

A red Mack truck is driving on a road with double yellow lines. The truck is in the center of the frame, moving away from the viewer. The background shows trees, a utility pole with a street light, and a clear blue sky. The scene is brightly lit, suggesting a sunny day.

Appendix 8 | Regional Freight Plan 2018-2045

1. Regional Freight Plan Purpose & Desired Freight Outcomes
2. Freight System & Market Overview
3. Identifying & Assessing Needs
4. Improvements & Solutions
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1.0 Regional Freight Plan Purpose and Desired Freight Outcomes

In 2004, the New York Metropolitan Transportation Council (NYMTC) published its first Regional Freight Plan, a document which provided, for the first time in this planning area, a comprehensive understanding of commodity flows, relative importance of major freight corridors, key infrastructure deficiencies and needs, and a series of outreach materials designed to help stakeholders and the public understand why freight is present in their communities and the activities it supports.

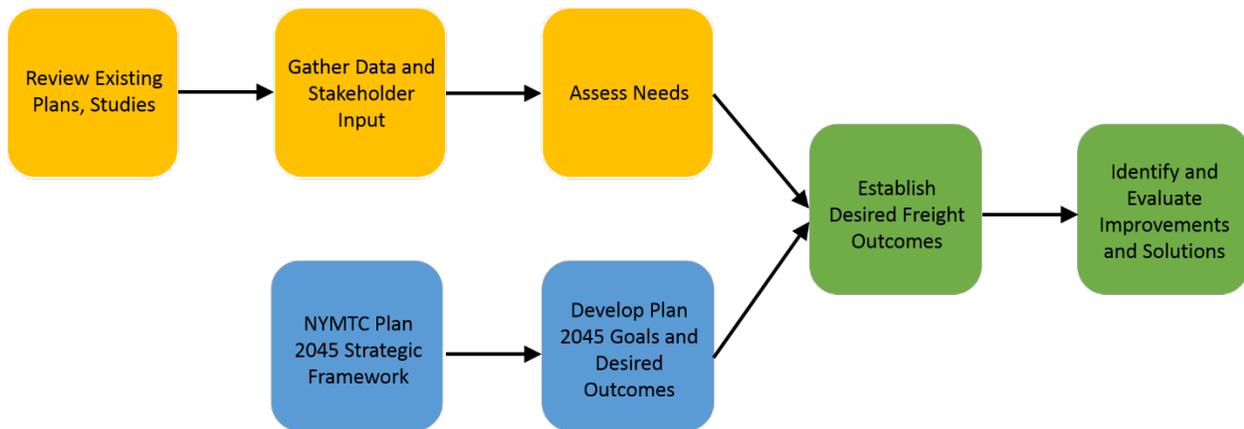
Since 2004, NYMTC's member agencies have pursued many of the recommendations set forth in that initial Regional Freight Plan and its periodic updates. In addition, global economic and logistics patterns have changed in light of the 2008-2009 recession, economic recovery, and rapid changes in supply chains in response to technological advancements and changing consumer demands. Regional trends such as proliferation of warehousing and distribution center space in central New Jersey, growing residential population in the region's core, and burgeoning tourism industry, also continue. New opportunities to move freight by rail or water as alternatives to trucking are being studied and implemented.

Looking forward, economic, technological, and regulatory changes will continue to affect the demand, volume, origins and destinations, modes of transportation, and routes that transport freight into, out of, within, and through the NYMTC planning area. New Federal guidance stemming from the Fixing America's Surface Transportation (FAST) Act, enacted in December 2015, requires that states develop statewide freight plans in order to obligate National Highway Freight Program funding for freight projects, and encourages metropolitan freight planning in coordination with the state and neighboring metropolitan planning areas. For these reasons, NYMTC has produced this Regional Freight Plan in order to document the goals and desired outcomes of NYMTC's members specific to freight transportation, freight needs and issues, and to identify freight-specific and freight-supportive improvements and solutions.

Per federal metropolitan planning requirements, NYMTC's new Regional Transportation Plan, *Plan 2045*, has been developed. *Plan 2045* maintains a shared vision of NYMTC's members for future regional passenger and freight mobility. *Plan 2045* includes this current Regional Freight Plan, which assesses the needs of legacy and emerging industries in the region, accounts for changing logistics patterns and consumer demands, identifies improvements and solutions for the freight system, and sets forth a plan for future investments in freight mobility.

Figure 1.1 illustrates the steps in the process of developing the Regional Freight Plan. First, existing plans and studies related to freight, including NYMTC's 2004 Regional Freight Plan, among other plans and studies completed by NYMTC members and neighboring regions, were reviewed to identify trends impacting freight demand, logistics, and travel patterns in the NYMTC planning area and surrounding areas. Freight, economic, demographic, environmental, and transportation performance data were gathered and analyzed, and input on trends, needs, and potential improvements and solutions was amassed from a broad range of public and private sector stakeholder groups. The first two steps, the outcomes of which are summarized in Section 2, provided the information needed to assess key freight transportation issues and needs, presented in Section 3. The Needs Assessment, along with the Plan 2045 Goals and Desired Outcomes informed the development of Desired Freight Outcomes listed in Section 1.1. Finally, improvements and solutions that could support or advance the Desired Freight Outcomes were identified and evaluated, and are presented in Section 4.

Figure 1.1 Regional Freight Plan Process



1.1 *Plan 2045* Shared Goals and Desired Freight Outcomes

The desired outcomes of this Regional Freight Plan reflect the aforementioned changes and the overall planning framework of *Plan 2045*, as reflected in the following shared goals of NYMTC’s members:

- Enhance the regional environment;
- Improve the regional economy;
- Improve regional quality of life;
- Provide convenient, flexible transportation access within the region;
- Enhance the safety and security of the transportation system for both motorized and non-motorized users;
- Build the case for obtaining resources to implement regional investments;
- Improve the resiliency of the regional transportation system; and
- Preserve the existing transportation infrastructure.

Figure 1.2 illustrates the *Plan 2045* shared goals as they relate to key topics and themes addressed in federal and state planning frameworks for freight.

Figure 1.2 Plan 2045 Goals and Federal and State Planning Frameworks

Theme	 National Freight Policy Goals	 New York State Freight Plan Goals	 NYMTC Regional Freight Plan Goals
Environment	✓	✓	✓
Economy	✓	✓	✓
Quality of Life			✓
Accessibility			✓
Safety and Security	✓	✓	✓
Resiliency	✓		✓
Smart Investment			✓
Infrastructure Preservation	✓	✓	✓
Technology/Innovation	✓		
Partnerships		✓	

This Regional Freight Plan’s desired freight outcomes, built from the framework of Plan 2045’s shared goals, impart a strategic direction to the Plan, and serve as critical criteria for the selection of the projects, programs, and initiatives which are recommended for study and/or implementation. Table 1.1 lists the desired freight outcomes associated with each of the *Plan 2045* shared goals. The numbers serve only as an organizational stratagem, and do not suggest any order of priority or importance among the goals or outcomes.

Table 1.1 Plan 2045 Shared Goals and Associated Desired Freight Outcomes

Plan 2045 Goals	Desired Freight Outcomes
1. Enhance the regional environment.	1a. Reduce freight's contribution to traffic congestion and pollutants that affect air quality. 1b. Reduced greenhouse gas emissions from commercial and service vehicles.
2. Improve the regional economy.	2a. A strengthened position of the region as a global and national gateway for goods. 2b. Goods movement integrated in region's strategic growth. 2c. Improved efficiency of goods movement in the region. 2d. Skilled workforce prepared to meet the needs of freight and logistics industries.
3. Improve regional quality of life	3a. Increased inter- and intra-regional mobility and accessibility for goods movement. 3b. Mitigation of negative externalities of freight transportation in the design, construction, and operation of the system. 3c. Coexistence of pedestrians, bicyclists, motorists, and commercial and service vehicles on roadways. 3d. Goods movement supports vibrant communities.
4. Provide convenient, flexible transportation access within the region	4a. An array of available and competitively-priced modal options and seamless intermodal transfer of goods. 4b. Efficient, safe, and reliable "last-mile" connections for freight deliveries. 4c. Increased reliability for freight trips.
5. Enhance the safety and security of the transportation system for both motorized and non-motorized users	5a. Reduced rate of annual injuries and fatalities resulting from truck-involved crashes and rail safety incidents. 5b. Increased safety and cargo security measures for freight transportation throughout the region. 5c. Enhanced coordination, data, and information sharing among members and other freight stakeholders. 5d. Promotion of safety and security improvements in all aspects of freight transportation planning and implementation.
6. Build the case for obtaining resources to implement regional investments.	6a. Coordinated long-term planning for the multimodal freight network, facilities, and terminals, which identifies priorities and supports the pursuit of funding and financing. 6b. An increase in the use of alternative methods of financing transportation investments to supplement existing Federal and State funding sources. 6c. Obtain a fair share of Federal funds available for freight, proportional to its needs and economic share relative to the nation. 6d. Elimination of unfunded mandates.
7. Improve the resiliency of the regional transportation system.	7a. Member-defined adaptation measures for critical components of the freight transportation system to accommodate variable and unexpected conditions without catastrophic failure. 7b. Freight transportation assets and freight-generating facilities are fortified from long-term climate change and sea level rise. 7c. Greater resiliency of the regional supply chain by identifying options for goods movement during and after events. 7d. Cooperative partnerships with federal, state, local agencies, and other freight stakeholders to adapt the freight transportation system and improve recovery from disruptions.
8. Preserve the existing transportation infrastructure.	8a. Making the investments necessary to maximize the useful life of existing freight assets and manage these assets in the most cost-effective manner through preventive maintenance. 8b. A supply of industrial land to house goods movement and related facilities is maintained to support current and future regional growth 8c. Protecting the existing freight network.

Note: The goals and outcomes are numbered strictly for the purpose of organization. No ranking or prioritization of the goals or outcomes has been performed.

1.2 Institutional Context

The Regional Freight Plan is a stand-alone plan for freight movement in the NYMTC planning area. It builds upon prior NYMTC freight planning efforts¹, and it is intended to identify priority issues and needs, projects and policies for member agencies to advance, and funding and implementation guidance. The Regional Freight Plan also informs, and is a component of, Plan 2045, the Regional Transportation Plan, and provides guidance to member agencies' prioritization and implementation of transportation projects and policies.

The Fixing America's Surface Transportation (FAST) Act establishes a national policy of maintaining and improving the condition and performance of the National Multimodal Freight Network, a network of highway, rail, water, and air freight transportation infrastructure currently being developed by the U.S. Department of Transportation (USDOT) with the input of state, metropolitan, and other stakeholders. The FAST Act directs USDOT to develop a National Freight Strategic Plan to assess condition and performance of the National Multimodal Freight Network, identify key features of the network and best practices for improving performance and mitigating community impacts, forecast freight volumes, address multistate projects and encourage multi-jurisdictional collaboration, and identify strategies to improve freight intermodal connectivity.

The FAST Act also establishes freight funding programs, including:

- The National Highway Freight Program, a funding program for freight projects on the National Highway Freight Network, which is a component of the National Multimodal Freight Network. The National Highway Freight Program is authorized to dispense more than \$1 billion per year (\$1.15 billion in Fiscal Year 2016, escalating annually to reach \$1.5 billion by Fiscal Year 2020), by formula to the states; and
- Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE), a discretionary grant program, authorized to dispense up to \$4.5 billion between FY 2016 and FY 2020 to fund critical freight and highway projects throughout the country.

The FAST Act requires that each state develop a state freight plan, which must comprehensively address freight planning activities and short- and long-term investments in the state. Beginning December 4, 2017, states must have a state freight plan consistent with FAST Act requirements in place to obligate National Highway Freight Program funds. The state freight plan must cover a five-year forecast period, be fiscally constrained, include a "freight investment plan" with a list of priority projects, and describe how the state will invest and match its National Highway Freight Program funds. The New York State Department of Transportation (NYSDOT) is developing the New York State Freight Plan according to these requirements. The NYMTC Regional Freight Plan serves as a critical input to the State Freight Plan, including freight data analysis, needs, and priorities of freight stakeholders in this portion of the

¹ In the years since the completion of the 2004 Regional Freight Plan, NYMTC staff and member agencies pursued many of the recommendations set forth in the Regional Freight Plan, having conducted a study of truck rest stops throughout the region, truck routes in New York City and Rockland County, and the feasibility of freight villages in the region, among other efforts. This Regional Freight Plan is informed by these efforts.

State of New York. The policy direction of the State Freight Plan influenced the development of desired freight outcomes of the Regional Freight Plan. For this reason, both plans have been coordinated at critical points in their concurrent development.

1.3 Regional Context

The Regional Freight Plan is intended to guide transportation investment decision-making among the member agencies in the ten-county NYMTC planning area, shown in Figure 1.2. Within the NYMTC planning area, several freight planning initiatives are underway, many of which are led by NYMTC member agencies. These efforts have provided, or soon will provide, analytical products and findings and recommended projects, policies, and/or actions that are inputs to the development and maintenance of the Regional Freight Plan. These efforts include:

- **Goods Movement Action Program (G-MAP).** The G-MAP vision is to support and to enhance the New York-New Jersey metropolitan region's position as a global center –a hub of commerce, culture, finance, and trade – through strategic goods movement initiatives. Led by the Port Authority of New York and New Jersey, New Jersey Department of Transportation, and New York State Department of Transportation, and supported by government, public agency, and industry partners, G-MAP provides a shared framework from which public and private partners can cooperatively address local, regional, and national goods movement challenges in the metropolitan region. To accomplish this, G-MAP offers a comprehensive action plan to improve the region's goods movement system through regulatory, operational, policy, and infrastructure initiatives. The cornerstones of G-MAP include:
 - Identification of a multimodal Regional Core Freight Network to target goods movement improvement initiatives along major freight gateways and corridors;
 - Partnership to advance 10 strategic Action Packages of regional initiatives to create a safe and efficient multimodal goods movement system; and
 - Implementation of Early Action initiatives that deliver tangible improvements to industry and the region's communities within the early implementation stages of G-MAP.²
- **Metropolitan Rail Freight Council Action Plan.** The Metropolitan Rail Freight Council (MRFC) is a coalition of public and private organizations dedicated to promoting greater rail freight use in the New York City region, particularly areas east of the Hudson River. MRFC is a unique collaborative effort to grow rail freight volumes, promote modal diversity, optimize existing network, invest in existing and new infrastructure, and to support good paying jobs in transportation. The MRFC Action Plan tracks progress on high-priority projects and initiatives, and enables MRFC partners to collaborate in order to overcome common challenges. The Cross Harbor Freight Program's Rail Freight Tunnel and enhanced car float system connecting Greenville, NJ with Sunset Park, Brooklyn, investments to the

² G-MAP: A Comprehensive Goods Movement Action Program for the New York-New Jersey Metropolitan Region, available from: <https://www.panynj.gov/gmap/>.

Travis Branch on Staten Island (international shipping containers), and Hunts Point Distribution Center (food related), are among the projects MRFC members agree are top priorities in the region.³

- **New York City Smart Truck Management Plan.** The New York City Department of Transportation is leading an effort that aims to enhance the economic vitality and quality of life for all New Yorkers by providing for the safe, efficient, and environmentally responsible movement of goods. The Smart Truck Management Plan's goals are to: improve safety for all road users; reduce truck-related congestion; improve trucking industry environmental performance; create a culture of compliance with truck-related regulations; support New York City's economy through more efficient goods movement and deliveries; expand partnerships with the freight and trucking industry; and Identify, evaluate, and invest in essential freight corridors. The Smart Truck Management Plan will identify and implement a series of regulatory, procurement, and partnership strategies, and produce a city-wide and series of borough truck freight plans.⁴
- **New York City Regional Resiliency Assessment Program (RRAP).** Led by the U.S. Department of Homeland Security and New York City Emergency Management, the Regional Resiliency Assessment Program (RRAP) is a cooperative assessment of specific critical infrastructure and a regional analysis to address a range of infrastructure resilience issues that could have regionally and nationally significant consequences. The RRAP aims to help NYCEM and other agencies to better understand how the supply chains of critical commodities work, how past emergencies have impacted those supply chains, and to engage public and private stakeholders. Key needs identified thus far include a need to retain a balance of assets which would support emergency response, opportunities to deliver freight by different modes to different locations in the event typical modes or facilities are disrupted, and to incorporate partners' capabilities into contingency plans.⁵

In addition, the freight transportation needs of the NYMTC planning area's business community and residents require the safe and efficient operation of warehouses, marine terminals, airports, highways, truck parking areas, and rail facilities and in neighboring jurisdictions. Along with coordination with the New York State Freight Plan, which covers the entire State of New York, the Regional Freight Plan has been developed in coordination with Connecticut Department of Transportation, which is currently developing its statewide freight plan, the New Jersey Department of Transportation, which is currently developing an update to its statewide freight plan, and metropolitan planning organizations and councils of governments in Connecticut, New Jersey, and Pennsylvania. This coordination has identified common needs and issues across the multiple jurisdictions and planning areas across the greater metropolitan region and Northeast Megaregion, identified potential impacts of changing economic conditions and transportation investments in neighboring areas, and identified projects and policies that could address common needs and support common goals.

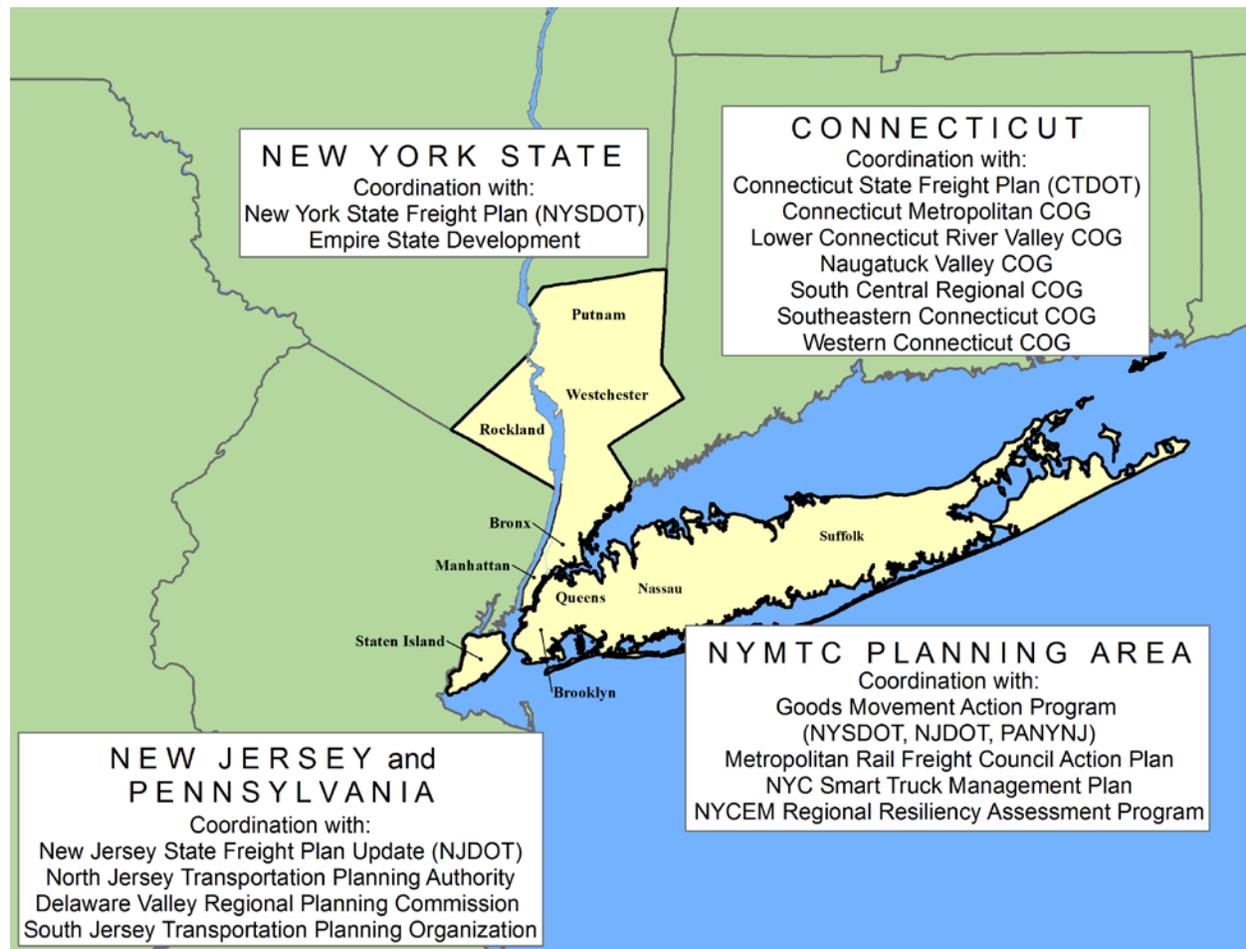
³ Metropolitan Rail Freight Council Action Plan, 2016.

⁴ "NYC Smart Truck Management Plan," a presentation delivered to NYMTC's Freight Transportation Working Group by Diniece Peters, December 6, 2016.

⁵ "NYMTC Regional Resiliency Assessment Program (RRAP) Update," a presentation delivered to NYMTC's Freight Transportation Working Group by Sandra Rothbard, September 29, 2016.

Figure 1.3 illustrates the freight planning efforts underway in the NYMTC planning area and in surrounding jurisdictions, which are being completed in coordination with the development of the Regional Freight Plan.

Figure 1.3 Relationship of the Regional Freight Plan to State and Multi-State Planning Initiatives



1.4 Required Federal Performance Measures

The development and application of performance measures enable agencies to gauge system condition and use, evaluate transportation programs and projects, and help decision-makers allocate limited resources more effectively than would otherwise be possible. The development of freight performance measures to support investment, operations, and policy decisions has attracted considerable interest from both public- and private-sector stakeholders. As such, the Department of Transportation (DOT) in many of the states, Metropolitan Planning Organizations (MPOs), and the Federal government have all contributed to the ongoing dialogue surrounding freight performance measures.

Performance measures are typically applied for the following general purposes:

- **Linking Actions to Goals.** Performance measures can be developed and applied to help link plans and actions to state and federal goals and objectives;
- **Prioritizing Projects.** Performance measures can provide information needed to invest in projects and programs that provide the greatest benefits;
- **Managing Performance.** Applying performance measures can improve the management and delivery of programs, projects, and services. The right performance measures can highlight the technical, administrative, and financial issues critical to governing the fundamentals of any program or project;
- **Communicating Results.** Performance measures can help communicate the value of public investments in transportation. They can provide a concrete way for stakeholders to see how transportation investments contribute to transportation system performance; and
- **Strengthening Accountability.** Performance measures can promote accountability with respect to the use of taxpayer resources. They reveal whether transportation investments are providing the expected benefit or demonstrate need for improvement.

The FAST Act continues the requirement that the U.S. Secretary of Transportation develop regulations (23 CFR 490) to establish Transportation Performance Management (TPM) in the metropolitan transportation planning process. The resulting rules, though not presently in effect and subject to change prior to becoming effective, together establish a set of transportation performance measures for State DOTs and Metropolitan Planning Organizations (MPOs).

With regard to the performance of the freight system specifically, the relevant federal rule, which is not yet in effect, requires states to set targets for freight performance measures and use these targets against which they can measure progress. Two primary measures for gauging freight performance are required (see Table 1.2 below): (1) percent of interstate system uncongested and (2) percent of interstate system providing for reliable travel times.

These congestion-related freight performance measures are based on average truck speeds. Calculating this performance measure will entail measuring average truck speeds on the interstate system within a specified time period and determining the amount of interstate route mileage (as a percentage of total mileage) that exhibits average truck speeds above the reference speed. The reliability performance measure is based on truck travel times on the interstate highway system.

Plan 2045's compliance with TPM requirements, as presently formulated, will be reflected in a Systems Performance appendix which will be amended into the Plan per the timeframes established by the FAST Act and related planning regulations.

Table 1.2 Freight Movement on the Interstate Performance Measures

Part 490 Subpart	Proposed Performance Measures	Proposed Metrics	Applicability
Freight Movement (Subpart F)	Percent of the Interstate System Mileage providing for Reliable Truck Travel Times	Truck Travel Time Reliability (TTTR)	Interstate System mileage within the State or each metropolitan planning area
	Percent of the Interstate System Mileage Uncongested	Average Truck Speed	Interstate System mileage within the State or each metropolitan planning area

Source: FAST Act and related planning regulations.

2.0 Freight System and Market Overview

The NYMTC planning area's freight transportation system includes roadways, rail lines and yards, marine terminals and waterways, air cargo facilities, and intermodal facilities, where freight is transferred from one transportation mode to another. This system handles the approximately 365 million tons of freight currently moving to, from, within and through the NYMTC planning area. Commodity flow forecasts suggest that as many as 610 million tons of freight may be moving through this system by 2045, an increase of 67 percent.

This section of the Freight Plan describes the components of the multimodal freight network in and around the NYMTC planning area, and details how the goods are moved, as well as current and projected demand and how key industry sectors use the system today. The section also describes the changes which may occur in response to changing demand, logistics, and technologies. The information in this section is a key input to the needs assessment and identification of projects in the Regional Freight Plan.

2.1 Freight System Description and Operating Characteristics

2.1.1 Roadway Network

A subset of the NYMTC planning area's roadway network, identified as "Strategic Freight Highways," is of particular importance to freight movement. Strategic Freight Highways serve as major freight gateways into and out of the planning area, as well as provide access to major freight-handling facilities such as seaports and rail intermodal terminals in New Jersey, and connections between major industrial clusters and the Interstate Highway System.

Strategic Freight Highways therefore link to freight-generating facilities such as manufacturing and resource-extraction facilities; to freight-handling facilities such as JFK International Airport and other intermodal terminals and warehouses/distribution centers, and to routes that can accommodate large and heavy loads to support emergency response. Strategic Freight Highways include the four classifications of roadway described in detail below:

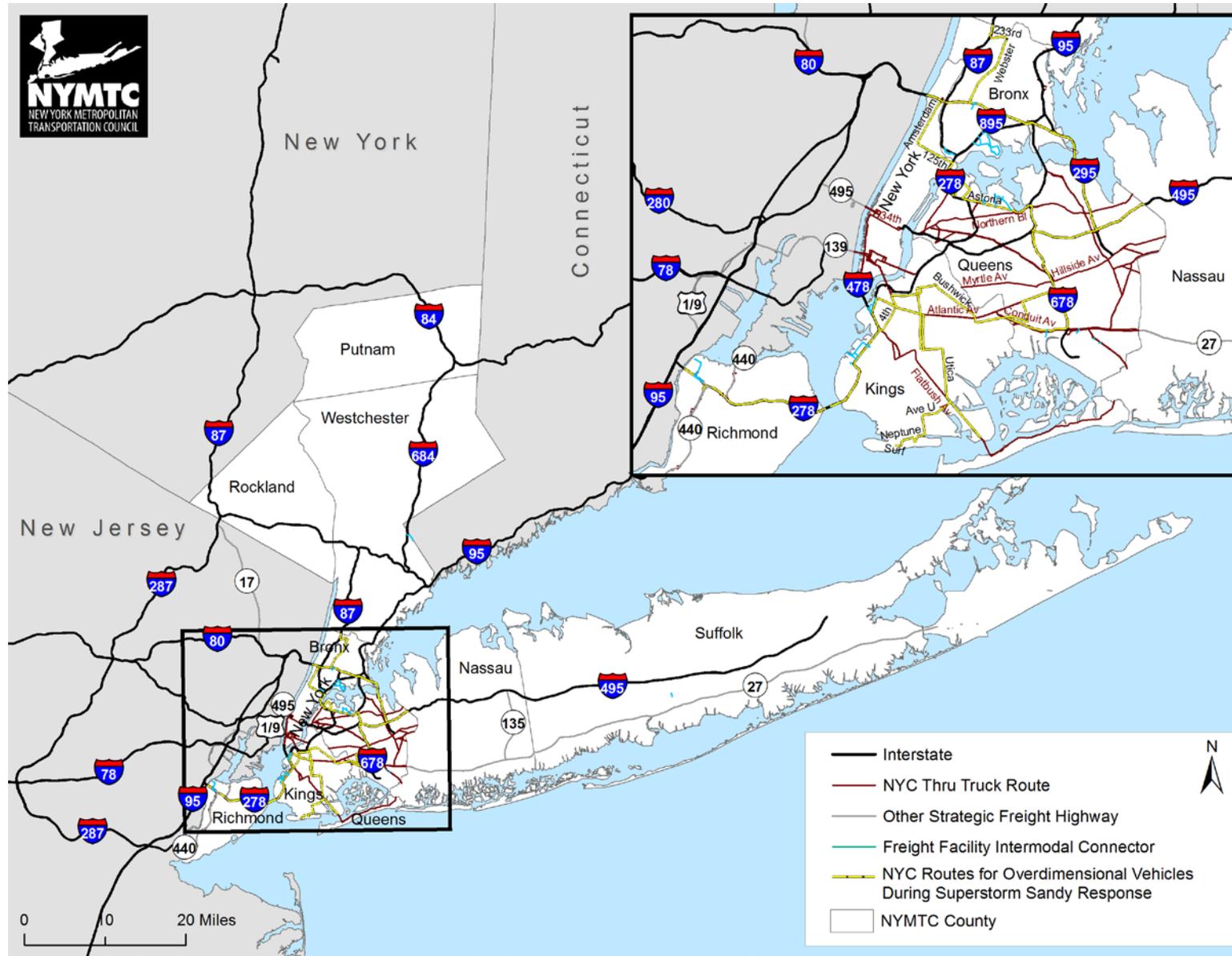
1. Portions of the National Highway Freight Network (NHFN) located in the NYMTC planning area. The Fixing America's Surface Transportation (FAST) Act established the NHFN to strategically direct Federal resources and policies toward the improved performance of the nation's transportation system.
2. The Interstate Highway System in and surrounding the NYMTC planning area serves as the primary gateway through which trucks enter and exit the planning area, and complete inter-county trips within the planning area;
3. Strategic Freight Highways beyond the NYMTC planning area. State highways throughout the NYMTC planning area, which carry Interstate-type levels of truck traffic, and state highways outside the NYMTC planning area that provide connections to key freight facilities, such as:
 - a. Hudson River crossings into Manhattan;
 - b. Port Newark/Port Elizabeth in New Jersey;

- c. Newark Liberty International Airport in New Jersey;
 - d. Rail intermodal yards, including Croxton, Little Ferry, North Bergen, and South Kearny in New Jersey.
4. The New York City Through Truck Route System⁶ as designated by the New York City Department of Transportation, which are allowable routes for inter-county truck trips (note that Interstate Highways within New York City are part of this system); and
 5. Designated Intermodal Connectors serving freight facilities, such as those connecting each of the planning area's international and regional airports to the National Highway System, the industrial portions of the South Brooklyn waterfront to Interstate 278, and providing access from Interstate 278 to and from the Hunts Point Food Distribution Center in the Bronx.
 6. Over-dimensional Emergency Response Routes, which have been used to help with relief efforts, including movement of generators and other equipment, delivery of food and supplies, and debris removal.

Figure 2.1 illustrates the Strategic Freight Highway network within and surrounding the NYMTC planning area.

⁶ New York City's comprehensive Truck Route Network is published in a map format making it easier for drivers to locate specific streets and intersections. The map also contains helpful information on truck route signage, weight limits and dimensions; overweight/over dimensional permitting and truck related violations as well as City, regional and state truck-related resources. Accessed at: <http://www.nyc.gov/html/dot/downloads/pdf/2015-06-08-truck-map-combined.pdf>.

Figure 2.1 NYMTC Planning Area Freight Highway Network



Source: Cambridge Systematics; NYCDOT

As Figure 2.2 shows, Strategic Freight Highways in the NYMTC planning area facilitate the movement of trucks performing one of five key trip purposes. A summary of the key roadway facilities supporting each truck trip purpose is described as follows:

- **Through** trips are found almost exclusively on interstate highways, and, in particular, those that provide access to the George Washington Bridge and Tappan Zee Bridge. Those two crossings of the Hudson River carry the highest volume of through truck trips in the planning area. Other chief routes for through trucks in the planning area, each of which carry more than 3,000 through truck trips per day, include:
 - Interstate 95 (including the Trans Manhattan Expressway, Cross Bronx Expressway, and New England Thruway) in Manhattan, the Bronx, and Westchester County;
 - Interstates 87 and 287 in Rockland and Westchester counties; and
 - Interstates 684 and 84 in Putnam and Westchester counties.⁷
- **Terminal and warehouse access** trips consist of trucks moving from origins outside the NYMTC planning area, which are destined for marine, rail, or air cargo terminals or warehousing or distribution center facilities in the planning area.
 - The most heavily-used route for inbound terminal truck trips is the corridor defined by interstates 80 and 95 in New Jersey, the George Washington Bridge, Cross Bronx Expressway, and Interstate 295 (Throgs Neck Bridge and Clearview Expressway). More than 7,700 trucks per day access the region using this route, as Figure 2.2 illustrates.
 - In the Bronx, about 1,800 of trucks divert off of this access route to connect to Interstate 87 southbound to Interstate 278 in order to reach Manhattan and western Queens and northern Brooklyn.
 - More than 1,400 trucks per day use Interstate 678 in northern and central Queens. About 400 continue to the vicinity of JFK International Airport.
 - About 3,000 trucks connect to Interstate 495 in Queens to reach locations in Nassau and Suffolk counties.
 - Other access routes for inbound terminal truck trips include the Interstate 84/Interstate 684 corridor, by which 2,600 trucks enter the planning area; Interstate 278 (Goethals Bridge and Staten Island Expressway), which 2,300 trucks use to enter the planning area daily; Interstate 95, where 2,000 trucks enter the region from Connecticut and points north and east; and Interstate 87 (New York State Thruway), which carries 1,300 inbound trucks destined for terminals in the planning area.

⁷ Daily truck volumes were estimated by developing a truck trip origin-destination matrix from the Transearch commodity flow database, and assigning the truck trip origin-destination matrix to the NYMTC Best Practice Model (BPM) regional travel demand model network.

- **Distribution and interplant** trips consist of truck trips between points in the NYMTC planning area and points elsewhere in the multi-state metropolitan region, including Orange and Dutchess counties in New York; Fairfield, Litchfield, and New Haven counties in Connecticut, and 13 counties in northern New Jersey.

The George Washington Bridge/Interstate 95, Goethals Bridge/Interstate 278, Tappan Zee Bridge/Interstate 87/Interstate 287, Interstate 287/Interstate 95 and Interstate 84/Interstate 684 are the primary gateway corridors into and out of the NYMTC planning area for freight traveling to or from other parts of the larger metropolitan region, as Figure 2.2 illustrates. About 3,700 distribution and interplant trips cross the George Washington Bridge daily. About 1,200 trucks cross the Goethals Bridge, and 1,000 trucks enter or exit the NYMTC planning area via Interstate 84 in Putnam County.

Other major highway corridors used for regional distribution and interplant trips include:

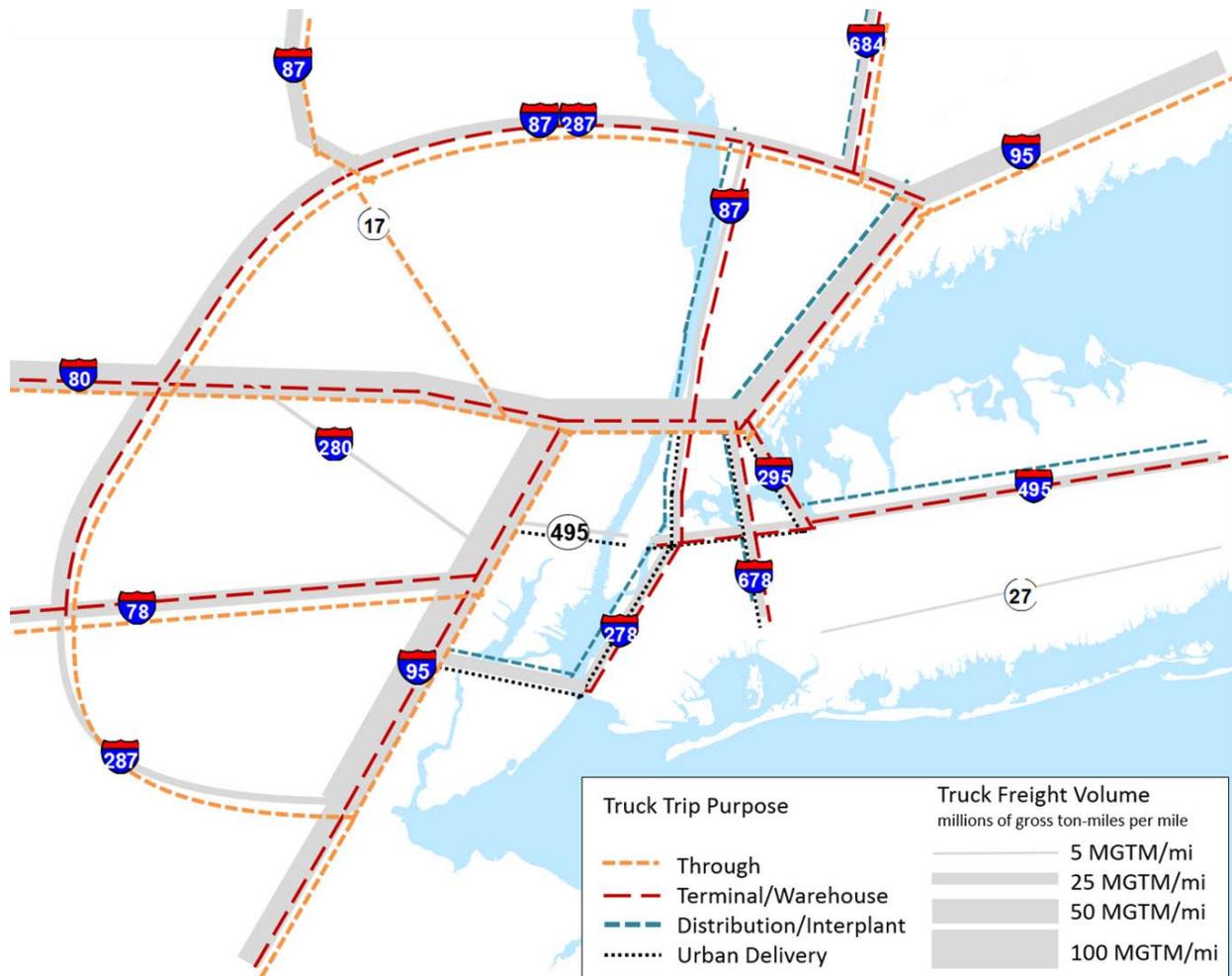
- Interstate 495, where 4,200 distribution and interplant trucks cross the border between Queens and Nassau County;
 - Interstate 295, where 3,500 distribution and interplant trucks cross the Throgs Neck Bridge daily;
 - Interstate 95 (Cross Bronx Expressway) in the Bronx, where 2,600 trucks travel daily;
 - Interstate 678, where nearly 2,000 trucks cross the Bronx-Whitestone Bridge each day;
 - the Interstate 87/Interstate 287 corridor, where 1,800 trucks cross the Tappan Zee Bridge daily; and
 - Interstate 95 (New England Thruway) in the Bronx and Westchester counties, where 1,800 trucks travel each day.
- **Urban freight and local delivery** trips consist of truck trips transporting freight from warehouses, distribution centers, and intermodal terminals in the NYMTC planning area to receivers who are also in the NYMTC planning area. The greatest volumes of urban freight and local delivery trips are found on the interstate highways. Interstate 495 carries the greatest number of trucks performing this trip type, and approximately 3,000 trucks in travel on this highway in eastern Queens and western Nassau County daily. Other major routes for urban freight and local delivery trips include:
 - Interstate 678 (Whitestone Expressway and Van Wyck Expressway), which carries 2,400 to 2,800 daily urban freight trucks;
 - Interstate 278 (Brooklyn Queens Expressway) in northern Brooklyn, which carries 2,100 urban freight and local delivery trucks per day;
 - Interstate 87 in the Bronx and Westchester Counties;

- Interstate 295 in the Bronx and Queens; and
- Interstate 95 in the Bronx.

All of the aforementioned routes carry more than 1,000 urban freight and local delivery trucks daily. Off of the interstate highway network, portions of Atlantic Avenue in Brooklyn and Queens carries 2,500 daily urban freight and local delivery trucks, Linden Boulevard in Brooklyn and Queens and the Conduit Avenue and Nassau Expressway corridor in Queens carry 2,200 and 1,100 daily trucks, respectively.

- **Local** truck trips are defined as trips whose destinations are in the same county as the origin, or a in a county neighboring the county of origin. For example, truck trips destined for Manhattan, which originate in Bronx, Brooklyn, Manhattan, Queens, or Hudson and Bergen (New Jersey) counties are considered local trips. Not surprisingly, due to the short distances traveled, local trips are more dispersed on the region's highway network, appearing on secondary and tertiary roads in greater volumes than most of the other trip types.

Figure 2.2 Truck Trip Purpose on Highway Network by Corridor



2.1.2 Rail Network

Most of the rail freight activity within the New York Metropolitan region takes place west of the Hudson River in northern New Jersey. The largest carload freight yards, intermodal terminals, rail-served industries and distribution centers are located in this area. East of the Hudson River, freight rail volumes are lower, yet rail serves an important role in carrying bulk commodities such as stone, sand, and liquids. A map of the lines where freight railroads own or have operating rights, and associated terminals, is shown in Figure 2.3.

Three Class I railroads operate in the New York Metropolitan region, including:

- CSX, which operates along the River Line in Rockland County, Hudson Line in Putnam, Westchester, and Bronx counties, the Hell Gate Line and Fremont Secondary from Bronx County into Queens County. CSX also provides local industry service to customers along the New Haven Line and to the Hunts Point Distribution Center in Bronx County;

- Norfolk Southern (NS), which only serves the New York Metropolitan region from the south and west, and its lines do not directly enter the NYMTC counties; and
- Canadian Pacific Railway (CP), which until 2010, operated carload train service east of the Hudson to Oak Point Yard and Fresh Pond Yard, established a haulage agreement with CSX, with CSX handling CP traffic in their trains south of Albany in 2014. CP retains trackage rights in lieu of the haulage agreement, but is not shown on Figure 2.3.

In addition, Conrail Shared Assets (CR), a switching carrier jointly owned by NS and CSX, operates in much of Northern New Jersey and over the Arthur Kill Lift Bridge to Arlington Yard and the Travis Industrial Track in Richmond County (Staten Island).

Rail customers in the NYMTC planning area are also served by five short line railroads, including:

- The New York and Atlantic Railway (NY&A) has held an exclusive franchise to provide freight service over trackage owned by the MTA Long Island Rail Road (LIRR) since 1997. The NY&A operates from a hub at Fresh Pond Junction in Queens. NY&A serves Brooklyn via the freight-only Bay Ridge Branch, and points west, east, and south on Long Island via LIRR's Lower Montauk Branch, Main Line, Babylon/Montauk Branch, and Port Jefferson Branch.
- New York New Jersey Rail, LLC (NYNJ), which is owned by the Port Authority of New York and New Jersey, operates a carfloat route across New York Harbor between Greenville Yard in Jersey City, New Jersey and the 65th Street Yard in Brooklyn. NYNJ also provides rail service along 1st Avenue in Sunset Park to the 51st Street Rail Yard and South Brooklyn Marine Terminal.
- The Providence and Worcester Railroad (P&W) maintains trackage rights with CSX to operate over the Hell Gate Line via Metro-North's New Haven route. The only regular move by P&W on this route is the handling of crushed rock in unit train service to Fresh Pond Junction on Long Island, which is the only commodity permitted under P&W's limited trackage rights.

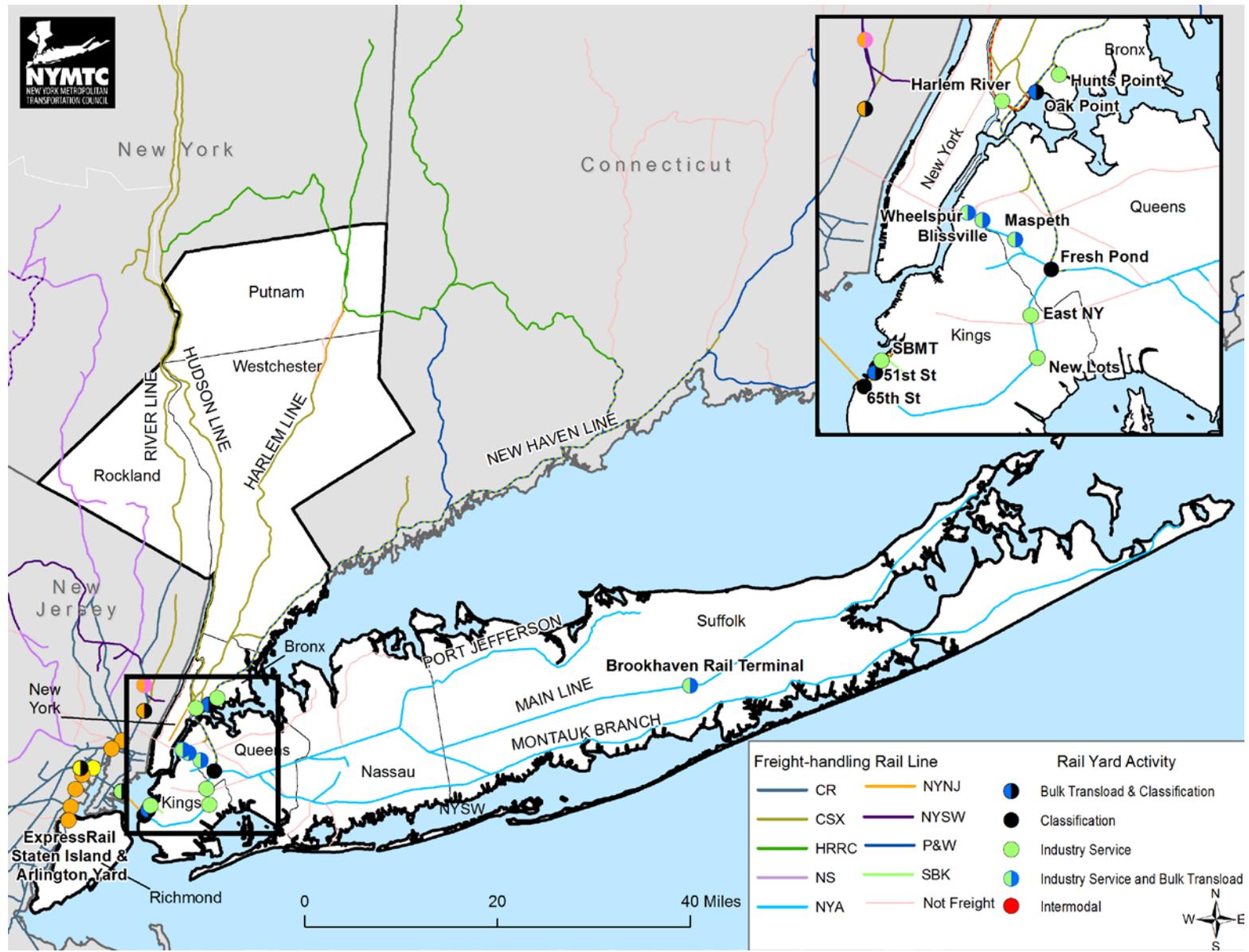
Two other short line railroads exist within the NYMTC planning area:

- The Housatonic Railroad (HRRC), which holds currently unused freight rights over Metro-North's Beacon Line, from Beacon east through Hopewell Junction to the New York-Connecticut state line.
- The South Brooklyn Railway (SBK) is a freight carrier owned by the MTA/New York City Transit that presently consists of isolated segments of track at 39th Street and 3rd Avenue and at NYCT's Coney Island Yards.
- In addition, the New York, Susquehanna, and Western Railway (NYSW) maintains trackage rights with NS to operate on the Southern Tier Line between Warwick, New York and Binghamton. NYSW operates on its own tracks north of Binghamton to Syracuse, in the Utica area, and between Warwick and Croxton in Jersey City, New Jersey. Although this railway does not traverse or provide service to customers in the NYMTC planning area, some rail shipments handled by NYSW originate or terminate by truck in the NYMTC planning area.

Within the NYMTC planning area, only a handful of carload service freight yards and terminals remain, with most previous facilities either converted to non-rail or non-freight rail uses. Each of the active terminals is mapped in Figure 2.3, coded by their type of use. Terminals and yards can be divided into three categories, which are as follows:

- **Industry Service** yards are designed to stage cars for the purpose of serving nearby industry. The largest industry yard in terms of activity is **Hunts Point**, which is located in New York City's Hunts Point Peninsula. A thriving industrial area in the South Bronx, it is best known as the primary food distribution center for produce, which often arrives by rail. There are 670 businesses, which collectively employ over 13,000 people.
- **Bulk Transload** terminals provide access to the rail network for shippers that do not have a rail siding next to their facility(ies). The Brookhaven Rail Terminal, currently handles construction materials and other bulk goods destined for central and eastern Long Island. The Port Authority of New York and New Jersey was recently awarded a FASTLANE grant to improve the transload capabilities of the 65th Street Rail Yard. The facility currently handles lumber and other wood products.
- **Carload Classification/Interchange** yards sort rail cars by destination for assembling into outbound blocks and trains. **Oak Point** and **Fresh Pond Junction** yards are the primary classification/interchange yards in the NYMTC planning area.
- **Intermodal** yards accommodate the transfer of intermodal containers, such as domestic trailers or international shipping containers, from truck to rail or vice versa. The only intermodal yard located in the NYMTC planning area is the ExpressRail Staten Island facility, which handles the transfer of international shipping containers that arrive and depart from New York Container Terminal, from ship to rail.

Figure 2.3 Rail Freight Network by Ownership



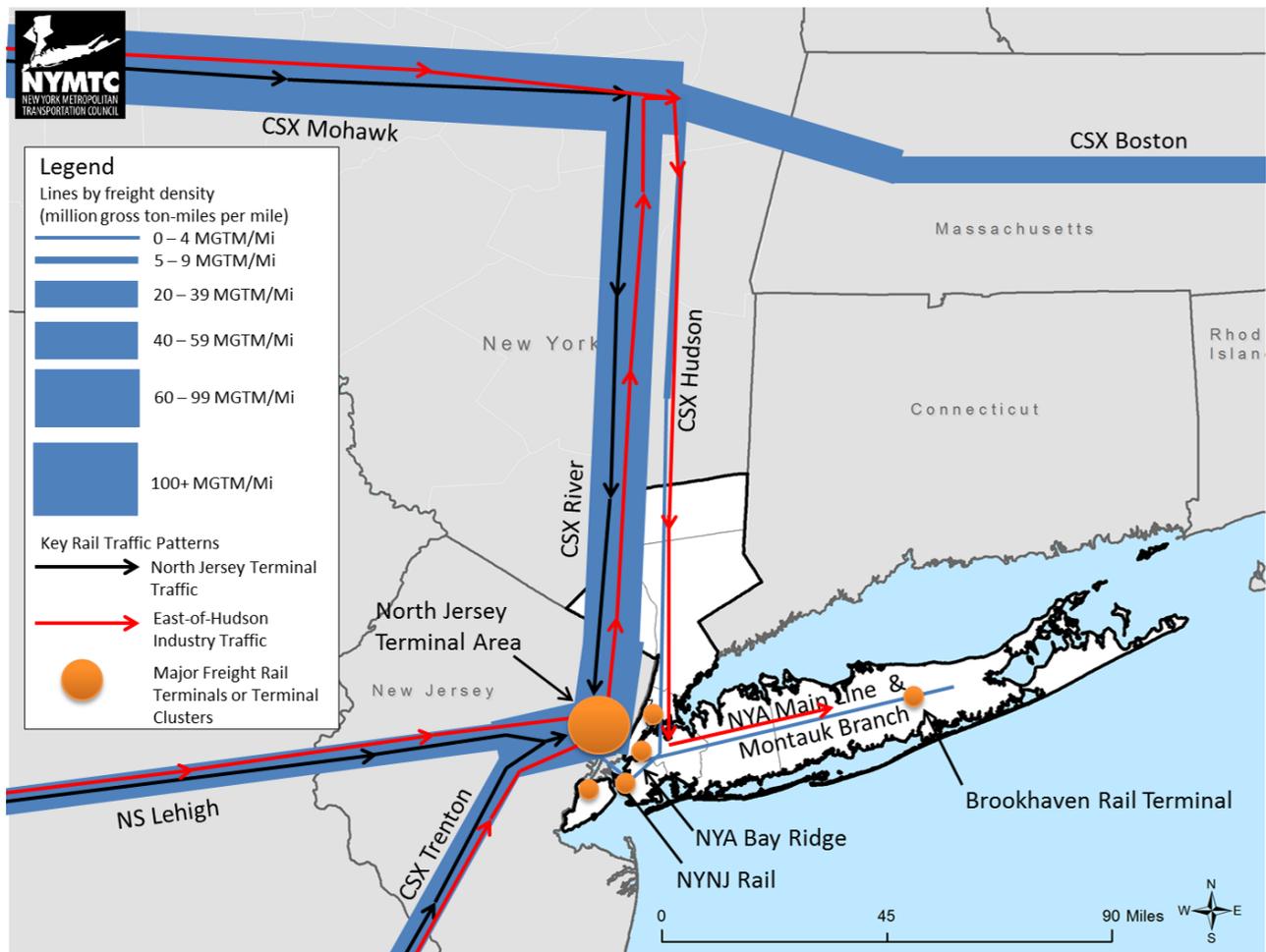
Source: National Transportation Atlas Database, 2015; Oak Ridge National Laboratory National Rail Network, 2014

Figure 2.4 illustrates, in a simplified schematic, the major freight rail corridors that traverse or pass near the NYMTC Region. The line weights correspond to the volume of freight handled on each corridor. As the figure suggests, the New York Metropolitan region is primarily connected to the national rail network via lines and terminals located west of the Hudson River. Intermodal terminals in northern New Jersey are connected to locations to the north and west by the CSX River Line and the CSX Mohawk Subdivision (historically, the New York Central Main Line). The NS Lehigh Line and CSX Trenton Line connect northern New Jersey terminals to locations in the southern and western states.

This network is serving the NYMTC planning area primarily in three capacities:

1. In this pattern, shown in Figure 2.4 in black arrows, inbound goods are transported by rail from origins throughout North America to intermodal terminals located in northern New Jersey. In northern New Jersey, shipments are transferred or transloaded to truck for delivery throughout the NYMTC planning area. Outbound shipments follow this pattern in reverse.
2. In this pattern, shown in Figure 2.4 in red arrows, goods destined for the east-of-Hudson portion of the NYMTC Region are transported by rail from origins throughout North America and approach the region via the CSX Mohawk Secondary, CSX Trenton Line, or NS Lehigh Line. Trains approaching from the latter two lines must travel north along the CSX River Line toward Selkirk, near Albany, which is the southernmost freight rail bridge over the Hudson River. From Selkirk, trains travel south along the Hudson Line into Putnam, Westchester, and Bronx counties. Traffic destined for Queens, Brooklyn, and Long Island cross the East River via the Hell Gate Bridge.
3. In 2016, approximately 3,500 loaded railcars used the NYNJ Rail carload float system between Greenville Yard in Jersey City, New Jersey and 65th Street Yard in Brooklyn, which provides a more direct route for traffic originating or terminating in the Southeastern United States, avoiding the approximately 280-mile trip via Selkirk. Selkirk remains an efficient routing for CSX traffic from Chicago and points west, because CSX uses Selkirk as a classification facility for traffic destined throughout New York and New England.

Figure 2.4 Major Freight Rail Corridors by Volume and Traffic Patterns Serving the NYMTC Planning Area



2.1.3 Waterborne Network

The Port of New York and New Jersey is the largest container port on the U.S. East Coast, and third-largest in the United States behind Los Angeles and Long Beach. In 2015, approximately 3.6 million containers, or 6.3 million twenty-foot equivalent units (TEUs) passed through the six container terminals within the Port. In the 10-year period between 2005 and 2015, the volume of containerized TEUs increased by 33 percent and 2015 volumes were about 10 percent higher than 2014 volumes. These container facilities are mapped in Figure 2.5.

About 70 percent of loaded TEUs are imports, while 30 percent contain goods that are being exported. The Port of New York and New Jersey's top international trading partners are China, which accounted for 29.3 percent of the Port's total trade volume in 2015, India (6.6 percent), Germany (5.3 percent), and Italy (4.4 percent). The top containerized commodities that traveled through the Port in 2015 included furniture (319,227 TEUs), apparel and accessories (203,208 TEUs), machinery and appliances (201,860 TEUs), and beverages (193,350 TEUs).

The Port serves as a major international gateway for imports and exports consumed and produced in the NYMTC planning area. In addition, the Port serves a primary market area consisting of seventeen states in

the Northeast, Mid-Atlantic, and Midwest. In 2015, the Port sent or received 59 percent of the TEUs that passed through North Atlantic ports between Maine and Virginia.⁸

The Port Authority of New York and New Jersey's long-range forecast (from 2017 to 2036) projects a 3.6 percent compound annual growth rate, with growth proportionally distributed across marine terminals in New York and New Jersey. The degree to which Global Container Terminal in Staten Island and Red Hook Container Terminal in Brooklyn share in this growth may depend on the new mix of ships calling in New York and New Jersey as the industry moves towards larger vessels.

Figure 2.5 Port of New York and New Jersey Marine Terminals



Source: Port Authority of New York and New Jersey

In addition to bulk and break-bulk terminals, there are nearly 200 private port facilities along various New York waterways handling a variety of cargo such as sand and gravel, petroleum products, paper products, etc. Table 2.1 below summarizes all port facilities listed in the U.S. Army Corps of Engineers ports database, which are located in the NYMTC planning area. Some of the facilities listed in the database represent individual piers, berths, or wharves contained within the same gate or operated by the same terminal operator. The data is separated into several waterways or other geographic areas. Facilities without any common location are included under 'Other', which includes several different waterways: Coney Island Creek, East River, Glen Cove Creek, Gravesend Bay, Jamaica Bay, Hempstead Bay, Manhasset Bay, Oyster Bay, Port Jefferson, Greenport, and Port Chester Harbor. Table 2.1 lists the number of facilities

⁸ "NAFTA Container Traffic, 1996-2015," American Association of Port Authorities, available from: <http://www.aapa-ports.org/unifying/content.aspx?ItemNumber=21048> (accessed April 14, 2017). Ports included in this analysis include: Baltimore, MD; Boston, MA; Hampton Roads (Norfolk), VA; New York and New Jersey, NY and NJ; Philadelphia, PA; Portland, ME; and Wilmington, DE.

which are categorized as able to handle each commodity type; as a result, facilities capable of handling multiple commodity types will be counted more than once. These facilities are mapped in Figure 2.6.

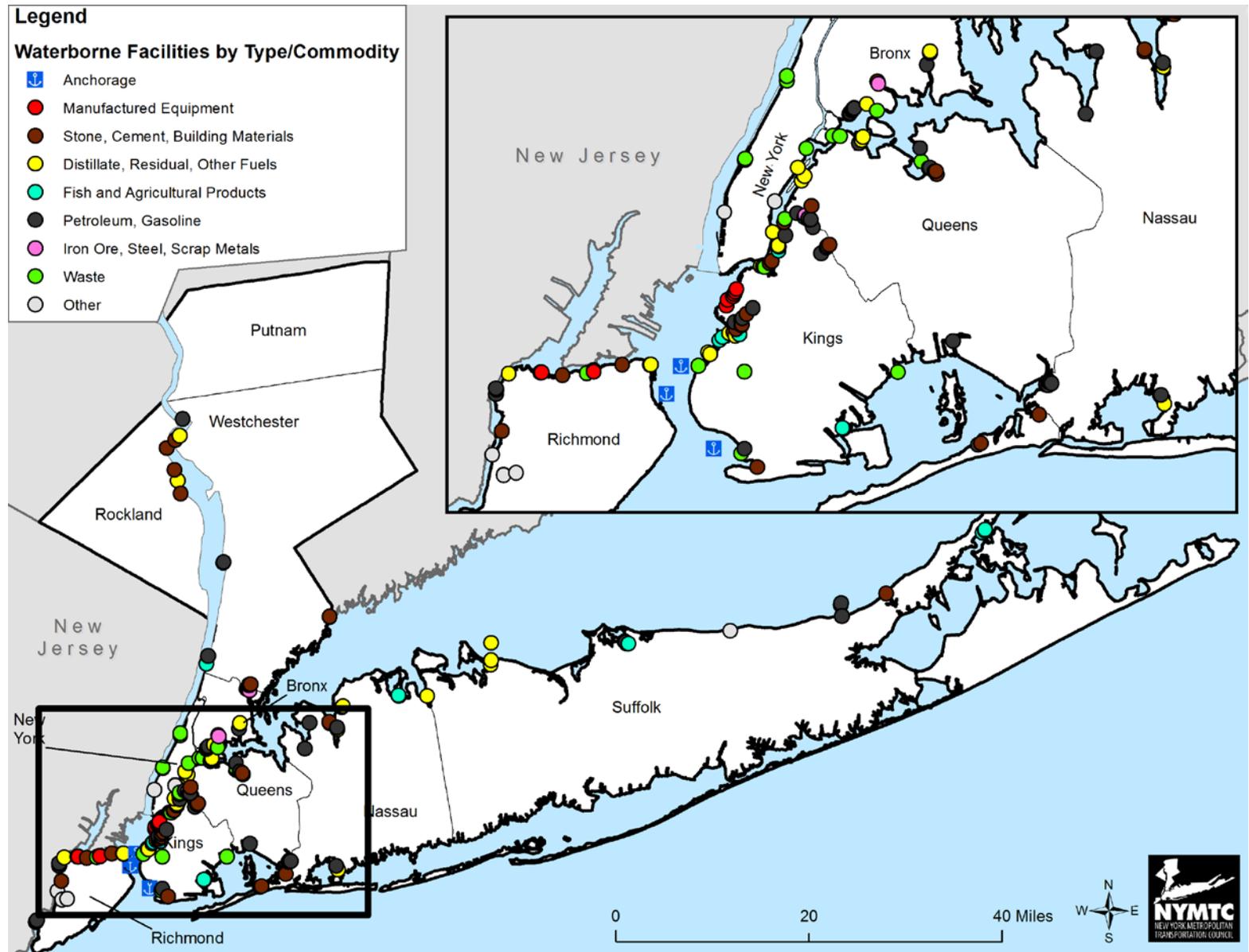
Table 2.1 Bulk and Break-bulk Waterborne Cargo Facilities in the NYMTC Planning Area

	Brooklyn Navy Yard	Newtown Creek	Red Hook	South Bronx	Staten Island (Kill van Krull)	Upper Bay (Sunset Park / Erie Basin)	Flushing Bay	East Chester Creek	Hudson River	Other	Total
Agricultural Products & Food	1	-	2	-	-	1	-	-	1	-	5
All Manufactured Equipment & Machinery	-	-	7	-	4	-	-	-	-	2	13
Building Cement & Concrete	3	-	-	-	-	2	1	-	-	-	6
Coal, Lignite & Coal Coke	-	-	-	-	-	-	-	-	-	2	2
Crude Materials, Inedible Except Fuels	-	-	-	-	3	-	-	-	-	-	3
Distillate, Residual & Other Fuel Oils	3	-	2	4	1	2	-	-	3	14	29
Fish	-	-	-	-	-	-	-	-	-	3	3
Forest Products, Lumber, Logs, Woodchips	1	-	-	-	-	-	-	-	-	-	1
Gasoline, Jet Fuel, Kerosene	-	4	-	-	-	-	-	1	2	1	8
Iron Ore and Iron & Steel Waste & Scrap	-	2	-	1	-	-	-	1	-	-	4
Paper & Allied Products	-	-	-	-	2	-	-	-	-	2	4
Petroleum and Petroleum Products	3	4	-	9	7	3	2	3	7	10	48
Sand, Gravel, Stone, Soil, Dredged Material, etc	5	2	-	1	3	4	4	7	5	7	38
Sulphur (Dry), Clay & Salt	-	-	-	-	1	-	-	-	-	-	1
Waste Material, Landfill, Sludge, Waste Water	5	1	1	1	1	1	1	-	4	7	22
Total	21	13	12	16	22	13	8	12	22	48	187

Source: U.S. Army Corps of Engineers, 2015.

It is important to note that some of the facilities listed in Table 2.1 currently may not be operational. Both privately-operated facilities and terminals operated by the Port Authority of New York and New Jersey are included as well. Many facilities also are receiving cargo for use directly on the wharf. For example, some petroleum receipt facilities are for supplying power to plants located near the water. As a result, not all of the facilities listed will generate significant road or rail activity when in use.

Figure 2.6 Waterborne Freight Terminals and Commodities Handled, NYMTC Planning Area



Source: U.S. Army Corps of Engineers, 2015

2.1.4 Air Cargo Network

Of the New York area airports in the NYMTC planning area— John F. Kennedy International Airport (JFK), LaGuardia Airport (LGA), Westchester County Airport (HPN), Long Island MacArthur Airport (ISP) and Republic Airport (FRG), only JFK has significant air cargo activity and it is ranked among one of the top air cargo gateways in the country. LGA, while handling significant domestic passenger traffic, does not handle any significant amount of air cargo. HPN is a regional commercial and general aviation airport and any cargo is incidental to the passenger and charter services operated there. As part of the New York metropolitan area, Stewart International Airport (SWF), and Newark Liberty International Airport (EWR) are key components of the international and domestic air traffic around New York City. Both airports have significant air cargo volumes. The airports in the NYMTC planning area are shown on a map in Figure 2.7.

For most of the past decade, air cargo tonnage at Port Authority-owned airports (JFK, LGA, EWR, and SWF) declined. The decline is attributed to slow economic growth, substitution of truck for air transport, weakened competitive position due to airline initiatives to expand operations at other airports, and strategic decisions by operators to shift to the Midwest and West to improve proximity to Asian markets for westbound traffic. Other impacts are fuel surcharges for air shipping, recession in the Eurozone economy, and a further shift from air to sea transport.⁹

In recent years, however, there has been a reversal in air cargo growth patterns. Regionally, Port Authority Airports experienced year-over-year growth in 2014 (+1.2%), 2015 (+1.4%), and 2016 (1.4%). Air Mail also grew year over year in 2015 (11.8%) and in 2016 (0.7%). Factors contributing to this growth include the strong and continuing rise of e-commerce, whether by general air cargo, express cargo, or by mail; lower fuel costs; and new airlines serving the JFK market from both European and Asian regions. In 2015, JFK ranked as the seventh top airport in the U.S. in terms of cargo tonnage.¹⁰

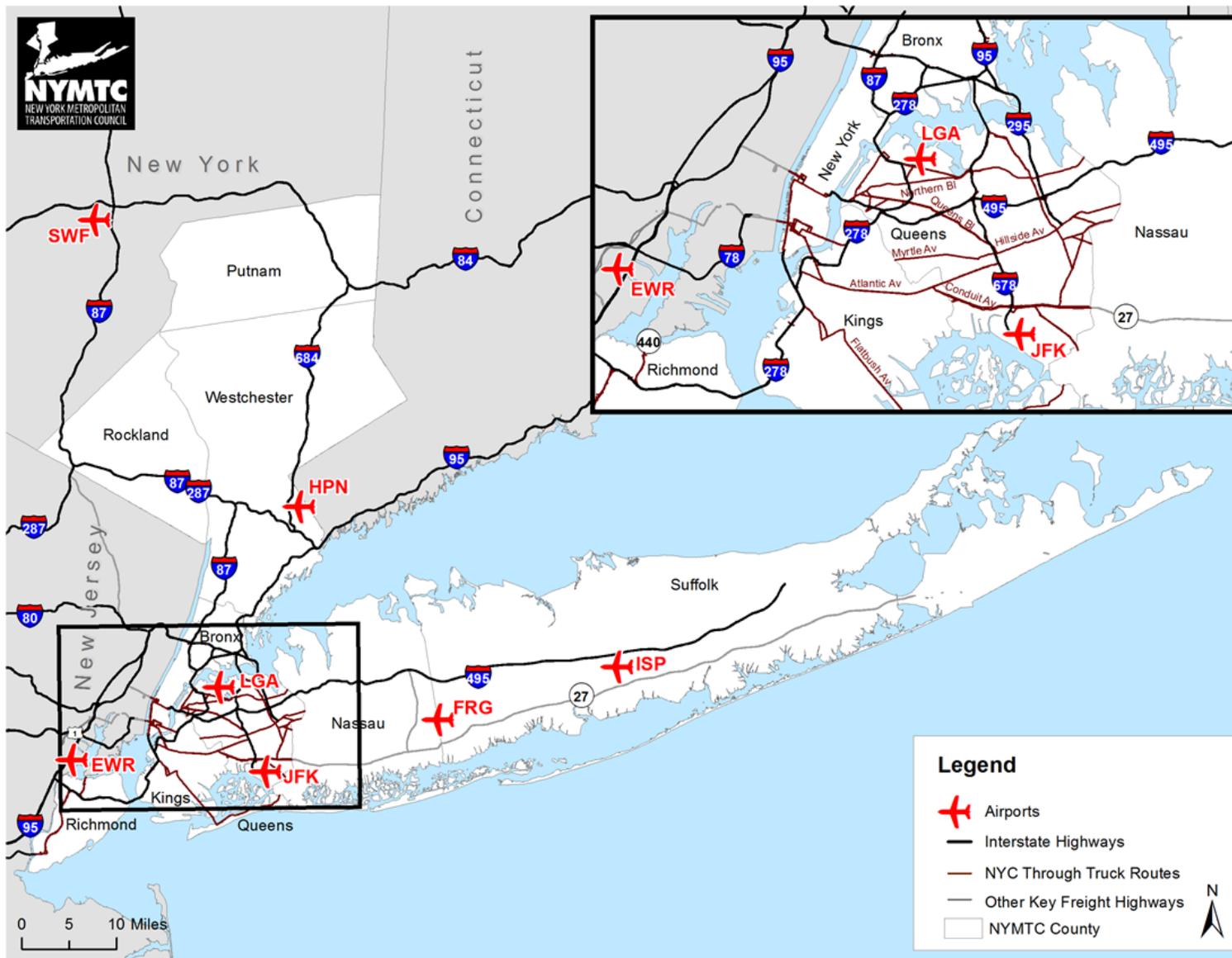
Europe and Asia were the two largest markets for international cargo by weight and were approximately equal in the import/export movements. Top air trade commodities by weight for import/export were machinery, electrical machinery, optical-medical instruments, plastic, woven apparel, fish/seafood, knit apparel, pharmaceutical products, iron and steel, and vehicles (non-railway).¹¹

⁹ *Year in Review: Traffic and Cargo Activity at the Port Authority Airports in 2012*, The Port Authority of New York and New Jersey.

¹⁰ “2015 North American (ACI-NA) Top 50 Airports,” Airports Council International – North America, available from: <http://www.aci-na.org/content/airport-traffic-reports> (accessed April 14, 2017).

¹¹ *2011 Airport Traffic Report*, The Port Authority of New York and New Jersey, April 2, 2012 (excludes Teterboro).

Figure 2.7 Airports In and Near the NYMTC Planning Area



Source: National Transportation Atlas Database, 2015.

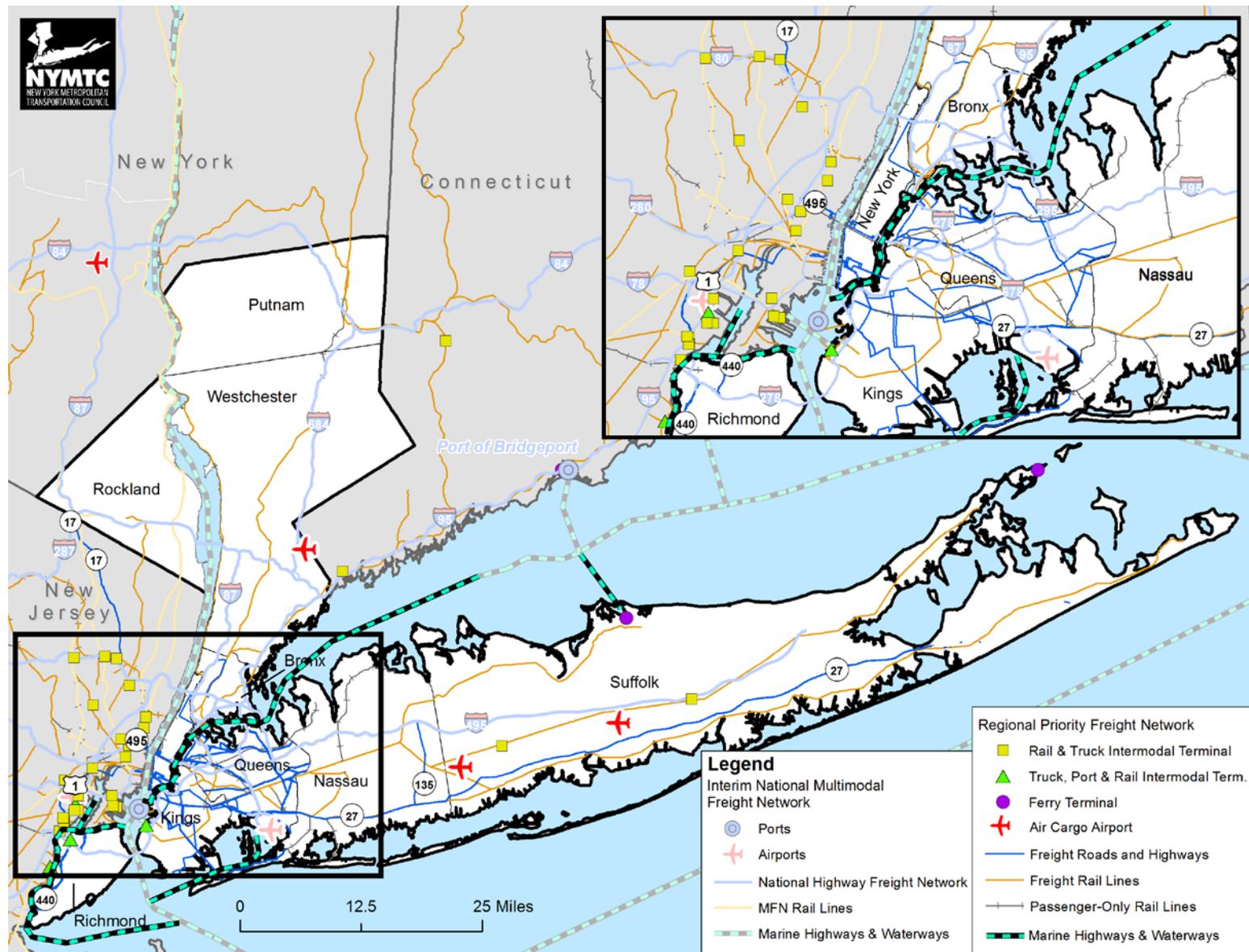
2.1.5 Multimodal Freight Network

As Figure 2.8 shows, the modal networks described above work together to move freight as safely and efficiently as possible. Intermodal freight infrastructure includes the terminal facilities at which freight is transferred or transloaded from one transportation mode to another. Examples of intermodal facilities include:

- **Truck-to-Rail Terminals.** In a multimodal supply chain, trains carrying containers and trailers represent one link in the intermodal chain that connects shippers with receivers. In order for the connections to occur, intermodal rail terminals are established to facilitate the transfer of containers and trailers between modes (truck to rail, and vice versa). At present, there are no rail/highway intermodal terminals located in the NYMTC planning area. Instead, intermodal rail trips begin or end at several terminals in New Jersey, with trucks hauling (“draying”) the trailers or containers between the terminals and the NYMTC planning area. Bulk commodities are often transloaded between railroads and trucks at rail yards and other facilities throughout the planning area. These bulk transload terminals provide access to the rail network for shippers that do not have a rail siding next to their facility(ies). The design of these terminals can range from simple to elaborate, depending on the types of commodities and volumes handled through them. The typical commodities being transloaded in the NYMTC planning area are waste and scrap materials, food, coal, lumber, building products, stone, and fuel.
- **Truck-to-Water Terminals.** Trucks carry approximately 80 percent of the containers that are imported or exported via the Port Authority marine terminals described in Section 2.1.3, and shipments are transloaded from truck to water, or from water to truck, at many of the bulk waterborne terminals in the NYMTC planning area. In addition, trucks collect municipal solid waste (MSW) across the region and transport it to MSW transload facilities in sealed containers. The containerized MSW is transferred from truck to rail or truck to barge and shipped out of the region. Long Island Sound Ferries Car ferries operating on Long Island Sound also accommodate trucks, but the volumes are relatively low. Currently, the existing year round ferry services carrying trucks in the NYMTC region include the Bridgeport–Port Jefferson Ferry, the New London–Orient Point Ferry, and the North Ferry serving Shelter Island.
- **Rail-to-Water Terminals.** Marine terminals and ports with on-dock rail access in northern New Jersey and the NYMTC region move containers, railcars, and bulk commodities between New Jersey and New York by rail and barge. The ExpressRail System is an on-dock intermodal rail service offered at Maher Terminal in Elizabeth, Port Newark Container Terminal in Newark, and New York Container Terminal in Staten Island. The ExpressRail facilities are supported by the Corbin Street Intermodal Support Yard, located to the west of the Port Newark/Port Elizabeth marine terminals. Between 1991 and 2016, ExpressRail volumes have increased 19-fold, from 27,700 containers to more than 540,000 containers. The Port Authority of New York and New Jersey is developing a new ExpressRail facility at Greenville Yard in Jersey City to handle containers imported or exported through the GCT Bayonne terminal.
- **Air-to-Truck Terminals.** The main purpose of air cargo facilities is to move cargo to and from landside to airside, from truck to aircraft efficiently. The types of air cargo facilities present in the region include:

- Integrator Operations, which are highly automated, customized facilities with dedicated loading and aircraft positions for parcel delivery companies such as UPS and FedEx. These facilities are located in the vicinity of JFK and Newark Liberty International airports.
- General Cargo Facilities, whether single tenant use or multitenant, are generally large warehouse facilities, located on or adjacent to the region's air cargo-handling airports.
- Freight Forwarders are combinations of cargo warehouse functions and office space for cargo brokers.
- Logistics Centers and Value Added Facilities accommodate additional logistics and supply chain functions, sometimes including other cargo modes. Value added operations process or repackage the product at the facility.
- Mail Centers can be stand alone or operations within cargo facilities and involve sortation equipment on various levels.

Figure 2.8 Multimodal Freight Network



Source: U.S. DOT, 2016; National Transportation Atlas Database, 2015; Oak Ridge National Laboratory National Rail Network, 2014.

2.2 Regional Commodity Flow Summary, 2012-2045

This section describes the flow of commodities throughout the NYMTC planning area in 2012 and forecasted flows in 2045. The commodity flow data sources are developed using data from the U.S. Census Bureau's Economic Census, performed once every five years. The most recent Economic Census was developed for the year ending in December 2012. The next Economic Census will be conducted for the year ending in December 2017.

This analysis uses a combination of data from Surface Transportation Board (STB), which provided a confidential dataset of rail waybill data for the State of New York, data from Information Handling Services (IHS) Transearch, which provided information for rail, truck, air, and water modes for the State of New York, and U.S. Department of Transportation (USDOT) Freight Analysis Framework (FAF) data and forecasts. Pipeline flows are not included in the database. The data represent flows of domestic freight, freight transported to or from Canada or Mexico, and the domestic leg of international freight, i.e., the transport of international imports from the port of entry to domestic destinations, and the transport of international exports from domestic origins to the international gateways.

The IHS Transearch data package provided county-level commodity flows for New York State and all bordering states (Connecticut, Massachusetts, New Jersey, Pennsylvania, and Vermont) for a 2012 base year and 2040 forecast year. The USDOT FAF provides forecasts through 2045, but at a more aggregated unit of geography, consisting of multi-county regions. Because of the county-level geographic detail in the IHS Transearch data, that package was used as the basis for this commodity flow analysis.

To extend the forecast year from 2040 to 2045, commodity-level growth rates were calculated for commodities transported inbound, outbound, internally and through the NYMTC planning area for the 2040-2045 period, according to the FAF. Those growth rates were applied to traffic transported inbound, outbound, internally, and through the NYMTC planning area according to the IHS Transearch 2040 forecast, to extrapolate a 2045 forecast. Although the geographic bounds of the New York, NY Bureau of Economic Analysis (BEA) region and the NYMTC planning area do not completely align (the BEA region includes Dutchess, Orange, and Ulster counties), the rates for the BEA region were deemed to be approximate to what the rates would be for the ten NYMTC planning area counties alone. The result of this effort was a commodity flow database with a 2012 base year and 2045 forecast year for the ten-county NYMTC planning area.

2.2.1 Analysis by Direction

In 2012, 365 million tons of freight moved into, out of, within, or through the ten-county NYMTC planning area. Table 2.2 presents the freight flows by weight and direction in 2012 and forecasted for 2045, in addition to the proportion of regional freight by direction. Approximately 174 million tons (48 percent) traveled inbound, 65 million tons (18 percent) traveled outbound, and 50 million tons (14 percent) was intraregional, having traveled from one point within the NYMTC planning area to another point within the NYMTC planning area. Through freight accounted for 76 million tons or 21 percent of the total.

By 2045 these flows are expected to grow by 67 percent, to 610 million tons. This growth in commodity flows reflects anticipated population and economic growth, increasing wealth and consumer spending, and increasingly complex logistics and distribution networks. Inbound flows are expected to grow 57 percent to 274 million tons, at an annual growth rate of 1.4 percent. Outbound shipments are expected to increase by 70 percent to 126 million tons, at an annual growth rate of 1.6 percent. Freight moving completely within the

NYMTC planning area is estimated to increase nearly 105 percent to 83 million tons, at an annual growth rate of 2.2 percent, and through freight is expected to increase to 126.3 million tons by 2045 a 66 percent increase, and 1.6 percent compound annual growth rate.

Table 2.2 Commodity Flow by Direction for NYMTC Planning Area, All Modes, 2012 and 2045

Direction of Movement	2012		2045		Total Growth (2012-2045)
	Tons (in millions)	% of Total	Tons (in millions)	% of Total	
Inbound	174.4	47.7%	274.1	44.9%	57.2%
Outbound	74.2	20.3%	126.0	20.7%	69.8%
Through NYMTC	76.1	20.8%	126.3	20.7%	66.0%
Intra-NYMTC	40.7	11.1%	83.4	13.7%	104.9%
TOTAL	365.3	100.0%	609.7	100.0%	66.9%

Source: 2012 IHS Global Insight Transearch Data, 2012 STB Waybill Sample

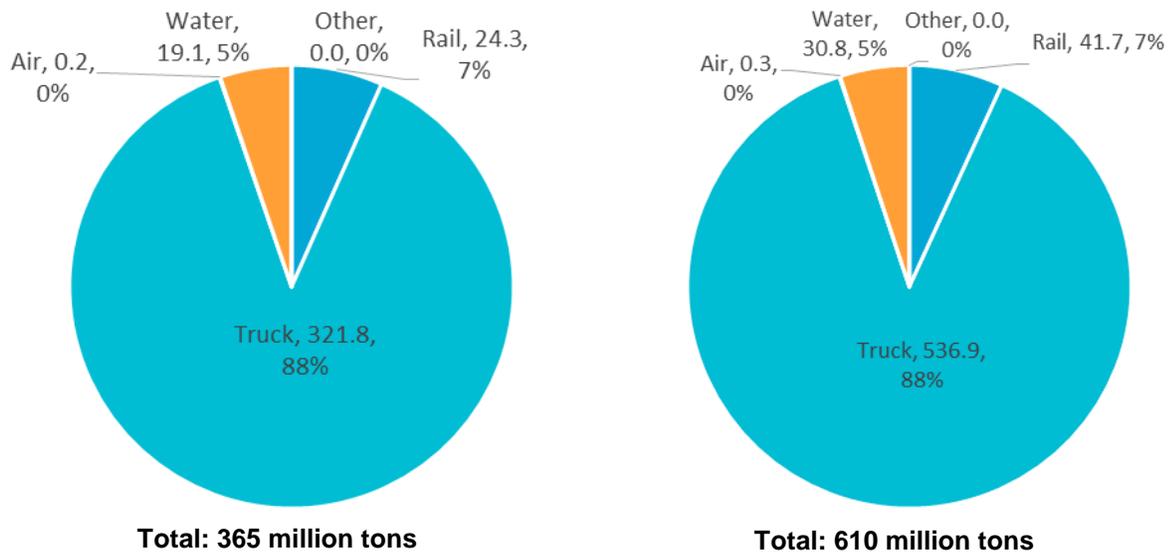
2.2.2 Analysis by Mode

Table 2.3 and Figure 2.9 display the breakdown of total freight tonnage by mode for 2012 and forecasted for 2045. Trucks were the dominant mode of freight transportation throughout the planning area. The NYMTC planning area is highly dependent on trucks for the movement of the vast majority of freight into, out of, through, and within the area. Approximately 88 percent of all freight tonnage in 2012 was moved by truck in all directions. Rail was the second most common mode, transporting nearly seven percent of freight tonnage in the same year, the vast majority of which was passing through the planning area. Freight transport by water comprised approximately five percent of freight tonnage. Air and other modes of transportation each accounted for less than one percent of flow by tonnage, through air carries lighter-weight, higher-value goods and plays an important role in transporting e-commerce shipments. These modes are not expected to change substantially between 2012 and 2045.

Table 2.3 Commodity Flow by Mode for NYMTC Planning Area, 2012 and 2045

Direction of Movement	2012		2045		Total Growth (2012-2045)
	Tons (in millions)	% of Total	Tons (in millions)	% of Total	
Rail	24.3	6.6%	41.7	6.8%	71.7%
Truck	321.8	88.1%	536.9	88.1%	66.8%
Air	0.2	0.1%	0.3	0.1%	66.2%
Water	19.1	5.2%	30.8	5.1%	61.8%
Other	<0.1	<0.1%	<0.1	<0.1%	445.6%
TOTAL	365.3	100.0%	609.7	100.0%	66.9%

Source: 2012 IHS Global Insight Transearch Data, 2012 STB Waybill Sample

Figure 2.9 Freight Tonnage by Mode, 2012 and 2045

Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

2.2.3 Analysis by Commodity

2.2.3.1. Top Commodities – Inbound to the NYMTC Planning Area

The top commodities by weight transported into the NYMTC planning area via all modes in 2012 and the 2045 forecast are presented in Table 2.4. The top five inbound commodities in 2012 were nonmetallic minerals, petroleum or coal products, food or kindred products, secondary traffic (defined here as freight flows to and from distribution centers or via intermodal facilities, typically representing consumer goods), and clay, concrete, glass, or stone products. Combined, these commodities accounted for over 70 percent of the total inbound freight in 2012 and are forecasted to account for 61 percent in 2045. The transport of inbound petroleum or coal products is forecast to decrease 21 percent between 2012 and 2045, representing a projected decline in coal, which is transported largely by truck and rail, for energy production, in favor of natural gas, largely transported by pipeline and not accounted for in this analysis. The remaining top nine commodities are all projected to increase in tonnage.

Table 2.4 Top 10 Inbound Commodities in NYMTC Planning Area, All Modes, 2012 and 2045

STCC Code	Commodity Description	2012 Tons (in millions)	% of Total	2045 Tons (in millions)	% of Total	Total Change (2012-2045)
14	Nonmetallic Minerals	51.8	29.7%	60.1	21.9%	16.0%
29	Petroleum or Coal Products	23.4	13.4%	19.1	6.7%	-18.4%
20	Food or Kindred Products	21.2	12.1%	41.0	15.0%	93.3%
50	Secondary Traffic	14.2	8.1%	25.7	9.4%	81.0%
32	Clay, Concrete, Glass or Stone	13.4	7.7%	23.0	8.4%	71.6%

01	Farm Products	8.0	4.6%	15.3	5.6%	91.3%
28	Chemicals or Allied Products	7.2	4.1%	17.8	6.5%	147.2%
40	Waste or Scrap Materials	5.8	3.3%	17.5	6.4%	201.7%
24	Lumber or Wood Products	5.8	3.3%	8.0	2.9%	37.9%
26	Pulp, Paper, and Allied Products	3.5	2.0%	6.4	2.3%	82.9%
	All Other Commodity Groups	20.0	11.5%	40.6	14.8%	103.0%

Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

2.2.3.2. Top Commodities – Outbound from the NYMTC Planning Area

The top commodities by weight transported out of the NYMTC planning area via all modes in 2012 and the 2045 forecast are presented in Table 2.5. The top five outbound commodities in 2012 were petroleum or coal products, waste or scrap materials, nonmetallic minerals, secondary traffic, and food or kindred products. Combined, these commodities accounted for over 81 percent of the total outbound freight in 2012 and are expected to account for 79 percent in 2045. The transport of outbound crude, petroleum, or natural gas is forecast to decrease by just over 85 percent between 2012 and 2045, as crude products currently transshipped through the NYMTC planning area, are expected to be transported to refining facilities in New Jersey, Pennsylvania, and other areas. The remaining top nine commodities are all forecasted to increase in tonnage.

Table 2.5 Top Outbound Commodities in NYMTC Planning Area, All Modes, 2012 and 2045

STCC Code	Commodity Description	2012 Tons (in millions)	% of Total	2045 Tons (in millions)	% of Total	Total Change (2012-2045)
29	Petroleum or Coal Products	16.4	24.4%	26.8	21.3%	63.4%
40	Waste or Scrap Materials	13.5	20.6%	22.6	17.9%	67.4%
14	Nonmetallic Minerals	10.7	16.3%	13.0	10.3%	21.5%
50	Secondary Traffic	8.8	13.5%	25.3	20.1%	187.5%
20	Food or Kindred Products	5.9	9.0%	11.5	9.2%	94.9%
32	Clay, Concrete, Glass or Stone	3.1	4.8%	6.0	4.8%	93.5%
28	Chemicals or Allied Products	1.9	3.0%	5.7	4.5%	200.0%
34	Fabricated Metal Products	0.9	1.4%	2.0	1.6%	122.2%
13	Crude Petroleum or Natural Gas	0.7	1.1%	0.1	0.1%	-85.7%
30	Rubber or Misc. Plastics	0.7	1.0%	1.6	1.2%	28.6%
	All Other Commodity Groups	4.7	7.2%	11.3	9.0%	140.4%

Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

2.2.3.3. Top Commodities – Within the NYMTC Planning Area

The top commodities by weight transported within the planning area via all modes in 2012 and expected in 2045 are presented in Table 2.6. The top five commodities moving within the NYMTC planning area in 2012 were secondary traffic, petroleum or coal products, nonmetallic minerals, clay, concrete, glass, or stone products, and waste or scrap materials. Combined, these commodities account for about 90 percent of the total freight moving within the NYMTC planning area in 2012 and that proportion is expected to remain constant at 89 percent in 2045. The transport of nonmetallic minerals within the NYMTC planning area is forecasted to decrease 28.3 percent between 2012 and 2045, due in part to expected relocation of some construction materials transfer and staging areas to outside of the planning area. Construction plans for several mega-projects in the planning area in coming decades could change this assumption. The remaining top nine commodities are all forecast to increase in tonnage.

Table 2.6 Top Commodities within the NYMTC Planning Area, All Modes, 2012 and 2045

STCC Code	Commodity Description	2012 Tons (in millions)	% of Total	2045 Tons (in millions)	% of Total	Total Change (2012-2045)
50	Secondary Traffic	26.8	54.1%	47.6	57.1%	77.7%
29	Petroleum or Coal Products	7.1	14.3%	7.1	8.5%	0.9%
14	Nonmetallic Minerals	4.6	9.4%	3.3	4.0%	-28.3%
32	Clay, Concrete, Glass or Stone	3.7	7.4%	6.3	7.5%	70.3%
40	Waste or Scrap Materials	2.4	4.9%	9.9	11.8%	309.3%
20	Food or Kindred Products	2.1	4.3%	3.3	4.0%	53.7%
28	Chemicals or Allied Products	0.6	1.2%	1.4	1.7%	139.4%
34	Fabricated Metal Products	0.3	0.6%	0.5	0.6%	77.1%
27	Printed Matter	0.2	0.4%	0.2	0.2%	-3.4%
24	Lumber or Wood Products	0.2	0.4%	0.2	0.2%	6.9%
	All Other Commodity Groups	1.5	3.1%	3.6	4.3%	136.9%

Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

2.2.4 Top Commodity Origin-Destination Pairs

The North American regions from which most commodities destined for the NYMTC planning area originate include neighboring states and regions, as Table 2.7 shows. About 21 percent of all inbound flows to the NYMTC planning area originated in New Jersey in 2012, while 20 percent originated in Pennsylvania, 15 percent came from portions of New York State outside the NYMTC planning area, and about 14 percent from the South Atlantic States, which include Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia. These top four regions were the origin of nearly 70 percent of all of the NYMTC planning area's inbound freight flows. By 2045, origin points in the Midwest and "All Other Origins" are expected to grow at a faster rate than from these nearer regions. The top four originating regions are expected to produce 64 percent of inbound freight flows in 2045.

Table 2.7 Top Trip Origins for Inbound Commodities, 2012 and 2045

State or Region	2012 Tons (millions)	% of Total	2045 Tons (millions)	% of Total	Total Change (2012-2045)
New Jersey	37.4	21.4%	48.4	17.6%	29.4%
Pennsylvania	34.3	19.7%	55.8	20.4%	62.7%
Rest of New York State	25.5	14.6%	38.4	14.0%	50.7%
South Atlantic States	23.5	13.5%	33.4	12.2%	42.5%
Midwest	14.5	8.3%	28.0	10.2%	93.7%
Massachusetts	10.6	6.1%	18.2	6.6%	71.8%
All Other Origins	28.7	16.5%	51.9	18.9%	80.6%

Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Most of the outbound commodity flows from the NYMTC planning area are destined for nearby states as well, as Table 2.8 shows. Pennsylvania and New Jersey together received about half of outbound shipments from the NYMTC planning area in 2012. Other top destination regions included the South Atlantic States, portions of New York State outside the NYMTC planning area, and Connecticut. By 2045, Pennsylvania and New Jersey are expected to remain the top destinations, together receiving about 49 percent of outbound flows. Commodities moving from the NYMTC planning area to the rest of New York State and to Massachusetts are expected to experience the greatest rate of growth through 2045.

Table 2.8 Top Trip Destinations for Outbound Commodities, 2012 and 2045

Table Header	2012 Tons (millions)	% of Total	2045 Tons (millions)	% of Total	Total Change (2012-2045)
Pennsylvania	17.6	26.2%	35.7	28.3%	103%
New Jersey	16.3	24.2%	26.6	21.1%	64%
South Atlantic States	7.5	11.2%	13.5	10.7%	79%
Rest of New York State	6.3	9.4%	14.6	11.6%	131%
Connecticut	5.4	8.1%	9.8	7.7%	79%
Massachusetts	4.3	6.5%	9.4	7.5%	117%
All Other Destinations	3.9	14.3%	16.4	13.0%	70.7%

Source: 2012 IHS Global Insight Transearch Data, 2012 STB Waybill Sample

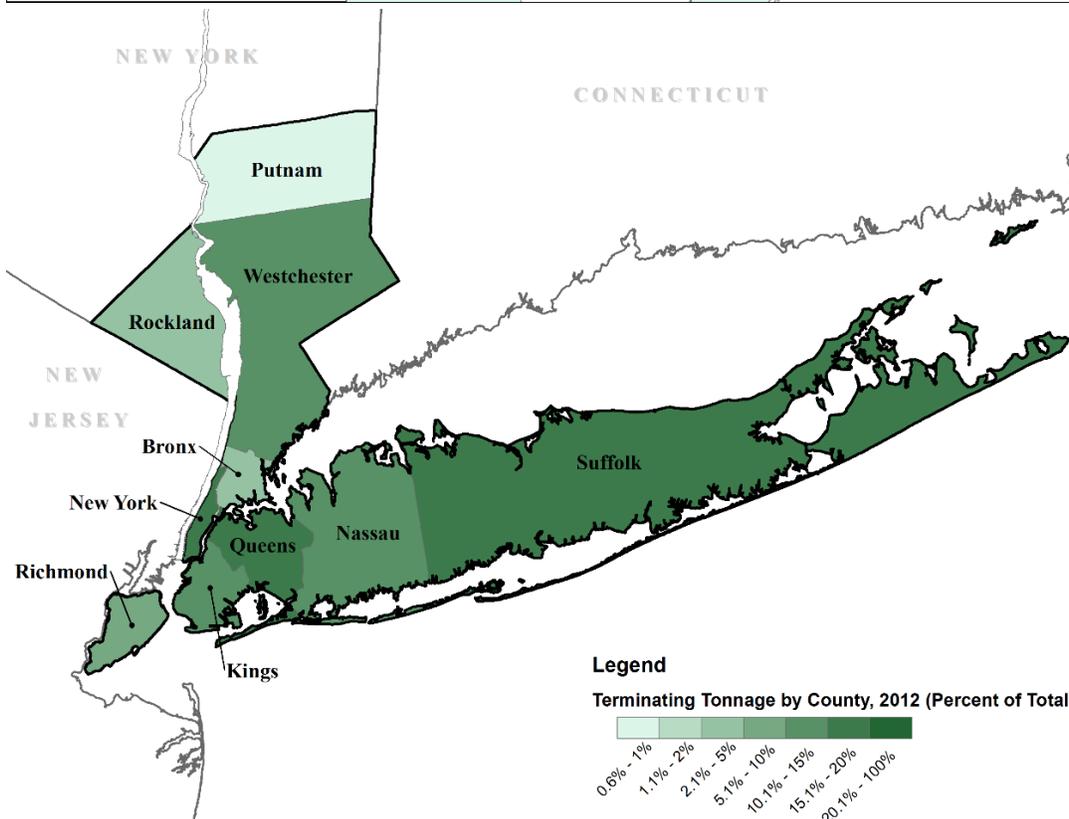
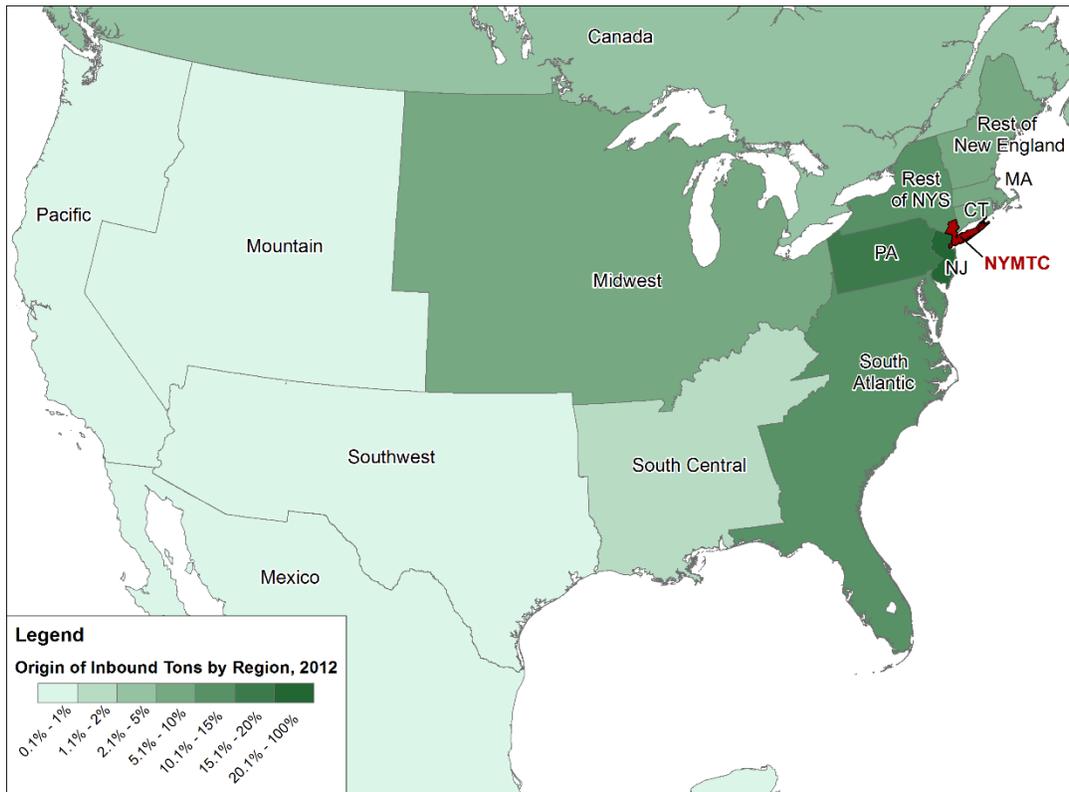
Figure 2.10 illustrates the geographic distribution of top origins of inbound freight flows in 2012, initially presented in Table 2.7, on a map of North American regions. The bottom map in Figure 2.10 illustrates the distribution of those inbound flows to their destinations within the NYMTC planning area. As shown, Suffolk County and the New York City boroughs of Queens and Manhattan were the top destinations of inbound commodity flows in 2012, each receiving more than 15 percent of the planning area’s inbound tonnage.

The top map in Figure 2.11 shows the geographic distribution of freight flows traveling outbound from the NYMTC planning area in 2012. Suffolk County was the top origin, generating about 20 percent of all outbound freight tonnage. Consistent with the data presented in Table 2.8, bottom map in Figure 2.11 shows

the distribution of outbound tonnage to the various regions of North America in 2012, with Pennsylvania, New Jersey, and the rest of New York State being the top destinations.

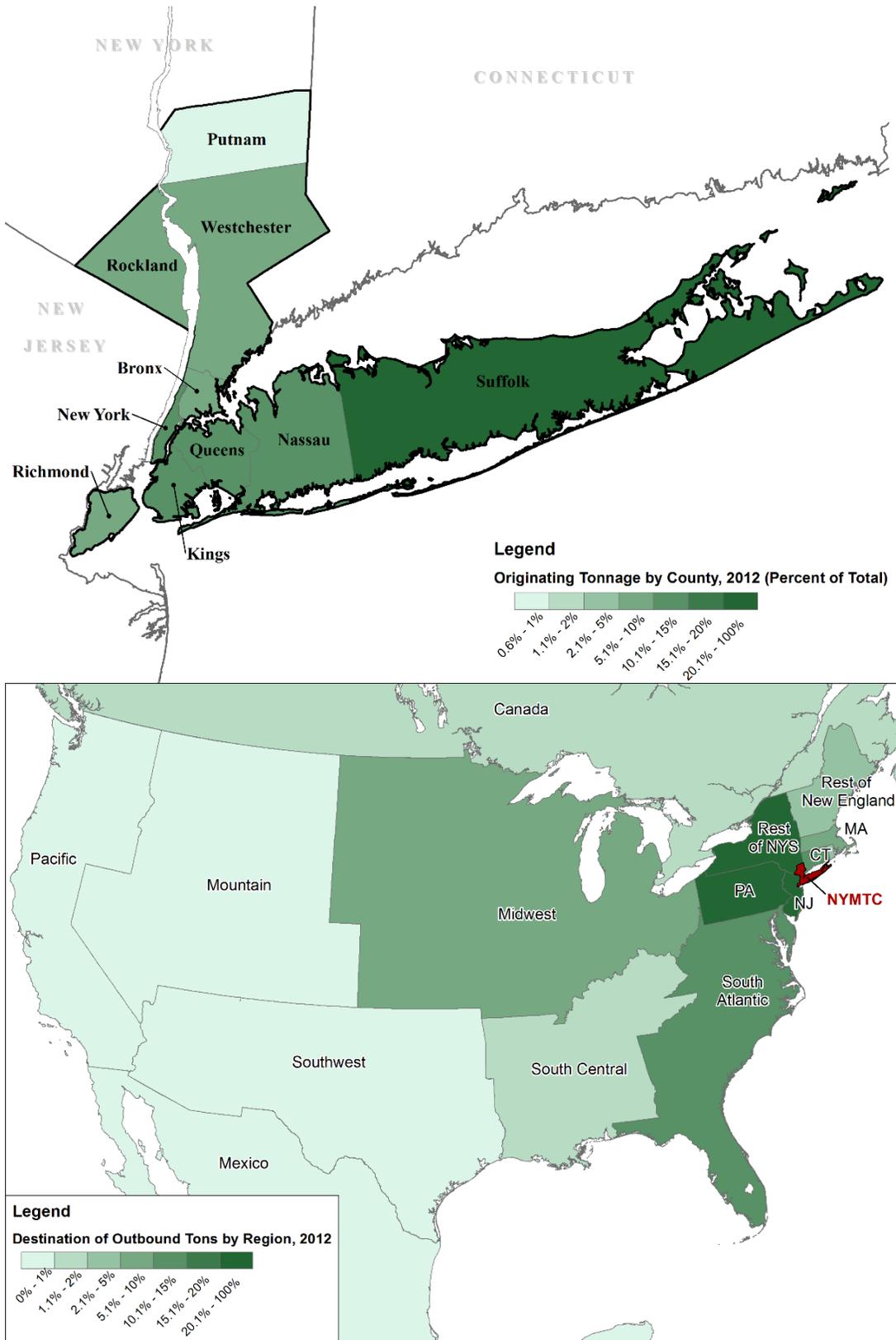
By 2045, as Figure 2.12 shows, Brooklyn is expected to capture a slightly larger share of flows traveling inbound to the NYMTC planning area, as Suffolk County and Manhattan remain among the top destinations for inbound flows. As Figure 2.13 shows, Suffolk County is expected to remain the top origin of outbound flows from the NYMTC planning area by 2045.

Figure 2.10 Out-of-Planning Area Origins and In-Region Destinations of Inbound Freight, 2012, by Tonnage



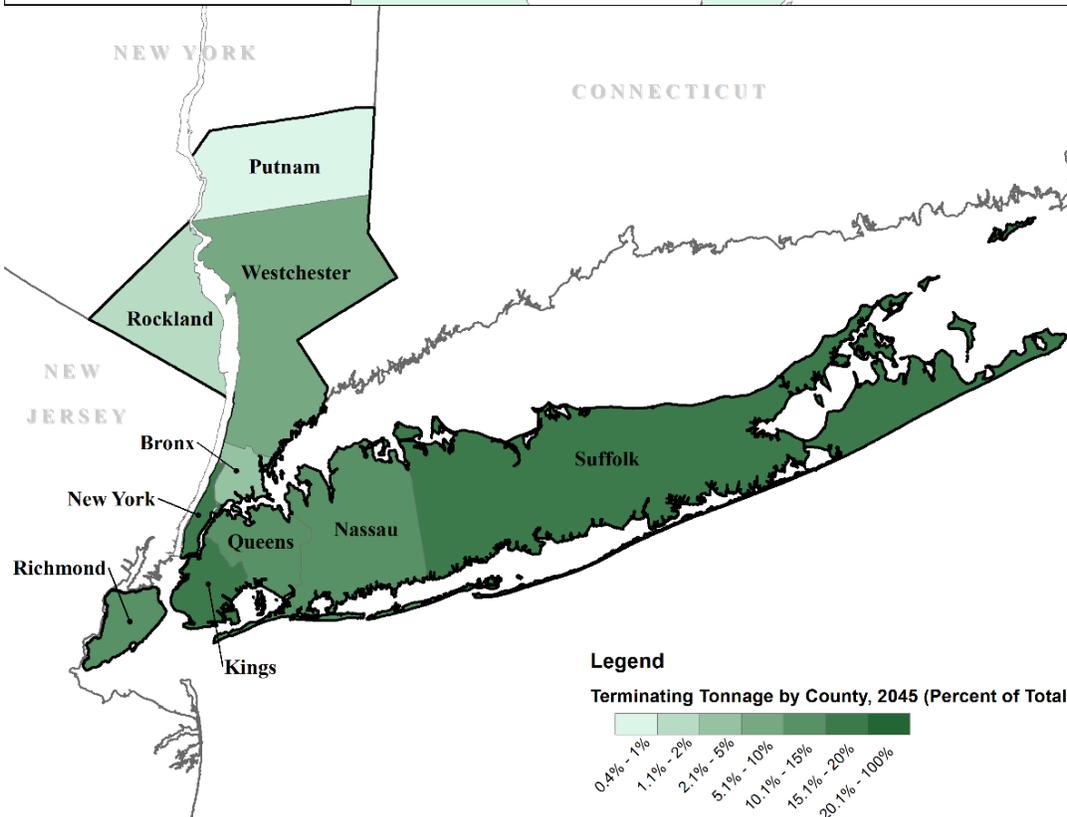
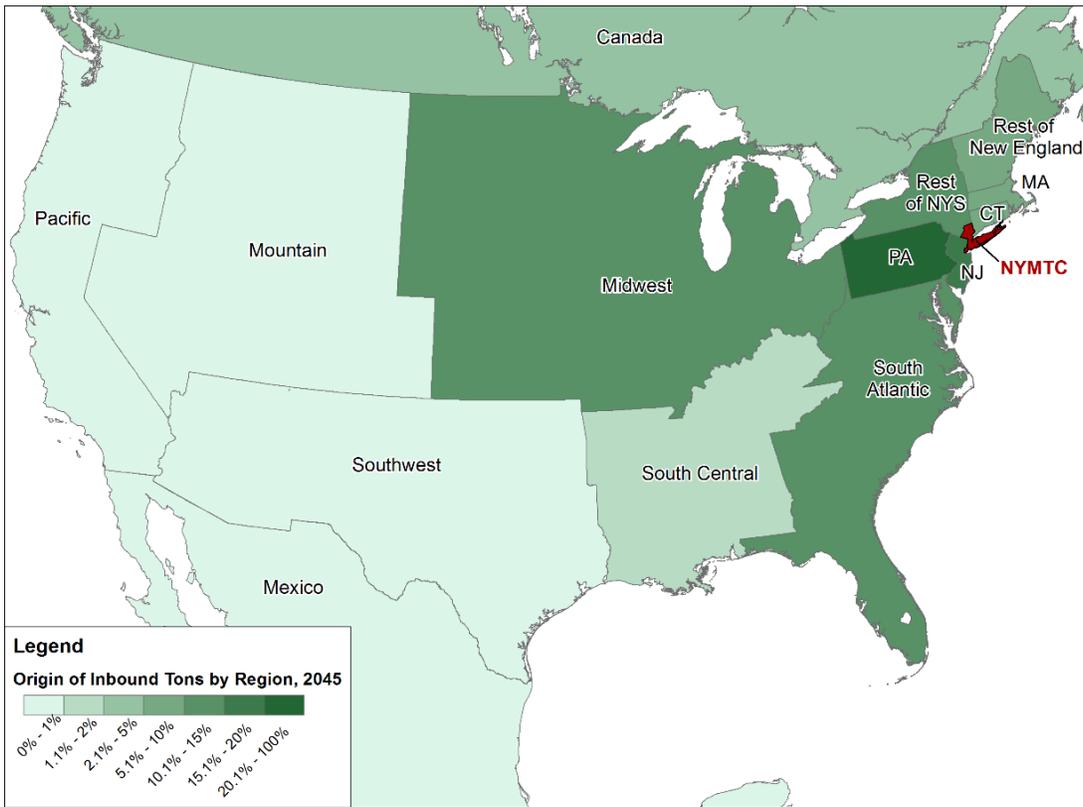
Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Figure 2.11 In-Planning Area Origins and Out-of-Region Destinations of Outbound Freight, 2012, by Tonnage



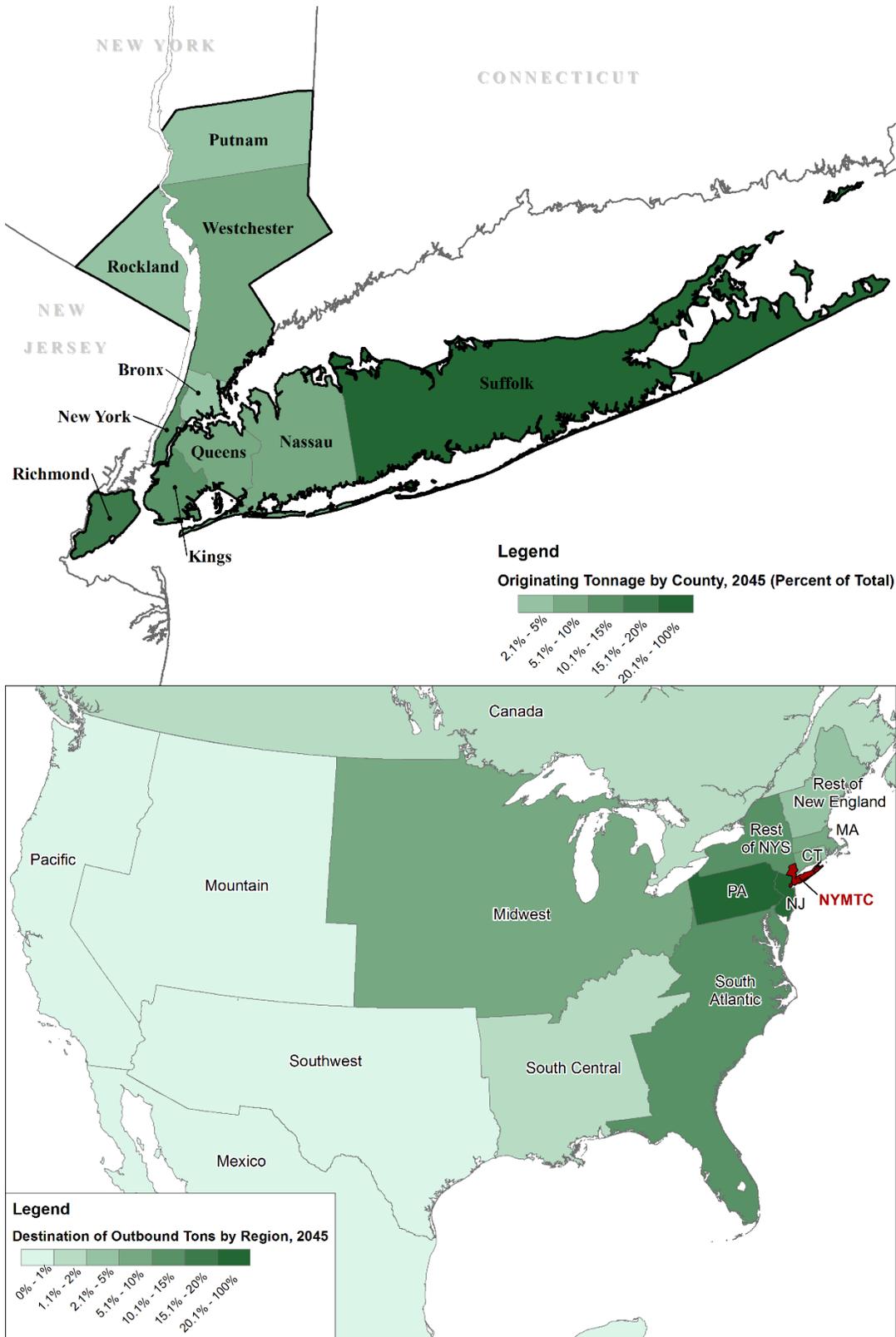
Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Figure 2.12 Out-of-Planning Area Origins and In-Region Destinations of Inbound Freight, 2045, by Tonnage



Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Figure 2.13 In-Planning Area Origins and Out-of-Region Destinations of Outbound Freight, 2045, by Tonnage

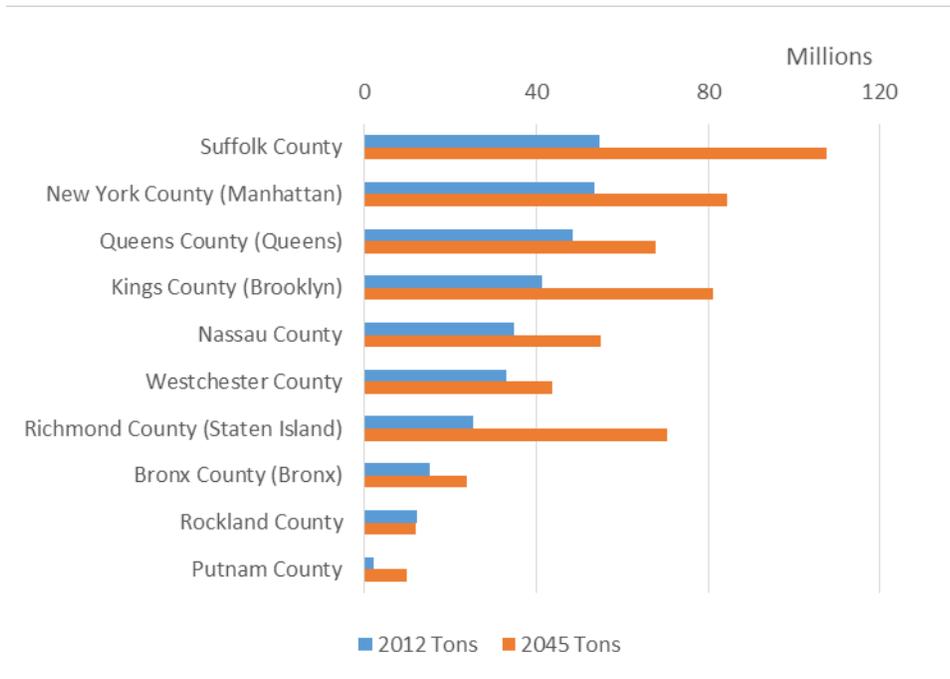


Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Figure 2.14 shows total tons moved in each county in 2012, and forecasted tons moved in each county in 2045. Suffolk County hosts the greatest volume of freight movements, by tonnage, in the NYMTC planning area. By direction, as shown in Figure 2.15, Manhattan receives a far greater share of inbound freight than outbound freight generated. Westchester County and Queens also receive greater shares of inbound freight than most of the rest of the planning area. Rockland County is the only county in the planning area that generates more outbound freight than inbound freight received, due in large part to the presence of quarries that generate heavy loads of outbound stone and construction material.

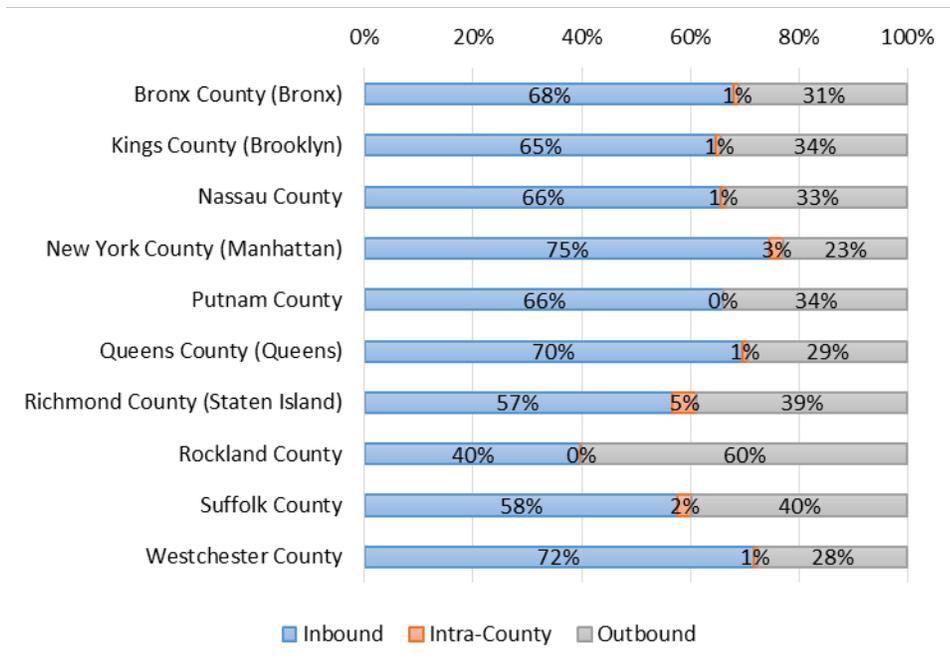
As Figure 2.16 shows, all counties in the NYMTC planning area are truck-dependent, sending and receiving the vast majority of freight by truck. Water achieves the greatest mode share in Staten Island, where 30 percent of freight moves by water, followed by Brooklyn, where nine percent of freight moves by water.

Figure 2.14 Tons by County, 2012 and 2045



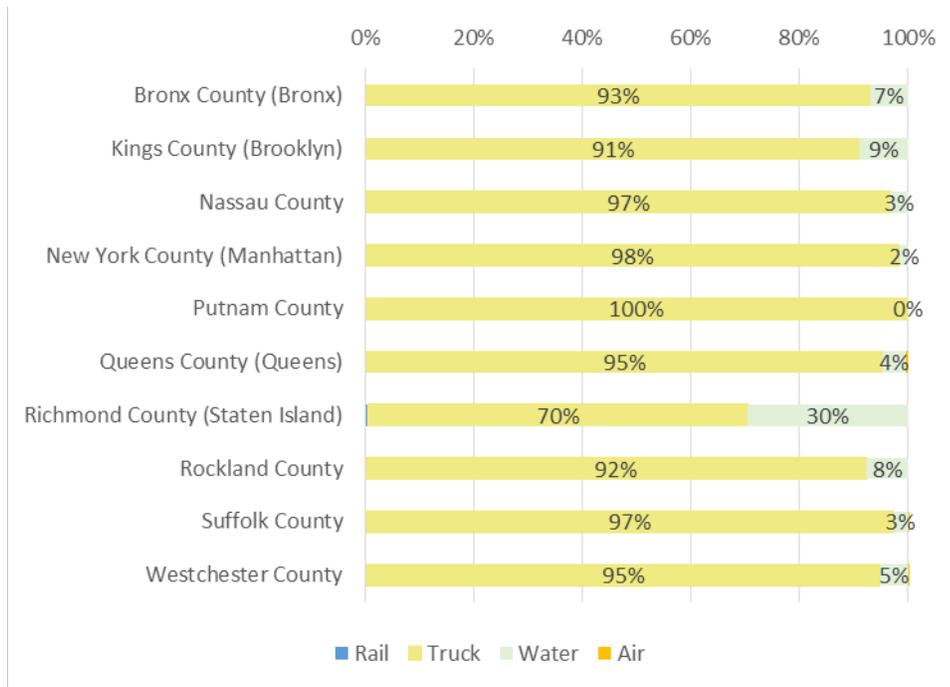
Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Figure 2.15 Tons by Direction by County, 2012



Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Figure 2.16 Tons by Mode by County, 2012

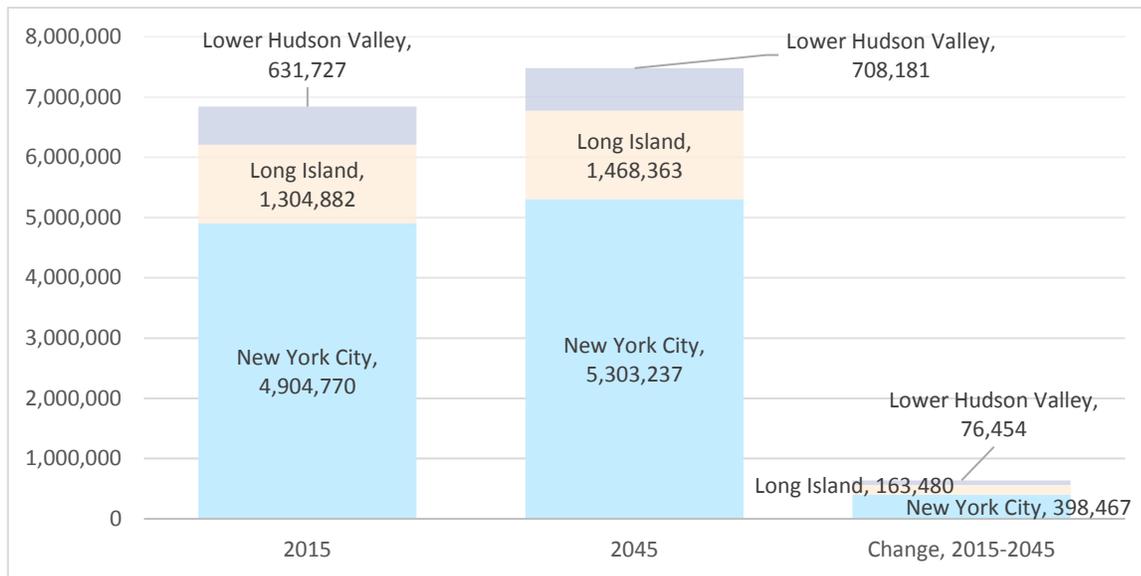


Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

2.3 Key Industry Sectors

In 2015, the NYMTC region’s employment exceeded 6.8 million. By 2045, employment in the NYMTC region is expected to approach 7.5 million (10 percent growth), as Figure 2.17 shows. Employment in New York City is expected to grow by the greatest number (approximately 400,000), and both the Long Island and Lower Hudson Valley shall expect greater percent change in employment than New York City, growing 12.5 percent and 12.1 percent, respectively.¹²

¹² NYMTC 2050 SED Forecasts.

Figure 2.17 Employment by Subregion, 2015 and 2045

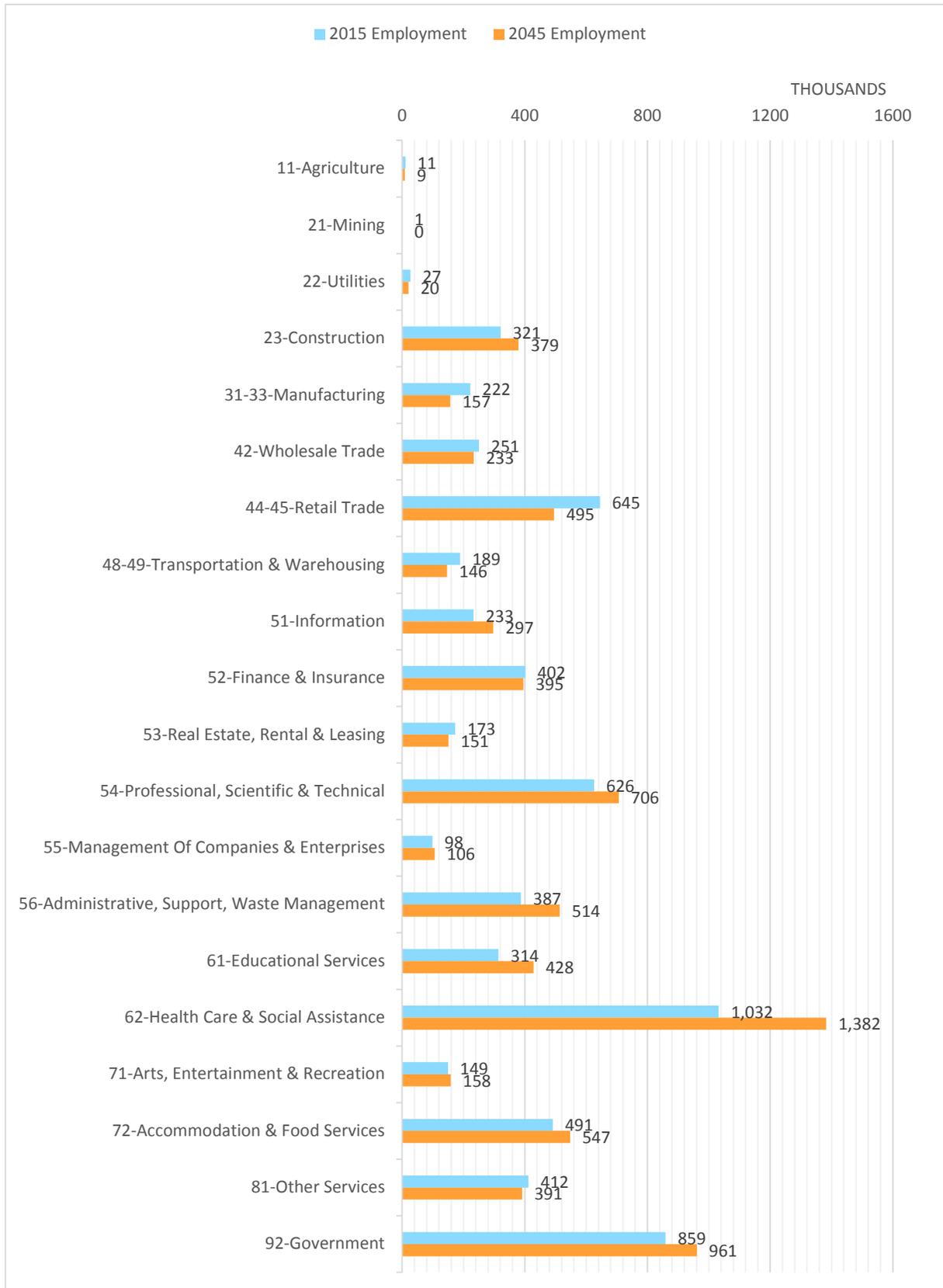
Source: NYMTC 2050 SED Forecast

Health care and social assistance, as an industry sector, employs more than one million workers, and was the largest industry sector by employment in 2015¹³, as Figure 2.18 shows. Government (859,000 jobs), retail trade (645,000 jobs), and professional, scientific, and technical services (625,000 jobs) are also among the top industry sectors by employment. About 554,000, representing eight percent of the NYMTC planning area's employment, are employed in goods-producing industry sectors, including agriculture, mining, construction, and manufacturing. Seventy-nine percent are employed in non-government service-providing sectors, and just over 12 percent are employed in government.

By 2045, most employment in the NYMTC planning area will likely be in the service-providing sectors, with goods producing sectors representing seven percent of the planning area's employment (545,000 jobs). Among goods-producing sectors, only construction is expected to grow in employment, while other sectors are expected to retract. Among the service-providing sectors, health care and social assistance is expected to be among the fastest-growing and will likely remain the largest sector by employment, adding 350,000 jobs (34 percent growth). Educational services (36 percent growth), administrative support and waste services (33 percent growth) are also among the fastest-growing sectors between 2015 and 2045.

¹³ NYMTC Socio-economic and demographic (SED) 2015 projections were developed from 2010 base year data, according to NYMTC's White Paper on Methodology for 2050 Forecasts, available from: <https://www.nymtc.org/DATA-AND-MODELING/SED-Forecasts/2050-Forecasts> (accessed March 19, 2017).

Figure 2.18 Employment by Industry Sector, in Thousands, 2015 and 2045



Source: NYMTC 2050 SED Forecast

The New York-Newark-Jersey City, NY-NJ-PA Metropolitan Area's economy generated \$1.67 trillion in Gross Domestic Product (GDP) in 2015.¹⁴ The GDP of the NYMTC planning area, in real 2010 dollars, is expected to approach \$2.58 trillion (55 percent growth).¹⁵ Figure 2.19 shows the GDP by industry sector in the NYMTC planning area and by subarea.

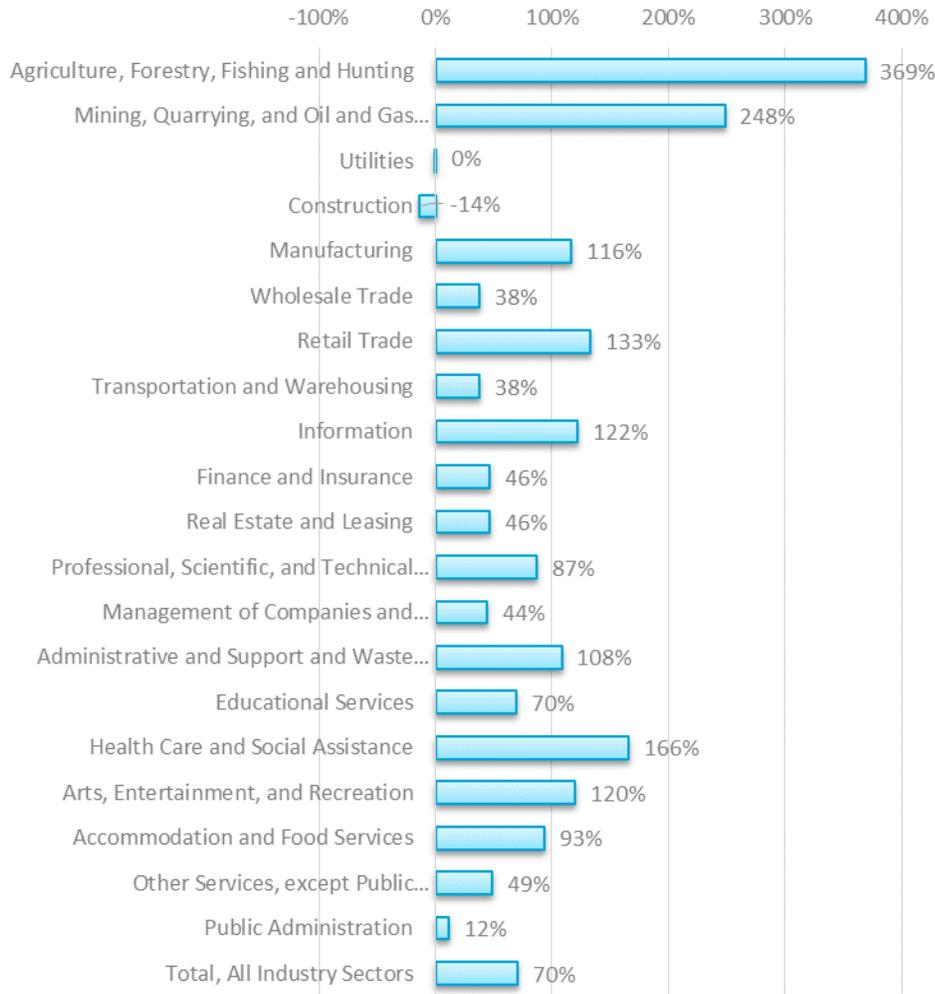
As Table 2.9 suggests, the NYMTC planning area encompasses a world center for **finance and insurance, real estate and leasing, professional and technical services, health care, and wholesale and retail trades**. Nearly 70 percent of the GDP is generated in these sectors. Growth projections anticipate that these sectors will generate 72 percent of the GDP by 2045. Other sectors that make up large shares of the planning area's economy and are expected to grow faster than the regional average include manufacturing, consisting primarily of chemicals, food, and computer and electronics manufacturing, and tourism-focused industry sectors such as arts and entertainment and accommodation and food services.

The regional offices of Empire State Development that cover the NYMTC planning area identify the sectors listed in bold in the paragraph above among the anchors of the economy in their respective regional markets. These anchors include biotech and biomedical, pharmaceuticals, agriculture and agribusiness, food processing, finance, advanced manufacturing, aerospace, tourism and hospitality, media and entertainment, software and technology, clean-tech and renewable energy, and government and defense.

¹⁴ I.H.S. Global Insight, Socioeconomic Data and Forecast, 2001-2040. 2015 was selected as the base year of analysis to align with the projected NYMTC SED data for 2015.

¹⁵ I.H.S. Global Insight.

Figure 2.19 Percent Change in Gross Domestic Product (GDP) by Industry Sector, 2015-2045



Source: I.H.S. Global Insight, Socioeconomic Data and Forecast, 2015-2040, extended to 2045 by Cambridge Systematics, inflated to real 2015 dollars using CPI.

**Table 2.9 Planning Area and Sub- Area Gross Domestic Product (GDP) by Industry Sector, 2015 and 2045
(millions of real 2015 dollars)**

Industry Sector	2015				2045			
	NYMTC Planning Area	New York City	Long Island	Lower Hudson Valley	NYMTC Planning Area	New York City	Long Island	Lower Hudson Valley
Agriculture, Forestry, Fishing and Hunting	\$824	\$34	\$626	\$164	\$3,864	\$122	\$3,014	\$728
Mining, Quarrying, and Oil and Gas Extraction	\$191	\$68	\$72	\$51	\$665	\$265	\$183	\$217
Utilities	\$18,936	\$13,290	\$3,177	\$2,469	\$18,875	\$14,272	\$2,769	\$1,834
Construction	\$54,751	\$30,245	\$17,180	\$7,326	\$47,216	\$25,109	\$16,627	\$5,480
Manufacturing	\$55,603	\$20,655	\$26,665	\$8,283	\$120,305	\$37,048	\$67,955	\$15,302
Wholesale Trade	\$69,723	\$42,408	\$20,773	\$6,542	\$96,145	\$51,233	\$34,738	\$10,174
Retail Trade	\$65,667	\$39,370	\$18,437	\$7,859	\$152,951	\$104,846	\$33,502	\$14,602
Transportation and Warehousing	\$37,082	\$26,935	\$7,722	\$2,425	\$51,213	\$35,117	\$12,173	\$3,923
Information	\$131,470	\$108,824	\$14,986	\$7,659	\$292,333	\$238,300	\$40,338	\$13,695
Finance and Insurance	\$317,611	\$258,785	\$40,600	\$18,226	\$465,271	\$389,023	\$51,794	\$24,453
Real Estate and Leasing	\$278,283	\$229,219	\$33,126	\$15,938	\$407,524	\$321,501	\$58,835	\$27,188
Professional, Scientific, and Technical Services	\$180,542	\$138,172	\$30,256	\$12,114	\$337,448	\$272,555	\$44,854	\$20,038
Management of Companies and Enterprises	\$21,280	\$15,235	\$3,408	\$2,636	\$30,677	\$19,233	\$8,095	\$3,348
Administrative and Support and Waste Management	\$62,290	\$41,350	\$14,811	\$6,129	\$129,868	\$78,812	\$36,282	\$14,773
Educational Services	\$23,317	\$17,961	\$3,359	\$1,997	\$39,525	\$29,174	\$7,010	\$3,341
Health Care and Social Assistance	\$115,366	\$78,093	\$25,366	\$11,908	\$307,093	\$219,393	\$59,754	\$27,946
Arts, Entertainment, and Recreation	\$23,427	\$16,559	\$4,285	\$2,583	\$51,466	\$37,783	\$8,140	\$5,543
Accommodation and Food Services	\$49,861	\$35,250	\$10,240	\$4,371	\$96,347	\$69,555	\$18,798	\$7,995
Other Services, except Public Administration	\$34,334	\$21,763	\$8,953	\$3,618	\$51,073	\$32,826	\$12,776	\$5,471
Public Administration	\$129,799	\$86,626	\$30,297	\$12,876	\$145,223	\$97,855	\$34,102	\$13,266
Total	\$1,670,358	\$1,220,846	\$314,340	\$135,173	\$2,845,081	\$2,074,022	\$551,740	\$219,319

Source: I.H.S. Global Insight, Socioeconomic Data and Forecast, 2015-2040, extended to 2045 by Cambridge Systematics, inflated to real 2015 dollars using CPI.

2.4 Profile of Key Supply Chains

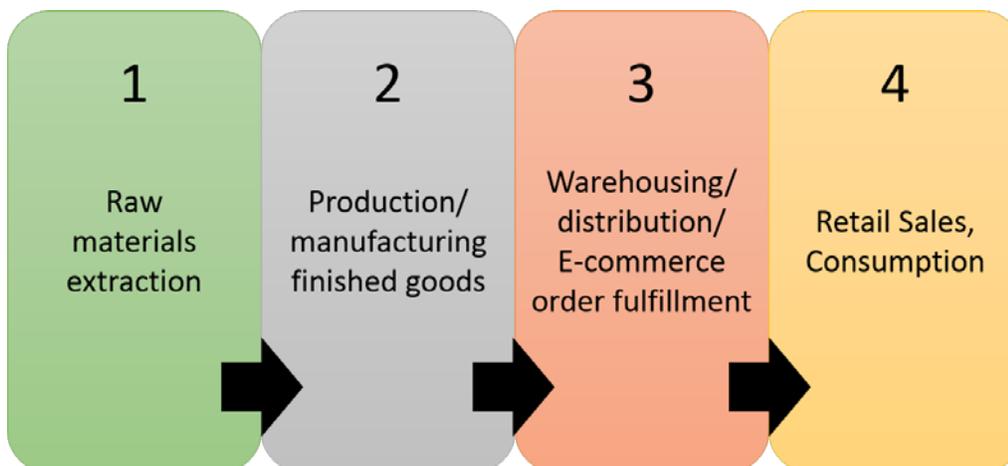
The public sector is accustomed to looking at freight transportation system performance in terms of network and corridor capacity, infrastructure condition and safety. As a consequence, transportation planners and engineers tend to focus on the average condition and performance of a system or facility, not on how an individual passenger or shipment moves through the transportation system. The study of supply chains, or the movement of materials and goods between the stages of production, manufacture, distribution, and delivery, provides planners and policy-makers with information about *how* the transportation system is being used.

Each business that sends or receives materials and goods has its own supply chain, relying on suppliers of input materials that come from specific places and have specific handling and transportation requirements. Outbound shipments must be picked up and delivered to customers, who may be located nearby or across the globe. While every business sets up and manages its own supply chain, businesses in similar industry sectors may have very similar supply chains, and require inbound and outbound shipments of the same or similar materials and goods, and/or serve customers in the same or similar markets. Understanding how these supply chains are organized can inform the public sector transportation planning process, by demonstrating the economic importance of key transportation assets, and the potential economic impacts or benefits of various transportation improvements to the NYMTC planning area, the state, and the nation.

As Figure 2.20 shows, most supply chains consist of four general stages:

- Stage 1 is the extraction of raw materials. This could include mining or quarrying for stone, raising crops and livestock;
- Stage 2 is the manufacturing or production of finished goods;
- In Stage 3, finished goods are moved to warehouses, distribution centers, or fulfillment centers, where they are packaged and prepared for:
- Stage 4, shipment to retail stores or direct-to-consumer.

Figure 2.20 Generic Supply Chain Steps



Each stage is connected by freight transportation. Raw materials need to be transported to manufacturing plants, finished manufactured goods must be transported from the factory to the warehouses and distribution centers. From the warehouses and distribution centers, shipments are delivered to stores or directly to consumers. The mode of transportation, length of haul, volume, and frequency of shipments vary by supply chain, and are influenced by factors such as the weight and value of the commodity being moved, locations of the sources of raw materials, locations of manufacturing facilities, and the geographic distribution of consumer markets.

Assessing opportunities to make strategic investments in the freight transportation system that directly improve supply chain¹⁶ performance, therefore, can be complex. Limited assessments of supply chain performance may result in a less cost-effective freight transportation system, less competitive industries and lost economic opportunity in a given region. Information on how supply chains perform from the perspectives of shippers, carriers and receivers is critical to knowing if supply chains are optimal and, if not, if and where public investment might improve their performance.

Additionally, transportation supply chains have the potential to be transformed by technological advances and economic changes. Technology has the potential to radically change many parts of the supply chain, and in particular the “last mile” of the chain that ultimately delivers the commodity to its final destination. Autonomous and airborne delivery methods will likely become prevalent during the period of this Plan. The Internet and communications technologies are already changing the characteristics and performance of the supply chain, as e-commerce shopping changes consumers’ purchasing habits and places greater emphasis on just-in-time performance to meet consumers’ delivery specifications. Emerging technologies such as additive manufacturing (i.e., “3D printing”) may eliminate whole portions of current supply chains.

The major industry sectors identified in Section 2.3—health care, tourism, wholesale and retail trades, finance and insurance, real estate and leasing, professional services, and information—composed 74 percent of the NYMTC planning area’s economy by GDP and 58 percent by employment, in 2015. About 57 percent of the planning area’s growth in employment and 83 percent of the planning area’s growth in GDP between 2015 and 2045 is expected to occur in these sectors. By 2045, these sectors are expected to grow and compose a larger share of the planning area’s GDP (78 percent) while maintaining a 58 percent share of employment.

These sectors rely on the movement of goods to and from their respective business establishments and job sites. The finance, insurance, and real estate sectors, for example, make heavy use of package delivery to receive office supplies, but are also dependent upon the movement of construction and building materials used to build new real estate inventory, fuel delivery to heat office and residential buildings, and solid waste removal.

The commodity groups shown in Table 2.10 include:

¹⁶ A supply chain is an end-to-end series of movements that a commodity makes between shipment and delivery. It may bring raw materials from mines to manufacturers, finished consumer products from manufacturers to wholesalers and retailers, food from farms to supermarket shelves or building materials from suppliers to construction sites. A supply chain may be a trip accomplished by a single truck move or a trip accomplished by a combination of truck, rail, ship, airplane or pipeline freight moves. A supply chain may be a short trip within a single metropolitan area, state or region, or a long trip spanning regions and continents.

- Food, including agricultural products, classified as Standard Transportation Commodity Code (STCC) 01, fresh fish or marine products (STCC 09), and food or kindred products (STCC 20);
- Construction materials, including nonmetallic minerals (STCC 14), lumber or wood products (STCC 24), clay, concrete, glass, or stone (STCC 32), primary metal products (STCC 33), and fabricated metal products (STCC 34);
- Parcels and secondary freight, including miscellaneous mixed shipments (STCC 46), small packaged freight (STCC 47), and secondary traffic (STCC 50);
- Energy products, including coal (STCC 11), crude petroleum or natural gas (STCC 13), and refined petroleum products (STCC 29); and
- Pharmaceutical drugs (STCC 283x); and
- Waste, including waste and scrap materials (STCC 40).

These groups of commodities together make up 89 percent of commodity flows into, out of, and within the ten-county NYMTC planning area. Through movements have not been included in this analysis because they do not support key industry sectors located in the planning area. The relationships between projected growth in major industry sectors in the planning area and growth in demand for commodities that support those industries are shown in Table 2.10.

Table 2.10 Commodity Groups Linked to Key Industry Sectors

Industry Sectors			Commodity Flows					
Sector	GDP (2015) Billions of 2015\$	GDP Growth (2015-2045)	Food	Construction Materials	Parcels/ Secondary Freight	Fuels/ Energy	Pharmaceuticals	Waste
Finance and Insurance	318	46%		X	X	X		X
Real Estate and Leasing	278	46%		X	X	X		X
Professional, Scientific, and Technical Services	181	87%		X	X	X		X
Information	131	122%		X	X	X		X
Wholesale and Retail Trades	135	84%	X	X	X	X	X	X
Health Care	115	166%	X	X	X	X	X	X
Tourism (Arts and Entertainment and Accommodation and Food Services)	131	102%	X	X	X	X		X
Millions of Commodity Tons in 2012)			37.7	99.5	50.6	46.2	0.8	21.7
Growth in Commodity Tonnage, 2012-2045			93%	97%	16%	23%	141%	130%

Source: I.H.S. Global Insight, Socioeconomic Data and Forecast, 2015-2040, extended to 2045 by Cambridge Systematics, inflated to real 2015 dollars using CPI; I.H.S. Transearch 2012-2040 database, extended to 2045 by Cambridge Systematics using U.S. DOT Freight Analysis Framework (FAF v4).

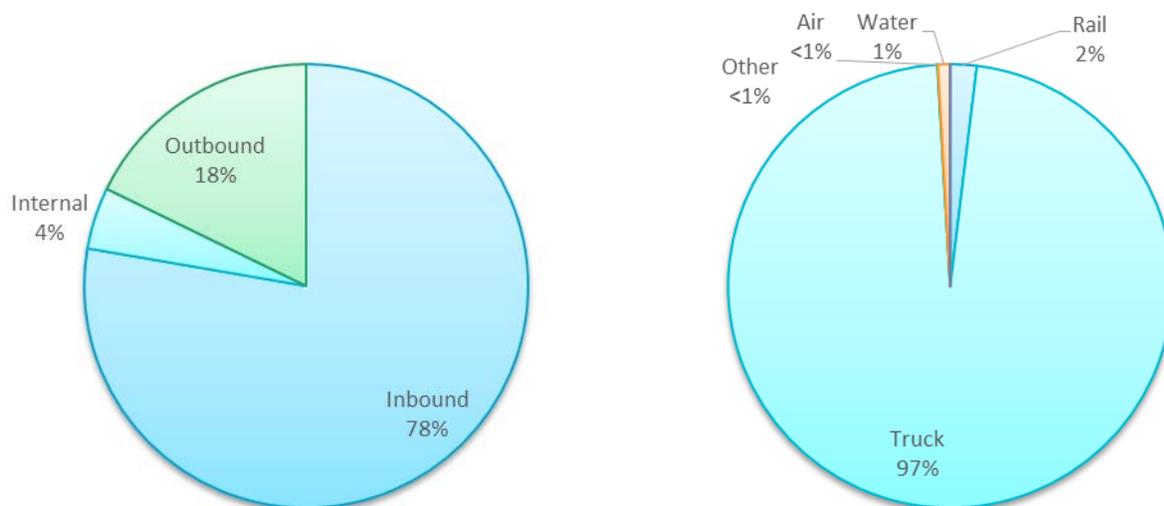
This section identifies and describes the supply chains tied to the four general stages shown in Figure 2.20—extraction, production, distribution and use—of the key commodity groups that support the primary and growing industry sectors in the planning area, including food, construction materials, parcels and secondary freight, energy products, pharmaceutical drugs, and waste.

The unique characteristics of each of the four stages and freight transportation features specific to each chain are illustrated and discussed. This analysis includes an overview of the commodity flows, including tons of goods moved, direction of movement (inbound, outbound, or intra-regional), points of origin and destination, and modes used to transport goods in the planning area and beyond. The information used to perform this analysis includes business establishment data from InfoUSA, industry employment and GDP data and commodity flow data from I.H.S. Global Insight, and interviews conducted with representatives of firms shipping, receiving, and/or transporting goods in each supply chain.

2.4.1 Food

In 2012, 37.7 million tons of food commodities, including food products, agriculture products, and meats, moved into, out of, or within the NYMTC planning area. Approximately 78 percent of the food products move in the inbound direction, making the NYMTC planning area a net-receiver of food, while 18 percent are distributed from the NYMTC planning area to other places, and four percent move within the planning area. About 97 percent of food moving in the planning area is moved by truck, two percent by rail, one percent by domestic water¹⁷, and less than one percent by air or other modes. Figure 2.21 shows the flows of food commodities by direction and by mode in 2012.

Figure 2.21 Distribution of Tons of Food by Direction and by Mode, 2012



Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

¹⁷ Note that water only includes domestic movements, mostly by barge, and does not include international ocean traffic. For example, bananas shipped from Central America to Red Hook Container Terminal are not included in the “water” tonnage, unless they are then transferred to a barge and transported from Red Hook to other locations in the United States.

Because most of the NYMTC planning area's food supply originates outside the planning area, it is important to understand where it originates, how it moves, and what key elements of the planning area's transportation infrastructure support this supply chain.

Approximately 19 percent of the food products traveling into the NYMTC planning area originate in Pennsylvania. This includes products raised or produced in Pennsylvania, and products that are moved to facilities in Pennsylvania from other points of origin by rail and then transferred or transloaded to truck for distribution in the NYMTC planning area. About 18 percent of the food products originate in the South Atlantic states, and 15 percent originate in New Jersey. Trucks carry 96 percent of the NYMTC planning area's inbound food commodities. Rail carries two percent of food tonnage, most of which originates in the Western United States and the Midwest, and one percent moves by water.

Approximately 18 percent of food moves outbound from the NYMTC planning area to other areas. The primary destinations of those outbound moves include the South Atlantic states, which are the destination for 19 percent of outbound food tonnage; New Jersey, the destination for 18 percent of outbound food tonnage; and Pennsylvania, the destination for 16 percent of outbound food tonnage. About 99 percent of outbound food is carried by truck. About 100 percent of intraregional food shipments move by truck.

The dominance of the truck mode in the food supply chain can be attributed in part to the relatively short length of most trips carrying food products. Trucking offers a lower cost-per-mile to shippers for trips shorter than 400-to-600 miles, depending upon the shipment and origin-destination specifications and the limitations on moving large quantities of food products by rail to customers located in the NYMTC planning area.

The transportation facilities used to carry food into, out of, and within the planning area include most of the planning area's interstate highways, including Interstate 95 and the George Washington Bridge, Interstates 78 and 80 in New Jersey, Interstate 87, Interstate 287, Interstate 295, Interstate 495, Interstate 678, Interstate 278. All of these interstates accommodate 200 or more truckloads of food per day. New York Route 27 in Nassau and Suffolk counties and New York Route 135 in Nassau County accommodate more than 150 truckloads of food daily. Ultimately, these shipments disperse onto other arterial roadways and collectors, New York City Truck Routes, and other streets and roads to reach customers. Most rail shipments of food enter the planning area from the north, using the Metro-North Railroad Hudson Line, Oak Point Link, Hell Gate Bridge and Fremont Secondary onto geographic Long Island and Fresh Pond Yard. Smaller volumes of food products use the New York-New Jersey rail carfloat and either terminate in Brooklyn or use the Bay Ridge Branch to reach Fresh Pond. From Fresh Pond Yard, goods are distributed by rail to eastern Long Island via the Long Island Rail Road Main Line and branches, Lower Montauk Branch toward Long Island City, or Bay Ridge Branch into Brooklyn.

By 2045, 72.7 tons of food commodities are expected to move in the planning area, representing 93 percent growth. The distribution of tonnage by direction, by mode, and by top origin-destination pairs is expected to remain relatively unchanged. As a result, a much greater volume of food flows will have to be accommodated on the planning area's highway network, or alternative methods for moving food products in the NYMTC planning area will have to be promoted in order to distribute food to business establishments and households in the planning area.

Figure 2.22 shows the movement of food products through the supply chain from agricultural production, through manufacturing processes and distribution networks, to consumption. The Figure shows separate, but connected tracks for goods produced domestically (in the United States) and goods produced

internationally, and then imported for consumption in the NYMTC planning area and elsewhere in the United States.

Beginning on the domestic track, Figure 2.22 shows the growing of crops, raising of livestock, or catching of seafood as the first step in the chain. The NYMTC planning area is home to businesses engaged in these activities, but most of the food products that are consumed here are produced in other parts of the United States.

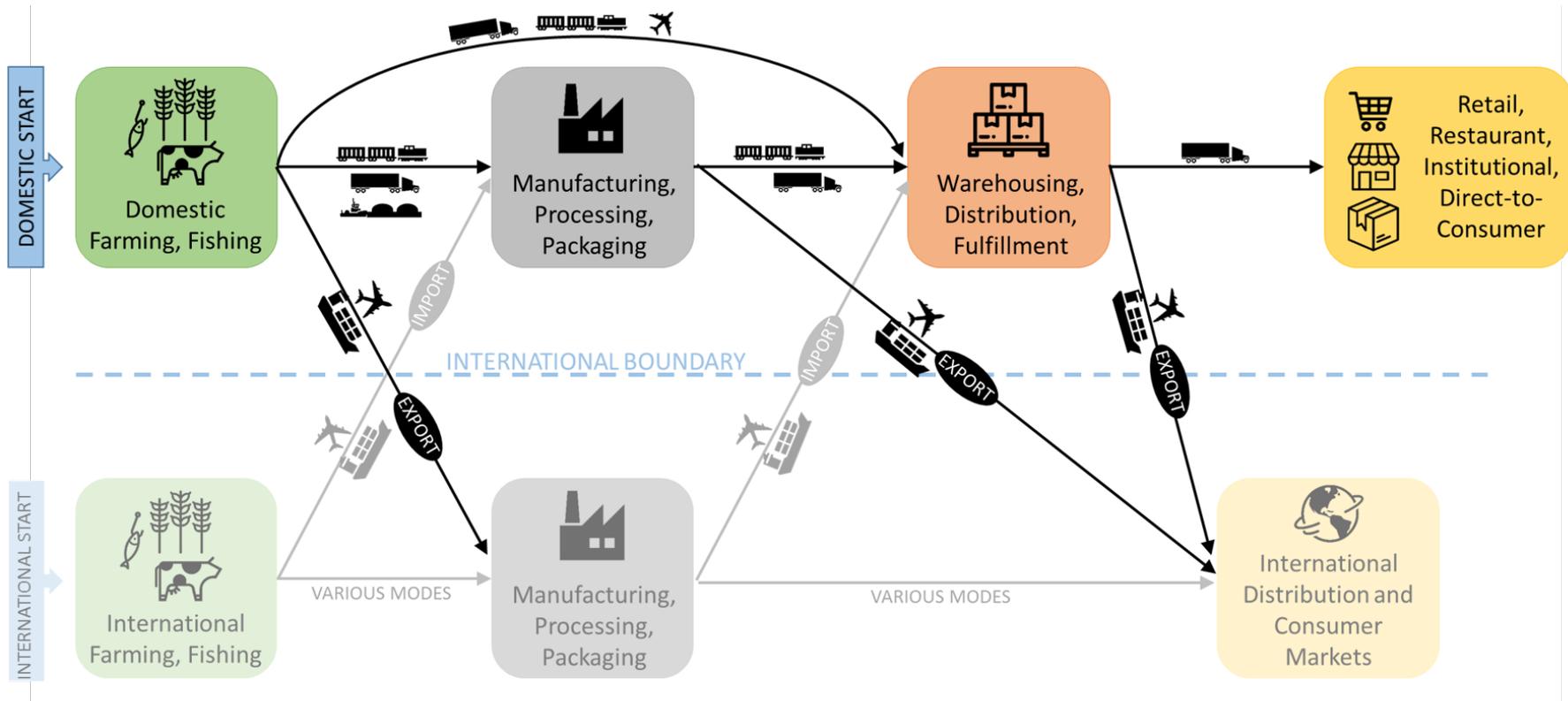
Some agricultural products, such as fresh produce, unprocessed seafood, etc., proceed to distribution. Because of the broad range in weight, size of shipment, and value of these products, they may be transported by truck, rail, air, or in bulk by barge, to manufacturing, processing, or packaging facilities to be made into processed food products. Some agricultural products produced in the NYMTC planning area and elsewhere in the United States are exported outside the country for international processing and/or consumption. These goods may be transported out of the country by sea, or in the case of high-value products such as fresh seafood, by air, though trucks most often make the “first mile” connection between the production location and the seaport or air cargo facility from which the goods will be exported.

Once produced, the processed food products and the fresh food products enter the distribution networks that connect the products to consumers, or are exported overseas. Food products destined for consumption in the NYMTC planning area may pass through warehouses and distribution centers located in the NYMTC planning area, or elsewhere in the Northeast or Mid-Atlantic states. The number of warehouse/distribution center stops and locations vary by company owning the products. Wholesalers distribute goods to be sold and distributed to retail stores or restaurants in the U.S. or abroad. Retailers may have their own networks of warehousing and distribution centers receiving shipments from the wholesalers, or acting in place of the wholesalers, to serve their respective networks of stores. With e-commerce growing to include online grocery shopping, many retailers are fulfilling e-commerce orders at the distribution center or operating e-commerce fulfillment centers.

Ultimately, food products are delivered by truck to make the final connection to retail stores, restaurants, institutions such as schools and hospitals, or directly to a consumer’s doorstep.

On the international track, agricultural or seafood products grown, raised, or caught overseas, including coffee, cocoa, or exotic seafood are imported to the United States by sea or air. These goods may be processed or packaged in the United States, or transported by various available transportation modes to manufacturing, processing, or packaging facilities in the country of origin. From there, the food products processed internationally may be imported into the United States by sea or air, or distributed to consumer markets in the country of origin.

Figure 2.22 Food Supply Chain in the NYMTC Planning Area



Transportation Modes:

-  Truck/dry van
-  Rail carload or intermodal
-  Bulk moves by barge
-  Container vessel
-  Air

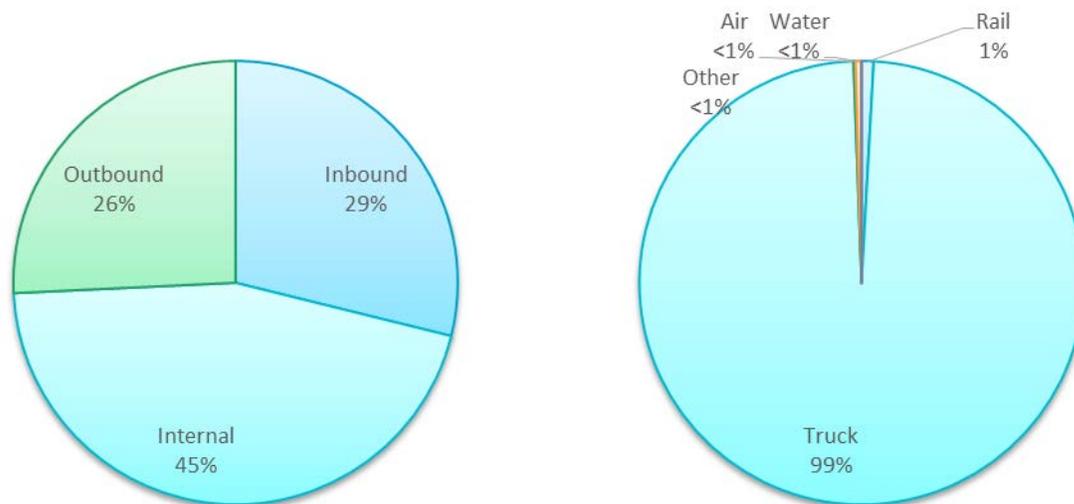
Source: Cambridge Systematics

2.4.2 Parcels and Secondary Freight

Parcels, mail, and secondary freight represent shipments of multiple or mixed commodities distributed from warehouses and distribution centers, order fulfillment centers, and mail sorting facilities. This group of commodities captures store delivery, direct-to-consumer delivery, and e-commerce fulfillment.

Approximately 50.6 million tons of these goods moved into, out of, or within the NYMTC planning area in 2012. As Figure 2.23 shows, about 45 percent of these shipments travel within the planning area entirely. Close to 30 percent travel inbound from other regions, and just over one-quarter (26 percent) travel in the outbound direction. About 99 percent of goods in this group travel by truck, with domestic air carrying close to one percent. It is important to note, once again, that air carries lighter-weight, higher-value goods, and plays an important role in the movement of parcels and secondary freight, including those supporting e-commerce economic activity.

Figure 2.23 Distribution of Tons of Parcels and Secondary Freight by Direction and by Mode, 2012



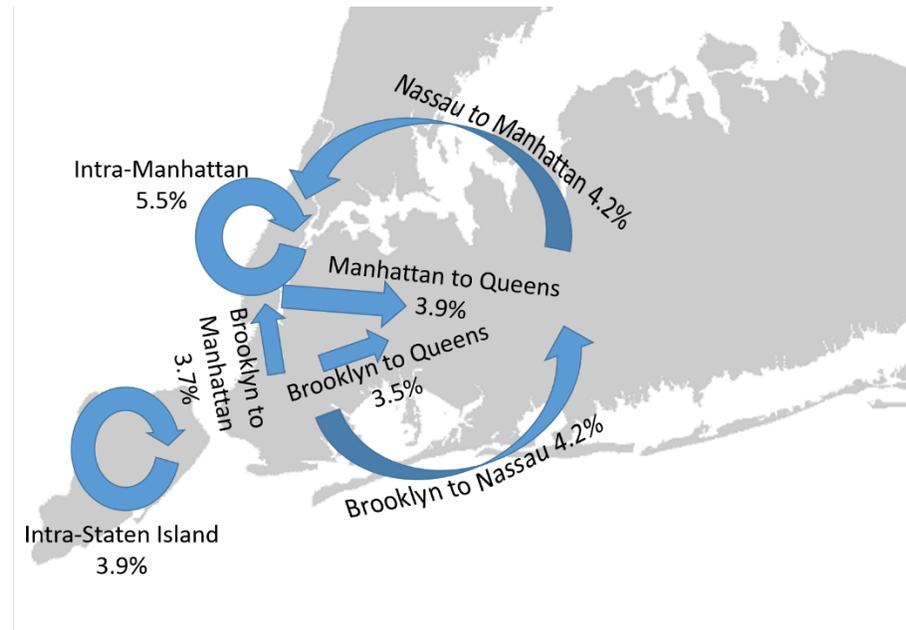
Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

The largest share, 45 percent, of parcels and secondary freight moves within the NYMTC planning area. All of these shipments are transported by truck. The top seven intraregional origin-destination pairs, representing 29 percent of all intraregional moves, and shown in Figure 2.24, include:

- Intra-Manhattan, 5.5 percent;
- Brooklyn to Nassau County, 4.2 percent;
- Nassau County to Manhattan, 4.2 percent;
- Manhattan to Queens, 3.9 percent;
- Intra-Staten Island, 3.9 percent;

- Brooklyn to Manhattan, 3.7 percent; and
- Brooklyn to Queens, 3.5 percent.

Figure 2.24 Top Intra-Regional Origin-Destination Pairs for Parcels and Secondary Freight, 2012



Source: 2012 IHS Global Insight Transearch Data

About 43 percent of inbound parcels and secondary freight originate in portions of New York State outside the NYMTC planning area, referred to hereafter as “Rest of New York State,” 25 percent originate in New Jersey, and 10 percent originate in the South Atlantic states. About 98 percent of inbound shipments are transported by truck, one percent by air, and less than one percent by all other modes combined.

About 34 percent of outbound parcels and secondary freight are destined for Pennsylvania, 31 percent for the Rest of New York State, and eight percent for the Midwest. Truck carries 97 percent of the outbound shipments, and two percent move by rail, primarily to distant markets in the Midwest and West.

The routes used to carry parcels and secondary freight in the NYMTC planning area include most of the planning area’s interstate highway network, which connect the planning area’s counties to one another and connect the planning area to out-of-region trading partners. Because the Rest of New York State is a major origination point, Interstate 87 and Interstates 684 and 84 are important for inbound and outbound flows, along with the George Washington Bridge connection to New Jersey and the South Atlantic states. Most of the rail traffic moves outbound via the Oak Point Link and MTA Metro-North Railroad’s Hudson Line. John F. Kennedy International Airport (JFK) is the primary node handling inbound air parcels and freight.

By 2045, 99.6 million tons of parcels and secondary freight are expected to move into, out of, and within the NYMTC planning area. Internal moves are expected to grow at a faster rate than inbound or outbound flows, and achieve 47.7 percent share of flows by tonnage in 2045. Originating tons are expected to grow fastest in Putnam and Suffolk counties, and in Brooklyn. Terminating tons are expected to grow fastest in the Bronx, Staten Island and Suffolk County. Mode splits and major out-of-region trading partners are expected to

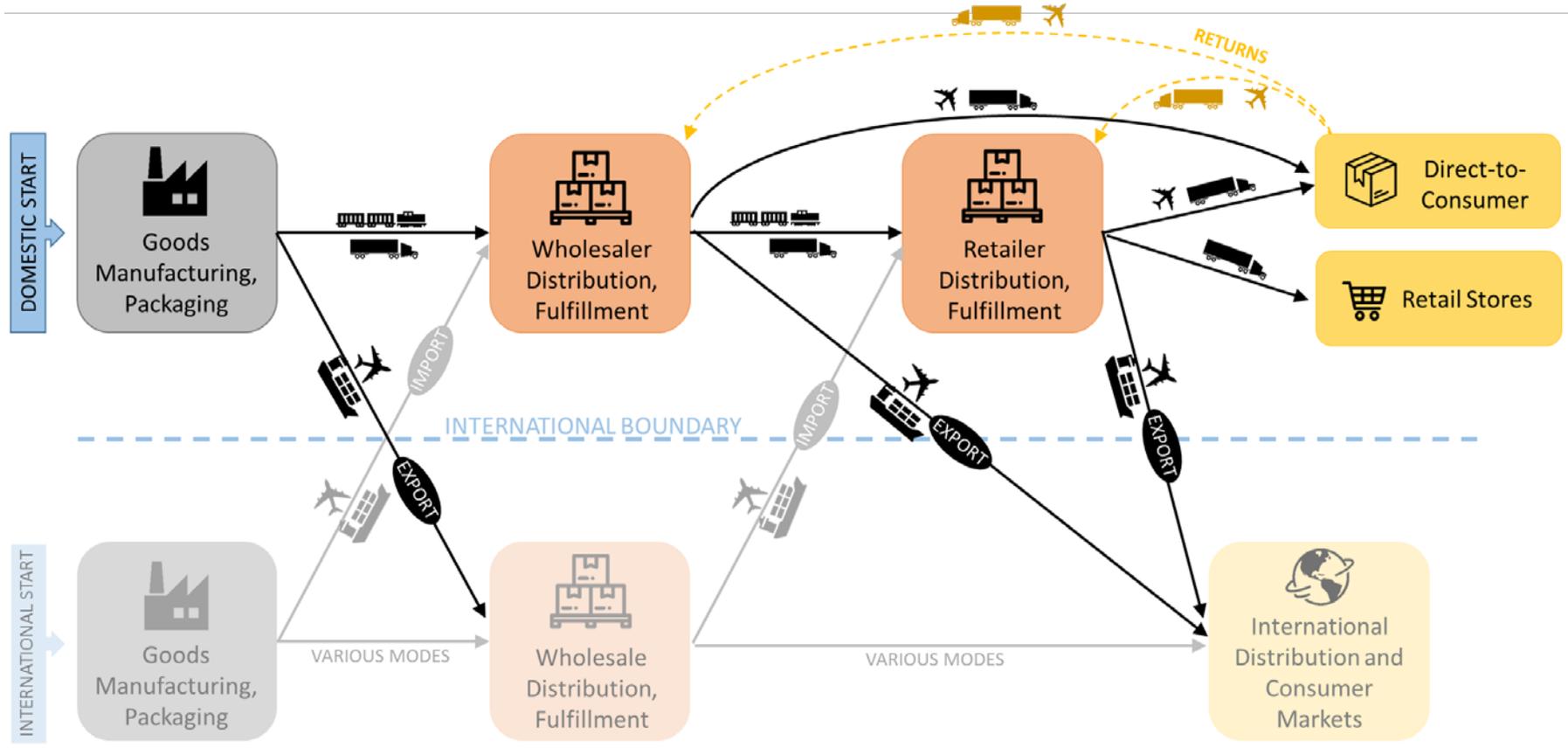
remain similar. As a result, the planning area's highway network will be expected to carry much greater volumes of truck traffic carrying parcels and secondary freight, unless production and distribution of parcels and retail commerce changes in response to unforeseen logistics pattern shifts, economic conditions, and distribution networks, or unless measures are taken to encourage use of alternative modes for distribution of goods in the NYMTC planning area.

Figure 2.25 illustrates the steps in the supply chain of parcels and secondary freight moving in the NYMTC planning area.

Parcels and secondary freight consist of the movement of manufactured consumer goods through warehouses, distribution, and e-commerce fulfillment centers to retail points of sale or directly to the consumer. Truck and air are the primary modes used to transport these goods between the stages in the supply chain.

One important distinction between this supply chain and others analyzed in this section is the addition of a "return" flow of items consumers wish to return. With the maturation of e-commerce in recent years, the return flow has become a bigger issue for retailers and wholesalers to accommodate. In 2015, e-commerce shoppers returned approximately 30 percent of the products they ordered, compared to nine percent of brick-and-mortar store purchases returned. Methods for receiving the returned e-commerce items vary, from presenting the consumer with a shipping label to affix to the shipment and return it by mail or parcel carrier, to the consumer returning the product to a brick-and-mortar store. In most instances, the retailer or wholesaler will dispose of, or recycle, the item.

Figure 2.25 Parcels and Secondary Freight Supply Chain in the NYMTC Planning Area



Transportation Modes:

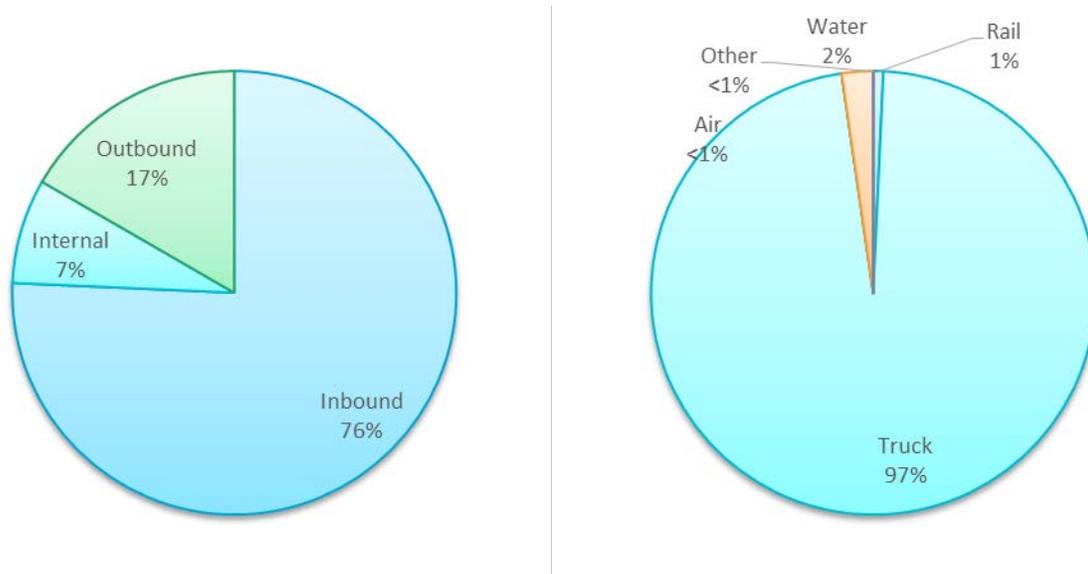
-  Truck/dry van
-  Rail carload or intermodal
-  Container vessel
-  Air

Source: Cambridge Systematics

2.4.3 Construction Materials

Construction materials include nonmetallic minerals, lumber, clay, concrete, glass, or stone products, primary metals, and fabricated metals. In 2012, approximately 99.5 million tons of these commodities moved to, from, or within the NYMTC planning area, as Figure 2.26 shows. About 76 percent moved in the inbound direction, 17 percent in the outbound direction, and seven percent within the planning area. About 97 percent of these products moved by truck, two percent by water, and one percent by rail.

Figure 2.26 Distribution of Tons of Construction Materials by Direction and by Mode, 2012



Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Inbound flows compose more than three-quarters of the movement of construction materials. More than one-quarter of construction materials (27 percent) inbound to the NYMTC planning area originate in Pennsylvania, 16 percent comes from New Jersey, and 15 percent comes from the Rest of New York State. About 96 percent of the inbound flows are primarily transported by truck, 3 percent by water, mostly from New Jersey, and 1 percent by rail.

Outbound construction materials are transported almost entirely by truck. The top destinations are New Jersey, where 31 percent of outbound construction materials are destined; Pennsylvania, destination of 21 percent of outbound flows of construction materials; and the South Atlantic states, destination of 14 percent of outbound flows. Intraregional construction materials flows move almost entirely by truck. Less than one percent moves by water.

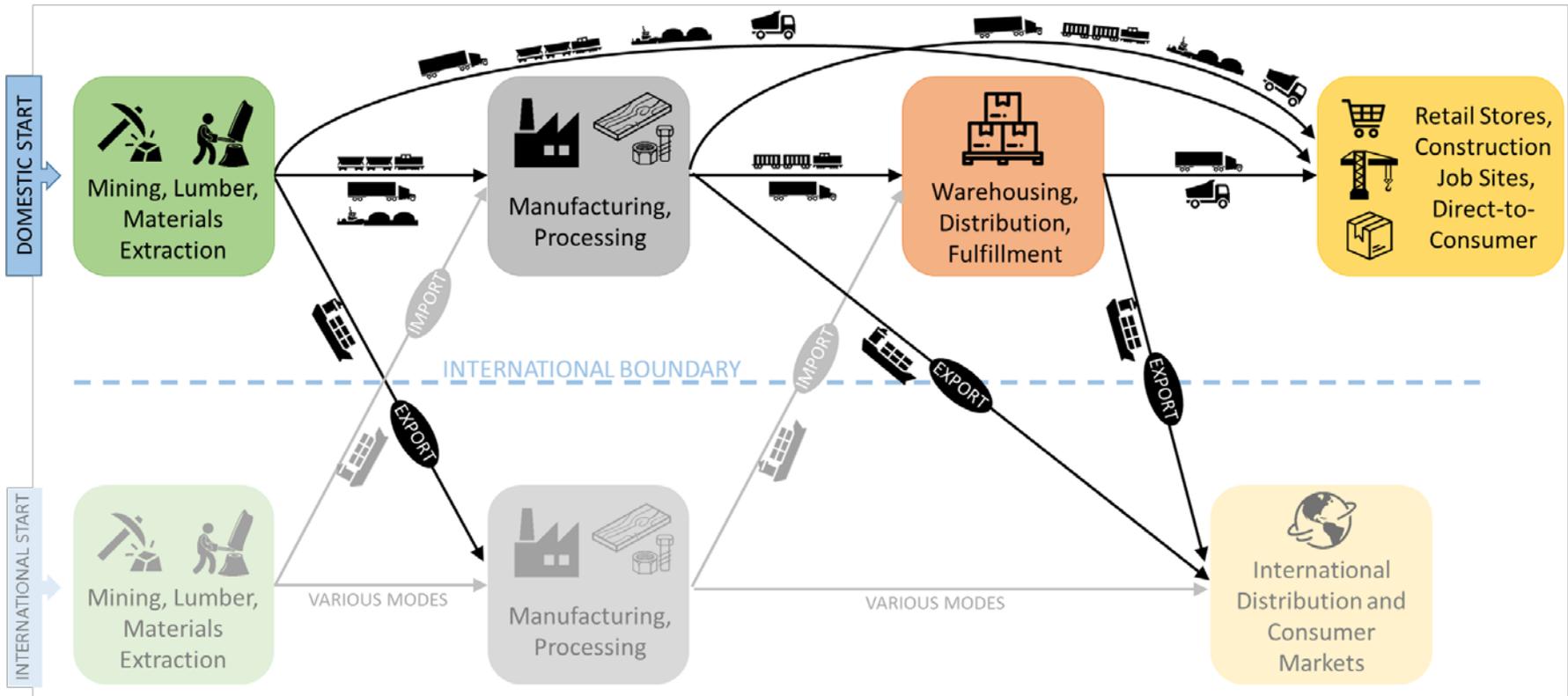
The routes used to transport construction materials in the planning area include Interstate 95 and the George Washington Bridge, along with the Interstate 78 and Interstate 80 corridors, which link the planning area to top points of origin in Pennsylvania, New Jersey, and the South Atlantic states. Within the planning area, Interstates 287, 87, 95, 295, 495, and 278 are critical elements of the network, collecting and distributing inbound and outbound trips, and accommodating intraregional flows. Goods moved by water depend on the Long Island Sound, East River, Hudson River, and Kill Van Kull. Occasional major projects may require movement of construction material by water to and from sites that do not handle these shipments typically.

By 2045, the movement of construction materials is expected to grow 23 percent to 122.6 million tons. Outbound and intraregional tonnage is expected to grow at faster rates, 33 percent and 34 percent, respectively, compared to inbound tonnage, which is expected to grow 20 percent between 2012 and 2045. Growth in intraregional moves, much of which moves by water, especially from Staten Island to Suffolk County, would lead to a slight growth in mode share for the water mode. About 3 percent of construction materials are expected to travel by water in 2045, up from 2 percent in 2012. Truck is expected to carry 97 percent, and rail is expected to carry less than 1 percent of construction materials in 2045.

Figure 2.27 illustrates the steps in the supply chain of construction materials moving in the NYMTC planning area. Because construction materials tend to be heavy and bulky, they are typically transported by rail, truck, or barge between the stages of the supply chain. Some materials, such as sand or clay, can be transported directly from the point of extraction to the construction site, most often by dump truck. Other products, such as dimensional lumber, screws and nails, and crushed stone or gravel, must be transported to a manufacturing or processing facility to be transformed into consumer-grade products before proceeding to construction sites or retail stores for sale.

While trucks often make the last-mile connection to job sites and retail stores, other modes may perform part of this delivery function in the NYMTC planning area. World Trade Center reconstruction has relied on supply of mixed concrete via barge. Some dimensional lumber and fencing products sold at Home Depot stores on Long Island, for example, are transported by rail to Brookhaven Rail Terminal in Suffolk County, and then distributed by truck to retail stores.

Figure 2.27 Construction Materials Supply Chain in the NYMTC Planning Area



Transportation Modes:

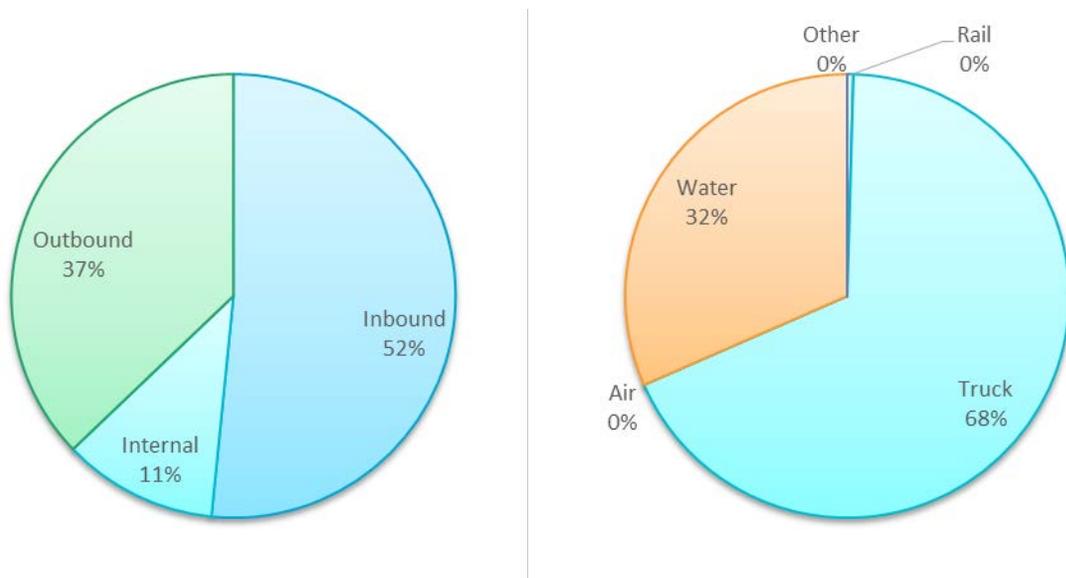
-  Truck/dry van
-  Container vessel
-  Rail carload or intermodal
-  Dump truck or concrete mixer
-  Bulk moves by barge

Source: Cambridge Systematics

2.4.4 Energy Products

Energy products include crude petroleum or natural gas and refined petroleum products. These products are used for transportation and heating fuels, and industrial applications. In 2012, about 46.2 million tons of energy products were transported into, out of, or within the NYMTC planning area. As Figure 2.28 shows, just over half of the energy products were moved into the planning area from elsewhere, 37 percent moved from the NYMTC planning area to other places, and 11 percent moved between origin and destination points within the planning area. Trucks carried about 68 percent of energy products in the planning area, nearly one-third of the energy products moved by water, while rail, air, and other modes carried less than one percent combined. Pipeline flows are not included in this analysis, though some of the truck, rail, and water flows may connect to pipelines at the beginning and/or end of the trip.

Figure 2.28 Distribution of Tons of Energy Products by Direction and by Mode, 2012



Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

About one quarter of all energy products that move in the NYMTC planning area are inbound from origins in New Jersey. New Jersey is the origin of 48 percent of the inbound energy products. Pennsylvania (10 percent), Connecticut (9 percent), and the rest of New York State (8 percent) are other top origins of inbound energy products. About two-thirds of inbound energy products move on trucks, and about one-third are transported by water. About 80 percent of the inbound water tonnage originates in New Jersey, and 12 percent originates in Canada.

Top destinations for energy products that travel outbound from the NYMTC planning area include New Jersey (44 percent), Pennsylvania (17 percent), Connecticut (12 percent), and the rest of New York State (12 percent). About 76 percent of outbound energy products are transported by truck, and about 24 percent move by water. Roughly 47 percent of the outbound waterborne energy products are destined for New Jersey, and 20 percent are destined for the rest of New York State.

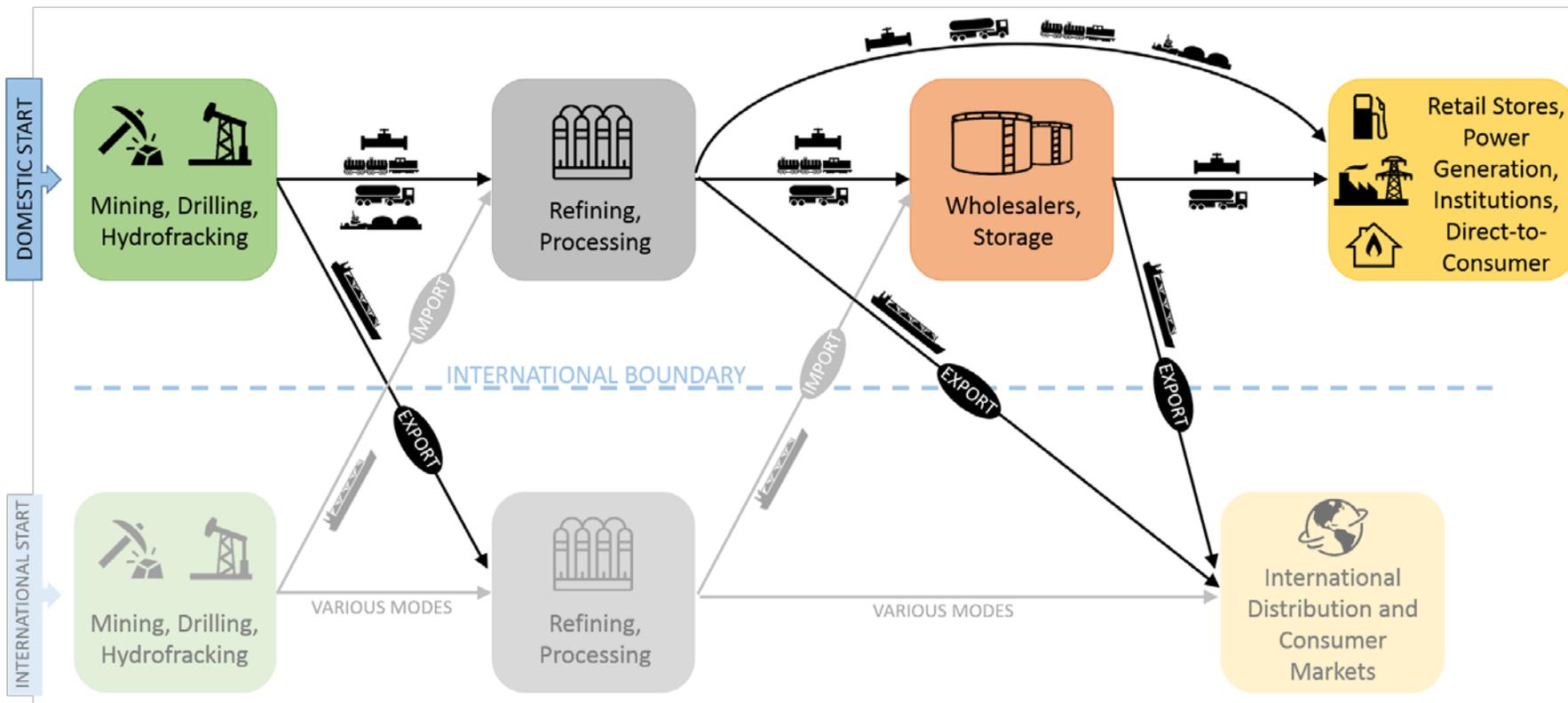
The highway facilities used to carry energy products to, from, and within the NYMTC planning area include the planning area's interstate highway network, especially Interstate 95, Interstates 78 and 80, Interstates

278, 678, 295, and 495. Key waterways include Arthur Kill, Kill Van Kull, Upper New York Bay, East River, Long Island Sound, and Jamaica Bay. Water-served fuel terminals are located on the west shore of Staten Island, La Guardia Airport in Queens, and United Riverhead Terminal on the north shore of Long Island in Suffolk County. Energy products are moved in smaller quantities to terminals and marinas along the south shore of Long Island in Nassau and Suffolk counties.

By 2045, the movement of energy products is expected to grow 16 percent, from 46.2 million tons to 53.4 million tons. Refined petroleum products and fuels are expected to experience the greatest rate of growth among energy commodities. Inbound flows are expected to represent half (50 percent) of energy product flows, with outbound and intraregional flows representing 36 percent and 13 percent of flows, respectively. Brooklyn is expected to be the top destination of inbound energy products, and Staten Island is expected to be the top origin of outbound flows. Waterborne is expected to achieve a greater mode share, carrying 45 percent of energy product tonnage, compared to 55 percent by truck, and less than one percent by other modes.

Figure 2.29 illustrates the steps in the supply chain of energy products moving in the NYMTC planning area. Unique features of the energy supply chain include the introduction of pipeline and tanker trucks, railcars, and marine vessels. Bulk energy products may be transported by pipeline from extraction locations to refining and processing facilities. In lieu of traditional warehouses and distribution centers, energy products may be stored in storage tanks prior to being distributed to customers. Energy product moves also include the movement of coal from mining locations to power generators, processors, or international markets.

Figure 2.29 Energy Product Supply Chain in the NYMTC Planning Area



Transportation Modes:

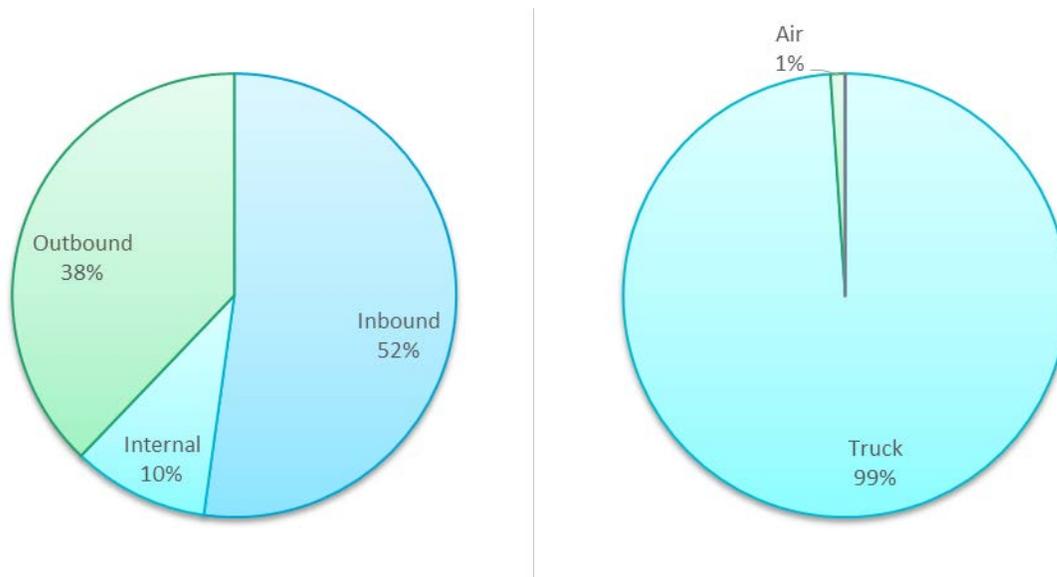
-  Tank truck
-  Rail tank cars
-  Bulk moves by barge
-  Tanker vessel
-  Pipeline

Source: Cambridge Systematics

2.4.5 Pharmaceutical Drugs

Pharmaceutical drugs are a critical commodity for the health care industry, which is the largest sector of the planning area's economy by employment and sixth-largest sector by GDP. In 2012, about 821,000 tons of pharmaceutical drugs traveled into, out of, and within the NYMTC planning area. More than half, 52 percent, traveled in the inbound direction, about 38 percent moved outbound, and 10 percent moved within the planning area, as Figure 2.30 shows. Due to the time-sensitivity and very high value of pharmaceutical drugs, about 99 percent of the pharmaceutical drugs move by truck, and one percent by air.

Figure 2.30 Distribution of Tons of Pharmaceutical Drugs by Direction and by Mode, 2012



Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Nearly half (47 percent) of the inbound pharmaceutical drugs originate in New Jersey. Other top origins include Pennsylvania and the South Atlantic states, which are the origins of 21 percent and 10 percent of inbound pharmaceutical drugs, respectively. Truck is the primary mode used to transport 99 percent of inbound pharmaceutical drugs, while one percent travels by air.

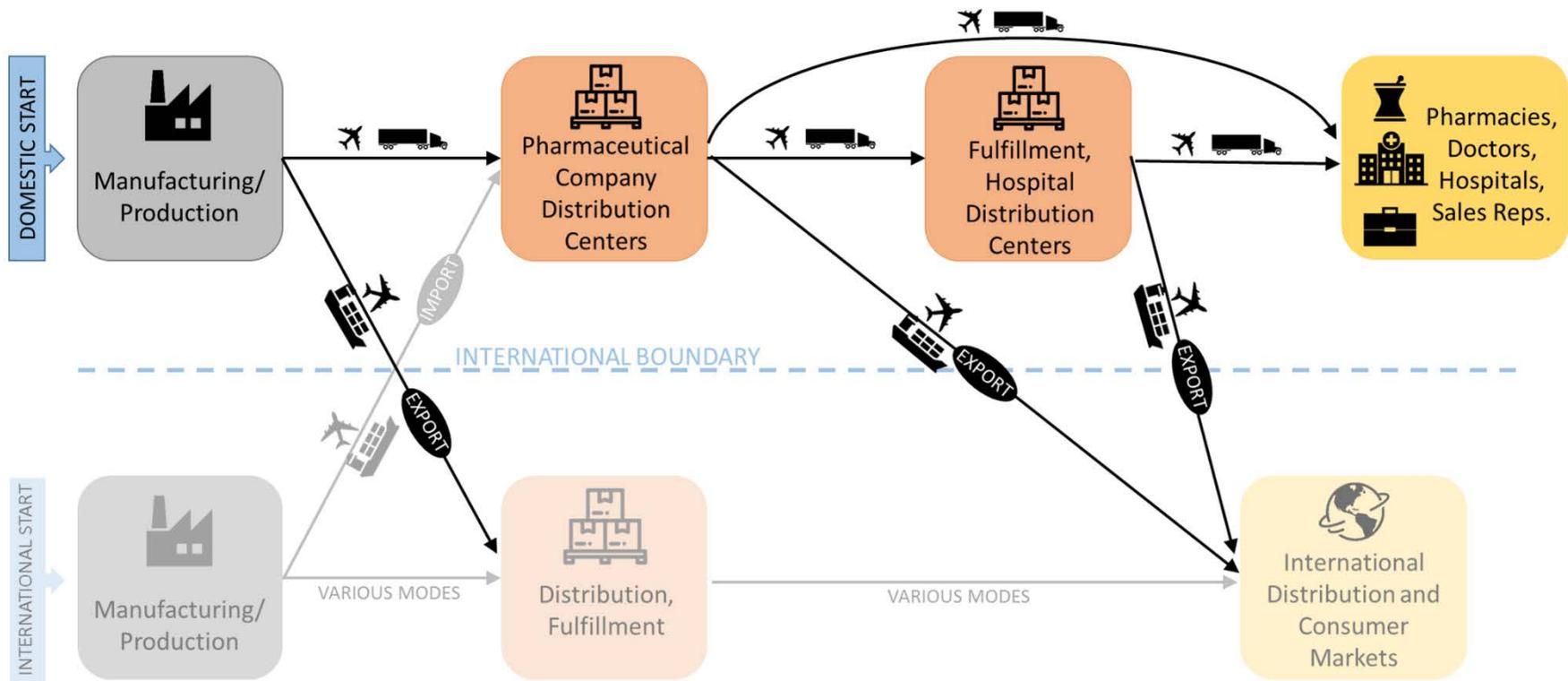
The top destinations for outbound pharmaceutical drugs include New Jersey (21 percent), the South Atlantic states (20 percent), Pennsylvania (15 percent), and the Midwestern states (14 percent). Trucks carry 99 percent of outbound pharmaceutical drugs, and air carries most of the remaining one percent.

The movement of pharmaceutical drugs in the planning area relies upon the planning area's interstate highway network. Key highway corridors include the Interstate 95 and George Washington Bridge corridor, Interstates 80 and 78 in New Jersey, Interstates 295, 495, 278, and 678, which connects to John F. Kennedy International Airport, the primary gateway for pharmaceutical drugs transported by air.

By 2045, the volume of pharmaceutical drugs is expected to increase 141 percent to more than 1.6 million tons. The primary direction of movement is expected to remain inbound, and the ratio of tonnage between truck and air, 99 percent to one percent, is expected to remain constant.

Figure 2.31 illustrates the steps in the supply chain of pharmaceutical drugs moving in the NYMTC planning area. Due to the high value and security requirements for transporting pharmaceutical drugs, trucks and air are the primary modes used to distribute these goods domestically. International imports and exports may move by air or by sea. The ultimate destination of the shipment could be a retail pharmacy, hospital or doctor's office, or pharmaceutical sales representatives, who receive and distribute samples of products.

Figure 2.31 Pharmaceutical Drugs Supply Chain in the NYMTC Planning Area



Transportation Modes:

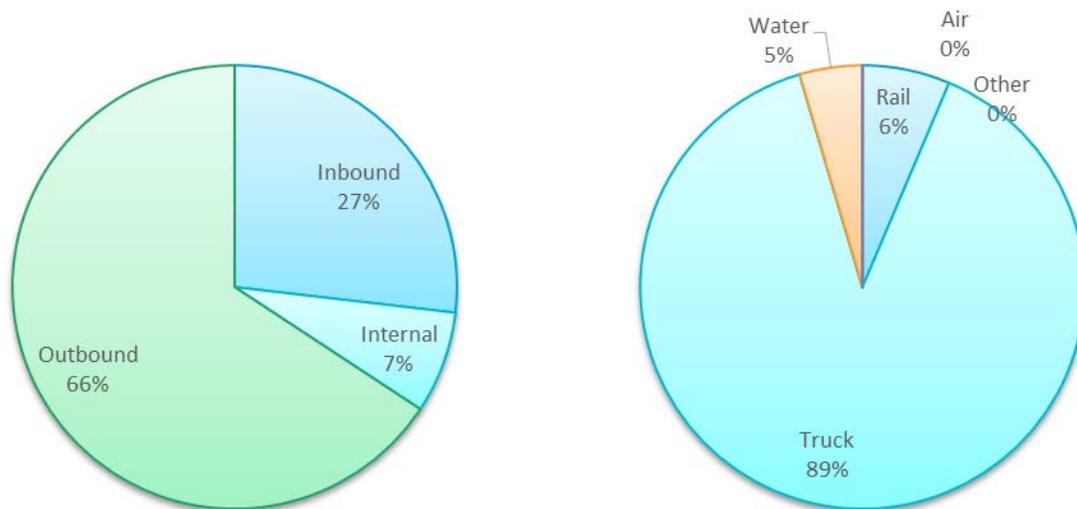
-  Truck/dry van
-  Container vessel
-  Air

Source: Cambridge Systematics

2.4.6 Waste

Waste includes waste and scrap materials, municipal solid waste, and construction and demolition debris. In 2012, 21.7 million tons of waste moved into, out of, and within the planning area. As Figure 2.32 shows, two-thirds of all waste movements in the NYMTC planning area are outbound, consisting largely of waste being exported for disposal or recycling outside the planning area. About 89 percent of waste moves by truck, six percent by rail, and five percent by water.

Figure 2.32 Distribution of Tons of Waste by Direction and by Mode, 2012



Source: 2012 IHS Global Insight Transearch Data, 2012 Surface Transportation Board (STB) Waybill Sample

Most of the inbound waste and scrap materials moves from New Jersey, Pennsylvania, or Canada. These top three origins represent 20 percent, 17 percent, and 15 percent of inbound waste flows, respectively. More than 99 percent of the planning area's inbound waste movements are transported by truck.

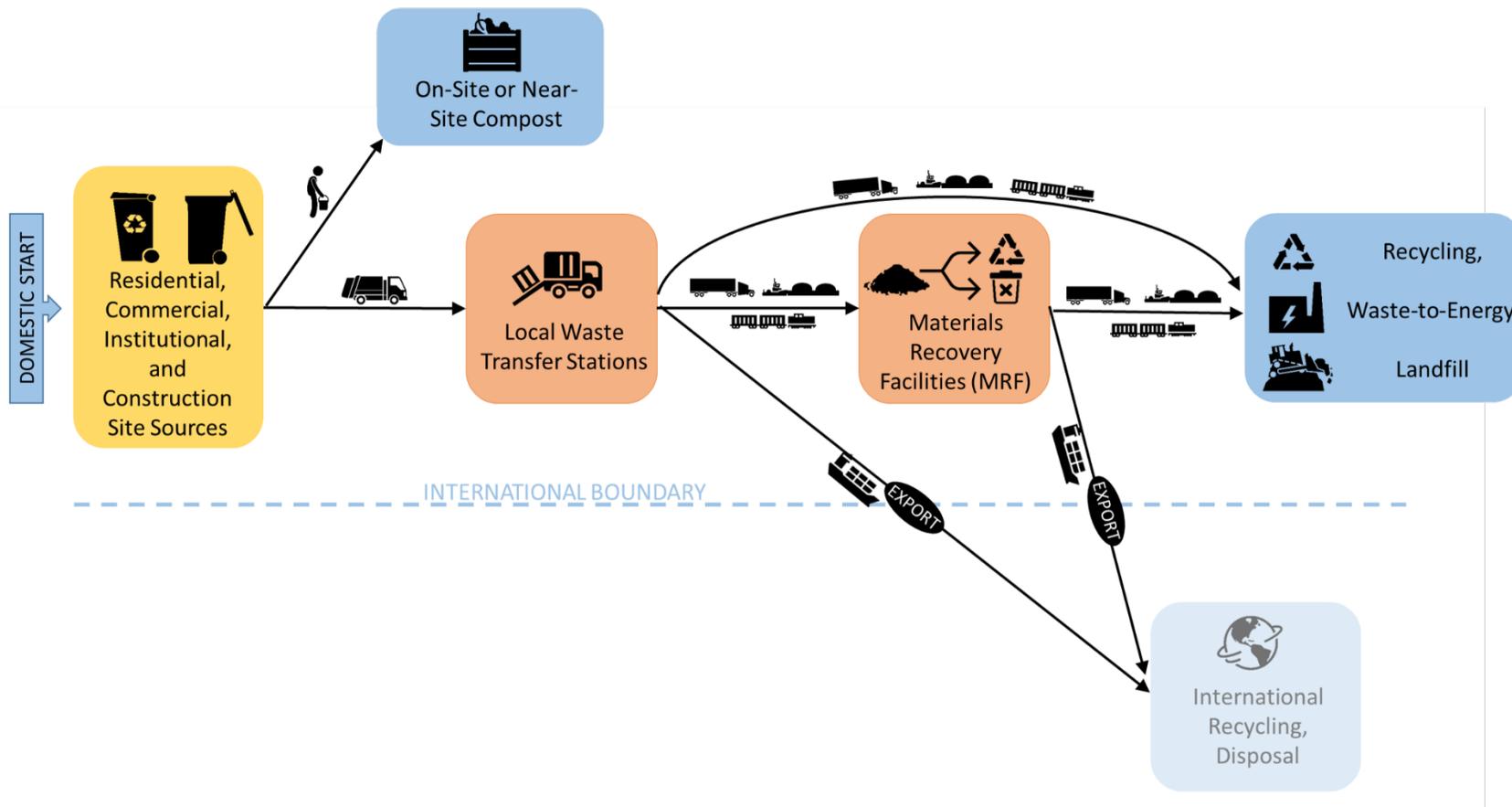
Nearly half (46 percent) of the waste moved out of the NYMTC planning area is transported to Pennsylvania. About 14 percent of outbound waste is destined for New Jersey, and 13 percent is destined for the South Atlantic states. Roughly 84 percent of outbound waste moves by truck, 9 percent is transported by rail, and 7 percent is moved out of the planning area by water.

Interstate highways connect the NYMTC planning area with destinations in New Jersey, Pennsylvania, the South Atlantic states, and eastern Canada. The principal highways used for carrying waste include the Interstate 95 and George Washington Bridge corridor, Interstates 80, 78, and 87. Within the planning area, Interstates 295, 495, 678, and 278 collect outbound trucks and distribute inbound and intraregional truck trips. Rail routes used to transport outbound waste include the Metro-North and CSX Hudson Line, Fremont Secondary, Bay Ridge Branch, and New York-New Jersey rail carfloat to New Jersey. The Conrail and Norfolk Southern Lehigh Line and the Conrail and CSX River Line are used to transport waste by rail to points west, north, and south of the NYMTC planning area. Waterborne shipments of waste rely on the New York City Marine Transfer Station network, the East River, Hudson River, Upper New York Bay, Flushing Bay, Gowanus Bay, Gravesend Bay, Arthur Kill, Kill Van Kull, and Atlantic Ocean.

By 2045, the movement of waste and scrap materials is projected to increase 130 percent to 50 million tons. Household and commercial municipal solid waste is projected to decline as product packaging, recycling, reuse, and other strategies reduce landfill-bound municipal solid waste streams. However, increased construction and demolition debris and outbound scrap metal are projected to account for considerable growth in this commodity group.

Figure 2.33 illustrates the steps in the supply chain of waste moving in the NYMTC planning area. The supply chain for waste operates in a different sequence of events relative to the generic supply chain or the previously-described supply chain examples. The chain begins at residential, commercial, institutional, and construction sites, which were the end points of most of the other supply chains. Some household waste products may be composted at home, or in a community garden compost. These wastes are carried by hand to the compost. Waste products that are recycled or disposed of off-site are placed on the curb, dumpster, or other holding area for pick-up. A local waste-collection vehicle picks up the waste and delivers it to a local transfer station. At the transfer station, waste products are compressed and loaded into sealed containers for transport by truck or rail to a materials recovery facility. At the materials recovery facility, waste is sorted into separate streams, including recyclable plastics, recyclable paper, recyclable glass, and waste for disposal. From there, the waste streams are transported to recycling facilities in the United States or overseas to be recycled into new products, to waste-to-energy plants where waste may be burned and converted to energy, or to landfills for disposal. Most of the landfill-bound waste generated in the NYMTC planning area is sent to landfills in other states.

Figure 2.33 Waste Supply Chain in the NYMTC Planning Area



Transportation Modes:

-  Truck/containerized waste hauler
-  Ocean vessel
-  Rail carload
-  Waste collection truck
-  Bulk moves by barge
-  Transport on-foot to on-site or near-site compost

Source: Cambridge Systematics

3.0 Identifying and Assessing Needs

This section describes the deficiencies, requirements, and limitations of the freight transportation system in and around the NYMTC planning area, and to answer the question: “What needs to be accomplished in order to achieve the desired outcomes described in Section 1?”

NYMTC’s initial Regional Freight Plan, adopted in 2004, identified several categories of needs for freight transportation, including roadway and rail capacity, economic development and environmental needs. Since 2004, NYMTC’s members have taken steps to address many of the needs in these categories. Also during this time, the NYMTC planning area has experienced a major recession, a devastating hurricane, renewed population and economic growth, and ongoing shifts in land use. These changes are producing new and different socioeconomic trends, economic clustering, and freight transportation needs. Many of these trends are documented in plans and studies led by NYMTC member agencies that have been completed or are ongoing.

To define and assess the NYMTC planning area’s freight transportation needs for the 2045 planning horizon on this Regional Freight Plan, the status of freight initiatives in the planning area and the larger metropolitan region have been reviewed, key needs and deficiencies identified in those efforts that remain to be addressed have been catalogued. The needs assessment builds on the original needs identified in the 2004 Plan which remain unresolved, or which have changed as a result of global economic, demographic, technologic, or regulatory trends since 2004. It uses a variety of information and input to identify new and emerging needs; such as previously adopted NYMTC Regional Freight Plans, NYMTC’s Congestion Management Process Report, and Goods Movement Action Program (GMAP), an effort led by the Port Authority of New York and New Jersey, New York State Department of Transportation, and New Jersey Department of Transportation.

In addition, analysis of the larger region’s economic composition, key supply chains, as described in Section 2, and five priority issues—last mile delivery needs, industrial land use changes, climate change vulnerability and preparedness, environmental justice, and regulatory harmonization—have identified additional needs and deficiencies that the Regional Freight Plan addresses. Data analysis, public, agency, and private sector outreach and engagement have supported contributed to this process.

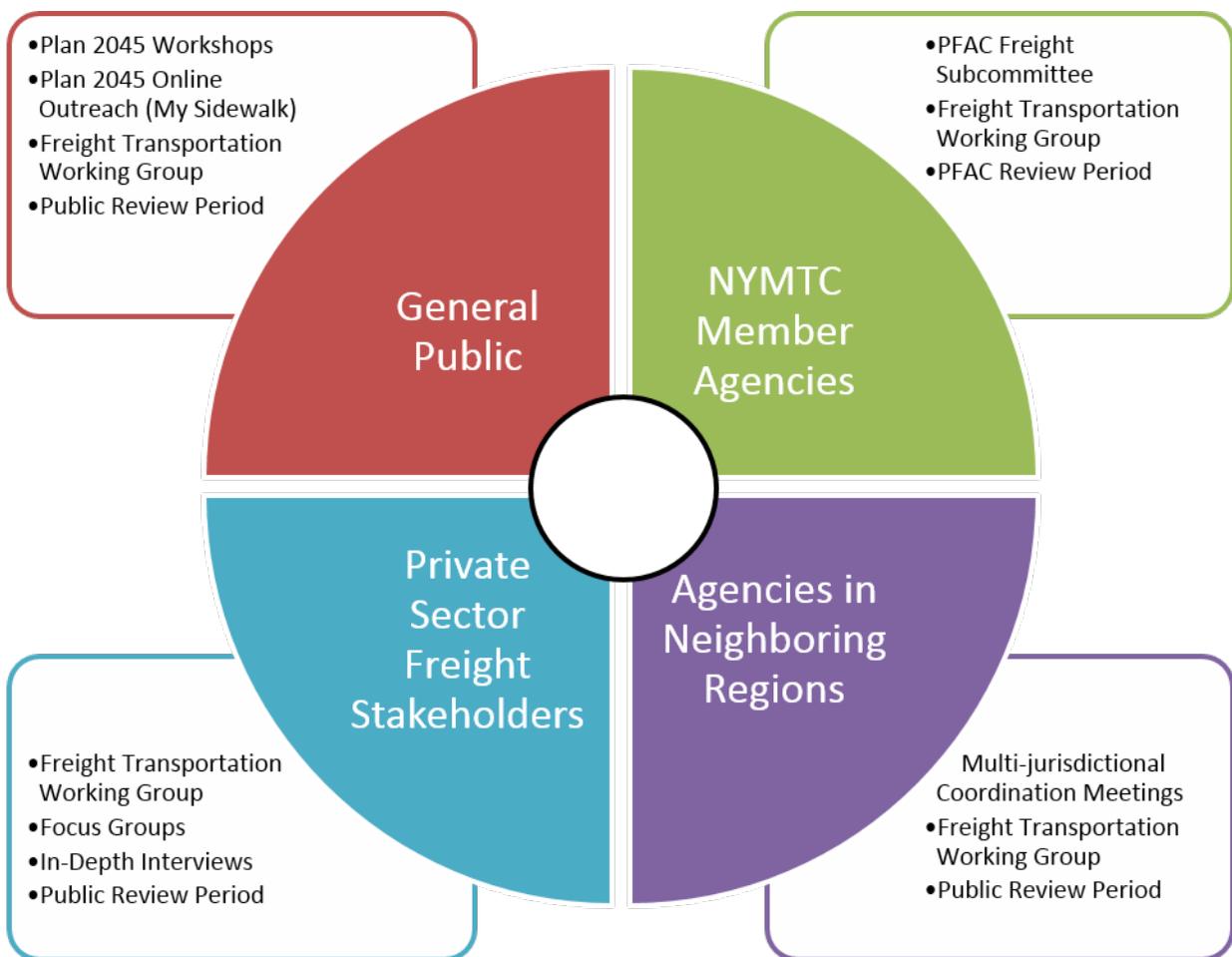
3.1 Public and Private Stakeholder Outreach and Engagement

Public sector and private sector stakeholders contributed to the identification of needs and potential projects and strategies. The outreach and engagement of these stakeholder groups included the following forums, described below and illustrated in Figure 3.1:

- **PFAC Freight Subcommittee.** The PFAC Freight Subcommittee consists of NYMTC member agencies convened on a regular basis throughout the development of the Regional Freight Plan. The PFAC Freight Subcommittee served as the Steering Committee for the Regional Freight Plan, contributing to the development of the scope and analysis methodologies and reviewing draft and final results and deliverables.
- **The NYMTC Freight Transportation Working Group (FTWG).** The FTWG consists of NYMTC members, other public sector transportation, planning, economic development, and environmental agencies, private sector representatives, researchers, and is open to the public. FTWG meets on a regular basis to discuss freight issues and initiatives in the planning area, and national issues and regulations that have local or regional impacts. The FTWG contributed to the refinement of the Regional Freight Plan scope, suggested freight needs and projects and policies to be included in the Plan.
- **Adjacent Planning Areas.** Recognizing that freight transportation needs and impacts cross jurisdictional boundaries, transportation planning agencies in surrounding jurisdictions contributed thoughts, ideas, and insights into emerging cross-jurisdictional trends, issues, and needs. Coordination included the engagement of the project teams developing the New York State, Connecticut, and New Jersey state freight plans, and metropolitan planning organizations and councils of governments in Connecticut, New Jersey, and Pennsylvania. Impacts of projects and other investments on freight transportation capacity and operations in the NYMTC planning area were discussed and accounted in the Needs Assessment and project and policy identification for the NYMTC Regional Freight Plan.

- Private sector focus groups and in-depth interviews.** The perspective of the shippers and receivers who rely upon efficient freight transportation, the carriers who provide freight transportation service, and logisticians who help companies manage supply chains, was a valuable component of the needs assessment and project and policy identification processes. A series of focus groups were convened, consisting of private sector freight stakeholders, with the purpose of identifying key issues and factors that influence transportation procurement decisions. Information gathered during the focus groups informed the development of interview discussion guides. The project team interviewed representatives from the key industry supply chains identified in Section 2.4 to learn about how their respective supply chains are organized—by activity, modes, and geography. The interviews also uncovered specific strengths, shortcomings, and needs apparent now and expected in the future.
- Public outreach.** Through the development of Plan 2045, public input related to freight needs and potential projects and policies was solicited and gathered. Methods for gathering this public input included a series of Plan 2045 public workshops held in each county in the NYMTC planning area, and an online public information and input tool.

Figure 3.1 Outreach and Engagement Activities



3.2 Current and Emerging Priority Issues and Needs

The framework for identifying the NYMTC planning area’s priority issues and needs, shown in Figure 3.2, provides the building blocks necessary to identify the key elements of the planning area’s freight transportation system and how they relate to one another and to the economy.

Figure 3.2 Needs Identification Framework

3.2.1 Economy

The economic structure of the NYMTC planning area – the types of industries and the number of households – determines the types and volumes of commodities that are moved. Needs supporting the economic development of the planning area include:

- Identify and pursue opportunities to develop local recycling capacity;
- Develop and expand education and workforce training in logistics/freight;
- Address factors contributing to truck driver shortage;
- Expand the inventory of refrigerated warehousing and distribution in the NYMTC planning area;
- Identify and pursue innovative finance schemes to fund capital investments;
- Maintain the Port of New York and New Jersey’s status as the top container port on the U.S. Atlantic coast;
- Preserve industrial use of waterfront terminals and adjacent areas;
- Further develop land use models that encourage compatibility between freight uses and urban context, including freight villages and urban logistics centers, where appropriate.

3.2.2 Logistics

Logistics describes where industries source, make, stage, and sell their materials, parts, and finished products – the activities and links that define their supply chains and distribution networks. Companies in the NYMTC planning area are constantly revising their supply chains to adjust to changes such as the introduction of e-commerce, on-line shopping, emissions controls, growth in export markets, near- and on-shoring of manufacturing, better traffic information and route planning software, amendments to truck driver hours of service regulations, etc. Changing logistics strategies are affecting warehouse locations and choice of truck types, truck routes, delivery times, etc. Specific needs related to logistics include:

- Reduce maritime vessel fuel consumption and vessel emissions;
- Improve safety of energy product moves by rail;
- Improve security against damage and theft of shipments;
- Identify, develop, and manage safe and secure locations to park trucks while the driver obtains the mandated amount of rest;

- Monitor and assess impacts of emerging technological advances in manufacturing and logistics, such as 3D printing, which could change the organization and geographic distribution of various industry supply chains;
- Increase goods movement by rail and water; and
- Discover, develop, and deploy technological advances in all stages of the supply chain, including materials extraction and agriculture, manufacturing, and logistics and distribution systems.

3.2.3 *Infrastructure and Operations*

Freight transportation infrastructure includes roadways, rail lines, waterways, air and telecommunication networks, truck and rail terminals, ports and airports, customs stations, distribution centers, etc. – all the physical facilities that enable industries and their freight carriers to move goods and execute their logistics strategies. Commodities flow over roads and rail lines and through ports and distribution centers represent the execution of industry supply chains using the available freight transportation infrastructure and services. When volumes of vehicles exceed capacity, or when operating characteristics of rail, marine, and air cargo systems result in breakdowns of system fluidity, there must be a set of capital and programmatic solutions to improve the operation of the system, including the following:

- Maintain a state of good repair systemwide;
- Maintain reliable travel time on the NYMTC planning area's Strategic Freight Highway Network;
- Establish 286,000-pound railcar capacity and Plate F dimensional capacity on lines and branches where freight service operates today, or is expected to operate in the near future, and double-stack container clearance on appropriate corridors;
- Improve cross-Hudson freight rail links;
- Improve freight rail and highway links to Hunts Point;
- Continue to improve truck access to/from John F. Kennedy International Airport;
- Reduce locomotive emissions via equipment upgrades and more efficient operation;
- Augment freight rail capacity, including weight limits, track condition and allowable operating speeds, vertical clearances, and operating windows, to accommodate construction material moves by rail;
- Reduce institutional barriers to seamless rail operations;
- Maintain authorized channel depths on navigable waterways throughout the NYMTC planning area; and
- Fortify freight network against flood and inundation risks associated with extreme weather events and long-term climate change.

3.2.4 *Regulation*

Finally, freight transportation operates within a framework of institutional and commercial relationships governed by statutes, regulations, standards, policies, and established practices and customs. The needs and opportunities created by changes including truck access and noise restrictions, reclassification of industrial and transportation land, regional coordination of freight initiatives, and shifts in Federal freight planning and funding as a result of the implementation of MAP 21 and FAST have been assessed, and include:

- Manage curbside parking and commercial loading zones in urban areas of the planning area;
- Explore policies to facilitate non-motorized delivery;
- Adopt transportation policies that contribute to reduced fossil fuel consumption;
- Maintain and enforce motor carrier safety regulations for hazardous and flammable materials;

- Anticipate and prepare to safely manage the deployment technological advancements such as connected and autonomous commercial vehicles, on public highways;
- Harmonize truck size and weight regulations across the multiple jurisdictions in the NYMTC planning area and in neighboring regions;
- Work with local planners to incorporate parcel delivery needs into zoning and/or building and site plan review processes;
- Manage demand for truck transportation by time-of-day through expanded off-peak delivery or pricing schemes; and
- Revise oversize and overweight (OS/OW) fees and fines, and truck tolls, to capture the cost of infrastructure wear and tear attributable to trucks.
- Establish land use, zoning, and development regulations that promote complementary urban and industrial uses and avoids placing industrial facilities into conflict with residential areas.

4.0 Improvements and Solutions

The improvements and solutions listed on the following pages represent investments and policies that support the desired outcomes of the Regional Freight Plan and to address the priority issues and needs listed in Section 3. Most of the improvements and solutions listed below are near-term actions, including projects that may be implemented within the 2018-2023 timeframe, policies that can be readily implemented, or studies, environmental review, or programming that can be implemented in the near-term to support capital investments to be made later in the future. Medium-term actions are expected to be implemented in approximately five to ten years, and long-term actions are expected to be implemented ten or more years from the adoption of this plan. The actions, therefore, are divided into four categories:

- Planning initiatives, which may study a wide variety of alternatives;
- Project planning and/or environmental reviews for vision projects;
- Programmed improvement projects; and
- Policies or programs that advance desired outcomes and address needs.

Improvements and solutions listed in the following tables are also categorized as being “freight-specific,” meaning the primary impetus for the project is to improve freight movement, and “freight-supportive,” meaning the primary impetus may not be related to freight, but that freight benefits can be expected as a result of the project.

Table 4.1 Planning Initiatives

No.	Item	Location	Primary Desired Outcome	Potential Private Benefits			Source
				Cost	Speed	Reliability	
GOAL: REGIONAL ENVIRONMENT							
91	* 286k railcar weight improvements. Strategy and study to identify and prioritize weight improvement projects on Bay Ridge Branch	NYMTC planning area	Reduce pollutants	✓	✓		MRFC Action Plan; Goods Movement Action Program
112	* Study potential construction and demolition debris (C&D) barge services. Initiate barge service to remove C&D waste from Manhattan to Brooklyn or NJ	New York City	Reduce pollutants	✓	✓	✓	Freight Transportation Working Group
188	* Identify locations and develop clean fuel and truck electric charging stations throughout the planning area	NYMTC planning area	Reduce pollutants	✓	✓	✓	Freight Transportation Working Group
194	* Explore options to accelerate the retirement of pre-2007 trucks operating in the planning area.	NYMTC planning area	Reduce pollutants	✓			PFAC Freight Subcommittee
85	* Pneumatic Tube Waste Collection Feasibility Study. Study options for installing and operating pneumatic tubes for waste collection in Manhattan's west side.	New York City	Reduce pollutants	✓	✓	✓	Freight Transportation Working Group
GOAL: TRANSPORTATION ACCESS							
103	* Blake Avenue transload facility. Study potential to develop a rail-truck transload facility at Blake Ave Yard along Bay Ridge Branch in Brooklyn.	New York City	Competitive modal options		✓	✓	Public Outreach
84	* Construction material transfer facility. Identify potential sites in Manhattan for transfer yard for construction material, and concrete mixing site, including 34th Street at 11th Ave.	New York City	Last-mile connections	✓	✓	✓	Freight Transportation Working Group
116	+ Route 202 corridor capacity improvements.	Lower Hudson Valley	Increased reliability		✓	✓	Private Sector Interviews
117	+ Route 6 corridor capacity and safety improvements.	Lower Hudson Valley	Increased reliability		✓	✓	Regional Freight Plan analysis; Private Sector Interviews
118	+ Route 100 corridor improvements. Improved ramps, turning lanes, and shoulders.	Lower Hudson Valley	Increased reliability		✓	✓	Private Sector Interviews
119	+ Route 52 corridor improvements. Improved ramps, turning lanes, and shoulders.	Lower Hudson Valley	Increased reliability		✓	✓	Private Sector Interviews
181	* Feasibility of cargo cycles. Evaluate the feasibility of cargo bicycle services to perform last-mile delivery	NYMTC planning area	Increased reliability	✓		✓	Public Outreach
131	* Study and identify strategies to address areawide truck movement issues	NYMTC planning area	Increased reliability	✓	✓	✓	Regional Transportation Plan 2040
132	+ I-287 Integrated Corridor Management, including corridor land use transportation impacts and transit-oriented development	Lower Hudson Valley	Increased reliability		✓	✓	Regional Transportation Plan 2040
199	* Study key bottlenecks at freight facilities in the NYMTC planning area, benchmark and target performance	NYMTC planning area	Increased reliability	✓	✓	✓	Public comment on Draft Plan 2045
GOAL: SAFETY AND SECURITY							
24	* Install over height detectors to protect against bridge strikes where needed	NYMTC planning area	Reduced injuries and fatalities	✓			NYMTC TIP 2017-2021; Regional Freight Plan analysis

195	*	Explore the use of sideguards and other urban truck safety solutions	NYMTC planning area	Reduced injuries and fatalities	✓	✓		PFAC Freight Subcommittee
10	+	Centerline audible roadway delineators on various highways in the Planning Area	Lower Hudson Valley	Reduced injuries and fatalities				NYMTC TIP 2017-2021
22	+	Safety upgrades: I-87 Spring Valley tolls	Lower Hudson Valley	Reduced injuries and fatalities				NYMTC TIP 2017-2021
92	+	Grade Crossing Elimination Program. Strategy and study to identify and prioritize grade crossing elimination projects	NYMTC planning area	Reduced injuries and fatalities				MRFC Action Plan; Goods Movement Action Program
164	+	Atlantic Avenue corridor safety improvements in Brooklyn and Queens	New York City	Reduced injuries and fatalities				Regional Transportation Plan 2045; Regional Freight Plan analysis
98	*	Study truck parking/staging capacity, needs, and potential project alternatives in the NYMTC planning area	NYMTC planning area	Safety and security in planning	✓	✓	✓	Regional Freight Plan analysis; Private Sector Interviews
196	*	Study potential public safety and environmental risks associated potential derailments and/or transport of certain commodity types	NYMTC planning area	Safety and security in planning			✓	Public comment on Draft Plan 2045
GOAL: REGIONAL INVESTMENTS								
86	*	Develop Tier II EIS for Cross Harbor Freight Program	NYMTC planning area	Coordinated long-term planning	✓	✓	✓	Regional Transportation Plan 2045;
127	+	I-84 widening; Widen I-84 from 4 lanes to 6 lanes from NY/CT border to I-684 interchange.	Lower Hudson Valley	Coordinated long-term planning		✓	✓	Multi-Jurisdictional Coordination; Regional Transportation Plan 2045
166	+	Airport Access - JFK improvements	New York City	Coordinated long-term planning		✓	✓	Regional Transportation Plan 2045; Governor's Office
120	+	Long Island Sound Crossing	Suburban Long island	Coordinated long-term planning		✓	✓	Private Sector Interviews; Governor's Office
153	+	Long Island Expressway Exit 32 to Exit 64, study demand management and congestion pricing	Suburban Long island	Coordinated long-term planning		✓	✓	Regional Transportation Plan 2040
104	*	North Shore (Staten Island) Freight Corridor Study. Consider alternatives for freight transportation on North Shore of Staten Island, including potential reactivation of North Shore Line for freight service	New York City	Coordinated long-term planning		✓	✓	Regional Transportation Plan 2045 Outreach
168	+	Clearview Expressway/Northern Boulevard Corridor Study of safety improvements	New York City	Coordinated long-term planning		✓	✓	Regional Transportation Plan 2045
113	*	Freight feasibility for Gateway Program	New York City	Coordinated long-term planning		✓	✓	Freight Transportation Working Group
197	*	Engage "thought leaders" in the area of "smart cities" to review and respond to freight issues in the NYMTC planning area	NYMTC planning area	Coordinated long-term planning	✓	✓	✓	Public comment on Draft Plan 2045
198	*	Study potential strengths, weaknesses, opportunities, and/or threats (SWOT) associated with technological advances in transportation and logistics, including workforce impacts and needs	NYMTC planning area	Coordinated long-term planning	✓	✓	✓	Public comment on Draft Plan 2045
200	*	Conduct establishment surveys to validate and/or project commodity flow data, in coordination with BPM surveys and data collection	NYMTC planning area	Coordinated long-term planning	✓	✓	✓	Public comment on Draft Plan 2045
GOAL: RESILIENCY								
144	+	Areawide roadways: flooding and drainage evaluation	Suburban Long island	Adaptation			✓	Regional Transportation Plan 2045
186	+	Freight resiliency from NY-NJ-CT Transportation Vulnerability Assessment	NYMTC planning area	Fortified assets			✓	Regional Freight Plan analysis; FHWA study
GOAL: PRESERVATION								
143	+	Areawide Bridge Assessment Study	NYMTC planning area	Protect freight network			✓	Regional Transportation Plan 2045

188	* Areawide Freight Land Use Study, to determine appropriate mix of land uses and to focus and support industrial preservation where appropriate	NYMTC planning area	A supply of industrial land	✓	✓	PFAC Freight Subcommittee; Regional Freight Plan analysis
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* = Freight-Specific Actions
 + = Freight-Supportive Actions

Table 4.2 Project Planning and/or Environmental Assessments

No.	Item	Location	Primary Desired Outcome	Potential Private Benefits			Source
				Cost	Speed	Reliability	
GOAL: REGIONAL ENVIRONMENT							
141	* CSX River Line second track, NJ border to Orange County line	Lower Hudson Valley	Reduce pollutants	✓	✓	✓	Regional Transportation Plan 2040
3	* Rockland County diesel retrofits. Replace all diesel powered county owned vehicles 8,500+ pounds with appropriate/best technology.	Lower Hudson Valley	Reduce GHG emissions	✓			NYMTC TIP 2017-2021
GOAL: REGIONAL ECONOMY							
89	* Howland Hook Marine Terminal rail yard expansion. Extend Arlington Rail Yard tail track and pursue IDA funding for rail yard equipment.	New York City	Goods movement supports growth	✓	✓	✓	MRFC Action Plan
27	* Pilgrim State Hospital Intermodal Facility Phase 2. Construct second phase of intermodal freight facility at Pilgrim State Hospital Site. May include highway infrastructure and/or rail infrastructure improvements.	Suburban Long Island	Goods movement supports growth	✓	✓	✓	NYMTC TIP 2017-2021
GOAL: TRANSPORTATION ACCESS							
176	* Howland Hook access improvement project	New York City	Competitive modal options		✓	✓	Regional Transportation Plan 2045
175	+ West Shore Expressway access ramps from Korean War Veterans Expressway interchange to Englewood Rd.	New York City	Last-mile connections		✓	✓	Regional Transportation Plan 2045
38	+ Mobility improvements on Bruckner, Cross Bronx, Major Deegan expressways. Cooperative Traffic Management strategies for mainline, service roads, and major signalized intersections/arterials.	New York City	Increased reliability		✓	✓	NYMTC TIP 2017-2022
7	+ I-684 interchange improvements; Exits 5&6.	Lower Hudson Valley	Increased reliability		✓	✓	NYMTC TIP 2017-2021
8	+ I-84 Integrated Corridor Management	Lower Hudson Valley	Increased reliability		✓	✓	NYMTC TIP 2017-2021
6	+ Intersection improvement: I/87 and US 9. Interchange improvements two turning lanes and second receiving lane.	Lower Hudson Valley	Increased reliability		✓	✓	NYMTC TIP 2017-2021
158	+ Bruckner Expressway/Sheridan Expressway/ Bruckner Expressway interchange	New York City	Increased reliability		✓	✓	Regional Transportation Plan 2045
174	+ Continuous service roads, West Shore Expressway. Intersections IMP at Arthur Kill - Arden Av, Arthur Kill - Huguenot Av, Arthur Kill - WSE NB Ramp	New York City	Increased reliability		✓	✓	Regional Transportation Plan 2045
133	+ I-287/I-87/ Route 17 interchange improvements.	Lower Hudson Valley	Increased reliability		✓	✓	Regional Transportation Plan 2045
145	+ NY 27 corridor improvements, including signal optimization and intersection improvements.	Suburban Long Island	Increased reliability		✓	✓	Regional Transportation Plan 2045
157	+ Hunts Point Interstate Access Improvement Project, including addressing geometric and operational deficiencies of Bruckner/Sheridan interchange, replacing truss bridge over Amtrak to provide three continuous lanes on Bruckner Exwy, replacing concrete decks and ramps, and improving pedestrian crossing at Hunts Point Avenue intersection.	New York City	Efficient, safe, and reliable last-mile connections	✓	✓	✓	Regional Transportation Plan 2045
197	* Thruway truck climbing lanes, Exit 11 to Exit 13	Lower Hudson Valley	Increased reliability			✓	Regional Transportation Plan 2045
GOAL: SAFETY AND SECURITY							
198	* Tappan Zee Bridge truck inspection checkpoints	Lower Hudson Valley	Increased safety and cargo security measures	✓		✓	Regional Transportation Plan 2045
GOAL: REGIONAL INVESTMENTS							
155	+ MTA LIRR Mainline Corridor Planning	Suburban Long island	Coordinated long-term planning		✓	✓	Regional Transportation Plan 2045

GOAL: PRESERVATION

87 *	Long Island City Rail Terminal/Wheelspur Yard improvements	New York City	Maximize useful life of assets	✓	✓	MRFC Action Plan
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* = Freight-Specific Actions

+ = Freight-Supportive Actions

Table 4.3 Programmed Projects

No.	Item	Location	Primary Desired Outcome	Potential Private Benefits			Source
				Cost	Speed	Reliability	
GOAL: REGIONAL ENVIRONMENT							
43	* Modernize Hunts Point Terminal freight rail, rail and traffic circulation improvements.	New York City	Reduce pollutants		✓	✓	NYMTC TIP 2017-2027
GOAL: REGIONAL ECONOMY							
95	* New York City Waterways Dredging Program: Eastchester Creek. Maintain authorized depth in navigable channels in Eastchester Creek.	New York City	Global and national gateway	✓		✓	PFAC Freight Subcommittee
26	* Pilgrim State Hospital Intermodal Facility Phase 1. Construct first phase of intermodal freight facility at Pilgrim State Hospital Site. May include highway infrastructure and/or rail infrastructure improvements.	Suburban Long Island	Goods movement supports growth	✓	✓	✓	NYMTC TIP 2017-2021
GOAL: TRANSPORTATION ACCESS							
171	+ Brooklyn-Queens Expressway / Grand Central Pkwy interchange improvements.	New York City	Increased reliability		✓	✓	Regional Transportation Plan 2040
193	+ NY 454 and NY 27 Intelligent Transportation Systems	Suburban Long Island	Increased reliability		✓	✓	Regional Transportation Plan 2045
GOAL: SAFETY AND SECURITY							
5	+ West Shore River Line grade crossing improvements. Safety measure improvements to allow designation of quiet zones for 13 public and 7 private crossings.	Lower Hudson Valley	Reduced injuries and fatalities				NYMTC TIP 2017-2022
62	* Truck rest area on I-495.	Suburban Long Island	Safety and security in planning	✓			NYMTC TIP 2017-2046
GOAL: PRESERVATION							
196	+ Structural steel repairs on Gowanus Expwy from 48 th ST to Hugh L. Carey Tunnel	New York City	Protect freight network		✓		Regional Transportation Plan 2045
161	+ Major Deegan Expressway corridor bridge rehabilitation.	New York City	Protect freight network		✓		Regional Transportation Plan 2045
170	+ Van Wyck Expressway bridge rehabilitation.	New York City	Protect freight network		✓		Regional Transportation Plan 2045
93	* Grand Street bridge replacement over Newtown Creek. Replace the century-old, narrow bridge with a wider span to facilitate traffic flow.	New York City	Protect freight network		✓		Regional Transportation Plan 2045
16	+ I-87 bridge rehabilitations	Lower Hudson Valley	Protect freight network		✓		NYMTC TIP 2017-2021
34	+ Major Deegan Expressway bridge & pavement rehabilitations	New York City	Protect freight network		✓		NYMTC TIP 2017-2021
39	+ Bruckner Expressway rehabilitations	New York City	Protect freight network		✓		NYMTC TIP 2017-2021
47	+ Atlantic Avenue Bridge rehab over LIRR	New York City	Protect freight network		✓		NYMTC TIP 2017-2021
51	+ Brooklyn-Queens Expressway bridge rehabilitations	New York City	Protect freight network		✓		NYMTC TIP 2017-2021
52	+ Van Wyck Expressway viaduct replacement	New York City	Protect freight network		✓		NYMTC TIP 2017-2021
53	+ Rehab bridges at Van Wyck/LIE interchange	New York City	Protect freight network		✓		NYMTC TIP 2017-2021
55	+ Staten Island Expressway bridge rehabilitations	New York City	Protect freight network		✓		NYMTC TIP 2017-2021
59	+ Broadway Bridge rehabilitation	New York City	Protect freight network		✓		NYMTC TIP 2017-2021
9	+ I-684 resurfacing	Lower Hudson Valley	Protect freight network		✓		NYMTC TIP 2017-2021
20	+ I-95 pavement rehabilitation	Lower Hudson Valley	Protect freight network		✓		NYMTC TIP 2017-2021
23	+ I-295 Clearview Expressway bridge rehabilitation and replacement	New York City	Protect freight network		✓		Regional Transportation Plan 2045
28	+ Preventative maintenance for NY 27 bridges	Suburban Long Island	Protect freight network		✓		NYMTC TIP 2017-2021
29	+ I-495 pavement rehabilitation	Suburban Long Island	Protect freight network		✓		NYMTC TIP 2017-2021
196	+ Bridge replacement of NY 135 over I-495 in Town of Oyster Bay	Suburban Long Island	Protect freight network		✓		Regional Transportation Plan 2045

48	+	Rehabilitation of Brooklyn-Queens Expressway from Sand St. to Atlantic Ave.	New York City	Protect freight network	✓	NYMTC TIP 2017-2021
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* = Freight-Specific Actions
+ = Freight-Supportive Actions

Table 4.4 Policies and Programs

No.	Item	Location	Primary Desired Outcome	Potential Private Benefits			Source
				Cost	Speed	Reliability	
GOAL: REGIONAL ENVIRONMENT							
90	* Railcar Clearance Improvement Program for double stack & auto carrier. Strategy and study to identify and prioritize clearance improvement projects on Bay Ridge Line.	New York City	Reduce pollutants	✓	✓	✓	MRFC Action Plan (DRAFT); Goods Movement Action Program
110	* Refrigerated warehousing. Develop vertical refrigerated warehousing at Hunts Point, Freight Village locations, or elsewhere as appropriate.	NYMTC planning area	Reduce GHG emissions	✓	✓	✓	Freight Transportation Working Group
187	* Clean Freight Corridors Program. Implement fleet replacements/upgrades, fueling, electric charging, and other services to support clean corridor goals.	NYMTC planning area	Reduce GHG emissions	✓			Freight Transportation Working Group
123	* Pursue funding to replace diesel locomotives with Tier 4 or cleaner locomotives	NYMTC planning area	Mitigated externalities	✓			Plan 2045 Outreach; PFAC Freight Subcommittee
GOAL: REGIONAL ECONOMY							
94	* NYC Waterways Dredging Program: Newtown Creek, Jamaica Bay, Flushing Bay. Maintain authorized depth in "secondary" navigable channels, including, but not limited to Newtown Creek, Jamaica Bay, Flushing Bay	New York City	Global and national gateway	✓		✓	PFAC Freight Subcommittee
106	* Brookhaven Freight Village	Suburban Long Island	Goods movement supports growth	✓	✓	✓	Regional Freight Plan analysis
107	* Sunset Park Multimodal Freight and Logistics Hub	New York City	Goods movement supports growth	✓	✓	✓	Regional Freight Plan analysis
108	* Canal Village Freight Village	Lower Hudson Valley	Goods movement supports growth	✓	✓	✓	Regional Freight Plan analysis
134	+ NYS Thruway Exit 10 economic development and light industrial park.	Lower Hudson Valley	Goods movement supports growth				Regional Transportation Plan 2045
GOAL: QUALITY OF LIFE							
124	* Replace gondola cars with sealed containers for waste hauling by rail	NYMTC planning area	Mitigated externalities				Plan 2045 Outreach
GOAL: TRANSPORTATION ACCESS							
180	* Regional truck navigation. Improve regional truck navigation by providing quality underlying data regarding truck route restrictions.	NYMTC planning area	Increased reliability		✓	✓	Goods Movement Action Program (G-MAP)
177	* Streamline permitting for oversize/overweight (OS/OW) vehicles across jurisdictional boundaries	NYMTC planning area	Increased reliability	✓			Goods Movement Action Program (G-MAP)
178	* Harmonize size and weight regulations across multiple jurisdictions in and beyond the planning area	NYMTC planning area	Increased reliability	✓			Goods Movement Action Program (G-MAP)
181	+ Gather GPS based truck traffic data citywide for planning purposes	New York City	Increased reliability		✓	✓	PFAC Freight Subcommittee; Plan 2045 Outreach
114	* Promote multiple mode access for freight development sites.	NYMTC planning area	Increased reliability	✓	✓	✓	Freight Transportation Working Group
109	* Regional Off-Peak Delivery Program. Expand participation in off-peak delivery programs throughout the region.	NYMTC planning area	Increased reliability	✓	✓	✓	Plan 2040 Freight Summary Report; Goods Movement Action Program

128	*	Infrastructure Bank. Create rail freight-focused infrastructure bank, which could be funded by both State DOTs, private railroad industry, and Federal government. Implementation to require creating a mechanism to agree on how projects should be identified and funded/financed.	NYMTC planning area	Increased reliability	✓	✓	PFAC Freight Subcommittee; MRFC Action Plan
GOAL: REGIONAL INVESTMENTS							
122	*	Freight data analysis tools. Develop freight data analysis and scenario planning tools for members and the public to access/use.	NYMTC planning area	Coordinated long-term planning	✓	✓	Plan 2045 Outreach
GOAL: PRESERVATION							
99	*	Land banking for freight/industrial uses. Work with State to develop "land bank" for industrial land, work with municipalities to adjust zoning to preserve industrial land.	NYMTC planning area	Preserve industrial lands	✓	✓	PFAC Freight Subcommittee
100	*	Redevelop brownfield industrial sites. Maintain/expand inventory of warehousing and distribution center space by redeveloping brownfields.	NYMTC planning area	Preserve industrial lands	✓	✓	2004 Regional Freight Plan
185	*	Commercial vehicle compliance. Improve regional commercial vehicle compliance through education and enforcement strategies, including the deployment of screening technology.	NYMTC planning area	Protect freight network	✓		PFAC Freight Subcommittee

* = Freight-Specific Actions
 + = Freight-Supportive Actions

Because the supply chains surveyed in Section 2.4 extend beyond the boundaries of the NYMTC planning area, a number of projects, programs, and policies in neighboring jurisdictions could support freight and goods movement in the NYMTC planning area, or could impact the freight transportation system in the NYMTC planning area. For instance, a highway or rail project in New Jersey or Connecticut could facilitate safe and efficient freight transportation to or from the NYMTC planning area. The same project could also generate greater volumes of truck, automobile, or rail traffic, that the transportation infrastructure in this planning area may have difficulty accommodating. Tables 4.5 and 4.6 list projects in Connecticut and New Jersey, respectively, which could have effects, positive and/or negative, on the NYMTC planning area. NYMTC member agencies and other stakeholders should continue to engage agencies and other stakeholders in these neighboring regions to coordinate planning and project development activities and ensure mutual benefits.

Table 4.5 Improvements and Solutions in Connecticut

Item	Source
I-84 Widening (to NYS line)	Regional Freight Plan analysis; CT Coordination Meetings
I-84/Route 8 "Mix Master" Interchange and Waterbury viaduct replacement	CT Coordination Meetings; "Let's Go CT"
Consider freight stakeholders and needs when planning new/enhanced passenger rail services	CT Coordination Meetings
Widen I-95 from New Haven to NY state line	Regional Freight Plan analysis; CT Coordination Meetings; "Let's Go CT"
Short sea shipping/marine highway networks	CT Coordination Meetings; Private sector interviews
286,000 pound railcar clearances on freight-served lines	CT Coordination Meetings
NEC FUTURE Tier II Environmental Impact Statement	CT Coordination Meetings
Identify locations to expand truck parking capacity in high-demand corridors	Regional Freight Plan analysis; CT Coordination Meetings
Danbury Branch improvements to provide full commuter rail service connection to New Haven Line	CT Coordination Meetings; "Let's Go CT"
New Haven Line track and structures rehabilitation	"Let's Go CT"
Clean Corridors	CT Coordination Meetings; Freight Transportation Working Group
Permitting coordination with neighboring jurisdictions	CT Coordination Meetings
Commercial vehicle compliance strategies	CT Coordination Meetings

Table 4.6 Improvements and Solutions in New Jersey

Item	Source
Lehigh Line 3rd Track	NJTPA; MRFC Action Plan
Harmonize truck size and weight regulations and permitting	G-MAP; NJTPA
Cross Harbor Freight Program Tier II EIS	MRFC Action Plan; Freight Transportation Working Group
Conrail Mainline Connectors, Improve southbound connector from Staten Island Railroad, among other locations on the Conrail Mainline	MRFC Action Plan
Infrastructure Bank: Annual, renewable funding pool for rail projects region-wide	MRFC Action Plan
Freight Rail Industrial Opportunity (FRIO) Corridors Program: Identify, develop, and undertake efforts to address weight or dimensional deficiencies on rail network in NJTPA region.	NJTPA
Implement recommendations of the Inventory and Assessment of Waterborne Transportation Resources	NJTPA
Marine Terminal roadway and access improvements	Regional Freight Plan analysis; G-MAP; PFAC Freight Subcommittee
Route 17 capacity expansion, Maywood, Rochelle Park	Regional Freight Plan analysis
Protect key freight highways, rail lines, and terminals from rising seas and flooding	Regional Freight Plan analysis; Freight Transportation Working Group
Short sea shipping/marine highway networks	Freight Transportation Working Group
NEC FUTURE Tier II Environmental Impact Statement	
Identify locations to expand truck parking capacity in high-demand corridors	Freight Transportation Working Group Regional Freight Plan analysis; CT Coordination Meetings
Permitting coordination with neighboring jurisdictions	G-MAP; NJTPA
Commercial vehicle compliance strategies	Freight Transportation Working Group

5.0 Implementation Guidance

Implementation of the freight transportation improvements presented in Section 4 will require coordinated efforts on the part of many public and private sector stakeholders. The process of developing the Regional Freight Plan has engaged stakeholders in establishing a baseline of data about freight and goods movement in the region, identifying and assessing freight transportation needs, gathering information on potential alternatives for improving freight and goods movement, and selection of recommendations. NYMTC member agencies along with their economic development, environmental, and planning partner agencies, and private sector stakeholders, will need to continue to sustain the momentum that has been built during the development of this plan. The three keys to successful achievement of the Regional Freight Plan's desired outcomes include:

- Continuing and expanding stakeholder engagement;
- Identifying and securing both traditional and new funding and financing options; and
- Measuring and monitoring progress toward success.

5.1 Continuing and Expanding Stakeholder Engagement

Various public and private stakeholders and participants are involved in the freight transportation planning process in different capacities depending on, for example, the type of infrastructure or policy being addressed, the scope of the project or policy change, and an alternative's stage in the planning, development, and implementation process. Throughout the process of planning, programming, and implementing projects, NYMTC members should ensure that appropriate public agencies, private stakeholders, and the public at large are engaged in the proper capacity.

- NYMTC members should continue ongoing communication with **sister agencies and neighboring regions**, keep them engaged in regional and subregional plans and studies, and be an engaged participant in their plans and studies to ensure that the goals of all agencies are mutually supportive and avoid potential conflicts. This coordination can be achieved through existing forums such as the NYMTC Freight Transportation Working Group, the North Jersey Transportation Planning Authority's Freight Initiatives Committee, the Metropolitan Area Planning (MAP) Forum, the New York State MPO Association's Freight Working Group, the Metropolitan Rail Freight Council and the I-95 Corridor Coalition, and by ensuring a broad representation on project steering and technical advisory committees.
- It is important to engage **private sector stakeholders**, including carriers, shippers and receivers, logistics professionals, and industry associations, because they operate the vast portions of the freight transportation system, are customers of freight services, and produce many of the jobs and economic activity that freight facilitates. Through forums such as the Freight Transportation Working Group, NYMTC members should conduct ongoing outreach with private sector to advance the recommendations in the Regional Freight Plan, including participating in the evaluation of alternatives, and funding discussions. By demonstrating the private sector benefits of freight investments, as they affect the cost, speed, and reliability of freight transportation, a case can be made for private sector participation in the funding or financing of some freight projects.

- The public at large has a stake in freight transportation needs and investments as well. The public consumes products, such as construction materials used to build homes, apparel and clothing, food, and household goods, and generates waste. Many individuals are employed in industry sectors that produce freight shipments. There are also negative impacts, such as pollutant emissions, noise, highway and rail safety, and traffic congestion, which affect communities throughout the NYMTC planning area. Through dissemination of public education materials, such as the *Basics of Freight Transportation in the NYMTC Region* brochure, NYMTC member agencies can help foster increased public education on how freight operates in the NYMTC planning area, its needs and issues, and its community benefits and impacts. Forums such as the Plan 2045 public involvement process, public information sessions and workshops to support planning studies and project development, and regular communication with elected officials, can ensure that public issues and needs are reflected in the planning, project development, and implementation processes.

5.2 Identifying Funding and Financing Options

A number of financing options are available to advance the recommendations presented in Section 4. While traditional funding programs are generally well known to NYMTC members, a number of new financing tools have been created or modified through the FAST Act that can be used to supplement traditional finance. Projects can become eligible for non-traditional funding and financing mechanisms based on the geographic location of the improvement, the size of the project, its impact on key metrics like safety or job creation, its impacts beyond the region, the ability to produce value capture opportunities, and its attractiveness to private investors.

There is a distinction between transportation funding sources and project financing instruments. The primary sources of revenues for public-sector transportation investments in New York State are motor fuel taxes, truck ton-mile fees, user fees (e.g., tolls, vehicle registration and driver's license fees, charges assessed by public freight transportation service providers, etc.), property taxes, real estate transfer taxes, and general tax revenues (primarily income, sales, and business taxes). The private sector raises revenue by charging fees for services and use of privately-controlled elements of the freight transportation system (vehicles, rail tracks, warehouses, etc.).

Public-private partnerships (or "3Ps") are often cited as one potential solution to funding shortfalls. In theory, every project requires coordination and collaboration between the public sector and private sector. However, unless the private sector contributes additional funding, these partnerships often simply provide access to some form of financing (typically bonds and other forms of loans) that must be paid back over time, with interest, using traditional freight transportation funding sources. Currently, under New York State law, it is not feasible to use private-sector financing for public transportation projects, outside of limited design-build contracts for large projects such as the *New NY Bridge* project replacing the Tappan Zee Bridge.

Plan 2045's Chapter 7 presents a complete set of long-range financial forecasts and an assessment of alternative funding strategies and their potential implementation in the NYMTC planning area.

5.3 Measuring and Monitoring Progress toward Success

The desired freight outcomes, presented in Section 1.1, provide a framework for the NYMTC planning area's future freight transportation system. One of the biggest challenges in transportation performance management is the measurement of success in the context of achieving goals and desired outcomes. The federally-required process of establishing benchmarks and targets for mandated performance measures, and

tracking performance over time using these measures, will allow NYMTC's members to observe the planning area's progress toward achieving the desired outcomes.

The data analysis, stakeholder input, needs assessment, and recommended improvements and solutions included within the Regional Freight Plan should provide NYMTC members with a path forward to use the planning area's freight transportation network, economic, and land and building assets to achieve the shared goals and desired outcomes presented in Section 1.1. The Regional Freight Plan therefore is available to inform current and on-going regional freight and broader transportation, economic, and land use planning activities performed by NYMTC member agencies, other public and private entities in the NYMTC planning area, and planning activities in neighboring jurisdictions.