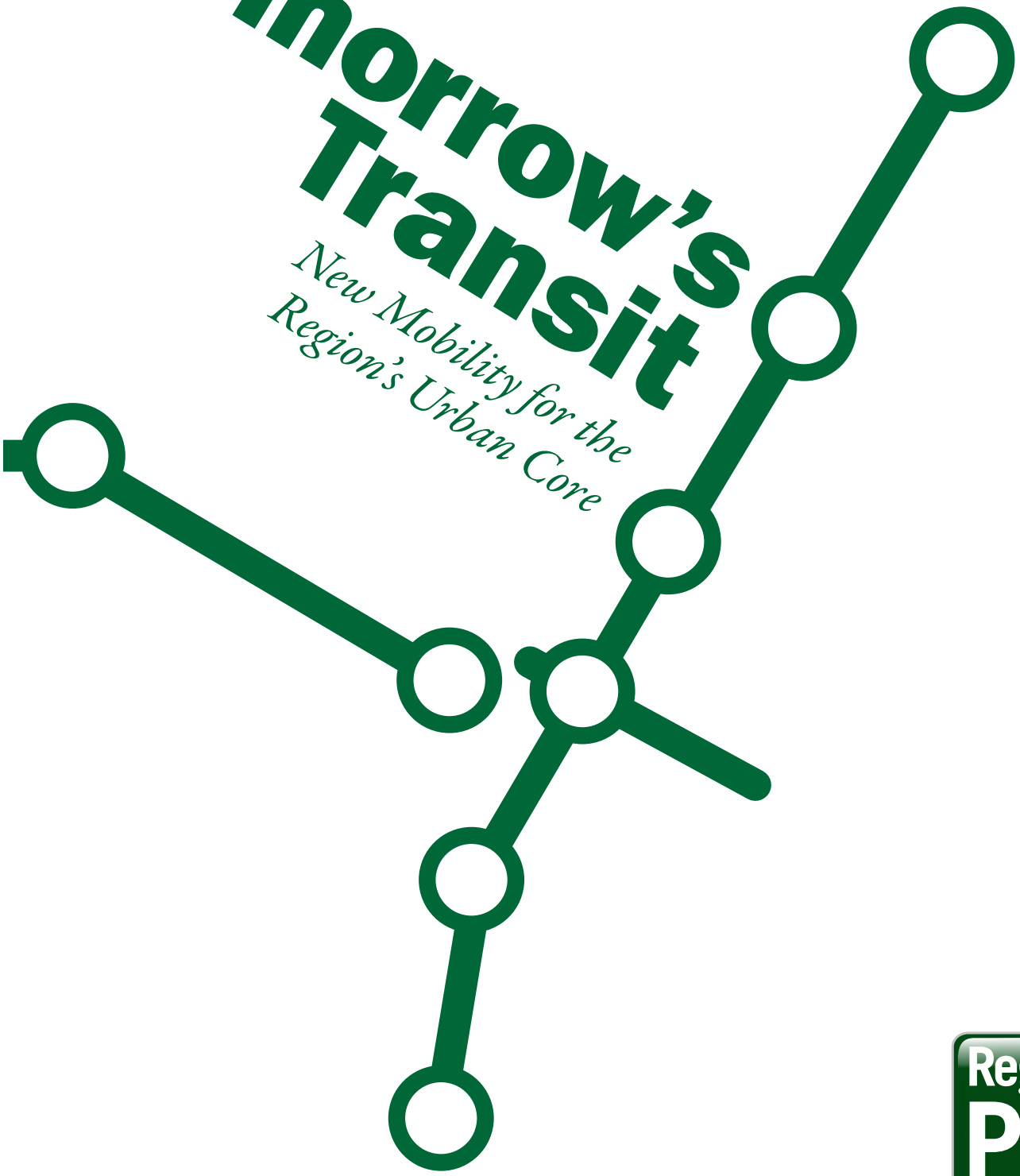
Tomorrow's Transit

New Mobility for the Region's Urban Core



Regional Plan Association
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In New York City on January 23, 2008

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Summary & Recommendations

In the last decade, the tri-state metropolitan area has made enormous strides toward expanding and modernizing its transit system to accommodate a new era of growth and prosperity. For the first time since the 1940s, several major expansion projects are either underway or expected to begin shortly. In particular, the "Mega projects"—Second Avenue Subway, East Side Access and Access to the Region's Core—are expected to become operational between 2015 and 2017 if full funding is secured. These projects are essential to the region's economy and environment, and their expeditious completion needs to remain a high priority for both the transportation agencies responsible for the implementation and the federal, state and local governments that must provide the remaining funds.

These projects form the core, as well as the largest and most expensive components, of an expanded network that will need further modernization over the next 30-40 years. Most importantly, these mega projects provide the transit capacity for the Manhattan Central Business District to grow and remain the engine for the region's economy. They also better connect different lines in the system and greatly expand service in many city and suburban markets. In addition, they make it possible to add services that can reach underserved markets and connect growing regional centers outside of Manhattan. Beyond the mega projects, other important projects are either under construction or in the latter planning stages, including a new PATH station and Fulton Transit Center in Lower Manhattan and the extension of the # 7 subway line to the Far West Side. However, most of these are also focused on Manhattan.

As critical as these projects are, they will not address all of the region's transit needs. The next generation of transit projects needs to cast a wider network to the outer boroughs and suburbs. Even now, many transit agencies are thinking beyond current projects, as demonstrated, for example, by a 40 year vision presented by Elliot G. Sander, CEO of the Metropolitan Transportation Authority in March 2008. Metropolitan planning organizations are also assessing new projects through their regional transportation plans, and the New York Metropolitan Transportation Council has developed a vision for regional growth that identifies targeted growth areas as well as transportation goals.

Continued investment in transit is essential to three overarching goals for the region, and new projects must be evaluated for the degree to which they achieve all three of these objectives:

- **Economic prosperity:** The region is projected to grow by an additional 3 million jobs and 4 million people over the next 25 years, or the equivalent of about $300 billion in economic output annually, provided that the infrastructure is created to accommodate them. Beyond this period, additional growth will undoubtedly require expansion beyond the projects already in the pipeline. With both highway and transit networks increasingly strained, transit will need to both provide the capacity to handle the additional travel demands, as well as the efficiency and convenience to compete with other global metropolises.

- **Sustainable growth:** Transit is a highly efficient use of resources that will be increasingly scarce on both a regional and global scale in the coming decades, including land, energy and air quality. Auto-led growth would greatly increase our consumption of these resources, reducing both competitiveness and quality of life. However, to be successful transit must not only provide sufficient capacity, it must also be attractive enough for people to choose it over the automobile. Besides items like price and customer service, it also means expanded coverage, so that more people have convenient access to transit; connectivity, so that they can move easily between different parts of the system; and speed, to limit the increasing amount of time devoted to commutation.

- **Equitable service:** If transit is vital to the economy as a whole, it is particularly important to low-income and auto-less residents who are more dependent on transit. The region's extensive transit network provides an advantage that the poor in most U.S. regions do not have, yet there are a number of low-income communities that have poor access to this network. The same attributes cited above—coverage, connectivity and speed—should also be criteria for evaluating how well new projects address poorer, underserved communities. Access and pricing policies are particularly important to insure that new investments are equitable as well as effective.

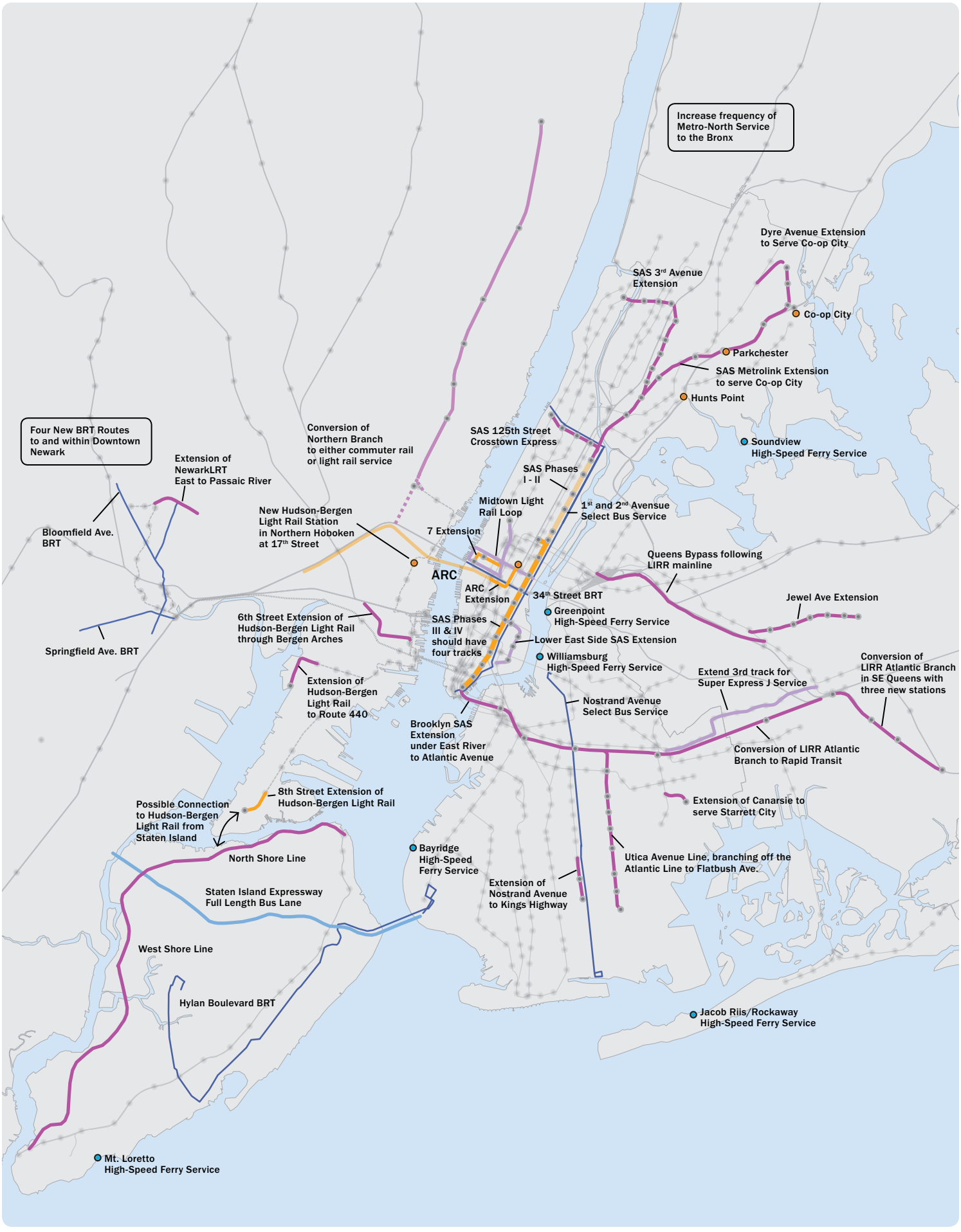
This report evaluates potential new initiatives by these criteria, with a focus on the region's urban core in the five boroughs of New York City and urban portions of northern New Jersey in Hudson and Essex counties. Most of this core area has the density to provide the most intensive transit service. Intra-suburban travel is also a growing market that requires its own discussion and transit recommendations. While beyond the scope of this report, a comparable analysis should be undertaken for these changing parts of the region.

Transit Investments and the Region's Economic Crisis

While the recommendations in this report are primarily intended to spur discussion of a long-term investment strategy for sustainable and equitable economic growth, it is also relevant to the immediate challenge of a regional economy that is quickly deteriorating in response to the Wall Street financial crisis. The region has entered a recession of unknown magnitude, and will require an assertive strategy to both contain the damage and rebuild a stronger economy as quickly as possible. A coherent program of staged transit investments can be a foundation of this strategy. Transit projects can provide immediate construction jobs and purchases that can help fill the void left by sharp declines in private construction projects. Especially if Washington adopts an expanded infrastructure program, a well-articulated investment strategy that adds to productive capacity can help build the case for the region's share of funding and insure that federal funding is spent efficiently. As this capacity comes on line, it will also shape the recovery that emerges and provide for expanded job growth over several business cycles.

The core of this investment strategy needs to be the capital programs of the Metropolitan Transportation Authority, the Port Authority, New Jersey Transit and the state transportation departments. Both maintenance of the existing system and the completion of expansion projects already in the pipeline need to be given a high priority, especially in a time of fiscal crisis when decisions could cause a functional deterioration that could continue

Figure 1: Recommendations: Region



for years. The recommendations that follow support these programs and a strategy for economic recovery in a number of ways:

- Many of the recommendations can be implemented relatively quickly and inexpensively. These can provide benefits that will both aid economic recovery and help to build support for the entire package of investments.
- Other projects would add to the value of the mega-projects. The Second Avenue Subway, East Side Access and Access to the Region's Core open multiple possibilities for new services. By articulating these enhancements, the value of these projects to a broader range of constituents can help to prioritize the projects and support a strategy for making the best use of these investments.
- Other new projects would be new mega projects and would have to be implemented over many years. While any discussion of funding these projects may be several years in the future, they help define a direction for regional development that is consistent with the goals of greater efficiency and equity.
- As a whole, the recommendations help fill some of the gaps for underserved markets and constituencies. All projects need to be evaluated for cost-effectiveness relative to the goals of economic prosperity, sustainable growth and equitable service, but the report provides for a more complete vision of what a comprehensive agenda should achieve.

Targets of Opportunity: High Need, Poor Access

The first criterion for identifying places where additional transit service is warranted is density. High-density indicates at least the potential to support more intensive transit service where none exists. However, there are still several parts of the urban core with high density and no rail service.

The majority of the region's poor are also clustered in high-density neighborhoods around the subway and commuter rail system, where auto ownership is less essential. However there are still large areas of the urban core where poverty is high and transit access is poor. Several of these neighborhoods have low auto ownership and the density to support rail transit. These areas, which should be given high priority for new service, include the south-central Bronx neighborhoods of Melrose, Morrisania and East Tremont, the central Brooklyn neighborhoods of Bedford-Stuyvesant, Bushwick and Brownsville, and the Lower East Side of Manhattan.

Other areas with high poverty and poor rail transit access, but higher rates of auto-ownership, are often on the fringe of the core area, and may not have densities that support rail transit. These include portions of south Brooklyn, southeastern Queens, the north shore of Staten Island, parts of Newark, Jersey City, Elizabeth, Paterson and Passaic in northern New Jersey, and parts of Yonkers and Mt. Vernon in southern Westchester. For these areas, other transit services, such as bus rapid transit or express bus service, may be more appropriate.

Recommendations

Report recommendations are presented for each of the five New York City boroughs and for the urban core of New Jersey (see Figure 1). In addition, overarching system-wide and land use recommendations are discussed. The projects recommended were informed by two brainstorming sessions and interviews with 25 transit experts, by existing studies and by the analysis depicted in the tables and figures of the report. Population density, rail transit and express bus coverage, travel times, poverty and auto-ownership were the main criteria considered. Projects were categorized as low (under $50 million), medium ($50-500 million) and high (over $500 million) in capital costs. Clearly, more detailed studies are needed to quantify costs and benefits of these projects, including economic development, land use impacts and operating costs. On the whole, however, they provide a starting point for determining the next generation of transit projects.

Several projects could improve service to high poverty areas at relatively low costs (either low or medium cost as described above). Some of these could be implemented relatively quickly, while others would need to await the completion of one of the mega projects. These include:

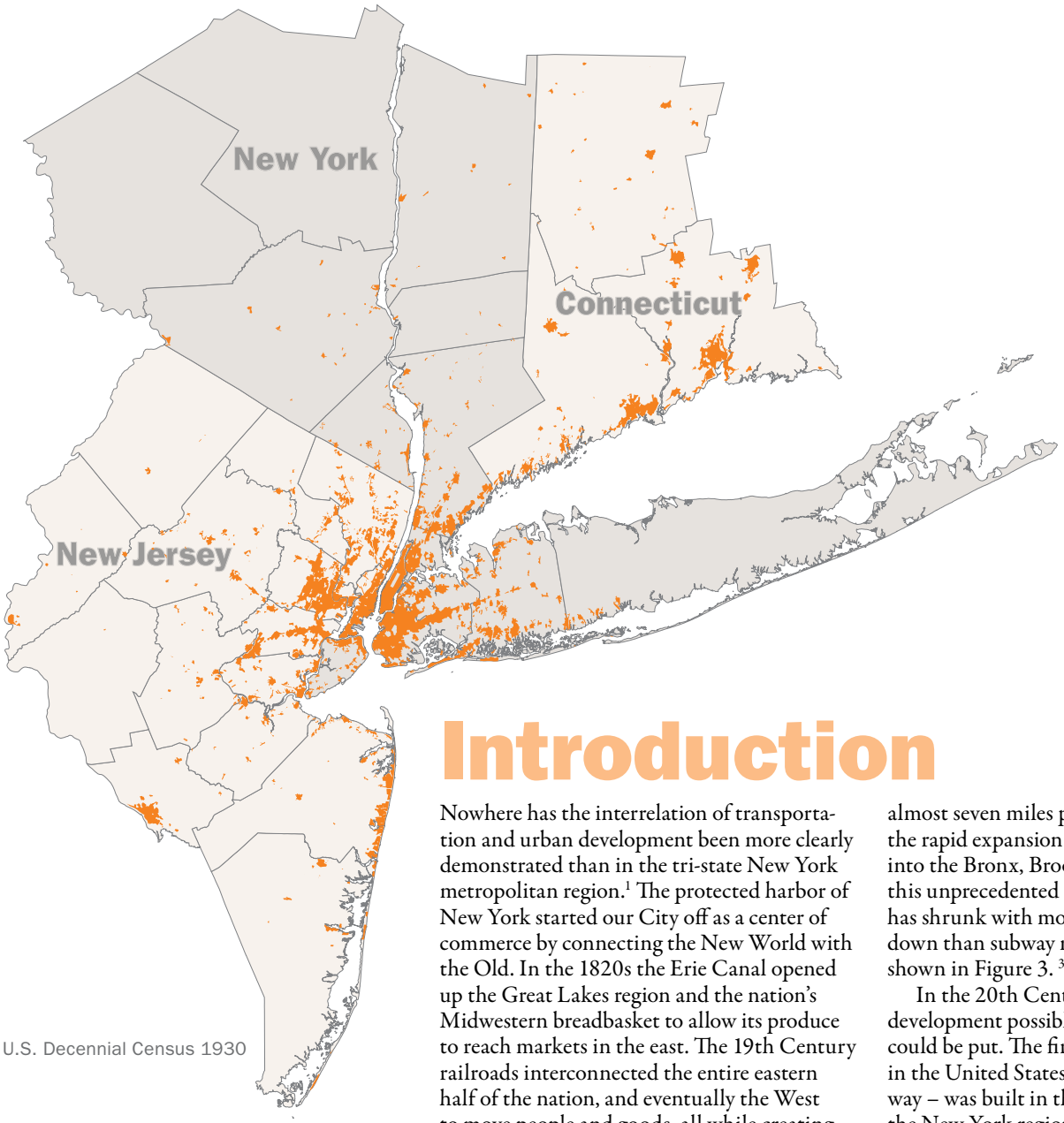
- Several Bus Rapid Transit routes are recommended, such as Nostrand Avenue (Brooklyn) BRT and the network of BRTs currently under consideration for Newark.
- Express subway service on unused middle tracks in Brooklyn, Queens and the Bronx, such as on the Dyre Avenue line in the Bronx and the J line in Brooklyn.
- Increased and discounted-price service on commuter rail lines within New York City, such as on Harlem and Hudson line stops in the Bronx, and at Long Island Rail Road stops in Queens, the latter when the East Side Access is completed.
- New entrances and transfers, such as a new entrance on the Canarsie L line at First Avenue to serve the Lower East Side.

Other projects would have higher capital costs, and take longer to implement, but would have larger system-wide benefits in addition to expanding service in low-income communities. These include:

- Commit to the construction of all Second Avenue Subway transfer stations, including a new one at Grand Street.
- Extend the Second Avenue Subway along with as many as six subway lines in the Bronx, Brooklyn and Queens, such as along the Third Avenue Corridor in the south-central Bronx.
- Establish transfer connections between subway lines in Long Island City at Queensboro Plaza, Queens Plaza and Court Square.
- Convert the Atlantic Branch of the LIRR to rapid transit service once East Side Access is implemented, providing service to central Brooklyn and south Jamaica.
- Accelerate consideration of options for the dysfunctional Nostrand Junction, including restructuring the Junction and extending the subway.
- Expand the Staten Island transit system with either light rail or BRT along the North and West shores of the Island.
- Construct three short extensions of the Hudson-Bergen and Newark City Subway light rail routes.

To be sure, RPA's transit recommendations in this report are not the only ones being considered. The official public agencies responsible for planning and operating transit in the Region have their own initiatives, many complementary and consistent with those in this report. Specifically, the two metropolitan planning organizations – the New York Metropolitan Transportation Council and the North Jersey Transportation Planning Authority – and the major transit providers – the Metropolitan Transportation Authority, NJ TRANSIT, New York City Department of Transportation, and the Port Authority of New York and New Jersey – all have been planning for new transit services in the urban core. While the concepts in this report are strictly those of Regional Plan Association, many have been developed after consultation with these agencies and are offered in the spirit of continued cooperation.

Figure 2: 1930 development pattern in the RPA region
Orange illustrates development pattern in New York region



U.S. Decennial Census 1930

Introduction

Nowhere has the interrelation of transportation and urban development been more clearly demonstrated than in the tri-state New York metropolitan region.[1] The protected harbor of New York started our City off as a center of commerce by connecting the New World with the Old. In the 1820s the Erie Canal opened up the Great Lakes region and the nation's Midwestern breadbasket to allow its produce to reach markets in the east. The 19th Century railroads interconnected the entire eastern half of the nation, and eventually the West to move people and goods, all while creating railroad towns that morphed into suburban settlements to serve as bedroom communities. Figure 2 illustrates how the development pattern in the New York region by 1930 had followed the rail network. Interurban and trolley systems established still more nodes of activity within our region, all built near train stations. Starting in the late 19th Century New York City began to build its rapid transit system, and in 1904 the opening of the first subway line jump-started an explosion of construction that added almost 240 miles in 35 years or almost seven miles per year,[2] making possible the rapid expansion of the City's population into the Bronx, Brooklyn and Queens. Since this unprecedented expansion, the system has shrunk with more miles of elevated torn down than subway miles added. This history is shown in Figure 3. [3]

In the 20th Century the automobile made development possible anywhere that a road could be put. The first limited access highway in the United States – the Bronx River Parkway – was built in the 1920s and up to 1940 the New York region had more miles of highway than the rest of the country combined. This system continued to expand after World War II, spurred first by the construction of toll highways and then after 1956 by the Interstate Highways system; from 1949 to 1974 the tri-state region built an average of 54 miles per year, with a virtual stoppage of construction from the 1990s on, as shown in Figure 4.

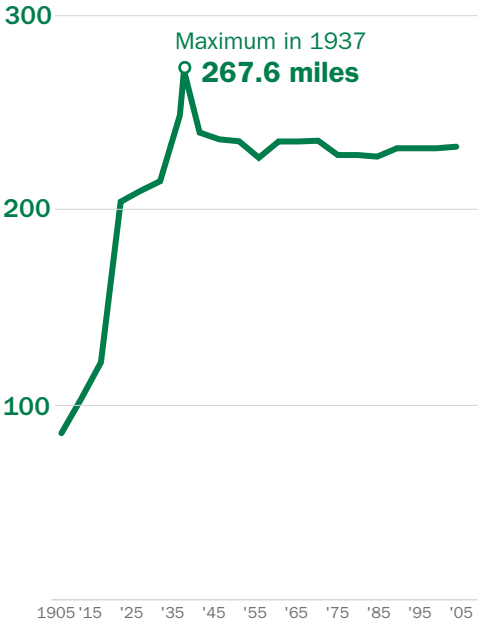
All the while the region interconnected this system with 26 major water crossings – bridges and tunnels that linked both sides of the Hudson, the island of Manhattan with Long Island, Long Island with the Bronx, Staten Island with New Jersey, and the last major

1 The RPA region is defined as the 31 counties in three states stretching from New Haven and Suffolk counties to the east, to the Delaware River in western New Jersey to the west, and from Litchfield, Dutchess, Ulster and Sullivan counties in the north to Ocean and Mercer counties in the south. In this report we refer to this area as the Region.

2 This included 11 miles of the PATH system and four miles for the Newark City Subway.

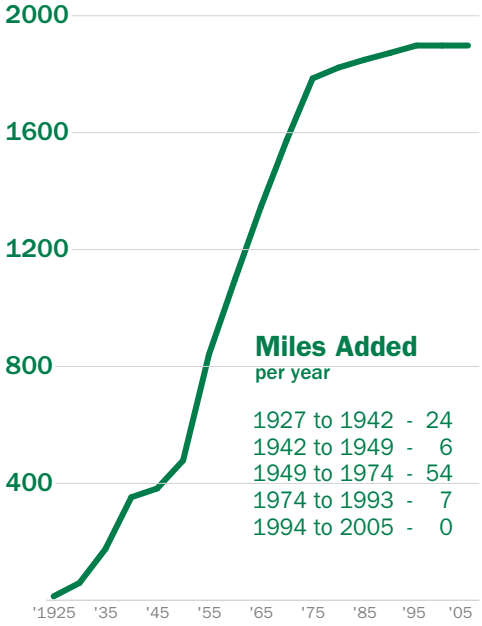
3 The chart shows the net miles in place; during the early part of the 20th Century many miles of elevated lines, mostly built in the 19th Century were torn down.

Figure 3: Subway Miles
New York region, 1905-2007



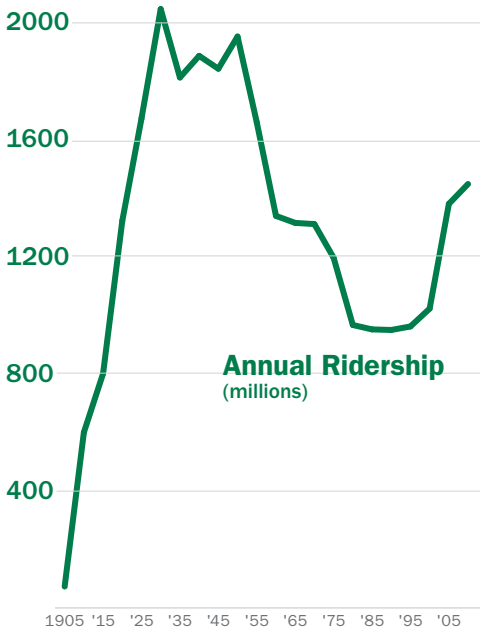
Source: RPA

Figure 4: Highway Miles
New York region, 1925-2005



Source: RPA

Figure 5: Subway Trips
New York region, 1905-2007



Source: MTA - New York City Transit

bridge, the Verrazano-Narrows, completed in 1964 spanned the harbor, tying Staten Island with Brooklyn.

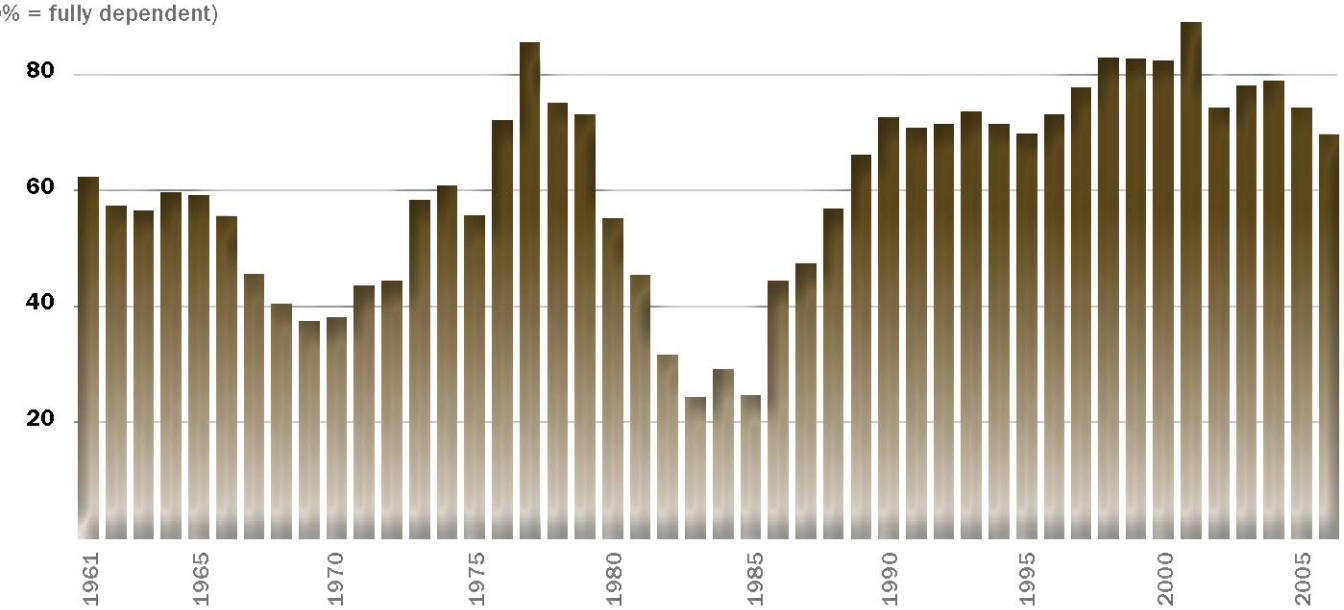
The road systems were built in response to the newest transportation mode, the motor vehicle, and together they set a pace and pattern of development unknown in history. Long Island is a case in point. From 1940 to 1960 Nassau County more than tripled its population from 407,000 to 1.3 million; Suffolk to the east did its neighbor one better by quadrupling its population from 276,000 to 1.1 million in a 20-year span starting in 1950.

However, the subway network has not been expanded materially in almost 70 years and the highway network has grown only slightly in 25 years, as depicted in Figures 3 and 4. Recent growth in ridership in the subway and commuter rail network has created crowding not experienced since just after World War II. Subway ridership has rebounded remarkably, adding a half billion trips annually in the last ten years, a growth of 47 percent, the happy result of the combination of the economic expansion of New York City, investments of over $30 billion in maintenance and repairs to overcome the damage of neglect in the 1950 to 1980 period, the decline in crime in the City and subway, and the advent of more attractive fare options made possible by technology. The subway ridership history in Figure 5 shows that there are now more people riding the subway than at any time since 1951 and 70 percent more than the low point in 1977.

The highway network is similarly suffering from congestion under the burden of growing automobile and truck travel and little in the way of expansion. Highway capacity expansion, with its huge monetary and neighborhood-impact costs, is unlikely to occur, and managing demand rather than adding capacity is appearing more and more likely.

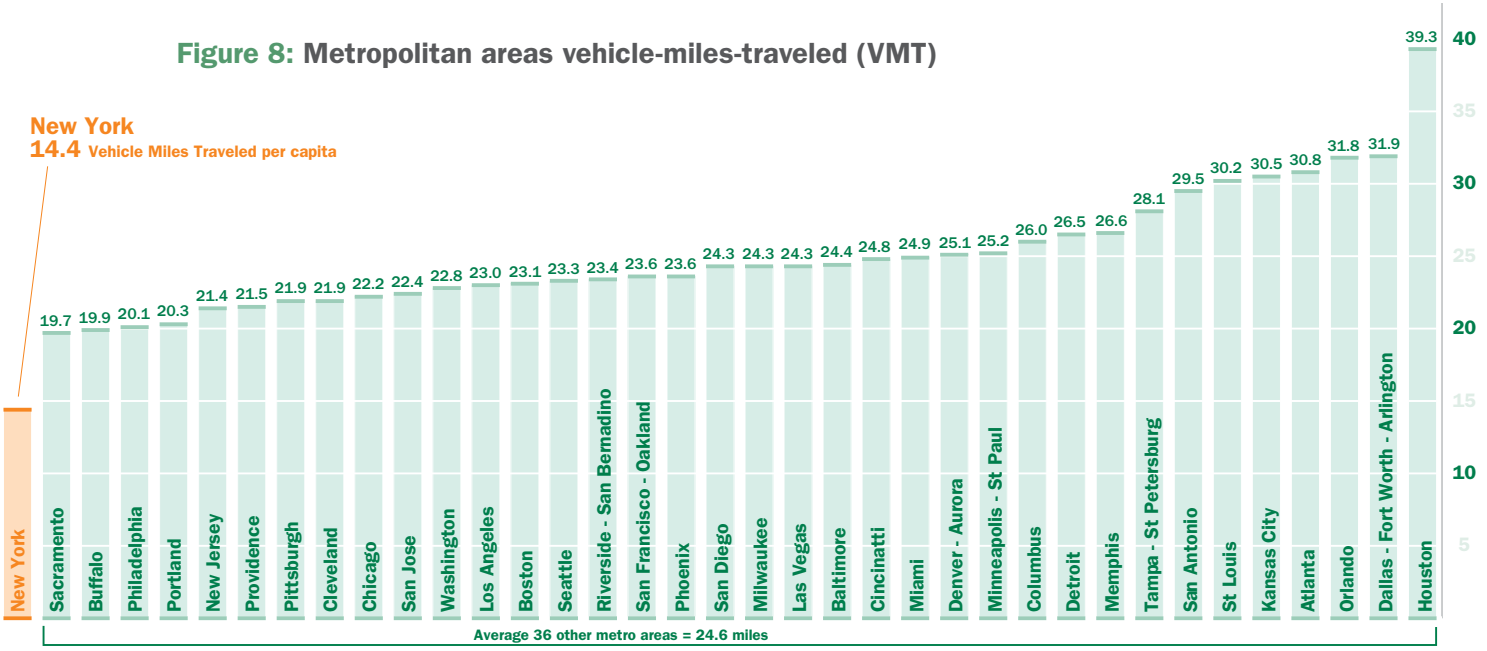
Against this backdrop, the national petroleum demand in the transportation sector continues to rely substantially on foreign sources found in volatile or unfriendly parts of the world, as depicted in Figure 6. Meanwhile, the price of gasoline has steadily grown, illustrated in Figure 7, in part a function of the nation's petroleum dependence, but increasingly because of the high cost of finding, extracting, refining, and distributing it. And perhaps most

Figure 6: U.S. transportation's dependence on unstable foreign sources of oil
(100% = fully dependent)



Source: Energy Administration - The Department of Energy

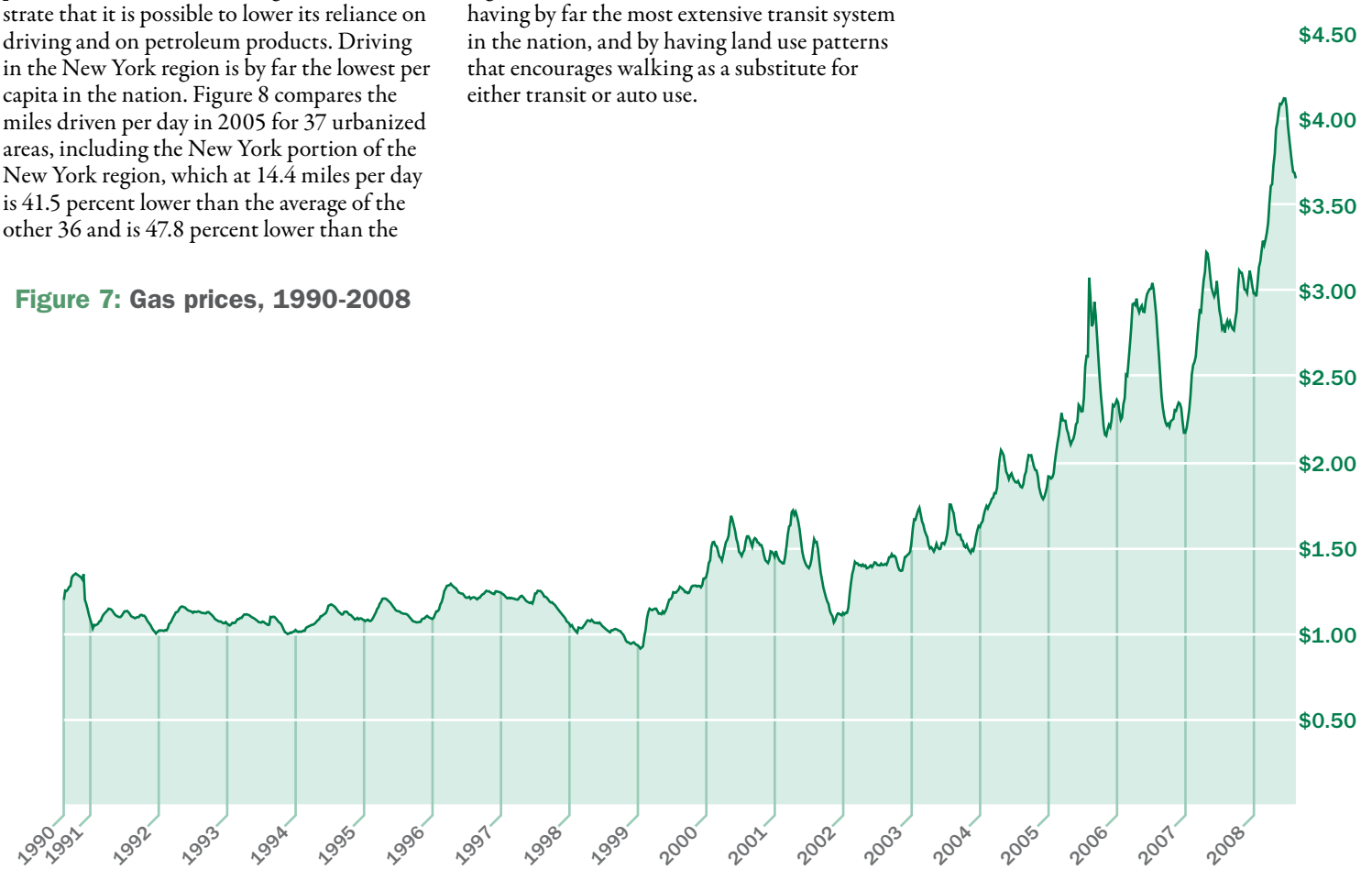
Figure 8: Metropolitan areas vehicle-miles-traveled (VMT)



Source: Federal Highway Administration, Highway Statistics 2006

alarming is the carbon footprint that auto use creates, leading to the heightened threat of global warming. While these are not matters that the New York region can solve, they are relevant for both the region and the nation for at least three reasons. First, the region does contribute to the problem and anything that can be done here to reduce driving can have a positive effect. Second, the region can demonstrate that it is possible to lower its reliance on driving and on petroleum products. Driving in the New York region is by far the lowest per capita in the nation. Figure 8 compares the miles driven per day in 2005 for 37 urbanized areas, including the New York portion of the New York region, which at 14.4 miles per day is 41.5 percent lower than the average of the other 36 and is 47.8 percent lower than the national average of 27.6 miles per day. Northern New Jersey, despite its largely suburban nature is 13 percent lower than the average of the other metros and 23 percent below the national average. And third, to the extent the region can lower its dependence on increasingly scarce, expensive and unreliable foreign oil, the more competitive and sustainable the region will be. This difference is a function of having by far the most extensive transit system in the nation, and by having land use patterns that encourages walking as a substitute for either transit or auto use.

Figure 7: Gas prices, 1990-2008



Source: Energy Administration - The Department of Energy

Growth and Travel Demand

The New York region is expected to grow significantly – if there is the capacity to handle the travel demand that comes with growth. Forecasts by the Metropolitan Transportation Council indicate that between 2005 and 2030 the region could add almost four million people and about 3 million jobs, 17 percent and 25 percent growth, respectively (Table 1). The population growth will be spread evenly in three sectors – about 1.3 million in each of three areas, New York City, the suburbs of the Hudson Valley -- Long Island, and Connecticut combined, and New Jersey. Three counties will add the most -- over 500,000 in Queens and about 300,000 each in Brooklyn and Suffolk – notably all on geographic Long Island. In percentage terms it is expected that the highest growth rates will be in the more exurban counties of the northern Hudson Valley and in western and central New Jersey.

The job growth will follow a similar pattern but with the 2.9 million spread somewhat less evenly. About 1.1 million will likely be added in New York City and New Jersey and only about 0.8 million in the suburbs of the Hudson Valley, Long Island and Connecticut combined. The counties that will grow in absolute terms the most are New York (Manhattan) adding over 600,000 jobs, with Suffolk, Brooklyn and Queens on Long Island, and the four central New Jersey counties in the I-287 and Garden State Parkway corridors – Morris, Middlesex, Somerset and Monmouth each adding over 100,000. These projections suggest that travel will grow most on Long Island, especially in Suffolk, in central New Jersey and for travel to Manhattan, especially from Brooklyn and Queens and from New Jersey.

The issue to be confronted then is how these projections and the travel demand they imply can be met in a sustainable manner, one that addresses the needs of all residents of the region equitably, particularly those without automobiles because of lower incomes, and those who must rely on automobiles despite having lower incomes because transit options are inadequate. To accomplish this, travel demand and equity concerns must be addressed together.

Using the population and employment forecasts, the Metropolitan Transportation Authority (MTA) has projected average weekday travel demand on a county-to-county basis,[1] yielding the likely transit and auto usage by market.[2] In Table 2 these county-level data are summarized by markets in the region, broadly organized by Central Business District-bound, "reverse," borough to borough, borough to suburb, suburb to boroughs, and suburb to suburb travel. The first column in the table indicates the current (2005) share of each market using transit. The second column indicates the expected growth in travel between 2005 and 2030 in each market. The third and fourth columns calculate the growth in the number of trips that would occur by auto and by transit, respectively, if the current transit shares were maintained in 2030. The important message conveyed in these last two columns is that if the options that travelers face do not materially change, then the region's transportation system would have to handle these numbers of added trips by auto and by transit, respectively. And if the objective is not to have any growth at all in auto travel, then the values shown in the second column would have to all be handled by transit. As Table 2 makes clear, the projected growth in automobile travel, particular in markets not involving the Manhattan Central Business District (CBD), is huge.

This is further demonstrated by two charts – Figures 9 and 10. In Figure 9 the number of added automobile trips that that are projected for each market in Table 2 are shown. Trips within suburban sectors: 1.174 million within New Jersey (West), 327,000 within Long Island (East), and 378,000 within the Hudson Valley (North) are not displayed because their size would dwarf the bars that are shown. This suggests that there will be vast growth in auto travel within these suburban locations where today only one or two percent of trips are by transit. Figure 10 highlights the other markets where auto trips will grow the most – trips within Queens, within Staten Island, within Brooklyn and from the boroughs, from the boroughs (mostly Queens) to Long Island, and finally to Manhattan CBD from the boroughs. For most of these markets, Table 2 shows that there is a sizable transit share already, but to pare down the high use of autos, the share will have to grow.

Figure 9 displays the number of transit trips expected if current shares remain in each market. This figure highlights the markets where additional transit capacity will be needed if the region is to merely hold its own regarding the expansion of auto travel. To attract some of the auto travel will therefore require even more capacity, and will also require a transit system that encourages auto users to shift their travel habits. Here the major markets requiring capacity growth are from the boroughs and from the west into the Manhattan CBD. Lesser, but important markets include travel within Brooklyn, Queens and the Bronx. These observations will help guide the exploration of transit alternatives later in this report.

1 These data include 28 of the 31counties in the RPA region, omitting three northern counties of Ulster and Sullivan in New York and Litchfield in Connecticut.
2 Walking and bicycling trips are not included in these data.

Table 1: Regional population & employment: 2005 to 2030

(in 1000s of persons)

	Population				Employment			
	2005	2030	Change	Percent Change	2005	2030	Change	Percent Change
NEW YORK CITY	8,209	9,492	1,283	15.6	4,177	5,243	1,066	25.5
Bronx	1,368	1,557	190	13.9	282	348	66	23.3
Kings	2,515	2,798	282	11.2	591	747	156	26.5
New York	1,583	1,709	126	8.0	2,546	3,189	644	25.3
Queens	2,273	2,795	523	23.0	635	771	136	21.4
Richmond	471	633	162	34.4	123	188	65	52.4
LONG ISLAND	2,837	3,220	383	13.5	1,489	1,812	323	21.7
Nassau	1,357	1,437	79	5.8	743	829	86	11.6
Suffolk	1,480	1,783	304	20.5	746	983	237	31.8
MID HUDSON	2,313	2,872	559	24.2	1,124	1,412	288	25.6
Dutchess	300	432	131	43.8	146	198	52	35.9
Orange	376	532	157	41.7	160	219	59	36.7
Putnam	102	134	32	31.8	37	48	11	31.0
Rockland	299	371	72	24.0	142	176	34	24.0
Sullivan	79	125	46	58.4	35	44	10	27.6
Ulster	189	266	77	40.7	86	107	20	23.7
Westchester	968	1,012	44	4.5	518	619	101	19.5
NEW JERSEY	6,927	8,202	1,275	18.4	3,882	4,986	1,104	28.4
Bergen	905	990	84	9.3	581	673	92	15.8
Essex	810	894	84	10.3	442	519	76	17.2
Hudson	622	744	122	19.5	287	360	73	25.5
Hunterdon	130	165	35	27.0	75	116	41	54.3
Mercer	367	483	116	31.7	260	325	65	24.9
Middlesex	786	957	171	21.8	503	644	141	28.1
Monmouth	652	732	80	12.3	332	470	138	41.4
Morris	495	557	62	12.6	367	488	121	32.9
Ocean	553	737	184	33.4	200	291	92	45.8
Passaic	499	559	60	12.0	218	238	20	9.2
Somerset	315	426	111	35.2	233	398	165	70.7
Sussex	152	199	47	30.6	59	85	27	45.2
Union	531	608	77	14.5	278	318	39	14.2
Warren	111	153	41	37.2	47	61	15	31.1
CONNECTICUT	1,958	2,292	333	17.0	1,072	1,275	203	18.9
Fairfield	916	1,067	151	16.5	535	635	101	18.8
Litchfield	192	255	63	32.7	94	120	27	28.6
New Haven	850	970	119	14.0	444	519	75	17.0
REGION	**22,245**	**26,077**	**3,833**	**17.2**	**11,744**	**14,727**	**2,984**	**25.4**

Source: New York Metropolitan Transportation Council Technical Memorandum by Urbanomics June 15, 2005

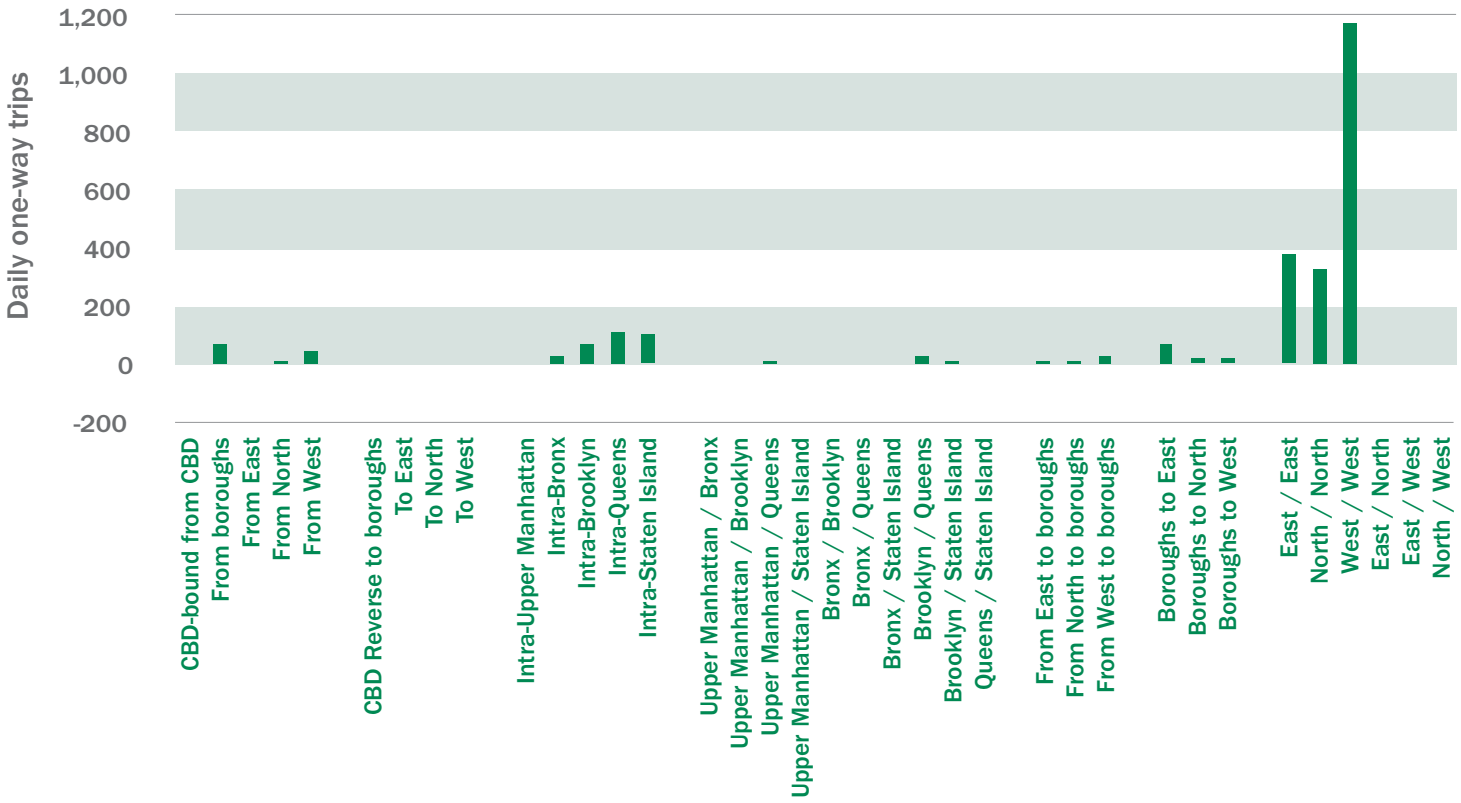
Table 2: Travel markets in the region

	REGIONAL MARKETS	2005 Percent Transit	Expected Trip Growth 2005 to 2030	Added Auto Trips at Current Share	Added Transit Trips at Current Share
CBD-BOUND	Within CBD	74	26,000	6,760	19,240
	From boroughs	72	256,000	71,680	184,320
	From East	71	19,000	5,510	13,490
	From North	62	35,000	13,300	21,700
	From West	62	136,000	51,680	84,320
	Sub-total	70	472,000	148,930	323,070
CBD REVERSE	To boroughs	53	18,000	8,460	9,540
	To East	66	2,600	884	1,716
	To North	42	2,300	1,334	966
	To West	13	8,900	7,743	1,157
	Sub-total	48	31,800	18,421	13,379
INTRA-BOROUGH	Upper Manhattan	69	2,200	682	1,518
	Bronx	47	67,000	35,510	31,490
	Brooklyn	46	133,000	71,820	61,180
	Queens	26	154,000	113,960	40,040
	Staten Island	8	115,000	105,800	9,200
	Sub-total	37	471,200	327,772	143,428
INTERBOROUGH	Upper Manhattan / Bronx	44	18,000	10,080	7,920
	Upper Manhattan / Brooklyn	69	10,000	3,100	6,900
	Upper Manhattan / Queens	56	30,700	13,508	17,192
	Upper Manhattan / Staten Island	63	1,100	407	693
	Bronx / Brooklyn	65	12,000	4,200	7,800
	Bronx / Queens	36	12,000	7,680	4,320
	Bronx / Staten Island	28	1,200	864	336
	Brooklyn / Queens	32	45,500	30,940	14,560
	Brooklyn / Staten Island	11	15,000	13,350	1,650
	Queens / Staten Island	9	8,300	7,553	747
	Sub-total	45	153,800	91,682	62,118
FROM SUBURBS TO BOROUGHS	From East	13	23,400	20,358	3,042
	From North	16	17,000	14,280	2,720
	From West	25	48,000	36,000	12,000
	Sub-total	20	88,400	70,638	17,762
FROM BOROUGHS TO SUBURBS	To East	11	80,000	71,200	8,800
	To North	50	57,000	28,500	28,500
	To West	6	25,000	23,500	1,500
	Sub-total	24	162,000	123,200	38,800
BETWEEN SUBURBS	East / East	3	388,000	378,300	9,700
	North / North	2	335,000	327,295	7,705
	West / West	1	1,187,000	1,173,943	13,057
	East / North	0	-1,100	-1,097	-3
	East / West	1	4,100	4,059	41
	North / West	2	-4,200	-4,129	-71
	Sub-total	2	1,908,800	1,878,372	30,428
	TOTAL	**19**	**3,288,000**	**2,659,015**	**628,985**

Source: Metropolitan Transportation Authority - Regional Transportation Forecast Model - O/D Trip Matrices - 2005/2030 for Autos and Transit Tripsl

Figure 9: 2030 added auto trips by market at current transit share

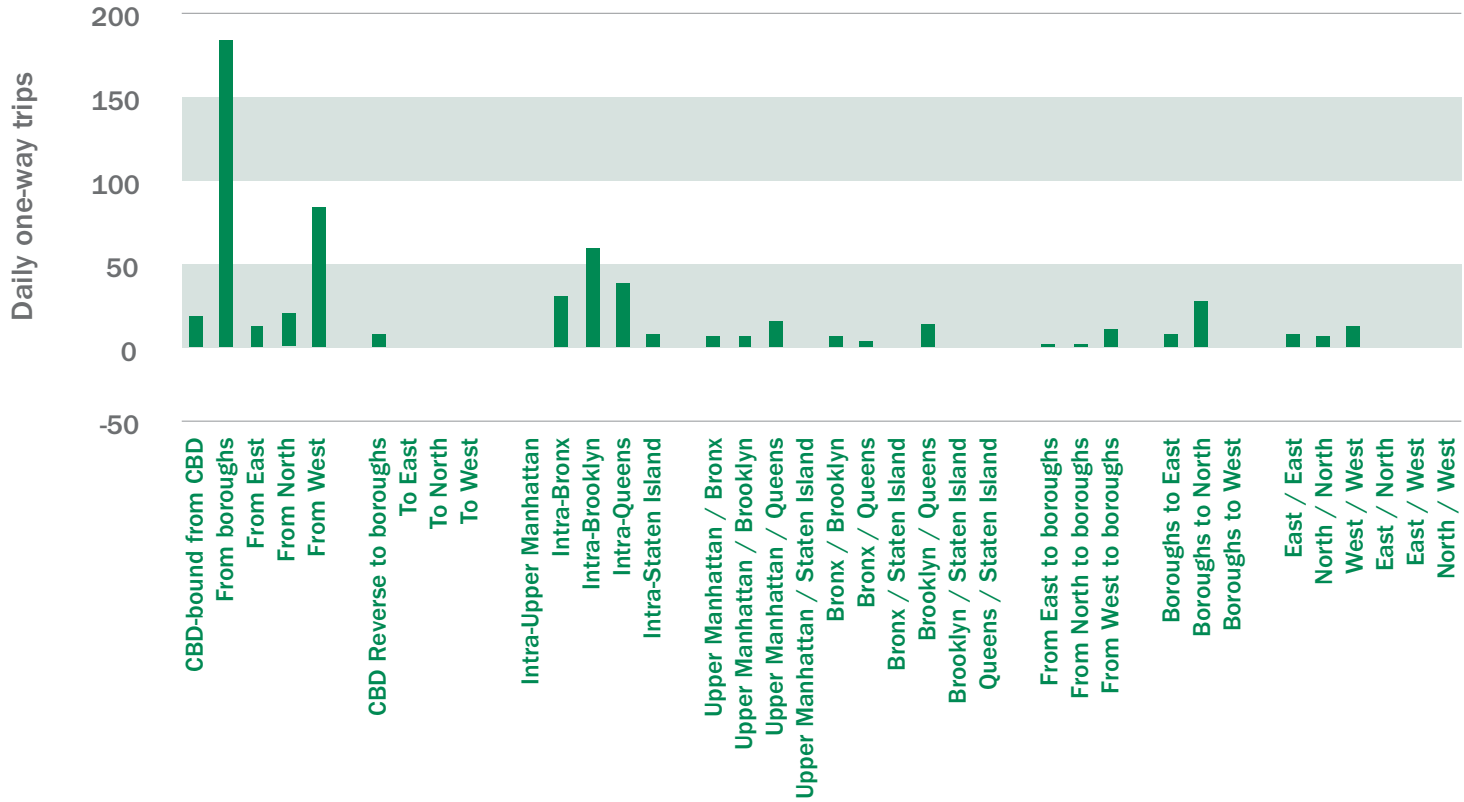
(in 1000s of persons)



Source: Metropolitan Transportation Authority - Regional Transportation Forecast Model Output

Figure 10: 2030 added transit trips by market at current transit share

(in 1000s of persons)

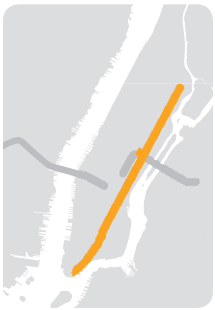


Source: Metropolitan Transportation Authority - Regional Transportation Forecast Model Output

The Megaprojects and Beyond

To be sure, some of the growth can be handled by transit expansion projects now in the offing. Three projects at various stages of commitment and funding stand out. In this report they are referred to as the "Megas" because of their high value in transforming the transit system and high cost.

Second Avenue Subway (SAS)



With the subway system getting back on its feet, the MTA has revived plans for the highest priority subway expansion – the SAS – and funding for the first phase of a four-phase program is mostly in place. Construction, or rather the resumption of construction after a 35-year hiatus, began in 2007 with an expected opening date of 2015 for the first phase from 105th to 63rd Street. The other three phases would extend the line north to 125th Street and Lexington Avenue and south to the Battery where it would be poised to be extended into Brooklyn in the future. The SAS would provide peak period capacity into Midtown and Lower Manhattan, capacity that has not been increased in over 60 years. It would relieve the hopelessly overcrowded Lexington Avenue line, giving relief not only to those living on the Upper East Side, but to Bronx residents and to the MTA's Metro North riders now using the Lexington line to reach Lower Manhattan. And it would save 20 minutes a day for those Upper East Siders destined for west Midtown by allowing them to avoid complicated transfers at crowded stations. Over 500,000 riders a day would benefits either directly or indirectly from this four-phased project.

The Second Avenue Subway will also create future opportunities for new service in other markets:

- From Queens down the SAS line to ease overcrowding on three subway services in that borough;
- From the Bronx to serve areas now without subway service;
- For the subway-starved Lower East Side;
- From Brooklyn to create easier transfers to the east side of Manhattan;
- From Jamaica and the Long Island Rail Road to Lower Manhattan and to the east side; and
- A one-seat ride service from Kennedy Airport to Lower Manhattan and possibly to the east side.

East Side Access (ESA)

Long Island Rail Road riders, long limited to arriving in Manhattan at Penn Station on the west side will benefit from a another long dormant project – East Side Access – now moving forward. By 2015 it will deliver riders to Grand Central Terminal on the east side of Midtown, where more of them are destined. The time and convenience savings of ESA are enormous. It will save 150,000 LIRR riders destined for east Midtown up to ¾ hours a day and eliminate transferring to buses, the subway or taxi with its direct east side service. The benefits will accrue to New York City residents in the form of more service in Queens and reduced subway crowding. More Queens' service is now precluded by the lack of capacity on existing trains; the capacity to bring LIRR trains into Manhattan will expand by 60 percent. With ESA, both the MTA's LIRR and the MTA's Metro North service will be housed at Grand Central Terminal, making travel between these two systems much easier, opening up transit options between the suburbs to the east and north. Finally, ESA will free some capacity at Penn Station to allow some Metro North trains on the Hudson and New Haven lines to reach the west side.

Access to the Region's Core (ARC)

To the west, NJ TRANSIT is moving forward with Access to the Region's Core, a project to double rail capacity from the west and relieve today's peak-period standing-room only situation. This project is partially funded and targeted for a 2017 opening. By providing badly needed transit capacity in the rapidly growing west-of-Hudson market, ARC will make it possible for rail lines in New Jersey that now require transfers to offer direct one-seat rides to the west side of Manhattan. It will also make it possible to add new rail services directly (or indirectly) into Manhattan that do not operate today, should they prove to be cost-effective. At least four such lines are currently under consideration by NJ TRANSIT.

The ARC project terminates on the west side and would not give New Jersey commuters the same "east side access" that the ESA project will give Long Islanders. However, the ARC design does not preclude an extension to the east side, which would only require about a 4,000 foot extension of the line.[1]

These projects, with their combination of new capacity, greater coverage, faster service, and better connectivity are expected to attract many more transit riders, reducing the reliance on auto travel in the most traffic congested urban area in the nation, the Manhattan CBD. And each opens up opportunities to go "beyond the Megas."

1 For a more detailed discussion of this issue see ARC & NYC – The New Trans Hudson Rail Tunnel: Making It Work Best; Regional Plan Association, March 2008.

Each of these Mega projects – Second Avenue Subway, East Side Access, and Access to the Region's Core – will relieve crowding and provide capacity for growth, but only in some sectors and for some travel markets. SAS does directly address the mobility needs of one lower income neighborhood – East Harlem and will provide crowding relief for riders from the several areas in Harlem and the Bronx with low incomes who now use either the Lexington Avenue line on the east side or the Broadway and Lenox Avenue lines on the west side. ARC will offer benefits to lower income people in urban areas in New Jersey, such as Newark, Elizabeth, Paterson, Passaic, New Brunswick and Perth Amboy, with added service to Manhattan. ESA can serve some lower income areas in South Jamaica, Elmhurst and Corona and will make possible Metro North service in areas of the Bronx and Upper Manhattan where reverse commuting to jobs in Westchester and Connecticut will be made easier in Hunts Point/ Longwood, Co-op City, Parkchester and West Harlem.

Beyond these three projects, if there is to be less reliance on automobile travel in the region then transit will have to become more attractive than it is today. The attributes that transit will require or improve upon are many. Some are related to overall qualities of the system. These include safety, both in the sense that the system is not likely to be subject to incidents or accidents that could cause bodily harm, and in the sense of free from crime or the fear of it. Second, passengers must believe that the system is reliable, that on any given day the likelihood is high of a train or a bus being available and keeping to its schedule. Attention must be paid to maintaining the vehicles and the rights- of-way and to the hidden elements of infrastructure such as drainage systems, power and signals. Third is the feeling that the passenger has that the system is of one of high amenity and a reasonably tolerable, if not a downright pleasant place to be in. This has many dimensions – lighting, cleanliness, ventilation, temperature, vertical assistance (escalators and elevators), information systems, and ease of payment.

Each of these – safety, reliability, and amenity – is for the most part unrelated to specific places of geography, but rather are features of the entire transit system. To meet reasonable standards of each is expensive and requires continued maintenance and upgrades. The transit systems in the region spend a large majority of their capital funds to keep the system safe and make it more reliable; they are in a continuing struggle to find the funding to go beyond that and upgrade it with amenity features.

The other critical characteristics required to keep current riders and attract new ones are more specific, to the service offered for the individual riders travel needs. These include capacity, coverage, connectivity and speed. Location is also essential for another criteria on equity, which measures how well those in need have access to transit.

Capacity

The opportunities to expand the capacity of the region's rail transit system are limited and expensive. But capacity is needed if the region is to meet the expected travel growth. In some cases, the maximum number of trains that can operate on a given segment of track has been reached and crowding has exceeded tolerable limits. In these corridors the ability to absorb expected travel growth has been exhausted. The limits may be defined not only by the size of vehicles but by the features of the signal system. This is particularly relevant for the economy of the region. Each 1,000 jobs not established in the region converts to a loss of approximately $100 million annually in the Gross Regional Product.[1] The workers filling these jobs will not be here if they do not have the capacity to get to work. Theoretically, if the anticipated growth of three million jobs in the next 25 years did not materialize, then the loss would reach a staggering $300 billion annually. The carrying capacity to bring these additional workers to their jobs is vital to the region's economy.

Today, capacity is exceeded in large portions of the transit system, including during peak periods on the subway system on the Lexington Avenue (#4 and #5), Queens Boulevard Line (E and V lines), the Flushing Line (#7), the West Side IRT (#1, #2, and #3), and the 14th Street – Canarsie L line; on the commuter rail system on the Northeast Corridor trains from New Jersey, and on the bus network from New Jersey that uses the Exclusive Bus Lane into the Lincoln Tunnel.

1 This estimate is arrived at by dividing the Bureau of Economic Analysis's estimate of the region's Gross Domestic Product, estimated at $1.2 trillion by the 12.3 million workers in the region.

Coverage

Coverage is defined here as the walking proximity that the rider has to the system. It should come as little surprise that the likelihood of using transit is closely tied to how near it is. Beyond about 1/3 mile there will be a falloff in the proportion of riders that will walk to a transit station or stop and an increase in the share of riders who will require another vehicle (transit or auto) to reach their boarding point. As the distance increases the potential rider will be encountering higher costs in time, cost or physical exertion to use transit and will increasingly consider not using it, all else being equal. It is therefore of great importance that when seeking to increase transit use we examine the areas of the region that are "uncovered."

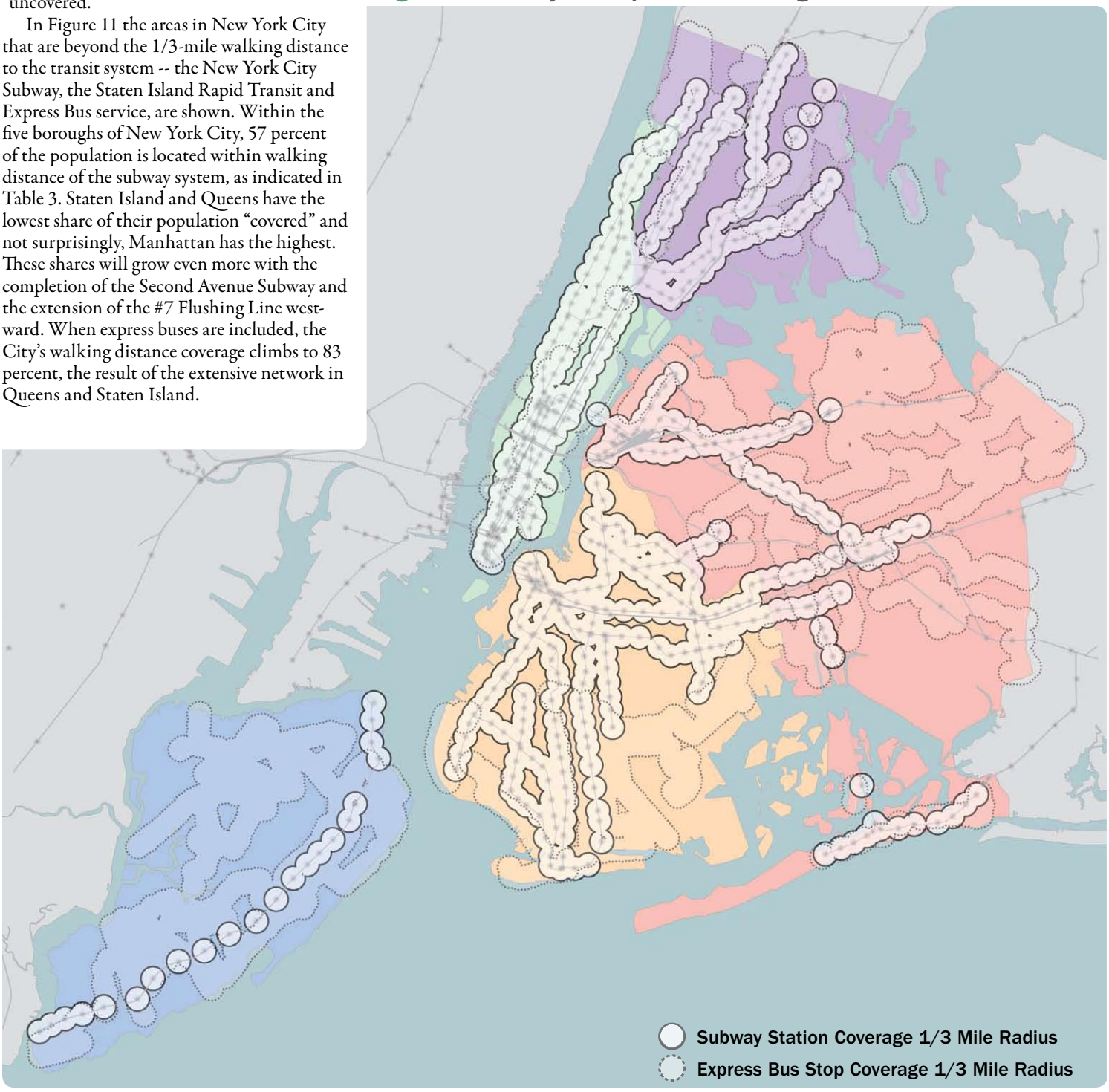
In Figure 11 the areas in New York City that are beyond the 1/3-mile walking distance to the transit system -- the New York City Subway, the Staten Island Rapid Transit and Express Bus service, are shown. Within the five boroughs of New York City, 57 percent of the population is located within walking distance of the subway system, as indicated in Table 3. Staten Island and Queens have the lowest share of their population "covered" and not surprisingly, Manhattan has the highest. These shares will grow even more with the completion of the Second Avenue Subway and the extension of the #7 Flushing Line westward. When express buses are included, the City's walking distance coverage climbs to 83 percent, the result of the extensive network in Queens and Staten Island.

Table 3: Population in New York City within walking distance of transit

Boroughs	Percent Covered		
	By Subway	By Subway & Express Bus	By Subway, Express Bus & Commuter Rail
The Bronx	59.0	77.7	83.1
Brooklyn	65.7	83.0	83.4
Manhattan	85.6	94.2	94.5
Queens	34.7	77.1	80.2
Staten Island	13.9	82.8	82.8
NYC TOTAL	56.9	82.6	84.6

US Decennial Census 2000 - Population by Blockgroup

Figure 11: Subway and express bus coverage



RPA

Connectivity

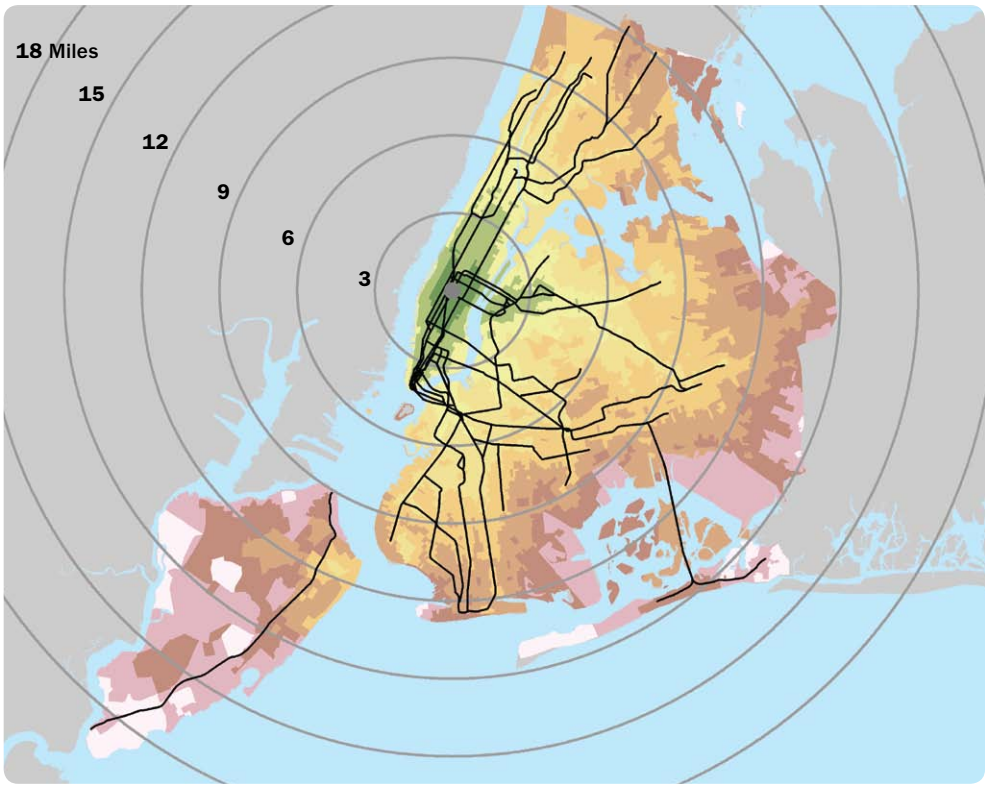
Connectivity is defined here as the ability to move people among the various parts of the transit network. In a well connected network it will be relatively easy to move among its segments, or better still, find it unnecessary to use more than one vehicle to complete the trip. The New York City subway system is, for the most part a well connected system. The system was designed with express and local services on most lines and with multiple routes using the same track, making transfers as easy as taking a few steps across a platform or climbing a single flight of stairs. Still, there are numerous opportunities for well placed transfers to be of great help to the rider. These transfers not only make the trip easier, but open up more destinations, increasing mobility and access.

Speed

Speed, or rather the lack of it, damages the transit network in two ways. The added travel time will deter potential riders and second, it will reduce the transit system's productivity by requiring more vehicles and labor than a faster system would to accomplish the same task. Figures 12 and 13 show the travel times by the faster transit mode (bus or subway) for representative locations in midtown and Lower Manhattan from the five boroughs. The maps superimpose the subway network and indicate concentric circles of equal distance to guide the eye. As would be expected, travel times are longer to Manhattan from more distant points and in locations without the subway. (Most notably, in between subway lines, to Lower Manhattan from the Bronx and southeastern Queens, and from Staten Island to Midtown.) Since Figures 12 and 13 also account for bus travel to Manhattan they highlight the deficiencies for both modes.

Figure 12: Average transit time to Midtown Manhattan

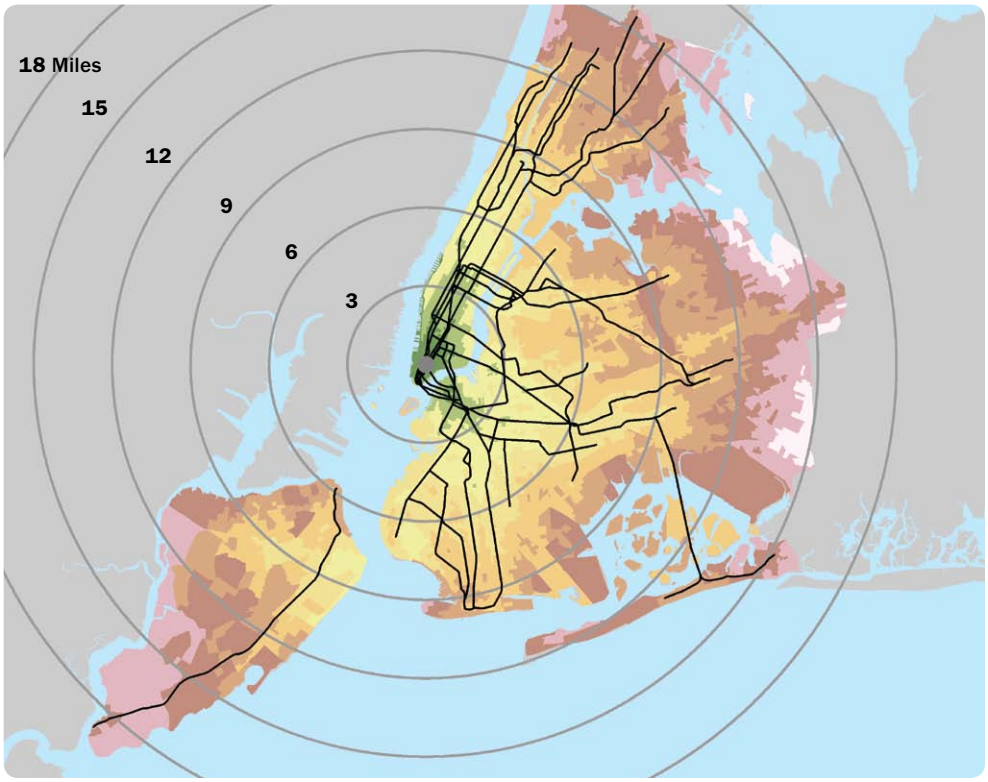
AM peak hour travel time from each block group zone by subway, bus, ferry, walking (excludes commuter rail)



Source: MTA - New York City Transit

Figure 13: Average transit time to Downtown Manhattan

AM peak hour travel time from each block group zone by subway, bus, ferry, walking (excludes commuter rail)



Source: MTA - New York City Transit

Average Travel Time (min)

- 12 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90+
- Subway

Equity

The region will have to address the demands for more transit travel with new investments, but can it do so equitably? To establish a basis for analysis and help diagnose where investments might be targeted to avoid creating greater inequity Figures 14 and 15 were developed. In Figure 14 the absence of an automobile is shown by mapping at a census tract level the density of households without automobiles as households per square mile, shown here for New York City and parts of the urban and inner suburban counties. Also, shown are the subway lines in the City, PATH and the light rail lines in New Jersey. The map is a tool for identifying concentrations of households without autos, AND where rapid transit or light rail services are unavailable. Of course, there may be a substantial amount of bus service in many of the areas where there is no rail service, but express bus service, in particular is more often focused on only the peak period and has a lower frequency of service than does the subway.

The absence of rail transit service can be the cause that leads to more auto ownership, i.e. without transit more people may opt for owning cars. Or the absence of transit service may be the effect of high auto ownership, i.e. where ownership is high, particularly in lower density areas, rail transit may not have been built. The map must be carefully interpreted. It shows that there are only a limited number of places where auto-less densities are high and where rail transit is absent. Within New York City, the Lower and Upper East Side and East Harlem, the south-central and southeastern Bronx (Soundview), the Bedford-Stuyvesant, Bushwick, Brownsville neighborhoods in central to south Brooklyn, and Jackson Heights and Elmhurst / Corona in Queens stand out. Within Manhattan, the SAS is intended to serve the high auto-less density areas of the Upper East Side and East Harlem.

Figure 15 illustrates how this phenomenon relates to equitable transit access. The areas of the inner part of the New York region, where more than 20 percent of the households have incomes below the official poverty level, are shown in color. The palette shows the share of all households in the census block that do not have an automobile available in their household. The light colors illustrate areas of high poverty and higher rates of auto ownership where poor transit makes buying a car necessary despite lower incomes. These are typically neighborhoods on the fringe of the core area where densities are relatively low and where convenient transit is less available. In New York City these include portions of south Brooklyn, southeastern Queens, Corona, and the north shore of Staten Island; in New Jersey these include Elizabeth, the western portions of Newark, Jersey City, Paterson, Passaic and parts of Clifton, and in southern Westchester in Yonkers and Mt. Vernon. These areas can be thought of as auto captive, where owning a car despite low incomes is more of a necessity because transit is relatively poor.

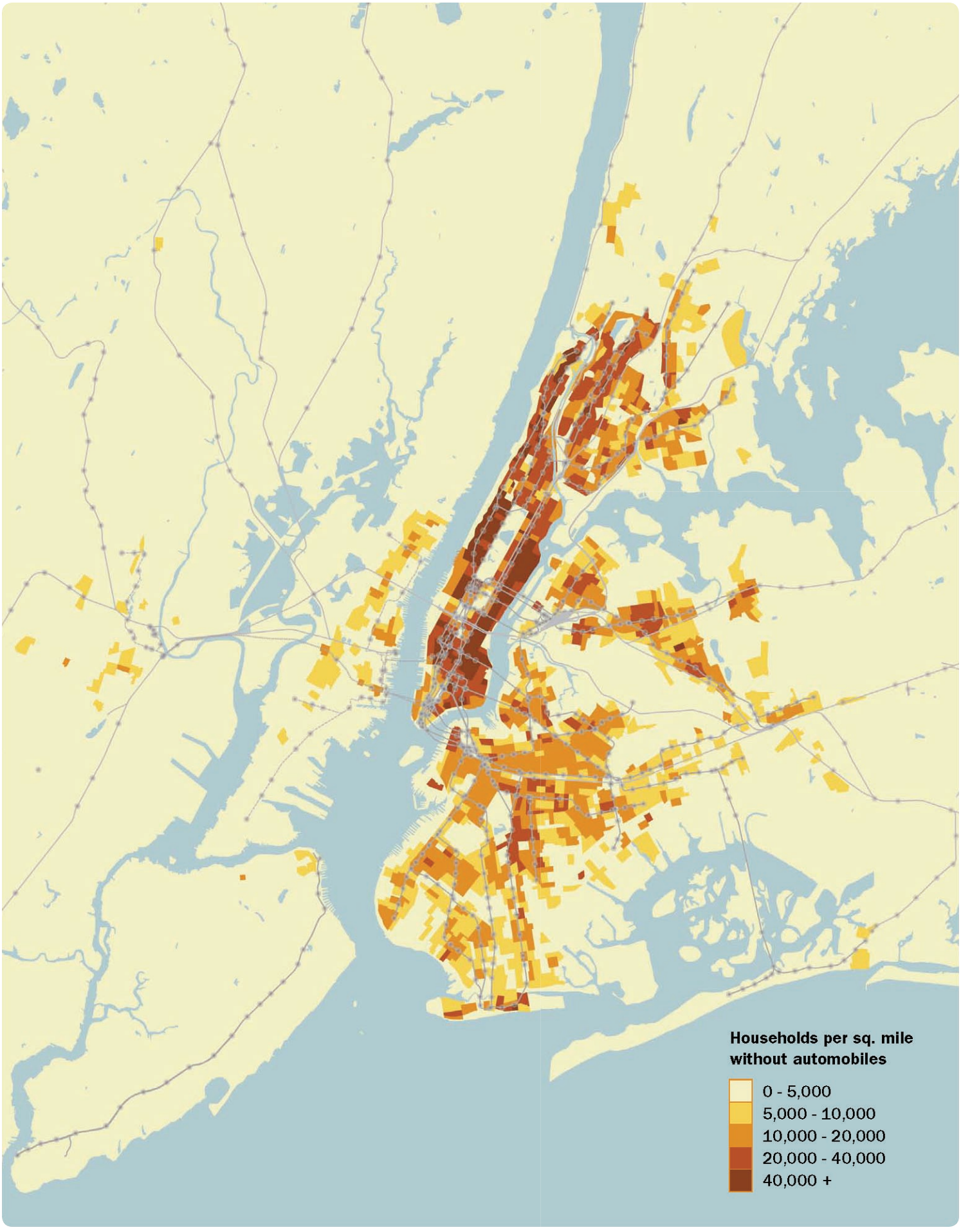
Areas with high rates of poverty and autolessness (dark colors) are typically located in the Core area, notably in Manhattan and the denser areas of the Bronx and Brooklyn. In the portions of these areas without subway service – Melrose and Morrisania, and East Tremont neighborhoods of the Bronx, the Lower East Side of Manhattan, Bedford-Stuyvesant and parts of Borough Park in Brooklyn – the need for transit options is the most pressing. These areas can be thought of as transit captive, areas where a car is somewhat less of a necessity, but where transit service is still poor.

Density and Public Transit

The symbiotic relationship between density, transit use and transit viability has been well documented and quantified.[2] Where more people live and /or work in close proximity, transit is more feasible; where transit is made more available, higher densities are established. As this report contemplates proposing additional transit services, these interlocking relationships should be kept in mind. As a guide, Figure 16 shows the residential densities in the five boroughs and the adjoining areas just to the north, east and west. It is obvious in this graphic how well, in general, the provision of rapid transit service conforms to the concept that density and availability of rail transit coincide. It is the exceptions – where areas are dense enough to support rail transit but do not have it – that will receive attention as each sector of the region's core is examined.

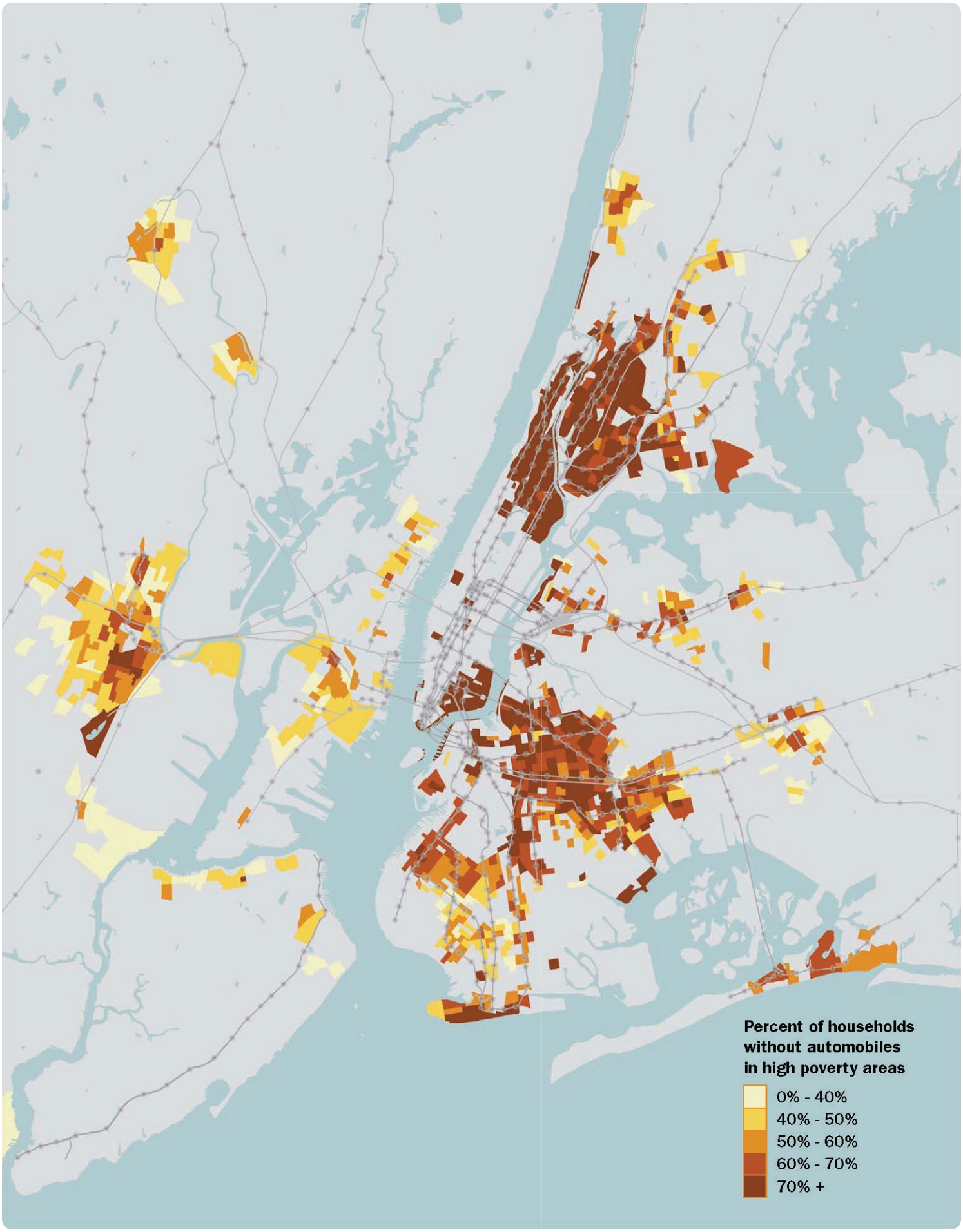
2 In 1977 Regional Plan Association published Public Transportation and Land Use Policy, the first full documentation of these relationships quantitatively. It established residential and non-residential density thresholds required to support a range of modes of public transit, including heavy rail (rapid transit), light rail, and express and local buses.

Figure 14: Autoless density in the urban core



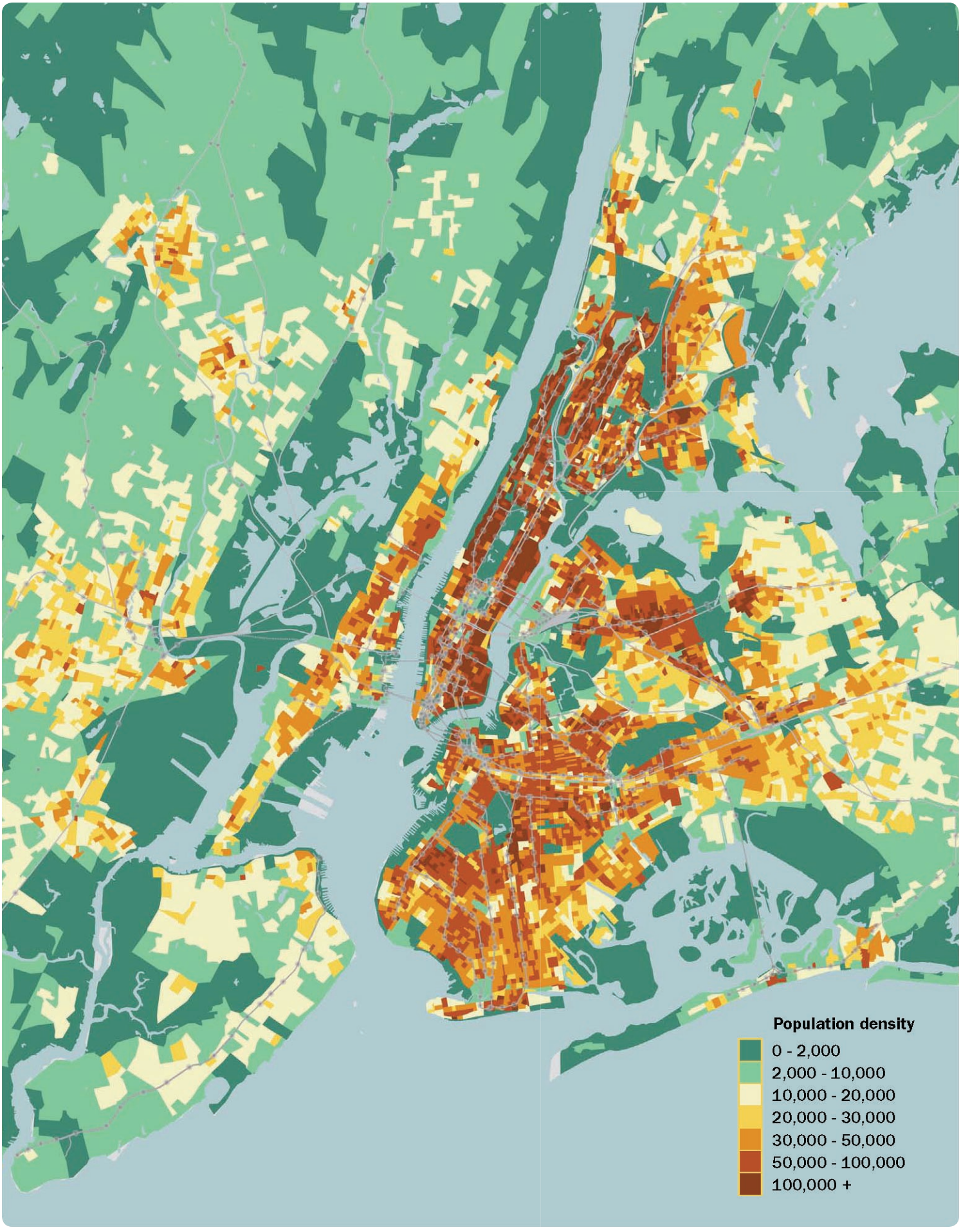
US Decennial Census 2000

Figure 15: Autoless households in high poverty areas



US Decennial Census 2000

Figure 16: Population density in the urban core



US Decennial Census 2000

Modal Opportunities

Expanded Subway Service

As observed earlier, the New York City subway system has hardly expanded in the last sixty years. During the first 30 years of the 20th Century plans were drafted to expand the system to cover much of the City, and in Manhattan to replace elevated lines with underground ones. By 1938 these plans were a reality, with most of the planned subway network completed, except for the Second Avenue Subway (SAS). The SAS was meant to substitute for the Manhattan Third Avenue elevated, which was eventually torn down in 1955. The existing network is replete with "bell-mouths," openings through which branches and extensions were to be built later to serve the further reaches of the Bronx, Brooklyn, and Queens. There are also numerous examples of excess tracks now not used or underused that can be employed more effectively. The Great Depression and World War II stopped building in its tracks and later the nation and the New York region had limited interest in subway expansion in light of declining ridership, growing automobile ownership and an expanding highway network.

The growth of the City's population, a revived economy, a rehabilitated subway network, and a recognition that auto travel must be limited in the Core of the region, has led to renewed interest in subway expansion, of which the restart of the Second Avenue Subway is the obvious example. However, new subway construction is very expensive – the eight miles SAS will cost about $2 billion per mile.

Fortunately, there are a number of upgrades of the subway system that can improve it short of these large expenditures. These include track improvements such as turnouts and turn-backs that can speed service, allow for greater service frequency and increase capacity.

At somewhat greater cost is the total reconfiguration of some bottlenecks, the most notorious of which is at Nostrand Avenue in Brooklyn, where the current track patterns limit capacity in much of the IRT system in Brooklyn, with a negative effect on the entire system. The complexity is captured even in the "simplified" description and illustration in Figure 17.

Likely to be still more expensive are upgrades to the signaling system, which is based on the 100-year old technology, known as electro-mechanical fixed-block. The MTA has begun to overlay this analog technology with digital systems – Automatic Train Supervision (ATS), to allow for centralized computer-assisted train dispatching and routing. Beyond that is Communications-Based Train Control (CBTC). The two can be seamlessly integrated. The 175-mile "A" Division (the old IRT) is currently being upgraded to ATS and the Division B track ATS is in the preliminary engineering stage. The next step would be the system-wide roll-out of Communications Based Train Control (CBTC), managed by ATS, which would completely replace the existing signaling system.

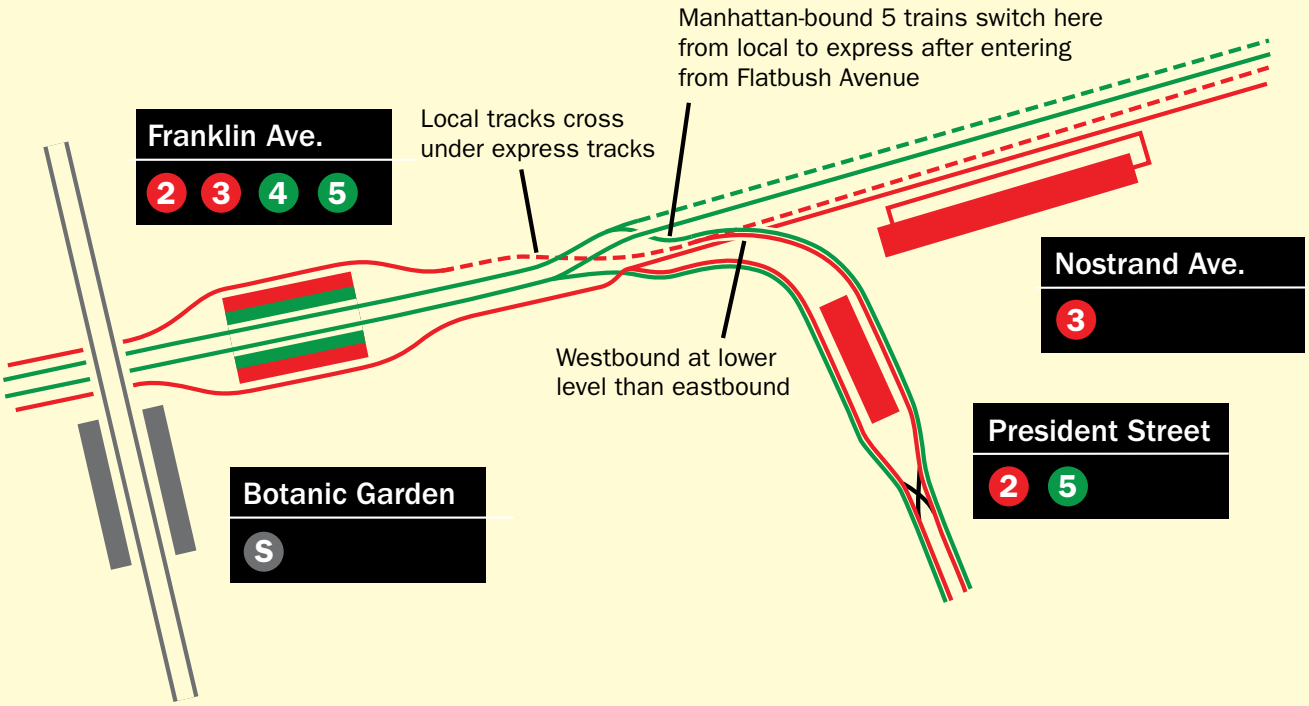
Because CBTC makes it possible to identify and control train movements in real time, safe braking distances can be minimized, and capacity and speed increased. It is estimated that the CBTC system could theoretically provide an additional 20 percent of daily capacity and at a minimum provide a 10 percent increase. However, CBTC is expensive and requires extensive testing. The Canarsie line CBTC pilot project has already cost the MTA more than $277 million to upgrade only 22.4 miles of track and still does not operate flawlessly. The cost for the wayside CBTC equipment installation alone has been estimated at $120 million, which translates to as much as $5.4 million dollars per track mile.

The New York City subway network, unlike most in the world, is to a great degree a four-track system that allows for multiple lines on the same or adjacent tracks and for both express and local service with across-the-platform transfers at express stops. These features give the system enormous operating flexibility and offer many travel options for the customer. Still, many transferring options are precluded despite lines crossing each other. Establishing new transfers can expand the value of the network, as has been demonstrated with transfers built in the early 1970s in Midtown.[1] Reduction in the difficulty of negotiating complex transfers within stations can ease crowding and speed riders' trips. The MTA has attacked this problem at some of the systems' busiest stations such as at Grand Central Terminal and Times Square, but others remain. Some subway lines have stations whose platforms can be lengthened, adding capacity, a strategy that has been successful. But added train capacity, either with longer or more frequent trains is often limited by the size of storage and maintenance areas, which are in short supply in the system. Any expansion involving more subway cars must address this problem.

Each of these subway improvements has limitations. Many, such as CBTC and the Nostrand Avenue problem entail great expense, and often only partially overcome fundamental weaknesses of the subway network – certainly with respect to system coverage. It may be that in some cases, an area of the City can only be given significantly improved service with new lines. This option cannot be discounted, particularly if one considers the long-term needs of the City and funding spread over many years.

1 In Urban Design Manhattan, published by RPA in 1968, three midtown transfers were recommended and all were built. These were at 53rd and Lexington Avenue, 42nd Street under Bryant Park, and at 50th Street and Broadway.

Figure 17: Nostrand Avenue junction track diagram



The junction is a segment of the Brooklyn IRT, between the Franklin and Nostrand Avenue stations, where the eastside #4/5 and west side #2/3 lines cross. Prior to reaching the junction, Brooklyn bound #4/5 trains run down the center two tracks of the four track right-of-way as an express service, with the #2/3 local service straddling the #4/5 on either side. After Franklin Avenue the island platform configuration is abandoned and replaced with two sets of stacked platforms, the upper level used for Brooklyn bound service and the lower level for Manhattan bound trains. The #3 local trains serve the southern tracks and two-level platforms. The #4 express trains run on the northern tracks, until the service reaches its terminus at Utica Avenue. At the same time this reshuffling is occurring, the #2 and #5 services are peeling off from the mainline, heading south down the Nostrand Avenue spur and terminating at Flatbush Avenue. For these services to stack and move to other lines they must cross under/over each other or navigate through a complex network of switches, creating multiple conflicts and degrading service. This is partially a result of the current signaling technology which, due to the required safety buffer necessitated by fix-block technology, does not allow for these movements to be synchronized or done in tandem with trains in close proximity to each other. CBTC would improve operation of the junction and is a less environmentally obtrusive and controversial option than tearing up Eastern Parkway and physically rebuilding the junction. The only impediment to this course of action is the relatively young age of the current non-CBTC compatible R62 rolling-stock on the #3 and #4/5, which still has another 20 years of service life before it will require replacement.

Based on original diagram courtesy of Tracks of the New York City Subway ©2008

Commuter Rail

The New York region has three distinct commuter rail networks – the Long Island Rail Road and Metro North, divisions of the MTA, and NJ TRANSIT's rail system. The LIRR stops in 19 locations in Queens and Brooklyn, and has terminals at Brooklyn's Atlantic Avenue Terminal and in Long Island City, in addition to its major station in Penn Station, and its future terminal at Grand Central Terminal when East Side Access is completed. The MTA's Metro North service stops at 11 stations in the Bronx, and in Manhattan at 125th Street and at its terminal in Grand Central Terminal. NJ TRANSIT only stops at Penn Station in New York but operates well over half of its train service through Newark's two stations – Newark Penn Station and Broad Street stations.

Many of the MTA's stations in New York City are underused. Both the MTA's LIRR and MTA's Metro North provide only limited service to many of them, with higher fares compared to the subway, with a policy of using their limited capacity for longer distance, higher paying customers. A small step to encourage the use of these stations has been instituted by the MTA, through a reduced fare for commuter rail trips in New York City on weekends. Two circumstances should encourage more use of these stations. When ESA opens, there will be increased capacity into Manhattan with the number of peak hour trains on the LIRR increasing from 36 today to about 60. This should open space for more Queens' residents to use the LIRR at such stations as Forest Hills and Kew Gardens and along the Main Line in Hollis and Queens Village, and in St. Albans, Locust Manor, Laurelton and Rosedale. Second, MTA's Metro North is considering routing some trains to Penn Station on the New Haven and Hudson Lines when ESA opens up some capacity at Penn Station, which could makes it possible to add service to new stations on those lines at Co-op City, Parkchester and Hunts Point in the Bronx and along Manhattan's west side.

Light Rail Transit

Light rail systems (LRT) can operate on city streets on their own or on shared rights-of-way. They can be above, below ground, or at grade. LRT has had a remarkable rebirth in the United States in the last generation. In 1970 there were only six systems in the nation, all vestiges of a vast trolley network built around 1900. Now there are 22 and counting, including the Newark City Subway which was among the early ones, and the new Hudson-Bergen light rail line which opened in 2000

and stretches from Bayonne through Jersey City and Hoboken to just south of the Bergen County border in North Bergen in Hudson County. There are no LRT systems left in the region east of the Hudson River.

LRT can provide the advantage of its own right of way, offering a traffic-free option and may have the permanence to encourage investment in the land surrounding the stations. For many people, it has a greater cachet than buses, whose reputation suffers from the repellent experiences that many potential riders had in their formative years on slow and bumpy rides to school. In New York City a number of LRT proposals have been made from time to time, without achieving a level of interest from either the MTA or the general public. The MTA, who would likely be responsible for building and operating them, does not have any experience with LRT, which may explain, in part, its reluctance to move such projects forward.

Express Buses

As shown earlier in Figure 11, the express bus system covers large areas of the boroughs other than Manhattan that are beyond walking distance of the subway system. The express bus network expanded mostly in the 1970s in response to the poor condition of the subways at the time and the desire to serve the "two-fare zones" that then existed, long before the free transfer between feeder buses to the subway was made possible with MetroCard. The express system addresses the coverage shortcomings of the subway admirably. However, many of the express bus routes have sparse service frequency in the off-peak periods, and even in the peak rarely match the frequency of the subway. They also can suffer the limitation of operating in mixed traffic, which is only occasionally addressed with preferential treatments, such as at the approach to the Queens-Midtown Tunnel and on the Gowanus Expressway feeding the Brooklyn-Battery Tunnel. Express buses also crowd Manhattan streets, especially Fifth, Madison, Lexington, and Third Avenues, and by massing along streets and avenues south of midtown and in Lower Manhattan before the afternoon peak, a practice that detracts from the neighborhoods in which it occurs. Despite these shortcomings, express buses fill an important role by serving areas without the densities to support new subway services and at much lower capital outlays.

The role of express buses in New Jersey has long been established with express bus service filling in the many gaps in coverage between PATH and the commuter rail network. Today, buses provide the most used transit option into Manhattan from the west with 181,000 using them daily, as much as the other transit modes – commuter rail, PATH and ferry combined.[2]

Figure 18: Bus Rapid Transit (BRT) routes

New York City: Department of Transportation

Bus Rapid Transit

In recent years, attempts to overcome the weakest feature of bus service – slow speed – has received attention with a concept known as Bus Rapid Transit (BRT). The intent of BRT is to speed up local bus service either by reduction of loading and unloading times or by allowing buses to avoid traffic congestion, or both. Loading and unloading speed-ups can be achieved by pre-paying fares before boarding and /or the use of smart cards that record payment without requiring the passengers to do anything but have the card in their possession, with more doors on buses, with lower floor buses to reduce the time to board and alight buses, and by encouraging more passengers to exit from the rear doors. The speed-up of the buses themselves can be done by creating either a right-of-way exclusively for buses or by giving them preferential treatment, including allowing buses to pre-empt traffic signals to give them more "green" time. Provision of their own right-of-way on existing streets would help still more, but requires that space used by vehicles – either for parking or moving – be given up for the buses.

The MTA and the NYC DOT have jointly embarked on a BRT program designed to find corridors in the City that would be appropriate for one or more of these treatments. They began by selecting 15 corridors, and then narrowed it down to five, one in each borough. The current program under serious consideration is shown in Figure 18. After an outreach effort that resulted in modifications to the initial program they have recently implimented two of these routes, Select Bus Service on Fordham Road and the first phase of the 34th Street busway, with the objective of launching the reamining three services and the full 34th Street Transitway over the next three to four years. As these routes become a reality, they should start forming a rational network of bus routes that links to the subway network.

2 Hub-bound 2005; New York Metropolitan Transportation Council

In Newark, NJ TRANSIT is working with the City to create upgraded bus services that will phase in BRT in stages on Bloomfield and Springfield Avenues leading to Downtown Newark, and potentially further.

Highway Managed Lanes

The New York State Department of Transportation has recently initiated a study of how each of the limited-access highways in New York City can be used to carry travelers more effectively. This could be done by reserving a lane for high occupancy treatment with passenger cars with two or more riders, for buses or for single occupant vehicles who pay a toll to use the lane, or even as truck-only lanes. These managed lanes could be carved from existing lanes, but this would remove some capacity for the vehicles that do not qualify for the lanes. Or it could be done by widening the highway, requiring more extensive construction and cost. These HOV/T lanes could be effective for transit in corridors where the density does not support rail transit.

Ferries

Since 1986, there has been a rebirth of ferry service in the New York region.[3] Today, the successful ferry operations fill a niche that other transit modes, by reasons of circuitry or slow speed, cannot fill as well. Opportunities for new ferry services still exist, but the public policy that limits operating subsidies for ferry services, with few exceptions, prevails. If this policy is relaxed and ferries are subsidized, as other transit modes are, they can offer the rider significant advantages over other modes in some limited situations or as a feeder to other transit modes. Ferries often suffer if connecting feeder bus service is not available.

3 For a full account of this phenomenon see Ferries in the Region: Challenges and Opportunities; Regional Plan Association; November 2006

The Process

To determine where possible transit improvements might be of most value, we examined several diagnostic maps including: a) the population density map, b) the rail transit and express bus coverage maps, c) the travel times maps, and c) the auto-less and poverty maps. To further assist the process, we developed a composite map that combined the density, coverage and income features. In this composite map in Figure 19 the three shades of brown show where there is no transit coverage, with the darkest showing where residential densities are high and incomes low, the medium dark shade showing where densities are high but incomes are not low, and the lightest showing where both densities are low and so is the incidence of low income residents. The neighborhoods in dark brown are those with the most urgent transit service problems AND where high densities would tend to make the solutions more effective. The medium brown areas are also ones where transit options could be very effective, although they do not target lower income users. The light brown areas, with lower densities are less likely to lend themselves to cost-effective solutions, yet their lower incomes suggest that they should not be ignored.

Second, a set of criteria was established to be used as "informal" screens for evaluating, at least on a preliminary basis, the concepts and projects considered. Each project being considered should meet one or more of these criteria that form the basis for setting priorities. These criteria are:

- Projects should be sustainable, defined here as projects that will attract many travelers from their cars and onto transit, thus making the region less dependent on oil and producing a lower carbon footprint that allows the region to grow and all of its citizens to prosper. To accomplish this it will be necessary to ensure safety and reliability to make the transit system as attractive as possible.
- Projects that are selected should be equitable to give the full range of the region's population access to activities, including jobs, and to provide mobility options to reduce reliance on automobiles for those who have them and quality transit choices for those who do not.
- Projects should provide the added transportation capacity to respond to the requirements of an expanding population and job base. Without the capacity to grow, the economy of the region will suffer.
- Projects should provide transportation benefits – easier access defined in coverage terms, faster service and more and easier connectivity to other areas of the region - to allow riders to reach more places.
- Projects should provide benefits to multiple markets to expand their potential for attracting travelers to transit and increase their potential for support among multiple constituents.
- Projects should be cost-effective, i.e. the project costs should be in line with the benefits they provide. This does not mean that the projects must be low cost, although that is desirable, but rather that for the level of funds expended they yield commensurate level of benefits.
- Because the shape of development measured in size, density and type drive the feasibility of transit service, projects should also be evaluated by how well they act as a catalyst for transit supportive development, and conversely, how well development can support transit.[1]

To assist in this process, RPA convened two brainstorming sessions – one in New York, the other in New Jersey – bringing together some 25 transit experts, each with many years of experience in the transportation planning field, to generate a wide range of transit concepts and options for consideration. These groups included but were not dominated by the transit providers. Participants are listed in the Acknowledgements section of the report. The conversations were recorded and a set of notes prepared for later use. Various documents previously prepared by members of these groups were also examined.[2]

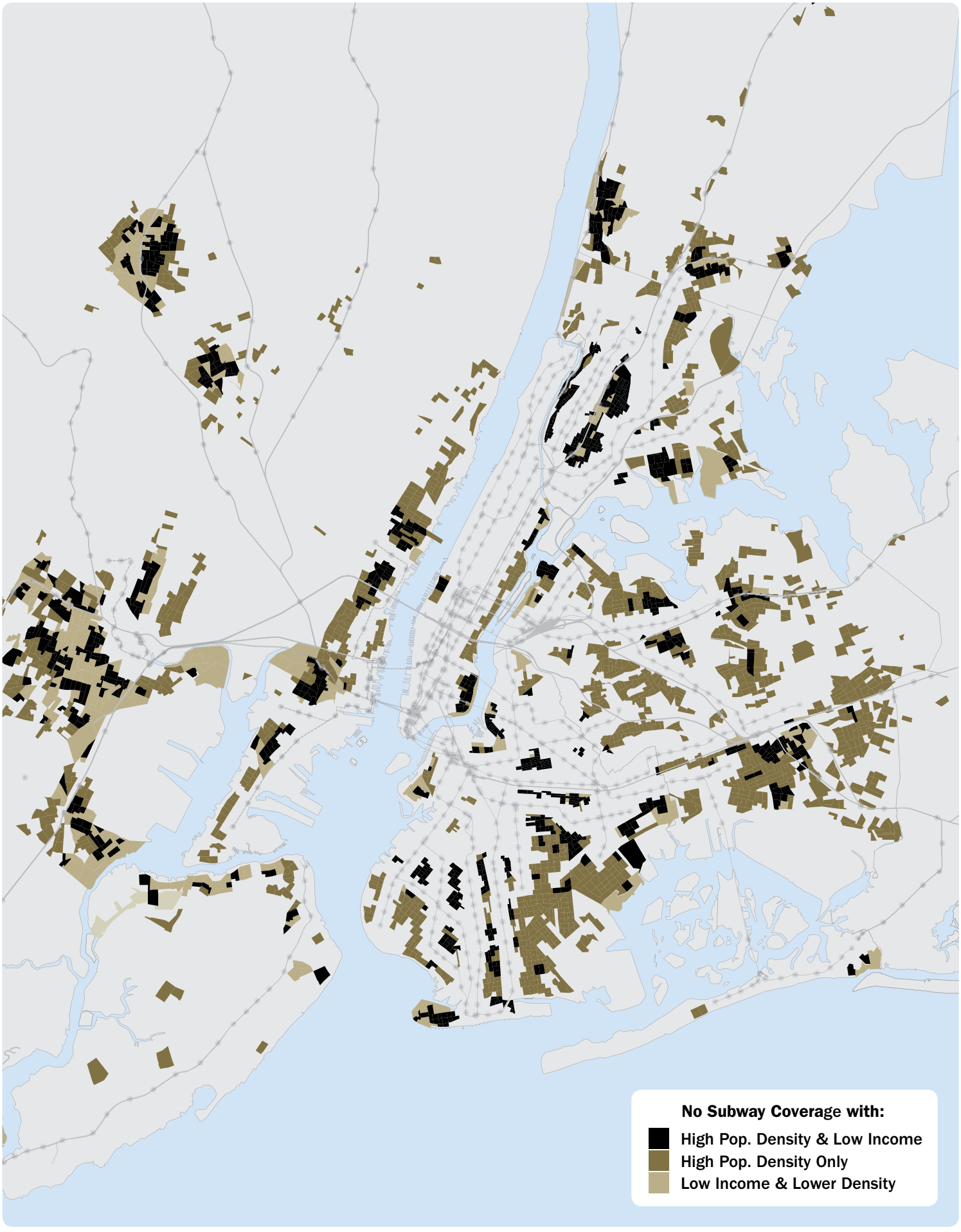
Finally, the criteria – sustainability, capacity, travel benefits, equity, cost-effectiveness, and supportive land-use – are used as screens to consider potentially worthy projects and concepts that could serve the corridor deserving of attention, as highlighted by the series of diagnostic maps.

This process is organized geographically. In the following section, each area in the region's urban core is presented separately. First, the most notable transit deficiencies are discussed. This is followed by a discussion of the transit projects that could address these problems. Finally, a list of recommendations is provided, roughly organized in sequence of time frame for implementation, with the short-term defined as less than three years, the mid-term as three to ten years, and the long-term more than ten years. Each recommendation is assigned a range for its capital cost – low is less than $50 million, mid- $50 million to $500 million, and high greater than $500 million. Finally, for each recommendation, the low income neighborhoods that would be benefited by the project are highlighted.

1 See Public Transportation and Land Use Policy, Pushkarev and Zupan, Indiana University Press, 1977, for a full discussion of this subject.

2 The two most notably examples are Rail Transit in New York: The Next 25 Years, Robert A. Olmsted; November 2007, and A Framework for Transit Planning in the New York Region, Prepared for the Metropolitan Transportation Authority by Regional Plan Association; April 1986

Figure 19: Composite: The urban core



US Decennial Census 2000

Area by Area Analysis

The Bronx

Transit Deficiencies

The composite map of population density, low income, travel times and transit coverage in the Bronx, shown in Figure 20, points to one conclusion: the south-central portion of the Bronx, comprising the Mott Haven, Melrose, and East Tremont communities, is the most obvious corridor in need of improved transit service that will benefit concentrations of relatively poor people. The inadequate service can be traced directly to the teardown in 1973 of the 5.5-mile Third Avenue elevated line. It was replaced by a bus service that connects to the #2 and #5 subway lines at 149th Street, but does not operate directly into Manhattan. The El, built in the 1888 to 1901 period, ran north-south through the corridor.

Slow travel times in the northern reaches of the borough are also a problem (note in Figure 13 how much slower it is to get to Lower Manhattan from the Third Avenue corridor than from surrounding neighborhoods). Among the areas with the slowest times are the Parkchester, Morris Park, and Westchester neighborhoods located between the Pelham Bay and Dyre Avenue lines, where express bus service is also non-existent. Co-op City, located north and east of those lines, also has long travel times so do the Soundview, Throgs Neck and Schuylerville neighborhoods along the East River, that have subways, and in the case of Soundview no express bus service.

The west Bronx neighborhoods of Highbridge and University Heights east of the Harlem River is a dense and poor corridor that also lack nearby subway service.

The north-south orientation of all the subway service in the Bronx makes travel in the east-west direction difficult and time-consuming. For these trips Bronx residents must rely on local buses, which are slow and subject to traffic delays. A more circuitous option involves using two north-south lines that converge, such as #2, #4, and #5 lines at 149th Street.

In sum, the main transit deficiencies in the Bronx include poor coverage and slow service in the Third Avenue corridor and along the ridge east of the Harlem River, lack of coverage in the northeastern and eastern parts of the borough, long travel times from the north and poor east-west transit. The problems of long travel times and lack of transit coverage is particularly acute at Co-op City, the home of 55,000 residents on 320 acres at the northeastern border of the borough.

Potential Actions to Improve Transit

Fortunately, serving the Third Avenue corridor is possible by expanding the Second Avenue subway from 125th Street. The SAS, with a "bell-mouth" at 125th Street is poised to allow for an extension into the Bronx and up Third Avenue. What to do beyond the Third Avenue corridor is less clear. Portions of the northern half of the Bronx are not well covered by the subway network and travel times by subway begin to stretch out to 60 minutes or more to Midtown Manhattan.

There are a number of options to extend the Third Avenue line further. In its 1999 MetroLink report,[1] RPA proposed to bend the line to the northeast under Boston Post Road and to have it emerge to join the at-grade Amtrak alignment near 180th Street. The line would stop near the Parkchester housing development, then at the hospital complex just south of Pelham Parkway with its concentration of hospital workers who would benefit from the line, and then leave the Amtrak alignment, diving underground to serve the massive and poorly served Co-op City housing development with as many as three stations.

Another option for reaching Co-op City is to branch off the existing Dyre Avenue #5 line, using its express track with a spur into Co-op City, but it would require dropping or reducing service on the two or three existing stations at the end of the line. However, ridership on these stations is growing, with about 7,000 daily riders combined at the last two and 5,500 at the third, making it difficult to argue for a project that would lead to any diminution of service there. This spur would also require more than one station to serve Co-op City well. This could be done independently of any extension of the SAS to Third Avenue, or can be done with the new SAS / Third Avenue line following the same alignment under Boston Post Road but with a connection to the Dyre Avenue line at 180th Street, rather than using the Amtrak alignment to reach Co-op City. Either the MetroLink proposal or the Dyre Avenue proposal would speed service from Co-op City, but the former would do more to speed service in the Amtrak / MetroLink corridor. Express service on Dyre Avenue can also be established by using its third track for peak period peak direction operations.

Either as an option to the proposals above or as an addition, the Third Avenue line can be extended to Fordham Road and then turned west to operate in an east-west direction, providing connections to the D train under the Grand Concourse, to the #4 at Jerome Avenue, and even as far as the Broadway #1 line in upper Manhattan. It also offers an east-west service as a faster alternative to buses in one of the busiest bus corridors in the borough.

If the MetroLink alignment or the SAS / Dyre alignment is chosen in addition to the Fordham line, the capacity of the Second Avenue line would be compromised, leading to a lower frequency of service for each. This would make it necessary to weave in three services to the SAS, not desirable from either an operational or frequency of service perspective. In the long term, a new deep tunnel would be required in Manhattan to overcome these limitations. Any of these options would speed service in the areas they serve, if relatively widely spaced stations were established.

Use of the MTA's Metro-North Harlem Line in the Bronx is another possibility for both the Third Avenue and "Heights" corridors. On the Harlem line this would be an option in place of the SAS extended into the Bronx since it is just three blocks to the west. But its stations are spread out and service is lacking today. To be seriously considered, service would have to be expanded significantly, which may not be compatible with current MTA Metro-North operations, and fares lowered to compete with the subway. Also, island platforms and extensions of the platforms would be needed to increase service. On the Hudson line, added service would be of limited value for the Heights because of the grade differences between the rail line and the residential areas.

In the current BRT study NYC DOT and the MTA examined the possibility of using Webster Avenue to the west as a BRT corridor, but ran up against the mandate to continue operation of bus service on Third Avenue, an agreement reached when the El came down. The more industrial land uses along Webster Avenue would generate fewer trips than along Third Avenue, but putting the BRT on Third Avenue would be more difficult than on Webster, without restricting auto traffic, given Third Avenue's narrower width. BRT might be useful for local service but it would require transfers to link to the subway system and the rest of the City.

The MTA and the City's BRT program has singled out the Fordham Road / Pelham Parkway corridor for early BRT treatment. This corridor is the second busiest in the Bronx and peak period speeds average less than 10

1 MetroLink: New Transit for New York, Regional Plan Association, 1999

Table 4: Bronx Transit Comparisons Source: RPA

A = Excellent **B** = Good **C** = Fair **D** = Poor **Alternative**	SAS Capacity	Coverage	Connectivity	Speed	Overall Benefits	Equity (Y=yes)	Intra-Bronx	Traffic reduction	Capital Cost	**1:** No Fordham Rd. **2:** No Co-op City **3:** Bypasses 2 existing stations **Negatives**	Score
3rd Ave & MetroLink to Co-Op City	Uses	A	B	A	A	Y	B	C	B	1	88
3rd Ave to Fordham Rd	Uses	B	B	B	B	Y	B	D	B	2	82
Existing Dyre Ave to Co-Op City	Does not use	C	C	A	B	Y	D	C	D	1,3	76
3rd Ave to Dyre Ave Express to Co-Op City	Uses	B	B	A	B	Y	B	C	B	3	85
3rd Ave to Fordham Rd. + West to 207th Street	Uses	B	A	B	B	Y	A	D	A	2	86
3rd Ave. to Fordham Rd. + MetroLink to Co-Op City	Overloads	A	A	A	A	Y	A	C	A		92
3rd Ave. to Fordham Rd + West to 207th & MetroLink to Co-Op City	Overloads	A	A	A	A	Y	A	C	A		92
3rd Ave. to Fordham Rd plus existing Dyre Ave. to Co-Op City	Uses	A	B	A	A	Y	A	C	B	3	89
3rd Ave to Fordham Rd plus Dyre Ave Express via Third Ave. to Co-Op City	Overloads	B	A	A	A	Y	A	C	A	3	91
3rd Ave. to Fordham Rd + West to 207th St & Dyre Ave Express via 3rd Ave to Co-Op City	Overloads	A	A	B	A	Y	A	D	A	3	89
MTA's Metro North	to be examined	C	B	A	B	Y	D	D	C	2	78
Bus Rapid Transit	Impacts roadway	C	C	C	C	Y	C	D	D	2	72

miles per hour. The agencies implemented the first of these BRT corridors in the Bronx in June 2008. It is offically reffered to as Select Bus Service (SBS), due to the decsion to only incrementially add BRT features, and will pilot the collection of fares off the vehicles and institution of a proof of payment system. If successful, it could pave the way for more widespread implementation elsewhere in the City.

Table 4, helps to sort out all of these Bronx options; similar tables could be helpful in other areas, if options are complex and numerous in one corridor. The table arrays the major characteristics of the options qualitatively. All alternatives but the use of the existing Dyre Avenue line with a spur into Co-op City (#3) pass muster on equity grounds; the Dyre Avenue spur would not serve the low income Third Avenue corridor in the south-central Bronx. Among the other subway alternatives, those with two separate services into the SAS (#6, #7, #9, and #10) would overload the capacity of that line or limit the frequency the new services could provide and would therefore be difficult to justify, since they would require building more capacity in the Second Avenue corridor. The remaining subway alternatives establish the dilemma: to avoid knocking out the last two stations on the Dyre Avenue line MetroLink would be a preferred approach to Co-op City, but if MetroLink is used it requires capacity from the SAS, precluding other services north of where it would bend northeastward, i.e. to Fordham Road. Without new capacity beyond the amount the SAS will provide, the choice becomes either serve lower Third Avenue in the Bronx and use MetroLink to reach Co-op City (#1), or operate the SAS up Third Avenue to Fordham Road (#2) or beyond (#5). With more – and more-expensive – capacity or by accepting a lower frequency of service, options other than these three remain in play. It is not possible to make a choice without a more detailed travel-demand-and-benefit analysis and more detailed cost estimates.

The two non-subway alternatives have the advantage of having lower costs, but each has issues that may make it ineffective or unworkable. The MTA Metro-North commuter rail option is unlikely to provide the frequency and span of service needed, and is uncertain as to its effects on railroad operations. As for the BRT option, it may not be possible to locate it on Third Avenue. Neither scores as well as the subway options regarding travel benefits. Still, their relatively low cost make them eligible for consideration at this time.

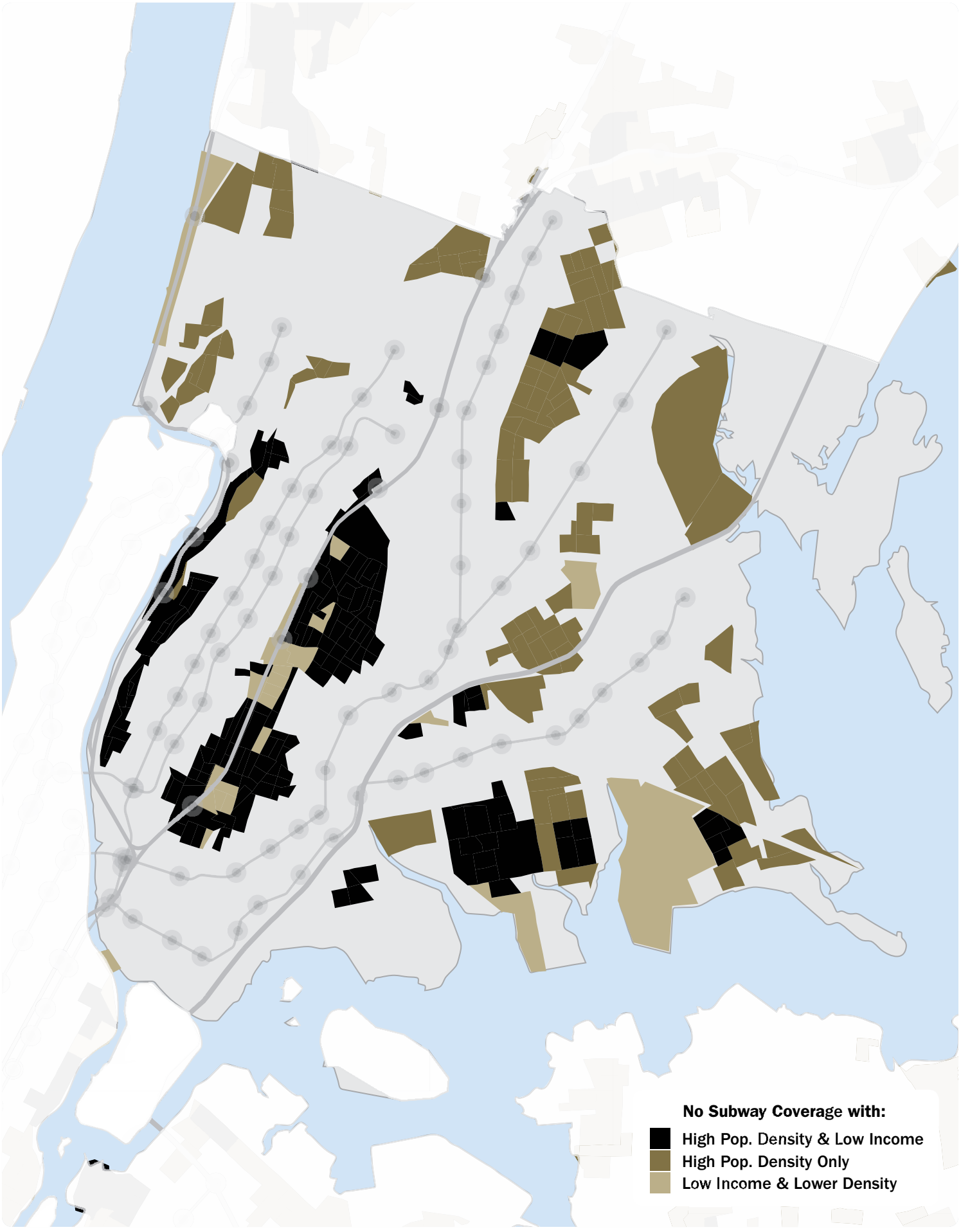
Another way of addressing the speed and coverage problems in northeast Bronx is using the New Haven line rerouted on the Amtrak right-of-way. MTA Metro-North has been studying the concept of routing trains into Penn Station with stops at Co-op City, Parkchester and Hunts Point. The service would be faster, but not very frequent and at Co-op City about two-thirds of the residents would still be beyond walking distance to the station. It also has a reverse commuting potential to Connecticut, for which there is a sizable market. This new service could only start after ESA is in place and only if the MTA's LIRR were to accede to the idea of giving up some of its capacity into Penn Station.

The lower density neighborhoods in the eastern parts of the Bronx are unlikely to be locations for high-cost subway solutions. The continuation or expansion of express bus service, possibly taking advantage of future "managed lanes" is a potential source of improvement. The proximity to the East River / Long Island Sound makes the consideration of ferry service possible, although that service is unlikely to be self-sustaining. This raises the issue of the most appropriate role of ferries and whether there is a public interest in subsidizing them.

Recommendations (Fig. 21)

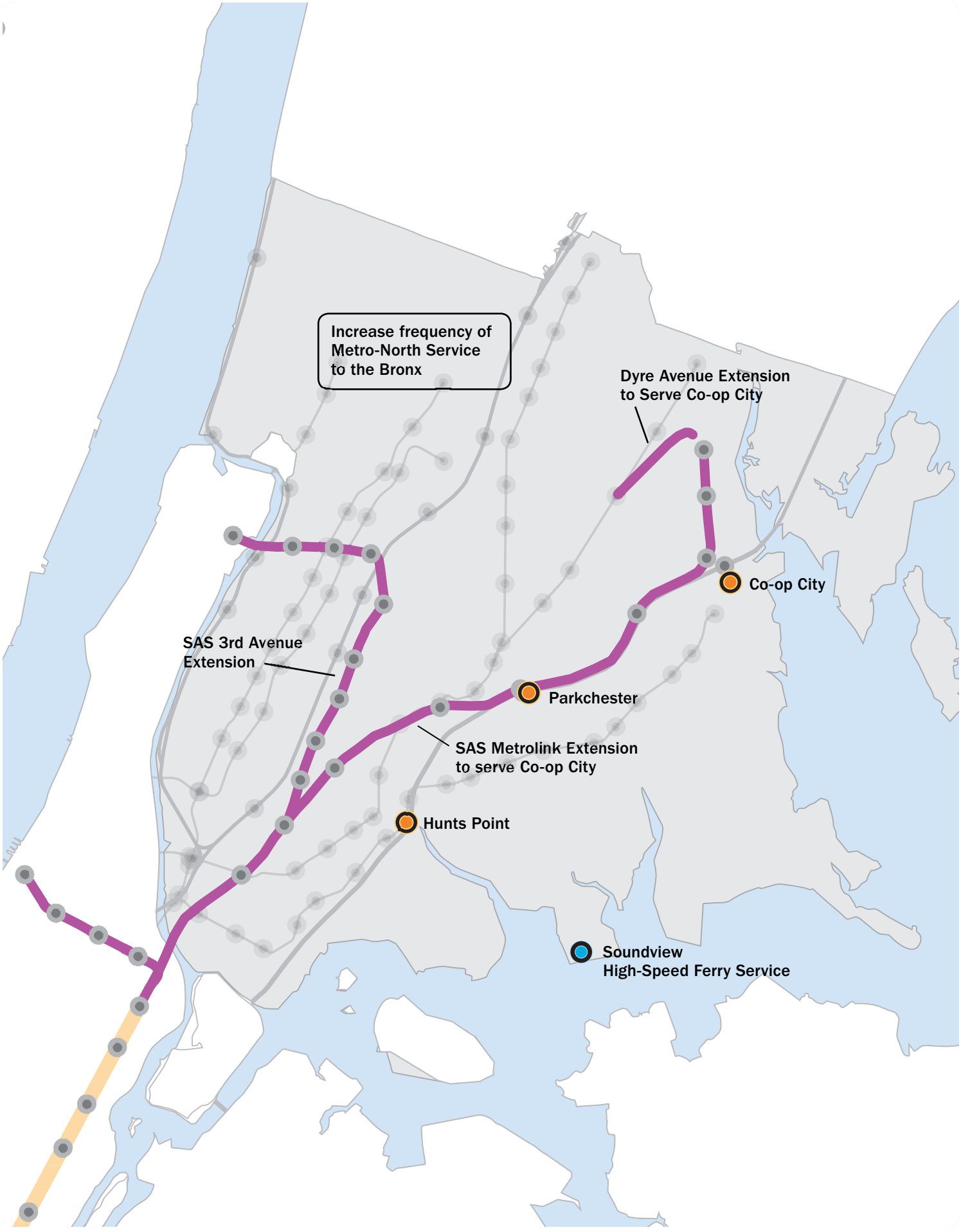
- Ferry service from Soundview and other eastern neighborhoods in the Bronx should be the subject of study by NYC:DOT's ferry office. These services should be evaluated to see if any necessary subsidies would be in the public interest. Soundview; Low capital; short-term
- MTA Metro-North should initiate an examination of whether and how it might best increase service at Bronx stations on the Harlem and Hudson River lines, and by introducing a fare that is attractive enough to encourage ridership. The prohibition now in place that prevents New Haven line trains from stopping in the Bronx at Harlem Line stations should be lifted to make this recommendation easier to carry out. Mott Haven, Melrose, Morrisania, East Tremont, Highbridge, University Heights; Mid capital; mid-term
- Initiate express service in peak hours and direction on the Dyre Avenue line and on other Bronx lines where a third track makes this possible such as on the #4 Jerome Avenue subway. Mid capital, mid-term
- Start on post-SAS planning, centered on serving the Third Avenue corridor in the south-central area of the borough to build public support and to cultivate a local champion. Mott Haven, Melrose, Morrisania, East Tremont, Fordham; High capital: long-term
- The SAS extension studies should include, the use of the Amtrak right-of-way as a means of adequate access to the northeast Bronx, including Co-op City should be the subject of early study. If multiple services from the Bronx into SAS are in excess of available capacity, consider a shuttle service arrangement for the line to Fordham Road. Fordham; High capital; long term.

Figure 20: Composite: Bronx



US Decennial Census 2000

Figure 21: Recommendations: Bronx



Queens

Transit Deficiencies

Transit in the borough of Queens, the largest in area among New York's five boroughs, is limited in a number of ways – poor subway coverage, excessive crowding, slow speeds, and limited intra-borough service. Sixty-five percent of the borough's population lives beyond walking distance of a subway stop, mostly in Eastern Queens, as noted earlier in Table 3. There are also several neighborhoods in western Queens without subway coverage, namely Jackson Heights, Maspeth, Glendale, Middle Village and Ridgewood. As Figure 22 shows, many, but not all, of the uncovered areas are at low densities making new subway lines problematic. They are not, for the most part, areas of lower incomes. But there are a number of exceptions in Jackson Heights, Corona, Elmhurst, and South Jamaica where incomes are lower or densities are higher. Much of Eastern Queens is served by express bus service, but it is often not a substitute for the subway, with its less frequent service, more limited time span of service in the midday and in the evening, and its limited connectivity to the subway network. As Figure 11 showed, some areas of Queens have neither express buses nor subways. These include College Point east of LaGuardia Airport, and the southern portions of Queens Village and Rosedale in the southeastern portions of the Borough. Most of Queens does not fall into the poverty definition used to construct Figure 15 on page 20. Those few areas that do have subway service, with two exceptions: South Jamaica and Far Rockaway.

Queens also is victim of subway crowding with the limited number of services converging in the borough to pack trains on the Queens Boulevard and Flushing lines. In the late 1960s the MTA's Grand Design called for two new subway services from Queens to use the new 63rd Street tunnel, one to go across to the west side under Sixth Avenue and the other to turn down the Second Avenue subway. To create that service, a new line in Queens would have to be built. Known as the Queens Bypass, it would parallel the LIRR to Jamaica. The fiscal crisis, the absence of funding and local opposition slowed and then killed the project. Instead, the Local Connector was built and opened in 2001, making it possible to use the capacity of the 63rd Street tunnel under the East River, finished almost 30 years earlier. But the Local Connector still leaves out the Queens Boulevard lines, since the new service, the V using the 53rd Street tunnel, is a local and is not fully used.

Figures 12 and 13 on page 17 show that the travel times to Manhattan from eastern Queens typically exceed one hour. For travel to Lower Manhattan the times generally are even longer since most of the subway service from Queens to Manhattan is through Midtown. The only direct subway service to Lower Manhattan is via the excruciatingly slow Jamaica El (J and Z lines) operating through Brooklyn.

Travel by subway within the borough is limited by the east-west orientation of most lines, and bus service operating north-south is slow and subject to traffic delays.

In sum, Queens transit suffers subway crowding and capacity problems into Manhattan, slow times and lack of subway coverage over a wide band from north to south throughout the eastern portions of the borough, plus similar conditions in selected locations such as Jackson Heights and Corona further west.

Potential Actions to Improve Transit

Improved coverage in Queens by totally new subway lines extended eastward is unlikely to occur anytime soon. However, there are opportunities to add coverage, ease capacity problems and speed service using either new or existing rights-of-way.

One opportunity could occur when the LIRR's East Side Access project is complete. The LIRR will have five western termini, three major ones when Grand Central Terminal is added to Penn Station and Atlantic Avenue in downtown Brooklyn. This will make it exceedingly difficult to maintain reliable and frequent LIRR operations. Conversion of the Atlantic Branch to transit use would eliminate one of the LIRR termini, simplifying the MTA's LIRR operations. This line originally functioned as a transit line and could again, if it were extended into Manhattan and connected to the Second Avenue subway which will be designed in Lower Manhattan to receive it, as proposed in RPA's MetroLink report. This would shave-off at least 20 minutes from Jamaica to Lower Manhattan travel time, and if the Atlantic Branch of the LIRR in southeastern Queens were converted to transit use, the travel time benefits would extend over a wider area where travel times are long today. It could be done by shifting current LIRR service from the Atlantic Branch in South Jamaica to the nearby Montauk Branch. A new station could be added in South Jamaica to the Atlantic Branch near the poorly served Jamaica Houses. The MTA has estimated this line would carry 100,000 riders a day if the Atlantic Branch were linked to the SAS, without accounting for any riders from points east. The quality of the two-mile elevated portion of the right-of-way in Brooklyn is suspect, and it would have to be determined whether it should be rehabilitated or buried. This concept will also be discussed in the Brooklyn section of this report. These steps might be possible prior to the completion of the SAS to Lower Manhattan, enabling the shift to a more rapid transit service at least as far as downtown Brooklyn.

Crowding on the Queens Boulevard subway lines would be eased somewhat by the conversion of the Atlantic Branch to rapid transit.

The opening of ESA, with more LIRR capacity and service dedicated to Queens' subway riders would also have some impact on crowding and would add a more transit-like coverage in Hollis and Queens Village.

Conversion of the V train to a combined local-express with installation of high speed switches as suggested by Olmsted[1], would add three express trains per hour.

Further diversion might be possible by speeding up buses along the Queens Boulevard corridor with BRT in the outer lanes, outfitted with pre-emptive traffic signals. Today in the peak period, bus routes on Queens Boulevard average only about 7 miles per hour. The BRT could be extended over the Queensborough Bridge, but would benefit from special preferential treatments on Manhattan streets. Or it might just be a Queens-only facility. Either way it could reduce crowding on the subway lines operating below it. For now, the MTA and the City have rejected the Queens Boulevard BRT as being exceedingly complex. Yet even these measures, with or without BRT, while offering some crowding relief, are unlikely to add enough capacity, to relieve the high level of growth expected from Queens to the Manhattan CBD as indicated earlier in Table 2 and Figures 9 and 10.

The 63rd Street tunnel under the East River was built as part of the 1968 Grand Design to funnel two subway services into Manhattan – one to the east side via the SAS and the other to the west side via a tunnel constructed in the early 1970s under Central Park. The intent then was to construct a high-speed bypass – the Queens Bypass – alongside the LIRR main line to Jamaica to feed—and speed—service into Manhattan. A total of four services would be provided in the Queens Boulevard corridor – two using the 63rd Street tunnel and two existing ones to Sixth and Eighth Avenues. The Bypass not only would add capacity into Manhattan, relieve crowding, and speed service, but it might also be a means of expanding coverage. It was the target of much opposition in the 1970s because of its impact on adjacent properties, and that along with the fiscal crisis at that time resulted in it being postponed indefinitely. However, if it were to proceed, there would need to be a determination of what the fourth service in the corridor would be in addition to the E, F and V. This could involve an expansion into southeastern Queens using the Atlantic Branch or a line under Jewel Avenue, or along the Long Island Expressway, or down the abandoned Rockaway Beach Branch right-off-way. One operating plan suggested by Olmsted would have five services, adding 15 expresses in the peak hour.[2]

Bus congestion in and around Jamaica Center is particularly acute. Many bus routes and high volumes of buses serve Jamaica and feed the subway lines at Archer Avenue and along Hillside Avenue. In their BRT outreach efforts the MTA and the City discovered that speeding buses, such as on Merrick Boulevard, which was one of the original BRT routes selected was less important to riders than addressing congestion at Jamaica Center. They have now redirected their efforts to focus on bus operations in Jamaica Center.

The best prospect for ferry service in Queens is from the Rockaway peninsula, where subway service is excessively time consuming. The Rockaway Park section to the west near Jacob Riis Park has been considered for ferries in the past, but studies have shown that it would require substantial subsidy to keep fares low enough to attract sufficient riders. As indicated earlier, the issue of the appropriate role for subsidized ferries requires attention.

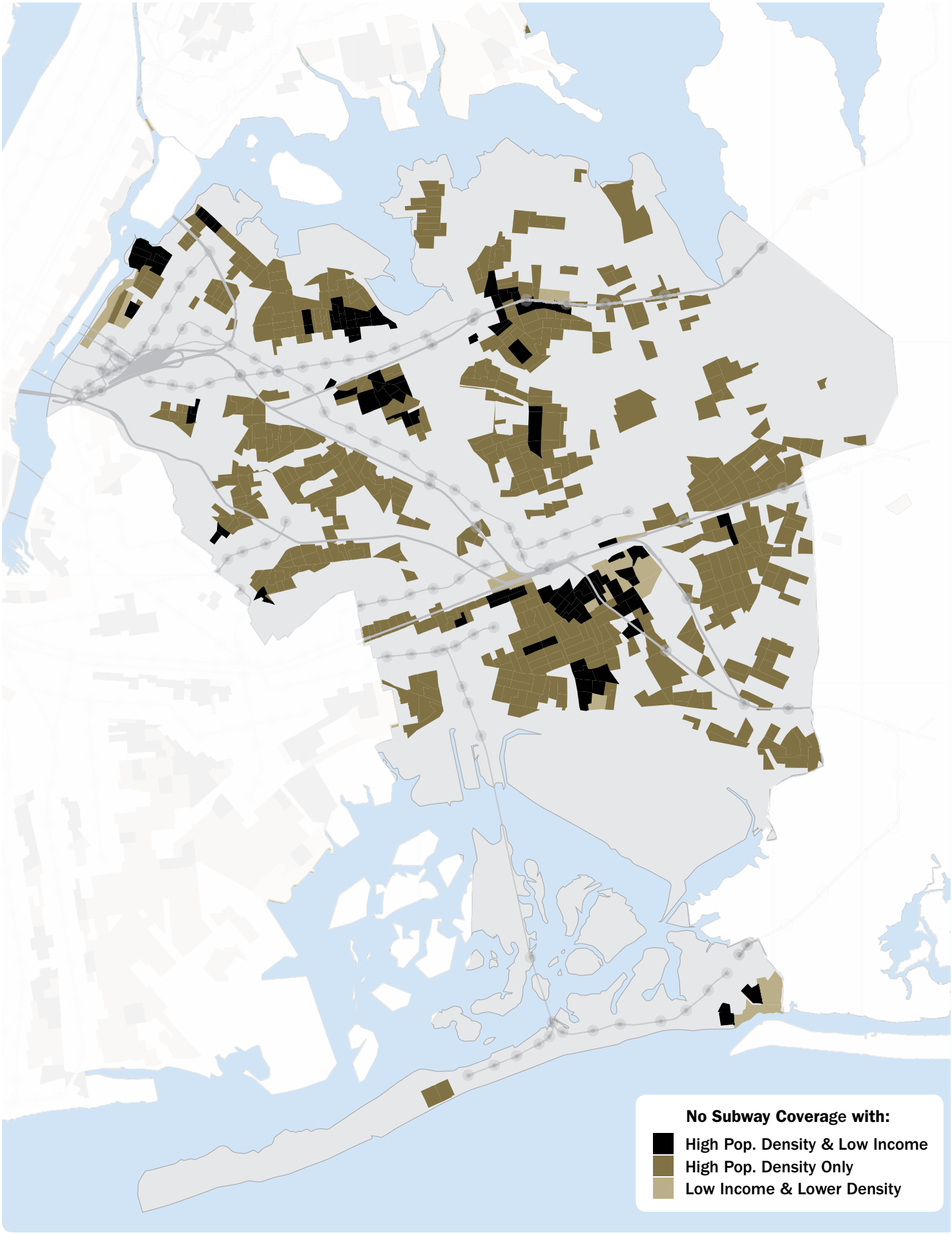
A project outside of Queens but very relevant to the Borough is the LIRR third-track project. Currently, the two-track Main Line between Bellerose and Hicksville operates both tracks in the peak direction during morning and afternoon peak hours, preventing "reverse" service to job locations on the Long Island that could be reached by City residents. The project would make this service possible. The project is opposed locally, since it would require some property taking, mostly where highway bridges over the railroad would have to be rebuilt.

1 Rail Transit in New York: The Next 25 Years, Robert A. Olmsted; November 2007, page 12.
2 Ibid, page 7.

Recommendations (Fig. 23)

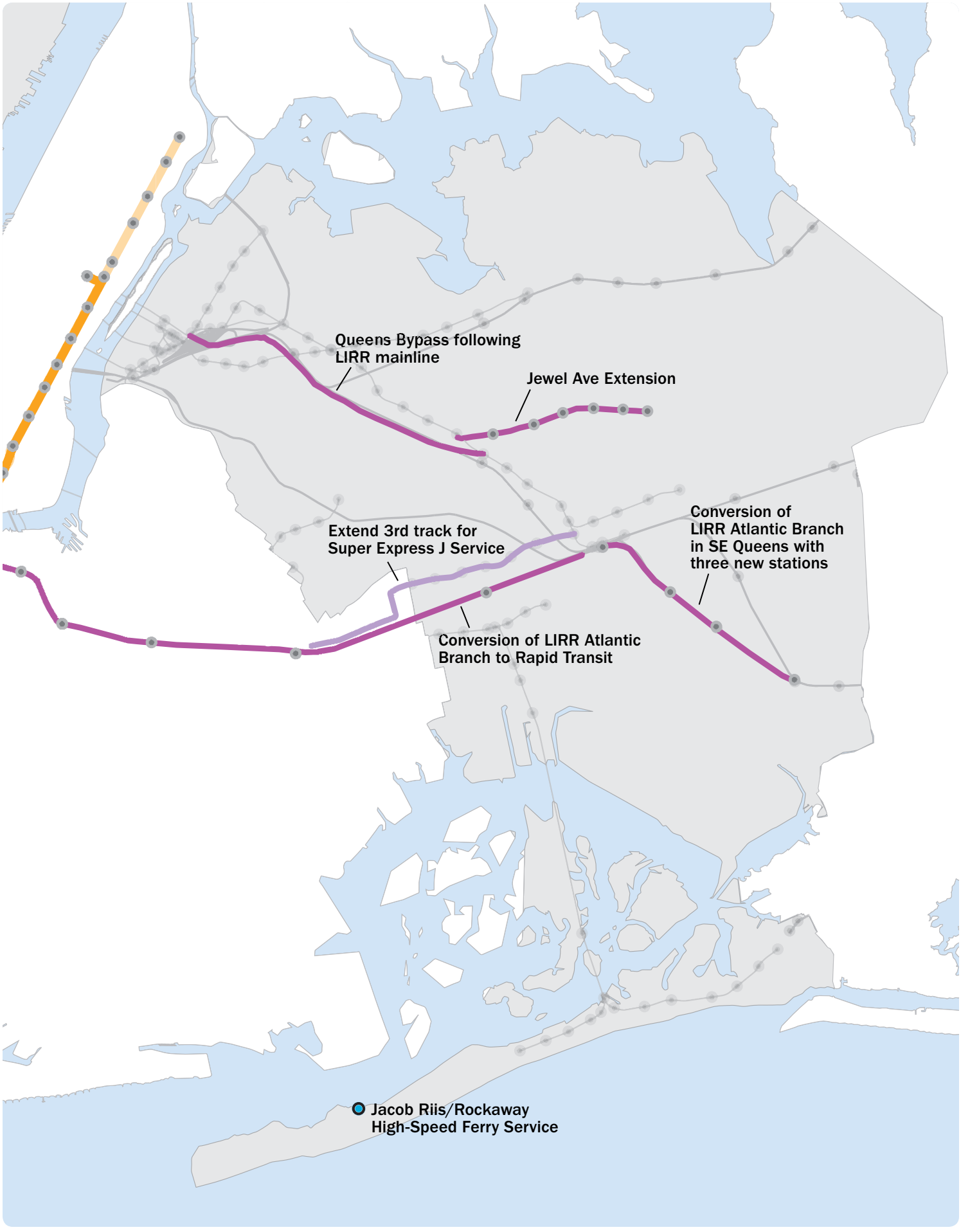
- Move forward with the LIRR third track project from Bellerose to Hicksville to give Brooklyn and Queens residents a transit choice to reach jobs in Nassau County. South Jamaica, East New York, Bushwick, Brownville; Mid capital; mid-term
- Establish transfer connections at two locations in Long Island City – connecting Queensboro Plaza and Queens Plaza and E, G , and V at Court Square. Widespread benefits in lower income areas throughout the borough; High capital; mid-term
- When ESA opens reconfigure LIRR service to offer expanded service at Queens stations with fares higher than the subway, but not at prohibitive levels. This service would relieve congestion on the Queens Boulevard line. Jamaica, South Jamaica; Low capital; mid-term
- The MTA and the City should revisit the prospects for a BRT on Queens Boulevard. Mid capital; mid-term
- Initiate studies now to plan for how best to use the Atlantic Branch of the LIRR once ESA opens. Arguments for its conversion to rapid transit service are strong. From the east there would be two services, one from the converted Atlantic Branch in South Jamaica with three stations, two existing ones and an added one in the lower income neighborhood in South Jamaica at Linden Boulevard. The benefits for Brooklyn are discussed in that section of this report. The services would be designed to connect to the SAS in Lower Manhattan and via Liberty Street to the area of the World Trade Center with the Brooklyn service, thereby creating a fast service to the east side of Manhattan and to Lower Manhattan from Jamaica, south and central Brooklyn, and via the JFK AirTrain station in Jamaica Center from the airport. Jamaica, South Jamaica; High capital; long-term
- Determine the extent to which crowding on the Queens Boulevard lines would be addressed by actions other than the Queens Bypass, and, if these are inadequate, renew consideration of that project to add capacity into Manhattan, which could include a Jewel Avenue or Rockaway Beach Branch corridors. High capital; long-term

Figure 22: Composite: Queens



US Decennial Census 2000

Figure 23: Recommendations: Queens



Brooklyn

Transit Deficiencies

Brooklyn, the City's most populous borough with 2.5 million people, is criss-crossed with subway service, yet it still leaves 41 percent of its residents living beyond comfortable walking distance of a subway station. The uncovered areas are generally at high enough densities to support subway service; they include some lower income neighborhoods, with Central Brooklyn and the others to the south, as shown in Figure 25. The largest area not covered by transit falls east of New York Avenue and south of Linden Boulevard in the neighborhoods of East Flatbush, Flatlands, Marine Park, the eastern portions of Sheepshead Bay, the southern portions of Canarsie and Spring Creek Towers (formerly Starrett City). Smaller areas of the Bushwick, Bedford-Stuyvesant, Crown Heights and Brownsville neighborhoods in Central Brooklyn and Bensonhurst in southwestern Brooklyn are also underserved, but each of these has multiple subway choices at its fringes. Figure 11 showed that express bus service fills in some of the gaps in the areas to the south, lowering uncovered areas to 23 percent, but notably leaving out East Flatbush. A number of neighborhoods along the East River, such as Red Hook and Greenpoint, are also further than a comfortable walk away from the subway.

Transit speeds more or less mirror the uncovered areas to the south, but slow speeds are also found in Gravesend, Coney Island and Sheepshead Bay, even where the subways operate.

The most crowded subway line from Brooklyn is the Canarsie L line. This crowding, caused by recent growth has come as a surprise, a result of the rapid gentrification in Williamsburg. Other areas in Brooklyn may share this experience as older neighborhoods gentrify.

The areas of Brooklyn that fit the poverty definition are extensive in Brooklyn, including much of Central Brooklyn from Bedford-Stuyvesant and Bushwick east to East New York, and to the south in Sunset Park, Flatbush, Borough Park and to a lesser extent in Gravesend.

The extraordinary confluence of transportation infrastructure at Broadway Junction, much of it in the form of two elevated subway lines – the Broadway J and the Canarsie L lines – ramps leading to an adjacent rail yard, and additional abandoned structures, some dating back to 1889, thwarts any hopes of regeneration of the area. Figure 24 gives one view of this metallic skyscape.

Local bus service, as in the other boroughs can be exceedingly slow. The heavy bus volumes on Nostrand Avenue, Flatbush Avenue, Kings Highway and Flatlands Avenue led the MTA and the City to include these corridors in their initial list of BRT candidates.

Like the other boroughs, Brooklyn suffers from having little subway service operating circumferentially. The one exception is the G line, which connects downtown Brooklyn with the two lines in Queens and to the Smith / 9th Street Station near Red Hook. The line remains one of the poorest performers in the system, with lower ridership since it does not directly serve Manhattan.

In sum, Brooklyn's transit deficiencies include the familiar combination of poor coverage, long travel times, overcrowding and poor cross-town choices. The spotty coverage occurs though much of the borough, slow trips are focused in the south and east, and capacity problems are most acute on the L line. Finally, the existing network of subways with its many elevated lines, exemplified most by the Broadway Junction area is a hindrance to redevelopment.

Potential Actions to Improve Transit

Against this backdrop the challenge is to find opportunities to expand transit's reach, but to accomplish this with faster travel speeds and shorter travel times. The proposal to establish rapid transit service on the Atlantic Branch of the LIRR, discussed in the Queens' section of this report, presents one such opportunity. Construction of a new subway line under Utica Avenue connected into the Atlantic Branch would add coverage in an area that is currently underserved by transit. The Atlantic Branch at Utica Avenue is elevated, as it is for 1.7 miles from Bedford Avenue to Ralph Avenue to the east. The elevated structure is old and the MTA is planning to include it in its upcoming five-year capital program (2011-2014) for rehabilitation. The northern portion of a new Utica line in Crowns Heights would include relatively low incomes areas. To the south the densities remain relatively high – mostly in the 20,000 to 30,000 per square mile range, sometimes higher – all the way to Flatbush Avenue. The line would also serve the Kings County hospital complex at Winthrop Street. The area would benefit from the fast service offered by connecting the line to the Atlantic Branch.

The capacity and speed concerns on the Canarsie L line are being addressed by the MTA with the recent installation of CBTC. With CBTC in place, the idea of adding service in the form of a new branch to Spring Creek Towers, where 14,000 residents live on a 140-acre site, should be considered. This could be done with a short branch via Pennsylvania Avenue.

The capacity issues on the IRT (numbered lines) in the area can be addressed by the previously mentioned Nostrand Avenue Junction improvements, which could speed train service and add capacity, today limited by this poorly designed confluence of tracks. The improvement would speed up service on the #3, which runs through the low income areas of East New York and the #4 which serves Crown Heights. It would also speed up the #2 and #5 lines down Nostrand Avenue where an extension further south as far as Kings Highway to the Marine Park community could make sense as still another way of relieving the operating problems created by Nostrand Junction. However, as indicated earlier, this step is best taken when CBTC is installed on these old IRT lines, which will likely have to wait for the current fleet's useful life to be reached. The Nostrand Junction tangle could also be relieved by switching the assignment of one of the two services running under Livonia

Avenue with one of the two running under Nostrand Avenue, but this would add another transfer for many subway riders in the area.

Meanwhile, a short-term boost in the form of a BRT on Nostrand Avenue, the busiest bus corridor in Brooklyn where peak period speeds slow to less than 7 miles per hour, is being advanced by the MTA and the City for 2011 implementation. It would have traffic signal pre-emption to speed buses and bus bulbs to move buses out of the traffic stream.

To address the Broadway Junction blight some have recommended rerouting the Jamaica El line into the Atlantic Branch, but that would entail enormous costs, disruption, and will lengthen the walking distance by up to 1,000 feet for many riders. It would also result in multiple stops on the Atlantic Branch and diminish the value of the express service from Jamaica discussed earlier in the Queens section of this report.

The Jamaica El, the oldest in the system, may currently carry the slowest service in the subway system, clocking in at 49 minutes from Sutphin Boulevard to Fulton Street in Lower Manhattan. To speed service a third track on the existing structure could be installed on the 2 ½ miles from 121st Street and Cypress Hills. There is room for the track, but it was never installed when that portion of the line opened in 1917. A peak-period, peak-direction express from Jamaica Center to Fulton Street, could make the run in 35 minutes, stopping only nine times.

To create intra-borough transit opportunities ideas include establishing a trolley line through the Brooklyn waterfront neighborhoods stretching from Sunset Park to the south to Greenpoint to the north. RPA examined this possibility in 2001 and concluded that relatively low ridership potential resulting in poor cost effectiveness, slow speeds in street traffic, and likely community opposition to street running would give this concept a low priority.

As in the other boroughs there are some limited opportunities for ferry service in Brooklyn. Among the possibilities are ferries to Lower Manhattan from Sheepshead Bay, Manhattan Beach, Floyd Bennett Field, and in Bay Ridge. Each might be combined with a ferry from Rockaway at Jacob Riis Park as discussed in the Queens section of this report. As with all ferry projects, these would benefit from a clear policy on public subsidies tied to the public interest.

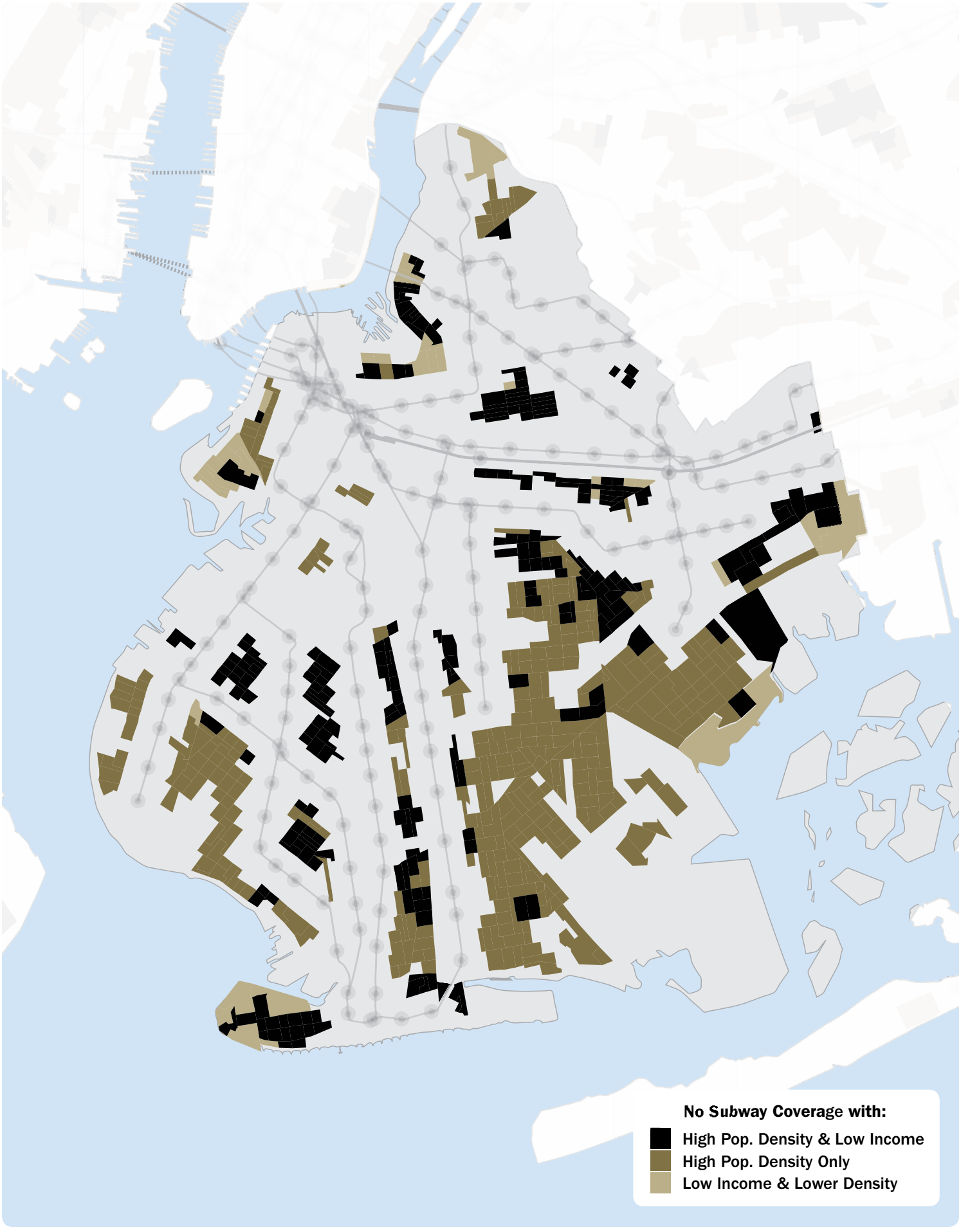
Recommendations (Fig. 26)

- Accelerate implementation of the BRT program along Nostrand Avenue. Low capital; short term.
- As with the other boroughs, consider possible ferry services from communities along the water's edge where transit options are poor today, provided the case could be made that the level of subsidies necessary are in the public interest. Low capital; short-term.
- The dysfunctional Nostrand Junction is at the heart of much of the capacity, travel times and reliability problems for subways in Brooklyn. The MTA should accelerate consideration of the options, whether it is by installing CBTC early, reconstructing the Junction, extending the subway down Nostrand Avenue or re-assigning the IRT numbered lines. As an early first step there should be an education campaign for subway riders in East New York and their elected officials to inform them of the benefits of a line assignment switch in advance of the more capital intensive solutions that might take many years. Move forward with the assignment change if the community is supportive. East New York, Brownsville, East Flatbush, Ocean Hill; Capital ranges depends on choice; mid-term
- Examine the cost effectiveness of initiating express service in the peak direction on the Jamaica Avenue J line. East New York; Mid capital; mid-term
- Explore the cost effectiveness and operating feasibility of a split of the Canarsie line to Spring Creek Towers via Linden Boulevard and Pennsylvania Avenue and, in concert with that, the establishment of express service either from Rockaway Park or Spring Creek Towers. Mid capital; mid-term
- Establish transfers at two locations in Brooklyn – connecting the J/M with the G at Broadway and Hewes Street and the #3 and the L at Junius and Livonia Avenues. Widespread benefits for many lower income areas in borough; Mid capital; mid-term
- Consider the long-term efficacy of replacing the aged Jamaica Avenue elevated line versus retaining it, parts of which are 115 years old.
- Convert the Atlantic Branch of the LIRR to rapid transit service. (This is also discussed in the Queens section of this report). In Brooklyn the converted Atlantic Branch would receive a new transit line from Utica Avenue that could be extended as much as four miles to Flatbush Avenue. The service starting in southeast Queens would offer a stop at East New York where riders from the A, C, J, and L trains could transfer for a high speed trip to downtown Brooklyn and Lower Manhattan by connecting the line to the SAS in Lower Manhattan and via Liberty Street in Manhattan to the World Trade Center area. It will create a fast service to the east and to Lower Manhattan from Jamaica, south and central Brooklyn, and via the JFK AirTrain station in Jamaica Center for the airport. East New York, Brownsville; High capital; long-term

Figure 24: Broadway Junction elevated structures

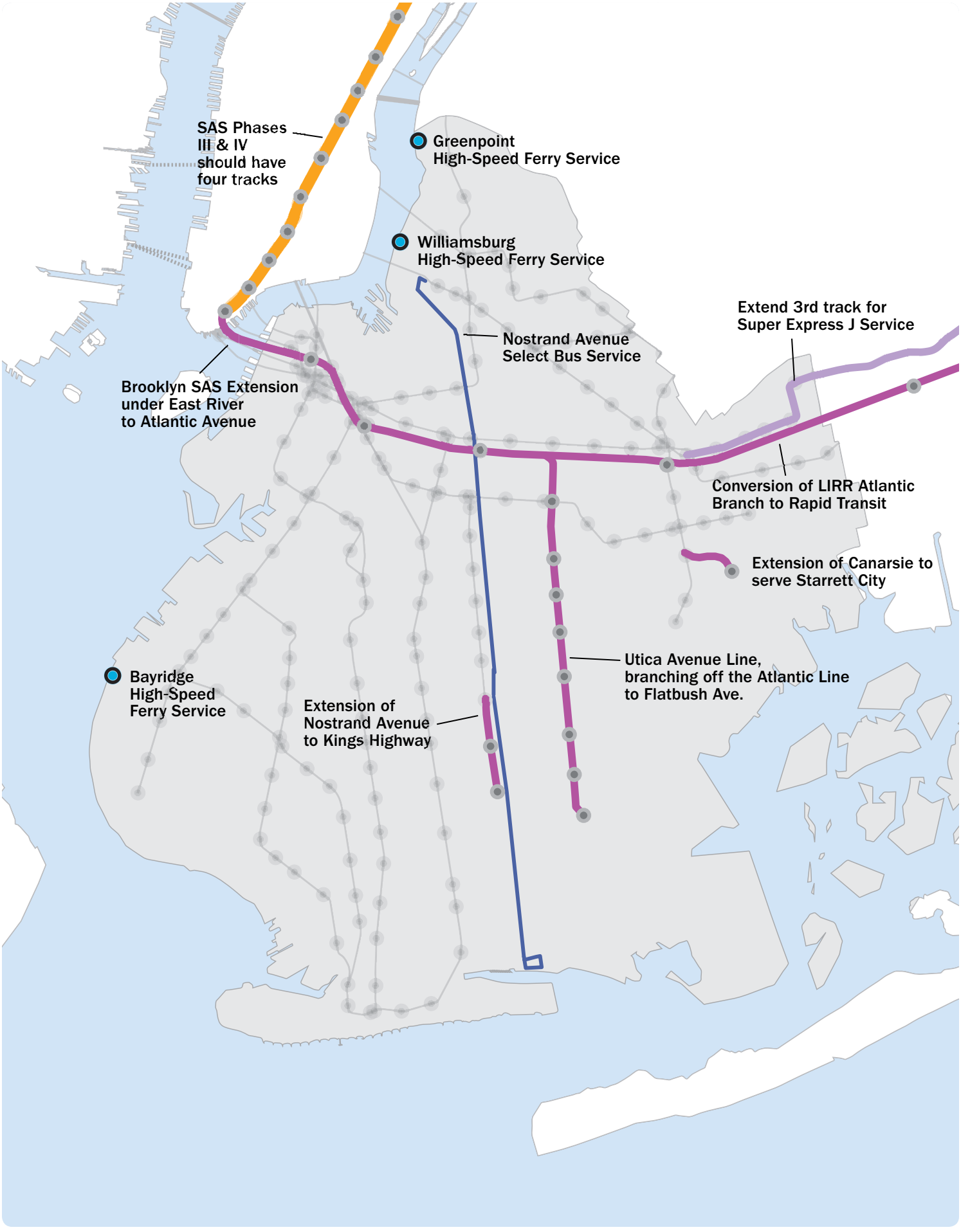
Photo: Jeffrey Zupan

Figure 25: Composite: Brooklyn



US Decennial Census 2000

Figure 26: Recommendations: Brooklyn



Staten Island

Transit Deficiencies

Staten Island, the least populous borough of New York City and the most distant from the concentration of jobs in Manhattan, does not have any subway service. It does have a converted commuter rail service – Staten Island Rapid Transit (SIRT) – which is under the purview of the MTA, and runs along the borough's southeastern flank. The Staten Island Ferry which operates from the Island's northern tip in St. George is fed by numerous bus routes that fan out from St. George, and also serve local trips. There is a network of express buses, concentrated in the more populous northern half of the Island that serves both Lower Manhattan and Midtown via Brooklyn, with a few operating through New Jersey. More recently, after many years of resistance by the MTA, bus service was successfully established to connect to the Hudson Bergen Light Rail Line in Bayonne, which brings riders to the rapidly growing Hudson County waterfront communities and with a connection to PATH, to Lower Manhattan.

As shown in Figure 27, the North Shore of Staten Island has some areas of moderate population density and scattered pockets of poverty, and bus travel speeds are low because of narrow roads and indirect bus routings through a difficult street grid. The poor transit options could explain the relatively high auto ownership levels in the corridor. More generally on the Island, the long travel times can be explained by geography. Staten Island is far from Manhattan and the options to get there are slow bus (or SIRT to the ferry) or circuitous (express bus).

In sum, Staten Island's transit deficiencies are greater than those in the other boroughs. The only rail line underperforms and serves only a small fraction of the borough's population, travel times to Manhattan often exceed 80 minutes, whether by express buses of the ferry, and local buses are hard pressed to serve the Island along narrow streets and crowded highways.

Potential Actions to Improve Transit

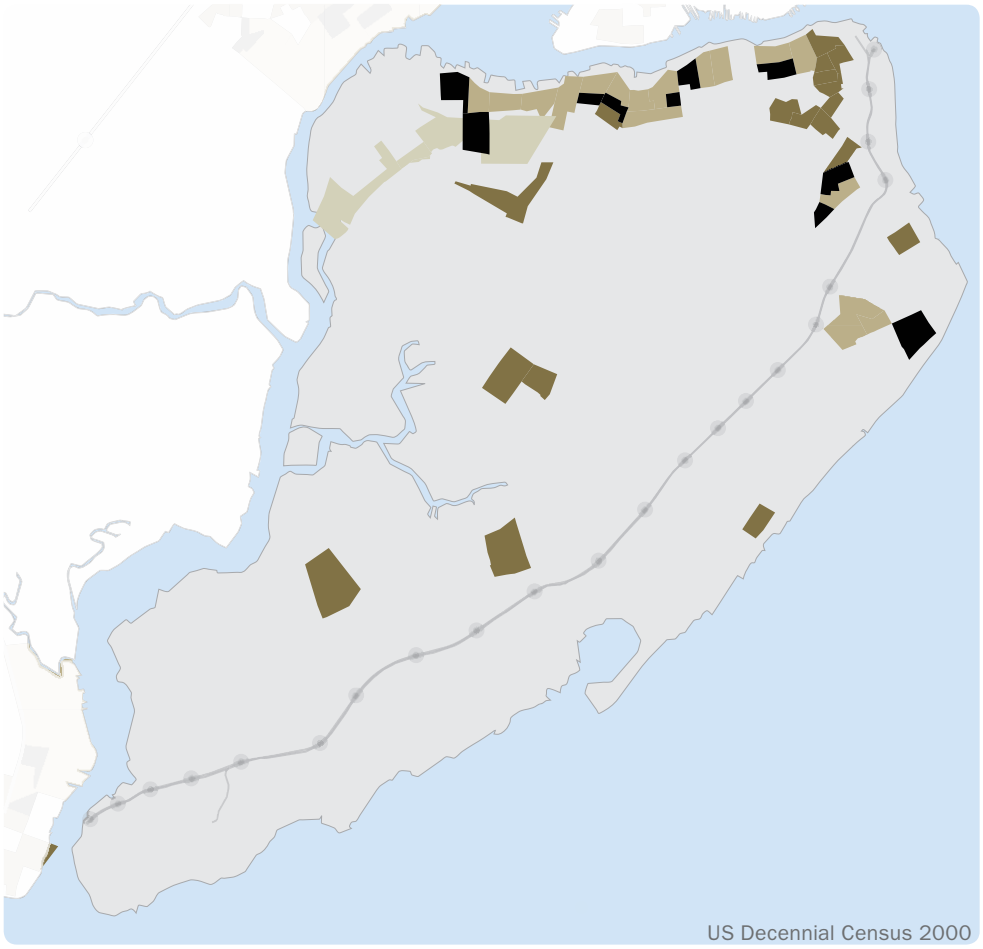
The most often mentioned option to improve transit service on Staten Island is the North Shore rail line. The NYC Economic Development Corporation and the NYC Department City Planning are about to embark on a joint land-use and transportation study of the corridor. The line might also be connected to the Hudson Bergen LRT using the Bayonne Bridge, which was built to accept rail, but the engineering obstacles are considerable, in part because of daunting elevation changes. The North Shore line's ridership prospects are compromised by the alignment along the waterfront, which limits the size of the commutershed. Another idea is to operate a rail line on the west side of the Island where transit service is poor. It too could be operated over the Bayonne Bridge, connected to the North Shore or both. Any of these concepts could also be thought of in BRT terms, where exclusive rights-of-way can speed bus service and provide more flexible route options and more frequent service and would be a lesser engineering challenge.

A similar joint land-use and transportation study has already begun that will address the potential for transit along the western side of the Island, roughly in the West Shore Expressway corridor. Currently, much of this area is being developed at low densities (see Figure 16) which does not augur well for an upgrade of public transit. Currently, the SIRT runs infrequently and is timed to meet the Staten Island ferry in the off-peak hours. Consequently, it largely serves as a feeder to the ferry. It is the least intensely used rapid transit system in the nation measured by the amount of service offered or the amount of travel on it. Like the North Shore line it too is ripe for consideration as a bus rapid transit system. If converted to BRT, portions of the current express bus routes could be used to speed journeys via Brooklyn to Manhattan and if the North Shore line were converted to BRT then a network of bus services, centered at St George, but providing for trips between the North and South Shores can be considered. Such a system could also incorporate the exclusive bus lane on the Staten Island Expressway.

In the short term, the MTA / NCYDOT BRT study is proposing to move forward with a BRT program along Hylan Boulevard, the busiest bus corridor in the borough, which would include median stations with a reversible lane, off-vehicle fare collection, and signal prioritization along a five-mile stretch from Richmond Avenue in Great Kills to the Staten Island Expressway. The expectation is for implementation in 2010.

The Port Authority of New York and New Jersey and NYC Economic Development Corporation are developing a ferry landing at Camp St. Edwards on the south shore of Staten Island, which could speed service from that part of the Island. A number of operators have expressed interest in providing service, but it remains to be seen whether higher fuel costs will narrowed the opportunity for profitable ferry service there and elsewhere.

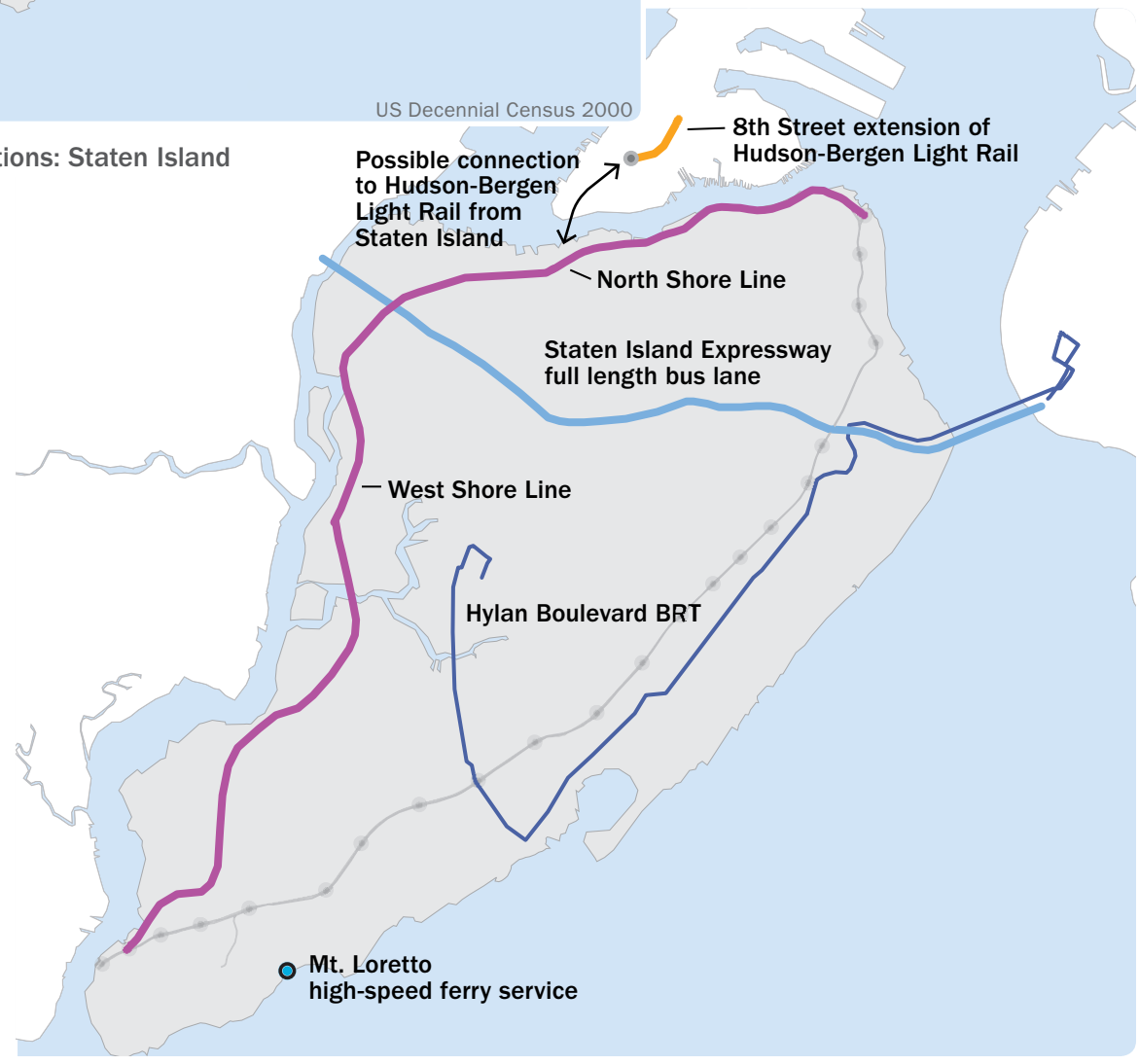
Figure 27: Composite: Staten Island



Recommendations (Fig. 28)

- The MTA and the NYCDOT should proceed with the Hylan Boulevard BRT. Low capital; short-term
- As with the other locations in the region, new ferry services should be evaluated for their public benefit to determine what subsidies to keep fares within reach are in the public interest. Low capital; short-term
- The studies of the North Shore and West Shore should be merged, or at least coordinated to examine more holistically the future transit network on Staten Island. The study (or studies) should determine how best to take advantage of the Staten Island Expressway preferential lane and how or whether to link it to the Hudson Bergen LRT. Port Richmond; High capital; long-term

Figure 28: Recommendations: Staten Island



RPA

Manhattan

Transit Deficiencies

By any definition Manhattan has the most extensive subway coverage of any of the boroughs, as befitting the highest density place in the region, indeed in the United States. Yet, there are areas that are poorly covered by subway service, most notably the Upper and Lower East Sides. The SAS will remedy this problem on the Upper East Side but not on the Lower East Side where the one station of the SAS to be built at Grand Street is not far enough to the east to serve the area. The dilemma stems from geography; the Lower East Side bulges out from the more streamlined shape of the rest of the island, making it difficult to be served by the mostly north-south subway routes that were intended to move people from the north to points in Midtown or Lower Manhattan. The Lower East Side also conforms to the low income definition in the report, as shown in Figure 29, reinforcing the need to pay attention to this problem. Over the years, many ideas have been advanced to address the absence of subway coverage on the Lower East Side, but to date none have been agreed to, much less built.

Much of the western edge of Midtown Manhattan between 14th Street to the south and 59th to the north is also beyond reasonable walking distance to the subway. The area between 30th Street and 42nd Street is expected to receive significant development in the coming years and has been rezoned by the City for that purpose. To help to overcome its inaccessibility, the City will be financing and the MTA building an extension of the #7 Flushing Line to 34th Street and Eleventh Avenue.

That many of the subway lines entering the Manhattan CBD are overcrowded in the peak morning and afternoon periods comes as little surprise. Four entry points stand out for their excessive crowding:

- the Lexington Avenue #4, 5, and #6 lines, which will be eased significantly by the SAS,
- the 53rd Street IND lines from Queens which can be aided by the various recommendations in the Queens section of this report,
- the Canarsie L at 14th Street, where congestion will be eased by CBTC as discussed in the Brooklyn section of this report, and
- the West Side IRT #,1, #2, and # 3 lines under Broadway, which can be indirectly helped by SAS, as some users of the west side subways from the Bronx switch to the Lexington Avenue lines or the SAS because they become less crowded. However, in this case, the remedy is unlikely to be enough. Development on the west side, particularly over the 60th Street rail yards, has added large numbers of transit riders. The creation of new west side capacity cannot be ignored.

Most of the subway service in Manhattan runs north-south. There is some service that connects riders to cross-town locations but they are confined largely to Midtown. Lower Manhattan is narrow enough that the absence of east-west routes is not a serious problem. But north of 63rd Street, the northernmost cross street with subway service under it, only slow bus service is available to reach from one side of the island to the other. This absence is understandable as the north-south subway routes were built to move people to and from the business core rapidly, and diversion to go cross-town was not logical.

Travel within the Manhattan CBD on the street surface is slow. Buses average as little as six miles per hour during much of the day and slow to walking speed in the peak period, taxis are expensive and often do not travel much faster, and walking distances of ½ mile or more are time-consuming. This problem is particularly acute in Midtown, which is over 1 ½ miles wide and where the scatter of high density destinations is found from river to river, from Central Park to below 34th Street.

In sum, Manhattan requires better and more direct Lower East Side transit service, better cross-town service in the north, more capacity on the west side, improved access to the Far West Side, and faster choices for short trips in the core. All these concerns should be addressed.

Potential Actions to Improve Transit

In its 1999 MetroLink report RPA proposed a solution to the subway access problem of the Lower East Side. It involved establishing a service that would branch off the SAS and then join the F line before running through the Rutgers Street East River Tunnel. That idea required a four-track SAS right-of-way that is not now being considered for the design of the fourth phase of the SAS. Another less expensive approach is to operate a branch of the L train down Avenue C, but hardly more than six trains an hour could be run before seriously compromising capacity from Brooklyn. It would be of some help to make the last station at First Avenue more accessible by the construction of an entrance at the Avenue A end of that station.

One opportunity to address the absence of east-west subway service in Manhattan has presented itself by the SAS. The alignment of the SAS will turn westward from Second Avenue under 125th Street where a transfer with the Lexington Avenue subway lines will be built. Extending the line under 125th Street, will create a fast option across town and numerous transfer opportunities. Connections to the #2 and #3 at Lenox Avenue, to the A, B, C, and D at St. Nicholas Avenue, and to the #1 at Broad-

way will establish enormous interconnectivity between all lines in the Bronx and upper Manhattan and to both the upper east and upper west sides and to both sides of Midtown. This will make especially difficult trips easier and faster, for example from Washington Heights along the A train route to the upper east side and from the Bronx to Broadway to west 125th Street and points north. These trips today are often so arduous that few even think of using the subway to make them. A ferry link at the Hudson to the extended line is also a possibility.

The SAS offers an opportunity to improve east-west access in Manhattan, south of Central Park too. Seven subway stations planned for the SAS have the potential to make the SAS more effective, but their construction is not assured.

To serve the Far West Side various ideas have been raised, including the extension of the L under 14th Street either to the north or south. The northern extension could go as far as 72nd Street or turn east to Columbus Circle. The #7 now planned to terminate at 34th Street could also be extended south.

To address the circulation problem in Midtown and potentially offer access to the Far West Side, in its Third Regional Plan RPA proposed a light rail loop that would cross 42nd Street, at the Hudson River turn back on 34th Street and then at Herald Square turn north up Broadway as far as Lincoln Square, closing Broadway to vehicular traffic. The loop would create transit options to all subway lines in Midtown, the three major suburban entryways at Grand Central, Penn Station and the Port Authority Bus Terminal, and to PATH. The loop would pass by many major tourist sights as well.

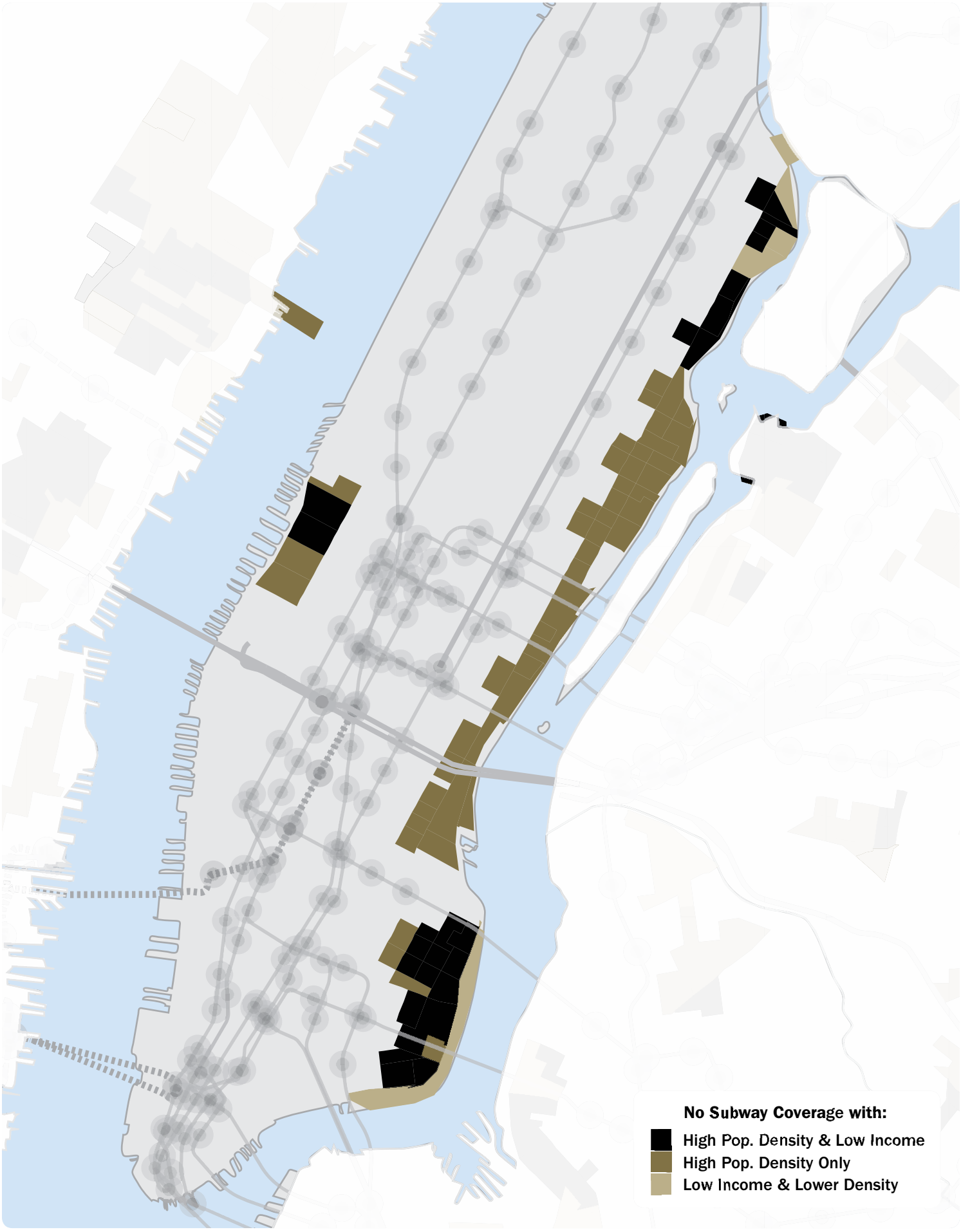
The MTA / NYCDOT BRT study is examining three corridors that would benefit Manhattan. One early implementation proposal is to install by 2009 bus lanes on First and Second Avenues, with BRT stations, bus bulbs for buses to pull out of traffic and real-time bus information. This would provide some relief for the congested Lexington Avenue Subway until the full-length Second Avenue Subway is completed. Another idea is to extend the Madison Avenue bus lanes south from their current terminus at 34tht Street to 23rd Street and add a bus lane to make two lanes on Fifth Avenue. Finally, 34th Street would be re-paved and re-striped to create a bus lane, which was just recently completed. The next phase of this innovative plan is to make 34th Street one-way eastbound east of Fifth Avenue and westbound west of either Sixth or Seventh Avenue to vehicles other than buses, opening up space for two-way exclusively-bus treatment from river to river. The traffic implication of this concept requires careful study.

The possibility of using the one-way pair of Columbus and Amsterdam Avenues, or West End Avenue below 72nd Street, as BRT corridors, creating a mostly transit, walkway and bikeway in this urban corridor should be investigated. This could ease subway crowding on the west side IRT as many short trips may us bus rather than the subway.

Recommendations (Fig. 30)

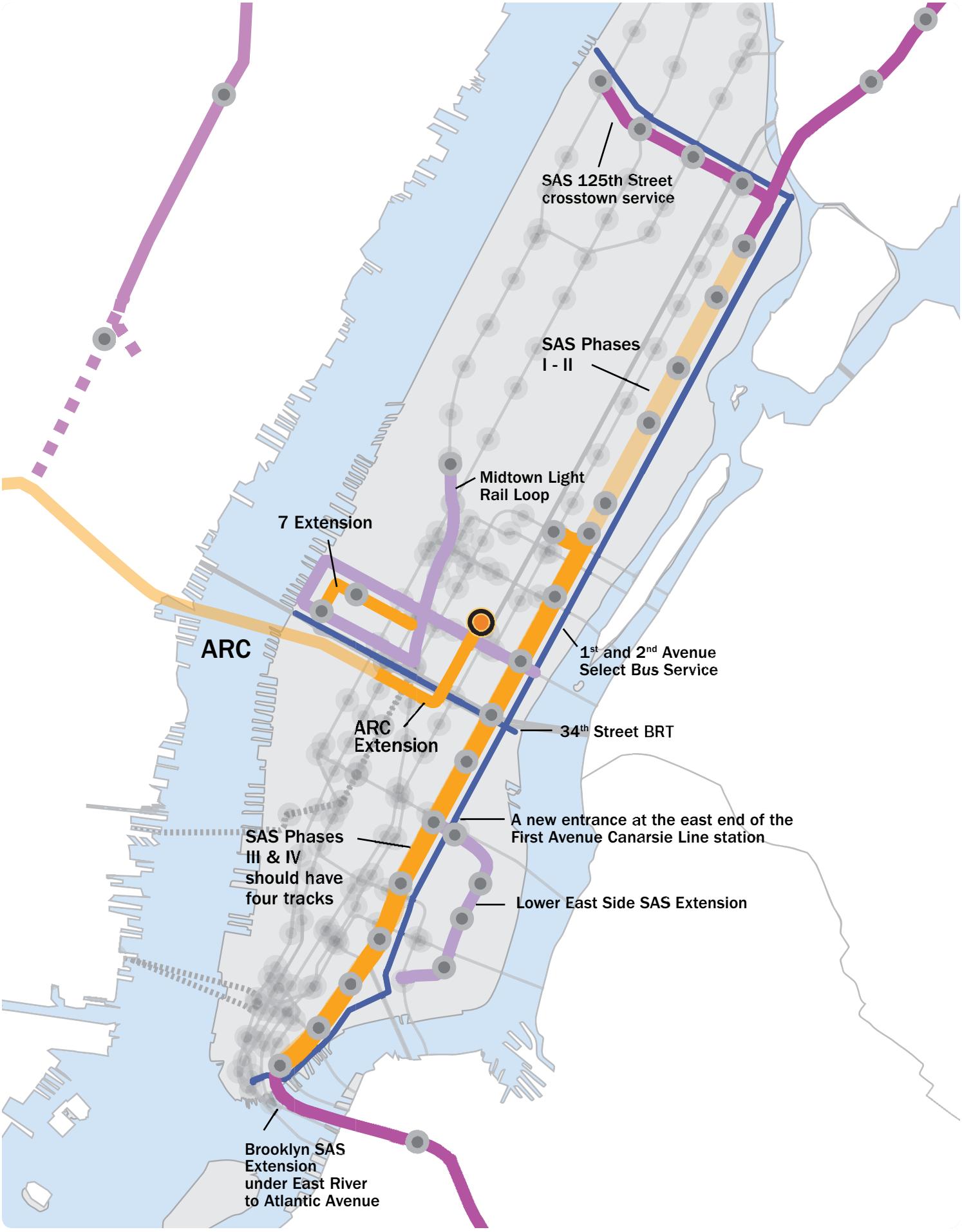
- Implement the two BRT proposals for Manhattan on the four north-south avenues. Low capital; short-term
- On 34th Street determine if the proposal to convert traffic to one-way outbound and establish a two-way bus lane is feasible from a traffic movement perspective, and if so implement it. Low capital; short-term
- For the #34 bus route on 34th Street, the #42 on 42nd Street and the #50 on 49th and 50th Street consider offering a no-fare ride. Most riders of these lines are likely to be paying as transferees to the subway and revenue losses will likely be small. The gain in travel time and reduced operating costs is likely to offset revenue losses, but this would have to be confirmed before proceeding with this recommendation. Low capital; short-term
- Construct an entrance at the east end of the First Avenue station on the Canarsie L line. Lower East Side; Mid capital; mid-term
- Explore the potential for BRT and a pedestrian / bikeway exclusive corridor for the one-way pair of Columbus and Amsterdam Avenues.
- Extend the SAS station on 125th Street westward to Broadway to create a multiplicity of transfers that would open up many opportunities for movement in upper Manhattan and between Manhattan and the Bronx. High capital; long-term
- Commit to the construction of all SAS transfer stations, including a new one at Grand Street. Widespread benefits for lower income areas throughout the City; High capital; long-term
- Reconsider the decision to limit the SAS south of 63rd Street to two tracks to make it possible to extend subway service into the Lower East Side. Widespread benefits for lower income areas throughout the City, especially for the Lower East Side; High capital; long-term
- Examine the midtown loop concept either as light rail or bus rapid transit and market as a general-purpose and tourist service with access to the FWS, the theater district, midtown hotels, the United Nations headquarters, Empire State Building and to all the transit entryways to Midtown. Also, consider the value of a separate elevated train that would be less expensive than subway tunneling and avoid street conflicts. These proposals can be studied in concert with the various subway extension proposals including the #7 Flushing line and the Canarsie L line. Widespread benefits for lower income areas throughout the City; Medium to high capital; long-term
- While not specifically discussed above, one transit-related project cries out to be included on any recommended list of transit improvements – the Moynihan Station complex. It would create the premier transit hub for three commuter railroads and Amtrak and be a catalyst for new adjacent development and for the entire west side from Eighth Avenue to the Hudson River. Widespread benefits in the region for all income groups; High capital; long-term

Figure 29: Composite: Manhattan



US Decennial Census 2000

Figure 30: Recommendations: Manhattan



Urban Core of New Jersey

The portion of northern New Jersey examined in this report includs Hudson County, Newark and the contiguous surrounding areas in Bergen, Passaic, Essex, and Union counties. As seen earlier in Table 1, northern New Jersey's 13 counties will experience population and employment growth rates slightly higher than the region's. However, the five inner counties cited above will experience somewhat lower growth than the region, with the exception of Hudson County, which is projected to add almost 20 percent to its population from 2005 to 2030 and to match the growth rate in jobs at 25.5 percent.

These projections would generate almost 1.2 million more trips daily within points west of the Hudson (including the New York State counties west of the Hudson), and as shown in Table 2, projected to be almost all in automobiles if there is highway capacity. This level of automobile growth cannot be accommodated in the absence of massive expansion in highway infrastructure which is untenable. Yet it will be an enormous task to shift even a small share of trips to transit.

Deficiencies

Figure 31 shows the composite density / low income and rail coverage map of the urban core area of northern New Jersey. It reveals a pattern of transit need in much of Newark fanning out in four directions from its core at Penn Station not served by rail transit (the Newark City Subway). These areas have a mix of high and moderate densities levels, widespread areas meeting the poverty definition and areas of low automobile ownership. The same is true in Jersey City, but the area where rail is unavailable and where poverty is widespread is spottier – confined largely to areas on the Palisades ridge west of the waterfront and to the southern part of Jersey City. Further north in Hudson County, Union City and North Bergen on the Palisades ridge centered on Bergenline Avenue, are also targets of opportunity, with high densities, poverty and no rail transit. Other more isolated locations are found in Elizabeth, Paterson and Passaic. All of these areas have extensive bus service but all of it is confined to operating on city streets, which translates into slow speeds.

For trans-Hudson trips into Manhattan, 136,000 additional trips are projected from west of the Hudson to Manhattan, with about 60 percent expected to use transit. The ARC "Mega" project would soak up much of that demand for trans-Hudson travel and plans by the Port Authority of New York and New Jersey currently underway would add capacity at the Lincoln Tunnel for more bus riders into the bus terminal at 41st Street. But auto use would still grow. One of the deterrents to using transit is the location of all transit delivery points in Manhattan, all on the west side – Penn Station at Seventh Avenue, the Port Authority Bus Terminal at Eighth Avenue and the PATH uptown branch at Sixth Avenue.

ARC will bring a benefit for many of the urban core communities in New Jersey, most especially Newark, where service frequency to New York would grow by 60 percent from both of Newark's stations – Newark – Penn Station and Broad Street. Service would be added from Elizabeth to the south, and one-seat rides to Manhattan for Paterson and Passaic, and possibly be used by a new line on the Northern Branch in southern Bergen County that could either be a commuter rail line that would use the ARC tunnel or an extension of the Hudson Bergen light rail line (HBLRT).

Potential Actions to Improve Transit

Aside from the NJ TRANSIT commuter rail network, the urban core has three rail systems each of which, at least theoretically, can be expanded:

- the Newark City Subway, a light rail line that is a vestige of the trolley network of the early 1900s, but which has been expanded slightly in the last ten years into Bloomfield to the north and with a connection between the two downtown Newark commuter rail stations;
- the PATH system, opened in 1908, that connects Newark with Jersey City and Hoboken and serves both Lower and Midtown Manhattan, and
- the new (2000) HBLRT system that connects North Bergen, Weehawken, Hoboken, Jersey City and Bayonne with a system that parallels the Hudson River waterfront.

The extension of PATH has been the subject of studies for at least the last 40 years. Ideas included extending PATH to replace the Raritan Valley Line (then Central Railroad of New Jersey or CNJ) as far as Plainfield, and to extend it to Newark Airport to provid a one-seat ride from Lower Manhattan to the airport. None of these has shown to be cost effective. The two light rail systems are the subject of a more realistic and modest inquiry.

The Newark Subway terminates north of Newark, where it was extended westward on the lightly used Orange Branch freight right of way. One idea is to build a branch of the Subway to the east onto the Orange Branch and then onto the Boonton Line in North Newark (recently abandoned of passenger service when the Montclair Connection was opened), and to the Passaic River and Route 21, with a park-and-ride there. The park-and-ride is unlikely to intercept many commuters who, when they reach it will be but a five to ten minute drive from downtown Newark. Another proposal[1] is to continue the recent westward extension on the Orange Branch and establish a transfer

1 Many of the ideas for improved transit in Newark were compiled by the Voorhees Transportation Institute at Rutgers for NJ TRANSIT.

at the Watsessing Station on the Montclair Branch on the NJT commuter rail network. The North Newark extension has some value in serving an area of moderate densities with a significant low income population. The westward extension doesn't meet either of those criteria.

At the downtown Newark end of the Subway two concepts have surfaced. One would extend the line from its underground terminal into Ironbound, a thriving ethnic community to the east. But this may not be possible from an operating perspective and with no obvious right-of-way on the area's narrow streets the project would face great opposition unless it was kept underground, which would be prohibitively expensive. The other concept is to continue the Subway south along Broad Street, serving the underserved and low income area south of Lincoln Park. This street is well named and could easily accommodate the right-of-way needed for a light rail line (or BRT) without impeding vehicle traffic.

The success of the HBLRT—its ridership has now climbed to 42,000 passengers daily—has generated many ideas as to how to extend it. As discussed earlier regarding Staten Island, one idea is to extend the line from Bayonne over the Bayonne Bridge and connect with one or more possible lines there.[2] This idea faces considerable engineering and cost issues, as discussed in the Staten Island section of this report.

The LRT was originally intended to extend into Bergen County to the Vince Lombardi park-and-ride lot on the New Jersey Turnpike. The LRT now terminates at Tonnelle Avenue in North Bergen and could be extended on the Northern Branch freight right-of-way. The other use of the alignment would be as a commuter rail line that would eventually connect into the ARC tunnel, giving that area of eastern Bergen County with low transit shares for trips into Manhattan a substantial improvement with a one-seat ride to Midtown. The HBLRT might also be extended into the Hackensack Meadowlands to serve the Xanadu entertainment site and the sports complex, but this concept would be expensive and of questionable cost-effectiveness to serve a development that is not designed for transit today.

Other ideas for expansion of the HBLRT is a short extension of its West End Branch to Route 440 and a new housing development on Society Hill nearby, and the use of the Sixth Street embankment in Jersey City, that could serve part of that city which meets the density and income criteria for improved transit service. This latter extension could also be extended as far as the Secaucus Junction, but the added connectivity is only partially redundant.

The success of the HBLRT in generating development on the western edge of Hoboken at 2nd and 9th Streets raises the possibility of another station in Hoboken at Grand Street and 17th Street where it could serve an industrial area ripe for redevelopment.

In the early planning stages of HBLRT there were thoughts about extending the line along the waterfront in Weehawken to the north along River Road, but unfortunately an available abandoned rail right-of-way was usurped for a housing development. Today, the explosive growth in the corridor, including many housing developments and national chain retail establishments, has created enormous traffic congestion problems.

Since the urban areas of northern New Jersey have extensive bus service, the BRT concept appears also to hold high promise. The trick is to find street rights-of-way that can be given up for that purpose. In Newark, NJ TRANSIT is working with the City of Newark to move gradually toward BRT services on Bloomfield and Springfield avenues to the northeast and southeast, respectively. Based on the composite map in Figure 31, the south Broad Street corridor which might alternatively be used for a street-running LRT as mentioned earlier, and the corridor to the north of Bloomfield Avenue along either Summer Avenue or Mount Prospect Avenue would seem to hold promise. A north-south "cross-town" BRT route could serve the university complex, link to the Newark City Subway at Orange Street, and might even be extended to Newark Airport. BRT appears to hold much early promise in this less-dense enviroment and is likely to be less expensive to construct than LRT extensions.

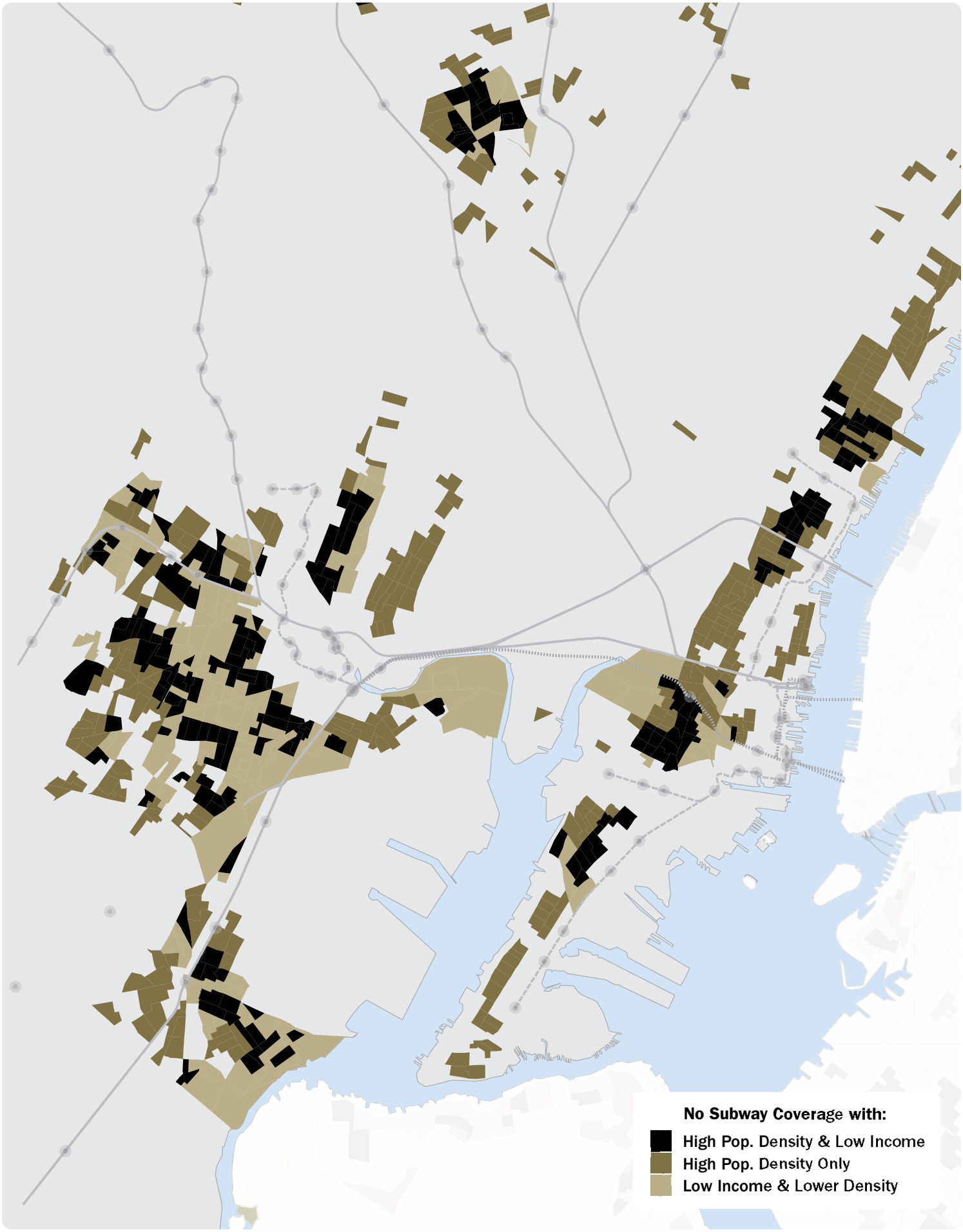
Recommendations (Fig. 32)

- NJ TRANSIT and Newark should move aggressively now to advance the currently programmed BRT network in Newark and extend it to include a cross-town route, the Summer / Mt. Prospect Avenue corridors and numerous other neighborhoods in Newark; Low capital; short-term
- Move forward with BRT along South Broad Street. South Broad Street; Low capital; short-term
- Develop travel demand estimates for the extensions of the Newark City Subway at its north end, the Route 440 extension of the HBLRT and the Sixth Street embankment both with and without a link to the Secaucus Junction. Coordinate with municipal officials regarding supportive land-use changes. Mid capital; mid-term
- Construct a new station on the HBLRT at Grand Street and 17th Street in Hoboken.
- Coordinate with the two Staten Island corridor studies on the possible extension of the HBLRT or for a BRT link to Bayonne. Low capital; mid-term
- An effort should be made to determine if a BRT-like project might still be possible in the River Road corridor along the Hudson River waterfront in northern Hudson and southern Bergen County. Mid capital, mid-term
- Bergenline Avenue, with its high density and large numbers of autoless households should be considered for a BRT treatment too. Mid capital, mid-term

Recommendations for the New Jersey urban core are presented in Figure 32.

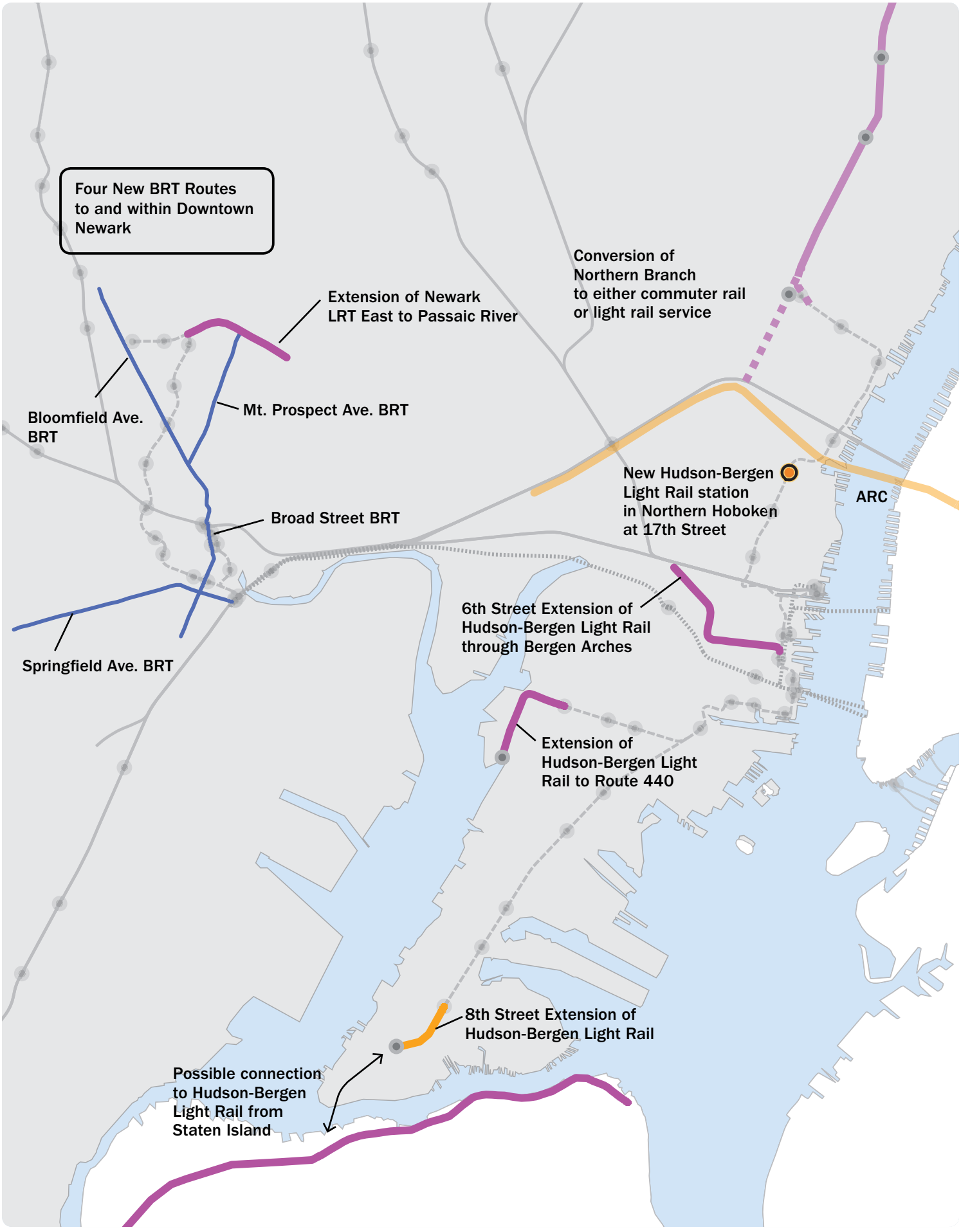
2 RPA proposed this in A Framework for Transit Planning in the New York Region, 1986.

Figure 31: Composite: The urban core of New Jersey



US Decennial Census 2000

Figure 32: Recommendations: The urban core of New Jersey



Other Recommendations

Airport Access

Deficiencies

The three major airports in the region – Kennedy, LaGuardia and Newark – are major trip generators and concentrations of employment. Improved ground access to all three have long been the subject of studies, but only when the passenger facility charge on airline tickets was initiated in the early 1990s did funding for long sought transit improvements become available. Consequently, the AirTrain systems at both Kennedy and Newark were built, but each has its limitations. In both cases, a two-seat ride is required to reach Manhattan, and Newark's AirTrain has proved to be of limited capacity. LaGuardia is even less advantaged with no direct rail service to Manhattan. And with the emergence of Stewart Airport as a reliever to the congestion at the three major airports, interest in direct rail service to Stewart is now the subject of a joint Port Authority / MTA study. This could most likely come about in the medium term with the completion of the ARC tunnel project, and in the long-term more conjecturally if commuter rail is the mode chosen to cross the Tappan Zee Bridge.

Potential Actions to Improve Transit

Kennedy Airport's AirTrain was designed to accept either a rapid transit or commuter rail vehicle should a one-seat ride routing be agreed to. Two possibilities exist. One is a rapid transit option that uses the LIRR's Atlantic Branch as described in the Queens section of this report. Another would connect AirTrain to the LIRR for a direct one-seat ride to Penn Station and / or Grand Central once the East Side Access project is complete.

In Newark, there is interest in extending PATH to Newark Airport from its current terminus at Newark Penn Station. This would create a one-seat ride from Lower Manhattan.

Another possibility would be to connect both the Newark and John F. Kennedy (JFK) AirTrains through Penn Station.

The extension of the N train in Astoria to LaGuardia Airport was studied in recent years but was rejected because it would require an elevated structure through a residential neighborhood. More possible is an AirTrain like service connecting the Woodside station of the LIRR and the #7 using the freight connecting track in Queens and the LIRR right of way.

Recommendations

- A full study of the benefits and costs of each of these airport access options should be advanced, but not in isolation from one another since their greatest value could be in the shift in air travel to less congested airports. Meanwhile, short-term actions such as the BRT service from Downtown Newark to the Airport should proceed.

System Changes and Complementary Policies

To this point we have focused our attention on transit improvements tied to some geography. Yet, much of what can be done to attract more travelers to the transit system transcends any particular location in the vast 12,800 square mile region. These actions include measures that would improve the transit system on a system-wide basis, measures that relate to changes in public policies, and measures even more specifically to land-use policies. These measures can benefit many demographic groups although they may be of greater value in some cases to those in lower income neighborhoods, which has received concentrated attention in this report. We would be remiss if we did not devote some brief attention to each of these areas.

System-wide Transit Improvements

- To make fare payment more convenient and make it possible to tailor fare levels to time of day and week, length of trip and quality of transit service, and to reduce operation costs, integrate fare media using smart card technology.
- To speed buses, purchase only low-floor buses, encourage riders to exit from the rear door, and establish off-fare collection using the smart card technology.
- Install time-to -next-vehicle information technology on all subway and bus routes, as is now available on the Canarsie L line.

Parking and Pricing Policies

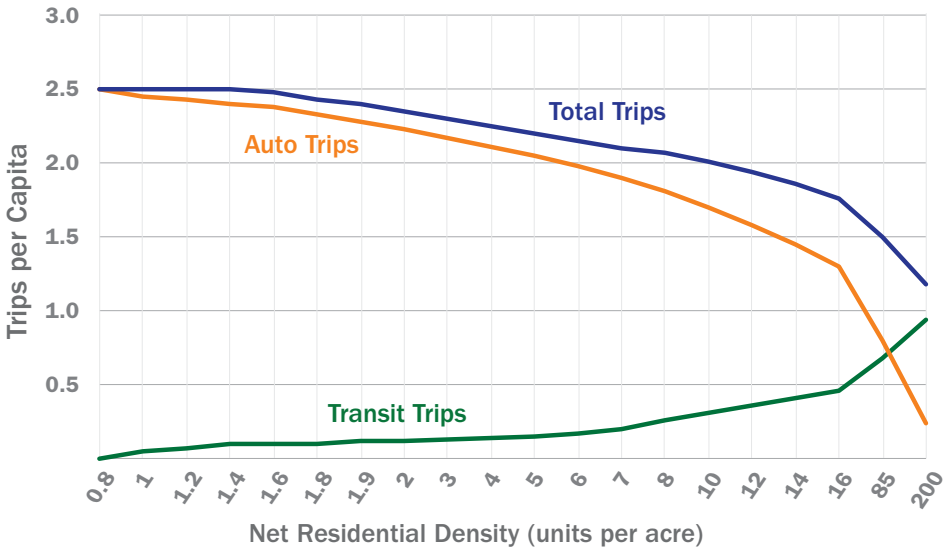
- To reduce the overabundance of low cost parking, establish parking ratio requirements in non-residential areas commensurate with the level and use of transit in the area.
- More generally, in transit-rich areas follow the lead of Manhattan and Jersey City and require lower parking ratio requirements and establish maximum, rather than minimum ratios.
- To reduce low cost parking on streets, to make the cost of using transit more competitive, and to provide more room for transit vehicles, deploy street parking meters more widely and raise prices.
- To help fund transit and lower traffic congestion, establish variable congestion pricing at entryways to areas of concentrated non-residential developments.
- To substitute for the coming reduction in gasoline revenues, and to help fund the increased transit that dependence on unreliable oil supplies and the expanding carbon footprint will require, increase tolls on toll roads and install them on non-toll roads, with variable time of day and day of the week pricing.

Land Use Policies

The reduction of automobile travel and the increase in transit travel will require major changes in land-use policies. Such measures will not come easy. Communities value the control they have on zoning, and many people prefer to live in low density environments. There are forces of change – a shift in the demographic profile toward those who prefer more urbane settings, the pressure of higher prices for driving, and the disillusion with suburban living. Yet, it is unclear if these shifts in attitudes and economics are permanent or strong enough to matter. What we do know is that when people live at higher densities they drive less and use transit more, as demonstrated in Figure 33, the last illustration in this report. It shows that at higher densities far more of the trips are made by transit or on foot (or bike). Accordingly, this report makes some land use recommendations.

- The MTA and NJTRANSIT should establish a priority subset of stations (out of the combined 900 they serve) for transit oriented development (TOD). The priorities would be based on availability of developable land, quality of transit service, and willing partners in the community. Among the areas that should receive the most attention are those where redevelopment in urban areas has begun or is anticipated soon. This could include areas of Brooklyn and the Bronx, which suffered most in the economic decline in the 1970s.
- The transit agencies should use successful TOD models as educational examples to encourage communities to participate in TOD programs.
- To overcome the fallacy that high density adds to costs and congestion, the states should document the actual situation.
- To encourage more development near stations, local efficient mortgages should be instituted by the state legislatures.

Figure 33: Impact of density on auto and transit trips



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Regional Plan Association (RPA) is an independent regional planning organization that improves the quality of life and the economic competitiveness of the 31-county, New York-New Jersey-Connecticut region through research, planning, and advocacy. Since 1922, RPA has been shaping transportation systems, protecting open spaces, and promoting better community design for the region's continued growth. We anticipate the challenges the region will face in the years to come, and we mobilize the region's civic, business, and government sectors to take action.

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