the transit service will tilt the traveler toward using their car, contributing to the environmental and social costs of using an automobile. Either way, better transit is good for both groups of people.

Other Factors That Influence Public Transit Ridership

Other factors were identified that influenced the travel mode used. The high cost of car use – including parking costs and tolls – help to explain why many choose not to drive. And the absence of a direct subway option that avoids multiple transfers (other than those across the platform) is another explanation why some people do not choose to use public transit.

By isolating these factors, we can identify the extent to which transit service matters and can be altered to provide more service.

Figure 4: Car-less Household Shares in Low Income Areas



It enables us to be more realistic as to what transit can accomplish and what it cannot, whether because the "cards are stacked" by non-transit service factors or the current configuration of the subway network, which has hardly changed in the last 70 years. [3]

When this is done it is found that these non-transit factors, especially income and job and residential density for work trips, account for more than three-fourths of the variation in the mode chosen to travel to work. Unfortunately, these factors are not easily changed in the near term. But over time, densities can be increased by zoning changes, toll policies can result in higher tolls where transit is readily available, and parking costs can increase naturally if parking supply is limited. Nor can the directness of subway service be modified without significant expenditures. Viable solutions in the short term include improvements in bus service, and possibly, in subway and commuter rail service. These possibilities will be discussed, informed first by the outreach to selected neighborhoods to gain the perspective of those who use the services on a daily basis. A fuller discussion of this analysis is presented in Appendix A.

3 This is done by a statistical process known as multiple regression analysis, which in this case takes all the non-transit service variables and "explains" how much of the variation in the mode chosen is caused by those variables and " how much is left to be explained by transit service.

Outreach: Input From the Community

Table 5: Characteristics of Selected Community Boards

CB	Populations Denstiy (Persons per Square Mile)	Ratio of Transit to Auto Based Work Trips	Percent Zero Car House- holds	Percent Two+ Car House- holds	Mean Household Income, $	2012 Avg. Weekday Subway Boardings	Percent of Community Board Served by Subway
BX9	42,362	2.57	46.0	16.2	48,308	31,785	31.2%
BK5	32,111	2.81	44.2	17.1	44,508	59,925	55.0%
MN11	50,317	9.70	74.5	5.3	53,745	73,056	47.4%
QN5	22,537	1.51	27.1	33.5	65,951	22,934	17.9%
SI1	12,988	0.82	16.2	47.5	73,524	NA	6.3%

Sources: U.S. Census Bureau 2010, Metropolitan Transit Authority, Regional Plan Association
Note: Staten Island has no subway and Staten Island Railway station counts are not taken since no fares are collected and therefore there are not turnstiles to count passengers.

The outreach process to communities in the boroughs had two purposes, to inform our understanding of how riders themselves value the various components of their transit service that evolved into the nine factors discussed earlier and to confirm or modify the transit service deficiencies in the neighborhoods that the analyses revealed. Given the size of the city, it is not realistic to engage every neighborhood. Rather, one community board from each borough was selected to distinguish among the unique transit characteristics of each borough, to buttress some of the insights gained from our analyses, and to add to our understanding of transit deficiencies as seen by users of the transit network.

The five community boards were selected, one from each borough, by considering a number of factors including: low transit use, low auto ownership (specifically, high shares of households without cars), income, the scope of existing transit services, existence of ongoing transit issues, history of activism on transportation issues (for which we relied on the experience and knowledge of advisory committee members), the ratio of transit to auto shares (a measure of transit orientation), and subway station boarding (orientation toward the subway). Income was used as a descriptor of the neighborhood and to evaluate diversity of transit choices considered. Before a final set of factors were agreed to, an attempt was to check for ethnic diversity across all five choices. After much discussion, the advisory committee reached consensus regarding these choices. Key characteristics of the five selected community boards are shown in Table 5 for the selected boards. They are mapped in Figure 5.

The five selected community boards have a wide range of characteristics. As might be expected, the Manhattan CB ranks highest on density and transit use, and the Staten Island CB ranks lowest on density and transit use, but high on auto ownership. Subway service availability and use is low in the selected Queens CB and doesn't exist at all in Queens. The neighborhoods in these selected community boards are listed in Appendix B.

A total of seven outreach meetings were held, either by meeting directly with the community boards or through meetings with larger groups of citizens organized by the boards. The concerns expressed varied widely with six items surfacing to be of most concern – long walking distances to subways or buses that give access to key destinations, necessity to transfer to reach desired destinations, slow and unreliable service, infrequent service, crowded conditions on buses, and lack of amenities. Each of the community boards are discussed below, highlighting their specific transit concerns.

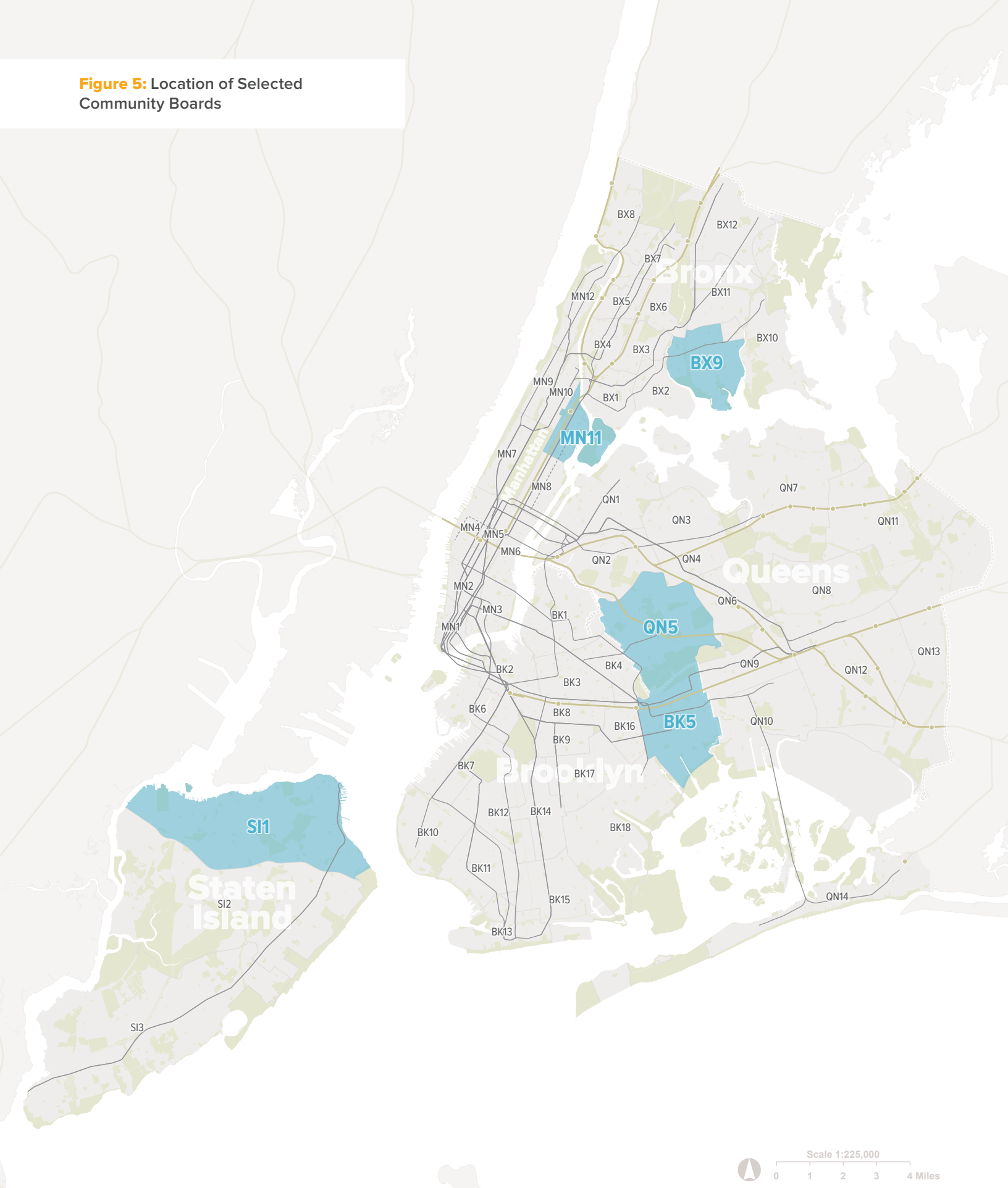
Queens Community Board 5

Queens Community Board 5 area is located on 7.5 square miles in south central Queens bordering on Brooklyn and includes the neighborhoods of Glendale, Maspeth, Middle Village and Ridgewood. The community board is situated along the Brooklyn border and suffers from limited subway service and poor bus service to the north to the rest of Queens and to the south to Brooklyn. It was chosen because of this isolation and because of the limited bus service to the adjoining borough of Brooklyn.

As of the 2010 US Census, there are 169,000 people living there with an average density of 22,500 per square mile, a 2 percent increase (3,000 people) from 2000. The population is just over one-half white non-Hispanic, a decline of some 10,000 in the ten-year Census period. The growth has been among Hispanics who have increased by 25 percent in that period to about one-third of the population, particularly in Ridgewood in the southwest portion of the CB, where they are now in the majority.

Just over 25 percent of the households in the area do not own a car, and another one-third own two or more cars, which is almost precisely the Queens borough-wide average. These community board-wide shares mask the distinctly different distri-

Figure 5: Location of Selected Community Boards



bution in the Ridgewood neighborhood where 51 percent are without a car and only 11 percent own two or more.

The bus network in the district includes 22 local routes that cover most of the district well. There are also 8 express routes. The subway service in the district is limited the Myrtle Avenue (M) line with four stations within the area serving the Ridgewood neighborhood. Most residents of CB5 who wish to travel by subway require buses as feeders. Maps showing the local bus, express bus and subway coverage for each of the selected community boards are presented in the Appendix B to this report.

The QN5 outreach meeting with its board members had about two dozen attendees and produced a lively discussion about transit needs in the district. The community board members were well versed in the local transit issues and an informed discussion took place regarding transit deficiencies.

The community board discussion produced the following key observations, concerns and suggested solutions:

Bus Service

- Select bus service has limited potential as a solution because of narrow streets and heavy truck use on some roads. The most likely possibility is along Woodhaven Boulevard, while outside the district would benefit QN 5. However, local opposition has held this project back. Woodhaven could be an alternative for buses to the beach and to the overcrowded Van Wyck Expressway.
- Service on the Q 24 and Q 35 routes are heavily used; evening and weekend service is limited.
- Services to Queens Boulevard shopping, Jamaica Center, and Flushing and to the beach (Rockaway) are limited.
- The Q24 should be extended to the M subway stop at Myrtle Avenue.

Subway Service

- A transfer point should be built between the L and G subway stations at Lorimer Street and Broadway.
- While the rerouting of the M to midtown has been a big improvement, it should not be turned into a shuttle late at night.
- Rehabilitation of M stations, long delayed, should be given priority.

Commuter Rail Service

- There was interest expressed in the construction of the third track on the Long Island Rail Road to provide reverse access to jobs on Long Island.

Underserved Areas Mentioned

- Maspeth Industrial Area with 15,000 jobs.
- Downtown Brooklyn from the northern part of the CB where there is no subway service.
- Both LaGuardia and JFK airports – slow bus service to LGA and no direct bus service from the community board area to JFK.
- St. Francis and Molloy High Schools.
- Brooklyn Museum and Prospect Park.
- Maspeth – no commuter rail, subway or express buses to Manhattan.
- Highland Park which could be accessed if the Q13 or the Q20 were rerouted.

New or Revived Rights-of-way

- Use of the Montauk Branch of the LIRR at the four stations in Queens should be revived.
- The Rockaway Beach Branch should be reactivated.
- The Triboro Rx concept should be applied along the Bay Ridge freight line.

Other Relevant Comments

- Interest in public transit is much greater in the southern part of the district (Ridgewood) and less so in Middle Village and Glendale.
- The land uses in the district, with its many cemeteries, result in circuitous travel.
- The bus depots serving the district are mostly across the borough border in Brooklyn, which tends to focus more service in Brooklyn, depriving the Queens 5 residents of bus service.
- There is interest in bringing bike share to the district.

Bronx Community Board 9

Bronx Community Board 9 area in the eastern part of the borough contains the neighborhoods of Castle Hill, Parkchester, Soundview, and Unionport, among others. There is limited subway service, with only one subway line, operating through the western side of the area, missing much of the community board area. The area is relatively isolated, cut off by the Bruckner Expressway from the rest of the Bronx. Reaching other parts of the borough often requires long rides on buses, sometimes requiring two or more transfers to complete a trip.

About 172,000 people live in this area of 4.1 square miles, at a density of 42,000 people per square mile. About 58 percent of the population identifies themselves as Hispanic, and another 31 percent as black. Fifty-four percent of the households in the area do not own a car, slightly higher than the borough-wide average of 46 percent, and only one in ten own two or more cars, less than the 18 percent in all of the Bronx.

The district is served by nine local bus routes. One interborough service, the Q44, operates to Queens. There are two express bus lines that stop in BX9. Subway service is limited

to #6 Pelham Bay line. More than half of the land area in BX9 district is beyond walking distance to a subway station.

The community board discussion produced the following key observations, concerns and suggested solutions:

- The #6 Pelham y line is beyond walking distance for many residents of the district.
- Hunts Point access requires two buses for residents of BX9 who work at the food market.
- The BX 5 bus route operates very inconsistently with poor headways.
- SBS service for the BX5 should be considered.
- BX 5 service does not operate late enough.
- Zerega Avenue should have bus route to serve the industrial area there and the new development at the Whitestone multiplex.
- Traffic conditions at the time of school let-out are a problem for buses, with crowding on the buses.
- The Bronx 36/39 on White Plains Rd experiences extreme cases of bunching.
- Close Avenue should have bus service.
- Express buses should terminate in lower Manhattan rather than terminating in Midtown.
- Express bus stops are not well located for many residents.
- There was concern about crowded buses.
- Service frequency was too limited on buses at midday.
- Service late at night was insufficient for late-night workers.
- Faster buses to the Hospital complexes, Co-op City, and the County Courthouse on 161st Street are needed.
- Express buses to LaGuardia Airport are needed.
- Bus access to St. Barnabas HS was needed.
- Transit access to the Grand Concourse was difficult.
- There is interest a ferry service to lower Manhattan from Soundview which is being considered by the NYCEDC, and
- There is enthusiasm about Metro-North's Penn Access plan not only for quicker commute it would provide to Manhattan but also because it would further open up job centers in Westchester and Connecticut.

Notably, nearly all issues raised were related to the inadequacies of the bus service, rather than the subways. This reflects both the problems this CB has with the quality of the bus service and the relative importance of buses to their mobility needs.

Brooklyn Community Board 5

Brooklyn Community Board 5 covers an area stretching from Broadway Junction south through New Lots to Starrett City and Spring Creek. Its subway service in the northern part of the district is plentiful, particularly where five lines converge at Broadway Junction at the CB's border, but service is slow and indirect to many places, particularly on the J line. The L line operates at the western edge of the district and the #3 penetrates the area and terminates in New Lots. The southern portion of the area is a "two-fare" zone and likely to be remote from many destinations.

There are parts of 13 local bus routes that operate in the district, generally covering the area well with a few exceptions. Of these, four are designated as Queens routes and are routed between the two boroughs. Bus service tends to be widespread in the southern portions of the district, particularly in Starrett City and Spring Creek, to compensate for the absence of any subway service. Three routes also operate as expresses to compensate for the isolation of these two neighborhoods.

Efforts to set up an outreach meeting with this community board were unsuccessful, despite repeated attempts. At one point a meeting was set up but a snowstorm forced its cancelation. Attempts to reschedule were also unsuccessful.

Manhattan Community Board 11

Manhattan Community Board 11 area is located between the Fifth Avenue and the East River from 96th Street north in Manhattan, entirely in East Harlem. The district's population stood at 120,500 according to the 2010 US Census, on a land area of just 2.4 square miles, putting the density at just over 50,000 persons per square mile. The district also includes Randall's and Ward's Islands (now joined), where 1,600 people live, largely in institutional quarters.[1]

Fifty percent of the population identifies themselves as Hispanic, and another 31 percent as black. The white population has grown by 69 percent in the 2000 to 2010 period, while the Hispanic and black populations have each declined. Three quarters of the households do not have an automobile available to them, 20 percent own one car, and a mere five percent own two or more. This 70/20/5 split mirrored closely the borough-wide average of 72/24/4.

The district is served by 19 bus routes, six with limited stops through the districts. These local routes cover the district thoroughly, operating on all the major north-south avenues, and on the major east-west streets of 96th, 106th, 116th and 125th Streets.

Subway service is confined to the Lexington Avenue line, with four stops from 96th to 125th Street, the last with express

1 Originally, the study was not going to look at Manhattan. However, the advisory committee felt that representation in the northern third of Manhattan was important. Manhattan Community Board 11 in East Harlem was chosen because it lacked subway coverage on its eastern half and it had limited east-west bus options.

trains (#4 and #5), with the local #6 service stopping at all of them. Five routes that operate along 125th Street offer service to the subway lines to the west, all out of the district.

The Metro North commuter railroad stops at 125th Street and Park Avenue in the northwest corner of the community board, where "reverse" service to Hudson Valley and southeastern Connecticut destinations are available.

The community board discussion, which included the major officers of the community board, produced the following key observations, concerns and suggested solutions:

- The M116 bus is very crowded for students traveling to Manhattan Science H.S.
- The new East River Plaza shopping center, the only shopping mall-style commercial center in East Harlem and with many national chain stores, located east of First Avenue between 116th and 119th Street, requires more than one transfer for many residents. Anyone beyond walking distance requires the use of the M116 bus which can be infrequent and/or crowded. The north south lines that connect to it are infrequent in some cases, especially the M1 and M101. Some routes do not extend north of 125th Street, and make it more difficult to reach that shopping center for those living to the north. Options for more direct service should also be considered.
- Reaching locations on the west side often requires two or more transfers. The M96 is infrequent during off hours. The M101, M102 and M103 are subject to bus bunching and consideration should be given to dividing these long routes. The M98 is a good service but does not run in off-peak hours or on weekends.
- Access to Randall's Island is dependent on the M35 bus route, which is also used by homeless and institutionalized members of the population to reach the facilities on the Island, mostly by boarding at the route's terminal at Lexington Avenue and 125th Street, causing crowded conditions that are unpleasant for all riders. (Following the meeting RPA experienced the difficulties firsthand on the M35 by riding this route, boarding at 125th Street). The community board has been in discussions with the MTA without a resolution to date. A number of remedies were suggested by MN11 members. These include:

  i. Extend the M100 onto Randall's Island and eliminate the M35. This would provide more frequent and less crowded service. It would also ease the pedestrian crowding issues at the M35 terminus.

  ii. Move the 126th Street Bus Depot onto Randall's Island and have the M15SBS and M15 local terminate on Randall's Island. This would also improve service frequencies and make use of articulated (longer, sixty-foot) buses as well as eliminating the M35 terminus. Moving the depot would also free up valuable real estate in upper Manhattan.

  iii. Extend a bus line through Randall's Island and into Queens. Such a route would require shorter headways and larger buses. Extending the line to Queens would also give residents of this borough direct public transit access to the Island.

- Transit service to recreational points in Queens, such as Citifield and Arthur Ashe stadium are limited.
- Access to the handicapped was also extensively discussed. Currently, there are a host of issues that limit the mobility of seniors and handicapped individuals. Among the remedies suggested were the revamping of subway escalators to accommodate wheelchairs, and the modification of the E-Hail program to accept them. The Access-a-Ride program was described as woefully inadequate today.
- The group was upset at the rejection of the M60 as an SBS service along 125th Street. However, since the meeting, there was a reversal and the M60 SBS has now opened, serving both the community and those using that route to reach LaGuardia Airport.
- The group expressed support for the Second Avenue subway continuation to 125th Street.

Staten Island Community Board 1

Staten Island Community Board 1 is located on the northern portion of the island. Given the nature of the Staten Island transit system and the isolation of the Island from the rest of the City, it was difficult to focus on the transit needs of just this area without fully considering the needs of the entire island. Therefore, the outreach meeting invited and included residents throughout the borough.[2]

The public transit system on Staten Island has two purposes – to serve people who travel within the Island and to serve those wishing to travel off-Island, largely to Manhattan. The locally oriented service is primarily local buses; 22 routes attempt to cover the 59 square miles of the borough. Fifteen of these routes also serve an off-island function – 12 by bringing riders to St. George to the ferry, two to Bay Ridge, Brooklyn, and one to the New Jersey Transit light rail line in Bayonne. The second purpose of Staten Island's transit system is to provide access to Manhattan. On Staten Island this is done in two ways – connections to the ferry at St. George by bus and by the SIR, a 14 mile, 22-stop rail line running the length of the borough along its southeastern flank and by the 28-route express bus network that uses the Verrazano-Narrows Bridge into Brooklyn and then to the Brooklyn-Battery Tunnel into Manhattan.

The community board discussion produced the following key observations, concerns and suggested solutions:

2 Selecting one community board for Staten Island was particularly difficult; however, transit deficiencies are similar throughout the island. While SI1 was selected, much of this report combines the research for the entire Island and thus much of the material and recommendations are presented for the entire borough.

Local Buses

- S40/90 is slow and crowded, in part because of school children use. The west shore expressway currently has no local bus service making the Teleport and DMV (the only one on the island) hard to reach.
- Local bus service does not solve the problem of travelling from the North Shore to the South Shore. Additionally, bus stops are poorly placed.
- There should be bike racks on buses.
- Buses will be further slowed when the SI Ferris Wheel opens.
- A reconfiguration of the S66, S57, and S54 routes is needed.

Express Buses

- There should be free transfers to and from express buses and other MTA services.
- The MTA should notify passengers of the presence of empty seats on express buses (perhaps using some form of sensor that detects if a seat is occupied) to avoid standees on long trips.
- Express buses from Tottenville should be reestablished.
- Express buses stop too frequently in Manhattan.
- The S89 should have a longer service span.

Ferry

- There is a desire for south island ferry service.
- Using ferry terminals as economic development opportunities was mentioned multiple times.
- It was suggested that tourists should pay to use the ferry while it remained free for residents of Staten Island.

North Shore

- There were mixed messages regarding the MTA decision to pursue this right-of-way as a busway. Many preferred light rail, but there was no strong consensus.

Miscellaneous

- There should be a bus or ferry service between Staten Island and Queens, particularly to make the new Ferris wheel and outlet mall more attractive.
- The NYC subway should be extended to Staten Island.
- There should be a bus service between Newark Airport and Staten Island.
- There should be two free transfers with MetroCards because of the excessively long trips Staten Island residents make.
- Increased frequencies were suggested to help boost SIR ridership.
- Traffic signal prioritization was suggested to help buses and cars move more efficiently on the Island.
- There are an insufficient number of places (TVM and retail outlets) to purchase MetroCards on Staten Island.
- There were repeated concerns of car pollution and the health effect it has on the local population.
- Bridge tolls were a lightning-rod issue, with strong interest in seeing lower tolls, even if current tolls might be used to improve transit.
- The general consensus of the group was that the Island has been neglected by the MTA and City.
- The fact that Staten Island has the longest commute time in the country was brought up multiple times. This reduces the quality of life for those on the Island as well as their ability to compete economically.

Outreach Summary

Residents of these areas have strong feelings about transit improvements, which they see as necessary and desirable. The reported feedback from these meetings was not scientific or exhaustive. Some of the outreach meetings were very well attended, others less so; some groups were more attuned to transit issues than others.

A number of themes emerged from the process. The local residents were overwhelmingly concerned about the quality of the bus service – it is too far away, it is slow, it is infrequent, and it is indirect for the places they most want to travel to. Some destinations are not served at all, especially to jobs sites nearby. The major complaint about subway service was its absence in their neighborhoods, which is understandable since the communities selected, for the most part were beyond walking distance of the subway network.

All concerns and proposed solutions should be addressed, even those that some might dismiss out of reach. In the next sections of the report, we take a quantitative approach to answer similar questions and find that residents' concerns are very real, and generally borne by the data.

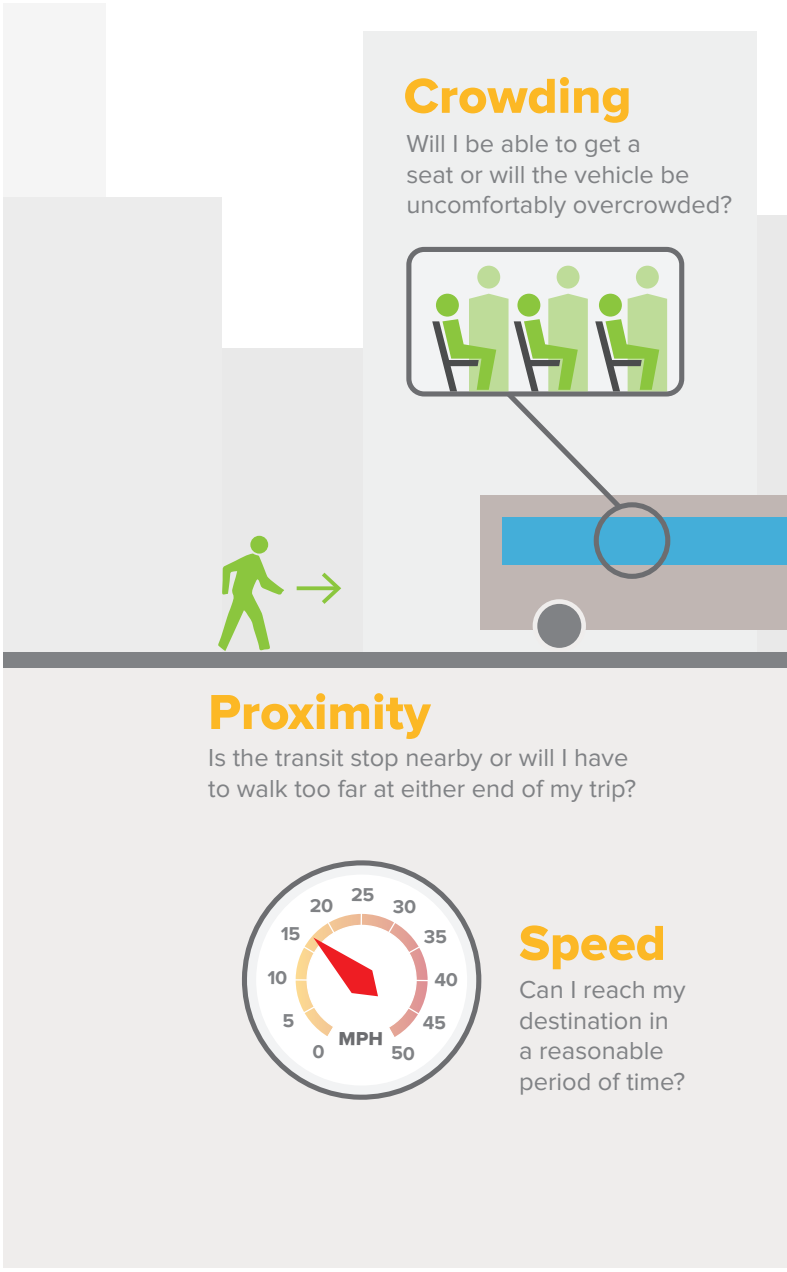
Nine Characteristics That Determine the Attractiveness of Transit

This section explores the characteristics that define how riders perceive the transit system, to isolate the factors causing performance to fall short of some reasonably objective standards. Many interrelated and complex factors go into the decision to use transit for a particular journey. Individuals considering transit may ask a series of questions, listed below. If all these could be answered favorably, ours would be a system that all New Yorkers could be proud of.

- **Proximity**: Is the transit stop nearby or will I have to walk excessive distances at either or both ends of the transit trip?
- **Frequency**: Will I have to wait at the transit stop an excessive amount of time?
- **Span**: Is the transit service available and /or frequent enough at the times I need to make the trip, particularly during late at night or early morning?
- **Speed**: Is the transit service slow, requiring a long time to reach my destination?
- **Crowding** (capacity): Will I be able to get a seat or will the vehicle be uncomfortably overcrowded?
- **Reliability**: Does the transit service arrive when I expect it to, based on the schedule?
- **Connectivity**: Will I get to where I am going without transferring to a second or worse a third vehicle?
- **Amenity**: Does the service give me a sense that the transit provider is interested in offering a high class service, including creature comforts, useful and timely information, and a pleasant physical environment?
- **Price**: Can I afford the fare or is it a heavy financial burden?

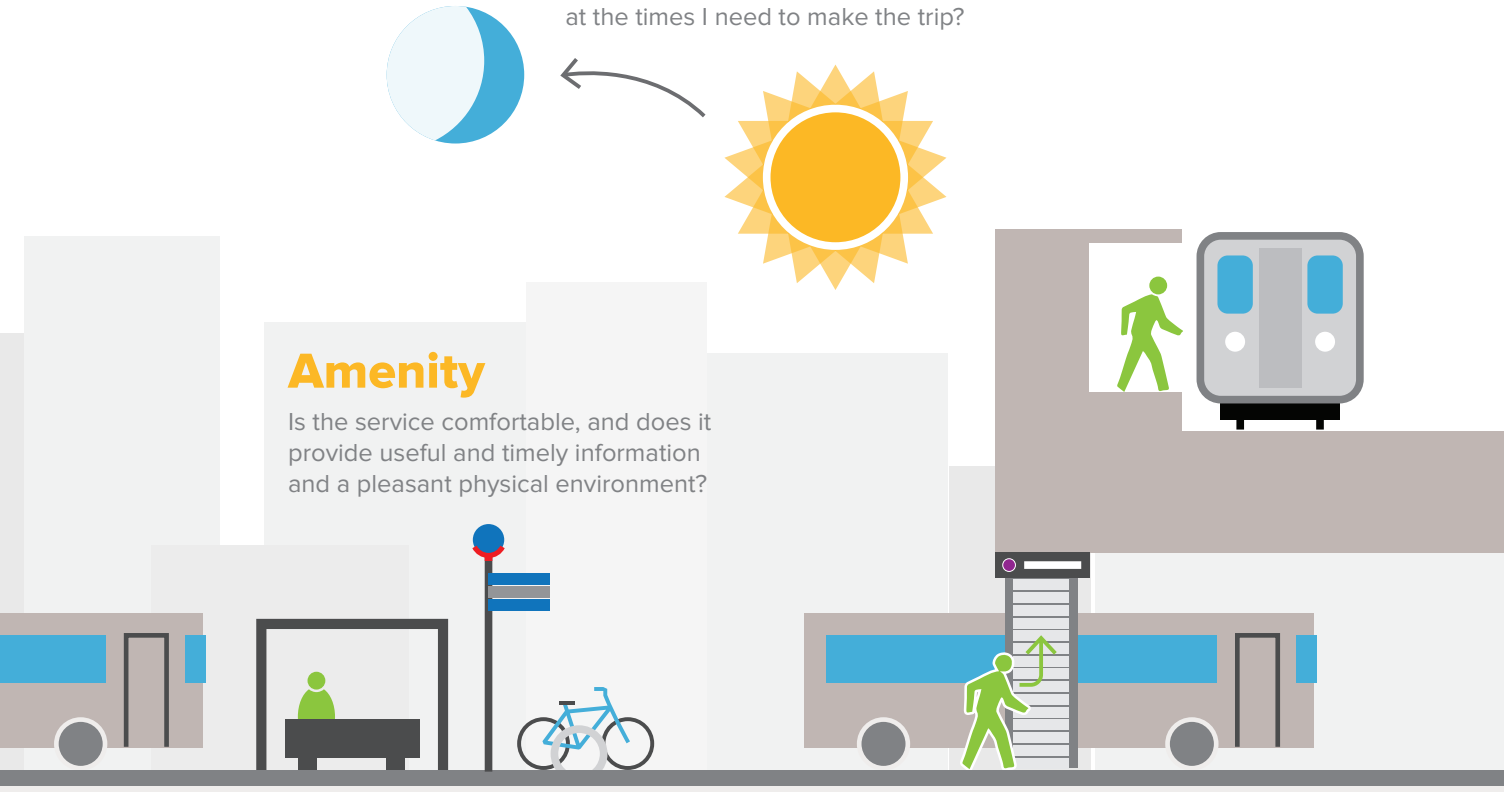
Each of these are factors can be identified with one word, with the number of mentions from the outreach meetings given here in parentheses: proximity *(17), frequency (7), span (4), speed (14), capacity/crowding (6), reliability (2), connectivity (15), amenity (6), and price (4).* A few stand out: proximity, connectivity and speed. This finding suggests that recommendations in this report should prioritize addressing these issues. It is also notable that concerns about price emanated primarily from Staten Island, where travel to Manhattan is more expensive for some commuters.

For each of these features the transit system should be able to provide the service at an acceptable standard. In this section performance standards are presented, where applicable, and are then applied to identify the deficiencies across the system. Some of these factors lend themselves to route- or geography-specific analyses, while others are system-wide in nature. Most of these are applicable to both the bus and subway systems, while a limited number are also relevant to the less widespread commuter rail and ferry services in the boroughs.



Span

Is service available and frequent enough at the times I need to make the trip?



Amenity

Is the service comfortable, and does it provide useful and timely information and a pleasant physical environment?

Frequency

Will I have to wait too long for a train or bus?

Connectivity

Will I get to where I am going without transferring to additional trains or buses?

Reliable

Does the transit service arrive when I expect it to, based on the schedule?

Price

Can I afford the fare?

Table 6: Share of NYC Population within Walking Distance of Buses, Subways and SIR by Borough

		Served by Local Bus		Served by Express Bus		Served by Subway		Served by Subway and/or Express Bus	
Borough	Total Pop	Population	Percentage	Population	Percentage	Population	Percentage	Population	Percentage
Bronx	1,385,108	1,352,410	97.6	716,034	51.7	805,235	58.1	1,051,276	75.9
Brooklyn	2,504,700	2,457,356	98.1	604,731	24.1	1,617,994	64.6	2,003,849	80.0
Manhattan	1,585,873	1,582,652	99.8	770,657	48.6	1,306,646	82.4	1,413,464	89.1
Queens	2,230,722	2,137,137	95.8	1,056,408	47.4	736,491	33.0	1,522,612	68.3
Staten Island	468,730	397,993	84.9	326,187	69.6	65,269	13.9	344,177	73.4
NYC	**8,175,133**	**7,927,548**	**97.0**	**3,474,018**	**42.5**	**4,531,635**	**55.4**	**6,335,380**	**77.5**

Sources: U.S Census Bureau 2010, Metropolitan Transit Authority, Regional Plan Association

Proximity

Is the transit stop nearby or will I have to walk excessive distances at either or both ends of the transit trip?

The subway and bus networks in New York City are very extensive; New York also has the most extensive passenger rail network of any U.S. city and rivals the extent of systems in other world cities. The subway system is 231 miles long, has 468 stations, and provides 26 separate services. There are 228 local bus routes in the five boroughs and another 45 express bus routes designed to move travelers to Manhattan from areas without subway service. Table 6 summarizes the population within walking distance of these services and Figure 6 shows where these areas are. The table assumes that the acceptable walking distances are one-third of a mile for subways and express buses and one-quarter of a mile for local buses.

As Figure 7 shows, the local bus service covers almost all of the populated parts of the city; 97 percent of the city's population is within walking distance of at least one bus route. Only Staten Island dips below 95 percent coverage. Of course, being near a bus route does not guarantee that the bus service is necessarily going where a particular rider wishes to go.

The subway system's coverage stands at 55 percent. Manhattan leads the way with 82 percent covered, and Staten Island lags at only 14 percent, accounted for by the Staten Island Rapid Transit system. When express buses are combined with subways (the premise being that they fill in gaps in subway coverage) then the subway and express bus combination climbs to 77.5 percent overall and at least 68 percent in each borough. The express buses alone provide extensive coverage of Staten Island, compensating for the absence of a robust rail system. To a lesser extent the same thing is true for Queens. However, they are not a direct substitute for the subway for a number of reasons because, for the most part, they do not operate throughout the day, late into the evening and on the weekends, and unlike the subway, they are largely point to point services that give access to only a limited number of locations in Manhattan.

The areas that stand out as being beyond a reasonable walk from the subway are concentrated in northeastern Queens (including the College Point and Whitestone), southeastern Queens (Springfield Gardens, Laurelton, Hollis, St. Albans, Rosedale, and South Jamaica), and south central Queens (Glendale, Maspeth, Middle Village), portions of south Brooklyn (Flatlands and portions of Canarsie) , the south central Bronx (Morrisania and East Tremont), the northwest Bronx (Riverdale), a number of neighborhoods in the northeast Bronx, and in the Lower East Side of Manhattan. Additionally, the only rail service on Staten Island is found along its southeastern flank; the rest of that borough relies on buses.

There is a long history of planning for the expansion of the NYC subway system to fill in some of these gaps. This will not be fully recounted here. Suffice it to say that gaps still exist and needs remain. The recommendations section of the report offers some approaches to fill these gaps.

Commuter rail and ferry coverage, when compared to the bus and subway coverage in the boroughs is extremely limited and their fares are considerably higher than subway or local bus fares. Thirty-six commuter rail stations are within New York City. Queens has 17 LIRR stations, mostly serving the outer portions of that borough that fill in the gaps in the eastern part of the borough without subway service. The Jamaica Center station provides connections to and from the LIRR with three subway line and many bus routes. The Bronx has 13 stations on the Harlem and Hudson lines operated by Metro North. A number of them have very limited service, particularly those in the southern part of the borough. The Fordham Road station is well situated to connect parts of the Bronx with the Westchester suburbs. Brooklyn has only three stations, with only Atlantic Terminal providing frequent service to Downtown Brooklyn. In Manhattan, the 125th Street station is well located for access at from 125th Street connecting Harlem to the Westchester suburbs. The two major stations – Grand Central and Penn Station offers wide access to the region and beyond.

Other than the Staten Island ferry, waterborne passenger service today is limited to the one Rockaway stop, Bush Terminal in Brooklyn and four Brooklyn and one Queens stop on the East River. These ferry stops only serve a small number of borough residents.

Figure 6: Subway and Express Bus Coverage in New York City

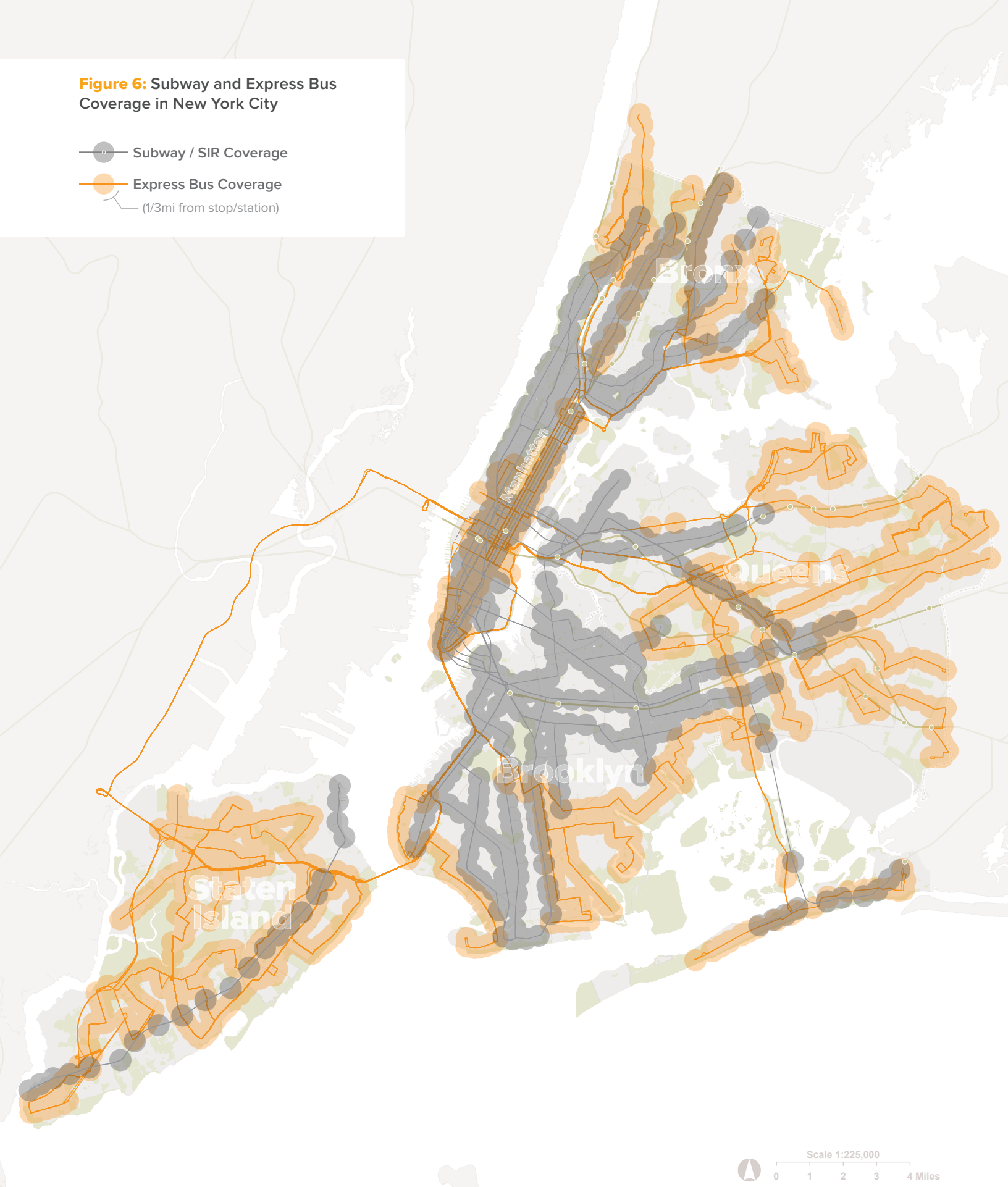


Figure 7: Local Bus Coverage

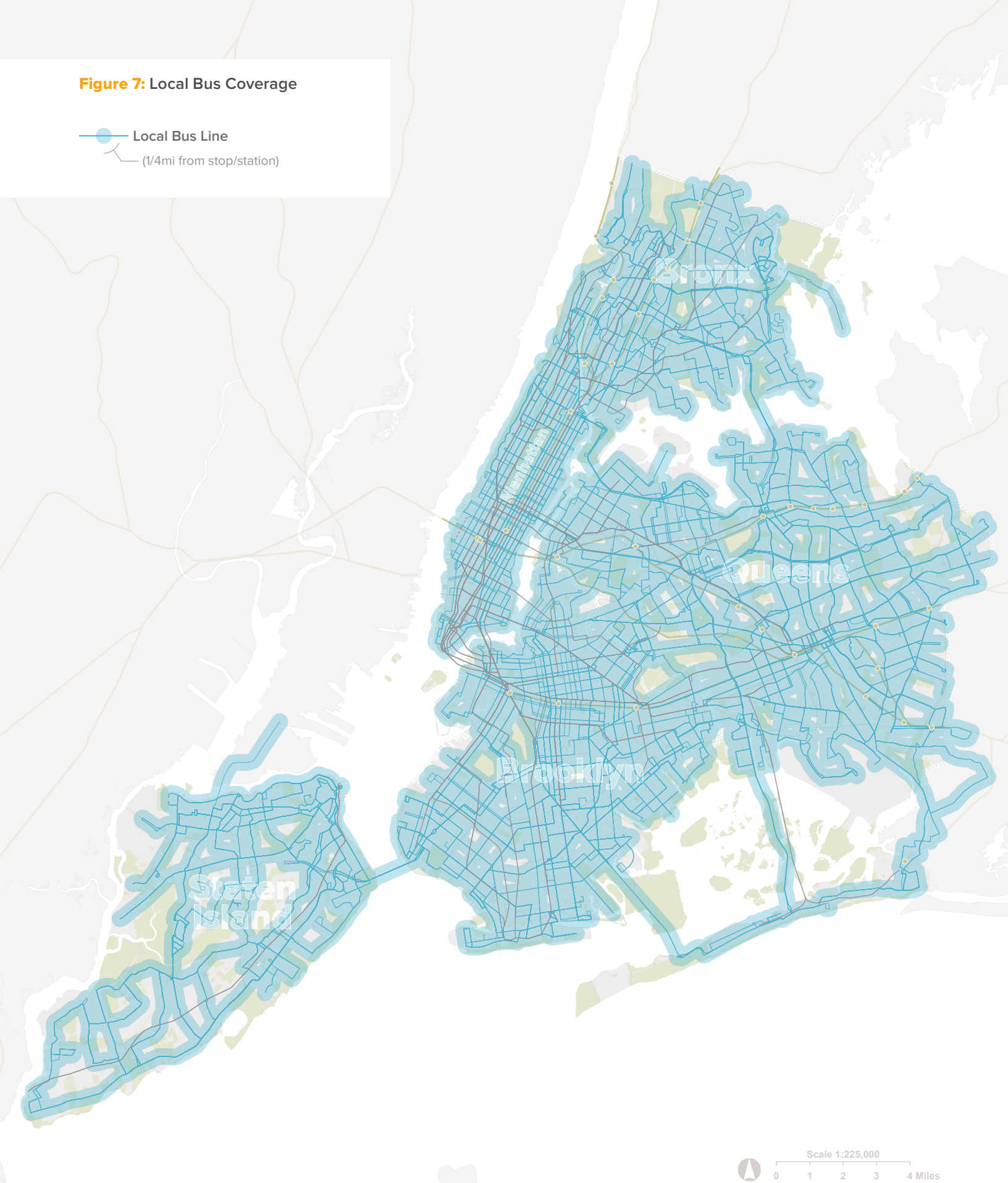
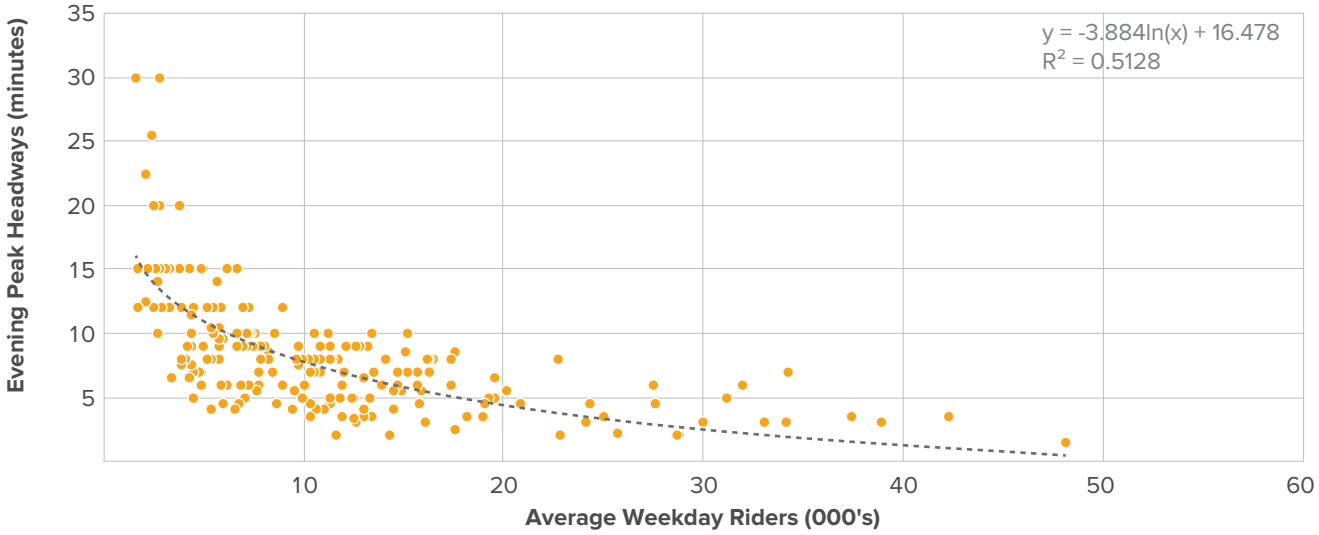


Figure 8: Evening Peak Headways and Weekday Ridership – MTA Local Bus Routes



Frequency

Will I have to wait at the transit stop an excessive amount of time?

Acceptable level of service must be weighed against ridership levels and the financial ability of the transit operator. It would be desirable to have service arrive every minute or two on every route every hour of the day, but this is not feasible. The transit operator must attempt to provide service in proportion to existing ridership. Yet, more service would likely result in more riders and conversely, less service would make it less attractive.

The question then is: Are there routes, times of day, and days of the week when the service delivered is less than it could be given existing ridership? With respect to buses, research has shown that when buses arrive every 12 minutes or less, passengers do not find it necessary to consult a timetable.[1] This is especially convenient for travel to and from work, which usually occurs in the traditional morning and evening peak hours. Accordingly, frequency performance standards are set here as follows:

- Six per hour or every ten minutes during peak hours;
- Four per hour or every 15 minutes during midday and the evening until 9pm; and
- Three per hour or every 20 minutes throughout weekends.

However, these standards might be too demanding if the ridership is not there. To test this, a series of four scatter diagrams were developed to compare ridership with current service frequencies on MTA bus routes. Figure 8 shows one of these which plots for weekday ridership against evening peak period headways, which is the span of time between departure of one bus and the arrival of the next.

Figure 8 indicates a reasonably close and expected relationship between the two. In general, the more riders there are the lower the headways. But if there are fewer riders, keeping a more exacting headway standard could result in excessive service and empty buses. Thus, the headway performance standard was relaxed using the relationship in Figure 8 and similar ones for the morning peak and midday periods, and for weekends. If weekday ridership dipped below 4,000 per day, the headway peak period threshold increased from 10 to 12 minutes and if it dipped below 2,000 per day it was relaxed still further to 15 minutes. Similar adjustments were made for middays and weekends. The application of these standards produces a list of local bus routes that could use more service. Table 7 enumerates how many routes in each borough fall short of adequate service frequencies at various times of day and days of the week. The table is most revealing in two respects. First, the evening peak has more inadequate routes than the other times. Second, the borough of Queens clearly is the most poorly served by this measure, accounting for well over half of the all the routes that fall short of meeting service frequency thresholds. Fifty-two separate routes have insufficient service during one of these five time periods, 24 in Queens alone. These routes are provided in Appendix C to this report.

There are also routes that meet the minimum standards but are so heavily used that they could use even more service. Using the scatter diagrams and best fit curves like the one in Figure 8, routes were identified that fall short of the service frequency that their ridership suggests. These are summarized by borough and time period in Table 8 and detailed in Appendix C. Brooklyn stands out as the borough with more instances where more frequent bus service is needed. In contrast there are no instances where Staten Island routes are so well used that they should be receiving more service than they currently receive. Forty-seven instances on 36 separate routes "deserve" added service based on this analysis. When added to the 56 routes falling short of the minimum thresholds, a total of 92 local bus routes of the 228

1 P.A. Seddon and M. P. Day, "Bus Passenger Waiting Times in Greater Manchester, Traffic Engineering and Control; January 1974.

Table 7: Bus Routes by Borough With Inadequate Service Frequency

	Weekdays			Weekend	
	AM Peak	Midday	PM Peak	Saturdays	Sundays
Bronx	2	2	4	1	1
Brooklyn	3	7	7	0	2
Manhattan	3	0	5	0	0
Queens	11	18	15	5	6
Staten Island	4	1	6	1	0
TOTAL	**23**	**28**	**37**	**7**	**9**

Source: Regional Plan Association

Table 8: High Ridership Routes Deserving Service Greater Than the Minimums

	Weekdays			Weekend	
	AM Peak	Midday	PM Peak	Saturdays	Sundays
Bronx	1	2	3	1	1
Brooklyn	4	5	7	0	3
Manhattan	4	0	4	2	2
Queens	1	2	1	2	2
Staten Island	0	0	0	0	0
TOTAL	**10**	**9**	**15**	**5**	**8**

Source: Regional Plan Association

Table 9: Local Bus Routes by Borough With Insufficient Late Night Service

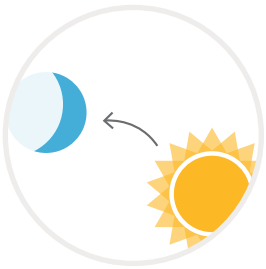
	Service Ends at:							
	7pm	8pm	9pm	10pm	11pm	Midnight	Total	All Routes
Bronx		1	1	1	3	14	20	39
Brooklyn			1		1	20	22	50
Manhattan		1			1	9	11	36
Queens		3		1		29	33	74
Staten Island	1				1	10	12	32
TOTAL	**1**	**5**	**2**	**2**	**6**	**82**	**98**	**231**

Sources: Metropolitan Transit Authority, Regional Plan Association
Note: The number of local bus routes in the city differs from table to table in this report, since the data varies by source. Some bus routes have variants that are counted in some cases and not others, and limited express service are sometimes counted and other times not.

in New York City are found to warrant additional service. The routes summarized here are listed in Appendix C.

The subway frequencies were examined to see if service fell short of the bus frequency standards. In no case did the subway not meet these standards. In contrast, almost all of the commuter rail stations have service that fell short of the frequency standards, the exceptions being Jamaica and Woodside on the LIRR and 125th Street and Spuyten Duyvil on Metro North. In those cases, riders are more likely to find it unnecessary to consult a time table in planning their arrival at the station.

In sharp contrast, the 36 commuter rail stations (excluding Grand Central Terminal and Penn Station) fall woefully short of providing frequent service in the boroughs. Only Woodside and Jamaica in Queens and 125th Street in Manhattan reached the 10 minute standard in the peak period for reverse commuters or the 15 minute midday standard. In the evening after 8pm the inner LIRR Brooklyn and Queen stations west of Jamaica and the Port Washington branch stations offer 30 minute service or better. Across the board, the southeast Queens and the Bronx stations do not reach any of these standards.



Span

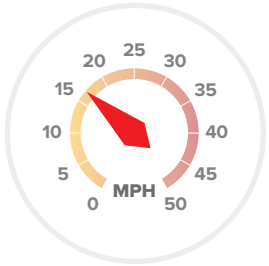
Is the transit service available and /or frequent enough at the times I need to make the trip, particularly during late at night or early morning?

Many New Yorkers depend on transit to get home from jobs that end well into the night. This is particularly true for late night shifts at hospitals and for restaurant workers. The subway operates on a 24-hour schedule but none of the bus routes do. Assigning performance standards to this feature is straightforward, if somewhat arbitrary: if there is bus service on weekdays as late as 1am then the bus route passes the test. While the compilation below indicates routes without weekday service as late as 1am, it might not be necessary to provide this level of service for routes with insufficient ridership. Only by examining the evening ridership patterns route by route could a definitive judgment be made. As Table 9 shows, the MTA provided local bus service until at least midnight for all but a handful (16) routes. Eighty-two routes end around midnight. The table provides a starting point to determine if there are some routes where late night service might be expanded.

Subway service in New York City, unlike any metro in the world, operates on a 24-hour basis. This puts an enormous burden on the MTA to maintain the system while trains continue to operate. For budgetary and maintenance reasons, the closing

of the system for a few hours overnight has been proposed from time to time, but has been rejected because of the burden to late night workers. However, there is now a program in placed to close service on line segments overnight to enable more rapid completion of needed maintenance tasks.

The commuter rail service at the 36 stations in the boroughs (outside Manhattan CBD) operated up to midnight in all but four stations – two lightly used stations in the Bronx, Tremont and Melrose, and Hunters Point and St. Albans in Queens. None of the ferry services operate past midnight other than the SI ferry, which operates on a reduced schedule through the night seven days a week.



Speed

Is the transit service slow, requiring a long time to reach my destination?

The speed of a bus route is dependent to a large degree on the density through which the route passes. In denser areas there is generally more traffic congestion that slows the service. There are higher ridership levels that can slow buses since the boarding and alighting process is longer. Express buses are intended to provide faster service for longer distances from areas of the city without subway service by making fewer stops and are routed over highways, which should speed them up. In Table 10 the average bus speeds for local and express service for all MTA buses is shown. As would be expected, in Manhattan the bus speeds are slowest, almost two miles under the citywide average of 8.2 mph, and in lower density Staten Island speeds are fastest, over three miles higher than the average. The ranking of speeds is the same as the average borough-wide population densities, as would be expected; the denser an area, the slower bus speeds tend to be. Express buses which operate from four of the five boroughs to Manhattan are surprisingly slow, likely a result of the time spent in Manhattan working their way through peak hour traffic.

The analysis isolated bus routes that function particularly slowly for the environment in which they operate. The average local bus route in New York City travels at only 8.2 miles per hour, slower in the Bronx, Brooklyn and Manhattan, and faster in Queens and Staten Island. Express routes average 11.4 mph. Table 10 indicates how many local routes in each borough fall one mph or more below their borough averages and how many express buses citywide fall one or more mph below the express bus average. Of the 228 local routes, 62 are characterized as slower. Fifteen of 62 express routes also fall short.

Table 10: Number of Routes by Borough with Slow Bus Speeds

		Speed (mph)	# Routes	# Routes > 1 mph Under Average
Local Routes	Bronx	7.6	39	10
	Brooklyn	7.8	50	7
	Manhattan	6.4	33	16
	Queens	9.2	74	22
	Staten Island	12.2	32	7
	All Local Routes	8.2	228	62
All Express Routes		11.4	50	15

Source: Metropolitan Transity Authority, Regional Plan Association

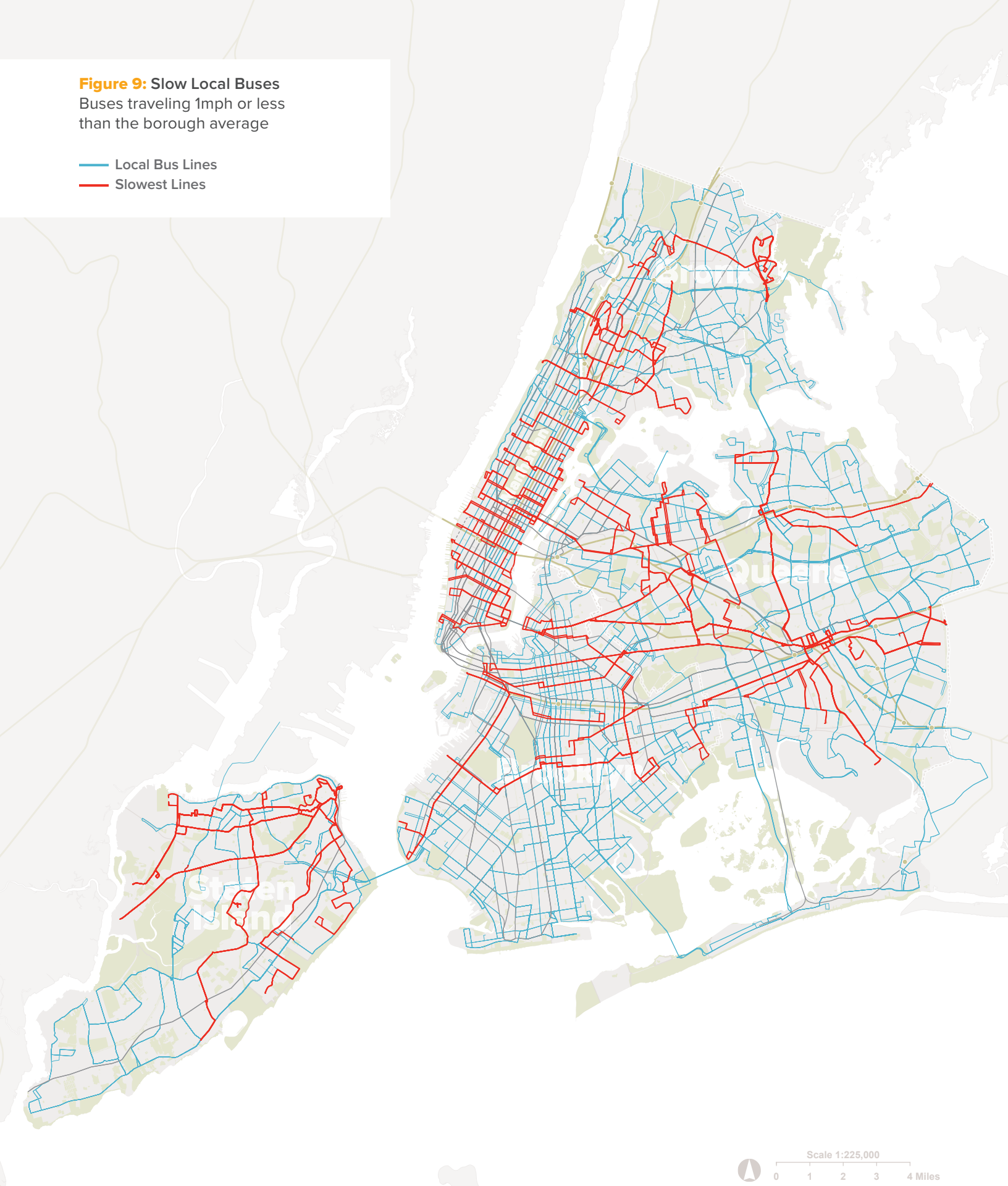
Figure 9 maps out these slow routes.
These include:

- In the Bronx, the slower routes are mostly in the south Bronx, with the exception of the B38 along Gun Hill Road.
- In Manhattan almost all of the slow routes operate as cross-towns. These routes must deal with the traffic signal green time advantage that avenues have over cross streets.
- In Brooklyn, many of the slow routes operate in an east-west direction, including routes that connect across the borough from New Lots to Sunset Park, and a number of routes that operate into downtown Brooklyn from both central Brooklyn and southern Queens locations.
- In Queens the routes that fall short of the speed standard serve Flushing, Jamaica Center, and Long Island City.
- On Staten Island all the slow routes feed directly into St. George and the Staten Island ferry. The routes operating on the north shore of the island are conspicuously included among these slow routes. They generally must negotiate narrow streets.

There are numerous steps that can be taken to speed buses. These include: increasing limited-stop bus service, increasing number of low-floor buses to speed boarding times, providing contactless fare payment , encouraging greater rear door use, instructing stricter enforcement of parking and traffic regulations, and increasing use of preferential treatments for buses. This tool box of measures can be combined to effect significant improvement in bus speeds.

Service on the New York City subway system averaged 18 miles per hour, more than twice the average local bus speed. Still, subway speeds can be increased too. Parts of the system have four tracks, allowing parallel express and local service. There are also segments of the system with three tracks, which allow for express service in the peak direction, but there are still other lines or line segments with a third track that is no longer used. These include the #4 line in the Bronx along Jerome Avenue and the Jamaica Avenue (J/Z) line in Queens. Subway service can be increased by eliminating some stops that are very lightly used and by upgrading its operation to communications based train control, a system that enables more trains to operate in the peak thereby alleviating crowding on all the lines reaching back into the neighborhoods currently experiencing overcrowding.

Figure 9: Slow Local Buses
Buses traveling 1mph or less than the borough average



Reliability

Does the transit service arrive when I expect it to, based on the schedule?

The unreliability of bus service is a source of continued frustration by riders of buses in New York City. The sight of two or three buses arriving in a pack after an overly long wait has been a staple of the New York transit experience for a long time. The MTA has taken measures to try to alleviate the problem, or to relieve some of the frustration by informing passengers when they can expect the next bus. The MTA is presently measuring this phenomenon at the bus route level on a sample basis using an indicator, but the analysis is not yet complete. It could be helpful to address specific traffic bottlenecks on a route by route basis through signal preemption for buses, queue jumping lanes, and other preferential treatments.

The subway system does not have to contend with street traffic; its reliability depends largely on how well its infrastructure functions, including its signal system. But a system as old as New York's will break down, and while the enormous investments made in the last 30 years have helped to militate against more frequent problems, more work is needed. Continued investment in the subway's infrastructure, particularly for stations and signals, is necessary to further improve its performance and prevent backsliding.

Crowding (capacity)

Will I be able to get a seat or will the vehicle be uncomfortably overcrowded?

The shortage of capacity for bus routes requires substantial detailed field data collection and analysis. However, the identification of those bus routes with high usage and deficient frequency, as summarized in Table 8 earlier, can serve as a useful surrogate. It stands to reason that routes with high ridership but inadequate service frequency are also routes that are likely to be overcrowded, and that addressing the frequency needs will result in less crowding and more capacity to serve existing riders. These routes are compiled in Appendix C.

Figure 10 highlights the twelve subway lines exceeding peak hour capacity based on RPA loading standards from the point in the network where the peak crowding conditions occur. The map shows substantial areas of the boroughs that tend to be faced with the most crowded subway lines, including much of the Bronx, east Harlem and Harlem in Manhattan, Astoria, Elmhurst, Corona, Flushing, Middle Village, Rego Park, Forest Hills, and Jamaica in Queens, and Greenpoint, Bushwick, East New York, Borough Park and Bensonhurst in Brooklyn.

Connectivity

Will I get to where I am going without transferring to a second or worse a third vehicle?

To examine how well the boroughs are connected by the subway network, high volume work-trip origin-destination[2] pairs without direct subway routes were identified and mapped. As shown in the series of maps in Figure 11A, the prevailing patterns for intra-borough poorly served markets include:

- In the Bronx, markets oriented in any east-west direction;
- In the Bronx, markets for travel within the northeast quadrant;
- In Queens, markets whose work destination were either in Long Island City or Astoria from many parts of central and eastern Queens;
- In central Queens, markets oriented in a north-south direction (e.g. between Glendale and Flushing);
- In eastern Queens, markets oriented in a north-south direction;
- In Brooklyn, markets oriented in an east-west direction toward communities along the waterfront from Bay Ridge up to Red Hook;
- In Brooklyn, from the neighborhoods of Starrett City, Spring Creek and Canarsie; and
- In Brooklyn, from neighborhoods in northern Brooklyn such as Bushwick to Sunset Park.
- The inter-borough markets with indirect or no subway services are shown in Figure 11B. These include:
- From Staten Island to the waterfront markets in Brooklyn;
- Between the Bronx and upper Manhattan;
- Between Rockaway and most of southern Brooklyn;
- From much of central and eastern Queens to downtown Brooklyn; and
- Between northern Brooklyn and south central Queens.

These shortcomings can all be traced to the limitations of the subway network. In many of the cases the indirectness in service can be traced directly to the orientation of the subway, radially toward Manhattan rather than circumferentially within and between the boroughs-- east –west in the Bronx, east-west in southern Brooklyn, north-south between northern Brooklyn and southern Queens. In other cases the subway may be routed toward Manhattan via Queens, missing Brooklyn destinations such as downtown Brooklyn or via Brooklyn, missing Queens destinations such as Long Island City. Finally, in some cases the subway just does not extent far enough, falling short of southern Brooklyn, eastern Queens, and of course to Staten Island. These findings suggest attention be paid to these underserved markets, either by expediting bus service in the short term, or subway or other rail options in the longer term.

Connectivity for bus travel is also important, especially for short trips. It is particularly galling for riders to be required to use two or more buses for short *as-the-crow-flies* trips. Where two buses are unavoidable, more frequent service, discussed earlier, would ease the burden of the transfer, leading to shorter waits. Amenities at the waiting areas, particularly weather protected shelters and "next bus" information would also be helpful. This raises the next category that can attract transit riders: service amenities.

2 Community board to community board

Figure 10: Subway Lines Exceeding Peak Hour Capacity, Standards and the Neighborhoods Affected

Source: Regional Plan Association; *Moving Forward: Accelerating the Transition to Communications-Based Train Control for New York City's Subways;* May 2014

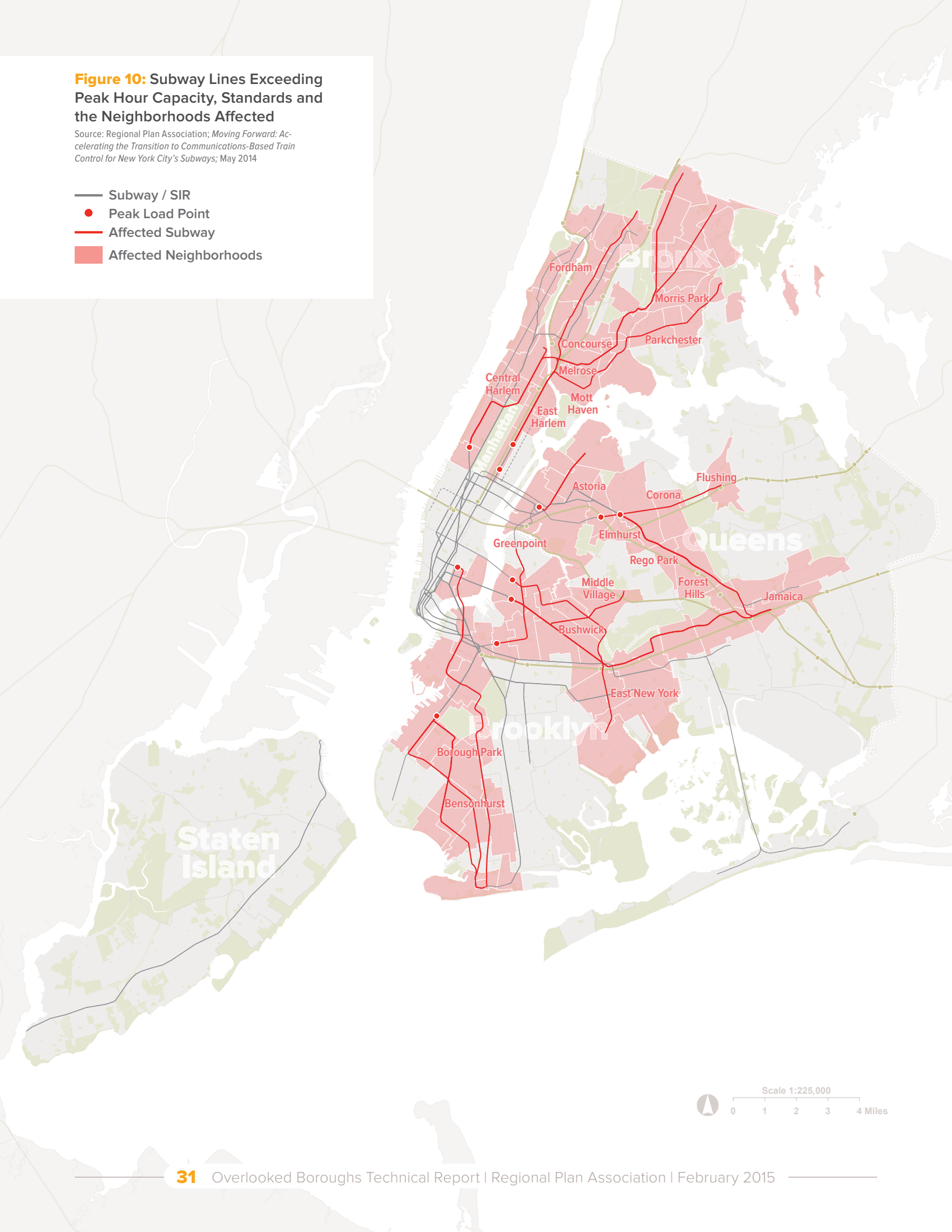
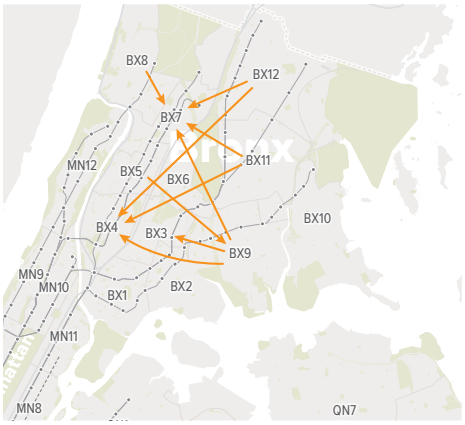


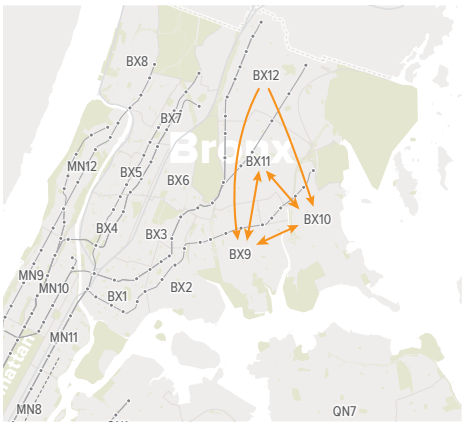
Figure 11A: Intra Borough Markets Poorly Served by Subway

Bronx

East-West



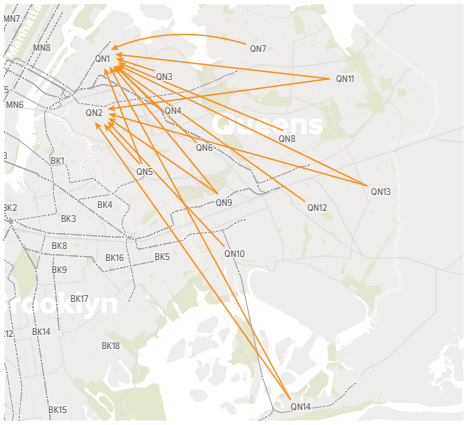
Northeast



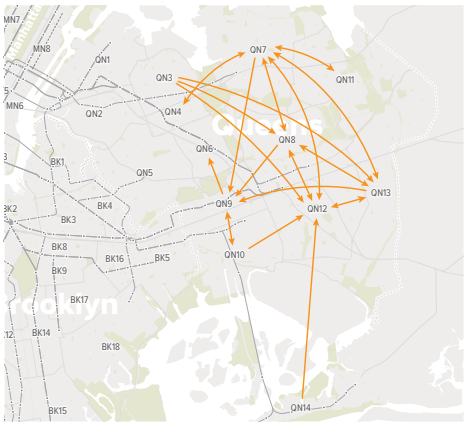
Southeast

Queens

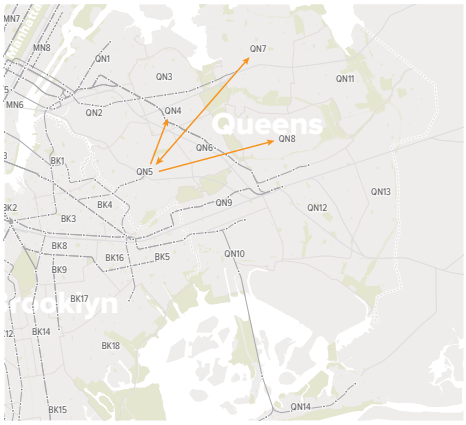
To CB1 and CB 2



East

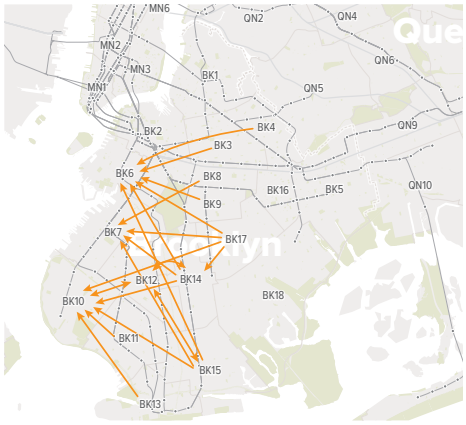


Central



Brooklyn

CB 6, 7, 10 & East-West



Inner

CB 18

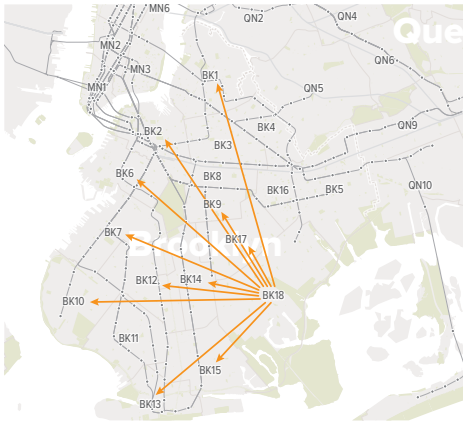


Figure 11B: Inter Borough Markets Poorly Served by Subway

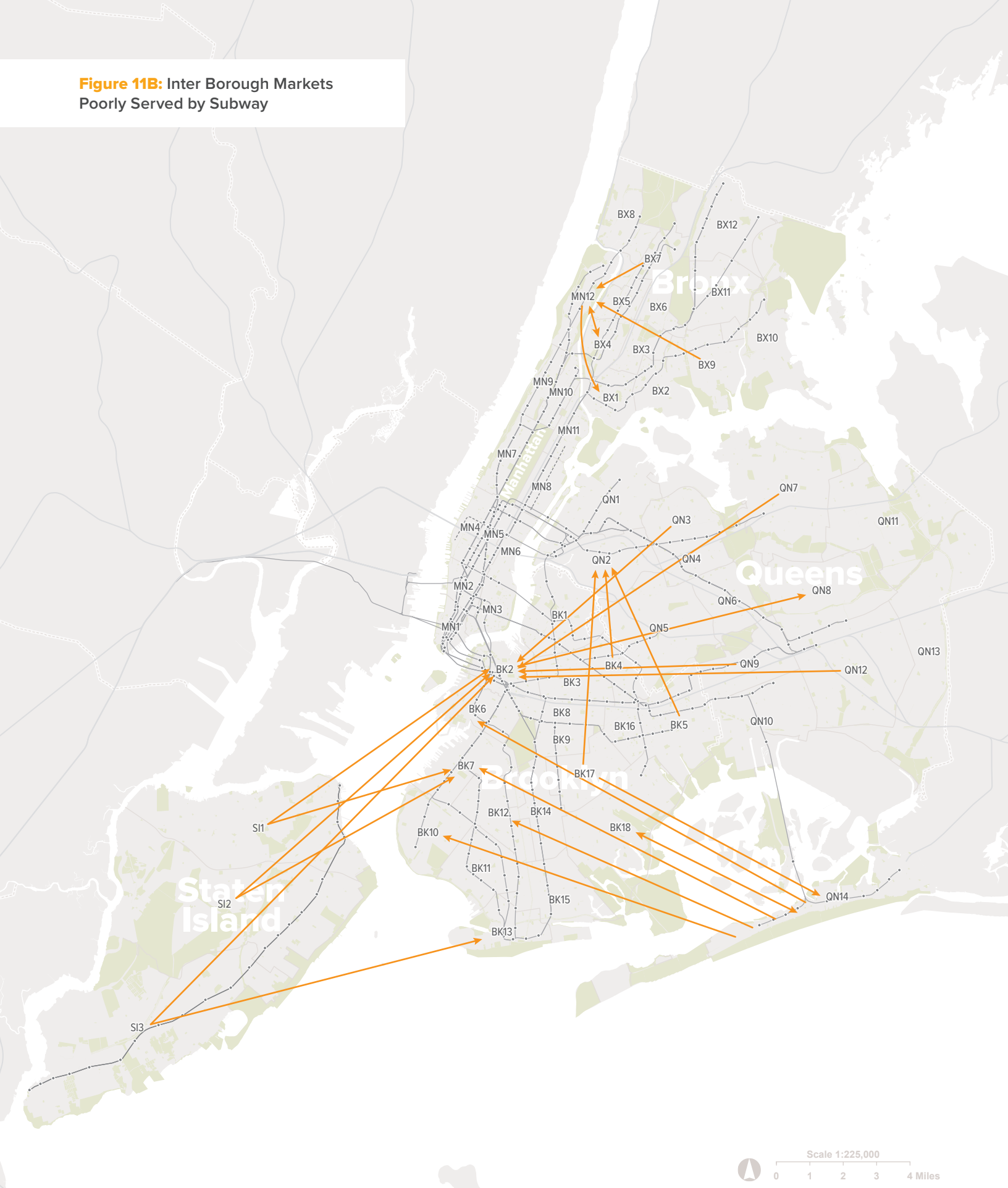


Table 11: Station Rehabilitation by Borough

		1992 to 1999		2000 to 2014		1992 to 2014	
Borough	# of Stations	Number	Percent	Number	Percent	Number	Percent
Bronx	68	6	8.8	40	58.8	46	67.6
Brooklyn	157	15	9.6	59	37.6	74	47.1
Queens	79	8	10.1	24	30.4	32	40.5
Upper Manhattan	38	4	10.5	9	23.7	13	34.2
Rest of Manhattan	79	37	46.8	18	22.8	55	69.6
TOTAL	**421**	**70**	**16.6**	**150**	**35.6**	**220**	**52.3**

Sources: Metropolitan Transit Authority, Regional Plan Association

Amenity

Does the service give me a sense that the transit provider is interested in offering a high class service, including creature comforts, useful and timely information, and a pleasant physical environment?

The subway stations are the front door for over 5 million riders a day, and their overall condition can reflect well or poorly on the MTA. Up until recently, upgrading of the stations in the boroughs outside of the CBD had been excruciatingly slow, as reflected in Table 11 and shown in Figure 12. The disparity of work done in the boroughs versus Manhattan from 96th Street and below is startling. Some of the disparity can be explained by priority given to higher volume stations, which tend to be in the Manhattan CBD, but as of 1999 only 22 stations were rehabbed in all of the Bronx, Brooklyn, Queens and upper Manhattan, while 26 were completed in Manhattan from 96th Street south. In recent years the boroughs have started to catch up, but northern Manhattan and Queens remains well behind. Much of the more recent work has been on a component-basis, rather than full rehabilitations, aimed at speeding the work and focusing on components in poorest conditions that might also be a safety hazard.

Buses are a second class mode of travel in the minds of many, not without some justification. While slow, bumpy, and unreliable might be the most likely words used to describe the bus ride itself, the off-vehicle experience also leaves a lot to be desired.

Amenities at bus stops can give the rider greater assurance that the transit operator cares. These can include bus shelters, bus schedules and maps, real time bus arrival information, and easier fare payment systems.

Shelters that are properly enclosed from the elements, with seating in a well-lit, safe environment offer both comfort and a sense of security at stops. Signage that clearly indicates the bus frequency by route and time of day and transit system maps that indicate transfer points should all be standard practice. Dynamic variable messaging signs with accurate bus arrival times can: ease rider anxiety, create a sense that the transit system is well run and reliable, and provide information about system delays and other urgent rider notifications. This information should also be made available via smartphones, web browsers, and other internet connected devices to allow riders control over their wait times. The MTA's BusTime system currently provides bus status on the internet and smartphones, based on distance from the stop rather than estimated bus arrival time, an easy to understand service indicator for riders.

Price

Can I afford the fare or is it a heavy financial burden?

Transit affordability is tied to income. In Figure 13 the City is mapped to show the share of income that is required for two people to purchase weekly MetroCards. Of course, the map does not account for individual situations and should be seen as a broad indicator of where the cost of transit may be burdensome; there may be fewer than two persons using transit in any individual household, incomes vary from the median within any particular census tract, either a monthly or single ride MetroCards may be used, etc.

The map indicates what would be expected: a pattern that closely reflects the lower income distribution of residents in New York City, particularly in the south and central Bronx, central Brooklyn, Coney Island, Far Rockaway, and Manhattan above Central Park. There are also significant sections of the city with moderate incomes and where the cost of transit exceeds five percent.

Whether these costs are excessive is discussed in the recommendations section of this report. Fare levels depend on operating budgets, labor costs, government contributions at all levels, and are part of an ongoing public debate. Suffice it to say here that many who pay large percentages of their income for public transit are disproportionately located in the Bronx, upper Manhattan and Brooklyn as indicated in Table 12. This suggests that special attention needs to be paid to the service offered in areas inhabited by low and moderate income families.

Figure 12: Subway Station Rehabilitation Progress Since 1992

Source: MTA and RPA

- Subway Station
- Rehabilitated (1992-1999)
- Rehabilitated (2000-2014)
- Component/Renewal (2000-2014)

Figure 13: Affordability of Transit Fare
Share of Income to Pay for
Two Monthly MetroCards

Source: US Census, RPA

- 0 - 4.9%
- 5 - 9.9%
- 10% or more

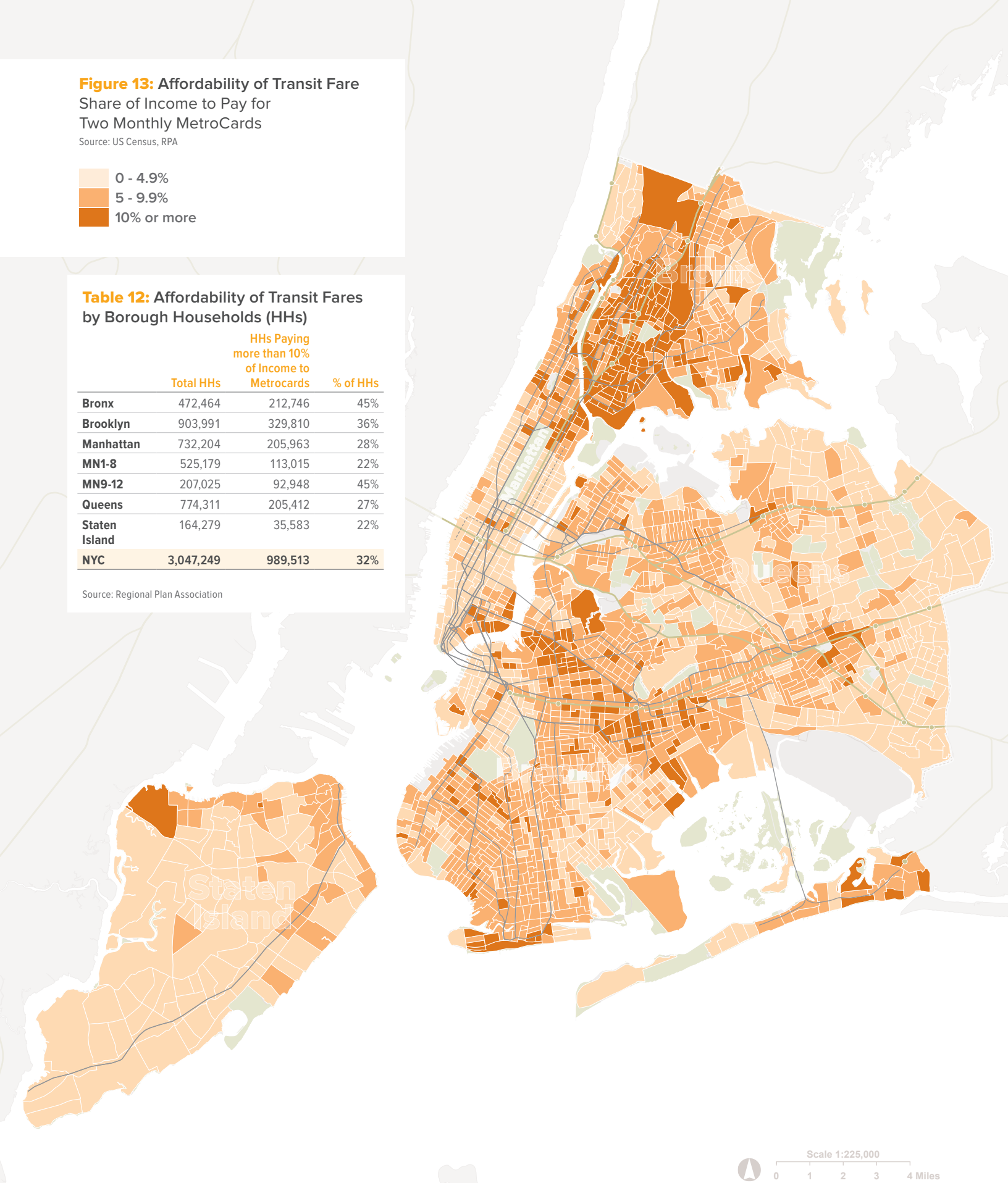


Table 12: Affordability of Transit Fares by Borough Households (HHs)

	Total HHs	HHs Paying more than 10% of Income to Metrocards	% of HHs
Bronx	472,464	212,746	45%
Brooklyn	903,991	329,810	36%
Manhattan	732,204	205,963	28%
MN1-8	525,179	113,015	22%
MN9-12	207,025	92,948	45%
Queens	774,311	205,412	27%
Staten Island	164,279	35,583	22%
NYC	**3,047,249**	**989,513**	**32%**

Source: Regional Plan Association

Recommended Actions

These recommendations aim to build on the positive features of New York City's vast transit system by addressing its weaknesses, especially ones that limit the mobility of borough residents. This translates to a set of recommendations that emphasizes the bus network and can more immediately be implemented. The objective is to improve the quality of the bus network by making it faster and more reliable. The recommendations also address the subway network and other modes that can supplement the bus and subway system, including the two commuter rail systems and to a lesser extent, ferries.

These recommendations are mindful of basic facts that underlie available travel choices. More than half of borough residents do not have access to a car. When the transit system does not meet their transit needs adequately, they have little choice but to suffer its indignities. Further, transit must overcome the dual handicap of time lost in access and in waiting for the vehicle, while these factors are largely absent for a trip made by car. For those with a car available, it offers instant availability at any time day and night, advantages difficult to overcome. This disadvantage for transit is particularly acute for shorter trips where in access and waiting times loom larger. The competitive disadvantages of transit can be overcome. When driving becomes expensive because of parking or tolls and traffic congestion becomes insufferable, the advantages that transit can offer come into play, provided transit's attractive features can be achieved.

The recommendations for improving the transit systems in the boroughs are based on the three sets of information gathered and discussed in this report. These include the analysis of the nine factors that influence transit use, the insights gained from the analysis of the non-transit factors that affect transit use, and the insights gained from the community board outreach.

The recommendations that emerge from these analyses and community inputs are reorganized by time frame of prospective implementation, i.e. what is the earliest possible time the recommendation could be put in place? Generally, recommendations that require considerable capital investment will take longer, those that can be accomplished with a change in operations or by policy fiat could happen quicker. Within that construct, the recommendations are organized by mode.

The Boroughs Deserve a First-Rate Bus System

Added Bus Service

This report identifies local bus routes in the boroughs that fall short of the reasonable standard of service frequency (see Table 7). Of the 228 local routes operated by the MTA, there are 89 instances during weekdays–in the morning peak, evening peak, or midday–when service is inadequate. Another 16 instances of weekend service shortfalls are identified. Taken together, there are 52 separate routes with insufficient service during one or more times. In addition, there are 35 other routes whose peak service levels could be increased given their high ridership levels (see Table 8). Adding service in these instances could reduce crowding.

Implementation of these recommendations would not only lead to shorter wait times and greater convenience for transit riders, but would also serve to mitigate the negative effect of transfers between buses where they are unavoidable.

Evening local bus service is also lacking in some cases. Sixteen routes end service by 11pm and another 82 end service at about midnight (see Table 9). These should be examined to determine if the last operating bus indicates a need for more late night service.

Express buses are mostly intended to fill in the gaps where subway service is lacking, even so, these buses almost exclusively serve the morning and evening peak periods leaving midday, late night, and weekend customers unserved. This provides support for the recommendation to operate express bus service at times other than the peak on weekdays and on the weekends.

The limited bus service to Brooklyn destinations from Bay Ridge, Bush Terminal, Sunset Park, and Red Hook indicates that expansion beyond the one Staten Island route to Brooklyn be considered, delivering riders to the R line subway station at 86th Street to distribute them further north. To the MTA's credit, there are already three Staten Island routes that do this. Other new or modified routes were suggested during the outreach process, including one along the industrial park area on Zerega Avenue in Bronx Community Board 9 (a direct route from that CB to Hunts Point versus the two buses presently required for a short trip to a major work destination), and a modified route to deliver workers to the industrial parks in Maspeth, Queens. The repeated mention of service to industrial areas suggests that the MTA should take a close look at all bus service to these areas.

Taken together, these recommendations for more bus service, if fully implemented, would hardly come free. They would have a significant impact on the MTA's operating budget, potentially requiring added rolling stock, bus storage, and maintenance facilities. A rough estimate of implementing the full set of bus service recommendations comes to about $28 million annually, which though less than one percent of the $3 billion spent annually for bus service, should be approached judiciously given the difficult budget situation. Thus, these recommendations should be seen as a starting point for the MTA with incremental changes implemented first, ones that could be accomplished with limited or no additions to the bus fleet or to bus facility requirements. As such, this report recommends the MTA initiate a demonstration program that selects two or more routes in each borough for both local and express bus service improvements in each time category, including late night local bus service, to demonstrate the value of the added services. Such a demonstration project would cost the MTA $10 million per year.

Each added service in the demonstrations would have a sunset clause that would result in the cessation of the demonstration should ridership gains not warrant their continuation. The experiment period should be two years. Ridership gains would be closely monitored. These criteria would be made public beforehand and publicly advertised on the routes, i.e. use it or lose it. Transportation advocates would also be asked to assist in deciding if the demonstration should be continued. Patterns of success (or failure) would suggest where further service increases should be tried. Of course, it would be valuable for the MTA to do this for all their routes and publicize them in order to make their decision making process more transparent.

Speedier Bus Service

Perhaps the most cost effective way of improving service to the boroughs is to speed up buses, particularly for markets where the subway option is poor, as highlighted in the discussion of subway connectivity. Unlike other recommendations requiring the addition of service that would add to the operating budget of the MTA, or new facilities that would add to the capital budget of the MTA, faster buses can actually save money. They do this by making the driver more productive, which in turn can be converted either into cost savings or more service. Thus, faster buses benefit both the MTA's bottom line and customer needs.

Buses are slow for many reasons.

- Spacing between bus stops is too close.
- It takes time for passengers to board and alight buses. Bus designs with high steps make matters worse.
- It takes time to process fare collection as customers fumble for their MetroCards.
- Many customers use the front door to leave the bus, delaying boarding passengers.
- Buses have to negotiate their way through traffic congestion.
- Buses, as do other vehicles, stop at traffic signals.
- Buses must share the street and even their dedicated stops with other vehicles, negotiating around: taxis picking up and dropping off customers, double parkers, illegal parkers in bus stops, bicyclists, and pedestrians.

Addressing these issues requires a program whose elements fall into distinct implementation categories – operational, capital and policy. Combined, these actions form a program of actions to speed up buses and make them more reliable. The recommended elements of the program have the following features:

More distant stops. There is a trade-off between less frequent stops to speed buses and longer walks for riders to and from the stops. It is possible to create two services on one route: one a limited stop service, and the other making all stops. This can be a compromise, but can avoid higher costs because the two service frequencies can reduce demand for local service. Technology also has the potential to speed up service, allowing for dynamic real-time bus routing based on passenger digital travel diaries or prompting riders to select their destination at the bus stop then informing them which bus will make their stop (i.e. similar to modern elevators that group passengers with common destinations).

Low floor buses. All buses should be converted to a low-floor configuration, from the high steps that slow boarding and alighting. This program is already underway; as of today, 68 percent of local buses are low floor, and the entire local bus fleet will become low-floor as older buses are retired. Combining low floor buses with the raising of street curbs by just a few inches can provide for level boarding, which would eliminate the need for ramps or the need to "kneel" the bus for elderly or disabled customers – further speeding up bus service.

More rear door use. Encourage passengers to leave by the rear door. This will reduce boarding and alighting time because boarding passengers will not have to wait for passengers to exit at the front of the bus. Replacement of older model buses to those with low-floor designs currently underway and pushing for buses with more sets of doors will also speed loading and unloading.

More efficient fare collection. Set up off-vehicle fare payment using a proof of payment system. Passengers will not only board faster, but they will also be able to board using either front or back doors. However, the high cost of this option makes it impractical for system-wide implementation. Alternatively, the MTA should shift to touch or vicinity passes, the successor to the MetroCard, which is fast becoming obsolete. The bus fleet is already equipped with the telecommunications subsystems, because of the BusTime program, and can support this real-time "open payment" fare collection system. The MTA should aggressively move to adopt this contactless card as part of its 2015-2019 Capital Plan. One of the outstanding issues that would need to be resolved is whether customers would be allowed to enter through all sets of doors (installing readers at all entries) or would be required to march by the bus driver to verify payment, as they do today. RPA recommends that the MTA pilots the

former on the busiest routes, allowing customers to use all doors with enforcement by fare control agents.

Preferential bus treatments. Establish preferential treatments for buses that would allow them to speed past seriously congested locations, i.e. "queue jumping." Physically separating these bus facilities from mixed-traffic has the benefit of ensuring that other vehicles will not block them, which has been a problem with painted bus lanes in New York City. Police camera enforcement of the bus lanes can help deter this type of behavior as well, but their use and numbers are limited by the State Legislature. Unlike most of the bus lanes in the city, queue jumps can be relatively short treatments – a block or two – that allow all buses to quickly move through a congested intersection or entrance to a major mixed-traffic facility. In some cases, a grade-separated treatment might be called for to maneuver buses around pedestrians and other surface traffic. In all cases, most of these treatments should be targeted for the benefit of the most number of routes and not be limited to just a handful of corridors.

Smarter response to traffic congestion. Identify locations where traffic congestion has the greatest effect of slowing buses and making them less reliable. A program of encouraging bus drivers to identify these locations may have a beneficial effect and should be tried. The GPS units onboard the buses should provide a clear indication of where the bottlenecks occur along the route. The GPS information along with driver observations should be used to target the placement of preferential treatments so buses may pass through without delay, or to alter the route to avoid areas prone to congestion (either permanently or temporarily, in the case of a construction zone).

More effective traffic signals. Provide signal pre-emption or transit signal priority for buses to allow the signal to turn green when buses are present – adjusting signal phasing to favor the bus.

Stricter enforcement. Focus enforcement attention at locations where bus delays caused by other vehicles are most severe, especially in cases when vehicles are blocking preferential treatments reserved for buses.

Many of these changes to speed buses can be made relatively quickly with operations and policy actions, while others, such as the eventual replacement of the current MetroCard system will take a few years to implement. The establishment of preferential treatment on city streets can be done quickly or take several years depending on the complexity and capital costs of the intervention.

Bus Rapid Transit / Select Bus Services

In 2008 the MTA and the NYC Department of Transportation, recognizing the problem of slow and unreliable buses, initiated a program to address it. Fifteen high priority corridors were identified and five were initially chosen, one in each borough. The objective was to replicate to the degree possible a bus rapid transit (BRT) system that has been successful elsewhere, most notably first in Curitiba, Brazil and Bogota, Columbia in South America, and then later in Los Angeles, Cleveland and Boston in the United States. These BRT systems, for the most part, have separate rights-of-way. They provide for off-vehicle fare collection, queue jumping and signal pre-emption, comfortable stations for passengers to wait, and an array of customer information, and service quality features.

Because the creation of separate rights-of-way is difficult where streets are not wide enough and may be costly to construct, the MTA/DOT program does not have all these features and is called Select Bus Services (SBS). The first project opened along Fordham Road in 2008 and has speeded up buses and attracted passengers. Seven routes have followed, with progress slowed by local resistance to closing lanes and removing parking. The Nostrand Avenue SBS in Brooklyn has the greatest number of BRT features. The agencies continue to pursue projects, and have issued a report[1] highlighting their progress and recommending corridors where a second wave of SBS routes could be installed. Their report considers many of the same deficiencies, including poor subway access and slow buses, discussed here.

In addition, the Pratt Center for Community Development issued a report in 2013 recommending eight corridors for study and possible implementation by the NYCDOT and the MTA.[2] Some overlapped with the MTA/DOT corridors. Pratt considered the lack of subway access, car ownership, income levels, and key destinations such as schools and hospitals in developing its recommendations. The Pratt proposals identify these corridors for BRT treatment although they recognize that creating them with the full bus separation from traffic may be difficult on some streets with insufficient rights-of-way.

Figure 14 shows the existing SBS routes, the additional corridors suggested by the MTA/DOT and the proposals by Pratt. The analysis in this report examines these proposed corridors and adds another dimension – poor subway connectivity as a criterion for consideration in the analysis. In those corridors where the configuration of the subway system makes the subway option a less attractive choice, the establishment of faster buses can help to fill the transit service gap by not only speeding buses, but by connecting places to make transit more "rapid."

Whether there are full BRT treatments possible among the proposals by the MTA/DOT and Pratt remains to be seen. In this report, the feasibility and acceptability of BRT or SBS are not judged other than to acknowledge the relative difficulty of installing bus treatments of any kind, depending largely on the available width of the rights-of-way and local opposition to losing vehicle space and parking. Narrower widths tend to result in local resistance from those concerned about loss of parking and of street capacity, which can result in more congestion for vehicles other than buses. In the assessment, BRT and SBS are grouped generically as "streetments," which are bus treatments to offer a variety of preferences for buses, with the precise features to be determined by the combination of physical feasibility and public acceptance.

1 NYCDOT and NYC Transit; *Introduction to Bus Rapid Transit Phase II*

2 Pratt Center for Community Development; *Mobility and Equity for New York's Transit Starved Neighborhoods: The Case for Full Featured Bus Rapid Transit*

Figure 14: Potential SBS/BRT Treatments to Speed Bus Service

Sources: NYCDOT and NYC Transit; *Introduction to Bus Rapid Transit Phase II*

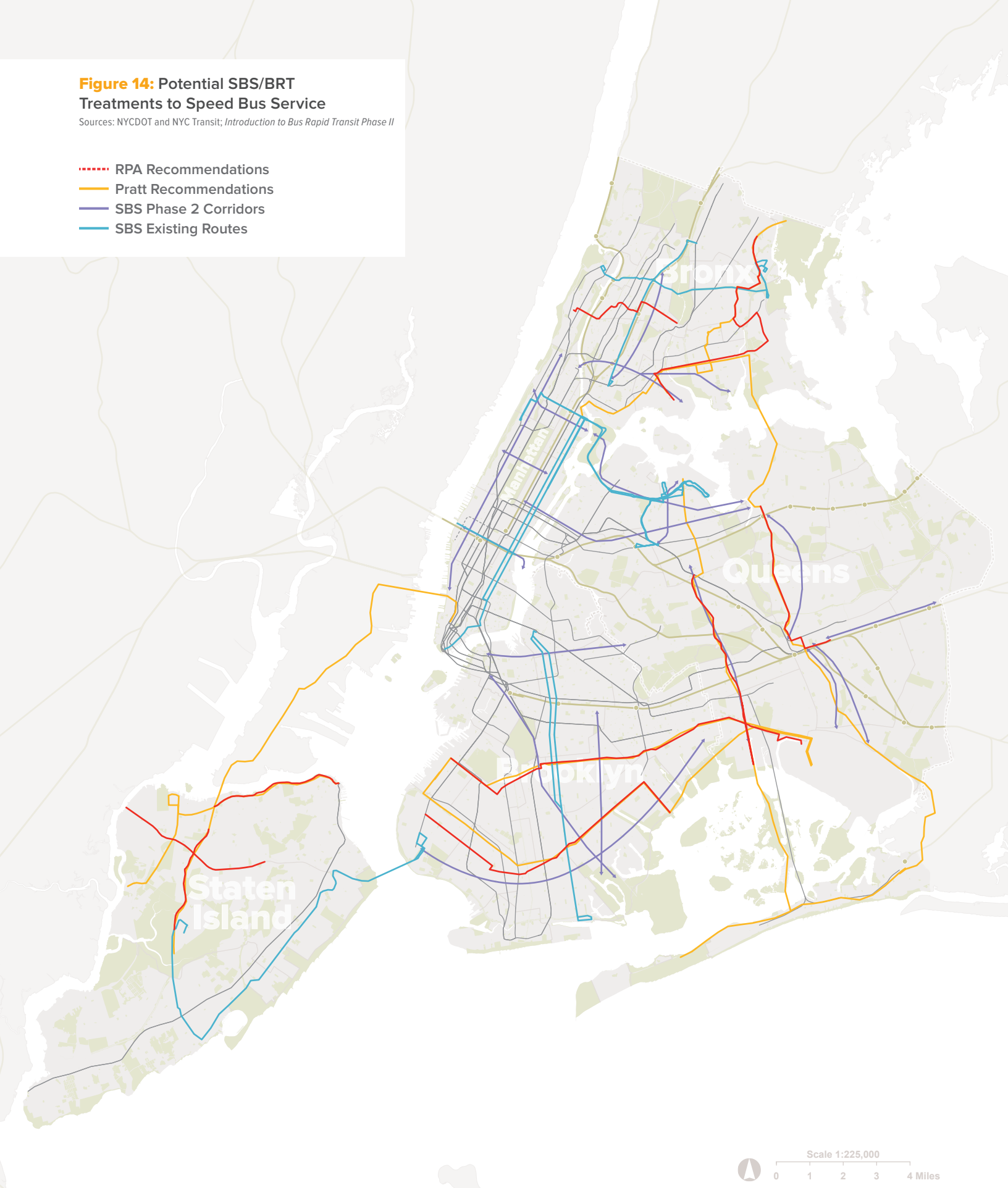


Figure 14 also maps the SBS/BRT corridors recommended here, overlaying them on the MTA/DOT and Pratt proposed corridors. The recommended corridors are described below:

East Bronx. This route would start in the north at the edge of Co-op City and terminate at the Hunts Point Market in the southeast Bronx. The routing would operate along Westchester Avenue and then either Crosby Avenue or East Tremont Road to reach Bruckner Boulevard, and then to Hunts Point Avenue and then terminate in the market. Among the routes that it could provide supplemental service over parts of their routes are the BX5, BX6, and BX8. These routes combine for about 43,000 riders on an average weekday. This corridor would serve parts of two corridors suggested by Pratt.

Bronx Crosstown. To address the problem of east-west transit dis-connectivity in the Bronx, one or more of three routes should be considered for SBS/BRT treatment. These include the BX6 along 165th Street (23,000 daily riders), the BX36 along West Tremont Avenue and 180th Street (31,000 riders), and the BX40/42 along East Tremont and Burnside Avenues (27,000 riders). The BX36 has the advantage since it extends into Washington Heights as far as the George Washington Bridge Bus Station for connections to west side subways and buses to New Jersey.

Central Queens. This route would connect Queens Boulevard to Howard Beach along Woodhaven Boulevard. It is the central part of a route suggested by Pratt from LaGuardia Airport to Rockaway. But the northern section of that route travels along narrow 94th Street and the southern portion from Howard Beach to Rockaway has little traffic to slow the current buses once Woodhaven Boulevard becomes Cross Bay Boulevard and heads toward the Rockaways, where the rights-of-way options are limited. The Woodhaven Boulevard section is wide and may be able to accommodate a more BRT-like service. Moreover, examination of the work trip origin-destination data indicates the highest ridership in the corridor is in the recommended segment. The local bus routes served are the Q21, Q41, and Q53, with combined weekday ridership of 25,000. This recommendation dovetails with the MTA/DOT's, which is pursuing this route as an SBS treatment for its next phase.

Eastern Queens. This route would connect the two major regional centers in Queens – Flushing and Jamaica. The agencies and Pratt each highlighted this corridor for bus treatment which would operate on Main Street, where there is an available median throughout most of its length. The Q44, with 17,000 daily riders would benefit with speedier service. The Pratt proposal suggested extending this route south to Far Rockaway along either Guy Brewer or Sutphin boulevards. However, when the MTA/DOT approached the south Jamaica community with this proposal there was more interest in addressing the complex set of routes in Jamaica Center along Archer Avenue. This extra wide street where 2,300 buses a day operate along 23 separate routes requires a significant rethinking as it labors to serve Jamaica Center and connection to three subway lines, the LIRR and the JFK AirTrain.

Brooklyn – Southeast to Southwest. The subway system is incapable of meeting the needs of the many east-west movements across south Brooklyn, as highlighted in the discussion of subway dis-connectivity. Two distinct corridors are identified to serve this large market – one more northerly than the other. Both corridors were also suggested by both the MTA/DOT team and Pratt. The more northerly would operate between Bush Terminal in Sunset Park in the west, through Flatbush, using Church Avenue (two moving lanes in each direction) and then the three-lane-in-each-direction Linden Boulevard to eastern Brooklyn. The routing could continue eastward into Queens, connecting to Conduit Avenue, and possibly to JFK airport. The western portion of the route has narrow streets to contend with and careful consultation and consensus building would be needed to speed buses there.
There are two major bus routes in the corridor (B15, B35) carrying a total of 34.000 riders on weekdays. The more southerly route in Brooklyn would have similar endpoints but would operate along Bay Ridge Parkway, Kings Highway, Flatlands Avenue and Rockaway Parkway. Each of those thoroughfares has two lanes in each direction, with the exception of some short stretches. An examination of the work travel data suggests that this southern segment is likely to have at least as much ridership potential as the more northerly route. Four bus routes operating in portion of this corridor – B6, B7, B9, B11 – with almost 38,000 daily riders who would benefit. Both routes have more ridership potential in their more westerly segments, but that is also in the areas where gaining more exclusivity for buses is more difficult.

Staten Island - North Shore or Staten Island Expressway Busway Extension. The analysis of the slow buses identified the bus routes on the north shore of Staten Island as particularly slow, where the streets are narrow with indirect orientations. Rather than using the streets, buses could operate on an abandoned rail right-of-way from Port Richmond to St. George where connections to the Staten Island ferry would be made or along the center median of the Staten Island Expressway by extending bus lane from Victory Blvd to the Goethals Bridge. The MTA has suggested operating the line on the rail right-of-way as an exclusive busway. They estimate the capital cost at $371 million. The project, like many at the MTA, is currently unfunded as the MTA battles for sufficient funding for its vast unmet needs. Pratt, which also supported this corridor for a bus treatment, suggested that the line extend south along South Avenue as far as Travis Avenue, or possibly as far as Fresh Kills Park. The South Avenue segment of the route proposed as a BRT by Pratt would operate through parkland and to the Staten Island Teleport, an office park that to date has not been successful in attracting much interest. Because of the lack of demand to the south, for now the route should terminate where it leaves the rail right-of-way in Port Richmond. Currently, there are four routes that more or less serve the corridor – S40, S46, S53, and S59. They carry about 12,000 passengers each weekday.

Pratt Center for Community Development; *Mobility and Equity for New York's Transit Starved Neighborhoods: The Case for Full Featured Bus Rapid Transit;* RPA

Staten Island - West Shore Corridor. This route would start of the Staten Island Mall in the center of the island using Richmond Avenue to extend as far as Forest Avenue. Richmond Avenue has a marked-off median area through much of its length, which is used for left turning lanes. The street is wide and can accommodate a bus treatment. Currently, all or portions of two bus routes (SI44, SI59) operate on some segment of Richmond Avenue along this proposed corridor. They carry 5,100 riders daily.

- Pratt had proposed extending the bus corridor into Bayonne across the Bayonne Bridge, along the peninsula and to and through the Holland Tunnel into Manhattan. Currently, the S89 follows this alignment on Staten Island and delivers riders only as far as the end of the Hudson-Bergen Light Rail line in Bayonne. This service carries about 1,000 riders in both directions on an average weekday. The segment of the proposal on the Bayonne Bridge is lightly used today and does not require any treatment to speed buses. Moreover, the BRT route in New Jersey is redundant with the successful light rail line that delivers workers to Jersey City and lower Manhattan today. Any bus treatment should be confined to Staten Island.

No corridors in Manhattan in the northern (the boroughs) portion of the Island are recommended here. The 125th Street corridor is in place in that highly congested street to speed slow buses. However, the buses on the other cross streets are mostly slowed by traffic signals at every avenue; the adjustment of the traffic signals to favor buses on the cross streets would be difficult because of the high volume of avenue traffic, and in most cases because of the progressive north-south signals.

The eight recommended SBS/BRT proposals are shown in Figure 14; they are summarized and compared in Table 13. The ease of implementation entries are a subjective assessment of how difficult installing preferential rights-of-way would be in the proposed corridor.

Table 13: SBS/BRT Recommended Corridor Summary

Corridor	Length (miles, approx.)	Ridership	Ease of Implementation
Eastern Bronx	10	High	Mixed
Cross Bronx	4	High	Difficult
Central Queens	8	High	Easy
Flushing –Jamaica	6	High	Moderate
South Brooklyn – Northerly	12	High	Mixed
South Brooklyn – Southerly	9	High	Difficult much of length
Staten Island – North Shore	4	Moderate	Easy, but costly
Staten Island – Expressway	5	Moderate	Moderate
Staten Island – West	3	Low	Moderate

Source: Regional Plan Association

Bus Amenities

Buses have the status of a second class mode of travel in the minds of many people, not without some justification. While slow, bumpy, and unreliable might be the most likely words used to describe the bus ride itself, the off-vehicle experience might also leave a lot to be desired.

Amenities at bus stops can give the rider greater assurance that the transit operator cares. These can include bus shelters, bus schedules and maps, real time bus arrival information, and easier fare payment systems.

Shelters that are properly enclosed from the elements, in some cases temperature controlled, with seating in a well-lit, safe environment can offer both comfort and a sense of security at stops. Dynamic signs with accurate bus arrival times can provide still further benefit by easing the anxiety of not being certain about the arrival time of the next bus, and can create a sense that the transit system is well run and reliable. Ideally, this information would also be made available via smartphones, web browsers, and other internet connected devices to allow riders to arrive at the stop close to the time that the bus does. The MTA's BusTime program currently provides this service. These amenities should be provided at as many bus stops as is feasible. However, installing true bus shelters at all bus stops, especially those which see a lower level of ridership, may not be cost-effective. However, these stops with lower ridership should still have real time information regarding the arrival of the next bus. One possible way to bring down the cost of these signs would be to partner with local merchants, who would be able to install signs that tapped into the MTA's bus information system. These merchants could be compensated directly or indirectly (e.g. through access to marketing in the form of signs informing potential customers they have time pick up coffee or a newspaper before their bus arrives) to ensure proper maintenance of the sign. A similar program has been tried in Chicago with some success. The MTA should also look for ways to inform bus riders on the bus or at the shelter on the status of connecting transit services – subways, commuter rail, ferries and other buses. Real-time connecting bus information should also be available to the users of the other modes as well, on their trains or at the stations.

Improve and Extend the Subway and Urban Rail System

Subway Upgrades

Recommended actions to improve service vary from rider behavior modification to system upgrades and expansion. A number of years ago the MTA undertook a campaign to encourage boarding riders to stand aside and wait until passengers leave the train. This small act of courtesy seemed to have had a lasting effect. Markers on platforms were placed to delineating door locations helped this process. At some particularly busy locations and stations, MTA personnel are used to prevent door holding -an even more aggressive long-term approach would be to install Platform Screen Doors, which further discourage this behavior. Both of these programs must be continually reinforced to prevent backsliding. Subway station upgrade in the boroughs has lagged until recently because stations were prioritized by individual ridership

levels. With the Manhattan stations generally more heavily used, their upgrades tended to go first. The MTA has recently shifted the station upgrades to a component based approach, which has the unintended effect of making the tracking of borough by borough progress less obvious. Still, there can be little doubt that borough station fixes have lagged, particularly in inner Brooklyn, most of Queens, and parts of Upper Manhattan, as Figure 11 shows. From an equity perspective, these areas should receive higher priority.

The acceleration of the replacement of the subway's fixed block signal system, some of it approaching 90 years old, is long overdue. The moving block system, known as Communications Based Train Control or CBTC, is a system that enables more trains to operate in the peak, alleviating crowding on all the lines reaching back into the neighborhoods currently experiencing overcrowding as shown earlier in Figure 9. The system would be more reliable and it would save money, as documented in the RPA report on the subject, *Moving Forward: Accelerating the Transition to Communications-Based Train Control for New York City's Subways*. The report recommends that this system be implemented more rapidly than the current pace, which would take over 100 years.

The MetroCard system, revolutionary just 18 years ago in transforming how subway and bus fares are paid, is fast approaching the end of its useful life, estimated to be 2019. It must be replaced. Advances in technology since its inception offer an opportunity to speed payment, lower costs, and create many opportunities for innovative fare policies. The MTA is currently in the midst of deciding how best to replace the system, which would serve to speed up buses too. RPA recommends the next-generation "open payments" fare system be implemented during the course of the MTA next five-year 2015-2019 Capital Plan. The agency has already laid the groundwork for this system in the course of its current capital plan through the telecommunications upgrades it has made throughout the subway system and the installations of wireless telecommunications systems on its buses as part of the BusTime program.

Continuation of Second Avenue Subway Progress

After a sorry and checkered history dating almost 90 years, construction has finally begun on the Second Avenue subway (SAS)– at least the first 1.3 miles of it on the upper east side of Manhattan. By 2016 this short segment will be open from 63rd to 96th Street. It may appear that its value is limited to Manhattan and is irrelevant to the needs of the boroughs, but it has beneficial ramifications for upper Manhattan and the Bronx since the new service will relieve the excessive crowding on the #6 for East Harlem residents and on all five lines in the Bronx – #2, # 4, #5, # 6 and the D/B Concourse, especially on the #4 and #5. Even larger benefits will be seen as future phases are implemented.

The planned future phases shown in Figure 15 have passed the federal Environmental Impact Statement review process and are in line for consideration for future funding. One phase could go north for three stations terminating at 125th Street, serving East Harlem and Harlem and providing a transfer point with Metro North. Two phases to the south could extend the line to the Battery. There is a strong argument to move quickly to build the north segment first as far as 116th Street, which would be relatively inexpensive since much of the tunnel is in place from earlier work, leaving the more expensive last piece to 125th Street for later. This report supports this argument.

Beyond that, arguments for the extension of the SAS into the Bronx and / or across 125th Street to the west each have much merit. The extension across 125th Street would knit together the north-south lines on the west side with the east side, creating numerous new and productive linkages for the subway network for upper Manhattan and Bronx residents. These possibilities can take many forms, as shown in Figure 14. All would establish or reestablish missing subway coverage either in the central Bronx in the Third Avenue corridor or further north, possibly to Co-Op City. It is time to begin serious discussions with the MTA and the affected communities to move this process along.

If SAS were extended southward to the Battery it could then be extended into Brooklyn to Atlantic Terminal and then operate on the Atlantic Branch out to Jamaica and beyond into southeastern Queens.

Other Subway Extensions

In addition to the subway extensions associated with the Second Avenue Subway there are numerous other possibilities that have long been under discussion to address the gaps in subway coverage in the City; In Brooklyn, these include the construction of the subway branch on Utica Avenue from Eastern Parkway, i.e. the extension of the #2 and # 5 Nostrand Avenue subway. In Queens, these include new lines under Jewel Avenue and Northern Boulevard; these lines would require a new tunnel under the East River.

Other Urban Rail Opportunities

Barriers to speeding up buses using city streets cannot always be overcome. This suggests that where there are underused or unused rail rights-of-way, new service should be considered. In Figure 16, a number of possibilities for rail service are shown that can address the deficiencies in boroughs' transit service. These include:

1. The interconnecting freight line (New York Connecting Rail Road) from the 65th Street Yard in Bay Ridge in Brooklyn through Queens, over the Hell Gate Bridge, and into the Bronx using the Amtrak right of way in the eastern part of that borough;

2. The Atlantic Branch of the LIRR between Jamaica and Atlantic Terminals (Barclays Center), which is to be converted to a shuttle once the LIRR connects to Grand Central Terminal upon the completion of the East Side Access project in the early 2020s;

3. The re-arrangement of operations on the two LIRR branches – Montauk and Atlantic – between Jamaica and Valley Stream on the LIRR's Babylon branch, where relatively sparse service is provided for the communities in South Jamaica;

Figure 15: Second Avenue Subway Phases and Possible Northern Extensions

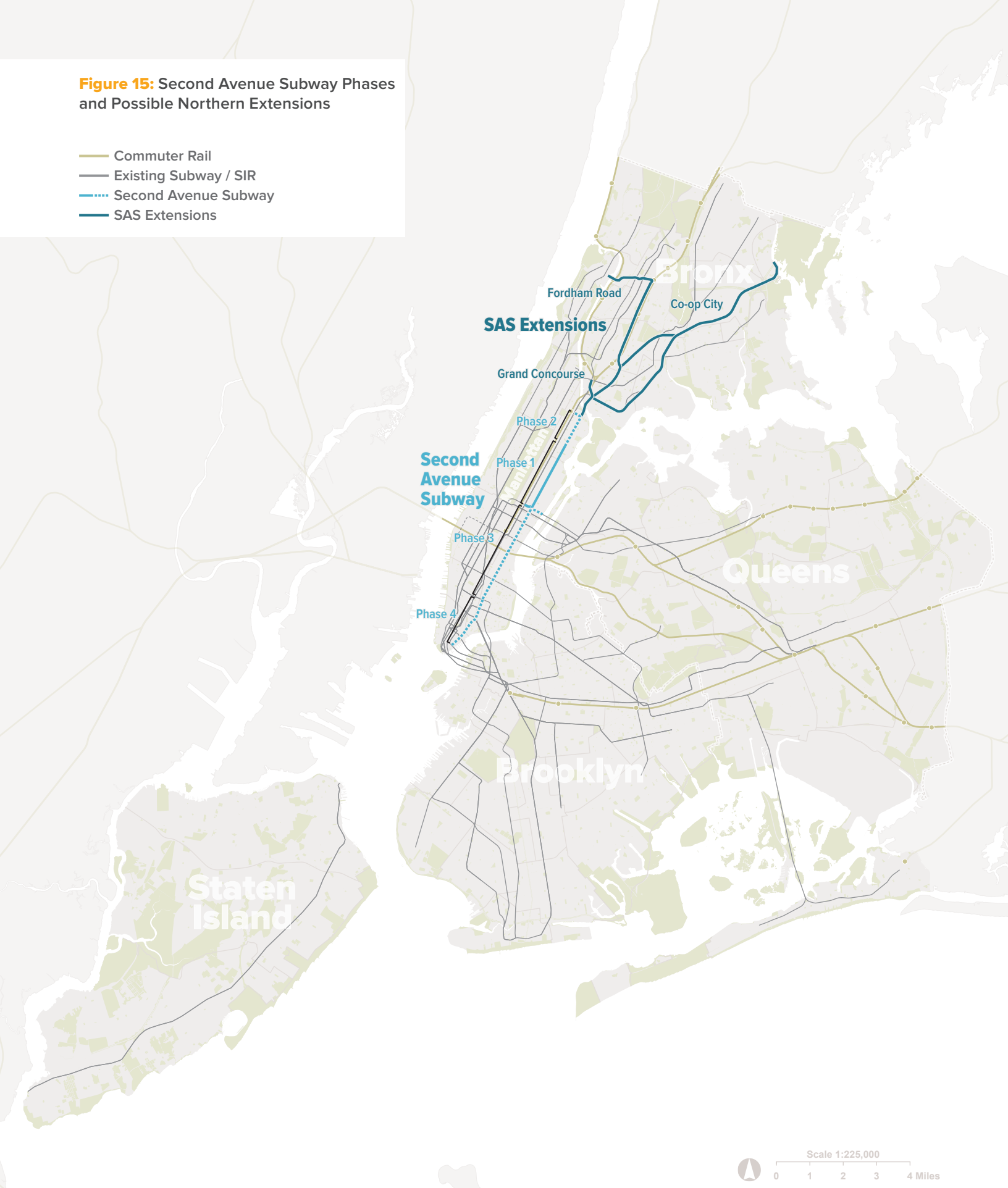


Table 14: Triboro Rx Stations

		# of Nearby Subway Lines	Annual Subway Station Boardings (mil.)	# Bus Routes	Annual Bus Route Riders (mil.)
Bronx	**Co-Op City South**	0	NA	2	22.3
	Eastchester Rd - Morris Park	0	NA	3	18.4
	Parkchester	1	4.7	5	24.9
	Hunts Pt Av/Garrison	1	3.3	3	20.8
Queens	**Astoria**	2	5.2	1	2.9
	Northern Boulevard	0	NA	3	5
	Jackson Heights	5	18	6	18.8
	Queens Blvd	0	NA	1	4.8
	Grand Ave	0	NA	2	11.4
	Metropolitan Ave	1	1.2	3	11.8
	Myrtle Ave	0	NA	2	6.8
Brooklyn	**Wilson Ave**	1	1.1	1	3.6
	East New York	1	0.4	1	5.5
	Livonia Ave	1	0.9	0	NA
	Rockaway Ave/Ave D	0	NA	1	3.6
	Brooklyn Terminal Market	0	NA	1	3.8
	Utica Ave/Farragut Rd	0	NA	1	15.4
	Brooklyn College	2	6.4	5	32.3
	Ave H/E 15th St	1	0.8	0	NA
	McDonald Ave	1	2	2	9.6
	New Utrecht Ave/62nd	2	1.9	1	4.3
	Brooklyn Army Terminal	2	3.8	3	5.9

Source: Regional Plan Association

4. The Rockaway Beach Branch (RBB), from Rego Park to Rockaway Boulevard in Ozone Park, long abandoned as a branch of the LIRR; and

5. The Lower Montauk Branch of the LIRR from Long Island City to Jamaica, currently used for freight and a very limited number of LIRR passengers trains.

Triboro Rx

Use of the interconnecting freight line for passenger service was proposed by Regional Plan Association in its Third Regional Plan, *A Region at Risk*, in 1996. The concept, dubbed Triboro Rx, would operate as a passenger rail line perpendicular to most of the subway lines built as radial services to deliver commuters and other travelers to Manhattan. The ability of this line to fill deficiencies in the transit service is demonstrated by shortcomings highlighted in the earlier discussion on subway connectivity. Specific markets poorly served by the subway or bus system could benefit from this service. These include the following markets: trips with an east-west orientation throughout southern Brooklyn; trips needing to connect parts of northern Brooklyn with portions of central Queens (CB5) or inner Queens (CB1 and CB2) with inadequate bus or subway service – including south to north markets into Maspeth and Long Island City); and, trips between Queens and the East Bronx.

Operating this line with the 22 well-placed stations tallied in Table 14–all near subway station transfer points or bus routes, and substantial standalone ridership– would provide ample opportunity for expanded mobility in the affected and connecting corridors with existing transit services. The line is shown in Figure 17.

The 24-mile line is intact and fully grade-separated, requiring no civil structure reactivation. The major capital investments necessary would be signals, new track, and stations. Rolling stock would also constitute a significant capital investment, but could be mitigated by using light rail vehicles for the mixed freight and passenger service, which could be made to comply with Federal Rail Administration crashworthiness regulation. More conventional, heavy rail vehicles would cost more.

The availability of this right-of-way depends on the feasibility of operating both freight and passenger service on the same right-of-way. Current freight operations are handled by CSX from Fresh Pond north into the Bronx. The segment south to Bay Ridge is operated by New York and Atlantic Railway Railroad and is owned by the LIRR.

To gain a sense of the market, Community Board (CB) pairs in the corridor were identified, and work trips currently made by each mode–bus, subway and auto–were "diverted" to the line using conservative diversion assumptions. Since the diversions were based only on work trips, these were expanded to account for non-work trips, based on current ratios of work to non-work trips on each of the modes. Not included are the many trips that might use the line in combination with connecting subway and bus service that stop at or near the proposed Triboro Rx stations. The resulting estimate is summarized in Table 15, organized by borough-to-borough travel flows. Over 100,000 riders a day are expected. The assumptions are detailed in Appendix C.

This estimate only accounts for those travelers with both ends of their trips in the corridor. It does not account for those

Figure 16: Unused or Underused Rights-of-Way for Possible Urban Rail Service

Table 15: Estimated Daily Travelers for Triboro Rx

Market		Diversion From: From Bus	From Subway	From Auto	Total Work Trips	Non-Work Trips	Total Trips
Intraborough	Intra Bronx	3,490	705	1,222	5,417	13,737	19,154
	Intra Queens	918	2,064	1,156	4,139	8,832	12,971
	Intra Brooklyn	5,066	1,751	3,273	10,090	26,663	36,753
	Intraborough Subtoal	9,474	4,521	5,651	19,646	49,232	68,878
Between Bronx and Queens	To Queens	168	1,017	442	1,627	3,176	4,803
	To Bronx	63	814	348	1,225	2,352	3,577
	Subtotal	231	1,831	790	2,852	5,528	8,380
Between Bronx and Brooklyn	To Brooklyn	-	636	178	814	1,348	2,162
	To Bronx	-	594	652	1,246	3,201	4,447
	Subtotal	-	1,230	830	2,060	4,549	6,609
Between Queens and Brooklyn	To Brooklyn	294	1,415	899	2,608	5,697	8,305
	To Queens	613	2,507	1,801	4,921	11,140	16,061
	Subtotal	907	3,923	2,700	7,529	16,837	24,366
	Interborough Subtotal	1,138	6,984	4,319	12,440	26,915	39,355
Grand Total		10,612	11,504	9,970	32,086	76,146	108,233

Source: Regional Plan Association

who might travel to or from outside the corridor on another transit vehicle before boarding or after alighting the Triboro Rx vehicles. These trips could add substantially to the traffic flow, therefore this estimate should be considered conservative. Nor does the estimate account for the development that may be spawned by the line itself, which could add to ridership totals, and could meet some of the city's needs for a growing population. This estimate should be seen as evidence of a sizable market. However, it is no substitute for a more nuanced approach, involving origin-destination data for non-work trips, diversion for trips with transfers to and from existing bus and subway services, and modal shifts based on a model that accounts for comparative network characteristics.

Table 15 reveals some highly relevant findings.

- Substantially more than half of the estimated trips – 62,000 of 109,000 would be internal to their own borough;
- Trips involving interchange between the Bronx and the two other boroughs account for only 19,000 trips, merely 17 percent of all trips;
- Most of the current bus trips diverted would be intra-borough trips; and
- The predominant diversion for Brooklyn-Queens trips would be from the subway, a market that requires many circuitous subway trips today, and which Triboro Rx would make much more direct

The Triboro Rx project addresses many of the nine factors that encourage people to use transit. It offers direct service for those travelers who must otherwise use two or more vehicles, it promises faster and more reliable service on rail by avoiding the traffic congestion of city streets, and it serves some areas that are devoid of any rail service including Glendale and Middle Village in Queens and Canarsie and Flatlands in Brooklyn.

LIRR Atlantic and Montauk Branches in South Jamaica, and the Atlantic Branch of LIRR from Atlantic Avenue to Jamaica

Subway service should be established on the LIRR Atlantic branch, allowing for the shift of LIRR service to the Montauk with more service, specifically, to Jamaica.

East of Jamaica Center, the Atlantic and Montauk lines of the LIRR branch out to the south and eventually connect with the Babylon Branch in Nassau County. Both have infrequent service today. The Atlantic Branch has three stops in Queens – Locust Manor, Laurelton and Rosedale and the Montauk Branch has but one – St. Albans. The service at the three Atlantic branch stations is limited to only seven trains in a 90 minute peak and hourly service at other times. The St. Albans station on the Montauk station has even less service. An added track would be required on the one-track Atlantic Branch, where room is available today.

This project would best be combined with the service on the portion of the Atlantic Branch between Jamaica and downtown Brooklyn and the Barclays Center. When the LIRR's East Side Access (ESA) project is completed in the early 2020s the LIRR intends to cease operation of through trains from Nassau and Suffolk counties on this line segment to Brooklyn. Instead, they plan to convert the service between the Barclays Center and Jamaica Center to shuttles. This raises a number of possibilities for greater use of this rail segment. It could be operated as a subway, with more frequent service and a transit fare level, making the line much more useful for residents of Jamaica and central Brooklyn. The line would be extended onto the Atlantic branch of the LIRR, which would be converted to a subway as discussed above. This would give southeastern Queens residents direct service to downtown Brooklyn and with a transfer at Jamaica frequent access to the subway network.

This report recommends the addition of the third track on the Atlantic Branch and its conversion to subway service, to give transit deprived residents of southeast Queens vastly improved transit service.

Figure 17: Alignment and Possible Station Locations for Triboro Rx and Atlantic Branch

Source: Regional Plan Association

Another option, not precluded by the recommendation above, is to operate a subway line branch off of Atlantic Avenue as an extension of the #2/#5 line down Nostrand Avenue, by constructing a branch from the #3 and #4 down Utica Avenue. This change would serve the isolated parts of the Canarsie and Flatlands neighborhoods in CB 18, which are devoid of subway service today. Unlike the Atlantic Branch and southeastern Queens options discussed above, this possibility would require new subway construction on new rights of-way. This line could also replace the slow and aged Jamaica line. It can be extended east of Jamaica Center to serve parts of south Jamaica, discussed above. This last option should be fully explored and decided upon in advance of ESA project completion.

Rockaway Beach Branch and the Lower Montauk Branch

The abandoned Rockaway Beach Branch has been the source of much interest for re-use since the day it was fully deactivated in 1962. Local opposition – the right-of-way was adjacent to resident properties – has prevented the use of the line for transit. Presently, there are three forces at work on the use of this fully grade-separated right-of-way. One group has strong interest in its reactivation for transit service. A second local group would use the right-of-way as a linear park – the Queensway, a proposal buoyed by the success of the High Line in Manhattan. The third force is backed by the adjacent residents who reject both these proposals, wishing to avoid any impacts in areas adjacent to their properties that some have usurped to extend their backyards.

There are numerous ways this line could be used for transit, whether as part of the LIRR or a subway. However, the activation of the LIRR on the line requires new capacity on the LIRR main line and under the East River, which is not present now and would be problematic even with the ESA. Reviving the line as a part of the subway system, could make use of the F train, currently limited to 15 trains per hour because of congestion on the Queens Boulevard lines. The line would have sufficient capacity in Manhattan and Brooklyn to run a more robust service through the 63rd Street tunnel than it does today, but only if new bypass capacity is constructed in Queens. The most feasible bypass alignment would use the Lower Montauk Branch of the LIRR, which is aligned through Long Island City, and then through Maspeth and Glendale, two neighborhoods presently unserved by the subway system. Some F train service would be rerouted to that line and connected to the RBB in Rego Park. However, passenger service on the Lower Montauk Branch, a critical corridor for goods movement, would have to be designed to comingle with existing and future increases in freight rail service.

If it becomes part of the subway, it is difficult to envision the RBB segment operating without being connected to either an existing or a new east-west bypass subway line in Queens. Almost 50 years have gone by without finding an acceptable bypass solution.

The RBB is of significant value, either as a linear park or for transit and should not be held hostage by residents who do not own the right-of-way.

Making Commuter Rail Work for Borough Residents

Reduction of Intra City Commuter Rail Fares

MTA's two commuter railroads – Metro North and the Long Island Rail Road – offer a "CityTicket" for $4.00 for single-direction one-way travel within New York City, but only on weekends, which severely limits its attractiveness to city residents. A peak-hour trip on weekdays is double that at $8.00 on the LIRR and $8.25 on Metro North. Off-peak weekday trips are $5.75 and $6.25, respectively. Many of the stations in the Bronx, notably, Melrose, East Tremont, University Heights, and Morris Heights, are low income areas without subway service, where the availability of more affordable fares could expand mobility enormously. Similarly, the two Brooklyn stations on the LIRR's Atlantic Avenue Branch would benefit from CityTicket fare levels at $4.00. Fares for 10-trip, weekly and monthly type tickets should also be reduced proportionately. All trips in the city on the two rail systems for trips at all times wholly within New York City would be set at the CityTicket half price level. The net loss in revenue for the MTA is estimated at $30 million annually.

Improve Boroughs' Service Frequency

The service frequency provided by the Long Island Rail Road and Metro North in the boroughs' 36 commuter rail stations almost universally fall short of being useful to residents who could benefit from them. In only a few cases, notably at Jamaica Center, Woodside, and 125th Street, is the service frequent enough for reverse commuting or midday use. It is recommended that the two railroads buttress their meager service to these stations, and with the bus network devise a "use-it-or-lose-it" demonstration program.

New York City Access to Long Island

The possibility of adding a third track to the main line of the LIRR from Floral Park to Hicksville has been discussed for some time. The project would make commuting by the LIRR from the boroughs, mostly from Queens and Brooklyn, a realistic option. Currently, it is not possible to operate trains in the reverse peak direction (eastbound in the morning and westbound in the evening), because of heavy flows to and from Manhattan that use both of the existing tracks. This project has been resisted locally by adjacent property owners, and to date, it is not certain if it will be built. Nevertheless, this report recommends this project because of its wide benefits to both the residents of New York City and the employers on Long Island.[3]

Bronx Access to Connecticut

Metro North has proposed a commuter rail service to link the Bronx with Penn Station. As many as four stations would be built in the borough with service operating on the Amtrak right-of-way to the Hell Gate Bridge into Queens and then into Penn Station via the LIRR's East River tunnels. The affected

3 For a more extensive discussion of the benefits of this project see RPA's *How the Long Island Rail Road Could Shape the Next Economy*; 2013.

Bronx neighborhoods –- Hunts Point, Parkchester, Pelham Parkway and Co-op City East – would benefit in two ways: they would have fast access to the Midtown West, and they would gain better access to jobs on the New Haven line in Connecticut, particularly in Stamford. However, this service is a long way off, requiring the completion of the LIRR East Side Access project to open up capacity at Penn Station, which will not occur until at least 2020. Use of that same right-of-way could come with the introduction of the Triboro Rx, if it is extended into the Bronx.

A More Equitable Fare Policy

The level of the subway and bus fare is a contentious subject that arises whenever a fare increase is contemplated. Arguments can be marshalled on either side of the issue – fares should be higher to cover the full cost of the service, which now requires over 40 percent of operations to be subsidized by government; or, fares should be lower to expand the attractiveness of transit, to add ridership, and to ease the burden on those who can least afford it. Today, this argument is at a stalemate, and history suggests that this stalemate will continue, with fares increasing at or below inflation rates, straining the MTA operating budget.

Substantial numbers of people in every borough, and especially in the Bronx and parts of Brooklyn, pay high shares of their incomes for transit fares and would be disproportionately affected by fare increases. One way to address this burden is with a "social" fare, which would allow discounts for qualifying individuals with limited incomes. Opponents worry the revenue loss would be too high, the administrative costs too burdensome, and the creation a new version of fare evasion too damaging, with some taking fraudulent advantage.

Explore Variable Pricing

Charging lower fares during off-peak times and weekends and higher fares during on-peak times follows the law of supply and demand; prices increase with demand. In addition to helping lower income residents who may travel more during off-peak hours, this policy could help transit operators spread widen the peak travel time window and decrease crowding, though it is important to note that recent trends have been moving in that direction without manipulating the fare.

Eventually, new fare collection technology may be able to offer one thing that we do not have today –- nuance. Distance based fares, paying more for more service, is one example.

Though distance based fares may sound fine in the abstract, they would be difficult to implement in the subway system in practice. Logistically, riders would have to pass a control point at both ends of their trips, especially problematic at exit points in heavily used stations. Politically, the policy is likely to result in opposition because of the large fare increases that longer-distance travelers will face, which in turn will exacerbate the equity problem in transit pricing since many working-poor must travel great distances from their homes to work.

Another option would be to tailor fares by mode. Similarly to distance based fares, this policy would make the fare more proportional to the service rendered by charging less for bus trips, which are, on average, half the length of subway trips. This would not require a new fare collection system and could be initiated earlier. However, this change would create a two fare system and could create the perception of a two-class system, one for bus riders and the other for subway riders.

Replace the MetroCard With Open Fare Contactless System

The aging MetroCard must be replaced soon. As the City moves closer to implementing this change, fare innovations should be considered that create a more nuanced fare system that takes into account affordability, particularly for the resident of the boroughs. Meanwhile, the simple change in the CityTicket on the commuter rail lines should move forward, since it requires little in the way of technology advances. The expansion of CityTicket on the railroads will be a helpful measure for many city residents, even in the absence of other currently fare reduction strategies for the bus and subway network.

Expansion of the Bike Share Program

The success of the City's Bike Share program, launched in the spring of 2013, has raised the possibility of program extensions to the boroughs in order to augment mobility in the boroughs and extend the reach of transit. Bicycles are one of many means to extend this reach, as are a range of traditional and innovative systems of car-sharing mechanisms that can link to the existing network.

Currently, the bike share program logs more than one million rides per month with 6,000 bikes operating among 332 docking stations located south of 60th Street in Manhattan, and in downtown Brooklyn, Brooklyn Heights, Fort Greene and Williamsburg. Despite this high use, the program is operating at a deficit due to a number of factors, including the unexpectedly high operating costs of maintaining and rebalancing bikes at major transit terminals, and the damage incurred as a result of Hurricane Sandy. The program is being reorganized to increase its financial stability, and care should be taken not to extend the program to lower density areas that could weaken its financial condition.

Any future extensions should be contiguous to current service areas, in order to maximize on existing higher ridership areas. If done in isolation, these extensions are likely to be less effective. This suggests that the first set of extensions be immediate north of 60th Street and at landfalls of the four NYC East River bridges in Brooklyn and Queens and adjacent to downtown Brooklyn. Local bike lane networks should be installed to encourage safer riding prior to any expansion into these neighborhoods.

The NYC Department of City Planning 2009 report, Bike-Share Opportunities in New York City, envisioned a more

extensive second phase that includes: all of Manhattan; much of the Bronx as far north as Moshulu Parkway and as far east as the Bronx River; the Queens neighborhoods of Astoria, Long Island City, Jackson Heights and Sunnyside; and, the Brooklyn neighborhoods of Greenpoint, Bedford-Stuyvesant, Crown Heights, and Sunset Park. That report acknowledged that each extension would weaken the network financially. Therefore, it would be prudent to increase the scope of the system incrementally so as not to spread the program too thin, with too few bicycles and docking stations over a wider area, eventually requiring more public subsidy. The value of this added service requires evaluation, just as it would for other investments that increase the financial burden on government. In any case, extensions should be implemented only after a financial plan is in place. If these conditions are met, the highly popular Bike-Share program can complement the boroughs' mobility network.

Added Ferry Service

The strong interest in expansion of ferry service in New York City's harbor and rivers is a result of the undeniable logic that the city's boroughs are bordered by navigable water. Before the many bridges and tunnels were built that knit the boroughs together, there were dozens of ferries plying the East and Hudson Rivers and upper harbor. By 1969, only the highly subsidized Staten Island ferry remained. Since 1986, with the inauguration of routes crossing the Hudson River, many privately operated new routes were tried and most discontinued when their revenues could not cover their operating costs. Others were subsidized temporarily to compensate for transit service losses in the wake of emergencies, such as 9/11 and Hurricane Sandy. The hurricane resulted in a ferry route from Rockaway that had failed earlier and was about to be discontinued. Recognizing that any new ferry service would require subsidy, the City instituted the East River service with numerous stops to connect Manhattan with the new developments on the Brooklyn and Queens waterfront, subsidizing the service at $3 million a year. The City plans to identify additional ferry services that will all almost certainly require subsidies.

As with the recommendations for added bus service, new ferry routes should contain a sunset clause such that if the service is unsuccessful it is discontinued. RPA has in the past examined the conditions under which ferry service has the best chance for success. As a guide, the following factors should be considered:

- Does the market have poor transit service, with little rail or bus improvement opportunities?
- Are large walk-on commuter-sheds or good transit delivery systems available at either or both ends of the prospective ferry route?
- Is there a large and dense pattern of development near either or both ends of the ferry route?
- Is there a direct and easily navigable water route? And, where applicable,
- Will developments near the waterfront site be willing to make permanent contributions to ferry operations?

When applying these criteria, few if any ferry routes are obvious, beyond the current Rockaway service. However, the current Rockaway ferry service with a stop at Bush Terminal and then onto Lower Manhattan should be retained given the isolation of the Rockaway peninsula demonstrated in this report and self-evident to its residents. Other routes, particularly those in areas of new waterfront development should be predicated on developer contributions. The Soundview neighborhood in the Bronx has been discussed as a new route to Lower Manhattan. However, its prospects are questionable without substantial subsidy given the criteria above, and if it is initiated, it should be clear that it must meet the "use it or lose it" demonstration criteria.

Appendix A: Factors Influencing the Choice of Transit: A Statistical Analysis

The choice to use public transit depends in large measure on factors other than the features of the transit system. Past research has continually shown that the compactness of the land uses in the area near the beginning or end of trips are highly relevant – where densities are high the automobile is more likely to encounter more traffic and move slower, the cost of driving will likely be higher, and the ownership of cars is likely to be less widespread.[1] Transit service, in general, with more people concentrated in a smaller area is likely to be more widespread and will provide more service.

To illustrate the impact of densities, a series of charts are presented next. Since it is the work trip that is under consideration, the job density at the work end of the trip and the residential density at the home end of the trip are considered. The observations are based on the 59 Community Board areas in New York City. Trips made on foot, by bike, and "trips" at home are not included to make the comparison between transit and auto clearer. In Figure A-1 the job densities are plotted against transit share for the 59 zones, revealing a close association and possibly cause-effect relationship between the two. Because the observations with the highest job densities in the Manhattan Central Business District and Downtown Brooklyn distorted the plot and made it difficult to see how the relationship performs for the rest of the city, these data points were excluded from the analyses. The linear relationship is strong with a high r-squared of 0.638 fit, meaning approximately 64 percent of the variation in transit shares for trips to work is associated and/or explained by job densities alone. The logic of the job density variable means that job density is a strong explanatory variable for transit share. Quantitatively, increases of 10,000 jobs per square mile add about 26 percent to the transit share.

At the residential end the work trip, a similar relationship exists as shown in Figure 6. Higher residential density is associated with higher transit shares in a curvilinear relationship with an r-squared of 0.650, where higher density is associated transit shares to grow at a declining rate. It is to be expected then that when the origin-destination modal shares are modeled, both the job and residential densities at the respective ends of the work trip will result in an excellent statistical fit. This analysis is presented below.

One of the reasons some of the observations in Figure A-1 may fall below or above their lines of best fit may be because of the mix of locations at the other end of the trip. This might be best explained with an example. The three CBs in Staten Island all fall below the line of best fit in Figure A-1 – lower than their job densities would suggest. This is undoubtedly because most of the people who fill those jobs also live on Staten Island where residential densities are low too. Thus, Figure A-2 is presented which shows the modal shares plotted against the residential density for the home end of the work trip. These two graphics suggests that considering both residential and job densities together – the residential density at the home end of the trip and the job density at the work end of the trip – should be especially fruitful.

In addition, the two density variables, the cost of using an automobile to travel to work may explain its use, and conversely the choice to use transit. To test this, these average daily parking cost and average toll paid daily were each estimated. But the cost of using a car may be of less consequence to those having higher incomes. Consequently, the median income of each of the CBs was also compiled for the analysis. These factors may be relevant too.

Transit or auto modes are not the only choices to be considered here. Some people walk / bike to work and still others work at home. The forces that drive these choices are also important to understand. If the city's future development patterns and actions (such as an expanded Bikeshare) lead to more walking and biking and the nature of work is influenced by technological changes, it can lead to a rise in the number of workers staying at home. Modeling these trips to assist the understanding of the dynamics of these trips is certainly worthwhile.

In Figure A-3 the percent of work trips that are made on foot and by bicycle in each CB is plotted against a function of both job and residential densities in that CB. Tests of the relationship showed that both the residential and job densities significantly affect walk/bike share, but neither was very strong alone. Combined as the square root of their products established a nice fit; where both densities were high, more people walked or biked and densities accounting for about 80 percent of the variation.

The choice of transit or driving might not the only choices. Some may work at home, with the commute no farther than the bedroom to the home office. When the data for work at home shares was examined densities did not seem to be much of an explanation. Rather, as shown in Figure A-4 there is a relationship, albeit a weak one, with income. In general, higher income areas tend to have a higher share of people working at home, but with some notable exceptions. The income factor could be explained by a greater share of residents who are self-employed entrepreneurs who do not travel to an office and by the assumption that these individuals might, but are not guaranteed to earn more.

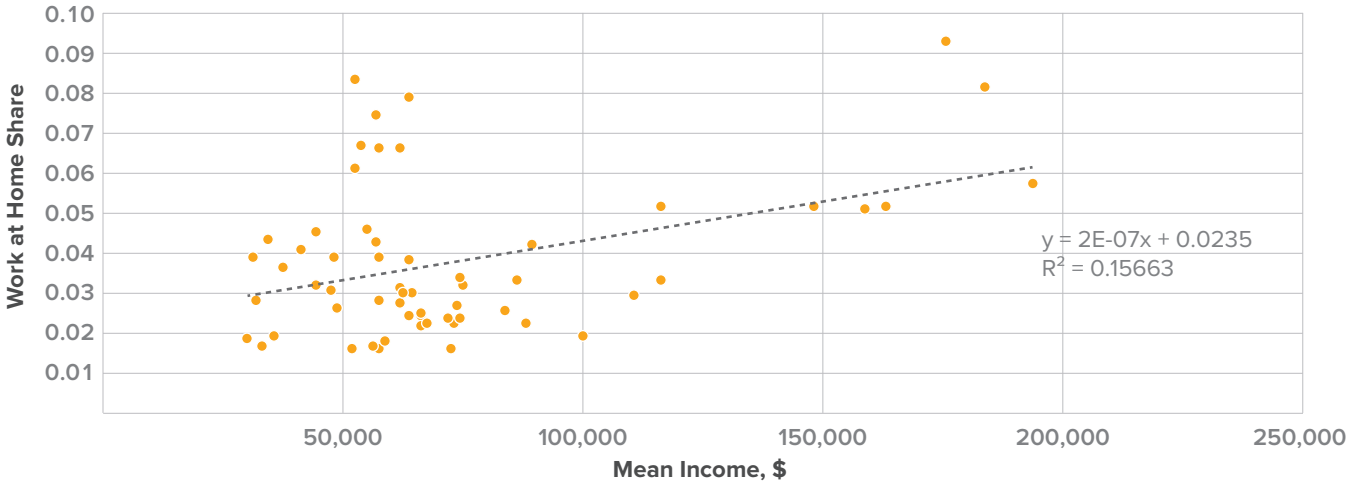
1 See Pushkarev and Zupan, *Public Transportation and Land Use Policy*, Indiana University Press, 1977

Figure A-1: Transit Share and Job Density, NYC Community Boards (Manhattan CBD and DT Brooklyn Excluded)

Figure A-2: Transit Share and Residential Worker Density, NYC Community Boards

Figure A-3: Walk/Bike Share as Function of Density Index*, NYC Community Boards

Figure A-4: Share Working at Home as Function of Income



When it comes to evaluating transit share and potential for added transit service, both the walker/bikers and those working at home should be accounted for.

The relationships in the preceding discussion account for those factors that are not directly associated with the transportation systems – residential and job densities, and income. When these are tested along with the transportation variables, they produce strong statistical relationships. These added variables include presence of direct transit service, cost of parking at the work destination, and the daily cost of tolls. This was done for all the CB to CB pairs in New York City. Those pairs with relatively few total trips were omitted where the small sample size would create statistical noise and obscure the relationship. Also omitted were CB pairs that were internal (to and from the same CB) since the large number of walking trips would also confuse the relationship. A multiple regression analysis using pairs with at least 1,000 trips (720 pairs) isolated the variables that are statistically significant. It produced this equation.

Transit Share = 23.20 Log ED + 22.41 Log RD – 0.177 INC + 5.39 T + 2.12 DS – 128.39

Where:

Transit Share = Percent of trips, exclusive of those on foot that are made by a transit mode;

ED = Employment Density (jobs per square mile in thousands);

RD = Residential Density (residential labor force per square mile in thousands);

INC = Median household income at residential end of work trip, thousands of dollars;

T = Daily tolls in dollars; and

DS = Direct subway service between the home and work CB with direct service having a value of one and indirect or no service a value of 0.

The r-squared of this equation is 0.761, which indicates that these five variables collectively explain over three-quarters of the variation in the independent variable, transit share. Each of these five variables and the equations constant are statistically significant and none of these variables fail the test of multi-collinearity, i.e. do not confuse the equation by two variables explaining the same phenomena, thereby substantially weakening their coefficients. However, Direct Transit was the weakest and barely made the statistical cut.

The equation can be interpreted as follows, all else being equal:

- Work locations with an order of magnitude higher in job density at the work location, say from 10,000 per square mile compared to 1,000 per square mile, or 100,000 per square mile compared to 10,000 per square mile, would have a higher transit share by about 23 percentage points;
- Residential locations with an order of magnitude density higher in residential labor force density, say 50,000 per square mile compared to 5,000 per square mile, would have a higher transit share by about 22 percentage points;
- Residential areas with a median income by $10,000 higher than another area would have a lower transit share of about 1.8 percentage points;
- Each added dollar of tolls would increase transit shares by about 5.4 percentage points: and
- Work trip markets with direct subway service would have about 2.1 percentage points higher transit shares.

A similar equation was developed with Manhattan CBD destinations kept out of the analysis, since it had a tendency to distort the relationship. The sensitivities of the variables were similar, except the job density variable that fit best was a linear rather than a logarithmic one. In this case, each 10,000 added jobs per square mile added about 4.2 percentage points to transit shares.

Appendix B: Data for Selected Community Boards

This Appendix presents detailed information about each of the five selected CBs. It begins by describing the transit service available and includes maps that show the areas in the district that are within walking distance of a subway stop and areas that are within walking distance of a bus line that accesses the subway. Those areas that fall into neither of these categories have poor access to the subway network and are handicapped in their residents' ability to move about the entire city. A second map shows the areas beyond walking distance of the local bus network in the district. Those areas beyond those distances are handicapped in a different way; they are limited in their residents' ability to move about locally.

Following the coverage discussion, data is presented which arrays the bus information for routes serving the district. Performance standards for speed, frequency and span developed earlier in this of service are applied to pinpoint those bus routes that are deficient in one or more ways.

To better understand the travel patterns for the five selected community boards, the same US Census data at the borough level shown earlier was recompiled at the community board level. For each of the five, the top ten CB job destinations are ranked (excluding Manhattan CBD community boards) to highlight where in the "boroughs" people need to get to for their jobs. These are shown in tables and maps that showing how these ten are distributed within the City.

Finally, the Appendix provides a list of major non-work destinations for the district, including schools, shopping districts, recreation, and hospitals, each likely to require transit access for district residents.

Table B-1: Neighborhoods in Selected Community Boards

BK5	BX9	MN11	QN5	SI1	
Broadway Junction*	Bronx River	East Harlem	Glendale	Arlington	Randall Manor
City Line	Castle Hill	Harlem*	Maspeth	Castleton Corners	Rosebank
Crypress Hills	Clason Point	Randalls Island	Middle Village	Clifton	Shore Acres
East New York	Harding Park	Wards Island	Ridgewood	Elm Park	Silver Lake
Highland Park	Parkchester			Fox Hills	St. George
New Lots	Soundview			Graniteville	Stapleton
Spring Creek	Soundview - Bruckner			Grymes Hill	Sunnyside
Starrett City	Unionport			Howland Hook	Thompkinsville
				Livingston	Ward Hill
				Mariner's Harbor	West Brighton
				Old Place	West New Brighton
				Park Hill	Westerleigh
				Port Ivory	Willowbrook*
				Port Richmond	

*denotes neighborhoods in more than one community district. Source:

Queens Community Board 5

The bus network in the district includes 22 local routes and 8 express routes. Seven of the 22 local routes are actually Brooklyn designated routes but serve at the edges of CB 5, particularly in the Ridgewood neighborhood. There are four significant east-west streets in the district – Grand Avenue, Flushing Avenue, Myrtle Avenue and Metropolitan Avenue, each with parking lanes on both sides of the street with only Metropolitan Avenue with more than one lane in each direction. North-south roads are even more constrained with only two streets – Fresh Pond Road and 80th Street – neither running entirely through the district, blocked by one or more of the seven major cemeteries. These cemeteries are a major feature of the district, consuming about one-third of its land area. All of these streets with their combined limitations of width, parking lanes and discontinuity result in slow movement of the numerous buses that use them, and prevent significant upgrades of travel speeds. The exception is on the eastern edge of the district, Woodhaven Boulevard which is oriented north-south with three lanes in each direction.

Local bus service covers the community board area well. As shown in Figure B-1, most of the area has at least one bus line within one-quarter mile of a bus route. This does not necessarily mean that residents have a route that accommodates all of their bus trips, however.

The accompanying map in Figure B-2 shows the areas of QN 5 within walking distance of a subway stop and within walking distance of a bus that serves subway stations. And it also shows those areas within a walk of the express bus stops. Large areas of this district, particularly in Maspeth and Glendale require a bus to reach the subway. Express buses help to fill in the gaps in Glendale, but not in Maspeth. Middle Village does benefit from the presence of express buses. Only the Myrtle Avenue (M) line, with four stations and terminating at Metropolitan Avenue in Middle Village directly serves the area. In addition, one station on the Canarsie L line is on the border and another is just outside it both within walking distance of some residents. The M service operates to Sixth Avenue in midtown Manhattan via the Williamsburg Bridge, with transfers to the L for trips to 14th Street in Manhattan which require an outdoor transfer and short walk between stations and direct transfers (changing levels only) to the J and Z services for trips to Lower Manhattan and to the G for trips to Downtown Brooklyn. Subways other than the M can be reached by using buses to various stations on the J, Z, and L and the A and C at Broadway Junction or from the north end of the district to the Flushing (#7) line.

Figure B-2 also shows the coverage provided by the supplementary express bus service and local bus coverage that feeds the M line. Two express routes stop in the district; another six stopping at its edge, mostly along Woodhaven Boulevard. All eight access the Long Island Expressway to reach the Queens-Midtown Tunnel and Manhattan, using the high occupancy lane (which also allows cars with three or more people) to provide a more reliable trip. The coverage by the local routes that feed the subway fills in the areas without either walking-distance subway or express bus service, with very limited areas left completely uncovered.

Figure B-1: Local Bus Coverage - Queens Community Board 5

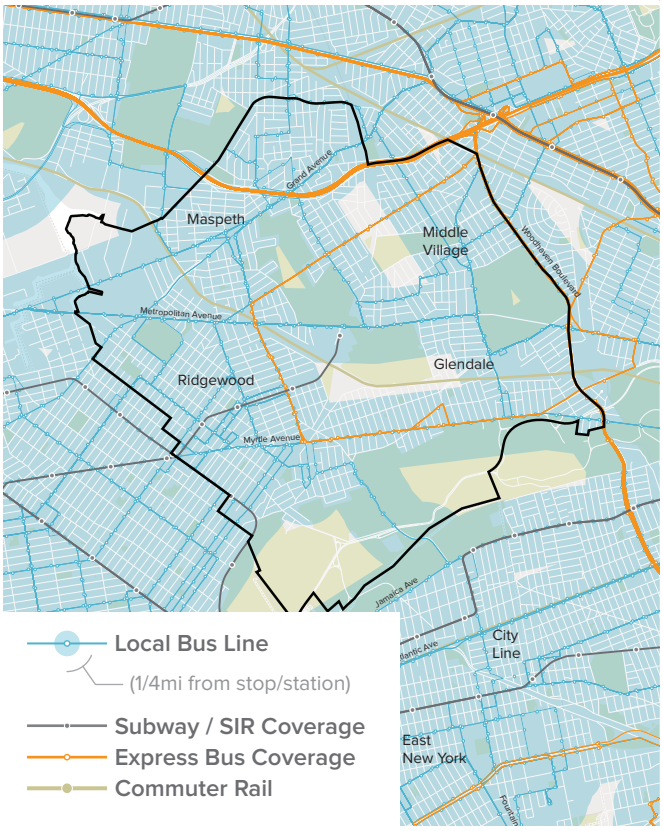


Figure B-2: Subway and Express Bus Access – Queens Community Board 5

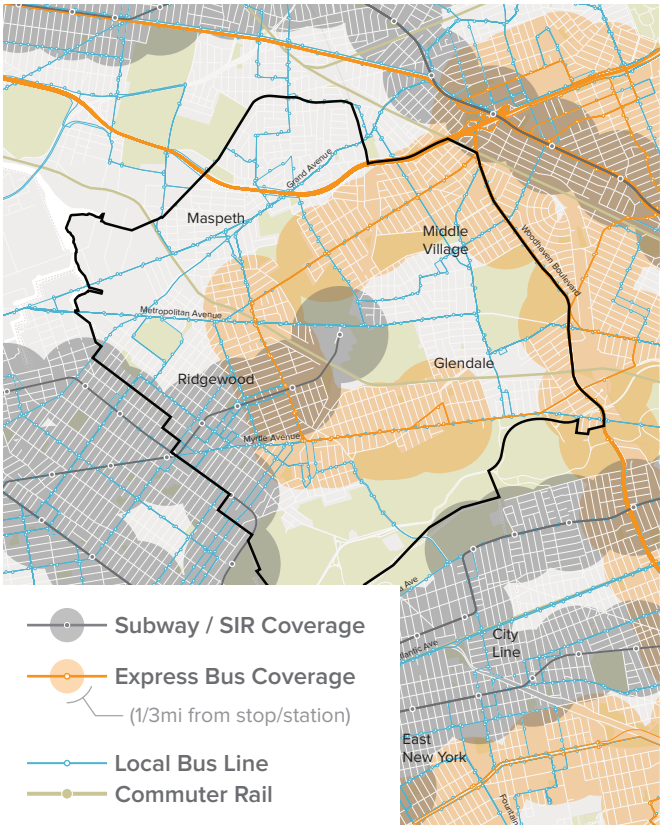


Table B-2: Bus Data for Queens Community Board 5

Route	Route Type	Bi-Directional Length of Route in QN5 (Mi)	Avg. Weekday Speed Across Entire Route (MPH)	Avg. Weekday Headway			Weekday Last Bus Run (Nearest hour)	Avg. Weekend Headway		2012 Annual Ridership	Stops at Subway?
				Morning (Min)	Mid-Day (Min)	Evening (Min)		Saturday (min)	Sunday (min)		
B13	Local	5.9	9.2	**12**	**20**	**12**	2:00am	**23**	**23**	1,647,034	No
B20	Local	4.3	8.2	7	12	8	2:00am	15	15	2,486,766	Yes
B26	Local	0.4	7.4	6	10	7	**12:00am**	9	11	3,353,974	No
B38	Local/LTD	5.5	7.1	2.5	4.5	4.5	**12:00am**	6	9	6,511,969	No
B52	Local	0.2	**6.6**	5.5	8	6.5	**12:00am**	9	13	4,036,731	No
B54	Local	0.2	**6.4**	8	10	7	**12:00am**	14	14	3,660,051	Yes
B57	Local	2.9	8.4	**12**	**20**	**15**	2:00am	20	20	1,860,333	Yes
Q11	Local	8.6	9.5	**15**	**30**	**15**	1:00am	**30**	**30**	1,727,537	Yes
Q18	Local	2.5	**7.6**	9	**20**	10	2:00am	20	20	2,590,414	No
Q21	Local	4.3	9.4	**30**	**30**	**30**	1:00am	10	30	1,147,774	Yes
Q23	Local	0.5	**7.8**	8	10	6	2:00am	10	12	4,965,290	Yes
Q29	Local	5.7	**7.8**	8	**20**	**10.5**	2:00am	15	20	1,863,833	No
Q38	Local	12.8	9.0	3.5	**20**	**12**	1:00am	**23**	**23**	1,923,934	Yes
Q39	Local	11.8	9.5	6.5	15	9.5	3:00am	**23**	**30**	1,590,125	Yes
Q47	Local	3.4	**8.1**	7.5	**20**	8.5	1:00am	**30**	**30**	2,289,537	No
Q52	LTD	2.1	15.0	**13.5**	**20**	**12**	1:00am	**30**	**30**	671,422	Yes
Q53	LTD	2.1	14.0	6.5	10	8.5	2:00am	10	11	5,007,501	Yes
Q54	Local	14.6	**8.2**	6	15	10	**12:00am**	19	20	3,863,969	Yes
Q55	Local	8.9	**7.9**	5.5	15	7	**12:00am**	12	20	2,336,379	Yes
Q58	Local/LTD	13.0	8.4	3	7	4	**12:00am**	6	6	9,145,098	Yes
Q59	Local	6.5	**8.1**	9	**20**	12	**12:00am**	15	15	2,227,165	No
Q67	Local	5.3	9.4	**12**	**30**	**14**	**12:00am**	**60**	**60**	685,648	Yes
QM10	Express	6.0	8.6	7	**none**	9.5	**11:00pm**	**none**	**none**	88,931	NA
QM11	Express	3.0	8.6	7	**none**	9.5	**11:00pm**	**none**	**none**	102,927	NA
QM12	Express	7.6	**7.7**	**11**	**none**	**16.5**	**8:00pm**	**none**	**none**	118,503	NA
QM15	Express	12.1	9.2	8	**60**	**14**	1:00am	**60**	**none**	341,048	NA
QM18	Express	1.4	**7.4**	**30**	**none**	**30**	**8:00pm**	**none**	**none**	57,599	NA
QM24	Express	24.8	**8.0**	5	**none**	8	**8:00pm**	**none**	**none**	291,655	NA
QM25	Express	12.4	**8.0**	5	**none**	8	**8:00pm**	**none**	**none**	76,627	NA
BM5	Express	5.3	10.9	**24**	**60**	**25.5**	**12:00am**	**60**	**none**	158,979	NA

Source: Metropolitan Transit Authority, Regional Plan Association
Note: Deficient routes shaded.

There is no commuter rail service in the district. The only possible option for commuter rail use is to access the Jamaica Center station of the LIRR either with local buses or with a bus - J/Z subway combination. The limitation for reverse service to Long Island destinations because of the absence of a third track on the LIRR main line further inhibits the use of the LIRR for district residents.

Data on all the bus routes serving QN5 is displayed in Table B-1. The data is revealing in many respects. First, as seen in the description of the other selected community boards, local bus service is exceedingly slow. No local route averaged more than 9.5 mph, with the lowest at 6.4 mph, and the rest clustering in the 7 to 8 mph range. The two limited stop services and the express service reach 15 mph.

Surprisingly, the speed of the express buses belies their name, with the eight routes hardly faster overall than the local routes. Undoubtedly, the time required to circulate locally and then having to negotiate crowded Manhattan streets slows down these routes.

Service headways vary widely too. Using the 10-minute rule of thumb for good service below which passengers no longer feel compelled to consult a schedule, 17 of the 22 local routes offer good service in the morning peak periods and 16 of the 22 in the evening peak. In midday, only half reach the service threshold of a bus every fifteen minutes, and of the 11 that do not, eight offer a bus every 20 minutes, or three per hour. On weekends, seven fall short of a bus every 20 minutes on both Saturdays and Sundays. But these routes are all among the more lightly used routes (less than 2 million annually) so it might not be reasonable to call for an increase in service. Four of the seven express buses serving QN 5 offer an attractive service frequency in the peak; only three are adequate in the evening peak and midday and weekend express service is largely non-existent.

Nighttime service ends at midnight or earlier for nine of the 22 routes, and all but one of the express services.

These deficiencies in express service are of special concern for a district such as QN 5, where subway coverage is so limited.

Not unexpectedly, as shown in Table B-2 and in Figure B-3, more QN5 residents work in their own community board than

any other. Almost 9,000 do so, and a high number work out of their home or have trip to work within walking distance. An equal number work in the two nearby CBs – QN1 and QN2 – when they are combined. These CBs include the neighborhoods of Hunters Point, Sunnyside and Woodside (QN2) and Long Island City, Astoria, and Steinway (QN1). Taken together, these three community board areas account for more than half of the top ten work sites and almost half of all Queens work destinations. In each of these cases, and indeed to all non-Manhattan job sites the share that use automobiles exceeds the share that use transit. This highlights the weaknesses of the transit network in this CB. The low transit use for traveling within QN5 can be attributed to the short distance involved. Few will voluntarily choose to wait for a transit vehicle if they have access to a car since the wait for the transit vehicle can easily exceed the time to make the trip by car.

The upper east side of Manhattan (MN8) is the next ranking destination, with ¾ of the trips made on transit, mostly by subway. The next three destination are all to Brooklyn, the first to BK2 which is downtown Brooklyn where transit shares are higher than auto shares, but the next two are CBs adjacent to QN5; again, for short trips the car is preferred. Overall, for these top ten, only 12 percent take the bus and 18 percent the subway. For all Queens' destinations the bus shares and subway share are each about 14 percent. These low transit shares for QN5 should not come as a surprise with its limited subway coverage and the various weaknesses of the bus network, requiring more than one bus to reach many places.

Queens Community Board 5 Access to Key Non-work Destinations

Downtown Brooklyn, the Fulton Street Mall and Barclays Center are difficult to reach for much of the district since only one subway line to Downtown Brooklyn penetrates the QN5. Bus service is either indirect or slow to these destinations. Other destinations also suffer from poor access - Flushing (indirect), Queens Center (infrequent), Citifield and Arthur Ashe Stadium (indirect). Among the schools, Brooklyn College, Queens College, LaGuardia Community and Richmond High School all require transfers for access. Rockaway Beach also requires two buses. A list of major destinations for the district is provided below.

Regional Centers

- Downtown Brooklyn
- Jamaica Center
- Flushing

Schools

- Queens College
- York College
- Brooklyn College
- LaGuardia Community College
- Grover Cleveland High School
- Christ the King High School
- Forest Hills High School
- Richmond High School

Parks / Open Space

- Flushing Meadow Park
- Rockaway Beach / Riis Park

Shopping Centers

- Queens Center Mall – Queens Boulevard
- Downtown Brooklyn – Fulton Street

Entertainment / Sports Venues

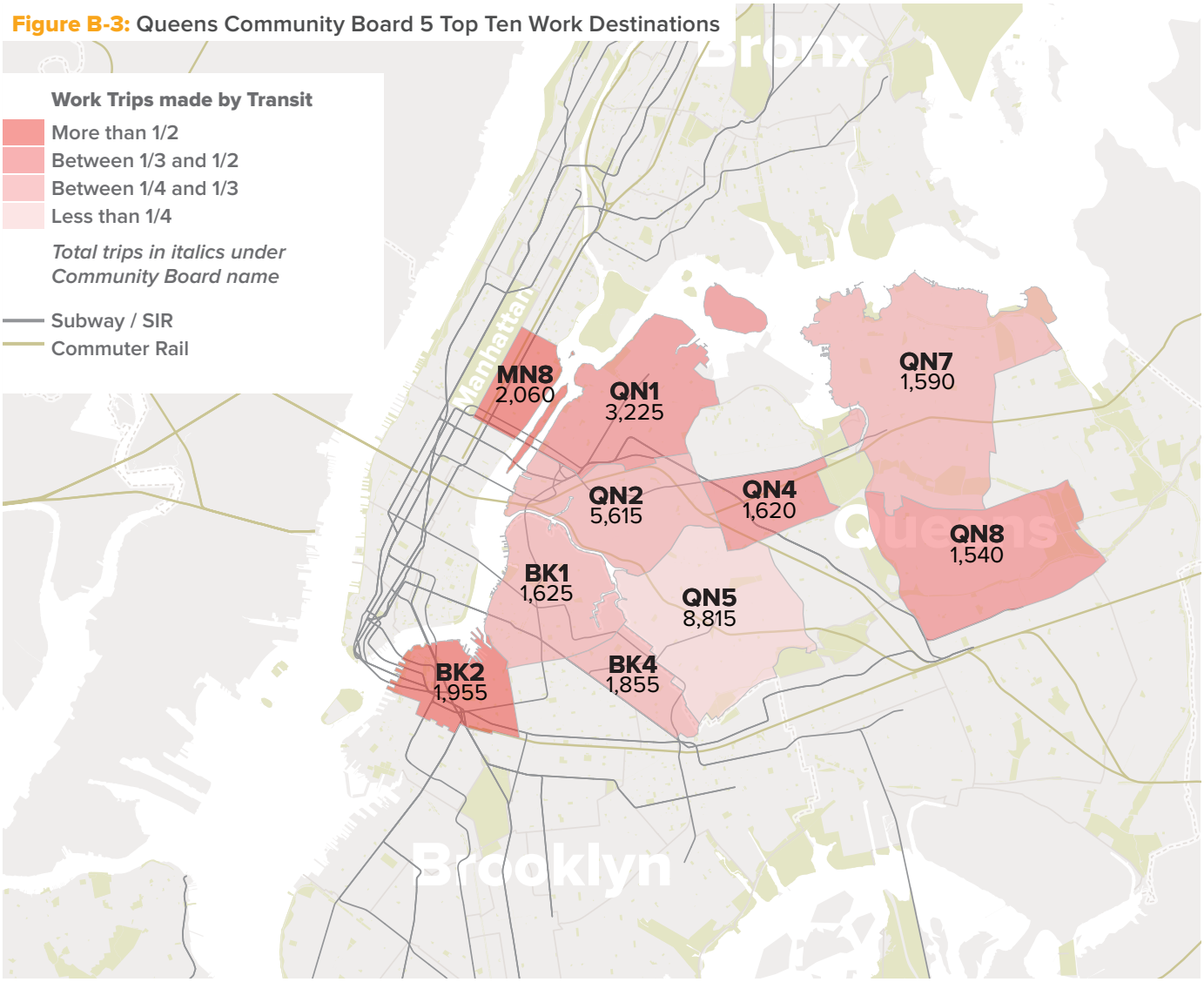
- Barclays Center
- Citifield
- Arthur Ashe Stadium

Table B-3: Top Ten Work Destinations for Queens Community Board 5 - 2010

		Percent				
CB	Total Trips	Bus	Subway	Transit	Auto	Walk or Work at Home
QN5	8,815	5.6	3.7	9.3	42.1	46.9
QN2	5,615	13.5	15.9	29.8	59.8	8.9
QN1	3,225	15.0	26.4	42.3	47.2	9.3
MN8	2,060	7.7	63.3	74.2	25.7	-
BK2	1,955	16.4	41.9	58.3	40.1	1.5
BK4	1,855	14.3	12.7	30.2	50.9	17.3
BK1	1,625	9.8	20.6	31.1	66.8	-
QN4	1,620	27.8	14.1	41.9	49.4	5.9
QN7	1,590	17.2	10.6	27.8	61.3	9.7
QN8	1,540	15.2	21.3	36.5	59.5	3.6
Top Ten	29,900	12.1	18.3	31.0	48.9	18.7
All Queens Destinations	31,993	14.0	13.6	28.0	52.0	18.6
ALL	74,310	11.7	40.6	53.4	36.9	8.9

Source: U.S. Census Bureau, American Community Survey 2006 to 2010

Figure B-3: Queens Community Board 5 Top Ten Work Destinations



Bronx Community Board 9

The district is served by nine local bus routes. One inter-borough service, the Q44, stops at the Hugh Grant Circle in Parkchester and links the Bronx with Flushing, Queens. The local routes operate on the major east-west streets, including Westchester Avenue and East Tremont Road, with other routes extending southward into the broad peninsula made up of the Soundview, Castle Hill, Clason Point and Harding Park neighborhoods. The local bus routes and the areas within a ¼ walk are depicted in Figure B-4. It is clear that just about the entire district is within a short walk of at least one bus route. Of course, that does not guarantee that the route nearby is also one that will take residents to all the places they wish to go.

Subway service within the community board is limited to #6 Pelham Bay line that runs through the northern portion of the district, making five stops, with one, the Parkchester station, offering a semi-express service that skips many of the stops farther south in the Bronx. When it reaches Manhattan, the #6 operates under Lexington Avenue on the upper east of Manhattan and then under Park Avenue South below 42nd Street. It is not possible to transfer from the #6 to a west-side train.

There is no commuter rail service in the district. Residents in the Castle Hill or Parkchester neighborhoods could take the Bx 22 bus to the Metro North station on the Harlem Line if they are destined to Westchester County locations. Using buses it is also possible to reach the Tremont Avenue Metro North station, but the Metro North service there is exceedingly poor and sporadic.

The accompanying map in Figure B-5 shows the areas of BX9 within walking distance of a subway stop and within walking distance of a bus that serves subway stations. And it also shows those areas within a walk of the express bus service. Five express routes operate through the area, but only two stop there. More than half of the land area in BX9 district is beyond walking distance to a subway station and therefore requires a local bus. Most of Soundview, Castle Hill and all of Clason Point are bus-to-subway territory. Express buses pick up some of the coverage near the Bruckner Expressway, but express buses mainly serve Manhattan, so it is not an option for all travel. Because the #6 does not provide any place of a transfer to trains traveling to the west midtown trains, BX9 residents now probably ride the White Plains Road or Dyre Avenue subway lines (#2 or # 5) to reach the west side of Manhattan. However, as Figure B-5 suggest, that requires a bus ride for some who otherwise could walk to the #6 or a longer bus ride for others. The one exception is the BX 5 bus line which connects with the 2 and 5 subway lines at the Simpson Street station. Once the Second Avenue subway is extended to 125th Street, this problem will be addressed, since it would allow riders on the #6 to transfer to the Second Avenue line which operates to the west side of midtown Manhattan.

Data on all the bus routes serving BX9 are displayed in Table B-4. Bus service is slow; only one exceeds 8 mph, with four at less than 7mph. As should be expected, the overall speeds of the express services are somewhat faster, but not by that much, ranging from 8 to 13 mph.

Figure B-4: Local Bus Service Coverage – Bronx Community Board 9

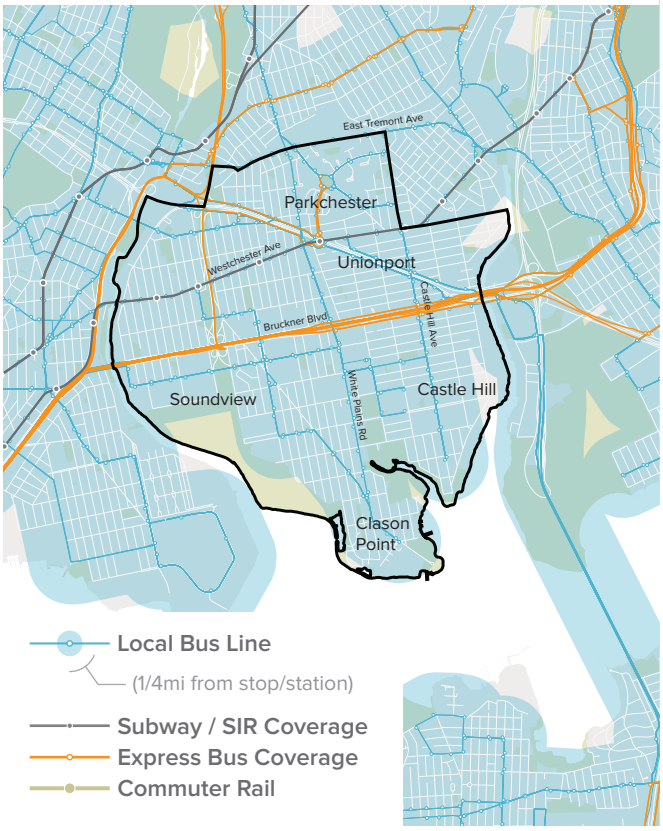


Figure B-5: Subway and Express Bus Access – Bronx Community Board 9

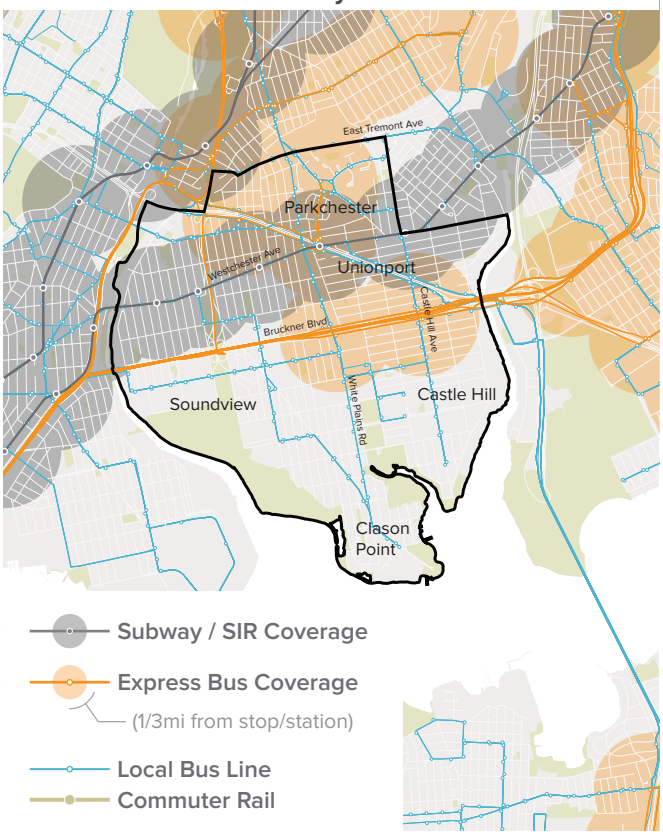


Table B-4: Bus Data for Bronx Community Board 9

Route	Route Type	Bi-Directional Length of Route in BX9 (Mi)	Avg. Speed Across Entire Route (mph)	Avg. Weekday Headway Morning (min)	Avg. Weekday Headway Midday (min)	Avg. Weekday Headway Evening (min)	Weekday Last Bus Run (Nearest hour)	Avg. Weekend Headway Saturday (min)	Avg. Weekend Headway Sunday (min)	2012 Annual Ridership	Stops at Subway?
BX22	Local	18.2	6.9	7	12	7	**12:00am**	11	13	4,730,005	Yes
BX27	Local	10.3	7.0	5	10	6	**12:00am**	10	15	2,304,467	Yes
BX36	Local	15.4	7.1	3	8	5	1:00am	8	8	9,625,389	Yes
BX39	Local	4.9	6.8	7	10	9	**12:00am**	12	13	5,409,742	Yes
BX4	Local	4.4	6.7	6	10	9	2:00am	10	13	3,781,876	Yes
BX40	Local	2.0	7.3	6	9	6	1:00am	12	11	8,108,698	Yes
BX42	Local	2.0	7.3	6	9	6	1:00am	12	11	8,108,698	Yes
BX4A	Local	5.5	6.7	6	10	9	2:00am	10	13	3,781,876	Yes
BX05	Local	35.2	8.6	4.5	10	6	1:00am	10	13	3,726,214	No
BXM11	Express	3.2	10.1	**12**	**30**	**12**	1:00am	**30**	**60**	359,336	NA
BXM6	Express	2.4	**8.4**	**20**	**60**	**20**	1:00am	**60**	**60**	204,868	NA
BXM7	Express	17.6	13.2	6.5	**30**	6.5	2:00am	**20**	**30**	923,098	NA
BXM8	Express	8.8	10.8	**11**	**30**	9	2:00am	**30**	**60**	494,535	NA
BXM9	Express	4.4	10.6	8.5	**30**	9	2:00am	**30**	**60**	623,652	NA
Q44	Interboro	17.1	10.3	3	5	4	1:00am	5	5	9,513,166	Yes

Source: Metropolitan Transit Authority, Regional Plan Association
Note: Deficient routes shaded.

Service headways for the local routes meet the service standards during weekday peaks of 10 minutes, for midday of 15 minutes, and for weekends of 20 minutes. The express bus service frequencies do not, particularly during midday weekdays and on weekends. Only two of the five routes have adequate midday service. The frequencies of the express bus service on weekends is poor, with 30 to 60 minutes the norm. Of the nine local and five express routes only three local routes do not provide service to 1am. These three are all local routes that operate in a north-south direction through areas beyond walking distance from the subway, handicapping late night travelers living in the Soundview, Castle Hill and Clason Point neighborhoods.

The BX9 top ten work destinations are listed in Table B-5 and depicted geographically in Figure B-6. They show the local nature of many trips to work, a repeating theme. As a work destination for its residents, BX9 is more than double the next ranking CB, which is the adjacent BX11 just to the north. The remaining CBs are rather evenly spread in the southern and eastern portions of the borough and to the upper east and west side in Manhattan.

Almost half of BX9 residents working in their own district either work at home or walk to work, and sizable shares walk to nearby CBs as well. Transit shares are higher to six of the eight Bronx destinations; the bus outranks the subway for all Bronx locations, while the subway is chosen more often for the two Manhattan CBs. The high bus use can be attributed to the limited subway options in BX9 and the low car ownership levels, particularly for travel within the borough where twice as many use the bus than the subway. With little prospect of new subway service, the priority should be on making this district's bus service more attractive for travel within the borough.

Bronx Community Board 9 Access to Key Non-Work Destinations

Virtually all the key non-work destinations listed below are difficult to reach by public transit from BX9 neighborhoods. Bus routes that do serve the district, with one or two exceptions do not connect directly with these destinations. Those destination in the west side of the Bronx, such as Montefiore Medical Center, Lehman College or the Fordham Road shopping district require either an exceedingly long bus trip or a down-and-back subway ride using the #6 to 125th Street in Manhattan. The Bay Plaza shopping center, Pelham Bay Park and the relatively nearby Jacobi Hospital is a two-bus ride. It is safe to say that Bronx Community Board 9 is very isolated, particularly for those residents without an automobile available.

Figure B-6: Bronx Community Board 9 Top Ten Work Destinations

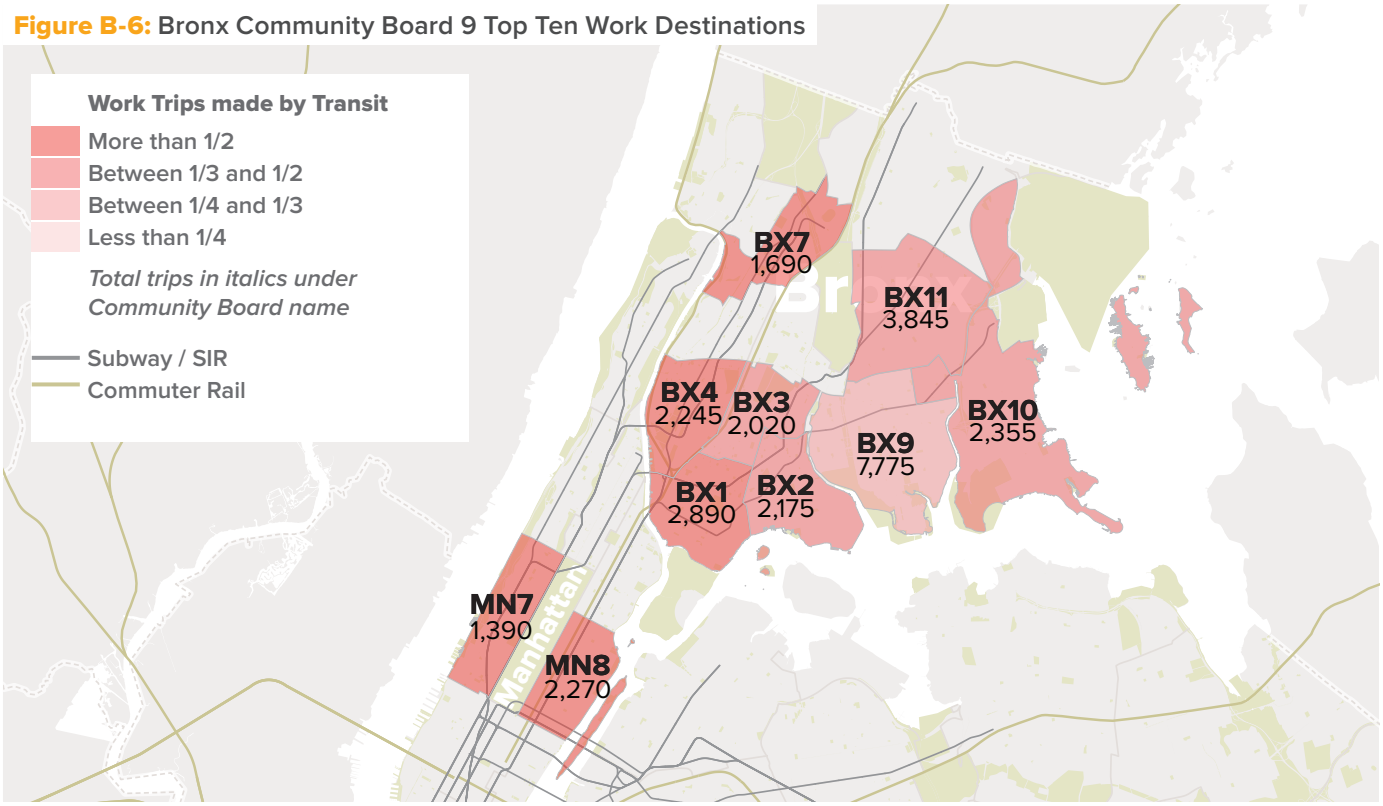


Table B-5: Top Ten Work Destinations for Bronx Community Board 9 - 2010

		Percent				
CB	Total Trips	Bus	Subway	Transit	Auto	Walk or Work at Home
BX9	7,775	20.8	7.3	28.2	23.0	48.6
BX11	3,845	29.9	16.5	46.5	39.1	12.7
BX1	2,890	36.7	17.5	54.7	41.0	3.8
BX10	2,355	28.2	20.2	49.5	43.9	3.2
MN8	2,270	4.8	79.1	85.0	13.0	0.4
BX4	2,245	37.6	23.6	62.3	29.8	8.9
BX2	2,175	26.9	18.4	45.7	45.9	7.8
BX3	2,020	26.5	11.9	39.9	54.2	5.4
BX7	1,690	39.9	18.0	61.5	36.6	1.8
MN7	1,390	14.4	63.7	80.2	20.5	-
Top Ten	28,655	26.0	22.1	48.9	33.0	17.4
All Bronx Destinations	29,705	29.7	14.5	45.0	36.9	17.4
ALL	**64,954**	**18.6**	**43.3**	**63.9**	**27.5**	**8.1**

Source: U.S. Census Bureau, American Community Survey 2006 to 2010

Among the key non-work destination for BX9 are:

Regional Centers

- Fordham Road

Schools

- City College
- Lehman College

Parks / Open Space

- Bronx Park
- Pelham Park

Shopping Centers

- Fordham Road
- Bay Plaza

Entertainment / Sports Venues

- Yankee Stadium

Hospitals

- Jacobi
- Montefiore Medical Center
- Bronx- Lebanon
- St. Barnabas Hospital
- New York Westchester Square Medical Center.

Brooklyn Community Board 5

The 16 local bus routes cover the district well and are used to access the five subway lines in the district or on its borders. The southern third of the district in the Flatlands, Starrett City and Spring Creek neighborhoods are less well served because of their distance from the subway lines. In the northern parts of the district along Jamaica Avenue residents, must rely on the slow Jamaica Avenue El, parts of which are more than 100 years old.

In Table B-6 the service data for the 16 bus routes that operate I BK5 are shown. Service frequency and span generally meet the deficiency standards used in this report, as does bus speed, but five routes to not provide service after midnight.

Brooklyn Community Board 5 is the only one of the five selected CBs where the top ranking CB destination was not itself, as shown in Table B-7 and Figure B-9. The downtown Brooklyn CB (2) outranked BK5. This can be attributed to the availability of two major subway lines that connect the areas, making BK2 the destination of choice for many. BK5 is different from the other selected CBs in other ways. Its highest ranking destinations are neither adjacent nor nearby. Not until the tenth ranked CB, BK4, is there an adjacent CB. This pattern can best be attributed to the availability of multiple subway options that make it possible for BK5 residents to reach more distant locations relatively quickly. Table B-7 illustrates this with the generally high subway shares, exceeding bus use in all but two cases. It is not a coincidence that these two exceptions are in Queens which are not reachable directly by the subway service in BK5. Almost 60 percent of this districts workers travel to Brooklyn job destinations by transit and about two-thirds of them use the subway. The message is clear. Where you have a more robust subway network more distant areas become accessible, increasing the mobility of more people.

Brooklyn Community Board 5 Access to Key Non-Work Destinations

Accessibility to major destinations by public transit from this district is decidedly mixed. Those living near the #3 New Lots subway line have direct subway access to such locations as Prospect Park, the Brooklyn Museum and Medgar Evers College; those near the northwest corner of the district have access to subway lines into downtown Brooklyn. Other neighborhoods in the district, particularly in the south in Flatlands, Spring Creek and Starrett City do not have those advantages with a bus ride to the subway. Other key destinations in Brooklyn are poorly served from all neighborhoods in the district. Two major hospitals in Flatbush require an awkward backhaul subway transfer and two others are inaccessible except with a long two-bus trip. Only Brookdale Hospital is easily accessible and then only for those living near the #15 bus route. Brooklyn College is hard to reach and King Plaza is virtually unreachable by transit.

Among the major non-work destinations for BK5 are:

Regional Centers

- Downtown Brooklyn
- Jamaica Center

Schools

- Brooklyn College
- Medgar J. Evers College
- Richmond Hill High School
- Boys and Girls High School

Parks / Open Space

- Prospect Park
- Coney Island

Shopping Centers

- Kings Plaza

Entertainment / Sports Venues

- Barclays Center
- Brooklyn Museum

Hospitals

- Beth Israel Medical Center
- Brookdale Hospital Medical Center
- University Hospital of Brooklyn
- Kings County Hospital Center
- Kingsbrook Jewish Medical Center

Figure B-7: Local Bus Access for Brooklyn Community Board 5

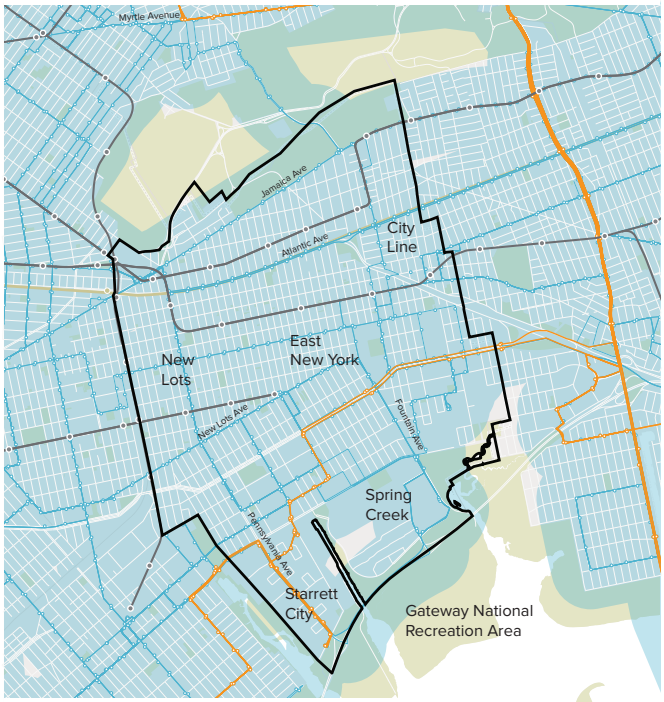


Figure B-8: Subway and Express Bus Access for Brooklyn Community Board 5

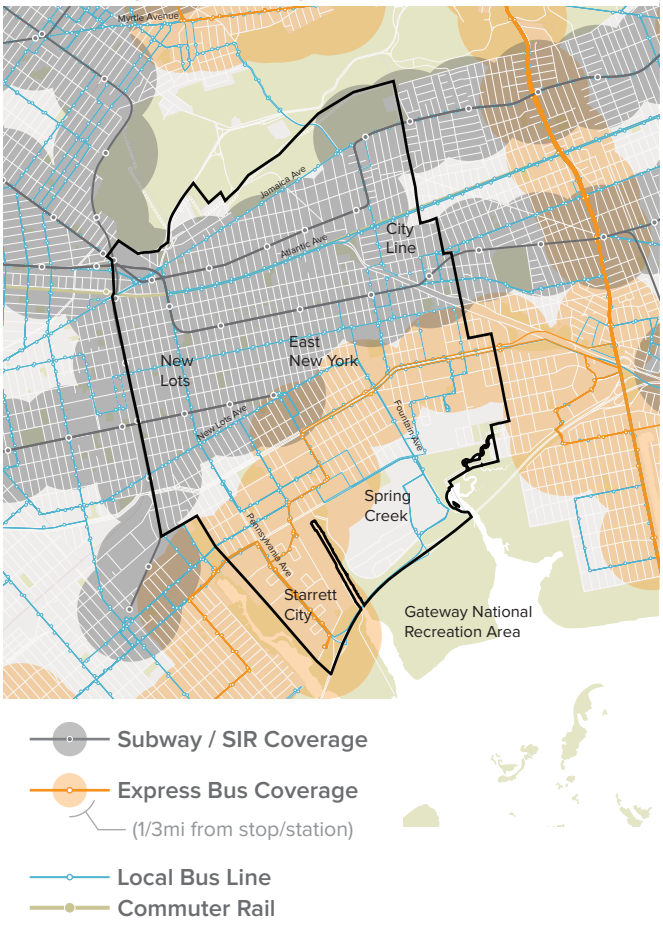


Table B-6: Bus Data for Brooklyn Community Board 5

Route	Route Type	Bi-Directional Length of Route in BK5 (Mi)	Avg. Speed Across Entire Route (MPH)	Avg. Weekday Headway Morning (Min)	Midday (Min)	Evening (Min)	Weekday Last Bus Run (Nearest hour)	Avg. Weekend Headway Saturday (min)	Sunday (min)	2012 Annual Ridership	Stops at Subway?
B103	LTD	0.2	9.6	2.5	7.5	3.5	2:00am	7.5	12	3,747,102	No
B12	Local	0.4	6.7	4	7	5	**12:00am**	5	10	5,490,791	Yes
B13	Local	8.6	9.2	**12**	**20**	**12**	2:00am	22	**23**	1,647,034	Yes
B14	Local	5.7	7.1	10	15	10	**12:00am**	11	20	2,301,166	Yes
B15	Local	30.0	9.8	4.5	9	8	1:00am	7	9	7,198,245	Yes
B20	Local	21.6	8.2	7	12	8	2:00am	15	15	2,486,766	Yes
B25	Local	0.4	7.7	8	9	8	**12:00am**	8	14	3,392,039	Yes
B6	Local/LTD	6.2	9.0	2.5	5	3.5	1:00am	4.5	8	13,279,268	Yes
B82	Local/LTD	6.5	8.2	3.5	10	4.5	1:00am	6	10	8,569,558	Yes
B83	Local	16.8	8.1	5.5	10	7	1:00am	7	16	2,599,400	Yes
Q07	Local	2.9	9.6	6	**20**	**10.5**	1:30am	20	30	1,574,342	Yes
Q08	Local	8.1	**7.6**	6.5	15	7	1:00am	11	16	3,158,685	No
Q24	Local	4.4	8.9	10	15	10	**12:00am**	11	17	2,520,125	Yes
Q56	Local	4.3	8.6	10	12	**12**	**12:00am**	12	16	2,900,108	Yes
BM2	Express	2.3	10.8	15	60	13	1:30am	**60**	**none**	272,302	NA
BM5	Express	6.4	10.9	**24**	**60**	**25.5**	**12:00am**	**60**	**none**	158,979	NA

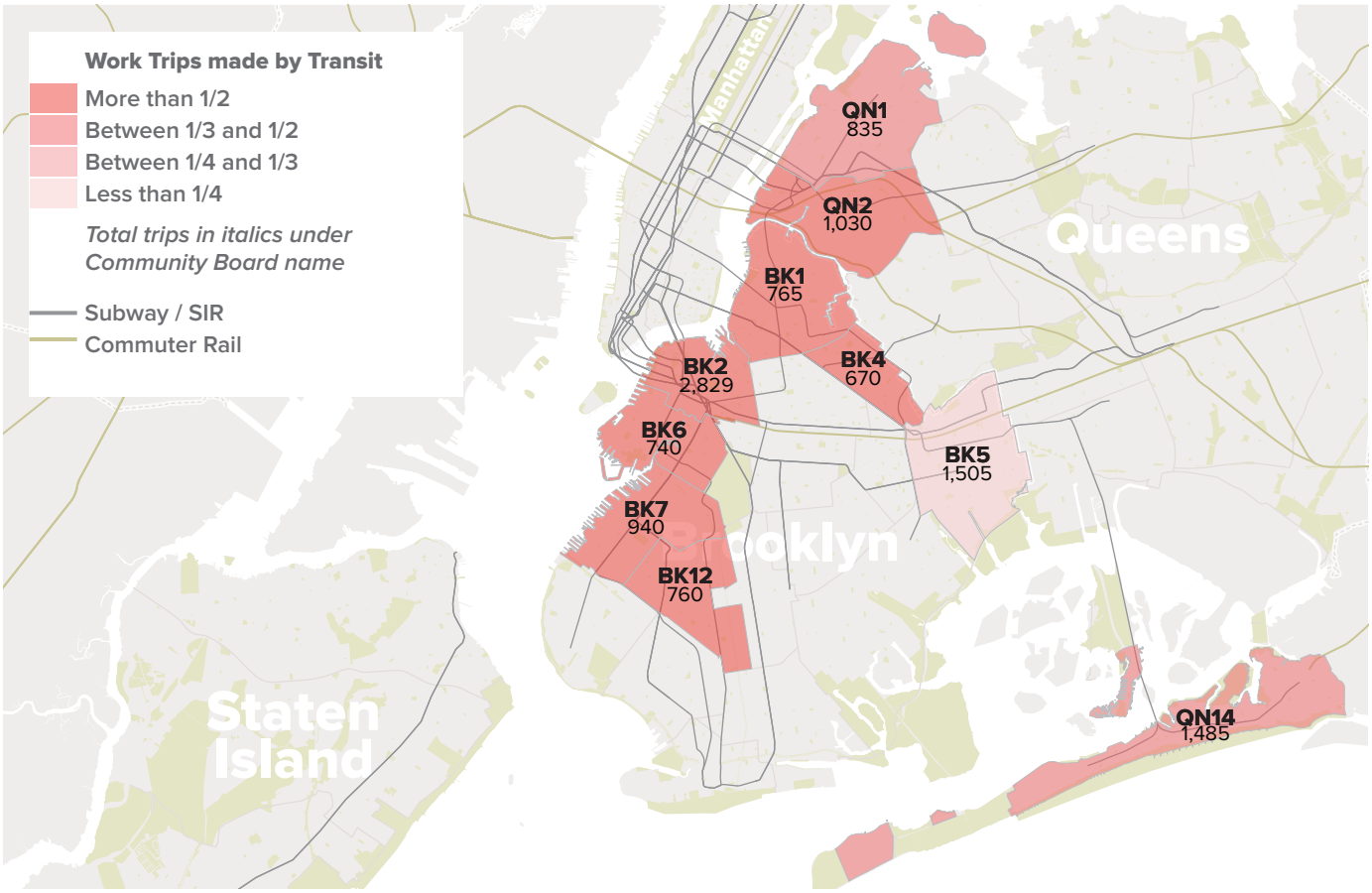
Source: Metropolitan Transit Authority, Regional Plan Association
Note: Deficient routes shaded.

Table B-7: Brooklyn Community Board 5 Top Ten Work Destinations

		Percent				
CB	Total Trips	Bus	Subway	Transit	Auto	Walk or Work at Home
BK2	2,829	16.3	44.9	65.5	27.9	6.9
BK5	1,505	4.3	4.0	8.3	15.3	77.1
QN14	1,485	24.9	21.2	46.1	36.4	16.8
QN2	1,030	27.6	25.7	53.3	45.5	-
BK7	940	25.5	41.5	69.7	22.3	8.0
QN1	835	12.6	26.9	39.5	56.9	2.4
BK1	765	10.5	57.5	68.0	32.0	-
BK12	760	2.0	67.8	72.4	25.0	2.6
BK6	740	23.6	41.9	65.5	33.8	2.7
BK4	670	15.7	35.8	51.5	43.3	6.0
Top Ten	11,559	16.4	34.9	52.7	31.9	15.4
All Brooklyn Destinations	12,914	17.0	40.6	59.4	26.3	14.3
ALL	**28,815**	**13.4**	**49.4**	**64.7**	**27.3**	**7.6**

Source: U.S. Census Bureau, American Community Survey 2006 to 2010

Figure B-9: Brooklyn Community Board 5 Top Ten Work Destinations



Manhattan Community Board 11

Local bus service in this district is characterized by a series of east-west and north-south streets conforming to the Manhattan grid. East-west routes operate from the East River to the Hudson River, connecting the district to the upper west side of Manhattan. The north-south routes cover each of the avenues, other than Park, where commercial traffic is not permitted. These routes operate on one-way avenues, which forces residents to walk an extra-long block in one direction, but the district is otherwise fully covered by local bus service, as is clear from Figure B-10.

Subway service is confined to the Lexington Avenue line, with four stops from 96th to 125th Street, the last with express trains (#4 and #5), with the local (#6) service stopping at all of them. Five routes that operate along 125th Street offer service to the subway lines to the west, all out of the district.

The Metro North commuter railroad stops at 125th Street and Park Avenue in the northwest corner of the community board, where "reverse" service to Hudson Valley and southeastern Connecticut destinations is available.

Figure B-11 illustrates the areas of MN11 within walking distance of a subway stop and within walking distance of a bus that serves subway stations. With the exception of a very small patch centered on east 103rd Street, the entire district is can reach the subway on foot or with a short bus ride.

The data for all the districts bus routes are shown in Table B-8. Most of the local bus service in the area does not reach the 8 mph threshold, even many of those with limited stops.

Adequate service headways are not reached in the peak periods on a few routes, but they each barely fall short. Midday service frequencies are met on all but two routes, and only three routes have weekend service found wanting. Surprisingly, five routes do no operate to 1am, two end service at 8pm and 9pm. As is usually the case, the routes with more limited frequencies or service spans, tend to be those with fewer riders.

The Manhattan 11 top ten, shown in Table B-9 and mapped in Figure B-123, also has more of its workers located within their own borders. One-third of the total of the ten are working locally. And as with the others, the next ranking destinations are close by; the first five CBs in the list are located in other CBs close by in Manhattan and account for about 13,000 of the 15,400 top ten trips. The remaining five are either in adjacent CBs in the south Bronx or eastern Queens or in Upper Manhattan (MN12). Manhattan 11 is unlike the other selected CBs in two important respects: it has a very high share of transit users – far exceeding drivers, and it has a substantial number of workers who reach their jobs on foot to nearby CBs. The choice of bus or subway among its transit commuters is very much dependent on the configuration of the subway; with only one north-south line in this district, trips to crosstown locations such as MN9 are more likely to be on the bus. With the prospects of new subway service with the completion of the first phase of the Second Avenue subway, and eventually with other phases, the choice of the subway over the bus or auto could shift, depending on where future phases are built.

Figure B-10: Local Bus Coverage for Manhattan Community Board 11

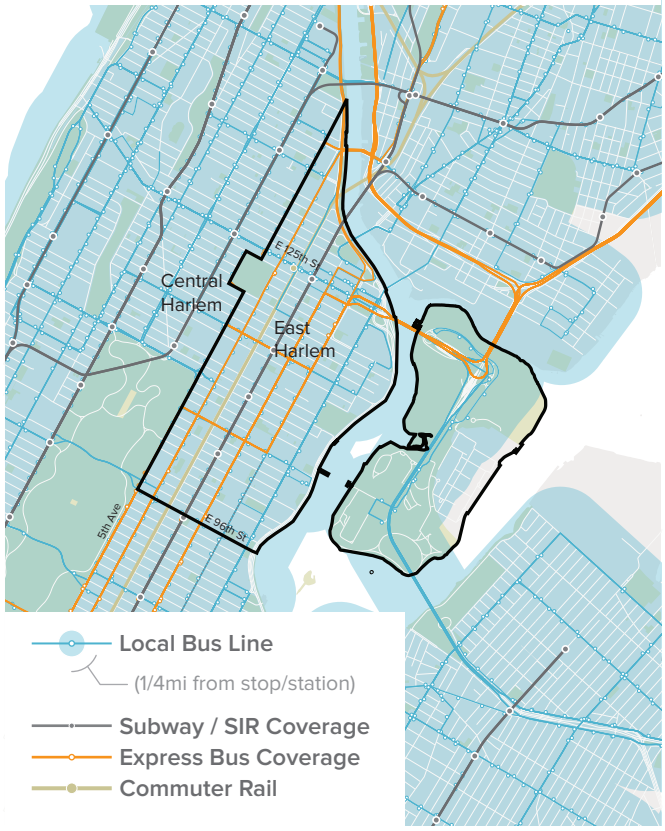


Figure B-11: Subway Coverage for Manhattan Community Board 11

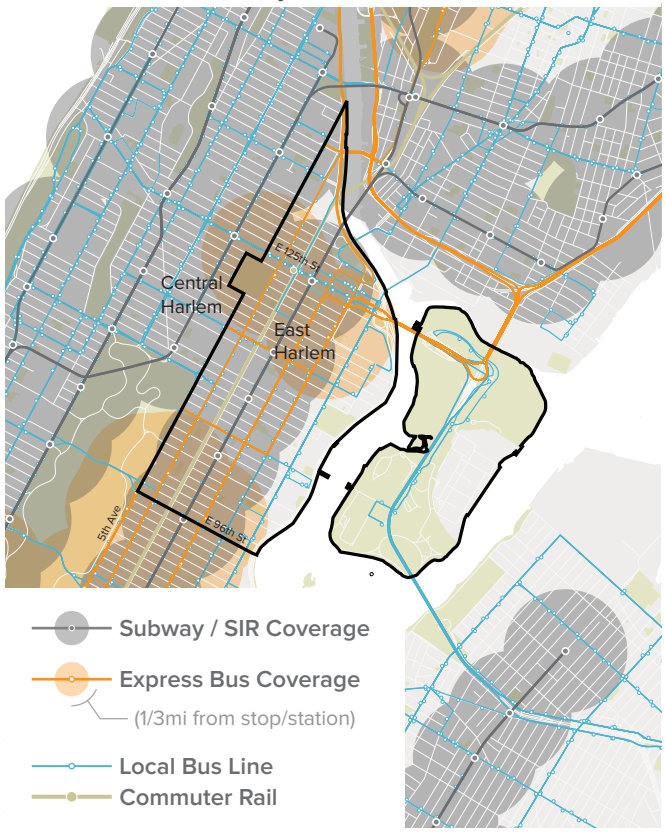


Table B-8: Bus Data for Manhattan Community Board 11

Route	Route Type	Bi-Directional Length of Route in QN5 (Mi)	Avg. Weekday Speed Across Entire Route (MPH)	Avg. Weekday Headway Morning (Min)	Avg. Weekday Headway Midday (Min)	Avg. Weekday Headway Evening (Min)	Weekday Last Bus Run (Nearest hour)	Avg. Weekend Headway Saturday (min)	Avg. Weekend Headway Sunday (min)	2012 Annual Ridership	Stops at Subway?
BX15	Local	2.7	6.4	7	7	7	**12:00am**	7	9	7,332,265	Yes
BX33	Local/LTD	0.6	5.6	12	**20**	**15**	1:00am	**23**	**27**	927,706	Yes
M01	Local/LTD	10.3	7.0	5.5	12	5	2:00am	13	14	3,499,775	No
M100	Local	1.1	6.4	8	9	7	2:00am	11	13	5,015,397	Yes
M101	Local/LTD	16.2	6.9	3	4	3	1:00am	4	4	9,022,029	Parallels subway
M102	Local	5.4	NA	10	12	11	2:00am	11	13	4,890,719	Parallels subway
M103	Local	8.3	NA	**12**	12	**12**	2:00am	11	12	4,031,622	Parallels subway
M106	Local	2.5	**4.8**	12	**30**	**15**	**9:00pm**	**30**	**30**	596,802	Yes
M116	Local	2.4	**5.3**	4	11	5.5	2:00am	13	13	2,919,040	Yes
M15	Local	9.2	6.9	9	9	9	1:00am	11	11	17,792,141	No
SBS15	SBS	9.2	8.9	3	8	5	**12:00am**	8	9	17,792,141	No
M02	Local/LTD	2.7	8.1	9	15	9	1:00am	13	15	3,718,446	No
M03	Local	3.5	7.2	**12**	12	10	2:00am	11	15	4,999,124	No
M35	Local	5.1	12.3	10	10	12	1:00am	**18**	**18**	539,857	Yes
M04	Local/LTD	6.3	7.1	5.5	10	5	1:00am	12	13	6,119,006	No
M60	Local	5.0	11.5	8	9	8	**12:00am**	8	10	5,667,885	Yes
M96	Local	0.4	**4.5**	3	5	3	**12:00am**	8	11	4,677,777	Parallels subway
M98	LTD	5.3	6.4	6	none	**12.5**	**8:00pm**	none	none	514,894	Parallels subway

Source: Metropolitan Transit Authority, Regional Plan Association
Note: Deficient routes shaded.

Table B-9: Top Ten Work Destinations for Manhattan Community Board 11, (Excluding Manhattan CBD) – 2010

CB	Total Trips	Percent Bus	Percent Subway	Percent Transit	Percent Auto	Percent Walk or Work at Home
MN11	5,315	10.2	8.9	19.4	6.4	72.7
MN8	3,850	25.2	32.1	62.6	8.7	19.1
MN7	1,570	21.0	56.7	85.4	4.1	6.7
MN10	1,135	26.9	28.6	55.5	7.4	36.6
MN9	860	59.9	14.0	73.8	13.4	11.0
BK2	620	8.9	73.4	85.5	15.2	-
QN2	585	3.4	60.7	81.2	13.7	-
MN12	545	22.0	36.7	58.7	26.6	13.8
BX1	535	10.3	54.2	81.3	18.7	0.7
BX4	390	30.8	44.9	93.6	6.2	-
Top Ten	15,405	19.7	29.3	53.0	9.0	34.4
All Manhattan Destinations	36,915	16.0	49.3	70.0	7.4	19.7
ALL	**43,172**	**14.8**	**51.8**	**71.6**	**8.7**	**17.1**

Source: U.S. Census Bureau, American Community Survey 2006 to 2010

M11's top five non Manhattan CBD major work destinations are all in Manhattan above 59th Street. As with the other CBs examined, most people work close to home. The other top destinations are all nearby too, with three in the South Bronx, another in Washington Heights and nearby QN5 in Long Island City rounding out the list. Of these the more difficult to reach by public transit are those requiring a "dog-leg" trip with a cross-town bus ride and then a north-south subway rider. The district in Queens requires a two-subway journey.

Manhattan Community Board 11 Access to Key Non-Work Destinations

The non-work destinations on the west side of Central Park are less accessible by public transit, relying on the slow crosstown buses and an extra transfer if the destination is to the north or south of the crosstown bus location. This restricts the ability of Manhattan 11 to reach destinations on the upper west side of Manhattan such as Columbia, City College, and the retail centers along Broadway. Midtown destinations also require a transfer, either bus-subway or subway-subway. The completion of the first phase of the Second Avenue Subway (SAS) in 2016 will address that limitation. Destinations on the east side are accessible, and the concentration of medical facilities will be made more so by the completion of the SAS.

Among the major non-work destinations for M11 are:

Regional Centers

- 125th Street

Schools

- City College (CUNY)
- Manhattan Center for Science and Mathematics

Parks / Open Space

- Randall's Island
- Central Park

Shopping Centers

- East River Plaza
- 125th Street

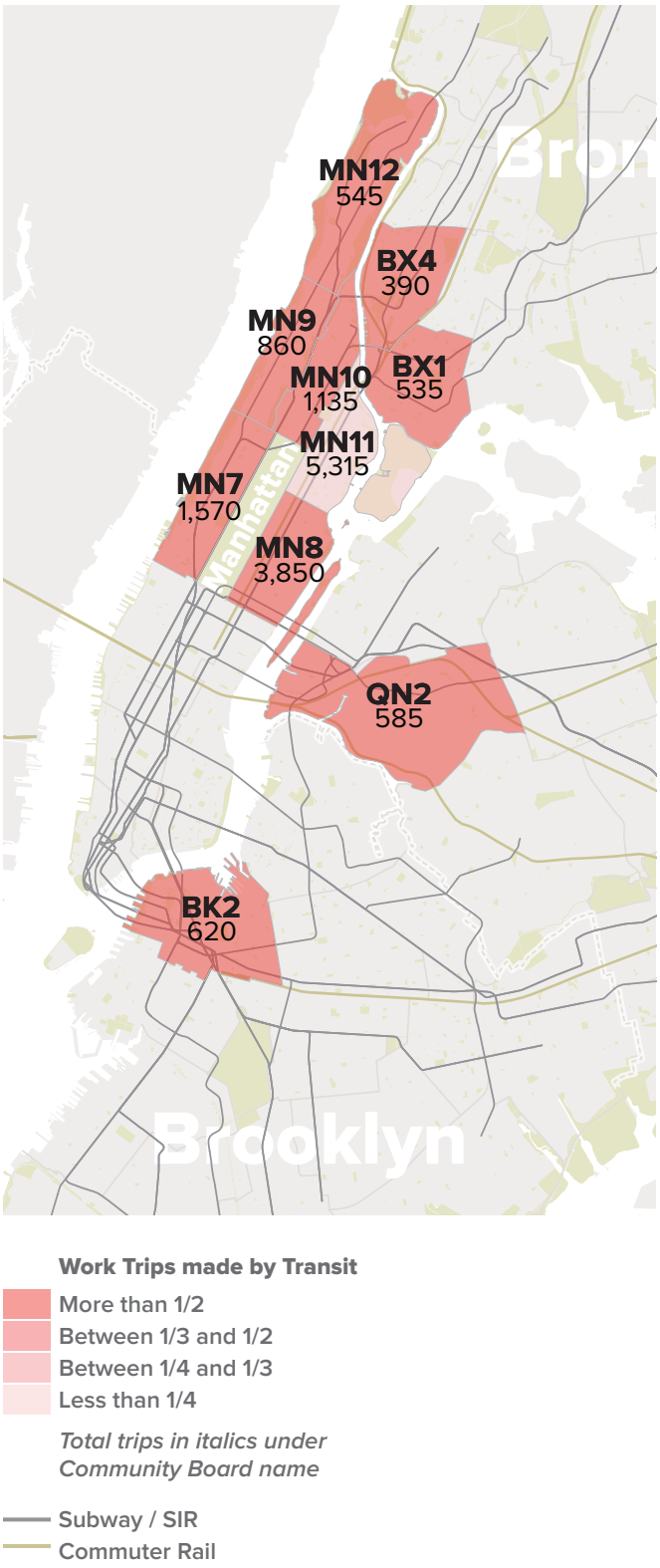
Entertainment / Sports Venues

- Madison Square Garden

Hospitals

- Mt. Sinai
- Harlem Hospital
- Hospital for Special Surgery
- Lenox Hill Hospital
- New York Presbyterian Hospital

Figure B-12: Manhattan Community Board 11 Top Ten Work Destinations



Staten Island Community Board 1

The bus network on Staten Island serves three purposes: 1) for intra-brought travel, 2) as a delivery system to the Staten Island ferry in St. George for travelers to Manhattan, and 3) as an express system to bring commuters and others to Manhattan. In Figure B-13 the 22-route local network that fulfills the first two of these purposes is shown. It covers well the northern parts of the borough but with gaps in the central and more southern parts of the borough where residential densities are lower. Figure B-14 depicts the coverage of the 20-route express bus network and the Staten Island Railway also. In addition to some of the low density gaps, there are also places in the northeastern parts of Staten Island where there is neither express bus service nor the SIR.

The local bus routes serving Staten Island are displayed in Table B-10. Unlike the bus route speeds in the other boroughs the services here all exceed the 8mph threshold. This can be explained by the lower densities on Staten Island and the lighter ridership. Service frequency is another matter, with lower levels of service provided, which fall short of the accepted thresholds.

Four of the 22 local bus routes fall below one mile per hour below the borough-wide average, all feeding St. George, mostly from points on or near the north shore. Service headways vary widely too. Using the 10-minute rule of thumb for good service below which passengers no longer feel compelled to consult a schedule, 18 of the 22 local routes offer good service in the morning peak periods, but half of the routes offer inadequate evening peak service. Worse, 16 routes provide frequencies in midday that fall short, five with half hourly service and two with none at all. On weekends, seven have no service at all and four do not meet the 20 minute headway standard on Saturdays and five on Sundays. Nighttime service ends before 1am on six of the 22 routes, four by 8pm.

Figure B-10: Local Bus Coverage for Staten Island Community Board 1

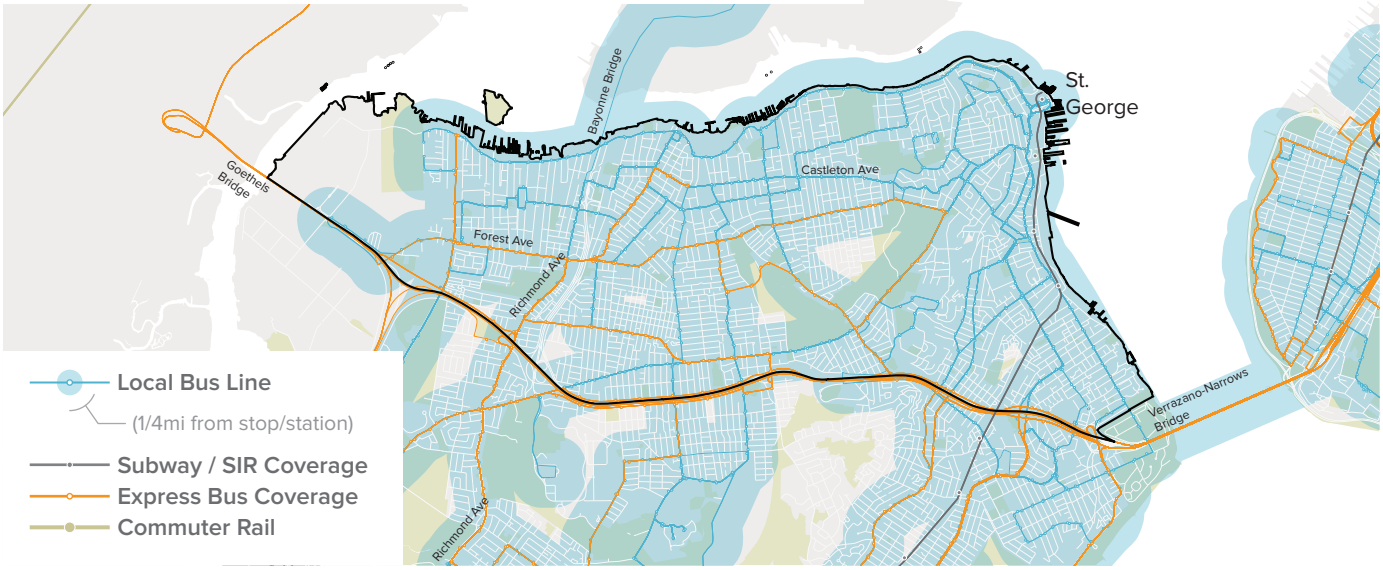


Figure B-11: Subway Coverage for Staten Island Community Board 1

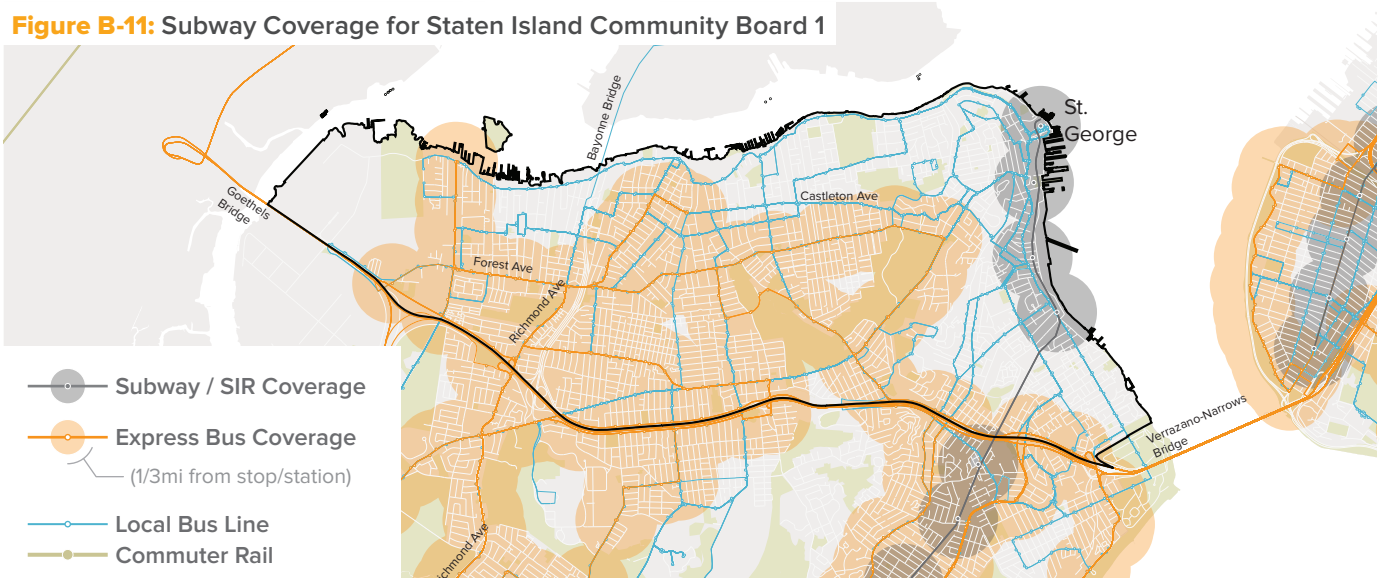


Table B-10: Local Bus Data for Staten Island

Route	Route Type	Avg. weekday Speed Across Entire Route (MPH)	Avg. Weekday Headway			Weekday Last Bus Run (Nearest hour)	Avg. Weekend Headway		2012 Annual Ridership	Stops at St. George Ferry?	Stops at SIRT?	Stops at 86th St. Brooklyn?
			Morning (Min)	Midday (Min)	Evening (Min)		Saturday (min)	Sunday (min)				
S4090	Local/LTD	12.0	5	**20**	9	**12:00am**	20	**27**	1,322,360	Yes	No	No
S4252	Local	**9.4**	15	**30**	15	2:00am	**30**	**30**	1,195,738	Yes	No	No
S4494	Local/LTD	11.2	5.5	**20**	8	1:00am	16	17	2,064,759	Yes	No	No
S4696	Local/LTD	**10.3**	7.5	15	10	**12:00am**	15	20	2,103,983	Yes	No	No
S4898	Local/LTD	**8.9**	6	15	5.5	**12:00am**	16	17	2,378,558	Yes	No	No
S5181	Local/LTD	11.3	8	**20**	8	**12:00am**	**30**	**30**	1,308,894	Yes	Yes	No
S53	Local	11.6	7	12	8	**12:00am**	12	11	3,223,159	No	Yes	Yes
S54	Local	10.4	9	**30**	5.5	**11:00pm**	**none**	**none**	377,190	No	Yes	No
S55	Local	14.1	15	**30**	**30**	**8:00pm**	**none**	**none**	138,268	No	Yes	No
S56	Local	12.1	**30**	**30**	**30**	**7:00pm**	**none**	**none**	158,183	No	Yes	No
S57	Local	11.6	**12**	**20**	8	**12:00am**	**30**	**30**	495,878	No	Yes	No
S59	Local	13.2	**12**	**20**	**15**	2:00am	**22**	**30**	1,215,207	No	Yes	No
S6191	Local/LTD	11.7	10	**20**	**15**	**12:00am**	20	17	1,378,342	Yes	No	No
S6292	Local/LTD	**10.1**	9	15	7	**12:00am**	16	16	1,499,918	Yes	No	No
S66	Local	12.7	15	**30**	**15**	2:00am	**none**	**none**	428,675	Yes	No	No
S7484	Local/LTD	15.6	9	**20**	**12**	**12:00am**	13	17	1,738,772	Yes	No	No
S7686	Local/LTD	10.7	10	**20**	7.5	**12:00am**	**30**	**30**	1,076,036	Yes	Yes	No
S78	Local	15.4	9	15	**15**	1:00am	16	17	1,988,371	Yes	Yes	No
SBS79	SBS	16.6	7	15	7.5	1:00am	10	12	2,979,363	No	Yes	Yes
S89 *	LTD	12.7	12	**none**	**12**	**8:00pm**	**none**	**none**	230,691	No	No	No
S92	LTD	**10.7**	15	**none**	**15**	NA	**none**	**none**	NA	No	Yes	No
S93	LTD	12.2	15	**none**	**15**	**8:00pm**	**none**	**none**	421,858	No	No	Yes

Source: Metropolitan Transit Authority, Regional Plan Association
Note: Deficient routes shaded.

Table B-11: Express Bus Data for Staten Island (CHECK)

Route	Weekday Morning Headway (Min)	Weekday Midday Headway (Min)	Weekday Evening Headway (Min)	Weekday Last Bus Run (Nearest hour)	Saturday Average Headway (min)	Sunday Average Headway (min)	Stops at SIRT?
X1	6	none	6	All Night	19	22	Yes
X2	10	none	12	8:00pm	none	none	No
X3	10	none	**30**	7:00pm	none	none	No
X4	17	none	18	8:00pm	none	none	Yes
X5	12	none	9	9:00pm	none	none	Yes
X7	10	none	14	8:00pm	none	none	Yes
X8	13	none	14	8:00pm	none	none	Yes
X9	12	none	11	8:00pm	none	none	No
X10	12	30	15	2:00am	28	30	No
X11	**19**	none	11	2:00am	none	none	No
X12/X42	9	none	11	11:00pm	none	none	No
X14	13	none	12	10:00pm	none	none	No
X15	12	none	9	10:00pm	none	none	No
X17	6	none	7	1:00am	35	none	Yes
X19	11	40	14	1:00am	none	none	Yes
X22	9	none	12	11:00pm	none	none	Yes
X23	11	none	15	9:00pm	none	none	Yes
X24	10	none	15	9:00pm	none	none	No
X30	**17**	none	**16**	10:00pm	none	none	No
X31	**20**	none	**18**	10:00pm	none	none	No

Source: Metropolitan Transit Authority, Regional Plan Association
Note: Deficient routes shaded.

All of the local bus routes on Staten Island are designed to feed some other transit service. As noted in the last three columns of Table B-10, the routes either feed the St. George ferry or the Staten Island Rapid Transit line, with two exceptions – the S89 which provides access to the Hudson Bergen Light Rail line, or the S93 which connects with the subway system in Bay Ridge, Brooklyn. However, both of these only operate in weekday peak periods.

Staten Island's extensive express bus service to Manhattan, as shown earlier, covers the island well. But, as is shown in Table B-11, in most all cases is available only during peak times on weekdays.

The top ten work destinations for Staten Island Community Board 1 are listed in Table B-12 and Figure B-15. As with the three of the other four CBs, the top ranked destination is internal. In SI1's case, 20,100 of the work trips, almost half of the top ten's trips are internal. Of these over 20 percent are actually not trips but work at home residents or made by a walk to work. The next two ranked CBs are also on the Island, so that the Staten Island destinations account for almost 35,700 of the top ten's 43,800. They also amount to more than half of all the places other than to Manhattan. These internal Staten Island trips are predominantly made by car with buses accounting for most of the rest. The other major destinations are either in Brooklyn or on Manhattan's east and west side north of 60th Street, as shown in Figure A-15. The Brooklyn destinations are strung out along the western edge of the borough, bordering New York harbor. Autos remain the prime mode for trips to Brooklyn, while for trips to Manhattan, 80 percent or more use public transit, either by bus, subway or ferry in some combination. Among the Brooklyn-bound commuters, BK2, downtown Brooklyn has the highest transit share; those destined there can either use the bus routes that connect to subway in Bay Ridge, Brooklyn, or use the ferry to Lower Manhattan and transfer to one of the many subway lines there to reach Brooklyn. The concentration of job locations within Staten Island creates the onus on transit providers to improve transit within Staten Island. The bus network is the main focus, with complementary role for the SIRT.

Staten Island Access to Key Non-Work Destinations

Transit access to key locations on Staten Island depends primarily on the bus network that covers the Island. Those locations in proximity to St. George such as Borough Hall and minor league ballpark at ST. George have rather good bus coverage and the SIR from much of the northern parts of the Island. The Staten Island Mall in the center of the island is served by more than a half dozen bus routes that radiate out to the north and to Richmond Avenue, Richmond Road and Arthur Kill Road to the south. The Bricktown Mall on the southern part of the island has some local bus coverage nearby. Other key destinations are less well served with Staten Island CUNY served by only three routes, Willowbrook Park with two routes, and Wagner College, St. John's University, Staten Island University Hospital North, and Great Kills Park with only one route each.

The major non-work destinations on Staten Island are:

Regional Center

- Borough Hall

Schools

- College of Staten Island (CUNY)
- St. Johns University
- Wagner College
- Curtis HS
- Port Richmond HS
- New Dorp HS
- Staten Island Technical HS
- Susan E. Wagner HS
- Tottenville HS

Parks / Open Space

- Gateway
- Silver Lake
- Fresh Kills
- Great Kills Park
- Willowbrook Park
- Wolfe's Pond Park

Shopping Centers

- Staten Island Mall
- Bricktown Mall

Entertainment / Sports Venues

- Staten Island Yankees

Hospitals

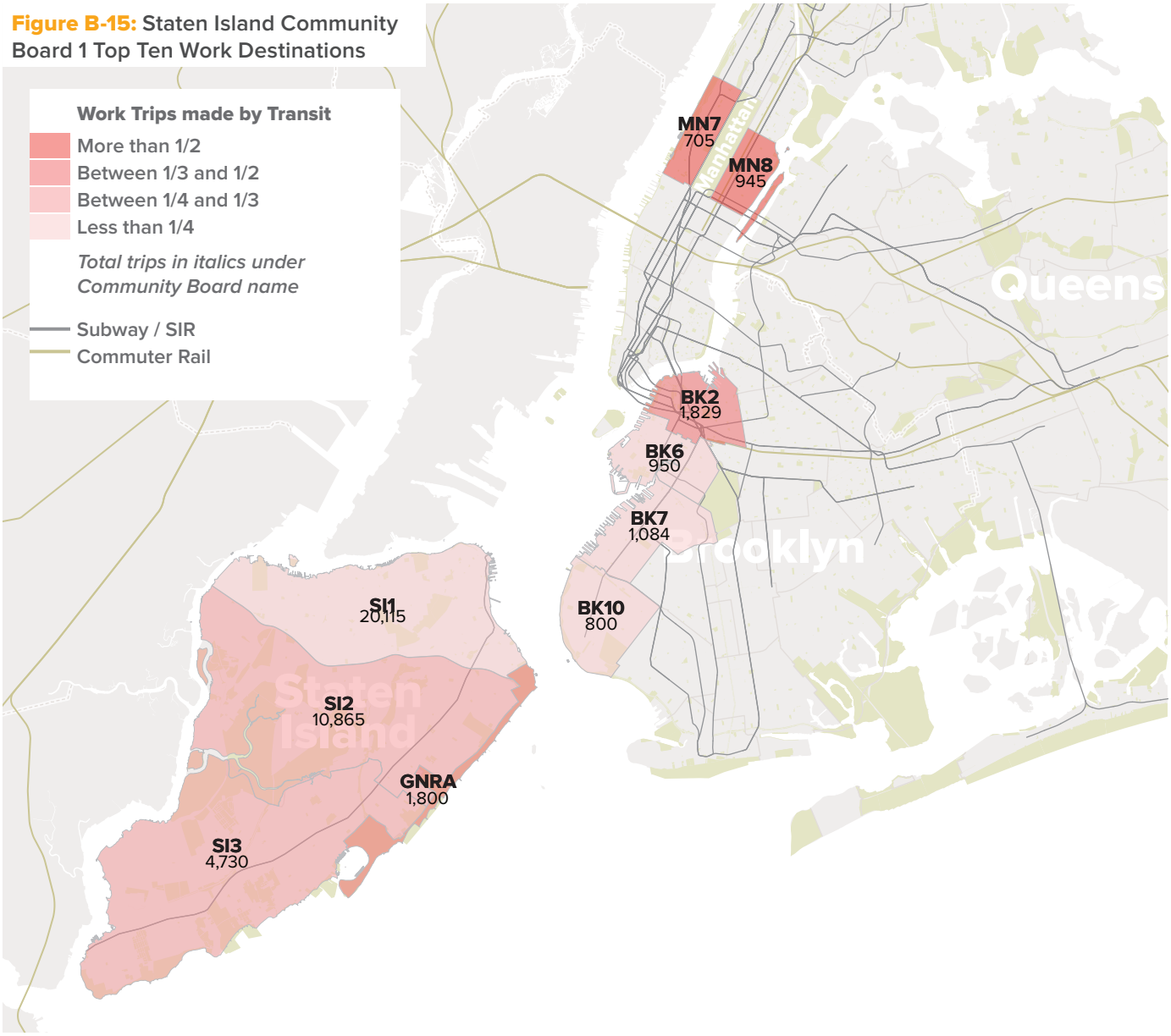
- Richmond University Hospital
- Staten Island University Hospital North

Table B-12: Top Ten Work Destinations for Staten Island Community Board 1 – 2010

		Percent					
CB	Total Trips	Bus	Subway	Ferry	Transit	Auto	Walk or Work at Home
SI1	20,115	21.4	0.4	0.5	22.7	54.7	21.3
SI2	10,865	24.8	0.8	-	25.6	72.3	1.5
SI3	4,730	26.6	2.9	0.5	31.6	66.6	1.8
BK2	1,829	18.0	8.4	14.8	41.2	59.2	-
GNRA	1,800	36.7	0.6	0.8	38.6	56.9	3.3
BK7	1,084	9.7	2.8	-	13.8	84.7	0.4
BK6	950	17.4	2.6	1.1	21.1	74.6	-
MN8	945	56.6	12.2	12.7	81.5	18.9	1.1
BK10	800	15.6	-	3.8	19.4	78.9	1.3
MN7	705	58.2	19.9	2.0	80.0	20.6	-
Top Ten	43,823	24.1	1.8	1.3	27.7	60.9	10.5
All Staten Island Destinations	35,710	23.1	0.9	0.3	24.8	61.7	12.7
ALL	67,253	28.2	3.7	7.8	40.3	51.7	7.1

Source: U.S. Census Bureau, American Community Survey 2006 to 2010

Figure B-15: Staten Island Community Board 1 Top Ten Work Destinations



Appendix C: Bus Route Details

Table C-1: All Bus Routes by Borough With Inadequate Service Frequency

Weekdays				Weekend	
AM Peak	Midday	PM Peak		Saturdays	Sundays
BX24	BX16	BX24	Q21	BX8	BX30
BX29	BX29	BX29	Q35	Q21	B7
B4	B4	BX33	Q38	Q47	B13
B13	B13	Bx34	Q48	Q50	Q11
B24	B16	B4	Q50	Q52	Q38
M3	B24	B13	Q56	Q67	Q47
M20	B57	B24	Q59	S51	Q52
M50	B64	B48	Q67		Q67
Q11	B70	B57	Q72		Q72
Q19	Q7	B64	Q102		
Q21	Q11	B70	Q103		
Q35	Q15	M8	Q104		
Q48	Q18	M20	S52		
Q50	Q21	M21	S55		
Q52	Q29	M98	S56		
Q72	Q36	M106	S57		
Q102	Q37	Q7	S59		
Q103	Q38	Q11	S61		
S52	Q41	Q19			
S56	Q47				
S57	Q50				
S59	Q52				
	Q59				
	Q67				
	Q76				
	Q77				
	Q103				

Table C-2: High Ridership Local Bus Routes Deserving More Service

Weekdays			Weekend	
AM Peak	Midday	PM Peak	Saturdays	Sundays
BX39	BX9	BX4	Bx21	BX21
B43	BX15	Bx21	M7	B43
B62	B6	Bx28/38	M101	B49
B63	B8	B3	Q44	B82
B68	B19	B9	Q54	M3
M7	B36	B15		M5
M60	B82	B39		Q54
M100	Q25	B43		Q65
M104	Q65	B62		
Q23		B63		
		M3		
		M5		
		M7		
		M60		
		Q53		

Appendix D: Ridership Assumptions for Triboro Rx

The assumptions used to estimate the number of riders on the Triboro Rx fall into two categories – the diversion assumed from each of the current modes – bus, subway and auto – and the assumption of the share of each mode's trips that are for work purposes. In Table D-1 the intra-borough and inter-borough diversion assumptions for bus, subway and auto are given. The bus and subway assumptions were based on an assessment of the overall quality of the current service. The auto diversion was based largely on distance. Shorter trips, i.e. intra-borough are likely to be more difficult to divert from cars.

Work trip and non-work splits by mode are based on data from the New York Metropolitan Transportation Council.

Table D-1: Modal Diversion Factors for Triboro Rx Estimates

Market	Diverted From:		
	Bus	Subway	Auto
Intra Bronx	33	10	10
Intra Queens	25	25	10
Intra Brooklyn	33	10	10
Between Bronx and Queens	33	33	20
Between Bronx and Brooklyn	0	25	30
Between Queens and Brooklyn	33	33	20

Transcribed from report. Source:

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Regional Plan Association

Regional Plan Association is America's oldest and most distinguished independent urban research and advocacy group. RPA works to improve the economic competitiveness, infrastructure, sustainability and quality of life of the New York-New Jersey-Connecticut metropolitan region. A cornerstone of our work is the development of long-range plans and policies to guide the growth of the region. Through our America 2050 program, RPA also provides leadership in the Northeast and across the U.S. on a broad range of transportation and economic-development issues. For more information visit, www.rpa.org.

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