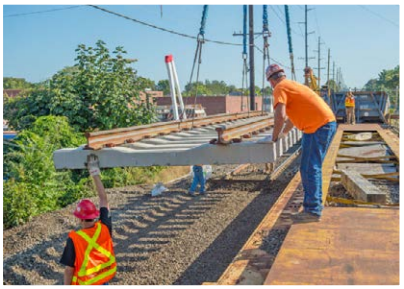
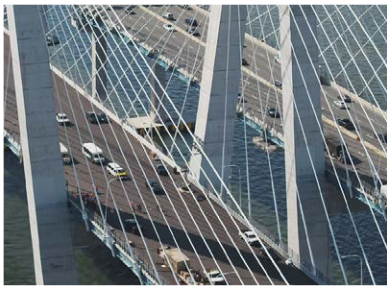
NYMTC
NEW YORK METROPOLITAN TRANSPORTATION COUNCIL

Moving Forward

Your Region, Connected





New York Metropolitan Transportation Council
Regional Transportation Plan
Adopted on September 9, 2021

Appendix H | Regional Freight Element

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1 COMMODITY FLOWS

Commodity flows are the movements of all types of goods, including—agricultural products, natural resources, food products, building materials, durable manufactured goods, and non-durable manufactured goods. Commodity flows support both producers and consumers in a region; commodity flows determine the need for and utilization of transportation assets and infrastructure; and commodity flow expectations provide an important framework for the planning of physical, operational, or regulatory improvements. A basic description of commodity flows impacting the multi-state New York City metropolitan region and the 10-county New York Metropolitan Transportation Council (NYMTC) planning area is the starting point for the ***Moving Forward*** *(****Moving Forward*** *or the Plan) Freight Element.*

1.1 DEFINITIONS AND DATA SOURCES

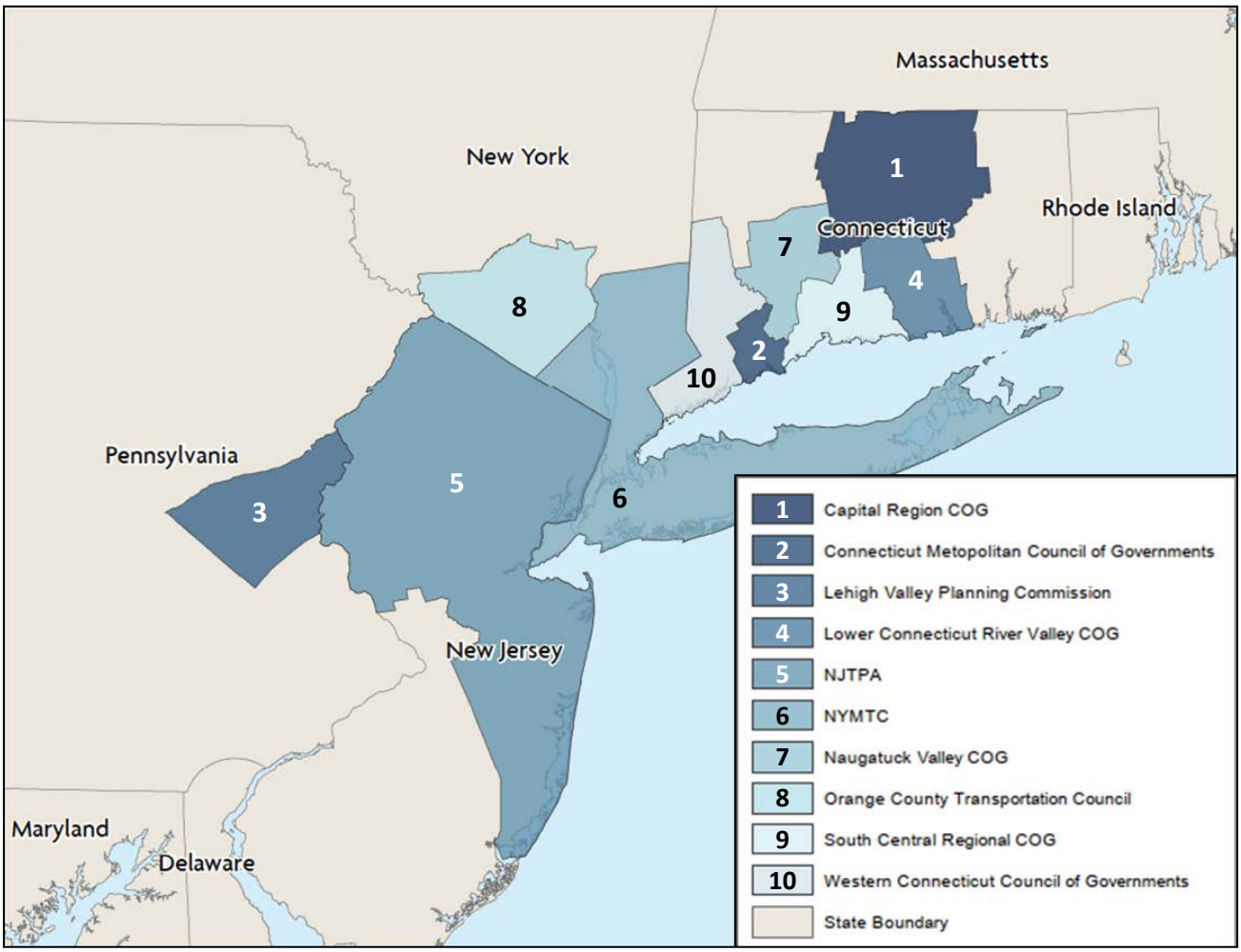
1.1.1 MEGAREGION GEOGRAPHY

NYMTC is an active member of the Metropolitan Area Planning (MAP) Forum, which comprises 10 regional planning agencies in New York, Connecticut, New Jersey, and Pennsylvania (***Figure H-1-1***). The MAP Forum provides a framework for better coordination of planning activities in the multi-state region and addresses megaregion freight movement issues as part of its ongoing activities.

Figure H-1-1

MAP Forum Geography

Source: New Jersey Transportation Planning Authority



1.1.2 NYMTC PLANNING AREA AND EXTERNAL MARKET AREAS

The NYMTC planning area is defined as the 10 NYMTC member counties, as illustrated in ***Figure H-1-2***. External market areas referred to in this analysis are illustrated in ***Figure H-1-3***.

Figure H-1-2

Counties Comprising the NYMTC Planning Area

Source: NYMTC

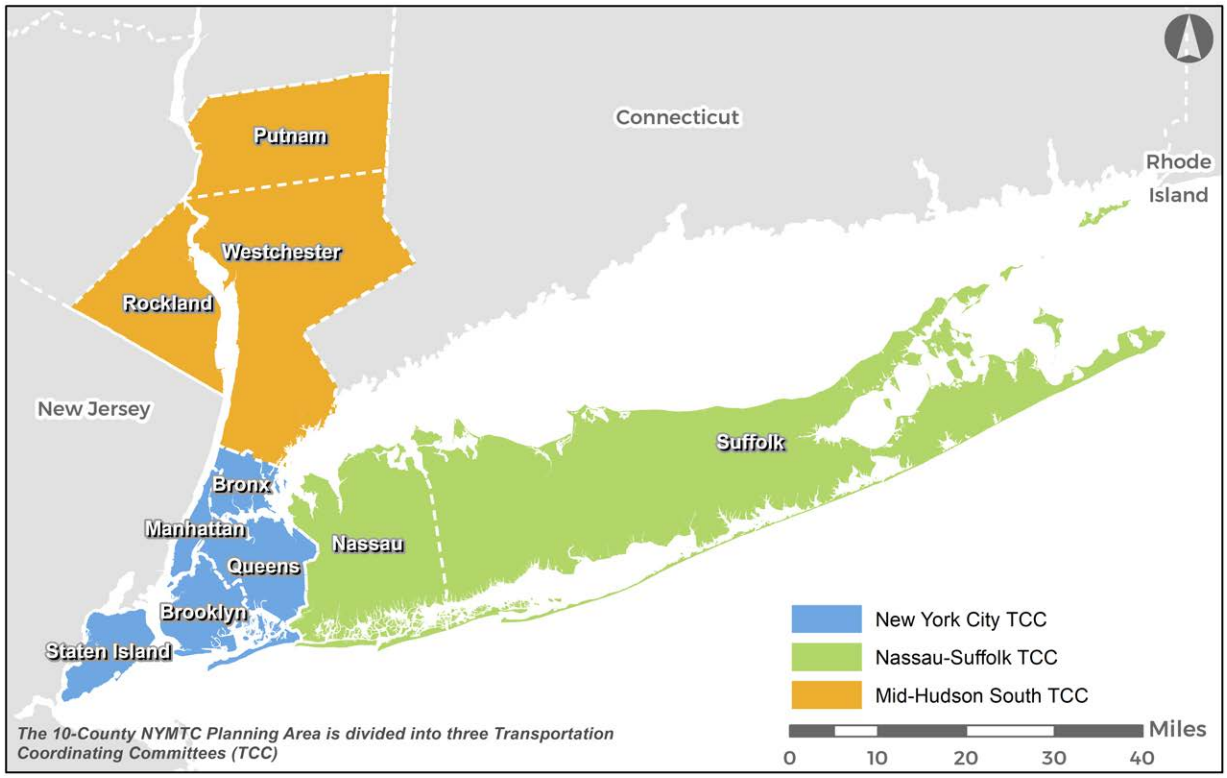
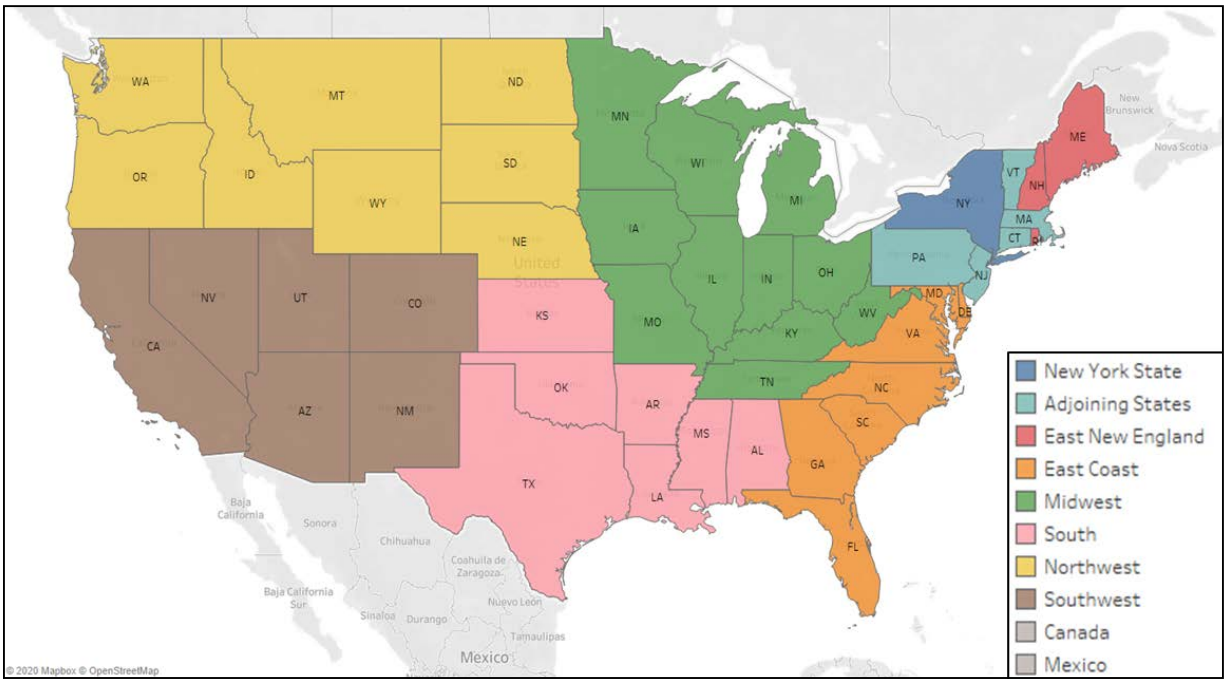


Figure H-1-3

Market Areas for Commodity Flow Analysis

Source: NYSDOT Transearch database



1.1.3 DATA SOURCES

A commercial dataset known as Transearch was used to develop estimates of domestic and North American Free Trade Agreement (NAFTA) commodity flow volumes for *Moving Forward.*[1] *NYMTC's Regional Freight Plan 2018–2045* previously included Transearch data with a 2012 base year; this updated analysis uses a 2018 base year. Primary specifications of the Transearch dataset are listed below.

- **Coverage years:** 2018 (current) and 2045 (forecast).
- **Measures:** tons, dollar value, and units (a "unit" is a single railcar or a single truck). Throughout this document, most of the analyses will address all three measures.
- **Transportation modes:** truck, rail, water, air, pipeline, or other/unknown. Freight trips via multiple modes (such as truck to rail or truck to water) are reported as separate modal trips. Truck volumes primarily reflect longer-distance moves by large trucks and may not capture smaller/local truck trips involved in redistributing goods for last-mile delivery.
- **Commodities:** specified according to Standard Transportation Commodity Code (STCC).[2]
- **Geography:** county level for New York State and adjoining states; multi-county Business Economic Area level for rest of the United States; state/province level for North America; and multi-state Market Group areas.
- **Trade types:** domestic (between two points in the United States); NAFTA-related (between points in the United States and provinces/states in Canada and Mexico); and the domestic portion of import/export trade (between the United States and non-NAFTA countries).[3] Where this document refers to "domestic" flows, it should be understood to include both types of movements.
- **Directions:** freight flows can be moving into a defined geographic area (inbound), moving out of that area (outbound), moving between counties in that area (within), or moving within a single county (internal).[4]

Data on all (NAFTA and non-NAFTA) international flows through the region's airports and seaports was obtained from various federal databases: the Bureau of Transportation Statistics "T-100" air cargo data series; the U.S. Army Corps of Engineers Waterborne Commerce of the United States; the U.S. Census Bureau USA Trade Online database; and the Federal Highway Administration (FHWA) Freight Analysis Framework (FAF).

1.2 MAP FORUM REGION COMMODITY FLOWS

1.2.1 SUMMARY OF MAP FORUM REGION DOMESTIC AND NAFTA FLOWS

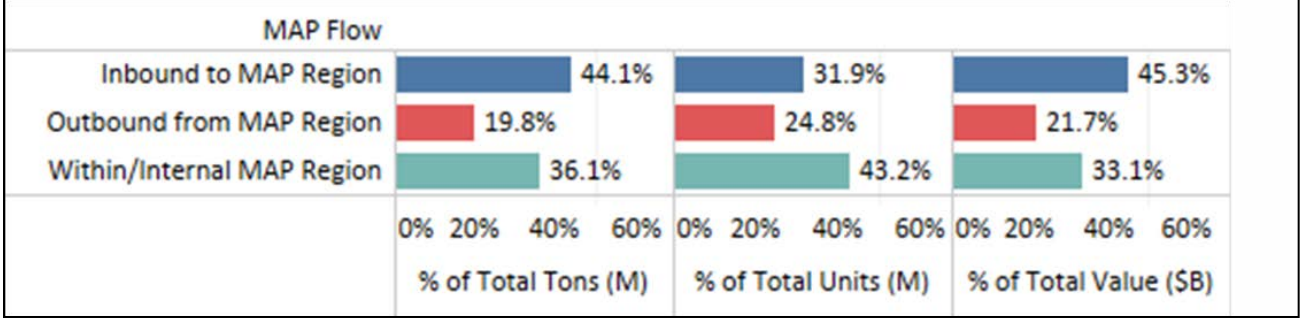
For domestic and NAFTA trade-related commodity flows in the MAP Forum region, Transearch estimates a total of 655 million tons of freight and 51 million units (trucks and railcars) with a value exceeding $1 trillion moving into, out of, and within the region in 2018. The largest shares of tonnage and value were moving inbound to the region, while the lowest were moving outbound. The largest shares of units were moving within the region, reflecting the redistribution of goods between producers, warehouse/ distribution facilities, and end users, with the inclusion of empty truck return moves reflected in the total. See ***Figure H-1-4***.

Figure H-1-4

MAP Forum Domestic Freight Flows (2018)

Source: Analysis of NYSDOT Transearch database

MAP Flow	Tons (M)	Units (M)	Value ($B)
Inbound to MAP Region	289.2	16.41	$463.19
Outbound from MAP Region	129.8	12.77	$221.60
Within/Internal MAP Region	236.4	22.20	$338.51
Grand Total	655.3	51.39	$1,023.30



1.2.2 MAP FORUM REGION DOMESTIC AND NAFTA FLOWS BY MODE

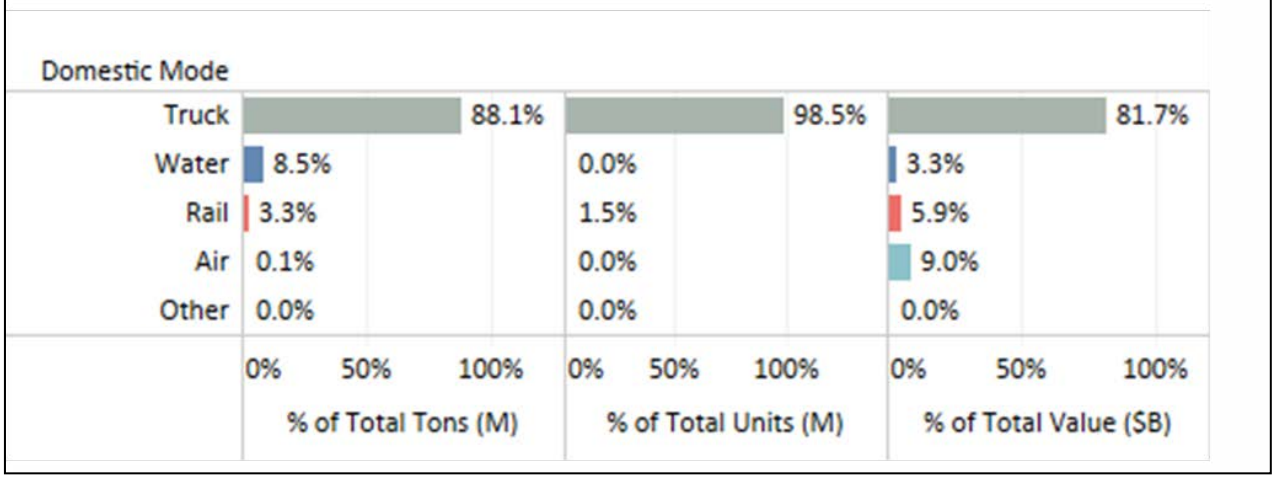
As shown in ***Figure H-1-5***, the modal distribution of freight shows that trucking accounts for 88 percent of tonnage, 82 percent of value, and more than 98 percent of units. Domestic water accounts for 8.5 percent of tonnage and 3.3 percent of value; rail accounts for 3.3 percent of tonnage and 5.9 percent of value; and air accounts for just 0.1 percent of tonnage but 9.0 percent of value (because the goods moved by air tend to be high value).

Figure H-1-5

MAP Forum Region Domestic Freight Flows by Mode (2018)

Source: Analysis of NYSDOT Transearch database

Domestic Mode	Tons (M)	Units (M)	Value ($B)
Truck	577.4	50.62	$835.95
Water	55.7	0.00	$34.08
Rail	21.4	0.76	$60.53
Air	0.8	0.00	$92.44
Other	0.0	0.00	$0.31
Grand Total	655.3	51.39	$1,023.30



1.2.3 MAP FORUM REGION DOMESTIC AND NAFTA FLOWS BY COMMODITY

The MAP Forum region handles a broad mix of commodity types; the leading commodities are different depending on tons, units, or value. Looking first at tonnage (see ***Figure H-1-6***) and then by tonnage, direction, and mode together (see ***Figure H-1-7***), the leading commodity groups are:

- **Non-metallic minerals** (e.g., sand, rock)—moving inbound and within the region, mostly by truck.
- **Petroleum** or coal products (refined fuels)—moving primarily within the region but also inbound and outbound, with a significant share by water.
- **Secondary traffic** (goods moved to or from warehouses and distribution centers)—moving primarily within the region but also inbound and outbound, exclusively by truck.
- **Waste or scrap materials** (including municipal solid waste (MSW) moving outbound plus scrap metal, paper, and glass for resale/reuse moving in all directions, with a significant share by rail.
- **Food or kindred products** (beverage and food products of all kinds)—moving primarily inbound, with some use of rail.
- **Clay, concrete, glass, stone**—moving primarily inbound, with some movement within the region, mostly by truck.
- **Chemicals and allied products**—moving primarily inbound with some movement outbound and within the region, mostly by truck but with some use of water and rail.
- **Farm products** (e.g., fruits, vegetables)—moving into the region by truck.

Figure H-1-6

MAP Forum Region Domestic Freight Flows (All Modes and Directions) by Commodity Tonnage (2018)

Source: Analysis of NYSDOT Transearch database

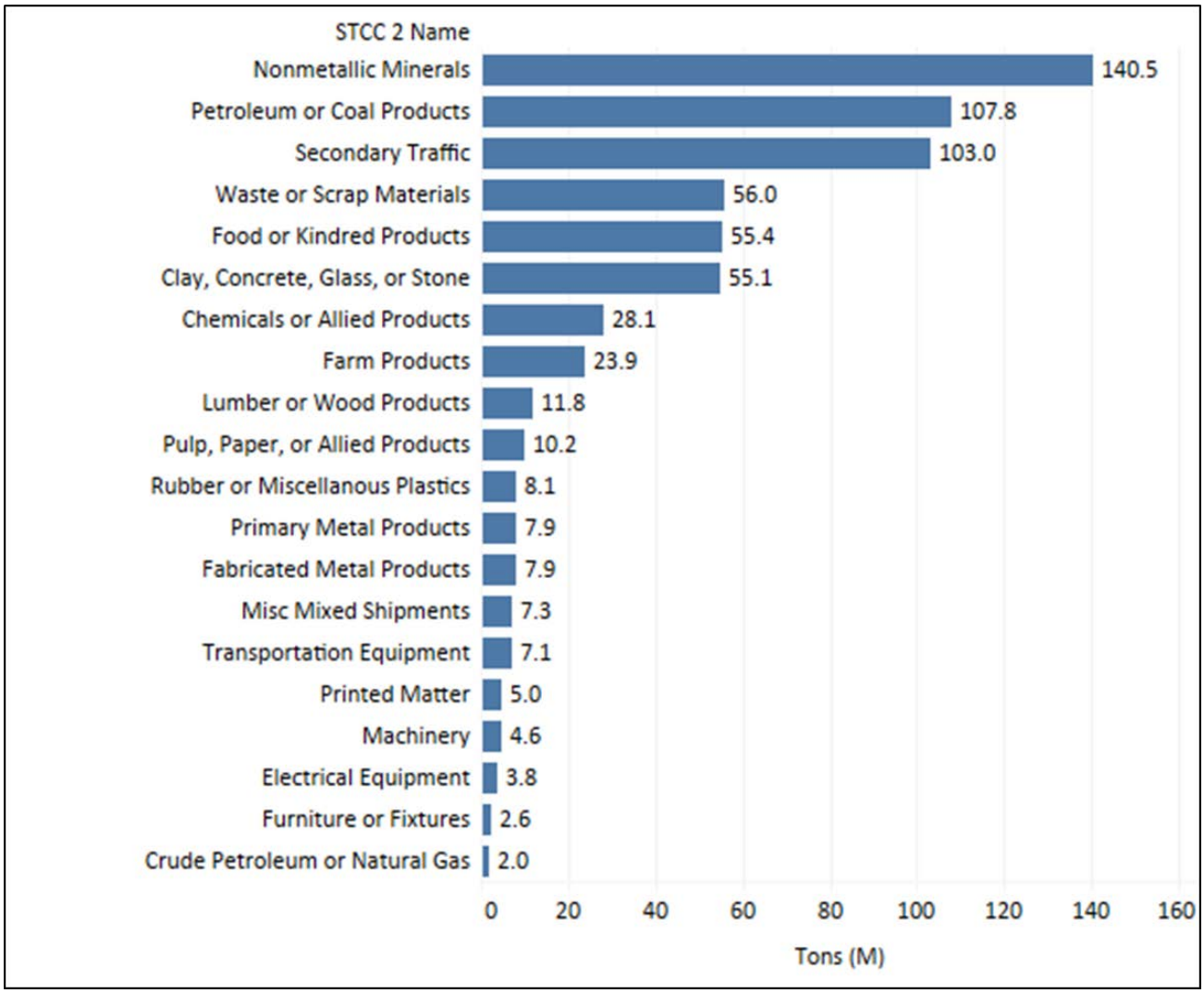
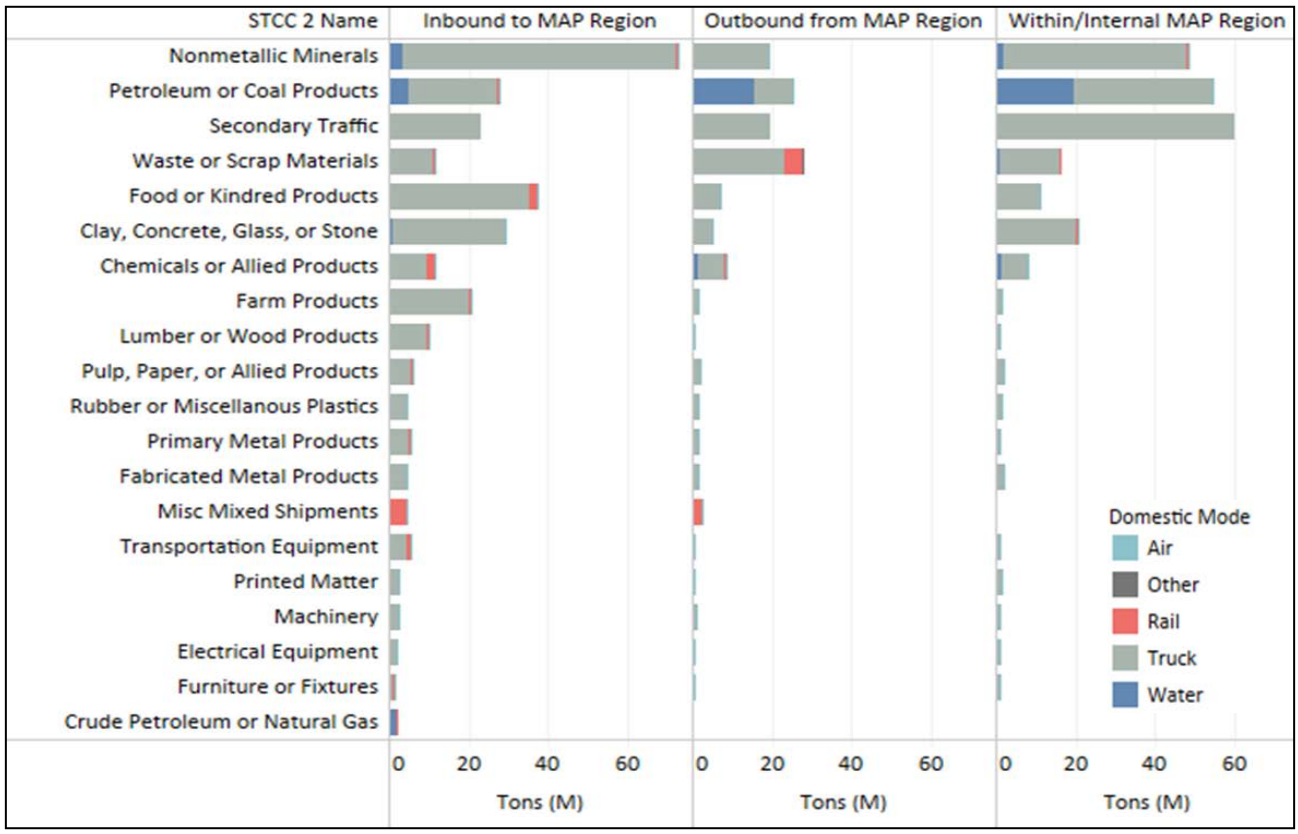


Figure H-1-7

MAP Forum Region Domestic Freight Flows by Commodity Tonnage, Direction, and Mode (2018)

Source: Analysis of NYSDOT Transearch database

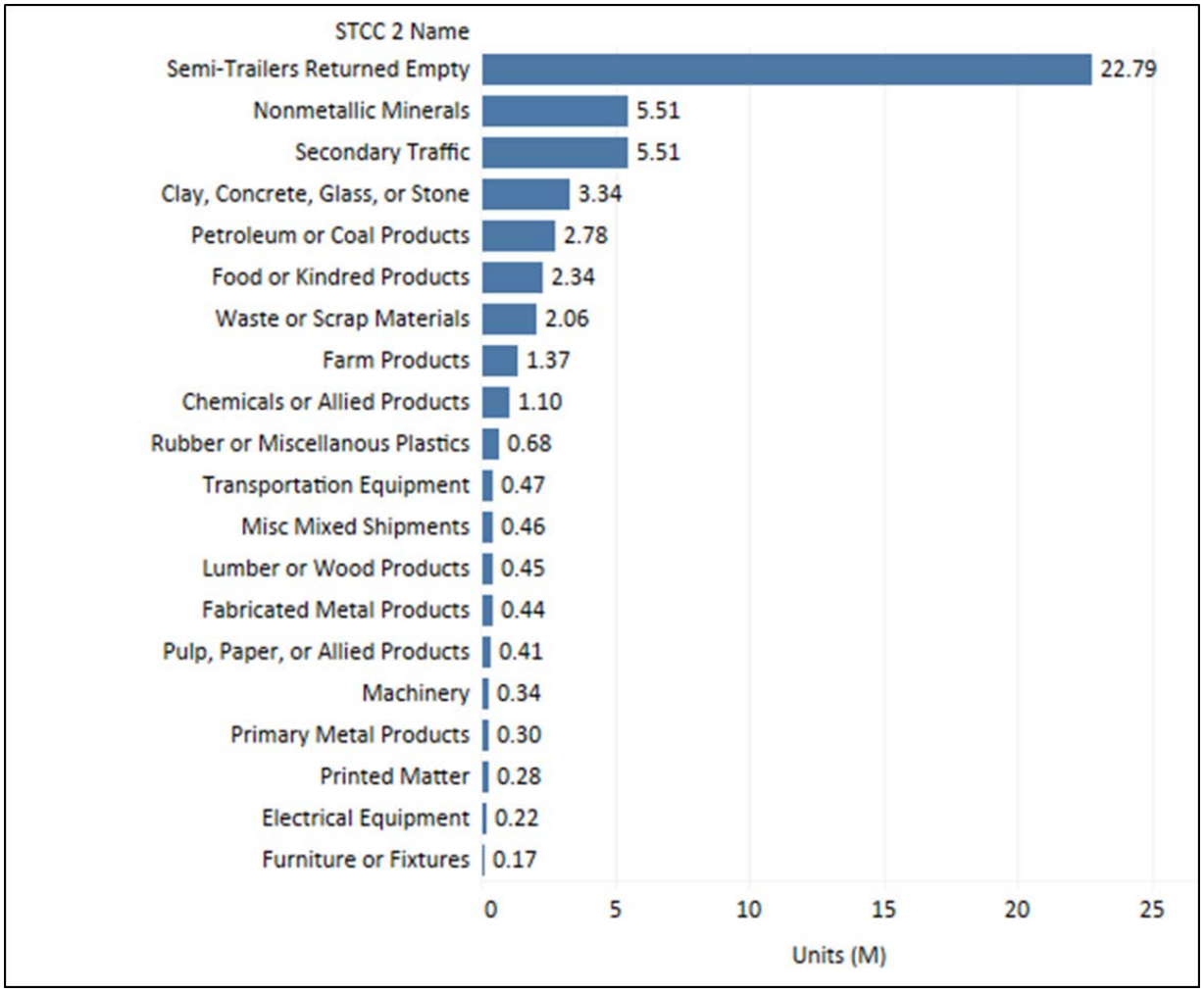


Transearch includes units for truck and rail but not for water or air, so it does not provide a complete measure, but it is informative, particularly regarding the leading commodity type (i.e., Semi-Trailers Returned Empty; ***Figure H-1-8***). Semi-Trailers Returned Empty are truck movements between loads—after trucks deliver loads, they may pick up a new load at the delivery location, but they often must travel empty to a different location to get their next load or return empty to their origin point. Empty trucks are, by a wide margin, the single largest class of unit movements, representing around 44 percent of all units in the dataset. As shown in ***Figure H-1-9***, the largest share of empty trucks is moving within the region, and the next largest is moving outbound; some empty trucks also move inbound to the region.

Figure H-1-8

MAP Forum Region Domestic Freight Flows (All Modes and Directions) by Commodity Units (2018)

Source: Analysis of NYSDOT Transearch database



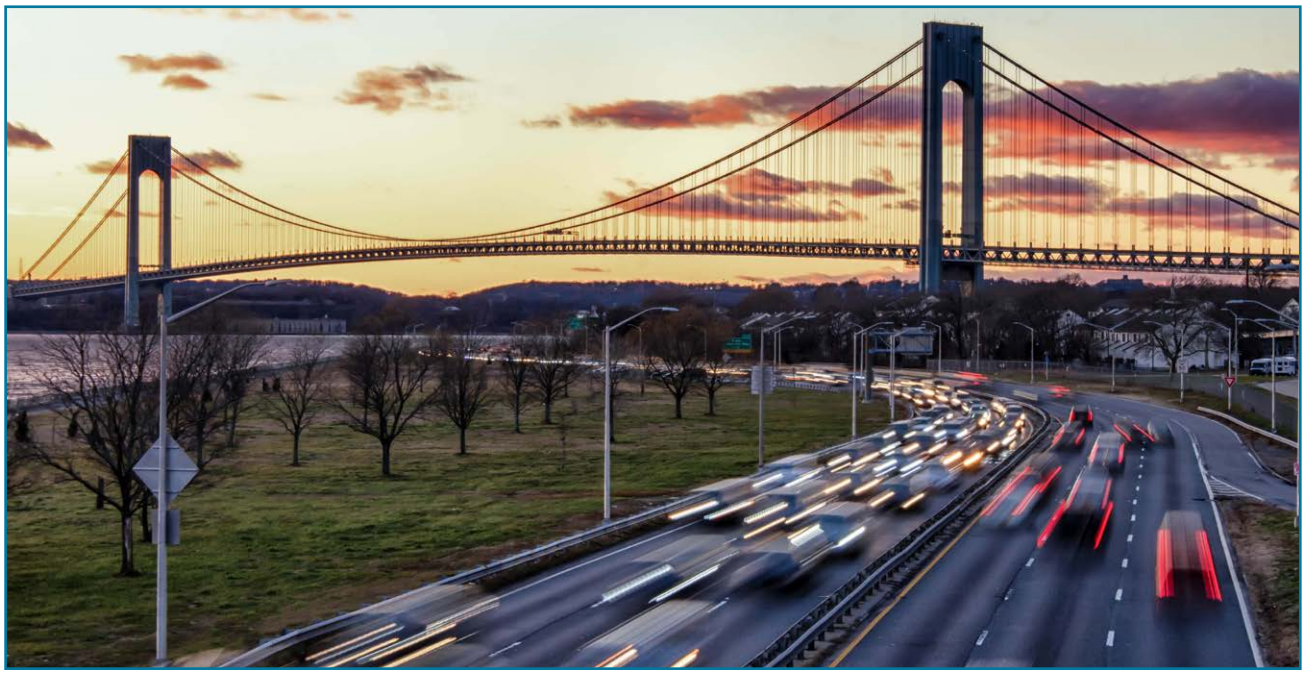
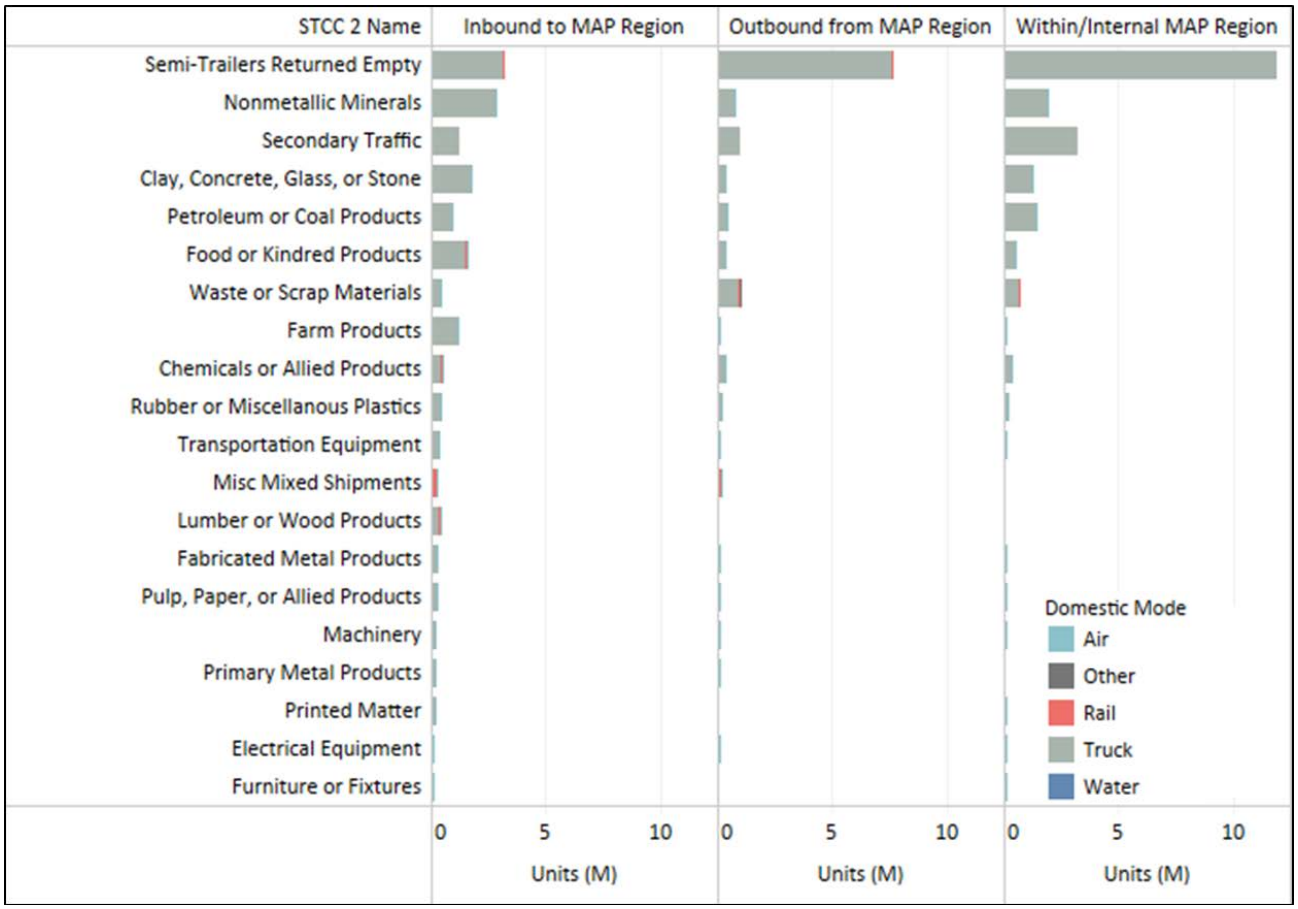


Figure H-1-9

MAP Forum Region Domestic Freight Flows by Commodity Units, Direction, and Mode (2018)

Source: Analysis of NYSDOT Transearch database



Looking finally at value (*Figure H-1-10*) and then value, direction, and mode together (*Figure H-1-11*), the leading commodity groups are:

- **Secondary traffic** (goods moved to or from warehouses and distribution centers)—moving primarily within the region, but with substantial shares both inbound and outbound via truck.
- **Chemicals and allied products**—moving inbound via truck with some rail and water and moving within the region and outbound primarily by truck.
- **Transportation equipment** (e.g., cars/trucks/buses and parts, aircraft, railcars, boats)—moving primarily inbound via truck, rail, and water.
- **Food or kindred products**—moving primarily inbound via truck.
- **Electrical equipment**—moving primarily inbound via truck and air, but also outbound via truck and air and within the region via truck.
- **Petroleum or coal products**—moving primarily within the region via truck and water, and outbound primarily via water and inbound primarily via truck.
- **Machinery**—moving primarily inbound via truck with some significant value by air.
- **Miscellaneous mixed shipments** (intermodal containers on rail)—primarily inbound but also outbound.

Figure H-1-10

MAP Forum Region Domestic Freight Flows (All Modes and Directions) by Commodity Value (2018)

Source: Analysis of NYSDOT Transearch database

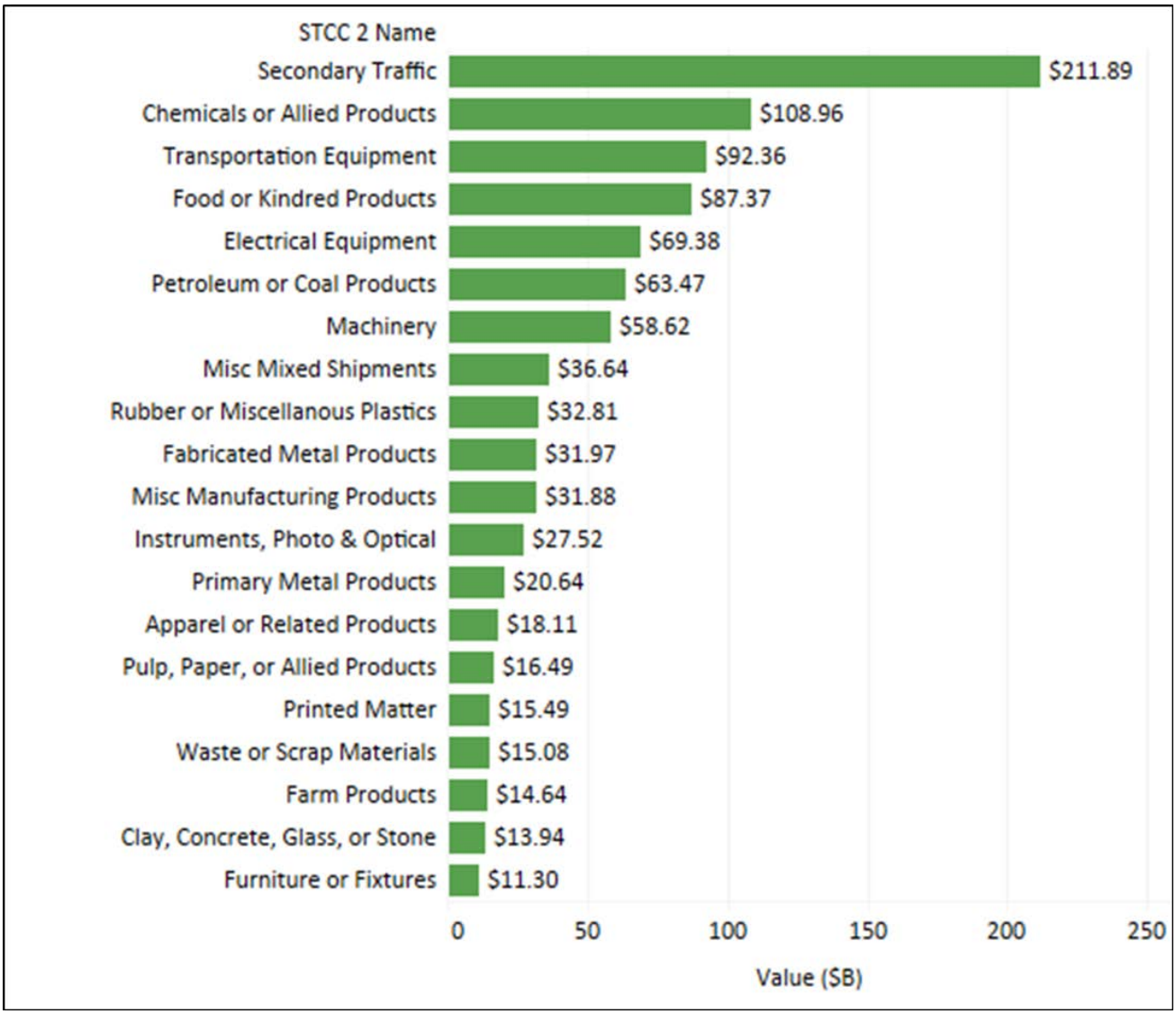
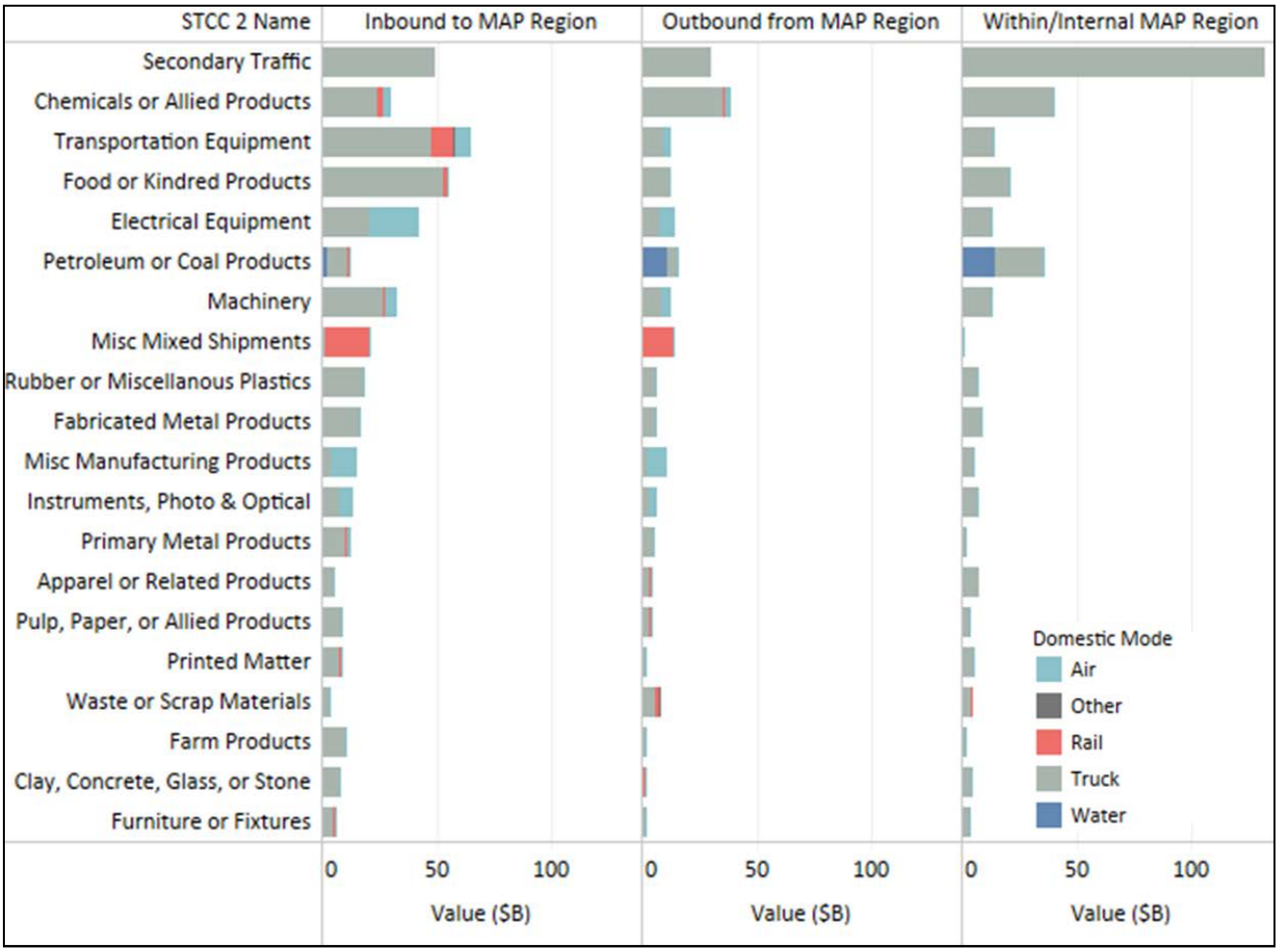


Figure H-1-11

MAP Forum Region Domestic Freight Flows by Commodity Values, Direction, and Mode (2018)

Source: Analysis of NYSDOT Transearch database



1.2.4 MAP FORUM REGION DOMESTIC AND NAFTA FLOWS BY ORIGIN-DESTINATION

As shown in ***Figure H-1-4***, 2018 tonnage estimates for the MAP Forum region are 289 million tons moving inbound, 130 million tons moving outbound, and 236 million tons moving within the region. ***Figure H-1-12*** and ***Figure H-1-13*** show the origins of inbound tonnage and destinations of outbound tonnage by general market area.

- For **inbound tonnage**, nearly 167 million tons have an origin in New York, New Jersey, Pennsylvania, Vermont, Massachusetts, or Connecticut. The next largest trading region is the southern East Coast (48 million tons) followed by the Midwest (39 million tons) and eastern New England (11 million tons).
- For **outbound tonnage**, nearly 82 million tons have a destination in New York, New Jersey, Pennsylvania, Vermont, Massachusetts, or Connecticut. The next largest trading region is the southern East Coast (20 million tons) followed by the Midwest (11 million tons) and eastern New England (10 million tons).

Figure H-1-12

MAP Forum Region Inbound Tonnage by Origin Region (2018)

Source: Analysis of NYSDOT Transearch database

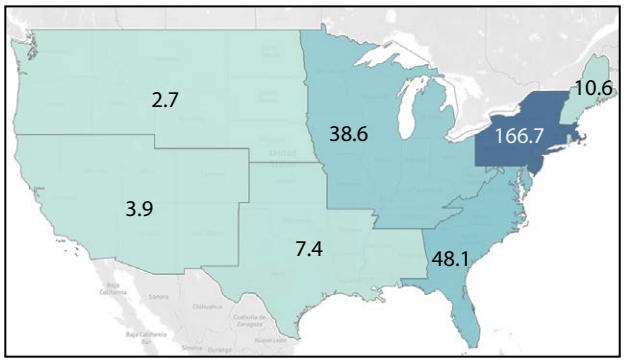
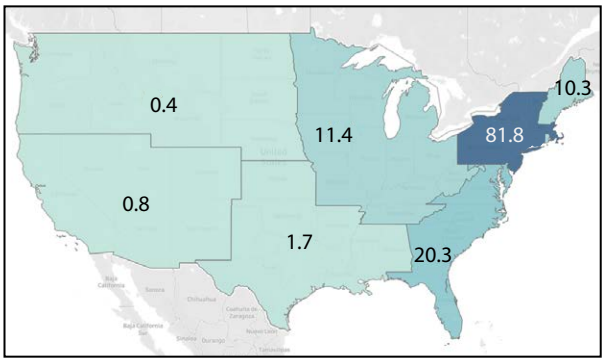


Figure H-1-13

MAP Forum Region Outbound Tonnage by Destination Region (2018)

Source: Analysis of NYSDOT Transearch database



For tonnage moving inbound to the MAP Forum region (excluding movements within the MAP Forum region itself), the leading origin states are Pennsylvania; New York, New Jersey, Maryland, Massachusetts, Ohio, Virginia, North Carolina, Illinois, Florida, Michigan, and Delaware. Significant rail tonnage originates in Illinois (where the western railroads interchange with the eastern railroads) and significant rail and water moves from other states. For value moving inbound to the MAP Forum region, the leading origin states are Pennsylvania, New Jersey, New York, Ohio, Illinois, Massachusetts, Michigan, Maryland, Virginia, and California. Compared to tonnage, value has more representation by non-truck modes. Rail is very significant for moves from Illinois, Ohio, Michigan, New York, and other states. Air accounts for much of the value from California and all of the value from Alaska (this is mostly Asian air cargo stopping in Anchorage to refuel) and is significant for Texas, Florida, Tennessee (FedEx hubs in Memphis) and Kentucky (UPS hubs in Louisville). See ***Figure H-1-14***.

For tonnage moving outbound from the MAP Forum region (excluding movements within the MAP Forum region itself), the leading destination states are Pennsylvania, Massachusetts, New York, New Jersey, Maryland, Rhode Island, Virginia, Ohio, New Hampshire, and Delaware. Water is an important mode for Massachusetts, New York, Rhode Island, and Maine. For value moving outbound from the MAP Forum region, the leading destination states are Pennsylvania, Massachusetts, New York, New Jersey, Maryland, Illinois, Ohio, Virginia, and California. The importance of air cargo is highlighted in moves to California, Washington, Kentucky, and other states. See ***Figure H-1-15***.

Figure H-1-14

MAP Forum Region Domestic Freight Flows by Origin of Inbound Tonnage and Value (2018)

Source: Analysis of NYSDOT Transearch database

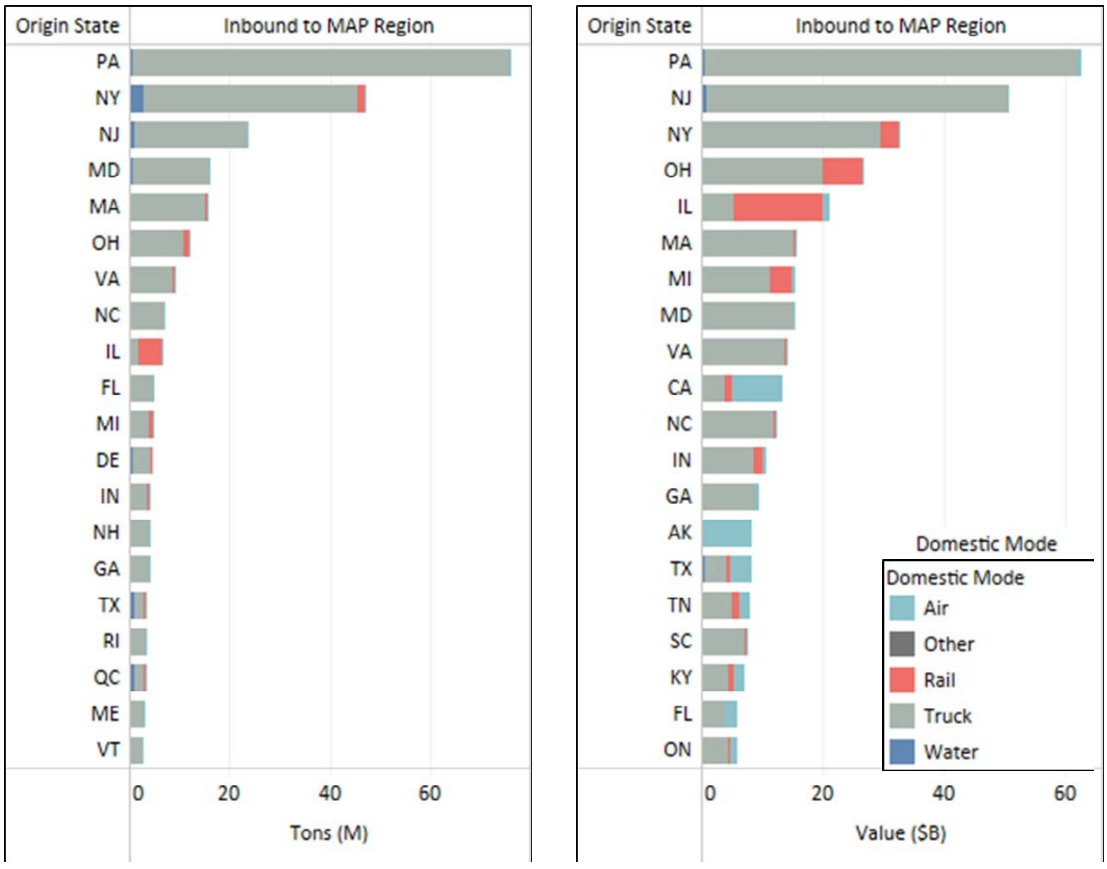
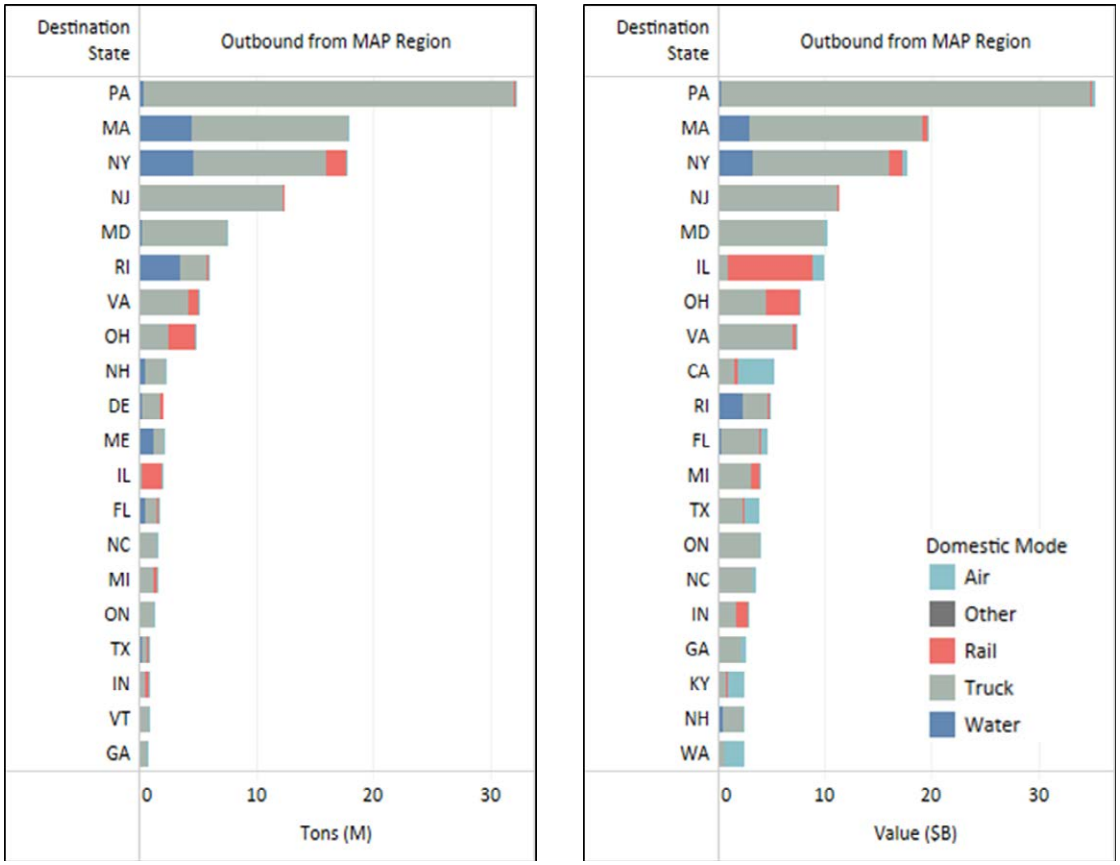


Figure H-1-15

MAP Forum Region Domestic Freight Flows by Destination of Outbound Tonnage and Value (2018)

Source: Analysis of NYSDOT Transearch database



Movements within the MAP Forum region itself can be analyzed at a high level by looking at the states of origin and destination for those internal movements. As shown in ***Figure H-1-16***, the leading internal moves by both tonnage and value are New York to New York; New Jersey to New Jersey; New Jersey to New York; New York to New Jersey; Connecticut to Connecticut; and New Jersey to Connecticut. Water is a significant mode for movements from New Jersey to New Jersey, New York, and Connecticut; rail does not handle a significant share of internal commodity flows within the MAP Forum region.

1.2.5 MAP FORUM REGION DOMESTIC AND NAFTA FLOW FORECAST

Between 2018 and 2045, domestic and NAFTA tonnage is forecast to grow from 655 to 890 million tons, from 51 to 72 million truck/rail units, and from $1.0 trillion to nearly $1.7 trillion in value (***Figure H-1-17***).

1.2.6 MAP FORUM REGION INTERNATIONAL FREIGHT FLOWS

Other than NAFTA trade, international freight flows are not provided in the Transearch database and are instead estimated from the U.S. Census Bureau USA Trade Online database, with validation from the U.S. Bureau of Transportation Statistics "T-100" air cargo dataset and the U.S. Army Corps of Engineers Waterborne Commerce of the United States. These figures are approximations only because the analysis geographies used in these datasets do not align exactly with the MAP Forum geography; however, the major facilities generating the most international traffic are accurately captured. See ***Tables H-1-1***, ***H-1-2***, and ***H-1-3***.

Figure H-1-16

MAP Forum Region Domestic Freight Flows by Origin and Destination of Internal Tonnage and Value (2018)

Source: Analysis of NYSDOT Transearch database

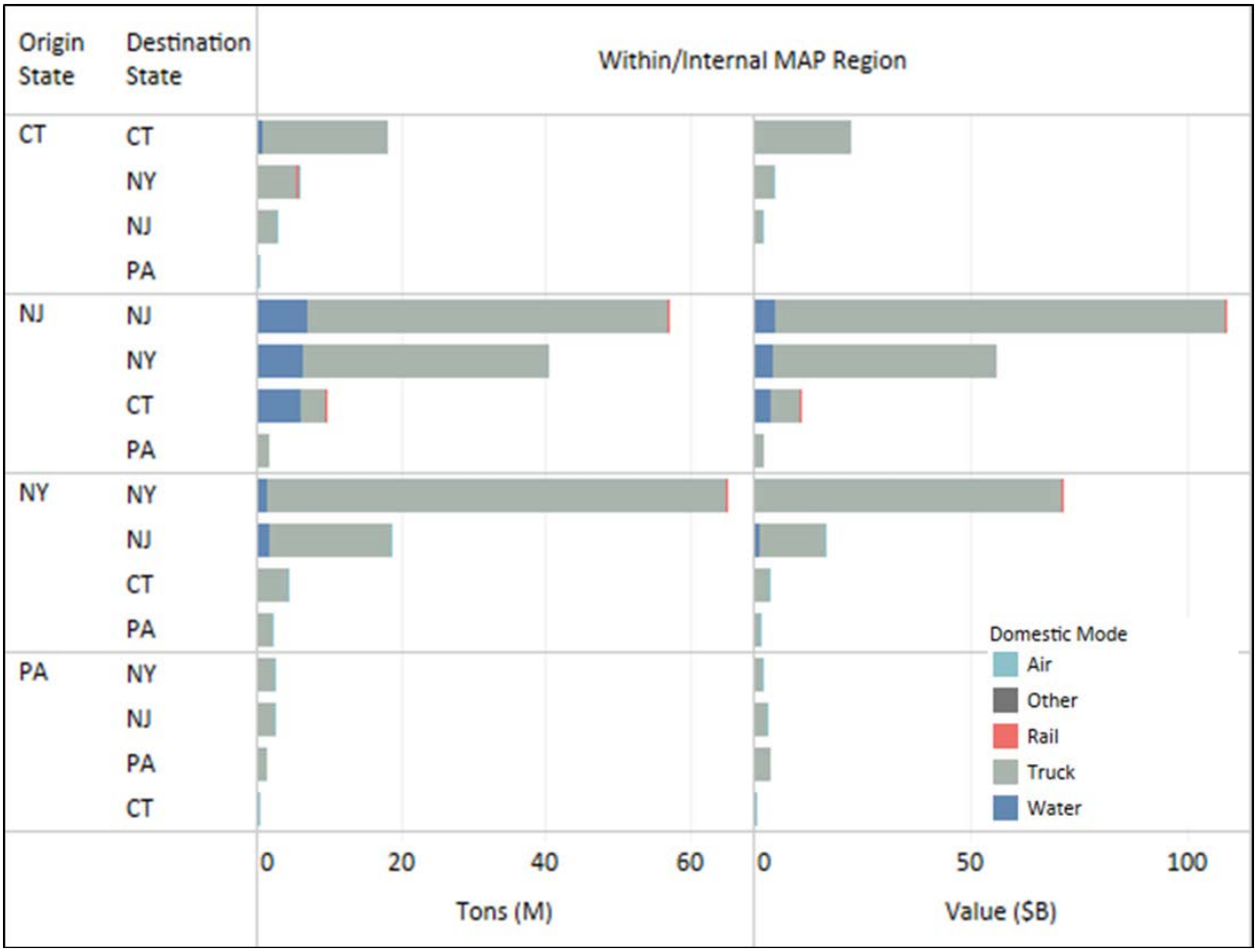


Figure H-1-17

MAP Forum Region Domestic Freight Flows (2018 and 2045)

Source: Analysis of NYSDOT Transearch database

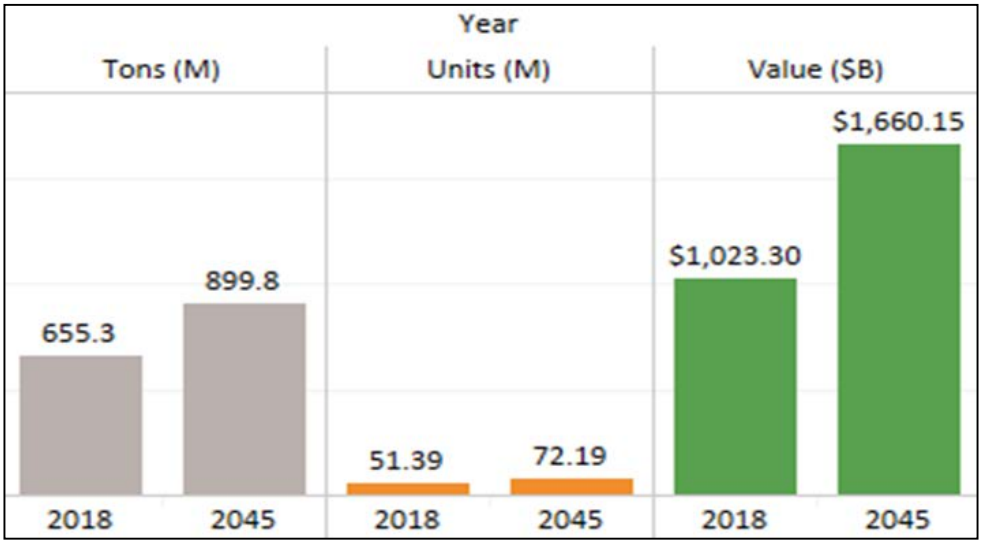


Table H-1-1

MAP Forum Region International Freight Flows—Exports (2018)

Source: USA Trade Online database (Air and Water); analysis of NYSDOT Transearch database (Truck and Rail)

Mode	Tons (M)	Units (TEUs, Trucks, Railcars) (M)	Value ($B)
Air	0.52	--	$98.24
Water	19.11	--	$45.21
Truck—NAFTA	2.74	0.13	$9.24
Rail—NAFTA	0.07	0.00	$0.19
Total Exports	**22.44**	**--**	**152.88**

Table H-1-2

MAP Forum Region International Freight Flows—Imports (2018)

Source: USA Trade Online database (Air and Water); analysis of NYSDOT Transearch database (Truck and Rail)

Mode	Tons (M)	Units (TEUs, Trucks, Railcars) (M)	Value ($B)
Air	0.87	--	$125.78
Water	75.89	--	$166.79
Truck—NAFTA	5.51	0.27	$15.48
Rail—NAFTA	0.61	0.01	$0.90
Total Imports	**82.88**	**--**	**$308.95**

Table H-1-3

MAP Forum Region International Freight Flows—Total (2018)

Source: USA Trade Online database (Air and Water); analysis of NYSDOT Transearch database (Truck and Rail)

Mode	Tons (M)	Units (TEUs, Trucks, Railcars) (M)	Value ($B)
Air	1.39	--	224.02
Water	95.00	--	212.00
Truck—NAFTA	8.25	0.40	24.72
Rail—NAFTA	0.68	0.01	1.09
Total	**105.32**	**--**	**461.83**

In 2018, the MAP Forum region handled an estimated 105.3 million tons of freight worth more than $461.8 billion as international trade via its seaports, airports, and truck/rail border crossings, making it one of the most important trading regions in the country.

Transearch includes estimates of around 66.8 million tons and $202.3 billion as the "domestic legs" of international trade flows. It appears Transearch is not capturing the remaining 38.5 million tons and $259.5 billion in international trade. Adjusted totals for the MAP Forum region reflecting all domestic and international flows can be estimated as:

- **Tons**: 655.3 million (from ***Figure H-1-17***) plus 38.5 million = 693.8 million
- **Value**: $1,023.3 billion (from ***Figure H-1-17***) plus $259.5 billion = $1,282.8 billion

1.3 NYMTC PLANNING AREA COMMODITY FLOWS

1.3.1 SUMMARY OF NYMTC PLANNING AREA DOMESTIC AND NAFTA FLOWS

In 2018, domestic freight flows inbound to the NYMTC planning area, outbound from the NYMTC planning area, between NYMTC planning area counties, and within NYMTC planning area counties totaled an estimated 302.1 million tons and 24.24 units (trucks and railcars), representing $430.72 billion in value in 2018. The NYMTC planning area is associated with 46 percent of tonnage, 47 percent of units, and 42 percent of value within the MAP Forum region.

As shown in ***Figure H-1-18***, the level of freight activity between NYMTC planning area counties differ significantly. Looking at origin regions (the counties in which freight trips begin), Suffolk County generates the highest tonnage, New York County generates the most truck trips, and Queens County generates the greatest value. Looking at destination regions (the counties in which freight trips end), New York County generates the highest tonnage, the most truck trips, and the greatest value. Five counties—New York, Queens, Kings, Nassau, and Suffolk—are among the leaders for both originated and terminated freight tonnage, but nearly every county has significant flows.

Figure H-1-18

Region-Level and County-Level Domestic Freight Flows (2018)

Source: Analysis of NYSDOT Transearch database; sorted by tons

Year	Tons (M)	Units (M)	Value ($B)
2018	302.1	24.24	$430.72

Year	Origin Region	Tons (M)	Units (M)	Value ($B)
2018	Suffolk County, NY	25.9	2.37	$31.30
	Queens County, NY	16.4	2.17	$46.00
	New York County, NY	14.9	3.36	$13.87
	Kings County, NY	13.7	1.98	$14.04
	Nassau County, NY	12.5	1.54	$12.47
	Rockland County, NY	9.9	0.62	$4.55
	Westchester County, NY	8.5	1.32	$6.78
	Richmond County, NY	8.3	0.84	$15.77
	Bronx County, NY	7.3	0.78	$6.78
	Putnam County, NY	1.8	0.15	$0.64

Year	Destination Region	Tons (M)	Units (M)	Value ($B)
2018	New York County, NY	63.5	3.77	$102.57
	Queens County, NY	35.6	2.31	$66.97
	Kings County, NY	33.7	2.13	$44.32
	Suffolk County, NY	31.7	2.52	$36.44
	Nassau County, NY	25.2	1.66	$32.07
	Westchester County, NY	23.6	1.42	$24.45
	Richmond County, NY	14.2	0.87	$26.19
	Bronx County, NY	11.9	0.82	$13.94
	Rockland County, NY	4.6	0.64	$5.09
	Putnam County, NY	1.5	0.16	$0.93

For the NYMTC planning area, 60.6 percent of tonnage and 64.7 percent of value moves inbound to the region, while 18.7 percent of tons and 18.1 percent of value moves outbound. Inbound tonnage and value are more than three times higher than outbound tonnage and value, which reflects the fact that the NYMTC planning area has a large population of consumers (who generate inbound flows) and a relatively smaller base of resource-producing and manufacturing industries (which generate outbound flows). Movements between and within the NYMTC counties represent 20.7 percent of tonnage and 17.3 percent of value, which indicates a high level of "redistribution" of goods. For example, inbound products such as food, fuel, or hardware are typically received first in large regional plants, warehouses, or distribution centers, and then moved again within the region to retail locations and customers. See ***Figure H-1-19***.

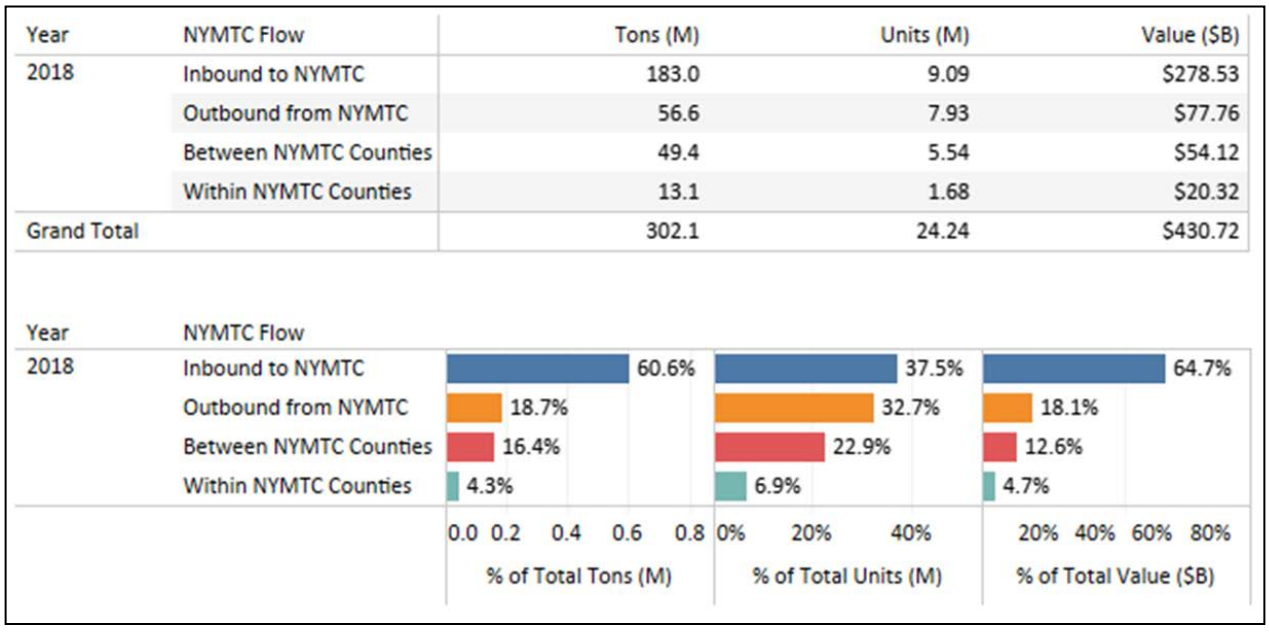
The number of inbound and outbound units is more balanced because the Transearch database includes estimates of empty trucks leaving the region without any associated tonnage or value. Regardless of mode, freight transportation systems function most efficiently when loads are directionally balanced, so that the movement of empty vehicles—trucks, railcars, ships, or aircraft—is minimized, and the most tons are moved with the least amount of fuel, vehicles, and vehicle miles-of-travel. Some parts of the United States are fortunate to enjoy balanced flows, but many areas do not, and the NYMTC planning area falls into the latter group. As a result, the region's freight transportation system endures multiple stresses: it must handle high levels of inbound freight and internally redistributed freight and the extra movements of empty vehicles leaving the region and returning to their home base. This imbalance is generated by the economic structure of the region, not by transportation policy. However, the coordination of economic development, land use, and transportation policy to promote more balanced freight flows may be an opportunity for the NYMTC planning area, and there are some emerging trends (discussed in ***Section 1.3.5***) that could facilitate improved directional balance.

Figure H-1-19

Region-Level Domestic Freight Flows by Direction (2018)

Source: Analysis of NYSDOT Transearch database; sorted by tons

Year	NYMTC Flow	Tons (M)	Units (M)	Value ($B)
2018	Inbound to NYMTC	183.0	9.09	$278.53
	Outbound from NYMTC	56.6	7.93	$77.76
	Between NYMTC Counties	49.4	5.54	$54.12
	Within NYMTC Counties	13.1	1.68	$20.32
Grand Total		302.1	24.24	$430.72



1.3.2 NYMTC PLANNING AREA DOMESTIC AND NAFTA FREIGHT MODES

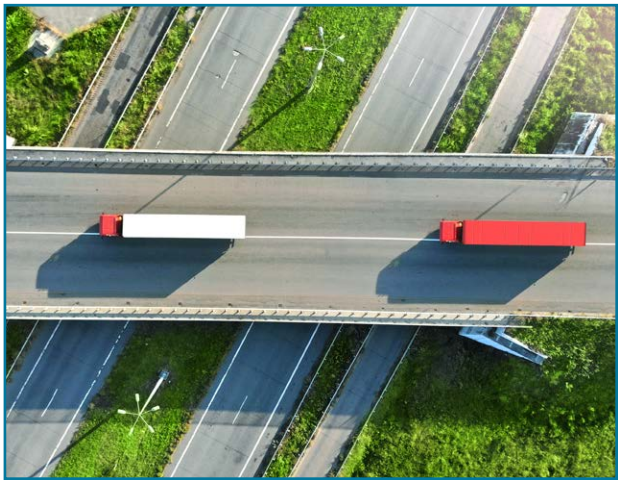
Freight is moved by different modes of transportation—truck, water, air, rail, or other. The NYMTC planning area is heavily dependent on trucks, which represent 92.5 percent of tons, 87.8 percent of value, and 99.6 percent of the units reported by Transearch (***Figure H-1-20***). Compared to the MAP Forum region as a whole, the NYMTC planning area is more dependent on trucks (92.5 percent of tons vs. 88.1 percent), less dependent on water (5.7 percent of tons vs. 8.5 percent), and less dependent on rail (1.7 percent of tons vs 3.3 percent). For air cargo, the NYMTC planning area and MAP Forum region shares of value are nearly identical (9.1 percent of value vs 9.0 percent).

As shown in ***Figure H-1-20***, Transearch also reports sub-modes for truck and rail. Around 49 percent of reported truck tonnage is moved in truckload form (where common-carrier trucks are fully loaded with a single commodity or customer load); around 48 percent of truck tonnage is moved by private trucks (owned by private fleets); and the remainder is reported as "L-T-L" (short for "less than truckload," a service where smaller shipments are consolidated to fill up larger trucks) or unknown (reported as NEC, short for not elsewhere classified). For rail, the two submodes are intermodal (the movement of shipping containers transferred to/from trucks or to/from seaports) and carload (all other non-intermodal railcar types); intermodal represents around 33 percent of the NYMTC planning area's rail tonnage but around 67 percent of its rail value.

As discussed in ***Chapter 4*** of this Freight Element, the NYMTC planning area includes major airports and seaports; some of their volume is domestic and is reported by Transearch, but much of it is international and is not included in the shares provided in ***Figure H-1-20***. Domestic water movements—primarily of fuels, sand, and rock, and other heavy lower-value commodities—account for 5.7 percent of tonnage and 2.1 percent of value. Domestic air movements—primarily of lighter, higher-value commodities—account for just 0.1 percent of tonnage but a very robust 9.1 percent of value.

Rail accounts for 1.7 percent of freight tonnage and 0.9 percent of freight value. These low figures are consistent with other mode share analyses performed in previous studies. Reasons cited for the low rail share include limitations on freight rail infrastructure (track network and railyard capacity), land use (particularly the availability of warehouse/distribution facilities essential for consolidating and de-consolidate rail container loads), lack of rail carload customers and service users (resource-intensive industries and manufacturers), and national railroad business practices (most rail traffic coming east to the New York "mega-region" terminates at major facilities in Pennsylvania or New Jersey, bypassing the NYMTC planning area except for traffic running through Rockland County).

It is important to note there is no optimal modal profile; each region is unique based on its economic structure, freight demand, and transportation assets. However, to the extent the NYMTC planning area's freight needs can effectively be met by modes other than trucks, pressures on constrained highways and streets may be relieved, and many initiatives are underway to explore and implement multimodal solutions (***see Chapter 3***). "Modal diversion" can be successful where alternative modes meet shipper and customer logistics needs related to reliability, cost, speed, safety/security, and in-transit visibility. ***Figure H-1-21*** illustrates the specific role that each mode plays depending on freight flow direction.

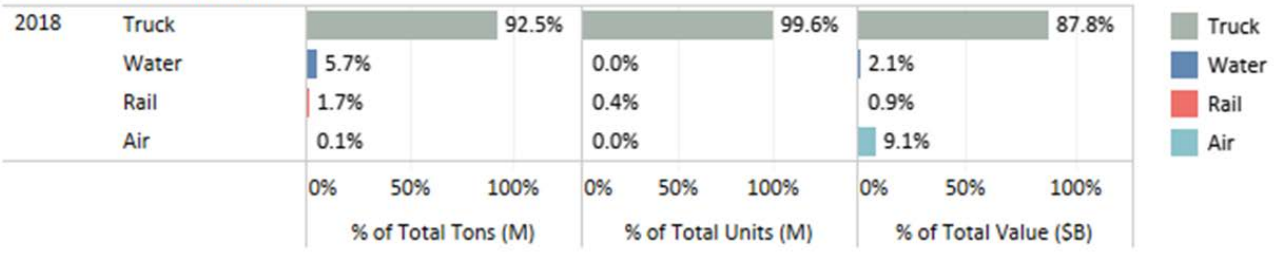


- **For flows inbound to the NYMTC planning area**, trucks account for 93 percent of tonnage and 89 percent of value. Water accounts for a strong 7 percent share of tonnage representing 2 percent of value. Rail accounts for 1 percent of tonnage and value. Air accounts for less than 1 percent of tonnage but 8 percent of value.
- **For flows outbound from the NYMTC planning area**, trucks account for 89 percent of tonnage and 72 percent of value; trucking is the leading mode but is less dominant outbound than inbound. Air represents less than 1 percent of tonnage and 22 percent of outbound value. Water accounts for 6 percent of tonnage and 3 percent of value, and rail accounts for 5 percent of tonnage and 3 percent of value.
- **For flows between and within the counties in the NYMTC planning area**, trucking is the dominant mode, representing 98 to 99 percent of tonnage and 99 to 100 percent of value. While trucking is clearly the dominant mode, rail and water may play an increasingly important role. Rail tends to be more cost effective over longer distances, although it can be competitive at short distances given enough volume and consistent demand. Several initiatives are underway to promote "Marine Highway" services within the NYMTC planning area and between the NYMTC planning area and northern New Jersey.

Figure H-1-20

Region-Level Domestic Freight Flows by Mode (2018)

Source: Analysis of NYSDOT Transearch database; sorted by tons



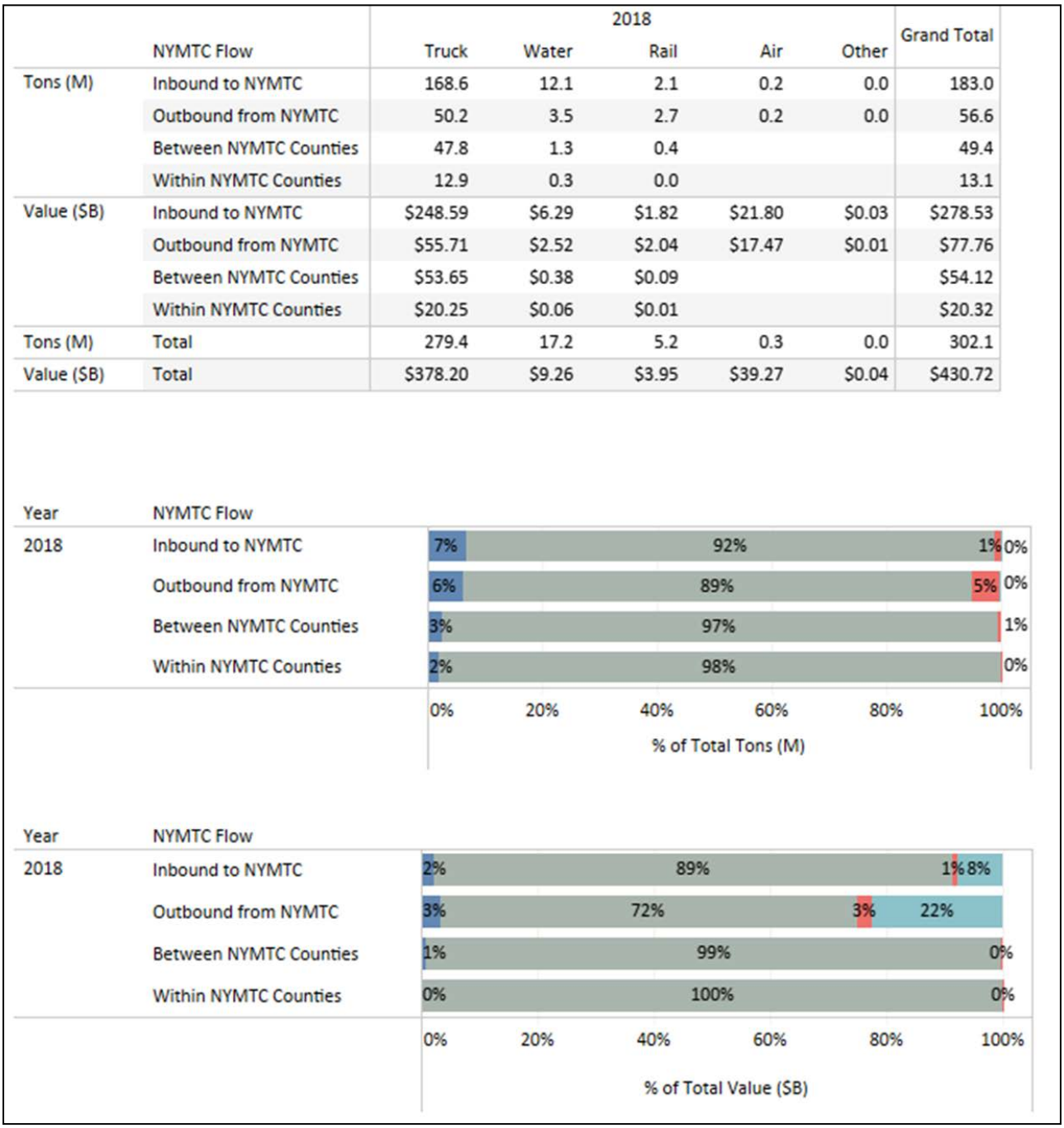
Year	Domestic Mode	Sub-Mode	Tons (M)	Units (M)	Value ($B)
2018	Truck	Truck Truckload	135.7	11.66	$207.48
		Truck PVT	133.7	11.65	$126.34
		Truck L-T-L	7.0	0.69	$36.31
		Truck NEC	3.0	0.15	$8.07
		Total	279.4	24.15	$378.20
	Water	Water	17.2	0.00	$9.26
		Total	17.2	0.00	$9.26
	Rail	Rail Intermodal	1.8	0.05	$2.47
		Rail Carload	3.4	0.04	$1.49
		Total	5.2	0.09	$3.95
	Air	Air	0.3	0.00	$39.27
		Total	0.3	0.00	$39.27
	Other	Foreign Trade Zones	0.0	0.00	$0.03
		Other	0.0	0.00	$0.01
		Total	0.0	0.00	$0.04
	Total		302.1	24.24	$430.72
Grand Total			302.1	24.24	$430.72

Figure H-1-21

Region-Level Domestic Freight Flows by Mode and Direction (2018)

Source: Analysis of NYSDOT Transearch database; sorted by tons

		2018					
	NYMTC Flow	Truck	Water	Rail	Air	Other	Grand Total
Tons (M)	Inbound to NYMTC	168.6	12.1	2.1	0.2	0.0	183.0
	Outbound from NYMTC	50.2	3.5	2.7	0.2	0.0	56.6
	Between NYMTC Counties	47.8	1.3	0.4			49.4
	Within NYMTC Counties	12.9	0.3	0.0			13.1
Value ($B)	Inbound to NYMTC	$248.59	$6.29	$1.82	$21.80	$0.03	$278.53
	Outbound from NYMTC	$55.71	$2.52	$2.04	$17.47	$0.01	$77.76
	Between NYMTC Counties	$53.65	$0.38	$0.09			$54.12
	Within NYMTC Counties	$20.25	$0.06	$0.01			$20.32
Tons (M)	Total	279.4	17.2	5.2	0.3	0.0	302.1
Value ($B)	Total	$378.20	$9.26	$3.95	$39.27	$0.04	$430.72



1.3.3 NYMTC PLANNING AREA DOMESTIC AND NAFTA FREIGHT COMMODITIES

Figure H-1-22 through *Figure H-1-27* describe, at a high level, the movements of particular commodities. The commodities are grouped according to the STCC code system, at the two-digit (less detailed) and four-digit (more detailed) levels.

Looking first at tonnage at the two-digit level and by direction (see *Figure H-1-22*):

- The **leading commodity group is nonmetallic minerals** (e.g., stone, gravel, sand, rock), which accounts for 66.8 million tons of the region's 302.1 million tons of freight. Around two-thirds of tonnage is moving inbound to the region.
- The **second leading group is "secondary traffic"** (e.g., moves to/from warehouse distribution centers, rail terminals, and air cargo terminals), representing 45.6 million tons. Around half (23.4 million tons) is moving between or within NYMTC counties, reflecting redistribution of goods within the region. Another 14.8 million tons are moving into the region, primarily from distribution centers located outside the NYMTC counties.
- The **third leading group is petroleum or coal products** (e.g., refined petroleum fuels, asphalt,), at 43.4 million tons. Slightly less than half the tons are moving inbound to the region; the remainder is distributed within the region or moved out of the region.
- The **fourth leading group is clay, concrete, glass, and stone** (e.g., cement, concrete, cut stone, commercial glass products, and clay for manufacturing processes) at 32.4 million tons. Around two-thirds of tonnage is moving inbound to the region.
- The **fifth leading group is waste and scrap materials** (including MSW plus metal, paper, glass, and other scrap materials or goods with resale value) at 29.4 million tons. Most of this tonnage is moving out of the region.
- The **sixth leading group is food or kindred products** (e.g., packaged food products, dairy products, and beverages) at 28.9 million tons. Almost all of this is inbound tonnage.
- The **top six groups account for 82 percent of tonnage.** Other important groups include chemicals, farm products, lumber and wood products, paper products, rubber and plastic, and fabricated metal products, all moving primarily inbound to the region.

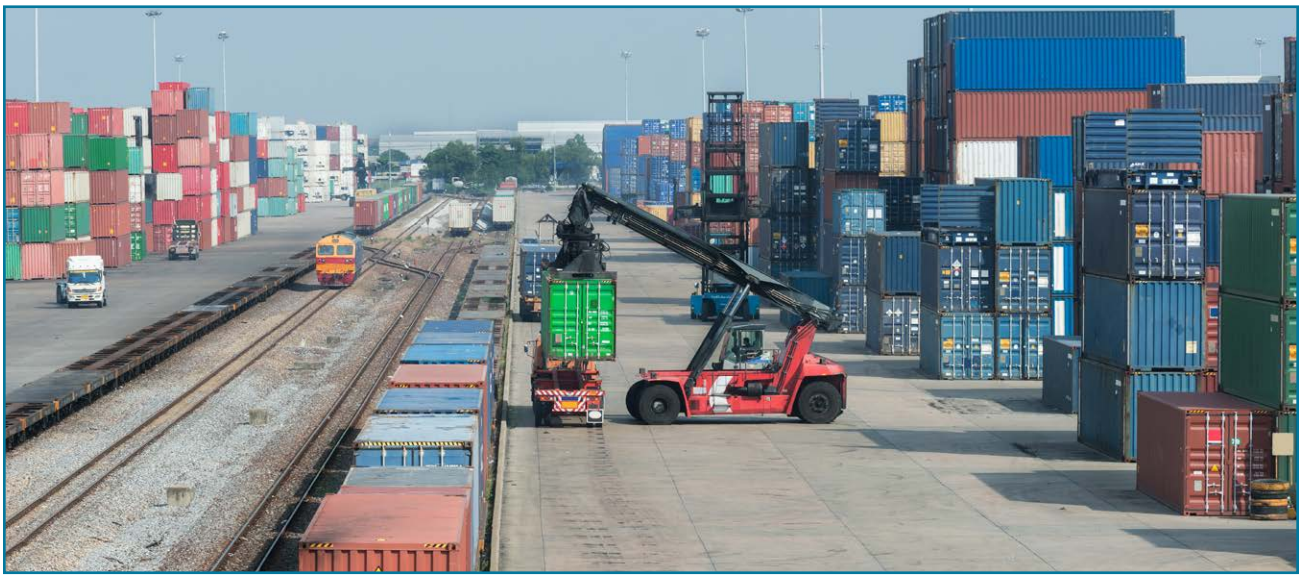


Figure H-1-22

Region-Level Domestic Freight Flows by 2-Digit Commodity Group and Direction—Tonnage (2018)

Source: Analysis of NYSDOT Transearch database; top 20 ranked STCC-2 commodity groups only

STCC 2 Name	Grand Total	2018 Inbound to NYMTC	2018 Outbound from NYMTC	2018 Between NYMTC Counties	2018 Within NYMTC Counties
Nonmetallic Minerals	66.8	44.5	10.0	9.8	2.5
Secondary Traffic	45.6	14.8	7.4	19.4	4.0
Petroleum or Coal Products	43.4	24.9	8.7	7.2	2.7
Clay, Concrete, Glass, or Stone	32.4	21.8	2.7	5.8	2.0
Waste or Scrap Materials	29.4	3.7	21.8	3.3	0.7
Food or Kindred Products	28.9	25.2	1.6	1.6	0.4
Chemicals or Allied Products	10.0	8.3	1.1	0.5	0.2
Farm Products	8.7	8.2	0.3	0.2	0.0
Lumber or Wood Products	7.6	7.0	0.2	0.3	0.1
Pulp, Paper, or Allied Products	3.9	3.4	0.4	0.2	0.0
Rubber or Miscellanous Plastics	3.9	3.2	0.4	0.2	0.0
Fabricated Metal Products	3.4	3.0	0.2	0.2	0.1
Printed Matter	3.1	2.6	0.2	0.3	0.1
Transportation Equipment	2.9	2.7	0.1	0.0	0.0
Primary Metal Products	2.6	2.2	0.3	0.1	0.0
Machinery	2.1	1.7	0.2	0.1	0.0
Electrical Equipment	1.7	1.4	0.2	0.1	0.0
Furniture or Fixtures	1.3	1.1	0.1	0.1	0.0
Misc Mixed Shipments	1.0	0.6	0.4		
Misc Manufacturing Products	0.9	0.6	0.1	0.1	0.0
	0 50 100 Tons (M)	0 50 100 Tons (M)	0 50 100 Tons (M)	0 50 100 Tons (M)	0 50 100 Tons (M)

Figure H-1-23 provides additional detail on the leading commodity groups by tonnage at the four-digit level and by mode. The leading groups are broken stone, warehouse and distribution center, petroleum-refining products, waste and scrap, gravel and sand, wet concrete, concrete products, and asphalt. Trucking is the primary means of handling every commodity, and in many cases, it is the only means. Water is significant for moving petroleum products and gravel and sand. Rail is significant for moving waste and scrap; it also handles broken stone and other products. Air does not have a significant share of tonnage in any commodity group.

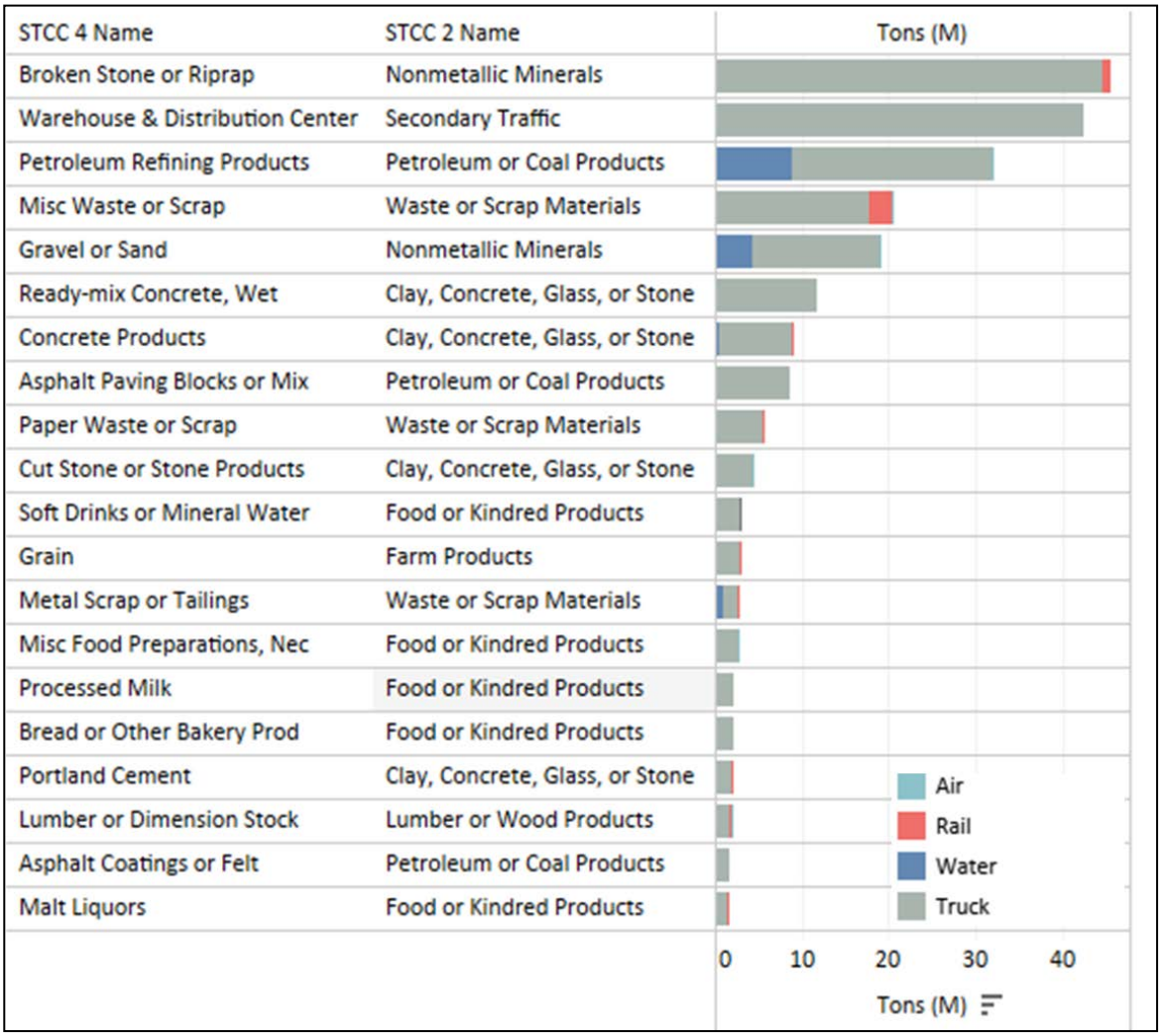
For units at the two-digit level and by direction (see *Figure H-1-24*):

- The **leading group is semi-trailers returned empty**, at 10.8 million units. These are trucks making empty return trips after delivering loads. Around half the empty trucks are moving outbound from the NYMTC planning area, and the rest are mostly moving between or within NYMTC counties. This is the mirror image of the directional imbalance in the region's tonnage: with more tonnage moving in the inbound direction, more

Figure H-1-23

Region-Level Domestic Freight Flows by 4-Digit Commodity Group and Mode—Tonnage (2018)

Source: Analysis of NYSDOT Transearch database; top 20 ranked STCC-2 commodity groups only



empty trucks are moving in the outbound direction. Of the 24.24 million units reported by Transearch, 24.15 million are trucks, and empty semi-trailers (at 10.8 million units) represent 45 percent of that total. In other words, of the truck trips estimated by Transearch, nearly half are moving air, not cargo. If this estimate could be confirmed by other data sources, it would be an important finding.

- The **other groups are composed of a mix of commodity types**, which are generally proportional to the volume and direction of tonnage flows.

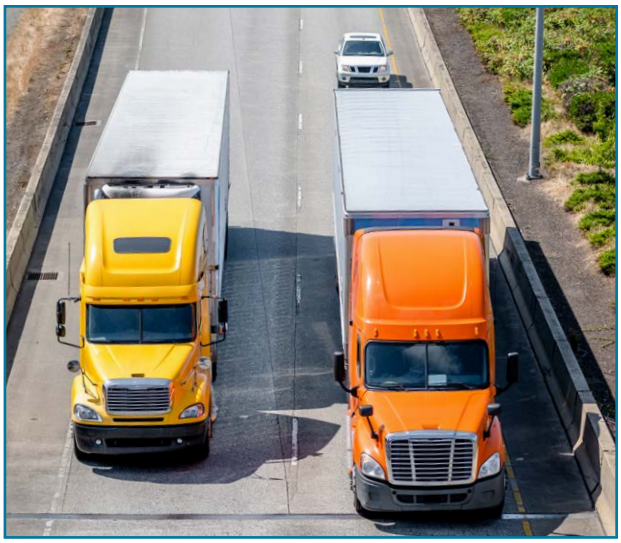


Figure H-1-24

Region-Level Domestic Freight Flows by 2-Digit Commodity Group and Direction—Units (2018)

Source: Analysis of NYSDOT Transearch database; top 20 ranked STCC-2 commodity groups only

STCC 2 Name	Grand Total	2018 Inbound to NYMTC	2018 Outbound from NYMTC	2018 Between NYMTC Counties	2018 Within NYMTC Counties
Semi-Trailers Returned Empty	10.82	0.85	5.68	3.25	1.05
Nonmetallic Minerals	2.54	1.67	0.40	0.37	0.10
Secondary Traffic	2.25	0.73	0.37	0.94	0.21
Clay, Concrete, Glass, or Stone	1.96	1.30	0.17	0.37	0.12
Petroleum or Coal Products	1.43	0.76	0.28	0.27	0.11
Food or Kindred Products	1.22	1.07	0.07	0.07	0.02
Waste or Scrap Materials	1.08	0.17	0.75	0.13	0.03
Farm Products	0.49	0.47	0.01	0.01	0.00
Chemicals or Allied Products	0.43	0.36	0.04	0.02	0.01
Rubber or Miscellanous Plastics	0.32	0.27	0.03	0.02	0.00
Lumber or Wood Products	0.29	0.27	0.01	0.01	0.00
Transportation Equipment	0.21	0.19	0.01	0.00	0.00
Fabricated Metal Products	0.19	0.16	0.01	0.01	0.00
Printed Matter	0.17	0.14	0.01	0.02	0.01
Pulp, Paper, or Allied Products	0.16	0.14	0.01	0.01	0.00
Machinery	0.15	0.13	0.01	0.01	0.00
Electrical Equipment	0.10	0.08	0.01	0.01	0.00
Primary Metal Products	0.10	0.08	0.01	0.00	0.00
Furniture or Fixtures	0.09	0.07	0.00	0.01	0.00
Misc Mixed Shipments	0.05	0.03	0.02		
Coal	0.00	0.00	0.00		
	0 5 10 15 Units (M)	0 5 10 15 Units (M)	0 5 10 15 Units (M)	0 5 10 15 Units (M)	0 5 10 15 Units (M)

Figure H-1-25 provides additional detail on the leading commodity groups by units at the four-digit level and by mode. The leading groups are semi-trailers returned empty, warehouse and distribution center, broken stone, petroleum-refining products, ready-mix concrete, waste and scrap, gravel and sand, and concrete products. Rail handles some share of units in many of these categories, but truck units are dominant in every group.

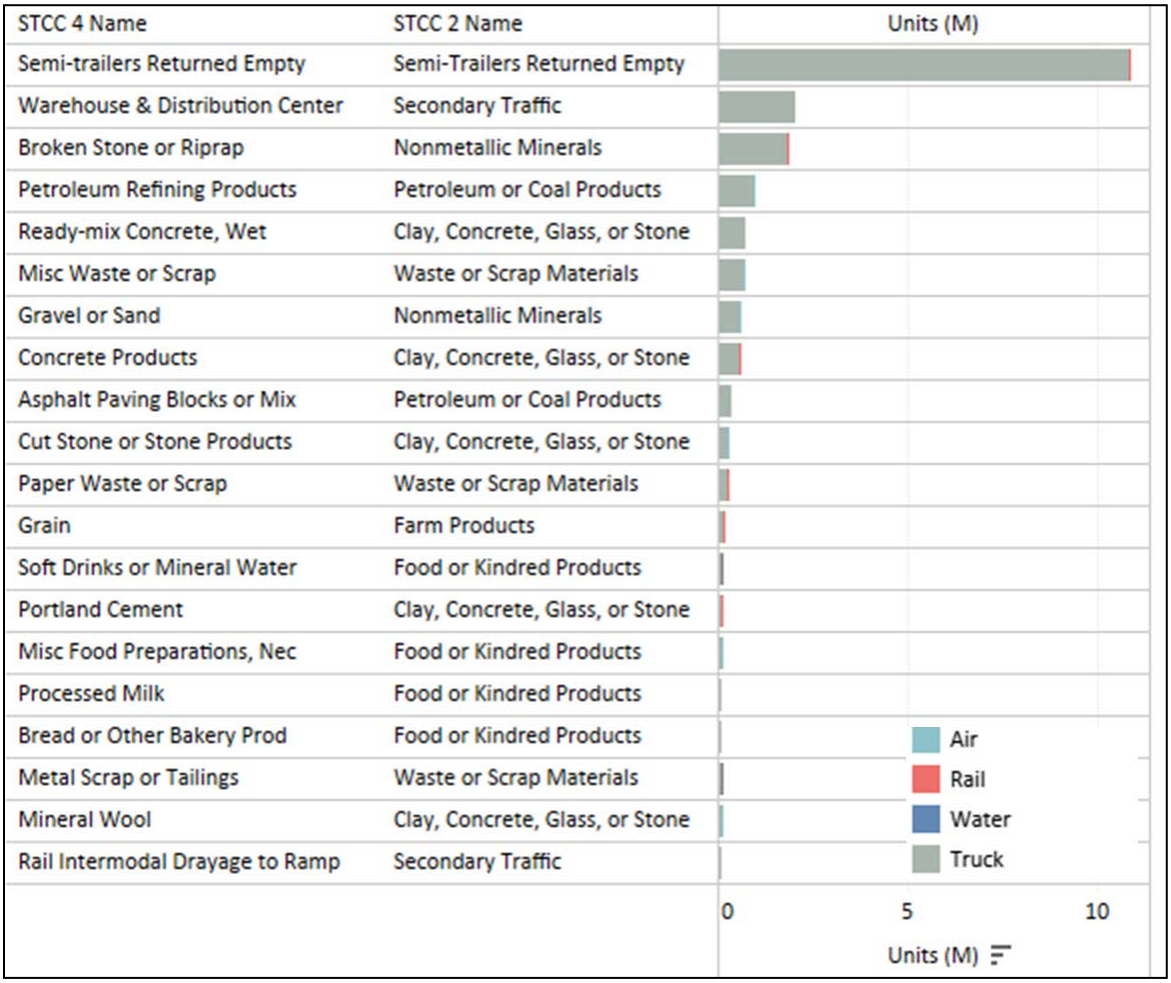
Value at the two-digit level and by direction (see *Figure H-1-26*) reveals:

- The **leading commodity group is secondary traffic** (e.g., moves to/from warehouse distribution centers, rail terminals, air cargo terminals) representing $70.55 billion in value. Nearly $24 billion is moving inbound to the region; nearly $12 billion is moving outbound from the region; and more than $35 billion is moving between or within NYMTC counties, reflecting the redistribution of goods from intermediate staging points in the region to end-users in the region. The total value of all domestic trade between and within NYMTC counties is $74.44 billion, and nearly half of this—$35.14 billion—is accounted for by secondary traffic, making it by far the largest category of internally oriented freight movement.

Figure H-1-25

Region-Level Domestic Freight Flows by 4-Digit Commodity Group and Mode—Units (2018)

Source: Analysis of NYSDOT Transearch database; top 20 ranked STCC-2 commodity groups only



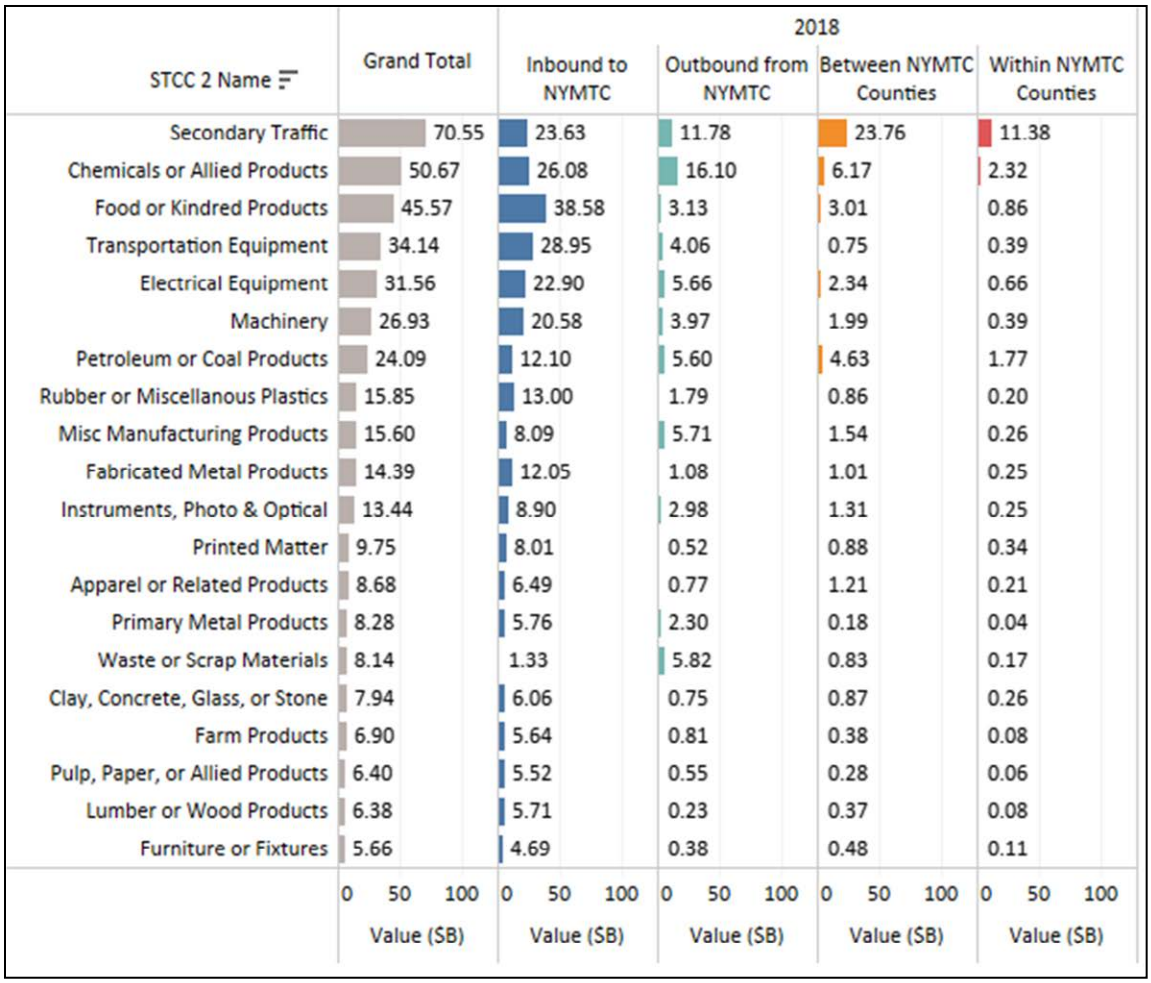
- The **second leading group is chemicals and allied products**, at $50.67 billion. Around half of this value is inbound to the region, but a significant amount is also outbound.
- The **third leading group is food and kindred products**, which is dominated by inbound flows.
- The **fourth leading group is transportation equipment** (e.g., motor vehicles and parts, railcars and parts, aircraft, and parts) at $34.14 billion. The fifth is electrical equipment, at $31.56 billion, and the sixth is machinery, at $26.93 billion. Flows for each are predominantly inbound, although there are smaller outbound flows.
- The **seventh leading group is petroleum or coal products**, at $24.09 billion. About half of this value is moving into the region; about a quarter is moving out of the region; and about a quarter is moving between or within NYMTC counties.
- The **top seven groups account for 66 percent of value.** Other important groups are listed in ***Figure H-1-26***.

Figure H-1-27 provides additional detail on the leading commodity groups by value at the four-digit level and by mode. The leading groups are warehouse and distribution center, petroleum-refining products, electrical equipment, miscellaneous manufacturing products,

Figure H-1-26

Region-Level Domestic Freight Flows by 2-Digit Commodity Group and Direction—Value (2018)

Source: Analysis of NYSDOT Transearch database; top 20 ranked STCC-2 commodity groups only



cosmetics and perfumes, rail intermodal drayage (trucks moving containers to intermodal railyards), bread and bakery products, waste and scrap, and air freight drayage (trucks moving air cargo from airports). There are hundreds of commodity groups represented in the dataset, and ***Figure H-1-27*** presents only the top 20. In the analysis of tonnage, air cargo is barely present; but in the analysis of value, air plays a very important role—it handles nearly all the value of electrical equipment; miscellaneous manufacturing products; instruments, photo, and optical; and machinery. Water has a significant share of petroleum-refining product value, while rail is visible for waste and scrap value.

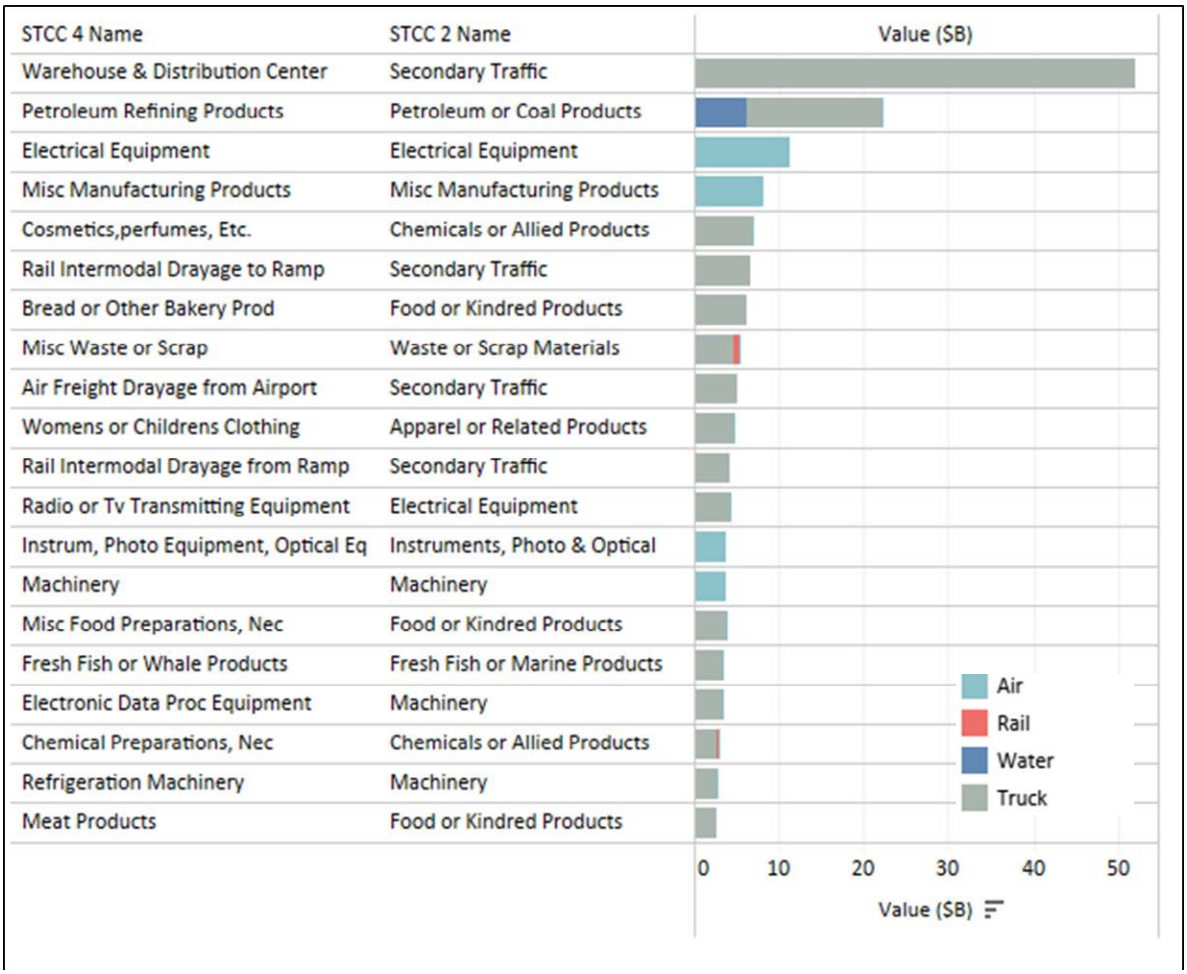
1.3.4 NYMTC PLANNING AREA DOMESTIC AND NAFTA FREIGHT ORIGINS AND DESTINATIONS

The NYMTC planning area has domestic trading relationships with the rest of New York, with states surrounding New York, and with the rest of the United States. Understanding these relationships is important to evaluate current and future transportation system performance and needs, and to faciliate institutional and intergovernmental relationships for freight planning.

Figure H-1-27

Region-Level Domestic Freight Flows by 4-Digit Commodity Group and Mode—Value (2018)

Source: Analysis of NYSDOT Transearch database; top 20 ranked STCC-4 commodity groups only



As shown in ***Figure H-1-19***, 2018 tonnage estimates for the NYMTC planning area are 183 million tons moving inbound, 57 million tons moving outbound, and 62 million tons moving between or within NYMTC planning area counties. ***Figure H-1-28*** and ***Figure H-1-29*** following show the origins of inbound tonnage and destinations of outbound tonnage by general market area.

- For **inbound tonnage**, nearly 128 million tons originates in New York, New Jersey, Pennsylvania, Vermont, Massachusetts, or Connecticut. The next largest trading region is the southern East Coast (25 million tons) followed by the Midwest (18 million tons).
- For **outbound tonnage**, nearly 46 million tons is destined for New York, New Jersey, Pennsylvania, Vermont, Massachusetts, or Connecticut. The next largest trading region is the southern East Coast (6 million tons) followed by the Midwest (3 million tons).

Origin market areas and states for freight received in the NYMTC planning area are illustrated in more detail in ***Figure H-1-30***.

- The NYMTC planning area receives an estimated 100.8 million tons of freight that originates in the New York-adjoining states of New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont. It receives 89.6 million tons originating in the state of New York (including 13.1 million within the NYMTC planning area counties, 49.4 million between NYMTC planning area counties, and 27.1 million from the remainder of New York). It receives 24.8 million tons from the East Coast market, 17.6 million tons from the Midwest market, and 12.7 million tons from other markets. The leading states for tonnage are New York (89.6 million); New Jersey (50.4 milllion); Pennsylvania (38.9 million); Maryland (8.1 million); Ohio (6.2 million); and Connecticut (6.0 million).
- The relationship is similar for value. The NYMTC planning area receives: $131.20 billion from the New York-adjoining states; $94.52 billion from New York State (including $54.12 billion between the NYMTC planning area counties, $20.32 billion within the NYMTC planning area counties, and $20.08 billion from the remainder of New York); $45.59 billion from the East Coast market; $42.92 billion from the Midwest market; and $38.75 billion from other markets. The leading states for value are New York ($94.52 billion), New Jersey ($88.19 billion), Pennsylvania ($32.27 billion), Ohio ($12.03 billion), and Virginia ($9.53 billion). California, Michigan, and Georgia are among the other leaders.

Figure H-1-28

NYMTC Planning Area Inbound Tonnage by Origin Region (2018)

Source: Analysis of NYSDOT Transearch database

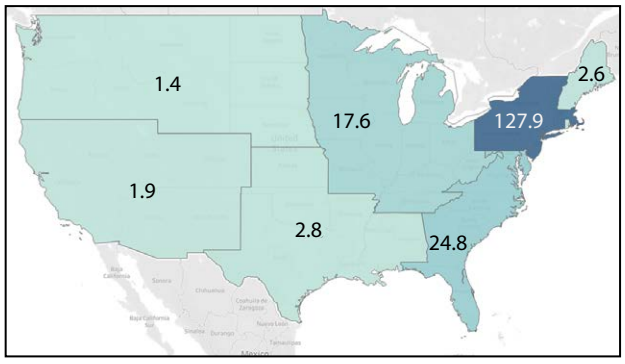


Figure H-1-29

NYMTC Planning Area Outbound Tonnage by Destination Region (2018)

Source: Analysis of NYSDOT Transearch database

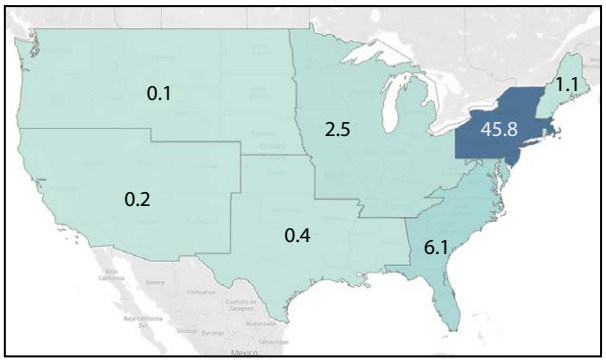
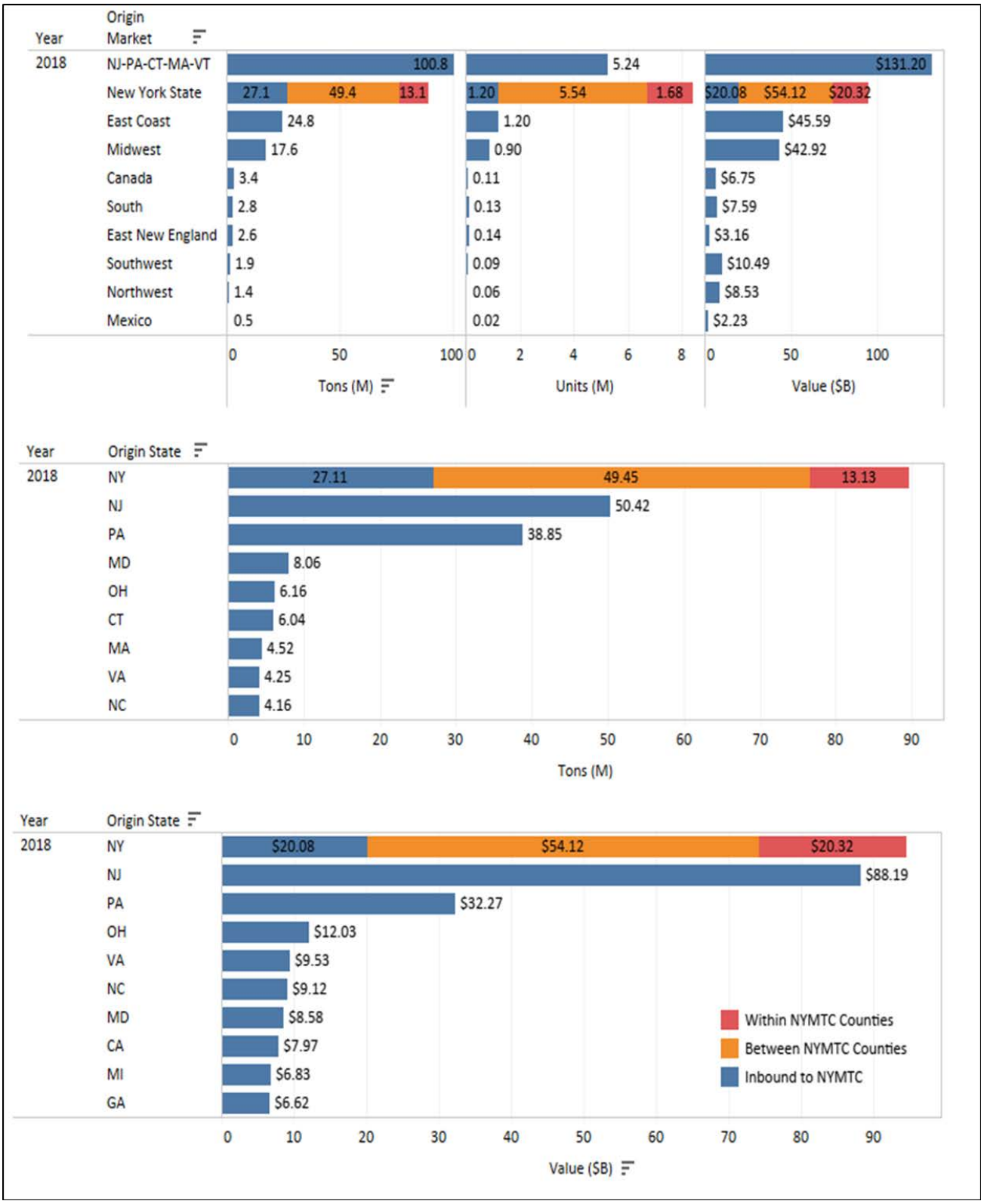


Figure H-1-30

Origin Markets/States for Domestic Freight Received in NYMTC Planning Area (2018)

Source: Analysis of NYSDOT Transearch database; top 10 ranked states only



Destination market areas and states for freight shipped from the NYMTC planning area are described in more detail in ***Figure H-1-31***.

- The NYMTC planning area ships an estimated 69.1 million tons of freight to destinations in the state of New York (including 13.1 million within NYMTC counties, 49.4 million between NYMTC counties, and 6.6 million to the remainder of New York). It ships 39.2 million tons of freight to destinations in the New York-adjoining states of New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont. It ships 6.1 million tons to the East Coast market, 2.5 million tons to the Midwest market, and 2.1 billion tons to other markets. Leading states for tonnage are New York (69.1 million), New Jersey (20.6 million), Pennsylvania (12.7 million), Connecticut (3.5 million), Maryland (2.4 million), and Massachusetts (2.2 million).
- Again, the relationship is similar for value. The NYMTC planning area ships: $80.29 billion to New York State (including $54.12 billion between NYMTC counties, $20.32 billion within NYMTC counties, and $5.85 billion to the remainder of New York); $37.04 billion to the New York-adjoining states; $10.08 billion to the East Coast market; $8.94 billion to the Midwest market; and $15.83 billion to other markets. The leading individual states for value are: New York ($80.29 billion), New Jersey ($19.10 billion), Pennsylvania ($10.66 billion), Connecticut ($3.78 billion), California ($3.58 billion), Massachusetts ($3.08 billion), and (interestingly) Alaska (with $2.72 billion in high value air freight, most of which presumably continues to Asia).

The data consistently support these findings:

- The NYMTC planning area is its own largest trading partner, but (as shown in ***Figure H-1-19***), trade between and within NYMTC counties accounts for only 21 percent of tonnage and 30 percent of value. (Note that volumes between and within NYMTC counties have both an origin and a destination in the NYMTC planning area, which is why they are shown on both ***Figure H-1-30*** and ***Figure H-1-31***.)
- For trade with external partners, the leading states (based on tonnage, value, shipments, and receipts) are New Jersey, Pennsylvania, and the remainder of New York. These states account for most of the inbound and outbound tonnage and value for the NYMTC planning area.
- Other states are also important partners for certain types of moves, although not to the same degree as New Jersey, Pennsylvania, and remainder of New York.

To better understand the trade interdependencies between the NYMTC planning area and partner states, ***Figure H-1-32*** through ***Figure H-1-35*** illustrate the leading commodities by direction, state, and transportation mode.

- As shown on ***Figure H-1-32*** (origin states for tonnage received in the NYMTC planning area), New Jersey is important for providing nonmetallic minerals; petroleum and coal products (by both truck and water); clay, concrete, glass, and stone; food and kindred products; secondary traffic; and chemicals. Pennsylvania is important for nonmetallic minerals; petroleum and coal products (truck only); food and kindred projects; farm products; lumber and wood products; secondary traffic; and chemicals. The remainder of New York State is important for nonmetallic minerals (by both truck and water); secondary traffic; clay, concrete, glass, and stone; petroleum and coal products; food and kindred products; and farm products.

Figure H-1-31

Destination Markets/States for Domestic Freight Shipped from the NYMTC Planning Area (2018)

Source: Analysis of NYSDOT Transearch database; top 10 ranked states only

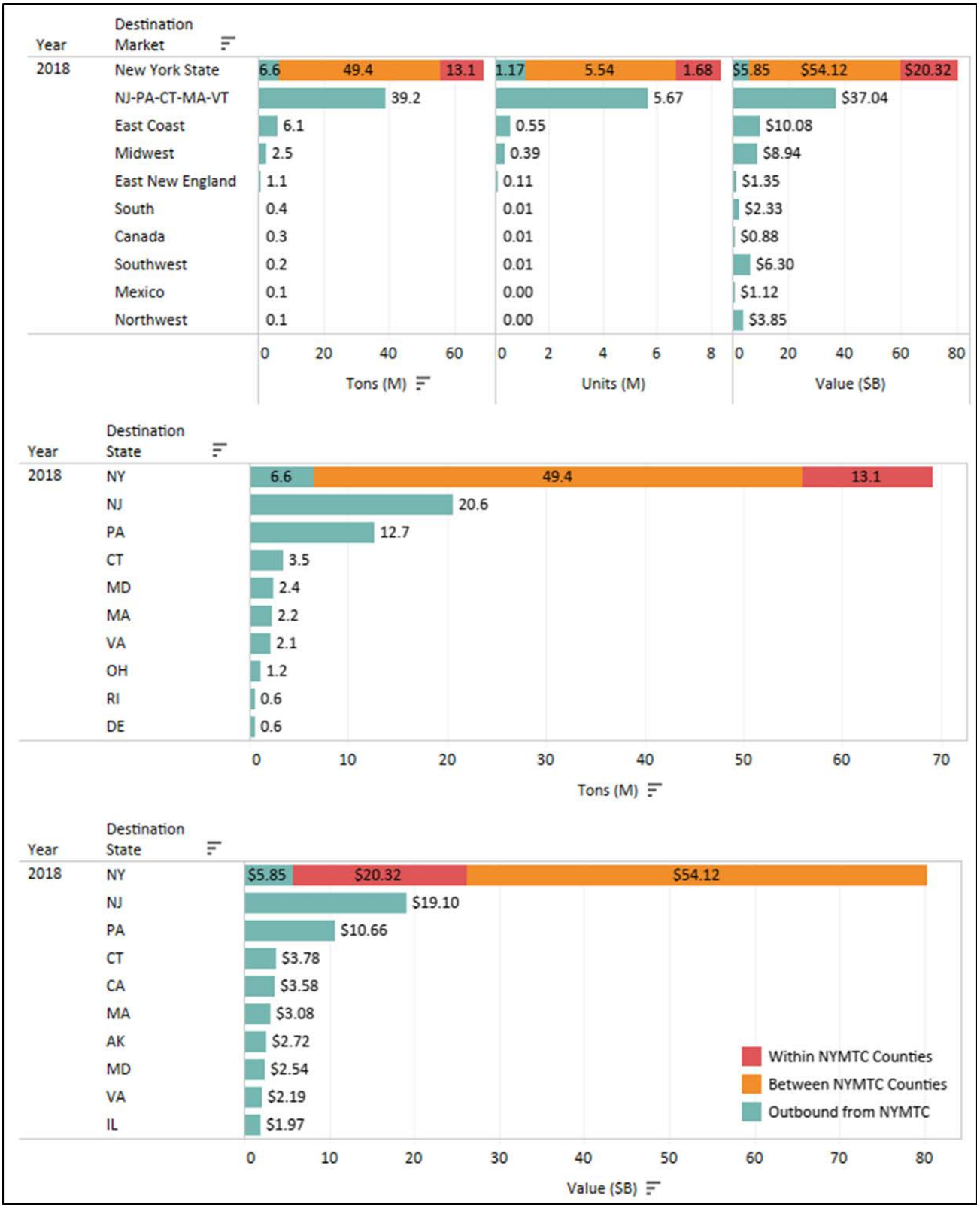


Figure H-1-32

Origin States/Commodities/Modes for Domestic Tonnage Received in NYMTC Planning Area, > 1M Tons (2018)

Source: Analysis of NYSDOT Transearch database

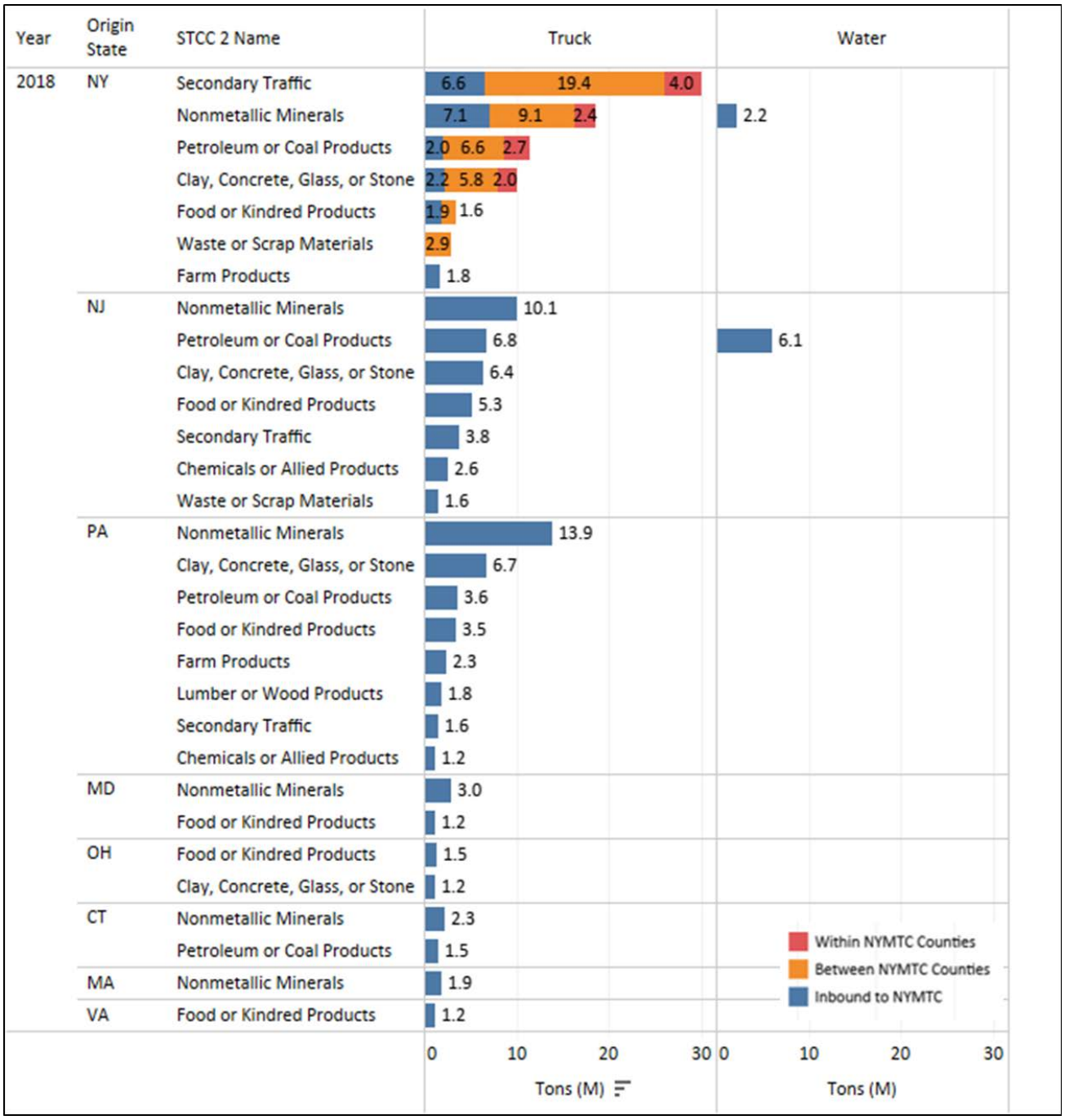
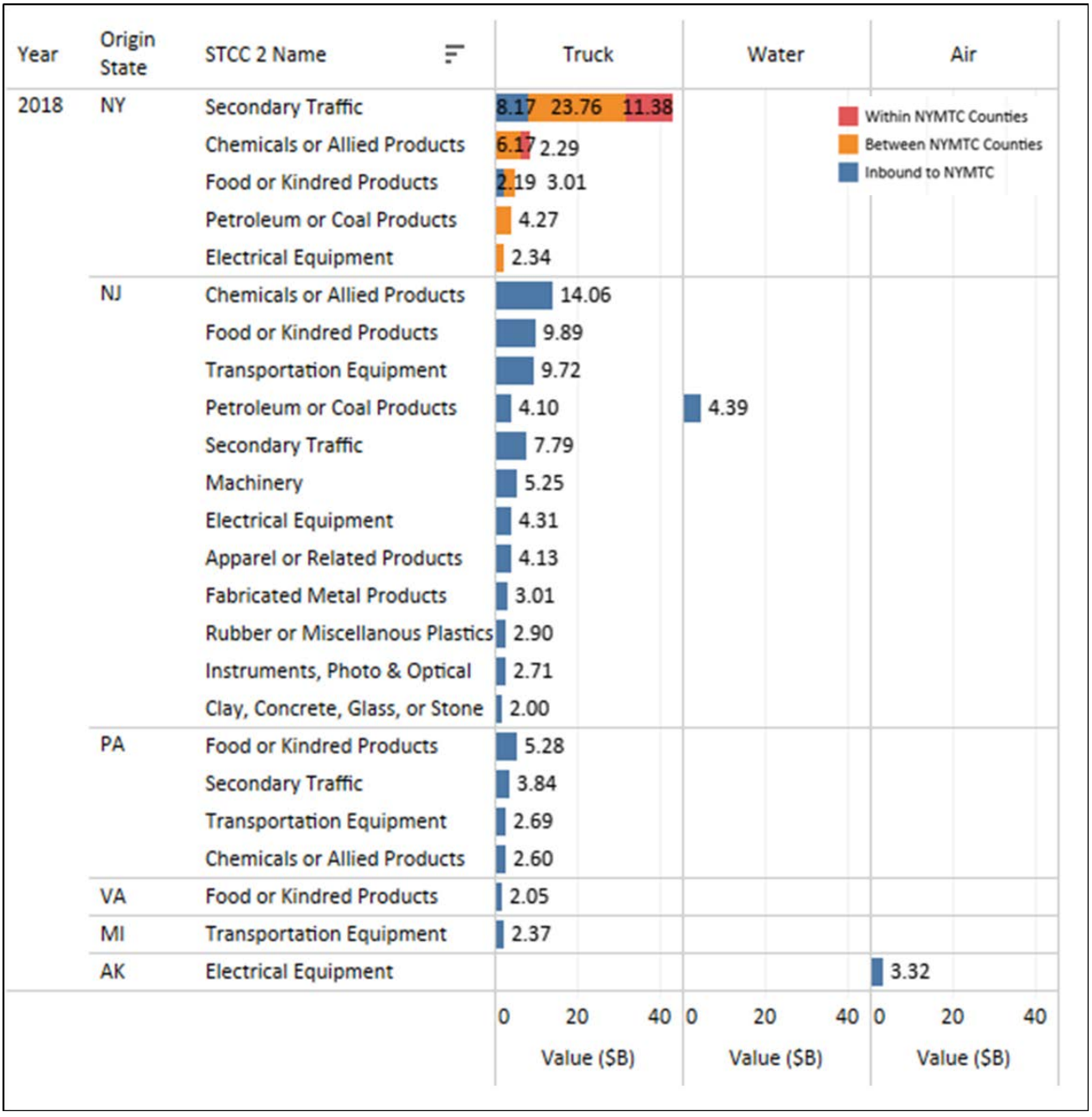


Figure H-1-33

Origin States/Commodities/Modes for Domestic Value Received in NYMTC Planning Area, > $2B Value (2018)

Source: Analysis of NYSDOT Transearch database



- As shown in ***Figure H-1-33*** (origin states for value received in the NYMTC planning area), New Jersey is important for providing many different commodity groups, including chemicals, food, transportation equipment, petroleum products (by truck and water), secondary traffic, machinery, equipment, and a range of consumer and industrial products. Pennsylvania is important primarily for food, secondary traffic, transportation equipment, and chemicals. The remainder of New York State is important primarily for secondary traffic. Electrical equipment received from Alaska by air (originating in Asia) is also identified as an important flow.
- As shown on ***Figure H-1-34*** (destination states for tonnage shipped from the NYMTC planning area), New Jersey is an important receiver for nonmetallic minerals, waste and scrap (by truck and water), and petroleum products (by truck and water). Pennsylvania is important primarily for waste and scrap, along with secondary traffic, nonmetallic minerals, and petroleum products. Two important rail flows (waste and scrap moving by rail to remainder of New York and to Virginia) are identified.
- As shown on ***Figure H-1-35*** (destination states for value shipped from the NYMTC planning area), New Jersey is an important receiver for chemicals, secondary traffic, petroleum products, waste and scrap, and food products. Pennsylvania is important primarily for secondary traffic, chemicals, and waste and scrap. Movement of electrical equipment to California by air is identified as a significant flow.

1.3.5 NYMTC PLANNING AREA DOMESTIC AND NAFTA FREIGHT TRENDS

NYMTC's *Regional Freight Plan 2018–2045* provided a commodity flow analysis using a 2012 base year Transearch dataset. Transearch is a model comprising many different inputs—it is not actual empirical data, and there are year-to-year variations in data collection and processing steps. Caution is required when comparing Transearch datasets from different years because differences could represent real changes or could be the result of data processing artifacts. However, it is not unreasonable to compare the *Regional Freight Plan 2018–2045* commodity flow estimates with the updated estimates at a high level, to see if the overall picture is the same or significantly different.

As shown in ***Table H-1-4***, domestic freight tonnage estimates from the Transearch 2012 and 2018 datasets are quite similar. Compared to 2012, the 2018 estimate is slightly higher; inbound and intra-NYMTC planning area tonnages are slightly higher; and outbound tonnage is slightly lower. These changes could be real effects or they could be the result of different processing methods, but the main takeaways are that overall freight tonnage is increasing, as expected; and the fastest growth is in intra-NYMTC planning area movements (reflecting increasing redistribution of goods through local warehouse/delivery centers, also as expected). This result suggests a good level of confidence in analyses that have been based on the 2012 data, and a good level of confidence in using the 2018 data in the future.

Figure H-1-34

Destination States/Commodities/Modes for Domestic Tonnage Shipped from the NYMTC Planning Area, > 0.5M Tons (2018)

Source: Analysis of NYSDOT Transearch database

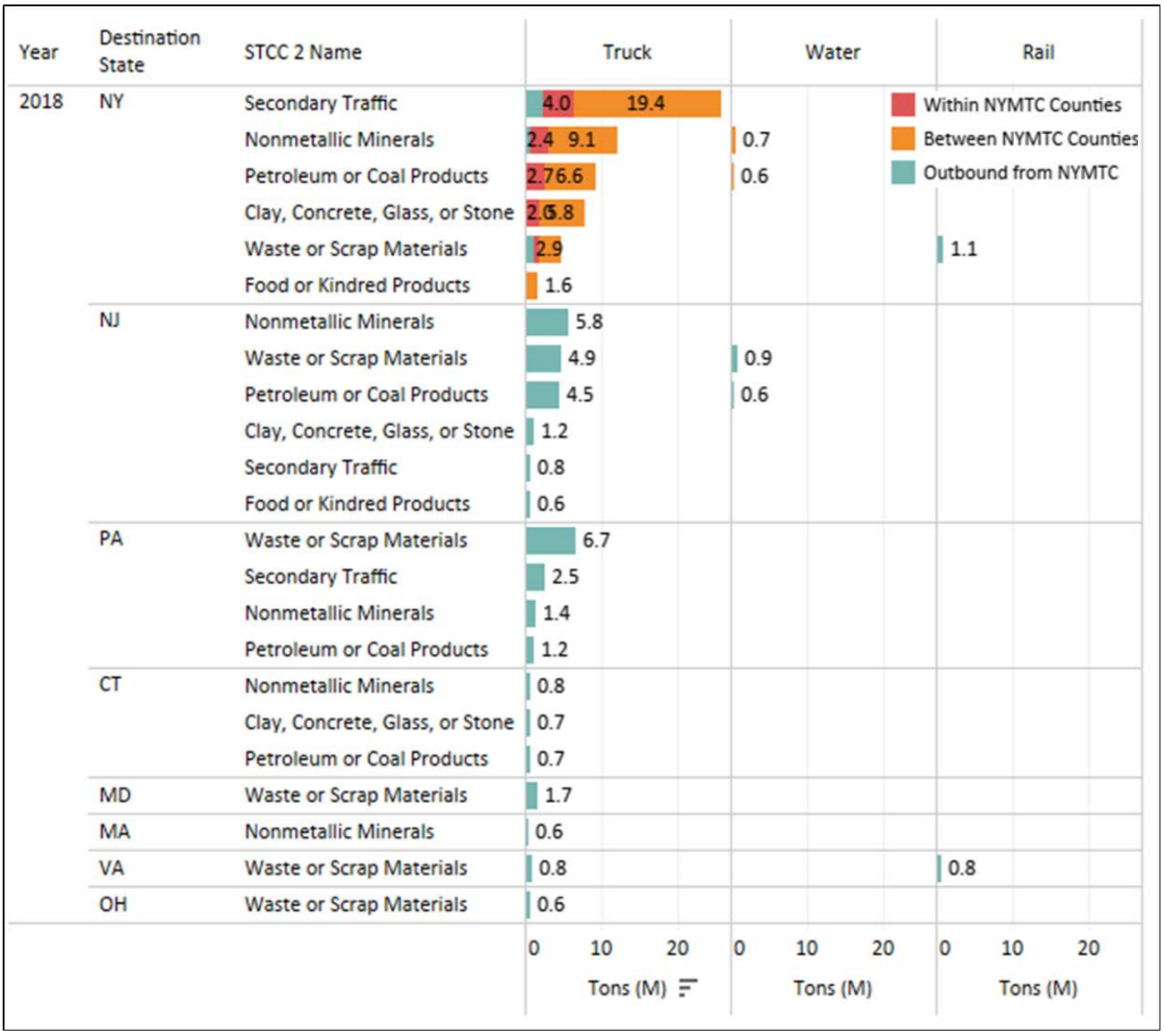


Figure H-1-35

Destination States/Commodities/Modes for Domestic Value Shipped from the NYMTC Planning Area, > $0.75B Value (2018)

Source: Analysis of NYSDOT Transearch database

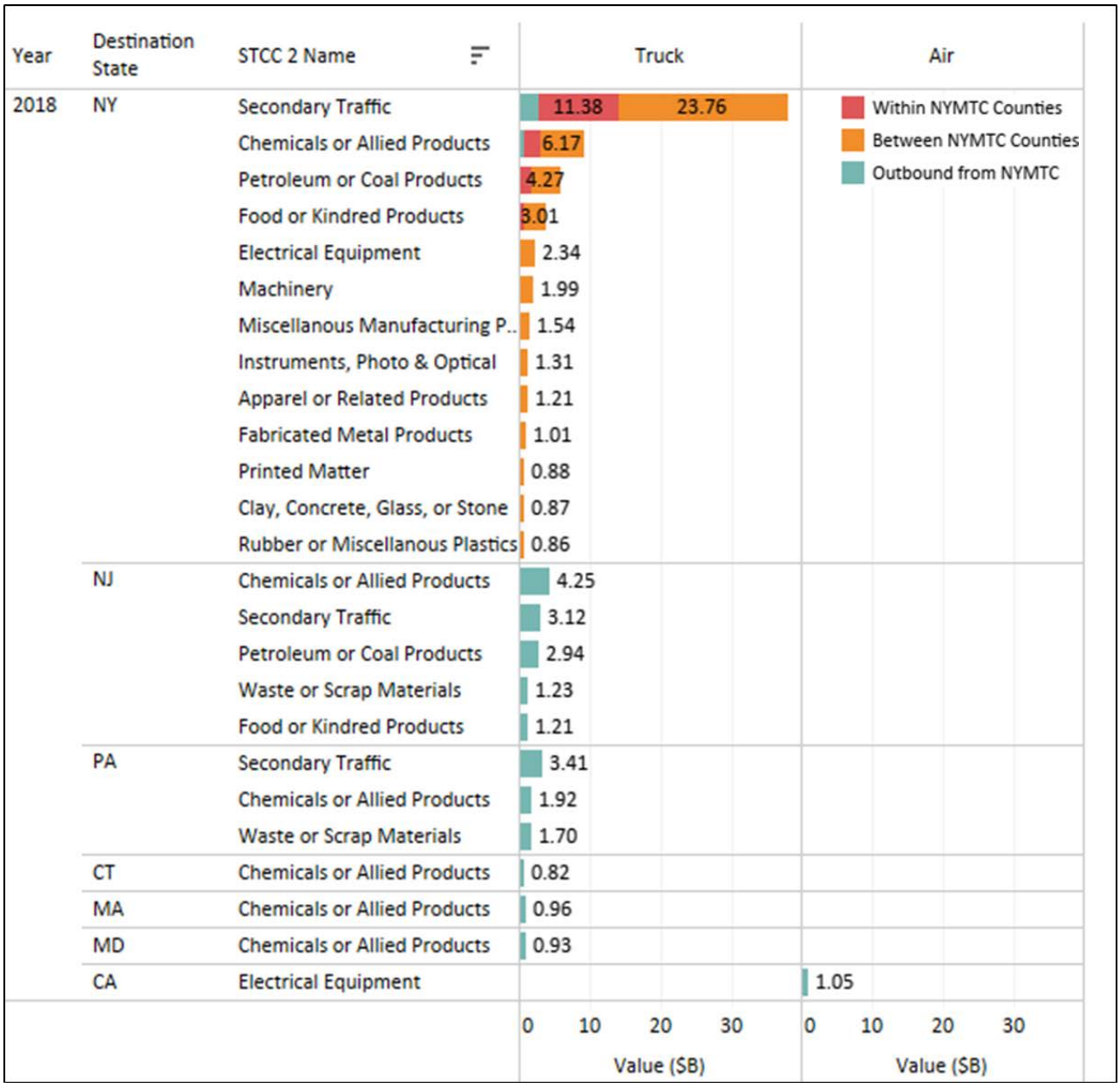


Table H-1-4

Freight Tonnage Estimates for the NYMTC Planning Area from 2012 and 2018 Transearch Datasets

Source: NYMTC Regional Freight Plan 2018–2045) and analysis of NYSDOT Transearch database

	2012 (Regional Freight Plan 2018–2045)	2018 (Moving Forward)
Inbound	174.4	183.0
Outbound	74.2	56.6
Intra-NYMTC	40.7	62.5
Total excluding through	289.3	302.1

1.3.6 NYMTC PLANNING AREA DOMESTIC AND NAFTA FREIGHT FORECASTS

The Transearch database includes current 2018 and forecast 2045 estimates. NYMTC planning area freight tonnage is projected to increase from 302.1 million to 429.0 million tons (+127.1 million); units are projected to increase from 24.24 million to 34.77 million (+10.53 million); and value is projected to increase from $430.72 billion to $729.27 billion (+$298.55 billion).[5] See ***Figure H-1-36***.

These forecasts are based on an econometric model by IHS Markit, which produces Transearch. It is not possible to reverse-engineer the various forecast assumptions; however, it should be noted that the forecast does not assume any sort of modal diversion or policy action to promote or discourage particular types of commodity-trade lane-mode flows—the forecast looks at underlying demand by commodity-trade lane-mode and grows it linearly based on economic forecasts. In addition, the forecasts do not reflect major disruptors or structural changes in the economy other than the continuing pronounced national decline of coal, which is an established trend. As a result, the forecasts show very little change in the distribution of freight by direction of flow (see ***Figure H-1-37***) or mode.

1.3.7 NYMTC PLANNING AREA INTERNATIONAL FREIGHT FLOWS

Other than NAFTA trade, international freight flows are not provided in the Transearch database and are instead derived from the FHWA FAF. While the FAF zone "NY Part NY-NJ-CT-PA" is not an exact match to the geography of the NYMTC planning area, it is a very close approximation and captures the primary international air and water gateway facilities. For analysis purposes, estimates of truck and rail trade with Canada and Mexico (from Transearch) are combined with estimates of international air cargo and ocean cargo trade with all countries (from FAF).

Table H-1-5, ***Table H-1-6***, and ***Table H-1-7*** show that in 2018, the NYMTC planning area exported an estimated 7.8 million tons of freight worth more than $120 billion; most of the tonnage was by water and most of the value was by air. The NYMTC planning area imported an estimated 10.6 million tons of freight worth more than $90 billion; again, most of the tonnage was by water and most of the value was by air. In total, the NYMTC planning area handled 18.4 million tons of international freight worth more than $211 billion.

Figure H-1-36

Region-Level and County-Level Domestic Freight Flows (2018 and 2045)

Source: Analysis of NYSDOT Transearch data

Year	Tons (M)	Units (M)	Value ($B)
2018	302.1	24.24	$430.72
2045	429.0	34.77	$729.27

Year	Origin Region	Tons (M)	Units (M)	Value ($B)
2045	Suffolk County, NY	40.6	3.56	$59.83
	New York County, NY	25.6	5.04	$21.59
	Kings County, NY	22.2	3.03	$21.65
	Nassau County, NY	15.6	2.05	$16.86
	Queens County, NY	15.4	2.72	$79.38
	Westchester County, NY	15.0	1.96	$10.82
	Bronx County, NY	12.7	1.23	$12.76
	Richmond County, NY	11.0	1.27	$22.17
	Rockland County, NY	5.5	0.52	$6.33
	Putnam County, NY	1.8	0.18	$0.94

Year	Destination Region	Tons (M)	Units (M)	Value ($B)
2045	New York County, NY	99.8	6.10	$187.34
	Suffolk County, NY	51.0	4.04	$69.09
	Kings County, NY	48.7	3.28	$71.32
	Queens County, NY	44.8	2.73	$102.55
	Nassau County, NY	36.5	2.34	$54.22
	Westchester County, NY	29.4	1.99	$38.73
	Richmond County, NY	19.2	1.26	$37.58
	Bronx County, NY	16.7	1.30	$24.56
	Rockland County, NY	6.5	0.56	$8.85
	Putnam County, NY	1.7	0.18	$1.35

Figure H-1-37

Region-Level Domestic Freight Flows by Direction (2018 and 2045)

Source: Analysis of NYSDOT Transearch data

Year	NYMTC Flow	Tons (M)	Units (M)	Value ($B)
2018	Inbound to NYMTC	183.0	9.09	$278.53
	Outbound from NYMTC	56.6	7.93	$77.76
	Between NYMTC Counties	49.4	5.54	$54.12
	Within NYMTC Counties	13.1	1.68	$20.32
	Total	302.1	24.24	$430.72
2045	Inbound to NYMTC	263.7	13.20	$476.94
	Outbound from NYMTC	74.7	10.99	$133.68
	Between NYMTC Counties	71.4	8.12	$88.91
	Within NYMTC Counties	19.1	2.45	$29.74
	Total	429.0	34.77	$729.27

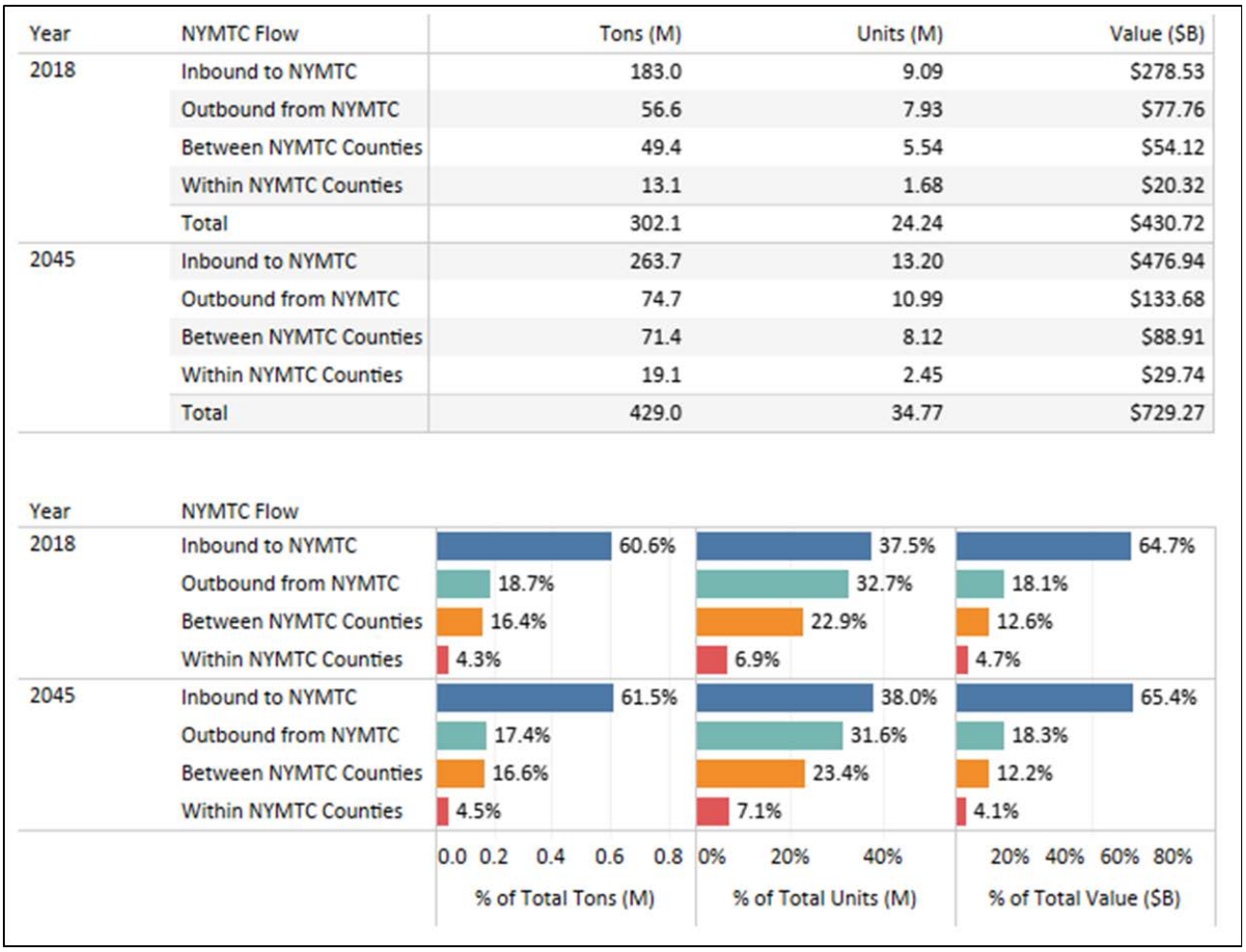


Table H-1-5

NYMTC Planning Area International Freight Flows—Exports (2018)

Source: FHWA FAF (Air and Water); analysis of NYSDOT Transearch database (Truck and Rail)

Mode and Facility	Tons (M)	Units (Trucks or Railcars) (M)	Value ($B)
Air	0.42		86.40
Water	7.08		32.86
Truck—NAFTA	0.30	0.02	1.23
Rail—NAFTA	0.00	0.00	0.00
Total Exports	**7.80**	**0.02**	**120.49**

Table H-1-6

NYMTC Planning Area International Freight Flows—Imports (2018)

Source: FHWA FAF (Air and Water); analysis of NYSDOT Transearch database (Truck and Rail)

Mode and Facility	Tons (M)	Units (Trucks or Railcars) (M)	Value ($B)
Air	0.53	--	79.02
Water	7.24	--	4.92
Truck—NAFTA	2.70	0.13	6.83
Rail—NAFTA	0.11	0.00	0.11
Total Imports	**10.58**	**0.13**	**90.88**

Table H-1-7

NYMTC Planning Area International Freight Flows—Total (2018)

Source: FHWA FAF (Air and Water); analysis of NYSDOT Transearch database (Truck and Rail)

Mode and Facility	Tons (M)	Units (Trucks or Railcars) (M)	Value ($B)
Air	0.95	--	165.42
Water	14.32	--	37.78
Truck—NAFTA	3.00	0.15	8.06
Rail—NAFTA	0.11	0.00	0.11
Total	**18.38**	**0.15**	**211.37**

Finally, Transearch provided forecasts for NAFTA truck and rail flows; forecasts for international air and water flows were derived from the FAF. Between 2018 and 2045, the NYMTC planning area is projected to gain more than 46 million tons of international freight worth $855 billion.

These projected growth figures may seem overly optimistic considering current conditions, but even if the full forecast is not realized by 2045, the clear indication is that the region should plan to accommodate robust and significant growth in international trade (*See Table H-1-8*).

Table H-1-8

NYMTC Planning Area International Freight Flows—Current (2018) and Forecast (2045)

Source: FHWA FAF (Air and Water); analysis of NYSDOT Transearch database (Truck and Rail)

Mode and Facility	Tons (M)	Units (Trucks or Railcars) (M)	Value ($B)
		2018	
Air	0.95	--	165.42
Water	14.32	--	37.78
Truck—NAFTA	3.00	0.15	8.06
Rail—NAFTA	0.11	0.00	0.11
Total	**18.38**	**0.15**	**211.37**
		2045	
Air	4.32	--	838.22
Water	54.19	--	212.40
Truck—NAFTA	5.92	0.30	15.56
Rail—NAFTA	0.08	0.00	0.08
Total	**64.51**	**0.30**	**1,066.26**
		Change	
Air	3.37	--	672.8
Water	39.87	--	174.62
Truck—NAFTA	2.92	0.15	7.49
Rail—NAFTA	0.03	0.00	(0.03)
Total	**46.13**	**0.15**	**854.89**

1.4 CONCLUSIONS

This chapter presents a substantial amount of information to meet two objectives: providing a "library" of commodity flow data and analysis for planners and stakeholders in the MAP Forum region and NYMTC planning area; and identifying some key take-aways.

Overall, more than 300 million tons of domestic freight worth more than $430 billion moves into, out of, and within the NYMTC planning area by truck, rail, water, air, and pipeline annually; around 18 million tons of international freight worth $211 billion is imported to and exported from the NYMTC planning area annually. Trucks are responsible for more than 92 percent of domestic tonnage and nearly 88 percent of domestic value. Around 61 percent of tonnage and 65 percent of value are moving inbound to the NYMTC planning area; around 19 percent of tonnage and 18 percent of value are moving outbound; and the remainder is moving between or within NYMTC counties. By far the largest trading partners for inbound and outbound tonnage and value are the states of New York, New Jersey, and Pennsylvania; however, there is substantial trade with the remainder of New England and the East Coast, as well as the Midwest states. The NYMTC planning area is expected to gain another 127 million tons of domestic freight worth nearly $300 billion by 2045, along with substantial growth in international freight.

Thinking ahead to potential Freight Element recommendations, relevant observations from the commodity flow analysis include the following:

- The need to **maintain connectivity** between the NYMTC planning area and adjoining markets within the MAP Forum region and with other national and global markets is critical to improving connectivity to accommodate anticipated growth.
- Given the region's high dependence on trucking, effective strategies to **reduce or mitigate the social impacts and costs of trucking** will be especially important and valuable.
- To reduce the amount of trucking, there may be value in exploring or encouraging strategies to **reduce the number of truck vehicle miles traveled associated with empty movements**, possibly through load-matching services and strategies.
- **Water and rail, while relatively limited in tonnage and value, are viable alternatives** to trucking for certain types of commodities and markets; continuing to explore means to maximize their potential will be important.

ENDNOTES

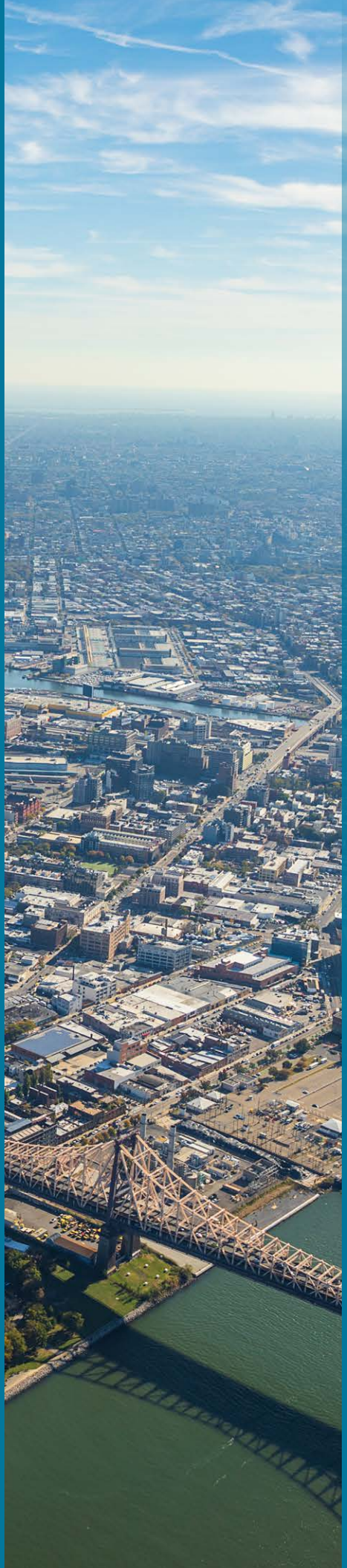
1 Transearch is developed annually by IHS Markit based on a rage of public and proprietary datasets and processing methods. See ***https://ihsmarkit.com/index.html***.

2 STCC codes are assigned to specific transported commodities. The codes are hierarchical: high-level aggregated commodity groups are specified with two-digit codes, which are then broken down to more specific commodity types as far as seven digits. Transearch provides data at the two-digit and four-digit levels. Note that other commodity flow databases, such as the FHWA FAF and U.S. Army Corps of Engineers Waterborne Commerce of the US use different commodity coding systems.

3 For international trade, the foreign origin and foreign mode is reported by Transearch only for NAFTA countries. For other international flows, Transearch may identify a 'domestic leg' (a move to or from an airport, seaport, or land border crossing) and specify its origin, destination, mode, and association with international trade, but it will not identify the foreign country or mode.

4 Through-county movements are not defined at the record level. However, through truck estimates can be developed for major highway corridors using network routing analysis. See Chapter 4 for results.

5 Note that the 2012 Transearch data used in the Regional Freight Plan 2018–2045 projected 483.5 million tons of inbound, outbound, and intra-region freight for 2045 (1.6 percent per year compound growth), compared with the new 2018 Transearch data projection of 429.0 million tons for 2045 (1.3 percent per year compound growth). The forecasts are based on national and global econometric analysis performed by IHS Markit (the Transearch vendor), which are updated periodically. Both forecasts are conservative and reasonable for planning purposes, and it is not unreasonable to look at them together as low and high scenarios for 2045.



2

REGIONAL ECONOMY

The commodity flows described in Chapter 1 are the measurable result of larger forces within the region's economy: the movement of goods produced by industries plus the movement of goods consumed by both industries (as inputs to their production processes) and by the general public. Demand for some types of goods may vary based on weather, economic conditions, or other factors, but the regional economy essentially determines the need to transport different types and quantities of goods. Not all industries generate significant demand for freight movement, but many do; and all consumers require, to varying degrees, essentials like shelter, food, fuel, clothing, household items, cars or bicycles, and other goods, which are purchased largely from employment wages.

To serve this need, industries and companies establish freight transportation supply chains, which are basically the instructions for how to move certain kinds of freight through international, national, regional, and local freight facilities. Supply chains can span continents, involve multiple transportation modes, and include one or more stages of "intermediate handling" such as value-added processing, warehousing, transfer between different sized trucks, movement between large and small distribution centers, and/or movement between distribution centers and retail outlets. Supply chains develop to meet shipper and customer performance needs. These needs vary depending on the type of commodity, but generally involve achieving appropriate levels of delivery reliability, transportation cost, delivery time, material security, in-transit visibility, and special handling considerations (e.g., "cold chain" compliance, hazardous materials handling, oversize/overweight shipments). Supply chains look to take advantage of a region's best-performing transportation assets and seek to avoid—where possible—its more expensive, congested, or inefficient routes and facilities. The sum total of thousands of overlapping, interwoven supply chains creates the freight transportation activity on the region's major highways, local streets, and railroads, and at its seaports and airports.

These conjoined drivers—population and employment, and the supply chains that have evolved to meet their needs—are discussed below.

2.1 POPULATION AND EMPLOYMENT

2.1.1 POPULATION

The most recent NYMTC Region Socioeconomic and Demographic (SED) projections cover the period 2010–2055.[1] The projections cover the 10-county NYMTC planning area, 4 additional counties in the Mid-Hudson region of New York, 14 counties in New Jersey, and 3 counties in Connecticut. For the 10-county NYMTC planning area, the base year 2017 population is 12,823,236; the estimated 2018 population is 12,831,939; and the projected 2050 population is 14,134,562. The population is expected to increase by 1,302,623 between 2018 and 2050; the projected compound annual growth rate (CAGR) for the period is 0.30 percent (***Table H-2-1***).

2.1.2 EMPLOYMENT

For the 10-county NYMTC planning area, the base year 2017 employed labor force is 5,958,569; the estimated 2018 employed labor force is 5,995,243; and the projected 2050 employed labor force is 6,812,446. The projected employed labor force increased by 817,202 between 2018 and 2050; the projected population CAGR between 2018 and 2050 is 0.40 percent. See ***Table H-2-2***.

Table H-2-1

Population Estimates

Source: NYMTC SED 2017 projections (draft)

	2017	2018	2050
NYMTC Planning Area	**12,823,236**	**12,831,939**	**14,134,562**
Net Added		1,302,623	
Compound Annual Growth Rate		0.30%	

Employment in "freight-intensive" industries (defined at the two-digit North American Industry Classification [NAICS] code level as shown in ***Table H-2-3***) represents an estimated 23.6 percent of all employment in 2018; the share of employment in freight-intensive industries is projected to decline to 18.3 percent by 2050.[2] Total freight employment is projected to decline from 1,412,534 in 2018 to 1,249,402 in 2050.

For the 10-county NYMTC planning area, the economy is largely focused on finance, health care, professional services, accommodation and food service, and government. Freight-intensive industries account for less than one-fourth of planning area employment today and are projected to account for a declining share in the future. However, almost all of the "other" industries depend heavily on the movement of foods and beverages, fuels, parcels and packages, materials and supplies, equipment and machinery, pharmaceuticals, waste, and other kinds of freight; thus, although they are not freight-intensive in terms of their employment, they are still freight dependent.

Table H-2-2

Employment Estimates

Source: Analysis of Quarterly Census of Employment and Workforce data

	2017	2018	2050
NYMTC Planning Area	**5,958,569**	**5,995,243**	**6,812,446**
Net Added		817,202	
Compound Annual Growth Rate		0.40%	

Table H-2-3

Classification of Industry Groups by 2-Digit NAICS Code

Source: WSP

"Freight Intensive"	"Other"
11—Agriculture	51—Information
21—Mining	52—Finance and Insurance
22—Utilities	53—Real Estate, Rental and Leasing
23—Construction	54—Professional, Scientific and Technical
31, 32, 33—Manufacturing	55—Management of Companies and Enterprises
42—Wholesale Trade	56—Administrative, Support, Waste Management
44, 45—Retail Trade	61—Health Care and Social Assistance
48, 49—Transportation and Warehousing	71—Arts, Entertainment and Recreation
	72—Accommodation and Food Services
	81—Other Services
	92—Government

2.1.3 COMPARISON OF GROWTH RATES

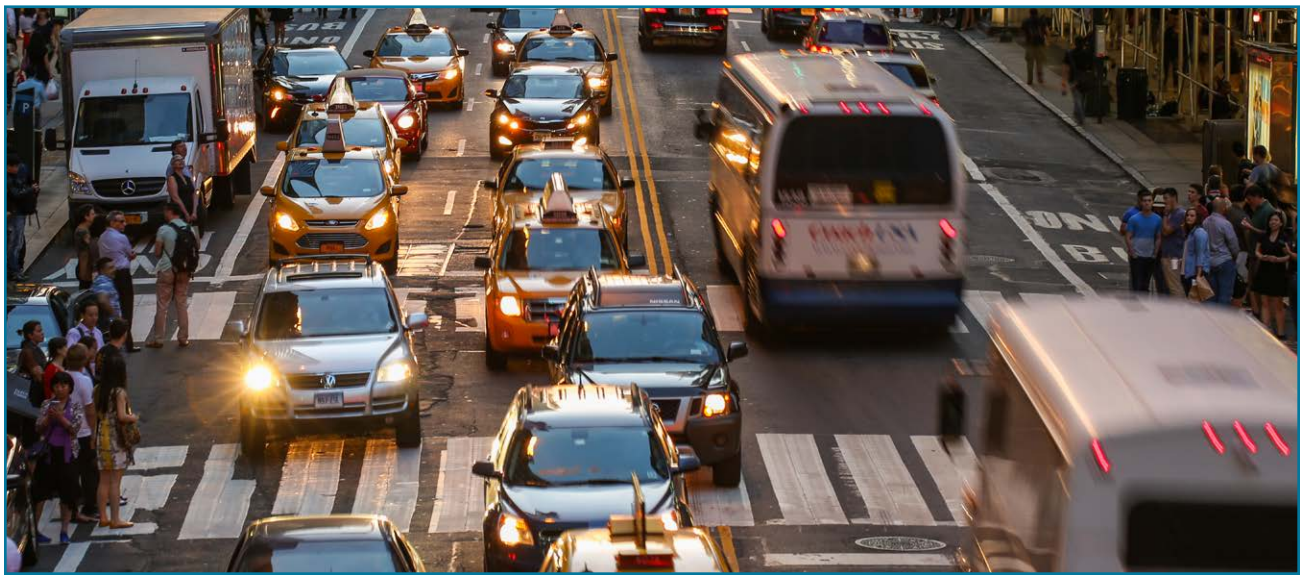
The available estimates for growth in population, employment, and freight volume are shown in ***Table H-2-4***. Population and employment are expected to increase more slowly than freight volume, and employment in freight-intensive industries is expected to decline as a share of total employment.[3]

Table H-2-4

Growth Rates for Commodity Flows, Population, and Employment in the NYMTC Planning Area

Source: NYSDOT Transearch Database and NYMTC SED Forecasts

	CAGR 2018–2045	CAGR 2018–2050
Commodity Flow Tonnage	1.31%	
Inbound only	1.36%	
Outbound only	1.03%	
Within only	1.38%	
Commodity Flow Value	1.97%	
Inbound only	2.01%	
Outbound only	2.03%	
Within only	1.74%	
Population		**0.30%**
Employment		**0.40%**
Freight-Intensive Industry Employment		**-0.38%**



While these growth rates may seem inconsistent, there are reasonable explanations for the differences. Population and employment are increasing, meaning consumption of freight by producers and consumers should increase. While freight-intensive employment is expected to decline in real terms, the productivity of employees in freight-intensive industries is expected to increase significantly, meaning more freight can be moved with fewer employees. The idea that commodity flow tonnage and value growth may outpace total employment and population growth is logical with the following assumptions:

- Increased employee productivity, which could result from a variety of factors but principally from automated/robotic-assisted production and warehouse handling, supported by improved information systems;
- Growth in direct-to-consumer (DTC) and direct-to-business purchasing, reducing the need for retail and wholesale operations;
- Increases in per-capita consumption of goods by individuals and/or industries;
- Increases in the average value per ton of goods being moved; and/or
- Increasingly complex supply chains, where more handling steps result in more trips for each unit of freight. For example, a 50-pound bag of wood chips moving from Texas to Suffolk County door-to-door by truck represents 50 pounds of commodity flow. That same bag moving by rail to a "big box" retailer offering e-commerce delivery may represent 200 pounds of commodity flow—50 pounds of truck drayage to a rail terminal, 50 pounds on a railcar, 50 pounds of truck drayage to a distribution center, and 50 pounds of delivery van drayage to the end user. Transearch data are based on the movement of vehicles, so each move is logged separately, even if it is the same shipment being moved in each case.

With freight tonnage and value growing faster than population, the amount of freight moved per resident of the NYMTC planning area will increase substantially. In 2018, around 23.5 tons of freight (roughly one fully loaded large tractor trailer) was moved per capita; by 2050, this figure is expected to increase to around 32.4 tons of freight per capita.

2.1.4 GROSS DOMESTIC PRODUCT IN FREIGHT-INTENSIVE INDUSTRIES

The gross domestic product (GDP) of the NYMTC planning area is estimated at $1.28 trillion in 2018.[4] Almost $198 billion in GDP is associated with freight-intensive industries, and the remainder is associated with other industries that use freight movement to varying degrees for essential materials, equipment, supplies, and transportation services. See ***Table H-2-5***.

Around 15.5 percent of GDP is in freight-intensive industries. The share of NYMTC planning area employment in these freight-intensive industries is somewhat higher (23.6 percent), because the GDP per employee in freight-intensive industries is somewhat lower on average. Within the NYMTC planning area, freight-intensive industries represented an estimated 1,412,534 jobs and $87 billion in total wages in 2018.[5] Leading industry groups are shown in ***Figure H-2-1*** and ***Figure H-2-2***.

Table H-2-5

Gross Domestic Product for Freight-Intensive Industries in the NYMTC Planning Area

Source: Analysis of Quarterly Census of Employment and Workforce data

		2018 GDP ($B)	% of 2018 GDP
Freight-Intensive	Wholesale trade	56.90	4.5%
	Retail trade	48.26	3.8%
	Construction	38.16	3.0%
	Manufacturing	26.76	2.1%
	Transportation and warehousing	20.16	1.6%
	Utilities	7.56	0.6%
	Mining, quarrying, oil and gas extraction	0.11	0.0%
	Agriculture, forestry, fishing and hunting	0.04	0.0%
	Subtotal, Freight-Intensive	***197.95***	***15.5%***
Other	Finance and insurance	276.95	21.7%
	Real estate and rental and leasing	184.89	14.5%
	Professional, scientific, tech services	124.39	9.8%
	Information	122.97	9.6%
	Government and government enterprises	115.57	9.1%
	Health care and social assistance	88.77	7.0%
	Arts, entertainment, recreation, accommodation, food	59.38	4.7%
	Administrative and support and waste services	34.81	2.7%
	Educational services	25.57	2.0%
	Other services (except government)	24.22	1.9%
	Management of companies and enterprises	19.8	1.6%
	Subtotal, Other	***1,077.31***	***84.5%***
Grand Total		**1,275.26**	**100.0%**

Figure H-2-1

Employment and Wages in Freight-Intensive Industry Groups (2-Digit NAICS Code), 2018

Source: Analysis of Quarterly Census of Employment and Workforce data

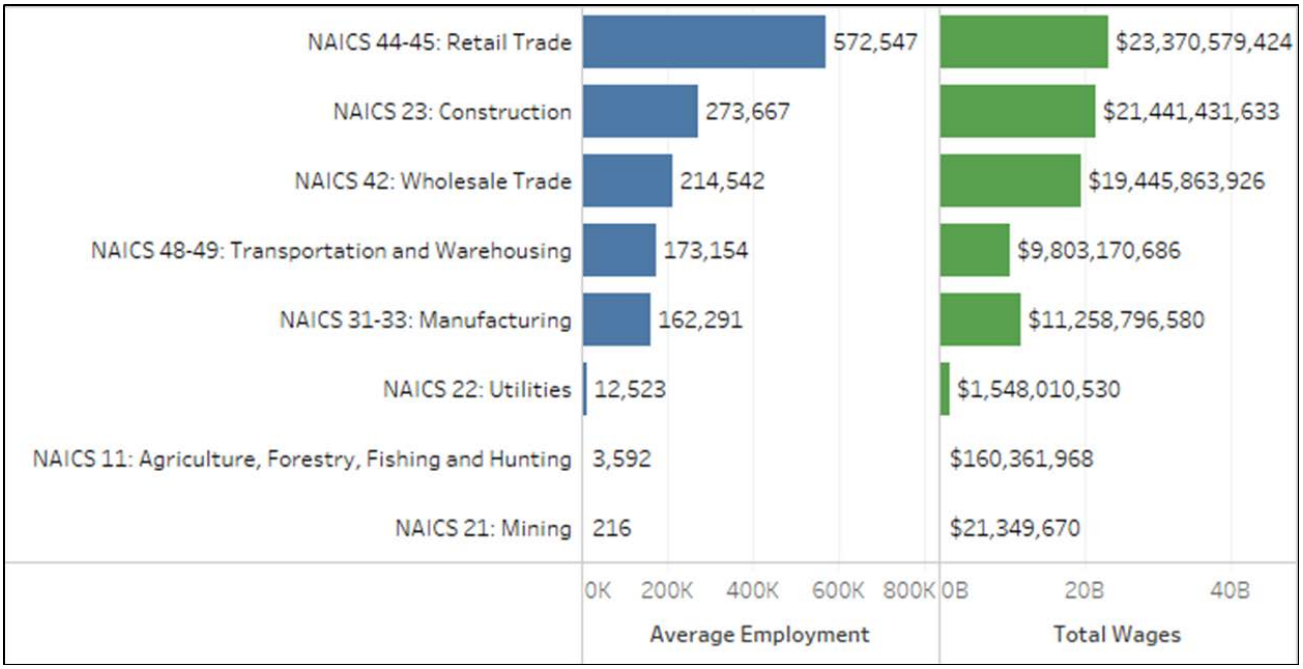
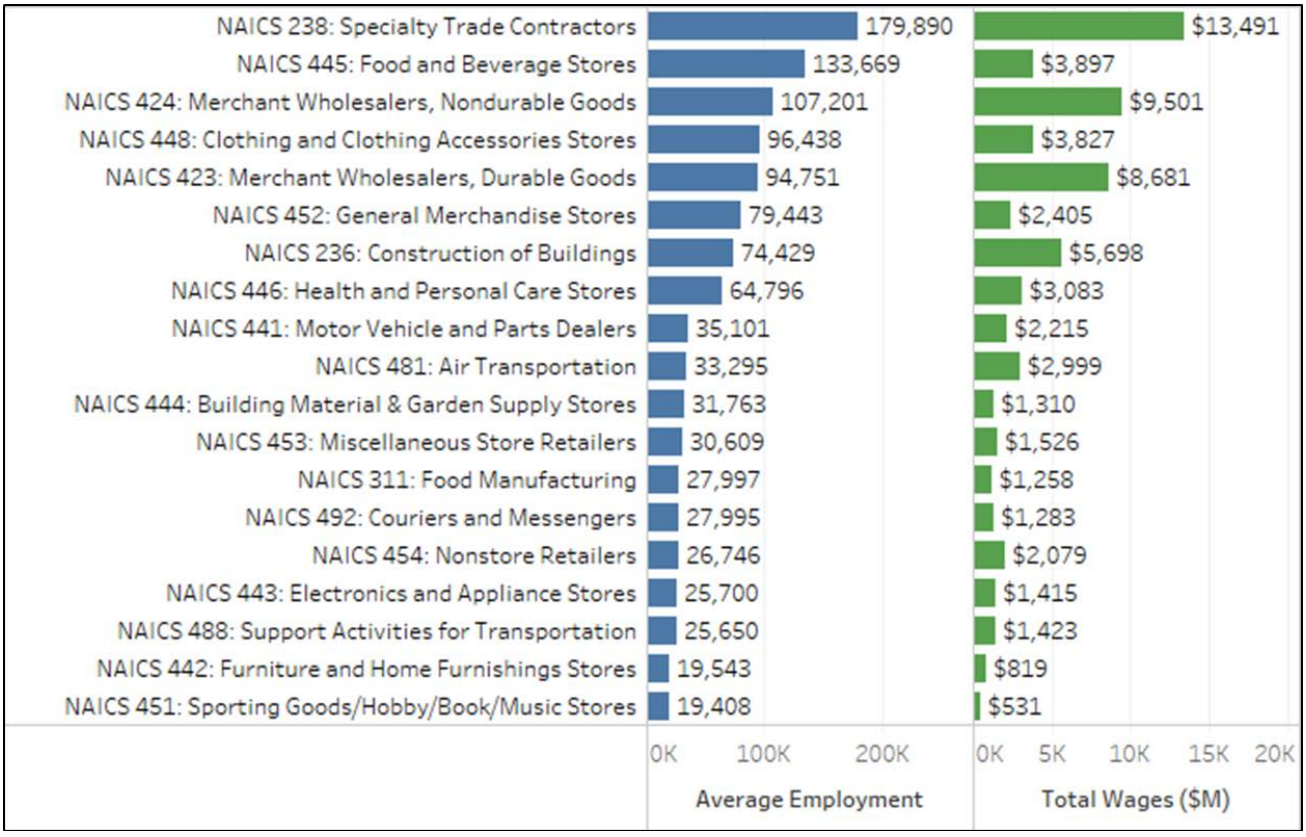


Figure H-2-2

Leading Freight-Intensive Industries (3-Digit NAICS Code) by Employment and Wages, 2018

Source: Analysis of Quarterly Census of Employment and Workforce data



Based on employment, retail is the most important freight-intensive industry group by a significant margin; the next most important groups are construction, wholesale trade, transportation and warehousing, and manufacturing. Utilities, agriculture, and mining make smaller contributions. Based on wages, the top three groups—retail, construction, and wholesale trade—are comparably important, followed by manufacturing and transportation and warehousing.

Each of the counties in the NYMTC planning area benefits from some level of freight-intensive employment and wages. Employment and wages from freight-intensive industries by county are shown in ***Table H-2-6***. The leading counties—New York, Suffolk, Queens, Nassau, and Kings—also represent the top five counties for originated and terminated commodity flows, as discussed in ***Chapter 1***.

Table H-2-6

Freight-Intensive Industry Employment and Wages by County, 2018

Source: Analysis of Quarterly Census of Employment and Workforce data

County	Employment	Wages
New York	315,272	$25,369,516,102
Suffolk	238,963	$13,829,106,990
Queens	230,262	$13,772,224,404
Kings	180,314	$8,155,825,474
Nassau	178,042	$10,290,296,586
Westchester	118,657	$7,803,857,681
Bronx	69,485	$3,317,014,918
Rockland	37,039	$2,105,365,861
Richmond	35,901	$1,944,948,280
Putnam	8,597	$461,408,121
Grand Total	**1,412,532**	**$87,049,564,417**

Figure H-2-3 and *Figure H-2-4* illustrate the leading NAICS groups for freight-intensive employment and wages at the county level, showing the characteristic "freight composition" of each county.

Figure H-2-3

Freight-Intensive Industry Employment (in Thousands) by 2-Digit NAICS Code and County, 2018

Source: Analysis of Quarterly Census of Employment and Workforce data

County	NAICS 44-45: Retail Trade	NAICS 23: Construction	NAICS 42: Wholesale Trade	NAICS 48-49: Transportation and Warehousing	NAICS 31-33: Manufacturing	NAICS 22: Utilities	NAICS 11: Agriculture, Forestry, Fishing and Hunting	NAICS 21: Mining	Grand Total
New York	157	43	73	18	24		0	0	315
Suffolk	78	47	38	19	53	1	3	0	239
Queens	63	54	22	71	20		0		230
Kings	78	34	24	20	20	4	0	0	180
Nassau	81	33	26	16	18	4	0		178
Westchester	49	29	14	11	13	3	0		119
Bronx	32	12	11	9	6		0		69
Rockland	15	7	5	3	7		0		37
Richmond	16	10	2	5	1	1			36
Putnam	3	3	1	0	2	0	0		9
Grand Total	573	274	215	173	162	13	4	0	1,413

Figure H-2-4

Freight-Intensive Industry Wages (in Millions of Dollars) by 2-Digit NAICS Code and County, 2018

Source: Analysis of Quarterly Census of Employment and Workforce data

County	NAICS 44-45: Retail Trade	NAICS 23: Construction	NAICS 42: Wholesale Trade	NAICS 31-33: Manufacturing	NAICS 48-49: Transportation and Warehousing	NAICS 22: Utilities	NAICS 11: Agriculture, Forestry, Fishing and Hunting	NAICS 21: Mining	Grand Total
New York	8,912	4,611	8,777	2,030	1,016		20	3	25,370
Suffolk	2,760	3,347	3,006	3,607	895	89	106	18	13,829
Queens	2,153	4,321	1,619	1,069	4,610		0		13,772
Nassau	2,931	2,563	2,174	1,208	908	500	8		10,290
Kings	2,684	2,032	1,282	889	823	439	6	1	8,156
Westchester	1,841	2,258	1,293	1,372	646	377	17		7,804
Bronx	1,000	896	747	282	391		1		3,317
Rockland	477	482	386	629	130		1		2,105
Richmond	520	774	91	69	365	126			1,945
Putnam	92	158	70	102	19	18	1		461
Grand Total	23,371	21,441	19,446	11,259	9,803	1,548	160	21	87,050

2.2 SUPPLY CHAINS

2.2.1 ABOUT SUPPLY CHAINS

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.[6]

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 establishes and manages its own supply chain, businesses in similar industry sectors may have 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. Although every supply chain is unique, most supply chains consist of four general stages as described below and illustrated in ***Figure H-2-5***.

- **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.
- **Stage 3** is when finished goods are moved to warehouses, distribution centers, or fulfillment centers, where they are packaged and prepared for Stage 4.
- **Stage 4** is the shipment to retail stores or DTC.

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 warehouses and distribution centers. From 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. Technology has the potential to radically change many parts of the supply chain, particularly the "last mile" of the chain that ultimately delivers the commodity to its destination.[7]

Figure H-2-5

Generic Supply Chain Diagram

Source: NYMTC Regional Freight Plan 2018-2045

2.2.2 CRITICAL SUPPLY CHAINS IN THE NYMTC PLANNING AREA

Freight-intensive industries depend largely or wholly on the movement of goods. Other industries (information, finance, real estate, professional services, management, administration, health care, recreation, accommodation and food services, and government) also depend on the movement of goods. The finance, insurance, and real estate sectors, for example, make heavy use of package delivery to receive office supplies but also depend on 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. Consumers depend on freight movement for the essentials of life—shelter, food, climate control, clothing—as well as its luxuries.

NYMTC's *Regional Freight Plan 2018–2045* identified six major industry groups (by STCC codes) with supply chains that are especially significant for the health and well-being of NYMTC planning area residents and businesses:

- **Food**: including agricultural products (STCC 01), fresh fish or marine products (STCC 09), and food or kindred products (STCC 20)
- **Parcels and secondary freight**: including miscellaneous mixed shipments (STCC 46), small packaged freight (STCC 47), and secondary traffic (STCC 50)
- **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)
- **Energy products**: including coal (STCC 11), crude petroleum or natural gas (STCC 13), and refined petroleum products (STCC 29)
- **Pharmaceutical drugs** (STCC 283)
- **Waste and scrap materials** (STCC 40)

For *Moving Forward, the Regional Freight Plan 2018–2045* analyses have been updated with the most recent available data. Generally, the findings and patterns reported in the Regional Freight Plan have been confirmed, with minor differences related to the updated data sources.[8]

2.2.3 SUPPLY CHAIN #1: FOOD

Food: including agricultural products (STCC 01), fresh fish or marine products (STCC 09), and food or kindred products (STCC 20)

DESCRIPTION OF SUPPLY CHAIN

Figure H-2-6 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.

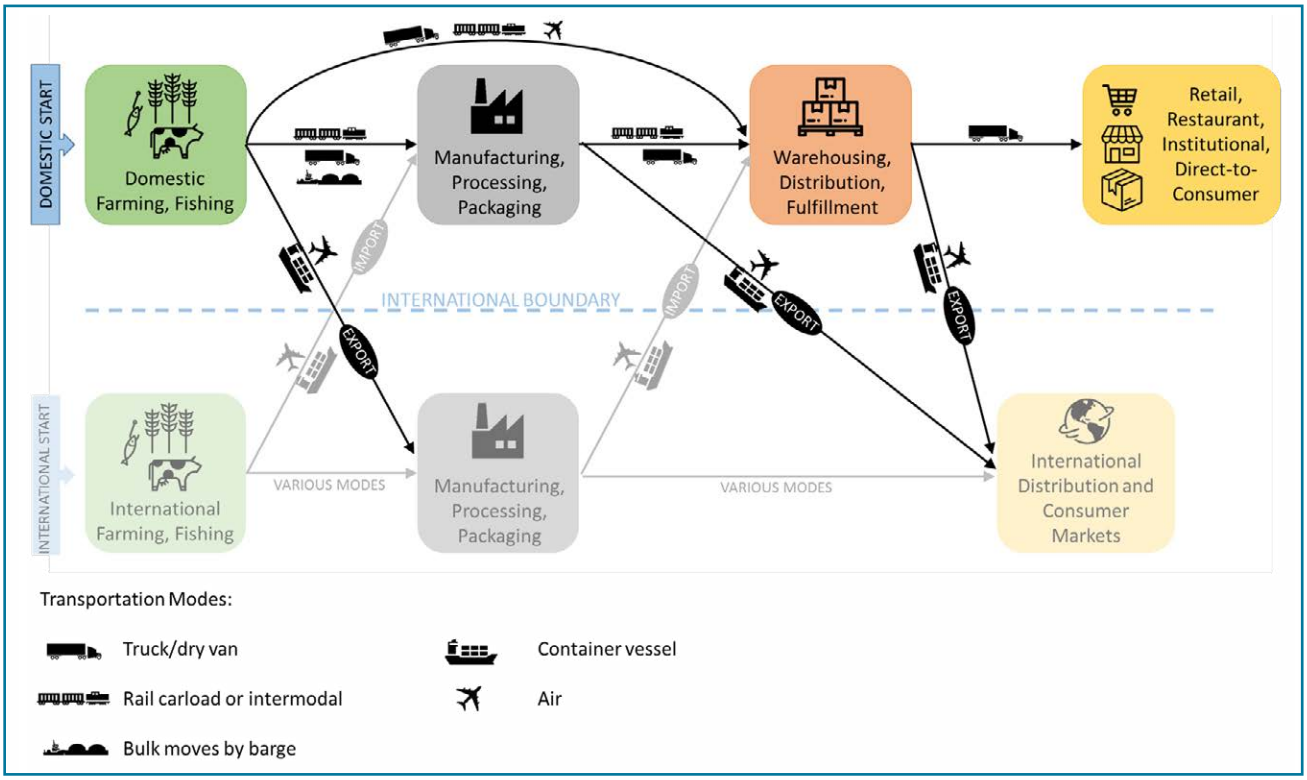
Beginning on the domestic track, *Figure H-2-6* shows growing crops, raising livestock, or catching seafood as the first step in the chain. The NYMTC planning area is home to businesses engaged in these activities, but most of the food products that are consumed here are produced in other parts of the United States.

Some agricultural products, such as fresh produce and unprocessed seafood, 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 processed into 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, although trucks most often make the "first mile" connection between the production location and the seaport or air cargo facility from which the goods are exported.

Figure H-2-6

Supply Chain Diagram—Food

Source: NYMTC Regional Freight Plan 2018–2045



Once produced, processed food products and fresh food products enter the distribution networks that connect the products to consumers or export them 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 the company owning the products. Wholesalers distribute goods to be sold and distributed to retail stores or restaurants in the United States or abroad. Retailers may have their own networks of warehousing and distribution centers that receive shipments from wholesalers or act in place of 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.

DOMESTIC COMMODITY FLOWS (INCLUDING DOMESTIC LEG OF INTERNATIONAL FLOWS)

In 2018, 38.0 million tons of food commodities, including food products, agriculture products, and meats, moved in, out , or within the NYMTC planning area (*Table H-2-7*). Approximately 89 percent of the food products moved in the inbound direction, making the NYMTC planning area a net receiver of food. Five percent of products were distributed from the NYMTC planning area to other places and 6 percent were moved within the planning area. About 97 percent of food moved in the NYMTC planning area was moved by truck (*Table H-2-8*).

Among NYMTC planning area counties, New York County had the largest share of tonnage by a significant margin, followed by Kings, Queens, Nassau, Suffolk, and Westchester counties. Richmond, Bronx, and Rockland counties also showed significant tonnage. For each county, the great majority of tonnage was in the inbound direction.[9]

Figure H-2-7 highlights an important issue in the analysis and interpretation of freight data. Bronx County shows inbound food tonnage but relatively little outbound food tonnage; however, much of the food tonnage is associated with the Hunts Point Food Distribution Center, which receives larger/longer-haul food shipments and then redistributes them locally as smaller/shorter-haul shipments. Transearch is likely capturing and reporting these outbound distribution moves as "Secondary Traffic" (movements out of warehouse facilities) and no longer tracking them as food shipments. More generally, it is also possible that Transearch is underallocating regional food tonnage to the Bronx, if its assignment procedures are not reflecting the specific and unique function of the Hunts Point Food Distribution Center.

Most counties were served almost entirely by truck, although some counties received rail shipments of food—particularly the Bronx (which hosts the rail-served Hunts Point Food Distribution Center) as well as Kings, Queens, and Nassau counties; Westchester County also showed water tonnage related to food products (*Figure H-2-8*).

For the 89 percent of tonnage moving inbound (*Figure H-2-9*), the dominant role of trucking can be attributed in part to the relatively short length of most trips carrying food products. Around 34 percent of tonnage arrived from Pennsylvania and New Jersey, and 50 percent arrived from the top four states (Pennsylvania, New Jersey, Maryland, and Ohio). This tonnage included products raised or produced in those states or products that arrived in those states (including imports via water

and imports/domestic freight via rail) and were then transferred to trucks for final delivery to the NYMTC planning area. Some tonnage from Florida arrived via water, while some tonnage from Illinois, California, Texas, Indiana, Missouri, and Virginia arrived by rail. The Illinois and Missouri tonnages may have included rail traffic from states farther west that was transferred from western to eastern railroads in those states. Looking at value, New Jersey generated the highest inbound value, possibly due to higher value imported goods arriving via that state's intermodal gateways.

Table H-2-7

Domestic Tonnage by Mode and Direction, 2018—Food

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	32.7	0.4	0.0	0.6	0.0	33.7
Outbound from NYMTC	1.9	0.1	0.0	0.0	0.0	2.0
Between NYMTC Counties	1.8					1.8
Within NYMTC Counties	0.5			0.0		0.5
Grand Total	36.9	0.5	0.0	0.6	0.0	38.0

Table H-2-8

Domestic Tonnage Shares by Mode and Direction, 2018—Food

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	86.2%	1.1%	0.0%	1.5%	0.0%	88.9%
Outbound from NYMTC	5.0%	0.1%	0.0%	0.0%	0.0%	5.2%
Between NYMTC Counties	4.7%					4.7%
Within NYMTC Counties	1.2%			0.0%		1.2%
Grand Total	97.2%	1.3%	0.1%	1.5%	0.0%	100.0%

Figure H-2-7

Domestic Tonnage by County and Direction, 2018—Food

Source: Analysis of NYSDOT Transearch data

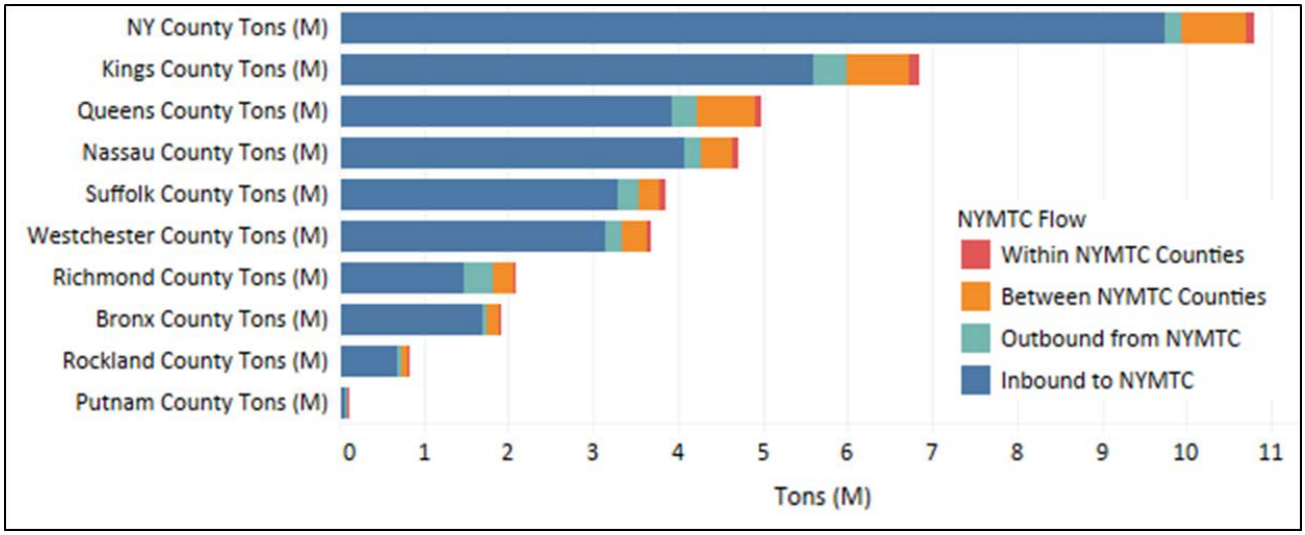


Figure H-2-8

Domestic Tonnage by County and Mode, 2018—Food

Source: Analysis of NYSDOT Transearch data

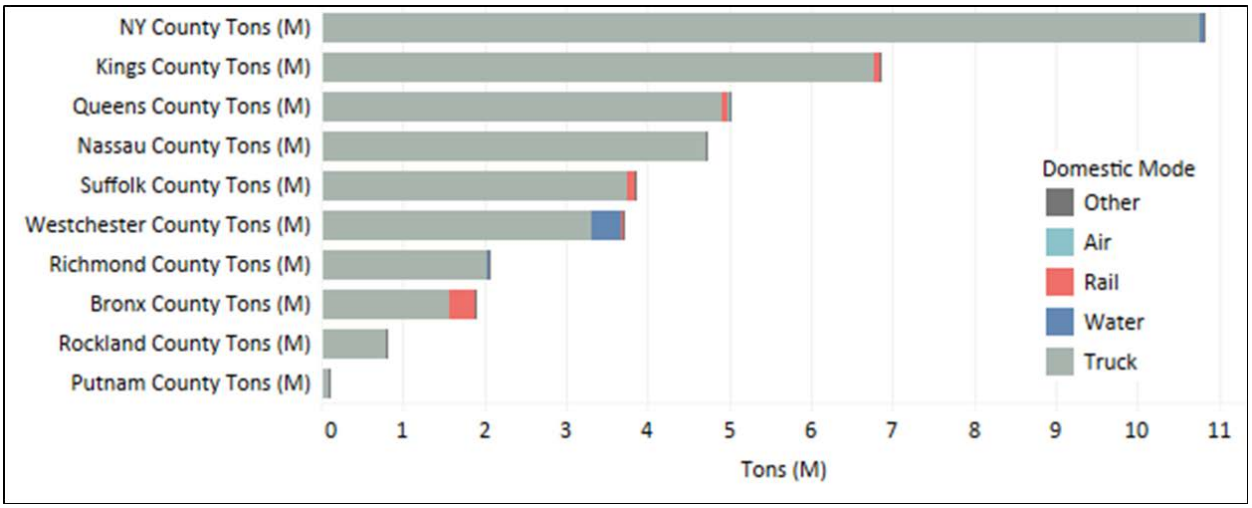
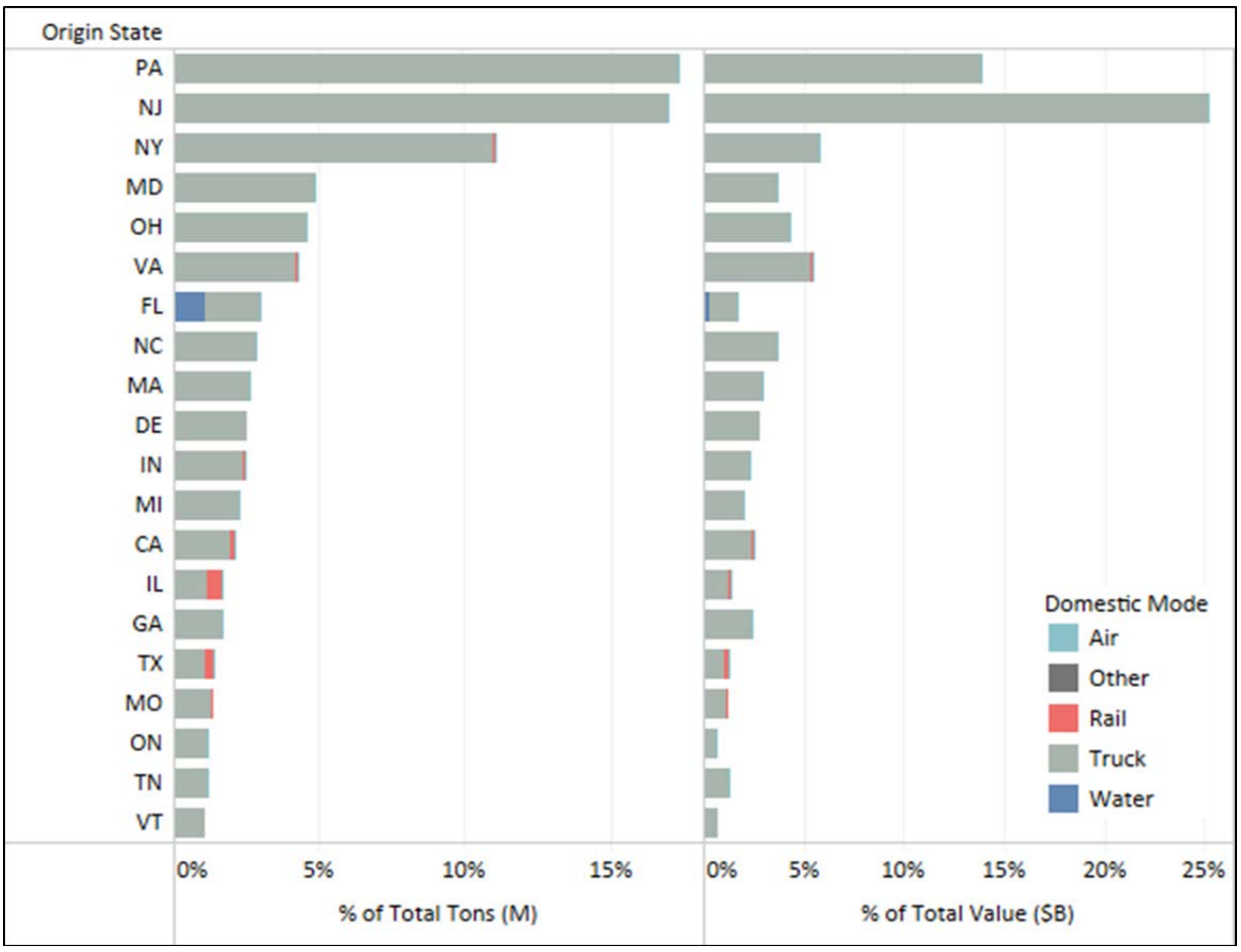


Figure H-2-9

Inbound Domestic Tonnage and Value by Origin State, 2018—Food

Source: Analysis of NYSDOT Transearch data



For the 5 percent of food tonnage moving outbound from the NYMTC planning area to other areas, the dominant destination was New Jersey, which was served primarily by truck along with a smaller share moving via cross-harbor waterborne service (***Figure H-2-10***). Other leading destinations—all served via truck—included Pennsylvania, Massachusetts, Connecticut, New York State, Maryland, and Virginia.

For the 6 percent of food tonnage moving between or within NYMTC planning area counties, the dominant trading pairs were Kings-New York and Queens-New York, primarily reflecting moves from wholesale and distribution facilities to retail outlets and restaurants (***Table H-2-9***). Interestingly, the Bronx—which hosts the Hunts Point Food Distribution Center—did not generate large internal regional flows compared to other origin-destination pairs. Kings and Queens were the leading origin regions; New York was the leading destination region.

As shown in ***Table H-2-10***, by 2045, food tonnage is expected to nearly double, from 38 million tons to 67 million tons, with value seeing a comparable increase. Directional shares are projected to be relatively unchanged, with inbound flows continuing to dominate. Modal shares are projected to be relatively unchanged, with trucking continuing to dominate.

Figure H-2-10

Outbound Domestic Tonnage and Value by Destination State, 2018—Food

Source: Analysis of NYSDOT Transearch data

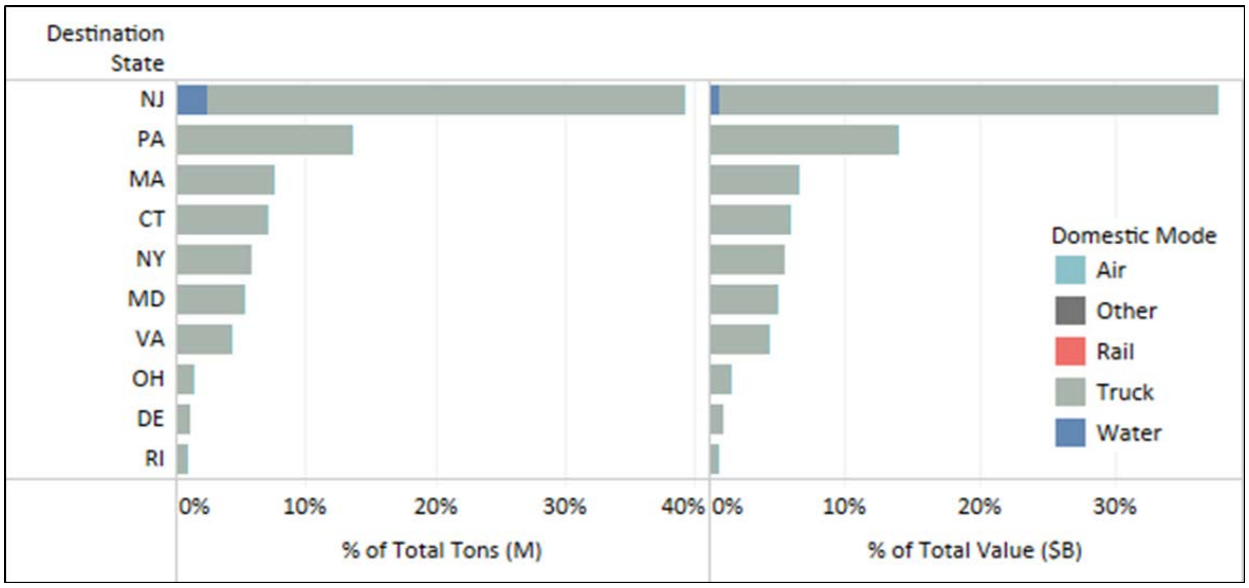


Table H-2-9

Domestic Tonnage and Value Moving Internally, 2018—Food

Source: Analysis of NYSDOT Transearch data

Origin Region	Bronx County, NY	Kings County, NY	Nassau County, NY	New York County, NY	Putnam County, NY	Queens County, NY	Richmond County, NY	Rockland County, NY	Suffolk County, NY	Westchester County, NY	Grand Total
Bronx County, NY	0.3%	0.2%	0.2%	0.1%	0.0%	0.6%	0.1%	0.0%	0.2%	0.6%	2.3%
Kings County, NY	0.5%	4.7%	1.7%	10.7%	0.0%	3.7%	1.1%	0.1%	1.1%	1.4%	25.2%
Nassau County, NY	0.3%	1.1%	2.6%	2.0%	0.0%	2.2%	0.1%	0.1%	0.9%	0.5%	9.8%
New York County, NY	0.0%	1.7%	0.5%	4.0%	0.0%	1.4%	0.1%	0.1%	0.4%	0.4%	8.7%
Putnam County, NY	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%		0.0%	0.0%	0.2%
Queens County, NY	1.5%	4.0%	4.0%	9.3%	0.0%	3.2%	0.3%	0.2%	0.7%	1.0%	24.3%
Richmond County, NY	0.3%	3.1%	0.9%	2.4%	0.0%	0.7%	0.4%	0.1%	0.7%	0.7%	9.1%
Rockland County, NY	0.1%	0.2%	0.1%	0.6%	0.0%	0.2%	0.0%	0.1%	0.1%	0.5%	1.9%
Suffolk County, NY	0.2%	0.8%	1.2%	1.8%	0.0%	0.6%	0.2%	0.1%	3.0%	0.7%	8.7%
Westchester County, NY	1.2%	1.2%	0.6%	2.2%	0.1%	0.8%	0.1%	0.5%	0.7%	2.5%	9.8%
Grand Total	4.3%	17.2%	11.8%	33.1%	0.2%	13.5%	2.4%	1.3%	7.9%	8.3%	100.0%

Table H-2-10

Domestic Tonnage and Value by Mode and Direction, 2018 and 2045—Food

Source: Analysis of NYSDOT Transearch data

		Tons (M)		Value ($B)	
NYMTC Flow	Domestic Mode	2018	2045	2018	2045
Inbound to NYMTC	Truck	32.7	57.5	45.97	79.73
	Water	0.4	0.7	0.18	0.28
	Air	0.0	0.0	0.14	0.24
	Rail	0.6	0.9	0.41	0.71
	Other	0.0	0.0	0.00	0.00
	Total	33.7	59.1	46.70	80.96
Outbound from NYMTC	Truck	1.9	3.3	4.15	6.98
	Water	0.1	0.1	0.04	0.06
	Air	0.0	0.1	0.13	0.78
	Rail	0.0	0.0	0.00	0.01
	Other	0.0	0.0	0.00	0.00
	Total	2.0	3.4	4.32	7.83
Between NYMTC Counties	Truck	1.8	3.5	3.86	6.73
	Total	1.8	3.5	3.86	6.73
Within NYMTC Counties	Truck	0.5	0.8	1.00	1.43
	Rail	0.0	0.0	0.00	0.00
	Total	0.5	0.8	1.01	1.44
Grand Total		38.0	66.8	55.89	96.95

INTERNATIONAL FLOWS

In 2018, for this supply chain, NAFTA trade with Canada and Mexico was estimated at 0.88 million tons inbound and 0.02 million tons outbound, almost wholly by truck, with a total value of $1.1 billion and strong growth forecast through 2045 (*Table H-2-11*).[10]

In 2018, for this supply chain, international seaports and airports in the NYMTC planning area imported 1.0 million tons of food-related commodities worth $3.1 billion, and exported 0.48 million tons worth $3.5 billion, excluding Canada and Mexico (*Table H-2-12* and *Table H-2-13*). In percentage terms, these volumes are expected to triple at a minimum by 2045.[11]

CRITICAL INFRASTRUCTURE

The transportation facilities used to carry food in, out, and within the planning area include most of the planning area's interstate highways, including Interstate (I)-95, I-78 and I-80 in New Jersey, I-87, I-287, -295, I-495, I-678, and I-278. 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 Metropolitan Transportation Authority (MTA) 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 Yard. From Fresh Pond Yard, goods are distributed by rail to eastern Long Island via the MTA Long Island Rail Road (LIRR) main line and branches, the Lower Montauk Branch toward Long Island City, or the Bay Ridge Branch into Brooklyn.

Table H-2-11

International NAFTA Tonnage and Value by Mode, 2018 and 2045—Food

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Domestic Mode	Tons (M) NAFTA 2018	Tons (M) NAFTA 2045	Value ($B) NAFTA 2018	Value ($B) NAFTA 2045
Inbound to NYMTC	Truck	0.82	2.13	0.988	2.341
	Water	0.04	0.09	0.035	0.057
	Air	0.00	0.00	0.006	0.013
	Rail	0.01	0.04	0.010	0.032
	Other	0.00	0.00	0.000	0.000
	Total	0.88	2.26	1.040	2.444
Outbound from NYMTC	Truck	0.02	0.05	0.047	0.108
	Water	0.00	0.00	0.003	0.005
	Air	0.00	0.00	0.000	0.002
	Other	0.00	0.00	0.000	0.000
	Total	0.02	0.05	0.051	0.115
Grand Total		0.90	2.31	1.091	2.559

Table H-2-12

International Seaport and Airport Imports (Excluding NAFTA) by Mode, 2018 and 2045—Food

Source: Analysis of USDOT FAF-4 data

Foreign Import Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	0.86	2.75	1.82	4.77
Air	0.13	0.27	1.29	2.77
Grand Total	1.00	3.02	3.12	7.54

Table H-2-13

International Seaport and Airport Exports (Excluding NAFTA) by Mode, 2018 and 2045—Food

Source: Analysis of USDOT FAF-4 data

Foreign Export Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	0.42	4.33	2.83	9.09
Air	0.05	0.16	0.71	2.02
Grand Total	0.48	4.50	3.54	11.10

2.2.4 SUPPLY CHAIN #2: PARCELS AND SECONDARY FREIGHT

Parcels and secondary freight: including miscellaneous mixed shipments (STCC 46), small packaged freight (STCC 47), and secondary traffic (STCC 50)

DESCRIPTION OF SUPPLY CHAIN

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, DTC delivery, and e-commerce fulfillment.

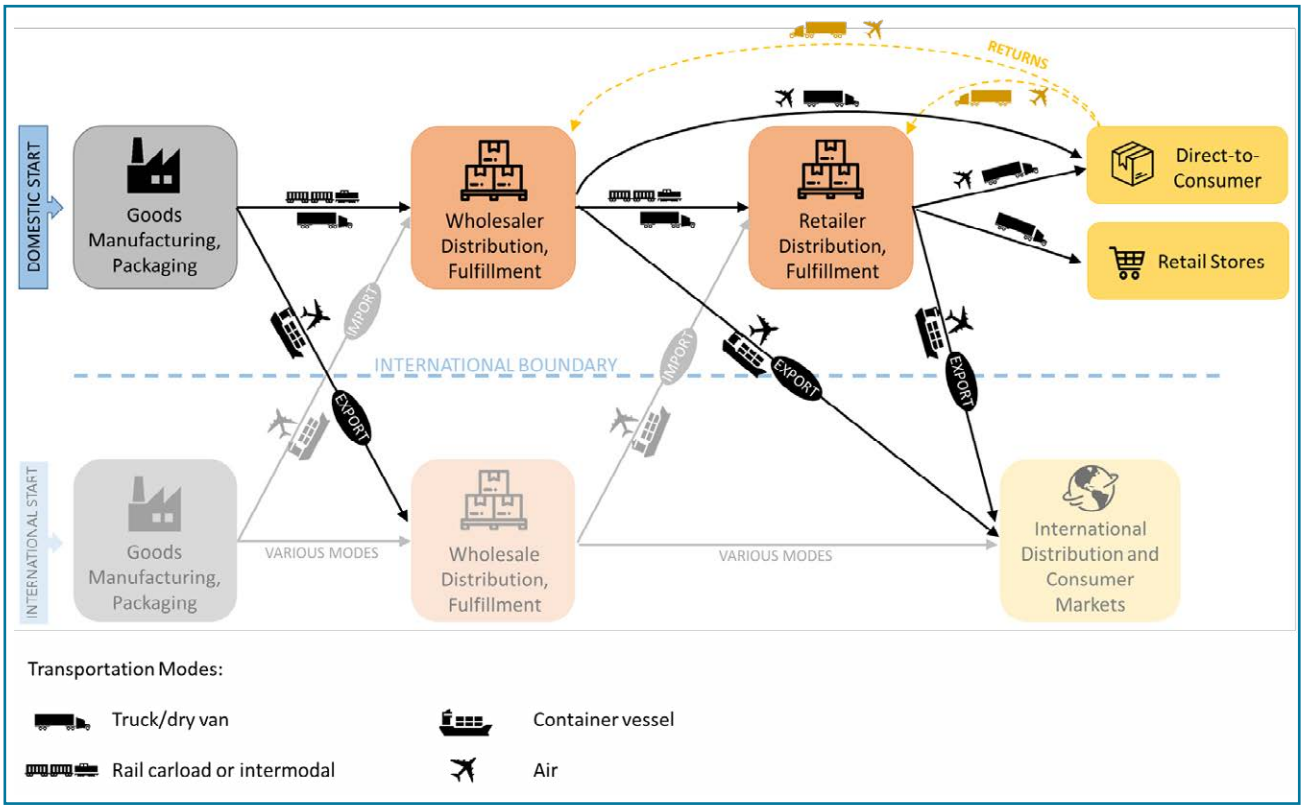
Figure H-2-11 illustrates the steps in the supply chain of parcels and secondary freight moving in the NYMTC planning area. Parcels and secondary freight consist of the movement of manufactured consumer goods through warehouses, distribution, and e-commerce fulfillment centers to retail points of sale 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 that 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. 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 H-2-11

Supply Chain Diagram—Parcels and Secondary Freight

Source: NYMTC Regional Freight Plan 2018–2045



DOMESTIC COMMODITY FLOWS (INCLUDING THE DOMESTIC LEG OF INTERNATIONAL FLOWS)

An estimated 46.6 million tons of these goods moved into, out, or within the NYMTC planning area in 2018 (*Table H-2-14*). As shown in *Table H-2-15*, just over half of these shipments traveled within or between NYMTC planning area counties; around one-third moved inbound to the planning area; and around one-sixth moved outbound. About 98 percent of goods in this group traveled by truck.

Movement of secondary freight is similar to the movement of food among NYMTC planning area counties, where New York County had the largest share of tonnage by a significant margin for parcels and secondary freight, followed by Kings, Nassau, and Queens counties (*Figure H-2-12*). Westchester, Bronx, and Richmond counties also had significant tonnage. For all counties, the predominant type of move was between the counties of the NYMTC planning area, followed by inbound moves, except for Richmond where within-county movement was the second leading flow type.

Most counties were served almost entirely by truck, except for Richmond County (with a small share of package and secondary traffic via rail) and Kings County (with a small share via water) (*Figure H-2-13*).

For the 33 percent of tonnage that was inbound, around 43 percent originated in portions of New York State outside the NYMTC planning area; around 25 percent originated in New Jersey; and around 10 percent originated in Pennsylvania (*Figure H-2-14*). By tonnage, inbound movements were primarily by truck. However, from the value perspective, there were meaningful shares of higher-value goods coming from New Jersey via water, from Missouri and Illinois via rail, and from the province of Ontario via air.

For the 16 percent of tonnage that is outbound, around 33 percent is destined for Pennsylvania, 30 percent for New York State, and 12 percent for New Jersey (*Figure H-2-15*). Trucks carry most of the tonnage and value but there are meaningful contributions by other modes—water to New Jersey; rail to Missouri, Illinois, and Ohio; and other non-truck moves.

According to *Table H-2-16*, the largest share—just over 50 percent —of parcels and secondary freight moves within the NYMTC planning area, and these movements were all served by truck. The leading origin-destination county pair moves by tonnage were:

- New York-New York, 7.3 percent
- Richmond-Richmond, 6.6 percent
- Nassau-New York, 5.5 percent
- Kings-New York, 4.8 percent

These were just the leading moves; in practice, the movements were "everywhere to everywhere" over the regional highway network. Leading origin counties were New York, Kings, Nassau, and Bronx. The leading destination county was New York.

By 2050, the current volume of 46.6 million tons is estimated to increase to 65.5 million tons of parcels and secondary freight moving in, out, and within the NYMTC planning area (*Table H-2-17*). Internal moves will continue to compose most movements, and trucks will continue to be the predominant mode.

INTERNATIONAL FLOWS

In 2018, for this supply chain, NAFTA trade with Canada and Mexico was estimated at 0.31 million tons inbound, almost wholly by truck, with a total value of nearly $1.3 billion (*Table H-2-18*). While air represented negligible tonnage, it accounted for about one-quarter of value. The forecast suggests that NAFTA tonnage and value in this supply chain will be relatively stable, or decline slightly, through 2045 (*Table H-2-18)*.[12]

In 2018, for this supply chain, all international seaports and airports in the NYMTC planning area imported and exported small volumes by tonnage and value to countries other than Canada and Mexico (*Table H-2-19* and *Table H-2-20*). However, FAF does anticipate a significant increase in the value of waterborne export value for parcels and secondary freight by water through 2045.[13] In percentage terms, the projected increase is extremely high and may represent an artifact within the FAF modeling process rather than an effect that should be reasonably expected.

Table H-2-14

Domestic Tonnage by Mode and Direction, 2018—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	15.1	0.1	0.0	0.2	0.0	15.4
Outbound from NYMTC	7.4	0.1	0.0	0.2		7.8
Between NYMTC Counties	19.4					19.4
Within NYMTC Counties	4.0					4.0
Grand Total	45.9	0.3	0.1	0.4	0.0	46.6

Table H-2-15

Domestic Tonnage Shares by Mode and Direction, 2018—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	32.4%	0.3%	0.1%	0.4%	0.0%	33.0%
Outbound from NYMTC	15.8%	0.3%	0.1%	0.5%		16.7%
Between NYMTC Counties	41.6%					41.6%
Within NYMTC Counties	8.7%					8.7%
Grand Total	98.4%	0.6%	0.1%	0.9%	0.0%	100.0%

Figure H-2-12

Domestic Tonnage by County and Direction, 2018—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

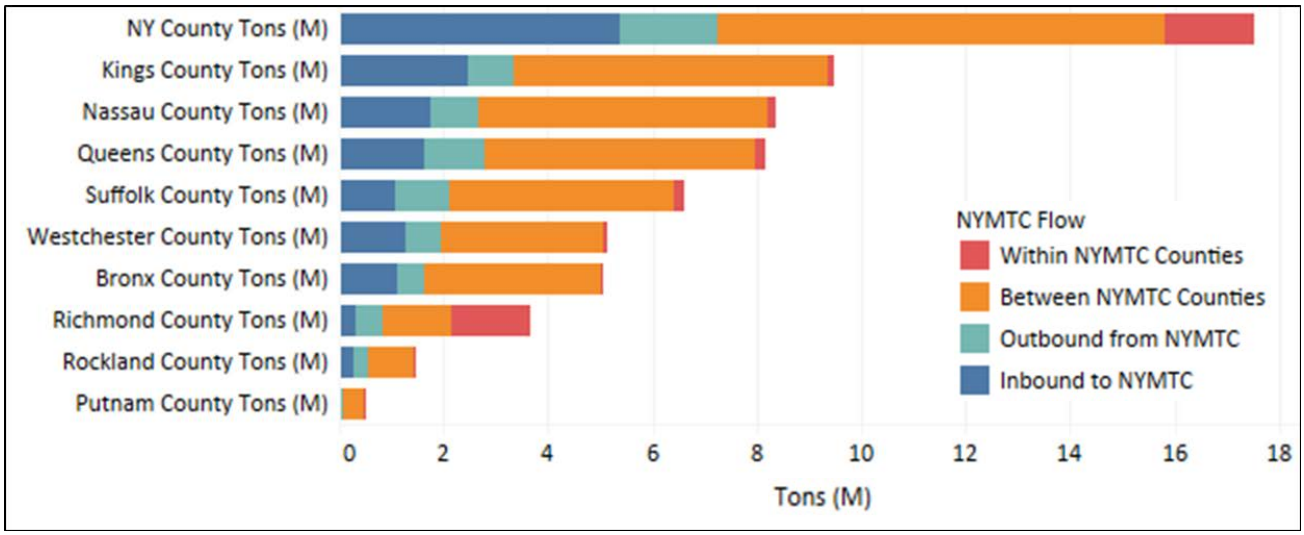


Figure H-2-13

Domestic Tonnage by County and Mode, 2018—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

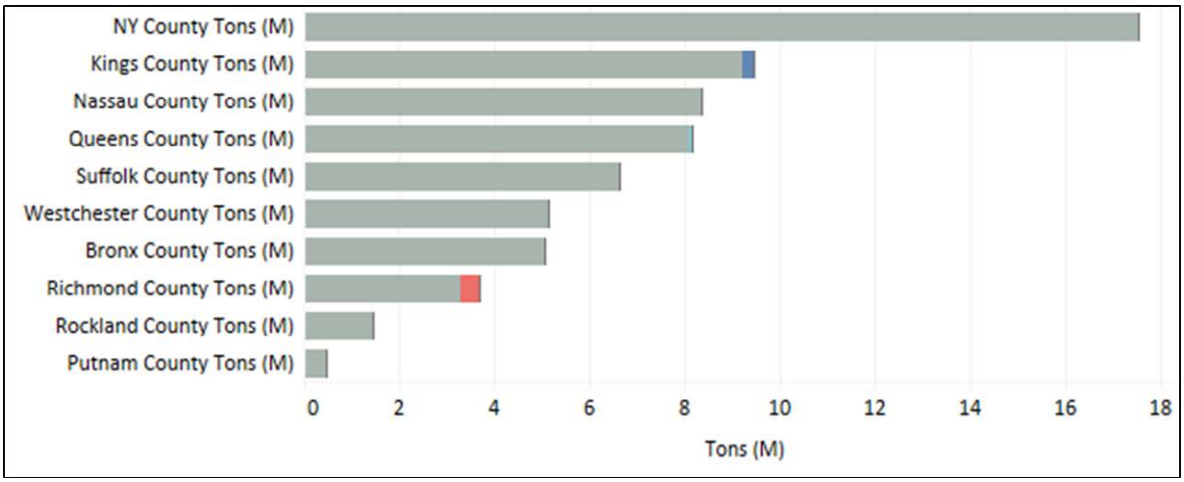


Figure H-2-14

Inbound Domestic Tonnage and Value by Origin State, 2018—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

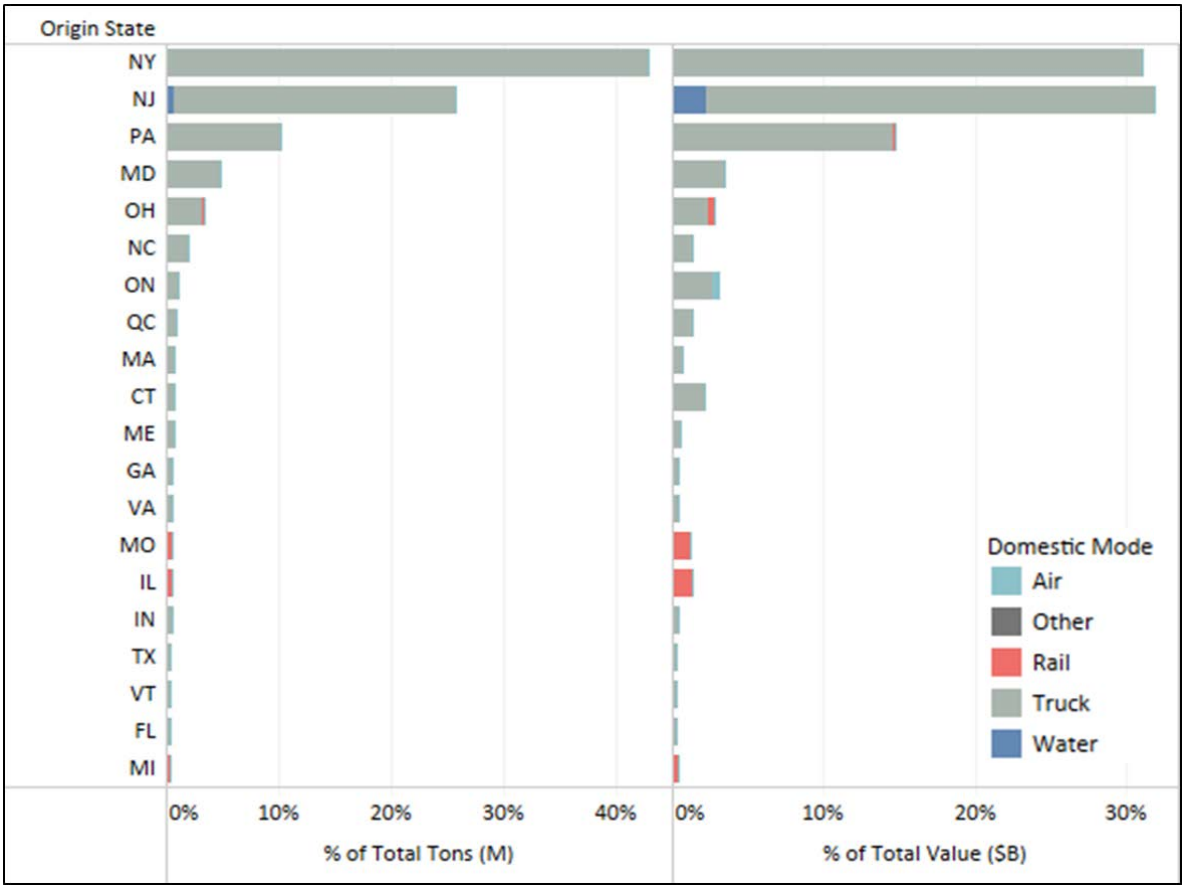


Figure H-2-15

Outbound Domestic Tonnage and Value by Destination State, 2018—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

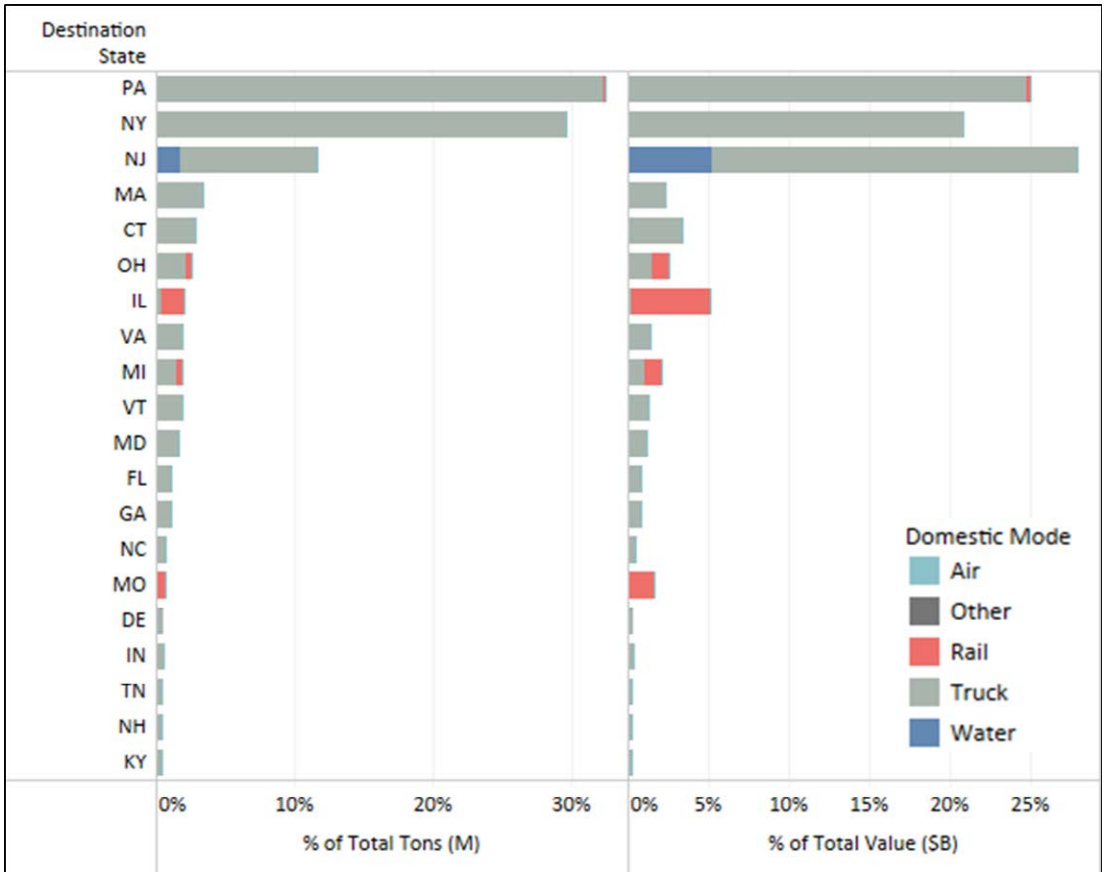


Table H-2-16

Domestic Tonnage and Value Moving Internally, 2018—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

Origin Region	Bronx County, NY	Kings County, NY	Nassau County, NY	New York County, NY	Putnam County, NY	Queens County, NY	Richmond County, NY	Rockland County, NY	Suffolk County, NY	Westchester County, NY	Grand Total
Bronx County, NY	0.2%	3.3%	1.8%	2.6%	0.1%	1.6%	0.3%	0.1%	0.8%	0.6%	11.4%
Kings County, NY	0.2%	0.5%	3.6%	4.8%	0.2%	3.4%	0.7%	0.2%	1.6%	1.1%	16.3%
Nassau County, NY	0.4%	0.8%	0.6%	5.5%	0.2%	3.3%	0.7%	0.3%	1.7%	1.2%	14.6%
New York County, NY	1.3%	2.8%	2.1%	7.3%	0.2%	3.8%	0.7%	0.5%	2.4%	2.1%	23.1%
Putnam County, NY	0.0%	0.0%	0.0%	0.1%	0.0%	0.4%	0.1%	0.0%	0.2%	0.1%	1.0%
Queens County, NY	0.5%	1.0%	0.8%	2.7%	0.0%	0.8%	0.7%	0.3%	1.8%	1.3%	9.9%
Richmond County, NY							6.6%	0.2%	1.3%	0.8%	8.9%
Rockland County, NY	0.0%	0.1%	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.9%	0.6%	2.0%
Suffolk County, NY	0.5%	1.1%	0.9%	2.9%	0.0%	0.3%	0.0%	0.1%	0.9%	1.4%	8.3%
Westchester County, NY	0.4%	0.7%	0.6%	1.9%	0.0%	0.2%	0.0%	0.1%	0.3%	0.4%	4.5%
Grand Total	3.5%	10.3%	10.3%	28.1%	0.7%	13.9%	9.9%	1.9%	12.0%	9.5%	100.0%

Table H-2-17

Domestic Tonnage and Value by Mode and Direction, 2018 and 2045—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Domestic Mode	Tons (M) 2018	Tons (M) 2045	Value ($B) 2018	Value ($B) 2045
Inbound to NYMTC	Truck	15.1	20.2	24.8	33.5
	Water	0.1	0.1	0.6	0.5
	Air	0.0	0.0	0.2	0.4
	Rail	0.2	0.2	0.8	1.0
	Other	0.0	0.0	0.0	0.0
	Total	15.4	20.5	26.4	35.3
Outbound from NYMTC	Truck	7.4	11.2	11.8	18.8
	Water	0.1	0.1	0.7	0.5
	Air	0.0	0.0	0.1	0.1
	Rail	0.2	0.2	1.2	0.9
	Total	7.8	11.5	13.8	20.2
Between NYMTC Counties	Truck	19.4	28.4	23.8	34.9
	Total	19.4	28.4	23.8	34.9
Within NYMTC Counties	Truck	4.0	5.0	11.4	13.8
	Total	4.0	5.0	11.4	13.8
Grand Total		46.6	65.5	75.3	104.1

Table H-2-18

International NAFTA Tonnage and Value by Mode, 2018 and 2045—Parcels and Secondary Freight

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Domestic Mode	Tons (M) NAFTA 2018	Tons (M) NAFTA 2045	Value ($B) NAFTA 2018	Value ($B) NAFTA 2045
Inbound to NYMTC	Truck	0.30	0.27	1.135	1.003
	Water	0.00	0.00	0.002	0.002
	Air	0.00	0.00	0.151	0.357
	Other	0.00	0.00	0.000	0.000
	Total	0.31	0.27	1.288	1.362
Outbound from NYMTC	Water	0.00	0.00	0.002	0.003
	Air	0.00	0.00	0.013	0.025
	Total	0.00	0.00	0.015	0.028
Grand Total		0.31	0.27	1.303	1.390

Table H-2-19

International Seaport and Airport Imports (Excluding NAFTA) by Mode, 2018 and 2045—Parcels and Secondary Freight

Source: Analysis of USDOT FAF-4 data

Foreign Import Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	0.00	0.00	0.00	0.02
Air	0.00	0.02	0.22	1.16
Grand Total	0.00	0.02	0.22	1.18

Table H-2-20

International Seaport and Airport Exports (ex. NAFTA) by Mode, 2018 and 2045—Parcels and Secondary Freight

Source: Analysis of USDOT FAF-4 data

Foreign Export Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	0.02	0.14	0.49	16.19
Air	0.00	0.00	0.09	5.54
Grand Total	0.02	0.14	0.59	21.73

CRITICAL INFRASTRUCTURE

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 counties in the planning area 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, I-87 and I-684 and I-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.

2.2.5 SUPPLY CHAIN #3: CONSTRUCTION MATERIALS

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)

DESCRIPTION OF SUPPLY CHAIN

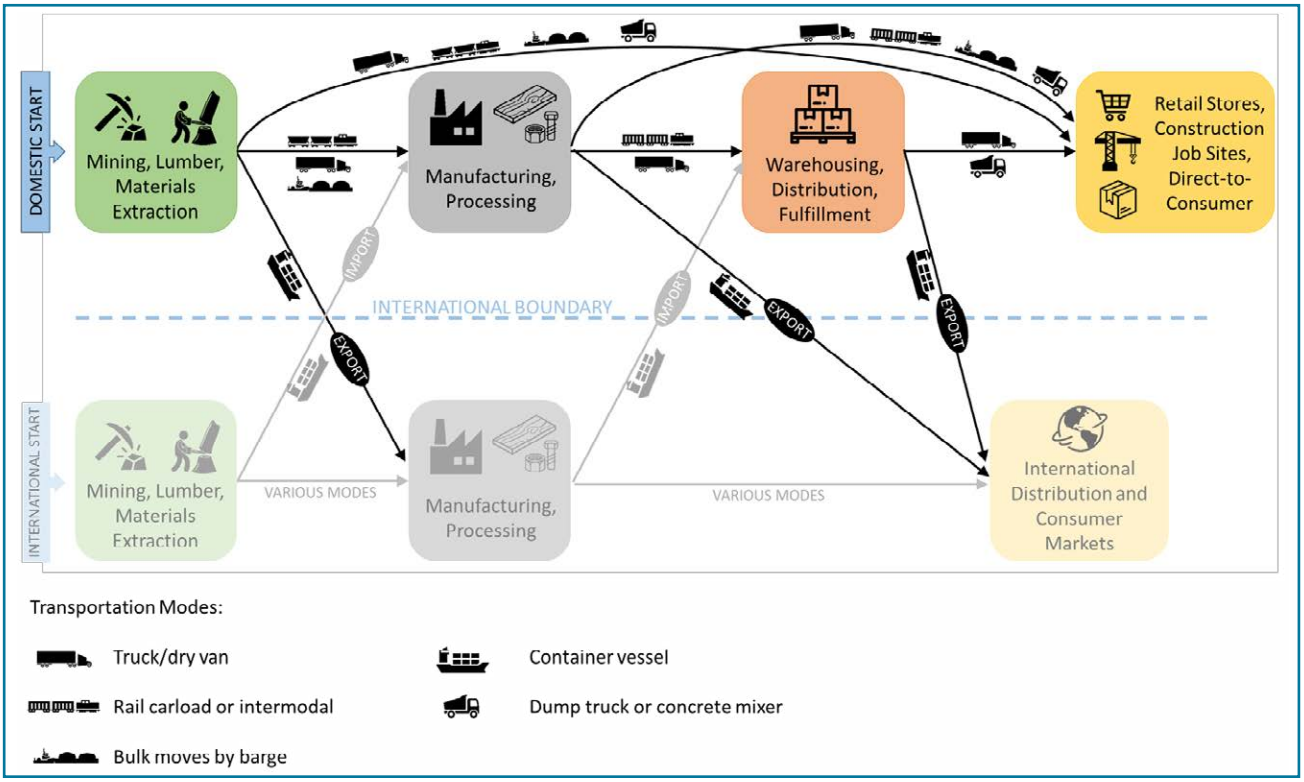
Construction materials include nonmetallic minerals, lumber, clay, concrete, glass, or stone products, primary metals, and fabricated metals. *Figure H-2-16* illustrates the steps in the supply chain of construction materials moving in the NYMTC planning area. Because construction materials tend to be 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 usually 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. For example, World Trade Center reconstruction 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 H-2-16

Supply Chain Diagram—Construction Materials

Source: NYMTC Regional Freight Plan 2018–2045



DOMESTIC COMMODITY FLOWS (INCLUDING THE DOMESTIC LEG OF INTERNATIONAL FLOWS)

In 2018 approximately 112.7 million tons of these commodities moved to, from, or within the NYMTC planning area (*Table H-2-21*). About 70 percent moved in the inbound direction, 12 percent moved in the outbound direction, and 18 percent moved within the planning area (*Table H-2-22*). About 94 percent of these products moved by truck, 5 percent by water, and 1 percent by rail.

Among the NYMTC planning area counties, the leading counties for tonnage handled were Queens, New York, and Suffolk; inbound and within-region flows dominated in each county, although Queens and Suffolk counties also generated some outbound flows (*Figure H-2-17* and *Figure H-2-18*). The next leading counties were Kings, Westchester, Nassau and Rockland; Rockland County is notable because it had more outbound and within-region tonnage than inbound tonnage.

Truck was the dominant mode for all counties, but most counties also handled construction materials by water, rail, or both modes. Additionally, Queens County handled a significant amount of valuable construction materials via air, which do not appear in the tonnage summaries.

Table H-2-21

Domestic Tonnage by Mode and Direction, 2018—Construction Materials

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	73.3	4.1	0.0	1.1		78.5
Outbound from NYMTC	13.1	0.3	0.0	0.0	0.0	13.5
Between NYMTC Counties	15.4	0.7				16.1
Within NYMTC Counties	4.4	0.2				4.6
Grand Total	106.3	5.2	0.0	1.2	0.0	112.7

Table H-2-22

Domestic Tonnage Shares by Mode and Direction, 2018—Construction Materials

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	65.0%	3.6%	0.0%	1.0%		69.7%
Outbound from NYMTC	11.6%	0.3%	0.0%	0.0%	0.0%	12.0%
Between NYMTC Counties	13.7%	0.6%				14.3%
Within NYMTC Counties	3.9%	0.2%				4.1%
Grand Total	94.3%	4.6%	0.0%	1.0%	0.0%	100.0%

Figure H-2-17

Domestic Tonnage by County and Direction, 2018—Construction Materials

Source: Analysis of NYSDOT Transearch data

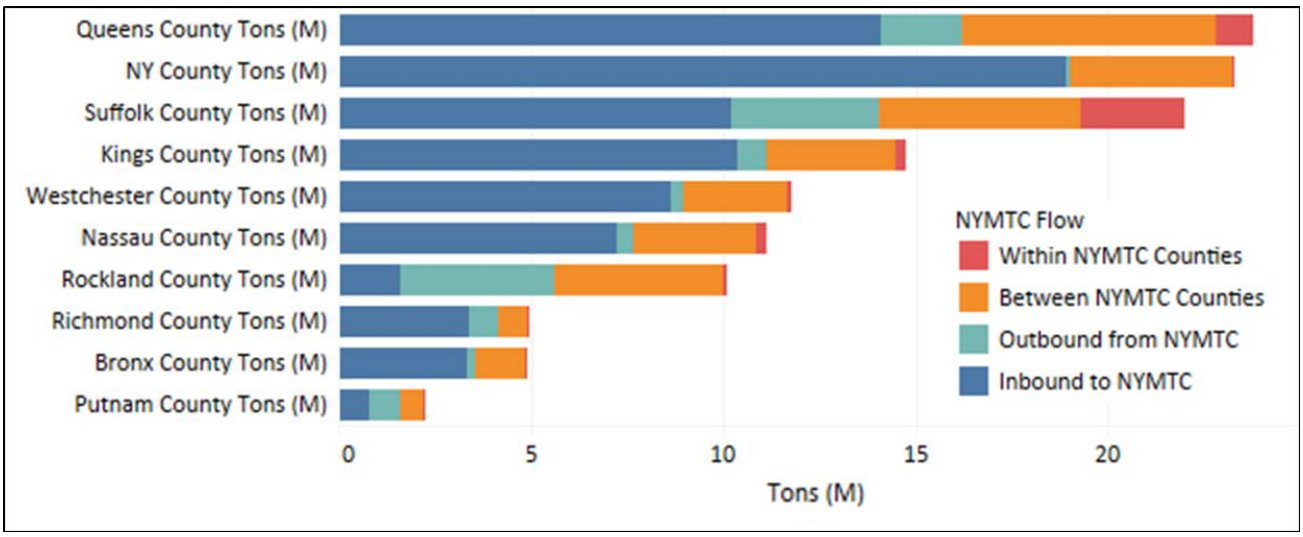
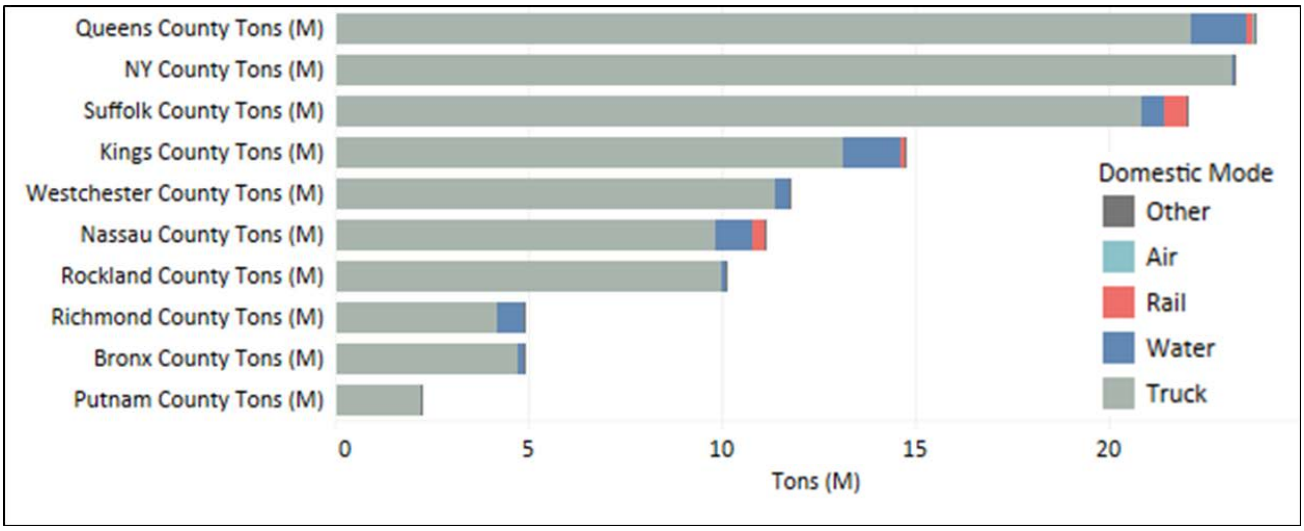


Figure H-2-18

Domestic Tonnage by County and Mode, 2018—Construction Materials

Source: Analysis of NYSDOT Transearch data



For the 70 percent of tonnage that was inbound, volumes were concentrated in three primary nearby states—around 30 percent arrived from Pennsylvania, 22 percent arrived from New Jersey, and 17 percent arrived from New York State (*Figure H-2-19*). From the perspective of value, sourcing was distributed over a much larger range of states, representing the movement of higher-value construction materials over longer distances. For tonnage, the primary mode was truck, although water and rail flows from New York State and rail flows from Connecticut were significant. For value, truck remained the primary mode, but air cargo became important for the movement of higher-value items from Quebec and Ontario.

For the 12 percent of tonnage that was outbound, the leading destination by far was New Jersey (53 percent) followed by other nearby states (Pennsylvania, Connecticut, New York, and Massachusetts), and movements were almost entirely by truck (*Figure H-2-20*). Like inbound value, the distribution of outbound value was more diversified, including not only nearby states but also more distant states, and including significant rail (Virginia, North Carolina) and air cargo movements (California).

For the 18 percent of tonnage moving within or between NYMTC planning area counties, movements were entirely by truck (*Table H-2-23*). Suffolk-Suffolk was by far the most significant move (12.9 percent of this tonnage), followed by 13 other origin-destination pairs with at least a 2 percent share of tonnage. Suffolk, Queens, and Rockland were the leading origin counties; Suffolk, New York, and Queens were the leading destination counties.

By 2045, the movement of construction materials is expected to grow from 112.7 to 158.1 million tons (*Table H-2-24*). Most of the growth is related to inbound tonnage, and trucking will remain the predominant mode, although water is expected to see tonnage gains as well.

INTERNATIONAL FLOWS

In 2018, for this supply chain, NAFTA trade with Canada and Mexico was estimated at 1.72 million tons with a total value of more than $2.8 billion (*Table H-2-25*). Water accounted for more than half of tonnage, while air accounted for more than one-third of value. The forecast suggests that NAFTA tonnage will roughly double through 2045, and value will increase substantially as well.[14]

In 2018, for this supply chain, international seaports and airports in the NYMTC planning area imported an estimated 2.1 million tons and exported an estimated 1.7 million tons, excluding Canada and Mexico (*Table H-2-26* and *Table H-2-27*). Import tonnage was higher by water and import value was higher by air; for exports, water had the leading shares of tonnage and value, but air also handled significant value. FAF anticipates declining import tonnage, increasing export tonnage, and dramatically increasing value in both directions.[15] Similar to parcels and secondary freight, the projected increase in value seems disproportionate, and may represent an artifact within the FAF modeling process rather than an effect that should be reasonably expected.

CRITICAL INFRASTRUCTURE

The routes used to transport construction materials in the planning area include I-95 and the George Washington Bridge, along with the I-78 and I-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, I-287, I-87, I-95, I-295, I-495, and I-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 typically handle these shipments.

Figure H-2-19

Inbound Domestic Tonnage and Value by Origin State, 2018—Construction Materials

Source: Analysis of NYSDOT Transearch data

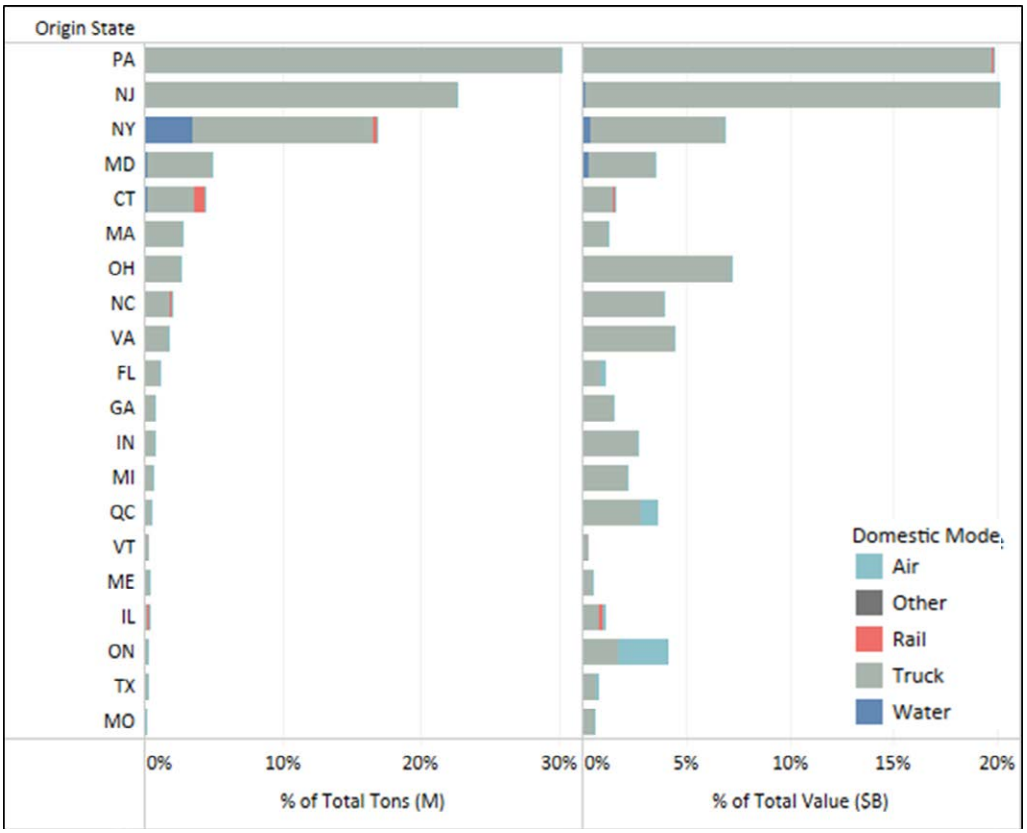


Figure H-2-20

Outbound Domestic Tonnage and Value by Destination State, 2018—Construction Materials

Source: Analysis of NYSDOT Transearch data

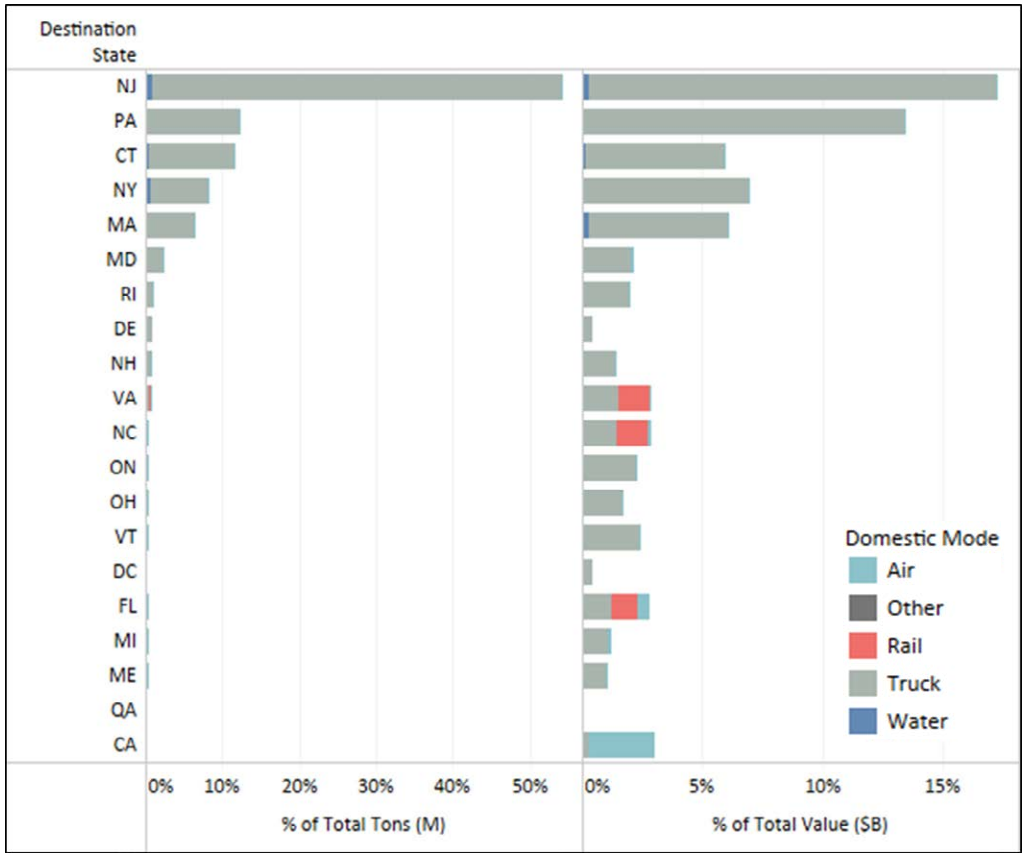


Table H-2-23

Domestic Tonnage and Value Moving Internally, 2018—Construction Materials

Source: Analysis of NYSDOT Transearch data

Origin Region	Bronx County, NY	Kings County, NY	Nassau County, NY	New York County, NY	Putnam County, NY	Queens County, NY	Richmond County, NY	Rockland County, NY	Suffolk County, NY	Westchester County, NY	Grand Total
Bronx County, NY	0.2%	0.2%	0.2%	0.0%	0.0%	0.6%	0.0%	0.1%	0.3%	0.6%	2.4%
Kings County, NY	0.2%	1.3%	0.6%	3.2%	0.0%	1.8%	0.3%	0.1%	0.8%	0.6%	8.8%
Nassau County, NY	0.4%	1.0%	1.3%	0.6%	0.0%	1.1%	0.1%	0.1%	1.3%	0.6%	6.6%
New York County, NY	0.0%	0.1%	0.1%	0.2%	0.0%	0.2%	0.0%	0.0%	0.1%	0.1%	0.7%
Putnam County, NY	0.1%	0.2%	0.2%	0.5%	0.1%	0.5%	0.0%	0.1%	0.3%	0.6%	2.6%
Queens County, NY	1.1%	2.8%	3.7%	5.9%	0.1%	4.8%	0.3%	0.3%	2.4%	2.0%	23.5%
Richmond County, NY	0.1%	0.6%	0.2%	0.5%	0.0%	0.3%	0.1%	0.0%	0.3%	0.2%	2.3%
Rockland County, NY	0.7%	1.4%	1.8%	3.6%	0.2%	4.6%	0.3%	0.7%	1.8%	5.4%	20.6%
Suffolk County, NY	1.3%	2.3%	3.2%	4.8%	0.1%	3.6%	0.3%	0.3%	13.2%	1.8%	30.9%
Westchester County, NY	0.2%	0.2%	0.1%	0.5%	0.0%	0.2%	0.0%	0.1%	0.2%	0.3%	1.8%
Grand Total	4.2%	10.1%	11.4%	19.8%	0.7%	17.7%	1.4%	1.8%	20.6%	12.2%	100.0%

Table H-2-24

Domestic Tonnage and Value by Mode and Direction, 2018 and 2045—Construction Materials

Source: Analysis of NYSDOT Transearch data

		Tons (M)		Value ($B)	
NYMTC Flow	Domestic Mode	2018	2045	2018	2045
Inbound to NYMTC	Truck	73.3	106.1	28.0	49.4
	Water	4.1	6.2	0.3	0.3
	Air	0.0	0.0	1.6	2.2
	Rail	1.1	1.1	0.2	0.2
	Total	78.5	113.5	30.1	52.1
Outbound from NYMTC	Truck	13.1	15.1	3.6	5.7
	Water	0.3	0.7	0.0	0.1
	Air	0.0	0.0	0.7	1.1
	Rail	0.0	0.1	0.2	0.4
	Other	0.0	0.0	0.0	0.0
	Total	13.5	15.9	4.5	7.3
Between NYMTC Counties	Truck	15.4	20.3	2.5	4.6
	Water	0.7	1.5	0.0	0.0
	Total	16.1	21.8	2.5	4.6
Within NYMTC Counties	Truck	4.4	6.7	0.6	0.9
	Water	0.2	0.2	0.0	0.0
	Total	4.6	6.9	0.7	0.9
Grand Total		112.7	158.1	37.8	64.9

Table H-2-25

International NAFTA Tonnage and Value by Mode, 2018 and 2045—Construction Materials

Source: Analysis of NYSDOT Transearch data

		Tons (M) NAFTA		Value ($B) NAFTA	
NYMTC Flow	Domestic Mode	2018	2045	2018	2045
Inbound to NYMTC	Truck	0.73	1.19	1.520	2.986
	Water	0.88	2.22	0.010	0.024
	Air	0.00	0.00	1.049	1.502
	Rail	0.05	0.02	0.014	0.012
	Total	1.66	3.43	2.593	4.525
Outbound from NYMTC	Truck	0.06	0.10	0.180	0.294
	Water	0.00	0.01	0.001	0.013
	Air	0.00	0.00	0.079	0.058
	Other	0.00	0.00	0.000	0.000
	Total	0.06	0.10	0.261	0.365
Grand Total		1.72	3.53	2.854	4.890

Table H-2-26

International Seaport and Airport Imports (Excluding NAFTA) by Mode, 2018 and 2045— Construction Materials

Source: Analysis of USDOT FAF-4 data

Foreign Import Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	2.08	1.58	0.33	2.15
Air	0.02	0.08	0.58	1.81
Grand Total	2.11	1.65	0.91	3.96

Table H-2-27

International Seaport and Airport Exports (Excluding NAFTA) by Mode, 2018 and 2045—Construction Materials

Source: Analysis of USDOT FAF-4 data

Foreign Export Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	1.65	2.76	1.86	7.59
Air	0.04	0.16	1.06	3.91
Grand Total	1.69	2.91	2.92	11.49

SUPPLY CHAIN #4: ENERGY PRODUCTS

Energy products: *including coal (STCC 11), crude petroleum or natural gas (STCC 13), and refined petroleum products (STCC 29)*

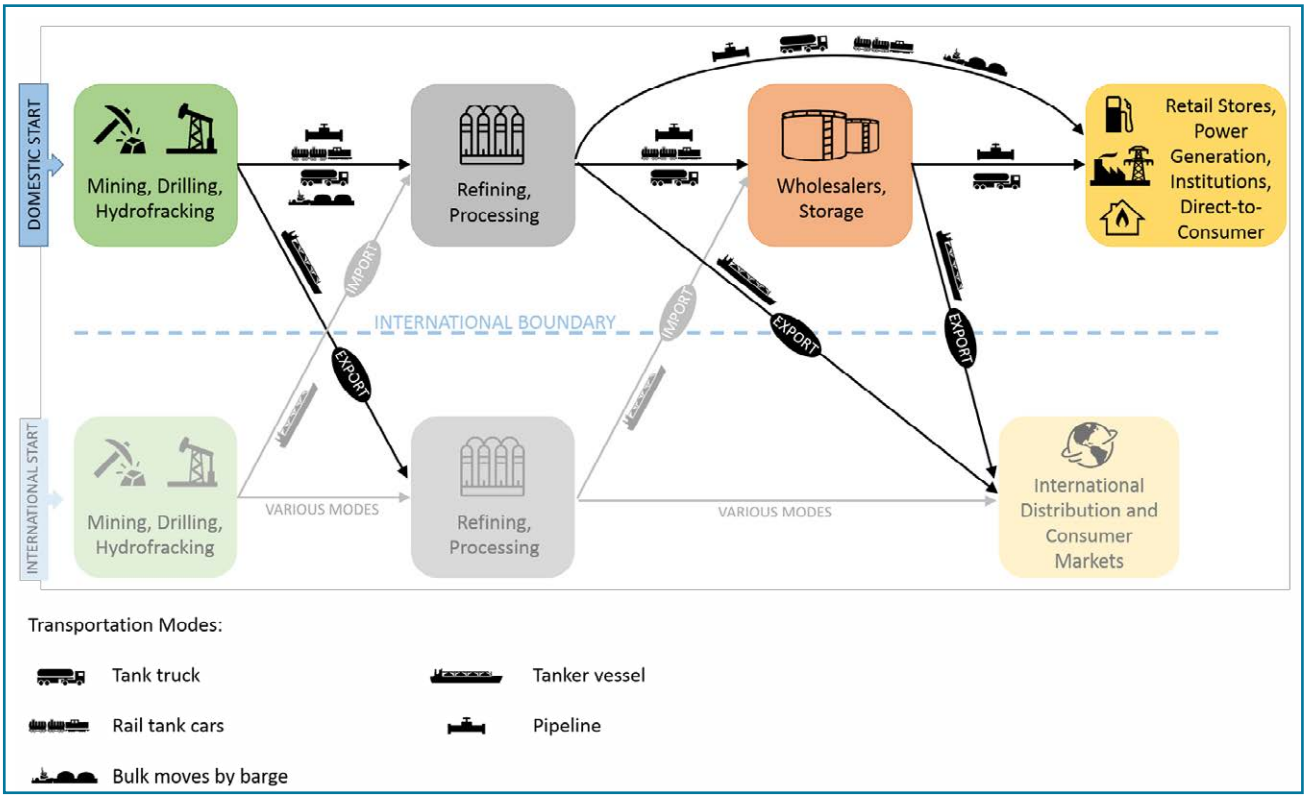
DESCRIPTION OF SUPPLY CHAIN

Energy products include crude petroleum or natural gas and refined petroleum products. These products are used for transportation and heating fuels and industrial applications. ***Figure H-2-21*** 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 H-2-21

Supply Chain Diagram—Energy Products

Source: NYMTC Regional Freight Plan 2018–2045



DOMESTIC COMMODITY FLOWS (INCLUDING DOMESTIC LEG OF INTERNATIONAL FLOWS)

In 2018, about 43.5 million tons of energy products were transported into, out of, or within the NYMTC planning area (*Table H-2-28*). Around 57 percent of tonnage was moved into the NYMTC planning area; 20 percent was moved out of the area; and 23 percent was moved within the planning area. Trucks carried almost 79 percent of energy products in the planning area, but water also had a substantial 21 percent share (*Table H-2-29*).

Among NYMTC planning area counties, the leading counties for tonnage handled were Suffolk and New York; Suffolk tonnage was relatively balanced between inbound, outbound, and internal movements, while New York tonnage was primarily inbound and between counties (*Figure H-2-22*). The next leading counties were Nassau, Westchester, Kings, Queens, Richmond, and Bronx.

Trucking was the most important mode for all counties, but water played a significant role for most counties, and in the case of Richmond, it was the dominant mode (*Figure H-2-23*).

For the 57 percent of tonnage that was inbound, more than half came from New Jersey; and of the amount from New Jersey, nearly half arrived by water (*Figure H-2-24*). Other significant origins included Pennsylvania, New York, and Connecticut. Unlike building materials, origins by tonnage and by value for energy products were nearly identical, because the products tended to be similar in value across different geographic sources.

For the 20 percent of tonnage that was outbound, the primary destination was New Jersey, which had nearly 60 percent of these flows; trucking was the primary mode, but water also had a significant share (*Figure H-2-25*). Other significant destinations included Pennsylvania (via truck), Connecticut (via truck and water), New York State (via water with truck), Massachusetts (mostly via water), and Rhode Island (via water). For the 23 percent of tonnage moving within and between NYMTC planning area counties, the leading origin-destination pairs were Suffolk-Suffolk, Suffolk-New York, and Suffolk-Nassau (*Table H-2-30*). Around 42.5 percent of internal tonnage originated in Suffolk County; leading destinations were New York County (22.6 percent), Suffolk County (17.8 percent), Nassau County (14.4 percent), Queens County (12.4 percent), and Kings County (11.5 percent).

By 2045, the movement of energy products is expected to grow modestly, from 43.5 million tons to 50.6 million tons (*Table H-2-31*). Inbound tonnage is projected to decline slightly, while outbound and internal tonnage is projected to increase. Water tonnages are projected to remain constant, with all growth coming from trucking.

INTERNATIONAL FLOWS

In 2018, for this supply chain, NAFTA trade with Canada and Mexico was estimated at 0.34 million tons with a total value of around $0.55 billion (*Table H-2-32*). Slightly more tonnage was outbound than inbound, and water handled three-fourths of tonnage. Through 2045, inbound tonnage is projected to decrease and outbound tonnage is projected to increase, leading to an overall increase to 0.55 million tons.[16]

In 2018, for this supply chain, international seaports and airports in the NYMTC planning area imported an estimated 1.7 million tons and exported an estimated 0.06 million tons, excluding Canada and Mexico, almost exclusively by water (*Table H-2-33* and *Table H-2-34*).[17] Imports are projected to decline to near zero, but exports are projected to increase, leading to a net gain in international waterborne tonnage.

CRITICAL INFRASTRUCTURE

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 I-95, I-78, I-80, I-278, I-678, I-295, and I-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.

Table H-2-28

Domestic Tonnage by Mode and Direction, 2018—Energy Products

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	18.2	6.6	0.0	0.0		24.9
Outbound from NYMTC	6.8	1.9	0.0		0.0	8.7
Between NYMTC Counties	6.6	0.6				7.2
Within NYMTC Counties	2.7	0.0				2.7
Grand Total	34.3	9.1	0.0	0.0	0.0	43.5

Table H-2-29

Domestic Tonnage Shares by Mode and Direction, 2018—Energy Products

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	41.9%	15.2%	0.0%	0.1%		57.2%
Outbound from NYMTC	15.6%	4.4%	0.0%		0.0%	20.0%
Between NYMTC Counties	15.3%	1.3%				16.5%
Within NYMTC Counties	6.2%	0.1%				6.3%
Grand Total	78.9%	20.9%	0.0%	0.1%	0.0%	100.0%

Figure H-2-22

Domestic Tonnage by County and Direction, 2018—Energy Products

Source: Analysis of NYSDOT Transearch data

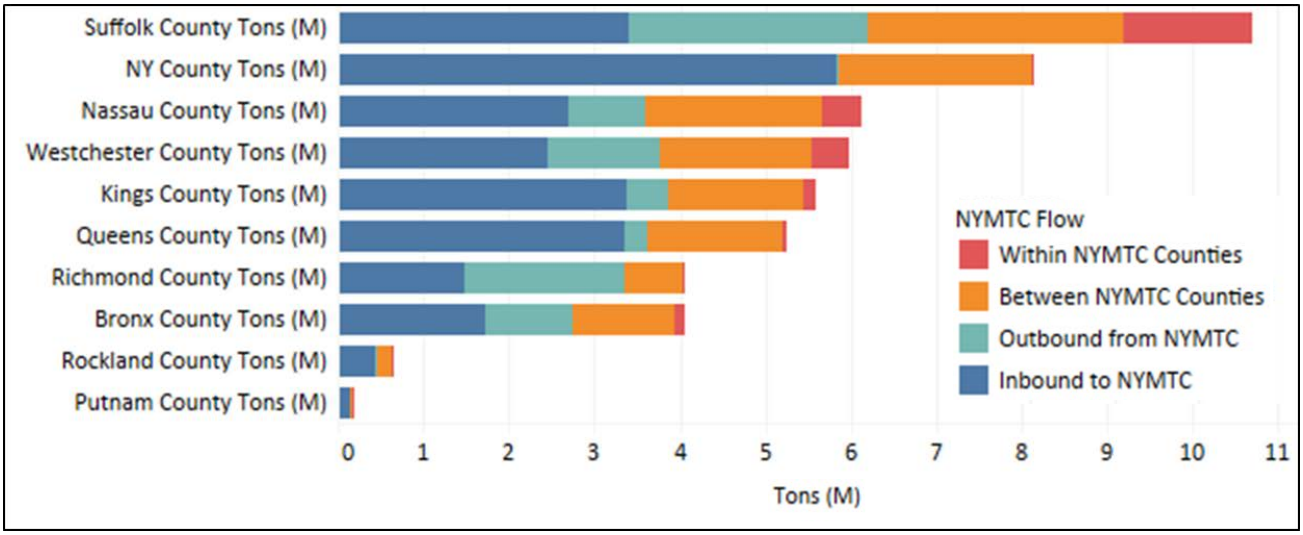


Figure H-2-23

Domestic Tonnage by County and Mode, 2018—Energy Products

Source: Analysis of NYSDOT Transearch data

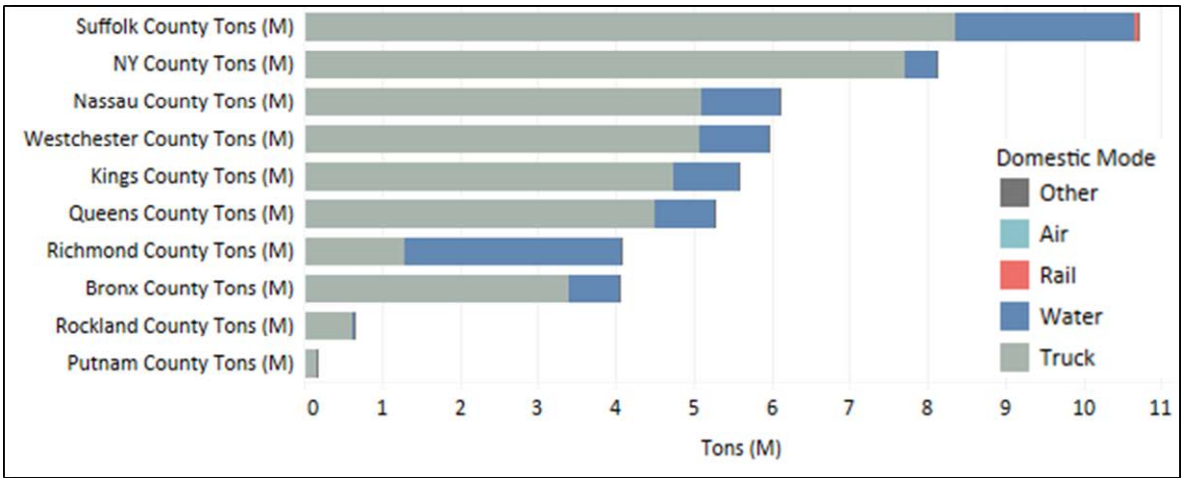


Figure H-2-24

Inbound Domestic Tonnage and Value by Origin State, 2018—Energy Products

Source: Analysis of NYSDOT Transearch data

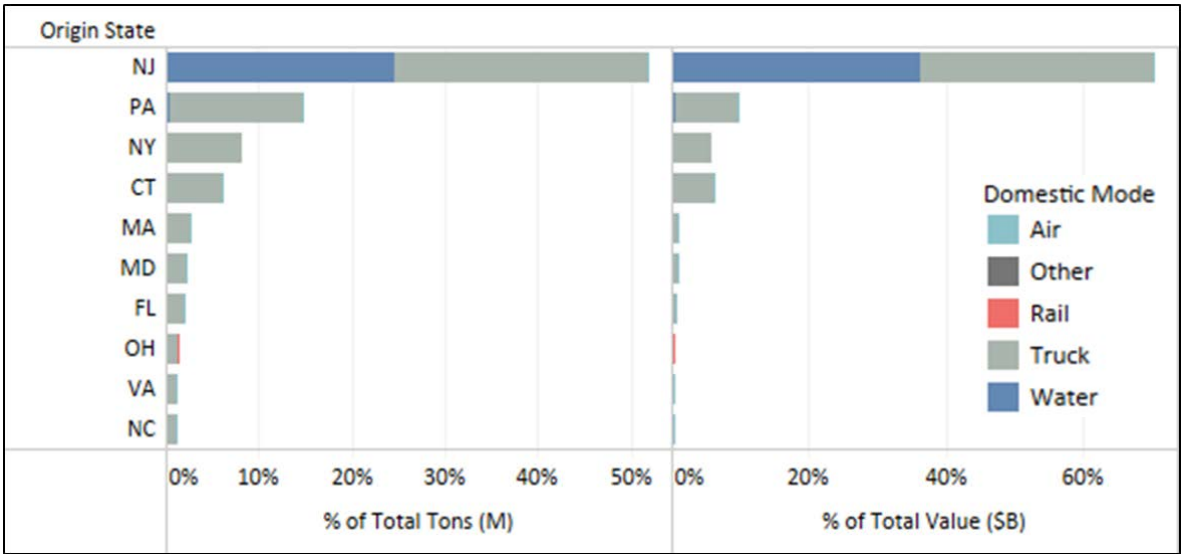


Figure H-2-25

Outbound Domestic Tonnage and Value by Destination State, 2018—Energy Products

Source: Analysis of NYSDOT Transearch data

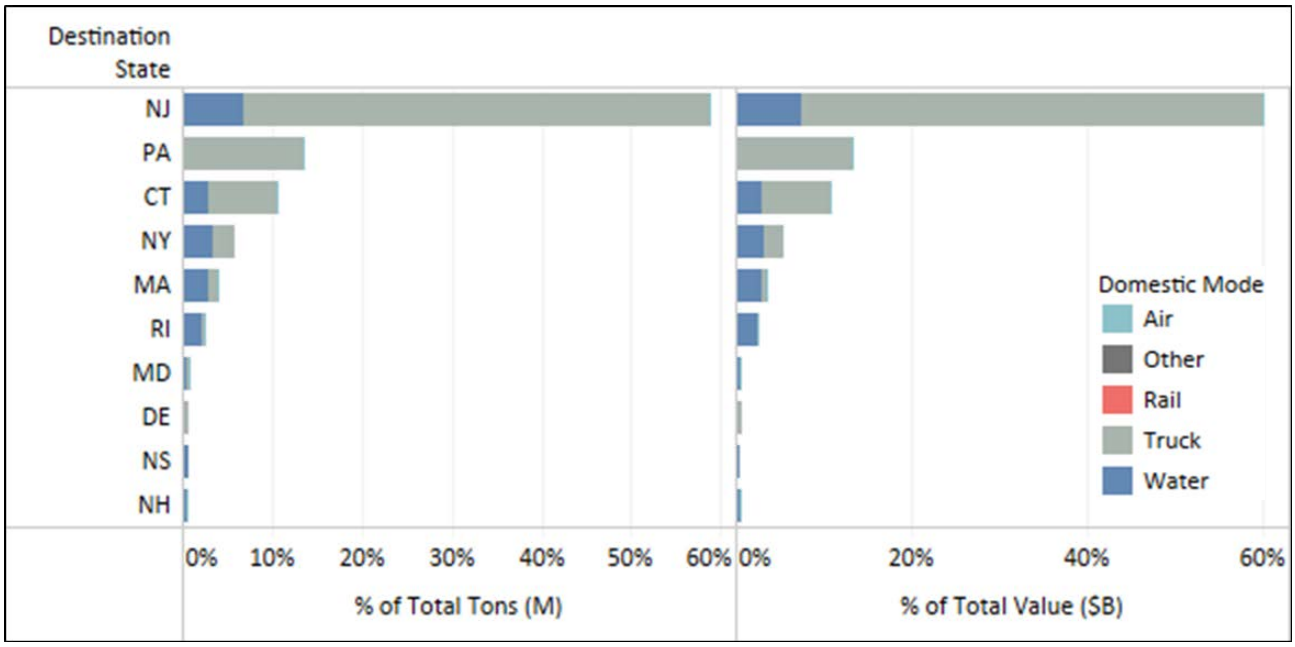


Table H-2-30

Domestic Tonnage and Value Moving Internally, 2018—Energy Products

Source: Analysis of NYSDOT Transearch data

Origin Region	Bronx County, NY	Kings County, NY	Nassau County, NY	New York County, NY	Putnam County, NY	Queens County, NY	Richmond County, NY	Rockland County, NY	Suffolk County, NY	Westchester County, NY	Grand Total
Bronx County, NY	0.2%	0.2%	0.2%	0.0%	0.0%	0.6%	0.0%	0.1%	0.3%	0.6%	2.4%
Kings County, NY	0.2%	1.3%	0.6%	3.2%	0.0%	1.8%	0.3%	0.1%	0.8%	0.6%	8.8%
Nassau County, NY	0.4%	1.0%	1.3%	0.6%	0.0%	1.1%	0.1%	0.1%	1.3%	0.6%	6.6%
New York County, NY	0.0%	0.1%	0.1%	0.2%	0.0%	0.2%	0.0%	0.0%	0.1%	0.1%	0.7%
Putnam County, NY	0.1%	0.2%	0.2%	0.5%	0.1%	0.5%	0.0%	0.1%	0.3%	0.6%	2.6%
Queens County, NY	1.1%	2.8%	3.7%	5.9%	0.1%	4.8%	0.3%	0.3%	2.4%	2.0%	23.5%
Richmond County, NY	0.1%	0.6%	0.2%	0.5%	0.0%	0.3%	0.1%	0.0%	0.3%	0.2%	2.3%
Rockland County, NY	0.7%	1.4%	1.8%	3.6%	0.2%	4.6%	0.3%	0.7%	1.8%	5.4%	20.6%
Suffolk County, NY	1.3%	2.3%	3.2%	4.8%	0.1%	3.6%	0.3%	0.3%	13.2%	1.8%	30.9%
Westchester County, NY	0.2%	0.2%	0.1%	0.5%	0.0%	0.2%	0.0%	0.1%	0.2%	0.3%	1.8%
Grand Total	4.2%	10.1%	11.4%	19.8%	0.7%	17.7%	1.4%	1.8%	20.6%	12.2%	100.0%

Table H-2-31

Domestic Tonnage and Value by Mode and Direction, 2018 and 2045—Energy Products

Source: Analysis of NYSDOT Transearch data

		Tons (M)		Value ($B)	
NYMTC Flow	Domestic Mode	2018	2045	2018	2045
Inbound to NYMTC	Truck	18.2	17.3	7.39	7.78
	Water	6.6	6.7	4.70	4.75
	Air	0.0	0.0	0.00	0.00
	Rail	0.0	0.0	0.02	0.02
	Total	24.9	24.1	12.12	12.55
Outbound from NYMTC	Truck	6.8	10.1	4.34	6.59
	Water	1.9	1.5	1.27	0.92
	Air	0.0	0.0	0.00	0.00
	Other	0.0	0.0	0.00	0.00
	Total	8.7	11.5	5.60	7.52
Between NYMTC Counties	Truck	6.6	9.5	4.27	6.31
	Water	0.6	0.7	0.36	0.41
	Total	7.2	10.2	4.63	6.71
Within NYMTC Counties	Truck	2.7	4.8	1.75	3.21
	Water	0.0	0.0	0.02	0.02
	Total	2.7	4.8	1.77	3.23
Grand Total		43.5	50.6	24.12	30.01

Table H-2-32

International NAFTA Tonnage and Value by Mode, 2018 and 2045—Energy Products

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Domestic Mode	Tons (M) NAFTA 2018	Tons (M) NAFTA 2045	Value ($B) NAFTA 2018	Value ($B) NAFTA 2045
Inbound to NYMTC	Truck	0.06	0.11	0.0323	0.0501
	Water	0.17	0.09	0.0787	0.0402
	Rail	0.00	0.00	0.0011	0.0000
	Total	0.23	0.19	0.1121	0.0904
Outbound from NYMTC	Truck	0.02	0.05	0.0091	0.0184
	Water	0.08	0.31	0.0466	0.1691
	Other	0.00	0.00	0.0000	0.0000
	Total	0.11	0.36	0.0557	0.1875
Grand Total		0.34	0.55	0.1678	0.2778

Table H-2-33

International Seaport and Airport Imports (Excluding NAFTA) by Mode, 2018 and 2045—Energy Products

Source: Analysis of USDOT FAF-4 data

Foreign Import Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	1.70	0.00	0.10	0.00
Air	0.00	0.00	0.00	0.00
Grand Total	1.70	0.00	0.10	0.00

Table H-2-34

International Seaport and Airport Exports (Excluding NAFTA) by Mode, 2018 and 2045—Energy Products

Source: Analysis of USDOT FAF-4 data

Foreign Export Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	0.06	0.45	0.14	0.96
Air	0.00	0.00	0.00	0.00
Grand Total	0.06	0.45	0.14	0.96

2.2.6 SUPPLY CHAIN #5: PHARMACEUTICAL DRUGS

Pharmaceutical drugs: (STCC 283)

DESCRIPTION OF SUPPLY CHAIN

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. *Figure H-2-26* 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.

DOMESTIC COMMODITY FLOWS (INCLUDING DOMESTIC LEG OF INTERNATIONAL FLOWS)

In 2018, slightly more than 1 million tons of pharmaceutical drugs traveled into, out of, and within the NYMTC planning area (*Table H-2-35*). Around 33 percent traveled in the inbound direction, 44 percent moved outbound, and 23 percent moved within the planning area (*Table H-2-36*). Due to the time-sensitivity and very high value of pharmaceutical drugs, about 99 percent of the pharmaceutical drugs moved by truck, and 1 percent by air; no tonnage is reported for other modes.

Figure H-2-26

Supply Chain Diagram—Pharmaceutical Drugs

Source: NYMTC Regional Freight Plan 2018–2045

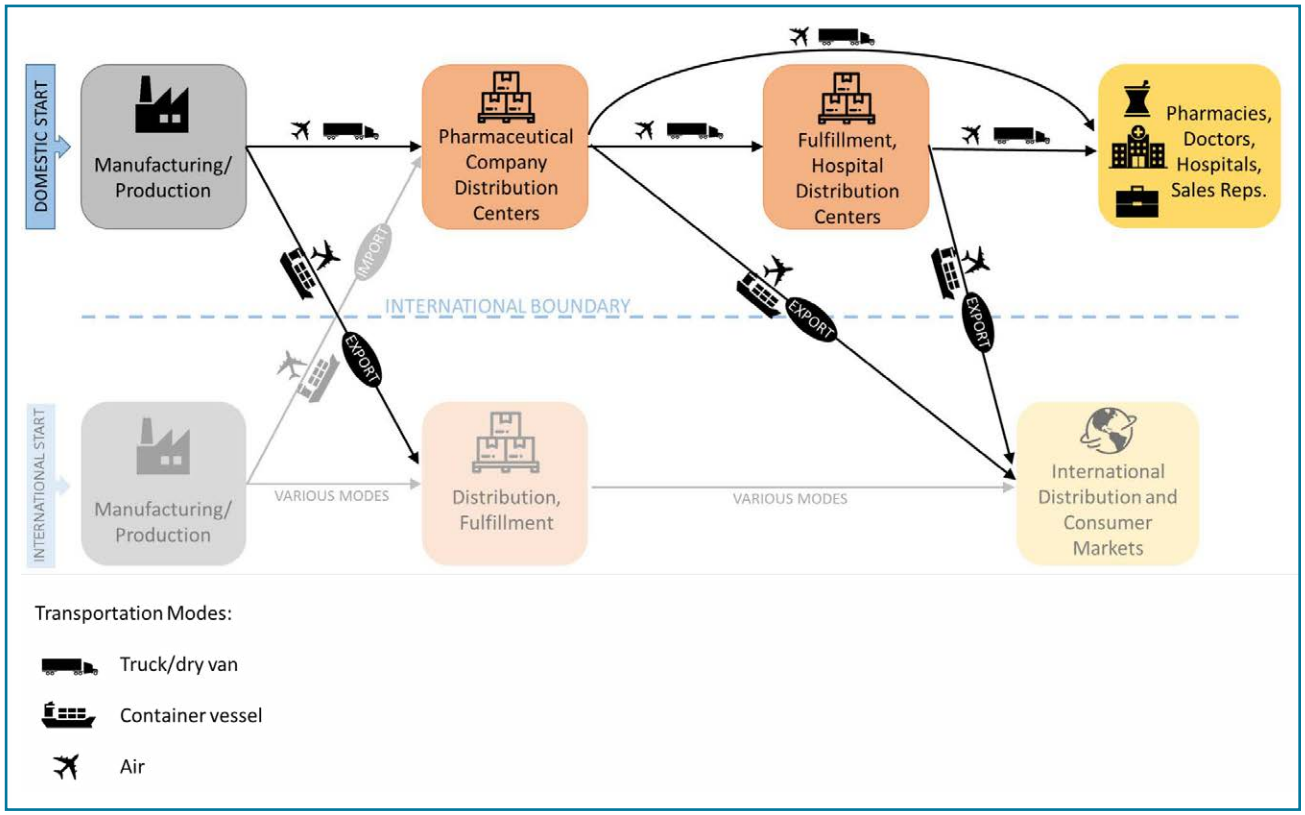


Table H-2-35

Domestic Tonnage by Mode and Direction, 2018—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Air	Grand Total
Inbound to NYMTC	0.33	0.00	0.33
Outbound from NYMTC	0.45	0.00	0.45
Between NYMTC Counties	0.16		0.16
Within NYMTC Counties	0.07		0.07
Grand Total	1.01	0.01	1.02

Table H-2-36

Domestic Tonnage Shares by Mode and Direction, 2018—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Air	Grand Total
Inbound to NYMTC	32.6%	0.3%	32.9%
Outbound from NYMTC	43.9%	0.3%	44.2%
Between NYMTC Counties	15.7%		15.7%
Within NYMTC Counties	7.1%		7.1%
Grand Total	99.4%	0.6%	100.0%

By a wide margin, the leading county for tonnage handled was Suffolk; the majority of its tonnage was exported out of the NYMTC planning area, and it had significant tonnage flows with other NYMTC counties and within the county itself (***Figure H-2-27***). Rockland and Nassau also generated important outbound tonnage flows. The leading counties for inbound tonnage were New York, Kings, Queens, Nassau, Westchester, Bronx, and Richmond. Almost all movements, as previously noted, were by truck. See ***Figure H-2-28***. Normally, a fully loaded tractor-trailer might carry up to 25 tons of cargo; pharmaceutical trucks carry far less tonnage per truck load because of their low weight, high value, and time-sensitivity.

For the 33 percent of tonnage that was inbound to the NYMTC planning area, more than 60 percent was delivered from New Jersey; Pennsylvania, New York, Massachusetts, and other states also supply the NYMTC counties (***Figure H-2-29***). Almost all the tonnage and value were moved by truck; movements by air from California were also significant.

For the 44 percent of tonnage that was outbound from the NYMTC planning area, the top destinations for outbound pharmaceutical drugs included New Jersey, Pennsylvania, and states in New England, the Mid-Atlantic and South Atlantic, Ohio, and Texas, all served via truck (***Figure H-2-30***).

For the 23 percent of tonnage moving within and between NYMTC planning area counties, the leading origin-destination pairs were Suffolk-Suffolk, Suffolk-New York, Suffolk-Nassau, and Suffolk-Kings (***Table H-2-37***). Around 73 percent of internal tonnage had an origin in Suffolk County and nearly 12 percent in Rockland County, highlighting the role of these counties as producers and suppliers for the NYMTC planning area. Excluding within-county moves, the leading receivers were New York, Nassau, Kings, Queens, and Westchester counties.

By 2045, the volume of pharmaceutical drugs is expected to more than double, from 1.0 to 2.2 million tons. The value of shipments is expected to increase dramatically, from $31 billion to $70 billion (***Table H-2-38***). Trucks will remain the dominant mode.

Figure H-2-27

Domestic Tonnage by County and Direction, 2018—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

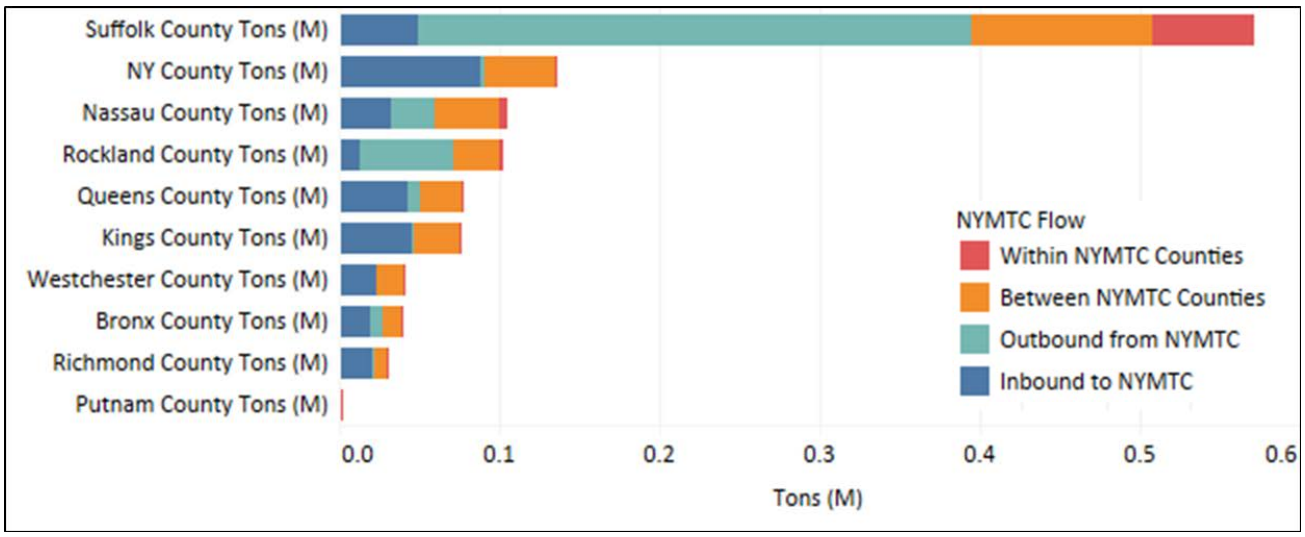


Figure H-2-28

Domestic Tonnage by County and Mode, 2018—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

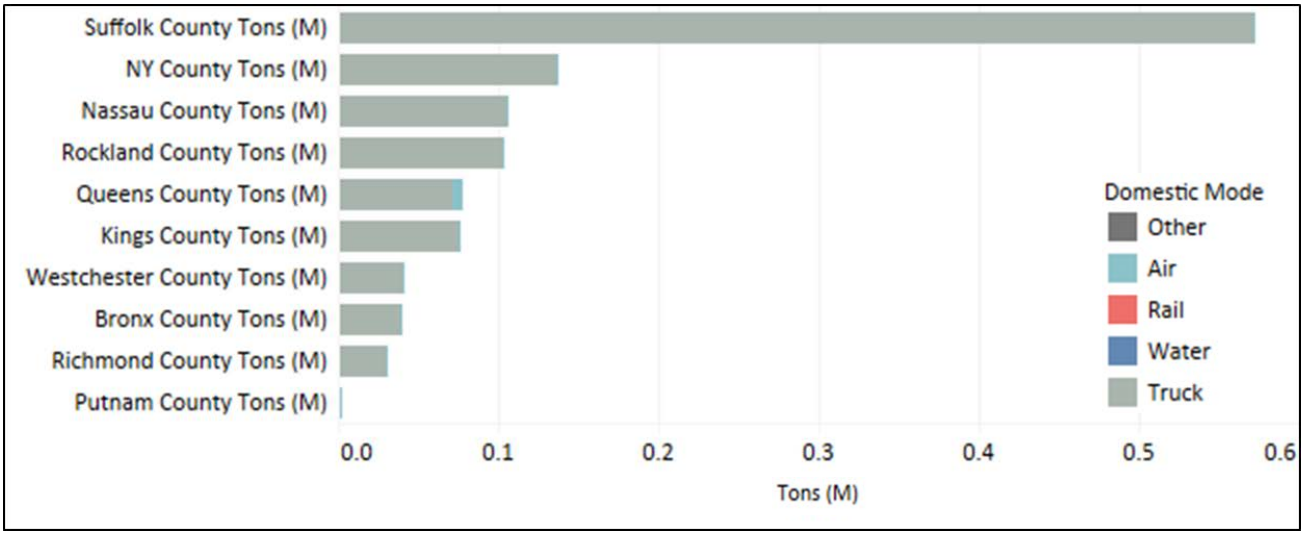


Figure H-2-29

Inbound Domestic Tonnage and Value by Origin State, 2018—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

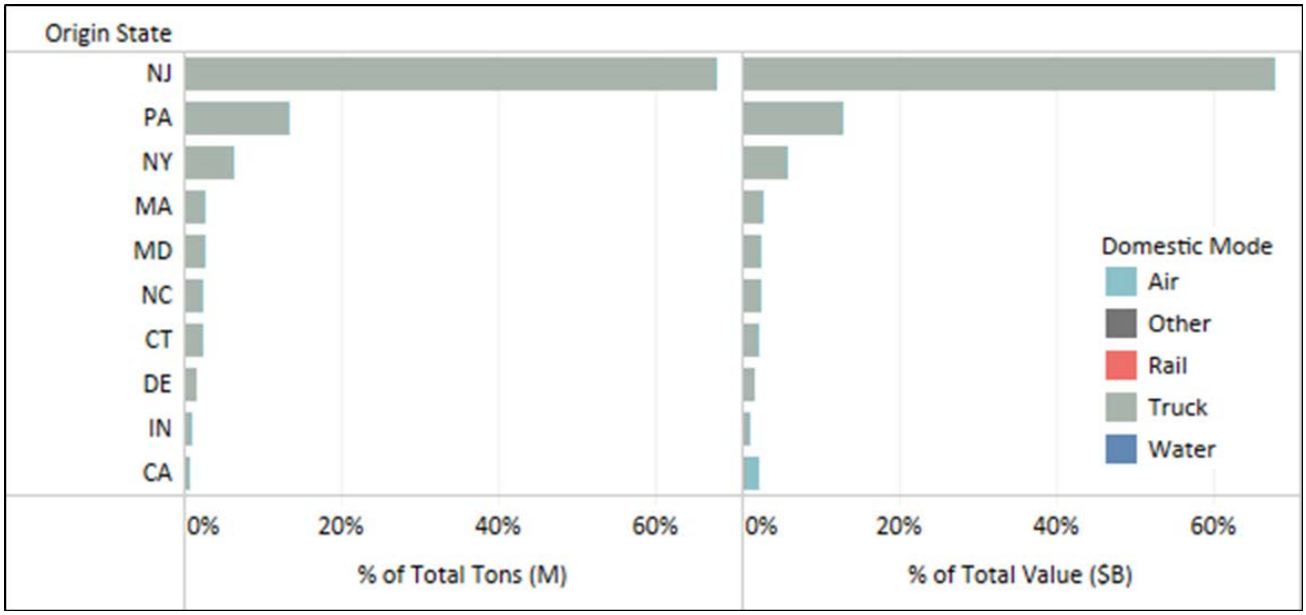


Figure H-2-30

Outbound Domestic Tonnage and Value by Destination State, 2018—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

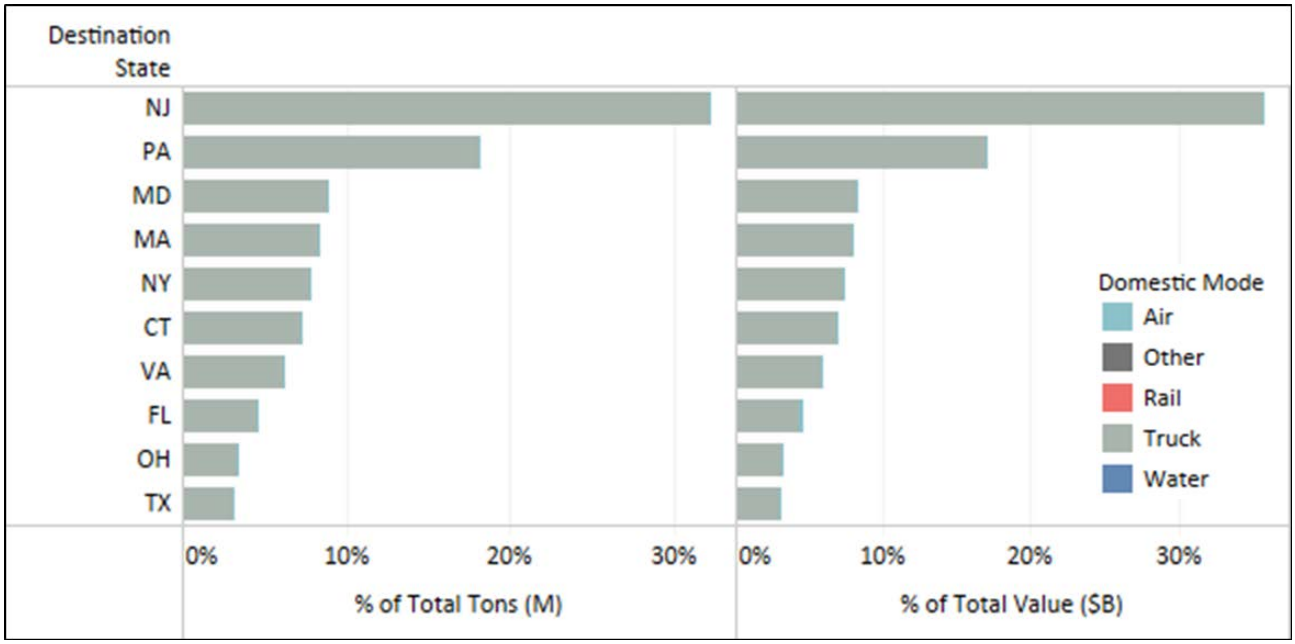


Table H-2-37

Domestic Tonnage and Value Moving Internally, 2018—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

Origin Region	Bronx County, NY	Kings County, NY	Nassau County, NY	New York County, NY	Putnam County, NY	Queens County, NY	Richmond County, NY	Rockland County, NY	Suffolk County, NY	Westchester County, NY	Grand Total
Bronx County, NY	0.3%	0.3%	0.2%	0.0%	0.0%	0.6%	0.1%	0.1%	0.2%	0.4%	2.1%
Kings County, NY	0.0%	0.1%	0.0%	0.3%		0.1%	0.0%		0.0%	0.0%	0.5%
Nassau County, NY	0.3%	1.2%	1.8%	1.3%	0.0%	1.9%	0.2%	0.2%	1.4%	0.3%	8.6%
New York County, NY		0.3%	0.1%	0.5%		0.2%	0.0%	0.0%	0.1%	0.1%	1.3%
Queens County, NY	0.2%	0.5%	0.5%	0.9%		0.4%	0.0%	0.0%	0.2%	0.1%	2.7%
Richmond County, NY	0.0%	0.1%	0.0%	0.1%		0.0%	0.0%		0.1%	0.0%	0.3%
Rockland County, NY	0.5%	1.0%	1.1%	2.7%	0.0%	1.5%	0.3%	1.0%	1.3%	2.0%	11.5%
Suffolk County, NY	2.1%	8.4%	8.8%	12.8%	0.2%	4.8%	2.6%	1.7%	27.2%	4.1%	72.8%
Westchester County, NY	0.0%	0.0%	0.0%	0.0%		0.0%		0.0%	0.0%	0.0%	0.1%
Grand Total	3.4%	11.8%	12.5%	18.6%	0.3%	9.5%	3.3%	3.1%	30.5%	7.0%	100.0%

Table H-2-38

Domestic Tonnage and Value by Mode and Direction, 2018 and 2045—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

		Tons (M)		Value ($B)	
NYMTC Flow	Domestic Mode	2018	2045	2018	2045
Inbound to NYMTC	Truck	0.3	0.7	9.64	19.87
	Air	0.0	0.0	0.61	2.11
	Total	0.3	0.7	10.25	21.99
Outbound from NYMTC	Truck	0.4	1.0	13.09	30.33
	Air	0.0	0.0	0.63	2.17
	Total	0.5	1.0	13.72	32.50
Between NYMTC Counties	Truck	0.2	0.3	4.88	10.03
	Total	0.2	0.3	4.88	10.03
Within NYMTC Counties	Truck	0.1	0.2	2.04	5.54
	Total	0.1	0.2	2.04	5.54
Grand Total		1.0	2.2	30.89	70.06

INTERNATIONAL FLOWS

In 2018, for this supply chain, NAFTA trade with Canada and Mexico was estimated at less than 10,000 tons with a value around $54 million, a very small share of regional trade (*Table H-2-39*). Through 2045, inbound tonnage is projected to increase to around 10,000 tons, and value is projected to increase to around $183 million, with outbound movements by air seeing the largest growth.[18]

In 2018, for this supply chain, international seaports and airports in the NYMTC planning area imported around 20,000 tons worth around $3.9 billion and exported around 20,000 tons worth around 2.9 billion, excluding Canada and Mexico, by water and air (*Table H-2-40* and *Table H-2-41*).[19] Imports are projected to double, and the FAF suggests a 10-fold increase in the tonnage and value of export traffic; this projection should be viewed with caution and may be an artifact of the FAF modeling process.

CRITICAL INFRASTRUCTURE

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

Table H-2-39

International NAFTA Tonnage and Value by Mode, 2018 and 2045—Pharmaceutical Drugs

Source: Analysis of NYSDOT Transearch data

		Tons (M) NAFTA		Value ($B) NAFTA	
NYMTC Flow	Domestic Mode	2018	2045	2018	2045
Inbound to NYMTC	Truck	0.00	0.00	0.0141	0.0540
	Air	0.00	0.00	0.0001	0.0004
	Total	0.00	0.00	0.0142	0.0543
Outbound from NYMTC	Truck	0.00	0.00	0.0175	0.0507
	Air	0.00	0.00	0.0223	0.0780
	Total	0.00	0.00	0.0398	0.1287
Grand Total		0.00	0.01	0.0540	0.1830

Table H-2-40

International Seaport and Airport Imports (Excluding NAFTA) by Mode, 2018 and 2045—Pharmaceutical Drugs

Source: Analysis of USDOT FAF-4 data

Foreign Import Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	0.01	0.01	0.03	0.30
Air	0.01	0.02	3.85	12.67
Grand Total	0.02	0.04	3.88	12.98

Table H-2-41

International Seaport and Airport Exports (Excluding NAFTA) by Mode, 2018 and 2045—Pharmaceutical Drugs

Source: Analysis of USDOT FAF-4 data

Foreign Export Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	0.02	0.17	0.69	4.50
Air	0.01	0.06	2.16	26.17
Grand Total	0.02	0.23	2.86	30.67

2.2.7 SUPPLY CHAIN #6: WASTE

Waste and scrap materials: (STCC 40)

DESCRIPTION OF SUPPLY CHAIN

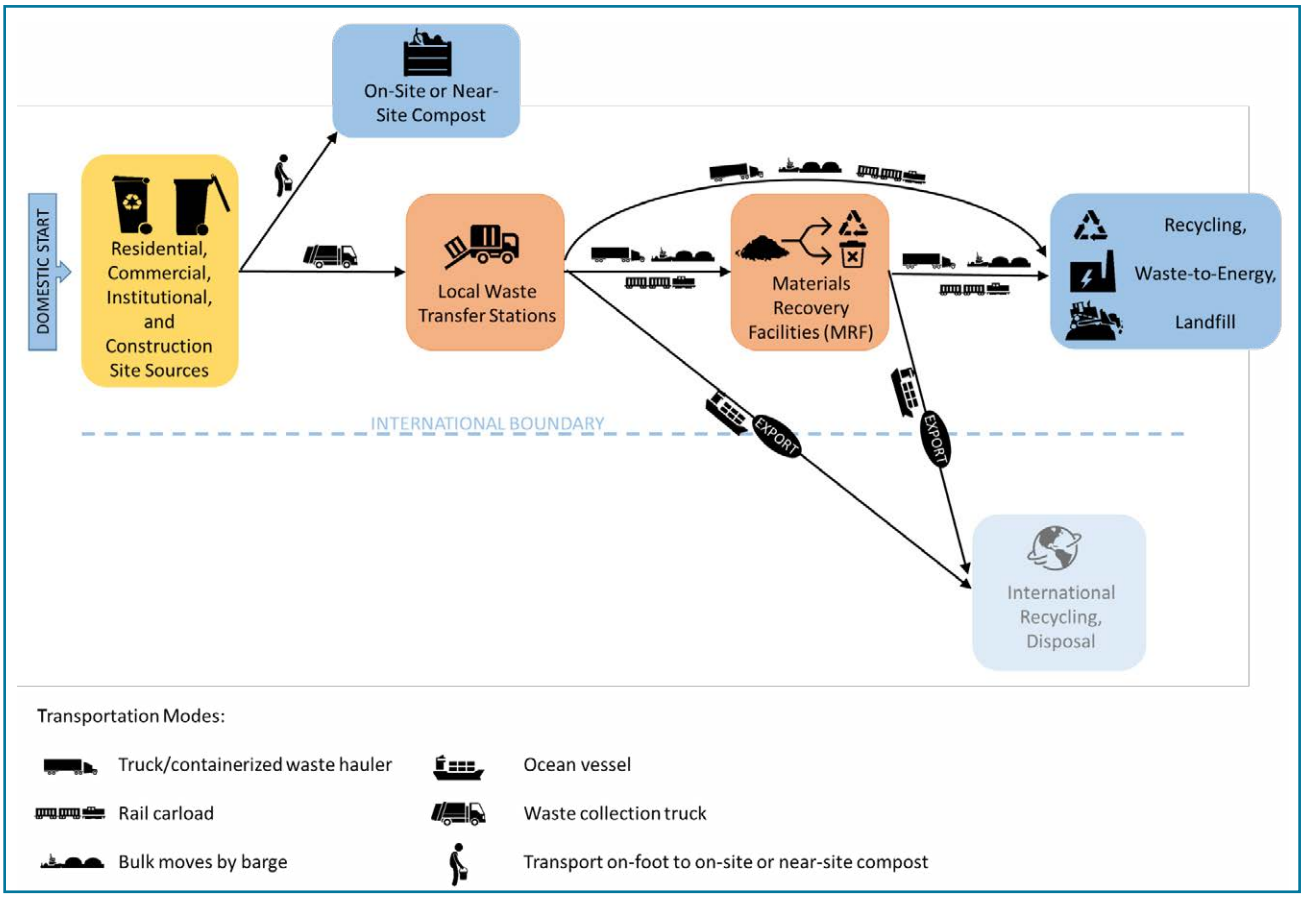
Waste includes waste and scrap materials, MSW, and construction and demolition debris. *Figure H-2-31* illustrates the steps in the supply chain of waste moving in the NYMTC planning area.

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 at the curb. 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 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, which includes construction and demolition residue, generated in the NYMTC planning area is sent to landfills in other states.

Figure H-2-31

Supply Chain Diagram—Waste

Source: NYMTC Regional Freight Plan 2018–2045



DOMESTIC COMMODITY FLOWS (INCLUDING DOMESTIC LEG OF INTERNATIONAL FLOWS)

Tonnage and value tabulations for STCC 40, Waste and Scrap, include ashes, chemical or petroleum waste, metal scrap or tailings, misc. waste or scrap, paper waste or scrap, rubber or plastic scrap, and textile scrap or sweepings. The category includes waste products that have resale value (such as scrap metal), recyclables (such as paper and plastic), construction/demolition debris, and MSW (trash and household garbage). Some MSW tonnage is captured in the data, but some data are missing, so these figures should not be taken as complete. Additionally, because some waste products have value for domestic and overseas customers, some waste is moving into the region for processing, use, and/or export.

In 2018, 25.7 million tons of waste moved into, out of, and within the planning area (*Table H-2-42*). Around 74 percent of tonnage was moving outbound from the region, around 13 percent was moving inbound, and around 13 percent was moving internally (*Table H-2-43*). Trucks handled around 87 percent of tonnage and other modes were also important, with rail handling more than 9 percent and water handling more than 3 percent.

Among NYMTC planning area counties, the leading counties for tonnage handled were New York, Kings, Suffolk, Queens, and Richmond (*Figure H-2-32*). As expected, heavily populated counties generated significant outbound waste flows. Interestingly, three counties—Richmond, Kings, and Suffolk—generated significant inbound flows, which may be related to recycling facilities, other local users and processors of waste products, and/or waste export facilities.

Truck was the leading tonnage mode for all counties except Bronx, where rail was the leading tonnage mode (*Figure H-2-33*). Other counties where rail was important include Richmond, Kings, Queens, Nassau, and Suffolk. Water was also important for Bronx, Queens, Kings, and to a lesser degree, Richmond counties.

For the 13 percent of tonnage moving inbound to the NYMTC planning area, most if not all this material was waste with some value as a commodity. More than 40 percent arrived from New Jersey; with other tonnage from Pennsylvania, New York, and other states (*Figure H-2-34*). Almost all inbound waste products were transported by truck.

Most of the 74 percent of tonnage moving outbound from the NYMTC planning area was MSW or construction/demolition debris with no value as a commodity. The most significant flows were to Pennsylvania and New Jersey, which received more than 55 percent of shipped tonnage (*Figure H-2-35*). Movements to Pennsylvania were by truck, and movements to New Jersey were by truck and water. The next most important destination states were New York and Virginia, and movements to these states were handled equally by truck and by rail. Other important receiving states included Maryland, Ohio, Connecticut, and Massachusetts.

For the 13 percent of tonnage moving within and between NYMTC planning area counties, the leading origin-destination pairs were Suffolk-Suffolk, New York-Kings, Nassau-Queens, New York-Richmond, and Kings-Richmond (*Table H-2-44*). Around 60 percent originated in New York, Suffolk, and Nassau; around 75 percent terminated in Richmond, Kings, and Suffolk.

By 2045, the movement of waste and scrap materials is projected to increase from 29.4 to 40.7 million tons (*Table H-2-45*). Household and commercial MSW is expected to decline as product packaging, recycling, reuse, and other strategies reduce landfill-bound MSW streams. However, increased construction and demolition debris and movements of scrap metal and other waste products with commodity value are projected to account for considerable growth in this commodity group.

Table H-2-42

Domestic Tonnage by Mode and Direction, 2018—Waste

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	3.7	0.0	0.0	0.0		3.7
Outbound from NYMTC	18.4	1.0		2.4	0.0	21.8
Between NYMTC Counties	2.9	0.0		0.4		3.3
Within NYMTC Counties	0.7	0.0				0.7
Grand Total	25.7	1.0	0.0	2.8	0.0	29.4

Table H-2-43

Domestic Tonnage Shares by Mode and Direction, 2018—Waste

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Truck	Water	Air	Rail	Other	Grand Total
Inbound to NYMTC	12.5%	0.0%	0.0%	0.0%		12.6%
Outbound from NYMTC	62.7%	3.3%		8.2%	0.0%	74.1%
Between NYMTC Counties	9.8%	0.1%		1.2%		11.1%
Within NYMTC Counties	2.3%	0.0%				2.3%
Grand Total	87.2%	3.4%	0.0%	9.4%	0.0%	100.0%

Figure H-2-32

Domestic Tonnage by County and Direction, 2018—Waste

Source: Analysis of NYSDOT Transearch data

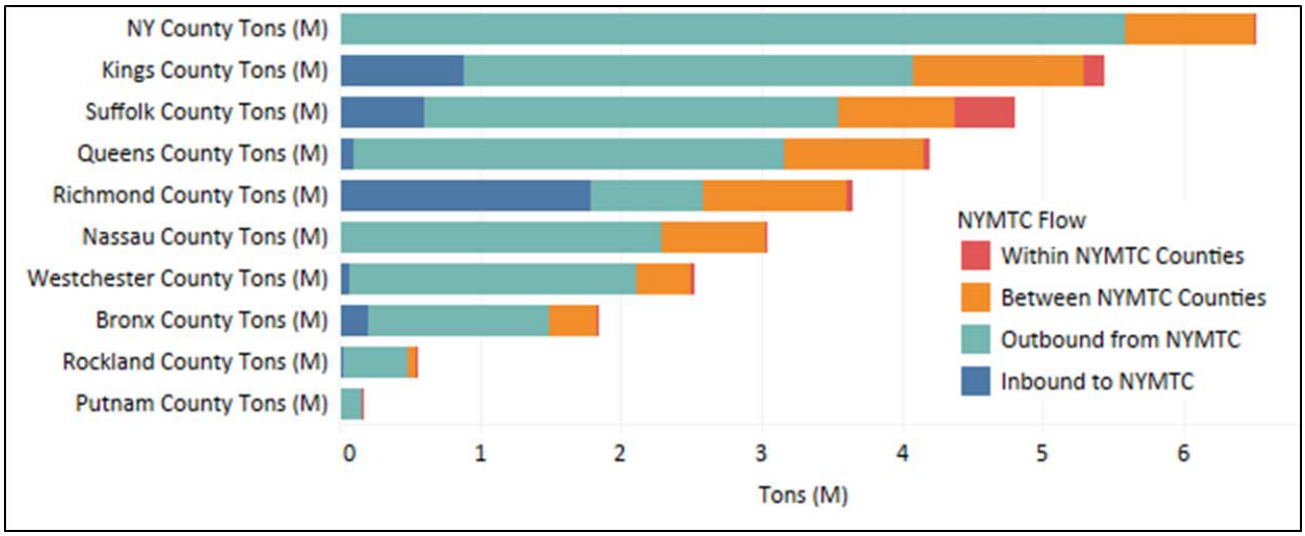


Figure H-2-33

Domestic Tonnage by County and Mode, 2018—Waste

Source: Analysis of NYSDOT Transearch data

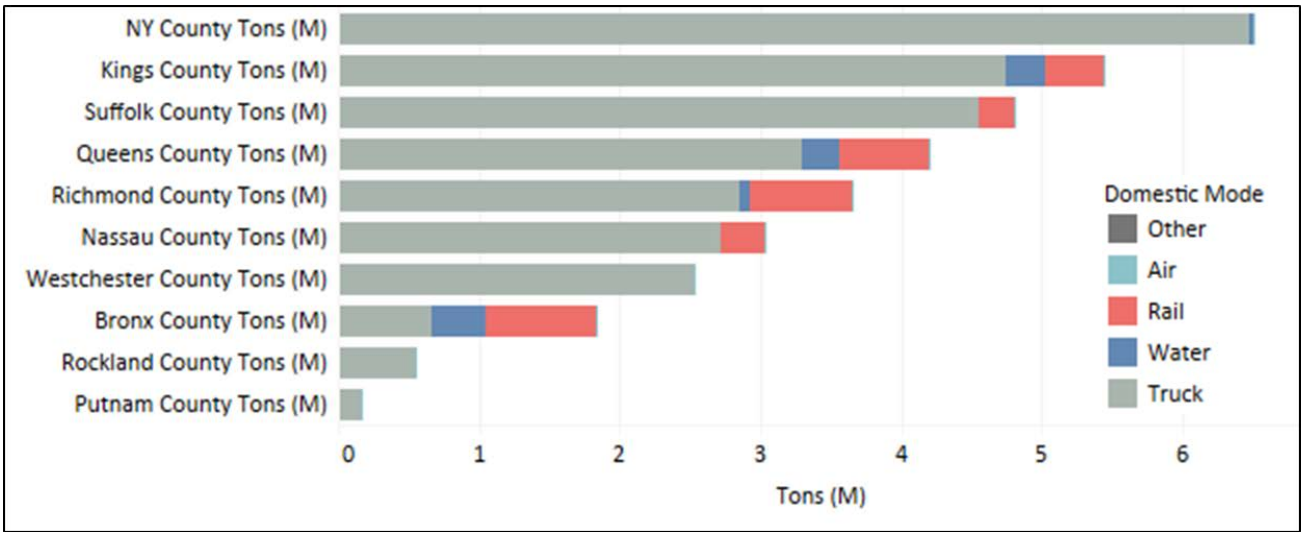


Figure H-2-34

Inbound Domestic Tonnage and Value by Origin State, 2018—Waste

Source: Analysis of NYSDOT Transearch data

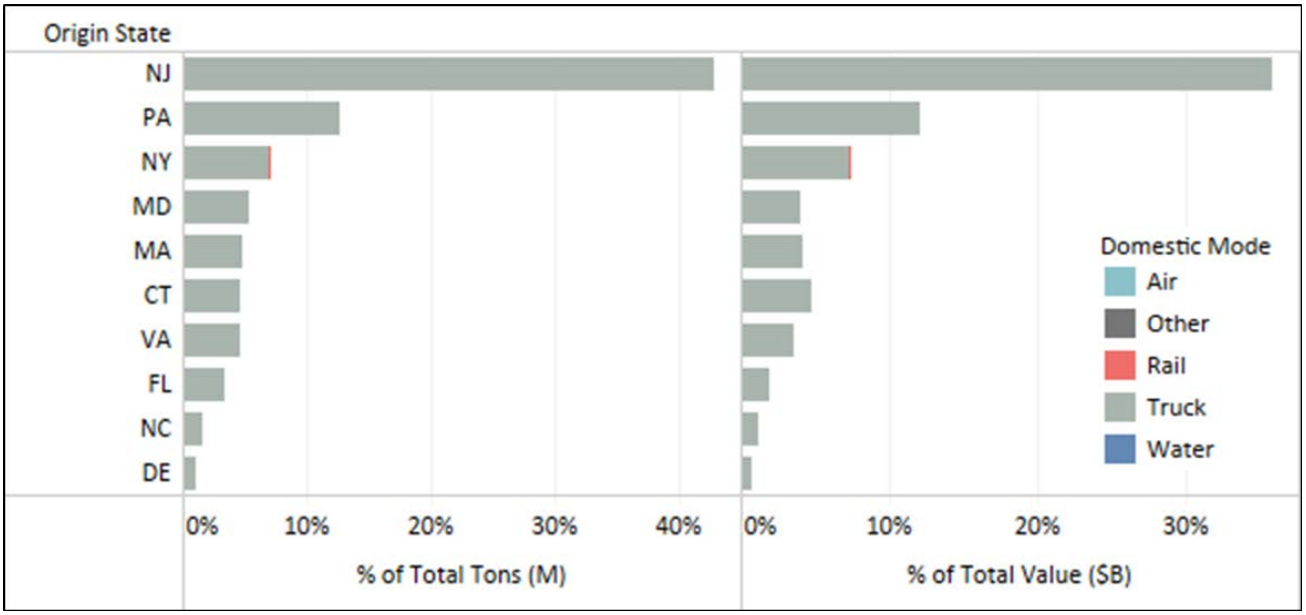


Figure H-2-35

Outbound Domestic Tonnage and Value by Destination State, 2018—Waste

Source: Analysis of NYSDOT Transearch data

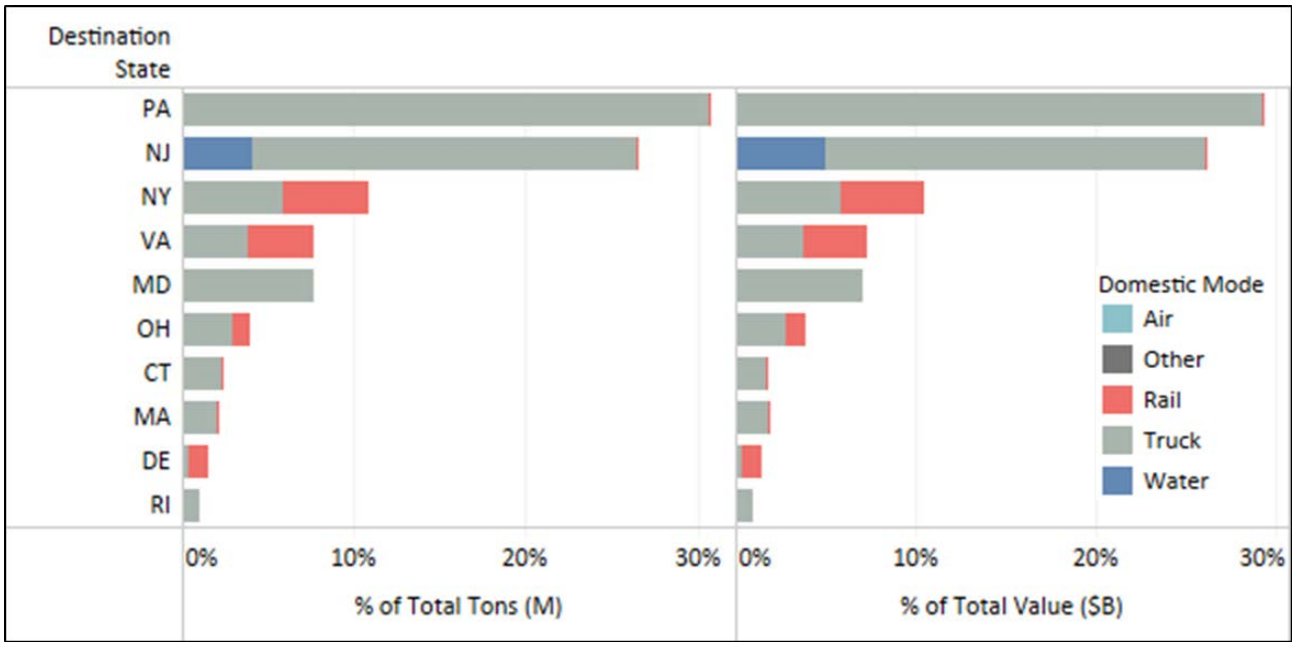


Table H-2-44

Domestic Tonnage and Value Moving Internally, 2018—Waste

Source: Analysis of NYSDOT Transearch data

Origin Region	Bronx County, NY	Kings County, NY	Nassau County, NY	New York County, NY	Putnam County, NY	Queens County, NY	Richmond County, NY	Rockland County, NY	Suffolk County, NY	Westchester County, NY	Grand Total
Bronx County, NY	0.0%	0.9%	0.0%			0.1%	1.5%	0.0%	0.1%	0.2%	2.8%
Kings County, NY	0.7%	3.5%	0.0%	0.0%		1.0%	6.0%	0.0%	1.7%	0.2%	13.2%
Nassau County, NY	0.7%	2.9%	0.1%	0.0%	0.0%	8.8%	2.6%	0.0%	3.4%	0.2%	18.7%
New York County, NY	0.2%	8.9%	0.0%	0.0%	0.0%	2.5%	6.8%	0.1%	4.2%	0.6%	23.4%
Putnam County, NY	0.0%	0.1%				0.0%	0.1%	0.0%	0.1%	0.0%	0.3%
Queens County, NY	1.8%	3.8%	0.0%	0.0%	0.0%	1.1%	2.6%	0.0%	2.3%	0.3%	11.9%
Richmond County, NY	0.0%	0.6%		0.0%		0.0%	1.0%	0.0%	0.0%	0.0%	1.7%
Rockland County, NY	0.2%	0.2%	0.0%	0.0%		0.1%	0.4%	0.0%	0.3%	0.2%	1.3%
Suffolk County, NY	0.6%	1.9%	0.0%	0.0%	0.0%	1.6%	3.2%	0.0%	10.7%	0.2%	18.3%
Westchester County, NY	1.6%	2.0%	0.0%	0.0%	0.0%	0.4%	1.8%	0.2%	1.7%	0.7%	8.5%
Grand Total	5.7%	24.8%	0.2%	0.1%	0.0%	15.6%	26.1%	0.5%	24.4%	2.6%	100.0%

Table H-2-45

Domestic Tonnage and Value by Mode and Direction, 2018 and 2045—Waste

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Domestic Mode	Tons (M)		Value ($B)	
		2018	2045	2018	2045
Inbound to NYMTC	Truck	3.7	6.4	1.22	1.78
	Water	0.0	0.0	0.00	0.00
	Air	0.0	0.0	0.10	0.18
	Rail	0.0	0.0	0.00	0.00
	Total	3.7	6.4	1.33	1.97
Outbound from NYMTC	Truck	18.4	24.2	4.90	6.83
	Water	1.0	1.1	0.31	0.36
	Rail	2.4	3.0	0.62	0.76
	Other	0.0	0.0	0.00	0.00
	Total	21.8	28.3	5.82	7.94
Between NYMTC Counties	Truck	2.9	4.6	0.73	1.10
	Water	0.0	0.0	0.00	0.01
	Rail	0.4	0.4	0.09	0.11
	Total	3.3	5.0	0.83	1.22
Within NYMTC Counties	Truck	0.7	0.9	0.17	0.21
	Water	0.0	0.0	0.00	0.00
	Total	0.7	0.9	0.17	0.21
Grand Total		29.4	40.7	8.14	11.35

INTERNATIONAL FLOWS

In 2018, for this supply chain, NAFTA trade with Canada and Mexico was estimated at 0.21 million tons with a total value of around $0.36 billion (*Table H-2-46*). Around three-quarters of tonnage was export handled by truck and water; one-quarter was import handled by truck with limited quantities by water and air. Through 2045, NAFTA tonnage is projected to triple to more than 0.71 million tons, with gains in both inbound and outbound flows.[20]

In 2018, for this supply chain, international seaports and airports in the NYMTC planning area imported very little, but exported more than 1.6 million tons worth an estimated $3.7 billion, excluding Canada and Mexico, almost exclusively by water (*Table H-2-47* and *Table H-2-48*).[21] Import tonnage and value is projected to increase slightly, and export tonnage and value is projected to increase dramatically; while it is reasonable to expect some increases, these projections may be overly optimistic.

Table H-2-46

International NAFTA Tonnage and Value by Mode, 2018 and 2045—Waste

Source: Analysis of NYSDOT Transearch data

NYMTC Flow	Domestic Mode	Tons (M) NAFTA 2018	Tons (M) NAFTA 2045	Value ($B) NAFTA 2018	Value ($B) NAFTA 2045
Inbound to NYMTC	Truck	0.05	0.21	0.019	0.071
	Water	0.00	0.00	0.000	0.001
	Air	0.00	0.00	0.098	0.182
	Total	0.05	0.21	0.116	0.254
Outbound from NYMTC	Truck	0.09	0.36	0.224	0.730
	Water	0.06	0.14	0.016	0.037
	Other	0.00	0.00	0.000	0.000
	Total	0.16	0.50	0.240	0.767
Grand Total		0.21	0.71	0.356	1.021

Table H-2-47

International Seaport and Airport Imports (Excluding NAFTA) by Mode, 2018 and 2045—Waste

Source: Analysis of USDOT FAF-4 data

Foreign Import Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	0.01	0.01	0.01	0.02
Air	0.00	0.00	0.05	1.19
Grand Total	0.01	0.01	0.06	1.21

Table H-2-48

International Seaport and Airport Exports (Excluding NAFTA) by Mode, 2018 and 2045—Waste

Source: Analysis of USDOT FAF-4 data

Foreign Export Mode	Tons 2018 (M)	Tons 2045 (M)	Value 2018 ($B)	Value 2045 ($B)
Water	1.63	18.40	2.30	14.54
Air	0.00	0.01	0.39	1.63
Grand Total	1.64	18.42	2.69	16.17

CRITICAL INFRASTRUCTURE

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 I-95 and George Washington Bridge corridor, I-80, I-78, and I-87. Within the planning area, I-295, I-495, I-678, and I-278 collect outbound trucks and distribute inbound and intraregional truck trips. Rail routes used to transport outbound waste include the MTA 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 the Atlantic Ocean.

2.2.8 CONCLUSIONS FROM SUPPLY CHAIN ANALYSIS

For freight moving in, out, and within the 10-county NYMTC planning area, these six commodity groups account for 271 million tons (around 90 percent of all tonnage) and $233 billion (around 54 percent of value). Some of these supply chains are impacted by the trends and disruptors discussed in ***Chapter 3***, which will affect how and where and why these commodities move and may determine future performance relative to forecast volumes. Each of these supply chains generate physical movements over the region's transportation infrastructure, creating pressures and demands that planning must address. Later chapters describe this infrastructure, identify critical bottlenecks and needs, and recommend projects and strategies for needed improvements.

ENDNOTES

1 Population and employment estimates are based on NYMTC SED 2017 projections, currently in draft form pending approval. Year 2018 population and employment estimates were developed by interpolating between reported year 2017 and year 2020 estimates, to align with the Transearch 2018 base year.

2 Employment by industry sector for 2018 is based on the Quarterly Census of Employment and Wage at ***https://dol.ny.gov/labor-data***. Employment projections by industry sector for 2050 are based on NYMTC SED 2015 projections because this information is not yet available from the 2017 projections. NAICS is the North American Industry Classification System. The system is hierarchical: detailed classifications are specified with 10-digit codes, then aggregated up to less detailed general group codes. This chapter uses two-digit and three-digit level codes.

3 Between 2020 and 2050, construction employment is projected to grow nearly 18 percent, but retail and manufacturing employment are each projected to decline by more than 30 percent, and transportation and warehousing employment is projected to decline by more than 24 percent.

4 Source: U.S. Department of Commerce Bureau of Economic Analysis; see ***https://www.bea.gov/tools/***.

5 Source: Quarterly Census of Employment and Wages; see ***https://dol.ny.gov/labor-data***.

6 NYMTC's Regional Freight Plan 2018–2045 provided a comprehensive examination of regional supply chains. With the availability of updated data, Moving Forward presents selected key information from the previous analysis with updated commodity flow and economic data. The transportation networks and facilities that serve the region's most critical supply chains are discussed later in the Moving Forward Freight Element.

7 Chapter 3 discusses emerging and anticipated changes in technologies and supply chains in detail.

8 All domestic/NAFTA tonnage and value estimates presented in this chapter are sourced from analysis of the NYSDOT Transearch database for 2018 and 2045. All other international tonnage and value estimates are sourced from an analysis of the USDOT FAF for 2018 and 2045.

9 Figure H-2-6 and similar county-level analyses in this chapter show "Between NYMTC County" tonnage for both the originating and terminating county, compared to other types of tonnage that are shown only for the originating, terminating, or "within" county.

10 Based on analysis of NYSDOT Transearch database.

11 Based on analysis of FAF 4.5. The FAF region "NY Part NY-NJ-CT-PA" includes the 10-county NYMTC planning area plus Dutchess, Orange, and Ulster counties; because the three additional counties do not contain major international air or water gateways, the FAF region is used to represent the NYMTC planning area. FAF uses the SCTG (Standard Classification of Transported Goods) system to develop commodity level estimates, not STCC which is used by Transearch. The SCTG commodity groups used to represent the food supply chain are agricultural products; alcoholic beverages; animal feed, eggs, honey; live animals and fish; cereal grains; meat, poultry, fish and seafood; milled grain products; and other prepared foodstuffs.

12 Based on analysis of NYSDOT Transearch database.

13 Based on analysis of FAF 4.5. The FAF region "NY Part NY-NJ-CT-PA" includes the 10-county NYMTC planning area plus Dutchess, Orange, and Ulster counties; because the three additional counties do not contain major international air or water gateways, the FAF region is used to represent the NYMTC planning area. FAF uses the SCTG system to develop commodity level estimates, not STCC which is used by Transearch. The SCTG commodity group used to represent the parcels and secondary freight supply chain is mixed freight.

14 Based on analysis of NYSDOT Transearch database.

15 Based on analysis of FAF 4.5. The FAF region "NY Part NY-NJ-CT-PA" includes the 10-county NYMTC planning area plus Dutchess, Orange, and Ulster counties; because the three additional counties do not contain major international air or water gateways, the FAF region is representative of the NYMTC planning area. FAF uses the SCTG system to develop commodity level estimates, not STCC which is used by Transearch. The SCTG commodity groups used to represent the construction materials supply chain are articles of base metal; monumental or building stone; natural sands; nonmetallic mineral products; other nonmetallic minerals; and wood products.

16 Based on analysis of NYSDOT Transearch database.

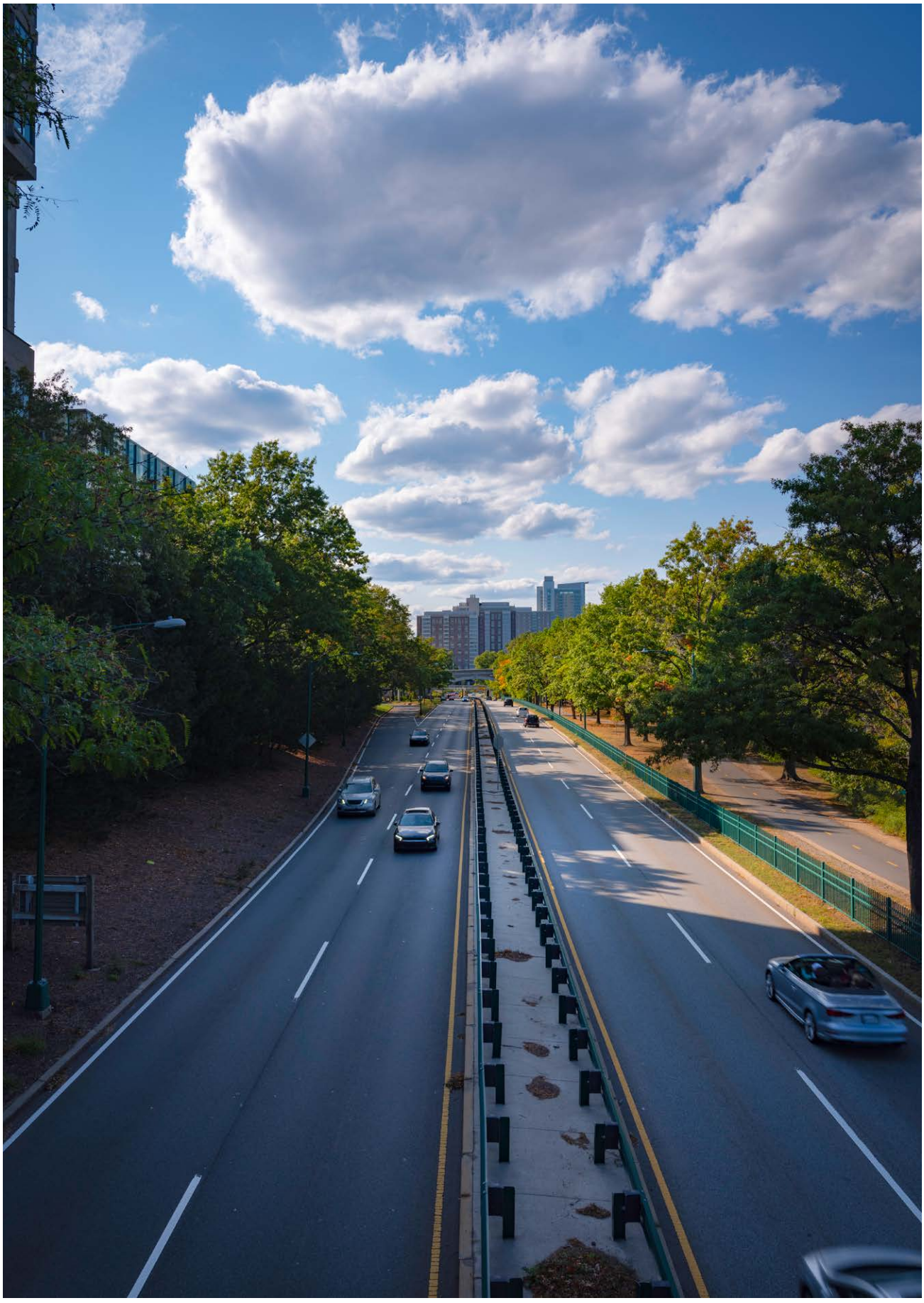
17 Based on analysis of FAF 4.5. The FAF region "NY Part NY-NJ-CT-PA" includes the 10-county NYMTC planning area plus Dutchess, Orange, and Ulster counties; because the three additional counties do not contain major international air or water gateways, the FAF region is representative of the NYMTC planning area. FAF uses the SCTG system to develop commodity level estimates, not STCC which is used by Transearch. The SCTG commodity groups used to represent the energy products supply chain are coal; crude petroleum; fuel oils; and gasoline, aviation fuel, and ethanol.

18 Based on analysis of NYSDOT Transearch database.

19 Based on analysis of FAF 4.5. The FAF region "NY Part NY-NJ-CT-PA" includes the 10-county NYMTC planning area plus Dutchess, Orange, and Ulster counties; because the three additional counties do not contain major international air or water gateways, the FAF region represents the NYMTC planning area. FAF uses the SCTG system to develop commodity level estimates, not STCC which is used by Transearch. The SCTG commodity group used to represent this supply chain is pharmaceutical products.

20 Based on analysis of NYSDOT Transearch database.

21 Based on analysis of FAF 4.5. The FAF region "NY Part NY-NJ-CT-PA" includes the 10-county NYMTC planning area plus Dutchess, Orange, and Ulster counties; because the three additional counties do not contain major international air or water gateways, the FAF region is representative of the NYMTC planning area. FAF uses the SCTG system to develop commodity level estimates, not STCC which is used by Transearch. The SCTG commodity group used to represent this supply chain is waste and scrap.



3 TRENDS AND DISRUPTORS

*In developing plans and policies in **Moving Forward** related to freight, it is important to understand baseline conditions and forecasts and how those conditions and forecasts might change in predictable and unpredictable ways. The commodity flows, economic drivers, and supply chains described in Chapters 1 and 2 are subject to a variety of trends, some predictable and some not. This chapter examines trends related to:*

- E-commerce
- Less-than-truckload (LTL) delivery
- Vehicle automation
- Warehouse design and automation
- Distributed manufacturing (three-dimensional (3D) printing)

Disruptors—which are episodic and/or difficult to model—can have significant or dramatic effects for both near- and long-term planning and include public health emergencies, geophysical events like storms and long-term climate change, economic or political disruptions, rapid advancement of technology, and many other possibilities. Disruptors may be independent of trends, or they may act to modify trends; for example, the clear trend for growth in e-commerce has been dramatically accelerated by the novel coronavirus (COVID-19) pandemic. In this chapter, case studies of two types of disruptors—climate effects and the COVID-19 pandemic—are explored with freight-focused analyses.

3.1 TRENDS

3.1.1 E-COMMERCE

E-commerce includes a variety of different purchasing methods. For purposes of data collection, the U.S. Census Bureau defines and tracks e-commerce as the value of goods and services sold online over open networks such as the Internet or over proprietary networks running systems such as Electronic Data Interchange (EDI), excluding agriculture, mining, construction, agents, brokers, and electronic markets in wholesale trade.[1]

- **E-commerce shipments** (e-shipments). Online orders accepted for manufactured products from customers, including shipments to other domestic establishments of the same company for further manufacture, assembly, or fabrication where price and terms of sale are negotiated over the Internet, Extranet, EDI network, email, or other online system. Payment may or may not be made online.
- **E-commerce sales**. E-commerce sales/revenues are sales of goods and services where the buyer places an order, or the price and terms of the sale are negotiated over the Internet, mobile device (m-commerce), Extranet, EDI network, email, or other comparable online system. Payment may or may not be made online.

Note that e-commerce is defined by the nature of the transaction, not the nature of the transportation means employed. The actual delivery of goods may be accomplished by trucking between two companies, direct delivery to homes or businesses, or pickups by customers at retail locations (known as buy online pickup in store or BOPIS), lockers, or other non-home locations.

Major businesses have used EDI to buy and sell their goods and services for decades, and because the U.S. Census Bureau's e-commerce sales data include EDI sales, these sales are reported as e-commerce sales. In addition, a significant proportion of wholesale trade sales are conducted using EDI. DTC sales of manufactured goods have emerged more recently as a substantial share of e-commerce activity.

According to the e-commerce platform development firm BigCommerce,[2] the primary stakeholders and business models in e-commerce include the following:

- Stakeholders
  - Businesses
  - Consumers
  - Government
  - Employees
- Business Models
  - Business-to-Business (B2B)—transactions where businesses sell goods or services to other businesses
  - Business-to-Consumer (B2C)—transactions where businesses sell goods or services to consumers
  - Consumer-to-Consumer (C2C)—transactions where consumers sell goods or services to other consumers (e.g., eBay)
  - Consumer-to-Business (C2B)—transactions where consumers sell goods or services to businesses
  - Government-to-Business (G2B)—transactions where governments sell goods or services to businesses (e.g., business license renewals)
  - Government-to-Citizen (G2C)—transactions where governments sell goods or services to citizens (e.g., driver's license renewals)

The most common types of e-commerce, and the ones with the greatest transportation system impacts, are B2B, B2C, and C2C. Major B2C companies include Amazon, Walmart, Target, and Home Depot; Amazon is also a leading B2B company. Examples of C2C companies (some of which also handle B2C transactions) include eBay and Etsy. Some e-commerce companies operate retail stores; these are known as "bricks and clicks" players and include Walmart, Target, and Home Depot. Others do not operate retail stores; these are known as "pure players."

In some cases, B2C is a mechanism to facilitate traditional multi-level sales (with a company selling to a retailer or one or more "middlemen" before reaching the customer); however, an important value of B2C is its ability to support "direct-to-consumer" (DTC or D2C) sales without intermediary parties.

B2C supply chains typically involve the receipt of goods from factories (domestic or international), storage and handling at one or more national/regional/local warehouses or distribution centers, and delivery to the customer. C2C supply chains tend to be direct moves between sellers and buyers using self-pickup/delivery or purchased transportation services. The final move to the customer is known as "last mile" delivery, and is generally accomplished using:

- U.S. Postal Service (USPS)
- United Parcel Service and FedEx
- Delivery Service Partners (networks of regional affiliates, essentially franchisees)
- Traditional trucking companies (for larger/heavier items)

E-COMMERCE COMMERCIAL EFFECTS

Prior to the COVID-19 pandemic, e-commerce represented more than 23 percent of sales in the manufacturing, services, retail, and wholesale sectors in 2018, the latest year for which data are available from the U.S. Census Bureau (***Table H-3-1***). Interestingly, while retail was the lowest user of e-commerce, largely as a result of including EDI transactions in the data, it still represented around $520 billion in sales. In the NYMTC planning area, New York City Department of Transportation's (NYC DOT) 2018 Citywide Mobility Survey indicated that 39 percent of New Yorkers received home delivery at least a few times a month.

Prior to the COVID-19 pandemic, e-commerce had shown consistent strong growth across all sectors. Between 2002 and 2018, e-commerce sales grew at 7.1 percent per year for wholesale, 11.0 percent per year for manufacturing, and 16.6 percent per year for retail. The growth

was especially dramatic for retail—in 2002, e-commerce retail sales were less than $45 million; by 2018, they had grown more than tenfold, to $520 million.[3] Technological advances supported online sales growth by allowing consumers greater access to product information; quick and easy price comparisons; and faster, cheaper, personalized delivery options. Moreover, as same-day delivery and free shipping on returns became more commonplace, the traditional value of brick-and-mortar stores diminished further, and many brick-and-mortar stores began accommodating the pickup of online orders, along with in-store e commerce returns. Prior to the COVID-19 pandemic, continued strong growth in the e-commerce share of retail was anticipated, with the 9.9 percent share in 2018 expected to exceed 40 percent by 2040 (*Figure H-3-1*).

Table H-3-1

Volume and Share of U.S. E-Commerce Sales (2018)

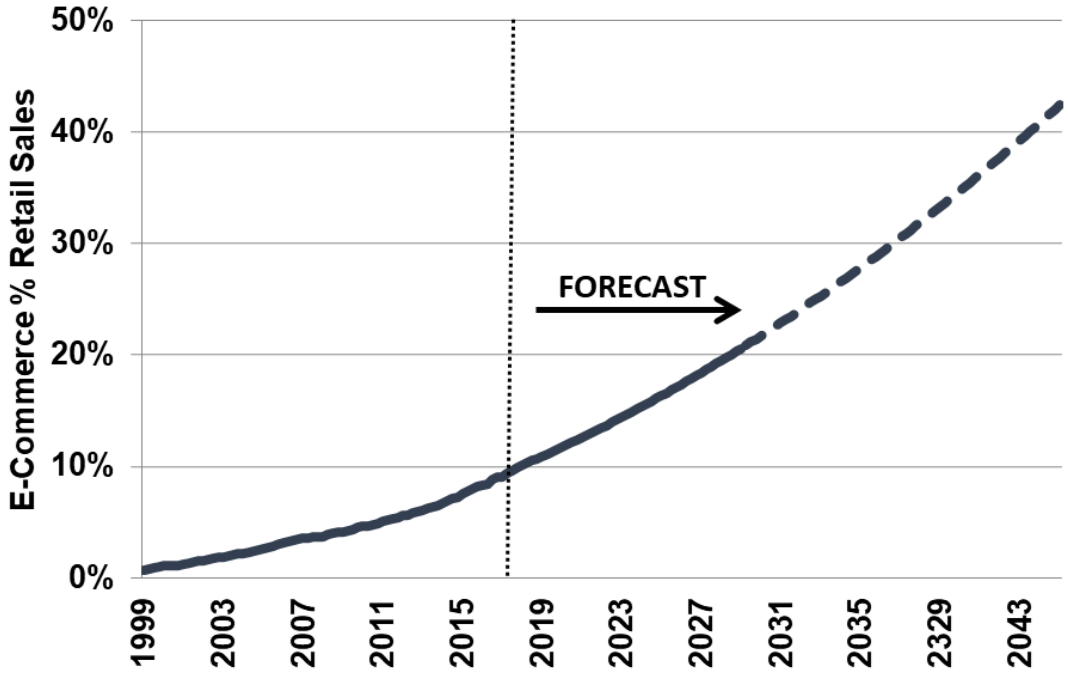
Source: U.S. Census E-Stats, https://www.census.gov/programs-surveys/e-stats/data/tables.html

Sector	Total Sales (Billions)	E-Commerce Sales (Billions)	% E-Commerce
Manufacturing	$5,955	$4,011	67.3%
Merchant wholesale	$8,192	$2,642	32.3%
Services	$16,196	$1,152	7.1%
Retail	$5,270	$520	9.9%
Total	**$35,613**	**$8,324**	**23.4%**

Figure H-3-1

Pre-COVID-19 Forecast of Growth in E-Commerce Share of Retail Sales

Source: U.S. Census Bureau, Cheng Solutions LLC



The COVID-19 pandemic dramatically accelerated the adoption of e-commerce for transactions, particularly B2C. The e-commerce share of retail sales grew steadily and consistently from 2011 through the first quarter of 2020, then jumped dramatically, from 11.8 percent in first quarter 2020 to 16.1 percent in the second quarter; it declined slightly to 14.3 percent in the third quarter (seasonally adjusted) (***Figure H-3-2***). With reference to the forecast in ***Figure H-3-1***, the anticipated 2023 shares were actually reached in the third quarter of 2020. Following recovery from the COVID-19 pandemic, the e-commerce share of retail may continue to "run ahead" of the forecast by several years, or it may revert to the forecast (which already assumes extremely strong growth), or it may be somewhere in-between. ***Section 3.2*** of this chapter addresses COVID-19 pandemic effects in more detail.

Decisions about e-commerce logistics are concentrated in the hands of a limited number of high-volume companies. Amazon is the undisputed leader in terms of U.S. e-commerce sales. In 2018, Amazon accounted for an estimated 48 percent of total U.S. digital sales; eBay was listed as a distant second at 7.2 percent, with Wal-Mart at 4.0 percent, according to eMarketer.[4] See ***Figure H-3-3***. Estimates for 2020 retail online sales show Amazon retaining a commanding market share, with Walmart becoming the second-largest company in this market.

E-COMMERCE LAND USE EFFECTS

Demand for additional warehouse square footage to serve e-commerce is substantial. The continued rise in e-commerce sales has significant implications for warehouse demand. The DTC market translates into fewer goods inventories in retail stores and more goods on warehouse racks for delivery. CBRE Research estimates that for every $1 billion increase in e-commerce sales, an estimated 1.25 million square feet of warehouse space is needed to keep up with demand. Using eMarketer's online sales forecast, CBRE estimates that e-commerce-generated warehouse demand grew, nationally, by an additional 191 million square feet from 2018 to 2020. There is growing interest in repurposing suburban shopping malls, urban parking lots, and other space that has become underutilized during the COVID-19 pandemic for warehouse/distribution operations.

The trend is towards smaller and/or closer-to-market warehouse/distribution facilities to supplement large mega-facilities in outlying areas. The rapid growth in the DTC market combined with faster delivery standards is having significant repercussions on warehouse location decisions. There is a notable shift away from the practice of using a small number of enormous facilities located at a considerable distance from the urban areas they serve, toward using more numerous, smaller industrial spaces located closer to the end consumer. For the NYMTC planning area, this has resulted in several new facilities in the outer boroughs of New York. Fresh Direct and Jet.com both opened new fulfillment centers in the Bronx in 2018. Similarly, Amazon opened a new fulfillment center in Staten Island, its first in the area. Amazon had previously served the New York market via facilities in New Jersey and Pennsylvania. Amazon and UPS also opened facilities in Brooklyn near Red Hook.[5] Third-party logistics providers are active in purchasing and converting space for this use.

E-COMMERCE TRANSPORTATION EFFECTS

Significant increases in e-commerce means significant increases in related truck trip generation. The estimated 191 million square feet of e-commerce space added between 2018 and 2020 generates an estimated 115,000 additional daily truck trips in the United States. The new truck trip generation consists of three parts: inputs to primary warehouse/distribution facilities; moves between primary and secondary warehouse/distribution facilities; and DTC deliveries to residential addresses, largely by parcel delivery companies. The rise in e-commerce and D2C retail is having significant repercussions for product distribution and delivery, with shipments increasingly going directly to individual residences, rather than brick-and-mortar storefronts. Many retailers are using large package delivery companies such as

Figure H-3-2

Estimated Quarterly U.S. Retail E-Commerce Sales as a Percent of Total Quarterly Retail Sales

Source: U.S. Census Bureau, https://www.census.gov/retail/mrts/www/data/pdf/ec_current.pdf

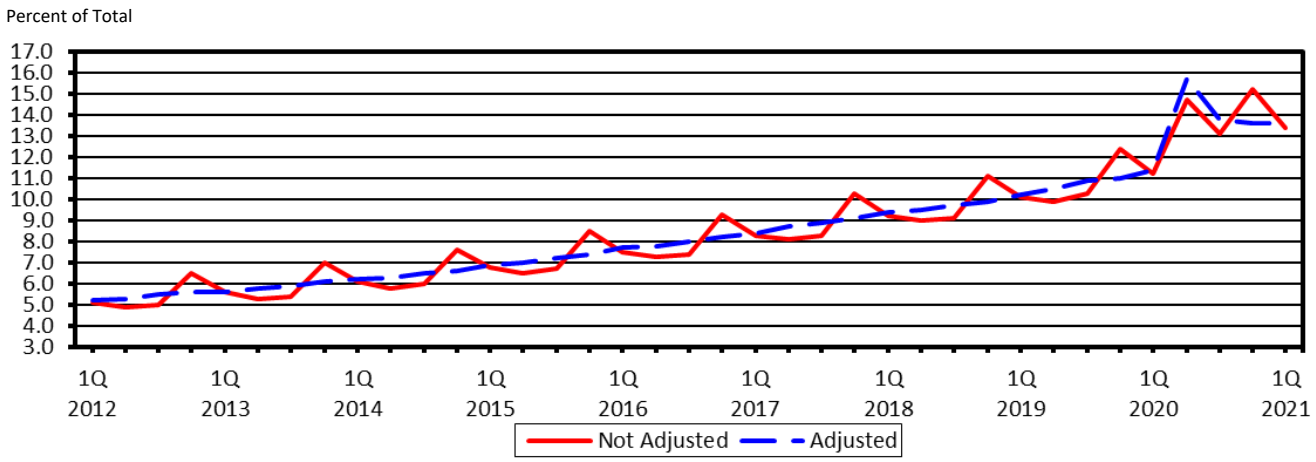
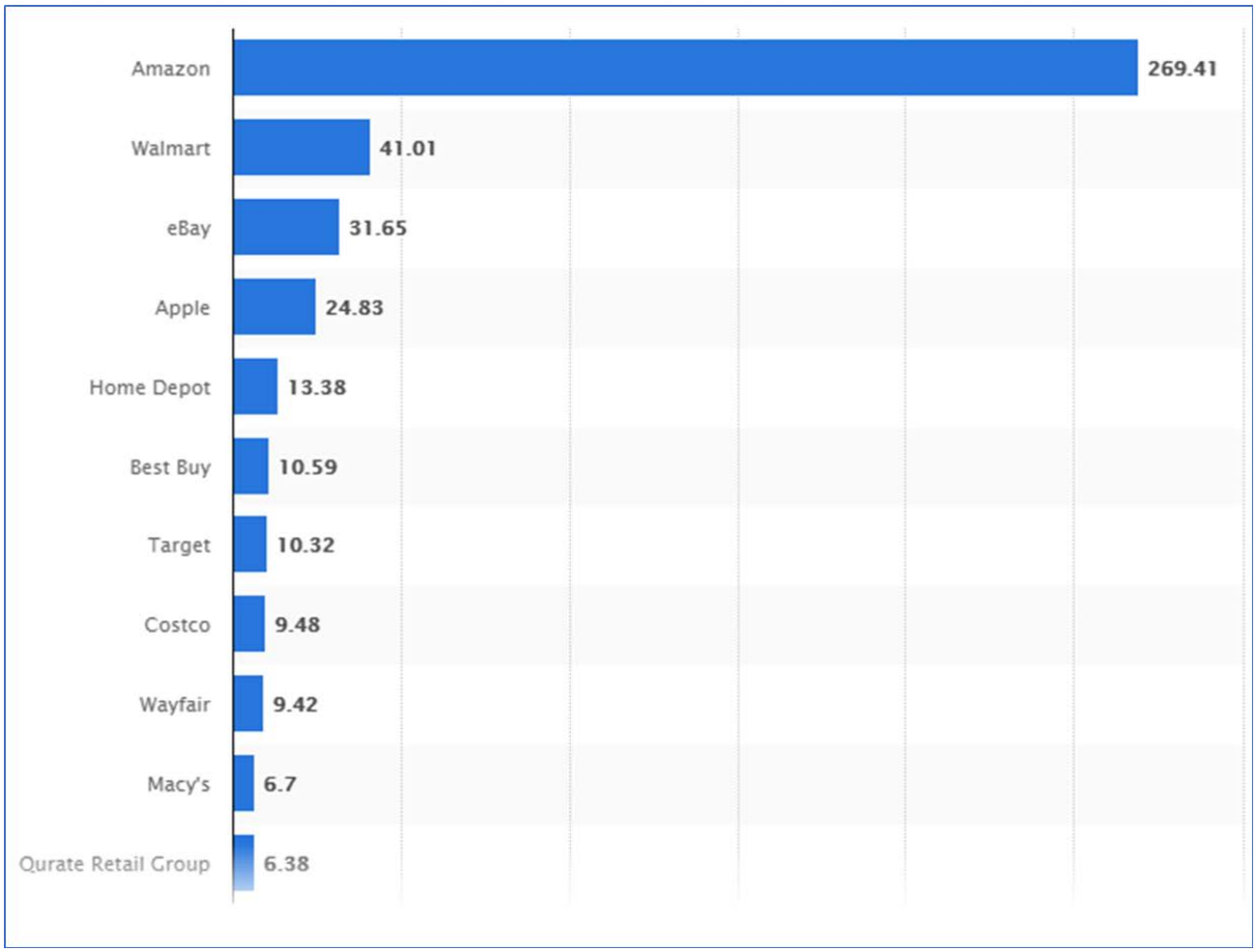


Figure H-3-3

Estimated Quarterly U.S. Retail E-Commerce Sales as a Percent of Total Quarterly Retail Sales

Source: Statista, https://www.statista.com/statistics/976083/leading-companies-ranked-retail-ecommerce-sales-usa/



USPS, UPS, and FedEx to handle these deliveries, significantly altering the business model for such companies. Amazon is also looking to grow its last mile delivery network through a network of regional delivery service partners (essentially transportation franchisees), Amazon. Other factors affecting trip generation from e-commerce include returns of wrong-sized or otherwise unwanted merchandise purchased electronically; failed delivery attempts requiring multiple trips; and replacement of damaged, lost, or stolen items.

Increasing use of parcel delivery means increased presence of these vehicle types on local streets and in residential areas. As previously noted, the primary last-mile delivery services are USPS, UPS, FedEx, and Amazon's delivery service partners. With more delivery vehicles on residential urban and suburban streets, there are increased safety risks from constrained geometries and road use conflicts, increased curb use/management pressures, and more quality of life (congestion, emissions, noise) effects.

There are practical limits to what can be delivered effectively via parcel services. For companies such as UPS and FedEx, home deliveries are generally less profitable than B2B deliveries—home deliveries generally consist of one (or a few) parcels per stop, while B2B deliveries often consist of a larger number of parcels per stop. Further exacerbating costs is the fact that consumers are increasingly purchasing bulk items such as furniture and appliances online. In response to these cost increases, both companies have repeatedly raised rates on large and oversized packages. The goal is not only to maximize profitability but also to discourage freight shippers from using their small-package network for items that should be moved via LTL or other freight services.

Increasing use of D2C services may result in offsetting reductions in auto trips. Increased deliveries directly to consumers results in the additional truck delivery trips, but to the extent that consumers no longer need to drive to stores for the delivered items, there is a corresponding reduction in consumer auto trips to the stores. Moreover, increased receipt of a full range of consumer products directly at home may contribute to conversion to car-light and car-free households in dense centers.

Pressures for rapid and reliable order fulfillment continue to grow overall, placing a premium on transportation reliability. Amazon continues to dramatically impact consumer expectations regarding product delivery standards. In 2005, the company started Amazon Prime, providing free two-day shipping on certain products to Prime members for an annual fee. More recently, Prime Now offers free same-day delivery in major metropolitan markets and faster and/or tailored delivery for select high-volume goods for an additional fee. Given Amazon's significant market presence, other major retailers have had little choice but to follow suit, offering a combination of free and/or faster delivery.

E-commerce is increasingly used for consumable goods with especially rapid delivery requirements, further highlighting the need for and value of transportation system reliability. While durable goods continue to lead e-commerce sales, many consumable goods, most notably groceries, experienced significant growth through 2018—and that growth accelerated substantially with the COVID-19 pandemic.

"Last mile" (the final stage of delivery to the customer's home or business) performance is especially important for e-commerce. The shift toward D2C delivery has forced many retailers to focus more on last-mile logistics, which is generally considered to be the most complex and costly portion of the delivery process. While many retailers continue to outsource this service to one of the big three delivery companies (USPS, UPS, and FedEx), some are opting for their own delivery services and service networks. The result of these developments is that the rise in e-commerce has produced a significant number of new participants in the distribution network and new vehicles on the road. At the same time, the customer may also be responsible for the last mile, through BOPIS transactions, use of Amazon lockers and UPS access points.

Crowd-sourced services are an increasingly attractive option for last mile deliveries. Similar to ride-hailing services, these services involve technology-enabled companies dispatching individual contractors who use their own personal vehicles for deliveries. This method is often used for meal and grocery delivery, as well as medical supplies, but a handful of successful startups, include Deliv, Instacart, and UberRush, have moved into other areas of retail. Additionally, Amazon has its own crowd-sourced delivery service called Amazon Flex. While such systems allow for fast, localized delivery with limited overhead to the company, there are costs to the overall transportation system (including increases to freight vehicle trips and miles of travel, freight-related congestion, unregulated vehicles, and reduced coordination of delivery services) in addition to the gig-based labor costs. Moreover, curb space for these deliveries is limited in dense areas, and double-parked vehicles are recognized for their impact on local traffic.

Alternative last-mile modes are being explored. NYC DOT's Commercial Cargo Bike Pilot launched in December 2019 with Amazon, DHL, and UPS, and recently expanded to include FedEx, Reef, and NPD Logistics. A one-year report will be available in the upcoming months. Small autonomous delivery vehicles have undergone pilot testing in urban areas and controlled geographies such as university campuses (see discussion on automation later in this chapter). Another possibility that has received considerable attention is drone delivery. Multiple groups are in various testing stages, including smaller companies like Workhorse and Matternet, as well as larger corporations like Google and Wal-Mart.

Additionally, Amazon has patented mobile drone delivery hubs that could travel along railroads, seaways, and roads. The federal government has also gotten involved via the Unmanned Aerial System Integration Pilot Program, which encourages local governments to partner with private companies. Rome, New York, is one if the seven unmanned aerial system test sites, and testing activities could potentially be expanded to the NYMTC planning area if take-off/landing zones are authorized. However, the regulatory and operational challenges for large-scale drone operations in urbanized areas of the NYMTC planning area would be substantial.

3.1.2 LESS-THAN-TRUCKLOAD DELIVERY

LESS-THAN-TRUCKLOAD COMMERCIAL EFFECTS

LTL motor carriage represents 5 percent of trucking operations but is poised for expansion. LTL trucking is a terminal operation that consolidates smaller shipments at handling centers, moves them in full trucks, then redistributes the full truckloads back to smaller shipments. The LTL market has many players, and the larger LTL carriers have a presence in multiple regions. Two of the largest carriers are owned by the two main, commercial parcel delivery companies: FedEx Freight and UPS Freight. Today, the LTL niche is ripe for expansion because of a combination of factors, including (1) truck driver shortages remain a chronic problem and have been made worse with the COVID-19 pandemic, and LTL is a more attractive (and easier to fill) job than long-haul trucking; (2) pressure on traditional store-based retailers from e-commerce and DTC delivery options (with response times being too fast, and shipment sizes too small, for conventional truckload operations); and (3) rising D2C shipments direct from manufacturers.

LTL is a logical complement to parcel delivery services and should grow at a corresponding rate. Amazon and others have been cultivating a broader array of products purchased through the home delivery channel. The list is increasingly long and diverse; it includes heavier goods such as pet food, furniture, and home goods. Portions of demand will not be met by the service offerings of parcel carriers. LTL is the next step up in shipment size, consolidation, and carrying capacity of delivery vehicles. Moreover, the regional carriers leading the LTL industry have perfected next day delivery networks that can satisfy the stringent service requirements of e-commerce. If parcel capabilities eventually are exceeded, LTL is the most likely alternative

because it has capacity for larger shipments while retaining the terminals and multi-stop operations that fit the logistics profile. Because so much of the growth in LTL has been attributable to the rapid growth in e-commerce and associated warehousing/fulfillment trends, it is reasonable to expect that the anticipated timeline for e-commerce growth would indicate a correlated growth in LTL.

LTL costs are higher than truckload services and the pressure to reduce operating costs will continue. LTL is a terminal operation whose handling process, plus the expense of dock hands, city and road tractors, and the terminals themselves add substantially to cost. For comparison, a truckload shipment involves one laborer, one pickup, one delivery, and one truck; LTL shipments involve several of each. Growth in LTL that replaces truckload shipping will inevitably bring higher costs for delivery of goods to the NYMTC planning area. Consolidation by any practical means is the obvious response and will be evaluated repeatedly. Technology is another way; the use of cheap radio frequency identification tags is an example of an efficient method for raising LTL terminal throughput and reducing delivered cost. LTL (and other sectors of the trucking industry) are increasingly benefiting from electronic information transfer, load-matching services, and other technology adaptations.

LESS-THAN-TRUCKLOAD LAND USE EFFECTS

Growth in LTL activity will generate growth in the number and intensity of terminal operations. LTL operates through networks of city terminals and hub terminals. The hubs are major intercity sorting locations but also include local pick-up and delivery functions. The terminals are cross-docks and do not store goods. Major LTL carriers operate 27 terminals within the NYMTC planning area, and another 49 terminals in surrounding areas within the multi-state New York City metropolitan region, notably in northern New Jersey and Orange County, New York (*Figure H-3-4*).

LESS-THAN-TRUCKLOAD TRANSPORTATION EFFECTS

LTL vehicle sizes vary, and the mix will depend on market needs. The typical equipment in LTL trucking is a 28-foot pup trailer, which can be used alone for city delivery or in pairs for intercity linehaul. The trailer is hitched to a city cab or a road tractor. Carriers also use 40-foot box trucks for city delivery; dry van trailers up to 53 feet in length for linehaul and city work; and a variety of other sizes depending on locations, volumes, restrictions and management preferences. Where LTL supplants parcel delivery, the equipment will be larger than parcel trucks; where LTL supplants truckload shipping, the equipment will be no larger and should be smaller overall. LTL equipment size should be generally stable in the years ahead, although federal regulation allowing 33-foot pup trailers (shorter than standard trailers that can be attached to trucks or other trailers, subject to allowable dimension restrictions) has been considered.

LTL service frequency and number of trips will increase. Growth in LTL shipping comes chiefly at the expense of truckload shipping. Because the total demand for goods is not falling and the requirement for faster time to market is not abating, then more LTL shipping entails more individual truck deliveries occurring more often. This adds to the pressure on highway and local road capacity and on the capacity of loading docks and street parking to absorb greater numbers of trucks.

LTL truck trip activity is not amenable to off-peak operations, meaning more trips in peak hours. City terminals must be situated to support morning delivery and afternoon pickup, allowing delivery as early as possible and pick-up as late as possible as a competitive requirement. Intercity linehaul schedules are a major constraint: off-peak pick-up and delivery is not much of an option because delivery does not begin until the overnight linehaul arrives and has been broken down into city trucks, and pick-ups do not extend late into the evening so the linehaul departs on time. Linehaul runs on a fixed schedule and cannot be compromised. With little time flexibility remaining, the city operation faces a persistent

challenge from congestion. LTL carriers contend with this by (1) using more trucks and making fewer stops with each, which raises costs and harms productivity; and (2) adding city terminals closer to more distant customers, which creates greater fixed expense. An important impact of larger LTL volumes in the NYMTC planning area therefore is more trucks running at peak hours because of linehaul constraints and the productivity effects of congestion.

3.1.3 VEHICLE AUTOMATION

VEHICLE AUTOMATION COMMERCIAL EFFECTS

Automated vehicle technologies for trucking—including driver assistance, autonomous vehicles, and connected vehicles—are evolving quickly. An increasing number of trucks are using sensor, communications, and/or processing software technologies for steering and braking assistance. Multiple vehicle manufacturers are actively engaged in developing fully autonomous trucks, which given the relative economic incentives, are expected to outpace autonomous passenger vehicles in terms of widespread commercial adoption. A related approach to autonomous vehicle operation that is drawing significant interest is platooning. Truck platoons use vehicle-to-vehicle communications and autonomous vehicle control technology to electronically "tether" tractor-trailers together in a convoy formation. These technologies offer the potential for an improved quality of life for truckers, helping the trucking industry address its well-documented challenges in attracting and retaining long-haul drivers. See ***Figure H-3-5***.

Figure H-3-4

LTL Terminals in and Surrounding the NYMTC Planning Area

Source: Carrier web sites

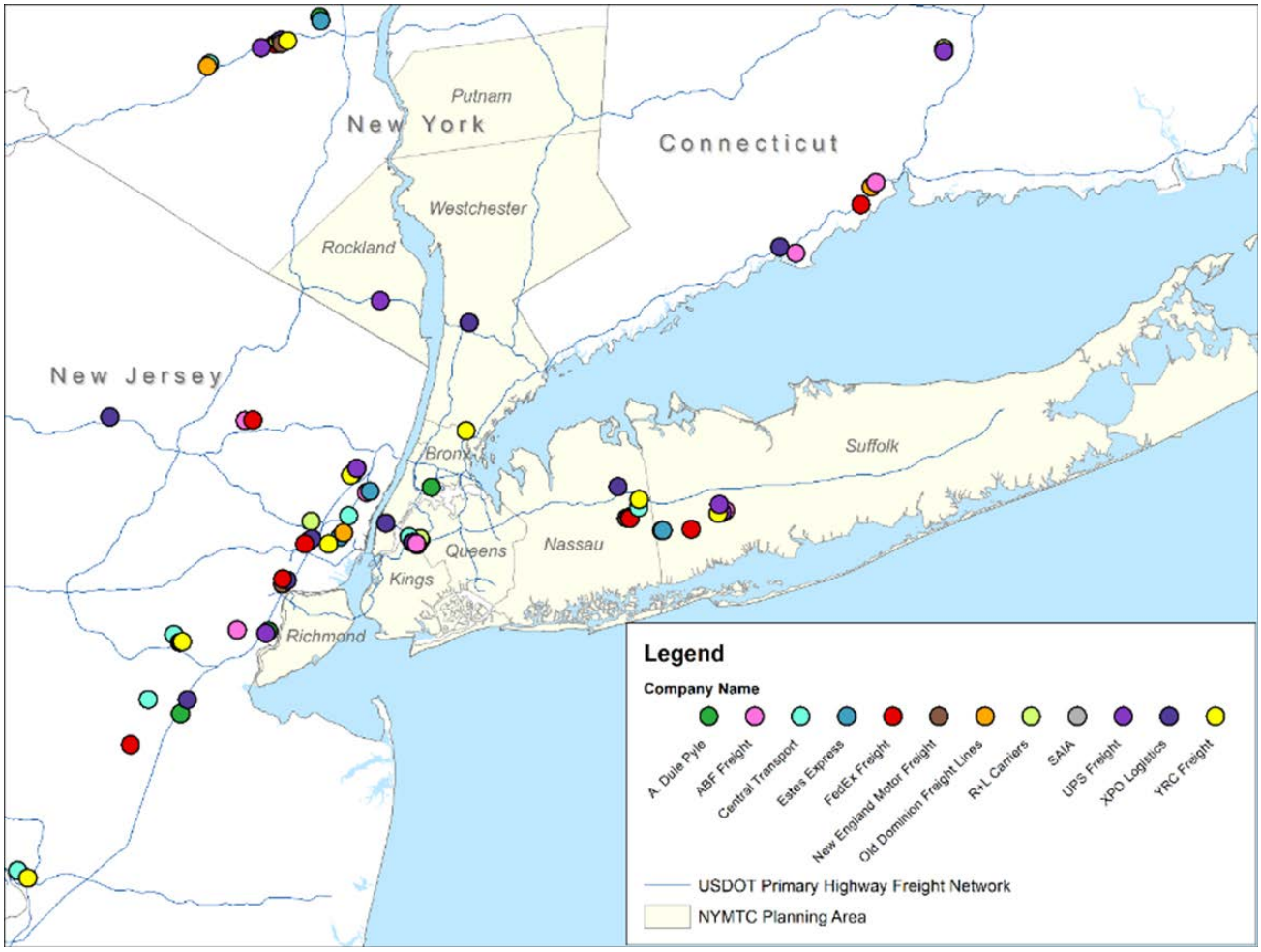


Figure H-3-5

Levels of Automation for Vehicles

Source: National Highway Traffic Safety Administration

Society of Engineers (SAE) Automation Levels		
0	No Automation	Zero autonomy; the driver performs all driving tasks.
1	Driver Assistance	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.
2	Partial Automation	Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.
3	Conditional Automation	Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.
4	High Automation	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.
5	Full Automation	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

Automated vehicle technology applications for U.S. linehaul freight rail service to date are focusing primarily on Positive Train Control (PTC). PTC is a processor-based/communications-based train control system. PTC helps prevent certain kinds of train accidents—train-to-train collisions, derailments caused by excessive train speed, train movements through misaligned track switches, and unauthorized train entry into work zones—by automatically controlling train speeds and movements if a train operator fails to take appropriate action in certain operational scenarios. By federal law, PTC must be installed on all mainlines carrying passengers or toxic-by-inhalation materials, and full national PTC implementation is imminent. While remote control locomotives are used within U.S. rail yards, fully automated trains are not used in U.S. linehaul service, and their adoption is not anticipated. However, railroads commonly use automated systems for dispatching, meet and pass trip planning, locomotive fuel trip time optimization, and signaling and train control, in addition to remote-controlled yard operations.

Fully autonomous "last foot" delivery robots are being developed and represent a long-term opportunity. These robots operate primarily in the space between the back of the truck and the front door of the customer and have significant potential especially in conjunction with driverless vehicles. Prototypes are being tested for food deliveries in Washington, D.C., and for parcel deliveries elsewhere.

VEHICLE AUTOMATION LAND USE EFFECTS

Automated transport equipment within marine terminals, rail terminals, and truck terminals should increase the throughput efficiencies of these facilities, allowing them to handle more freight within smaller footprints. These efficiencies may vary widely, depending on the type and degree of automation. However, some measurable efficiencies should be achieved in the long term. The most likely effect is to slow the pace of physical expansion and new terminal construction to accommodate growing demand over time.

Automated vehicle technologies could reduce the need for truck driver rest areas. Hours of service regulations stipulate that a driver can be on-duty for up to 14 consecutive hours, drive up to 11 of those hours, and must rest at least 10 hours before starting a new shift. With high or full vehicle automation, a driver could potentially sleep in the sleeper berth during long stretches of interstate highway while the vehicle remains under autonomous control; drivers would be able to rest and drive simultaneously, allowing for greater flexibility and productivity, and reducing the need to use designated (or undesignated) rest areas to address hours of service requirements.

Advanced "last foot" delivery strategies may reduce the demand for and/or duration of commercial vehicle parking. One could envision a scenario in which a delivery vehicle (manned or possibly automated) could stop briefly, discharge one or more delivery bots (and/or employees), then drive to its next delivery point, returning later to pick up the bots (and/or employees) after the deliveries in a given area are completed. See ***Figure H-3-6***. This could dramatically reduce the time needed for commercial vehicle parking in residential areas and on congested urban streets. However, they would also require the allocation of adequate sidewalk/street space to support their operations; this becomes a question for freight-inclusive "Complete Streets" design strategies.

VEHICLE AUTOMATION TRANSPORTATION EFFECTS

Automation could substantially reduce fuel, labor, and/or equipment costs for trucking, thereby potentially reducing the cost of truck transportation for the region's freight customers. For example, predictive cruise control, which combines cruise control with the Global Positioning System and topographical data can optimize fuel performance across varying terrains, while platooning can also improve fuel efficiency. If drivers can fulfill their rest requirements while in their vehicles, it means fewer truck drivers need to be hired, more deliveries can be completed in a given period, and fewer trucks need to be purchased by fleet operators. These savings would be offset by the technology costs but could provide a meaningful advantage to customers. Trucking costs in the NYMTC planning area are among the highest in the nation, so this is an important consideration.

Figure H-3-6

Delivery Robot in Washington, D.C.

Source: Washington Post

Automation could provide meaningful transportation safety benefits by reducing truck crashes. An often-cited statistic to back up this statement is the fact that approximately 90 percent of commercial truck accidents are caused or worsened by human error, either by a truck driver, other drivers, other vehicle passengers, cyclists, or pedestrians. Some evidence exists that recently implemented technologies such as forward collision warnings and automatic emergency braking systems enhance safety. However, further research on the benefits of higher levels of automation is needed to quantify the benefits.

Achievement of truck-related transportation benefits is more likely in the long term than the near term. The commercial integration of highly automated trucks faces significant barriers. The hardware issues are relatively minor, but the software issues are not. In addition, there are significant infrastructure, legal and liability, regulatory, political, and community acceptance issues to be resolved. However, freight industry professionals generally believe that these issues will be overcome in stages, largely between 2025 and 2035.

Automation could provide meaningful transportation safety benefits by reducing rail-vehicle collisions in the long term. The types of crashes and incidents that PTC is designed to address are relatively infrequent for freight railroads. However, the rail industry is very interested in the potential for control technologies that would warn—and if necessary, stop—appropriately equipped motor vehicles from approaching or entering unsafe rail crossings. Automated locomotives are already used in U.S. railyards to improve safety and efficiency (See ***Figure H-3-7***).

Automation is a proven strategy to improve transportation safety within marine terminals and to reduce truck queueing inside and outside terminals, and it should be increasingly effective over time. Worker lost-time incident rates are lower in automated terminals, and to date, there have been zero serious casualties in any of the world's automated terminals. See ***Figure H-3-8***. Automated and semi-automated terminals incur far less damage to containers, cargo, and equipment because of more precise motion control. Automated and semi-automated gate processing systems can significantly reduce trucker wait time at terminal gates, as well as wait time within the terminal while a container is unloaded from or loaded to a chassis. Some of these tools are already in place in the NYMTC planning area, and their use is expected to increase as conditions permit/dictate.

Figure H-3-7

Remote Control Locomotive Operations are Common in US Railyards

Source: Federal Railroad Administration

Figure H-3-8

Automated Guided Vehicle in a Container Terminal, Altenverder, Germany

Source: WSP

3.1.4 WAREHOUSE DESIGN AND AUTOMATION

WAREHOUSE DESIGN AND AUTOMATION COMMERCIAL EFFECTS

Growth in supply chains that emphasizes fast times-to-market is leading to growing demand for cross-dock facilities, warehouses, distribution centers, cold storage facilities, and fulfillment centers to support these activities. Cross-docking refers to a simple re-sort system where shipments arriving in one trailer are moved into several other departing trailers bound to different destinations; this operation is known as transloading. LTL terminals are cross-docks. Cross-docking facilities are typically oblong concrete docks with arriving trailers on one side and departing trailers on the other. The purpose of cross-docking is to maintain consolidation (i.e., full trailers, which cost less to transport per shipment), while allowing shipments to move to different destinations. Warehousing has a related but different function. Warehouses temporarily store product inventory and then send it on to end-points. Many retailers have evolved sophisticated inventory management systems to "pull" materials from warehouses on an as-needed basis, thus optimizing use of retail floor space. Supply chains will continue to seek to minimize inventory because it is expensive to own and hold—inventory carrying costs typically total between 18 and 25 percent of the value of goods. Compared to cross-docks, warehouses require more space and racks to hold goods, and more labor and material handling equipment to move them in and out of storage. Like warehouses, distribution centers also store products, although the duration of storage tends to be shorter, and distribution centers may also offer value-added services like cross-docking, product mixing, packaging, and order fulfillment. A fulfillment center is a type of distribution center specializing in or offering order fulfillment. The term "warehouse" is often assumed to include both distribution centers and fulfillment centers (since the main function in each case is storage of goods), but not cross-docks (since the main function in this case is fast transfer between freight vehicles).

The drive for faster time-to-market creates increasing demand for both warehouses and cross-docks. Cross-docks may seem better suited to metropolitan environments because of their more modest size. However, they depend on goods in motion (or goods stored in trailers, which are difficult to access). As response time shrinks—under pressure from same day and next day e-commerce service offerings—portions of inventory must be held nearby. Moreover, as the variety and volume of products moved in e-commerce channels expands, more nearby inventory is required. E-commerce fulfillment centers differ from traditional distribution centers in their requirement for greater labor input, which results from small order sizes and varied stock keeping unit content typical of on-line consumer purchases. They are nevertheless significantly automated facilities.

Warehouse, distribution center and fulfillment center growth is extremely strong. Distribution centers have proliferated at an astounding pace. Nationally, annual development of new warehouse and distribution space has more than tripled in the past five years. Eastern Pennsylvania, northern New Jersey, and the NYMTC planning area comprise one of the two largest distribution center markets in the country, along with Southern California, and this rapid growth is expected to continue.

WAREHOUSE DESIGN AND AUTOMATION LAND USE EFFECTS

Supply chains are evolving to use different kinds of facilities in different locations. In these multi-stage networks, goods are held at and directed from several points with facilities of different sizes and functions deployed along the chain. Large and increasingly automated distribution centers are situated at the outskirts of a delivery region to serve multiple submarkets with diverse volumes of ready inventory. The enormous growth of northern New Jersey and eastern Pennsylvania as the main staging centers for New York City and the Northeast is a good example. The regional distribution centers feed smaller facilities and cross-docks situated closer to and inside the submarkets.

Warehouse automation is allowing for more throughput from smaller and taller facilities. Automated warehouses can increase throughput per square foot (and thus per acre) by as much as three times. Aisles between storage racks can be narrower and the height of the racks taller because robotics replace forklifts. This configuration allows more product to be handled and stored horizontally and vertically, and it pushes warehouse ceiling heights to well above 40 feet. Combinations of material handling and optical equipment enable greater precision in picking and packing inventory, which enables management of larger volumes and greater varieties of products. Companies interested in warehouse automation must weigh the high initial costs of acquiring the equipment and management systems, relative to the reductions in operating costs over time. Today, large-scale automation resides primarily at large, regional distribution centers, but the use of optical equipment, robotics, and related systems will almost certainly be increasingly deployed in smaller facilities over time. For example, the grocery chain Fresh Direct has opened a 10,000 square-foot "micro fulfillment center" in Washington, D.C., featuring high stacking and robotic operation; the concept is expected to be rolled out in other urban areas.

Multi-stage logistics and automation have driven rapid growth in the development of smaller distribution centers. The average size of distribution centers has dropped to 220,000 square feet, a decline of 15 percent between 2013 and 2017. In fact, the growth in these centers has occurred at both the larger (1 million+ square feet) and smaller (under 250,000 square feet) ends of the size range, as would be expected from multi-stage distribution strategies. The growth is driven by the continuing demand for faster times to market, with e-commerce acting as a significant driver. The result is more distribution staging closer to end-markets, with the emphasis on delivery more than storage.

Demand for smaller, closer-in space is being met largely through urban infill. Demand is being met through development or redevelopment in areas that are mainly built out—this represents a major shift from practices of the past decades. The supply of new urban infill properties has been flat while vacancy rates have rapidly declined. See ***Figure H-3-9***. In response, some companies are repurposing facilities or leasing out portions of underutilized space. Outer regions are also seeing redevelopment through adaptation, as shopping mall sites and other large retail (or former retail) properties are being converted to warehouse/distribution functions.

Multi-story warehousing is an emerging strategy to meet close-in demand on constrained infill sites. Already in use overseas, the first multi-story facility opened in Seattle at the end of 2018. The Seattle property comprises 590,000 square feet on less than 14 acres in an urban setting just 5 miles from downtown. The facility has three stories, with an external ramp that accommodates trucks with 53-foot trailers. Capacity per acre is tripled versus traditional one-story facilities, demonstrating how these designs are adapted to the smaller sites and costlier land characteristics of urban infill. Architects report the minimum lot size for these designs is 3 acres. See ***Figures H-3-10*** and ***H-3-11***.

WAREHOUSE DESIGN AND AUTOMATION TRANSPORTATION EFFECTS

Warehouse development means more inbound and outbound truck trips; automated and multi-story facilities bring a substantial increase in freight generation per acre. Per-acre trip generation rates for multi-story facilities could be multiple times the traditional rates. Automation has a comparable effect, which could be more impactful in the NYMTC planning area as adaptation costs decline. Cross-docks also have high volume profiles because they are intended as fast truck-to-truck transfers.

Figure H-3-9

Vacancy Rates for Urban and Non-urban Infill

Source: Jones Lang LaSalle

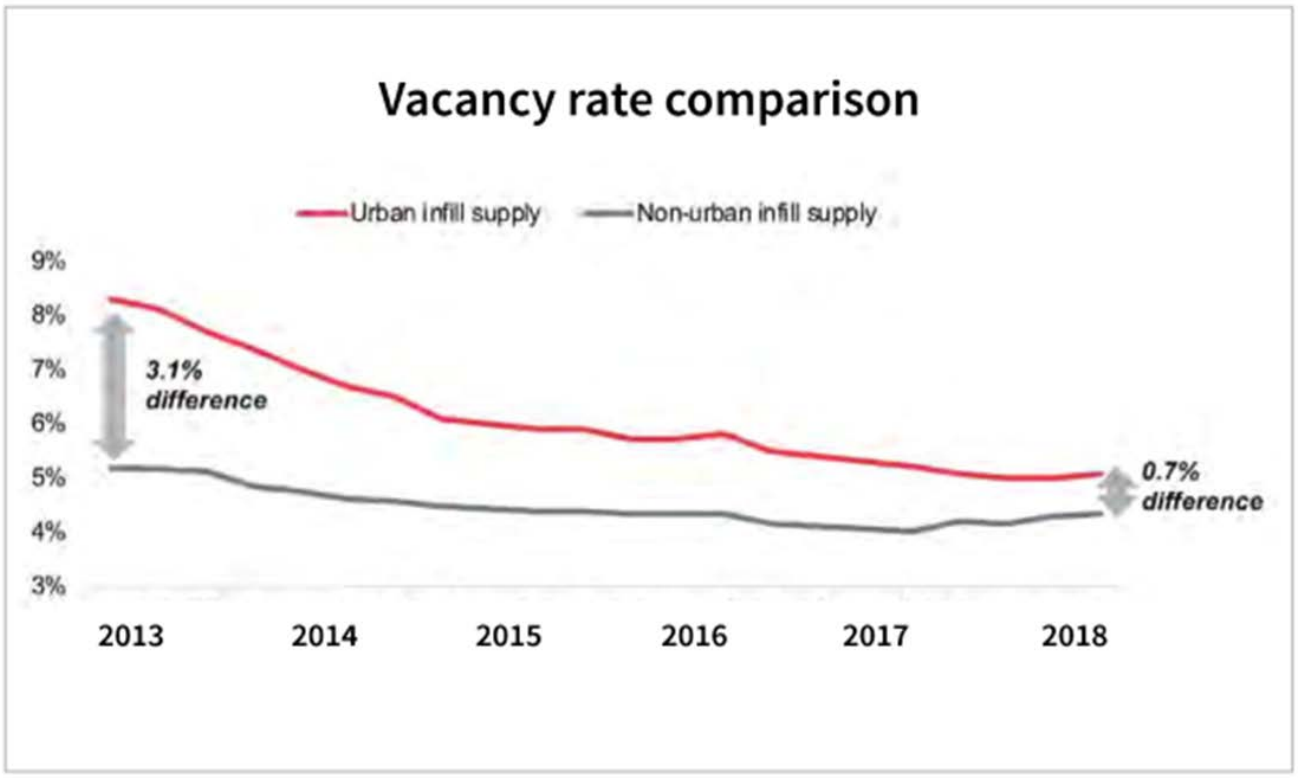


Figure H-3-10

Prologis Seattle Three-story Warehouse

Source: Prologis

Figure H-3-11

Four-story Warehouse Being Developed in Maspeth Neighborhood of Queens, New York

Source: RXR Realty, LBA Logistics

Facility development in urban areas changes truck trip distribution and network assignment patterns. Traditionally, a freight receiver in the NYMTC planning area might have been served directly via truck from a single regional distribution center in northern New Jersey or eastern Pennsylvania. With multi-stage warehousing, the trip may now be from a regional distribution center to a smaller urban facility and then to the freight receiver. New truck trips will be generated in the areas hosting urban centers and on the corridors connecting them to freight receivers. Conversely, truck trips may be avoided in corridors that formerly provided direct connections. Carefully managing the location of urban facilities—and aligning locations with truck route network management—will be a critical topic for freight transportation planning.

3.1.5 DISTRIBUTED MANUFACTURING

DISTRIBUTED MANUFACTURING COMMERCIAL EFFECTS

3D printing technology is advancing rapidly. 3D printing is a type of additive manufacturing where products are formed by layering materials, as opposed to subtractive (cutting away) or formative (molding) techniques. 3D-production machinery is loosely referred to as "printers" and includes inkjet printers used with ceramics and concrete, although these printers are just one of a half dozen types. Similarly, the raw materials may be referred to metaphorically as "inks"; the actual materials include plastics, metals, and even food in various forms. Fused deposition modeling of plastics is the most common and probably best-known production method; it uses melted filaments extruded through a nozzle. 3D printers are operated from software that contains the design specifications. The size of the additive manufacturing industry was $7.3 billion worldwide in 2017, growing 17 percent over 2016; the industry is forecast to grow at a compound annual rate of 15.2 percent in the five years through 2023. The growth rates cited above imply that the size of the 3D market will double within five years.

3D processes are being applied primarily to component manufacturing. 3D is not primarily about stand-alone machinery for fabricating entire products; instead, it is a flexible and sometimes superior technique for improving production of components within existing manufacturing processes that reduces costs and makes factories more competitive. Consumer electronics, medical devices such as hearing aids, aircraft components, footwear, and toys are examples of product types; concrete panels can also be manufactured in this process. See ***Figure H-3-12***.

3D processes will enable and facilitate systems of "distributed manufacturing." Distributed manufacturing refers to the potential for efficient production of components and goods near the points of demand, leading to many small factories situated in and serving many local markets. This contrasts with the long-standing imperative for factories to achieve economies of scale through mass production, and to locate large plants in limited numbers where the availability of raw materials, affordable skilled labor, vendors, or other factors of production make the achievement most efficient.

DISTRIBUTED MANUFACTURING LAND USE EFFECTS

3D printing location networks are being established in current freight-handling locations. UPS launched a network of desktop models (defined as costing less than $5,000) in 2016, in a joint venture with the enterprise software systems company SAP and the 3D printing specialists Fast Radius. The network originally had 60 UPS store locations, including two in the NYMTC planning area (and none in New Jersey), plus industrial grade equipment at the UPS national air hub in Louisville, Kentucky. In 2019, the network was reduced to 31 locations, with one in NYMTC planning area (and still none in New Jersey), although office stores like Staples also offer printers. Industrial grade printers placed in UPS truck terminals would be a natural future step if the market demand developed.

Future 3D printing locations may be in the home or at commercial locations anywhere in the NYMTC planning area. There is no clear way to isolate the locations where new production may occur. Food, health care products, and construction materials are affected industries active in the territory, but metropolitan New York is a massive consumer market with continuing demand for replacement parts and finished goods. Industries that can serve it effectively from a local base will try to, whether fabrication occurs in New York, New Jersey, or farther out. Moreover, 3D printing is a disruptive technology, implying that new business models will come to the fore and supplant some of the old products and patterns of supply.

Parts warehouses could be replaced at least in part by printing sites, and factory location decisions may become less dependent on the labor costs for components. Markets like New York—with high cost labor and large local demand—are a more attractive option for component assembly operations than they have been in recent years.

DISTRIBUTED MANUFACTURING TRANSPORTATION EFFECTS

Demand for the transportation of materials to feed 3D processes will grow. Many of these feedstock materials are heavy (e.g., metals, ceramics, concrete) and might be suitable for bulk transport as demand grows, although some sort of protective packaging seems likely in many cases. One possibility is the development of local depots that break down bulks into consumable bundles for regional delivery, in addition to direct deliveries in volume to factories. The sources of inks are not well defined, because they are specialty items thus far. Presumably the industries that produce plastics, metals, ceramics and other inputs will be able to serve the new and growing demand, although from which plants in which states remains to be seen. One type of input is plastic resins, which are by-products of petroleum refining; the largest U.S. source region for plastic resins is the Gulf Coast, but the greater New York-New Jersey-Pennsylvania region is also a significant source for these resins, which could be used locally and/or exported.

The NYMTC planning area is likely to produce more component parts and finished goods moving short distances and import less component parts and finished goods moving long distances. Inbound products serving the regional population seem the most probable to be shifted, although outbound goods may be affected. For example, specialty foods such as chocolate and some baked goods are existing applications of 3D printing; NYMTC area producers may adopt it while continuing to ship to external markets as well as locally. Shipments to the NYMTC area of large volumes from some external sites in the United States or abroad, might be replaced by local shipments from points of production inside the NYMTC planning area. The length and complexity of supply chains for product deliveries may be generally reduced, meaning more goods can be delivered with lower per-unit transportation impacts.

Flows by water and could be impacted, although it is too early to anticipate the nature and extent of impacts. Seaports could face losses of international trade if more materials and products are made domestically, or air cargo could be reduced if high-value goods are made locally, although in both cases other business opportunities could offset any losses. For example, inks could grow as import or export commodities by water, and air will remain vitally important as a fail-safe system for supply chain breakdowns and disruptions.

Rail will remain important. Rail will be viable for containerized transport of inks, and potentially for carload transport of inks in bulk. At least one of the Class I railroads in NYMTC planning area has targeted the market for inks. Carriage of goods produced by integrated factories shipping longer distances will continue to be modally competitive, especially for intermodal transport.

The role of local trucking will be increasingly important. Motor carriage will handle local and regional delivery of products. Compared to today when some of those products move from around the nation and world, there will be less modal diversity in affected supply chains. Trucks also will be important for delivery of inks, especially where volumes are small, or producers are regional, or for intermodal drayage.

Figure H-3-12

Concrete Slab from 3D Printer

Source: Elsevier Journal (Ngo, Kashani, Imbalzano, Nguyen, and Hui)

3.1.6 SUMMARY OF EFFECTS

The key trends, and their effects in the areas of commercial activity, transportation, and land use, are summarized and listed in ***Table H-3-2***.

Table H-3-2

Checklist of Key Trends and Observed/Anticipated Effects

Source: WSP

E-commerce	
Commercial Effects	E-commerce market share is substantial and growing rapidly, with growth trends being accelerated by the COVID-19 pandemic.
	E-commerce is project to continue its rapid growth and generate sustained changes in the way goods are purchased.
	Decisions about e-commerce logistics are concentrated in the hands of a limited number of high-volume companies.
Land Use Effects	There is substantial demand for additional warehouse square footage to serve e-commerce.
	The trend is towards smaller and/or closer-to-market warehouse/distribution facilities to supplement large mega-facilities in outlying areas.
Transportation Effects	Significant increases in e-commerce means significant increases in related truck trip generation.
	The new truck trip generation consists of three parts: inputs to primary warehouse and distribution facilities; (as needed) moves between primary and secondary warehouse and distribution facilities; and D2C deliveries to residential addresses, largely by parcel delivery companies.
	Increasing use of parcel delivery means increased presence of these vehicle types on city streets and in residential areas.
	There are practical limits to what can be delivered effectively via parcel services.
	Increasing use of D2C services may provide offsetting reductions in auto trips and reduced overall auto dependency.
	Pressures for rapid and reliable order fulfillment continue to grow overall, placing a premium on transportation reliability.
	E-commerce is being increasingly used for consumable goods with especially rapid delivery requirements, further highlighting the need for/value of transportation system reliability.
	“Last mile” performance is especially important for e-commerce.
	Crowd-sources services are an increasingly attractive option for last mile deliveries.
	Alternative last-mile modes are being explored.

Less-than-Truckload (LTL) Delivery	
Commercial Effects	LTL motor carriage represents 5 percent of trucking operations but is poised for expansion.
	LTL is a logical complement to parcel delivery services and should grow at a corresponding rate.
	LTL costs are higher than truckload services and there will be continuing pressures to reduce operating costs.
Land Use Effects	Growth in LTL activity will generate growth in the number and intensity of terminal operations.
Transportation Effects	LTL vehicle sizes vary, and the mix will depend on market needs.
	LTL service frequency and number of trips will increase.
	LTL truck trip activity is not amenable to off-peak operations, meaning more trips in peak hours.
Vehicle Automation	
Commercial Effects	Automated vehicle technologies for trucking—including driver assistance, autonomous vehicles, and connected vehicles—are evolving quickly.
	Automated vehicle technology applications for U.S. linehaul freight rail service focus primarily on PTC.
	Automated equipment and control systems have been adopted in most major U.S. marine container terminals, but the nature and extent of adoption varies, and is generally less than in other countries.
	Fully autonomous "last foot" delivery robots are being developed and represent a long-term opportunity.
Land Use Effects	Automated transport equipment within marine terminals, rail terminals, and truck terminals should increase the throughput efficiencies of these facilities, allowing them to handle more freight within smaller footprints.
	Automated vehicle technologies could reduce the need for truck driver rest areas.
	Advanced "last foot" delivery strategies may reduce the demand for and/or duration of commercial vehicle parking.
Transportation Effects	Automation could substantially reduce fuel, labor, and/or equipment costs for trucking, thereby potentially reducing the cost of truck transportation for the region's freight customers.
	Automation could provide meaningful transportation safety benefits by reducing truck crashes.
	Achievement of truck-related transportation benefits is more likely in the long term than the near term.
	Automation could provide meaningful transportation safety benefits by reducing rail-vehicle collisions in the long term.
	Automation is a proven strategy to improve transportation safety within marine terminals, and to reduce truck queueing inside and outside of terminals, and it should be increasingly effective over time.

Warehouse Design and Automation	
Commercial Effects	Warehouses (including distribution centers and fulfillment centers) and cross-dock facilities are needed to support supply chains that emphasize fast times-to-market.
	The drive for faster time-to-market creates increasing demand for both warehouses and cross-docks.
	Warehouse, distribution center, and fulfillment center growth is extremely strong.
Land Use Effects	Supply chains are evolving to use different kinds of distribution center facilities in different locations.
	Warehouse automation is allowing for more throughput from smaller and taller facilities.
	Multi-stage logistics and automation have driven rapid growth in the development of smaller distribution centers.
	Demand for smaller, closer-in space is being met largely through urban infill.
	Multi-story warehousing is an emerging strategy to meet close-in distribution center demand on constrained infill sites.
Transportation Effects	Warehouse development means more truck trips on both the inbound and outbound sides; and automated and multi-story distribution centers bring a substantial increase in freight generation per acre.
	Distribution center development in urban areas changes truck trip distribution and network assignment patterns.
Distributed Manufacturing	
Commercial Effects	3D printing technology is advancing rapidly.
	3D processes are being applied primarily to component manufacturing.
	3D processes will enable and facilitate systems of "distributed manufacturing."
Land Use Effects	3D printing location networks are being established in current freight-handling locations.
	Future 3D printing locations may be in the home, or at commercial locations anywhere in the NYMTC planning area.
	Parts warehouses could be replaced at least in part by printing sites, and factory location decisions may become less dependent on the labor costs for components.
Transportation Effects	There will be growing demand for the transportation of inks to feed 3D processes.
	The NYMTC planning area is likely to produce more component parts and finished goods moving short distances, and import less component parts and finished goods moving long distances.
	Flows by water and air could be impacted.
	Rail will remain important.
	The role of local trucking will be increasingly important.

3.2 DISRUPTORS

Trends are changes that can be observed over time and can be reasonably predicted or projected to continue or change. By contrast, disruptors are unpredictable and (often) unexpected events. Disruptor events can dramatically influence freight movement by changing patterns of production, consumption, and supply chain logistics, either temporarily or for sustained periods. These disruptors represent risks to freight system infrastructure and operations. One measure of freight system "resiliency" is the ability to withstand the impact of disruptors and recover quickly to pre-disruptor conditions.

Disruptors are addressed comprehensively in the Resilience Goal Module of Moving Forward. Two specific disruptors that can significantly impact freight—climate and the COVID-19 pandemic—are discussed below.

3.2.1 ANALYSIS OF CLIMATE AS A FREIGHT TRANSPORTATION DISRUPTOR

STORM EVENTS

Most of the NYMTC planning area sits at a relatively low elevation and is surrounded by water. The risks to such a region from major storm events, like Hurricanes Sandy, Irene, and Lee, have been well-documented. Temporary closure or blockage of ports, navigation channels, airports, tunnels and underpasses, bridges, low-lying rail lines and highways, and vulnerable warehouse and storage structures can lead to significant breakdowns in the movement of critical commodities: food, essential packaged goods, fuels, building materials, pharmaceuticals; and waste products. As discussed in ***Chapter 2***, the NYMTC planning area depends heavily on other regions to supply it with many of these goods, and in some cases the nearby inventory stocks (especially for food) are limited to several-days' supply, so the effects of disruptions from weather events may be felt very quickly and very deeply.

NYMTC has an established goal to improve the resiliency of the region's transportation system through: adaptation measures for critical components of the transportation system to accommodate variable and unexpected conditions without catastrophic failure; identifying options for goods movement during and after events; and cooperative partnerships with public and private partners to implement adaptations and improve recovery planning and operations.[6]

NYMTC participated in an FHWA study published in 2017 (the Post Hurricane Sandy Transportation Resilience Study in New York, New Jersey, and Connecticut[7]). The study identified four primary causes of damage (coastal flooding, river flooding, wave action, and wind), along with many types of infrastructure failure impacting freight (e.g., downed trees and other debris, erosion/washout, inundation, mechanical damage, loss of electrical substations, loss of signal or sign controls, and loss of navigation channel markers).

Nationally, adaptation measures to these types of damage typically focus on three strategies: avoiding the development of infrastructure in high-risk areas where possible; "hardening" facilities where risks cannot be avoided; and designing alternative routes, modes, and supply chain strategies to relieve the transportation burden on higher-risk assets, as much as practical. Hardening may include: elevating above floodplain or protecting with floodwalls; building to withstand stronger winds, wave action and scour, and periods of prolonged inundation; upgrading drainage and runoff capability; installing backup electrical/utility systems; establishing 'safety zones' for protection of cargo and high-value assets; reducing hardscape with protective planted areas; and other measures. Regional planners must consider which of these strategies are most applicable based on specific conditions and risks. See ***Table H-3-3***.

Table H-3-3

Potential Impacts from Storm Events

Source: Moving Forward Freight Element Analysis

Demand for certain types of commodities could be temporarily higher or lower depending on the extent and duration of disruptions.
Transportation infrastructure could be built to higher standards of resistance, and 'redundant systems' including alternative modes could be emphasized.
Supply chains may increasingly shift to lower-risk modes and routes, placing greater stress on those assets, unless the region's higher-risk freight transportation routes and facilities are protected.

SEA LEVEL RISE

For freight, the protection of low-lying infrastructure is especially crucial, as many of the region's most critical freight assets—JFK and LaGuardia airports, the marine terminals at Red Hook and Sunset Park (as well as those in New Jersey), industry clusters along the Newtown Creek in Brooklyn and Queens—are in such low-lying areas. Gradual sea level rise amplifies the flood, surge, and wave action damage potential from storm events but allows time for the types of adaptations listed above.

On the other hand, rapid and catastrophic sea level rise means the nearly immediate and sustained inundation of low-lying infrastructure. At any given moment, there is a finite risk of such an event occurring, and the assessment of that risk is an important factor in determining the timing and extent of protective adaptations before the fact.

The primary driver of sea level rise is climate warming, and a primary policy response has been to promote reductions in the emission of greenhouse gases. In 2019, the State of New York executed the single largest contract by any state for offshore wind energy procurement, and also enacted Climate Leadership and Community Protection Act.[8] The Act calls for 70 percent renewable energy by 2030, zero-carbon emissions energy by 2040, greenhouse gas emission reduction to 85 percent of 1990 levels by 2050, and economy-wide carbon neutrality by 2050. Today, around 36 percent of the state's greenhouse gas emissions are from transportation. The details of the plan are yet to be determined but could impact freight movement in significant ways. See ***Table H-3-4***.

Table H-3-4

Potential Impacts from Sea Level Rise

Source: Moving Forward Freight Element Analysis

Nationally, the movement of coal has already declined precipitously due to reduced use by domestic electric utilities and falling export demand. Continued shifts away from fossil fuels will reduce the amount of crude and refined petroleum fuels moving into and within the NYMTC planning area by international water, domestic water, and domestic truck modes, while receipts of natural gas (by rail, truck, and/or water) are likely to increase in the near-term.
Construction of clean energy infrastructure will be a major undertaking, involving significant freight movement for installation of energy production components and their ongoing maintenance; offshore wind energy installation in particular will require enhancements to marine terminal infrastructure to support production and staging of offshore wind components.
As businesses and consumers shift to new energy sources, costs may be higher, potentially impacting the livability and economic competitiveness of the region; but over the long term, such effects should be offset by lower risk and improved quality-of-life for the region.

CHANGES IN TEMPERATURE AND PRECIPITATION

Changes in temperature and precipitation are less selective in their effects and will affect every part of the United States and the world. Because these effects are truly global in nature, the scale of potential impacts—while impossible to predict with accuracy—may be dramatic. Parts of the world will become hotter; parts will become wetter or dryer; and weather will become more unpredictable, with longer periods of destructive flooding or drought. See ***Table H-3-5***.

Table H-3-5

Potential Impacts from Changes in Temperature and Precipitation

Source: Moving Forward Freight Element Analysis

The NYMTC planning area is likely to require more energy for heating and cooling in response to increased temperature fluctuations, which may translate into the movement of more fuels (natural gas et al) and/or construction of larger than anticipated energy production facilities.
Inland transportation systems that move goods to and from the NYMTC planning area—rivers, highways, railroads, and airports—will experience more frequent and severe outage periods, impacting the reliability of goods movement for the region's consumers and producers.
Transportation of critical goods such as food may be especially impacted. Food production itself is likely to change—locations of suitable growing regions are shifting, and the risks to annual production are increasing—both of which highlight the value of greater food self-sufficiency for the region through source diversity, local production, and robust supply chain infrastructure.

3.2.2 ANALYSIS OF THE COVID-19 PANDEMIC AS A FREIGHT TRANSPORTATION DISRUPTOR

Planners have been aware of climate risks for decades, and considerable work has been done in framing the issues, risks, and potential responses. In contrast, the transportation and supply chain impacts of the COVID-19 pandemic were not clear until the pandemic was underway. Manufacturers, transportation and logistics service providers, intermodal facility operators, and others responded "on the fly" and with overall success. In terms of freight transportation, the impacts of the COVID-19 pandemic have not been catastrophic—the freight system continues to function with critical supply chains largely operating as designed—but there have been some significant adjustments and modifications that are worth noting. The primary effects are summarized in ***Tables H-3-6***, ***H-3-7***, and ***H-3-8***.

BUSINESS SECTOR ACTIVITY AND EMPLOYMENT

The COVID-19 pandemic dramatically changed the structure of the national and regional economy. In November 2019, prior to the pandemic, the unemployment rate for the New York-Newark-Jersey City-NY-NJ-PA metropolitan statistical area was 3.4 percent; in November 2020, it had increased to 9.5 percent. Over the same period, the national rate increased from 3.3 percent to 6.4 percent.[9] It should be noted that economic indicators are changing rapidly from month-to-month and reflect a complex mix of both direct and indirect effects. However, the data show that NYMTC planning area and the MAP Forum region suffered a substantially greater rate of job loss than the country as a whole.

As shown in ***Figure H-3-13***, industry sectors such as leisure and hospitality (including restaurants and hotels) were hit hard, with job losses exceeding 40 percent compared to 2019. However, other sectors of the economy—other services, construction, trade, and transportation—also saw job losses exceeding 10 percent.

Figure H-3-13

Change in New York Area Employment, August 2019 to August 2020

Source: U.S. Bureau of Labor Statistics

New York area employment (number in thousands)	Aug. 2020	Change from Aug. 2019 to Aug. 2020	
		Number	Percent
Total nonfarm	8,752.6	-1,176.1	-11.8
Mining, logging, and construction	380.9	-48.7	-11.3
Manufacturing	328.9	-31.0	-8.6
Trade, transportation, and utilities	1,536.4	-176.5	-10.3
Information	284.9	-16.5	-5.5
Financial activities	758.2	-44.2	-5.5
Professional and business services	1,446.6	-179.9	-11.1
Education and health services	1,854.1	-138.7	-7.0
Leisure and hospitality	587.9	-404.9	-40.8
Other services	367.8	-61.1	-14.2
Government	1,206.9	-74.6	-5.8

Table H-3-6

COVID-19 Pandemic Impacts on Business Sector Activity and Employment

Source: Moving Forward Freight Element Analysis

Reduced demand by freight-intensive industries (like construction) and freight-dependent industries (like leisure and hospitality) have led to lower volumes of goods being produced, consumed, and transported; this in turn has led to reduced employment in the trade and transportation sector.

E-COMMERCE

With the COVID-19 pandemic, less consumer and business purchasing is being done through traditional face-to-face retail outlets, and more is being done through e-commerce channels and direct delivery to end users. At the onset of the pandemic, between March and April 2020, retail sales dropped by 16.4 percent overall, but sales by non-store retailers (including Amazon and other e-commerce retailers) increased by 8.4 percent. See ***Figure H-3-14***. E-commerce—which had been expanding rapidly—received a powerful and immediate boost from the COVID-19 pandemic (***Table H-3-7***).

This effect continued into succeeding months. As reported by the U.S. Census Bureau:

- In the second quarter of 2020, total retail sales declined by 3.9 percent compared to the first quarter of 2020, but e-commerce sales increased by 31.8 percent over the same period. In the second quarter of 2020, e-commerce accounted for 16.1 percent of all retail sales (seasonally adjusted), a share increase of more than 3 percent from the previous quarter.
- In the third quarter of 2020, total retail sales declined by 1.0 percent compared to the second quarter of 2020. E-commerce sales in this period accounted for 14.3 percent of total sales (seasonally adjusted). In non-adjusted terms, e-commerce sales declined slightly (by 0.6 percent) from the second to third quarters.[10]

MODAL UTILIZATION

Looking at impacts on specific modes, the picture is mixed.

- Nationally, 2019 was not a strong year for rail, primarily because of declining volumes in coal (due to lower domestic and export demand) and grain (due to lower export demand). On top of this, the COVID-19 pandemic resulted in a rapid loss of rail volume. For 2020 year-to-date (YTD) through October 10, rail carloads were down by 15 percent and rail intermodal lifts were down by 5.5 percent.[11] However, rail volumes began to recover in the third quarter; for the most recent available week, rail carloads were down by 5.2 percent compared to the same week in 2019, while rail intermodal volumes were actually up by 8.4 percent, resulting in a total weekly volume in excess of 2019 levels.[12] Compared to 2019, 2020 YTD (through November) intermodal rail lift volumes at Port Authority of New York and New Jersey (Port Authority) terminals were actually higher by 5.6 percent versus last year.[13] Volumes for the New York & Atlantic Railroad (NY&A), which operates in Brooklyn-Queens-Nassau-Suffolk counties, dropped significantly in the early part of 2020, but beginning in June 2020 had recovered to levels similar to 2019; food and beverage volumes remain somewhat depressed, while movements of waste materials are higher than normal, likely reflecting changes in where waste is being generated (more from home, less from workplaces, schools, and restaurants).[14]

Figure H-3-14

Change in Retail Sales, March 2020 to April 2020

Source: https://www.cnbc.com/2020/05/15/this-breakdown-of-retail-sales-data-shows-why-amazon-is-leading-the-stock-market.html

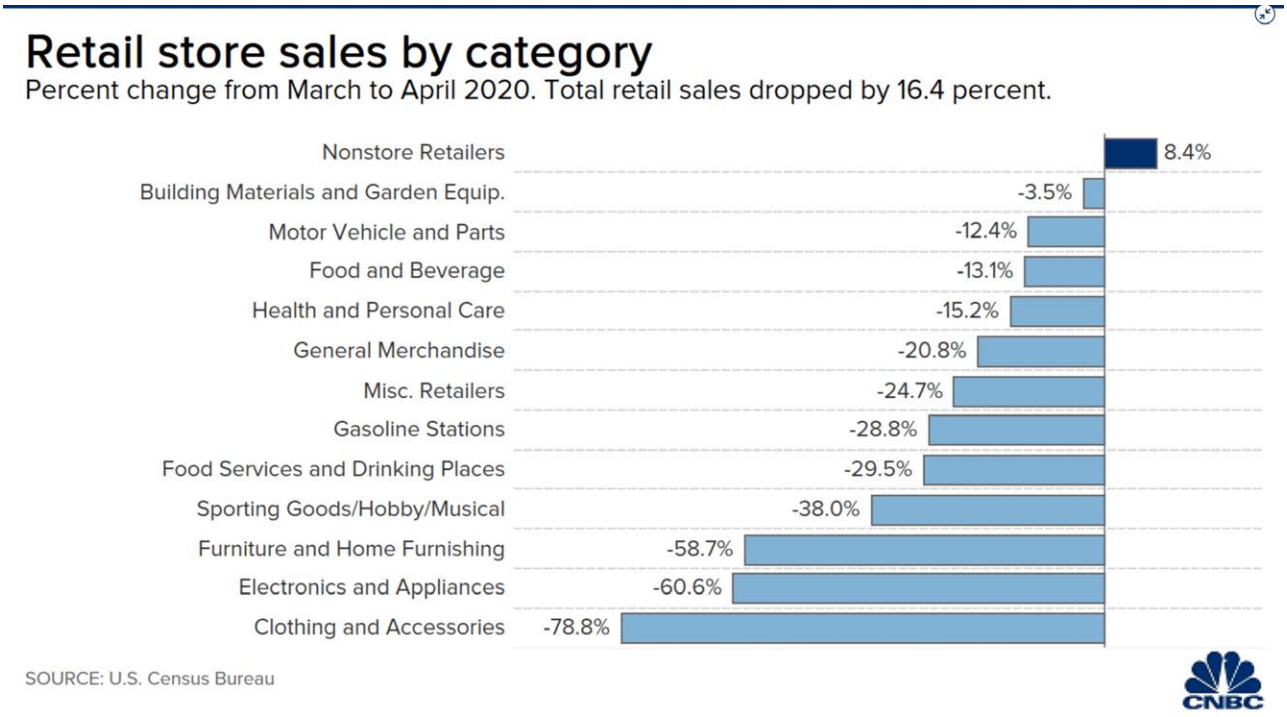


Table H-3-7

COVID-19 Pandemic Impacts on E-Commerce

Source: Moving Forward Freight Element Analysis

Pressures on e-commerce supply chains and last-mile delivery systems have increased quickly and substantially due to the COVID-19 pandemic, even though total retail sales have slowed.

Further research is needed to clearly understand the extent to which the COVID-19 pandemic-driven acceleration of e-commerce utilization may be sustained into the future.

- Port Authority marine terminal intermodal volumes YTD through November 2020 were just 0.1 percent lower than through November 2019.[15] Imports drove this increase, suggesting that inventory is being replenished and that prior growth drivers (including a growing share of mega-containership trade with Asia and Europe) are reasserting themselves. Loaded container imports were up 2.3 percent, while loaded exports were down 9.8 percent.[16]
- JFK air cargo volumes (measured in short tons) YTD through October 2020 were around 17.2 percent lower than comparable volumes for 2019. The loss was due to declines in international trade; domestic air cargo traffic increased by 19.2 percent YTD compared to 2019, while international air cargo declined by 27.1 percent as a result of international flight restrictions.[17]
- Trucking volumes nationally are down compared to 2019. The American Trucking Association compiles an index of truck tonnage (where 100 equals year 2015 levels); it found the August 2020 index was 8.9 percent lower than the August 2019 index, and declined by 5.6 percent compared to July 2020.[18] The low-water mark was the April-May period, where trucking declined to levels not seen since 2017; June saw a strong rebound, followed by declines in July and August (see ***Figure H-3-15***). Research by the American Trucking Research Institute suggests these declines were associated almost entirely with reductions in long-haul (over 1,000 miles) trucking. Before the pandemic, 32.7 percent of driver trips were longer than 1,000 miles, compared to 22.7 percent during the pandemic. In contrast, 7.8 percent of driver trips were local and fewer than 100 miles before the pandemic, compared to 18.2 percent during the pandemic. This shift in trucking distance is consistent with the increased utilization of e commerce, which depends heavily on trucking for regional distribution and last-mile delivery.
- Within the region, a truck driver survey performed by MAP Forum members and partner agencies found that during the pandemic, truckers generally experienced reduced congestion (due to fewer cars on the roads), but many (70 percent) experienced shortages of trucker services like rest areas and food services, and some (30 percent) experienced longer turn-times at their pickup and delivery points because of worker shortages at those facilities. Truck driver shortages, a chronic problem even in the best of times, has become more of a challenge for the industry during the pandemic. A follow-up workshop on truck parking further highlighted the desire for improved truck parking capacity and enhanced trucker services. Within the NYMTC planning area, bridge and tunnel crossing volumes dropped significantly during the initial months of the pandemic but are recovering to more typical levels.[19]

Table H-3-8

COVID-19 Pandemic Impacts on Modal Utilization

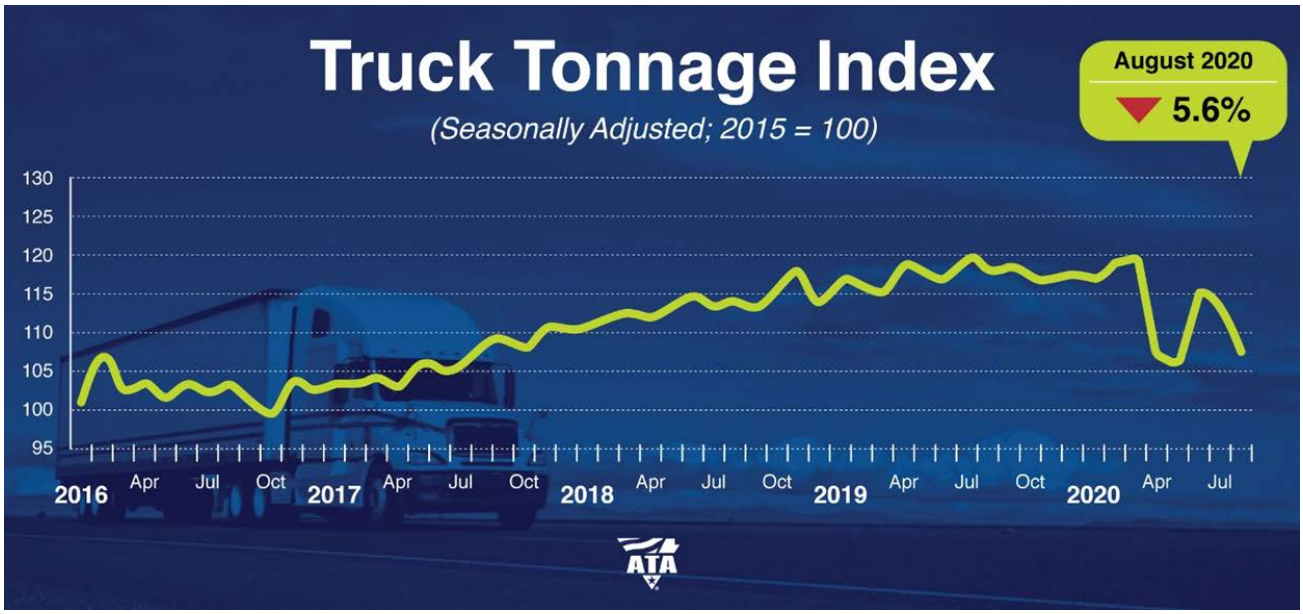
Source: Moving Forward Freight Element Analysis

With respect to freight modal activity, the COVID-19 pandemic is having mixed effects. For some modes, like water and rail, it appears to be following the pattern of a "V-shaped" event, characterized by sudden and rapid declines in freight volumes, followed by recovery to prior levels over a relatively short period. For others, like trucking and (especially) international air cargo, the declines have persisted.
Trucking has benefitted from reduced highway congestion but suffered shortfalls in trucker services and driver availability, while international air cargo has been impacted by reductions in international flights.
As of this writing, the pandemic remains an active threat; conditions could change, and future forecasts remain uncertain.

Figure H-3-15

American Trucking Associations Truck Tonnage Index through August 2020

Source: American Trucking Associations



3.3 IMPACTS OF TRENDS AND DISRUPTORS ON FORECASTS AND SUPPLY CHAINS

IMPACTS ON FORECASTS

Considering the identified trends, the 2050 domestic tonnage forecast presented in *Chapter 1* appears reasonable for planning purposes, although it likely understates the importance and growth of shorter-haul trucking movements, especially on local last mile delivery routes. However, the forecast does not reflect the impact of the COVID-19 pandemic, and further research could modify the forecasts to account for these effects.

The FAF-based international tonnage forecasts appear to have enough inherent uncertainty that attempting to adjust them for trend impacts would not yield informative results. A new version of FAF is due for release in 2021, and forecasts can be updated and analyzed for trend impacts at that time, or other regional forecasts may become available for use.

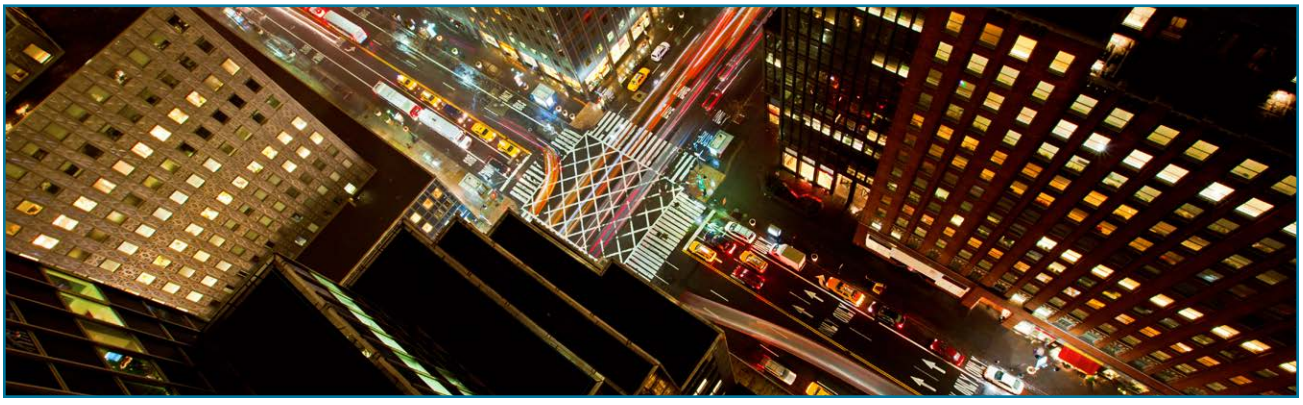
IMPACTS ON SUPPLY CHAINS

Growth in e-commerce, changes in the use of LTL trucking, increased use of automation across all modes and facilities, modern multi-story warehouse design and infill development, and increased use of distributed manufacturing all point to a future where the NYMTC planning area is more self-sufficient and more dependent on shorter-haul trips. Today, conventional trucks accommodate these types of trips, but in the future, more advance types of trucks may be available. The types of commodities where water and rail play their largest roles—fossil fuels and waste—are likely to hold a declining share of regional goods movement, although adaptation of these modes to handle e commerce and other growth commodities is an important opportunity, and these moves may not lose market share if they are successful in adapting.

The region is served by a set of well-established supply chains, and growth in freight volumes through 2050 is projected to be positive but modest. It is reasonable to anticipate recovery at the conclusion of the COVID-19 pandemic, but whether all modes will share equally in that recovery—particularly in the near term—is unknown.

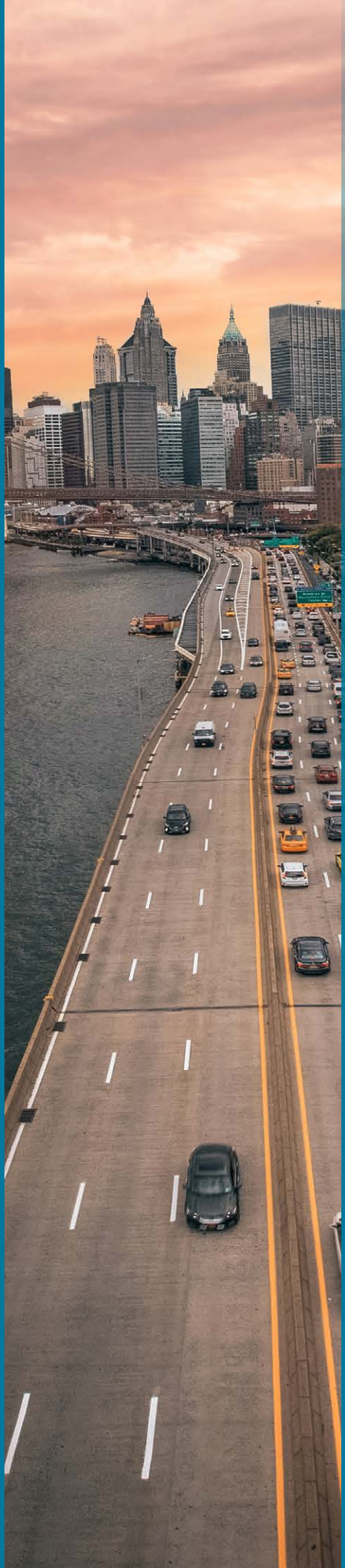
The greatest long-term risk may be from climate events, which could generate substantial and permanent changes in how supply chains are constructed and used. Planning for future conditions should explore and consider alternative scenarios for critical supply chains, particularly food and fuel, where the impacts and risks are likely to be greatest. The planning targets presented in *Chapter 2* of the Freight Element are a good starting point, but more detailed investigations may be warranted.

Finally, to address the potential effects of compound disruptors—two or more events (e.g., storms, pandemics, armed conflict, economic or technological upheaval)—collaborative scenario planning by NYMTC, its member agencies, and its MAP Forum partners, may be a valuable tool to develop strategies for robust and resilient supply chains serving the NYMTC planning area and the larger region.



ENDNOTES

1 *https://www.census.gov/programs-surveys/e-stats/about.html.*
2 *https://www.bigcommerce.com/articles/ecommerce/#types-of-ecommerce.*
3 U.S. Census Bureau, *https://www.census.gov/data/tables/2018/econ/e-stats/2018-e-stats.html.*
4 E-marketer is a subscription-based market research company. See *https://www.emarketer.com/.*
5 *https://commercialobserver.com/2020/11/amazon-red-hook-brooklyn-warehouse-lease/.*
6 *https://www.nymtc.org/Regional-Planning-Activities/Resiliency-Planning.*
7 *https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/hurricane_sandy/index.cfm.*
8 *https://www.nyserda.ny.gov/~/link.aspx?_id=4653F132009B492D8B7BC6805A564C46&_z=z.*
9 *https://www.bls.gov/web/metro/laummtch.htm.*
10 *https://www.census.gov/retail/index.html#ecommerce.*
11 *https://www.aar.org/wp-content/uploads/2020/10/2020-10-14-railtraffic.pdf.*
12 *https://www.aar.org/wp-content/uploads/2020/10/2020-10-14-railtraffic.pdf.*
13 Port Authority, communication of October 21, 2020.
14 New York & Atlantic Railroad, communication of October 21, 2020.
15 *https://www.panynj.gov/port/en/our-port/facts-and-figures.html.*
16 Port Authority, communication of October 21, 2020.
17 *https://www.panynj.gov/airports/en/statistics-general-info.html.*
18 *https://www.trucking.org/news-insights/ata-truck-tonnage-index-fell-56-august.*
19 Port Authority, communication of October 21, 2020.



4 FREIGHT TRANSPORTATION INFRASTRUCTURE

Chapters 1, 2, and 3 of this Freight Element describe the physical and economic movements of freight in the NYMTC planning area and how those movements may change in the future based on key trends and disruptors. Chapter 4 introduces the freight transportation infrastructure that accommodates these movements, considering the primary freight modes of truck, rail, air, water, and pipeline. NYMTC is currently preparing a complementary consideration of freight land uses—another critical component of freight infrastructure.

4.1 TRUCK FREIGHT

4.1.1 NETWORK ELEMENTS

A subset of the NYMTC planning area's roadway network, identified as strategic freight highways, are critical to freight movement. Strategic freight highways serve as major freight gateways into and out of the planning area provide access to major freight-handling facilities such as seaports and rail intermodal terminals in New Jersey, and offer 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 and other intermodal terminals and warehouses/ distribution centers, and to routes that can accommodate large and heavy loads to support emergency response.

The interstate highways, state highways, and other road classification types that are most critical for NYMTC planning area truck movement are considered the strategic freight highway network. This network includes roadway segments within and outside the NYMTC planning area itself.

Within the NYMTC planning area, facilities include:

- National Highway Freight Network routes. The Fixing America's Surface Transportation Act established this network to strategically direct federal resources and policies toward the improved performance of the nation's transportation system. The National Highway Freight Network includes all interstate highways and other roads determined to be especially important for freight movement.
- Federally designated National Highway System connectors, which provide "last mile" connections between the National Highway System and major freight facilities including airports, marine terminals, rail terminals, and freight-intensive land use clusters.
- The New York City Through Truck Route System[1] as designated by NYC DOT, which designates allowable routes for inter-county truck trips (note that interstate highways within New York City are part of this system).
- Over-dimensional Emergency Response Routes specified by NYC DOT for Superstorm Sandy relief efforts, including movement of generators and other equipment, delivery of food and supplies, and debris removal.

Outside the NYMTC planning area, facilities include:

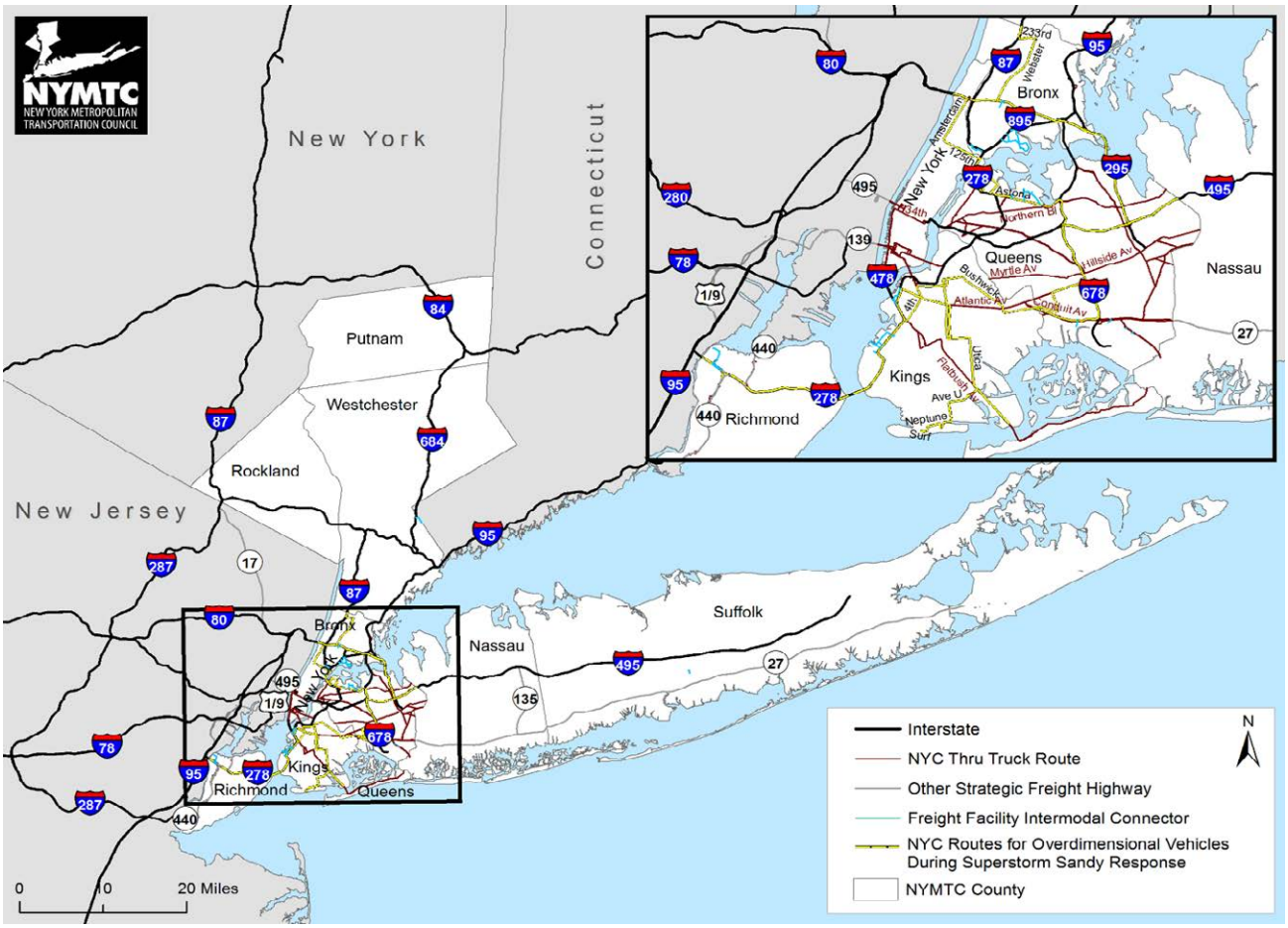
- The Interstate Highway System surrounding the NYMTC planning area. These interstates are the primary gateways by which trucks enter and exit the planning area and complete inter-county trips within the planning area.
- State highways throughout the NYMTC planning area, which carry interstate-type levels of truck traffic, and state highways outside the NYMTC planning area that provide connections to key freight facilities, such as: Hudson River crossings into Manhattan; Port Newark/Port Elizabeth in New Jersey; Newark Liberty International Airport in New Jersey; and rail intermodal yards, including Croxton, Little Ferry, North Bergen, and South Kearny in New Jersey.

Figure H-4-1 illustrates the major components of the strategic freight highway network.

Figure H-4-1

NYMTC Planning Area Freight Highway Network

Source: Cambridge Systematics, from National Transportation Atlas Database and NYC DOT data, and WSP



4.1.2 TRUCK CORRIDOR PROFILES

The network elements in ***Figure H-4-1*** can be viewed as a set of primary corridors, each with certain characteristics and functions for the NYMTC planning area. These corridors are supported by a vast network of arterials and local/last-mile roads, of such number and diversity that describing each is impractical. As a general introduction to the region's truck network, the following section summarizes selected heavily used truck corridors, using two data sources:

- Truck counts. The New York State Department of Transportation (NYSDOT) performed daily truck volume counts at more than 7,000 unique locations in the NYMTC planning area during 2017, 2018, and 2019.[2] These counts were combined and averaged for related roadway segments within a given county, to generate descriptive estimates of average daily truck traffic (ADTT).
- Transearch estimates. Count data do not provide information on the service characteristics of different truck routes—factors such as the leading origin and destinations of trucks on a route, or the mix of commodities, or the overall "trip purposes" each route is serving. This type of information can be inferred from NYSDOT's Transearch database, which includes modeled assignments of truck tonnage to regional highway routes. Note that Transearch is a model, not empirical data; it assigns traffic only to a limited highway network, and it does not include all trucks captured by the NYSDOT counts. Within these limitations, however, Transearch provides useful characterizations of truck corridors not otherwise obtainable.

Summary profiles for selected corridors are illustrated in *Figure H-4-2* through *Figure H-4-13*.[3] Note that the tabulations are based on truck units (e.g., the modeled movement of actual vehicles, not freight tonnage or value), and consider empty backhauls (truck making empty return trips after delivering freight).

I-84

I-84 is an important truck route traversing Putnam County. It links Connecticut and New England with other major interstate corridors including I-87 in New York and I-81 in Pennsylvania, which in turn connect to I-90, I-80, I-78, and other east-west corridors. I-84 has an ADTT of 21,511 in Putnam County. At the point where I-84 crosses the Putnam County/Connecticut line, almost 80 percent of trucks are passing through the NYMTC planning area; around 10 percent are inbound, and 10 percent are outbound. The leading inbound commodities are nonmetallic minerals, food products, and empty trailers; the leading outbound commodities are empty trailers. Most of the origins and destinations served are outside the NYMTC planning area in New England, New Jersey, eastern Pennsylvania, Washington, D.C., Metro, the Midwest, and even as far as Atlanta and Los Angeles.

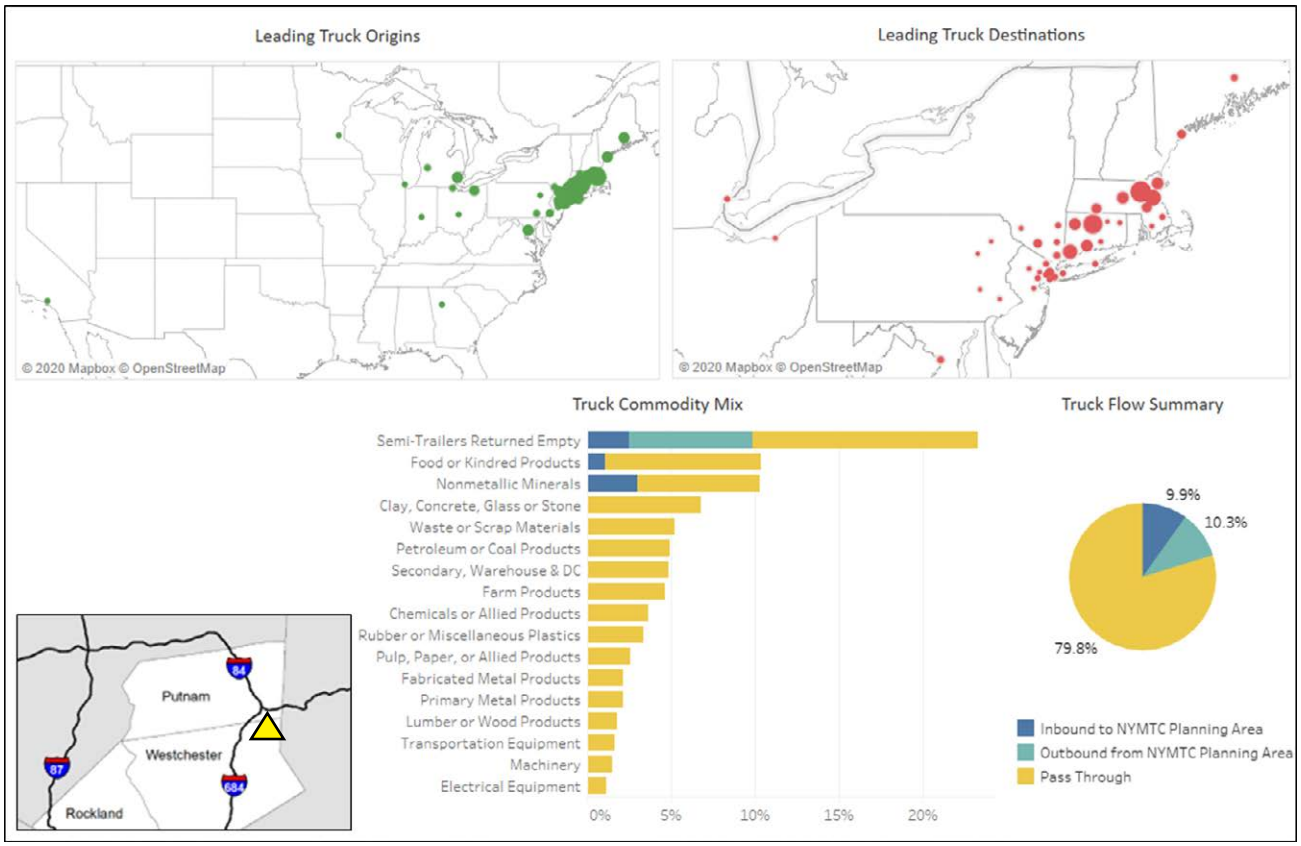
I-95

I-95 is one of the most important truck routes in the country, running from the Canadian border in Maine to the tip of South Florida and linking the entire eastern seaboard. From the north, it enters the NYMTC planning area at the Connecticut/Westchester County line and traverses Westchester; traverses the Bronx (as part of the Cross Bronx Expressway); crosses the northern tip of Manhattan; and exits to

Figure H-4-2

Truck Corridor Profile—I-84 at Putnam/Connecticut Line

Source: Analysis of NYSDOT Transearch data



New Jersey via the George Washington Bridge, becoming the New Jersey Turnpike. I-95 has an ADTT of 54,748 at the George Washington Bridge and 34,882 averaged throughout the Bronx, and an ADTT of 26,829 averaged throughout Westchester.

At the George Washington Bridge, around 40 percent of truck movements are inbound to the NYMTC planning area, 33 percent are outbound, and 27 percent are pass-through. The leading inbound commodities are nonmetallic minerals; clay, concrete, glass and stone; food and kindred products; petroleum products; warehouse and distribution center traffic; chemicals; farm products; and rubber and plastic products. The leading outbound commodities are semi-trailers returned empty, waste and scrap, petroleum products, warehouse and distribution center traffic, and nonmetallic minerals. With nearly three-quarters of George Washington Bridge traffic having an origin or destination in the NYMTC planning area, the leading origins and destinations are New York county, Bronx, Westchester, Queens, Nassau, and Suffolk; Brooklyn, which is served more directly through the I-278 corridor, has less George Washington Bridge traffic. Other leading origins and destinations are located throughout New England; northern and southern New Jersey; eastern Pennsylvania (e.g., Susquehanna, Northampton, Lehigh, Berks, Monroe, Philadelphia); the Washington, D.C., metro area; and Ohio and Michigan.

At the Connecticut/Westchester line, the share of pass-through traffic increases to almost 59 percent, as eastbound freight destined for the NYMTC planning area has left the I-95 corridor; 23 percent of truck trips are outbound from the NYMTC planning area and 18 percent are inbound. The leading inbound commodities are semi-trailers returned empty, petroleum and coal products, and nonmetallic minerals; the leading outbound commodity is semi-trailers returned empty. Most trade is between northern New Jersey and New England, with some origins and destinations in Southeastern Pennsylvania; the Washington, D.C., metro area; North Carolina; and even Florida. At this point, other corridors besides the George Washington Bridge have fed into I-95, which accounts for some of the origin-destination differences observed.

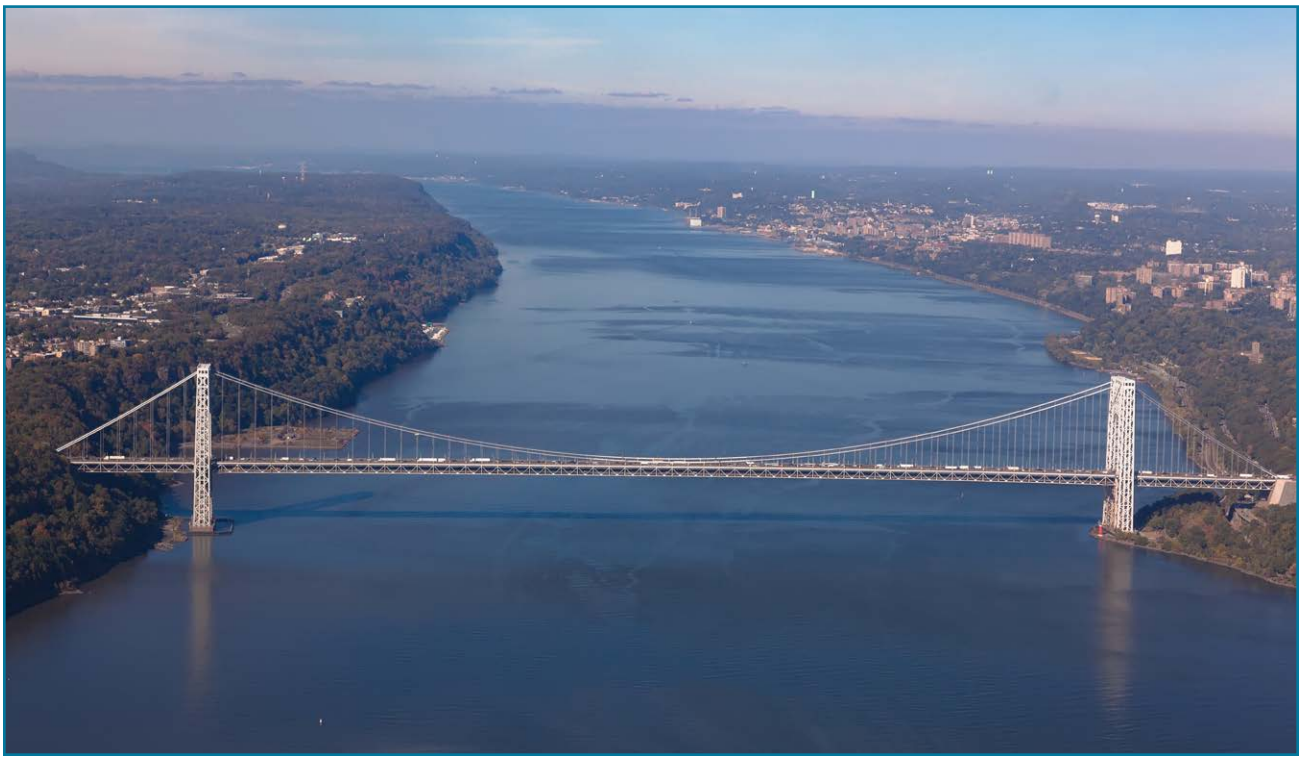


Figure H-4-3

Truck Corridor Profile—I-95 at George Washington Bridge

Source: Analysis of NYSDOT Transearch data

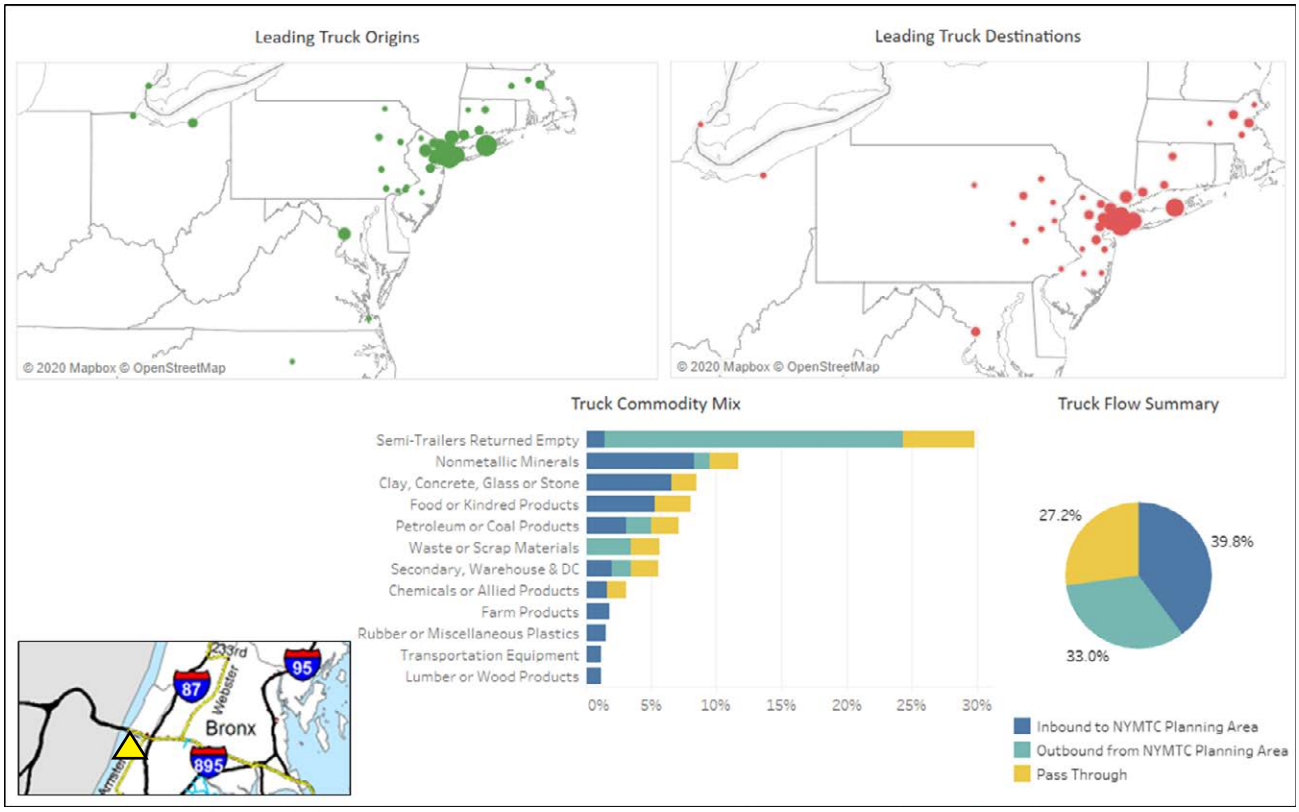
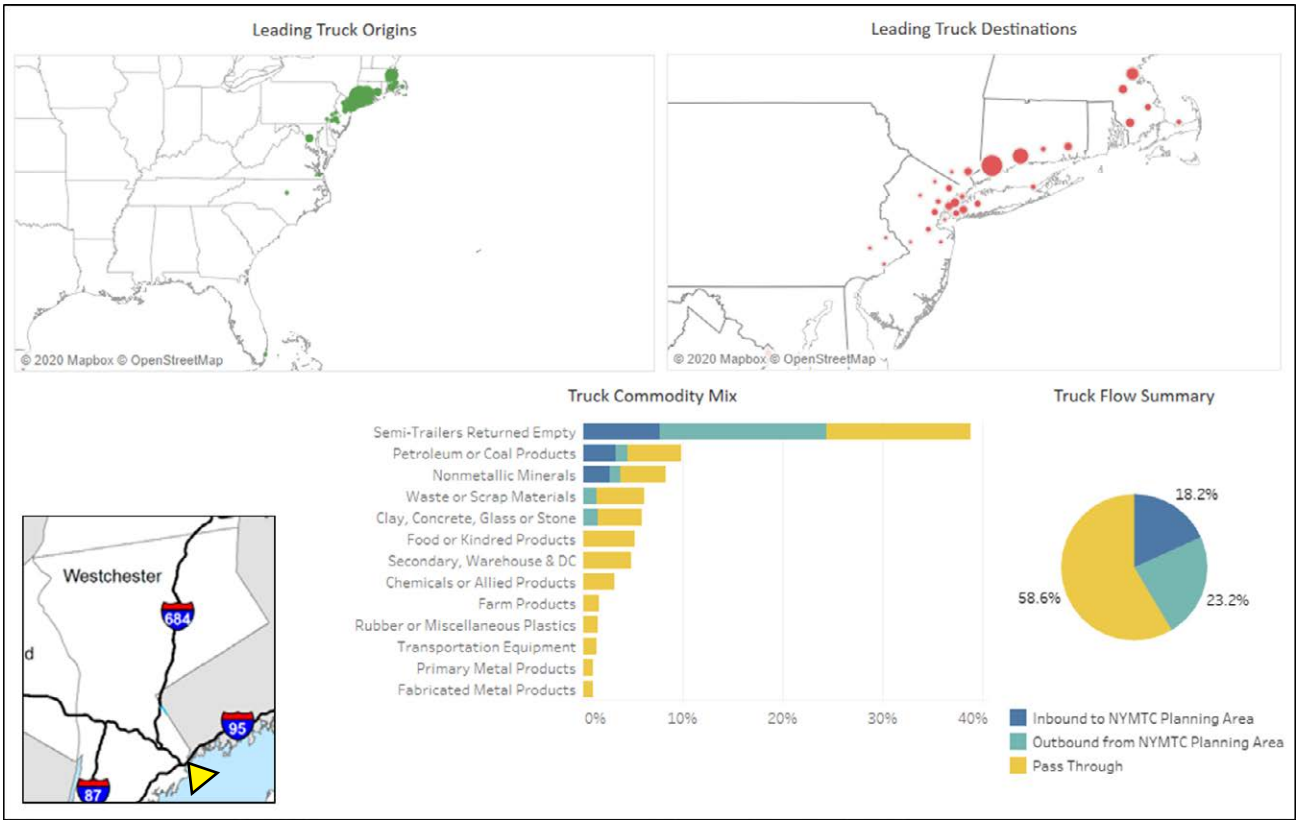


Figure H-4-4

Truck Corridor Profile—I-95 at Westchester/Connecticut Line

Source: Analysis of NYSDOT Transearch data



I-287/NJ-440/NY-440

I-287/NY-440 functions as a semi-circular connector road for the New York-New Jersey metropolitan area. One end of I-287 begins in Westchester at a junction with I-95; from there, I-287 continues west across Westchester, joins with I-87, and crosses the Hudson River into Rockland County on the Governor Mario M. Cuomo Bridge; and then I-287/I-87 continues west to the edge of Rockland County. At that point, I-87 turns north through New York while I-287 turns south and then east through New Jersey. I 287 eventually becomes NJ-440, crosses the Arthur Kill to Staten Island on the Outerbridge Crossing, and becomes NY-440. From there, NY-440 runs north as the Pearl Harbor Memorial Expressway, intersecting I-278 and then returning to New Jersey (as NJ-440) over the Bayonne Bridge. I-287 carries very high truck volumes—it has an ADTT of 52,265 averaged in Rockland and 51,179 averaged in Westchester—while volume on NY-440 is significantly lower, with an ADTT of 5,800 averaged in Richmond.

At the Governor Mario M. Cuomo Bridge, around 18 percent of trucks are passing through the NYMTC planning area. Around 10 percent are handling movements between Westchester, Rockland, and other NYMTC planning area counties. Around 40 percent are inbound to the NYMTC planning area, and 32 percent are outbound. The leading commodities moving within the NYMTC planning area are nonmetallic minerals, semi-trailers moving empty, and warehouse and distribution center. The leading inbound commodities are nonmetallic minerals; warehouse and distribution; clay, concrete, glass and stone; food and kindred products; farm products; and petroleum products. The leading outbound commodities are semi-trailers returned empty, warehouse and distribution center traffic, and waste and scrap. Leading origins and destinations in the NYMTC planning

area include Rockland, Westchester, New York county, Kings, Queens, Nassau, and Suffolk; outside the planning area, leading origins and destinations include northern New Jersey, southeastern Pennsylvania, New York State, and New England.

At the Outerbridge Crossing, all truck movements are inbound to or outbound from the NYMTC planning area, in equal shares, with no pass-through movements. The leading inbound commodities are nonmetallic minerals; clay, concrete, glass and stone; food and kindred products; farm products; chemicals; and warehouse and distribution center traffic. The leading outbound commodities are semi-trailers returned empty, waste and scrap, petroleum products, and warehouse and distribution center traffic. Leading origins and destinations within the NYMTC planning area are Richmond, Kings, Queens, Nassau, and Suffolk counties; outside the planning area, leading origins and destinations include New Jersey, eastern Pennsylvania, Maryland, Virginia, North Carolina, and Florida.

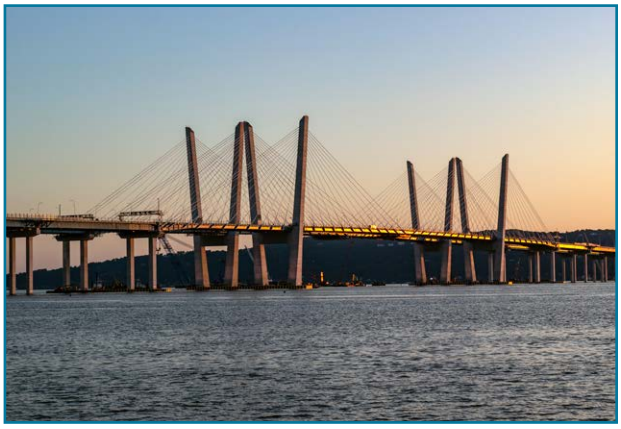


Figure H-4-5

Truck Corridor Profile—I-287 at the Governor Mario M. Cuomo Bridge

Source: Analysis of NYSDOT Transearch data

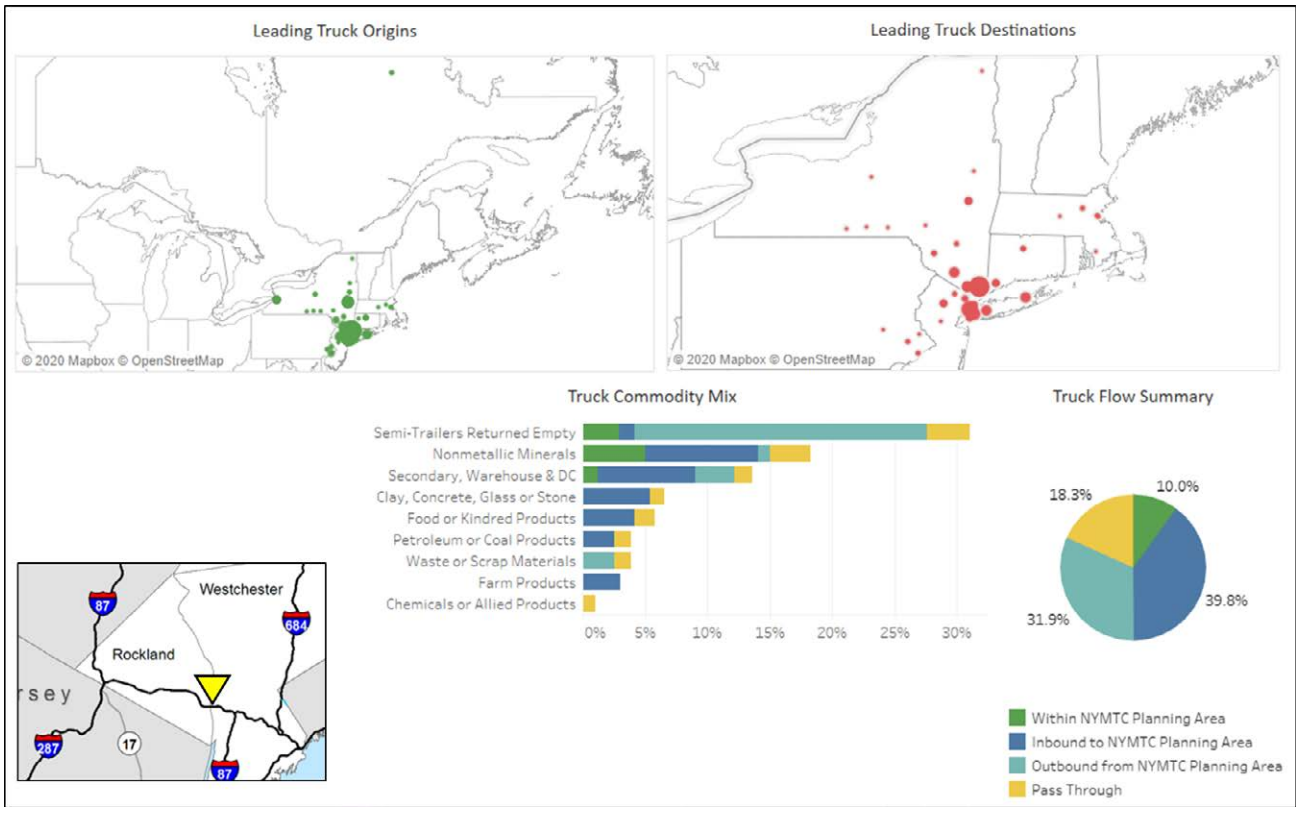
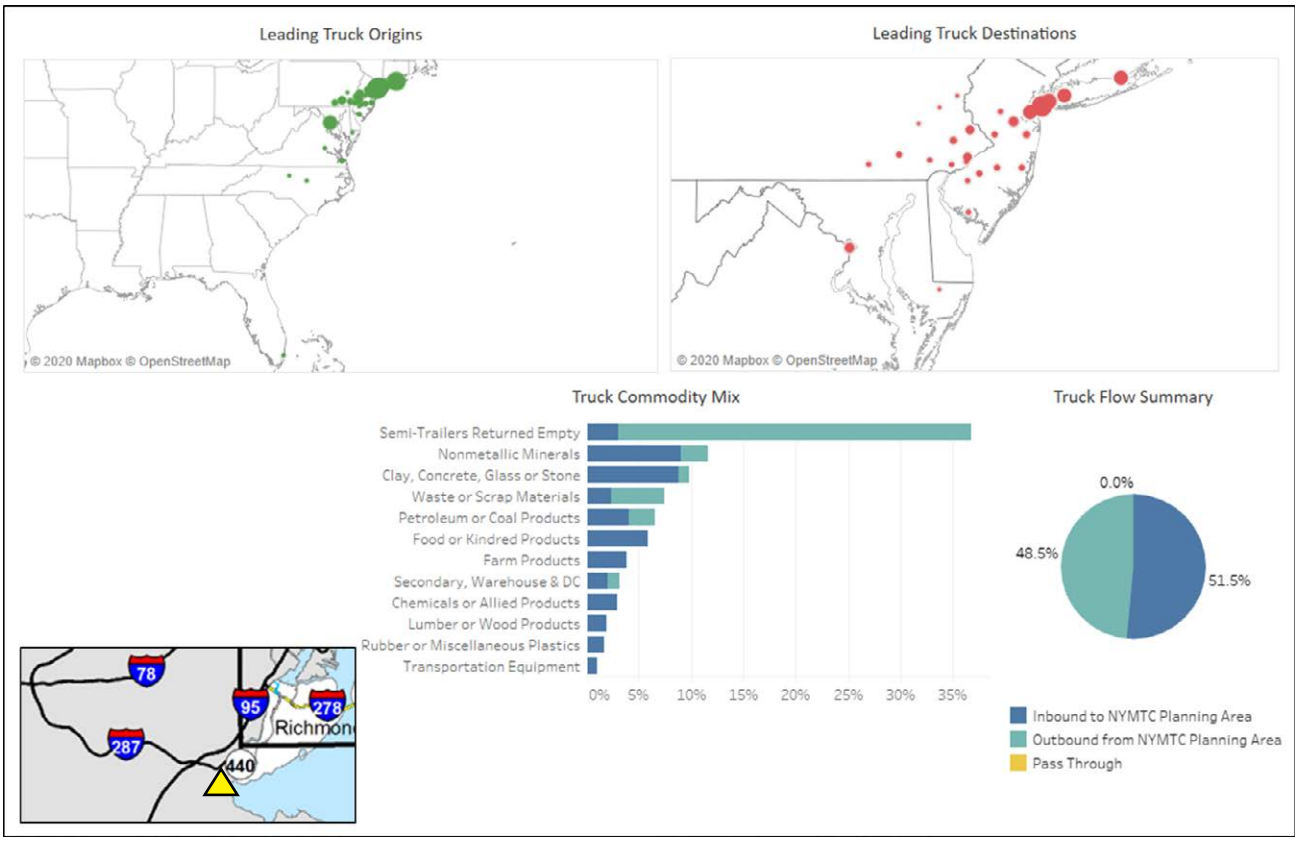


Figure H-4-6

Truck Corridor Profile—NY-440 at Outerbridge Crossing

Source: Analysis of NYSDOT Transearch data



I-278

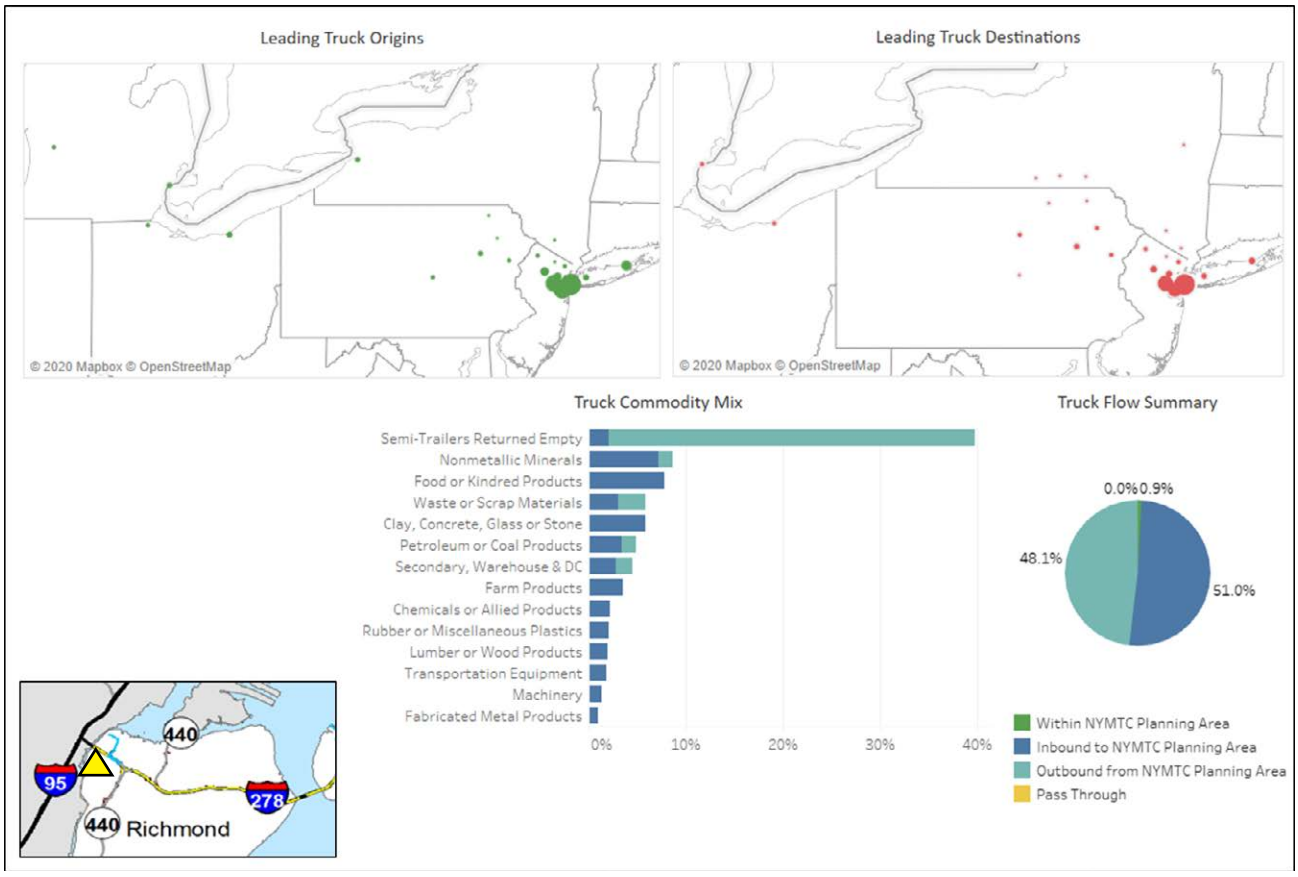
I-278 provides a unique freight transportation function in the NYMTC planning area. It links all five New York City boroughs, connects them with I-95 at both its southern and northern ends, directly serves all three of the NYMTC planning area seaports and other major industrial clusters (e.g., South Brooklyn, Maspeth, Hunts Point), and provides essential connections to major east-west routes running through Brooklyn, Queens, Nassau, and Suffolk. I-278 was developed in segments over time, often in extremely constrained rights-of-way requiring creative engineering solutions, and as a result, much of I-278 is not built to design standards suitable for modern large combination vehicles. Without I-278, it is difficult to envision how much of the NYMTC planning area could be served.

At its southern end, I-278 begins at U.S. 9 in Elizabeth, New Jersey, and crosses the Arthur Kill via the Goethals Bridge to Staten Island. I-278 continues east as the Staten Island Expressway and crosses New York Harbor via the Verrazzano-Narrows Bridge to Brooklyn. In Brooklyn, I-278 continues north as the Gowanus Expressway, crosses the Gowanus Canal, and becomes the Brooklyn-Queens Expressway (BQE). The BQE continues north, crosses the Newtown Creek into Queens on the Kosciusko Bridge, crosses I-495, joins the western segment of the Grand Central Parkway, and reaches the East River in Astoria, Queens. I-278 then travels over the Robert F. Kennedy Bridge—actually a network of bridges—onto Randall's and Wards Islands, where a second bridge provides a connection to East Harlem in Manhattan and a third bridge carries I-278 mainline traffic north into the

Figure H-4-7

Truck Corridor Profile— I-278 at Goethals Bridge

Source: Analysis of NYSDOT Transearch data



Bronx. After reaching the Bronx, I-278 intersects I-87 (the Major Deegan Expressway) running west, and itself continues northeast as the Bruckner Expressway. East of Westchester Creek in the Bronx, I-278 joins with the Cross Bronx Expressway, allowing traffic to continue northeast along I-95, or return to Queens via I-678 (to the Whitestone Bridge) and I-295 (to the Throgs Neck Bridge). Before reaching Westchester Creek, there is a connection between I-278 and the Cross Bronx via Sheridan Boulevard (NY-895), formerly the Sheridan Expressway (I-895). I-278 has averaged daily truck counts of 26,333 in Richmond; 34,514 on the Gowanus in Brooklyn; 27,517 on the BQE in Brooklyn; 15,561 on the BQE in Queens; and 24,436 on the Bruckner in the Bronx.

The I-278 corridor is very much a local-serving route, with no estimated pass-through traffic at any of the segments examined. At the Goethals Bridge, I-278 handles a balance of inbound and outbound trucks and no moves between the NYMTC planning area counties; moving north along the corridor, the "within NYMTC planning area" share rises to 40 percent at the Kennedy Bridge. The composition of traffic changes as well. At the Goethals Bridge, the leading commodities are semi-trailers returned empty, food, nonmetallic minerals, farm products, clay concrete glass stone, petroleum products, and warehouse and distribution center. Moving north through port and industrial clusters, the share of warehouse and distribution traffic rises significantly. The NYMTC planning area locations best served include Richmond, Kings, Queens, Bronx, and Manhattan, although Nassau and Suffolk traffic is also significant on the BQE portion (because the BQE provides access to I-495). External origins and destinations primarily include northern New Jersey, eastern Pennsylvania, eastern New York State, and parts of the Midwest.

Figure H-4-8

Truck Corridor Profile—I-278 at Verrazzano-Narrows Bridge

Source: Analysis of NYSDOT Transearch data

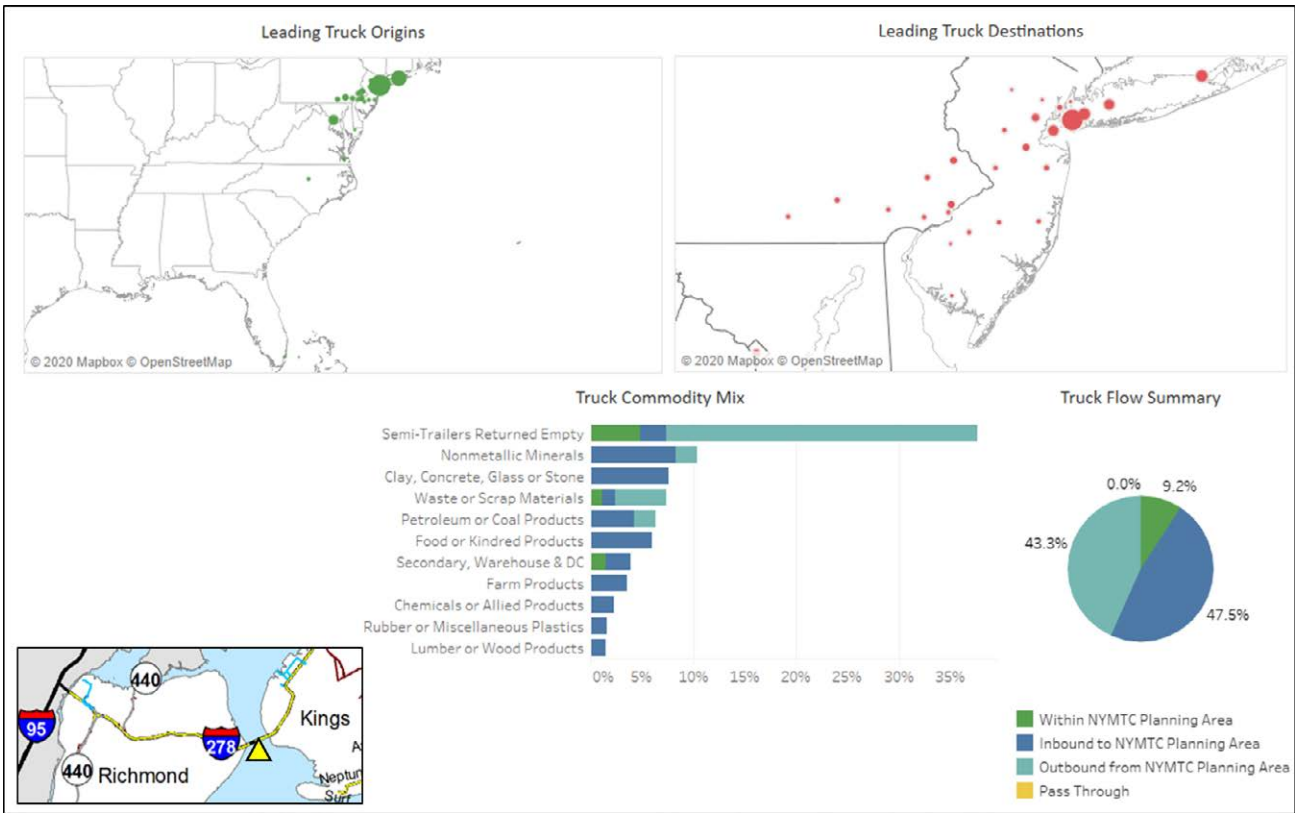


Figure H-4-9

Truck Corridor Profile—I-278 at Kosciusko Bridge between Kings and Queens

Source: Analysis of NYSDOT Transearch data

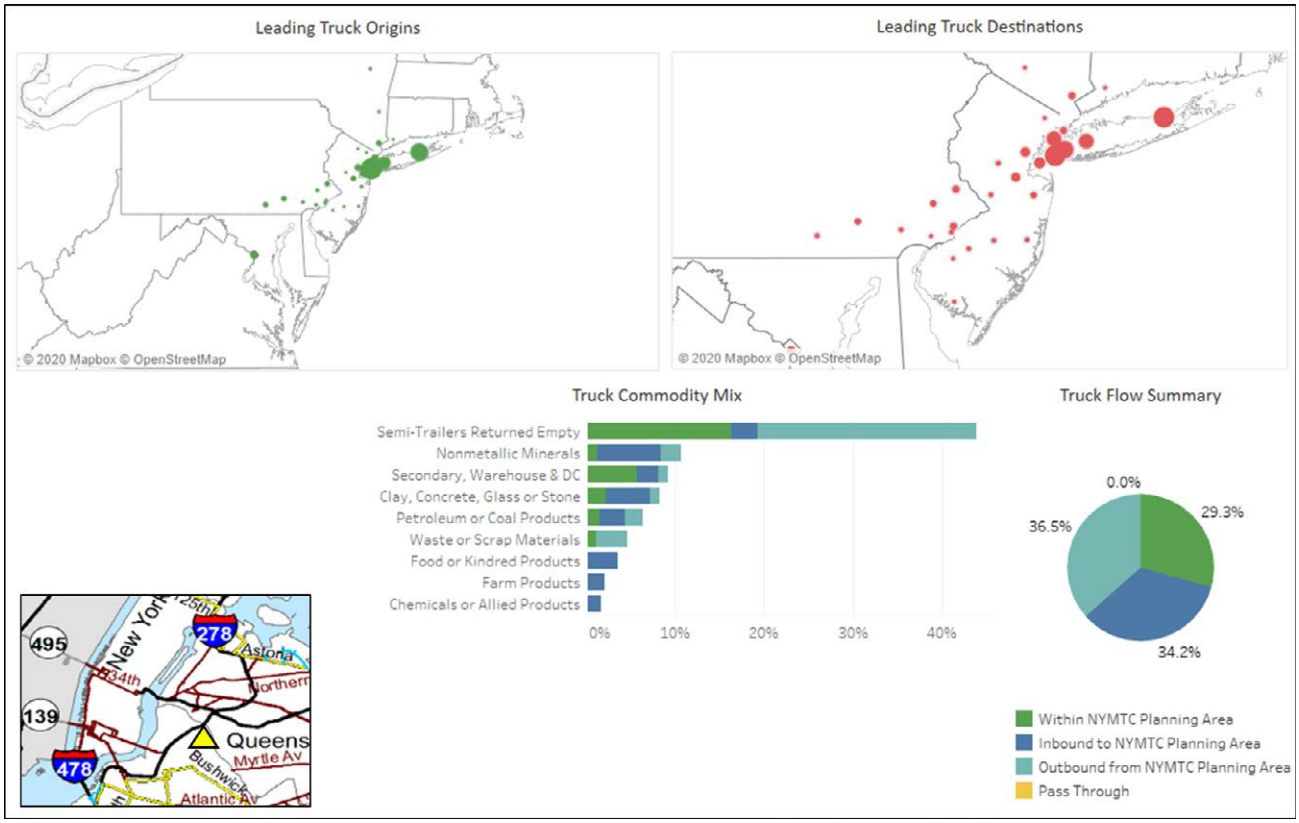
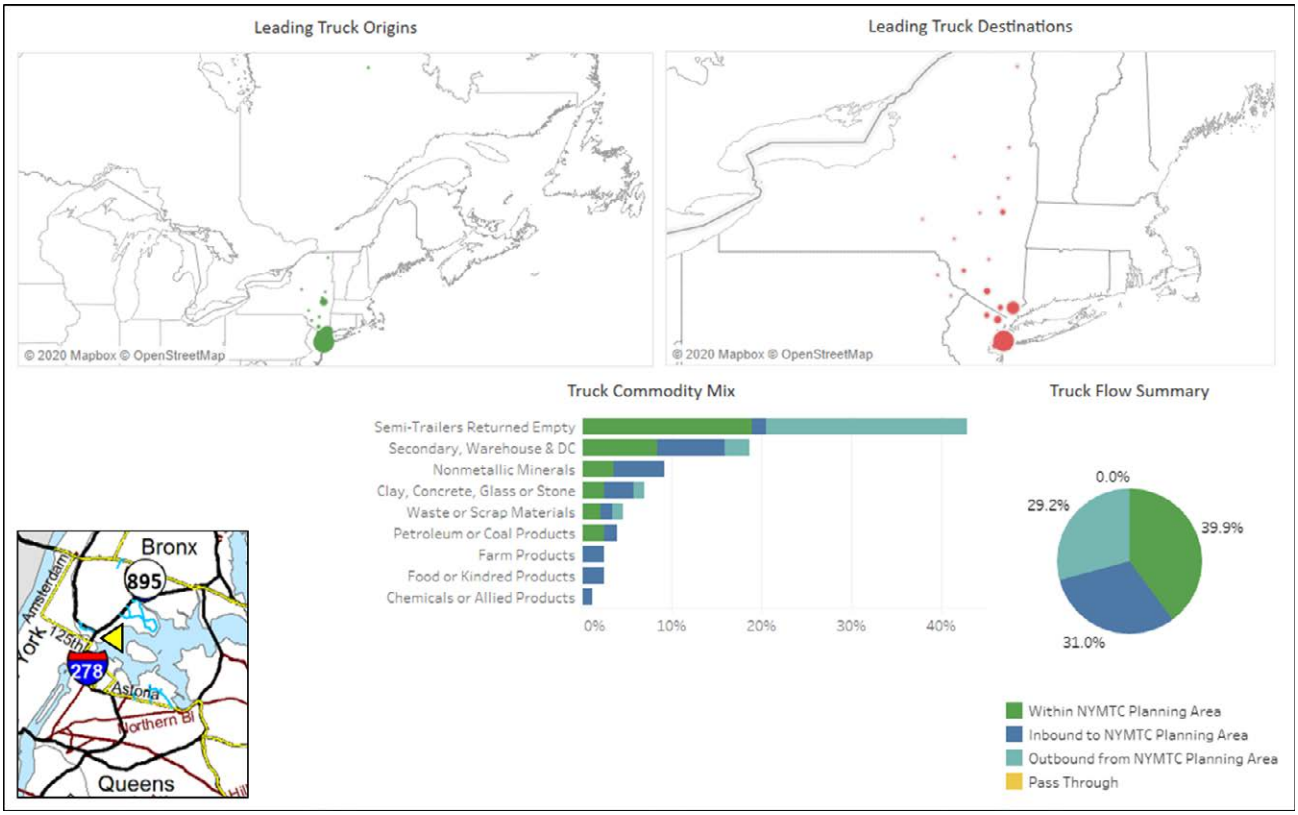


Figure H-4-10

Truck Corridor Profile—I-278 at Robert F. Kennedy Bridge

Source: Analysis of NYSDOT Transearch data



I-495

Like I-278, I-495 serves a unique freight transportation function in the NYMTC planning area. It provides the only direct interstate highway access for Nassau and Suffolk counties, and connects them via Queens to the rest of the national highway network. It also serves as the primary east-west truck route for Queens, connecting geographic Long Island to Manhattan (via tunnel), to the Bronx (via connections to the Throgs Neck, Whitestone, and Kennedy Bridges). Apart from I-495, the only major east-west truck route serving Nassau and Suffolk is NY-27 (Sunrise Highway).

At its western end, I-495 begins in Manhattan and runs through the Queens-Midtown tunnel, then continues east (as the Long Island Expressway) for almost 75 miles to Riverhead, New York. It terminates at NY-25, which provides truck access further east to Orient Point at the eastern tip of Long Island's North Fork. Along the way, I-495 crosses (and connects) I-278, I-678, I-295, and dozens of important state and local roads. I-495 has averaged daily truck counts of 25,881 in Queens; 29,540 in Nassau; and 19,204 in Suffolk. I-495 also provides access for vehicle ferry services crossing Long Island Sound (Port Jefferson-Bridgeport and Orient Point-New London); both services accommodate trucks.

Like I-278, the I-495 corridor is very much a local-serving route, with no estimated pass-through traffic at any of the segments examined. Moving east, the share of traffic moving between NYMTC planning area counties increases, from 21 percent to 44 percent. This is consistent with changes in the observed origin destination patterns. In Queens, much of the traffic is associated with Kings, Queens, Nassau, and Suffolk; at the Queens/Nassau line, most of the traffic is associated with Nassau and Suffolk; and at the Nassau/Suffolk line, all traffic has a Suffolk origin/Suffolk destination. I-495 handles a typical mix of commodities—semi-trailers returned empty, nonmetallic minerals, clay concrete glass stone, warehouse and distribution center, waste, food products, farm products, and chemicals. Warehouse and distribution center traffic becomes a higher share of the commodity mix moving farther east.

Figure H-4-11

Truck Corridor Profile—I-495 East of Interchange with I-278 in Queens

Source: Analysis of NYSDOT Transearch data

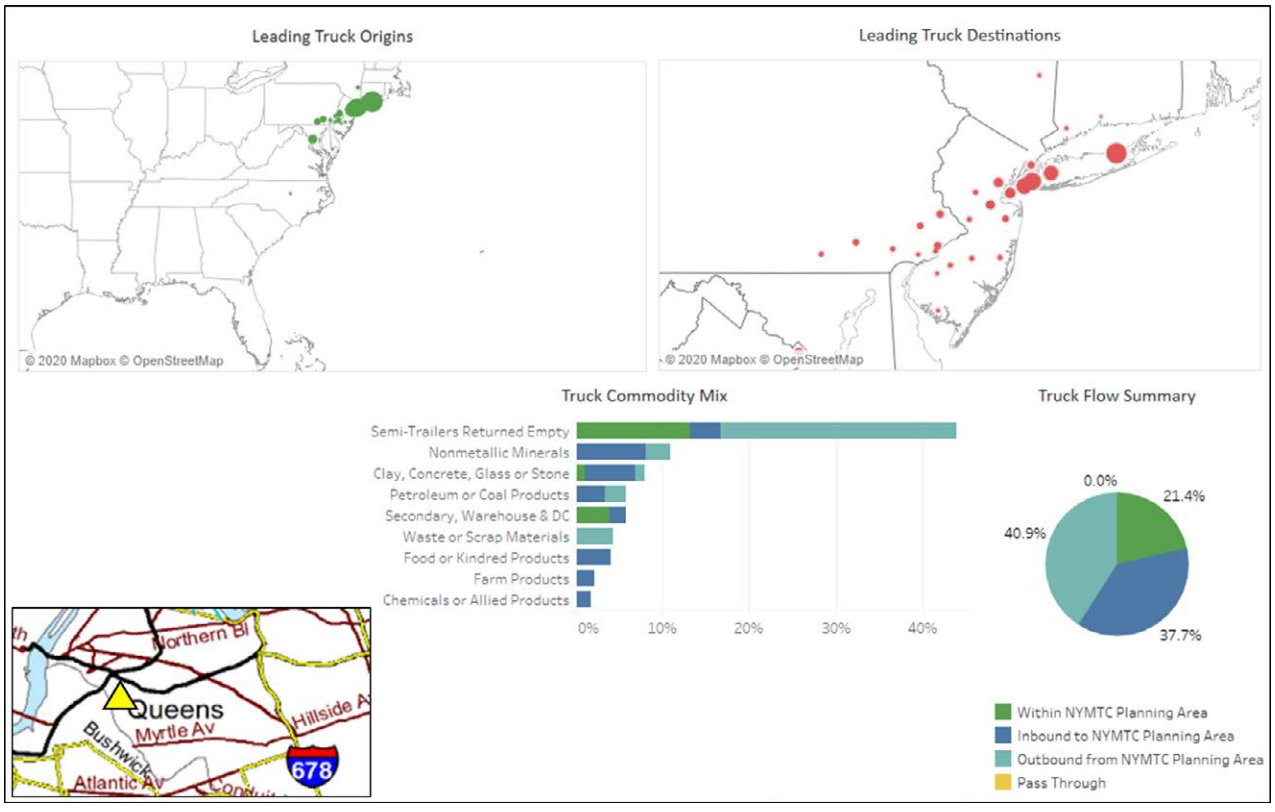
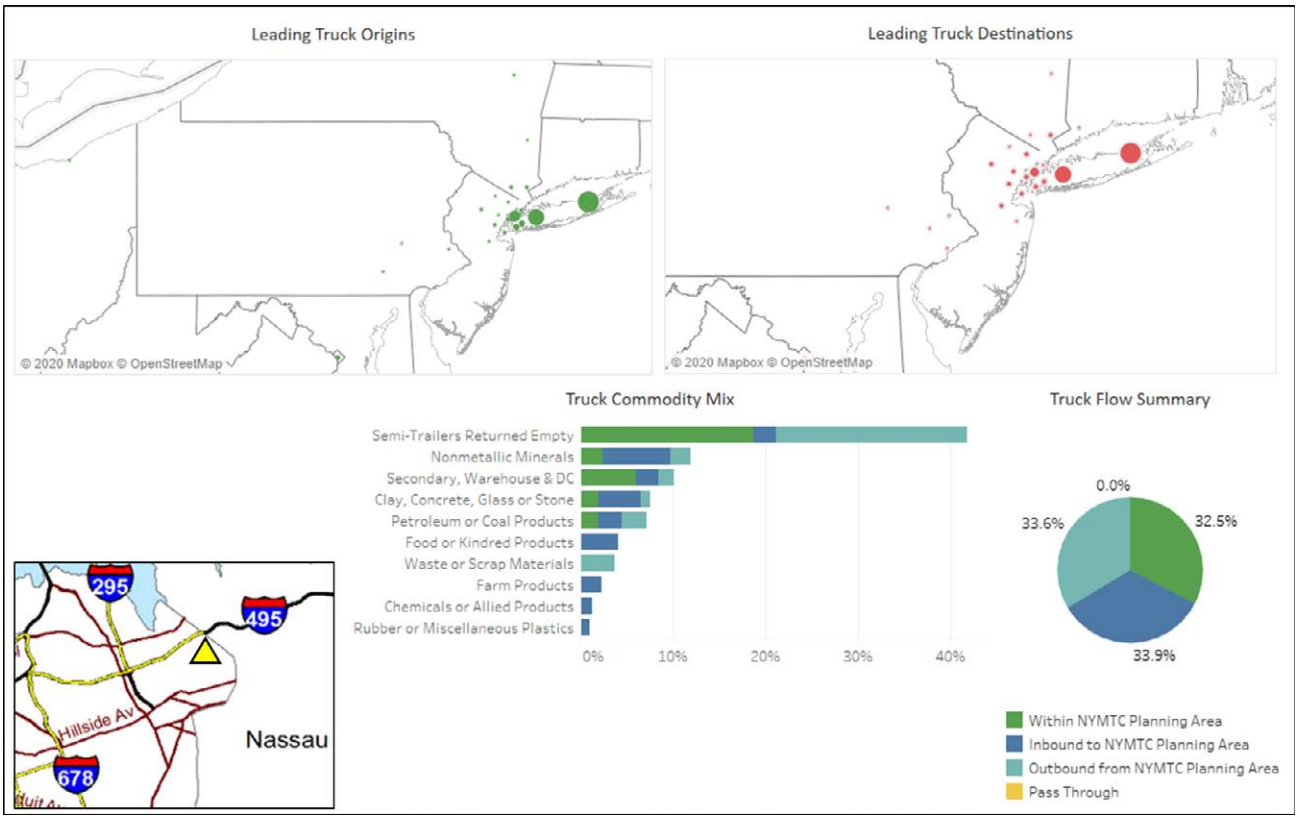


Figure H-4-12

Truck Corridor Profile—I-495 at Queens/Nassau Border

Source: Analysis of NYSDOT Transearch data



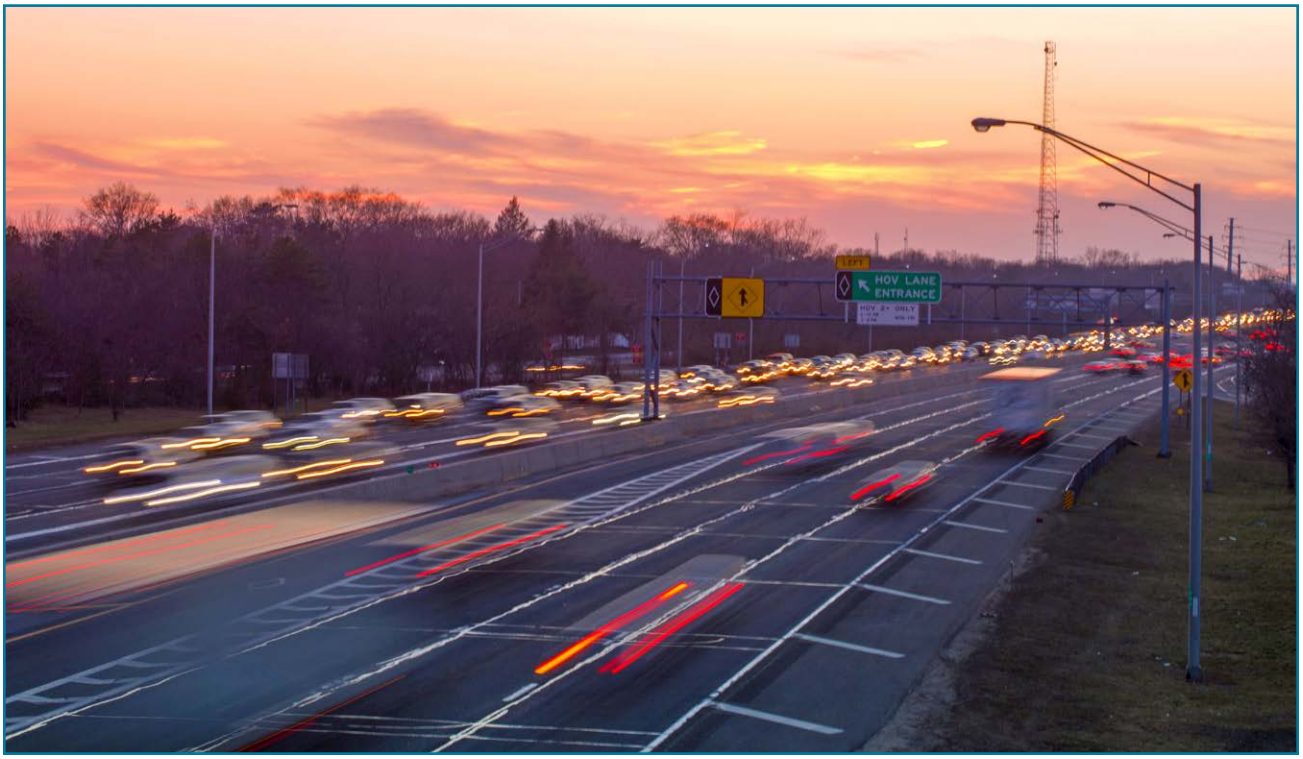
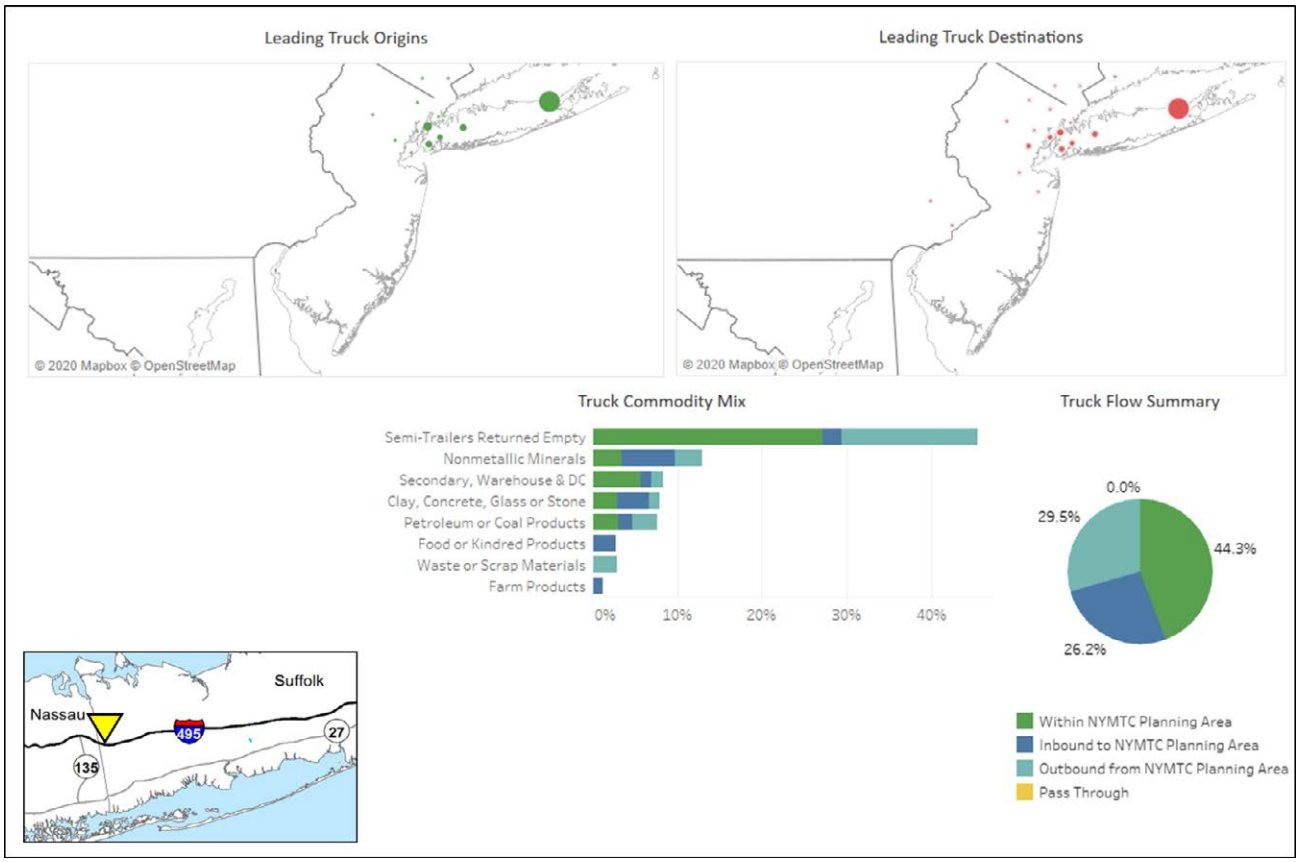


Figure H-4-13

Truck Corridor Profile—I-495 at Nassau/Suffolk Border

Source: Analysis of NYSDOT Transearch data



OTHER ROUTES

Other routes with more than 2,500 trucks per day averaged over a county are listed in *Table H-4-1*.

Table H-4-1

Other Routes With Over 2,500 Trucks Per Day, Averaged Across County

Source: Analysis of NYSDOT traffic count data (2017-2019)

Road Number/Name	County	Averaged ADTT
I-295	Bronx	24,477
I-87	Bronx	21,175
I-895	Bronx	11,328
I-695	Bronx	9,303
Leggett Ave	Bronx	6,077
E 133rd St	Bronx	3,473
Randall Ave	Bronx	3,238
Food Center Dr	Bronx	2,874
Halleck St	Bronx	2,774
Linden Blvd	Kings	5,729
Hugh L Carey Tunnel	Kings	4,759
Williamsburg Brg	Kings	4,477
Humboldt St	Kings	4,287
Mcguinness Blvd	Kings	4,214
Flatbush Ave Ext	Kings	4,036
Prospect Expy	Kings	3,349
Meeker Ave	Kings	2,971
Flatlands Ave	Kings	2,790
Caton Ave	Kings	2,720
Metropolitan Ave	Kings	2,527
Greenpoint Ave	Kings	2,524
Rockaway Tpke	Nassau	3,092
Rt-135	Nassau	2,529

Road Number/Name	County	Averaged ADTT
Holland Tunnel	New York	27,042
Hugh L Carey Tunnel	New York	18,215
Rt-9a	New York	7,695
West St	New York	6,523
Williamsburg Brg	New York	4,619
Delancey St S	New York	4,606
Canal St	New York	3,854
11th Ave	New York	3,211
12th Ave	New York	3,032
I-684	Putnam	9,950
Deans Corner Rd	Putnam	6,551
Clearview Expy	Queens	19,911
I-678	Queens	15,432
Throgs Neck Brg	Queens	13,536
Bronx Whitestone Brg	Queens	13,012
Astoria Blvd S	Queens	8,808
Nassau Expy	Queens	6,302
S Conduit Ave	Queens	4,308
Rockaway Blvd	Queens	2,937
Queens Blvd	Queens	2,755
Northern Blvd	Queens	2,745
Veterans Rd E	Richmond	6,676
Bayonne Brg	Richmond	4,333
I-87	Rockland	26,024
Rt-27	Suffolk	3,133
Farmingdale Rd	Suffolk	2,829
Townline Rd	Suffolk	2,621
I-87	Westchester	15,790
I-684	Westchester	12,571

4.2 RAIL FREIGHT

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 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 H-4-14***.

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**, 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**, 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 Canadian Pacific Railway traffic in its trains south of Albany in 2014. Canadian Pacific Railway retains trackage rights in lieu of the haulage agreement but is not shown on ***Figure H-4-14***.

In addition, Conrail Shared Assets, a switching carrier jointly owned by Norfolk Southern 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).

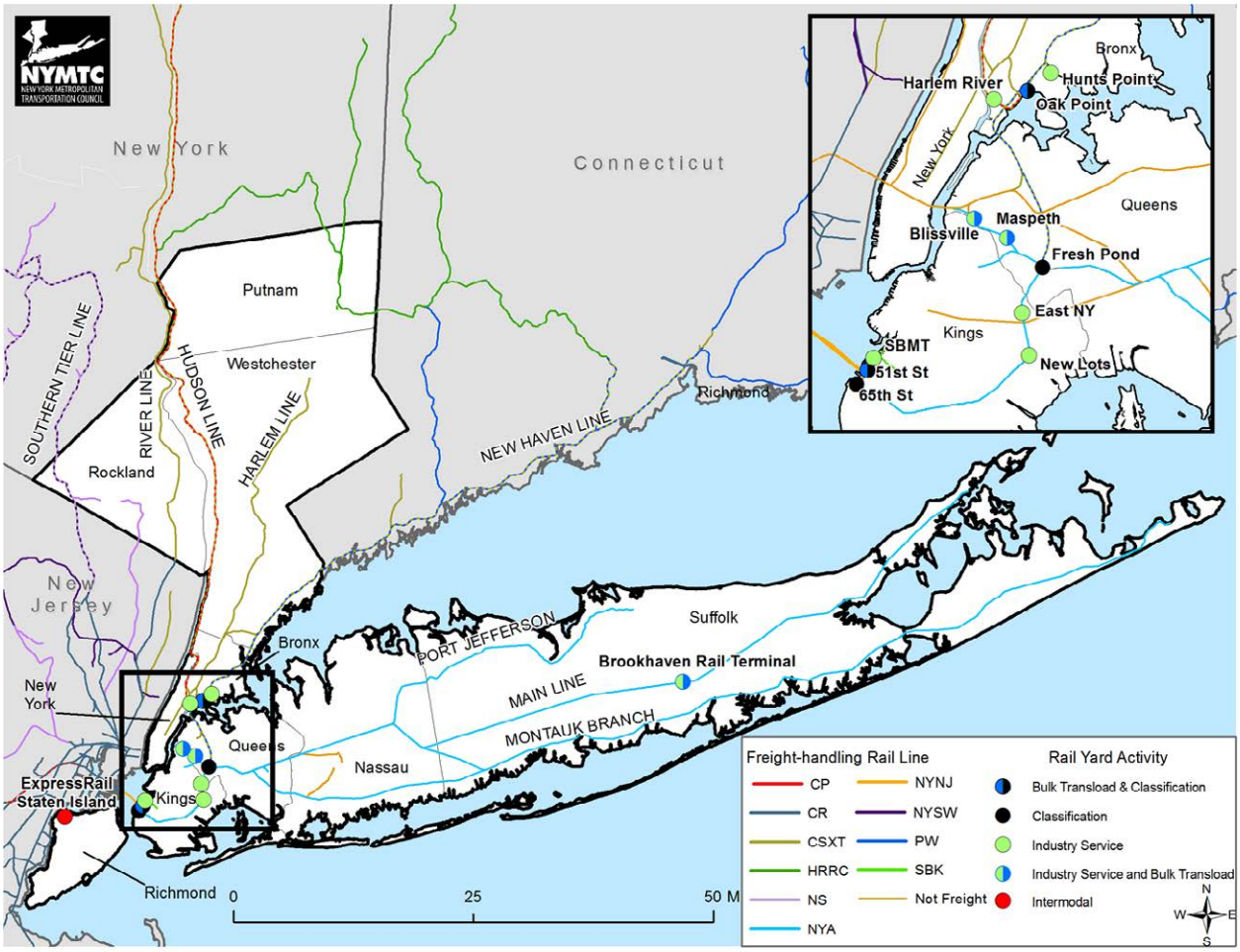
Rail customers in the NYMTC planning area are also served by five short line railroads, including:

- **The New York & Atlantic Railway (NY&A)** has held an exclusive franchise to provide freight service over trackage owned by the MTA 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 MTA LIRR's Lower Montauk Branch, Main Line, Babylon/Montauk Branch, and Port Jefferson Branch.
- **New York New Jersey Rail, LLC (NYNJR)**, which is owned by the Port Authority, operates a carfloat route across New York Harbor between Greenville Yard in Jersey City, New Jersey, and the 65th Street Yard in Brooklyn. NYNJR also provides rail service along 1st Avenue in Sunset Park to the 51st Street Rail Yard and South Brooklyn Marine Terminal (SBMT)/Sims Recycling.
- **The Providence and Worcester Railroad**, which maintains trackage rights with CSX to operate over the Hell Gate Line via Metro-North's New Haven route. The only regular move by Providence and Worcester Railroad 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 the railroad's limited trackage rights.
- **The Housatonic Railroad**, 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**, 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.

Figure H-4-14

Rail Freight Network by Ownership

Source: Cambridge Systematics, from National Transportation Atlas Database and Oak Ridge National Laboratory National Rail Network



In addition, the New York, Susquehanna, and Western Railway maintains trackage rights with Norfolk Southern to operate on the Southern Tier Line between Warwick, New York, and Binghamton. The railway 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 the New York, Susquehanna, and Western Railway 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 H-4-14***, coded by their type of use. Terminals and yards are divided into the following service types:

- **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.

- **Bulk Transload** terminals provide access to the rail network for shippers that do not have a rail siding immediately accessible on-site. The Brookhaven Rail Terminal currently handles construction materials and other bulk goods destined for central and eastern Long Island. The 65th Street Railyard terminates the NYNJR rail float operation in Brooklyn and accommodates bulk transload operation.
- **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.
- **Industry Service** yards and sidings are designed to stage cars for the purpose of serving nearby industry. The largest industry yard in terms of activity is Hunts Point, which on 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 and receives some food products by rail. NY&A also serves customers and properties between 65th Street and Fresh Pond Junction, including Glenwood Mason Supply; Favorite Plastics; Brooklyn Resource Recovery; Manhattan Beer (currently inactive); Brooklyn Terminal Market; Gershow Recycling; and CBS Foods.[4]

Figure H-4-15 illustrates, in a simplified schematic, the major freight rail corridors that traverse or pass near the NYMTC planning area, along with their primary functions.

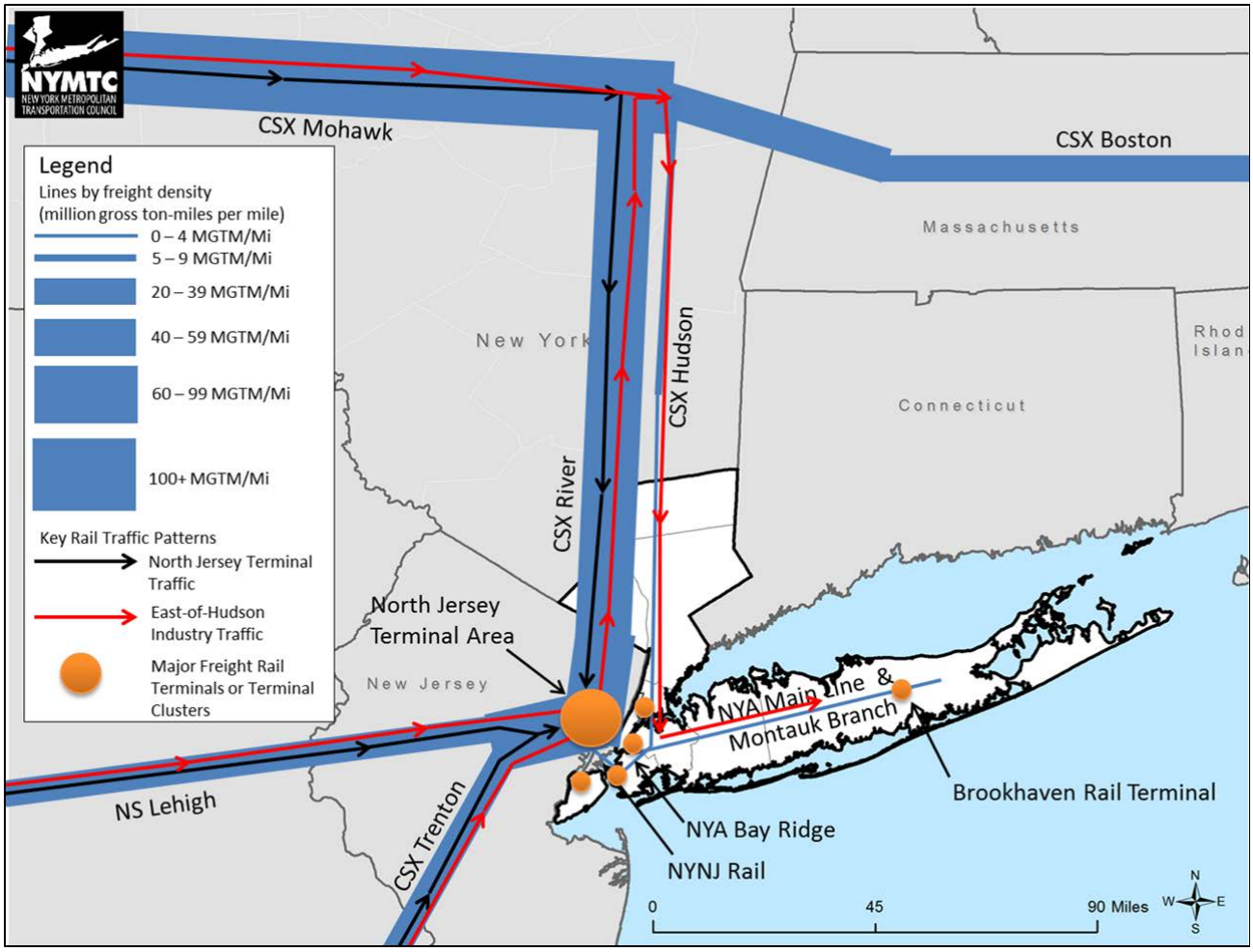
The line weights correspond to the volume of freight handled on each corridor. The most heavily-used segments are the CS Trenton Line and Norfolk Southern Lehigh Line, which run through New Jersey to Pennsylvania, and the CSX River Line, which connects to the CSX Mohawk Line running west (also known as the "water level route") and the CSX Boston Line running east. A portion of the CSX River Line traverses the NYMTC planning area west of the Hudson River. The other lines in the NYMTC planning area—the Bay Ridge Branch between 65th Street and Fresh Pond Junction, the Fremont Secondary between Fresh Pond Junction and Amtrak's Hell Gate Bridge, and the Montauk Branch—are lightly used by comparison.

- East-of-Hudson industry traffic flows are shown in red arrows. The primary rail service to the NYMTC planning area is via transfer from rail to truck at major carload and intermodal terminals in northern New Jersey. Direct service, which is considerably lower in volume, is provided via:
  - CSX track serving terminals in the Bronx.
  - CSX track running over Amtrak's Hell Gate Bridge and down the Fremont Secondary to Fresh Pond Junction and then interchanging with the NY&A. CSX currently performs one round trip per day along the Fremont Secondary, and the Providence and Worcester Railroad also performs one round trip per day over Hell Gate in peak service periods.
  - NYNJR railcar float service. In 2019, 4,355 revenue railcars were interchanged between the NYNJR and NY&A at 65th Street.[5] These railcars used the NYNJR 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.
  - Conrail track running over the Arthur Kill Lift Bridge and terminating on Staten Island.

Figure H-4-15

Major Freight Rail Corridors Serving the NYMTC Planning Area

Source: Cambridge Systematics, from Federal Railroad Administration data



4.3 WATERBORNE FREIGHT

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. It comprises public terminals under the management of the Port Authority (which leases property to private terminal operators) as well as privately owned/privately operated freight terminals and docks.

4.3.1 PORT AUTHORITY OF NEW YORK AND NEW JERSEY

In 2019, Port Authority marine terminals handled 86.2 million tons of international trade worth nearly $205.8 billion. Slightly less than half of tonnage, but nearly 90 percent of value, was moved as "general cargo" (in containers, as automobiles, or in packaged or "unitized" form), while the remainder was moved as "bulk" cargo (as liquid or dry commodities moved in loose form without packaging, on tankers and similar vessels). Leading general cargo import commodities included beverages, plastics, and furniture; leading general cargo export commodities included wood pulp, wood and wood products, and vehicles and parts. Leading bulk import commodities included mineral fuels and oils, sulfur, and organic chemicals; leading bulk export commodities include mineral fuels and oils, iron and steel, and oilseeds and grains. Trade with China accounts for 23.5 percent of total volume, followed by India (8.3 percent), Germany (5.1 percent), and Vietnam (4.8 percent).[6] Port Authority's container terminals handled 4,238,107 international containers (7,471,131 twenty-foot equivalent units or TEUs), ranking third among all U.S. container ports. Roughly the same number of containers are imported and exported; however, nearly all import containers are full, while 60 percent of export containers are shipped empty due to lack of export commodities to fill them.[7]

Container facilities are located in New Jersey (Port Newark, Elizabeth Port Authority Marine Terminal, and Port Jersey in Bayonne); on Staten Island (the Howland Hook Marine Terminal, also known as New York Container Terminal or MTA New York City Transit); and in Brooklyn (the Brooklyn Port Authority Marine Terminal in Brooklyn, also known as Red Hook Container Terminal). As shown in ***Figure H-4-16***, between 85 and 90 percent of the bi-state region's marine container traffic flows through terminals in New Jersey.

Major automobile terminals are located at Port Newark and Port Jersey, and capacity for handling other commodities is distributed throughout the region.

4.3.2 PUBLIC MARINE FREIGHT TERMINALS IN THE NYMTC PLANNING AREA

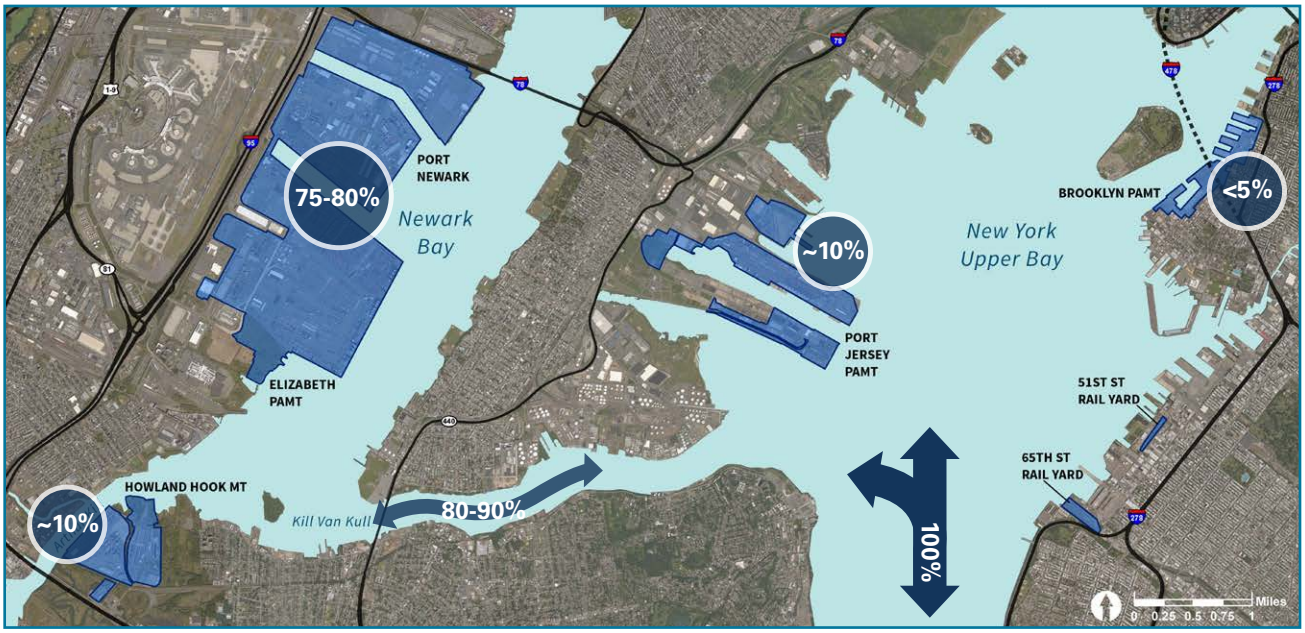
There are three public marine freight terminals in the NYMTC planning area:

- Howland Hook on Staten Island, portions of which are owned by the City of New York and leased to the Port Authority. The facility focuses on container movement but has also handled bananas in the past. Howland Hook has excellent access from I-278, and the site is served by a Port Authority "ExpressRail" intermodal facility, with rail connections over the Arthur Kill Lift Bridge to northern New Jersey and the national freight rail network. In 2018, NYC DOT improved access to Howland Hook Marine Terminal with a rule change increasing allowable weights for trucks carrying sealed ocean containers from 80,000 pounds up to 90,000 pounds.

Figure H-4-16

Marine Container Terminal Locations and Volume Shares

Source: Port Authority, Port Master Plan 2050

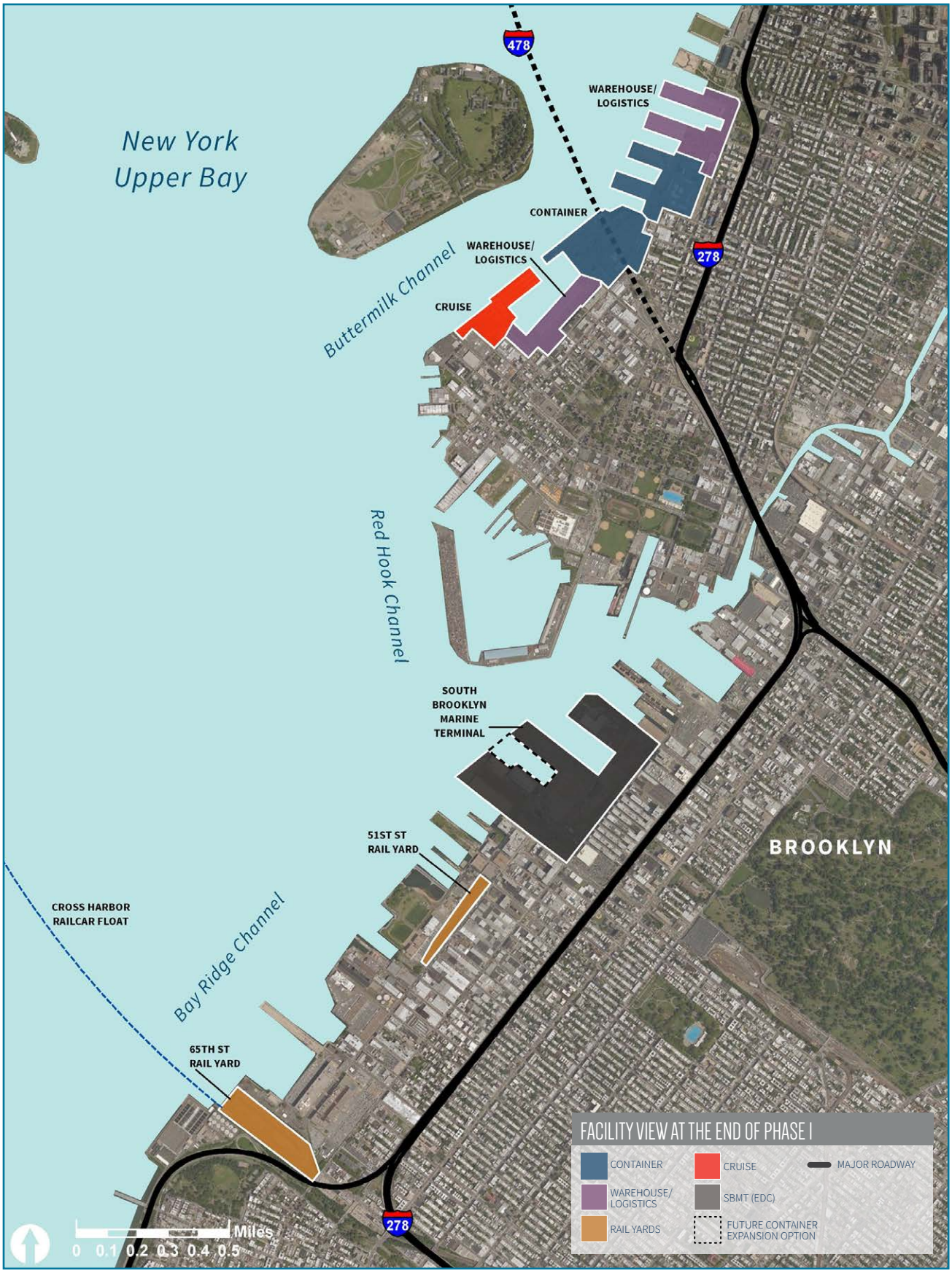


- Brooklyn Port Authority Marine Terminal, portions of which (generally referred to as Red Hook Marine Terminal) are owned by the City of New York and leased to the Port Authority. The complex includes the Red Hook Container Terminal operation as well as other facilities for handling and storing vehicles, salt, stone, palletized freight, "project cargo" (heavy-lift items), and other commodities. The complex includes major facilities for beverage warehousing and distribution. Red Hook is accessible from I-278 and is linked to New Jersey not only by trucking, but also by a cross-harbor container barge operation calling at Port Newark. Red Hook does not have rail service.
- SBMT is owned by the City of New York, and is located along the Brooklyn waterfront north of the 51st Street Railyard shown on ***Figure H-4-16***. It was an important container terminal in the 1980s, but after the ocean carrier (U.S. Lines) went bankrupt, operations ended, and the facility was idled for years. Reactivation of the facility began with construction of the Sims Recycling facility at the north end of the terminal (between 29th and 31st streets), state of good repair improvements to the terminal, and (most recently) execution of a lease agreement with a terminal operator. The terminal operator intends to handle a mix of commodities including project cargo related to wind energy facility installation and similar construction projects, building materials, vehicles, and other opportunity cargo. SBMT is accessible from I-278 and is served directly by rail along First Avenue, linking it to the NYNJR railcar float service at 65th Street. The location of the marine terminal in relation to other facilities is best illustrated in the "Phase I" development plan from the Port Authority's recent Port Master Plan 2050, shown on ***Figure H-4-17***.

Figure H-4-17

Locations of Brooklyn Marine Cargo Facilities with Reactivation of the South Brooklyn Marine Terminal

Source: Port Authority, Port Master Plan 2050



4.3.3 OTHER MARINE CARGO FACILITIES IN THE NYMTC PLANNING AREA

In addition to the public terminals noted above, the U.S. Army Corps of Engineers "Master Docks" database reports 132 other marine cargo facility locations in the NYMTC planning area (*Table H-4-2*).[8] This count includes facilities with a stated purpose of shipping or receiving waterborne freight, and excludes facilities with occasional shipments or receipts; vessel fleeting or storage areas; and maritime support services such as repair, refueling, and drydocking. Note that publicly operated sanitation facilities for the movement of MSW by water are included in this tabulation. The data should be used with caution—although it was updated in 2019, much of the information dates from the original survey of 1997—and some facilities may be inactive or may have been redeveloped. The data are best interpreted as an estimate of facilities intended for, and likely capable of, handling marine cargo on a regular basis.

As shown in *Table H-4-2*, more than half of the "other" marine cargo facilities are associated with the movement of fuels (e.g., petroleum, refined petroleum products, gasoline/diesel/aviation fuel, heating fuel oils). Construction materials (e.g., sand, stone, wood, iron and steel, concrete) is the next-leading category, followed by waste (including MSW, paper). Around one-fourth of these facilities are in Kings County, abutting New York Harbor, the East River, the Gowanus Canal, and Newtown Creek. Most other NYMTC planning area counties have a significant number of facilities, excepting Rockland and Putnam.

Figure H-4-18 illustrates the locations of these facilities by county and commodity group.

Table H-4-2

Other Marine Cargo Facilities in the NYMTC Planning Area

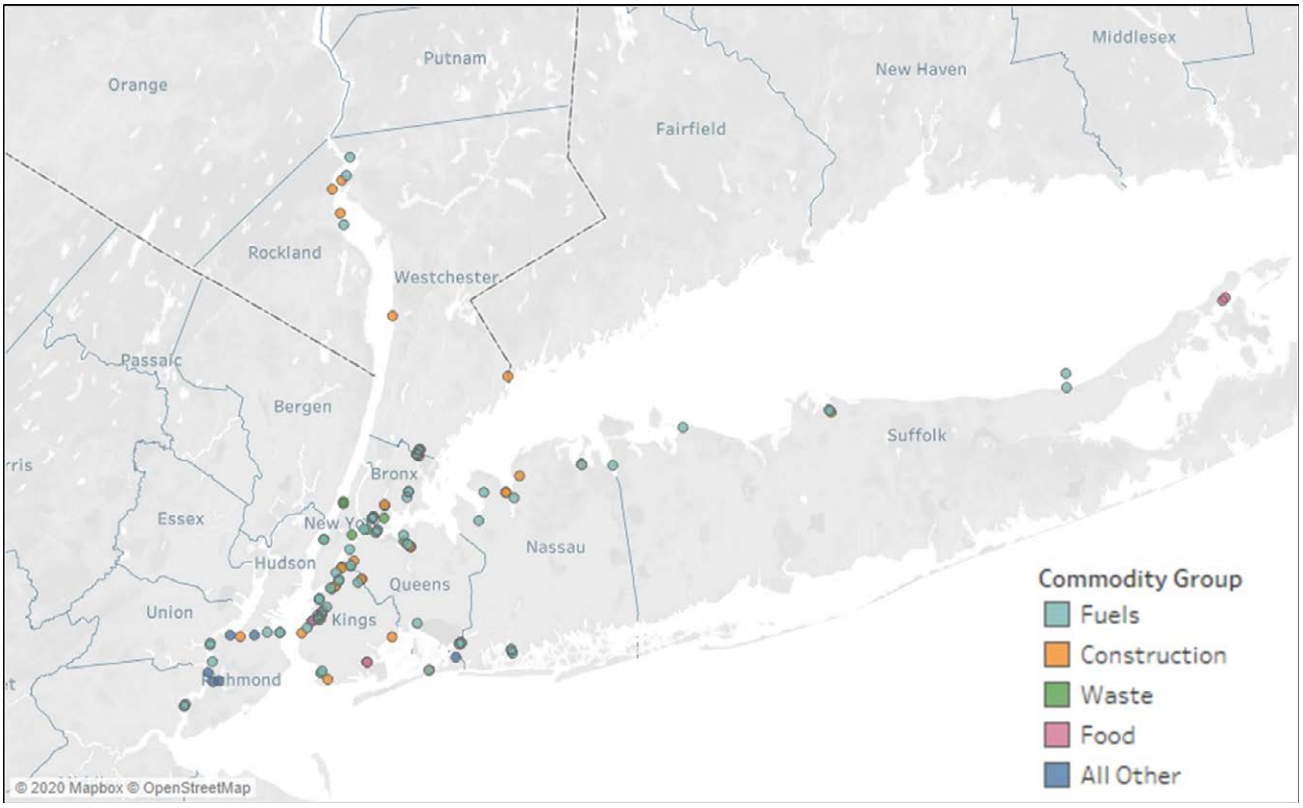
Source: WSP analysis of U.S. Army Corps of Engineers "Master Docks" database

County Name	Fuels	Construction	Waste	Food	All Other	Grand Total
Kings	13	12	5	3	1	34
Nassau	10	6			1	17
Queens	9	6	2			17
Bronx	10	4	1		1	16
Richmond	9	1			5	15
Westchester	6	6				12
New York	5		4			9
Suffolk	6	1		2		9
Rockland	1	2				3
Grand Total	**69**	**38**	**12**	**5**	**8**	**132**

Figure H-4-18

Locations of Other Marine Cargo Facilities by Commodity Group

Source: WSP analysis of U.S. Army Corps of Engineers "Master Docks" database



4.4 AIR FREIGHT

Of the New York area airports in the NYMTC planning area—JFK, LaGuardia Airport, Westchester County Airport, Long Island MacArthur Airport and Republic Airport—only JFK has significant air cargo activity and it is ranked among one of the top air cargo gateways in the country. LaGuardia Airport, while handling significant domestic passenger traffic, does not handle any significant amount of air cargo. Westchester County Airport is a regional commercial and general aviation airport and any cargo is incidental to the passenger and charter services operated there. The NYMTC planning area is also served by air cargo through Newark Liberty International Airport and Stewart International Airport, both of which have significant air cargo volumes but are outside the NYMTC planning area.

According to the Port Authority:[9]

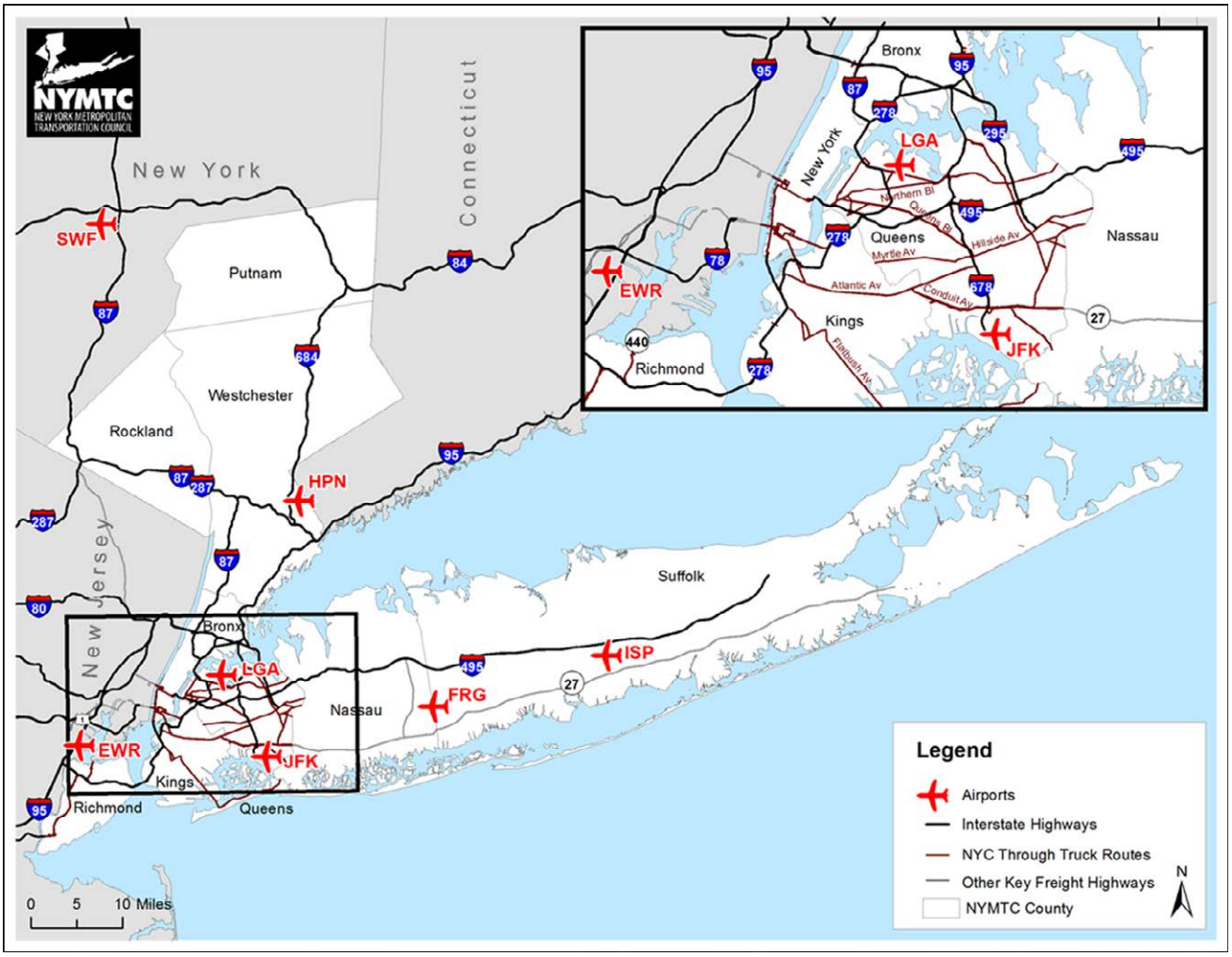
- JFK Airport covers a total of 4,930 acres and is served by around 80 airlines connecting it to around 170 nonstop destinations. Air cargo operations are supported by nearly 4 million square feet of warehouse and office space in a designated Foreign Trade Zone.
- Services are provided by a combination of all-cargo aircraft and passenger aircraft carrying "belly cargo." In 2019, JFK had 13,483 all-cargo flights and 355,514 scheduled passenger flights and carried 1,311,164 tons of cargo. JFK ranked 21st among all world airports and sixth among U.S. airports, behind Memphis (the FedEx hub), Louisville (the UPS hub), Anchorage (a major refueling stop for transpacific routes), Miami, and Chicago.[10]
- During the Great Recession of 2007–2009, JFK cargo volumes dropped significantly. After 2009, cargo volumes recovered slightly, but not to pre-recession highs, and since 2010 cargo volumes have been relatively stable, between 1.32 million and 1.42 million tons per year.
- Fifteen air cargo carriers account for 50 percent of JFK cargo tonnage. The top five, with a cumulative share of 28 percent, are: Delta, FedEx, American, Cathay Pacific, and UPS.

Locations of airports in and near the NYMTC planning area are shown on ***Figure H-4-19***.

Figure H-4-19

Airports In and Near the NYMTC Planning Area

Source: Cambridge Systematics, from the National Transportation Atlas Database



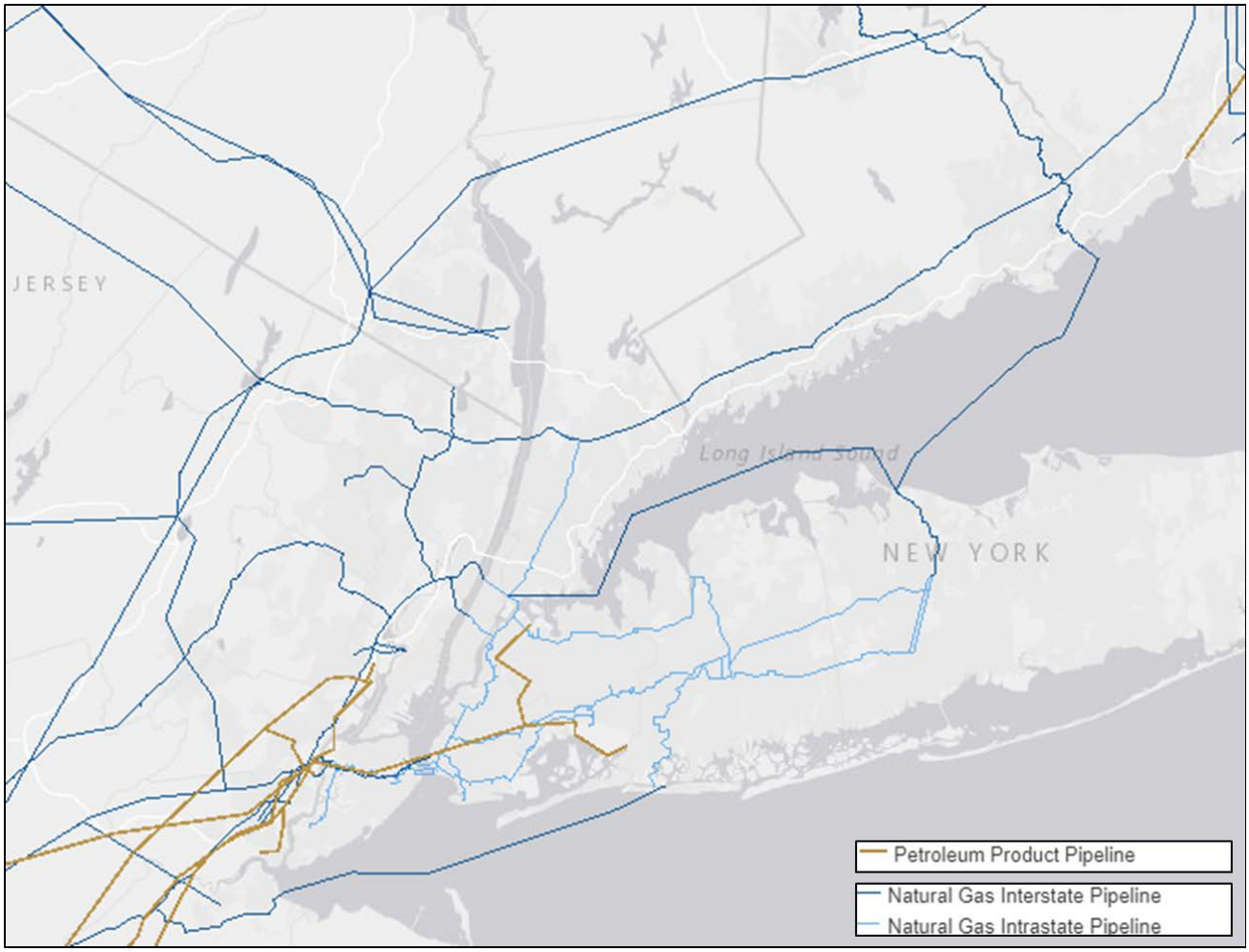
4.5 PIPELINES

Pipelines are extremely important for certain commodities in much of the country, but pipeline networks and utilization in the NYMTC planning area is relatively limited (*Figure H-4-20*). Buckeye Pipeline operates a petroleum products network from New Jersey, across Staten Island, and through Brooklyn and Queens, to supply aviation fuel to JFK and LaGuardia airports. Other counties are served by interstate and intrastate natural gas pipelines.[11]

Figure H-4-20

Petroleum Product and Natural Gas Pipeline Networks

Source: U.S. Energy Information Administration



4.6 MULTIMODAL FREIGHT NETWORK

These modal networks—truck, rail, water, air, and pipeline—sometimes work independently, but often work together as part of a connected multimodal system, with freight handled multiple times by multiple transportation modes as it moves from origin to destination. Examples of intermodal facilities include the following.

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. 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 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 at their facility. The design of these terminals can range from simple to elaborate, depending on the types of commodities and volumes handled. 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. Although the number varies by year, truck generally carry around 85 percent of the containers that are imported or exported via Port Authority container terminals, and shipments are transloaded between water and truck at many of the bulk waterborne terminals in the NYMTC planning area. In addition, trucks collect 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. Ferries operating in Long Island Sound also accommodate trucks, but the volumes are relatively low. Currently, the existing year-round ferry services carrying trucks in the NYMTC planning area 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 planning area 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 Port Newark, Port Elizabeth, Port Jersey, and Howland Hook. 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 2017, ExpressRail volumes have increased 19-fold, from 27,700 containers to more than 568,000 containers.

Air-to-Truck Terminals. Very few air cargo customers have access to their own air cargo facilities. The vast majority rely on trucks to perform air cargo pickups and deliveries at their facilities. 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 near 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.

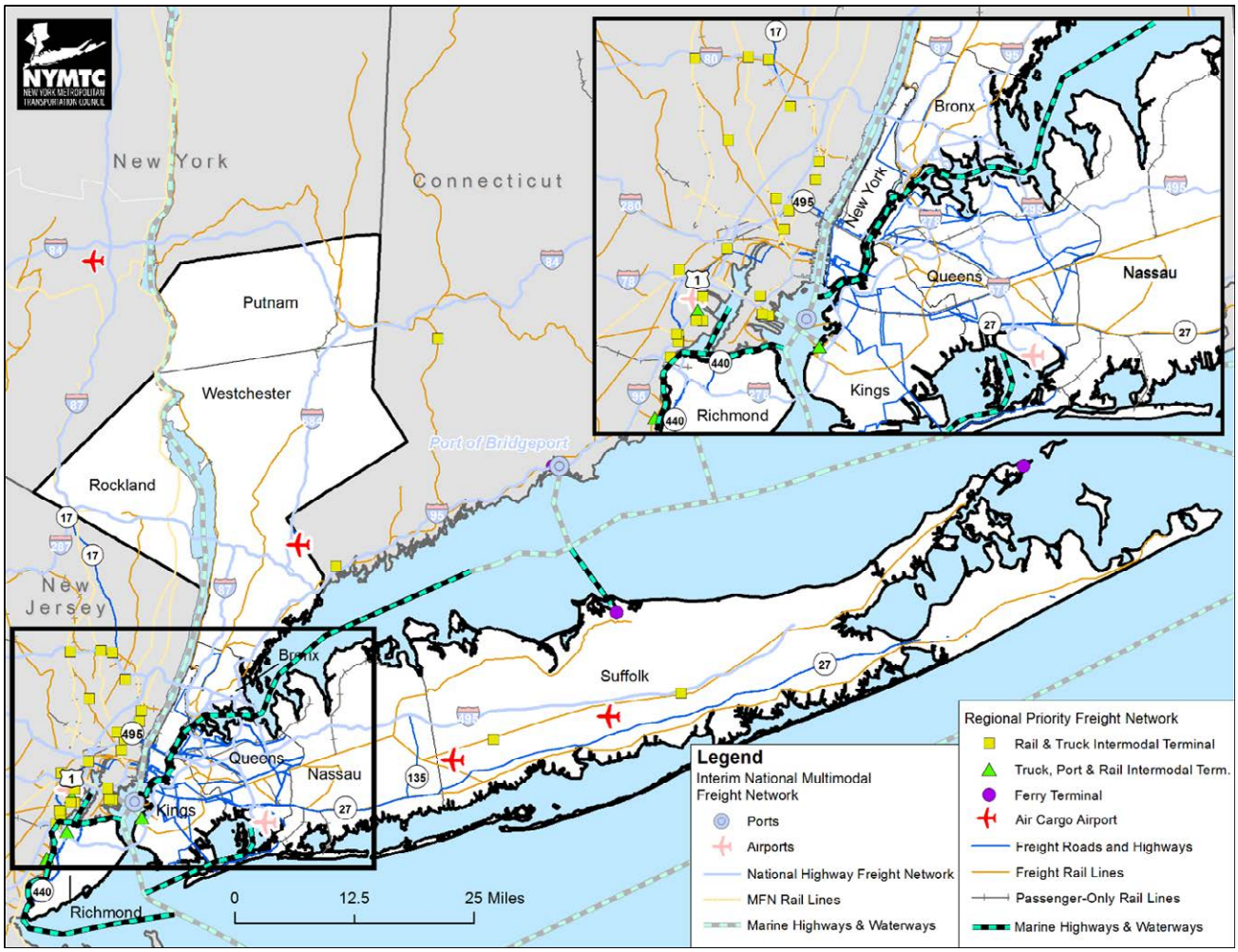
Mail centers can be stand alone or operations within cargo facilities and involve sortation equipment on various levels.

Figure H-4-21 illustrates the primary transfer points—or intermodal facilities—in this system.

Figure H-4-21

Multimodal Freight Network

Source: Cambridge Systematics, from National Transportation Atlas Database, Oak Ridge National Laboratory National Rail Network, and USDOT Interim National Highway Freight Network. Note that the Interim National Highway Freight Network was produced in 2016 but has not yet been finalized.



4.7 CONCLUSION

Commodity flows and supply chain operations in the NYMTC planning area are accomplished using a vast and mature set of modal networks—truck, rail, water, air, and pipeline—operating both independently and as linked intermodal systems. The performance of the modal networks and the intermodal facilities that connect them is critical to accomplishing safe, efficient, reliable, resilient, and equitable freight transportation for the region. Performance factors are discussed in ***Chapters 5*** and ***Chapter 6*** of this Freight Element and are crucial to the formulation of plan recommendations.

ENDNOTES

1 New York City's comprehensive Truck Route Network. ***http://www.nyc.gov/html/dot/downloads/pdf/2015-06-08-truck-map-combined.pdf***.

2 The counts cover FHWA vehicle classes 5-7 (single-unit trucks) and classes 8-13 (combination trucks). Chapter 5 provides definitions for each truck class, presents truck counts for the entire network including arterials and local roads, and uses the information to identify bottlenecks on road types where travel time information is available from the National Performance Measurement Research Data Set (NPMRDS).

3 Source for each of these figures is WSP analysis of NYSDOT 2018 Transearch data.

4 NY&A, March 2020 interview.

5 NYNJR, March 2020 interview.

6 All 2019 Port Authority marine terminal data are from ***https://www.panynj.gov/port/en/our-port/facts-and-figures.html***.

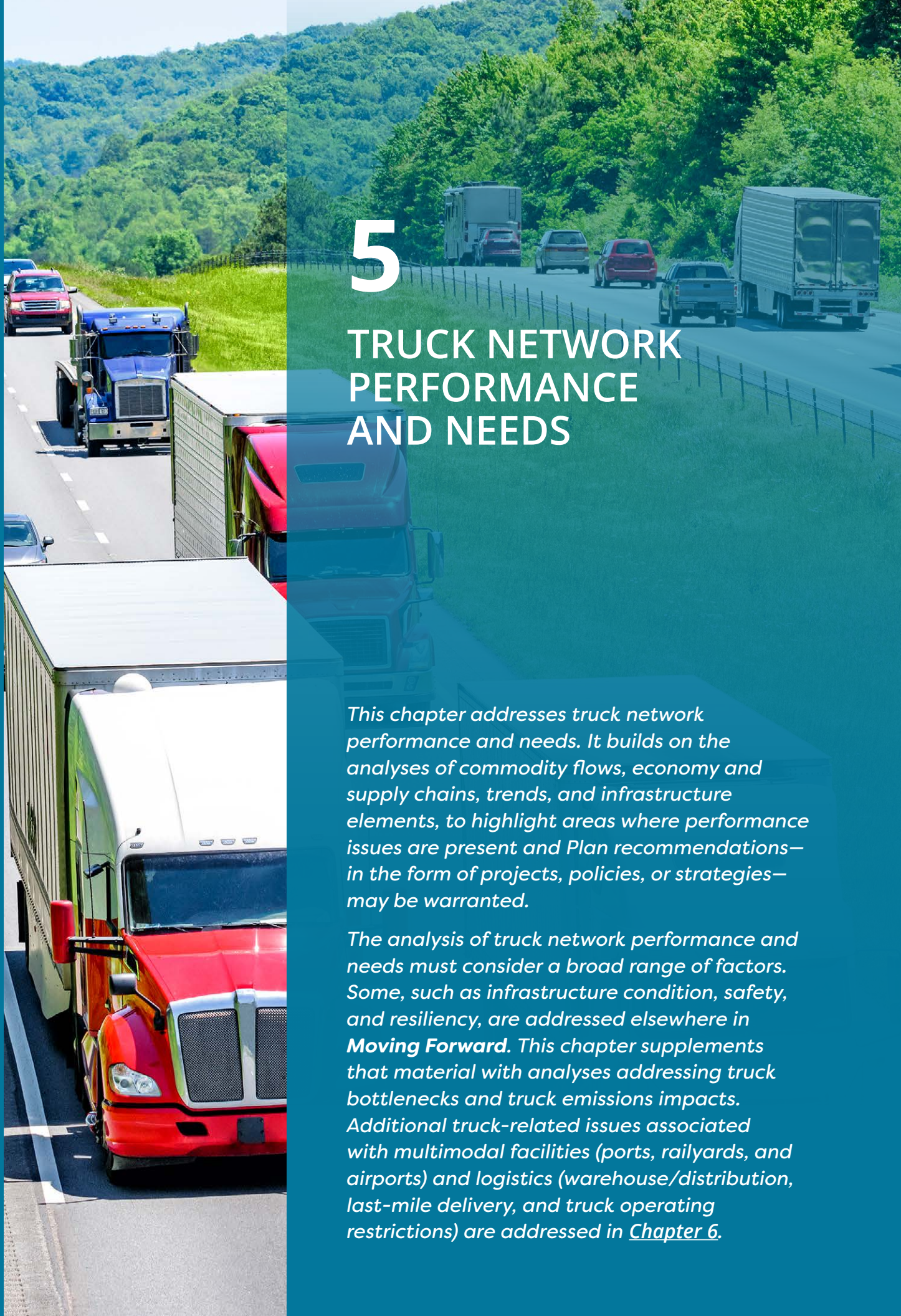
7 ***https://www.panynj.gov/port/en/our-port/facts-and-figures.html***. Note that international shipping containers come in various sizes (20, 40, 45, and 48 feet), so TEUs are used as a standardized measure, along with the actual number of containers.

8 ***https://publibrary.planusace.us/#/series/Data%20for%20Downloading***.

9 ***https://www.panynj.gov/airports/en/statistics-general-info.html***.

10 By comparison, LaGuardia Airport handled 6,376 tons of cargo in 2019.

11 ***https://www.eia.gov/beta/states/states/ny/data/dashboard/imports-exports-movements***.



5 TRUCK NETWORK PERFORMANCE AND NEEDS

This chapter addresses truck network performance and needs. It builds on the analyses of commodity flows, economy and supply chains, trends, and infrastructure elements, to highlight areas where performance issues are present and Plan recommendations—in the form of projects, policies, or strategies—may be warranted.

The analysis of truck network performance and needs must consider a broad range of factors. Some, such as infrastructure condition, safety, and resiliency, are addressed elsewhere in ***Moving Forward****. This chapter supplements that material with analyses addressing truck bottlenecks and truck emissions impacts. Additional truck-related issues associated with multimodal facilities (ports, railyards, and airports) and logistics (warehouse/distribution, last-mile delivery, and truck operating restrictions) are addressed in Chapter 6.*

5.1 TRUCK BOTTLENECKS

5.1.1 APPROACH

For this analysis, a "truck bottleneck" is a location on the roadway where the combination of high truck volumes and significant link-level delay and unreliability produce two effects: significant travel time delays for truck drivers and significant costs for freight customers due to delay and unreliability. These two effects—delay and cost—can be normalized on a per-mile basis to identify the best and worst performing segments of National Highway System roadways in the NYMTC planning area.

Work steps involved:

1. **Analyzing Highway Performance Monitoring System (HPMS)** estimates of daily truck counts over the National Highway System, as reported in the National Performance Measurement Research Data Set (NPMRDS).[1]
2. **Analyzing NPMRDS data on average truck travel times** (taken continuously at 5-minute intervals) on individual links in the HPMS[2] and calculating hourly average travel times throughout the day.
3. **Using NYSDOT truck counts to develop time-of-day profiles** to allocate the HPMS 24-hour counts to one-hour intervals, to calculate the number of trucks traveling at different times throughout the day and experiencing different link speeds.
4. **Calculating the location and amount of travel time delay and unreliability** experienced by the total population of trucks, by combining the truck volume and truck travel time information.
5. **Calculating the dollar costs** of truck delay and unreliability.
6. **Summarizing the results** to highlight critical bottleneck locations.
7. **Aggregating the bottleneck location** metrics to quantify performance at the corridor/route level.

5.1.2 HIGHWAY PERFORMANCE MONITORING SYSTEM TRUCK VOLUME ESTIMATES

In some cases, roadway segments with significant delays may be lightly used by trucks due to location or operating restrictions. Therefore, it is important to distinguish between performance issues that affect trucks and those that do not by understanding how truck travel is distributed over the network. The NYSDOT truck count data, while highly detailed, were available only for a limited number of count stations. Therefore, HPMS estimates for year 2019 were used. NYSDOT generates these estimates annually and reports them to FHWA, and the HPMS data are also contained in NPMRDS. The HPMS data cover the full National Highway System and are matched (in NPMRDS) with corresponding information on travel times by roadway segment.

HPMS data were tabulated for all trucks, as well as for two separate types of trucks. Trucks associated with FHWA Class 5, Class 6, and Class 7 represent single-unit trucks (where the truck cab and body are permanently attached), while FHWA Classes 8 and above represent combination trucks (where the cab and chassis can be separated), as shown by ***Figure H-5-1***. Combination trucks are used primarily for long-distance freight transportation and "primary moves" to transload terminals, intermodal terminals, warehouse/distribution centers, and major customers; single-unit trucks are used primarily for "secondary moves" (last-mile deliveries from warehouse/distribution centers), moves to smaller customers, and moves over dimensionally restricted segments of the region's truck network. Data in this chapter are shown in some cases for all trucks combined (Classes 5-13), or separately for single unit (Classes 5-7) and combination (Classes 8-13) trucks. Pickup trucks and two-axle delivery vans (Class 3) are not included in the data.

As shown on *Figure H-5-2*, the highest bi-directional truck volumes are seen on the major interstate corridors and connectors:

- I-684 and I-84 in Putnam
- I-87 and I-287 in Rockland
- I-287 and I-95 in Westchester
- I-95, I-87, I-278, I-678, and I-295 in the Bronx
- I-278 in Staten Island
- I-278 in Brooklyn
- I-278, I-495, I-678, and I-295 in Queens
- I-495 in Nassau
- I-495 in Suffolk

Large combination trucks show high AADT on these interstate highways and a limited number of other major routes, such as NY-27 in Nassau and Suffolk and US-1 in Westchester. Combination truck volumes are especially high in Westchester and Rockland, over the Governor Mario M. Cuomo Bridge (I-287 between Westchester and Rockland), and over the George Washington Bridge. Combination truck volumes are substantially lower over most other parts of the roadway network. See *Figure H-5-3*.

Single-unit trucks show a very different distribution pattern (see *Figure H-5-4*). Single-unit volumes are highest on I-278, I-495, the Cross Bronx/Bruckner/Major Deegan Expressways, the Whitestone Bridge/Van Wyck Expressway, the Throgs Neck Bridge/I-295, and NY-440. Single-unit volumes are substantial over much of the regional roadway network.

As a percentage of total AADT (all vehicle types), trucks represent the highest (at or near 20 percent) percentages on I-95, I-87, I-287, I-684, and segments of other roads—some of which are interstates and some of which are non-interstate arterials and local-serving roads. Almost every segment in the five boroughs, other than truck-restricted parkways, shows substantial (5 to 15 percent) truck shares, as does I-495. The lowest truck shares (below 5 percent) are seen on non-interstate segments in Nassau, Suffolk, Westchester, Rockland, and Putnam. See *Figure H-5-5*.

Figure H-5-1

FHWA Vehicle Classifications

Source: FHWA

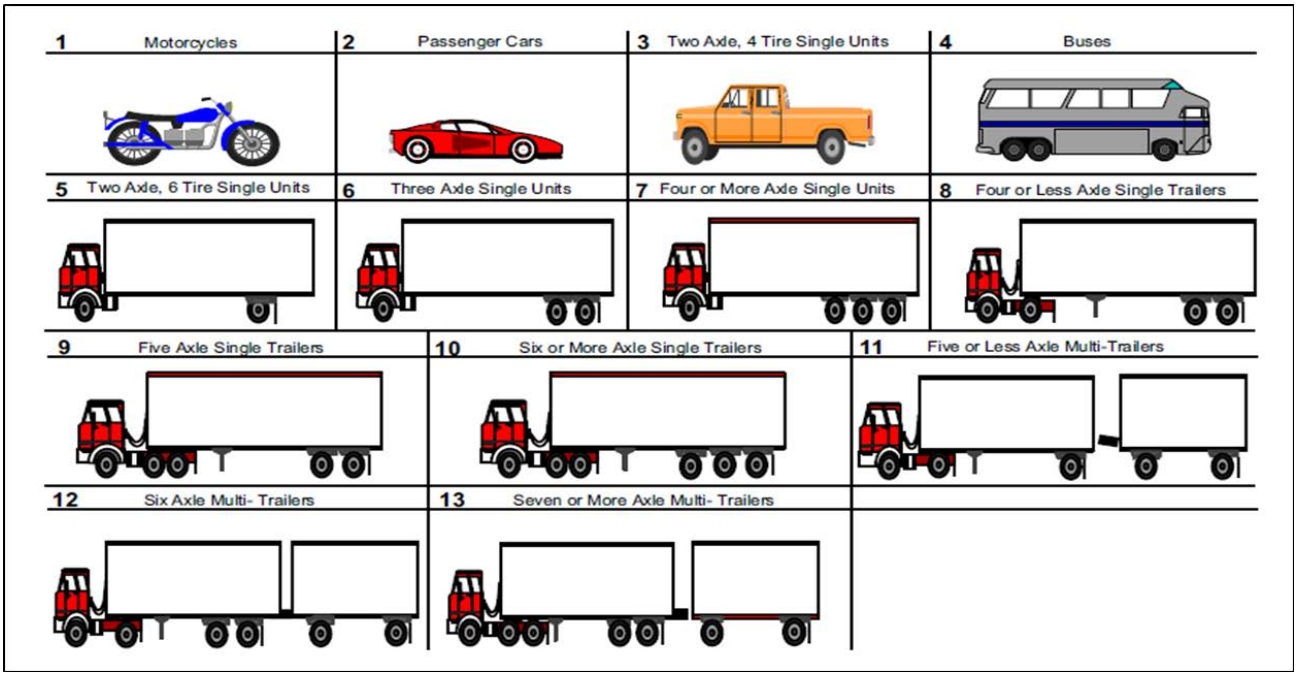


Figure H-5-2

Bi-Directional Average Daily Truck Volumes, Class 5-13 and >= 500

Source: WSP analysis of 2019 HPMS data

Figure H-5-3

Bi-Directional Average Daily Truck Volumes, Class 8-13 and >= 250

Source: WSP analysis of 2019 HPMS data

Figure H-5-4

Bi-Directional Average Daily Truck Volumes, Class 5-7 and >= 250

Source: WSP analysis of 2019 HPMS data

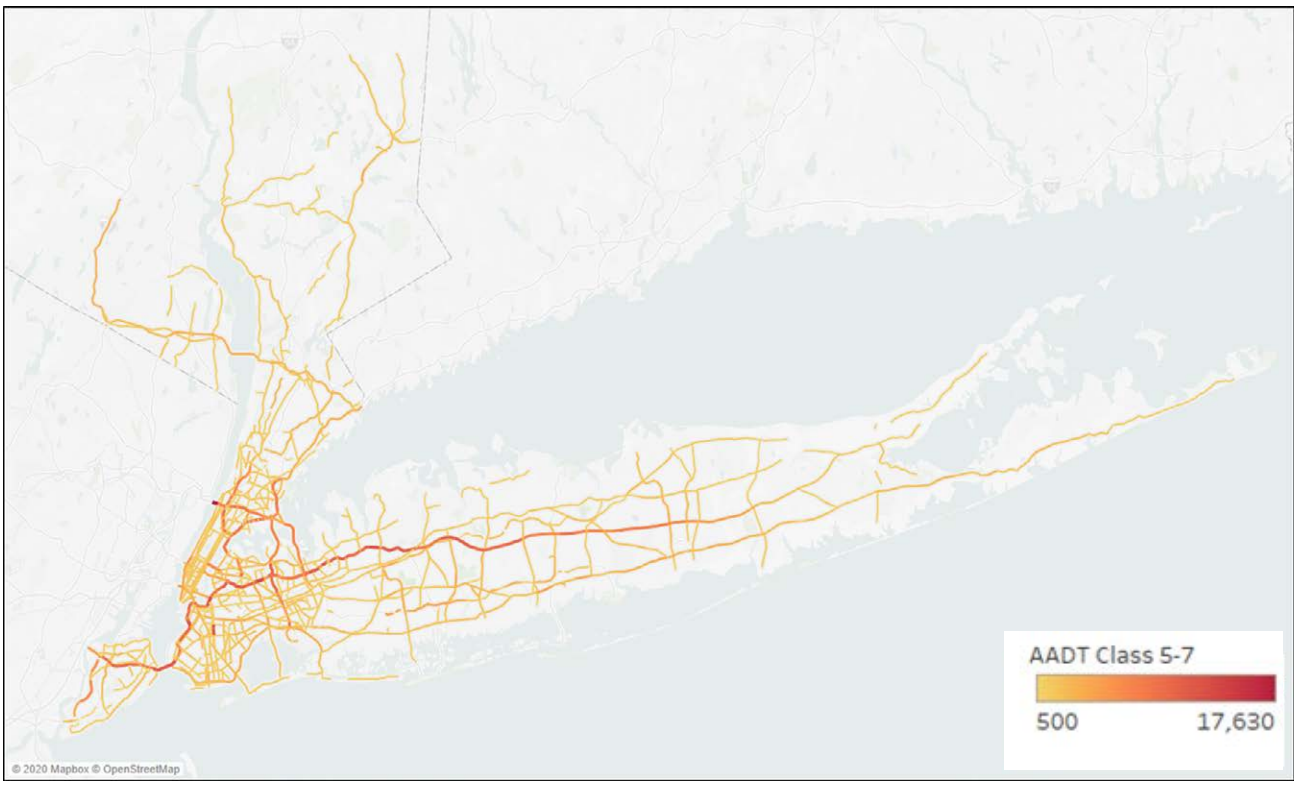


Figure H-5-5

Truck AADT (Class 5-13) as a Percentage of Total AADT (all Vehicles)

Source: WSP analysis of 2019 HPMS data

5.1.3 NPMRDS TRAVEL TIME METRICS

Travel time delay due to congestion is a primary measure of a truck bottleneck. Distinguishing between recurring (typical or expected every day) and non-recurring (not typical/expected) congestion is important because research shows that freight shippers and receivers are much more concerned about non-recurring congestion than recurring congestion. Motor carriers understand recurring congestion and schedule deliveries that account for slower speeds when they must travel during congested periods. On the other hand, non-recurring congestion—which may not be accounted for in logistics plans—can disrupt production, cause a stock-out at a store, or lead to a missed intermodal transfer at an airport, seaport, or rail terminal. On-time performance, which is one of the most important factors in modern-day supply chains, becomes much more difficult with high levels of non-recurring congestion.

NCHRP Report 925, *Estimating the Value of Truck Travel Time Reliability*, outlines an approach for estimating recurring and non-recurring congestion impacts using travel time data.[3] To calculate the recurring and non-recurring congestion metrics, it is necessary to process the NPMRDS truck travel time data (excluding other vehicle types) to estimate the following for each roadway segment:

- **The 10th percentile hourly truck travel time** (only 10 percent of travel times are better, and 90 percent are worse) over 24 hours, representing uncongested or "free-flow" operation.
- **The average truck travel time**, representing typical operation, measured separately for each hour.
- **The 95th percentile hourly truck travel time** (95 percent of travel times are better, and only 5 percent are worse), representing significantly congested operations, measured separately for each hour.

Figure H-5-6 and *Figure H-5-7* illustrate how these metrics translate into average travel speeds for trucks over the entire year. Most of the network in the five boroughs has average truck travel speeds under 25 miles per hour (mph); in other NYMTC planning area counties, these low speed segments are more limited to key corridors. Looking at congested travel speeds (associated with 95th percentile travel times) under 25 mph, the five-borough network shows even worse performance, and much more of the network in other NYMTC planning area counties is shown to be impacted. For local streets with low speed limits, 25 mph is not bad performance—in fact, it may represent the best safe operating speed—and the intent of these two figures is simply to show the locations where truck travel occurs at faster and slower speeds. Later in this chapter, delays compared to normal "free-flow" speeds (which consider the design and operating characteristics of each road) are calculated.

Figure H-5-6

Average Daily Truck Speeds Under 25 mph

Source: WSP analysis of 2019 NPMRDS data

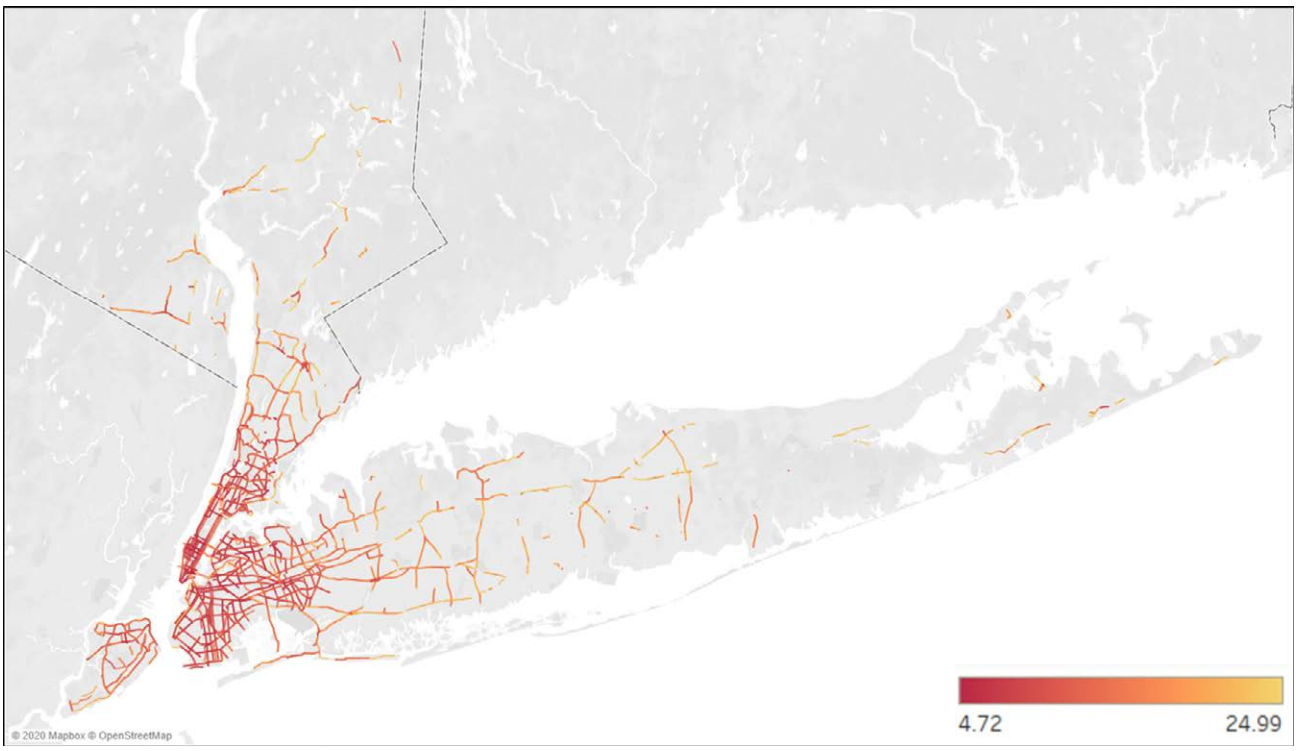
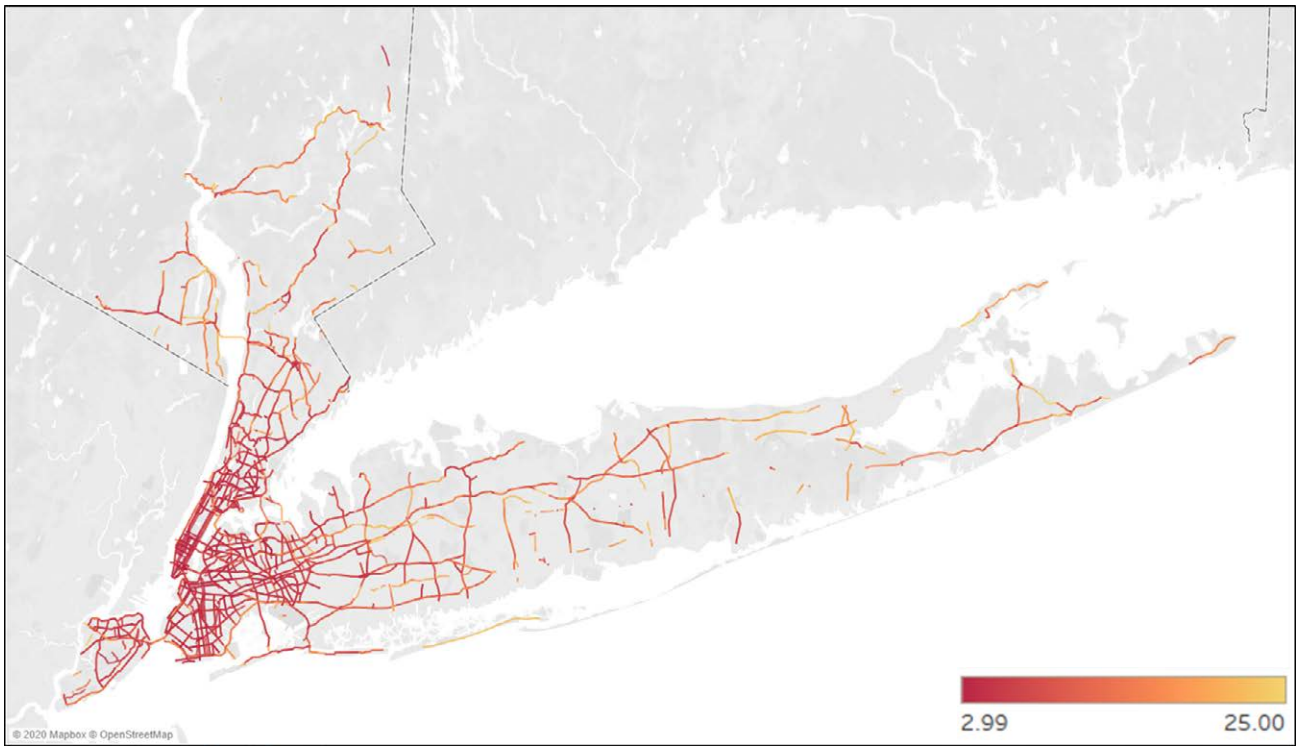


Figure H-5-7

Congested Daily Truck Speeds (95th Percentile Travel Time) Under 25 mph

Source: WSP analysis of 2019 NPMRDS data



5.1.4 NYSDOT TRUCK COUNTS AND HOURLY DISTRIBUTIONS

During any given day and on any given roadway link, trucks may experience typical (average) travel times, uncongested (10th percentile) travel times, significantly congested (95th percentile) travel times, or anything in between. It is important to understand how many trucks are using each roadway link at each hour of the day, to determine the number of trucks experiencing different travel times. The HPMS data provided with NPMRDS represent an average day but does not include hourly distributions.

To develop these distributions, an additional data source—NYSDOT hourly traffic counts—was utilized. NYSDOT counts were obtained for the NYMTC planning area for 2017, 2018, and 2019. A total of 5,100 unique count stations yielded 47.4 million truck counts at 15-minute intervals across the NYMTC planning area. Count data were provided by roadway functional class, direction of travel, and truck type (based on FHWA vehicle classifications).[4]

Using a nearest neighbor geospatial join, WSP assigned hourly truck patterns from the 5,100 NYSDOT count stations to every link in the NPMRDS network for the NYMTC planning area. This analysis produced a breakdown of the daily HPMS volumes to an hourly level throughout the NYMTC network, by direction of travel, roadway classification, and truck type.

Hourly truck count data for non-holiday weekdays were then tabulated. Weekends were excluded from the time-of-day profile estimation due to the much lower number of available count records and reported truck trips (as shown in ***Figure H-5-8***). The largest number of NYSDOT counts were performed on Tuesdays and Wednesdays, and the largest number of trucks were also recorded on those days. Each NYSDOT count station was active for between 3 and 14 days, with an average range of between 4 and 5 days. In some cases, count stations were not active for all hours of each day, so counts were normalized to adjust for over/undercounting of certain hours at each location.

This process generated a per-hour average count profile for each count station in the NYMTC planning area, with detail available at three key levels—roadway functional class, direction of travel, and truck type. Combination trucks, which are most prevalent on interstate highways, show two characteristic peaks—one in the pre-AM rush hour, and one mid-day. Single-unit trucks, which are most prevalent on arterials and local roads, show a single peak with the highest activity throughout mid-day hours. See ***Figure H-5-9*** and ***Figure H-5-10***.

Figure H-5-8

NYSDOT Truck Count Data by Day-of-Week

Source: WSP analysis of NYSDOT truck count data

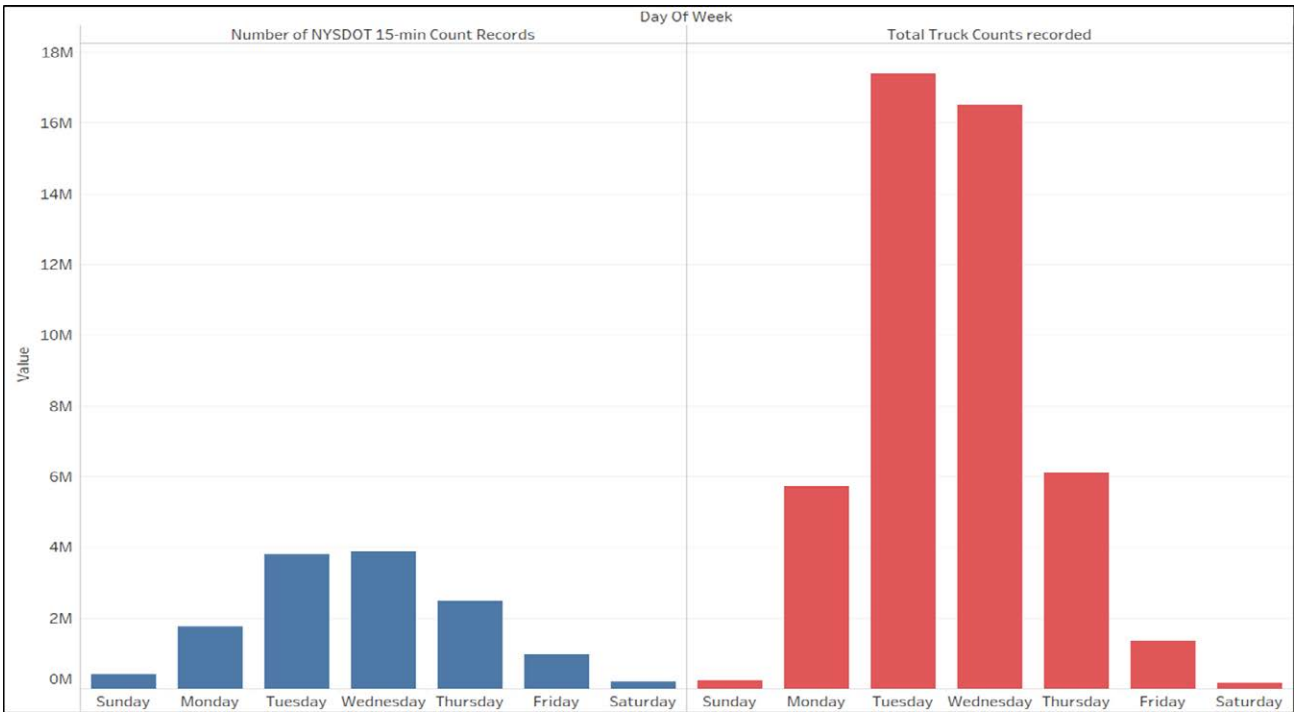


Figure H-5-9

Hourly Distribution of Truck Volumes by Truck Type for NYMTC Planning Area

Source: WSP analysis of NYSDOT truck count data

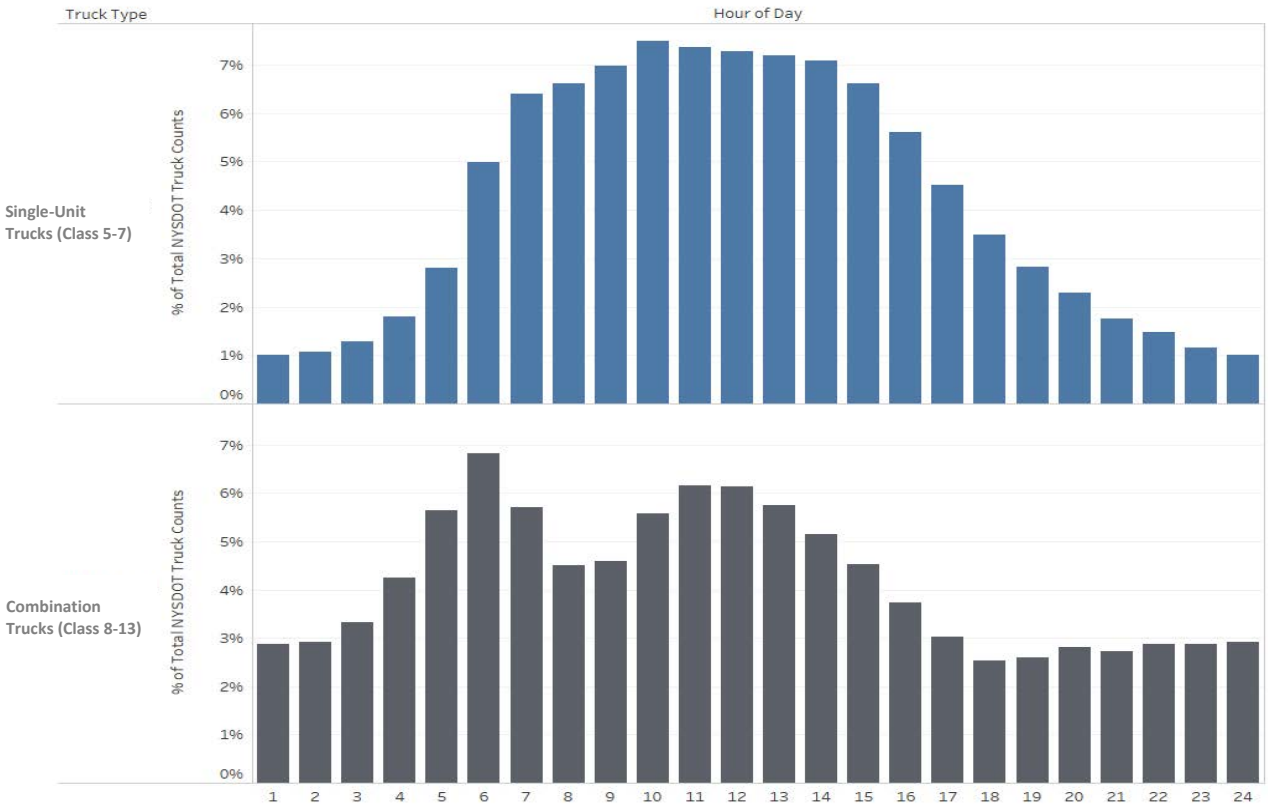
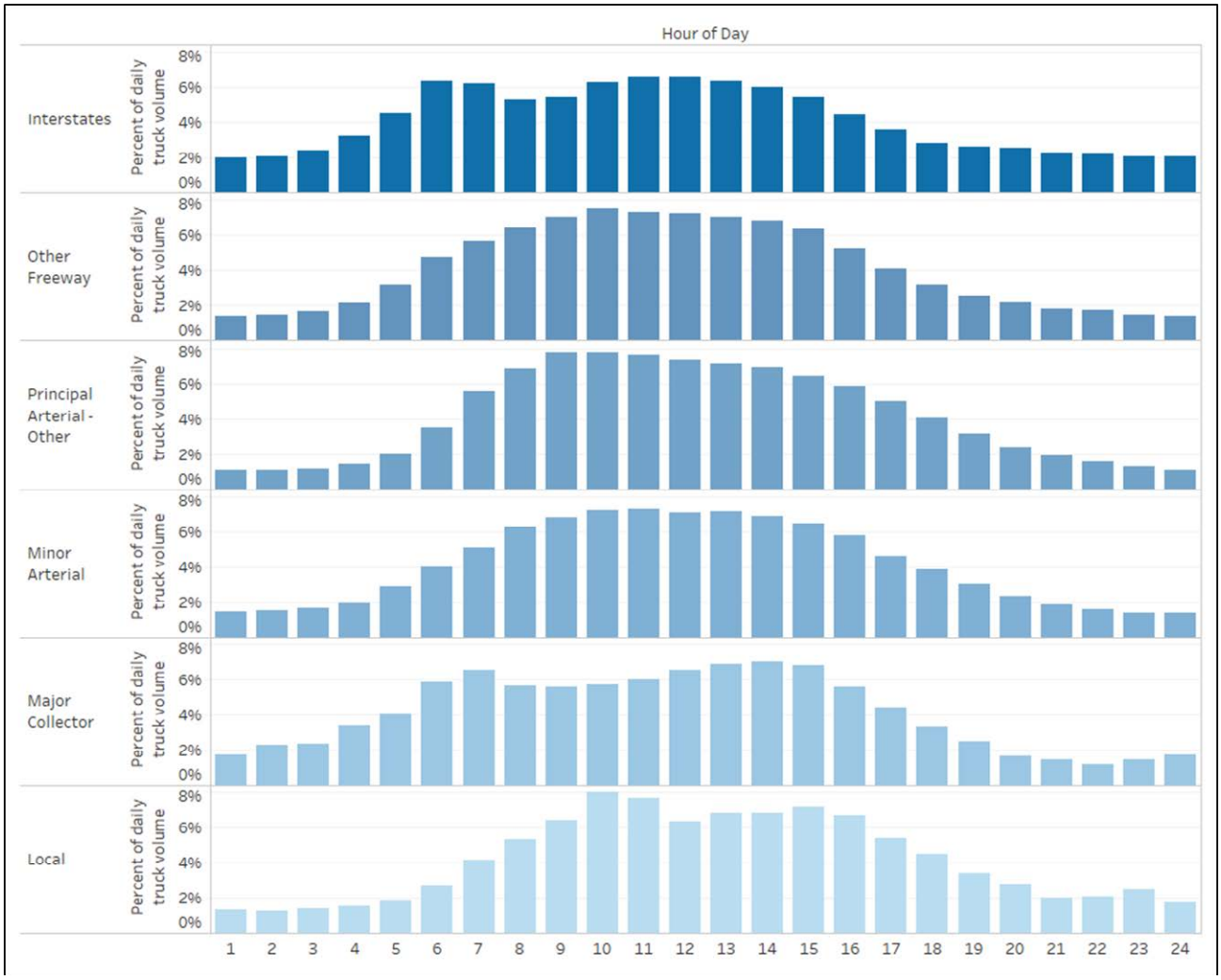


Figure H-5-10

Hourly Distribution of Truck Volumes by Roadway Classification, NYMTC Planning Area

Source: WSP analysis of NYSDOT truck count data



5.1.5 TRAVEL TIME DELAY AND UNRELIABILITY

Information from the previous steps—number of truck trips per segment per hour, truck travel speed per segment per hour, and key network performance threshold values—was then combined to estimate the duration of truck delays from recurring congestion and non-recurring congestion.

- **Recurring congestion** was measured as Vehicle Excess Hours of Travel (VEHT), calculated for each hour as amount by which the average travel time exceeded the free flow (10th percentile) time, times the number of trucks traveling in that hour, summed for all 24 hours. VEHT was summed over the network to get a total measure of performance and divided by the length of each segment to create a normalized VEHT-per-mile metric for each segment. High VEHT values result from the combined effects of (a) many trucks, and (b) average speeds that are substantially slower than free flow.

- **Non-recurring congestion** was measured as the vehicle hours of unreliability (VHU), calculated for each hour as the amount by which the 95th percentile travel time exceeded the average travel time, times the number of trucks traveling in that hour, summed for all 24 hours. VHU was summed over the network to get a total measure of performance and divided by the length of each segment to estimate a normalized VHU-per-mile metric for each segment. High VHU values result from the combined effects of (a) many trucks, and (b) 95th percentile travel times that are significantly worse than normally occurring average speeds.

As shown on ***Figure H-5-11***, the highest rates of recurring congestion (VEHT per mile) are observed on certain key interstate corridors: I-278, I-495, I-95, I-87, I-695, and I-95, which is not surprising. What may be surprising is that other non-interstate routes—including segments of Atlantic Avenue, Linden Boulevard, NY 25, NY 27, Canal Street, Second and Third Avenues in Manhattan, the Queensboro Bridge, and many other routes—also show significant VEHT per mile. The greatest concentrations of high VEHT per mile segments are in Manhattan, Brooklyn, Queens, and the Bronx. Moving west to Staten Island, north to Westchester/Rockland/Putnam and east to Nassau/Suffolk, fewer high VEHT segments appear, but they do appear in each county in the NYMTC planning area. The effects of unreliability (VHU per mile) tend to appear on fewer routes but do affect both interstates and non-interstates in each NYMTC planning area county. As shown on ***Figure H-5-12***, the clearest impacts are on I-278, I-495, I-95, I-87, and sections of NY 27, NY 25, Atlantic Avenue, Linden Boulevard, and other routes.

Summing VEHT and VHU at the county level, the total impact of recurring and non-recurring truck delay is estimated at more than 194,000 hours per day in the NYMTC planning area (***Table H-5-1***). The three highest-delay counties—Queens, Kings, and Bronx—experience 57 percent of total regional delay hours.

Figure H-5-11

Vehicle Excess Hours of Travel per Mile per Day (scaled from 20 to 150 or more hours)

Source: WSP analysis of 2019 NPMRDS data

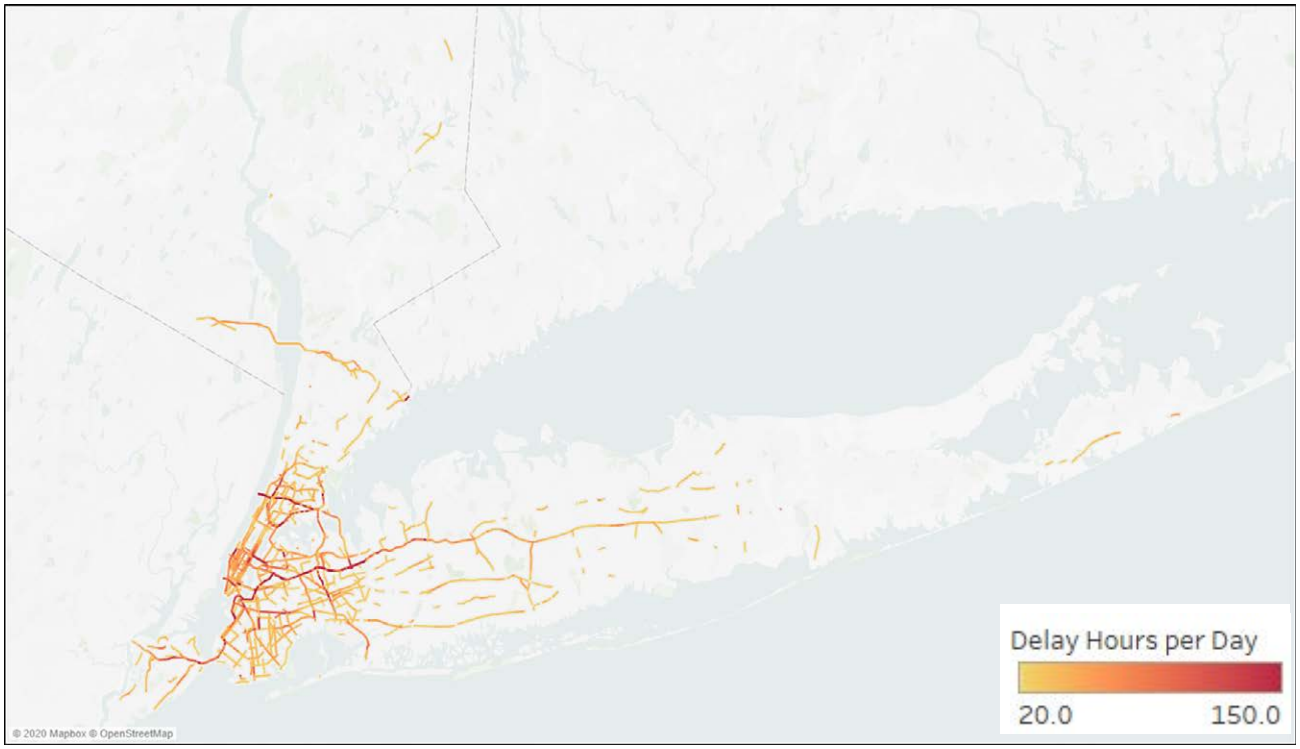


Figure H-5-12

Vehicle Hours of Unreliability per Mile per Day (scaled from 20 to 150 or more hours)

Source: WSP analysis of 2019 NPMRDS data

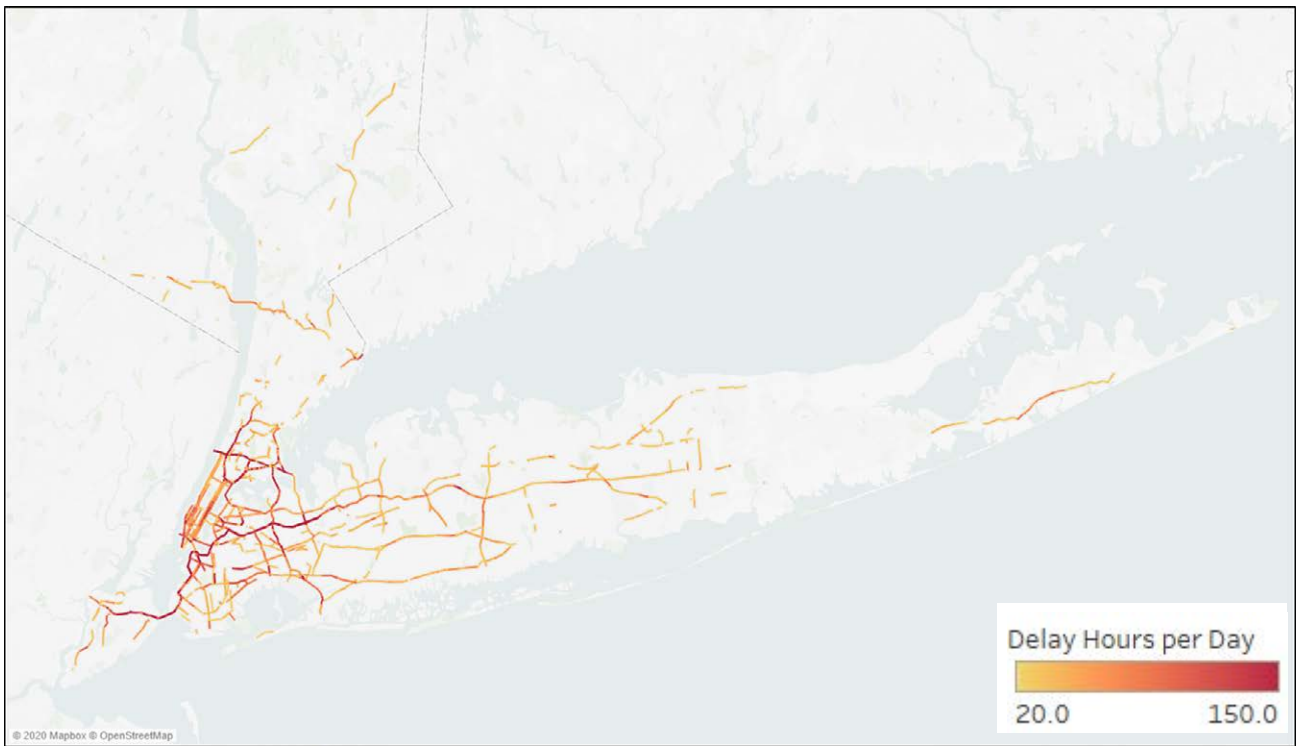


Table H-5-1

Average Truck Delays (Hours per Day) by County, 2019

Source: WSP analysis of 2019 NPMRDS data

County	Recurring Truck Delay (Hours per Day)	Non-Recurring Truck Delay (Hours per Day)	Total (Hours per Day)
Queens	22,286	25,437	47,724
Kings	18,793	16,784	35,577
Bronx	12,246	14,397	26,643
New York	10,670	9,995	20,666
Suffolk	8,274	10,868	19,141
Nassau	7,996	8,858	16,854
Westchester	5,831	5,243	11,074
Richmond	4,864	6,074	10,938
Rockland	2,247	1,837	4,084
Putnam	706	713	1,419
Grand Total	**93,914**	**100,205**	**194,119**

5.1.6 MONETIZED IMPACTS OF DELAY

To better understand the economic costs of truck delays—for the trucking industry and for the customers that depend on trucking to ship and receive goods—the delay values presented in ***Table H-5-1*** can be monetized using factors from NCHRP Report 925, which conducted a large national stated-preference survey to quantify how motor carriers and freight shippers value travel time delay and unreliability, relative to their expected travel times and costs. The key calculations are:

- **VEHT (recurring congestion delay time)** is valued at $66 per hour. Note that FHWA values total commercial vehicle travel time at $33 per hour, applied to all operating hours; this method uses a higher value per hour, but applies it only to delay time rather than total travel time.
- **VHU (non-recurring congestion delay time)** is valued at $160 per hour. This represents costs to freight shippers and receivers from missed pickup and delivery schedule times, which have ripple effects throughout their supply chains (such as needing extra labor/operating hours, requiring replacement goods and materials to be obtained from other sources quickly at higher cost, disrupting just-in-time production schedules).

Based on these monetization factors, the cost of truck delays within the NYMTC planning area is estimated at more than $22.2 million dollars per day, or roughly $5.7 billion dollars per year (at 260 days per year). The highest total costs are generated by delays in Queens, Kings, and Bronx (***Table H-5-2***). On a cost per system-mile basis, which normalizes the differences between larger-mileage and smaller-mileage counties, the highest costs are experienced in the Bronx and Manhattan, followed by Queens and Brooklyn.

Table H-5-2

Average Truck Delay Costs per Day by County, 2019

Source: WSP analysis of 2019 NPMRDS data

County	Recurring Truck Delay (Hours per Day)	Non-Recurring Truck Delay (Hours per Day)	Total (Hours per Day)	Cost Per Mile per Day	Cost Per Mile Rank
Queens	$1,470,876	$4,069,920	$5,540,796	$11,406	3
Kings	$1,240,338	$2,685,440	$3,925,778	$11,014	4
Bronx	$808,236	$2,303,520	$3,111,756	$14,015	1
New York	$704,220	$1,599,200	$2,303,420	$13,045	2
Suffolk	$546,084	$1,738,880	$2,284,964	$2,495	7
Nassau	$527,736	$1,417,280	$1,945,016	$4,834	6
Westchester	$384,846	$838,880	$1,223,726	$2,122	9
Richmond	$321,024	$971,840	$1,292,864	$7,307	5
Rockland	$148,302	$293,920	$442,222	$2,246	8
Putnam	$46,596	$114,080	$160,676	$1,488	10
Grand Total	**$6,198,324**	**$16,032,800**	**$22,231,124**		

5.1.7 BOTTLENECK LOCATIONS

Interstate highways account for around 45 percent of the cost of delay; principal arterials also account for around 45 percent; and the other 10 percent is associated with other freeways, minor arterials, major collectors, and local roads. Within these roadway classifications, specific bottleneck locations can be identified and ranked based on their associated user costs from recurring and non-recurring delay.

Given the uncertainties built into the analysis process, location-specific findings are best treated as diagnostic information to highlight locations likely to be most problematic.[5] In many if not most cases, the results should not be surprising to those familiar with the regional roadway network; in some cases, there may be questions about why certain locations are identified or not identified, and those cases could warrant more detailed investigation and validation.

At the location level, just 2.7 percent of NPMRDS system mileage accounts for 25 percent of truck delay cost in the NYMTC planning area; 10.6 percent of mileage accounts for 50 percent of cost; and 28.7 percent of mileage accounts for 75 percent of cost. Locations accounting for 25 percent of truck delay cost in the NYMTC planning area (see ***Figure H-5-13***) include:

- George Washington Bridge, Verrazzano-Narrows Bridge, Queensboro Bridge, Williamsburg Bridge, Kennedy Bridge, Whitestone Bridge, Governor Mario M. Cuomo Bridge
- I-278 and portions of Nostrand Ave in Brooklyn
- I-495 and portions of I-678, Rockaway Boulevard, Cross Bay Boulevard, and Woodhaven Boulevard in Queens
- I-95, I-87, and I-287 in the Bronx
- Portions of I-278 and portions of Richmond Ave. in Staten Island
- Portions of RT-9A (West St.) and 12th Ave in Manhattan
- Portions of I-495 and NY-27 in Nassau
- Portions of I-684 in Putnam

Many other segments and corridors become visible on ***Figure H-5-14*** (locations accounting for 50 percent of truck delay cost) and ***Figure H-5-15*** (locations accounting for 75 percent of truck delay cost).

Figure H-5-13

Bottleneck Locations Accounting for 25 Percent of Truck Delay Cost in the NYMTC Planning Area

Source: WSP analysis of 2019 NPMRDS data

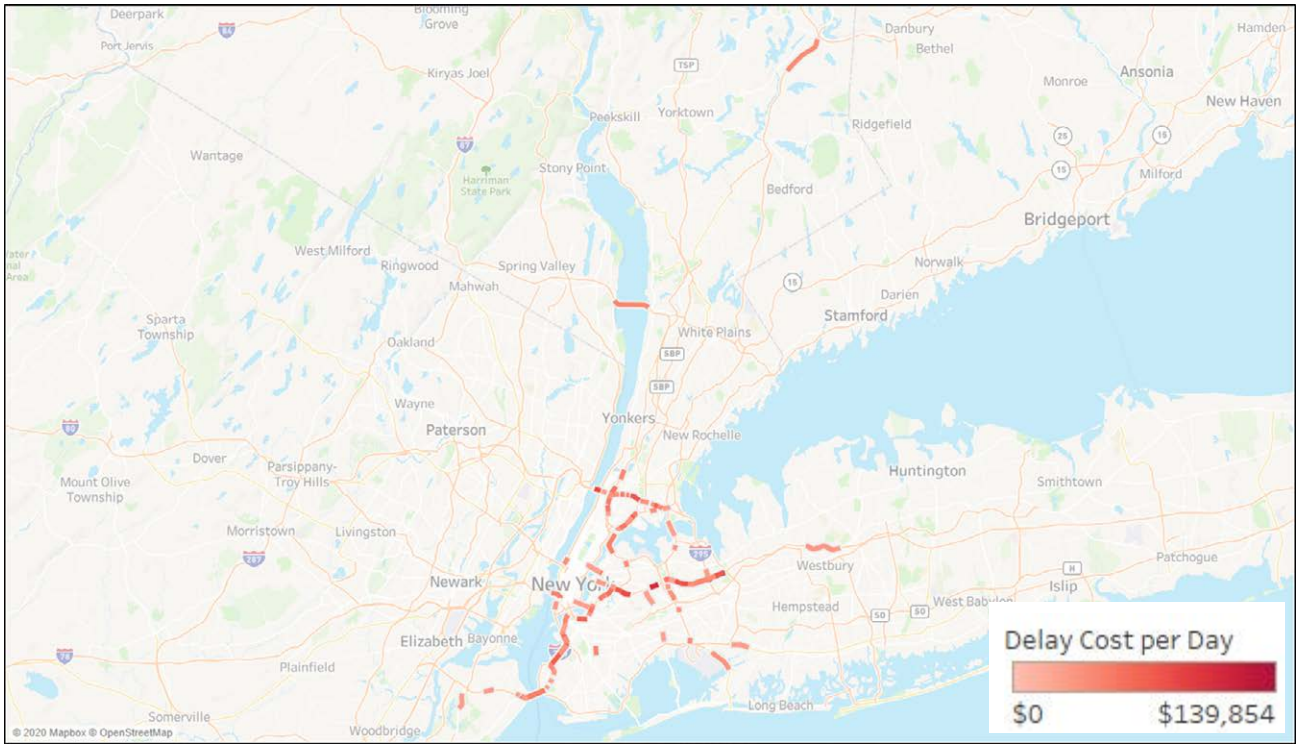


Figure H-5-14

Bottleneck Locations Accounting for 50 Percent of Truck Delay Cost in the NYMTC Planning Area

Source: WSP analysis of 2019 NPMRDS data

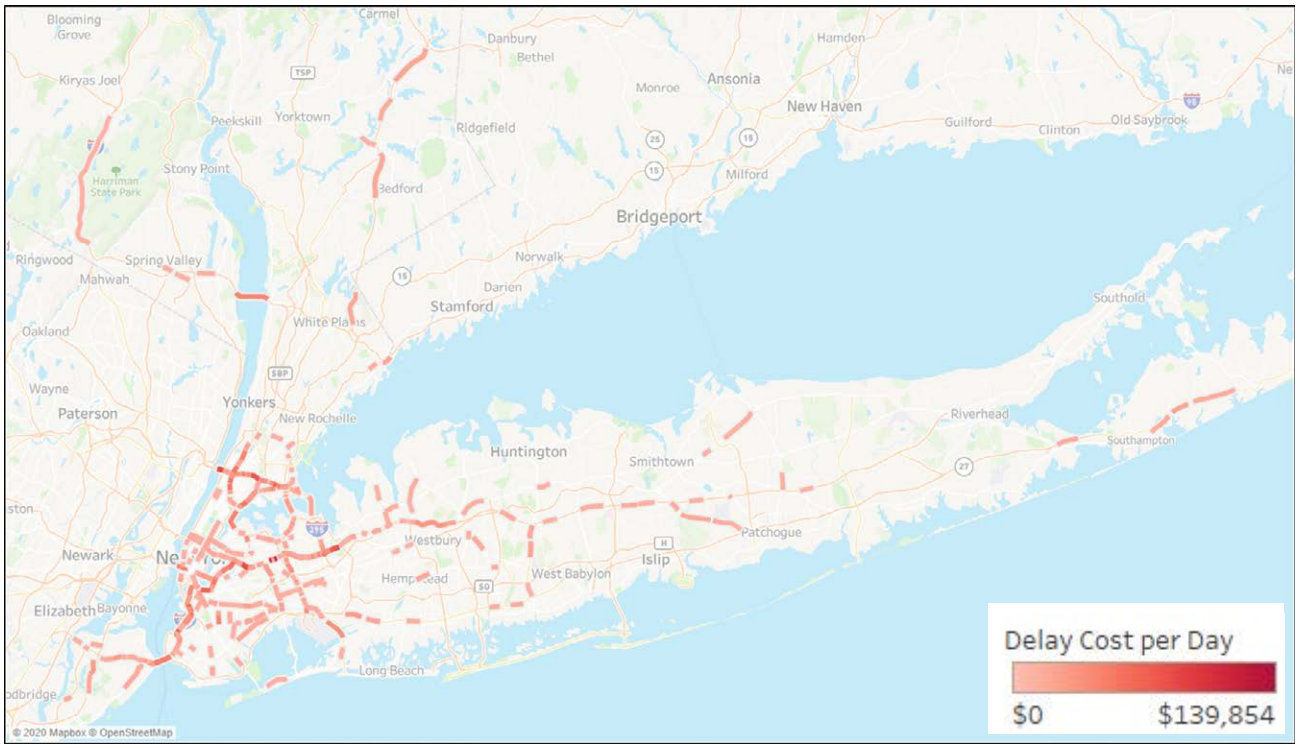


Figure H-5-15

Bottleneck Locations Accounting for 75 Percent of Truck Delay Cost in the NYMTC Planning Area

Source: WSP analysis of 2019 NPMRDS data

5.1.8 CORRIDOR AND ROUTE PERFORMANCE

To stitch together the bottleneck location results and provide a more wholistic, corridor-oriented perspective, truck delay costs per day were summed for every traffic message channel associated with a particular named/numbered road within each NYMTC planning area county.

Table H-5-3 shows the top 20 ranked routes by county, which together account for just over 50 percent of all truck delay costs in the NYMTC planning area. The top five corridors—which by themselves account for 25 percent of all truck delay costs in the NYMTC planning area, are: I-495 in Queens, I-278 in Kings, I-278 in Richmond, I-95 in the Bronx, and I-678 in Queens.

Table H-5-3

Truck Delay Cost per Day Summed by Route and County—Top 20 in NYMTC Planning Area

Source: WSP analysis of 2019 NPMRDS data

County	Road	Cost ($/Day)	Cum. Share	Rank
Queens	I-495	2,066,220	9.3%	1
Kings	I-278	1,400,787	15.6%	2
Richmond	I-278	890,400	19.6%	3
Bronx	I-95	753,240	23.0%	4
Queens	I-678	679,013	26.0%	5
Bronx	I-87	656,371	29.0%	6
New York	George Washington Bridge	476,744	31.1%	7
Bronx	I-278	475,682	33.3%	8
Nassau	I-495	450,778	35.3%	9
Suffolk	RT-27	443,759	37.3%	10
Suffolk	I-495	415,889	39.2%	11
Bronx	Bruckner Boulevard	337,989	40.7%	12
Nassau	RT-27	308,829	42.1%	13
Queens	RT-25	294,614	43.4%	14
Queens	RT-25A	285,833	44.7%	15
New York	RT-9A	281,784	46.0%	16
Kings	Atlantic Avenue	270,582	47.2%	17
Queens	I-278	261,841	48.4%	18
Suffolk	RT-25	247,159	49.5%	19
Nassau	RT-24	236,080	50.5%	20

Table H-5-4 through *Table H-5-13* list routes in each NYMTC planning area county with truck delay costs of more than $40,000 per day (around $12 million per year).

Table H-5-4

Truck Delay Cost per Day Summed by Route and County—Nassau

Source: Analysis of NPMRDS data

County	Road	Cost ($/day)
Nassau	I-495	450,778
Nassau	RT-27	308,829
Nassau	RT-24	236,080
Nassau	RT-25	156,334
Nassau	RT-25A	86,892
Nassau	RT-107	84,150
Nassau	Peninsula Boulevard	81,740
Nassau	Glen Cove Road	78,197
Nassau	RT-106	71,168

Table H-5-5

Truck Delay Cost per Day Summed by Route and County—Suffolk

Source: Analysis of NPMRDS data

County	Road	Cost ($/day)
Suffolk	RT-27	443,759
Suffolk	I-495	415,889
Suffolk	RT-25	247,159
Suffolk	RT-110	200,804
Suffolk	RT-347	159,269
Suffolk	RT-454	140,286
Suffolk	CR-97	89,748
Suffolk	RT-25A	78,861
Suffolk	RT-231	68,390
Suffolk	RT-112	65,111
Suffolk	CR-83	58,927
Suffolk	RT-109	45,687
Suffolk	RT-111	41,643

Table H-5-6

Truck Delay Cost per Day Summed by Route and County—Putnam

Source: Analysis of NPMRDS data

County	Road	Cost ($/day)
Putnam	I-684	67,679

Table H-5-7

Truck Delay Cost per Day Summed by Route and County—Rockland

Source: Analysis of NPMRDS data

County	Road	Cost ($/day)
Rockland	I-87/I-287	170,861
Rockland	RT-59	122,038
Rockland	RT-303	43,139

Table H-5-8

Truck Delay Cost per Day Summed by Route and County—Westchester

Source: Analysis of NPMRDS data

County	Road	Cost ($/day)
Westchester	I-95	169,987
Westchester	I-287	164,015
Westchester	US-9	77,848
Westchester	I-87	75,224
Westchester	US-6	61,101
Westchester	RT-100	56,937
Westchester	RT-9A	50,288
Westchester	RT-119	42,929

Table H-5-9

Truck Delay Cost per Day Summed by Route and County—Bronx

Source: Analysis of NPMRDS data

County	Road	Cost ($/day)
Bronx	I-95	753,240
Bronx	I-87	656,371
Bronx	I-278	475,682
Bronx	Bruckner Boulevard	337,989
Bronx	I-295	133,599
Bronx	I-678	98,020
Bronx	I-895	90,716
Bronx	E 233RD ST	50,261
Bronx	US-1	47,328
Bronx	Gun Hill Road	44,270
Bronx	I-695	42,058
Bronx	Tremont	41,975

Table H-5-10

Truck Delay Cost per Day Summed by Route and County—Kings

Source: Analysis of NPMRDS data and NYMTC TIP

County	Road	Cost ($/day)
Kings	I-278	1,400,787
Kings	Atlantic Avenue	270,582
Kings	RT-27	231,378
Kings	Flatbush Avenue	180,072
Kings	Hamilton Avenue	166,316
Kings	Flatlands Avenue	100,044
Kings	Coney Island Avenue	99,505
Kings	Nostrand Avenue	96,338
Kings	4th Avenue	88,245
Kings	65th Street	85,972
Kings	3rd Avenue	66,771
Kings	Utica Avenue	58,346
Kings	Grand Street	50,738
Kings	Williamsburg Bridge	47,441

Table H-5-11

Truck Delay Cost per Day Summed by Route and County—New York

Source: Analysis of NPMRDS data

County	Road	Cost ($/day)
New York	George Washington Bridge	476,744
New York	RT-9A	281,784
New York	Broadway	147,186
New York	3rd Avenue/3rd Avenue Bridge	121,176
New York	2nd Avenue	116,717
New York	Amsterdam Avenue	84,171
New York	1st Avenue	71,780
New York	Canal Street	62,674
New York	Avenue of the Americas/ 6th Avenue	60,726
New York	I-278	58,663
New York	Williamsburg Bridge	56,320
New York	Holland Tunnel	47,464
New York	10th Avenue	46,355
New York	Lexington Avenue	42,013
New York	Delancey Street	40,612

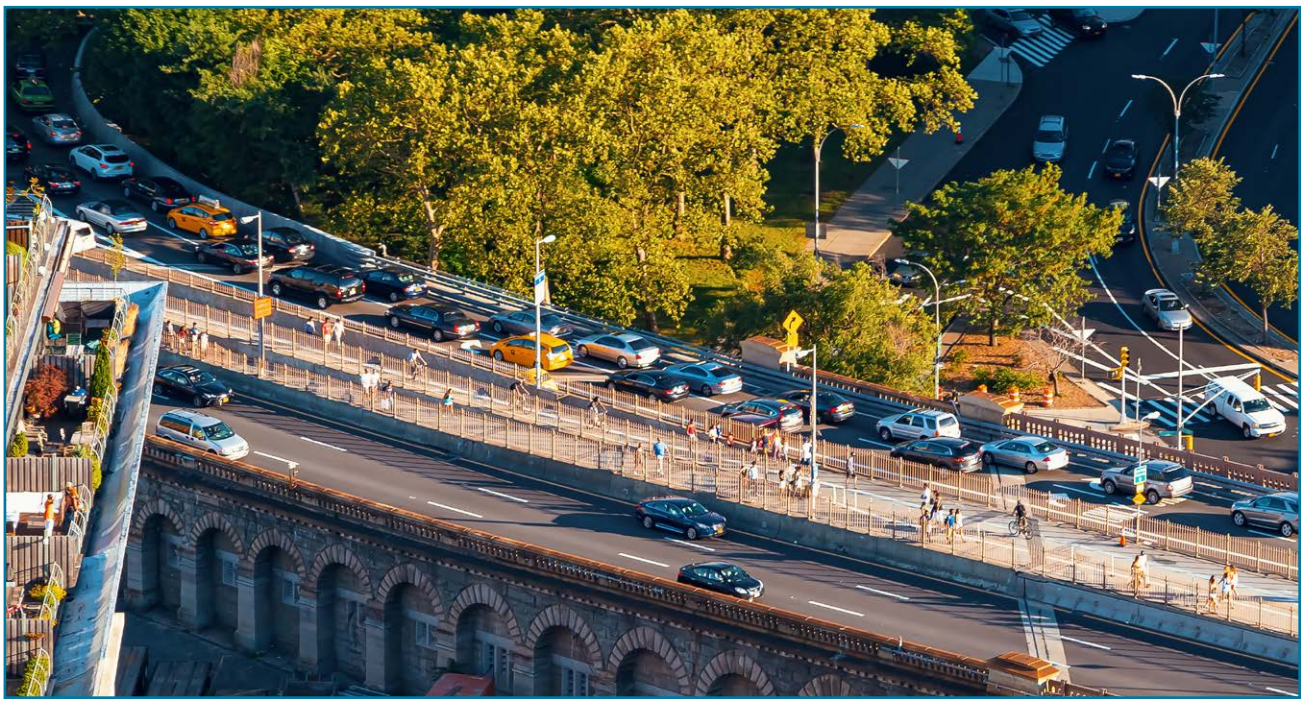


Table H-5-12

Truck Delay Cost per Day Summed by Route and County—Queens

Source: Analysis of NPMRDS data

County	Road	Cost ($/day)
Queens	I-495	2,066,220
Queens	I-678	679,013
Queens	RT-25	294,614
Queens	RT-25A	285,833
Queens	I-278	261,841
Queens	Borden Ave/Queens-Midtown Expressway	212,655
Queens	Woodhaven Boulevard	138,438
Queens	Rockaway Boulevard	135,062
Queens	I-295	117,502
Queens	Astoria Boulevard	100,634
Queens	Queensboro Bridge	97,198
Queens	RT-27	76,260
Queens	Jamaica Avenue	59,543
Queens	Main Street	58,102
Queens	21st Street	54,754
Queens	Atlantic Avenue	53,811
Queens	Union Turnpike	53,728
Queens	Cross Bay Boulevard	51,763
Queens	Springfield Boulevard	45,597
Queens	Francis Lewis Boulevard	44,062

Table H-5-13

Truck Delay Cost per Day Summed by Route and County—Richmond

Source: Analysis of NPMRDS data and NYMTC TIP

County	Road	Cost ($/day)
Richmond	I-278	890,400
Richmond	RT-440	86,056
Richmond	Hylan Boulevard	80,156
Richmond	Richmond Avenue	61,347
Richmond	Forest Avenue	50,042

Many of these routes are the subject of improvements that are programmed, planned, or under consideration. However, those improvements may not have direct or significant effects on truck delay costs. Chapter 7 of this Freight Element lists two recommendations to evaluate the freight corridors listed in Table H-5-4 through Table H-5-13 in greater detail by evaluating the freight benefit of improvements programmed/planned/under consideration, identifying unaddressed freight performance issues, and suggesting potential actions focused on reducing truck delay costs.

5.2 TRUCK EMISSIONS

Inefficiencies in the truck network create delays in the movement of freight, which translate directly into costs for the region's transportation service providers and freight shippers and receivers. More generally, trucking operations create other types of impacts, including societal impacts such as air emissions, noise, congestion, crashes, and infrastructure wear and tear. Reducing truck delay is one strategy to reduce emissions—the less time trucks spend on the road, and the less start-and-stop movements they perform, the lower their emissions will be. However, bottleneck elimination is only one potential avenue for addressing emissions, and others will likely be needed.

Transportation is the largest individual sector contributing to greenhouse gas emissions in New York State, accounting for 36 percent of all emissions in 2016.[6] Most greenhouse gas emissions come from fuel combustion in New York, and the transportation sector accounts for 44 percent of fuel combustion emissions.[7] The emissions from the transportation sector are dominated by combustion of gasoline and diesel fuel for the purpose of powering internal combustion engines.[8]

Because freight vehicles have run predominantly on petroleum diesel for decades, they have contributed to pockets of high pollution exposure in communities near major freight corridors. Environmental justice communities are those that are disproportionately burdened by these emissions, suffering higher rates of pollution exposure without necessarily benefiting economically from the freight activity that generates the emissions burdens. As planners devise strategies to shift a portion of current and future freight activity from on-road trucks to other inherently more efficient modes like rail and barge, most freight activity is likely to be transported by trucks for the foreseeable future. Therefore, it is especially imperative to transition freight vehicles to non-diesel energy sources.

Facilitating a transition of some of the freight transportation fleet from diesel to alternative fuels, through strategic investments in alternative fuel infrastructure, presents an exciting opportunity to improve air quality and, potentially, spin off other categories of public benefits. NYMTC has initiated a Clean Freight Corridors Planning Study to facilitate increased adoption of high-efficiency, low-emission alternative technologies for freight transportation in the New York metropolitan region. This study was recommended in the *Regional Freight Plan 2018–2045*, and preliminary findings have been prepared for use in this Freight Element.

- Compared to the rest of the nation, the greater New York City metropolitan region has high concentrations of diesel pollution, which has a strong and negative impact on the health of its citizens largely owing to the fine particulate matter in diesel exhaust. The most impacted areas appear as pollution "hotspots" corresponding to the most urbanized and/or port areas, namely New York City, Newark, New Haven, Hartford, and Bridgeport.
- In compliance with Title VI of the Civil Rights Act of 1964, NYMTC works to ensure that all its plans, programs, procedures, policies, and activities do not have disproportionate adverse effects on minority and low-income populations. To identify these priority environmental justice areas, NYMTC designates census tracts with at least 57 percent minority population and 14 percent of persons below the poverty line as "Communities of Concern." ***Figure H-5-16*** through ***Figure H-5-18*** display the spatial relationships between these Communities of Concern and diesel emissions within the NYMTC planning area.
- New York City contains the greatest density of Communities of Concern in the region, and these census tracts in the five boroughs of New York City tend to be concentrated in and around diesel particulate hotspots (see ***Figure H-5-16***). This reflects the proximity of these communities to freight hubs, including Hunts Point in the South Bronx, Maspeth and the area surrounding JFK

International Airport in Queens, and Southwestern Brooklyn including Red Hook and Sunset Park, as well as the presence of dense, heavily trafficked and often intersecting major highways and crossings throughout Brooklyn, Queens, the Bronx, and northern Manhattan. In general, the areas with the heaviest and most concentrated diesel emissions are highly correlated with the presence of Communities of Concern in New York City.

- On Long Island, the relationship between Communities of Concern and diesel particulate matter is less clear (see ***Figure H-5-17***). Not only do Nassau and Suffolk counties contain fewer Communities of Concern than the New York City boroughs, but the particulate concentrations from diesel emissions are significantly lower as well. As such, there is less interaction between Communities of Concern and diesel particulate matter in these counties. The highest levels of diesel particulate matter are seen near the border of Nassau with Queens, near the JFK Industrial Business Zone and several major New York City highways, but only two Communities of Concern are located near the pollution hotspot (in Elmont and Inwood).
- The same largely is true in the Lower Hudson Valley, apart from the southern portion of Westchester County closest to New York City—particularly in Yonkers and Mount Vernon. Those communities overlap starkly with high concentrations of diesel particulate matter associated with emissions centered in the Bronx and northern Manhattan. As the distance from New York City increases, there are fewer Communities of Concern and lower levels of diesel particulate matter in most of Westchester as well as in all of Putnam and Rockland counties. See ***Figure H-5-18***.
- In the NYMTC planning area, denser and more highly urbanized areas tend to have greater concentrations of Communities of Concern as well as significantly higher concentrations of diesel particulate matter. Consequently, as NYMTC freight planning proceeds, measures to reduce diesel emissions in the most highly urbanized and polluted areas of its planning area, such as recommending the placement of alternative fueling infrastructure in industrial zones within New York City, will have the greatest potential to mitigate impacts of freight-sourced air pollution on Communities of Concern.
- Although there is significant policy support for diesel alternatives within the study region, additional actions must be taken to achieve the policy objectives (for greenhouse gas emissions, air quality, and zero-emission sales) of the states and cities in this region. Scaling up adoption of diesel alternatives requires a robust and holistic policy environment that supports fleet procurement (e.g., through purchase incentives) and operation (e.g., through utility investments and accommodating rate design) to enable all-electric and alternative fuel technologies to better compete with diesel technology on a total cost of ownership basis.

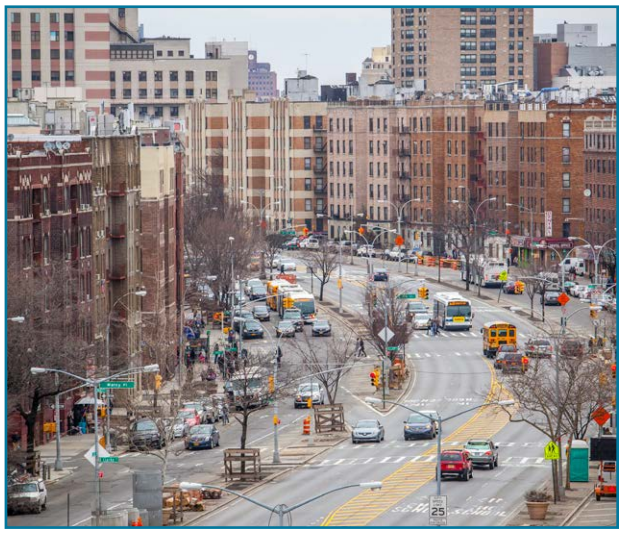


Figure H-5-16

Communities of Concern and Diesel Particulate Matter: New York City

Source: Cambridge Systematics et al., NYMTC Clean Freight Corridors Planning Study, draft in progress

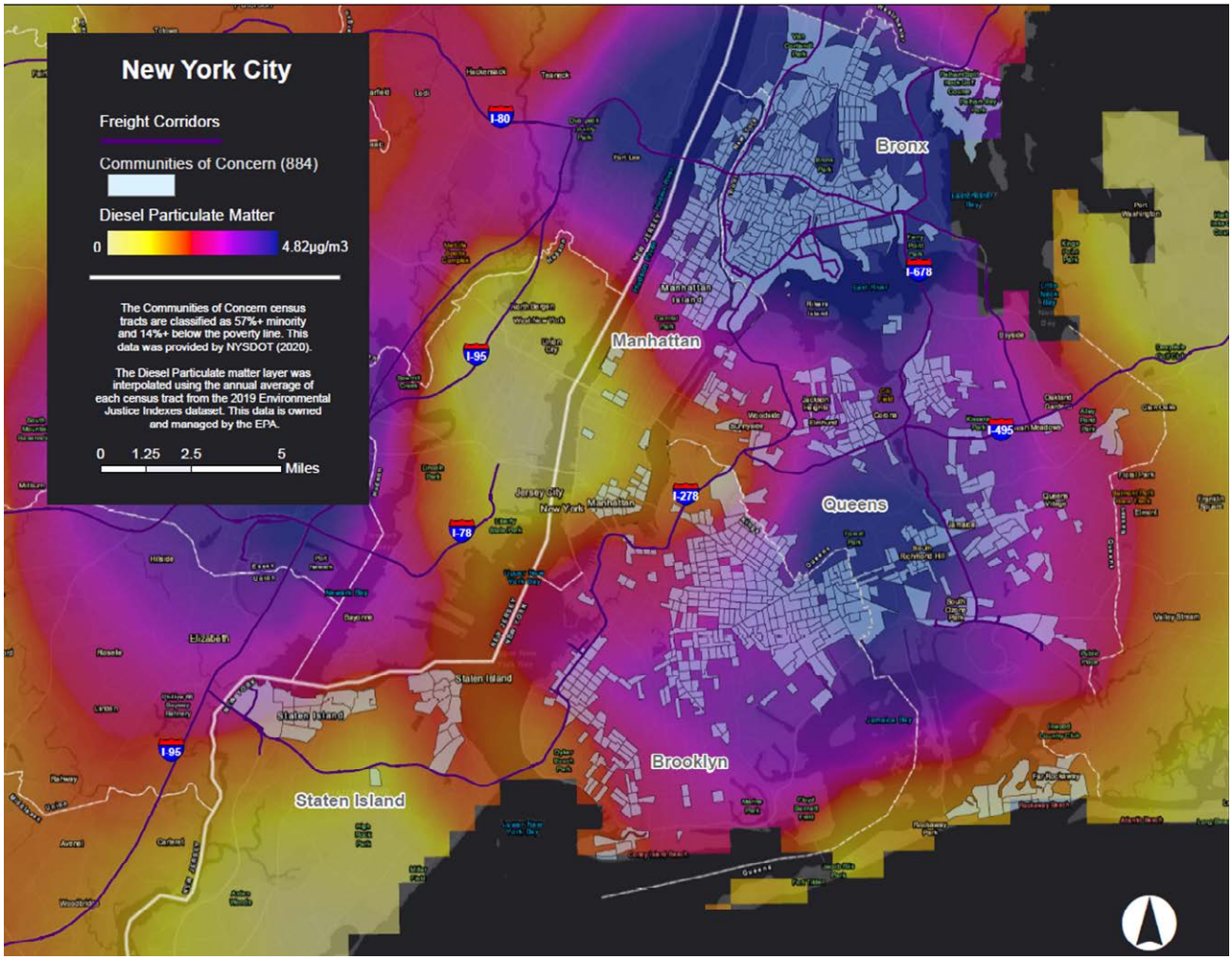


Figure H-5-17

Communities of Concern and Diesel Particulate Matter: Long Island

Source: Cambridge Systematics et al., NYMTC Clean Freight Corridors Planning Study, draft in progress

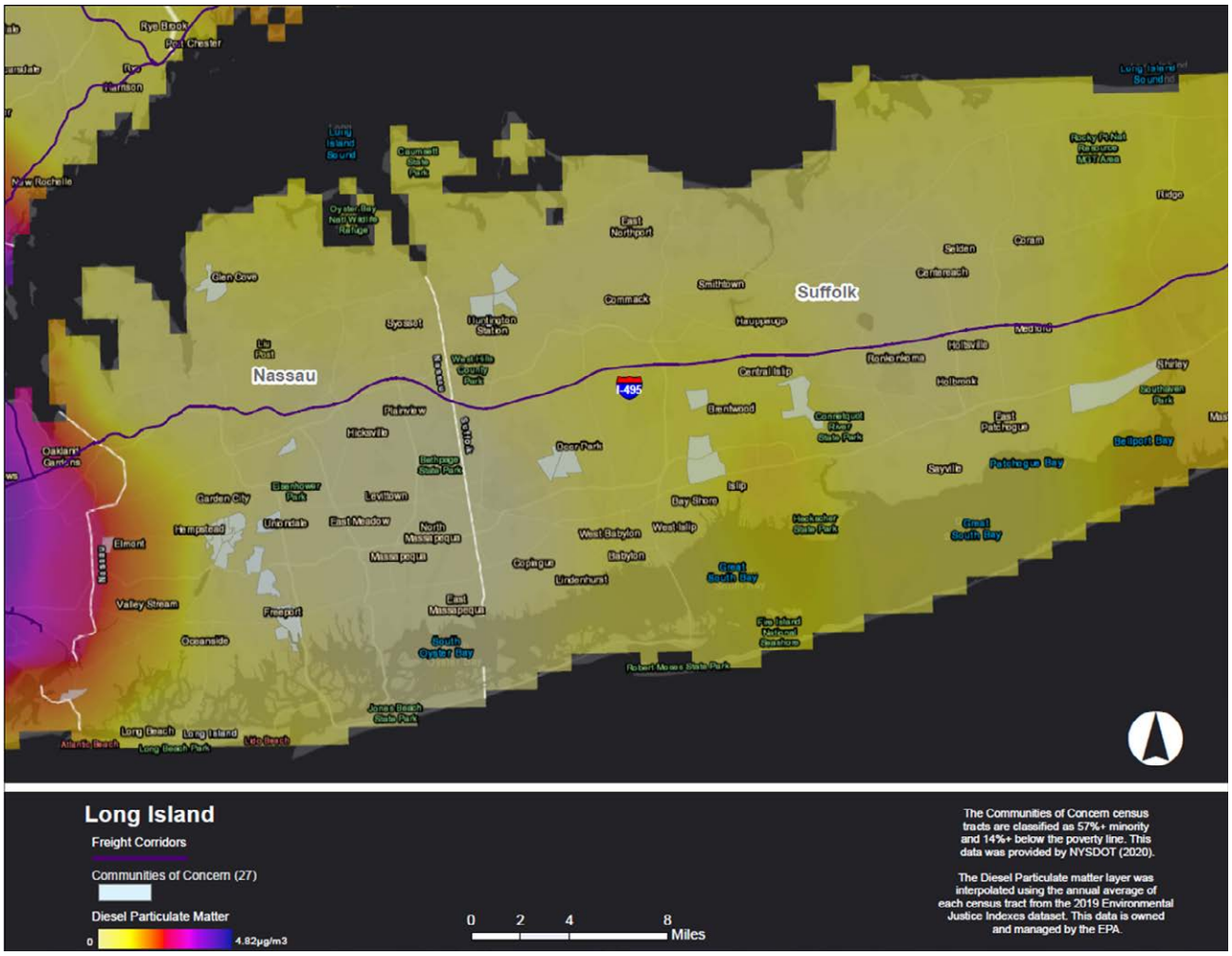
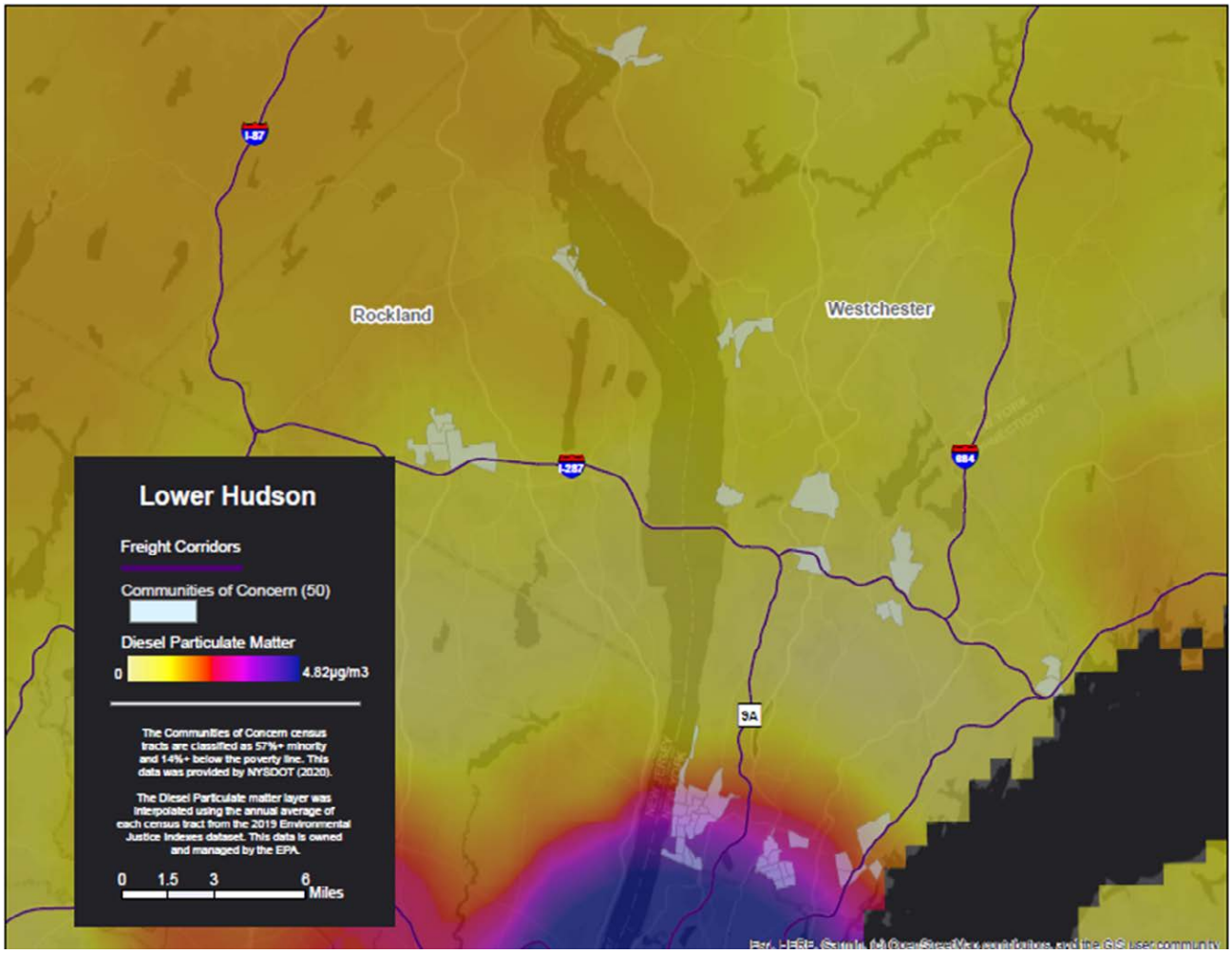


Figure H-5-18

Communities of Concern and Diesel Particulate Matter: Lower Hudson Valley

Source: Cambridge Systematics et al., NYMTC Clean Freight Corridors Planning Study, draft in progress



5.3 CONCLUSION

Truck density, truck delay, and truck emissions locations have a high degree of correspondence, tending to concentrate most heavily in Queens, Kings, and Bronx counties and extending from there into adjacent counties. Therefore, from a network and corridor perspective, it makes sense to consider these issues together.

This chapter has identified truck volumes and truck performance for the NYMTC planning area, identified key bottleneck corridors and locations, and quantified the costs—in terms of both time and money—these bottleneck locations and corridors impose on the region. The list of bottlenecks is a rich source of material for the development of plan, project, and strategy recommendations, which are presented in ***Chapter 7*** of the Freight Element.

Similarly, the mapping of emissions associated with truck network activity highlights the critical impacts of truck emissions on sensitive communities. Projects addressing truck volumes and bottlenecks in the most sensitive areas could be prioritized and implemented along with Clean Freight Corridor initiatives to reduce emissions from trucking operations in these areas and elsewhere.

ENDNOTES

1 NPMRDS is developed and made available to public agencies by FHWA. HPMS data are reported annually by states to FHWA.

2 NPMRDS travel time data are sourced from INRIX and covers the HPMS network.

3 Guerrero, S. E., et al. 2019. Estimating the Value of Truck Travel Time Reliability, National Cooperative Highway Research Program Report 925, Transportation Research Board.

4 The same NYSDOT counts were also used to identify major truck corridors in Chapter 4.

5 In reviewing the location-specific findings, readers should be aware of these limitations in the source data:

- NPMRDS travel time data capture a sample of total truck activity, not every truck, and it covers only activity on the National Highway System (interstates, principal arterials, and connectors). Travel time data are not adjusted for deliberate stops or construction activities.
- NPMRDS travel time data are associated with the physical highway network through a defined set of traffic message channels and then linked to HPMS road segments. The association process includes approximations and may contain errors, particularly: at interchanges; with parallel facilities such as frontage roads or high-occupancy vehicle lanes; and/or on routes prohibiting all commercial trucks or certain type of commercial trucks. Road naming can be inconsistent.
- HPMS truck count data necessarily include estimations—not every road can be physically counted or counted all the time. The NYSDOT count data used to develop time of day distributions represent a limited number of samples, at different days and (in some cases) years.

6 NYSERDA. July 2019. Greenhouse Gas Inventory 1990–2016. ***https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Energy-Statistics***.

7 NYSERDA. July 2019. Greenhouse Gas Inventory 1990–2016. ***https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Energy-Statistics***.

8 NYSERDA. July 2019. Greenhouse Gas Inventory 1990–2016. ***https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Energy-Statistics***.

6

MULTIMODAL FREIGHT PERFORMANCE AND NEEDS

This chapter of the Freight Element addresses performance and needs related to multimodal freight networks, facilities, and logistics. It serves as a companion to the detailed analysis of the NYMTC planning area primary truck network in Chapter 5, providing the larger multimodal and geographic context.

To identify multimodal freight performance and needs issues, NYMTC's Regional Freight Plan 2018–2045 drew on a series of platform documents, including but not limited to, the Port Authority's Goods Movement Action Plan (GMAP) and Cross Harbor Freight Program Tier I Environmental Impact Statement, New York City Economic Development Corporation's (NYCEDC) FreightNYC, the Metropolitan Rail Freight Council's (MRFC) Rail Freight Action Plan, and NYMTC studies of freight village opportunities and truck parking and other materials. The needs and issues identified in Regional Freight Plan 2018–2045 addressed both urban and non-urban areas of the NYMTC planning area; they are carried forward as part of the Moving Forward Freight Element and presented in Chapter 7.

To supplement the *Regional Freight Plan 2018–2045* findings, this chapter draws on recent work to implement modal system plans and on newly available plans, studies, and inputs provided by NYMTC members and other relevant agencies, including:

- *Port Master Plan* (Port Authority)
- *Delivering New York: Smart Truck Management Plan* (NYC DOT)
- *JFK Air Cargo Market Analysis and Strategic Plan* (NYCEDC and Port Authority)
- Consultation with adjoining planning organizations and regions, including the North Jersey Transportation Planning Authority, various councils of government in southwestern and central Connecticut, and the Lehigh Valley Planning Commission and Northeastern Pennsylvania Alliance in eastern Pennsylvania.
- Member agency and public feedback

Although the new material tends to focus on urban counties in the NYMTC planning area, some of the findings—particularly related to warehouse/distribution and truck management—are applicable in both urban and non-urban areas.

6.1 PORTS AND MARINE HIGHWAY SERVICES

6.1.1 HOWLAND HOOK

NYCEDC's *FreightNYC* emphasizes the importance of container operations at Howland Hook (Global Container Terminal New York), as summarized in ***Figure H-6-1***. More recently, the Port Authority's Port Master Plan also identifies issues and recommendations for the Howland Hook area. As shown in ***Figure H-6-2***, the Howland Hook area includes a diverse set of mutually supporting freight operations, including marine container handling; truck chassis storage; ExpressRail service for containers; adjacent expansion area for warehouse/logistics functions; the nearby Arlington Yard rail facility; and (south of I-278) the Matrix Global Logistics Park, which has seen significant development of warehouse/distribution space in the past decade including three buildings leased to Amazon. Identified issues related to performance and need, as well as actions currently planned or recommended by other agencies, are summarized in ***Table H-6-1***.

Figure H-6-1

Global Container Terminal New York Description from FreightNYC

Source: See https://edc.nyc/sites/default/files/filemanager/Programs/FreightNYC_book_DIGITAL.pdf

TESTIMONIAL
GCT New York

GCT New York on Staten Island is one of two container terminals in the city—and the largest in the state. While the freight moved through GCT New York comes from across the globe, the team working there is decidedly local. Nearly two-thirds of GCT New York's 360 employees live in New York City, hailing from four of the city's five boroughs.

In addition to international freight, GCT New York transfers about half of the city's volume of solid waste. Barges loaded with containerized municipal solid waste in Queens and Manhattan are unloaded at GCT New York and put on trains. This water-to-rail transfer eliminates over 100,000 truck trips each year.

Effective January 2018, NYCDOT designated a route from the Goethals Bridge to GCT New York to permit trucks hauling sealed shipping containers to operate safely and legally on city streets and highways.

Trucks that are up to 73-1/2 feet in length that are carrying sealed shipping containers and weighing up to 90,000 pounds can use this route, making this NYC port regionally and globally competitive.

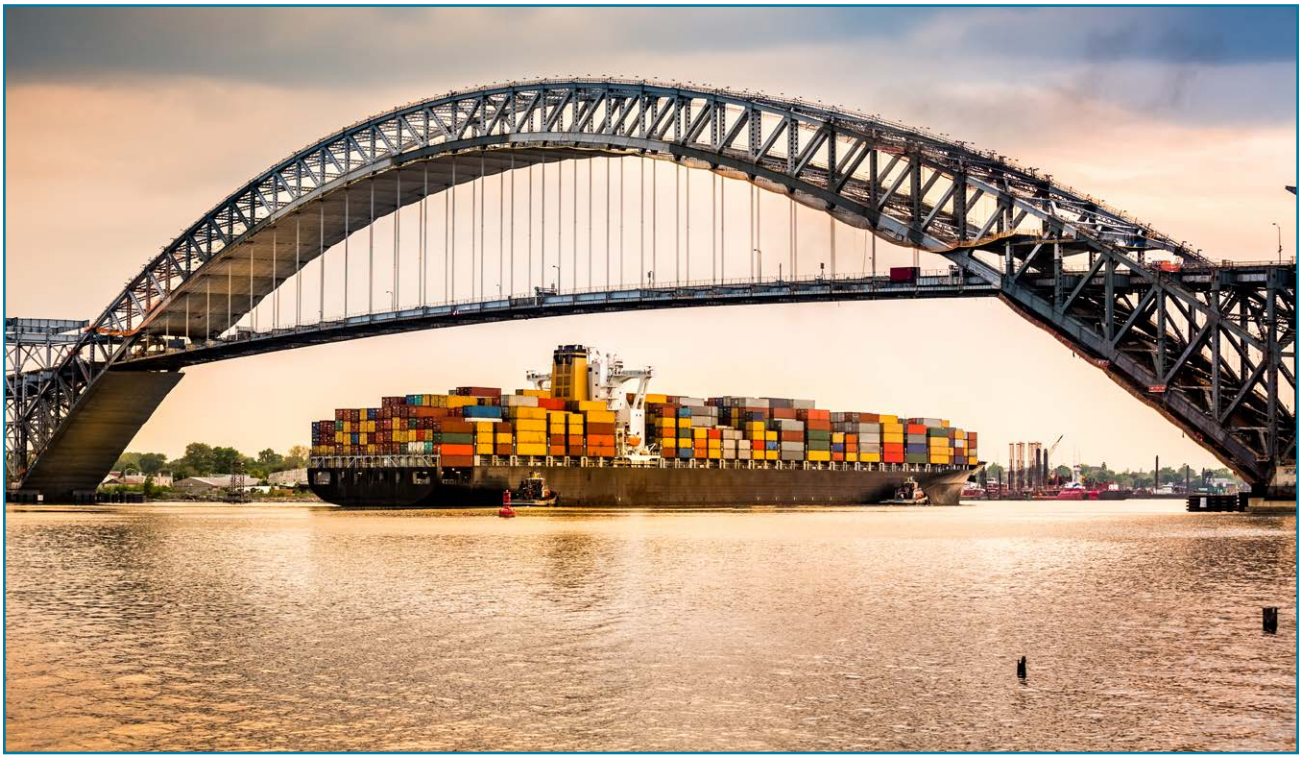


Figure H-6-2

Howland Hook Area Facilities Map

Source: Port Authority Port Master Plan

Table H-6-1

Howland Hook Performance and Need Issues

Performance or Need Issue	Recommended/Planned Action	Source
Need for improved truck access	Realign Forest Avenue	NYCEDC
	Improve connectivity between container facilities, railyards, warehouse/distribution centers, and I-278 by realigning Western Avenue, realigning the terminal exit gate and outbound roadway extension, and designating connection to Matrix as a Marine Terminal Highway	Port Authority
	Review existing container cargo toll discount program to ensure equity with New Jersey container terminal access costs	Port Authority
Need for improved rail access	Expand ExpressRail with additional tracks 8-11 and corresponding improvements at Arlington Yard	Port Authority
Need for additional cargo handling market opportunities	Diversify marine terminal cargo handling to include offshore wind, renewable energy support, project cargo, temperature-controlled commodities, and roll-on/roll-off cargo	Port Authority
	Support full build-out of Matrix site	NYCEDC

6.1.2 RED HOOK AND SOUTH BROOKLYN MARINE TERMINAL

NYCEDC's *FreightNYC* also addresses opportunities at the Red Hook Container Terminal and SBMT. The Red Hook area has hosted marine cargo activity continuously for well over 150 years; SBMT was inactive for some time but is being improved, and NYCEDC has contracted with a terminal operator to resume active service on the site. ***Figure H-6-3*** presents NYCEDC's description of Red Hook.

As depicted on ***Figure H-6-4***, Red Hook includes container terminal operations, warehouse/logistics space, and a cruise terminal. Red Hook also handles roll-on/roll-off cargo, project cargo, and bulk cargo as opportunities arise. Red Hook does not have rail access, but a container barge service is available between Red Hook and Port Newark as an alternative to trucking.

SBMT is expected to handle a wide range of cargo types, including offshore wind energy components[1] and other project cargo, construction materials, and roll-on/roll-off cargo. SBMT is served by a single-track rail line running in the First Avenue right-of-way, connecting to a small railyard at 51st Street and a larger railyard at 65th Street. At 65th Street, SBMT rail traffic can move west via the NYNJ railcar float operation, or east and north along the Bay Ridge Branch. Primary truck access for both terminals is via I-278 and surface streets. Identified issues related to performance and need, as well as actions currently planned or recommended by other agencies, are summarized in ***Table H-6-2***.

Figure H-6-3

Red Hook Container Terminal Description from FreightNYC

Source: See ***https://edc.nyc/sites/default/files/filemanager/Programs/FreightNYC_book_DIGITAL.pdf***

TESTIMONIAL

Red Hook Container Terminal

The Red Hook Container Terminal on the Brooklyn waterfront serves as a major gateway for food and beverage importers in New York. The terminal not only brings into the city your favorite beer, cider, and wine, but also imports roughly 4 million bananas each week along with other items in your pantry. The 80-acre terminal employs over 400 women and men and is home to 1.2 million square feet of vital distribution space that is increasingly in demand. By utilizing New York City's waterfront, the terminal also eliminates over 30,000 truck trips from New York City streets each year.

A major customer at Red Hook is Seaboard Marine, an ocean carrier with shipping services across North America, including the Brooklyn waterfront, the Caribbean, and Central and South America. With a fleet of approximately 25 vessels and over 55,000 dry, refrigerated, specialized containers and related equipment, Seaboard Marine provides cargo-shipping services between over 25 countries in the Western Hemisphere.

Figure H-6-4

Red Hook and SBMT Area Facilities Map

Source: Port Authority Port Master Plan

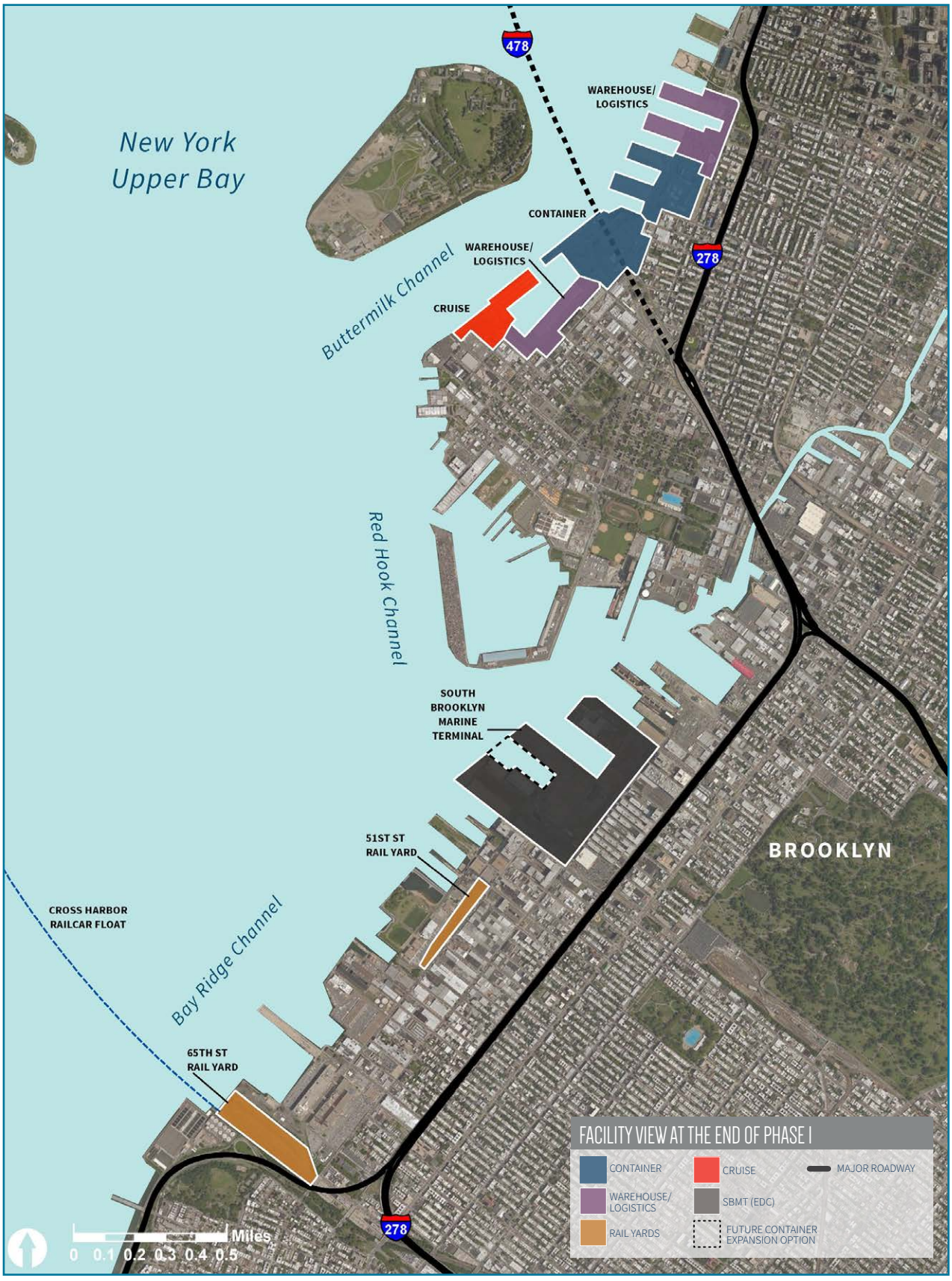
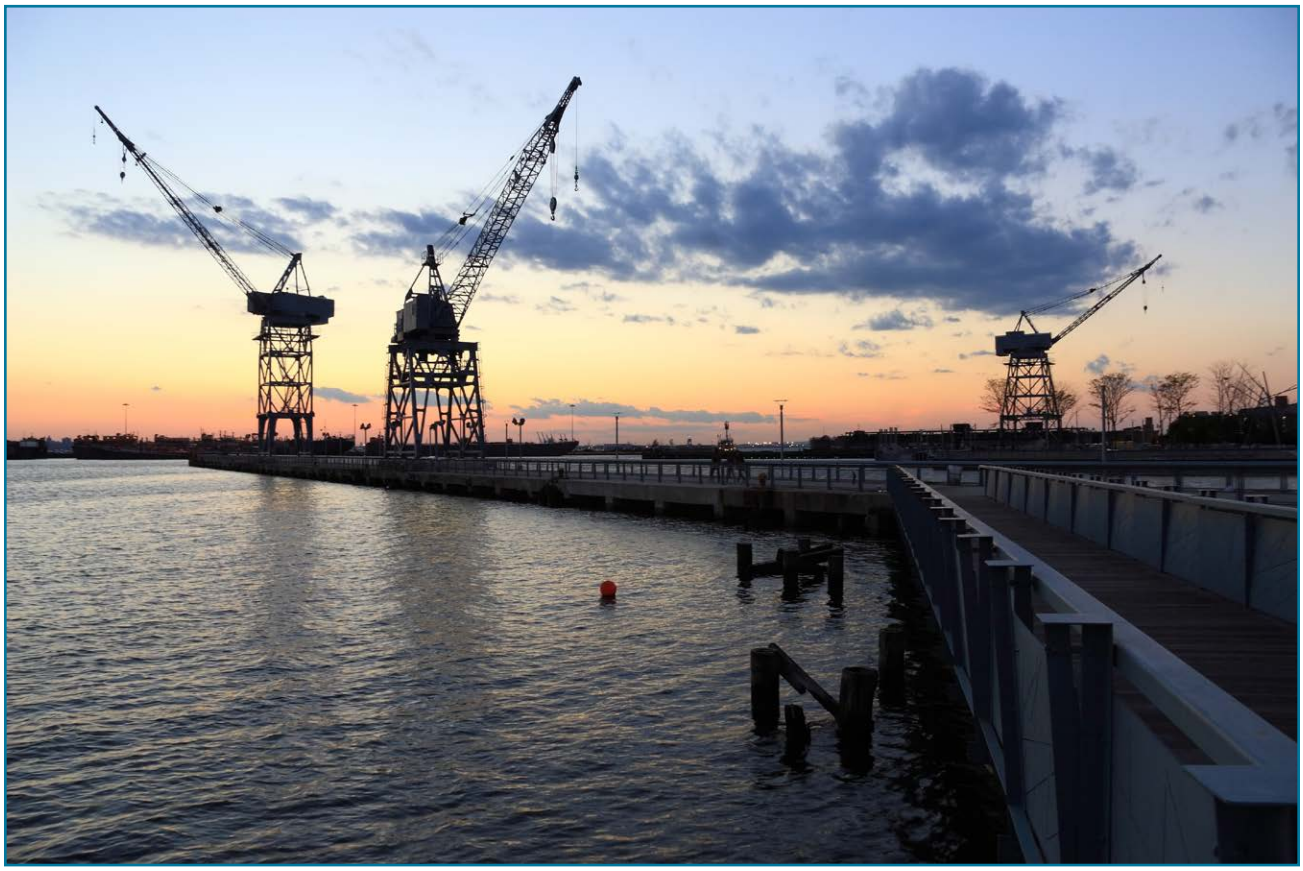


Table H-6-2

Red Hook and SBMT Performance and Need Issues

Performance or Need Issue	Recommended/Planned Action	Source
Need for improved truck access	At SBMT: terminal upgrades to support offshore wind and other cargo for near-term operations, accommodating future introduction of container handling operations	NYCEDC
Need for improved rail access	At SBMT: convert First/Second Avenues to one-way pair for improved truck access and rail operations	NYCEDC
	At SBMT: maintain connectivity to NYNJ Rail and consider connectivity to proposed Cross Harbor freight rail tunnel	Port Authority
	At Red Hook: maintain barge service performance	NYCEDC
Need for additional cargo handling market opportunities	At Red Hook and Sunset Park: support and enhance current cargo operations, assess emerging market opportunities, and implement infrastructure improvements as needed	Port Authority



6.1.3 MARINE HIGHWAY SERVICES

Over the past 15 years, several important studies of "marine highway" services for the NYMTC planning area have been conducted. The term "marine highway" is a formal designation by the U.S. Department of Transportation Maritime Administration for waterborne services that provide alternatives to trucking along congested highway route and corridors. Marine highway services can be provided by shallow-draft barges or deeper-draft self-powered vessels; they can operate over short or long distances; and they can handle containers and other unitized non-bulk commodities. NYCEDC, the Port Authority, and many other partners have come together as the North American Marine Highway Alliance to explore, promote, and implement these services (***Figure H-6-5*** and ***Table H-6-3***).

Figure H-6-5

Marine Highway Initiative Description

Source: Port Authority Port Master Plan

Waterways & Marine Highway

The Port Authority has initiated a joint study with the USACE to refine navigability on existing waterways and assess the timing and scale of future deepening projects.

Existing Cross Harbor Railcar Float operations between South Brooklyn and Greenville Yard will continue to be supported.

Recognizing the untapped potential and excess capacity of the coastal waterways, the Port Authority's Port Department has made regional barge service one of its strategic initiatives. The Port Authority and NYCEDC will continue to support the North Atlantic Marine Highway Alliance (NAMHA, initiated in 2018), which will seek to foster the use of barge services to offset the use of trucks and supplement rail cargo to and from the Port.

The development of the NAMHA complements Freight NYC, a plan released by NYCEDC designed to reduce dependency on trucking distribution of freight in and around New York City in favor of rail and marine barging.

As freight volumes increase and incoming vessels increase in size, barging presents one part of a sustainable solution. The development of the Marine Highway will aim to help reduce the reliance on trucks to transport goods to and from the port.

Commodities such as beverages, wood, paper, rubber, and iron and steel have been identified as ideal candidates for distribution via the Marine Highway.

Table H-6-3

Marine Highway Performance and Need Issues

Performance or Need Issue	Recommended/Planned Action	Source
Need for marine options for local truck delivery	Explore Marine Highway service(s) between Port Raritan, New Jersey; Manhattan Cruise Terminal; Red Hook/SBMT area; and Hunts Point area	NYCEDC, New Jersey DOT, and other partners
	Fund marine terminal development at the Hunts Point Food Distribution Center	NYCEDC
Need for network of short-haul and long-haul marine highway service options	Explore full range of terminal, route, and service options through comprehensive North American Marine Highway Alliance study	North American Marine Highway Alliance Partners

6.1.4 VESSEL NAVIGATION IMPROVEMENTS

As ocean-crossing cargo vessels become larger, they require deeper channels. Vessel owners and operators will concentrate the use of these vessels only at ports deep enough to accommodate them. The vessel navigation channels serving most of the traffic in the Port of New York and New Jersey (comprising facilities in the NYMTC planning area and northern New Jersey) were deepened to 50 feet in 2016. A 1,200-foot portion of Howland Hook wharf adjoins a 50-foot channel; the Buttermilk and Bay Ridge channels serving Red Hook and SBMT are currently 40-foot deep. The U.S. Army Corps of Engineers is currently conducting a navigational improvement study to determine whether to recommend further deepening. Port Authority believes that a target operating depth of 55 feet will allow the region to accommodate the next generation of container ships entering global service.[2]

6.2 RAIL NETWORKS AND TERMINALS

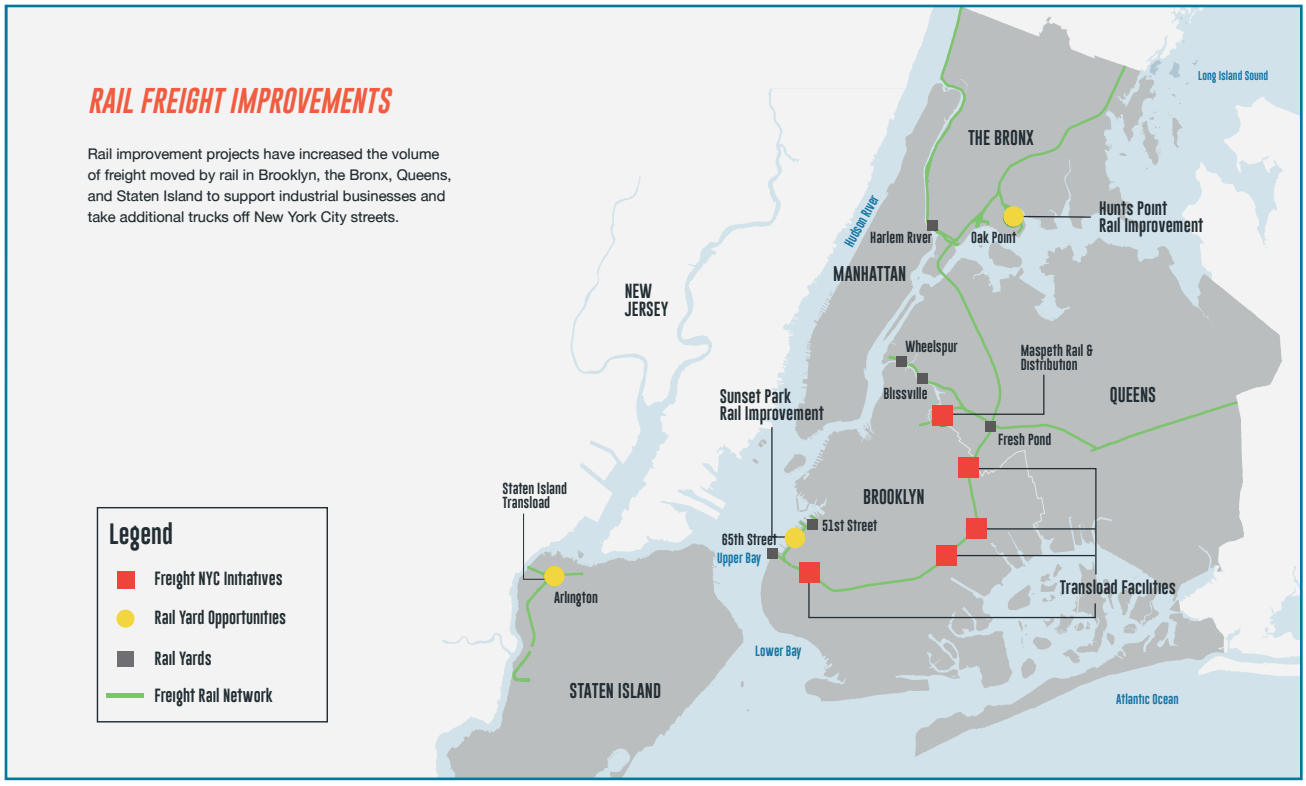
6.2.1 SERVICE FOR CUSTOMERS IN THE NYMTC PLANNING AREA

FreightNYC places a strong emphasis on opportunities to maintain and improve freight rail service for customers in the region by providing transload terminals (serving multiple customers who truck goods to and from the rail facility), direct sidings to customer properties, and passing tracks where needed to ensure efficient movement of railcars along single-track lines. *FreightNYC* also endorses a comprehensive set of recommendations by MRFC, some of which have already been funded and implemented. *FreightNYC* recommendations are illustrated on ***Figure H-6-6***, and NYCEDC and MRFC recommendations not yet implemented are summarized in ***Table H-6-4*** and ***Table H-6-5***. Currently, the New York City's top local service initiative is the development of a transload terminal at the Wheelspur site in Long Island City, Queens, which is shown as an existing yard in ***Figure H-6-6***.

Figure H-6-6

Customer-Serving Rail Freight Improvements Recommended in FreightNYC

Source: See ***https://edc.nyc/sites/default/files/filemanager/Programs/FreightNYC_book_DIGITAL.pdf***



An emerging issue concerns the movement of MSW by rail. As described in ***Chapter 2***, rail is an important component of waste movement supply chains in the NYMTC planning area. The last operating landfill on Long Island is scheduled to close in 2024, and one proposal to remove municipal waste from the island is to move it by rail. Currently, waste-handling railcars are moved off the island by the NY&A, which operates over MTA LIRR tracks to Fresh Pond Junction, then transfers the cars to CSX, which hauls them north over the Fremont Secondary and Hell Gate Bridge through the Bronx. Both the NY&A and CSX are aware of community concerns regarding impacts of waste operations at Fresh Pond and have worked to schedule and coordinate operations to minimize impacts. Increased movements of waste by rail from Long Island moving through Fresh Pond could generate additional or different impacts and corresponding operational planning responses and/or physical improvements.

Table H-6-4

Customer-Serving Freight Rail Performance and Need Issues

Performance or Need Issue	Recommended/Planned Action	Source
Need for transload terminals to serve local rail freight customers	Develop transload operations at Wheelspur site in Long Island City initially, then subsequently at Maspeth and other strategic sites along the Bay Ridge Branch	NYCEDC, MRFC
Need for terminals to accommodate railcar handling and switching	Continue to explore improvement opportunities as needed at Arlington Yard (Staten Island), Hunts Point (Bronx), and 65th Street (Brooklyn)	NYCEDC, MRFC
	Improve railcar storage and handling capacity on the Fremont Secondary	MRFC
Need to accommodate all types of freight railcars	Improve freight rail infrastructure in Brooklyn and Queens to provide vertical clearance for double-stack containers and "autorack" railcars	MRFC
Need for cleaner operations	Upgrade locomotive equipment to cleaner fuel operation	MRFC

Table H-6-5

Rail Network Connectivity Performance and Need Issues

Performance or Need Issue	Recommended/Planned Action	Source
Need for improved rail access to the East-of-Hudson region	Support enhancements to NYNJR railcar float operations and *Cross Harbor Freight Movement Program Tier II Environmental Impact Statement* investigations	Port Authority, NYCEDC, MRFC
Need for other network improvements and connections	Support needed improvements (additional track and sidings, bridge improvements, vertical clearance improvements, and/or weight-handling upgrades) in New Jersey	MRFC

6.2.2 RAIL NETWORK CONNECTIVITY IMPROVEMENTS

Freight rail operations in the NYMTC planning area are part of a much larger national rail network, and the effectiveness of local rail service depends in large part on the effectiveness of connections—both physical and operational—to the national network. For the East of Hudson region—Brooklyn, Queens, Nassau, and Suffolk—these connections are limited to the NYNJ railcar float operation (running between 65th Street Yard in Brooklyn and Greenville Yard in Bayonne) and the Fremont Secondary (running between Queens and Bronx over Amtrak's Hell Gate Bridge). Moving north from the Bronx, the first place to cross the Hudson River to reach the West of Hudson region is at Selkirk, New York, near Albany, on the CSX line.

For decades, planners and policymakers have contemplated and studied a more direct rail connection between New Jersey and the East of Hudson to serve multiple railroads. Most recently, these efforts have been documented in the *Cross Harbor Freight Program Tier I Environmental Impact Statement*, and in the subsequent Tier II Environmental Impact Statement currently under development. The preferred Cross Harbor alternative is for a double-track, double-stack cleared freight rail tunnel generally paralleling the car float route between Greenville Yard and 65th Street (see ***Figure H-6-7***). Planners have also considered the need for improvements on other critical segments and chokepoints in the regional rail network that affect service to the NYMTC planning area but are physically located in New Jersey.

Figure H-6-7

Alignment of Proposed Cross Harbor Freight Rail Tunnel

Source: Port Authority Port Master Plan

6.3 AIR CARGO

Air cargo performance and needs for the NYMTC planning area have been examined mainly in two documents: the 2013 *JFK Air Cargo Study* and an internal follow-up investigation of JFK markets and strategies by NYCEDC and the Port Authority.

Generally, all air cargo operations require:

- Adequate facilities and space for cargo storage, cargo build-up and breakdown, forklift maneuverability, and container storage
- Adequate ramp space, access for aircraft, and room for extensive trucking operations
- Support services for cargo terminal handling, aircraft handling (maintenance, repair, fueling), security, ancillary services (catering, crane operations), and container stations
- Ability to handle special cargo, such as perishables, live animals, hazardous goods, high value items, and out-sized cargo

The crucial need at JFK is for facilities that are modern and designed for today's logistical systems and their functional interactions, particularly facilities that can service the combination airlines that operate both wide-body passenger aircraft and freighters. These airlines require flexible facilities that offer short tug times to the passenger parking areas, adequate hardstands to park and handle freighter aircraft, warehouse facilities that can accommodate oversize freight, and adequate space for ground handling equipment storage. Most important are ways to address the integration of on-airport facilities and services with "off-airport" facilities and services—partly by bringing many of them onto airport grounds—and to develop logistics infrastructure to support value-added services in fast-growth commodity types, including but not limited to e-commerce, pharmaceuticals, and other cold chain freight. In some cases, capturing air cargo market opportunities may require providing space for non-air operations that are integrated into customer business models. A chronic issue at JFK is that most of the off-airport facilities that provide logistics and support services are in obsolete buildings in Springfield Gardens, with no viable properties within reasonable distance to offer alternatives. This issue impacts the productivity, cost, and competitive position of JFK versus other major air cargo gateway options.

The continued success of the freight industry operating at JFK Airport depends on the robustness of the surrounding network of roadway infrastructure. This network is an operating environment for goods approaching and departing JFK, and its quality and performance have direct consequences for air cargo productivity. It is therefore critical that policies and improvements that enhance the regional highway network are targeted to meet the needs of cargo operations and the supply chains they serve. Challenges for the roadway network serving JFK include:

- High traffic volumes and high-frequency truck crash locations
- Deficient bridge and pavement conditions
- Poor connections between JFK and supporting facilities in adjacent Springfield Gardens
- Limited choice of truck routes and restrictions on 53-foot trailers

Prior to March 2015, trucks with 53-foot trailers were prohibited from using all roadways within New York City, except for a route to Nassau and Suffolk counties. Despite the prohibition, many operators used 53 foot trailers to move freight into, out of, and within New York City, often resulting in traffic stops and fines. Through collective effort between NYCEDC, the Port Authority, NYSDOT, and NYC DOT, a 53-foot trailer truck route linking JFK Airport, New Jersey (via the George Washington Bridge), New England (via I 95), and Long Island (via the Long Island Expressway east of I-295) was developed and approved. While this route is a substantial positive step, it is a circuitous route for the significant number of trucks traveling to New Jersey, particularly for those destined to the distribution center clusters that serve the region and the seaports. These trucks travel via the chronically congested Van Wyck Expressway and the George Washington Bridge but could benefit from a more direct route through Brooklyn and Staten Island. Further, the lack of redundant routes does not allow for vehicles to bypass congestion (recurring or non-recurring). NYC DOT is working to provide enhanced truck route connectivity through rule changes and updates to New York City's 2021 truck route map. See ***Table H-6-6*** for a summary of air cargo performance and need issues.

Table H-6-6

Air Cargo Performance and Need Issues

Performance or Need Issue	Recommended/Planned Action	Source
Need for on-airport facilities to support emerging markets and air cargo logistics	Focus on improvement/redevelopment of on-airport infrastructure and logistics facilities to support e-commerce, temperature-controlled commodities, and other identified growth markets	NYCEDC, Port Authority
Need for significantly improved access to JFK	Continue to explore potential enhancements to the New York City truck route system to close gaps in the system, provide more alternative access routes to JFK Airport, and provide more 53-foot truck routes	NYCEDC, Port Authority
	Prioritize roadway improvements that directly benefit JFK: bridge and pavement condition projects; safety and capacity enhancements; and major corridor mobility on key routes such as I-678, I-278, I-495, and I-95 that link JFK with regional and national markets	NYCEDC, Port Authority
	Explore the potential for barge/Marine Highway service to support construction and operations	Port Authority
	Explore innovative truck access strategies, including advanced technology trucks and creative use of existing rights-of-way	NYCEDC
	Provide improved signage and wayfinding for truck traffic between JFK Airport and Springfield Gardens	NYCEDC, Port Authority

6.4 WAREHOUSE/DISTRIBUTION AND LAND USE

In *FreightNYC*, NYCEDC recognizes that the much of the NYMTC planning area is served by a set of "freight hubs" representing clusters of freight and industrial activities and land uses. ***Figure H-6-8*** illustrates freight hub locations in New York City. Important freight hubs are available in other NYMTC planning area counties; the supply chain analysis in ***Chapter 2*** presents warehouse/distribution volume data for each county, and NYMTC is currently conducting a freight land use study to document all hub characteristics.

A sound urban freight distribution strategy is to intensify development within and around freight hubs and provide them with multimodal transportation connections offering reliability, cost effectiveness, modal choices, and (to the extent practical) neighborhood buffering (***Figure H-6-9***). This is similar to the freight village concepts previously studied in the region and can apply in both urban and non-urban areas. An intensification strategy can be further complemented with the development of "inland ports." An inland port is a specialized kind of freight hub, intended to serve as a collector and distributor of cargo for airports and/or seaports; essentially, they function as off-site extensions of the airports or seaports, located closer to freight shipper and receiver locations. Inland ports must provide effective transportation to/from the ports and airports they serve, and often include space for warehouse/distribution and industrial activity (***Figure H-6-10***).

FreightNYC cites two related challenges to warehouse/distribution space in the urban center. One is the age of developed space, much of which was built to standards (for overall square footage, vertical height, and column spacing) that no longer apply.

Figure H-6-8

Freight Hub Locations

Source: FreightNYC

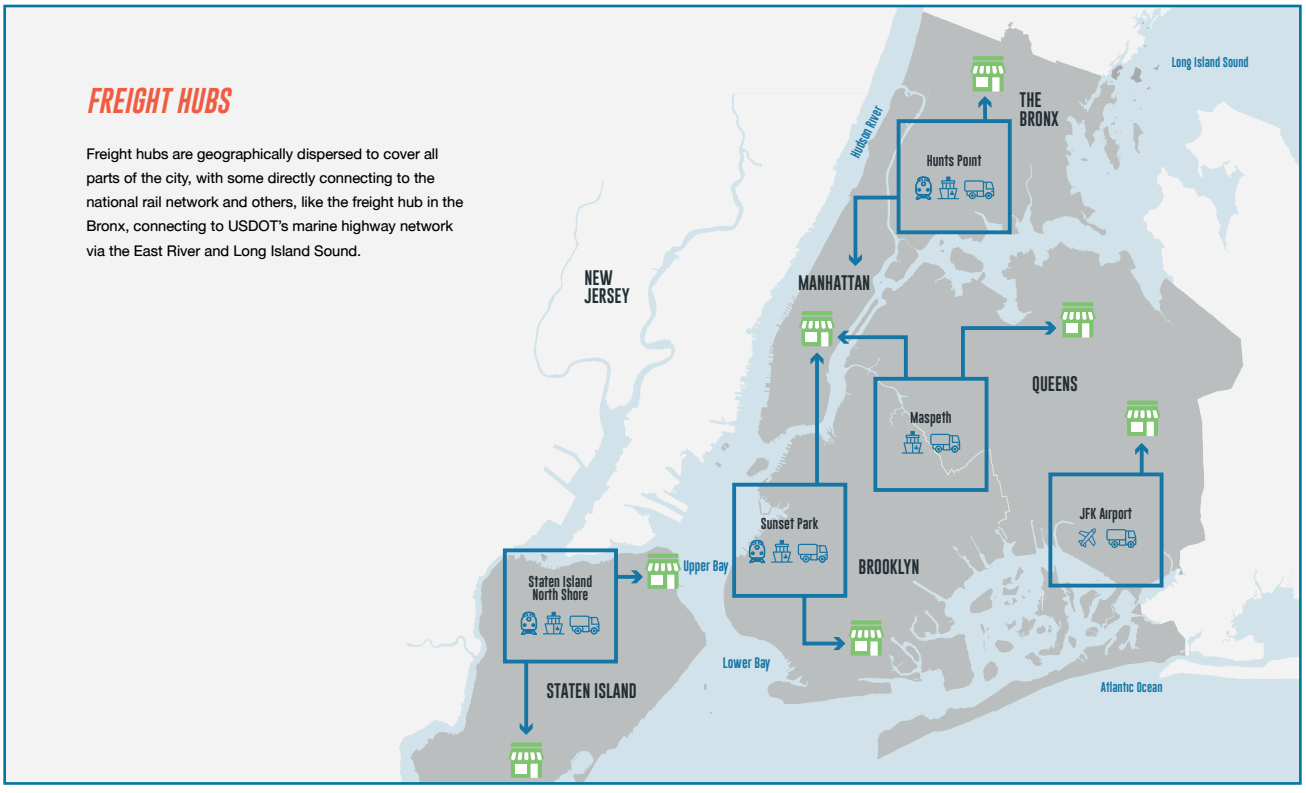


Figure H-6-9

Urban Distribution Concept

Source: FreightNYC

URBAN DISTRIBUTION VISION

Develop Freight Hubs Connected to Multimodal Freight Network

Freight hubs are existing industrial areas where multiple forms of transportation (rail, maritime, and highway) support urban distribution and manufacturing businesses. Freight hubs also host support facilities, such as off-street truck plazas and alternative fueling stations. The City will assist in making wise investments in freight hubs that meet current freight demand while accommodating growth in e-commerce, ensuring economic growth, and making New York City more resilient against supply chain disruption. This vision relies on the other maritime, rail, and clean truck visions described.

Strategies

- Support the development of geographically dispersed freight hubs across the city in the following locations:
  - Brooklyn: The Brooklyn Army Terminal in Sunset Park
  - The Bronx: Bathgate, Hunts Point
  - Queens: Maspeth, JFK Area
  - Staten Island: West Shore and North Shore
- Build supporting freight transportation infrastructure:
  - Brooklyn: Develop a marine terminal to serve east-of-Hudson businesses; improve local and regional access to Sunset Park freight facilities
  - The Bronx: Develop a barge terminal to serve Hunts Point Food Distribution Center; improve regional access to Hunts Point Food Distribution Center
  - Queens: Improve rail infrastructure
  - Staten Island: Improve rail infrastructure; support the development of a truck plaza; support Global Container Terminal—New York
- Improve rail infrastructure in Brooklyn, the Bronx, Queens, and Staten Island

Potential Benefits

Jobs created:
~4,000 including material handlers, warehouse associates, logistics coordinators, and Class A truck drivers

Truck miles eliminated per year:
~40 MILLION

Greenhouse gas eliminated per year:
~65,000 METRIC TONS

Particulate matter eliminated per year:
~24,000 POUNDS

Figure H-6-10

Inland Port Concept Description

Source: FreightNYC

INLAND PORTS: A MODERN VISION FOR FREIGHT

Inland ports are efficient distribution facilities usually located several miles from expensive coastlines or harbors. They are typically served by rail connections from a seaport and have good highway access in an area appropriate for freight uses. In addition, they are convenient to large population centers and labor markets and feature value-added services such as US Customs inspections, light manufacturing, and assembly of goods prior to "last-mile" delivery. Freight planners in Southern California and Virginia are thinking innovatively about how to move freight between seaports and inland ports as part of a modern freight supply chain.

Inland Port Best Practices

Alameda Corridor

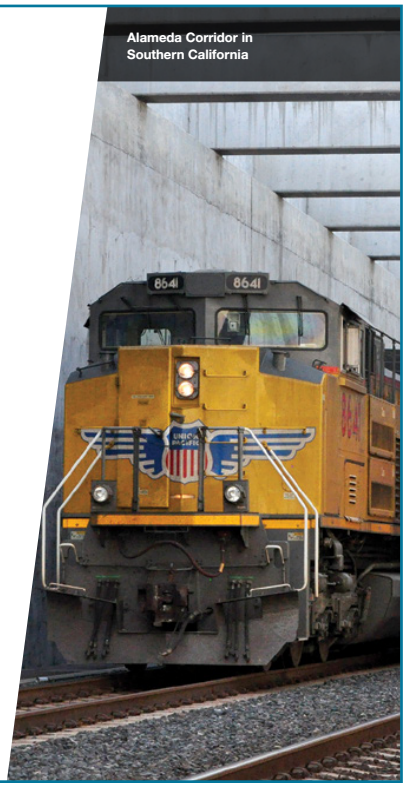
In Southern California, the Alameda Corridor Transportation Authority developed a 20-mile rail cargo expressway that links the marine ports in Long Beach and Los Angeles with the transcontinental rail network near downtown Los Angeles. At 50 feet wide and 33 feet deep, the project's centerpiece is the Mid-Corridor Trench, which carries freight trains in an open trench 10 miles long. The corridor, which has been operational since 2002, has the capacity to handle 150 trains each day.

Virginia Inland Port

The Virginia Port Authority created the Virginia Inland Port, a 161-acre intermodal container transfer facility, to better serve the Washington DC and Baltimore metro regions. The port, which is served by almost 20,000 feet of rail track, has prompted such well-known companies as Home Depot, Kohl's, and Red Bull to open new distribution centers nearby, bringing increased value to the region's economy.

Strategy

- New York City will evaluate siting options for an inland port that leverage existing rail corridors. This will provide users of the inland port with the quick and reliable access needed to ensure goods are delivered on time.



Alameda Corridor in Southern California

Another is the fact that a huge amount of warehouse/distribution space has been developed in outlying areas. Most new space was developed in northern New Jersey and northeastern Pennsylvania to take advantage of less expensive land and the ability to reach larger service markets throughout the Mid-Atlantic and New England via the interstate highway system. Non-urban counties in the NYMTC planning area have also seen new warehouse development, creating opportunities (in the form of job creation) and challenges (in the form of traffic, safety, truck parking, and neighborhood issues).

As discussed in ***Chapter 3***, key trends include:

- Growing need for distribution space located close to end-users, leading to redevelopment of available urban properties, in some cases with multi-story buildings.
- High demand and high lease costs in traditional warehouse areas, leading many users to locate even farther away from the NYMTC planning area (e.g., in South Jersey, Delaware, the Poconos).
- Repurposing of retail centers and stores for warehouse and order fulfillment, driven primarily by increased e-commerce and BOPIS operations; some of these changes may be temporary, but some may be permanent.
- Significant shortages of warehouse/distribution workforce and the growing importance of efficient transportation to allow workers to reach job locations.

See ***Table H-6-7*** for a summary of warehouse/distribution and land use performance and need issues.

Table H-6-7

Warehouse/Distribution and Land Use Performance and Need Issues

Performance or Need Issue	Recommended/Planned Action	Source
Need to understand current and emerging freight hub characteristics and opportunities in both urban and non-urban areas of the NYMTC planning area	Perform comprehensive freight land use study for the NYMTC planning area (underway)	NYMTC
Need for freight hub development that meets e-commerce and other emerging needs	Facilitate development of needed warehouse/distribution space and support with necessary transportation services and improvements	NYCEDC
Need to use inland port concepts where beneficial	Continue to explore potential inland port sites and operating models, focusing initially on the JFK area and potentially using improvements to Linden Boulevard and the Bay Ridge Branch to provide connections to port facilities in Brooklyn	NYCEDC

6.5 TRUCK MANAGEMENT

6.5.1 TRUCK MANAGEMENT AT THE REGIONAL LEVEL

With increases in trucking demand, pressure for reliable on-schedule performance, urban congestion and roadway unreliability, and hours-of-service enforcement, the availability of well-located truck parking facilities has become increasingly important. These facilities allow trucks to better plan their trips and help them meet delivery requirements within their allotted daily driving hours. Before the COVID-19 pandemic, the availability and suitability of truck parking and truck service areas had been identified as a significant truck management issue for this region and for virtually all major U.S. metropolitan regions. The pandemic—and the temporary closure of some facilities—amplified existing deficiencies. New York City opened two temporary rest areas, one in Staten Island and one in the Bronx, to provide additional support for critical trucking operations.

To better understand trucking issues, the MAP Forum agencies collectively conducted a survey of truck drivers serving the region in May 2020. More than 300 responses were received, and the results were published in July 2020 (see ***Table H-6-8***).

The leading problem areas cited were congestion and truck parking availability, followed by tolls and loading dock detention (e.g., slow turnaround at customer locations). With the COVID-19 pandemic, many truckers experienced reduced congestion, but they also had greater difficulty in finding parking and other services. Truckers are most interested in travel plazas and service areas that offer secure parking, restrooms, food, lighting, fuel, and Wi-Fi. Finally, more than two-thirds of the surveyed truckers make more than one pickup or delivery per week in the PA-NJ-NY-CT area, suggesting that even knowledgeable "regulars" were encountering difficulties. Again, while the pandemic has highlighted these challenges, they existed well before the pandemic, and are likely to exist well after the pandemic has subsided unless acted upon. NYMTC led a tri-state (New York, New Jersey, Connecticut) study of truck parking in 2009, and metropolitan planning organizations and states represented in the MAP Forum have continued to advance their own studies and initiatives. These issues apply throughout the MAP Forum region and in both urban and non-urban counties in the NYMTC planning area.

Driver shortages, long recognized as a major challenge for the trucking industry, have become even more acute with the pandemic, particularly for long-haul truckers. The public sector cannot be responsible for private business labor issues or practices, but it can work to understand and assist in addressing factors contributing to truck driver shortages because labor failures that affect this critical service have significant negative public impacts on the region's producers and consumers. One emerging response to the combination of high demand and labor availability is load-matching. As discussed in ***Chapter 1*** and ***Chapter 2***, much of the region's truck traffic is actually "empty backhauls." Some trucks (e.g., specialized tankers or trucks delivering to construction sites) are limited to one-way moves because there is nothing for them to bring back to their origins. However, other types of trucks, especially dry vans, can be loaded with a wide range of goods, but may travel loaded in only one direction because of the difficulty of finding a suitable return load near the delivery point. Load-matching services work to identify suitable backhauls, which reduces the number of empty truck moves and increases the productivity of truck driver hours.

Another issue, also discussed in ***Chapter 5***, is the need for cleaner truck operations at the regional level, along primary corridors and at critical hubs, and especially where these corridors and hubs affect sensitive communities in both urban and non-urban counties within the NYMTC planning area and MAP Forum region (***Table H-6-9***). The NYMTC Clean Freight Corridors Planning Study currently underway is expected to identify opportunities for greater implementation of zero-emissions and clean fuel strategies for trucking.

Table H-6-8

MAP Forum Agency Truck Parking Survey—Questions and Number of Responses

Source: MAP Forum Truck Parking Survey, July 2020

What are your biggest obstacles to delivering goods in the PA-NY-NJ-CT Region?	
Congestion on roadways and crossings	118
Rest area availability	115
Tolls	57
Loading docks/detention	43
Tickets and enforcement	17
Congestion at the ports	17
Other	24
How have truck movements changed for better or worse with the pandemic?	
Less traffic	231
Difficulty finding rest areas, restaurants	203
Turn times increased at facilities	87
Turn times decreased at facilities	23
Availability of permits for overweight loads	6
Other	18
What types of services and amenities should current and future truck stops, rest areas, and travel plazas offer to the trucking community?	
Available secure parking	252
Restrooms	245
Food	201
Overhead lighting	155
Fuel	134
Wi-Fi	120
Other	31
How frequently do you make pickups and deliveries in PA, NY, NJ, CT?	
Several times a week	102
Daily	100
Two or less times a month	42
Once a week	32
Less than 12 times a year	15
I do not make pickups or deliveries	5

Table H-6-9

Truck Management Performance and Need Issues—Regional

Performance or Need Issue	Recommended/Planned Action	Source
Need for truck driver rest areas and services	Recommendations from various studies and agencies (metropolitan planning organization and DOT)	MAP Forum region
Need to address truck driver shortage	Address factors contributing to truck driver shortage	*Regional Freight Plan 2018–2045*
Need to address emissions impacts of truck operations within and around the NYMTC planning area	Conduct Clean Freight Corridors Planning Study (underway)	NYMTC

6.5.2 TRUCK MANAGEMENT IN THE URBAN CORE

The urban core of the NYMTC planning area—the five boroughs of New York City—face additional challenges because of their high population density, high demand for goods, and constrained infrastructure. Few routes are designated to legally handle 53-foot trailers; the designated truck route network is limited; commercial traffic is prohibited on most parkways[3]; other than limited access routes, virtually every route is shared with cars, buses, bicycles, and pedestrians; and most truck routes traverse a diverse mix of commercial and residential land uses where the presence of trucks may create safety, congestion, noise, and emissions impacts.

These impacts—which are over and above the truck network bottleneck issues discussed in ***Chapter 5***—have been examined by NYCEDC through its *FreightNYC* implementation efforts (see ***Table H-6-10***). While the needs were identified from the perspective of New York City, they are relevant for the entire NYMTC planning area.

NYC DOT is developing a plan to improve the quality of life for all New Yorkers through the safe, reliable, and environmentally responsible movement of goods. Known as the Smart Truck Management Plan, this comprehensive plan serves as a blueprint for enhanced freight management in New York City, outlining strategies and actions to advance New York City's vision of a safe, sustainable, equitable, and efficient last-mile freight delivery system. The forthcoming plan builds on existing truck safety, freight demand management, and compliance programs and policies, and introduces new and innovative approaches to improving freight management and partnerships across New York City. The extensive set of issues and recommendations identified by NYC DOT are listed in ***Table H-6-11***. While some of these findings are relevant primarily in urban areas, many apply to the entire NYMTC planning area.

Table H-6-10

Truck Management Performance and Need Issues—Urban Core

Source: https://edc.nyc/sites/default/files/filemanager/Programs/FreightNYC_book__DIGITAL.pdf

Performance or Need Issue	Recommended/Planned Action	Source
Improve truck access at network level	Develop commercial pilot on Belt and other parkways	NYCEDC/NYC DOT
	Managed-Use Lanes Phase 1: Establish regional managed-use lanes along Staten Island Expressway, Van Wyck	NYCEDC
	Support eastbound Goethals Bridge access ramp	NYCEDC
Reduce dependence on trucking where possible	Promote development of maritime and rail as modal alternatives, where feasible	NYCEDC
Reduce environmental and community impacts of trucking	Support the development of clean fuel infrastructure in freight hubs, including sites for compressed natural gas and electric charging, while promoting truck safety measures to help meet NYC DOT's Vision Zero goals	NYCEDC
	Pilot initiatives for tenants in New York City-owned properties to green their own supply chains through logistics consolidation, carbon-neutral shipping, and clean vehicle use	NYCEDC
	Support expansion of NYC DOT's Hunts Point Clean Trucks Program in other truck hubs and Industrial Business Zones	NYCEDC

Table H-6-11

Truck Management Performance and Need Issues – Urban Core

Source: NYC DOT's Smart Truck Management Plan

Strategies to Address Performance or Need Issues	Recommended / Planned Action	Source
Safety		
Reduce the severity and frequency of truck-involved crashes through innovative street design	Implement new design standards based on best practices to enhance truck safety at intersections and along corridors	NYC DOT
Increase awareness of truck obstructed vision areas	Promote, expand, and enhance initiatives for truck obstructed vision areas awareness	
Improve safe movement of trucks and promote safer designs and technology	Enhance city partnerships for safer streets and truck movement and promote the use of safe equipment and truck designs citywide	
	Advance safe operation of private waste hauler vehicles	
	Launch urban driving awareness initiatives for truck drivers	
Efficiency		
Reduce overall congestion resulting from truck trips	Increase the number of participants in the Off-Hours Deliveries Program	NYC DOT
	Promote urban freight consolidation concepts (use of shared loading docks and facilities and coordinated timing of delivery activity, reducing the need for curbside stops)	
	Pilot shared-use storage locker solutions for improved last-mile goods delivery	
Streamline regulations and restrictions to align with practices that reduce externalities and costs of freight transportation within New York City	Pursue a rule change to amend truck width limits	
	Pursue policy reform of overweight truck permitting and application process	
	Manage the New York City Urban Goods Truck Route Network (revise, monitor, and periodically update)	
Improve delivery vehicles' access and mobility for the last 50 feet	Improve commercial vehicle access at the curb	
Maintain and improve truck freight mobility and access	Study the prioritization of goods movement along with transit movement in dense commercial corridors	

Strategies to Address Performance or Need Issues	Recommended / Planned Action	Source
Sustainability		
Incentivize the use of cleaner fuels and technology; promote and advocate for the use of zero emission vehicles	Reduce emissions from private truck fleets in priority communities	NYC DOT
	Reduce the number of older transport refrigeration units and pilot zero emission refrigeration technology	
	Encourage uptake of zero-emission vehicles and cargo bicycles for last-mile freight deliveries	
	Incentivize the uptake of cleaner trucks through city contracts	
	Promote New York City to Zero and Low Emission Truck Manufacturers and support the funding and installation of alternative fuel infrastructure	
Reduce noise from truck deliveries	Identify and promote quiet delivery practices for both goods transporters and receivers	
Improve Truck Route Network wayfinding in New York City	Enhance the citywide truck signage wayfinding program	
Improve the trucking industry's compliance of local rules and regulation	Promote regulations to reform commercial parking rules and reduce placard abuse	
Reduce the number of bridge strikes and over-height incidents within the city	Expand and enhance the Bridge Strike Reduction Program	
Utilize enforcement approaches that protect communities and infrastructure and foster a culture of compliance in the trucking industry	Work with New York Police Department and other enforcement agencies to develop data-driven citywide truck enforcement strategies and training programs	
Reduce the impact and incidence of overnight truck parking on residential communities	Identify solutions to mitigate overnight truck parking in residential areas	

Strategies to Address Performance or Need Issues	Recommended / Planned Action	Source
Partnerships and Knowledge		
Develop partnerships and reward programs to spur positive behavior in the city's freight activity	Ensure continuous freight industry engagement through a freight advisory committee	NYC DOT
Work with businesses, communities and partners to implement freight initiatives	Explore opportunities to integrate freight demand management in large freight generators	
	Increase public engagement, awareness, and education of freight transportation	
Improve freight data and information for decision-making	Establish an annual freight data collection program	
	Partner with university researchers to evaluate freight transportation needs and challenges	
Integrate freight activity into planning efforts	Enhance standards and guidance to ensure freight activity is properly integrated within complete street design	
	Evaluate future land use development and freight impacts	

6.6 MULTI-STATE METROPOLITAN REGION PLANNING

Because freight and passenger movements to and from the NYMTC planning area must traverse freight infrastructure in adjoining "boundary" regions, it is important to understand how transportation infrastructure and services are planned and, to the extent possible, coordinated across regions. The MAP Forum is an important mechanism for accomplishing this, and for this Freight Element, targeted consultation was conducted with the North Jersey Transportation Planning Authority, the Lehigh Valley Planning Commission, and various Connecticut metropolitan planning organizations and councils of governments. These consultations highlighted boundary initiatives of particular interest.

Some of the recommendations previously identified in ***Sections 6.1*** through ***6.5*** are bistate/multi-state initiatives involving the NYMTC planning area and boundary regions. Other noteworthy freight-supporting projects and initiatives in boundary regions not previously mentioned are listed in ***Table H-6-12***.

6.7 CONCLUSION

The performance and needs statements and corresponding recommendations identified in this chapter offer a multimodal complement to the highway network-focused performance and needs analysis of ***Chapter 5***. Taken together, the findings of the *Regional Freight Plan 2018–2045* and the updated information presented in ***Chapters 5*** and Chapter 6 frame a comprehensive set of issues and opportunities to be addressed by the *Moving Forward Freight Element* recommendations in ***Chapter 7***.

Table H-6-12

Other Freight-Supporting Projects and Initiatives in Boundary Regions

State Location(s)	Lead Contact(s)	Item
CT, NY, NJ, CT, PA	Port Authority et. al.	GMAP multimodal freight program recommendations
ME, MA, RI, CT, NY, NJ, PA, DE	North American Marine Highway Alliance	Marine Highway coastwise service planning
NY, NJ	North Jersey Transportation Planning Authority, New Jersey DOT, NYCEDC, et al.	Waterborne freight recommendations from Inventory and Assessment of Waterborne Transportation Resources
MA, CT, NY, NJ, PA, DE, MD, DC	Amtrak	Northeast Corridor Future Tier II Environmental Impact Statement
NY, NJ	Amtrak	Gateway Program
NJ	Port Authority	Port Authority Marine Terminal, Rail Access, and Highway Access improvements (Port Newark/Elizabeth and Bayonne)
NJ	North Jersey Transportation Planning Authority	Freight Rail Industrial Opportunity Corridors Program recommendations to address weight or dimensional deficiencies on rail network in North Jersey Transportation Planning Authority region
		Industry-level freight forecasts to 2050
		Pilot Concept Development Study Implementation: Dover and Rockaway Rail Realignment Project, Hackettstown Bridge over Drain Weight Restriction Elimination Project
		Truck parking study
PA	Lehigh Valley Planning Commission	FedEx Ground Hub in Lehigh/continuing rapid warehouse/distribution center development
		Better connection of PA TPK with I-78 and I-80 via PA 33
		Norfolk Southern mainline improvements

State Location(s)	Lead Contact(s)	Item
PA	Northeastern Pennsylvania Alliance	I-80 reconstruction and modernization from Delaware River to I-380
		I-81 reconstruction and widening, Scranton/Wilkes Barre
		I-476 (Pennsylvania Turnpike Northeast Extension) planning
		Multi-metropolitan planning organization freight planning (Northeastern Pennsylvania Alliance, Lehigh Valley Planning Commission, Lackawanna/Luzerne)
CT	Various	I-84 Widening (to New York State line)
		I-84/Route 8 "Mix Master" Interchange and Waterbury viaduct replacement
		Consider freight stakeholders and needs when planning new/enhanced passenger rail services
		Widen I-95 from New Haven to New York state line
		Bridge 32 over MTA Metro-North Railroad into Stamford
		286,000-pound railcar clearances on freight-served lines
		Pan Am railways system improvements
		Identify locations to expand truck parking capacity in high-demand corridors
		Danbury Branch improvements to provide full commuter rail service connection to the New Haven Line
		New Haven Line track and structures rehabilitation
		Gold Star Bridge (U.S. 1 over the Thames River)
		Permitting coordination with neighboring jurisdictions
		Commercial vehicle compliance strategies

ENDNOTES

1 In January 2021, the New York State Energy Research and Development Authority announced two awards for offshore wind development, including "a cutting-edge staging facility and operations and maintenance hub at the South Brooklyn Marine terminal."

2 A stakeholder communication by the Port Authority, dated November 19, 2020, states: "The Port Authority feels strongly that the only option is to deepen our channels to 55' MLLW to: maximize the safety, efficiency and capacity of the navigational channels; allow vessels to maximize their load factor while allowing adequate under keel clearance and align channel depths with the draft of the largest vessels capable of passing under the Verrazzano-Narrows and Bayonne Bridges with an air draft of 215' (24,000 TEUs). To strengthen our position for this essential deepening and channel improvement project, we ask our Port stakeholders to submit letters of support to the USACE, supporting a minimum deepening depth of 55' MLLW. Understanding that your business may not directly use 55' of channel depth, we believe that the safety, efficiency, and capacity gains from this project will benefit all of us in the Port of New York and New Jersey, from the smallest work boats to the largest container vessels."

3 Exceptions include the Grand Central Parkway between BQE and the Robert F. Kennedy Bridge, which allows trucks 12 feet, 6 inches and under, with 3 axles, 10 tires (or less) (see note: ***http://www.trucknyc.info/***).

7

SHARED VISION GOALS AND ACTION ITEMS

This chapter presents the Freight Element's recommendations. It addresses:

- The Shared Vision for Regional Mobility and related goals and objectives presented in ***Chapter 1*** of *Moving Forward*, which guide all elements of *Moving Forward*, including the Freight Element
- Freight-related needs, issues, and recommendations relevant to the Shared Vision
- Freight-specific action items for inclusion in the larger set of projects, programs, and studies recommended by *Moving Forward*

7.1 SHARED VISION FOR REGIONAL MOBILITY

Chapter 1 of *Moving Forward* presents the following Shared Vision for Regional Mobility and related Vision Goals and objectives, which serve as a strategic framework for the Plan's components. The Vision Goals and objectives are presented below.

The elected and appointed officials who make up the New York Metropolitan Transportation Council (NYMTC) recognize that mobility—the ability of people and goods to move easily and safely to, from, and between locations—is crucial to the lives of everyone who lives, works, or visits the NYMTC planning area. Therefore, we aspire to (1) ensure that the mobility provided reaches everyone in a sustainable, healthy, and equitable manner; (2) invest efficiently for these transportation needs; and (3) respond effectively to the transportation challenges of tomorrow.

When we come together as NYMTC, we form a regional council that is the federally required metropolitan planning organization (MPO) for New York City, Long Island and the Lower Hudson Valley. As NYMTC, we will pursue our shared vision through the metropolitan transportation planning process built from this regional transportation plan (RTP). To do this, we envision a transportation system that:

- *Ensures the safety and security of people and goods across all uses and modes.*
- *Is maintained, operated, and coordinated to better enable inclusive, reliable, easy, accessible, and seamless travel across the region while striving to enhance equity in the services provided.*
- *Efficiently serves today's population and plans for the growing number of residents, workers, and increasing amount of goods.*
- *Minimizes its greenhouse gas emissions and other impacts on the environment, especially the effects of climate change.*
- *Is resilient and can mitigate, adapt to, and respond to chronic and acute stresses and disruptions.*

The Vision Goals and objectives are listed below.

SAFETY AND SECURITY: A transportation system that ensures the safety and security of people and goods across all uses and modes.

- Ensure that investments in existing physical assets protect the safety of, among others, passengers and freight systems.
- Promote safe streets and intersections.
- Keep transportation systems secure from threats.
- Coordinate safety management, training, and education across jurisdictional borders.
- Improve the safety and security of system operations.

RELIABLE AND EASY TRAVEL: A transportation system that is maintained, operated, and coordinated to better enable inclusive, reliable, easy, accessible, and seamless travel across the region while striving to enhance equity in the services provided.

- Rebuild/replace and modernize the assets that comprise the region's vast transportation infrastructure for passengers and freight.
- Improve first- and last-mile access to transit.
- Provide more frequent and reliable transit service.
- Improve accessibility to the transportation system for users of all abilities.
- Invest in improving the integration of the multimodal transit network.
- Improve the integration of freight modes and facilities.
- Invest in collection and sharing of quality transportation data.
- Promote equitable transportation and workplace access opportunities for all populations regardless of age, ability, race, ethnicity, or income.

CHANGING DEMAND: A transportation system that efficiently serves today's population and plans for the growing number of residents, workers, and increasing amount of goods.

- Invest in system capacity to satisfy demand, relieve overcrowding, address bottlenecks, and improve performance for passengers and freight, with an emphasis on core markets and activity centers.
- Expand the reach of the system to underserved communities and emerging markets, addressing passenger transportation as well as access to goods and freight services.
- Encourage walking and biking, transit-oriented development, complete streets, parking and curb management, and other long-term sustainable land use strategies that support passenger and goods movement.
- Modernize local freight networks to efficiently plan for growth in the volume of and change in product deliveries.
- Incorporate emerging and innovative transportation services and tools into efficient network design.

REDUCING ENVIRONMENTAL IMPACT: A transportation system that minimizes its greenhouse gas emissions and other impacts on the environment, especially the effects of climate change.

- Encourage alternatives to single-occupant vehicle trips.
- Encourage lower-emissions alternatives to trucking.
- Modernize vehicle fleets to higher-standard and lower-emissions vehicles.
- Efficiently manage limited roadway capacity to mitigate congestion and vehicular emissions.
- Promote responsible environmental stewardship in transportation projects.
- Address unequal impacts of transportation emissions on communities.

RESILIENCY: A transportation system that is resilient and can mitigate, adapt to, and respond to chronic and acute stresses and disruptions.

- Protect and fortify major transportation assets.
- Continue to invest in sea level rise and climate change risk analyses for transportation assets.
- Improve regional coordination on emergency and long-term responses to system-wide climate impacts.
- Enhance the transportation network's resiliency by increasing travel options and redundancies.

7.2 RECOMMENDATIONS

Within the strategic framework of the Shared Vision for Regional Mobility, the Freight Element identifies recommendations from three primary sources:

- **The *Regional Freight Plan 2018–2045* recommendations.** The *Regional Freight Plan 2018–2045* preceded *Moving Forward's* Freight Element and identified a series of freight recommendations addressing economy, logistics, infrastructure and operations, and regulation. Some of these recommendations have already been completed; most of the other recommendations are carried forward into this Freight Element in an updated form.
- **Guidance on resiliency and equity issues as defined by NYMTC's members and by public and stakeholders' input**. The Shared Vision for Regional Mobility brings additional focus to issues of resiliency and equity. While these issues were addressed to some degree in the previous freight plan, the current Freight Element more specifically addresses the meaning of resiliency and equity in the context of regional goods movement and identifies appropriate actions.
- **The various technical analyses, described in *Chapters 1* through *Chapters 6*, that shaped *Moving Forward's* Freight Element.** These analyses identified issues and opportunities for actions to implement the Vision Goals with respect to freight.

Freight actions are compiled from these sources with input from NYMTC members and the larger *Moving Forward* public engagement process. Each action item is designed to pursue one or more of the Vision Goals and related objectives. The action items are briefly summarized in *Table H-7-1* along with their relevance to the Vision Goal(s). *Table H-7-2* provides additional detail for the particular components of each action item. Each action item is numbered for reference only; the numbers do not reflect any priority or ranking among the actions.

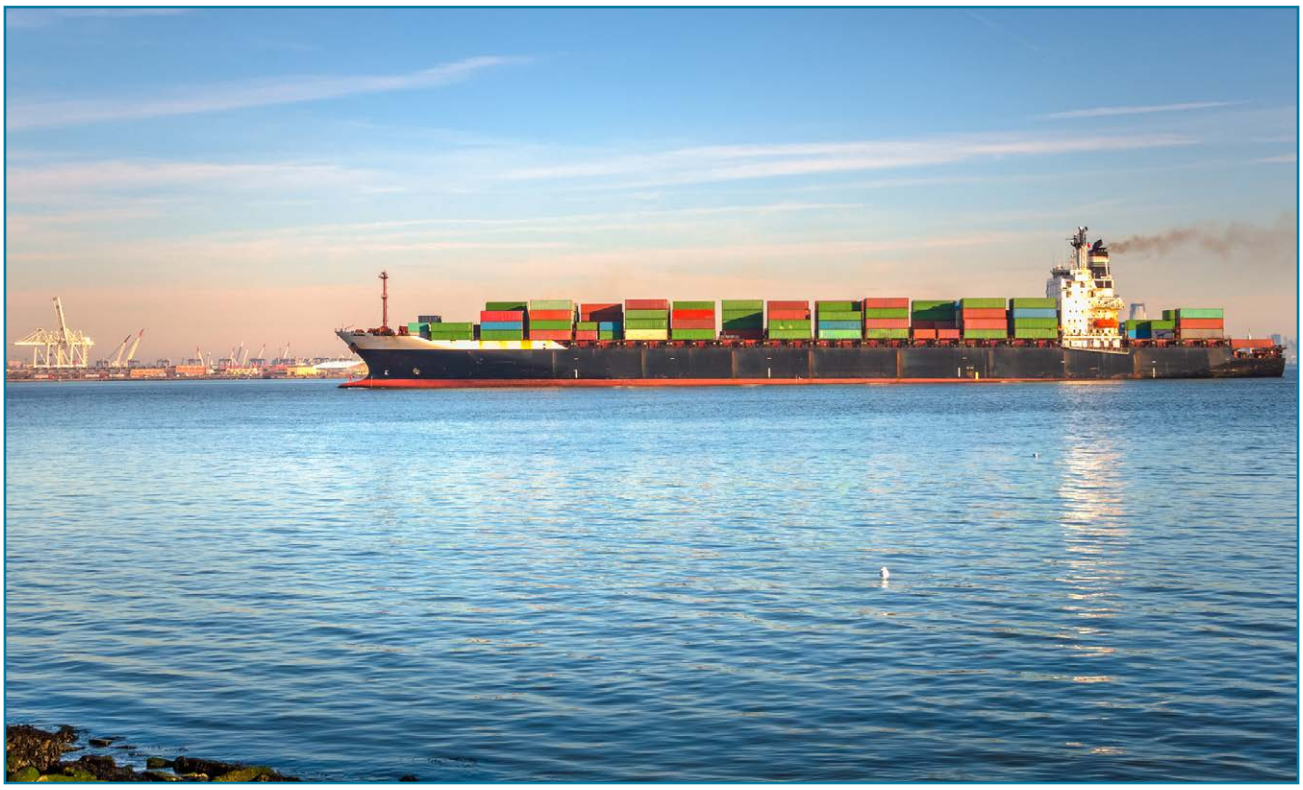


Table H-7-1

Moving Forward Freight Element Action Item Summary

Action Item					Relevance to Vision Goals				
No.	Action Summary	Type	Scale	Addresses	Safety and Security	Reliable and Easy Travel	Changing Demand	Reducing Environmental Impact	Resiliency
1.1	Continue to develop an integrated regional Freight Data Program.	Data	Multi-state region	Data Analysis		●	●		
2.1	Employ load matching platforms to reduce truck VMT, empty truck backhauls, and empty container moves.	Program	NYMTC planning area	Supply Chains			●	●	
2.2	Perform a regional study of needs and opportunities associated with the movement of MSW and construction and demolition debris	Study	Multi-state region	Supply Chains			●	●	
3.1	Forecast the medium-term and long-term effects of the COVID-19 pandemic on modal volumes, e commerce activity, and critical supply chains.	Data	Multi-state region	Trends and Disruptors			●		●
3.2	Develop scenario-based multimodal freight forecasts and assessments.	Data	Multi-state region	Trends and Disruptors	●		●		●
3.3	Advance the recommendations of the USDOT Automated Vehicles Comprehensive Plan.	Program	NYMTC planning area	Trends and Disruptors	●		●	●	
4.1	Perform a critical goods movement corridors study focusing specifically on opportunities to reduce trucking delays and related costs in the corridors responsible for 50 percent of delay costs.	Study	Multi-state region	Truck Network		●	●	●	
4.2	Assess and implement actions to reduce truck delay and related costs in the priority goods movement corridors identified in the Freight Element.	Program	Multi-state region	Truck Network		●	●	●	

Action Item					Relevance to Vision Goals				
No.	Action Summary	Type	Scale	Addresses	Safety and Security	Reliable and Easy Travel	Changing Demand	Reducing Environmental Impact	Resiliency
4.3	Develop Integrated Corridor Management (ICM) systems for I 87/287 and the Bruckner, Major Deegan, and Cross Bronx Expressways.	Program	NYMTC planning area	Truck Network		●	●	●	
5.1	Address access and performance issues for the Howland Hook Marine Terminal, SBMT, and Red Hook Marine Terminal.	Program	New York City	Ports and Marine Highways	●	●	●	●	●
5.2	Continue development of regional marine highway services in conjunction with North American Marine Highway Alliance planning and implementation efforts.	Program	Multi-state region	Ports and Marine Highways		●	●	●	●
5.3	Implement Port Authority Port Master Plan recommendations, including ongoing study of a program to deepen navigation channels.	Program	Multi-state region	Ports and Marine Highways		●	●	●	●
5.4	Maintain authorized navigation channel depths on all waterways.	Program	Multi-state region	Ports and Marine Highways	●				●
5.5	Reduce maritime fuel consumption and vessel emissions.	Program	Multi-state region	Ports and Marine Highways				●	
5.6	Develop Shoreham Deepwater Port Feasibility Study.	Study	Suffolk County	Ports and Marine Highways		●	●	●	●
6.1	Develop Long Island Freight Intermodal Terminal at Pilgrim State Hospital site.	Project	Suffolk County	Rail Networks and Terminals		●	●	●	●
6.2	Develop other transload yards and improvements in the NYMTC planning area to enhance regional freight rail volumes and address community impacts.	Program	NYMTC Planning Area	Rail Networks and Terminals		●	●	●	●
6.3	Advance the Cross Harbor Freight Program Tier II Environmental Impact Statement improvements.	Program	Multi-state region	Rail Networks and Terminal		●	●		●

Action Item					Relevance to Vision Goals				
No.	Action Summary	Type	Scale	Addresses	Safety and Security	Reliable and Easy Travel	Changing Demand	Reducing Environmental Impact	Resiliency
6.4	Develop other regional and national rail freight connectivity improvements.	Program	Multi-state region	Rail Networks and Terminal		●	●		●
6.5	Reduce barriers to seamless rail operations.	Program	Multi-state region	Rail Networks and Terminal		●	●		●
7.1	Develop on-airport freight infrastructure and logistics facilities at JFK Airport.	Program	New York City	Air Cargo		●	●		●
7.2	In conjunction with the Van Wyck Expressway capacity and access improvements, support a diversified program of JFK Airport freight access improvements.	Program	New York City	Air Cargo	●	●	●	●	●
8.1	Complete the Regional Freight Land Use Study and integrate the resulting land use data.	Data	Multi-state region	Land Use		●		●	
8.2	Facilitate development of needed warehouse/ distribution space in alignment with existing transportation system capabilities and improvement opportunities.	Program	Multi-state region	Land Use		●	●	●	
8.3	Develop potential freight village locations, inland port sites, and similar development models that integrate land use and multimodal transportation.	Program	NYMTC planning area	Land Use		●	●	●	
9.1	Apply freight safety principles from New York City's Vision Zero initiative across the larger region as appropriate.	Program	Multi-state region	Truck Network	●				
9.2	Study the potential for commercial use of the Belt Parkway and for managed use lanes on the Staten Island and Van Wyck Expressways.	Study	New York City	Truck Network		●	●	●	

Action Item					Relevance to Vision Goals				
No.	Action Summary	Type	Scale	Addresses	Safety and Security	Reliable and Easy Travel	Changing Demand	Reducing Environmental Impact	Resiliency
9.3	Implement the recommendations from NYC DOT's Delivering New York: Smart Truck Management Plan and apply principles across the larger region where applicable.	Program	Multi-state region	Truck Network	●	●	●	●	●
9.4	Implement truck inspection checkpoints on Governor Mario M. Cuomo Bridge.	Project	Westchester County	Truck Network	●				
10.1	Develop greater freight transportation system resiliency by identifying critical risks and prioritizing projects and actions to address them in collaboration with regional partners.	Program	Multi-state region	Resiliency	●				●
11.1	Complete the Clean Freight Corridors Planning Study and implement recommendations to expand truck access to charging and alternative fueling facilities.	Program	Multi-state region	Equity				●	
11.2	Prioritize improvements to corridors with high costs from delays that also have particularly high impacts on disadvantaged communities.	Program	Multi-state region	Equity		●	●	●	
11.3	Develop a more equitable freight transportation system.	Program	NYMTC planning area	Equity		●	●	●	
12.1	Continue regional and megaregional collaboration through the MAP Forum, New York State MPO Association, and the Eastern Transportation Coalition.	Program	Multi-state region and Northeast megaregion	Collaboration		●	●		

Action Item					Relevance to Vision Goals				
No.	Action Summary	Type	Scale	Addresses	Safety and Security	Reliable and Easy Travel	Changing Demand	Reducing Environmental Impact	Resiliency
12.2	Coordinate with responsible state and regional partners to identify needs and opportunities for truck inspection locations, weigh-in-motion facilities, truck parking and staging locations, and alignment of size/weight and other operating regulations.	Program	Multi-state region and Northeast megaregion	Collaboration	●				
12.3	Continue to implement regional GMAP recommendations.	Program	Multi-state region	Collaboration	●	●	●	●	●
12.4	Invest to achieve and maintain a state of good repair for the multimodal freight system in collaboration with public and private funding partners.	Program	Multi-state region and Northeast megaregion	Collaboration	●	●			●
12.5	Explore regional and megaregional pooled fund approaches for critical freight investments.	Study	Multi-state region and Northeast megaregion	Collaboration	●	●	●	●	●

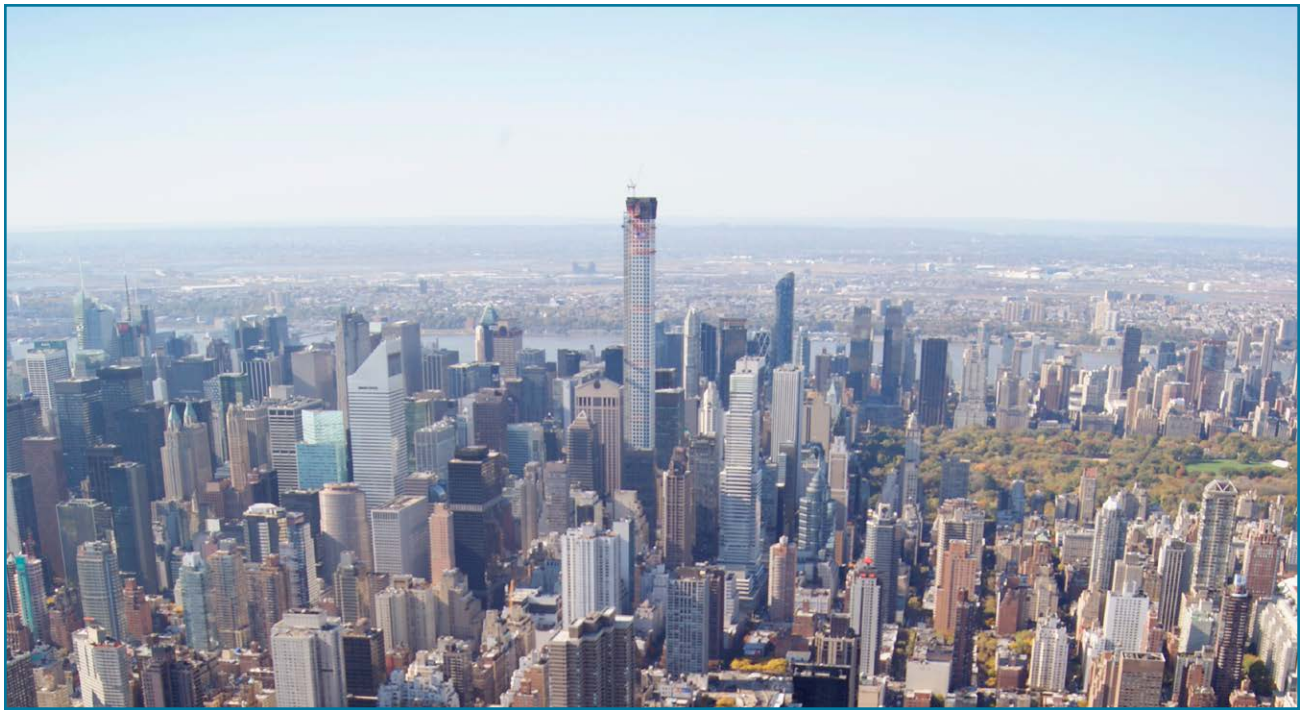


Table H-7-2

Moving Forward Freight Element Action Item Descriptions

Action	Description
1.1	Continue to develop an integrated regional Freight Data Program. Regional freight data, including but not limited to the data directly used in *Moving Forward*, should be developed and shared among member agencies and with MAP Forum region partners.
2.1	Employ load matching platforms to reduce truck VMT, empty truck backhauls, and empty container moves. *Moving Forward* analysis quantified that a large percentage of trucks are moving empty, creating traffic impacts without moving freight. While this is unavoidable in many cases because of the nature of truck delivery services, there are strategies that show promise in reducing the number and distance of empty truck moves.
2.2	Perform a regional study of needs and opportunities associated with the movement of MSW and construction and demolition debris. With the closure of regional landfills, the transportation of MSW to locations outside the NYMTC planning area will be a critical challenge, even with reductions in the rate of MSW production related to recycling and other efforts. The best utilization of truck, rail, and water modes to accomplish these moves is an important region-wide transportation issue. Various agencies and transportation carriers have studied the question extensively, and the opportunity for NYMTC is to build on this work and identify needed multimodal freight transportation improvements at a regional level.
3.1	Forecast the medium-term and long-term effects of the COVID-19 pandemic on modal volumes, e-commerce activity, and critical supply chains. Significant uncertainty currently exists about the ways the pandemic and changes in purchasing patterns will permanently affect freight demand and supply chains. These effects need to be studied and understood to better support long-range planning for freight.
3.2	Develop scenario-based multimodal freight forecasts and assessments. The COVID-19 pandemic and other trends and disruptors are not adequately reflected in the econometric forecasts typically used to support freight planning affect freight forecasts. A larger regional approach to freight forecasting, which accounts for and directly addresses risk and uncertainty, could be valuable for the NYMTC planning area and the MAP Forum region as a whole.
3.3	Advance the recommendations of the USDOT Automated Vehicles Comprehensive Plan. Automated Driving Systems could improve safety and mobility for both freight and passenger movement. The Automated Vehicles Comprehensive Plan outlines mechanisms to promote collaboration and transparency regarding self-driving systems; modernize the regulatory environment to remove unnecessary barriers to implementation; and prepare the transportation system for Automated Driving System implementation. See ***https://www.transportation.gov/AV***.
4.1	Perform a critical goods movement corridors study focusing specifically on opportunities to reduce trucking delay and related costs in the corridors responsible for 50 percent of delay costs. These are the most critical path segments of the region's truck network and should be addressed as a priority. Key routes to be addressed include interstates 87, 95, 278, 495, and 678; state routes 9A, 24, 25, 25A, and 27; and the George Washington Bridge, Bruckner Boulevard, and Atlantic Avenue.

Action Description	
4.2	Assess and implement actions to reduce truck delay and related costs in the priority goods movement corridors identified in the Freight Element. The detailed highway performance analysis presented in ***Chapter 5*** of this Freight Element identified 101 corridors with truck delay costs of $12 million per year or more. Many of these routes are the subject of improvements that are programmed, planned, or under consideration. However, those improvements may not have direct or significant effects on truck delay costs. As an immediate next step, NYMTC should evaluate the freight benefits of improvements programmed, planned, or under consideration; identify unaddressed freight performance issues; and suggest potential actions focused on reducing truck delay costs.
4.3	Develop ICM systems for I-87/287 and the Bruckner, Major Deegan, and Cross Bronx Expressways. ICM is a concept to better coordinate and use multimodal assets at the corridor level; freight movement can benefit even where ICM targets passenger traffic. NYSDOT has advanced ICM for I-87/287, and the strategies should be advanced for other key routes where beneficial.
5.1	Address access and performance issues for the Howland Hook Marine Terminal, SBMT, and Red Hook Marine Terminal. At a facility level, the following actions are identified. • Howland Hook: realign Forest Avenue, Western Avenue, and terminal exit gate/outbound roadway extension; support full buildout of the Matrix site and designate the roadway connection to Matrix as a Marine Terminal Highway; review the container cargo toll discount program to ensure equity with New Jersey container terminal access costs; expand ExpressRail with additional tracks 8-11 and improve Arlington Yard; and diversify cargo to include offshore wind, renewable energy support, project cargo, temperature-controlled commodities, and roll-on/roll-off cargo. • SBMT: upgrade terminal to support offshore wind and other cargo at SBMT for near-term operations; convert First/Second Avenues to one-way pair and realign the First Avenue rail line; maintain connectivity to NYNJR; and accommodate future container handling operations and connections to the proposed Cross Harbor freight rail tunnel. • Red Hook: maintain and enhance current barge and liner services; explore new market opportunities; and provide infrastructure improvements as needed.
5.2	Continue development of regional marine highway services in conjunction with North American Marine Highway Alliance planning and implementation efforts. Near-term opportunities include new intra-harbor marine highway services between Port Raritan, Manhattan, Brooklyn, and the Bronx; construction of marine facilities at the Hunts Point Food Distribution Center; and exploration of larger regional and coastal strategies through the North American Marine Highway Alliance.
5.3	Implement the Port Authority Port Master Plan recommendations, including an ongoing study of a program to deepen navigation channels. The Port Master Plan includes a broad range of recommendations for marine terminal and access improvements supporting the recommendations listed above as well as port-wide improvements.
5.4	Maintain authorized navigation channel depths on all waterways, including deep-draft channels serving major public marine terminals and shallow-draft channels accommodating or potentially accommodating barge traffic.

	Action Description
5.5	Reduce maritime fuel consumption and vessel emissions. The use of cleaner diesel fuel, more efficient diesel engines, and alternative fuel engines should be promoted for marine freight vessel operations within the NYMTC planning area. NYMTC should assist vessel owners, operators, and regulatory agencies to identify clean vessel implementation and funding opportunities.
5.6	Develop Shoreham Deepwater Port Feasibility Study. This is a recommendation carried forward from Plan 2045.
6.1	Develop Long Island Freight Intermodal Terminal at Pilgrim State Hospital site. This is a recommendation carried forward from *NYMTC's Regional Freight Plan 2018–2045*.
6.2	Develop other transload yards and improvements in the NYMTC planning area to enhance regional freight rail volumes and address community impacts. Besides the Pilgrim site, there are many other opportunities to improve rail service for NYMTC planning area users. These include: transload operations at the Wheelspur site in Long Island City (initially) and at Maspeth and other strategic sites along the Bay Ridge Branch (subsequently); opportunities at Arlington Yard (Staten Island), Hunts Point (Bronx), and 65th Street (Brooklyn); container/transload operations at the former Pilgrim State Hospital (Suffolk); railcar storage and handling on the Fremont Secondary and Bay Ridge Branch and in the Fresh Pond Yard area; vertical clearances for double-stack containers and "autorack" railcars; and locomotive equipment upgrades for cleaner fuel operation.
6.3	Advance the Cross Harbor Freight Program Tier II Environmental Impact Statement improvements. The Cross Harbor Freight Program is a recommendation carried forward from *NYMTC's Regional Freight Plan 2018–2045*.
6.4	Develop other regional and national rail freight connectivity improvements. In addition to the Cross Harbor Freight Program, there are many other opportunities to improve rail connectivity between the NYMTC planning area and the national freight rail system. These include near-term enhancements to the NYNJR railcar float operations; advancement of the CSX River Line second track; exploration of freight in the Gateway Program; and needed improvements (additional track and sidings, bridge improvements, vertical clearance, weight-handling upgrades) in New Jersey.
6.5	Reduce barriers to seamless rail operations. Railcar exchanges between different operating railroads often involve delays, added costs, and other impacts. More efficient or "seamless" exchange of railcars between major national railroads and regional railroads is an opportunity to improve the speed, reliability, and attractiveness of freight rail service for customers. Some of the barriers can be addressed with physical and operating improvements, while others are institutional and require partnership approaches.
7.1	Develop on-airport freight infrastructure and logistics facilities at JFK Airport. Focus on improvement/redevelopment of on-airport infrastructure and logistics facilities to support e-commerce, temperature-controlled commodities, and other identified growth markets.

Action	Description
7.2	In conjunction with the Van Wyck Expressway capacity and access improvements, support a diversified program of JFK Airport freight access improvements. Identified opportunities include enhancements to the New York City truck route system to close gaps in the system to provide more alternative access routes to JFK Airport and more 53-foot truck routes; prioritized roadway improvements that directly benefit JFK Airport (e.g., bridge and pavement condition projects); safety and capacity enhancements; major corridor mobility on key routes such as I-678, I-278, I-495, and I-95 that link JFK Airport with regional and national markets; marine highway service to support construction and operations; innovative truck access strategies, including advanced technology trucks and creative use of existing rights-of-way; and improved signage and wayfinding for truck traffic between JFK Airport and Springfield Gardens.
8.1	Complete the regional freight land use study and integrate the resulting land use data. Significant information is available for freight-related land uses, facilities, clusters, and hubs in New York City through the Smart Truck Management Plan, and work underway by NYMTC will provide corresponding needed detail for a geographic area.
8.2	Facilitate development of needed warehouse/distribution space in alignment with existing transportation system capabilities and improvement opportunities. Needs for warehouse/distribution space are changing rapidly; new capacity is needed, in new locations (in many cases very close to end-users even in urban areas), and with new types of structures (multi-story, temperature-controlled, highly automated). Structures are being built on available sites, on sites made usable through redevelopment, and through adaptation of existing freight and non-freight structures. In this rapidly changing environment, NYMTC and its member agencies will need to monitor evolving needs for multimodal transportation access.
8.3	Develop potential freight village locations, inland port sites, and similar development models integrating land use and multimodal transportation. A previous NYMTC study of freight village feasibility identified several opportunities that were advanced in the *Regional Freight Plan 2018-2045*. These explorations should continue and evolve in light of changing freight demand and logistics needs. Additionally, a new near-term inland port opportunity has been identified for development in the JFK Airport area, potentially using improvements to Linden Boulevard and the Bay Ridge Branch to provide connections to port facilities in Brooklyn.
9.1	Apply freight safety principles from New York City's Vision Zero initiative across the larger region as appropriate. The intent is to expand successful elements of the program to the full NYMTC planning area to achieve more safety benefits over the total system.
9.2	Study the potential for commercial use of the Belt Parkway and for managed use lanes on the Staten Island and Van Wyck Expressways. This is a specific recommendation of *FreightNYC*.

Action Description	
9.3	Implement the recommendations from New York City's Smart Truck Management Plan and apply principles across the larger region where applicable. The plan addresses a broad range of issues and presents recommendations organized around 4 overarching goals, 32 strategies, and 101 initiatives and recommendations. (See ***Chapter 6*** of the Freight Element for additional details.) • **Safety**: initiatives will reduce the severity and frequency of truck-involved crashes and improve truck safety in New York City through engineering, education, awareness, partnerships, and legislative policy. • **Efficiency**: initiatives align rules, regulations, and industry practices to enhance the efficiency of truck movement in New York City. • **Sustainability**: initiatives will improve the environmental sustainability of truck movement within New York City and foster a culture of compliance with truck-related regulations through signage, targeted enforcement, and technology advancement. • **Partnerships and knowledge**: initiatives will develop partnerships and reward programs to spur positive behavior in New York City's freight activity; increase public engagement, awareness, and education of freight transportation; and improve freight data and information for decision-making
9.4	Implement truck inspection checkpoints on Governor Mario M. Cuomo Bridge. This is a specific recommendation carried over from *NYMTC's Regional Freight Plan 2018–2045*.
10.1	Develop greater freight transportation system resiliency by identifying critical risks and prioritizing projects and actions to address them in collaboration with regional partners. The goal of resiliency planning, the risks to be considered, and the actions to be implemented are listed below. • **Vision Goal**: A resilient system is defined as having the ability to sustain supply chains and deliver goods during and following disruptive events without reduced levels of service and to withstand, adapt to, and recover quickly from short-term disruptions and unexpected changes in the infrastructure. Critical risks to be addressed in planning include: condition and failure risk of aging infrastructure, especially bridges and tunnels, as a result of climate change, weather, and other natural disasters; lack of alternatives to truck modes; limited labor force for freight movement; overall lack of capacity; and impediments to exchanging critical information. • **Risks**: Agencies in the NYMTC planning are well aware of risks from natural events and human actions and have developed resiliency and response plans to carry out their missions under conditions of disruption. Recognizing that the NYMTC planning area depends on a series of critical supply chains, each with vulnerabilities and risks, these regional resiliency planning efforts should be coordinated and focused around the protection and hardening of critical freight supply chains. • **Actions**: Steps to address resiliency risks may include: repair, hardening, and continuing maintenance of infrastructure to resist natural and human-made disruptions, particularly for aging infrastructure; freight demand management strategies and contingency planning; greater modal and geographic distribution of freight capacity and facilities to reduce risk exposure; introduction of alternative fuel-capable vehicles; and greater federal investment and improved collaboration and data-sharing between regional governments and private sector partners.
11.1	Complete the Clean Freight Corridors Planning Study and *implement recommendations* to expand truck access to charging and alternative fueling facilities. The study is identifying impacts, opportunities, and improvements for clean vehicle infrastructure and reduced community impacts.

Action Description	
11.2	Prioritize improvements to corridors with high costs from delays. NYMTC's ongoing Clean Freight Corridors Planning Study is documenting that many truck corridors with high delay costs also generate significant impacts in Communities of Concern. As that study concludes and further investigation of truck performance corridors is undertaken, project opportunities common to both studies should be prioritized.
11.3	Develop a more equitable freight transportation system. This is a programmatic activity across other action items and NYMTC's Title VI program. • **Vision Goal**: Key features of an equitable freight transportation include externalities such as air quality, noise, congestion, and safety that are not distinguishable between "advantaged" and "disadvantaged" areas; impacts on low-to-moderate income communities that are not disproportionate; access to and costs of goods via retail outlets and e-commerce deliveries that are comparable across communities, and quality of infrastructure supporting freight activity that is comparable. • **Issues**: Issues to be addressed include disproportionate impacts on environmental justice, minority, and low-to-moderate income neighborhoods from diesel emissions and air quality, congestion, safety, and noise; growing impacts of last-mile delivery trucks in residential neighborhoods and around new fulfillment center development; lack of access to retail and delivery services; and lack of access to freight employment locations in disadvantaged communities that are most burdened by freight impacts. • **Actions**: Equity-promoting projects may include expanding the Hunts Point Clean Truck program and other electric/zero emissions truck promotion incentives; working to retire high-emission locomotive engines; providing increased funding for and use of rail and water transportation in lieu of trucks; promoting use of cargo bikes, electric bikes, and last-mile non-truck micro-mobility strategies; distributing freight land uses more equitably and thoughtfully, with better separation from sensitive land uses and better accessibility for workers in disadvantaged communities; promoting freight consolidation; increasing community engagement opportunities and partnerships; and prioritizing other equity-supporting safety and sustainability recommendations from the Smart Truck Management Plan.
12.1	Continue regional and megaregional collaboration through the MAP Forum, New York State MPO Association and the Eastern Transportation Coalition. These organizations are important resources for data exchange, plan and project coordination, and advancement of freight solutions across jurisdictional boundaries.
12.2	Coordinate with responsible state and regional partners to identify needs and opportunities for truck inspection locations, weigh-in-motion facilities, truck parking and staging locations, and alignment of size/weight and other operating regulations. These are challenging issues and meaningful improvements will require collaboration and implementation across geographies, public agencies at all levels of government, and private stakeholders.

Action Description	
12.3	Continue to implement regional GMAP recommendations. This is a recommendation carried forward from *NYMTC's Regional Freight Plan 2018–2045*. GMAP is a multimodal, multi-agency program that includes a broad range of projects, programs, and strategies, many of which are identified as specific action items in the *Moving Forward* Freight Element. Opportunities to implement other GMAP recommendations will be considered as appropriate.
12.4	Invest to achieve and maintain a state of good repair for the multimodal freight system, in collaboration with public and private funding partners. State of good repair is the foundation for all freight movement; where multimodal networks cannot provide the levels of safety, efficiency, and performance they are designed for, the entire system and its users are negatively impacted. Good repair for networks within the NYMTC planning area is obviously important and, given that significant amounts of freight move between the NYMTC planning area and other regions and states, good repair for the larger system is also critical.
12.5	Explore regional and megaregional pooled fund approaches for critical freight investments. The Freight Element has shown how each county in the NYMTC planning area depends on the freight infrastructure in other NYMTC planning area counties, and how the NYMTC planning area as a whole depends on freight infrastructure in the MAP Forum region and beyond. Dedicated freight funding is difficult to find and usually restricted in how and where it is applied. Nevertheless, it is worth exploring opportunities for regional and multi-state pooled funding programs to address freight transportation issues (resiliency, performance, safety, equity) and land use/land banking/redevelopment and reuse opportunities. The overall goals would be to grow the total amount of available freight funds and increase the flexibility in applying those funds. Existing programs such as the CREATE program in Chicago, which combines federal, state, regional, and private funds to fund rail projects from a prioritized list as funds allow, could serve as a model.

7.3 FREIGHT ELEMENT IMPLEMENTATION

7.3.1 IMPLEMENTATION GUIDANCE

This Freight Element is an integral part of *Moving Forward* and its implementation will be accomplished within the context of broader planning to achieve the full Plan's recommendations.

Implementation of the freight transportation improvements and actions presented in this chapter will require coordinated efforts on the part of many public and private sector stakeholders. The process of developing the Freight Element 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 selecting recommendations. NYMTC member agencies; 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 Freight Element's recommendations are:

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

7.3.2 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 MAP Forum's Multi-State Freight Working Group, the North Jersey Transportation Planning Authority's Freight Initiatives Committee, the New York State MPO Association's Freight Working Group, the Metropolitan Rail Freight Council, and the Eastern Transportation Coalition, and by ensuring a broad representation on project steering and technical advisory committees. Additionally, NYMTC (as an MPO) has a major role to play in informing state freight plan updates, as well as and monitoring the implementation of projects identified in the Plan to ensure that they meet the regional (MPO) goals.
- 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 the forums identified earlier, NYMTC should conduct ongoing outreach with the private sector to advance the recommendations in this Freight Element, including participating in the evaluation of alternatives and funding discussions. By demonstrating the private sector benefits of freight investments, particularly as these investments 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 also has a stake in freight transportation needs and investments. 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. Negative effects associated with freight transportation, such as pollutant emissions, noise, highway and rail safety, and traffic congestion, affect communities throughout the NYMTC planning area. Dissemination of public education materials, such as the Basics of Freight Transportation in the NYMTC Region brochure, 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.

7.3.3 IDENTIFYING FUNDING AND FINANCING OPTIONS

Several financing options are available to advance the recommendations presented in this chapter. While traditional funding programs are generally well known to NYMTC members, a number of new financing tools have been created or modified through federal authorizing legislation 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), 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).

Public-private partnerships are often cited as one potential solution to funding shortfalls. As discussed in the **Chapter 5** of *Moving Forward*, 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 was used for the new Governor Mario M. Cuomo Bridge.

7.3.4 MEASURING AND MONITORING PROGRESS TOWARD SUCCESS

The desired freight outcomes, as documented in the *Moving Forward* Shared Vision and Goals, provide a framework for the NYMTC planning area's future freight transportation system. As discussed in ***Chapter 3*** of *Moving Forward*, one of the biggest challenges in transportation performance management is measuring 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 this Freight Element should provide NYMTC members with a path forward to use the planning area's freight assets—its economy, land, buildings, and facilities—to achieve the shared goals and desired outcomes presented. The Freight Element is available to inform current and ongoing 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.

ACRONYMS AND ABBREVIATIONS

3D	Three-Dimensional
B2B	Business-to-business
B2C	Business-to-consumer
BOPIS	Buy Online Pickup in Store
BQE	Brooklyn-Queens Expressway
C2B	Consumer to Business
C2C	Consumer to Consumer
CAGR	Compound Annual Growth Rate
COVID-19	Novel Coronavirus
DTC	Direct-to-consumer
EDI	Electronic Data Interchange
FAF	Freight Analysis Framework
FHWA	Federal Highway Administration
G2B	Government to Business
G2C	Government to Consumer
GDP	Gross Domestic Product
GMAP	Goods Movement Action Plan
HPMS	Highway Performance Monitoring System
I	Interstate
ICM	Integrated Corridor Management
JFK	John F. Kennedy International Airport
LIRR	Long Island Rail Road
LTL	Less-than-truckload
MAP Forum	Metropolitan Area Planning Forum
mph	Miles Per Hour
MRFC	Metropolitan Rail Freight Council
MSW	Municipal Solid Waste
MTA	Metropolitan Transportation Authority
NAFTA	North American Free Trade Agreement
NAICS	North American Industry Classification System
NPMRDS	National Performance Measurement Research Data Set
NY&A	New York & Atlantic Railway
NYC DOT	New York City Department of Transportation
NYCEDC	New York City Economic Development Corporation
NYMTC	New York Metropolitan Transportation Council
NYNJR	New York New Jersey Rail, LLC
NYSDOT	New York State Department of Transportation
PTC	Positive Train Control
SBMT	South Brooklyn Marine Terminal
SCTG	Standard Classification of Transported Goods
SED	(NYMTC Region) Socioeconomic and Demographic
STCC	Standard Transportation Commodity Code
TEU	Twenty-foot Equivalent Unit
USPS	U.S. Postal Service
VEHT	Vehicle Excess Hours of Travel
VHU	Vehicle Hours of Unreliability
YTD	Year-to-date