University Transportation Research Center - Region 2

Final Report

Study of Goods Movement through I-278 NYC and NJ

Performing Organizations: - Regional Plan Association
- Rensselaer Polytechnic Institute
- University Transportation Research Center – Region 2

March 2012

Sponsor:
New York State Department of Transportation

University Transportation Research Center - Region 2

The Region 2 University Transportation Research Center (UTRC) is one of ten original University Transportation Centers established in 1987 by the U.S. Congress. These Centers were established with the recognition that transportation plays a key role in the nation's economy and the quality of life of its citizens. University faculty members provide a critical link in resolving our national and regional transportation problems while training the professionals who address our transportation systems and their customers on a daily basis.

The UTRC was established in order to support research, education and the transfer of technology in the field of transportation. The theme of the Center is "Planning and Managing Regional Transportation Systems in a Changing World." Presently, under the direction of Dr. Camille Kamga, the UTRC represents USDOT Region II, including New York, New Jersey, Puerto Rico and the U.S. Virgin Islands. Functioning as a consortium of twelve major Universities throughout the region, UTRC is located at the CUNY Institute for Transportation Systems at The City College of New York, the lead institution of the consortium. The Center, through its consortium, an Agency-Industry Council and its Director and Staff, supports research, education, and technology transfer under its theme. UTRC's three main goals are:

Research

The research program objectives are (1) to develop a theme based transportation research program that is responsive to the needs of regional transportation organizations and stakeholders, and (2) to conduct that program in cooperation with the partners. The program includes both studies that are identified with research partners of projects targeted to the theme, and targeted, short-term projects. The program develops competitive proposals, which are evaluated to insure the mostresponsive UTRC team conducts the work. The research program is responsive to the UTRC theme: "Planning and Managing Regional Transportation Systems in a Changing World." The complex transportation system of transit and infrastructure, and the rapidly changing environment impacts the nation's largest city and metropolitan area. The New York/New Jersey Metropolitan has over 19 million people, 600,000 businesses and 9 million workers. The Region's intermodal and multimodal systems must serve all customers and stakeholders within the region and globally.Under the current grant, the new research projects and the ongoing research projects concentrate the program efforts on the categories of Transportation Systems Performance and Information Infrastructure to provide needed services to the New Jersey Department of Transportation, New York City Department of Transportation, New York Metropolitan Transportation Council , New York State Department of Transportation, and the New York State Energy and Research Development Authorityand others, all while enhancing the center's theme.

Education and Workforce Development

The modern professional must combine the technical skills of engineering and planning with knowledge of economics, environmental science, management, finance, and law as well as negotiation skills, psychology and sociology. And, she/he must be computer literate, wired to the web, and knowledgeable about advances in information technology. UTRC's education and training efforts provide a multidisciplinary program of course work and experiential learning to train students and provide advanced training or retraining of practitioners to plan and manage regional transportation systems. UTRC must meet the need to educate the undergraduate and graduate student with a foundation of transportation fundamentals that allows for solving complex problems in a world much more dynamic than even a decade ago. Simultaneously, the demand for continuing education is growing – either because of professional license requirements or because the workplace demands it – and provides the opportunity to combine State of Practice education with tailored ways of delivering content.

Technology Transfer

UTRC's Technology Transfer Program goes beyond what might be considered "traditional" technology transfer activities. Its main objectives are (1) to increase the awareness and level of information concerning transportation issues facing Region 2; (2) to improve the knowledge base and approach to problem solving of the region's transportation workforce, from those operating the systems to those at the most senior level of managing the system; and by doing so, to improve the overall professional capability of the transportation workforce; (3) to stimulate discussion and debate concerning the integration of new technologies into our culture, our work and our transportation systems; (4) to provide the more traditional but extremely important job of disseminating research and project reports, studies, analysis and use of tools to the education, research and practicing community both nationally and internationally; and (5) to provide unbiased information and testimony to decision-makers concerning regional transportation issues consistent with the UTRC theme.

Project No: 55785-00-01

Project Date: June 2012

Project Title: Study of Goods Movement through I-278 NYC and NJ

Principal Investigators:

Dr. Robert E. Paaswell
Distinguished Professor of Civil Engineering,
Director, CUNY Institute for Urban Systems
Director Emeritus, University Transportation Research Center, City College of New York
Email: paaswell@utrc2.org

Dr. José Holguín-Veras
Professor
Rensselaer Polytechnic Institute
Email: jhv@rpi.edu

Christopher Jones
Vice President for Research
Regional Plan Association
Email: chris@rpa.org

Benjamin Miller
Senior Research Associate
University Transportation Research Center
Email: bmiller@utrc2.org

Richard Barone
Director of Transportation Programs
Regional Plan Association
Email: rbarone@rpa.org

Performing Organizations:
Regional Plan Association
University Transportation Research Center – Region 2
Rensselaer Polytechnic Institute

Sponsors:

New York State Department of Ttransportation (NYSDOT)

To request a hard copy of our final reports, please send us an email at utrc@utrc2.org

Mailing Address:

University Transportation Reserch Center
The City College of New York
Marshak Hall, Suite 910
160 Convent Avenue
New York, NY 10031
Tel: 212-650-8051
Fax: 212-650-8374
Web: www.utrc2.org

Board of Directors

The UTRC Board of Directors consists of one or two members from each Consortium school (each school receives two votes regardless of the number of representatives on the board). The Center Director is an ex-officio member of the Board and The Center management team serves as staff to the Board.

City University of New York
Dr. Hongmian Gong - Geography
Dr. Claire McKnight - Civil Engineering
Dr. Neville A. Parker - Civil Engineering

Clarkson University
Dr. Kerop D. Janoyan - Civil Engineering

Columbia University
Dr. Raimondo Betti - Civil Engineering
Dr. Elliott Sclar - Urban and Regional Planning

Cornell University
Dr. Huaizhu (Oliver) Gao - Civil Engineering
Dr. Mark A. Turnquist - Civil Engineering

Hofstra University
Dr. Jean-Paul Rodrigue - Global Studies and Geography

New Jersey Institute of Technology
Dr. Steven Chien, Civil Engineering
Dr. Priscilla P. Nelson - Geotechnical Engineering

New York University
Dr. Mitchell L. Moss - Urban Policy and Planning
Dr. Rae Zimmerman - Planning and Public Administration

Polytechnic Institute of NYU
Dr. John C. Falcocchio - Civil Engineering
Dr. Elena Prassas - Civil Engineering

Rensselaer Polytechnic Institute
Dr. José Holguín-Veras - Civil Engineering
Dr. William "Al" Wallace - Systems Engineering

Rochester Institute of Technology
Dr. James Winebrake -Science, Technology, & Society/Public Policy

Rowan University
Dr. Yusuf Mehta - Civil Engineering
Dr. Beena Sukumaran - Civil Engineering

Rutgers University
Dr. Robert Noland - Planning and Public Policy
Dr. Kaan Ozbay - Civil Engineering

State University of New York
Michael M. Fancher - Nanoscience
Dr. Catherine T. Lawson - City & Regional Planning
Dr. Adel W. Sadek - Transportation Systems Engineering
Dr. Shmuel Yahalom - Economics

Stevens Institute of Technology
Dr. Sophia Hassiotis - Civil Engineering
Dr. Thomas H. Wakeman III - Civil Engineering

Syracuse University
Dr. Riyad S. Aboutaha - Civil Engineering
Dr. O. Sam Salem - Construction Engineering and Management

The College of New Jersey
Dr. Michael Shenoda - Civil Engineering

University of Puerto Rico - Mayagüez
Dr. Ismael Pagán-Trinidad - Civil Engineering
Dr. Didier M. Valdés-Díaz - Civil Engineering

UTRC Consortium Universities

The following universities/colleges are members of the UTRC consortium.

City University of New York (CUNY)
Clarkson University (Clarkson)
Columbia University (Columbia)
Cornell University (Cornell)
Hofstra University (Hofstra)
New Jersey Institute of Technology (NJIT)
New York University (NYU)
Polytechnic Institute of NYU (Poly)
Rensselaer Polytechnic Institute (RPI)
Rochester Institute of Technology (RIT)
Rowan University (Rowan)
Rutgers University (Rutgers)
State University of New York (SUNY)
Stevens Institute of Technology (Stevens)
Syracuse University (SU)
The College of New Jersey (TCNJ)
University of Puerto Rico - Mayagüez (UPRM)

UTRC Key Staff

Dr. Camille Kamga: *Director, Assistant Professor of Civil Engineering*

Dr. Robert E. Paaswell: *Director Emeritus of UTRC and Distinguished* Professor of Civil Engineering, The City College of New York

Dr. Claire McKnight: *Assistant Director for Education and Training; Associate Professor of Civil Engineering, City College of New York*

Herbert Levinson: *UTRC Icon Mentor, Transportation Consultant and Professor Emeritus of Transportation*

Dr. Ellen Thorson: *Senior Research Fellow, University Transportation Research Center*

Penny Eickemeyer: *Associate Director for Research, UTRC*

Dr. Alison Conway: *Associate Director for New Initiatives and Assistant Professor of Civil Engineering*

Nadia Aslam: *Assistant Director for Technology Transfer*

Dr. Anil Yazici: *Post-doc/ Senior Researcher*

Nathalie Martinez: *Research Associate*

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Study of Goods Movement through I-278 NYC and NJ **Task 4.2: Multimodal Goods Movement on the I-278 Corridor: Reducing Friction and Maximizing Economic Opportunity Through Integrated Logistics Strategies**		5. Report Date June 2012 6. Performing Organization Code
7. Author(s) **Dr. José Holguín-Veras (RPI), Christopher Jones (RPA), Richard Barone (RPA), Benjamin Miller (UTRC)**		8. Performing Organization Report No.
9. Performing Organization Name and Address Rensselaer Polytechnic Institution, 110 Eighth Street, Troy, NY USA 12180 Regional Plan Association, 4 Irving Place, 7th Floor, New York, NY 10003 University Transp. Research Center, 135th Convent Avenue, MR 910, New York, NY 10031		10. Work Unit No. 11. Contract or Grant No. 55785-00-01
12. Sponsoring Agency Name and Address New York State Department of Transportation 50 Wolf Road Albany, NY 12232		13. Type of Report and Period Covered 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The I-278 Intermodal Corridor is the term used in this project to define the interconnected network of roadway and rail-freight facilities that arc between the New Jersey-New York connection at the Goethals Bridge and the Queens-Bronx connection at the Triborough Bridge, including the existing and proposed rail-freight connections across New York Harbor between Bayonne, New Jersey and Southwest Brooklyn.

The goals of the I-278 Corridor Multimodal Goods Movement project are to provide recommendations for (a) reducing the roadway congestion that is expected from increasing freight volumes and any increasing roadway friction that could result from improved cross-harbor rail freight connections, and (b) maximizing the economic development opportunities that accrue from these increased transport efficiencies and from the new ancillary logistical facilities that will be required to manage distribution functions in the Corridor.

17. Key Words	18. Distribution Statement
I-278, Corridor, Goods Movement, Roadway, Freight	

19. Security Classif (of this report)	20. Security Classif. (of this page)	21. No of Pages	22. Price
Unclassified	Unclassified	123	

Form DOT F 1700.7 (8-69)

Disclaimer

Study of Goods Movement through I-278 NYC and NJ

SAFE-TEA LU Earmark #3437 / PIN X760.25.12

Task 4.2

Final Report

Multimodal Goods Movement on the I-278 Corridor:
Reducing Friction and Maximizing Economic Opportunity
Through Integrated Logistics Strategies

June 2012

Research Team

Regional Plan Association
University Transportation Research Center – Region 2
Rensselaer Polytechnic Institute

Table of Contents

I. Purpose

The I-278 Intermodal Corridor is the term used in this project to define the interconnected network of roadway and rail-freight facilities that arc between the New Jersey-New York connection at the Goethals Bridge and the Queens-Bronx connection at the Triborough Bridge, including the existing and proposed rail-freight connections across New York Harbor between Bayonne, New Jersey and Southwest Brooklyn.

The goals of the I-278 Corridor Multimodal Goods Movement project are to provide recommendations for (a) reducing the roadway congestion that is expected from increasing freight volumes and any increasing roadway friction that could result from improved cross-harbor rail freight connections, and (b) maximizing the economic development opportunities that accrue from these increased transport efficiencies and from the new ancillary logistical facilities that will be required to manage distribution functions in the Corridor.

Prior deliverables in this project included:

- Review of Cross-Harbor Freight Movement Project Draft Environmental Impact Statement (April, 2004)
- Candidate Projects and Policies Related to Transportation Improvements in the Interstate 278 Corridor to be Considered for Further Examination
- Analysis Of Freight Trip Generation In The I-278 Region
- Role of Pricing in Reducing Truck Trips
- City Logistics Initiatives To Improve Freight Traffic Conditions In New York City
- Framework for Implementation of Financial and City Logistics Measures
- Corridor Overview/Existing Conditions for I-278 Study Area, New York City
- Agency Survey of the I-278 Study Area – Status of Projects Underway, Planned, or Proposed
- Non-Agency Stakeholder Outreach
- Surveying the Past to Forecast Future Growth
- Highway Improvements, Preferential Treatments, and Tolling Policies
- Logistics Sector Definition, Description and Mapping
- I-278 Land Use Analysis
- A Scan of Innovative Logistics for Metropolitan New York's 21st Century
- Alternative Corridor Development Strategies
- Evaluation of Corridor-Wide Alternatives

The purpose of the present report is to summarize the salient findings of all of these tasks in order to provide an integrated set of recommendations for achieving the goals outlined above.

II. Context: Existing Conditions and Outlook

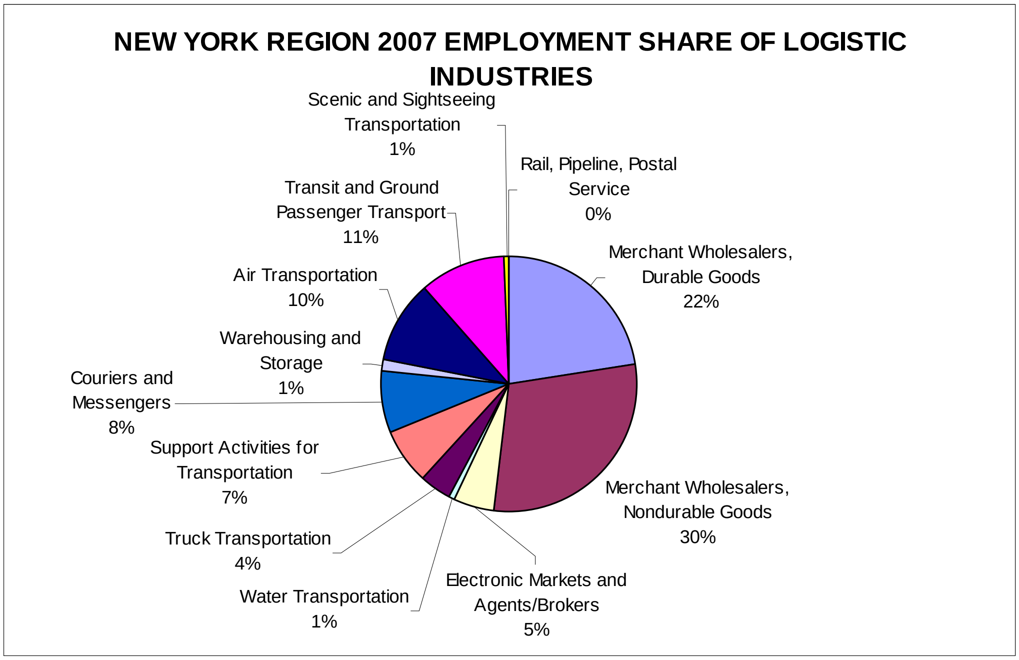
Existing conditions, trends and outlook for both the logistics industry and the study area were examined in detail in several technical memoranda. The following begins with a summary of logistics sector characteristics and larger industry trends from tasks 3.1 and 3.3. Highway conditions, traffic volumes and forecasts and stakeholder perspectives summarize the findings of tasks 2.1 through 2.4. The description of corridor land use conditions highlights the findings from task 3/2.

II.A. Logistics Sector Characteristics and Outlook

The Logistics Sector includes any activity involved with the distribution of goods from the point of extraction or production to its final end use. Broadly defined, it includes transportation, storage, packaging, wholesaling and support services. The sector is critical to the functioning of the regional economy, it is also a significant source of income and blue-collar employment. Several trends in the last few decades have magnified the importance of logistics as an economic engine in its own right. The sheer increase in the volume of freight, driven by an expansion of global trade, population growth and rising incomes, has driven growth in the industry. Technological change and a sharp drop in the cost of moving goods has driven productivity growth created new supply chains, businesses and professions. The decline of manufacturing has also left logistics as one of the few sectors capable of creating new well-paying jobs that do not require post-secondary education.

The sector does not fall neatly into industrial classifications. Some industries, such as trucking, warehousing and wholesaling are entirely devoted to goods distribution. Other transportation industries, such as air transportation, carry both goods and passengers. Figure 4.1.1 shows the sectors of a broad definition that includes all transportation and wholesale industries. Some parts of the following analysis also refer to "core" distribution activities that only include industries that are primarily devoted to goods movement. Even the broader definition below does not include the trucking and warehouse activities of manufacturing and retail firms, which is a substantial part of the goods distribution network.

Figure 4.1.1



As in the rest of the country, the majority of the region's Logistics jobs are in Wholesale Trade (Sector 42), fairly evenly divided between Durable and Nondurable Wholesaling, although, again, the region's Wholesaling share is somewhat smaller than that in the nation as a whole (57% vs. 61%). Air transportation's share in the region is somewhat higher than it is nationally (10% vs. 7%).

The New York region has slightly fewer Logistics employees than does the rest of the country (6% as opposed to 8% of total employment), but the region's Logistics employment is significantly skewed toward the west side of New York Harbor, where most of the region's port, rail-freight, and warehouse and distribution facilities are currently located. The region's Retail sector has only a slightly smaller share of total employment than does the rest of the country (10% v. 11%).

Regional Logistics workers earn, on average, almost 13% less than employees in other non-manufacturing sectors, but this is slightly more than employees in manufacturing establishments receive. The average number of Logistics employees per establishment is fewer than that in manufacturing industries or in other non-manufacturing industries.

But these earnings and establishment-size figures vary considerably across the Logistics sector. Workers in Wholesale Trade, which has a relatively high proportion of white-collar office jobs, have the highest earnings, while most Transportation Industries pay about the same or somewhat less than do manufacturing firms. The Transportation Industries that have the least connection to goods movement—Transit and Sightseeing—have the lowest earnings in the Transportation sector. Relatively low wages are also paid in Warehousing, Truck Transportation, and Couriers. Air Transportation, which is dominated in the region by national airline companies, has the highest number of employees per firm. The smallest firms are found in Wholesale Trade and Trucking, where local firms predominate. Industries that are predominately made up of small-scale firms are frequently characterized by high firm turnover and more-intense price competition.

Table 4.1.1
NEW YORK REGION AVERAGE EARNINGS AND EMPLOYEES PER ESTABLISHMENTS BY SECTOR (2007)

	Earnings	Employees per Establishment
Logistics	$ 62,791	11
Manufacturing	$ 57,985	18
All Other	$ 71,962	15

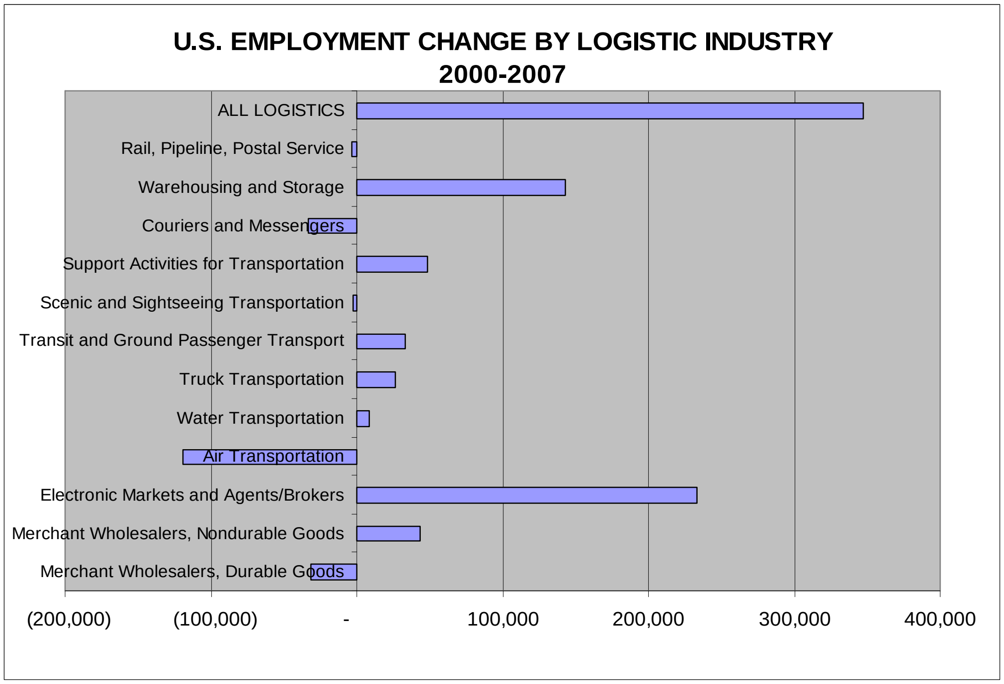
Table 4.1.2

NEW YORK REGION AVERAGE EARNINGS AND EMPLOYEES BY ESTABLISHMENT BY LOGISTIC INDUSTRY, 2007	Earnings	Employees by Establishment
Merchant Wholesalers, Durable Goods	$ 70,475	9
Merchant Wholesalers, Nondurable Goods	$ 74,039	10
Electronic Markets and Agents/Brokers	$ 89,600	5
Air Transportation	$ 65,269	118
Water Transportation	$ 82,109	42
Truck Transportation	$ 43,516	8
Transit and Ground Passenger Transport	$ 33,529	23
Scenic and Sightseeing Transportation	$ 30,981	15
Support Activities for Transportation	$ 51,043	12
Couriers and Messengers	$ 40,107	33
Warehousing and Storage	$ 44,780	22
Rail, Pipeline, Postal Service	$ 68,697	8
Logistics	$ 62,791	11

The Logistics industries in New York City produced a Gross Domestic Product of $25.8 billion in 2003. At an average of $101,000 per worker, this is less than per the average worker earnings in all industries ($139,000).

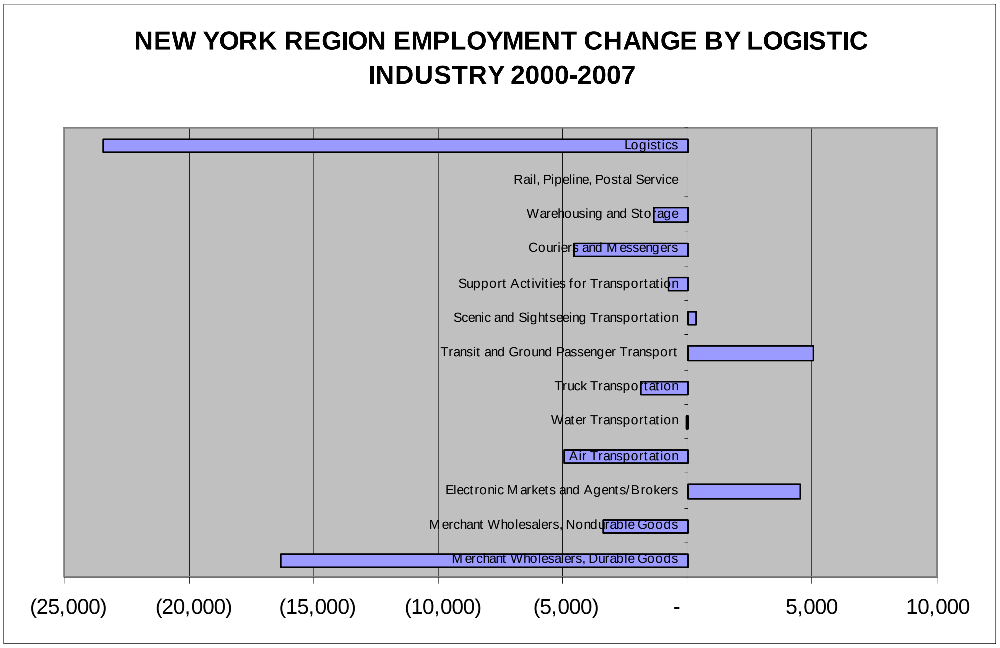
Nationally, Logistics employment has grown somewhat more slowly in recent years than has employment in U.S. industries overall (1.6% a year from 1980-2000, increasing by 38% vs. a 46% growth in overall employment). This rate of growth has slowed in the past decade (0.3% a year from 2000-2007), to less than half the rate of other industries. Growth has concentrated in Warehousing and Electronic Markets and Brokers, while employment in Air Transportation, Courier Messengers, and Durable Goods Wholesaling has decreased.

Figure 4.1.3



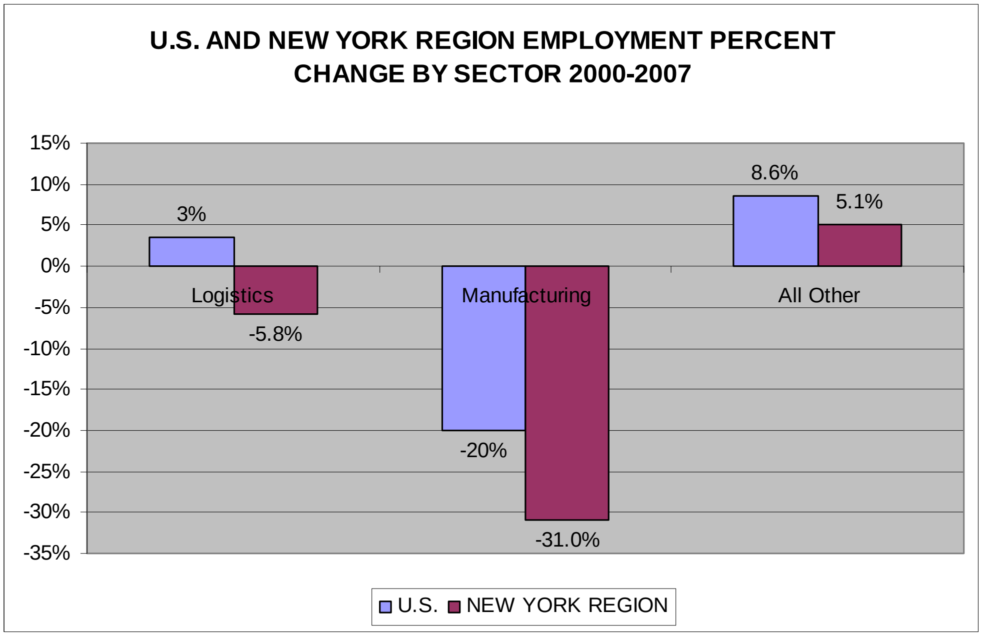
In the New York Region, Logistics sector employment decreased over the 2000-2007 period, especially in Durable Goods Wholesalers. Only Transit/Ground Transportation and Electronic Brokers/Agents showed any substantial growth. This decrease in most Logistics sectors suggests that Logistics activity in the New York Region has moved to other areas, including parts of Northeastern and Central Pennsylvania, Central New Jersey, and Upstate New York.

Figure 4.1.4



The Region's employment growth in all sectors has lagged behind that of the U.S. The lag in Logistics sector growth has been relatively less than the lag in Manufacturing growth, but greater than the lag in growth for other Non-manufacturing Industries.

Figure 4.1.5



While the Logistics sector is projected to grow in the coming years at the same modest rate as in the recent past, freight traffic—truck and cargo volumes—is expected to grow much faster. The Comprehensive Port Improvement Plan noted an 85% increase in cargo passing through the Port of New York and New Jersey between 1992 and 2002 and projected a doubling of the 2002 volume by 2040.[1] The New York Metropolitan Transportation Council (NYMTC) projected a 47% increase in all freight traffic volumes[2] in the 10-county NYMTC region from 1998 to 2025—from 333 to 491 million tons.[3]

II.B Global and Regional Trends Relevant to the Future of Urban Goods Distribution in the New York Metropolitan Region

The planning of major infrastructural systems—as New York's historical experience with such significant transportation facilities as the PATH tunnels under the Hudson River, the Amtrak tunnels under the Hudson and East Rivers, and the subway system, demonstrates—must be

---

[1] Environmental Assessment of the Comprehensive Port Improvement Plan for the Port of New York and New Jersey, Executive Summary, ES-1, October 2007.
[2] These volumes include freight traffic into, through and out of the ten-county region.
[3] NYMTC Regional Freight Plan, p. 2-1, April 2004.

predicated on the assumption that these expensive structures will remain in place for many decades, or even centuries, during which radically different technologies, energy sources, operating regimes, and institutional arrangements may come into use. Transportation planners are thus charged with the responsibility of planning systems that can be used by today's technologies and operating systems but do not preclude their use by the general system types we might anticipate for the future.

While it is impossible to predict specific forms of technological innovation that may be decades away (as it would have been in 1950 to envision digital wireless traffic-control technology) or newly erupted design and operational constraints (such as those imposed by the need to defend against global terrorism), some fundamental trends (such as the declining availability of petroleum-based fuels and the increasing congestion of surface-roadway networks) and some dynamics inherent to the functioning of any living system (such as the need for linearity in any kind of transport system) nonetheless suggest both constraints and opportunities that should frame our planning boundaries. Most of these trends are global. But some are either unique to New York or are particularly relevant to it because of its specific geographic and demographic conditions.

II.B.1. Survey of Major Trends

The following broad trends are among the dynamic phenomena most likely to affect the future distribution of freight in the New York Metropolitan region. Many are overlapping, all are evolving, and most are difficult to measure. In combination, they create a complex context for strategic thinking and planning.

Industrial processes and organization

- *Technological:* There will be continuing technological innovation, including: advances in IT systems; increased use of data-heavy applications (e.g., point of sales data used instantaneously for new orders); increased automation; more-efficient transport equipment (e.g., increased use of bi-directional power); advances in warehousing/cross-docking systems; advances in tunneling techniques, including micro-tunneling; expanded use of tube freight.

- *production processes:* There will be continuing changes in manufacturing, including increased reliance on local assemblage based on subcomponents from multiple remote locations, and on Just-In-Time lean inventories and agile logistics.

- *logistics management systems:* There will be continuing advances in Supply Chain Management, such as the continued breakdown of corporate silos through cross-cutting upstream, downstream, and horizontal coordination; the formation of more joint-operational relationships between uni-modal transport carriers to produce intermodal networks; continued increases in the outsourcing of logistics; and continuing increases in "pull" rather than "push" systems. There will be more flexible, scalable logistics platforms based on IT and Web 2+x.0[4] approaches; reduced reliance on storage vs. increased reliance on maximizing efficient flow capacity; more-frequent shipments with longer trip times, rather than less-frequent shipments with shorter trip times; and major retailers will continue to take charge of up-stream flows (from vendors) as well as downstream flows (to the customers).

- *dividing lines between public and private*: Complex institutional relationships, such as public-private partnerships, will continue to evolve. These will feature varying responsibilities between public and private entities for capital and operating costs, facility and equipment ownership, and operations.

- *freight volumes*: Factors driving growth include globalization; Just-In-Time (JIT) production/distribution systems; lean inventory; stock-space constraints.

<u>Land use and infrastructure capacity</u>

- *congestion*: There is limited potential for roadway expansion vs. projected increases in population, employment, freight volume, and travel volume.

[4] Web 2+x refers to Web applications that facilitate participatory information sharing and collaboration on the World Wide Web.

- *development density*: There are significant constraints on the potential for warehouse/distribution center expansion.

- *energy constraints:* These will decrease the predictability and increase the volatility of energy supplies, as there will be changes in energy sources and forms and energy costs will continue to increase.

- *\environmental concerns:* There will be continuing concerns with environmental impacts, including carbon emissions, effects on public health and safety, and noise.

- *settlement pattern:* Increasing urban density will be paralleled by continuing exuburban dispersal, contributing to density constraints and travel demand.

- *Land use:* There will be continued pressure for waterfront development, waterfront re-zoning for residential and mixed use, and public access to the waterfront.

- *urban pedestrian zones:* The region's cities will see greater numbers of bike lanes and vehicular access restrictions.

Transportation systems

- *hub-and-spoke networks:* These will continue within and between all transport modes, resulting in phenomena such as increased short-sea shipping; continuing substitution of warehouse capacity by in-transit allocation of inventory; continuing agglomeration of distribution functions and companies; expanded use of freight villages.

- *trends toward smaller shipment (less-than-carload [LCL]) sizes:* Due to and enabled by the evolving Supply Chain Management advances noted above, and more specifically to changes in the "goods moved" themselves, such as the continued trend toward higher-value, more time-sensitive, lighter-weight commodities, less-than-carload shipments will continue to play a major role in goods distribution chains.

- *big-box retailing:* As mega-corporations continue to exert a controlling influence on the logistics industry, integrating entire upstream-downstream logistics flows, there will be a continuing increase in the reliance on data-intensive control applications.

- *increases in the dominance of containers over trailers:* Containers themselves will continue to evolve to (a) maximize efficiency and minimize repacking between transport modes (e.g., as in the increasing use of 53-foot containers) and (b) incorporate modularization, so that "layers" of containers fit inside each other, like Russian dolls.

- *expansion of regulatory controls:* These will affect phenomena such as truck sizes and weights; tolling schedules (e.g., time-of-day pricing, congestion pricing, fuel-tax pricing, vehicle-miles-travelled pricing, carbon taxes); driver/operator hours; carbon-cap trading.

- *expansion of the role of e-commerce:* This will result in phenomena such as the continued diminution of the retail store's role as a node in the distribution network and continued specialization in individualized store inventories, distributed from more-remote locations.

- *trends in roadway vs. railway velocities*: Roadway speeds will continue to decrease while rail speeds will continue to increase as increasing freight and passenger travel demand increases congestion on roadways while the effects of technological innovations (including IT advances) and public-private capital investments increase average speeds on rails (and above rails [maglev] and in rail-substitute guideways [tubes], etc.).

- *Trends in passenger rail service.* Passenger rail service—which already predominates on the regional heavy rail network—will grow even more intensive as commuter railroads and Amtrak respond to strong ridership growth with increased service and capital improvements.

While these changing conditions are expected to play a role in shaping the future of goods movement and distribution in the New York metropolitan region, some factors that have longplayed an important role in the evolution of the region's freight networks are not expected to change. These include:

- *Geography.* With Europe, South America, Africa and (via the Panama and Suez Canals) Asia, at its front; the interior of the North American continent at its back; and the densely developed Atlantic seaboard stretching north and south at either side, the New York region has a unique place in the national and global flows of people and goods.

  But New York Harbor and Long Island Sound, which offer maritime access to the rest of the world (as they once also did, via the Erie Canal, to the North American hinterland), separate the metropolitan archipelago from the rest of the continent. Despite whatever new Harbor or Sound crossings may be built in the decades ahead, these portals will always represent potential choke-points due to their restricted number within the dense filigree of the rest of the region's transportation network. The region's security will therefore always depend on the effective redundancy of these crossings.

  The Northeast Corridor, in which the metropolitan region occupies a mid-way position in the Portland-Norfolk Atlantic Seaboard megalopolis, is the most densely populated band of territory in the country. It is thus not only a highly attractive market, by virtue of its large demand within a small footprint, but a highly congested one. It is 700 miles from one end of the corridor to the other—just over the 400-500-mile range often considered viable for freight rail operations. Most goods movements within the corridor are for distances of under 300-400 miles—which is at or below the limits often thought feasible for rail. But since volume and frequency can compensate for increased rail-operations costs, while the costs imposed by roadway congestion can make rail more-competitive with trucking, distances generally considered "short-haul" may be more practicable for rail transport than elsewhere in the country.

  The metropolitan region—like most urban centers around the world—owes its location to flows of trade rather than to stores of raw material. Because it does not have industries that extract materials from fields, forests, or mines, all these materials—most notably, by volume, construction materials, foodstuffs, and other non-durable and durable consumer items—are inbound to the region. The volume of outbound materials is much smaller. This means that the primary focus of logistics activities will be on inbound distribution, including transloading and store-door or last-mile deliveries.

- *Water-bound population density*. Because of the inherent limits on developable acreage imposed by the estuarine system in which the region is enmeshed—and the relative scarcity of waterway crossings mentioned above, as well as the region's geographically and historically derived place in the global flow of people, goods, and capital—the region's density—barring major catastrophe—will continue into the foreseeable future to be unique by North American standards. This will have a concomitant effect on property values.

  This density is likely to remain the continent's greatest concentration of market demand. However, the cost of real estate in the region imposes a significant limitation on the availability of storage space for inventory. The region's receivers therefore are even more dependent than those in other cities on frequent, dependable, relatively low-volume freight deliveries and pick-ups.

  The region's population is likely to retain its extraordinary diversity in terms of income, education, ethnicity, and varying sources of international and domestic immigrants. This diversity will affect both the supply side (the range of goods and services the region is capable of producing) and the demand side (the specialized goods sought by residents from varying educational and income levels and differing ethnicities and geographic backgrounds).

<u>II.B.2. Implications for Freight Transport in the Region</u>

The implications of these dynamic trends and static conditions for future freight transport and distribution in the metropolitan region, very briefly, include these:

- Implications of globalization: global trade, which requires a combination of marine or air transport with some form or forms of surface transportation, is inherently intermodal.

- Intermodality inherently favors standardization of equipment, infrastructure, and operations, and inter-operability of system components between transport modes, geographies, and operating entities. In particular, intermodality favors containerization. Containers are of standard sizes irrespective of their content commodities. Depending on the distribution systems and requirements, standard container sizes may be nested inside each other to allow step-down distribution as the delivery reaches the ultimate end-user.

- Containerization, in turn, favors automation and digital tracking-and-control systems and it requires transfer facilities which tend to be large and to be located in greenfield areas. The development of major new greenfield transfer facilities is a significant source of sprawl as constellations of ancillary warehousing, distribution facilities, and manufacturing/assemblage or value-added facilities develop around them.

- Energy constraints and efforts to reduce greenhouse gas emissions will put an increasing premium on achieving efficiency and will favor the use of electricity for motive power, since electric power can be generated from a variety of sources, including those that are most desirable from the perspectives of sustainability and reduced environmental impacts. Electric power also offers operational characteristics that can increase efficiency and capacity, such as allowing an increase in overall speed through faster acceleration and deceleration, decreased headways, smaller and more-flexible train units (e.g., electric multiple unit [EMU] equipment and bi-directional trains), and increased automation. These characteristics in turn make short-haul, more-frequent rail service more economically competitive with trucking, particularly given the levels of regional traffic congestion, since volume and frequency compensate for reductions in rail-trip length.

- In addition to favoring short-haul rail, the region's unusually severe congestion levels will also encourage the use of other technologies that involve trade-offs between increased capital and operating costs in return for increased productive use of limited capacity. Such technologies include expanded use of underground systems (tunnels and tubes) and vertical/multi-level distribution/logistics nodes (including rail-truck transfer facilities) that may involve decking over existing structures (e.g., rail yards, utility facilities)—including linear structures (e.g., highways, rail lines)—or subterranean excavations. Such systems are likely to be automated and may involve increasingly sophisticated distribution arrangements for last-mile receivers.

- Beyond the decking of linear facilities, there is likely to be an increased emphasis on sharing linear right-of-ways (ROWs) between an increasing variety of uses, perhaps with dedicated channels at various levels within larger ROW envelopes to maintain safety and increase efficiencies and velocity. Some forms of shared ROWs (again, the sharing may involve tracks or levels dedicated to specific forms) are relatively familiar in the region: passengers and freight on the same or parallel tracks; passenger cars, trucks, and rail (perhaps with bike lanes and sidewalks) sharing access on various specific lanes, with an elevated rail line in the median. Other forms of right-of-way sharing are equally common: electricity and data-transmission lines sharing subway and highway tunnels; water, sewage, and steam lines sharing street beds. Still other forms of right-of-way sharing may become more common in the region, such as dedicated truck lanes built on decking above rail tracks. Existing tunnels, such as subways, may support new auxiliary uses, such as pneumatic tubes for the collection and transport of discarded materials. Existing copper and fiber-optic cables may be used for transmitting different forms of energy and information, just as radio band-width can be shared by different uses (e.g., GPS, RFID). Rail track can be used for contact with wheels or as maglev platforms.

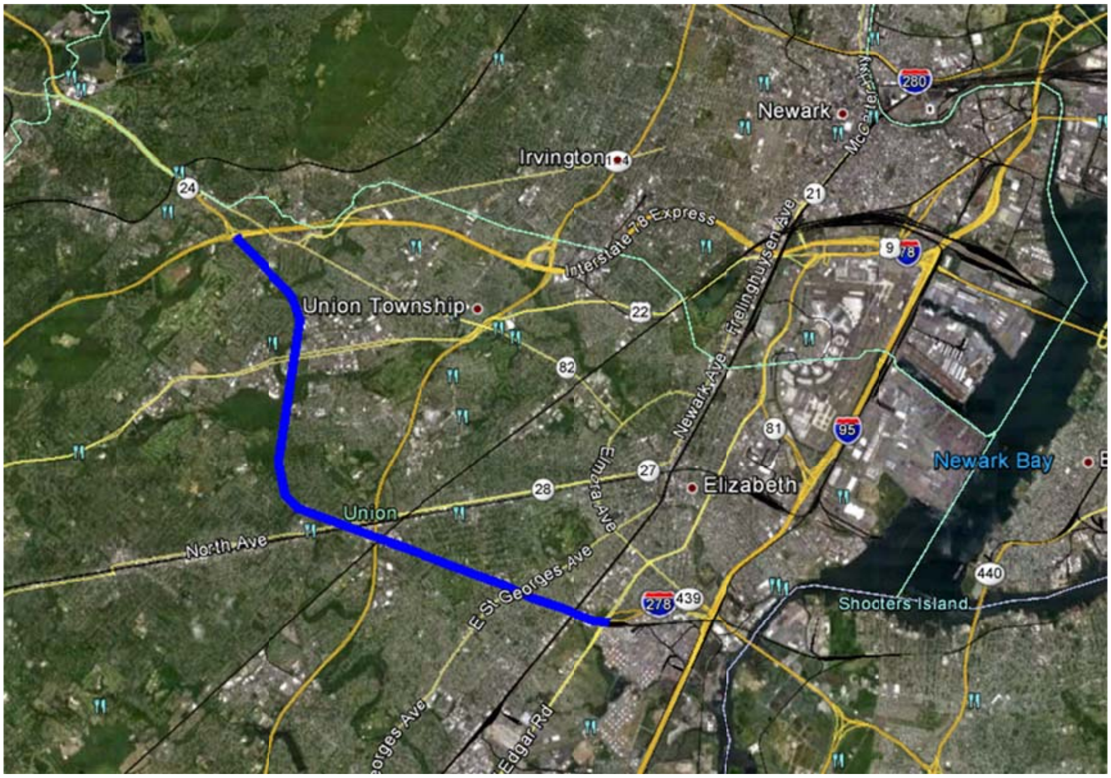
The bottom-line conclusion to be drawn from this appraisal of general and specific trends facing the future of goods movement in this metropolitan region is that roadway-surface freight transport will become increasingly difficult and costly in this region, while the use of rail and other advanced forms of non-roadway technology will increase.

II.C. Corridor Conditions and Traffic

Starting at Exit 13 of the New Jersey Turnpike and terminating at Route I-95 in the Bronx, the 35 route miles of I-278 include five expressways and four major water crossings. The major expressways that combine to form the Corridor are the Bruckner, a small segment of the Grand Central Parkway, the Brooklyn-Queens Expressway, the Gowanus Expressway, and the Staten Island Expressway. The major water crossings are the Goethals, Verrazano Narrows, Kosciuszko, and Triborough Bridges. The Brooklyn Battery Tunnel and Williamsburg Bridge directly connect to the Corridor and are included for completeness as well. Some of these structures date back as far as the early 1930's, before the Interstate system was even conceived and uniform standards created. This "hodgepodge" of roadway designs from different eras has resulted in an Interstate with sections containing no shoulders, tight curves, narrow lanes, and one of the few Interstates in the country with insufficient clearances for large trucks. Most of the Corridor is built on elevated viaducts, with a few sections in open cuts, and portions of the Gowanus and the Staten Island Expressway at-grade. As originally planned I-278 would have continued over the Goethals Bridge, with a direct connection to route I-78. However, this connection was abandoned and remains as a "missing link" in this circumferential expressway.[5]

Figure 4.1.5.2: The Missing Link – Approximate Alignment of I-278 & I-78 Connection

[5] Anderson, S. (2009). *New York City Roads.com*. Retrieved August 2008, from New York City Roads.com: http://www.nycroads.com/



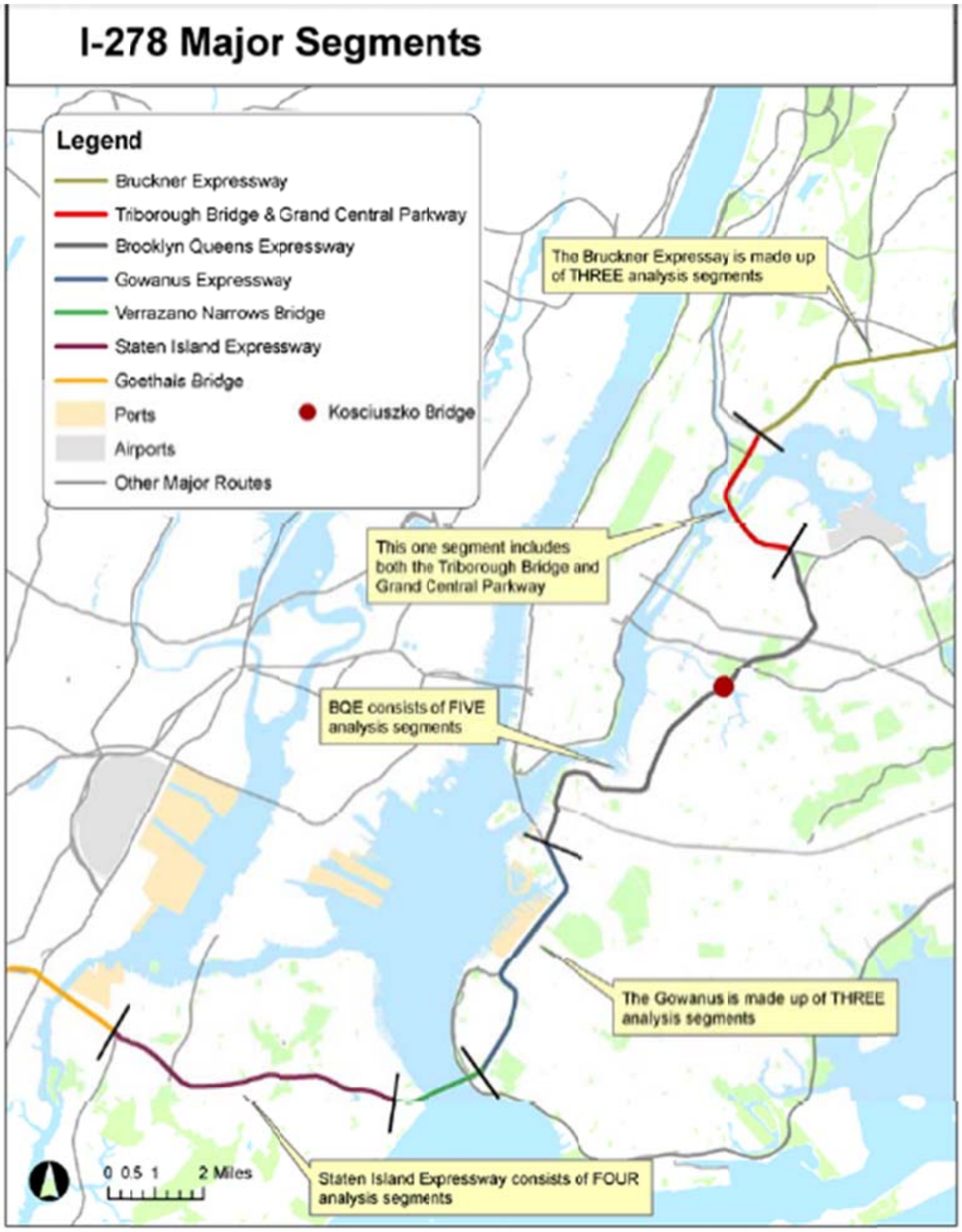
Source: Google Earth Imagery

Note – this would have completed the I-287/278 circumferential route via Route 24

In order to characterize conditions on this corridor, 19 segments were defined.

Table 4.1.3: Segment Listing

The I-278 Corridor in New York City	
Segment Name	***Length (in miles)***
Goethals Bridge	**1.60**
Goethals Bridge-Martin Luther King Expwy	1.56
Martin Luther King Expwy-Slosson Ave	2.07
Slosson Ave-Targee St	1.42
Targee St-Lily Pond Ave	1.40
Staten Island Expressway	**6.46**
Verrazano Narrows Bridge	**2.02**
Verrazano Bridge-Belt Pkwy	2.31
Belt Pkwy-Prospect Expwy	2.21
Prospect Expwy-Battery Tunnel	1.05
Gowanus Expressway	**5.57**
Battery Tunnel-Manhattan Bridge	2.14
Manhattan Bridge-Williamsburg Bridge	2.41
Williamsburg Bridge-I-495 (LIE)	2.34
I-495 (LIE)-Queens Blvd	1.31
Queens Blvd-Grand Central Pkwy	2.07
Brooklyn-Queens Expressway	**10.27**
Grand Central Parkway	**1.10**
Triborough Bridge	**2.27**
Triborough Bridge-Sheridan Expwy	2.03
Sheridan Expwy-Bronx River Pkwy	0.79
Bronx River Pkwy-I-95	1.88
Bruckner Expressway	**4.70**
NJ Section to Routes 1/9	**1.00**
Total Length of I-278 Corridor	**35**
Source for Roadway Lengths: NYSDOT	



Due to the problems it faces—such as the fact that there is recurrent peak-period congestion along many sections of the highway, and that better connections to the adjacent marine terminals are needed—improvements to this Corridor, the only continuous north-south freeway in New York City, are critical for accommodating the growing volume of freight movements in the region.

These are the major conditions that characterize the Corridor:

Recurrent congestion

Average annual daily traffic on the I-278 Corridor ranges from 90,000 vehicles on the Bruckner to over 200,000 vehicles on the Verrazano Bridge. Most of this volume—over 80% on most segments—is made up of automobiles. The extensive delays experienced on a daily basis on the Staten Island Expressway, Gowanus, and Brooklyn Queens Expressway cause losses of time that translate directly into economic costs. This congestion must be alleviated if I-278 is to be transformed into an attractive and efficient route for transit and goods movement.

Freight needs

Although the waterfront in these boroughs has been transitioning from industrial to residential over the last twenty years, there are places in Brooklyn where a working waterfront still exists. In the boroughs of the Bronx and Staten Island industrial uses appear to be experiencing growth. There are also locations such as the shore of Newtown Creek, an old industrial area that forms the natural border between Brooklyn and Queens, where a number of Brownfield sites exist and where freight facilities might be explored.

There are four major concentrations of port facilities in close proximity to the I-278 Corridor. These facilities generate a considerable number of truck trips since the majority of the cargo offloaded at the ports is destined for the local market, resulting in over 80% (by weight) of both imports and exports being moved by truck. Most of this traffic uses the New Jersey Turnpike (I-95) to access points west (I-78 and I-80), south (I-95 multi-state corridor to Philadelphia) or north (I-95 to the George Washington Bridge to New York City, Lower Hudson Valley, and Connecticut). However, I-278 receives a large share of freight traffic from Howland Hook/New York Container Terminal (NYCT) in Staten Island and the Red Hook Container Terminal in Brooklyn. It is also used by trucks originating from the ports in New Jersey that are destined for Staten Island, Brooklyn, Queens, and Long Island (and, in a few cases, Manhattan). NYCT has the potential to expand, as do the ports in Brooklyn. However, the congestion that currently plagues the Corridor makes it difficult to justify expansion of these facilities. In addition to these facilities, there are a handful of secondary freight sites that contribute to the volume of trucks on the Corridor. Some of these sites, such as Hunts Point, are already growing, and others have the potential to grow considerably in the future. In addition to Hunts Point, these secondary facilities include the Brooklyn Navy Yard and Newtown Creek at the border of Brooklyn and Queens.

Figure 4.1.6: Major Port Facilities

<u>Tolls</u>

Three of the Corridor's major crossings are tolled: the Goethals, Verrazano Narrows, and Robert F. Kennedy Bridges. NJ Turnpike Interchange 13, the Bayonne Bridge, and the Brooklyn-Battery Tunnel are other tolled facilities that connect directly to I-278.

The PANYNJ is responsible for the Goethals and Bayonne Bridges, both of which have one-way tolls. The Goethals Bridge is tolled in the eastbound direction; Bayonne Bridge tolls are collected in the southbound direction. The PANYNJ maintains an E-ZPass differential of four dollars and fifty cents less than cash fares during off-peak hours to encourage less peak-period travel. The PANYNJ also maintains an E-ZPass differential of two dollars and fifty cents less than cash fares during the peak period to incentivize drivers to switch to the speedier E-ZPass system. The PANYNJ has introduced variable-time-of-day pricing for large trucks to encourage overnight deliveries: between midnight and 6am, trucks with at least six-axles receive a 25%

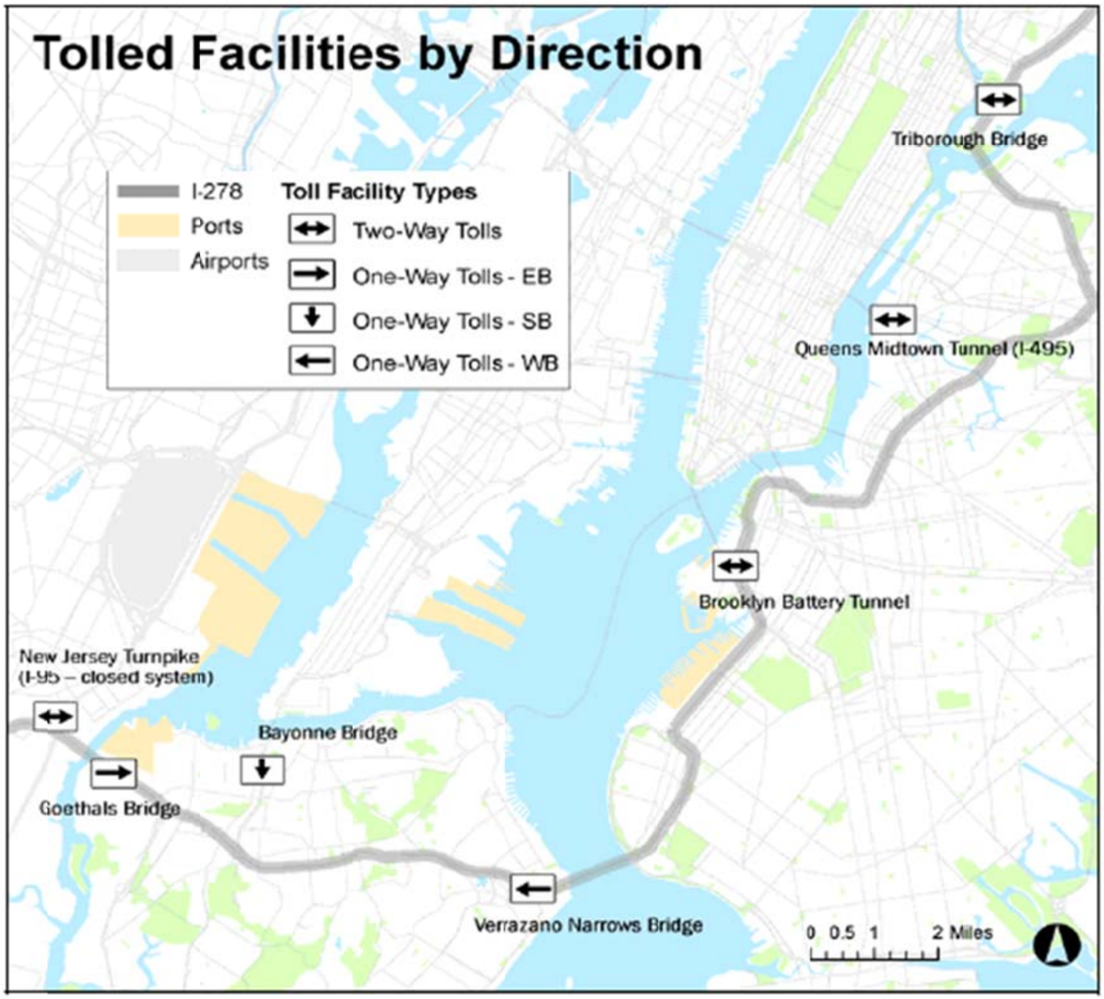
discount. All vehicles pay the same toll whether they use cash or E-ZPass during the peak commutation periods.

MTA Bridges and Tunnels controls the Verrazano Narrows Bridge (VNB), Triborough Bridge and Brooklyn Battery Tunnel. The VNB is tolled in the westbound direction only, whereas all other MTA-controlled facilities are tolled in both directions. To make up the difference, the VNB's one-way tolls are doubled. The MTA maintains an E-ZPass versus cash differential throughout the entire day to encourage users to transition from cash to cashless payments. The toll rates are $6.50 cash and $4.80 for E-ZPass (doubled for VNB). There is a 30% discount for trucks that use E-ZPass, but unlike the PANYNJ tolls, this rate does not vary by time of day.

The NJ Turnpike Authority operates the Interchange 13 tolling facility that connects the NJ Turnpike, a closed-system tolled roadway, to the Goethals Bridge/I-278. The Authority maintains a 35% discount for off-peak E-ZPass travel; cash and E-ZPass tolls are identical during the peak periods for autos. There is a 10% discount for truck E-ZPass users during the peak-periods and a 25% discount for E-ZPass truckers during off-peak hours.

The following map shows where and in which directions tolls are collected.

Figure 4.1.7: Tolled Facilities by Direction



Source: PANYNJ, MTAB&T & NJ Turnpike Authority

<u>Preferential treatments</u>

While automobile traffic predominates on the I-278 Corridor, it also serves as a critical link in the City's express bus transit network. I-278 makes it possible for the MTA to transport thousands of Staten Island residents over the VNB and onto the Gowanus to Downtown Brooklyn, as well as through the Brooklyn-Battery Tunnel to Lower Manhattan. The Corridor also serves express buses destined to Midtown for New Yorkers who live elsewhere in Brooklyn, in Queens or in parts of Nassau County. However, large automobile and truck volumes considerably reduce the speed of these "express" services during peak-periods. To combat this problem, NYSDOT and the MTA have implemented a number of preferential treatments over the last several decades. These provisions primarily consist of striped bus lanes or High Occupancy Vehicle lanes. Currently, NYSDOT operates two such facilities on the Gowanus and Staten Island Expressways, and the MTA operates one in the Brooklyn Battery Tunnel.

Figure 4.1.8: Existing Preferential Treatments

Source: NYSDOT & MTAB&T

<u>Transit service</u>

I-278 serves as a major transitway for express bus service to the central business district in Manhattan. The Staten Island Expressway and Gowanus, as noted earlier, both have sections of bus and/or HOV lanes to speed bus service on the Corridor. There are forty-nine bus routes on the corridor. Approximately two-thirds of them are Express Buses, while the remaining local buses use the Corridor only for short segments. 60 percent (n 29) of the bus routes start in Staten Island, with the majority (24) crossing the Verrazano Narrows Bridge destined for Manhattan or Downtown Brooklyn. Four routes, the X17, X22, X23, and X30, cross the Goethals Bridge to access Manhattan via the New Jersey Turnpike and Lincoln Tunnel. Ten Express Bus routes in the Bronx use the Bruckner and cross into Manhattan via the Triborough at 125th Street.

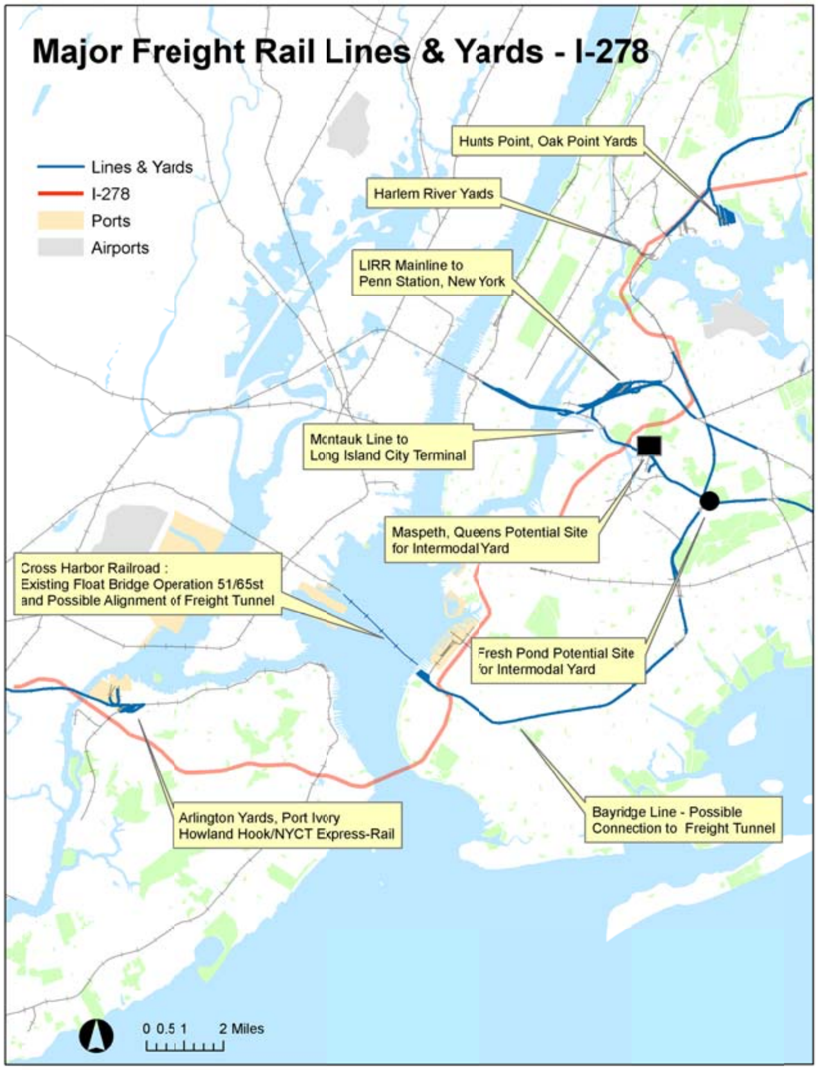
Rail service

A number of freight rail lines and yards intersect or are in close proximity to the corridor. In Staten Island, the renovation of the Arthur Kill railroad lift-bridge in 2006 and reconstruction of the Arlington Yards has reintroduced freight rail service to Staten Island. In the Bronx, the Oak Point Yards serve Hunts Point, with a connection via the Oak Point Link and Bay Ridge line over the Hell Gate Bridge to Fresh Pond Yard in Queens for CSX and Canadian Pacific trains.

The Montauk and LIRR Mainline are two passenger rail lines that intersect with I-278; some freight service runs on both lines east of the I-278 Corridor. The Bay Ridge line is a circumferential line that closely parallels I-278; it starts in Bay Ridge Brooklyn and terminates in the Bronx. This line is lightly used, with only one of its four tracks currently in service (except for a southern section of the line that is double-tracked). The Cross-Harbor Freight Rail Tunnel would upgrade this line for all types of modern rail equipment to provide access to Long Island and points north. A major truck-rail container facility might be located in Maspeth, Queens (the black square on the map), either where the Montauk branch crosses the Bay Ridge line at Fresh Pond or further west along Newtown Creek.)[6]

[6] New York City Economic Development Corporation (2004). *Cross Harbor Freight Movement Project*. Retrieved August 2008, from Cross Harbor DEIS Sections: http://www.crossharborstudy.com/view.htm

Figure 4.1.9 - Major Rail Lines & Yards



<u>Roadway configuration</u>

The I-278 Corridor generally has six travel lanes, three in each direction, but lacks right and left shoulders. There are several sections where a moving lane is used to create a deceleration or acceleration lane for an exit or, in one instance, an HOV /Bus lane on the Gowanus. A major deficiency is the lack of break-down lanes/shoulders on most of I-278. This is the result of the fragmented nature of the roadway. Parts of the Gowanus, BQE, and Bruckner were built before national Interstate highway standards calling for 12ft lanes, 10ft right paved shoulders, and 4ft left paved shoulders were enacted in 1956.

Figure 4.1.10: Travel Lane Example: Gowanus Segment

The aerial photograph above illustrates a number of the issues that affect many sections of the Corridor. It displays a section of the Gowanus Expressway around the 39th (west, purple) and 38th (west) Street exits. Note the green eastbound HOV lane, which limits westbound traffic to only two lanes on this segment of I-278 during the AM peak-period. The lack of adequate acceleration and deceleration lanes on most of I-278 (highlighted here in purple) slows the flow of through traffic and presents a potential hazard for entering or exiting the expressway. As in many other locations on the Corridor, particularly on the Bruckner, BQE, and Gowanus Expressways, shoulders are also absent from this segment of the roadway.

Trucks are also barred from traveling in the left lane along most of the Corridor; State law prohibits this on multi-lane routes with at least three lanes in the direction of travel.

The following table gives the number of lanes, length, and shoulders along each section of the Corridor.

Table 4.1.4: I-278 Segment Length, Lanes & Shoulders

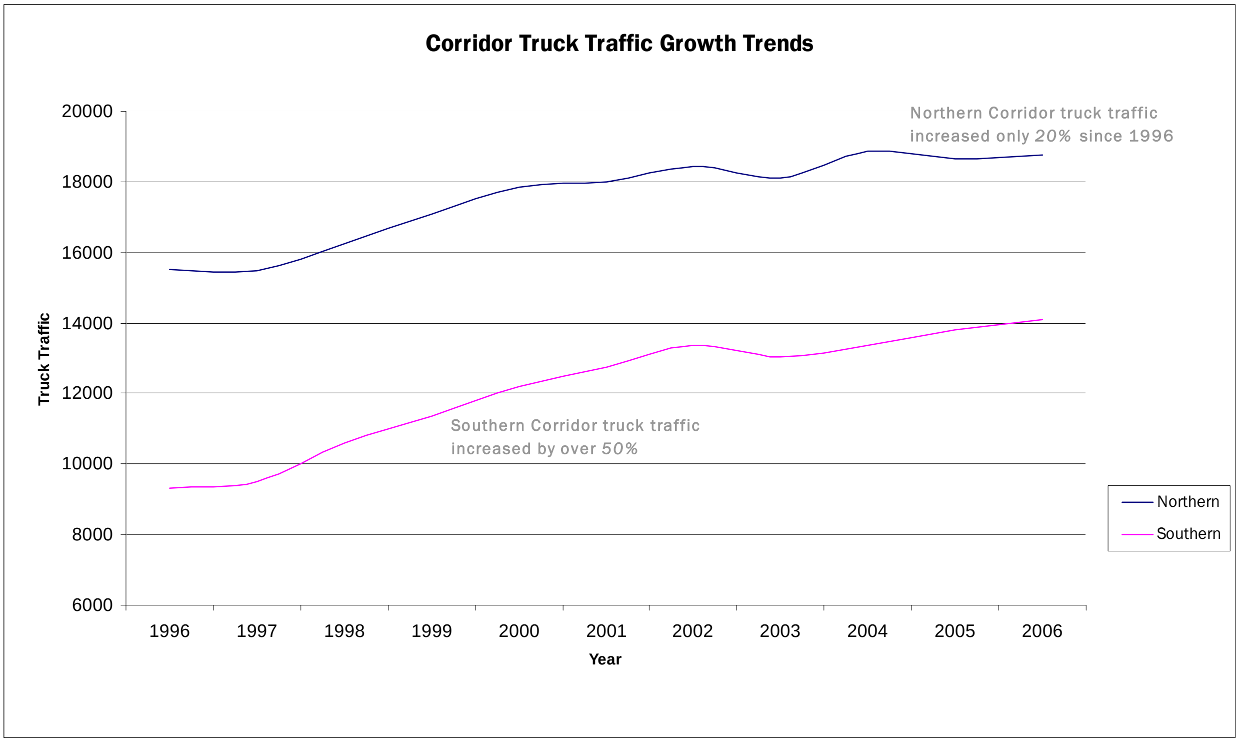
Segment	Length*	Lanes	Shoulders
Bruckner Expressway	7.6	**3 (6)**, but numerous lane-drops and two short sections with only two-lanes	**Partial**, only eastern segment before I-95 had shoulders
Grand Central	3	**3-4 (6-8)**	**Partial**
BQE	11.6	**3 (6)**, but numerous lane-drops and several sections with only two-lanes	**No**, most of the roadway does not have shoulders or has nonstandard shoulder widths
Gowanus	6.1	**3 (6)**, 2 in EB w/HOV	**Partial**, trenched (western) segment has right-hand shoulders, but viaduct does not
Prospect to BQE	1.4	**3 (6)**	**Partial**
55th Street - Prospect	1.9	**3(6)a**	**No,** lack of shoulders on viaduct
South of 55th Street	2.8	**4(8)b**	**Yes,** Mainly trenched (western segment) with shoulders
Staten Island Expressway	7.7	**3 (6)**	**Yes** and center median
Notes * *Includes the water crossings* a 3EB +HOV + 2 WB - 6-10am b 4EB + HOV + 2 WB – 6-10am ( ) Two Direction Lanes			

Source: NYSDOT – Skycomp Imagery and RPA

Traffic volumes

Truck traffic volumes on major crossings located in the Southern Corridor increased by over 50%, while the Northern Corridor experienced a growth rate of only 20%. It must be noted that the actual increase in truck traffic volumes on both Corridors was approximately the same.

Figure 4.1.11: Corridor Truck-Traffic Growth Trends



Source: NYMTC

Average annual daily traffic (AADT) for the entire I-278 Corridor is approximately 124,064[7] vehicles per-day. The following table breaks down AADT by nineteen major segments and aggregates the traffic numbers by the five major expressways and three crossings (the Kosciuszko Bridge is included as part of the BQE segment).

---

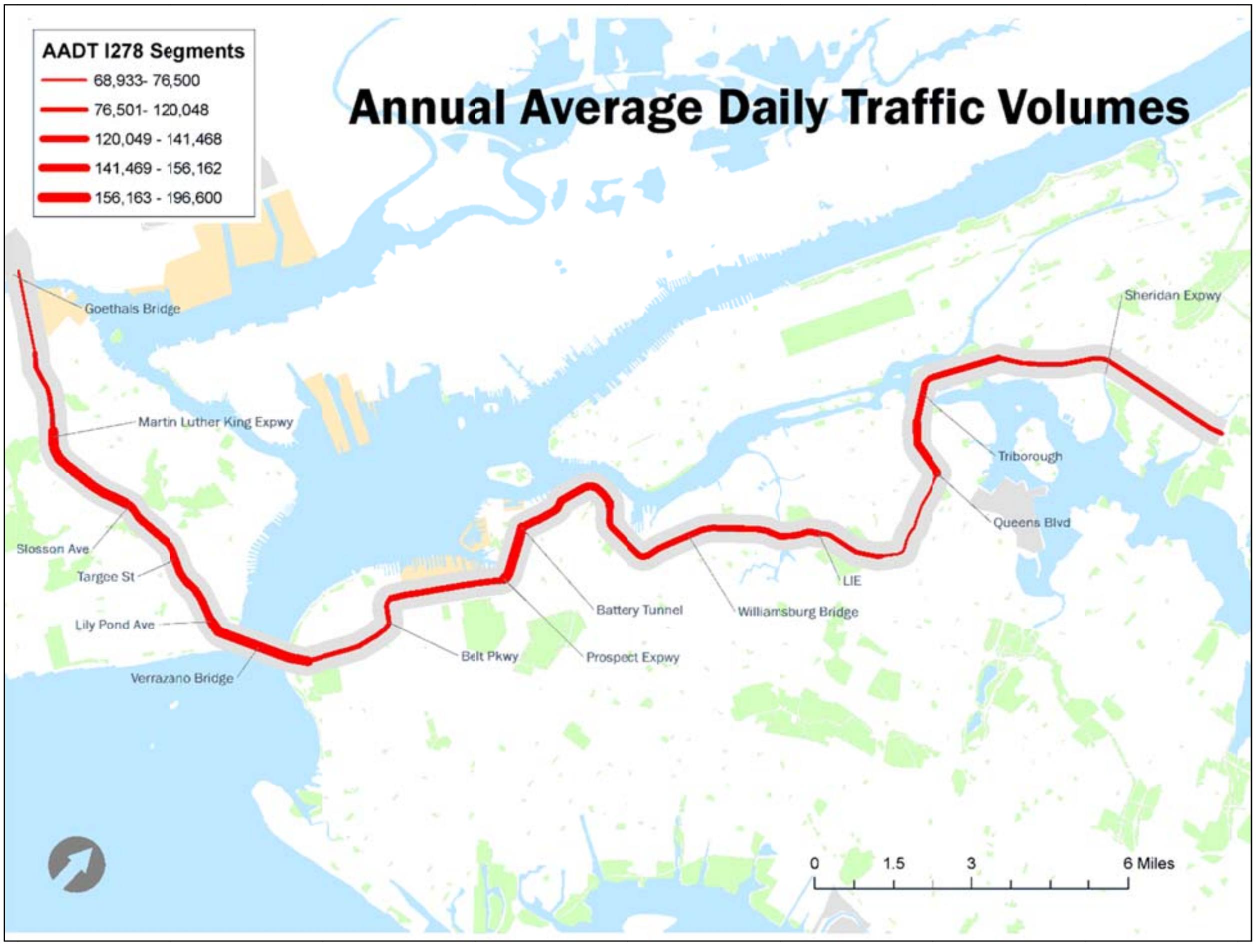
[7] Reported by New York State DOT 2004 by aggregating segment AADT data, using the following weighted average calculation: Corridor-Wide AADT = AADT seg1 * Segment Length seg1 + AADT seg2 * Segment Length seg2 + …. / Total Length of all Segments = Segment Length seg1 + Segment Length seg2 + …

Table 4.1.5: Average Annual Daily Traffic, 2004-2006

Average Annual Daily Traffic – 2004/2006		
Segment Name	**AADT***	**Rank (Top-5)**
Goethals Bridge	76,500	
Goethals Bridge-Martin Luther King Expwy	97,826	
Martin Luther King Expwy-Slosson Ave	**167,949**	
Slosson Ave-Targee St	156,162	
Targee St-Lily Pond Ave	151,539	
Summary - Staten Island Expressway	*135,361*	3
Verrazano Narrows Bridge	196,600	1
Verrazano Bridge-Belt Pkwy	112,147	
Belt Pkwy-Prospect Expwy	132,287	
Prospect Expwy-Battery Tunnel	**167,591**	
Summary - Gowanus Expressway	*132,416*	5
Battery Tunnel-Manhattan Bridge	**141,469**	
Manhattan Bridge-Williamsburg Bridge	120,048	
Williamsburg Bridge-I-495 (LIE)	132,294	
I-495 (LIE)-Queens Blvd	110,374	
Queens Blvd-Grand Central Pkwy	68,933	
Summary - Brooklyn Queens Expressway	*85,731*	
Grand Central Parkway	150,667	2

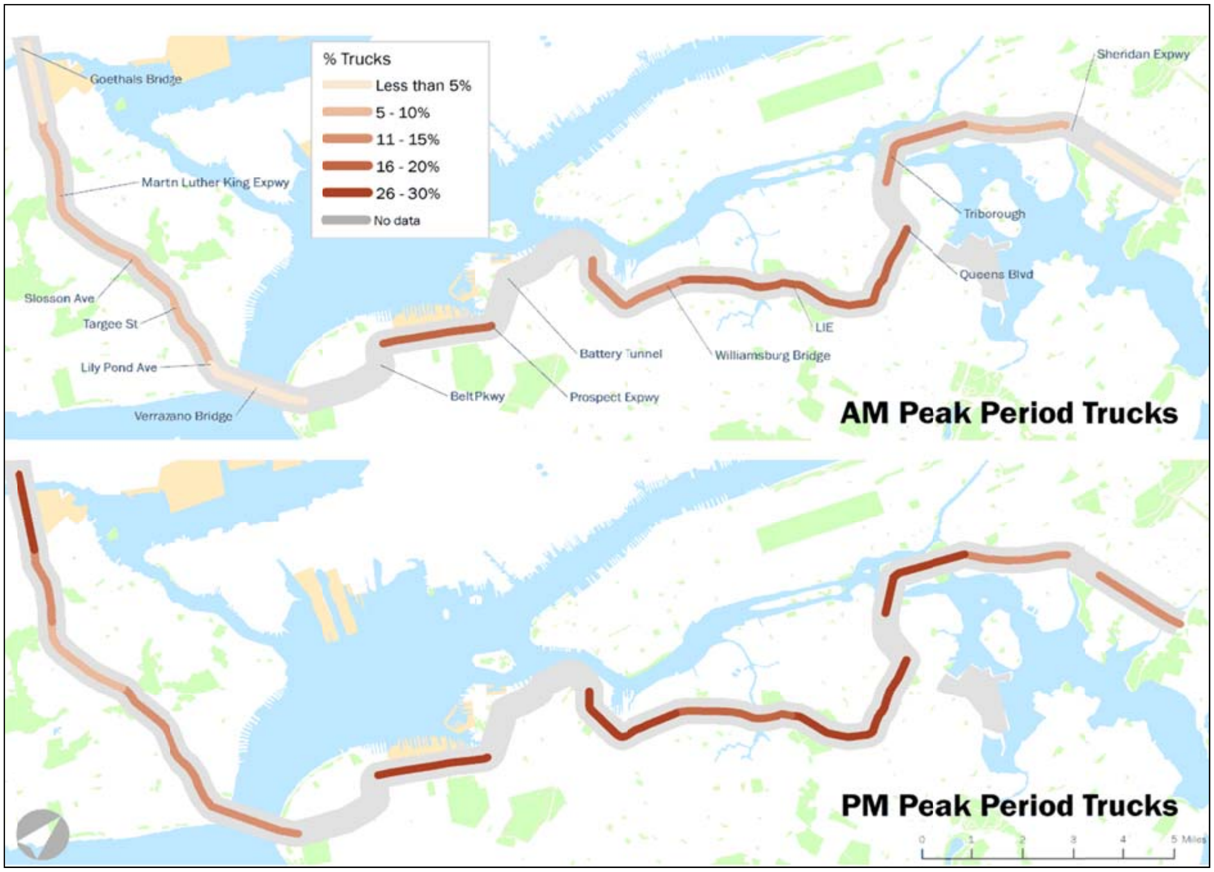
Triborough Bridge (Robert F. Kennedy Bridge)	134,443	4
Triborough Bridge-Sheridan Expwy	103,182	
Sheridan Expwy-Bronx River Pkwy	**113,029**	
Bronx River Pkwy-I-95	95,008	
Summary - Bruckner Expressway	*101,322*	
Total I-278 Corridor-Wide AADT	**124,064**	
** Annual Average Daily Traffic, data is for all travel lanes and includes trucks, autos, and buses. Source: NSDOT 2004 & 2006*		

Figure 4.1.12: Annual Average Daily Traffic Volumes



Source: NYMTC & NYSDOT

Figure4.1.13: AM & PM Peak-Period Truck Traffic



Source: NYSDOT – Managed Use Lane Study

Travel patterns

The traffic volumes indicate three major patterns along I-278:

- Through-traffic from New Jersey over the VNB to the LIE and points east
- LIE to Williamsburg Bridge and Downtown Brooklyn
- Staten Island Expressway/VNB to Brooklyn Battery Tunnel and Downtown Brooklyn

Regarding truck movements in particular, a PANYNJ survey based on data collected in 2000 found that:

- From 1991 to 2000 there was a shift in truck origins, with a greater number of truck trips originating from outside the 29-county PANYNJ region. This shift reflects the development of a distribution center on the fringe of the region in Pennsylvania off I-78.

- There was an increase in the number of trucks with destinations in the New York region from 80% in 1991 to 82% in 2000, meaning that local truck traffic and associated impacts are increasing.

- There was a 5% increase in empty trucks.

- Truck size grew considerably over the 10-year period. In 1991 only 830 trucks drivers reported that their trucks were 102 inches or wider on the Staten Island Bridge. In 2000 that number grew to 2,305, almost 27% of the total truck traffic. This is particularly prevalent on the Goethals, where nearly 30% of the truck traffic consists of trucks 102 inches or wider; these are typically destined for Howland Hook/New York City Container Terminal. We would anticipate that this share would increase if the survey was taken today.

- Overall 27% of truck drivers surveyed said they were independent; the Goethals Bridge had the highest share at 39%.

- The survey found that 10% of the overall traffic volumes on the southern corridor (I-278/Staten Island Expressway) were trucks.

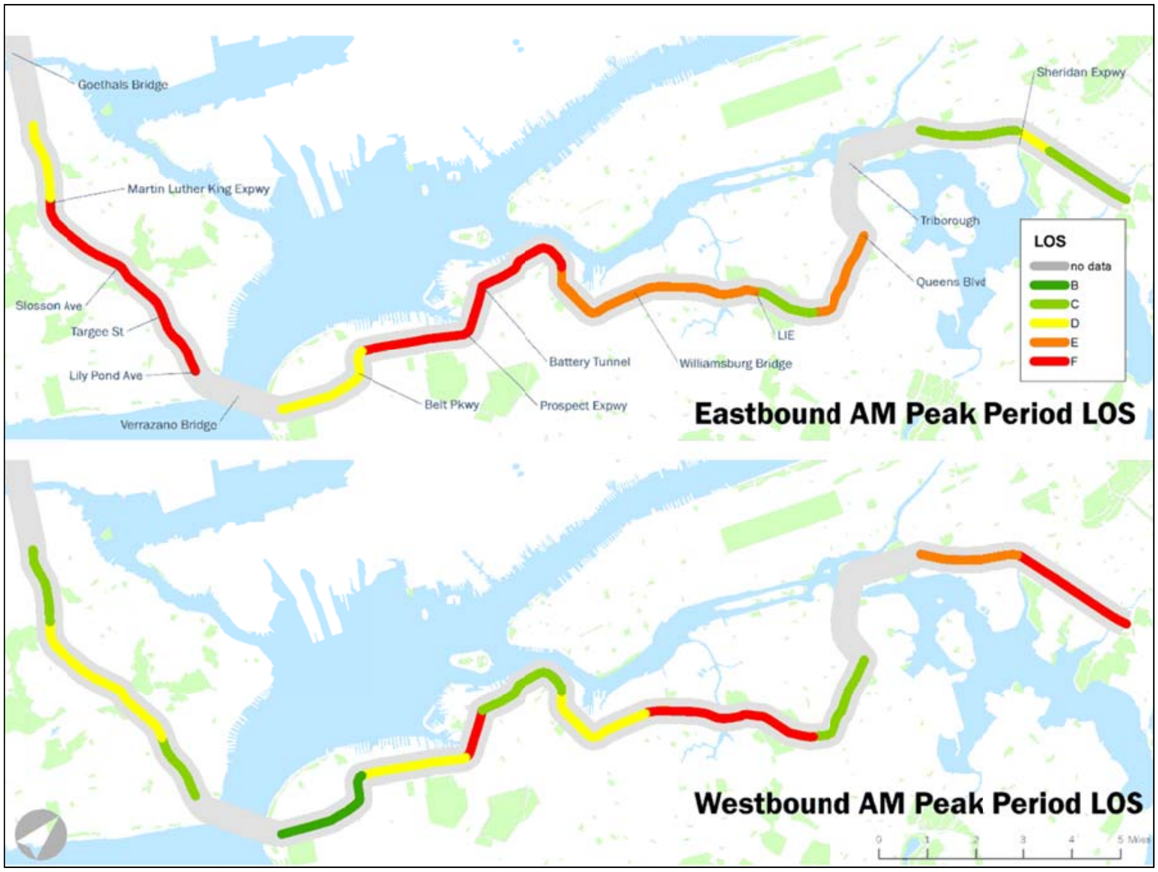
- In 1991, 72% of the truck traffic traveled during day-periods and 28% overnight. In 2000, 67 % of the truck traffic traveled during peak-period and 33% overnight, a trend that is moving in the right direction.

- Truck-freight commodities on the Corridor. The top commodity in 1991 and 2000 is food at 25%. This is reasonable since most of the truck trips in the region have local origins and destinations. There has been an increase in construction materials, both concrete/glass and lumber, which corresponds to the building boom that was underway in the late 1990’s.

Transportation equipment also merits its own share in 2000 (5%), which is indicative of the increased pace of investment in new rolling stock in NJ and NY.

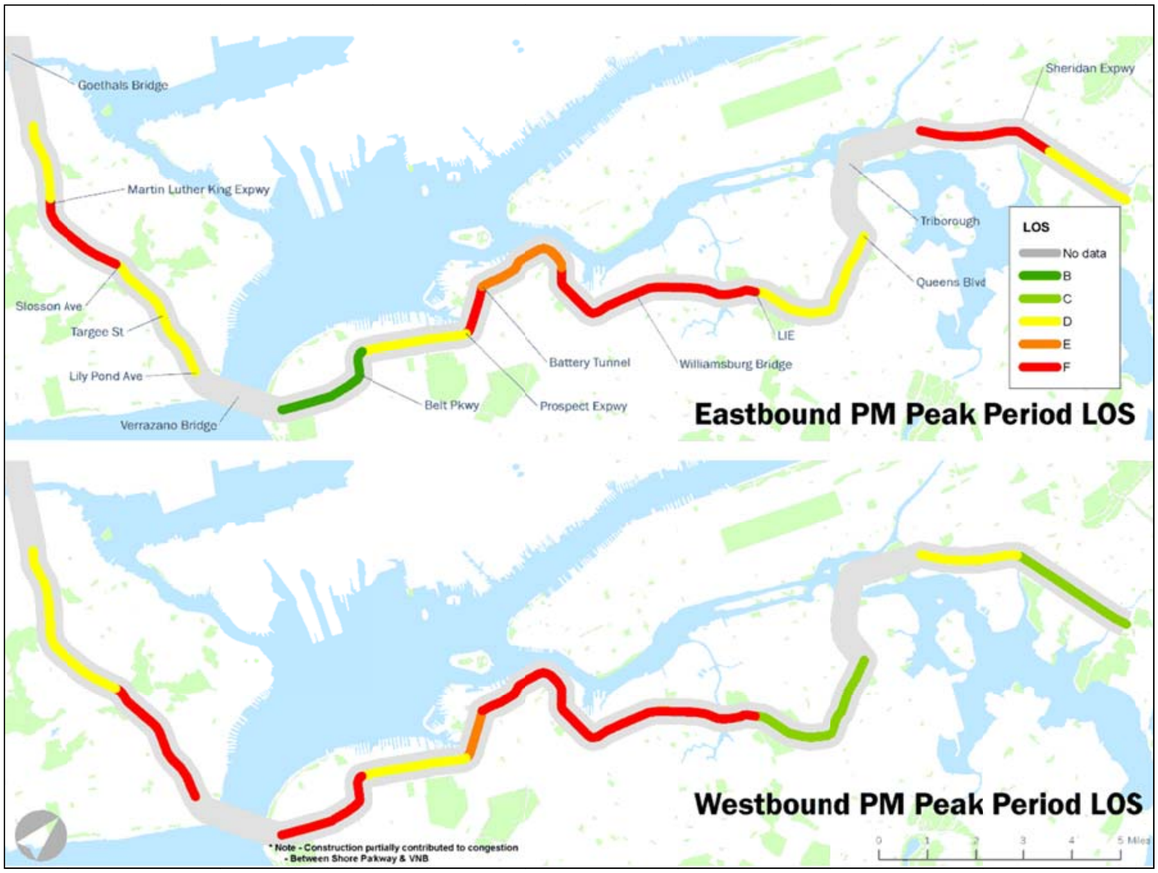
- Traffic operations

Figure 4.14: Level of Service, AM Peak-Period, by Direction



Source: NYSDOT – Skycomp Traffic Observations – 2007

Figure 4.15: Level of Service, PM Peak-Period, by Direction



Source: NYSDOT – Skycomp Traffic Observations - 2007

The average travel speed for the entire Corridor is approximately 35mph for both the AM and PM peak-periods. The posted speed limits on I-278 are 45 and 50mph. Based on the reported average speed of 35mph, motorists can traverse the entire length of corridor in approximately an hour. Overall delays caused by excessive congestion are close to thirty minutes.

Overall Corridor Assessment

For any roadway to be an effective transportation corridor it must be designed to operate safely and efficiently. When high truck volumes are added to the equation the design challenges are increased. I-278 suffers from many deficiencies that limit its ability to operate as a safe and reliable roadway for both cars and trucks. This results in crashes and congestion, limiting the average speeds on the Corridor. Many bottlenecks are caused by the age of the various sections of the Corridor. The earliest-completed sections in Brooklyn and Queens were not designed with freight in mind, at least with regard to the trucks of today, which have significantly increased in size even during the past decade or two. Large portions of the BQE and Gowanus were constructed during earlier years, before shoulders were required and when lane widths were narrower. The majority of the Corridor does not meet the standards established for the Interstate System in 1956, which called for 12 ft lane widths, 10 ft right paved shoulder, a 4 ft left paved shoulder, and design speeds of 50 to 70mph. On the BQE, for example, there are places with no shoulders and lanes less than 12 ft. Without adequate shoulders there is no refuge for disabled vehicles, causing them to block a lane of traffic and severely reducing the capacity of the roadway. Additionally, the geometry of the roadway makes it necessary in certain segments, such as on the connection between the GCP and BQE, to restrict speeds.

Compounding these problems are insufficient deceleration and acceleration lanes for many exits and entrances located on the Corridor. In some cases exits steeply drop off the Corridor without any deceleration lane, creating a dangerous situation that can lead to serious accidents. This substandard design increases the potential for conflicts and generates delays due to reduced safe-stopping-sight distance—the length of roadway ahead that is visible to the driver. This results from the lack of shoulders that reduces the driver's field of vision, and substandard geometry—the curves and various elevations a driver must negotiate. Additionally, I-278 has a fragmented character, with sections knitted together over several decades and legacy infrastructural features such as the Kosciuszko Bridge, which was constructed for the purpose of connecting local roadways in Brooklyn and Queens on either side of Newtown Creek. All this leads to a confusing array of intersections, merges, and lane imbalances that become the major congestion points on I-278. It is difficult to correct these deficiencies without major reconstruction.

The major operating constraints include the following:

- The lack of shoulders or breakdown lanes limits the ability to cope with accidents and recover quickly.

- Road geometries create unsafe operating conditions and require speed restrictions.

- The constrained rights-of-way do not allow for managed-use lanes in most segments without reducing the number of general-purpose lanes.
- Lane drops are common wherever major roadways converge.
- Incomplete interchange at 39th St

Major sections of the I-278 corridor with design and operating deficiencies include the following:

- The moveable bridge over the Westchester Creek (Unionport)--when open it delays I-278 traffic
- Bruckner-Sheridan Interchange—a curve on a steep grade, convergence and lane imbalance
- Brooklyn Queens Expressway (BQE) between Grand Central Parkway and Long Island City–substandard geometry, including tight ramps
- BQE - Long Island City Interchange
- Kosciuszko Bridge over Newtown Creek–steep grade and lane convergence, especially on the eastbound approach
- BQE at Williamsburg Bridge–eastbound route convergence and lane imbalance
- BQE at Wythe Avenue—chronic spillback onto the mainline
- BQE–Cantilevered Section—substandard geometry and lack of shoulders
- Gowanus at BQE and Brooklyn Battery Tunnel—complex interchange with short weave
- Gowanus at Prospect Expressway—westbound left exit and northbound lane imbalance
- Gowanus Viaduct—substandard geometry and lack of shoulders
- Gowanus at Shore Parkway—westbound left exit to parkway and eastbound left entrance from parkway; eastbound lane imbalance (route convergence)

- Verrazano Narrows Bridge—left-side access to Shore Parkway (non-standard design); tolls collected in westbound direction only (in contrast to other water crossings where tolls are collected on approaches to New York City or in both directions)

- Staten Island Expressway (SIE)—440 Interchange—heavy merges and weaving with ramps too closely spaced

- SIE at Forest Avenue Exit (eastbound)—inadequate ramp geometry, capacity, and intersection design deficiencies results in spillback onto expressway

- Goethals Bridge—narrow four lane bridge without shoulders

Additional design and operating problems are found at the BQE interchanges with Atlantic Avenue and Laurel Hill Boulevard, and the Staten Island Expressway at Todt Hill Road. The following map shows the major operating and design deficiencies in the Corridor.

Figure 4.1.16: Identified Design and Operational Deficiencies

As the region grows traffic will increase, both in the form of passenger cars and commercial vehicles. This will put still more pressure on Interstate 278 and the road network that connects to it. While the outcome of the Cross Harbor Tunnel EIS may relieve some of this burden, complementary steps to manage travel demand, improve the highway network, even in small steps and creating a more effective rail freight network that interfaces with the highway network will all have to be part of the solution.

II.D Planned Agency Actions

Public agencies recognize the need for better transportation through the I-278 corridor and its surroundings. A broad range of short- and long-term improvements have been identified. These improvements are in various stages of development and funding constraints could limit their early implementation.

The planned and programmed improvements are shown in Table 4.1.6. This table gives the location and type of each improvement, the agency involved, and the underlying rationale.

Table 4.1.6: Planned Agency Improvements

Location	Existing Problems	Improvement	Lead Agency	Expected Completion Date
Goethals Bridge	Insufficient capacity; narrow lanes; lack of shoulders; functionally obsolete	Replacement bridge with more lanes and standard geometry	PANYNJ	2017
Howland Hook and Port Ivory Access routes	Truck congestion on local roads and back onto I-278	Phased access/egress improvements paced with growth in activity and related transportation pojects, including the near term reconfiguration of Forest Avenue, construction of new eastbound exit ramp, and possible westbound ramp	PANYNJ, NYC DOT, NYC EDC, NYS DOT	2017
Staten Island Expressway	Congestion; weaving caused by interchange and access point placement; non-standard elevation changes; tight curves	Construction of auxiliary lane between the Verrazano-Narrows Bridge and Bradley Ave.; six new entrances and exits; flattening of inclines; straightening of curves through Sunnyside	NYS DOT	on hold
Verrazano-Narrows Bridge	Left side exits	Relocation of left side Shore Parkway access ramps to right hand lanes; reomval of eastbound toll plaza	MTA	2014
Gowanus Expressway	Narrow lanes; lack of shoulders; congestion; functionally obsolete	Interim deck replacement; widened interchanges at Shore Pkwy and Prospect Expwy; widened connector ramp with eastbound BQE	NYS DOT	2016
Brooklyn-Queens Expressway Cantilever and downtown section	Congestion; narrow lanes; lack of shoulders; tight curves; short ramps	Basic rehabilitation, direct replacement, replacement with realignment, or tunnel replacement	NYS DOT, NYC DOT	undetermined
Kosciuszko Bridge (BQE)	Poor site distance; steep grades for trucks; narrow lanes; poor merge conditions	Two replacement bridges with total of 9 lanes; reduced elevation; improved ramp merges and access	NYS DOT	begins 2014
Bruckner Expressway-Sheridan Interchange	Congestion; substandard geometry; severe grade changes; inefficient access to Hunts Point Market	Reconstruction as high-level crossing that eliminates substandard geometries; construction of new ramps to and from Leggett Ave	NYS DOT	2015

Source: Discussion with Various Public Agencies

The Final EIS for replacing the Goethals Bridge has been completed. Improvements and widening of the Staten Island Expressway had been scheduled but have recently been put on hold for budgetary reasons. Reconfiguring the ramp system between the Verrazano-Narrows Bridge and the

Shore Parkway are under consideration. Sections of the Gowanus Expressway and the Brooklyn-Queens Expressway have existing plans for improvement or replacement. Collectively, these projects, when implemented, have the potential to reduce crashes and congestion in the I-278 corridor. More detailed description of ongoing projects and proposals follow and can also be found in subtask 2.2.

A Goethals Bridge

The Port Authority is exploring options to finance replacement of the Goethals Bridge through a public-private partnership. The new bridge would increase capacity from two to three lanes in each direction, widen the lanes, and create shoulders in each direction. A proposed corollary project would improve connectivity for traffic moving between the bridge and Routes 1 and 9. The Port Authority projects a 2017 completion date subject to remaining approvals and financing arrangements. The design reserves space for future transit.

B Howland Hook and Port Ivory Access

The Port Authority, New York City agencies, and the marine terminal operator (NY Container Terminal) are coordinating efforts to reduce traffic back-ups on the streets leading to the terminal gate entrance with interim improvements on Forest Avenue. Looking farther ahead, PANYNJ is proposing a capital project that would provide more direct access to the terminal for trucks entering Staten Island via the Goethals Bridge. NYCEDC is the lead local sponsor for an ongoing environmental review of potential expansion of the marine terminal to the adjacent Port Ivory site, which includes potential access improvements and street network changes. In addition, the terminal operator and PANYNJ and NYCEDC anticipate continued development of rail-freight capability for container transport and other freight shipments through Arlington Yard.

C Staten Island Expressway

The New York State Department of Transportation (NYSDOT) has two projects on the SIE to improve operations and safety. The SIE Access Improvements project began construction in 2010 and will add auxiliary lanes and reconfigure the access ramps between Fingerboard Rd. and Clove Rd. The new roadway configuration will open up the bottleneck west of the toll plaza, reduce weaving and travel times. The project is expected to be completed in 2013.

The second project planned for the SIE began construction in the fall of 2011. The project will extend the Bus/HOV Lane approximately two miles from Slosson Ave. to Victory Blvd, and provide auxiliary lanes from Bradley Ave. to Clove Rd. The section between Slosson Ave. and Manor Rd. will be completely reconstructed to improve the nonstandard sight distance, clearances, and also to provide shoulders. These improvements are expected to improve the travel time over

Todt Hill where the expressway is chronically congested. The project is anticipated to be completed in 2014.

D Verrazano-Narrows Bridge

The Metropolitan Transportation Authority (MTA) has long-range plans to reconfigure the ramp system between the bridge and the Shore Parkway. The objective is to provide all access to the Shore Parkway from the right-hand side of the Bridge. This treatment, expected to be completed in 2014, would eliminate a non-standard and non-intuitive arrangement and allow the existing AM peak period contra-flow priority vehicle lane to be extended across the bridge onto the Staten Island Expressway.

E Gowanus Expressway

The Gowanus Expressway has been the subject of many studies over the past several decades. Both short- and long-range proposals have been identified. A full replacement design, however, has not yet been fully developed.

In the meantime, an interim deck-replacement project is underway that will extend the useful life of the existing roadway and make some performance and safety improvements. The Shore Parkway and Prospect Expressway interchanges will be widened to allow for continuous inbound and outbound bus/HOV lanes from the Brooklyn Battery Tunnel to the Verrazano-Narrows Bridge. This will eliminate the need for buses to merge back into the regular travel lanes, as they currently do. Additionally, the eastbound BQE connector ramp was widened to provide a shoulder and improve sight distances that should help reduce accidents and improve performance during non-recurrent incidents.[8] These short-term improvements are expected to be completed in 2016 and will allow the viaduct to function safely for another 15-20 years.[9]

F Brooklyn-Queens Expressway

NYSDOT, in partnership with NYCDOT and the Federal Highway Administration, was advancing a tiered EIS to study and document improvements to the 1.5-mile segment of the BQE between Atlantic Avenue and Sands Street in Kings County, New York.

With the scarcity of funds under which the New York State Department of Transportation must currently operate, it is incumbent upon the department and New York City Department of Transportation to find a balance between the need to maintain our aging infrastructure, ensure safety and mobility, and promote a climate that helps ensure our continued economic recovery. NYSDOT has reviewed the status of its current list of capital projects and has made a decision to reduce the scope, defer or cancel projects as the department moves towards a

[8] https://www.nysdot.gov/regional-offices/region11/projects/project-repository/gowanus-interim-deck-replacement/faq.html
[9] https://www.nysdot.gov/regional-offices/region11/projects/project-repository/gowanus-interim-deck-replacement/faq.html

preservation-first approach. While NYSDOT plans to advance a select number of beyond preservation projects– extension of the bus/HOV lane on the Staten Island Expressway which began in fall 2011, and the replacement of the Kosciuszko Bridge connecting Queens and Brooklyn scheduled for a 2014 start—NYSDOT terminated certain projects that are not fundable at the current time or in the foreseeable future. This decision affected the subject EIS.

NYSDOT will continue to work with NYCDOT to advance timely repairs to structures, roadways, and appurtenances, promoting a state of good repair and ensuring the continued safe operation of this important roadway. Termination of the EIS and repair of the roadway would not preclude future plans for the roadway to be considered and addressed in a comprehensive manner should funds become available.

G Bruckner Expressway

NYS DOT is planning to reconstruct the Bruckner-Sheridan interchange and bring it up to federal highway standards so that the narrow right-of-way, substandard geometry, and severe grade changes would be eliminated. Through the construction of a six-lane crossing over the Bronx River, vehicles would be able to travel through the interchange at faster speeds and avoid bottleneck conditions. Additionally, the project would provide direct access to the Hunts Point peninsula from the expressway system to reduce the number of trucks traveling over the local streets. The Hunts Point access will improve commerce as well increase safety for pedestrians on the local streets.

In 2008 NYSDOT publicly released several alternative refinements. Currently, the preferred option for accessing the Hunts Point peninsula is a new interchange at Oakpoint Avenue instead of at Leggett Avenue and instead of an extension of Edgewater Road. The Oakpoint Avenue interchange completely avoids residential areas and provides direct access to the Hunts Point peninsula and to the markets from I-278.

The revised vertical profile of the Bruckner/Sheridan Interchange Bronx River crossing virtually eliminates the option to extend Edgewater Road and prevents trucks from directly accessing the market from the Sheridan Expressway. Instead, trucks would continue onto I-278 and then exit at Oak Point interchange. This alignment is being considered because of community concerns over the height of the three-level Bronx River crossing and additional pedestrian and vehicle safety concerns due to the width of the Edgewater/Bruckner Boulevard intersection that was originally proposed. These new options would offer significant improvements over present conditions since trucks that currently exit the Sheridan Expressway at Westchester Avenue and travel on local streets could instead access the markets directly from the expressways. The project is scheduled to begin sometime in 2014 or 2015.

II.E Survey of Corridor Stakeholders

Interviews with representatives of key stakeholder groups along the Corridor in late 2009 found that, from these groups' perspective:

- **Conditions on I-278 are consistently seen as poor, and the highway's unpredictable traffic and frequent congestion are often viewed as its worst traits.** Stakeholders stated that congestion is worst in Brooklyn, and unlike in Queens or Staten Island, there are rarely windows when traffic clears, or opportunities to travel against traffic during peak times. Additionally, stakeholders felt that Brooklyn offers fewer alternative routes to I-278 than Queens does.

  For those operating large trucks, road geometry on the highway and through the surrounding network is an issue, but for direct distributors using smaller trucks, the simple number of vehicles causing congestion is the main challenge. For the latter, roadway geometry does not pose any specific problems.

- **Much of the market for East-of-Hudson logistics business is for frequent, small-scale deliveries, which exacerbates the effects of prolonged periods of congestion.** Logistics businesses in Brooklyn and Queens were described as being oriented towards smaller, local, constant deliveries—direct distribution, essentially. Interviewees believe that these boroughs cater to and support a different goods movement market than New Jersey does and feel there is not the space or real estate market on the east side of the Hudson River to handle the large-scale distribution centers that abound in New Jersey and Pennsylvania and that require extensive handling and breaking down of goods. New Jersey also handles goods destined to the hinterlands, which many of the interviewees felt could not as easily be handled by Brooklyn or Queens, which already have large markets to serve with limited available space.

  Due to congestion on the approaches to New York, interviewees who deal with truck deliveries feel that New Jersey cannot as efficiently deliver to New York customers who are not adjacent to the entry points from New Jersey—specifically the markets of Queens and Brooklyn. Since the two sides of the port are seen as catering to different markets, improvements and policies should be developed accordingly.

- **A number of stakeholders feel that existing regulations are enforced in a lax manner, which limits their confidence that new regulations, such as pricing policies or managed-use lanes, would be implemented effectively.** The effectiveness of any newly proposed road policies aimed at improving the flow of truck traffic, such as truck-only lanes or improved street routing, would rely on accurate and aggressive enforcement, according to several interviewees. The benefits will not be realized if trucks are incorrectly diverted or if other vehicle types are able to occupy the lanes.

- **The effectiveness of variable tolling is seen by I-278 users as dependent on a range of factors that need to be considered besides the tolls themselves.** Interviewees noted that variable tolling causes truckers to shift their times of travel only if they have the ability to adjust their schedules, which is more likely for long-haul truckers (i.e. those dropping an entire container at a site) but highly unlikely for those delivering directly to customers or to facilities that demand certain delivery times. Changing these delivery windows would likely result in increased labor costs, potentially making this an unpopular option for many receivers. Additionally, end-users who deal with small quantities of cargo are likely to be willing to pay the one-time higher fee to receive cargo when they need it and can afford to receive it, while those requiring many trips with high volumes of goods are seen as more likely to be influenced by the variable prices. Several stakeholders with knowledge of delivery in the corridor stated that customers often don't take advantage of off-peak deliveries, so truckers and those involved in direct distribution are concerned that variable tolling would not allow them to alter travel patterns, even while forcing them to pay higher fees. Keeping ports open later and incentivizing customers to receive goods in the off-peak would be necessary to complement any variable-tolling policies.

- **Nearly all interviewees emphasized the importance of East-of-Hudson land-uses in limiting the potential for expanded or even maintained freight handling within New**

York City. Unless additional East-of-Hudson capacity is added and investments in freight-handling facilities are made, many interviewees feel that, while better rail-access is desirable, the expense of developing significantly improved cross-harbor freight connections, such as a rail tunnel, could not be justified. This East-of-Hudson deficiency would likely limit the number of trains using a tunnel, underutilizing the capacity of such a new cross-harbor link.

The interviewees generally feel that the relatively few remaining properties that are large enough, relatively cost-effective enough, and located close enough to highways, rail, and industrial activities to support industrial uses must be preserved or allowed to be redeveloped for freight and logistics uses. Maspeth and Long Island City in Queens, the waterfront area in South Brooklyn, and the region around Oak Point in the Bronx are the specific areas that the various stakeholders see as most suitable for further rail, warehousing, and distribution facilities.

The value and development-costs of many of the properties in these areas that remain underdeveloped and that could be used for goods movement, however, are higher than the profit-potential of freight-related uses of the sites. Interviewees feel that aid for expenditures such as the initial land purchases and for costs related to development, such as environmental remediation, would be required to make the use of these sites feasible.

- **There is consensus that any added freight capacity for warehousing and distribution facilities East-of-Hudson could be filled from local demand in Brooklyn and Queens alone.** Our interviewees suggested that demand more than outstrips the potential for added capacity. Specifically, there is a dearth of cold-storage facilities for foodstuffs throughout the I-278 corridor.

  Several interviewees believe that the tunnel would best be used for East-of-Hudson areas not easily accessible from New Jersey, whether by truck or by existing rail crossing, rather than for areas that are accessible in Staten Island and the Bronx.

- **Interviewees who deal with warehousing and are involved in direct distribution see the future of the Brooklyn port as residing in Sunset Park, which is attractive because of its rail accessibility (from the Bay Ridge Line) and because of the character of this waterfront neighborhood.**

- **The stakeholders believe that population and demand growth will increasingly pressure freight movement to become more efficient and intelligently managed.** East-of-Hudson freight operations, including rail infrastructure and smart roadway policies, will become increasingly important as the region's population grows in the coming decades, while the bridge and tunnel crossings between New Jersey and New York are expected to remain essentially unchanged. Over the next fifty years, the only improvements to road crossings that stakeholders foresee are the replacement of the Goethals Bridge and a new Tappan-Zee Bridge. Freight currently carried by truck will be in direct competition with increasing passenger movements, and land that is suitable for freight logistics will be increasingly in competition with other forms of real estate development.

II.F Forecasted Truck Travel on the Corridor

In order to develop recommendations for Corridor improvements, the Study Team developed a forecast of predicted truck traffic demand on the basis of NYMTC's Best Practice Model. The major findings of this effort were these:

- PlaNYC estimates that the city's population will grow to over 9 million by 2030. While Staten Island is expected to experience the highest rate of growth—24.4% between 2000 and 2030—the other boroughs that I-278 passes through are all predicted to grow significantly as well: Brooklyn by 10.3%, Queens by 15.3%, and the Bronx by 9.3%. An estimated 750,000 jobs are also expected to be added to New York City by 2030. The higher travel demand that this growth will place on I-278, as a result of increased passenger transportation needs and increased demands for goods, will put even more stress on a system that is already heavily taxed.

- The roadways have essentially reached their capacity during peak travel times and are now forcing additional drivers into other travel periods of the day instead.

- The results of this regression analysis show that a very high proportion of the change in truck volumes is explained by changes in population. In fact, 80% of the change in truck volume on the major crossings can by explained by changes in population.

- NYMTC's Best Practice Model (BPM) is an activity based travel-demand model that uses transit ridership, traffic volumes, demographic and socioeconomic data and travel behavior surveys as inputs to predict detailed travel patterns and growth in the New York metropolitan region.

- The model area covers 28 counties in New York, New Jersey, and Connecticut. It includes more than 3,500 transportation analysis zones (TAZs) and includes most road facilities, from minor arterials through freeways, and all forms of public transit.

- The most innovative aspect of the BPM model is its use of "journeys" rather than "trips." A journey is defined as travel between two principle locations but stops between those two points can be incorporated as part of the same journey. For example, rather than treating a trip from home to daycare and then daycare to work as two trips, the BPM treats those movements as a single journey with a stop along the way and, in the process, more accurately reflects the way people actually move.

- The model was last substantially updated in 2002 [10]to incorporate 2000 Census results relating to land-use, population, and employment. However, the fact that the BPM still uses year 2000 demographic data is a weakness of the model. Additionally, the survey results are from the late 1990s and, therefore, further removed from current realities. Since the original survey was conducted, gas prices have risen, the economy boomed but

[10] The BPM updated again in 2009 to a base-year of 2005, which included more recent screenline traffic counts and select SED inputs, among several other revisions.

then greatly contracted over the past three years, and New York City has continued to evolve.

- It is also important to note that NYMTC's bus volumes remain unchanged between 2010 and 2035. This is because there are no MTA projects in the Transportation Improvement Plan (TIP) for new bus services on the I-278 corridor (although there are plans to extend the bus lane on the Staten Island Expressway [SIE]). The model does not project higher bus volumes as a result of increased demand, as it does for all other modes of transportation.

- Truck volumes are projected to increase 2% annually over the next twenty-five years, growing at a faster pace than other vehicular traffic. This can be explained by per capita consumer demand, which is growing at a faster rate than the region's population and by the maturity of the automobile market in the region.

- Much of the corridor at some point throughout the day is near or at capacity now, as we documented in Task 2.1. Not surprisingly, many of the areas congested today are projected to get worse by 2035. The VNB and SIE will see significant increases in congestion during both the AM and PM peak-periods. Additionally, the GCP and RFK Bridge segment will be over-capacity, experiencing V/C ratios over 1 by 2035. The Bruckner and Gowanus Expressways both show a slight decline in congestion, which partially corresponds to the projected decrease in traffic volumes on these segments.

II.G Land Use Context: I-278 Corridor Area Definition and Characteristics

For purposes of this analysis, the primary study area was defined as any area of Brooklyn or Queens within one mile of I-278, the Bay Ridge Rail Line, Bushwick Branch Rail Line, or Montauk Rail Line. As described in the following section, a secondary study area also included any areas adjacent to any through or local truck routes connected to these freight facilities. This definition accounts for any area that could be made more attractive for goods distribution uses through highway improvements to I-278 or improvements in the rail network that could affect truck flow in the corridor.

Selected land uses, including Industrial & Manufacturing, Transportation & Utility and Parking & Vacant lands, are described to characterize the areas around the I-278 and the rail lines. A listing of the building types in these categories is found on page 10. These land uses were selected because they are largely industrial or transportation-related in character, are major end-users of truck and rail freight, and are more likely than are other uses to allow redevelopment. Retail is also a destination for truck shipments but, with the exception of some "big box" retail, it is more likely to be dispersed in commercial and residential areas than concentrated in industrial areas that would be the likely location of distribution facilities. The selected land uses have been analyzed to show the total area for each land use, and the square footage of underdeveloped properties.

Table 4.1.7

Table 1.

Square Feet of Land by Land Use in Brooklyn and Queens by Distance from I-278 and Bay Ridge, Montauk and Bushwick Rail Lines

Land Use	1/2 Mile	1 Mile	Rest of BK/QN	BK/QN
Parking & Vacant	40,087,084	71,302,344	160,001,812	231,304,156
Transportation & Utility	41,718,503	78,186,171	262,562,568	340,748,739
Industrial & Manufacturing	97,383,923	126,934,819	33,129,156	160,063,975
Selected Land Uses	179,189,510	276,423,334	455,693,536	732,116,870
All Other Land Uses	577,073,492	1,110,947,904	2,131,994,894	3,242,942,798
All Land Uses	756,263,002	1,387,371,238	2,587,688,430	3,975,059,668

As shown in Table 4.1.7, the proportion of the selected land uses (Parking & Vacant, Transportation & Utility and Industrial & Manufacturing) within a half-mile of I-278 or the rail lines is slightly higher than is the proportion within one mile of these facilities. These uses occupy 179 million square feet, or 24%, of the land within a half-mile of the highway and rail lines, and 276 million square feet, or 20%, of the land within one mile. For the rest of Brooklyn and Queens, these logistics-related uses represent 18% of the land area.

This shows that locations closer to I-278 and the rail lines are more likely to have concentrations of logistics-related uses, but that other uses, especially residential, predominate throughout all areas. Even within a half-mile, approximately three-fourths of the land is occupied by housing, office buildings, parks and other non-industrial or non-transportation-related activity.

Target Corridors

The methodology uses Geographic Information System (GIS) analysis to integrate three factors essential to the location of logistics facilities:

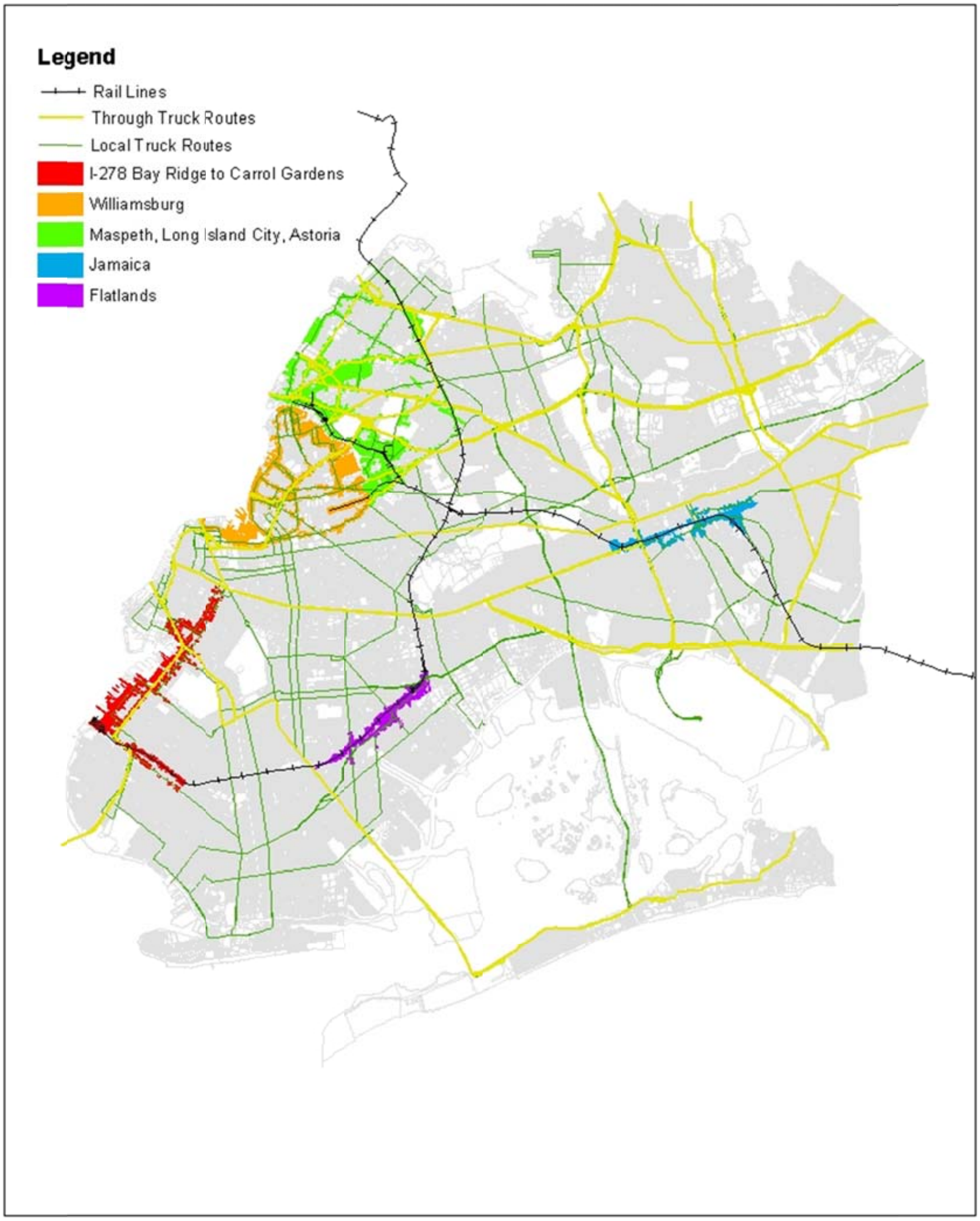
1. Demand for goods shipments, defined by the clustering of warehousing, manufacturing and other users;
2. Development capacity, defined as land availability and land use context; and
3. Transportation access, defined as sites having access to truck routes or rail lines.

Based on these factors, logistics clusters were grouped into five target areas that are defined by specific freight routes and identifiable neighborhoods. Boundaries for the target areas are as follows:

- I-278 from Bay Ridge to Carroll Gardens: 66th and 54th Streets, South; 15th Ave and 5th Ave., West; 59th St and Atlantic Ave,. North; Bay Ridge Channel and Columbia St., East
- Williamsburg: Nassau St., South; Flushing Ave., Southeast; Newtown Creek and Brooklyn-Queens Border, North; East River, West
- Maspeth, Long Island City, Astoria: Bay Ridge Line, Northeast; Newtown Creek and Brooklyn-Queens Border, South, East River, West
- Jamaica: Lefferts Blvd. West; Hillside Ave., North; 190th St. and Farmers Blvd., East; Liberty Ave., South
- Flatlands: Flatbush Ave.. West; Flatlands Ave., Southeast; Pennsylvania Ave./Linden Blvd., Northeast; 200 feet from Bay Ridge Line, Northwest

Figure 4.1.17

Target Areas abutting Bay Ridge Rail Line, Montauk Rail Line
Bushwick Rail Branch, Local and Through Truck Routes



<u>Area 1: I-278 from Bay Ridge to Carroll Gardens</u>

The "I-278 from Bay Ridge to Carroll Gardens" target area runs parallel to the piers and port facilities that define Brooklyn's working waterfronts in neighborhoods such as Sunset Park and Red Hook. As shown in Table 4, the area has a high concentration of Warehouses (29%) and

Factory and Industrial Buildings (17%). Other important building classes in the area are Gas Stations and Parking Lots, each of which includes 15% of the selected building classes in the target area. Most of these properties are privately owned.

In terms of lot area, a few Transportation facilities occupy 44% of total land in the selected building classes. The second-largest building type is Warehouses, with 21% of all lot area in the selected classes. In terms of building square feet, Transportation Facilities again comprise the largest share, at 32%, while 28% are Loft Buildings, 25% Warehouses and 10% Factory Buildings.

Of particular interest for this area is the large number of relatively small warehouse and factory properties interspersed between vacant parcels, gas stations and parking lots. These indicate possibilities for infill development, but also probable challenges for site assembly.

Area 2: Williamsburg

The Williamsburg target area, which is changing rapidly through residential conversions and new residential construction under a recent rezoning, is a mixed-use area that retains a large industrial base. It has more properties in Factory and Industrial Buildings and Warehouses, which represent, respectively, 27% and 24% of the parcels in the selected building classes, than there are in the other selected building classes. The next-most-common of the selected building classes are Parking lots (17% of the logistics-related total) and Vacant Land (14%) Most of these are privately owned. In terms of lot area, the largest segment of the logistics-related universe is Factory and Industrial Buildings (29%), followed by Transportation Facilities (27%) and Warehouses (24%). The rest of the logistics-related building classes have low shares of the group's land area. In terms of building area, Factories and Warehouses comprise an even higher proportion of the logistics-related inventory (38% and 33% of the gross square footage, respectively), while Transportation facilities represent 18% of building floor space.

There are a few large properties, including the Brooklyn Navy Yard, that are rented to multiple small, mostly manufacturing, tenants. Most, however, are relatively small, both in terms of lot size and building area. The 502 Warehouses average 23,000 square feet and the 249 Factory

Buildings average 53,000 square feet. There are also 5 million square feet of Vacant Land and Parking Lots, which indicate the potential for infill and site assemblage.

Area 3: Maspeth, Long Island City, Astoria

The Maspeth/Long Island City/Astoria target area includes the largest industrial area in the five boroughs, along with several residential neighborhoods. Of the selected building classes, Warehouses represent 23% of the properties, followed by Factory and Industrial Buildings at 19% and Vacant Land at 18%. Other significant uses are Parking lots at 11% and Gas Stations at 10% of all logistics-related properties in the target area. As in most of the other target areas, most of the logistics-related properties are privately owned.

Of particular interest is the cluster of warehouses in Maspeth, which includes both large and small properties and has access to both rail service and truck routes. The 27 million square feet of warehouse space is divided among 653 properties, with an average building size for Warehouses of 35,000 square feet. There are also 9 million square feet of Vacant Land and Parking Lots, mostly on small lots.

Area 4: Jamaica

The Jamaica target area is a narrow rail corridor in a largely residential section that has recently been rezoned to increase residential densities. Compared with the other areas, it is relatively small, with 517 logistics-related properties on 10,600,00 square feet of land. It has a more even distribution of properties, with Vacant Land comprising the largest proportion of the logistics-related group (24% of the properties), followed by Warehouses (17%), Utility Bureau Properties, Parking Lots and Gas Stations (13% each) and Garages (12%). As with other target areas, most of these properties are privately owned.

In terms of land area, the largest share is for Utility Bureau Properties (35% of logistics-related lot area), followed by Warehouses (18%) and Parking Lots (12%). Factory and Industrial Buildings and Gas Stations each represent 10% of the logistics-related land area. 36% of the logistics-related building square footage is concentrated in Warehouses, while Factory and Industrial Buildings occupy 33% of the logistics-related floor space.

While there may be some limited opportunities to expand distribution space, both the limited amount of land and the distance from other freight clusters and major highways make this a less-likely location for logistics development.

Area 5: Flatlands

As in Jamaica, the Flatlands target area also is a narrow rail corridor whose logistics-related properties are evenly distributed among the sub-classes.. Of the nearly 500 logistics-related properties on 12,300,000 square feet of land, 23% are Vacant Land, 21% Warehouses, and 20% Gas Stations. Other significant building classes are Factory and Industrial Buildings at 12% of properties, Utility Bureau Properties at 11% and Garages at 10%.

In terms of lot area, the largest logistics-related building classes are Warehouses (31%) and Factory and Industrial Buildings (21%). Gas Stations occupy 16% of logistics-related land and Utility Bureau properties and Other Public Facilities 12% each. Building area is mostly concentrated in Warehouses, at 50% of existing floor space, followed by Factory and Industrial Buildings at 23%, Gas Stations at 14%, and Other Public Facilities at 10%.

Development potential is limited, but somewhat more attractive for logistics facilities than in Jamaica. The corridor is closer to Brooklyn's primary industrial areas and is under less pressure for residential development.

III. Logistics Policy Options

The study examined policy options that could be utilized in either a regional or corridor strategy to improve goods movement efficiency. These can be grouped broadly under the categories of pricing, regulation and technology, and are summarized below.

.

III.A Role of Pricing in Reducing Trips

Road pricing is an important policy tool with demonstrated benefits in the effort to manage traffic congestion. These pricing initiatives may have different policy goals, such as, e.g., the reduction of environmental pollution, the spread of peak demand or the generation of revenues to be invested in the transportation system. A variety of attributes of the pricing scheme determine the success of these policies, including the amount of the charge, the type of charge, the level of enforcement and the availability of alternatives (if any) to using the priced facility.

Road pricing is based on the fundamental assumption that a new equilibrium solution can be reached, such that deadweight losses11 can be eliminated, by adjusting the private costs of driving felt by drivers to match the social costs their driving produces. There is empirical evidence as well as theoretical support showing that, in the case of automobile transportation, road pricing is an effective transportation demand management approach. In the case of passenger transportation, the decision maker is the unit of demand. This translates into a clear situation, from a behavioral point of view, in which the individual making the travel decision directly feels the impact of the tolls.

The case of urban freight is very different than the passenger case. Although freight road pricing has been generally successful in achieving certain policy goals such as the generation of revenue, a significant body of evidence questions the effectiveness of freight road pricing for the specific goal of shifting urban truck traffic from regular business hours to the off-hours. There are many

[11] A deadweight loss indicates the economic inefficiency or the cost to society when total welfare is not maximized. This loss in economic welfare may be due to market failures or to government interference (e.g., taxes or quotas).

reasons for this, but the most important factor is the fact that receivers are the key decision-maker when determining delivery times.

Specific lessons to be learned from the analyses of these behavioral data are that: (1) carriers have a limited ability to unilaterally change delivery times as the receivers must be willing to change their operations to accommodate the new delivery time in the off-hours (where additional costs may be incurred due to the need for additional staff and operational cost expenses that would not accrue during the regular hours); and, (2) it is unlikely that cordon tolls alone on freight vehicles will be an effective measure in inducing delivery switches to the off-hours due to the limited ability of carriers to provide the receivers with a price signal that would induce them to change their behavior.[12]

In order for the carriers to change their behavior, the receivers must agree to the change. A new policy paradigm is needed that addresses this fact. These new policies need to specifically target the receivers of freight in addition to the carriers. These policies shall be referred to as "carrier-receiver" policies. The purpose of these policies is to combine portions of carrier-centered policies (e.g., freight road pricing) with policies that center on the receivers.

An analysis of policy alternatives carried out by the Project Team using behavioral models showed that a financial incentive would induce receivers to switch to the off-hours.

A pilot test of policies designed to foster off-hour deliveries by targeting receivers was conducted in Manhattan by Holguín-Veras in the fall of 2009. The pilot test targeted food and retail establishments. Twenty-five receivers and eight carriers successfully participated. Instead of using the approach of charging carriers more for delivering during the regular hours, a financial incentive was provided to receivers to induce them to agree to receive deliveries during the off-hours.

[12] Holguín-Veras, J. (2006). Potential for Off-Peak Freight Deliveries to Congested Urban Areas Rensselaer Polytechnic Institute. http://www.rpi.edu/~holguj2/OPD/OPD_FINAL_REPORT_12-18-06.pdf.

Congestion pricing may reduce congestion by inducing behavioral changes in key areas of travel patterns, including time of day, route and even mode choice of discretional traveling. However, freight carriers may not have flexibility in their travel patterns as those decisions are restricted by their fixed assets and customer requests.

The conclusions of the Study Team's analysis:

- Financial incentives to receivers (e.g., tax breaks) would allow carriers to change their hours, thus significantly reducing their travel time and service time (time required to make deliveries) and costs.

- This would also produce benefits for all other roadway users.

- Pricing schemes can raise revenues to offset the costs of the incentives to receivers.

    - Such pricing schemes may be of many sorts, static and dynamic, and based on travel or parking.

- Pricing schemes alone—without incentives to receivers—are ineffectual in shifting truck traffic to off hours.

III.B City Logistics

Policy initiatives for city logistics include road pricing, licensing, regulation, and parking and unloading strategies. Licensing and regulation include policy measures such as vehicle restrictions, time-windows, load factor controls and low emissions zones.

A literature review shows that:

- Road-pricing alone (without complementary receiver incentives, as shown in the pricing task) are ineffective in improving freight-traffic flow.
- Vehicle restriction, a form of licensing or regulatory control, generally has negative impacts on city accessibility, environmental quality, and logistics costs, and can increase the total number of vehicles in a city. On the other hand, relaxing vehicle restrictions has shown positive influence on transport efficiency.
- Results from *load factor control* initiatives are predominantly positive, but enforcement of this policy is not easy. It is therefore questionable whether this is the best measure to encourage carriers to consolidate loads outside city centers in order to reduce the number of partly loaded or empty vehicles in the city.
- *Low emission zones* focus on reducing pollution and might increase costs for carrier companies.
- Locally regulated *delivery time-windows* may improve the attractiveness of city centers and the traffic safety for people visiting the city, but these improvements come at the expense of both the environment and the logistics costs. It was also found that relaxing time restrictions and allowing night deliveries might be good for the environment.
- *Dedicated infrastructure initiatives* can originate from the attempt to ban or restrict urban freight operations. They have shown positive effects in accessibility and transport efficiency.
- Parking and unloading policies have been effective in reducing urban congestion, although the overall sustainability of these impacts might be low.

Company-driven initiatives include carrier cooperation, improved vehicle routing, and technological vehicle innovations. As the name implies, carrier-cooperation initiatives require competing carriers to cooperate with each other by consolidating goods at a terminal or by using a neutral carrier, with the objective of reducing the number of half-filled vehicles delivering to the same urban area. Vehicle-routing initiatives aim at improving vehicle routing and scheduling with the objective of reducing, e.g., the number of trips or the total miles traveled. Technological vehicle innovation initiatives are easily implemented because they do not require the carrier to change its operations, but only the type of vehicle used.

- Carrier-cooperation initiatives encourage carriers to voluntarily cooperate among themselves. The results from these policies are mixed: costs to carriers rose in three of the initiatives discussed by Quak, whereas two other initiatives showed a reduction in these costs.[13] An important characteristic of these initiatives is that they do not offer a real incentive for carriers to participate, other than any gains in the public perception for the company's social and environmental reputation. Overall, carrier-cooperation initiatives have shown positive impacts on urban accessibility, on the environment, and on transport efficiency. Increasing the carriers' willingness to cooperate and share valuable information with competitors remains a significant challenge in implementing this type of initiative.

- Technological vehicle innovation: the use of in-vehicle technologies generally resulted in positive environmental impacts. The advantage of this type of initiative is that it usually does not require major changes in urban freight transport operations or infrastructure.[14] However, some initiatives have to be either initiated or funded by governments because companies do not seem to recognize the potential benefits from new technologies and may need incentives to embrace them.

[13] Quak, H. J. (2008). Sustainability of urban freight transport retail distribution and local regulations in cities, Erasmus Research Institute of Management: 1-242.
[14] Ibid.

Physical infrastructure initiatives: In addition to road improvement, physical infrastructure initiatives also include urban consolidation centers, underground logistics systems and standard-load-unit strategies.

- Urban consolidation centers include distribution centers, freight platforms and freight villages, among others. They provide improved results in cases of high frequency and low volume deliveries. Their objective is to bundle inner-city transportation activities to minimize the number of large or partly filled vehicles entering the city. Only a small percentage of carriers use these centers when they are available, particularly in cases where participation is voluntary. Even if policy restrictions are mandated, many carriers still prefer to deliver to stores directly. Another drawback from this initiative is that traffic congestion may increase since a larger number of smaller vehicles would be necessary to deliver the same freight volume to urban centers.
- ~~Underground logistics systems, e.g., pipelines or tube-based transportation, solve almost all negative impacts associated with freight transportation, but at high capital cost. They therefore generally require public subsidies that reflect the public externality benefits.~~

- Standardization of load-units initiatives make transshipment easier and cheaper, increasing accessibility, lowering pollution, increasing efficiency, lowering costs. But they require high initial investment from many stakeholders and their use on a limited scale usually increases total transportation costs.

Transport reorganizing initiatives include strategies such as transport auctions and intermodal transport.

Based on the review of City Logistics options, several initiatives are proposed for implementation in New York City in the short- to medium-term. In summary, the initiatives proposed are:

1. Off-hour delivery program
2. Joint distribution centers
3. Development of pick-up and drop-off points

4. Parking fees initiative
5. Reserved parking areas
6. On-street loading bays
7. Improved traffic guidance

These strategies do not require major changes in infrastructure or capital expenditures, except for the joint distribution center initiative. The strategies could be grouped in three categories, according to their complexity, capital requirements and expected impact on freight traffic.

The first category includes the parking fees, on-street loading bays and the traffic guidance systems, which are less disruptive to current operations. Although these initiatives are not expected to have the highest impacts on freight traffic, previous experience has shown that they can increase its efficiency. These initiatives usually have good acceptance from the different stakeholders involved, which could facilitate their implementation in the short-term.

The second category is composed of the medium-term initiatives 2, 3 and 5. Strategies in this group require higher capital expenditures for the construction of the distribution centers, transshipment platforms, or to acquire the land for the reserved parking areas. If applied as discussed in the previous section, these initiatives have the potential to be highly effective in reducing freight traffic congestion by significantly increasing the efficiency of the urban delivery operations.

The third category includes the off-hour deliveries initiative, which could have the largest impact on the freight traffic in NYC. With an adequate incentive plan, an off-hour delivery program could provide economic benefits to both carriers and receivers, while reducing the externalities associated with freight activities in such a congested area. Special care must be taken to avoid placing excessive burdens on any stakeholder. In order to do this, decision makers should understand the necessary conditions for the successful implementation of off-hour delivery programs and the effects of different incentive plans.

III.C Innovative Techniques for Enhancing Urban Rail Freight Flows, Rail-Truck Transfer, Last-Mile Distribution

The Study Team conducted a scan of urban goods-movement techniques that are not yet in established use in this region but which might address some of the previously identified freight challenges in the I-278 Corridor.

These techniques can be divided into these categories:

- Transport technologies
  - Guideway type (bi-rail, monorail, maglev, “auto-roadway;” tube; rubber wheel, steel wheel, air cushion)
  - Propulsion type (non-linear motor, linear motor, pneumatic)
  - Power units (locomotive, tractor), multiple units
  - Non-automated, automated
  - Shuttles
    - Bi-directional
  - Equipment, e.g.:
    - Rolling Shelf
- Road-rail transfer/interface
  - Interoperable rolling stock (bi-modal equipment requiring varying degrees of customized equipment: RoadRailer, RailRunner, etc.)
  - Railcars that can accommodate highway equipment (with varying degrees of customization and with varying transfer-facility requirements, i.e., Iron Highway/Expressway, Rolling Road/Landstrasse; Trailer-on-Flatcar) without vertical-lift transfer operations (horizontal systems self-loading systems)
  - Interoperable containers (e.g., swap-bodies)
  - Horizontal transfer equipment (e.g., Mobiler)
- Transfer yard design and yard and train operations
  - Bulk transload via containerized intermodal
  - Technology: automated, cranes, size, throughput, etc.

        - Double-decked with truck access likewise submerged
        - Linear transload
        - Yard network/train operations (e.g., block trains/mega-hubs)
        - Relation to ancillary facilities surrounding, and induced facilities
    - Distribution center operations
        - Satellite consolidation centers
        - Vertical
        - Automated
    - First/last-mile shipment/receipt arrangements
    - Information and Communication Technology (ICT) options, or
    - Institutional arrangements
        - Control and access arrangements
        - Financial incentives
        - Tolling policies
        - Regulatory constraints

<u>Transport technologies</u>

The most basic factors related to transport technologies are those related to propulsion and guidance methods; these may be integrally related (as in the case of linear-induction or pneumatic tubes), or not.

While conventional roadway equipment is non-automated, systems with automated, segregated guideways have been demonstrated, as well as systems with semi-automated (i.e., "electronic tow bar") guidance on non-segregated roadways.

Conventional railways use "non-linear" diesel, diesel-electric, or electric motors on two rails, but systems have been demonstrated that use single (mono-) rails and/or linear motors (including maglevs, with varying guidance systems).

Tube systems, powered both pneumatically and with linear electro-magnetic or linear electro-magnetic pneumatic propulsion have also been demonstrated.

While current North American freight railroads are predominantly diesel or diesel-electric-powered, due to a variety of converging factors it is likely that within the coming decades North American railroads will increasingly become electrified.

With the advent of widespread electrification, linear electro-magnetic motors (whatever guidance system may be adopted—i.e., the currently conventional two-rail system, or some other)—will become more common.

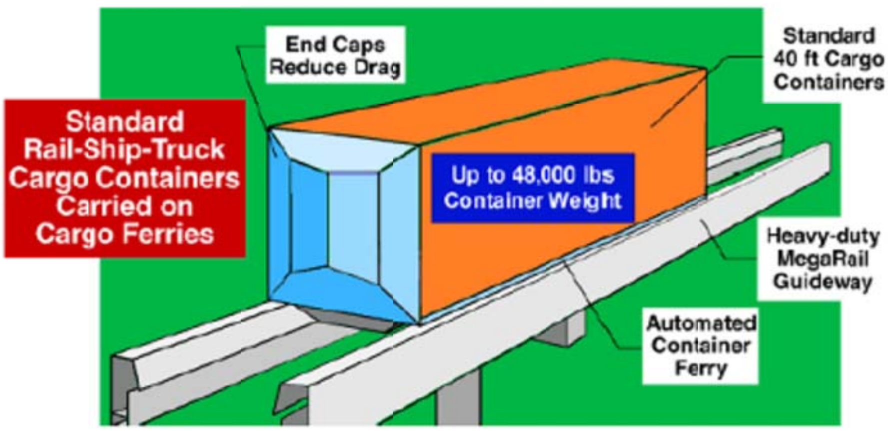
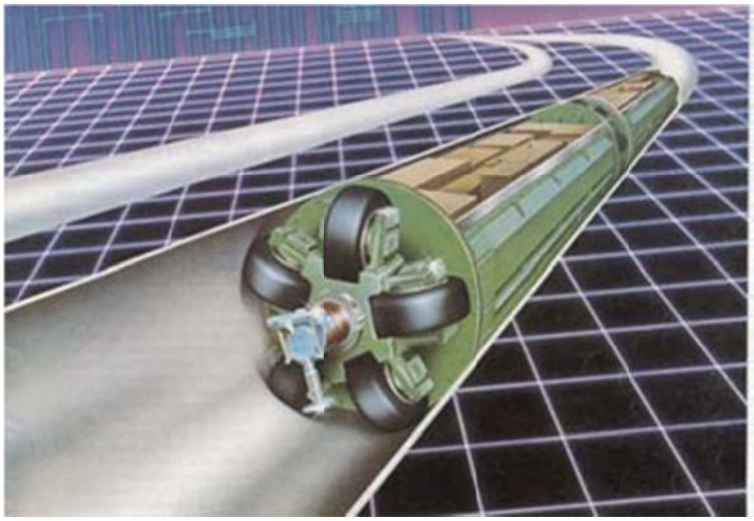


Figure 4. Schematic picture of the CargoRail "Freight Ferry" on the guideway (courtesy of MegaRail Transportation Systems, Inc.)

Figure 10. Transport of containers by the Auto-GO system (courtesy of Titan Global Technologies Ltd.) i



Conceptual Design for a Tube System[ii]

Power units

While conventional railroads use power units (often in distributed form) to propel unpowered cars, the advantages of “multiple unit” technology (which is generally electric [EMUs], but can be diesel [DMUs]) have long been apparent (particularly with regard to rapid-transit) for particular applications.

The advantages of multiple unit technology for freight transport in a region with metropolitan New York’s circumstances (degree of interaction with passenger rail, density, volume of demand, congestion, lack of space)—especially as electrification becomes more widely spread—are apparent (e..g., ability to accelerate and decelerate, with concomitant benefits for capacity and frequency; the operational flexibility accorded shorter [and possibly more-frequent] trains).

Automation

Advantages of electrification include: access to more-reliable, less-polluting, less costly sources of energy; operational benefits; reduced public-nuisance and increased public health and safety; beneficial impacts on capacity.

With an increasing degree of electrification—especially with fixed-guideway systems—automation options become increasingly available.

Automated railway (and other fixed-guideway) systems have been demonstrated in a variety of transit and industrial applications. The difficulties in extending these systems to non-transit and non-industrial applications have largely been due to the degree to which general freight (and passenger) applications take place in less controlled environments (e.g., environments that are subject to the elements, to interference by non-railroad movements [e.g., at-grade road crossings], to unrestricted access [trespassing], and to non-routine routes and schedules).

Figure 11. AGV operating in European Combined Terminal (ECT) in Rotterdam, Netherlands (obtained from Frog Systems website)

Figure 13. Kögel Kamag AGV for Port of Singapore (obtained from Kögel Kamag website)

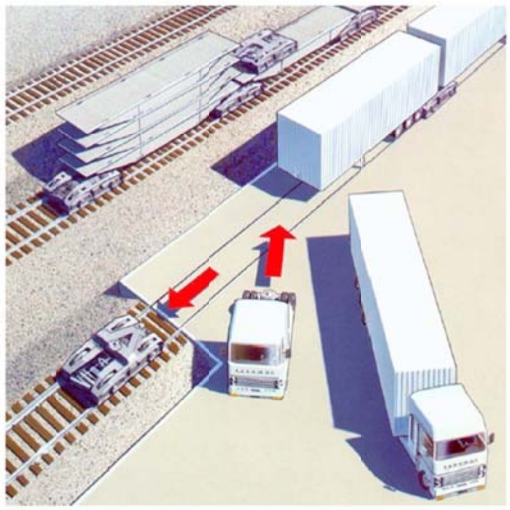
Figure 16. CombiRoad vehicle at the testing facility in Ridderkerk, Netherlands (courtesy of TNO) iii

<u>Shuttles</u> can offer high-frequency service customized to volume demands and may involve automated and/or bi-directional equipment and/or multiple-unit equipment (EMUs/DMUs). Example: CargoSprinter.

CargoSprinter[iv]

Bi-modal technologies include equipment such as the generally similar RoadRailer, RailRunner, Combitrailer, Rail-Trailer, E-Coda, and Combitrans products. This type of equipment has evolved since the early 1980s, when it came into use in the US and Europe. This type of equipment generally requires dedicated trains (an exception is RailRunner), it allows the same trailer/chassis combination to be mounted directly on rubber wheels or rail bogies. The horizontal transfer between rubber or steel wheels minimizes yard costs; reduced yard costs in turn allow smaller, more-dispersed facilities that can reduce dray distances.

v

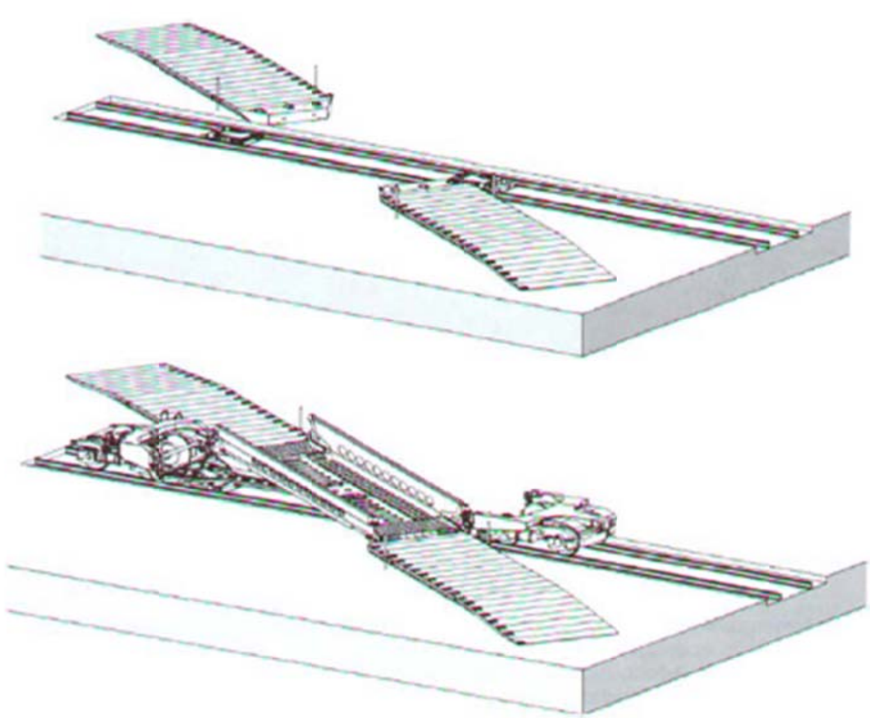


Coda-E (Netherlands and Sweden) vi

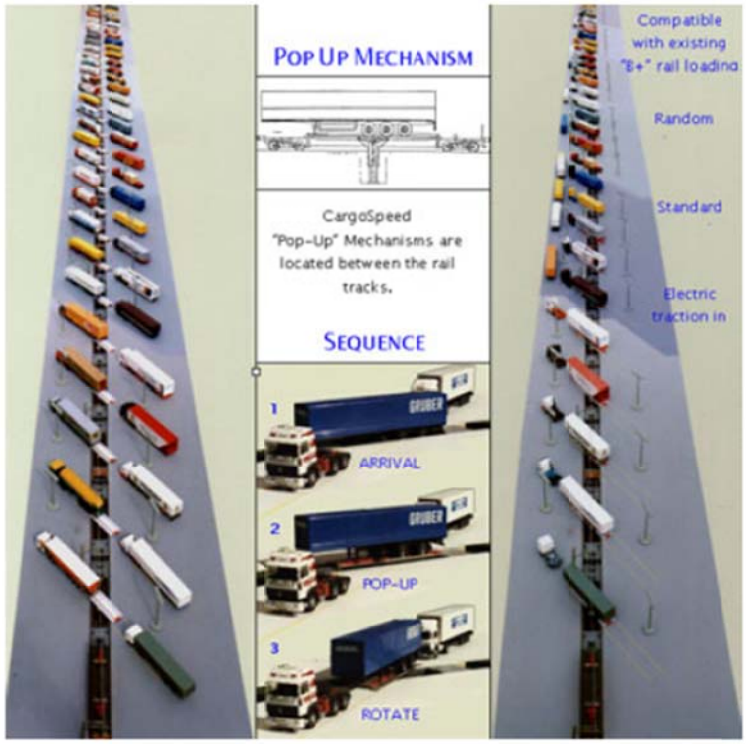
Horizontal transfer technologies

As a group, horizontal transfer technologies share many of the advantages of bi-modal systems; yard requirements are relatively modest, allowing the potential for relatively short hauls. They also offer additional advantages (and disadvantages). These technologies come in two basic types: those that do not require any specific kind of non-rail equipment (i.e., container, trailer, or chassis/truck type) and those that do require specialized containers and roadway equipment.

- Horizontal transfer with non-specialized roadway equipment. One type of system (e.g., Iron Highway, Expressway), involves continuous 10-car-length platforms with moveable hitches on articulated bogies that are loaded circus-ramp style. In another system, Rolling Road, tractors are left hitched to the trailers and the drivers stay with the truck or ride in a passenger car ("accompanied transport"). A third type (e.g., Modalohr, CargoSpeed) uses turntables or swiveling pockets beneath the track to twist flatbed cars at an angle to allow the loading of trailers by tractors. Like bi-modal systems, they offer the advantage of inexpensive yards that are potentially suitable for short-haul rail, with the additional advantage that no custom trailers or chassis are needed: any trailer or container-on-chassis, including any form of specialized trailer (e.g., a tanker) of any standard length, can be accommodated.



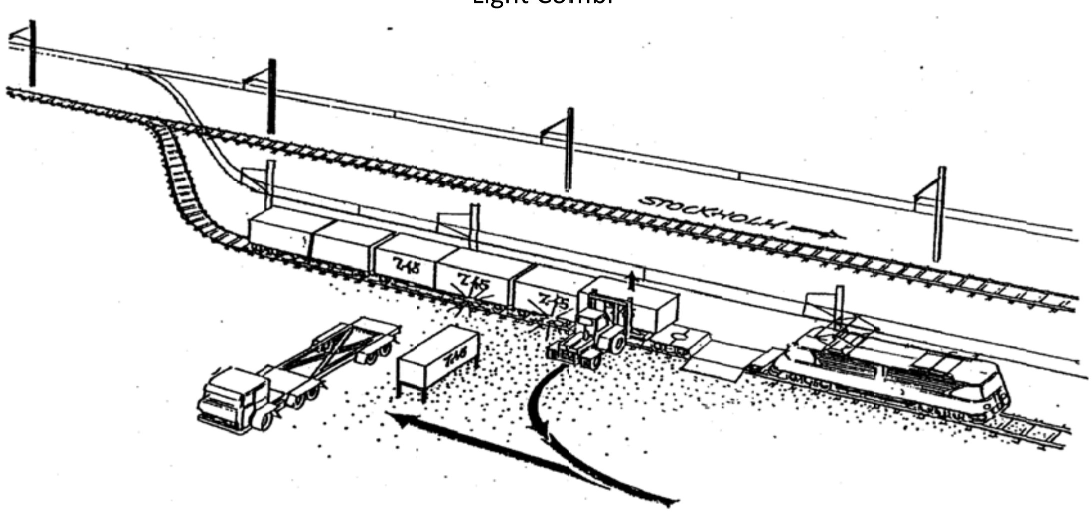
Modalohr France



The CargoSpeed System [vii]

- Horizontal transfer with specialized roadway equipment. In this type of system (e.g., Light Combi, Kombilifter, CarConTrain, Steelbro Sidelifter) various types of containers and swapbodies are moved on and off rail cars with other specialized forms of moving equipment.

Light Combi



[viii]

Kombilifter

ix

CarConTrain

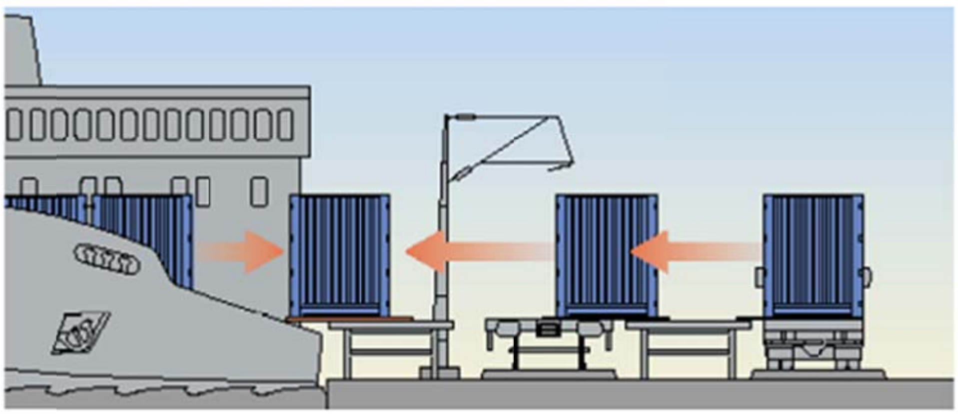


Figure: Example of a horizontal transfer system, the Swedish CarConTrain system (CCT). The system can transfer containers and swap-bodies of different widths and lengths between different modes of transport and to and from storage positions. The system can be fully automated.

x

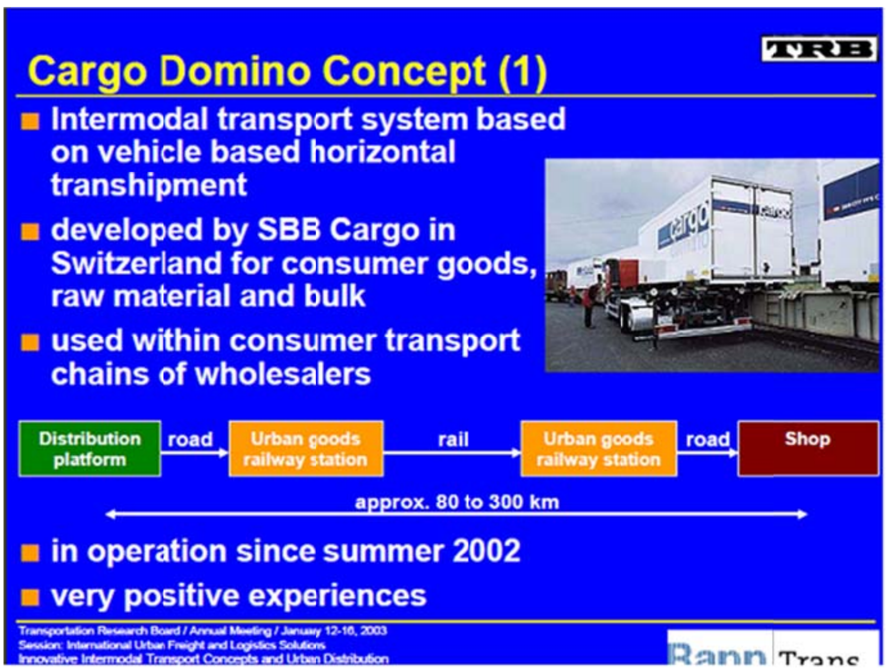
Steelbro Sidelifter

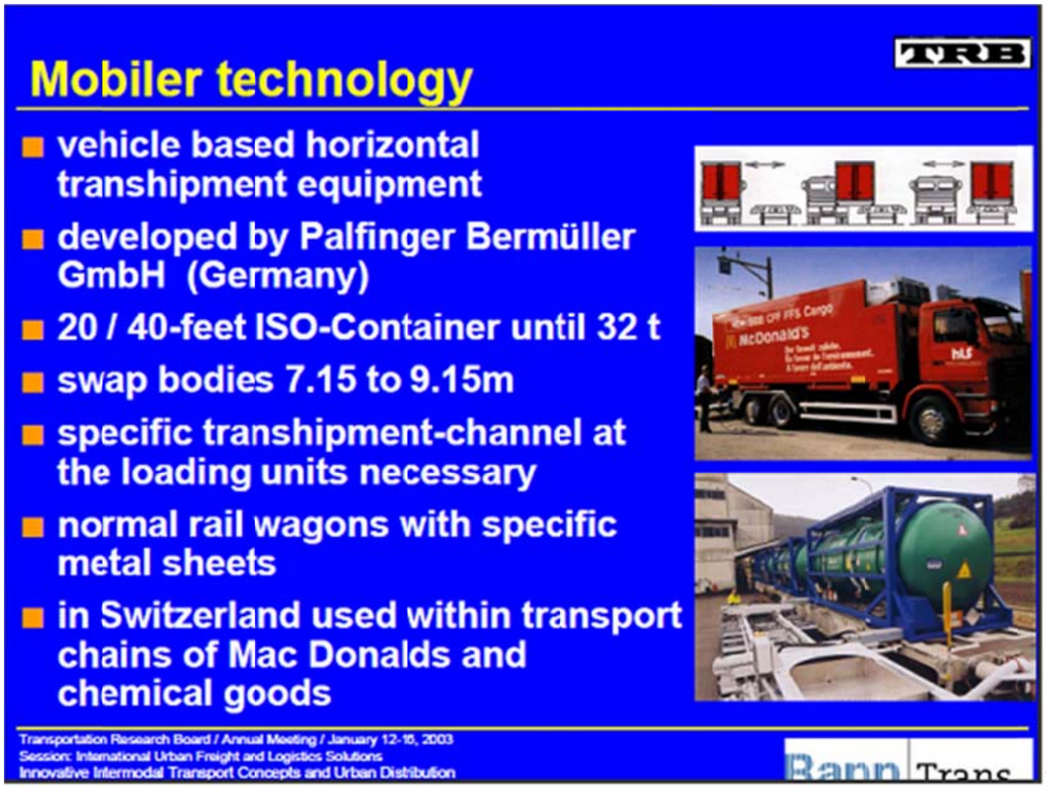
xi

- Horizontal transfer equipment requiring specialized containers and roadway equipment. These technologies (ACTS, CargoDomino, Cargo Express/Mobiler) require custom rail and rubber-wheel equipment to achieve the same advantage of low yard costs, so that decentralized, small-scale facilities sited near the final receiver can be feasible.

ACTS

xii





[xiii]

Interoperable Containers

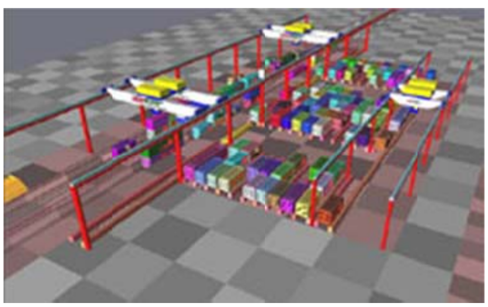
One type of interoperable container that is in wide use in Europe but relatively uncommon in the US is swap-bodies. The differences between swap-bodies and conventional trailers are that they are not mounted on chassis when they are carried on railcars and that they have foldable legs which, when extended, allow the container to be placed on the ground at the height of a loading dock so that they can be loaded and unloaded in the absence of a chassis, and they can be mounted or dismounted from a chassis by a tractor-trailer driver without the use of a vertical lift device or any other assistance. Given the advantages they offer over conventional trailers mounted on chasses, they may have particular relevance for the NY region. Another type of technology is modular boxes (e.g., Combibox).

xiv

xv

Yard technology

There are various options for increasing yard capacity on a small footprint through combinations of small-scale design, double-decking, and automation. Working examples may be found in Verona (Compact Terminal/CargoDrome) and Amsterdam.



xvi

The Study Team identified several criteria to assess the viability of these freight distribution options given current and projected conditions in the metropolitan region:

- Backward and Forward Adaptability. Is the technology compatible with existing technology so that it can be used now or in the near-term without displacing other long-term options (Adaptability-Present)? Does it maximize the utility of existing facilities and minimize disruption to existing facilities? Does it permit operations within the constraints of the region's existing infrastructure (e.g., the LIRR third rail east of Jamaica, Queens, whose horizontal clearance constraints preclude the use of conventional double-stack well-cars)? Does it take maximal advantage of existing rail capacity and ROW? Is it compatible with the overall regional freight distribution system? Does it provide for direct access to the Hunts Point Market food distribution center? Can it be readily adapted to potential future conditions (Flexibility-Future)?

- Standardization, global interoperability. Is it compatible with the standard gauge, standard clearances, motive power, grades, speeds, braking systems, signalization and control technologies? Does it use standardized (preferably modular) container units? Can these container modules be efficiently transferred between modes? (And can the transport equipment [rolling stock] be moved between networks [e.g., rail and road, or various rail systems]. Or does the modular container system itself facilitate the customization of network segments for specialized equipment adapted to local conditions)? Is it compatible for operation with shared passenger systems?

- Ease of automation.

- Security enhancement.

- Robustness/redundancy.

- Minimize economic, environmental, social costs; maximize benefits. Is it efficient in terms of cost and energy use? Does it maximize the capacity of roadways, rail lines and terminals, and distribution centers? Does it increase system velocity? Reduce system space requirements? Minimize emissions of air pollutants and noise?

- Conducive to a bilateral port.

- Promotes efficient competition.

IV. Potential Corridor Actions

This section sets forth short- and long-range roadway improvement opportunities and policy changes for the I-278 corridor and its environs. The proposed recommendations build upon the detailed analysis contained in the existing conditions subtask of the report (Task 2.1) and aim to reduce congestion and improve efficiency in anticipation of likely future growth (Task 2.4). These improvements and recommendations are designed to complement existing public agency plans for improving movement through the corridor.

The basic objective is to make the I-278 corridor more efficient in serving freight and passenger movements. Accordingly, the report presents a broad range of improvement possibilities. Suggested actions include operational and physical improvements, priority lane treatments, and tolling policy changes.

IV.A Summary of Physical Highway Treatments

Shoulders and bays. Shoulders along freeways provide space for vehicles to pull out of moving traffic lanes during break-downs and emergencies, and they provide space for emergency maneuvers that help vehicles avoid accidents. In these ways, shoulders help reduce the extent of non-recurring congestion when incidents do occur, and they improve the safety of a roadway.

While shoulders are common on most modern freeways, on I-278 approximately 25.5 of the 70 miles of roadway in both directions are without shoulders. Eight feasible sites for shoulder or bay improvement identified in an initial screening were ranked according to three criteria: high accident and injury rates; low level of service (LOS); and distance from other shoulders or bays. Candidate locations that ranked high with regard to all of these criteria were given a high rating; those that ranked high with regard to two of those criteria were given a medium ranking; locations that ranked high with regard to one or none of these criteria were given a low priority.

This system of ranking resulted in one high-priority shoulder opportunity, one medium-priority shoulder opportunity, and 6 low-priority shoulder and bay opportunities.

Figure 4.1.18: Locations of Proposed Shoulders and Bays

- High Priority
  - Westbound – near Amity St. – Brooklyn

- Medium Priority
  - Westbound – near 65th Pl. & Laurel Blvd – Queens

- Low Priority
  - Westbound – near Brooklyn Heights – Brooklyn
  - Westbound – near 70th St. – Queens
  - Westbound – near 65th St. – Queens
  - Westbound – near St. Michaels Cemetery – Queens
  - Eastbound – near 92nd St. – Brooklyn
  - Eastbound – near 65th Pl. – Queens

Elimination of highway access points. Because I-278 travels through a dense urban area and connects with several river crossings and other freeways, it has several clusters of very closely spaced entrances and exits. The western section of the Staten Island Expressway, the segment of the Brooklyn-Queens Expressway (BQE) that connects with the East River bridges, and the section of the BQE between the Kosciuszko Bridge and Queens Boulevard have particularly high densities of access points.

The main reason for removing ramps on I-278 is to improve freeway flow. In several sections of the corridor, service roads parallel the freeway and could accommodate displaced traffic. In the case of this report's recommendations, which deal specifically with improving the movement of freight through the corridor, special consideration is given to areas of high importance for freight movement so that direct access to or from these areas is not compromised.

After these criteria were applied to each ramp, a ranking was calculated to determine the desirability and feasibility of removal. The safety, level of service, and lane-length criteria were analyzed to give each ramp a desirability ranking for removal of low, medium, or high. The existence of add-a-lane entrance ramps, exit-only ramps, or connections with key infrastructure then determined whether or not a ramp could be removed. Because ramp removal is a significant action to take, only ramp removals that ranked medium or high and were not eliminated for other reasons are recommended for consideration. Nonetheless, temporary closure may be an appropriate first step at these locations before permanent removal is considered. Further traffic-impact analyses at these points are essential before any decisions to close the ramps are made.

Ramp metering. Ramp metering is a freeway-management system that regulates the flow of vehicles entering a highway from the highway's entrance ramps. The main objective is to smooth the flow of merging vehicles so that freeway travel speeds can be maintained and so that the bottlenecks caused by many cars trying to merge into a single lane at one time can be avoided. Usually a single lane is metered. Sometimes, a second non-metered lane is provided for buses and car pools.

In already-congested sections of I-278, reducing the additional pressure of multiple vehicle merges at one time can help maintain the freeway traffic flow and prevent merges worsening existing congestion.

After each of the ramps that passed the initial screening was evaluated based on the four criteria, 6 entrance ramps were recommended for metering based on their combination of desirability and feasibility factors.

Ramps that fed into sections of freeway with low LOS and high accident rates were given a high desirability for metering. Those with low LOS but average or below-average accident rates were given a medium desirability. As stated previously, metering ramps that feed into highly congested segments of roadway is most desirable since metering aims to reduce pressure caused by merges on already-congested sections of a freeway. However, at a certain threshold of congestion, metering will not improve traffic flow because the volume on the road already exceeds the roadway’s capacity. Similarly, if the ramp’s volume-to-capacity ratio exceeds the ratio of the freeway that it feeds into, metering will not be effective. Since ramp volumes were not obtained for this analysis, all ramps identified for metering should be studied further to ensure that congestion is not so heavy as to minimize the effectiveness of meters.

After the initial screening was made according to LOS and safety, those ramps with inadequate queuing space or acceleration lanes and those that connect to critical or significant freight-related infrastructure were eliminated from consideration, even if they are otherwise highly desirable for metering. Those ramps with sub-standard geometry (i.e. inclines) were given a low feasibility ranking. Any ramps that met the recommended ramp and acceleration lane lengths and did not obstruct freight movement were given a high feasibility ranking.

The study recommends that New York State Department of Transportation (NYSDOT) further assess the feasibility of installing ramp meters at the following entrances:

- High Priority
    - Westbound Old Fulton St. entrance
    - Westbound School Rd. entrance

- Medium Priority
    - Eastbound Slosson Ave. entrance
    - Eastbound Sands St. entrance
    - Eastbound Tillary St. entrance

- Eastbound Broadway entrance

Replace left-side freeway access. Left-side freeway entrances and exits are considered non-standard in modern highway design. They violate the basic principle of design consistency since most access is provided from the rightmost travel lanes. They require entering and exiting vehicles to use the higher-speed travel lane, which interrupts the flow of vehicles traveling in the fastest lane and forces extra lane changes.

Since trucks are prohibited from using the leftmost travel lane, they must change lanes immediately after entering or immediately before exiting a freeway with left-hand access points, which is likely to disrupt the flow of traffic.

There are four left-side exits and three left-side entrances along I-278 in New York City. Five left-side exits/entrances were recommended for removal and replacement due to a segment LOS of E or greater.

- High-Priority Removal (shown in Figures 5-6 and 5-7)
  - Eastbound I-87 exit
  - Westbound Sheridan Expressway entrance (Plans to reconstruct the Sheridan-Bruckner interchange should incorporate right-side access - see Section 6, Long Range Improvements).

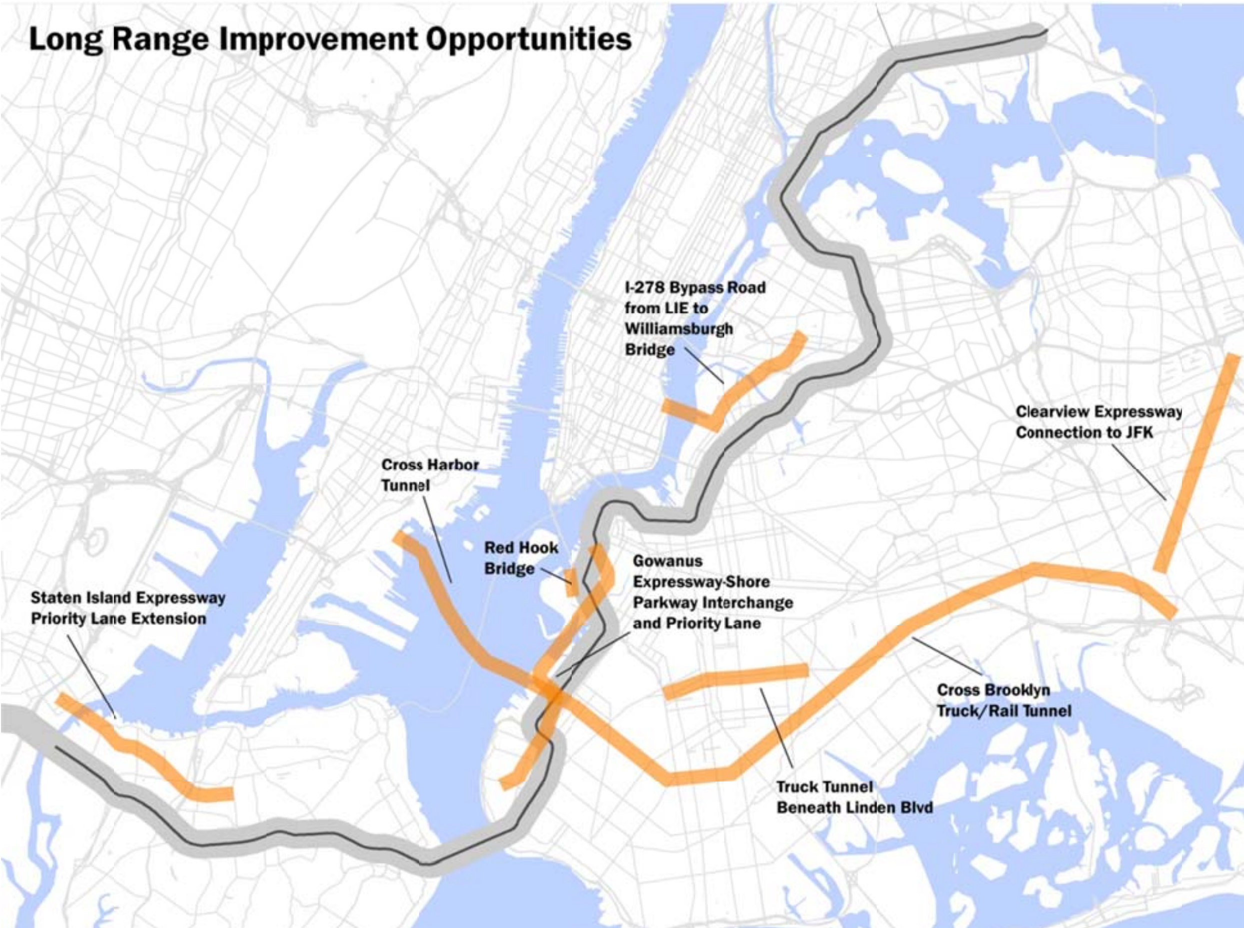
- Low-Priority Removal
  - Eastbound Belt Parkway East exit
  - Eastbound Shore Parkway Entrance (This will require major reconstruction)
  - Westbound Shore Parkway Exit (This will require major reconstruction)

IV.B Long-Range Improvements

The need to modernize and rebuild the Gowanus Expressway has long been recognized. Numerous studies and environmental assessments have been prepared over the years to address major safety and congestion problems. Existing plans call for widening the Staten Island Expressway to eight lanes and extending the median bus lanes from Slosson Avenue to Victory Boulevard.

In addition to the major improvements planned by public agencies for the I-278 corridor, several additional opportunities for longer-term improvements emerged from a review of existing and likely future roadway systems. These opportunities – including some "visionary policies" – attempt to further improve freight and general traffic flow through the broader I-278 corridor. The discussion that follows describes the features, benefits, impacts, and implementation concerns associated with each possible improvement. The more promising options are shown in Figure 4.1.19. All would require substantial capital investment and therefore should be evaluated along with other capital needs.

Figure 4.1.19: Long Range Improvement Options



The Study Team recommends that these additional long-range improvements to the Corridor be considered:

- Rebuild the Gowanus- Shore Parkway interchange and replace existing expressway.
- Extend the SIE preferential treatment from Victory Blvd to the new Goethals Bridge, improving inter-state transit mobility.
- The construction of a Cross-Brooklyn freight tunnel using the southern east-west segment of the Bay Ridge rail line right-of-way (about 8 miles) could provide needed efficient freight routes through southern Brooklyn.

- A parallel exclusive right-of-way for trucks and buses traversing I-278 between the BQE-LIE interchange and the Williamsburg Bridge connection would have several advantages.

- Development of an exclusive truck/bus tunnel between the Clearview Expressway and JFK Expressway would provide an alternate route for trucks destined to or starting at JFK International Airport.
- The Linden Boulevard tunnel would consist of a 3.5-mile tunnel that would connect the Prospect Expressway around Caton Avenue with Linden Boulevard just east of Kings Highway, thereby bypassing the narrow congested roadway to the west. Given the heavy transit ridership in the Church Avenue-Linden Boulevard corridor, the tunnel could also accommodate buses operating as Select Bus Service (or BRT).
- The possibility of a new water crossing that connects Red Hook with Third and Fourth Avenues in Brooklyn should be explored.

IV.C Summary of Preferential Treatments

Priority lanes give preferential treatment to special groups of roadway users by allowing only those targeted users access to the designated lanes. The selected users can then bypass congestion in the regular (mixed-use) travel lanes. Preferential treatments are implemented to promote the efficient movement of certain types of vehicles, in the case of trucks and buses, and to encourage modal shifts that make more efficient use of the roadway, in the case of buses and high-occupancy vehicles.

There are currently segments of I-278 that accommodate preferential bus lanes. Buses are given preferential treatment on the Staten Island Expressway between Slosson Avenue and the Verrazano-Narrows Bridge toll plaza in both directions and on the inbound/eastbound Gowanus Expressway via a contra-flow lane from 92nd Street to the Brooklyn Battery Tunnel (BBT), except for a 10-block gap between 55th and 65th Streets. On the latter, passenger cars with three or more occupants can also use the inbound lane (assuming they have EZ-Pass) from the Belt/Shore Parkway to the Brooklyn Battery Tunnel between 6 AM and 10 AM. Outbound/westbound buses travel in the mixed-traffic lanes, except through the section of the Staten Island Expressway where exclusive bus lanes exist. There is no preferential treatment for trucks along I-278.

Adding new lanes to be designated for preferred roadway users along the sections of I-278 that do not currently have them would be very costly due to the freeway's constrained right-of-way. Taking a lane from existing traffic in the peak direction is likely to lead to unacceptable levels of congestion in the mixed-traffic lanes and could produce unacceptable congestion in the remaining lanes.

To analyze the feasibility and desirability of each possible take-a-lane and add-a-lane treatment, the volume-to-capacity (V/C) ratios of eight segments of I-278 were assessed in each direction in both the AM and PM peak periods under different preferential lane treatment policies. In doing so, V/C ratios under existing conditions were assessed to determine whether a preferential lane was needed; the V/C ratio of the potential preferential lane was determined to assess whether implementing the treatment would reduce congestion for the selected user; and the V/C of the remaining lanes were measured to assess whether mixed traffic would be significantly disadvantaged as a result of the preferential lane policy. Though this analysis was conducted for each variation of lane treatments, none proved possible or desirable throughout the entire corridor.

Instead, there are certain interventions that can be made that can provide missing links by implementing contra-flow lanes:

- Gowanus Expressway Contra-flow Lane Extension: A suggested concept for providing a continuous contra-flow inbound bus lane from around 86th Street to the Brooklyn-Battery Tunnel is shown in Figure 4.1.20. The lane extension requires closing the westbound left-side entrance to the Shore Parkway from the Gowanus Expressway during the weekday AM peak period (about 6:30 A.M. to 10:00 A.M.). A similar weekday AM peak period ramp-closure takes place at the westbound ramp to the Prospect Expressway. A movable physical barrier (or traffic posts) should be used to deter errant motorists, and variable message signs should be installed to inform drivers of whether the connection is open or closed. A westbound left-turn lane and adjustments to the traffic signal sequence at the 86th Street-Fourth Avenue junction would be necessary. The extended and continuous contra-flow HOV lane would save about 4,000 travelers an estimated 5 minutes each during the AM peak hour. Fewer than 1,000 outbound travelers would be inconvenienced by having to exit at 39th Street and travel to Shore Parkway via Second Avenue.

Figure 4.1.20: Gowanus Contra-flow Lane Configuration

- Williamsburg Bridge Contra-flow Lane: A westbound AM peak-period contra-flow lane on the BQE approach to and across the Williamsburg Bridge would give buses, carpools, and light trucks priority access to Lower Manhattan.

- BQE/Kosciuszko Bridge Priority Lanes: After the new Kosciuszko Bridge over Newtown Creek is completed, it will be feasible to implement a northbound PM peak contra-flow lane for priority vehicles. This lane could extend to the Long Island Expressway interchange.

- Trucks on the Shore Parkway: The prohibition of commercial vehicles along the Shore Parkway is a major constraint for truck travel between JFK and eastern New Jersey. NYC DOT's South Brooklyn Study explored the possibility of allowing trucks on the Belt Parkway and did not support this change. In the future, consideration should be given to permitting certain types of commercial vehicles to use the Shore Parkway, particularly after reconstruction of the roadway. Small trucks (parcel pickups) and larger single-unit vehicles could be allowed on the Parkway between the Verrazano-Narrows Bridge (I-278) interchange and Conduit Avenue on weekdays. Suggested hours are 7 AM to 3 PM eastbound and 10 AM to 7 PM westbound so that these trucks do not add congestion to peak commuting routes.

IV.D Summary of Tolling Policy Actions

Tolls and other road pricing policies have long been advocated by many transportation and planning professionals as a means of better-managing scarce road space, relieving congestion, and encouraging motorists to pay for the costs they impose on society. In recent years, public officials have increasingly recognized tolls as a way to both increase revenues and reduce congestion.

Tolls are especially important in the I-278 corridor, where major expansion in road capacity is costly and impractical. Pricing can help relieve congestion since additional capacity will be difficult to provide. Changes in toll structure can encourage drivers to modify routes or alter the time of day when travel occurs.

Three separate highway agencies—The New Jersey Turnpike Authority, The Port Authority of New York and New Jersey and The Metropolitan Transportation Authority—collect tolls in the I-278 corridor or at locations that indirectly affect traffic in the corridor.

Impacts of changes in tolls on traffic volumes can be measured using the concept of price elasticity, which is defined as the ratio of the traffic-volume change to the price change. Thus, if the price increased by 50 percent and use of the system declined by 8 percent, the elasticity would be 8 divided by 50: - 0.16.

Various candidate policies relating to tolls were identified. These candidate policies can take many forms, particularly in light of changing technologies that make it possible to collect tolls without requiring vehicles to stop or even slow down at the point of collection. The policies evaluated were:

- Variable tolls on the Port Authority Staten Island crossings and on the Verrazano-Narrows Bridge
- Variable tolls on the Port Authority Staten Island crossings and on the Verrazano-Narrows Bridge – Trucks Only
- Tolling policy changes for the Verrazano-Narrows Bridge
    - Two-way toll
    - Two-way variable toll
    - Two-way variable toll– Trucks Only
    - One-way eastbound variable toll
    - One-way eastbound variable toll – Trucks Only

- New regional toll system keyed to VMT

After evaluating the above policies and other actions the Study Team arrived at the following conclusions:

- Eastbound variable tolls are desirable on the Verrazano-Narrows Bridge. They would complete the system of inbound tolls on water crossings, and enable toll structures to be coordinated with those at the Goethals Bridge. Increased use of E-ZPass, future fully electronic pricing, and planned auxiliary lanes will minimize queuing on the Staten Island Expressway. Provide fully electronic pricing as soon as possible.

- Variable time-of-day pricing has merit although the actual travel impacts will likely be small, based on a review of existing data. An initial step might be to consider removing commuter discounts on existing crossings).

- Possibly providing fully electronic toll pricing on the new Kosciuszko Bridge over Newtown Creek when the bridge is open to traffic would 1) serve to further test the practicality of electronic toll collection, and 2) serve as a precursor to electronic tolling along I-278.

- The existing toll systems in the New York metro region are complex. Toll collection is complicated by the many toll-collecting agencies in the region, each with its own bottom line to consider. Therefore, simplification is desirable, especially over the long run.

- Modern technology can handle any of the toll-collection options. The increased application of global positioning systems (GPS), such as the ones used today to give instantaneous in-vehicle directions, will make these tolling options more reliable, involve no cash, and do away with toll plazas altogether, making concerns like those that led to the eastbound-only toll on the VNB moot. These technologies can also be used to modify the toll system to vary fees based on the time of day.

- Eventually, consideration should be given to expanding fully electronic pricing based or all-electronic tolling (AET) on vehicle type, time-of-day and vehicle miles traveled to other expressways and parkways in the New York metro region.

V. Corridor Development Opportunities and Alternatives

Creating a more-efficient goods distribution network along the I-278 corridor requires a combination of transportation infrastructure improvements and management policies, land use regulations and development policies. The integration of these elements can be as complex as devising, evaluating and implementing individual policy actions, but is essential to achieving multiple goals—improving the flow of freight traffic, reducing friction between passenger and freight transportation, accommodating increased demand and maximizing economic-development opportunities. In particular, both existing and future destinations of different types of goods must be taken into account to prioritize transportation improvements and target land use and economic-development policies, and these approaches should be mutually supportive.

Building on the study's land-use and transportation analysis, the team matched logistics-industry facility needs with potential development opportunities in the corridor, which is defined as any area of Brooklyn or Queens with truck or rail access to I-278, the Bay Ridge Rail Line, Bushwick Branch Rail Line, Montauk Rail Line, or through and local truck routes connected to I-287 or the rail lines. These facility needs and opportunities have the most direct economic implications for both the efficiency of the I-287 freight distribution network and the potential for business development and job creation. Alternative corridor strategies that combine development and transportation actions are then evaluated for a range of economic and environmental benefits.

It should also be noted that two large centers of distribution activity exist along I-278 in Staten Island and the Bronx—the New York Container Terminal in Howland Hook and the Hunts Point Food Distribution Center. While these are beyond the scope of the study area, they affect the demand for logistics facilities in the Brooklyn and Queens portion of the corridor. Both are already the focus of intensive City efforts to expand distribution capacity.

The New York Container Terminal is a valued Staten Island employer and much of the waterfront along the Kill van Kull, including the New York Container Terminal and Port Ivory, has been designated a Significant Maritime and Industrial Area, a designation intended to preserve and enhance maritime uses. Future growth at Howland Hook is constrained by road access. Seventy one percent of the terminal's truck traffic relies on I-278 to access markets in New Jersey and New York, via the Goethals Bridge. There are no direct exits off I-278 to the port complex, requiring truckers to take a circuitous route that is prone to queuing delays. New York Container Terminal, Inc. has proposed to develop a new 50-foot deep container ship berth, to be known as Berth 4, in the northwestern corner of Staten Island on a 39-acre vacant parcel. The proposed berth and associated marine container terminal would be developed primarily on a portion of the former Port Ivory site, a former marine-related site and partial brownfield which is owned by the Port Authority of New York and New Jersey. This proposal to expand the New York Container Terminal onto the adjacent Port Ivory site is currently undergoing environmental review.

The Hunts Point Food Distribution Center is a 329-acre facility that occupies nearly half of the Hunts Point Peninsula in the South Bronx, The peninsula is a diverse, industrial neighborhood with a solid residential community of roughly 12,000 residents. The Hunts Point Food Distribution Center is comprised of over 155 public and private wholesalers, including the Hunts Point Terminal Produce Market, the Cooperative Meat Market, and the New Fulton Fish Market, who generate more than $3 billion in sales annually. The food markets have been concentrated here in recent years and there has been some growth in production and small business incubation with continued attention from the New York City Economic Development Corporation. Any strategy for concentrated and large distribution centers should factor plans by the City of New York to continue and expand the Hunts Point Food Distribution Center that already exists and functions as a key industrial facility for the handling of food products.

V.A. Potential Development Sites in the I-278 Corridor

The five Opportunity Areas identified in the land use analysis in Section II.F. were analyzed to identify sites that could accommodate a range of facility types. These specific sites were identified by selecting clusters of vacant land, parking lots and potentially underdeveloped manufacturing and industrial parcels. The process involved the following steps:

1) For each of the five Opportunity Areas, parcels were selected that either abutted or were within 200 feet of a rail freight line or a through or local truck route.
2) Of these parcels, those selected were either vacant, parking or industrial property in which the actual square footage on the site was less than the potential development possible under current zoning.
3) Either single parcels or groups of contiguous parcels with lot areas of at least 200,000 square feet were selected. As shown in Table 3.4.8, the smallest lot size generally required for any of these facilities is 200,000 square feet for a regional warehouse or a

multi-tenant facility. In some cases, small parcels with other characteristics that abutted these clusters within the same block have been included on each site in order to assemble parcels that would have the area and shape necessary to accommodate the type of buildings described in the previous sections.

4) These sites were assessed against the profile and facility needs of the Opportunity Area.

It is important to emphasize that these sites met minimum requirements for further assessment. There has been no evaluation of topography, existing uses or environmental conditions, much less of market feasibility. Particularly for the sites with multiple parcels, the hurdles to development may be too great to overcome. However, they do indicate the potential for facility development and are a starting point for site-specific analysis.

The following describes the characteristics of the sites identified for each Opportunity Area, and the development alternatives that these imply.

Area 1: I-278 from Bay Ridge to Carroll Gardens

As shown in the map below, the I-278 corridor from Bay Ridge to Carroll Gardens Study Area has only three sites for redevelopment based on the criteria identified above. Two of these sites are located on the eastern side of the Gowanus Canal and the third site on the Southwest Brooklyn waterfront. This area is unique because of the piers, port areas and waterfront uses that are not captured in this classification scheme, but which may be prime candidates for distribution facilities. Fortunately, this area was studied extensively as part of the NYMTC Freight Villages study and the findings are incorporated in the discussion of development alternatives.


Opportunity Sites, I-278 From Bay Ridge to Carroll Gardens
Legend
Selected Sites
Rail Lines
Through Truck Routes
Local Truck Routes
1
2
3

The combined lot area for each site allows buildings that require more than 300,000 sq.ft. of lot size (regional warehouse, multi-tenant, office show room, R&D flex) on sites 2 and 3. Their combined total assessed value is about $6M for Site 2 and $10M for Site 3 and their unused development rights are about 300,000 sq. ft. Site 1 was described above and only has one lot with a current building of 316,000 sq. ft., total assessed value of $13M and about 2.5M unused development rights.

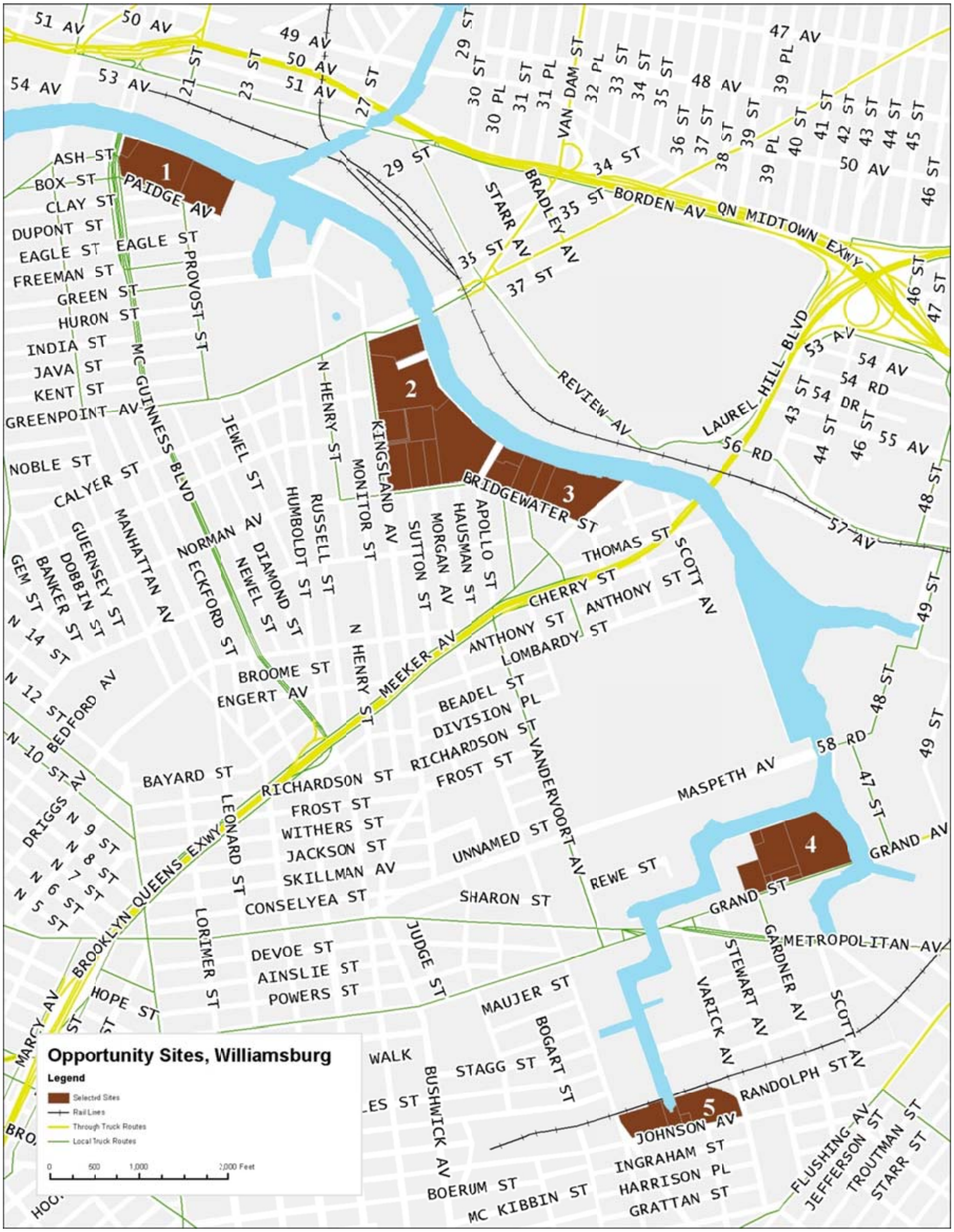
The most potent development alternatives for this area would appear to be focused on Site 1 along the waterfront in the southern end of the area. As a single lot with 1.4 million square feet, most of it unbuilt, it could potentially be redeveloped for a number of logistics uses. Given its transportation access and the business/shipment profile of the Bay Ridge-Carroll Gardens corridor, a multi-purpose facility including some combination of heavy distribution, refrigerated distribution and light manufacturing could be one possibility. Sites 2 and 3 could provide smaller distribution, flex or multi-tenant space.

The larger possibilities for the area, using waterfront and other sites not captured in this analysis, are contained in the assessment of a freight village at Sunset Park by Rutgers University for NYMTC. Facilities supporting their activities include light and heavy warehousing, general light industrial and cross-docking facilities, an industrial park and, usually, intermodal terminals. The study rated Sunset Park highly as a potential location for a freight village, although several issues would need to be resolved.

Area 2: Williamsburg

The Williamsburg Study Area's Opportunity Sites are all located along Newtown Creek and the English Kills, between Guinness Boulevard and Johnson Avenue. The area has five sites for development as shown in the map below. The sites are zoned for heavy M3 manufacturing, have between three and nine lots, and the largest lots vary between 228,000 and 433,000 sq. ft. with industrial and manufacturing buildings on the lots now. The development possibilities on these large lots include: regional warehouse, multi-tenant, office show room, and R&D flex.

The combined lots for each site would permit a broad range of new buildings, including regional warehouse, multi-tenant, office show room, R&D flex, truck terminal, light manufacturing, refrigerated distribution and bulk warehouse. Most of the sites have about 200,000 sq. ft. of developable area. Sites 1, 4 and 5 are valued at between $5-6M and Sites 2 and 3 at between $8-12M. Unused development rights include between 570,000 sq. ft. for Site 5, 662,000 sq. ft. for Site 3, 855,000 sq. ft. for Site 1, 1.8M sq. ft. for Site 4, and 2.8M sq. ft. for Site 2.

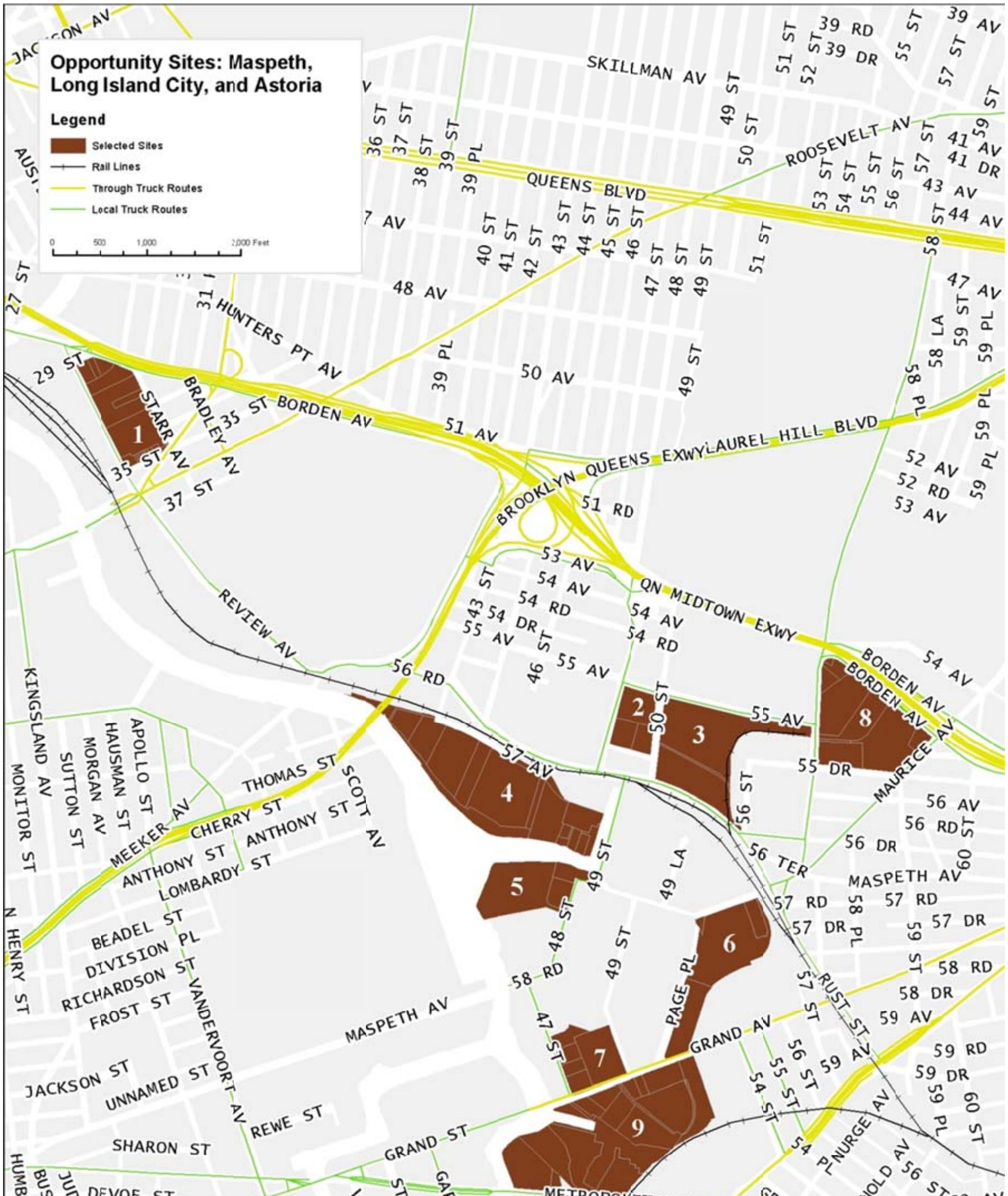

Opportunity Sites, Williamsburg
Legend
Selected Sites
Rail Lines
Through Truck Routes
Local Truck Routes
0
500
1,000
2,000 Feet
1
2
3
4
5
PAIDGE AV
BRIDGEWATER ST
KINGSLAND AV
MC GUINNESS BLVD
GREENPOINT AV
BROOKLYN QUEENS EXWY
MEEKER AV
GRAND ST
GRAND AV
METROPOLITAN AV
MASPETH AV
JOHNSON AV
RANDOLPH ST
QN MIDTOWN EXWY
BORDEN AV
REVIEW AV
LAUREL HILL BLVD
VANDERVOORT AV
CHERRY ST
THOMAS ST
ANTHONY ST
LOMBARDY ST
SCOTT AV
RICHARDSON ST
FROST ST
STAGG ST
BUSHWICK AV
INGRAHAM ST
HARRISON PL
GRATTAN ST
BOERUM ST
MC KIBBIN ST
FLUSHING AV
JEFFERSON ST
TROUTMAN ST
STARR ST

Development alternatives in Williamsburg are shaped by a number of factors. Four of the five sites are in the same general area along Newtown Creek, and two, Sites 2 and 3, are adjacent to each other. Four have water as well as truck access, but only one, Site 5, has rail access. Sites 2 and 4 are relatively large. The major challenge is that there are only a few individual parcels that are large enough on their own, and most parcels are already developed to some degree. Land assemblage could be problematic and expensive.

On the other hand, there would appear to be a strong need for additional distribution facilities of various types and sizes given Williamsburg's business profile. Both wholesalers and a variety of manufacturers are located here, and the Williamsburg rezoning left much of this area zoned for continuing industrial use. While there may be some opportunity for developing a large, multi-purpose distribution facility, it is probably more feasible to develop a range of smaller facilities targeted to particular uses that would not require extensive land assemblage—refrigerated distribution for food, heavy distribution and regional warehouses for other wholesaling, fabricated metals, and other manufacturing, bulk facilities for scrap and construction materials.

Area 3: Maspeth, Long Island City, Astoria

The Maspeth/Long Island City/Astoria Study area has nine potential development sites that are generally located between Borden Avenue/the Queens Midtown Expressway and Newtown and Maspeth Creeks in Queens. The sites in this area are industrially zoned, with a range of light and heavy manufacturing uses. Sites 1, 4 and 9 have more than 25 lots each, Site 8 has 17, and the rest fewer than seven lots or parcels. The largest parcel in Site 3 would allow a regional warehouse, multi-tenant facility, office show room, R&D flex facility, or a truck terminal, while the largest parcels in Sites 5, 6, 8 and 9 would accommodate buildings such as a regional warehouse, a multi-tenant facility, office show room, or R&D flex facility. Site 1's largest parcel would allow a regional warehouse or multi-tenant building while the largest lots in Sites 2 and 7 would not be able to accommodate by themselves any of the types of logistics buildings identified.


Opportunity Sites: Maspeth, Long Island City, and Astoria
Legend
Selected Sites
Rail Lines
Through Truck Routes
Local Truck Routes
0 500 1,000 2,000 Feet

If Sites 4, 8 and 9 were assembled they would allow any of the identified building types. They have between 1.2M and 5.5M sq. ft. of unused development rights and are assessed at $27M to $35M. Site 2 has enough area to support a regional warehouse, multi-tenant building or office show room. Site 7 would allow those buildings or an R&D flex building. Site 5 would allow those building types or a truck terminal.

Since it is the largest of the five logistics areas, it is not surprising that Area 3 has the most numerous and complex development possibilities. Most of the nine sites are clustered at the southern end of the area, and have a mixture of rail, truck and water access. Taken as a whole, the lot area of all of these sites exceeds 13 million square feet. However, most combine a number of small lots with a mix of uses and intensities.

Site 4 is probably the best example of both possibilities and complexities. It includes 30 individual parcels with over 3 million square feet of lot area, of which less than 500,000 square feet is covered by existing buildings. Combining several of these parcels could be a daunting task. However, several lots could be developed on their own. Site 4 (along with Sites 5, 6, and 7) is part of the "Phelps-Dodge"/Maspeth properties involved in the long and controversial history related to plans for a cross-harbor freight tunnel.

In terms of specific land uses, the number of food shipments in the area indicates a need for refrigerated space. This would also be a prime area for a large heavy distribution center or a consolidated distribution complex with multiple uses, including light manufacturing and assembly. An alternative strategy would be a network of smaller buildings that make use of the range of potential development locations.

<u>Area 4: Jamaica</u>

The area in Jamaica, Queens only has one opportunity site. The area in generally located between Dunkirk St and 180 St, Liberty Avenue and 110 Avenue.

The site has 10 lots zoned for light-manufacturing and the largest site is used for transportation and utility making the site difficult to redevelop. The site has 10 lots zoned for light-manufacturing and the largest site is used for transportation and utility making the site difficult to redevelop.

Through land assemblage the site could accommodate several logistics buildings and the largest site could accommodate some smaller building types. Almost 75% of the site is used for transportation. The site's land use and ownership indicate that it is unlikely to be redeveloped, since this would require the use of parcels associated with transportation and utility uses.

Area 5: Flatlands

The Flatlands Study Area has 5 Opportunity Sites which are generally located along the Bay Ridge Rail Line between E 56 St. and E 105 St.

All of the sites are zoned for manufacturing uses, except Site 1, where there are 10 residentially zoned parcels that were included since they are part of the same block on which is located the largest developable parcel in the area, a 238,000-sq.-ft. industrial property. That individual parcel could accommodate a regional warehouse, a multi-tenant building, or an office show room. The lots on Sites 2 through 5 are all zoned for manufacturing. The largest are between 316,000 and 406,000 sq. ft., enough for a regional warehouse, a multi-tenant building, an office show room or a R&D flex building. The number of lots per site varies between one and two for Sites 2 and 5 and between six and seven for Sites 3 and 4.

The assemblage of the sites would allow a regional warehouse, a multi-tenant building, office show room or an R&D flex building on Site 5, and those building types or a truck terminal on Sites 2 and 4. Site 3 could accommodate those building types or a light-manufacturing building. The sites are generally underdeveloped, with low assessed values, and relatively little currently-built area.

Because of the relatively small size of both its logistics sector and development sites, this area is more appropriate for either small, specialized facilities or bulk-storage facilities that could make use of Flatlands' access to the Bay Ridge Line.

Summary

In all, 23 potential redevelopment sites were identified within these opportunity areas. Most sites included multiple properties. In total, these sites included 201 properties, 23.5 million square feet of land, 12.4 million square feet of existing building area, and 31.5 million square feet of unused development rights under existing zoning.

Table 4.1.8: Summary of Potential Development Site Characteristics

Area	Site#	Number of Lots	Lot Area	Building Area	Assessed Total	Unused Development Rights
1-Bay Ridge-Carroll Gardens	1	1	1,445,318	316,478	$ 13,495,500	2,572,666
1-Bay Ridge-Carroll Gardens	2	2	399,635	488,367	$ 5,638,500	312,863
1-Bay Ridge-Carroll Gardens	3	11	332,356	363,405	$ 10,555,200	300,896
2-Williamsburg	1	3	565,875	276,546	$ 5,463,675	855,074
2-Williamsburg	2	9	1,518,901	221,092	$ 12,732,750	2,814,839
2-Williamsburg	3	5	598,844	534,846	$ 8,320,500	662,216
2-Williamsburg	4	8	1,055,436	217,489	$ 6,623,100	1,892,641
2-Williamsburg	5	4	417,785	265,055	$ 6,009,750	570,325
3-Maspeth-LIC	1	25	1,098,720	1,121,976	$ 35,392,648	4,370,971
3-Maspeth-LIC	2	3	293,060	-	$ 2,929,500	586,120
3-Maspeth-LIC	3	5	1,735,202	1,210,426	$ 17,720,100	526,650
3-Maspeth-LIC	4	30	3,011,741	472,043	$ 29,457,460	5,554,368
3-Maspeth-LIC	5	3	527,794	75,655	$ 2,943,900	979,333
3-Maspeth-LIC	6	5	1,139,738	1,245,200	$ 37,677,150	1,034,744
3-Maspeth-LIC	7	7	403,160	724,212	$ 48,519,000	80,989
3-Maspeth-LIC	8	17	2,153,095	870,605	$ 27,670,950	1,276,778
3-Maspeth-LIC	9	26	3,038,346	1,412,362	$ 35,964,450	4,661,396
4-Jamaica	1	10	887,802	437,786	$ 7,370,550	450,492
5-Flatlands	1	11	259,220	168,390	$ 3,339,874	88,719
5-Flatlands	2	2	733,388	1,087,000	$ 21,510,000	161,346
5-Flatlands	3	7	794,607	254,571	$ 5,540,850	1,333,697
5-Flatlands	4	6	702,228	400,806	$ 5,721,300	299,125
5-Flatlands	5	1	406,000	274,340	$ 6,030,000	129,920
TOTAL	23	201	23,518,251	12,438,650	$ 356,626,707	31,516,168

V.B. Evaluation of Alternative Corridor-Development Strategies

The potential development sites identified above were consolidated into three alternative configurations reflecting different strategies for accommodating an increased volume of freight. Each of these strategies was then associated with combinations of transportation recommendations that would have the most impact on the locations and facility types specified in each strategy. The strategies were then evaluated against potential benefits, costs, and impacts using tools developed in previous tasks.

The three strategies outlined below would target these development opportunities with a range of public policies and investments. The first strategy would take advantage of economies of scale and concentrate the development of new logistics facilities in a few locations. It would reinforce the clustering of similar activities, but would require the most aggressive set of public policies to support land assemblage, site-specific infrastructure investments, and business attraction. The second strategy would encourage infill development on a wider range of smaller sites. This would still require some land assemblage and land use and development policies that would support new facilities in appropriate locations. The third strategy would not target any specific locations, allowing the market to respond to the demand for new facilities under existing land-use and development regulations.

Strategy 1: Concentrated, Large Distribution Centers

This strategy would promote concentrated development of large facilities or clusters of buildings in a few locations in the five opportunity areas. The approach would have several advantages from both an economic and transportation perspective. The advantages of urban consolidation centers include environmental and social benefits due to the more-efficient and less-intrusive transport operations. These initiatives usually lead to better planning and logistics operations and promote the introduction of new information systems and the implementation of better systems for inventory control. Consolidation centers can also be integrated with other policy and regulatory initiatives, particularly those promoting greener and more sustainable last-mile deliveries.

Successful implementation can be difficult to achieve. There are high initial costs, a need for strong involvement by public institutions, and the need for strong participation by carriers to achieve the volume necessary for economies of scale. The specific location of the consolidation center has major impacts on its success or failure through its effects on implementation costs, carrier participation, and minimizing the total number of vehicle miles traveled.

There is no minimum size for an urban consolidation center, but the RPI research team estimated that the total area needed to establish a center with the capacity to handle New York City freight volumes on a daily basis is approximately 500,000 square feet. Of the 23 potential development sites in the five opportunity areas, 16 could theoretically accommodate a center of this size. Eleven of these are either in Williamsburg (Area 2) or Maspeth-Long Island City-Astoria (Area 3). Nine of these are grouped in a relatively small area on either side of Newtown Creek. These two areas also have the largest concentrations of existing destinations for freight carriers. One site in Area 1, the Brooklyn Meat Market site, is a single lot with 1.4 million square feet.

These ten potential locations are shown in Table 4.1.9. Although four sites in Flatlands and Jamaica meet the threshold lot area for a large distribution center, these areas have relatively small concentrations of freight-related businesses and destinations. Two sites in Areas 2 and 3 were also not included in this strategy since they are outside of the core areas with concentrated logistics activities and development sites. While these other sites could be targets for a consolidated freight activities, this policy scenario focuses on areas where these would be most likely and which could accommodate the largest amount of new development.

Table 4.1.9
Potential Development Sites for Strategy One

Area	Site#	Number of Lots	Lot Area	Building Area	Assessed Total	Unused Development Rights
3-Maspeth-LIC	3	5	1,735,202	1,210,426	$ 17,720,100	526,650
3-Maspeth-LIC	4	30	3,011,741	472,043	$ 29,457,460	5,554,368
3-Maspeth-LIC	5	3	527,794	75,655	$ 2,943,900	979,333
3-Maspeth-LIC	6	5	1,139,738	1,245,200	$ 37,677,150	1,034,744
3-Maspeth-LIC	8	17	2,153,095	870,605	$ 27,670,950	1,276,778
3-Maspeth-LIC	9	26	3,038,346	1,412,362	$ 35,964,450	4,661,396
2-Williamsburg	2	9	1,518,901	221,092	$ 12,732,750	2,814,839
2-Williamsburg	3	5	598,844	534,846	$ 8,320,500	662,216
2-Williamsburg	4	8	1,055,436	217,489	$ 6,623,100	1,892,641
1-Bay Ridge-Carroll Gardens	1	1	1,445,318	316,478	$ 13,495,500	2,572,666
TOTAL		109	16,224,415	6,576,196	$ 192,605,860	21,975,631

In addition to these sites, the 97 acre (4.2 million square feet) site of the Brooklyn Army Terminal was identified as the location of a potential Freight Village by the NYU-Rutgers team for the NYMTC Freight Villages study. Proximity to the 65th Street Rail Yard and the South Brooklyn Marine Terminal, in addition to I-278, make this a particularly attractive site for concentrated logistics activity.

As a scenario for evaluating a strategy of concentrating new distribution capacity, Strategy One assumes development of a freight village in Sunset Park and the development of an equivalent amount of space in 2-4 locations in Williamsburg or Maspeth near Newtown Creek. Specifically, potential sites include:

- Sunset Park Freight Village
- Sites 2, 3 and 4 in Williamsburg
- Sites 3, 4, 5, 6, 8 and 9 in Maspeth-Long Island City

The amount and type of development assumed for these sites is taken from the Freight Villages study and the study team's analysis of logistics facilities requirements. This translates into 1.8 million square feet of building space on the 4.2 million square feet of lot area. Development in the Williamsburg and Maspeth areas is assumed to cover similar acreage with the same average lot coverage. The same 4.2 million square feet would represent 28% of the 14.8 million square feet on the nine potential development sites. Unlike the Sunset Park space, land assemblage would be required on any of these sites, although several have large parcels that could accommodate all or most of a consolidated distribution center.

The program for the space would likely be different from that for the Sunset Park facility. Refrigerated warehouse space would be a large component to accommodate latent and future demand, and both heavy and light distribution space with some value-added light manufacturing could meet a diversity of business needs. One potential configuration might be a 1-million-square-foot refrigerated warehouse facility, a 1.6-million-square-foot heavy distribution facility, and two 800,000-square-foot consolidated distribution centers for light warehousing and related activities.

In total, this strategy would develop a total of 3.7 million square feet of building space on 8.5 million square feet of land. As stated earlier, this would represent only a portion of the space needed to accommodate future demand, but would be likely to encourage further clustering of logistics facilities in these locations.

<u>Priority Transportation Improvements for Strategy 1</u>:

Several transportation improvements described in detail in the deliverable for Task 2.5 would have particular relevance for this strategy.

There are three NYSDOT projects that are in the planning stages or underway that will improve these segments of the corridor and access to the sites. The Gowanus Expressway rehabilitation is currently underway, but may be insufficient to serve an expanded Sunset Park; ~~the BQE cantilevered section is in the early planning stages and some of the options that have been discussed might significantly impact the travel times between Maspeth and Sunset Park;~~ and the Kosciuszko Bridge project is scheduled to commence in 2014 and will dramatically improve the performance of that corridor segment and access to Maspeth.

There are three additional visionary improvements that are applicable to this strategy—the Linden Blvd. Truck Tunnel, the Red Hook Bridge, and the Cross-Brooklyn Truck/Rail Tunnel.. These projects would improve circulation between the two sites and access to other parts of Brooklyn and Queens, creating redundancy in roadway network for trucks.

In addition, there are specific highway actions for shoulders, ramp-metering and left-hand exits that directly impact the development areas and should be given a higher priority under this strategy.

Three preferential treatments directly impact the two sites and would result in improved access and traffic flows. The contra-flow lane on the Shore Parkway would reduce congestion at the VNB and the construction of a bypass would fill the gap in the existing Gowanus contra-flow bus/HOV lane (part of the Gowanus rehabilitation project); both treatments would improve the flow of traffic on the Gowanus Expressway. A preferential treatment from I-495 to the Williamsburg Bridge would create an uncongested route for light trucks between Maspeth and Manhattan.

Strategy 2: Dispersed Infill Distribution Facilities

This strategy would promote a more-dispersed distribution of the same amount of new development assumed in Strategy One. Rather than concentrating capital investment and programmatic resources to achieve economies of scale in a few locations, it would take advantage of opportunistic infill development throughout the five target areas. This would be less likely to achieve the same efficiencies in terms of fewer truck miles traveled for the amount of freight processed, or provide the size and type of space demanded by some carriers and end-users. However, it would create facilities that are closer to a larger number of end-users, have lower implementation costs, and carry less risk of not achieving sufficient carrier participation to generate a sufficient return on investment and capacity utilization.

In this scenario, all 23 development sites would be potential targets for investment. Accommodating the same 8.5 million square feet of land requirements that are assumed in Strategy One would require developing 36% of the 23.5 million square feet of lot area in these sites (This is higher than the 28% of the 16.2 million square feet of potential site lot area in Strategy One because Strategy Two does not assume development of the Sunset Park Freight village.)

Large land assemblage in scenario would be rare, with most of the development taking place either on single lots or after assemblage of a few lots that are more easily acquired and developed. Therefore several of the larger, multiple-lot sites could be the location of several, independently-developed facilities. Most could be developed under existing zoning, but the strategy assumes that land use reviews and economic development incentives would encourage logistics-facility development in these locations. In particular, brownfield redevelopment and environmental remediation programs will be key to developing many of these locations. Some public infrastructure investments may also be needed in some locations.

Priority Transportation Improvements for Strategy 2:

This strategy further distributes the siting of freight facilities in Brooklyn and Queens. Nevertheless, many of the same improvements recommended in Strategy 1 are still applicable. Unlike Strategy 1, the Task 2.5 recommendations should be given more of an equal weight as the overall efficiency of the corridor is more critical in this scenario. Individual sites are not likely to concentrate truck traffic as much as the prior approach, negating the need to prioritize capacity and access constraints for specific segments (BQE and Gowanus). Two sites, Jamaica and the Flatlands are not adjacent to the I-278 corridor and would rely on it less for access than would sites in the Bay Ridge-to-Carroll Gardens corridor, Williamsburg, or the Long Island City-Maspeth-Astoria area. Improving the level of service on the corridor for through-traffic will make it a more attractive and reliable route for sites that are not proximate to the Interstate.

The Cross-Brooklyn truck facilities should be given a higher priority since the area served would include Flatlands, which is adjacent to the Bay Ridge line where the truck-way would be located. These routes could also serve as feeders to the corridor for Flatlands and Jamaica. Extending the Clearview Expressway would help alleviate congestion on the Van Wyck Expressway, which would improve access to Jamaica. However, both the Cross-Brooklyn truck tunnel and the Clearview Expressway extension are capital-intensive projects, and the distributed nature of these sites makes it unlikely that there will sufficient "critical mass" to justify their expense on the basis of logistics-development opportunities alone.

No additional preferential treatments or tolling policies would apply to these areas.

Strategy 3: As-of-Right, Market-Driven Development

This strategy would make few policy changes to promote the development of new distribution capacity in specific locations. It would, however, maintain existing zoning in industrial areas to permit the development of new facilities. It is likely that less new capacity would be built, particularly in locations where new infrastructure or the use of public land would be required. Facilities would be even more dispersed than in Strategy 2, although the sites identified in the five Opportunity Areas would remain the most attractive locations for private development.

For the purposes of this analysis, it is assumed that the amount of non-publically aided development would be the same in all three strategies. Therefore, Strategy 3 would see 8.5 million fewer square feet of development than either Strategy 1 or 2

Many of the transportation policies articulated in Section III. A and B are applicable to this strategy. These are actions that do not require significant capital investment, making them ideal for a market-based approach where the government does not promote specific areas for industrial redevelopment. This approach is more flexible and reactive than are the improvements suggested in the previous strategies, enabling the government to enact/deploy, in consultation with the private sector, variable parking fees, traffic guidance systems and off-peak delivery windows in response to congestion if or when it materializes.

Evaluation of Alternative Strategies

The three alternative strategies can be differentiated on several different scales. Regional employment and economic impacts are determined by the level and type of new activity that is generated, and by any resulting improvements in productivity. Productivity can be improved by the more-efficient use of transportation infrastructure, land, facilities or labor as a result of facility configuration or transportation improvements. Congestion and environmental benefits result primarily from a relative difference in either the number or length of truck trips. Costs result primarily from infrastructure investments and public subsidy. Implementation barriers and risks result from the complexity and challenges imposed on both public and private stakeholders. Community impacts address how each of these benefits and costs are distributed among different neighborhoods. The sections below address each of these in turn, and summarize the alternatives for each of these factors at the conclusion.

Regional employment and economic benefits

This assessment compares the likely employment and output that would result from the amount and type of development that would occur under each strategy, and the relative differences in efficiency and productivity that each would create.

The scenarios for Strategies 1 and 2 assume similar amounts and type of development—3.7 million square feet of building space on 8.5 million square feet of land that would not occur under the assumptions for Strategy 3. Therefore, the employment, output and wages generated by these strategies should be similar. The mix of facilities and the space efficiencies would vary between the two scenarios, but would likely have only a marginal impact on the number and type of on-site jobs created. However, the chances of implementation, and the larger impacts on productivity, could vary significantly between these two strategies.

Using utilization assumptions and national multipliers from the U.S. Bureau of Economic Analysis (RIMSII), Table 4.1.10 shows estimates of approximately 5,000 jobs, $250 million in earnings and $380 million in output generated from these 1,835 on-site jobs. These represent the annual totals at full build-out of these alternatives. Totals would be achieved after a number of years of phased development.

Table 4.1.10
Employment, Earnings and Output Estimates for Strategies 1 and 2

Direct Employment (2000 sf/workers))	1,835
Earnings/Employee (Task 3.1)	$62,791
Earnings from Direct Employment	$115,221,485
Direct, Indirect and induced Employment	5,097
Direct, Indirect and Induced Earnings	$252,871,472
Output	$380,165,330

Source: Regional Plan Association

These estimates do not include estimates of the broader productivity gains for both passengers and truckers resulting from the transportation investments assumed in these strategies. These benefits, which include savings in travel time and costs, are difficult to quantify, particularly for the combination included in these strategies. However, it can be assumed that these would be larger for Strategy 1 than Strategy 2, since the level of investment and mobility enhancements is larger in the first strategy. It is more difficult to compare the impacts of non-capital investments in Strategy 3 to the capital investments assumed in the other two strategies, but in practice it should be possible to combine some of the demand management practices assumed in the third strategy to complement capital investments to expand capacity assumed in the first two.

Congestion and Environmental Benefits

Most of the environmental benefits of these strategies would accrue from reduced congestion emanating from a reduction in either the number or length of truck trips. Many of the transportation improvements would also improve the flow of auto travel. Since increased development of logistics facilities will attract more truck trips, these benefits should be seen in relative terms between the different strategies. Strategies 1 and 2 assume the same level of demand, so the number and length of trips would be determined by how the activity is organized. Strategy 3 would presumably generate less activity and fewer truck trips.

Based on NYMTC's Freight Village study, the 97 acres of development for Sunset Park would generate 780 daily truck trips without an intermodal terminal and 1,240 with the intermodal terminal. 35 truck trips would be generated in the AM Peak without the Intermodal Terminal and 63 trips with it. There would be 81 truck trips in the PM Peak without and 117 with the Intermodal Terminal studied. If we assume development in Williamsburg and Maspeth would generate a similar number of truck trips in Strategy 1, then we would assume an additional 1,500-2,500 daily truck trips.[15]

One of the primary purposes of freight villages and consolidated distribution centers is to make the total delivery system more efficient. As stated in the paper on City Logistics in Task 1.9: "The advantages of urban consolidation centers include environmental and social benefits due to the more efficient and less-intrusive transport operations. These initiatives usually lead to better planning and logistics operations and promote the introduction of new information systems and the implementation of better systems for inventory control. Consolidation centers can also be integrated with other policy and regulatory initiatives, particularly those promoting greener and more sustainable last-mile deliveries." Often, carriers can bundle small deliveries into a single trip.

[15] Rutgers Center for Advanced Infrastructure and Transportation and New York University Rudin Center for Transportation Policy and Management, "Task 6 – Site Impact Assessment," Feasibility of Freight Villages in the NYMTC Region, March 2011, pp.24-28

The NYMTC Freight Villages Study also modeled several scenarios against a base case that assumed no freight village. Each scenario reduced the total number of truck miles traveled, from a low of 2% to a high of 23%.[16] Each of these scenarios included proportionately lower travel costs, air pollution, accidents and noise.

Given these results, Strategy 1 would have the greatest overall environmental benefits. Strategy 2 would likely have the least by having the greatest amount of activity distributed over the largest area. Strategy 3 would be in the middle. Simply by having less activity, it would generate fewer truck trips, but would do less to rationalize existing trips than the first strategy.

<u>Costs and Risks</u>

Estimating the costs of the different strategies is beyond the scope of this effort, but it is a straightforward exercise to determine the relative difference in costs among the three scenarios. Strategy 1 would be the most capital-intensive, with location-specific transportation investments in addition to corridor-wide improvements, and site assemblage and preparation would likely require significant public investment, particularly since some targeted property is publically-owned. Strategy 3 would be the least expensive, since it emphasizes demand management policies over capital investment. The degree of cost difference would be greatest between Strategies 2 and 3, and least between Strategies 1 and 2.

Implementation barriers and risks involve a more complicated assessment. Clearly, Strategy 1 has a high threshold for success. It would require substantial land assemblage and site investments. Enough private carriers would need to participate to make the projects viable. Community opposition could also be more intense, although there could also be a number of community benefits. The projects would likely need to be phased over multiple real estate cycles, creating greater risk to financing and completion.

Strategy 2 has the advantage of spreading the risk by not "putting all eggs in one basket." Smaller projects would be easier to design and finance, and community consensus may be easier to achieve. Failure of one project would have a smaller impact on the overall objectives of the strategy. However, this approach also carries its own risks. It may be more difficult to reach the target

[16] Ibid, pp. 15-20

development and capacity goals if not enough infill projects are completed. It will also be more difficult find locations for activities with large or specialized space requirements.

Strategy 3 has fewer risks on the development side, but the demand management policies that are envisioned to improve delivery-system efficiency and traffic flow will almost certainly encounter resistance and could be as difficult to implement as capital investments. However, fewer resources will have been put at risk in trying to implement the initiatives.

Conclusion

In general, Strategy 1 has the greatest potential benefits, but also carries the highest costs and risks. Strategy 2 would potentially yield similar employment benefits and has fewer risks, but would not achieve the same productivity or environmental benefits. Strategy 3 could provide significant productivity and environmental benefits at a relatively low cost, but little in employment and related economic benefits from expanded facility capacity.

This evaluation only considers benefits and costs at the regional scale. There would also be significant community-level impacts, both in terms of economic opportunity and truck-related environmental impacts. Without a detailed analysis, it is impossible to analyze the precise areas that would be impacted, and to determine whether the benefits would outweigh the negative impacts for particular communities. Strategy 1 would clearly impact three specific communities—Sunset Park, Williamsburg and Maspeth—but the actual impacts, including which neighborhoods and constituencies would be most affected, would depend on the precise design and location of the facilities and on any policies that might be put into place to maximize local benefits and mitigate negative impacts. Both benefits and costs would be more dispersed under Strategies 2 and 3.

The strategies are also hypotheticals intended to draw distinctions between alternative approaches and identify issues to be considered in the design and execution of actual policies. In reality, a holistic strategy for logistics in the I-278 corridor would likely be a hybrid of these three approaches and would evolve over time. For example, a single freight village or consolidated distribution center would require substantial planning and investment, and could be developed in tandem with more-opportunistic infill development to expand capacity with smaller facilities. Physical improvements in the transportation network could also be combined with parking and pricing policies and other demand-management tools. Fully evaluating any of these options would require in-depth market analysis, engineering feasibility and financial evaluation of actual project designs.

[i] http://www.state.nj.us/transportation/refdata/research/reports/FHWA-NJ-2004-011.pdf , 4-30-10.
[ii] http://www.freightpipelinecompany.com/Final_Report_NYSERDA.pdf, 4-20-10
[iii] NJTPA, 12-04, http://www.state.nj.us/transportation/refdata/research/reports/FHWA-NJ-2004-011.pdf , 4-30-10
[iv] http://keeptexasmoving.com/var/files/File/TTCPrjctsTTC35/PrjctPlanDvlpmnt/First_MDP/Appendix-9.pdf, 4-13-10 http://www.freightpipelinecompany.com/Final_Report_NYSERDA.pdf, 4-20-10
[v] http://www.triplecrownsvc.com/Bimodal.html, 3-10-09
[vi] http://www.railrunner.com/technology/whitepapers/SGKV_feasibility_on_european_rail_itineraries.pdf, 6-18-10
[vii] http://www.railrunner.com/technology/whitepapers/SGKV_feasibility_on_european_rail_itineraries.pdf, 6-18-10
[viii] Nelldal, Bo-Lennart, ed., Efficient train systems for freight transport: A systems study, 2005, http://www.kth.se/polopoly_fs/1.42736!0505_summary.pdf, 6-15-10.
[ix] www.ort-poitou-charentes.asso.fr/etudes/.../ChantiersTC-PC%20.pdf , 2-17-10
[x] Nelldal, Bo-Lennart, ed., Efficient train systems for freight transport: A systems study, 2005, http://www.kth.se/polopoly_fs/1.42736!0505_summary.pdf, 6-15-10.
http://www.hgu.gu.se/Files/foretagsekonomi/LoT/Johan/Publications/Reviewed_articles/1998_NOFOMA_Evaluation.pdf, 6-16-10.
[xi] http://www.retrack.eu/downloadables/Deliverables/D2.3-Public-Terminal%20Technology%20and%20Systems-Final%20v2-Islam-24012008.pdf, 6-17-10
[xii] http://www.tuchschmid.ch/en/kombiverkehr/referenzen.html, 2-10
http://www.railcargo.at/en/Customer_Service/Equipment/ACTS/index.jsp, 6-15-10
http://www.rapp-trans.ch/media/trans/schweiz/Presentations/2003/trb__15jan03_msr.pdf , 4-22-10
Commercial operation since 1987: http://www.promit-project.net/UploadedFiles/Deliverables/PROMIT_BPH3_April09_cp_MSR.pdf, 6-21-10
[xiii] Http://www.rapp-trans.ch/media/trans/schweiz/Presentations/2003/trb__15jan03_msr.pdf, 4-22-10
http://www.promit-project.net/UploadedFiles/Deliverables/PROMIT_BPH3_April09_cp_MSR.pdf, 6-21-10
[xiv] http://www.ectri.org/YRS09/Papiers/Session14/Eiband_A_Session14_Transport_Economics_and_%20Bevaviour.pdf, 2-24-2010
[xv] http://www.railwatch.org.uk/backtrack/rw94/rw094p04.pdf, 4-16-10
http://www.rapp-trans.ch/media/trans/schweiz/Presentations/2003/trb__15jan03_msr.pdf , 4-22-10
[xvi] http://www.tuchschmid.ch/en/kombiverkehr/referenzen.html
Rotterdam from Pielage.