Moving Forward 2055

Connecting Communities, Creating Opportunities

NYMTC
NEW YORK METROPOLITAN TRANSPORTATION COUNCIL

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MOVING FORWARD 2055

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 NYMTC'S SHARED VISION

1.1 OUR REGION AND ITS NEEDS

As of 2022, the New York metropolitan region is home to 23.0 million people and 12.4 million jobs. Its economy accounts for nearly 10 percent of the United States' gross domestic product. The region's residents, workers, and visitors depend on safe, accessible, and efficient transportation.

Movement of people and goods is vital to our region's economic health. To ensure continued vitality, our region needs reliable and well-maintained transportation infrastructure. It also needs to be safe, fair, human-centered and provide meaningful choices to individuals of all abilities. It needs to adapt to shifting travel patterns from trends such as telecommuting and e-commerce, prepare for new technologies, and contribute positively to a healthier environment.

The transportation network is not limited to moving people. Every day, millions of tons of goods are on the move, being delivered to residences, area stores, and restaurants. Cargo moves to and from intermodal centers, distribution centers, and warehouses, traveling within and outside of the region.

Our region is on the move. While the communities that comprise our vast region may move differently, we all collectively share our need to get around easily and safely. Our transportation network is, and will continue to be, an engine of regional opportunity for communities and commerce, and a connection hub for our country to the rest of the world.

1.2 OUR GUIDING PRINCIPLES

The New York Metropolitan Transportation Council (NYMTC) is the federally required metropolitan planning organization (MPO) for New York City, Long Island, and the Lower Hudson Valley.

We, the elected and appointed officials that comprise the council, affirm the value of regional planning. While recognizing that our responsibility is limited to just 10 of the New York metropolitan region's 31 counties, we acknowledge that mobility—the ability of people and goods to move easily and safely to, from, and between locations—is crucial to the lives of residents and visitors alike, as well as the region's economic vitality.

Nine guiding principles inform our regional transportation planning process:

1. We will value the needs of all users across our region.
2. We will seek to use funding for transportation efficiently, no matter its source.
3. We will consider all modes of transportation to achieve connected networks that accommodate all modes and all users.
4. We will plan for modal shifts, first/last mile connections, and multi-system accessibility and operability.
5. We will support multi-agency approaches to better integrate the regional transportation system.
6. We will collaborate and coordinate with other government entities to address regional challenges.
7. We will engage the public and community stakeholders through workshops, webinars, and other outreach to help guide key decisions in the planning process.
8. We will invest in the collection and sharing of quality metrics and data related to transportation.
9. We will be open to innovation and technological advancements to enhance our transportation system.

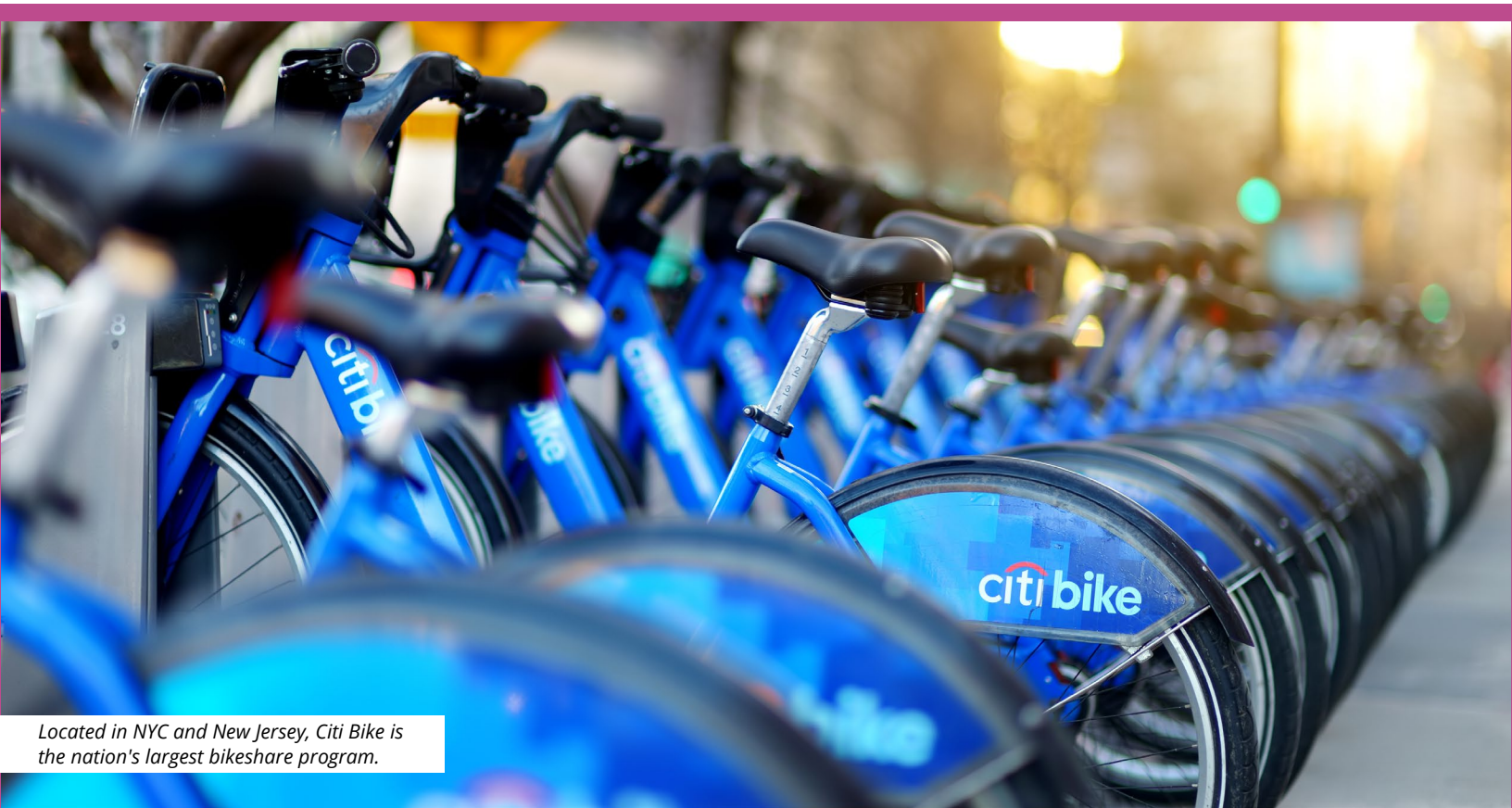
These guiding principles shape how we follow our vision and pursue our goals.

1.3 OUR VISION AND GOALS

All people, regardless of race, disability status, age, or socioeconomic background have a right to live, work, and play in communities that are safe, healthy, and free of harmful environmental conditions. Our shared vision is one in which safe, accessible, and efficient mobility for people and goods is made possible by well-maintained and reliable infrastructure.

Furthermore, we envision a future where transportation infrastructure and technology enhance community health, minimize pollution, and where strategic investments in transportation drive continued economic growth.

Extreme weather, for example, is an increasing threat that our region must respond and adapt to. The transportation sector in our region is also a leading contributor to harmful air pollution. It is crucial that we provide options that enhance our ability to further reduce air pollution and help mitigate the effects of extreme weather events.



Located in NYC and New Jersey, Citi Bike is the nation's largest bikeshare program.

Given this vision, we seek to establish and maintain a transportation system for which:

1.4 OUR OBJECTIVES IN PURSUING THESE GOALS

As we pursue our goals, the following objectives will focus our vision and help target activities.

1. A transportation system for which safety and security are maximized for people and goods across all uses and modes.

a. Ensure that investments in transportation assets enhance the safety and security of passengers and freight systems.

b. Prioritize safe streets, intersections, railroad grade crossings and shared-use right of ways, and establish road safety initiatives that follow a Safe System approach.

c. Coordinate safety management, training, and safety education for all who share our streets across jurisdictional borders.

d. Improve operational safety and security, incorporating the changing nature of transportation and technology so that transportation facilities safely accommodate all travelers.

e. Strengthen connected vehicle programs and policies, and champion driver assist programs and other technologies that contribute to overall system and individual user safety.

f. Improve in-person and automated safety enforcement procedures.

g. Prioritize the safety of transportation system operators, workers, and contractors through planning and coordinated management of work zones.

Bicycle infrastructure supports safe cycling in Jackson Heights, Queens.

2. A transportation system for which infrastructure is maintained and improved in a sustainable manner.

a. Maximize environmental/fiscal sustainability and minimize carbon intensity when maintaining, improving, modernizing, and/or replacing transportation infrastructure.

b. Reimagine and repurpose the assets that comprise the region's transportation infrastructure so as to reconnect communities and improve accessibility across all modes.

c. Rebuild, replace, and/or modernize needed transportation assets for passengers and freight.

d. Invest in the integration of the region's multimodal transit network.

e. Create efficient and environmentally sound freight networks, systems, and facilities.

f. Plan and manage work zones and Maintenance and Protection of Traffic programs to efficiently advance infrastructure upkeep.

g. Plan for the development and use of advanced technologies and materials.

The new East Lincoln Avenue bridge in Lower Westchester replaced an aging asset and improves flood resiliency.

3. A transportation system for which resiliency is supported through mitigating, adapting to, and responding to chronic and acute stresses and disruptions.

a. Protect and fortify major transportation assets.

b. Invest in extreme weather vulnerability analyses and material solutions for transportation assets.

c. Improve regional coordination on emergency and long-term responses to system-wide extreme weather impacts and sea level rise.

d. Enhance the transportation network's resiliency by increasing travel options and redundancies.

e. Collaborate on resiliency projects that have significant transportation implications.

f. Coordinate across jurisdictions to advance resiliency and sustainability.

g. Prioritize resiliency and sustainability in a manner that considers the needs of designated Communities of Concern.

h. Invest in future energy infrastructure to minimize the impact of grid events and supply chain disruptions on the transportation system and its users.

i. Promote resiliency strategies that account for environmental determinants of health and their impact on vulnerable communities.

The Drewville Road Bridge over the Croton River in Putnam County was replaced in 2023.

4. A transportation system for which congestion is mitigated through investments and technology in support of healthier communities, more seamless travel, improved quality of life, and regional economic competitiveness.

a. Sustainably manage current and future demands, with an emphasis on expanding active transportation and transit.

b. Support mobility for all users by encouraging active transportation, micromobility, complete streets, and other strategies.

c. Modernize local freight networks to efficiently plan for growth in the volume of and change in product deliveries.

d. Expand the reach of the system to emerging markets, addressing access to and incentivizing employment, social, and recreational opportunities.

e. Incorporate emerging and innovative technologies, transportation services, and tools into efficient network design, operations, and monitoring.

f. Coordinate with governing bodies for clearer accountability, funding, and planning arrangements.

Grand Central Madison opened in January 2023 and is the country's largest passenger rail terminal to be built in 67 years.

5. A transportation system for which land use decisions are encouraged in support of strategic transportation enhancements and improving modal choices.

a. Encourage transit-oriented development as well as parking, curb, and property management, micro-mobility pathways, and other long-term sustainable land use strategies that support passenger and goods movement while reducing pollution.

b. Encourage strategic distribution of growth throughout the region by prioritizing density over less dense development near transit, and by prioritizing transit investments where development is occurring.

c. Help create/sustain vibrant communities through placemaking.

d. Leverage land use mechanisms to improve access to destinations.

e. Manage the First-Mile, Last-Mile planning process through collaboration with transportation and land use planning officials and affected stakeholders.

f. Consider the impacts that transportation policies and projects will have on land values and proactively mitigate negative effects on existing communities.

The New York City skyline at sunset.

6. A transportation system for which fairness in transportation is advanced and access to opportunities is improved for all communities.

a. Improve first- and last-mile access to transit.

b. Improve accessibility to the transportation system for users of all abilities.

c. Provide more frequent and reliable transit service.

d. Strategically expand transportation services and information to enhance mobility in communities with the greatest mobility needs.

e. Improve access to social and economic opportunities for all populations, regardless of age, ability, race, ethnicity, or income.

With the completion of elevators, the Grand Street Subway Station is now fully accessible.

7. A transportation system for which environmental impacts—including harmful air pollutants—are significantly reduced through technology applications, increased use of greener travel options, and improved system efficiency.

a. Support land use sustainability through improved and efficient transportation services and facilities, which enable more efficient land uses.

b. Practice environmental stewardship in the maintenance and enhancement of the transportation system.

c. Promote and improve public transportation and active transportation modes, such as walking and cycling, to reduce pollution, improve air quality, and support public health.

d. Support lower- and zero-emission alternatives to current trucking through vehicle technology and greater modal balance.

e. Modernize public vehicle fleets to lower- and zero-emission vehicles and support the conversion of private vehicles.

f. Efficiently manage limited roadway capacity to mitigate congestion and vehicular pollutants.

g. Address unequal impacts of transportation sector pollution on certain communities.

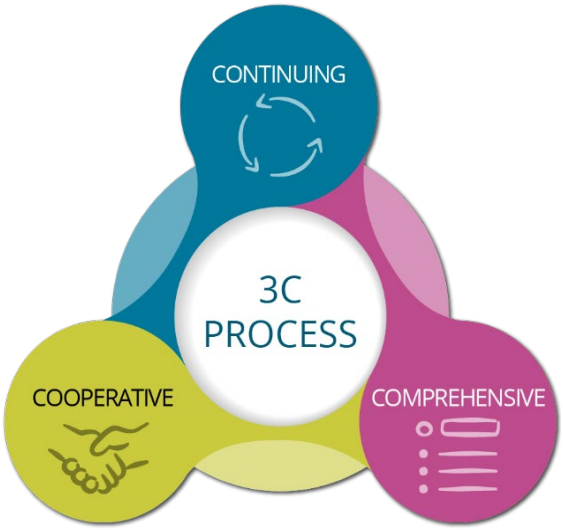
The MTA will replace and transform its entire bus fleet with zero-emissions vehicles by 2040.

2 HOW TRANSPORTATION PLANNING HAPPENS

2.1 ORGANIZATION AND CONTEXT

Federal legislation requires that any urbanized area (UZA) with a population greater than 50,000 must have an MPO to plan for and make decisions on the use of Federal transportation funding. MPOs ensure that existing and future expenditures for transportation projects and programs are based on a continuing, cooperative, and comprehensive planning process (also known as the 3C Process, seen in Figure 2.1). Among other functions and requirements, MPOs cooperate with state agencies and public transportation operators to program Federal funds for eligible transportation projects.

Figure 2.1 MPO 3C Process



Source: Cambridge Systematics.

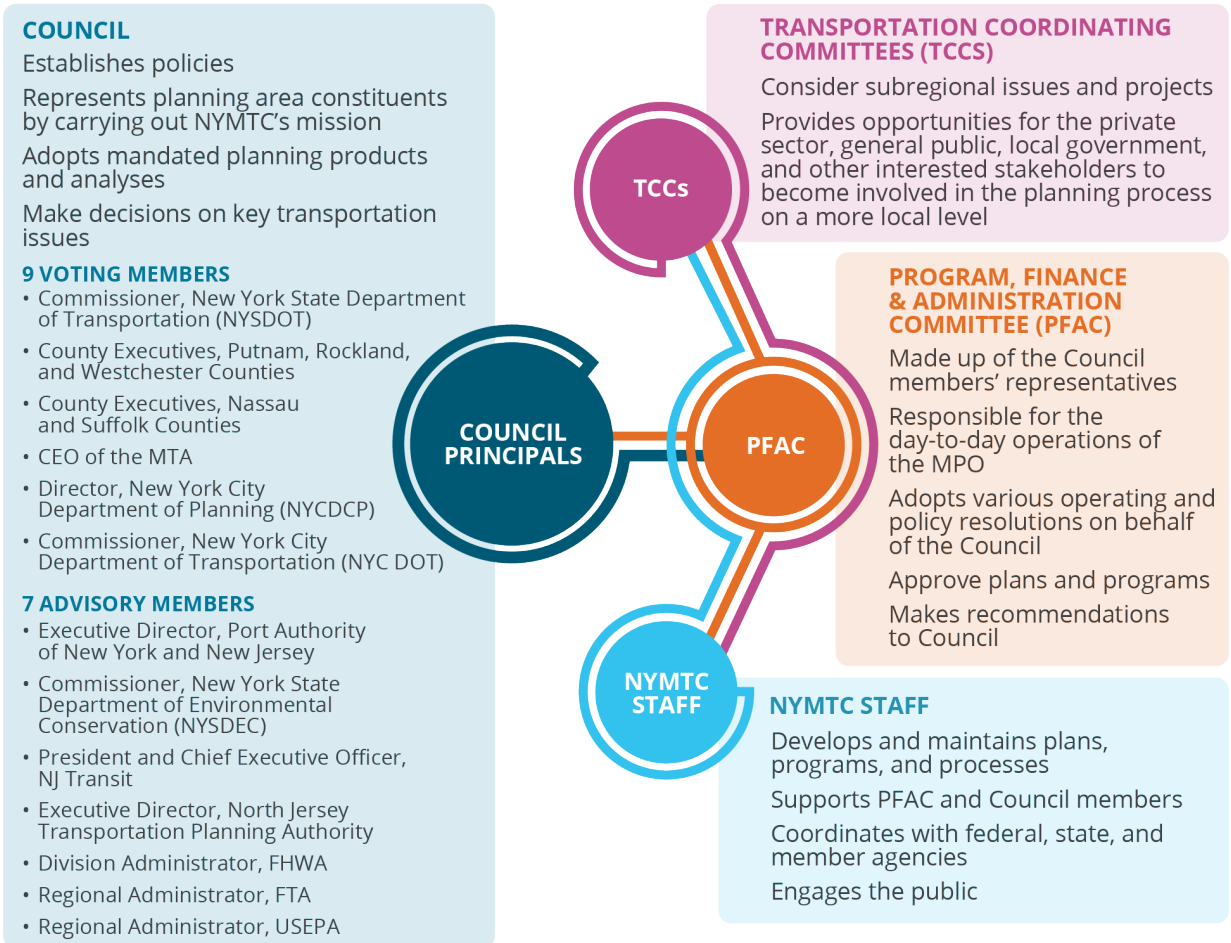
As the MPO for New York City, Long Island, and the Lower Hudson Valley, NYMTC serves as a collaborative planning forum for the five boroughs of New York City; Nassau and Suffolk counties on Long Island; Putnam, Rockland, and Westchester counties in the Lower Hudson Valley; the State of New York; and the Metropolitan Transportation Authority (MTA) to undertake the federally mandated planning process and access Federal funding for transportation projects.

NYMTC's Council is advised by the Port Authority of New York and New Jersey (Port Authority), New Jersey Transit (NJ TRANSIT), and the North Jersey Transportation Planning Authority (NJTPA), as well New York State's Department of Environmental Conservation (NYSDEC), the U.S. Environmental Protection Agency (USEPA), and two modal administrations of the U.S. Department of Transportation (U.S. DOT)—the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). NYMTC's Shared Vision for Regional Mobility, which guides *Moving Forward 2055*, is built around these members and advisers' strategic goals; associated objectives; and related projects, programs, and studies.

2.1.1 STRUCTURE

The NYMTC Council is comprised of the chief elected or appointed officials of its member agencies, which include nine voting members and seven non-voting advisory members (see Figure 2.2). NYMTC operates through four standing committees—the Program, Finance, and Administration Committee (PFAC) which oversees the day-to-day operations of the organization, and three geographically based Transportation Coordinating Committees (TCC) that provide subregional planning forums. These committees make recommendations to the Council based on their areas of expertise. NYMTC is supported by professional staff that are responsible for conducting the daily business of the organization.

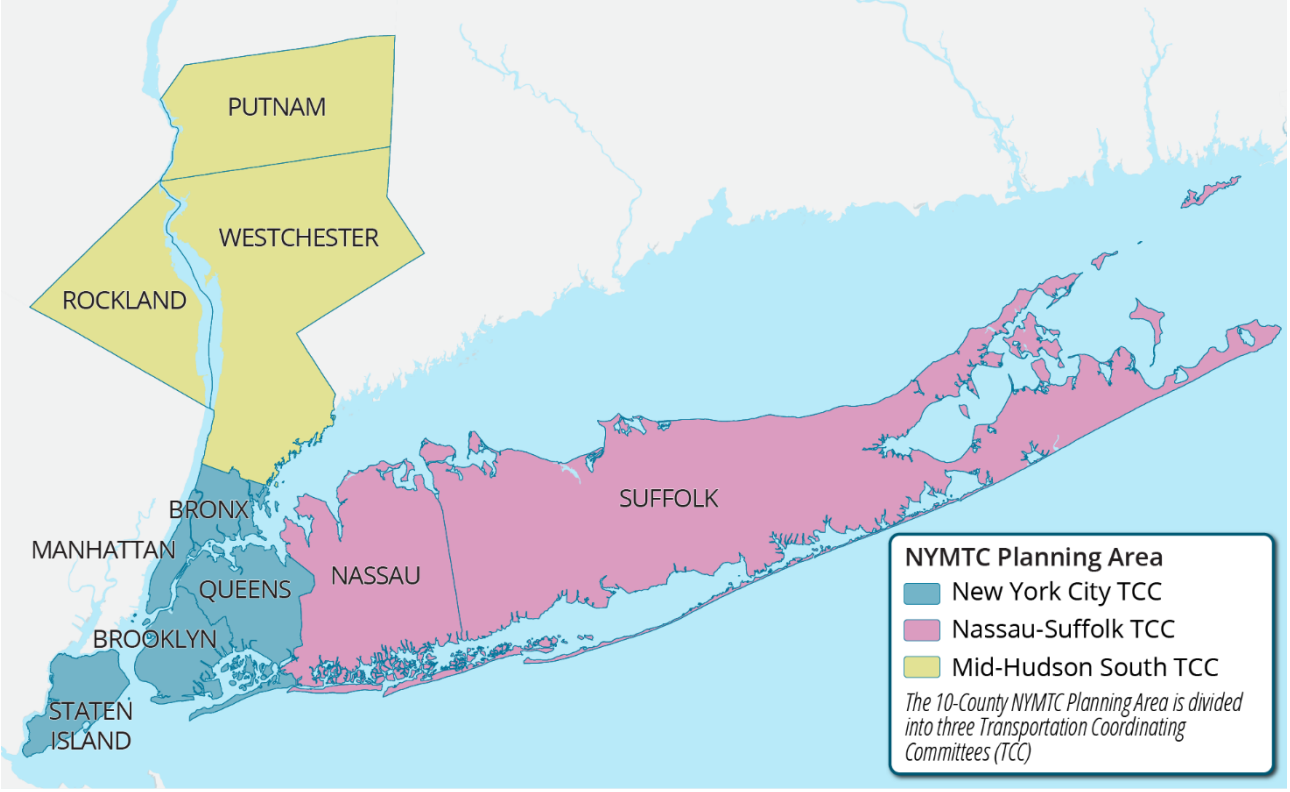
Figure 2.2 NYMTC Organization



Source: NYMTC.

As shown in Figure 2.3, NYMTC's members are also divided into three geographically based TCCs representing New York City, Mid-Hudson South, and Nassau/Suffolk to address subregional transportation needs and issues.

Figure 2.3 NYMTC Planning Areas and TCCs



Source: NYMTC.

ORGANIZATIONAL RESPONSIBILITIES

Federal legislation and related planning regulations require MPOs to produce a 20+ year horizon long-range Regional Transportation Plan (RTP), a five-year Transportation Improvement Program (TIP), and an annual Unified Planning Work Program (UPWP). *Moving Forward 2055* is the RTP for fiscal years 2026–2055 for the NYMTC planning area. *Moving Forward 2055* includes forecasts of future conditions and needs and potential transportation improvements, as well as a shared strategic vision for transportation and development within the NYMTC planning area.

Thus, *Moving Forward 2055* fulfills Federal planning requirements and maintains NYMTC's eligibility for Federal funding for transportation planning and improvement projects. NYMTC acts as a regional forum for collaborative planning and facilitates informed decision-making among its members by providing sound technical analysis and forecasts. This ensures that the region is prepared to receive the maximum Federal funds available to support progress towards mobility goals.

2.1.2 THE METROPOLITAN TRANSPORTATION PLANNING PROCESS

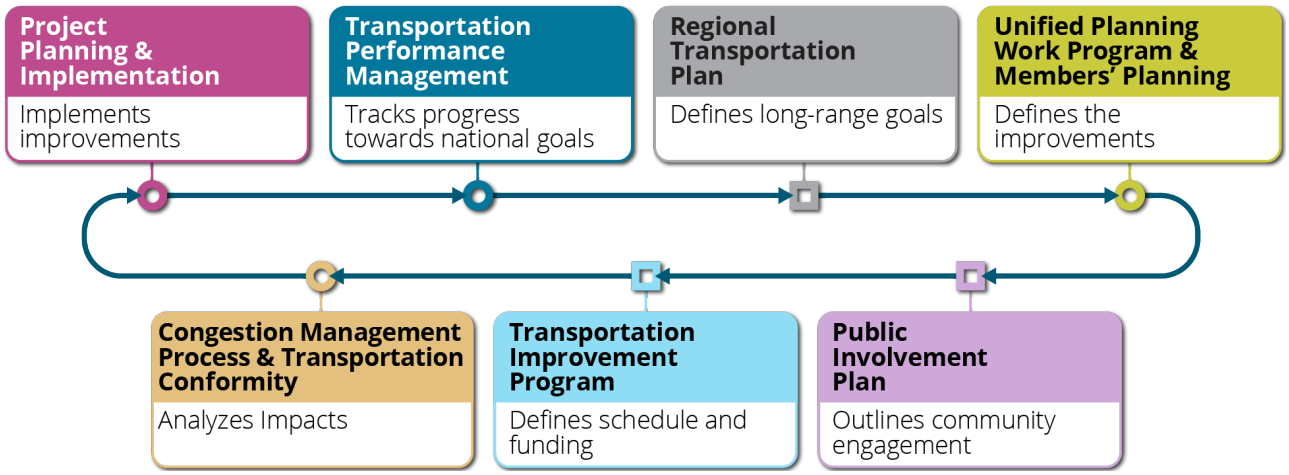
Transportation issues cross the boundaries and responsibilities of individual jurisdictions and organizations, and each member agency of NYMTC brings a unique perspective and jurisdictional responsibilities to the transportation planning process. However, when these members come together as NYMTC, they collectively pursue their Shared Vision for Regional Mobility and its relationship to future growth and development in the NYMTC planning area.

FEDERAL REQUIREMENTS

The U.S. Congress authorizes Federal funding for transportation improvements through multi-year authorization legislation. The Infrastructure Investment and Jobs Act (IIJA) is the current Federal transportation legislation that authorizes funding and establishes the requirements for the metropolitan transportation planning process that governs NYMTC's activities. The IIJA was signed into law in 2021 and carried forward most of the requirements of its predecessor legislation, including the requirement for transportation performance management.

The federally required metropolitan transportation planning process establishes a continuing, comprehensive and cooperative regional framework for multimodal transportation planning. As part of this process, NYMTC is required to produce the following products and analyses. Figure 2.4 depicts the relationships of these products within the overall process.

Figure 2.4 Metropolitan Transportation Planning Products and Process



Source: NYMTC.

FOUR PLANNING PRODUCTS

1. The RTP, (this document) describes long-range goals, objectives, and needs, typically over a 20- to 25-year horizon.
2. The TIP defines Federal funding for specific transportation projects and actions, typically over a five-year period.

3. The UPWP determines how Federal funding for planning activities will be spent over the course of a program year.
4. A Public Involvement Plan describes and guides efforts to include communities, stakeholders, and the public in the ongoing planning process.

THREE PLANNING PROCESSES

1. The Congestion Management Process (CMP) monitors and forecasts traffic congestion, and considers congestion-reduction strategies in federally designated Transportation Management Areas.
2. Transportation Conformity is a quantitative demonstration of how the fiscally constrained RTP and TIP conform to transportation vehicle and equipment (also known as mobile sources) pollution targets set in response to federally mandated air quality standards.
3. Transportation Performance Management is defined as a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals, as seen below.

NATIONAL TRANSPORTATION GOALS AND PLANNING FACTORS

The U.S. Congress established National Transportation Goals in the areas of safety, pavement and bridge infrastructure, congestion reduction, system reliability, freight movement, environmental sustainability, and project delivery. These goals, which appear in Table 2.1, were carried forward into the IIJA, along with related Federal requirements for transportation performance management.

Table 2.1 National Transportation Goals

Goal Area	National Goal
Safety	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
Infrastructure Condition	To maintain the highway infrastructure asset system in a state of good repair.
Congestion Reduction	To achieve a significant reduction in congestion on the National Highway System.
System Reliability	To improve the efficiency of the surface transportation system.
Freight Movement and Economic Vitality	To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
Environmental Sustainability	To enhance the performance of the transportation system while protecting and enhancing the natural environment.
Reduced Project Delivery Delays	To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

Source: 23 United States Code Section 150.

In addition to the National Transportation Goals, 23 Code of Federal Regulations (CFR) 450.306 (B) indicated the following:

The metropolitan transportation planning process shall be continuous, cooperative, and comprehensive, and consider implementation of projects, strategies, and services that address the following factors:

1. *Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.*
2. *Increase the safety of the transportation system for motorized and non-motorized users.*
3. *Increase the security of the transportation system for motorized and non-motorized users.*
4. *Increase accessibility and mobility of people and freight.*
5. *Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and state and local planned growth and economic development patterns.*
6. *Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight.*
7. *Promote efficient system management and operation.*
8. *Emphasize the preservation of the existing transportation system.*
9. *Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation.*
10. *Enhance travel and tourism.*

These Federal planning factors are considered in NYMTC's Shared Vision for Regional Mobility and *Moving Forward 2055's* goals and related objectives shared in Chapter 1 and, consequently, in the strategies and actions guiding NYMTC's activities as detailed throughout this document. Table 2.2 links the *Moving Forward 2055* goals to the Federal planning factors, showing overall alignment between regional goals and the Federal planning factors (which represent the Federal goals in Table 2.1).

Table 2.2 *Moving Forward 2055* Strategic Consistency Matrix

Moving Forward 2055 Goals	National Goals & Federal Planning Factors									
	Support Economic Vitality	Increase Safety & Security	Increase Accessibility and Mobility	Improve Efficiency	Improve the National Freight Network	Protect and Enhance the Environment	Enhance Integration & Connectivity	Emphasize System Preservation	Improve Resiliency & Reliability	Enhance Travel & Tourism
1 A transportation system for which safety and security are maximized for people and goods across all uses and modes.	●	●			●					●
2 A transportation system for which infrastructure is maintained and improved in a sustainable manner.	●					●		●		
3 A transportation system for which resiliency is supported through mitigating, adapting to, and responding to chronic and acute stresses and disruptions.		●			●	●		●	●	
4 A transportation system for which congestion is mitigated through investments and technology in support of healthier communities, more seamless travel, improved quality of life, and regional economic competitiveness.	●		●	●	●	●	●		●	
5 A transportation system for which land use decisions are encouraged in support of strategic transportation enhancements and improving modal choices.	●		●		●	●	●			
6 A transportation system for which fairness in transportation is advanced and access to opportunities is improved for all communities.	●	●	●	●			●			●
7 A transportation system for which environmental impacts—including harmful pollution—are significantly reduced through technology applications, increased use of greener travel options, and improved system efficiency.				●		●		●	●	

Source: Cambridge Systematics.

2.1.3 MEASURING PERFORMANCE

Starting with the 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21), and further detailed through subsequent authorizations and rulemakings, state DOTs, MPOs, and transit providers have integrated performance management approaches into surface transportation planning and programming. MPOs are required to include in their plans "a system performance report and subsequent updates evaluating the condition and performance of the transportation system with respect to the performance targets." NYMTC's System Performance Report can be found in Chapter 3 of *Moving Forward 2055*.

Performance management requirements were further stipulated in the Metropolitan Transportation Planning Final Rule issued May 27, 2016, in Section 23 CFR 450.306(d). The MAP-21 legislation transformed the Federal-aid program by placing greater emphasis on performance-based planning, where performance measures and targets provide an objective means of informing decisions about strategies and investments when making decisions about transportation investments.

U.S. DOT recommended a framework for performance management that should result in a performance-based transportation plan. The framework includes four phases—(1) planning; (2) programming; (3) implementation and; (4) evaluation:

- The planning phase consists of setting a strategic direction ("Where do we want to go?"). It encompasses goals and objectives and performance measures.
- The programming phase includes an analysis of how a region will move forward in achieving identified goals and objectives through investments and policies ("How are we going to get there?").
- The implementation phase tries to answer the question, "What will it take?" through delivery of transportation projects and services and maintenance and operation of the system.
- The evaluation phase seeks to answer the question, "How did we do?" as a means to identify opportunities for new planning and investment.

NYMTC is actively implementing a performance-based approach to address metropolitan transportation planning requirements. *Moving Forward 2055's* Shared Vision for Regional Mobility augments this federally required framework to measure the Plan's progress toward achieving the resulting strategic framework.

2.2 REGIONAL PLANNING CONTEXT—THE MULTISTATE METROPOLITAN REGION

The multistate metropolitan region surrounding New York City lies at the heart of the Northeast Megaregion, the most densely populated, urbanized land in the country. The Megaregion (also referred to as the Megalopolis), as defined by the U.S. Census Bureau, and presented in Figure 2.5 includes the metropolitan areas of Washington, D.C., Baltimore, Philadelphia, New York City, and Boston. According to the U.S. Census Bureau, the Megaregion is home to approximately 50 million people, more than 15 percent of the nation's total population.[1] The Megaregion is also a major contributor to the U.S. economy, producing one-fifth of the national gross domestic product (GDP) in 2022.[2]

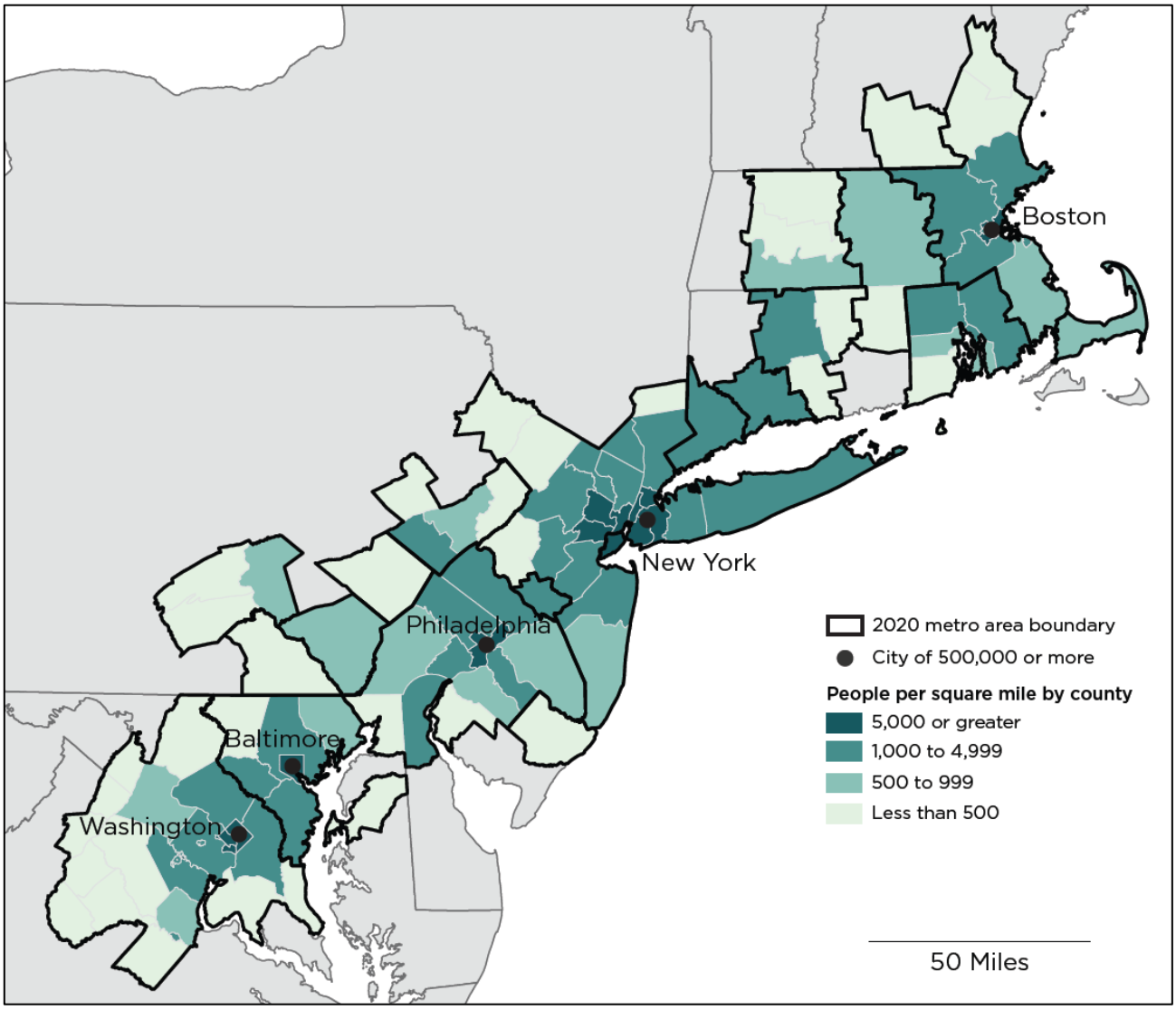
Within the Megaregion, the multistate metropolitan region which includes New York City is approximated by several Metropolitan Statistical Areas (MSA), which are delineated by the Office of Management and Budget. In the multistate metropolitan region, these MSAs include:[1]

- New York-Newark-Jersey City, NY-NJ-PA MSA
- Allentown-Bethlehem-Easton, PA-NJ MSA
- Kiryas Joel-Poughkeepsie-Newburgh, NY MSA
- Bridgeport-Stamford-Danbury, CT MSA
- New Haven, CT MSA
- Waterbury-Shelton, CT
- Hartford-East Hartford-West Hartford, CT MSA

Based on the populations of these MSAs, this multistate metropolitan region is home to 24.5 million people (2022 estimate) and covers 34 counties.[3] In 2022, the GDP of the metropolitan region was $2.5 trillion, which ranked eighth among the world's countries while accounting for roughly 10 percent of the 2022 U.S. GDP of $25.5 trillion.[4]

[1] The MSAs are based on an approximation of the regions defined by the Metropolitan Area Planning (MAP) Forum, a consortium of 10 MPOs—including NYMTC—and councils of government from New York, New Jersey, Connecticut, and Pennsylvania.

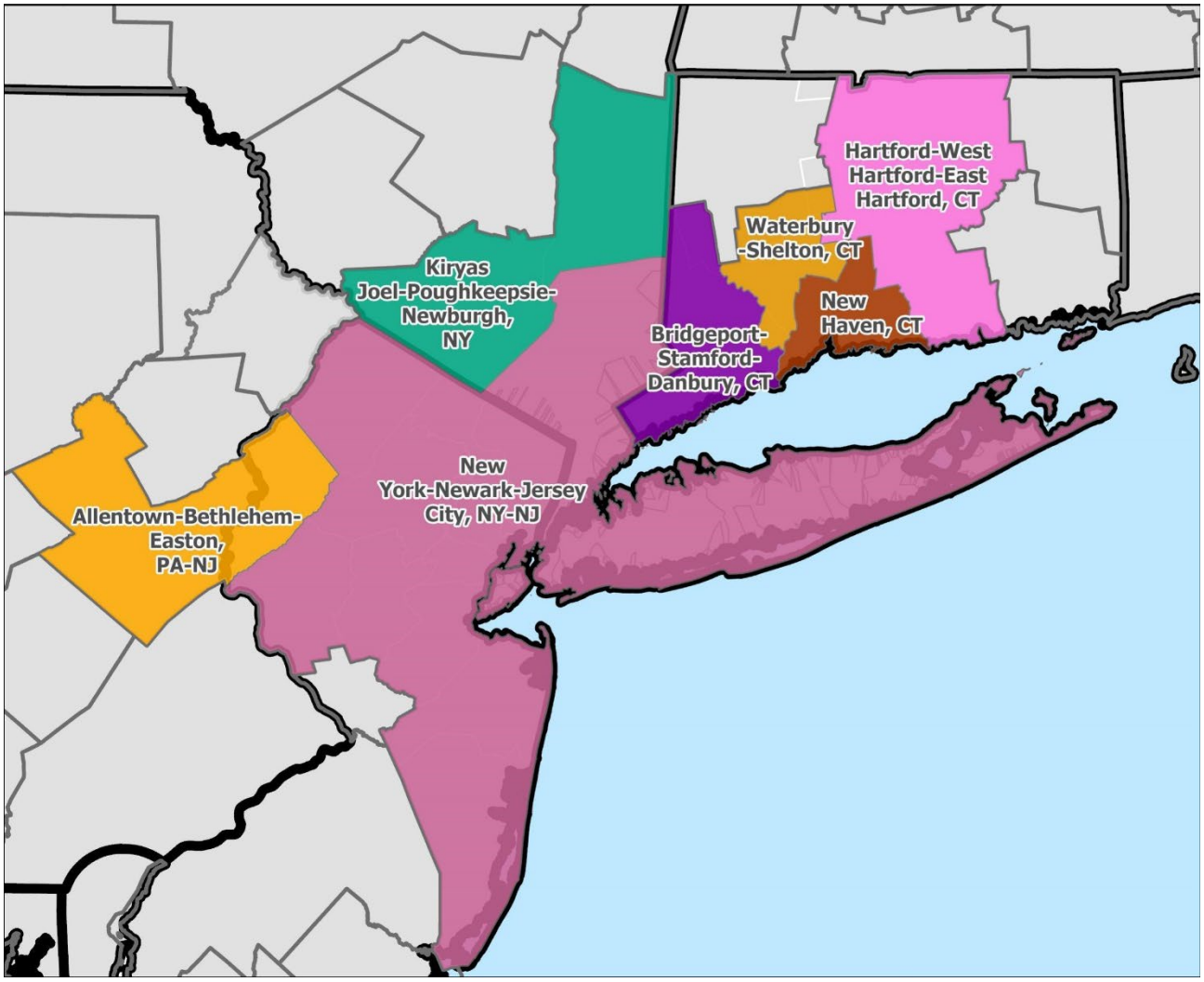
Figure 2.5 The Northeast Megaregion



Source: U.S. Census Bureau, 2021.[5]

While New York City is the largest municipality in the multistate metropolitan region, the region also contains the largest cities in New Jersey (Newark, Jersey City, and Paterson) and Connecticut (Stamford, Bridgeport, New Haven, Waterbury, and Hartford) as well as large suburban municipalities on Long Island (Hempstead, Brookhaven, and Babylon), in the Lower Hudson Valley (Yonkers, Mount Vernon, Newburgh, New Rochelle, Poughkeepsie, and White Plains), and throughout Connecticut and New Jersey.

Figure 2.6 Map of Metropolitan Statistical Areas



Source: U.S. Census Bureau.

The multistate region approximated by the MSAs represented in Figure 2.6 also includes the planning areas of various MPOs and councils of government (COG), including:

- The Orange County Transportation Council in New York State;
- The North Jersey Transportation Planning Authority in New Jersey;
- The Lehigh Valley Planning Commission in eastern Pennsylvania;
- The Western Connecticut, Naugatuck Valley, Connecticut Metropolitan, South Central Regional, Capitol Region, and Lower Connecticut River Valley COGs in southwestern and central Connecticut.

2.2.1 REGIONAL CHARACTERISTICS

GEOGRAPHY AND ENVIRONMENT

At the geographic center of the multistate metropolitan region lies New York City, which is comprised of five boroughs stretched across all or parts of three islands as well as a portion of the mainland. The City shares a natural harbor at the southern end of the Hudson River with northern New Jersey to the west. East of the City lies Nassau and Suffolk counties on Long Island, known for their beach-lined coastline and barrier islands.

To the west of New York City across the Hudson River lies northern New Jersey, an area that contains thirteen counties, several large cities, and many populous suburban communities within the multistate metropolitan region. Further west, the easternmost portion of Pennsylvania lies at the foothills of the Blue Mountains and is characterized by the valleys formed by the Lehigh River and Delaware River—the latter of which creates the border between Pennsylvania and New Jersey. This area, known as the Lehigh Valley, is the third most populated area in Pennsylvania and serves as the Western gateway to the larger metropolitan regions to the east and south.

North of New York City in the metropolitan region is the Lower- and Mid-Hudson Valley, a region comprised of six counties (Westchester, Rockland, Putnam, Orange, Ulster, and Dutchess). This area is dotted with suburban communities of varying size and small urban centers, as well as Federal, state, and local areas for recreation, forest and wildlife including the Delaware Water Gap National Recreation Area and Harriman and Bear Mountain State Parks. Additionally, while Rockland County is bounded by the two state parks, it also is home to over 300,000 people in high-density suburbs. The county has the smallest available land area of any county in New York outside of New York City. To the east of the Hudson Valley counties are the southwestern and central sections of the State of Connecticut. This area of Connecticut includes eight of the largest communities in the state, including the City of Hartford, which is the state capital, as well Bridgeport, New Haven, Stamford, Waterbury, Danbury, Greenwich, and Norwalk.

ECONOMY

Although economic activity in New York City—Manhattan in particular—predominates, Long Island, the Lower Hudson Valley, northern New Jersey, eastern Pennsylvania, and southwestern and central Connecticut all contribute significantly to the multistate region's economy. Agriculture and tourism are important to the Long Island and Hudson Valley economies. Northern New Jersey is home to the busiest port on the United States' East Coast, the Newark-Elizabeth Marine Terminal, which handled over 9 million twenty-foot equivalent units (TEU), which are units of cargo capacity, in 2022.[6] The suburban areas close to New York City also have their own economic ecosystems, often including major corporations. Rockland and Westchester Counties in New York State and the southwestern portion of Connecticut, for example, are home to major business centers that draw commuters who live in New York City and elsewhere in the region.[7] The Route 110 Corridor in Suffolk County on Long Island is a similar suburban business center.

Areas further from the New York City core have varied economic profiles. Eastern Pennsylvania, for example, is a major industrial, business, and natural resource center that has historically been

manufacturing-based and is currently the site of a variety of industrial firms, such as the global headquarters of Air Products and Chemicals, Mack Trucks, Olympus Americas, as well as warehouses and distribution centers.[8] Central New Jersey is home to several major pharmaceutical companies. Orange County has also become a center for warehouse distribution and procurement centers with an emerging film industry, due in part to small urban centers like Newburgh.

DEMOGRAPHICS

The multistate metropolitan region's population is also large and diverse, with a variety of large communities hailing from all over the world. The U.S. Census Bureau estimates that in 2022, the region's population was 24.5 million,[9] with nearly 27 percent born outside of the United States. As many as 800 languages are spoken within the region. A large population provides a large workforce, and in 2022 the total size of the region's workforce was 12.9 million.[10] Of those employed, the largest shares of jobs were in educational, health and social services; professional, scientific, and waste services; retail trade; and finance and real estate.[11]

2.2.2 TRANSPORTATION SYSTEM OVERVIEW

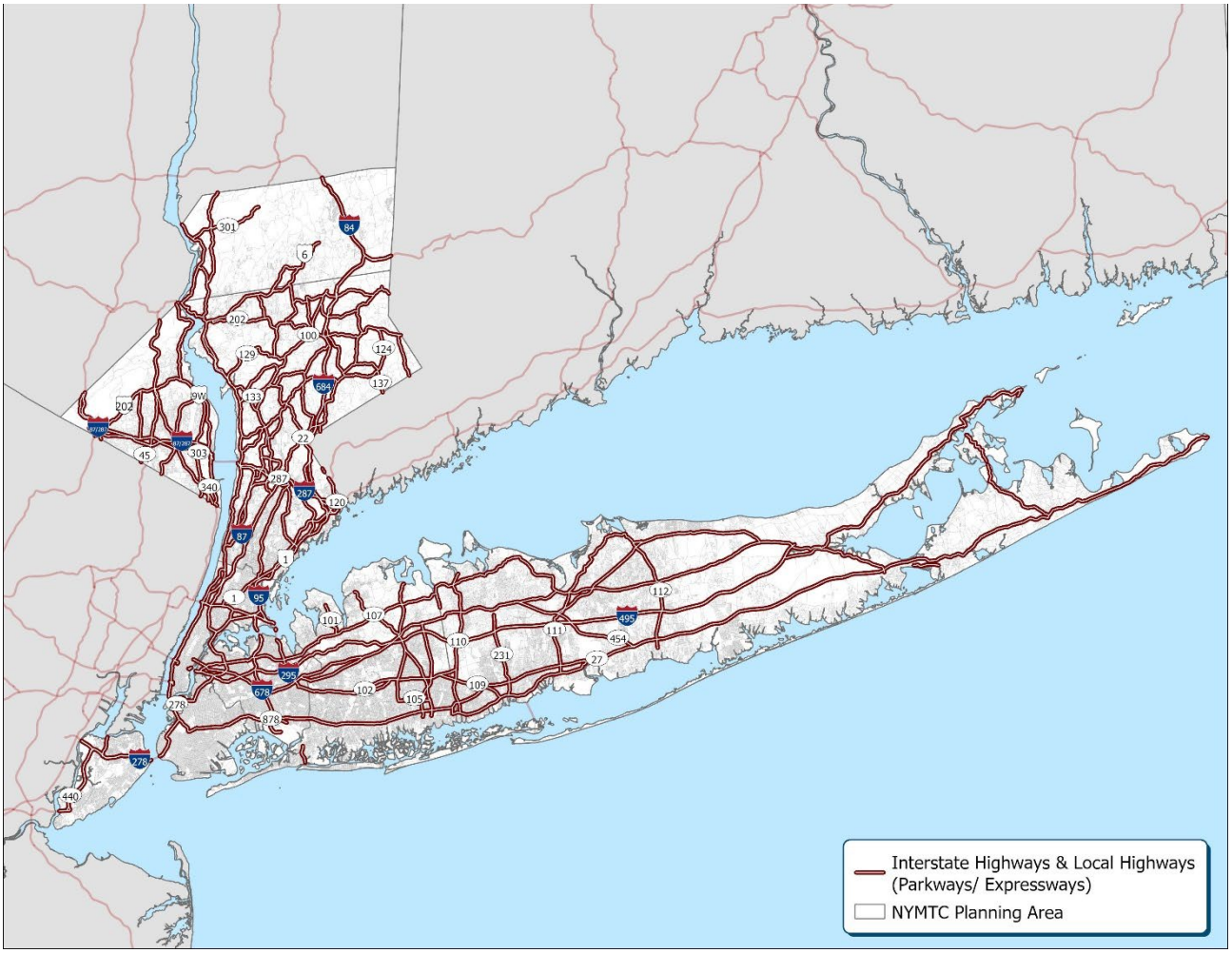
In a region as large, diverse, and economically robust as the multistate region, a transportation system that reliably moves goods and people is vital to supporting economic activity and enhancing quality of life for its residents. The transportation system of the multistate metropolitan region is large, complex, and aging. The system is tied together by a network of highways and rail lines, while its topography and water bodies are crossed by elevated roadways and rail lines, as well as bridges and tunnels. Protected lands in the region are a welcome natural resource, but they often disrupt the continuity of transportation facilities, including trip duration. The region's transportation system is outlined below.

MAJOR ROADWAYS

Major roadways in the NYMTC planning area are presented in Figure 2.7 and include:

- Interstate highways I-78 and I-80, which extend from New York City west into Pennsylvania;
- I-84, which extends from Pennsylvania through both New York and Connecticut;
- I-95, a north-south highway which includes the, the Cross Bronx Expressway and the New England Thruway, as well as the New Jersey Turnpike;
- I-87, which becomes the New York Thruway between New York City and Albany;
- I-278, which connects four of New York City's five boroughs, while forming a partial beltway around Manhattan;
- I-287, which forms a partial belt around New York City through Westchester County, Rockland County and northern New Jersey;
- I-495, known as the Long Island Expressway; and
- I-684, linking Westchester County and Putnam County.

Figure 2.7 Interstates, Highways, and Major Highways (Parkways/Expressways) Within NYMTC Region



Source: NYMTC.

Additional major highways within the multistate metropolitan region include:

- NY Route 17, which is being assessed for conversion to I-86 in the future;
- I-91, a north-south highway between New Haven and the Canada-United States border;
- I-280, which links I-80 to the New Jersey Turnpike;
- U.S. Route 22 which extends from northern New Jersey through the Lehigh Valley in Pennsylvania and connects to I-78 as well as I-80, by way of PA Route 33; and
- The Garden State Parkway, which links northern New Jersey to New York State and I-287 in Rockland County.

BRIDGES AND TUNNELS

Given the multistate region's topography, bridges and tunnels are common, carrying both roadways and rail lines across or under rivers and other water bodies. Major crossings include:

- Four bridges and two tunnels crossing the East River between Manhattan, Brooklyn, and Queens,
- One bridge and two tunnels crossing the Hudson River between Manhattan and northern New Jersey,
- Three bridge crossings between Staten Island and northern New Jersey,
- Three bridge crossings between western New Jersey and the Lehigh Valley in Pennsylvania, part of the Delaware River Joint Toll Bridge Commission system.
- Various significant bridge crossings of water bodies in northern New Jersey and the Hudson Valley, and
- Various rail tunnel crossings part of the MTA, NJ TRANSIT, and Port Authority Trans-Hudson systems.

PASSENGER RAIL FACILITIES

Rail services are provided by:

- NJ TRANSIT, the MTA's Metro-North Railroad (MNR), and MTA Long Island Rail Road (LIRR) commuter rail networks;
- CTrail Hartford Line and Shore Line East commuter rail service;
- MTA New York City Transit's (NYCT) subway network;
- Port Authority Trans-Hudson (PATH) rail rapid transit service;
- NJ TRANSIT's Hudson-Bergen Light Rail and Newark Light Rail systems; and
- The National Railroad Passenger Corporation (Amtrak) provides intercity rail services along the Northeast Corridor.

FREIGHT RAIL FACILITIES

Three Class I railroads operate in the multistate region—CSX, Norfolk Southern, and Canadian Pacific Railway. In addition, Conrail Shared Assets, a switching carrier jointly owned by Norfolk Southern and CSX, operates in much of northern New Jersey and in Staten Island. One major freight terminal in Bethlehem, PA is operated by Lehigh Valley Rail Management. Various short-line railroads also serve the region.

PORT FACILITIES

Maritime freight facilities are located at the Port of New York and New Jersey in Brooklyn, Staten Island and northern New Jersey, and at John F. Kennedy International Airport, as well as at reliever ports in Bridgeport, New Haven, and New London, CT.

FERRY SERVICES

The multistate region is well-served by ferries:

- In New York City, ferries connect various points throughout the City as well as provide intercity service to more distant locations in New Jersey, Connecticut, and Long Island. Major operators include the NYC Department of Transportation (NYC DOT), and operator of the Staten Island Ferry, Hornblower (operator of NYC Ferry), NY Waterway, and Seastreak.
- NY Waterway, under contract to MTA MNR, also has ferry service in the Hudson Valley between Newburgh and Beacon as well as between Haverstraw and Ossining, in both cases, connecting passengers to MNR rail service.
- Long Island Ferry Service operates across the Long Island Sound between Orient Point on Long Island's North Fork to New London as well as from Port Jefferson on the North Shore to Bridgeport. Other Long Island ferries connect Montauk with Block Island, Rhode Island, and New London, Connecticut.

AIRPORTS

The multistate region is served by both commercial service and general aviation airports:

- The multistate region is served by five major commercial airports—John F. Kennedy International Airport and LaGuardia Airport in Queens, NY; Newark Liberty International Airport in Newark, NJ; Bradley International Airport outside Hartford, CT; and Lehigh Valley International Airport in Lehigh County, PA.
- A variety of smaller commercial and general aviation airports also service the area, including Long Island MacArthur Airport and Republic Airport in Suffolk County, NY; Westchester County Airport in Westchester County, NY; Stewart International Airport in Orange County, NY; Teterboro Airport in Bergen County, NJ; and Tweed New Haven Regional Airport in New Haven, CT.

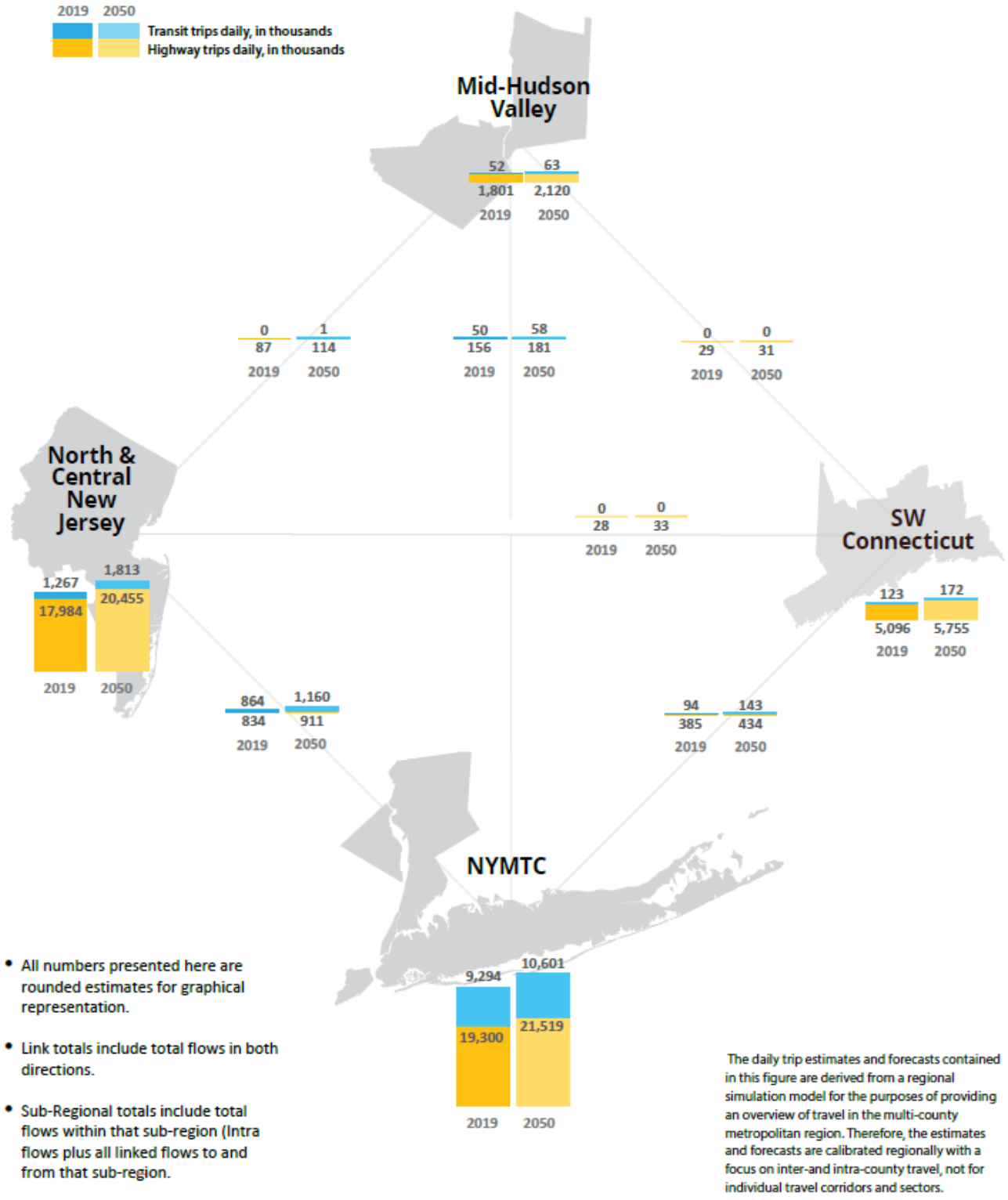
2.2.3 METROPOLITAN TRAVELSHED

Figure 2.8 is a representation of the daily travelshed throughout most of the multistate metropolitan region. The travelshed represents average daily travel patterns between adjacent metropolitan regions. Daily transit and highway trip estimates are shown for 2019 and forecasted to the 2050 horizon year within and between four subregional areas—northern and central New Jersey, southwestern Connecticut, the Mid-Hudson Valley, and the NYMTC Region. These estimates are derived through the New York Best Practice Model (NYBPM), an activity-based transportation demand model that covers 28 metropolitan area counties and is maintained by NYMTC. Figure 2.9 represents the movement of commerce within and between these same subregions and is also forecasted to the 2050 horizon year.

Figure 2.8 demonstrates that in terms of daily trips made *between* the subareas, the majority of inter-area trips are and will be made between the NYMTC region and northern and central New Jersey, and between southwestern Connecticut and the NYMTC region. These sets of inter-area trips also feature significant proportions of transit trips. While there is significant current and projected travel between the four subareas, most current and future trips are and will be *within* each subarea, with the greatest volume of daily intra-area trips being made in northern and central New Jersey and within the NYMTC region. By far, the greatest number of daily transit trips made within a subarea are and will be within the NYMTC region.

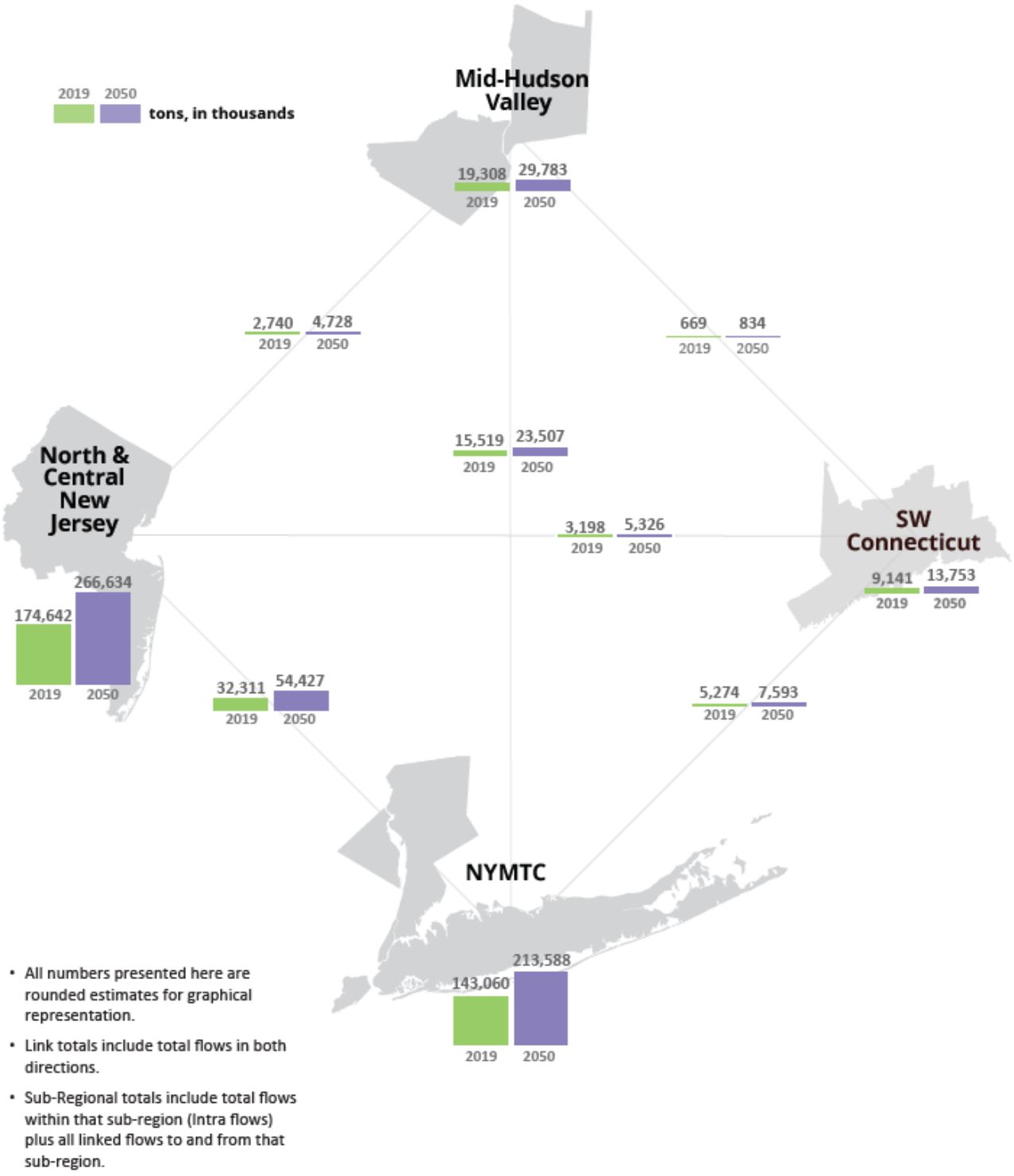
Figure 2.9 shows that regarding inter-regional freight commodity flows, most current and future freight movement, by tons, will occur between the NYMTC region and northern and central New Jersey, and between the Mid-Hudson Valley and the NYMTC region. For intra-regional commodity flows, the greatest tonnage of freight being moved is and will be within northern and central New Jersey, and within the NYMTC region.

Figure 2.8 Multistate Metropolitan Travelshed



Source: NYMTC.

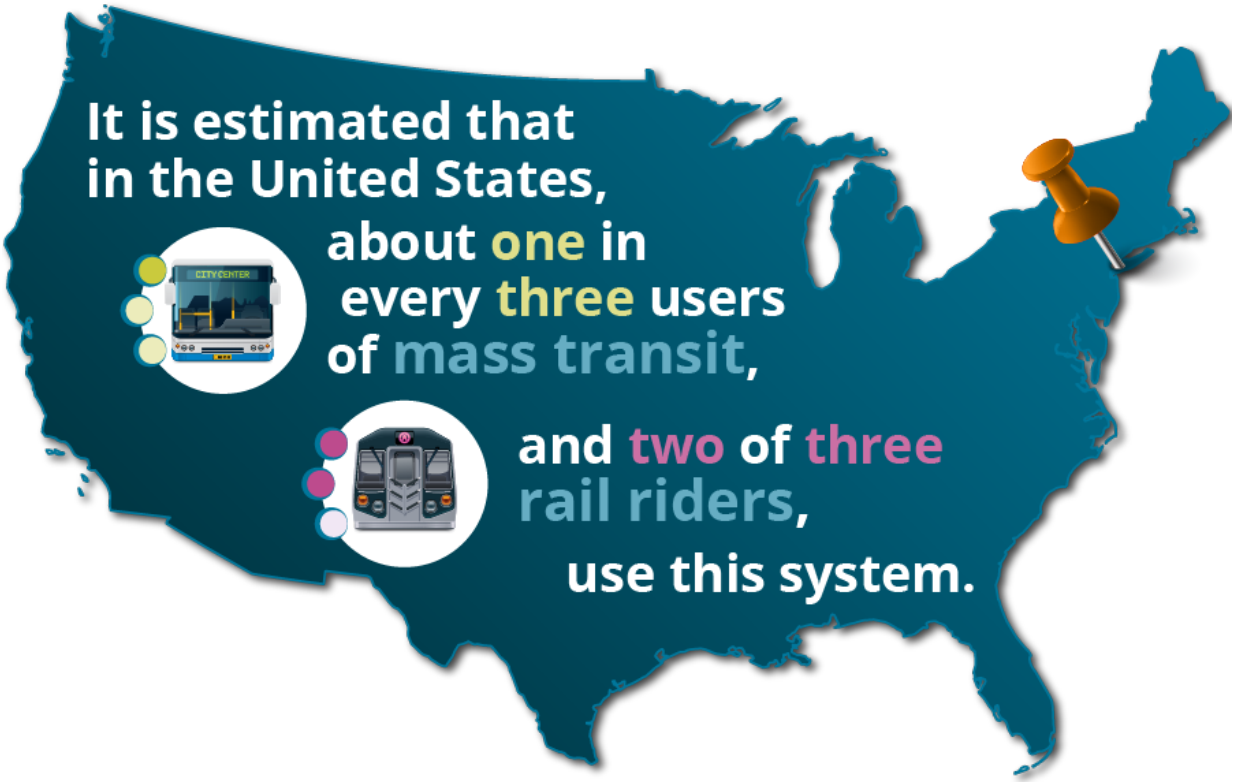
Figure 2.9 Multistate Metropolitan Freight Commodity Flows



Source: NYMTC.

The core of the multistate metropolitan region is notable for its mass transit system. As depicted in Figure 2.10, it is estimated that in the United States, about one in every three users of mass transit, and two of three rail riders, use this system.[12] New York City is served by an extensively used subway and bus system, and its more immediate suburban neighbors are served by commuter rail and local bus systems, including NJ TRANSIT, one of the largest statewide, transit systems in the country. Despite the robust transit system, gaps still exist within the network. For example, there is not a one-seat ride (meaning that the rider does not have to make transfers or connections) via rail to New York City for locations west of the Hudson in the region. Intercity travel is provided by Amtrak, long-haul buses, and air travel facilities. The region is the busiest airspace in the United States, with major airports in the region's core serving more than 130 million passengers annually.[13]

Figure 2.10 Magnitude of Mass Transit Ridership in the Region



Source: Cambridge Systematics.

2.2.4 TRANSPORTATION INVESTMENTS

Due to the continued growth of the region and aging infrastructure that requires renewal, several regionally significant improvements to the transportation infrastructure are either planned or are being implemented in the multistate metropolitan region. Major New York City-focused projects include the second phase of the Second Avenue Subway in Manhattan, the Hudson Tunnel and various other trans-Hudson River rail and vehicular crossing improvements, the Interborough Express in Brooklyn and Queens, and commuter rail improvements involving Penn Station.

While passenger transport is critical, these important projects are not limited to the movement of people. In such a densely populated and economically active region, freight transportation is critical as well, and several major projects are dedicated to freight in the region. For example, the Port Authority's Cross Harbor Freight Program is seeking to address the difficulty of moving freight from one side of New York Harbor to the other by examining a wide range of alternatives, including railcar and truck floats, container barges, and a cross-harbor rail tunnel.

A variety of improvement projects in the multistate metropolitan region, including those mentioned above, are designated as *boundary projects* whose impacts cut across planning areas and state lines. Critical boundary projects include the following:

NEW HAVEN LINE/I-95 SECTOR

- The Penn Station (New York) Access project will provide direct access for the MTA MNR's New Haven Line in Westchester County, New York and southwestern Connecticut to Manhattan's Penn Station[14] and create four new neighborhood stations in the eastern Bronx.
- The second phase of the Southeast, New York-to-Danbury, Connecticut Link Feasibility/Planning Study that is assessing the feasibility of restoring passenger rail service on the Beacon Line between Connecticut and Putnam County, NY, where it would connect to the MTA MNR Harlem Line.
- I-95 improvement projects in Connecticut from Stamford to Bridgeport and Old Lyme to New London, New Haven Line commuter rail service improvements, and new rolling stock purchases for the Shore Line East Rail Line.
- New Haven Main Line improvements, including a replacement of the Devon moveable bridge carrying the four-track main rail line over the Housatonic River between Stratford and Milford.
- Northeast Corridor Improvements include the replacement of seven power substations along the New Haven Line, track structure modifications, and rail replacements/drainage improvements.
- The Regional Value Capture Feasibility Study analyzing the potential of implementing value capture techniques to fund capital improvements along the Danbury and New Canaan branches of the New Haven Line in Connecticut.
- All six stations along the Waterbury Branch Rail Line are undergoing upgrades or replacements, to ensure stations are accessible for all riders.
- Replacement of Connecticut River Bridge between Old Saybrook and Old Lyme with a modern and resilient movable bridge immediately south of the existing structure.
- New Haven to Providence (Rhode Island) Capacity Planning Study for future infrastructure, speed, and capacity improvement options between the two cities.

EAST LOWER HUDSON VALLEY/CONNECTICUT SECTOR

- Various improvement projects along I-84 in both Connecticut and the Hudson Valley, including a complete replacement of the I-84/Route 8 interchange in Waterbury, CT and improvements to the I-84/I-684 interchange in northern Westchester County, NY.
- U.S. Route 7/Connecticut Route 15 interchange project in Norwalk will reconfigure the on and off ramps and provide new connections to and from both highways, which are of interregional importance.
- The recently completed Charter Oak Bridge project (I-91/Route 15 in Hartford) has addressed the congestion that had caused this location to appear on the American Transportation Research Institute's list of top 100 truck bottlenecks in the country.
- The WALK Bridge Replacement, planned for completion in 2029, will replace the original bridge with a new $925 million bridge with two independent, movable spans that are designed and constructed to be resilient and sustainable for extreme weather events.
- Merritt Parkway (Connecticut Route 15) ramp metering to address congestion and current volumes and speeds.
- The Route 1 Bus Rapid Transit Project in the heavily traveled Route 1 corridor between the New York State line and New Haven.
- The ongoing Greater Hartford Mobility Study will identify significant capital improvement projects related to the I-84 viaduct in Hartford as well as the interchange of I-84 and I-91.
- The Western Connecticut Council of Governments' Regional Transit Study will look at three public bus transportation systems (CTransit, HART, and Norwalk Transit District), two of which also serve Westchester and Putnam destinations.
- The Naugatuck River Greenway Trail, a planned 44-mile multi-use trail connection between the confluence of the Naugatuck and Housatonic Rivers in Derby and Torrington.
- The Pequonnock River Trail, which will provide a 16-mile continuous shared-use trail from Long Island Sound through Trumbull to the Monroe-Newtown town line.

TRANS-HUDSON SECTOR

- West-of-Hudson transit improvements, including improvements to the Port Jervis Line in Orange County, NY.
- The Restore the George Program, a $2 billion, decade-long project to rehabilitate and replace major components of the George Washington Bridge.
- The Lincoln Tunnel Helix Replacement in Weehawken, NJ.
- The Hudson Tunnel Project to create an additional rail tunnel that would preserve the current functionality and strengthen the resiliency of the Northeast Corridor's Hudson River rail crossing between New Jersey and New York. The project is one major component of the Gateway Program.

- The Gateway Program's strategic rail infrastructure improvements designed to improve current services and create new capacity that will double passenger trains running under the Hudson River.
- The Cross Harbor Freight Program for rail freight across New York Harbor.
- The Port Authority Bus Terminal Replacement and the redevelopment of Penn Station on Manhattan's west side.
- The expansion and modification of Secaucus Junction Station in New Jersey.
- Public transit service expansion to Newark Liberty International Airport, to improve airport access.
- Construction of the Bergen Loop track in Secaucus, NJ, which will enable a one-seat commuter rail ride to Manhattan from West of Hudson communities in New York State (Rockland and Orange counties) and New Jersey (Bergen County).

NEW YORK CITY SECTOR

- Phase II of the Second Avenue Subway Project to extend the subway to the Upper East Side and Eastern Harlem sections of Manhattan.
- The Interborough Express Project to develop surface transit along the Bay Ridge Line in Brooklyn and Queens.
- Airport access improvements, including transit and roadway improvement for John F. Kennedy International Airport and bus service improvements to LaGuardia Airport.

NORTHERN NEW JERSEY/EASTERN PENNSYLVANIA SECTOR

- The Port Street Corridor Improvement Project, a projected $176 million rehabilitation and modernization project to improve safety and truck access at the northern end of Port Newark.
- Newark Bay-Hudson County Extension from New Jersey Turnpike Interchange 14 in Newark to Jersey Avenue in Jersey City, NJ.

REGIONAL RAIL CORRIDORS

The following rail corridors are part of the IIJA-created Corridor Identification and Development Program:

- Reading-Philadelphia-New York Corridor connecting Reading, PA with Philadelphia, and New York City with new intermediate stops at Pottstown, Phoenixville, and potentially Norristown, PA, then using the Northeast Corridor between Philadelphia and New York.
- Scranton to New York Penn Station Corridor connecting Scranton, PA, and New York City with intermediate stops at Stroudsburg and Mt. Pocono, Pennsylvania, and Blairstown, Dover, Montclair, Morristown, and Newark, NJ.
- Amtrak to Long Island Corridor connecting Long Island, NY, to the national intercity passenger train network by extending three existing daily round trips between Washington, D.C., and New York City, east to Ronkonkoma, NY.

- Empire Corridor improving existing Amtrak Empire service between New York City and Niagara Falls, NY, via Albany, Utica, Syracuse, Rochester, and Buffalo, NY, by adding frequencies, reducing travel time, and improving reliability.
- Hartford Line Corridor improving existing Amtrak Northeast Regional, Springfield Shuttles, Valley Flyer, and CTrail Hartford Line service as well as the Vermonter and future Inland Route corridors by restoring and constructing new rail infrastructure including track, stations, signal upgrades, and safety enhancements.

2.3 THE TRANSPORTATION SYSTEM IN THE NYMTC PLANNING AREA

The transportation system in the NYMTC planning area is one of the most complex and highly used in the world. It includes critical components of regional and national transportation networks that move both people and cargo. The share of passenger trips using public transportation is much higher in the NYMTC planning area than in other metropolitan regions in the United States. In addition, the planning area is an important hub of air and freight travel with three major international airports and several other reliever airports and aviation facilities. The Ports of New York and New Jersey also serve vital roles in the national and international freight distribution network.

The scale of the transportation system in, and adjacent to, the NYMTC planning area is immense. System components include:

- A total of 1,300 track miles of commuter rail; 665 mainline track miles of subway tracks; thousands of route miles of local, express, commuter, and intercity bus routes; and an aerial tramway.
- An extensive network of passenger hubs, such as bus terminals and subway transfer facilities, ferry landings, and transportation stations where people transfer between modes, including one of the most heavily used rail-to-airport links in the country.
- As of 2022, 1,522 lane miles of bike lanes were installed in New York City, ranging from shared-use bicycle trails to on-road bicycle lanes, in addition to pedestrian sidewalks, trails, and paths.[15] Long Island features 477 miles of bicycling lanes and paths. While the Lower Hudson Valley has over 100 miles of bike lanes.[16,17,18]
- More than 50,000 lane miles of roads and highways, including more than 30 major bridges crossing navigable waterways, four major underwater vehicular tunnels, and special lanes for high-occupancy vehicles and buses.
- Five commercial service airports, major passenger and air cargo operations and supporting infrastructure, and general aviation and heliport facilities.
- Major deep-water seaport facilities owned and operated by a mix of public- and private-sector entities, plus an extensive network of marine cargo support infrastructure and services.
- An extensive network of docking facilities along inland waterways supporting barge and ferry services.

- More than 400 route miles of freight rail, using track miles often shared with commuter rail services.
- A widespread network of freight hubs, including intermodal transfer facilities, rail yards, and truck-oriented warehouse and distribution centers.
- Supporting infrastructure like rail yards and highway maintenance facilities, highway rest areas, parking lots and garages, bus depots and transit storage yards, bicycle parking areas, toll gantries, signage, signals, enforcement cameras, electronics, and other equipment.

NYMTC's Moving Forward 2055 Interactive Map visualizes some of the most important components of the transportation system, including major highways and transit stops.

2.3.1 PUBLIC TRANSPORTATION

Subway service in and around New York City constitutes one of the largest and most complex services of its kind in the world, serving the boroughs of Manhattan, Brooklyn, Queens, and the Bronx, as well as portions of northeastern New Jersey. On Staten Island, a surface rapid rail system links 22 communities.

RAPID RAIL/SUBWAY

Components include:

- The MTA NYCT subway system operates more than 6,553 subway cars on 27 routes, 665 miles of track and serves 472 stations. In 2023, the subway served approximately 3.6 million passengers per weekday and a total of 1.15 billion passengers for the year.[19]
- MTA Staten Island Railway is part of the NYCT system; it offers 24-hour service on a single line of 21 stations from Tottenville at the southern end of the island to St. George Terminal in the north. Its infrastructure includes 29 track miles of mainline track, four track miles of yard and non-revenue track, 54 mainline switches, two support and maintenance shops, 29 bridge structures, and nine power substations. In 2023, the Staten Island Railway served 2.2 million customers. In 2024, Staten Island Railway introduced new trains as part of a fleet modernization program.
- Port Authority, PATH is a rapid rail system comprising four service routes and 13 stations in Manhattan, Hoboken, Jersey City, Harrison, and Newark. The PATH system operates 24 hours a day, seven days a week. In 2023, PATH transported 60 million passengers.[15]

BUS TRANSIT

Bus transit operators in the NYMTC planning area include NYCT, MTA Bus Company (MTA Bus), Nassau Inter-County Express (NICE), Suffolk Transit, the Westchester Bee-Line System, Putnam Area Rapid Transit (PART), Transport of Rockland (TOR), New York State's Department of Transportation (NYSDOT) Hudson Link service between Rockland and Westchester counties, and other service providers.

NEW YORK CITY SERVICES

- The MTA and NYCT provide around-the- clock bus service in New York City via 238 local bus routes, 20 Select Bus Service (SBS) routes, and 75 express routes. In 2023, these two bus divisions served more than 1.4 million customers on an average weekday and 427 million annually. There are 5,800 vehicles in the fleet, which traveled 152 million miles in 2023, all of which are accessible under the Americans with Disabilities Act (ADA).
- The MTA's Access-A-Ride paratransit service provides public transportation for eligible customers with disabilities that prevent them from using the public buses and subways. This service operates within the five boroughs of New York City and within a three-quarter-of-a-mile corridor beyond fixed-route service and to nearby areas of Nassau and Westchester counties. The service is a shared-ride program that operates without closures throughout the year. In 2023, there were a total of 11.3 million customers served and 8 million trips completed.
- SBS is New York City's program to improve bus speed, reliability, and convenience; it was implemented as a partnership between NYC DOT and NYCT. SBS is New York City's brand of bus rapid transit, a system implemented around the world to provide a cost-effective approach to transit improvements. SBS offers an immediate improvement to New York City's bus transit network by improving mobility and reducing congestion and air pollution.

  SBS uses techniques and technologies such as dedicated bus lanes and queue jumps, off-board fare collection, and transit signal priority to improve the quality and performance of bus transit. SBS is also designed to make bus service easier to use, through features like bus bulbs at stop locations, high-quality passenger information, and overall attention to pedestrian and vehicular safety. Twenty SBS routes have been implemented throughout New York City, incorporating various elements of bus rapid transit to serve the different types of bus routes and streets. This includes the 2019 initiation of the M14 SBS on 14th Street in Manhattan, which features a "busway" design that limits vehicles other than buses and trucks to ensure greater transit speeds and reliability.

  In addition to SBS, as part of its Better Buses initiative, NYC DOT is implementing bus priority projects on other key corridors that serve multiple bus lines throughout New York City.

LONG ISLAND SERVICES

- NICE operates 38 fixed-route bus lines throughout Nassau County, western Suffolk County, and eastern Queens. NICE operates a fleet of 278 ADA-accessible, compressed natural gas-powered buses. In 2016, NICE introduced new service models to Nassau County with the addition of both a flexible and community shuttle service. Additionally, routes that were previously underutilized were re-engineered as community shuttles offering more frequent service during peak hours and doubling as paratransit transit vehicles during off-peak hours. In 2023 NICE carried 23.6 million passengers.

  NICE also operates a fleet of 108 paratransit vehicles for its Able-Ride paratransit service, a shared, door-to-door service for those who cannot use the standard bus transit service. Able-Ride provides about 1,200 rides a day throughout most of Nassau County.

- Suffolk County Transit provides bus service throughout Suffolk County with 25 fixed routes and two Microtransit zones, which are located on the South Fork of Long Island. It operates a fleet of 155 transit buses. In 2024, fixed-route and Microtransit served over 3.3 million passengers. Suffolk County Transit provides paratransit service through its Suffolk County Accessible Transportation (SCAT) program, which operates a fleet of 190 buses and serviced over 625,000 passengers in 2024.
- Municipal Systems also serve Long Island. The City of Long Beach in Nassau County operates a five-route bus system (with a seasonal weekend trolley route) that serves the City of Long Beach, with one route operating east to the hamlet of Point Lookout. The Town of Huntington in northwestern Suffolk County also operates its four-route bus system, called Huntington Area Rapid Transit.

LOWER HUDSON VALLEY SERVICES

- PART consists of three fixed-route bus lines that operate in the eastern part of Putnam County. One of the routes serves northern Westchester County and another connects to Housatonic Area Rapid Transit in western Connecticut. Effective May 12, 2025, PART Route 3 was replaced by a microtransit pilot called Putnam on Demand. The new service is operated by VIA and serves all of Patterson, and parts of Carmel and Southeast. PART also operates the Croton Falls Commuter Shuttle during workdays, and the Cold Spring Trolley runs seasonally between Cold Spring and the City of Beacon in Dutchess County to the north. PART is a flag system except for the system's central transfer point at the Putnam Plaza; there are no fixed stops and passengers can flag a bus anywhere along its routes. Some stops are also "on-call," which means that passengers need to call in advance to reserve a pickup. PART Paratransit offers a transportation service for people with disabilities who are unable to use PART. Operation coincides with the hours of the PART fixed-route system.
- TOR is Rockland County's fixed-route bus service comprised of 10 routes with a fleet of 43 buses. A municipal bus service is provided by Clarkstown Mini-Trans, which is operated by the Town of Clarkstown and has five routes operating Mondays through Saturdays. Several private bus operators offer service to and from Rockland County, primarily serving New York City-bound commuters. These include Coach USA's Rockland Coaches, the Coach USA Express, Coach USA/ Shortline, Monsey Trails, and Saddle River Tours/AmeriBus.
- Rockland County's paratransit service, called TRIPS, is a curb-to-curb, shared-ride paratransit service for eligible Rockland residents. TRIPS offers two levels of service. ADA TRIPS service is designed to meet the service criteria established by the Federal Government and serves as Rockland's complementary paratransit bus service to the municipal, fixed routes. Regular TRIPS service is reserved for residents with physical, mental, developmental, or intellectual disabilities or older adults who are aged 60 or older who find it difficult or impossible to use municipal, fixed-route bus service.
- The Bee-Line System operates 60 routes in Westchester County with a service area that extends from the northern and central Bronx through Westchester and into Putnam County with peak-hour express service to Midtown Manhattan. All Bee-Line System routes serving the Bronx connect with NYCT subway and bus terminals. In 2023, the Bee-Line fixed-route system had an annual ridership of 28.7 million. The Bee-Line System operates fixed-route service with 325 buses of varying types

and sizes, including 301 hybrid/electric buses. Westchester County introduced its first six all-electric buses into the fleet in 2021. All Bee-Line buses except those operating express service to Manhattan are fitted with exterior bicycle racks. Westchester County Bee Line ParaTransit provides ADA-accessible vehicles for all eligible ridership throughout the county. ParaTransit provides wheelchair-accessible vehicles along with smaller type vehicles along with a car for hire service in designated areas of the county. ParaTransit operates 100 vehicles for over 6,000 registered riders with approximately 1,200 daily trips.

- Connecticut Transit is a statewide public benefit corporation that operates the I-Bus express service between Stamford and White Plains seven days a week.
- NYSDOT sponsors several Hudson Valley services, including the Hudson Link between Rockland and Westchester counties; the Orange-Westchester Link Express between Orange County and Tarrytown and White Plains in Westchester County, and the Leprechaun Connection between Poughkeepsie in Dutchess County and White Plains.

MAJOR BUS SERVICES

New York City is a central destination for bus services carrying passengers from as close as Hudson County, NJ, and as far as Montauk and western Pennsylvania. Most commuter buses to Manhattan from west of the Hudson River operate to/from the Port Authority Bus Terminal in midtown Manhattan, with a smaller number using the George Washington Bridge Bus Station in northern Manhattan and a few lines that operate into Lower Manhattan or to the east side of Manhattan.

NJ TRANSIT provides commuter bus service to the Port Authority Bus Terminal, the George Washington Bridge Bus Station, and Lower Manhattan from destinations throughout New Jersey, while private bus carriers provide services from areas in New Jersey and New York west of the Hudson River and eastern Pennsylvania. Major private operators between New Jersey and New York include Academy serving the Route 9 corridor, Lakeland serving the I-80 corridor, and Trans-Bridge serving the I-78 corridor. A major bus holding company, Coach USA, operates numerous commuter bus services into New York City from New Jersey, Rockland County, Orange County and points along the NY-17 corridor. Coach USA also operates the Orange-Westchester Link under contract with NYSDOT. The Orange-Westchester Link provides bus service between Monroe and White Plains, NY. Rockland Coaches, which is owned by Coach USA, operates bus routes in Rockland County, NY, and Bergen County, NJ, with service to both the Port Authority Bus Terminal and the George Washington Bus Station.

Other commuter bus services from Rockland County include Monsey Trails, providing service to Midtown Manhattan, Lower Manhattan, and Brooklyn; and Coach USA's Shortline, providing service to midtown Manhattan, Wall Street, and the Port Authority Bus Terminal. Leprechaun Lines provides commuter bus service, partially under contract with NYSDOT, between Newburgh, Stewart Airport, and Beacon Train Station in Orange and Dutchess counties, as well as between Poughkeepsie and White Plains.

Commuters from exurban communities in the multistate metropolitan region also have access to commuter services into New York City. Trans-Bridge Lines operates peak-directional service between Lower

Manhattan and the Bethlehem/Allentown/Easton region of Pennsylvania. Similarly, Martz Trailways provides service between northeastern Pennsylvania communities such as the Poconos, Scranton, and Wilkes-Barre to the Port Authority Bus Terminal, Lower Manhattan, East Midtown, and intermediate points.

To provide additional options for commuters in Danbury, CT, MTA began a shuttle bus between New Fairfield, CT, and the MNR station in Southeast, NY. The service provides four morning trips and 11 evening trips and is operated by Connecticut's Housatonic Area Regional Transit. Housatonic Area Regional Transit provides shuttle service from Danbury, Ridgefield, and New Fairfield to MNR rail stations during peak hours. Connecticut Transit also operates the I-Bus Express service between Stamford and White Plains.

COMMUTER RAIL

Three commuter rail services operate in the NYMTC planning area—LIRR, MNR, and NJ TRANSIT. LIRR and MNR are subsidiaries of MTA. Compared to subway service, commuter rail services offer inter- and intraregional transportation services with longer distances between stations, wider coverage areas, zoned fares, and a greater emphasis on rider comfort due to longer passenger trips:

- MTA LIRR is the oldest continuously operating railroad in the country and the busiest commuter railroad in North America, with an annual ridership of 65.2 million customers in 2023.[20] The LIRR system is comprised of approximately 700 miles of track situated on eleven different branches, serving 126 stations, and stretching 120 miles from Montauk on the eastern tip of Long Island to Penn Station and Grand Central Madison in midtown Manhattan, Atlantic Terminal in Brooklyn, and Long Island City in Queens. In 2023, to coincide with the opening of Grand Central Madison, 275 trains were added to the weekday schedule bringing the total to 943 daily trains. In addition, MNR and LIRR began offering combo tickets allowing passengers to travel on one ticket between any two stations operated by those two railroads with a transfer at Grand Central.
- MTA MNR serves customers throughout New York and Connecticut on the Hudson, Harlem and New Haven lines, and in Orange and Rockland counties on the Port Jervis and Pascack Valley lines. MNR also manages the Hudson Rail Link feeder bus service in the Bronx and the Haverstraw-Ossining and Newburgh-Beacon ferries, all of which connect with the Hudson Line. MNR annual ridership in 2023 was 60.1 million.[21] Services from the Hudson, Harlem and New Haven Lines terminate at Grand Central Terminal in Midtown Manhattan. Services from the Pascack Valley and Port Jervis Lines terminate in Hoboken, NJ where riders can then transfer to PATH trains or ferry services to Lower Manhattan. Passengers on these lines may also connect to Penn Station-bound trains at Secaucus Junction in Secaucus, NJ.
- NJ TRANSIT is a statewide public benefit corporation that operates commuter rail service to and from Manhattan via Penn Station, within New Jersey, and provides service from Rockland and Orange Counties in New York via contract with Metro-North.

FERRY SERVICES

New York City is well-served by ferries that connect to various points throughout the City as well as intercity service to more distant locations in New Jersey, Connecticut, and Long Island. Major operators of ferries in New York City include NYC DOT (operator of the Staten Island Ferry), Hornblower (operator of NYC Ferry), NY Waterway, and Seastreak. Ferries access terminals at St. George Terminal in Staten Island, Whitehall Terminal, Battery Park City, World Financial Center in Lower Manhattan, and various terminals on the East and West sides of Midtown. In 2022, New York City ferries served 24.9 million riders:

- The Staten Island Ferry is the busiest and most frequent water transportation service in the New York City area, with an extensive peak and off-peak schedule connecting St. George Terminal on Staten Island to Whitehall Terminal at the southern tip of Manhattan operating a round-the-clock fare-free service. The ferry carries approximately 16.5 million passengers annually on its 5.2-mile run. A fleet of ten boats make 117 weekday trips between the two terminals, and 96 trips each day on Saturdays and Sundays.[22] In recent years, the Staten Island Ferry has transitioned to burning ultra-low sulfur fuel and embarked upon a fleet-wide pollution reduction program with the installation of various technologies. In 2022, the Staten Island Ferry introduced three new high-capacity ferry boats as part of an ongoing fleet renewal program.
- NYC Ferry operates across New York City's waterways, connecting Manhattan to Brooklyn, Queens, Staten Island, and the Bronx. NYC Ferry has a fleet of 38 vessels, which carry passengers between more than 20 landings along six routes covering over 60 miles of waterway combined. Additionally, a summer weekend shuttle travels between downtown Manhattan and Governor's Island. In 2023, NYC Ferry served approximately 6 million riders.
- Three companies (NY Waterway, Seastreak, and Liberty Landing Ferry) operate the trans-Hudson ferry routes in a public-private partnership, mostly using publicly owned terminals. These three companies currently operate 19 trans-Hudson ferry routes, operating between twelve New Jersey terminals and four Manhattan terminals. Of the 19 routes, 16 carry passengers from landings in Bergen and Hudson counties in New Jersey to Manhattan. Three routes carry passengers between Monmouth County in New Jersey and Manhattan.
- MTA MNR, in collaboration with NYSDOT, operates ferry service between the Village of Haverstraw in Rockland County and the Ossining MTA MNR station in Westchester County, as well as service between the City of Newburgh in Orange County and the Beacon MTA MNR station in Dutchess County. The Haverstraw-Ossining Ferry operates weekdays, with six trips to Ossining between 5 and 9 a.m. and nine trips to Haverstraw between 5 and 10 p.m. As part of a pilot service enhancement program, the Haverstraw-Ossining Ferry also ran three morning trips and nine afternoon and evening trips on weekends through November 10, 2024. The Newburgh-Beacon Ferry operates weekdays, with six trips to Beacon between 5 and 9 a.m. and eight trips to Newburgh between 5 and 9 p.m. Both ferries provide service to and from the MTA MNR Hudson Line. The service is operated by NY Waterway under contract to MTA MNR.
- Long Island Ferry Service operates across the Long Island Sound between Orient Point on Long Island's North Fork, and New London, CT as well as from Port Jefferson on the North Shore to

Bridgeport, CT. Other Long Island ferries connect Shelter Island with Greenport and North Haven, Montauk with Block Island, RI, Fishers Island, NY, to New London, and the South Shore communities of Bay Shore, Sayville and Patchogue to communities on Fire Island including Kismet, Saltaire, Ocean Beach, Seaview, Ocean Bay Park, Cherry Grove, Fire Island Pines, and Davis Park, among others. In 2022, Long Island ferries served 6.8 million riders.

SHARED MOBILITY

Shared mobility can be defined as transportation services and resources that are shared among users, either at the same time or one after another. This includes public transit, taxis and limos, bike sharing, carsharing (round-trip, one-way, and peer-to-peer), ridesharing (i.e., non-commercial services like carpooling and vanpooling), ride-sourcing or ride-hailing, ride-splitting, scooter sharing (now often grouped with bike sharing under the heading of micromobility), shuttle services and microtransit, jitneys and dollar vans, and more.

Shared mobility includes transportation services and resources that are available to travelers on a pay-per-use basis, such as renting a shared scooter for a short trip. As noted by FHWA, the growing availability and use of smartphone and Internet-based platforms facilitates shared mobility and multimodal transportation options more broadly. However, this has given rise to safety-related concerns, particularly in the micromobility devices' areas of operations, namely the speed of scooters and e-bikes on sidewalks and in bicycle lanes. Additional rules and regulations may be necessary to ensure the safety of all travelers.

CitiBike, a dock-based bikeshare program, began operations in May of 2013 and currently covers all of Manhattan, South and West Bronx, Western Queens, and large portions of Brooklyn along with Jersey City and Hoboken, with ridership exceeding 100,000 per day during peak season. NYC DOT conducted a pilot project of dockless e-scooters in East Bronx which averaged over 2,800 trips per day in its first year. Other entities such as, MTA and Port Authority (through a partnership with Oonee) feature secure bike parking at select locations within the region. Other private entities, like Revel offer secure parking for small electric vehicles, among other types of electric vehicles, at selected locations.

Additionally, recent alterations to the zoning laws in New York City facilitate the creation of designated locations for carsharing at parking facilities.

In 2021, Suffolk County Transit replaced its 10A fixed route bus with on-demand Microtransit service. The service area covers parts of the South Fork including Southampton and Sag Harbor. In 2024, fixed routes 10B and 10C, which served the Town of Easthampton, were replaced with on-demand Microtransit service. Total Microtransit ridership for 2024 across both the Southampton and East Hampton zones was 42,248.

2.3.2 ROADWAYS, BRIDGES AND TUNNELS

ROADWAYS

Roadway facilities are grouped into functional classes according to the type and character of service they provide. New York State currently uses seven functional classifications, which are further distinguished as

urban and rural facilities. Apart from three classes—Urban Local, Rural Minor Collector, and Rural Local—all are eligible for Federal funding.

There are 32,173 lane miles of interstates, arterials, collectors, and local roadways serving residents and visitors to the NYMTC planning area. Many of these roadways are heavily used despite their age, contributing to the need for repair and upgrade work throughout the region.

Local roadways—which include city, town, and village streets—make up 80 percent of the NYMTC planning area's public space and are used by all transportation modes—private vehicles, commercial vehicles, buses, cyclists, and pedestrians. Peripheral facilities include parking, bus stops, bicycle racks, and other features to support commerce.

BRIDGES AND TUNNELS

The NYMTC planning area is home to more than 3,200 bridges of all types, including more than 30 major bridges crossing navigable waterways. Among the major bridges connecting various parts of the planning area and other parts of the region are the George Washington Bridge; the Verrazano-Narrows Bridge; the Governor Mario M. Cuomo Bridge; the Robert. F. Kennedy Bridge; the Brooklyn, Manhattan, Williamsburg, and Ed Koch Queensboro bridges across the East River; the Goethals Bridge, the Bayonne Bridge, and Outerbridge Crossing; and the Bronx-Whitestone Bridge, and the Throgs Neck Bridge.

Additionally, four major underwater vehicular tunnels provide intra- and interregional transportation connections—the Lincoln and Holland Tunnels connect New York City with New Jersey, the Queens-Midtown Tunnel connects Queens to Manhattan, and the Hugh L. Carey Tunnel connects Manhattan and Brooklyn.

2.3.3 ACTIVE TRANSPORTATION

PEDESTRIAN AND BICYCLE FACILITIES

Walking and bicycling are integral parts of life in the NYMTC planning area, providing residents with a means for commuting and travel for recreational purposes. According to the U.S. Census Bureau's American Community Survey (ACS) Five-Year Estimates for 2021, 5.8 percent (651,360) of daily commuters in the region either walk or ride a bicycle as a means of travel to work. Of these active transportation commuters, approximately 90 percent walked to work, with the remaining 10 percent biking to work..[23]

The NYMTC planning area has seen significant development of both on and off-street bicycle and shared-use facilities, hiking trails, bike share and scooter rentals. The region is home to more than 500 miles of existing protected on-street bike lanes. While transit ridership declined precipitously during the COVID-19 pandemic, bicycle usage increased dramatically. The East River Crossings are among the busiest bridges for bicycling in North America. Overcrowding on the shared pedestrian and bicycle path on the Brooklyn Bridge led to the opening of a new dedicated bicycle facility on the Brooklyn Bridge in 2022.

In 2019, as part of the Vision Zero Initiative, NYC DOT released Green Wave, a plan aimed at both improving cyclist safety and creating a more convenient enjoyable and fair riding experience.[24] As part of the plan,

NYC DOT committed to increasing the mileage of protected bicycle lanes it installed annually. In 2021, the Department released the NYC Streets Plan, a five-year transportation plan that augmented the GreenWave cycling goals and increased the protected bicycle lane targets from 30 to 50 miles annually. Since 2014, New York City has expanded the bicycle network with approximately 590 lane miles of new and upgraded bicycle facilities, including 189 miles of protected lanes installed in New York City as of January 1, 2023, for a total of 1,525 miles of bike lanes of which 644 miles are protected lanes.

Suffolk County has 825 miles of hiking and walking trails and 99 miles of shared-use paths. There are 2,820 miles of sidewalks across the 10 towns of Suffolk County, and, in most cases, sidewalks are on both sides of the street. Suffolk County has over 350 miles of on-road bicycle routes including 125 miles of on-road bicycle lanes. Additionally, Suffolk County has 88 miles of mountain biking trails.

The NYSDOT Long Island Region (Region 10) has 137 miles of on-road bicycle routes representing more than a third of Long Island's 477 miles of bicycling facilities.

Nassau County has 11 miles of on-road bicycle routes and 90 miles of shared-use paths. Additionally, Nassau County has another 12 miles of bicycle facilities planned or under construction. A compilation of bicycle facilities by ownership is provided in the Active Transportation Plan (Appendix C).

The development of exclusive bikeways in Nassau County has primarily been oriented toward recreational use. Complete Streets projects have been a focus for the county. A bike share system known as Bethpage Ride PedalShare operates isolated bikeshare networks across Long Island. Bikeshare is available in Southampton Village, Bridgehampton, Hampton Bays, Riverhead, Patchogue, Lindenhurst, Babylon, Huntington, Port Washington, and on the campus of SUNY Farmingdale State College with 52 stations.

The City of Long Beach has a high population density (in comparison to other Long Island communities) and limited parking supply. These factors encourage residents and visitors to use public transportation and walk and bicycle to travel around Long Beach.

The existing regional bicycle and pedestrian trailways and pathways in Westchester County consist of off-road paths, road shoulders, and formal bicycle routes along selected roads. Most off-road paths are multi-use, though some are restricted for pedestrians only. Westchester County's bicycling and hiking trail system has been developed along parkways and on former railroad and aqueduct rights-of-way to provide a countywide trail network connecting employment centers, downtowns, schools, and parks.

Putnam County has two built trail systems that now are part of the Empire State Trail. The original Putnam Trailway runs from the Westchester County line into the Village of Brewster. The Maybrook Trailway which follows the former New Haven Railroad bed, connects to the Putnam Trailway in the Village of Brewster and then runs east along Route 6 to Danbury, CT, and north through the Town of Patterson into Dutchess County. The Maybrook Trailway eventually flows through Hopewell Junction southwest to Beacon and northeast to Millerton.

2.3.4 GOODS MOVEMENT

Chapter 4 of Appendix D, the Regional Freight Element, provides a detailed description of goods movement infrastructure in the NYMTC planning area. Information from the Regional Freight Element is excerpted below. A subset of the NYMTC planning area's roadway network, identified as "Strategic Freight Highways," is of particular importance to freight movement. Strategic Freight Highways serve as major freight gateways into and out of the planning area and provide access to major freight-handling facilities such as seaports and rail intermodal terminals in New Jersey and connections between major industrial clusters and the Interstate Highway System. Strategic Freight Highways link to:

- Freight-generating facilities such as manufacturing, resource-extraction facilities, off-shore wind farms, recycling/waste facilities, construction-sites, and other broad freight generators;
- Freight-handling facilities such as JFK Airport, Howland Hook Container Terminal, and other intermodal terminals and warehouses/distribution centers; and
- Routes that can accommodate large and heavy loads to support emergency response.

Most of the rail freight activity within the multistate metropolitan region occurs 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, solid waste, and liquids. Three Class I railroads operate in the multistate region, along with five short-line railroads. 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.

The Port of New York and New Jersey is the largest container port on the East Coast, and the 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 and privately operated freight terminals and docks. In addition to the port facilities noted above, the U.S. Army Corps of Engineers "Master Docks" database reports 132 other marine cargo facility locations in the NYMTC planning area. 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.

Over the past 20 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. DOT Maritime Administration for waterborne services that provide alternatives to trucking along congested highway routes 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. The New York Economic Development Corporation (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.

Of the larger New York area airports in the NYMTC planning area—John F. Kennedy International Airport, LaGuardia Airport, Westchester County Airport, Long Island MacArthur Airport, and Republic Airport—only JFK has significant air cargo activity, and it is ranked among the top air cargo gateways in the country. LaGuardia Airport, while handling significant domestic passenger traffic, does not handle a 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.

2.3.5 AVIATION

AIRPORTS

The Port Authority operates the busiest system of airports in the Americas and the second busiest airport system in the world behind only London, serving nearly 128 million passengers and handling more than a million tons of cargo in 2022.

The Port Authority operates five airports:

- John F. Kennedy International Airport (JFK) is one of the world's most iconic aviation facilities and the metropolitan region's busiest airport with more than 55 million annual passengers in 2022. JFK is the number one U.S. gateway for international travelers serving approximately 27 million international passengers and handles the bulk of the region's air cargo handling more than 1.5 million tons of air cargo.
- Newark Liberty International Airport (EWR), which is adjacent to NYMTC's planning area in northern New Jersey, currently ranks twelfth in passenger traffic with more than 44 million annual passengers in 2022. It is also the region's small-package hub handling approximately 750,000 tons of air cargo.
- LaGuardia Airport (LGA) is the region's premier short-haul domestic airport with more than 29 million passengers in 2022. It has the distinction of handling more passengers per square mile per year than any other airport in the world.
- New York Stewart International Airport (SWF) is the gateway to the Hudson Valley, serving 300,000 passengers and handling 25,000 tons of cargo in 2022.[25]
- Teterboro Airport is the busiest general and corporate aviation airport in the country and serves as an important reliever airport for the region. Couriers and small package cargo shippers operate while serving as a receiving point for human organs used in life-saving transplant operations performed at medical centers throughout the region.

Another relevant airport in the NYMTC planning area is Westchester County Airport (HPN), a county-owned airport classified as a small hub airport by the Federal Aviation Administration. In 2022, enplanements at Westchester County Airport numbered 892,000; deplanements totaled 889,000. This airport serves the Lower Hudson Valley and southwestern Connecticut. Additionally, Long Island MacArthur Airport (ISP),

owned and operated by the Town of Islip, is classified as a small hub airport by the Federal Aviation Administration. This airport primarily serves eastern Long Island and is connected to LIRR at its Ronkonkoma station just north of the airport's northern boundary. In 2022, enplanements at MacArthur Airport numbered 610,000; deplanements totaled 614,000. These two airports, along with SWF, have attracted low-cost operators intending to avoid the region's busy major airports. General aviation airports in the planning area include Republic Airport in Farmingdale, Gabreski Airport in Westhampton, and Village of East Hampton Airport in East Hampton. Seasonal commercial seaplane traffic operates out of New York Skyports on the East River to Eastern Long Island and Massachusetts serving approximately 2,400 passengers in 2022.

HELIPORTS

New York City has three main public heliports—Downtown Manhattan/Wall Street, East 34th Street, and West 30th Street—generating more than 55,000 flights per year. Many of these flights were for air tour service, followed by commercial, corporate, itinerant, news gathering, military, and public safety operations. The Downtown Manhattan/Wall Street heliport is capable of handling high-security flights, such as the President of the United States or foreign diplomats during the annual United Nations General Assembly.

2.3.6 OTHER TRANSPORTATION MODES

TAXIS AND FOR-HIRE VEHICLES

In New York City, the New York City Taxi and Limousine Commission licenses more than 110,000 vehicles that collectively transport over 750,000 passengers each day. Several taxi services exist in the counties outside New York City including nine taxi companies in Putnam County and thirty-three in Suffolk County).

App-based, high-volume for-hire vehicles through Uber, Via, and Lyft also provide travelers in the region with mobility options. Uber was launched in New York City in May 2011; Via was launched in September 2013, and Lyft was launched in July 2014.However, these services were not approved to operate in Long Island and the Hudson Valley until 2017. In 2017, New York State legislation began allowing ride-hailing companies to provide services statewide.[26] The rapid growth of Transportation Network Companies (TNC) may be attributable to the numerous advantages and conveniences that TNCs provide over other modes of transportation, including point-to-point service, ease of reserving rides, shorter wait times, lower fares (relative to taxis), ease of payment, and real-time communication with drivers. The availability of this new travel alternative improves mobility for some residents, including those with special needs, workers, and visitors.

LONG-DISTANCE AND INTER-CITY BUSES

New York City is a major hub for long-distance and intercity bus services, with buses traveling to destinations like Washington, D.C.; Boston, MA; and Philadelphia, PA; and more distant locations like Norfolk, VA; Atlanta, GA; Pittsburgh, PA; and Toronto, Canada. Many of the intercity buses travel in and out of the Port Authority Bus Terminal and the George Washington Bridge Bus Station in Manhattan and other locations throughout the NYMTC planning area. Major intercity operators from the Port Authority Bus

Terminal include Greyhound for destinations across the United States and into Eastern Canada, Adirondack Trailways for destinations across New York State, and Peter Pan for service along the Northeast Corridor. Following extensive growth in curbside intercity buses, a significant share of the intercity service now operates from curbside locations in Midtown, Chinatown, and outer borough stops.

Intercity bus travel gained popularity because of discount Chinatown operators, also known as "curbside" operators, which led to other competing services offered by companies like Megabus, although this particular service has ceased all operations across the country. FlixBus, which had previously offered service exclusively on the New York to Boston and Washington corridor has expanded its curbside operation operating from Penn Station. FlixMobility, the parent company of FlixBus, purchased Greyhound in October 2021 and subsequently discontinued Greyhound's BoltBus "curbside" brand in favor of the FlixBus brand.

Megabus, and FlixBus offer discount express city travel between New York and various cities throughout the eastern United States and Canada, including Washington, D.C., Boston, Philadelphia, Albany, and Toronto. Other bus companies such as Vamoose Bus and Go Buses offer less variety in destinations (mostly to the Washington, D.C., and Boston areas) and similar amenities. A number of these discounted services arrive and depart from on-street locations in Midtown Manhattan instead of the Port Authority or George Washington Bridge Bus Station. Flixbus operates from a stop at the corner of 31st Street and 8th Avenue. "Chinatown" buses, which began providing intercity service in the late 1990s, also provide frequent, inexpensive bus services from primarily Manhattan's Chinatown, the West Side of Manhattan, and the outer boroughs to areas along the Eastern Seaboard as far south as Florida. Lucky Star also offers services to Washington, D.C., and Boston.

OurBus is a service planning and ticket sales company that partners with bus carriers to operate routes. It relaunched a direct New York to metropolitan Boston route formerly operated by Coach Company, now one of its partners, serving Worcester, Methuen, and Lowell, MA. In June 2020, it added a New York–Boston Back Bay route, followed by a college-oriented pop-up route between Long Island and Boston and another pop-up, connecting Hyannis, MA; Providence, RI Island; and New York.[27]

INTER-CITY PASSENGER RAIL

Since 1971, Amtrak has been the provider of intercity, long-distance passenger rail service in the NYMTC planning area. Amtrak serves four stations in the NYMTC planning area—Penn Station, New Rochelle, Yonkers, and Croton-Harmon. Penn Station served over 8 million Amtrak passengers beginning or ending their trips in 2022.

Amtrak's services include:

- Acela/Northeast Regional Service between Boston and Washington, D.C., Acela service uses a dedicated fleet of trains to provide high-speed express service along the corridor, while Northeast Regional trains use standard Amtrak equipment and make more stops. Amtrak's Northeast Regional and Acela services carried approximately 9.2 million passengers in 2022.

- Empire Corridor Service between New York City and Albany with daily service to Buffalo and Niagara Falls with over 1 million passengers between New York City and Albany in 2022. This includes the Adirondack to Montreal; the Maple Leaf to Toronto in cooperation with VIA Rail Canada; the Ethan Allen Express to Burlington, VT; and the Berkshire Flyer to Pittsfield, MA. The Berkshire Flyer is funded by Massachusetts and the Ethan Allen Express is funded by Vermont while all other daytime services are funded by New York State.
- Northeast Corridor through Services to, from, or through Penn Station that travels along the Northeast Corridor to access other state corridor routes. These include through trains to the New Haven-Hartford-Springfield corridor; the Vermonter service to St. Albans; numerous Northeast Regional extensions to Virginia points (Norfolk, Roanoke, Richmond, and Newport News); the Carolinian to Raleigh, Greensboro, and Charlotte; the Pennsylvanian to Pittsburgh; and frequent Keystone Service to Lancaster and Harrisburg via Philadelphia.
- Amtrak also operates Long-Distance Services to and from New York. These include the Silver Service (Silver Star and Silver Meteor) from New York to the Carolinas, Savannah, and Florida points; the Crescent to Atlanta, Birmingham, and New Orleans; the Lake Shore Limited to Cleveland, Toledo, and Chicago; the Cardinal to Cincinnati, Indianapolis, and Chicago; and the Palmetto to Savannah. All these trains operate once daily except for the Cardinal, which originates or terminates in New York on Sundays, Wednesdays, and Fridays.

ROOSEVELT ISLAND TRAM

The Roosevelt Island Tram operates between the island and Manhattan and supplements subway service. Originally opened in 1976 pending the completion of a subway station, the Tram, operated by the state-run Roosevelt Island Operating Corporation, now carries 2 million people per year as of 2022.

TOUR BUSES

Tour buses in New York City serve tourists who are either riding in a closed loop or using a system of "hop on-hop off" routes to visit specific attractions or neighborhoods. Although bus tourism has historically been confined to the Manhattan Central Business District with occasional forays into Brooklyn, tour buses are now a more common sight in Upper Manhattan as well. Several companies operate downtown and uptown hop-on-hop-off bus loops. The bus tour industry has also expanded to include topic-specific tours, often centered on popular TV shows, local foods, or specific cultural sites.

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3 A CONTEXT FOR OUR PLANNING—TRENDS AND CHANGE

3.1 OVERVIEW

Moving Forward 2055 defines NYMTC's Shared Vision for Regional Mobility and describes the recommended approaches, actions, and investment of resources in projects, programs, and studies to pursue this shared vision during the planning period. These recommended actions and investments—both speculative and defined—use the shared vision as a strategic framework. However, before advancing the vision, it is important to assess the current performance of the transportation system and forecast future conditions in the NYMTC planning area and the larger multistate metropolitan region. Chapter 3 describes this related performance and anticipated future conditions to provide context for *Moving Forward 2055's* recommended actions and investments.

3.2 STATE OF THE SYSTEM

Under Federal metropolitan planning regulations, NYMTC must apply a transportation performance management approach in carrying out its federally required transportation planning and programming activities. The process requires the establishment and use of a coordinated, performance-based approach to transportation planning and programming in support of national goals for Federal-aid highway and public transportation programs.

This System Performance Report, required by Federal regulation through 23 CFR 450.324, is an element of *Moving Forward 2055* that describes the condition and performance of the transportation system, identifies relevant performance targets, and reports on current progress in meeting the targets. It addresses the federally required performance measures and targets for highway safety, bridge condition, pavement condition, highway system performance, freight reliability, congestion, transit asset management, and transit safety.

3.2.1 HIGHWAY SAFETY PERFORMANCE

FHWA's Highway Safety Performance Management rule established five performance measures for safety on all public roads:

1. Number of Fatalities.
2. Rate of Fatalities per 100 million Vehicle Miles Traveled (VMT).
3. Number of Serious Injuries.
4. Rate of Serious Injuries per 100 million VMT.
5. Number of Nonmotorized Fatalities and Serious Injuries.

NYSDOT set 2025 statewide highway safety targets in August 2024. The following steps were used in setting the 2025 targets:

1. Estimation of existing trend—As recommended by FHWA, a linear trendline was estimated using a five-year moving average (current year plus four preceding years).
2. Adjustment for reasonability—Having considered the percentage change between 2017 and 2021 and between 2014 and 2018, a cap allows for a target that forecasts a significant reduction but recognizes that large decreases are difficult to sustain year after year.
3. Consideration of external and other factors—External and other factors such as VMT, population, and safety programs were considered in the development of the targets.

Table 3.1 presents the 2025 targets, as well as the last five years for which final performance data is available. To be consistent with the performance measures, all data shown below is a five-year rolling average. NYMTC has agreed to support the NYSDOT statewide 2025 targets.[1]

Table 3.1 Statewide Safety Performance and 2025 Targets (5-Year Rolling Average)

Performance Measure	2018	2019	2020	2021	2022*	*2025 Target*
Number of Fatalities	1,038	1,016	998.0	1,021	1,054.8	1,011.0
Rate of Fatalities per 100 Million VMT	0.844	0.827	0.842	0.888	0.930	0.881
Number of Serious Injuries	11,119	11,287	11,198.2	11,145.6	11,056.6	11,034.1
Rate of Serious Injuries per 100 Million VMT	9.041	9.176	9.432	9.656	9.706	9.557
Number of Combined Non-Motorized Fatalities and Non-Motorized Serious Injuries	2,638	2,672	2,666.4	2,645.8	2,664.8	2,615.2

Source: NYSDOT.

ASSESSMENT OF PROGRESS IN ACHIEVING TARGETS

New York State's 2023–2027 Strategic Highway Safety Plan (SHSP) uses data-driven analysis to identify the state's safety needs, set goals for reducing fatal and serious injury crashes, and allocate investments in safety projects and programs. The SHSP guides statewide efforts to address safety and defines a framework for implementation activities. NYSDOT's Highway Safety Improvement Program (HSIP) focuses on the planning, implementation, and evaluation of the SHSP. It emphasizes data-driven approaches to improving highway safety, focuses attention on relevant emphasis areas, and implements a range of SHSP strategies and countermeasures. As part of this process, NYSDOT produces an annual report that documents the statewide performance targets.

In supporting the statewide highway safety targets, NYMTC continues to program Federal funding for projects and activities that address fatalities and serious injuries within its planning area through this Plan and through the TIP. NYMTC supports a host of safety programs designed to reduce fatal and serious injury crashes, including the HSIP, New York City's Vision Zero, and the NYSDOT Pedestrian Safety Action Plan. *Moving Forward 2055's* shared vision includes a Vision Goal that safety and security are maximized for people and goods across all uses and modes.

As shown in Table 3.1, the five-year rolling average for number of fatalities in 2022 surpassed the 2018 figure, after three consecutive years with lower fatalities than 2018. As VMT declined during the pandemic, and the total number of fatalities and serious injuries remained constant or increased, the rate of fatalities and rate of serious injuries notably increased. The five-year average for non-motorized fatalities and serious injuries has gradually increased since 2018. FHWA annually completes an assessment of progress toward achieving safety targets for each state.

A state makes significant progress toward its safety targets when at least four of the five targets have been met, or the actual outcome was better than the baseline performance.

If a state has not met or made significant progress toward meeting performance targets, the State DOT must comply with additional deferral requirements for minimum investments in highway safety projects through the HSIP and submission of an HSIP Implementation Report. For the most recent assessment of progress, New York State did not make significant progress towards meeting the safety targets. The 2023–2027 SHSP highlighted several thematic areas where the state feels it can make improvements to the number and rate of fatalities and serious injuries. This includes strategies for improving intersections, improving safety for vulnerable road users, safety enforcement, vehicle design, and post-crash care, across the entire state. Implementation of these strategies through the HSIP and other state and regional programs will help the region make progress toward the *Moving Forward 2055* goal of a "transportation system for which safety and security are maximized for people and goods across all uses and modes."

PAVEMENT AND BRIDGE CONDITION

FHWA established the following six performance measures for pavement and bridge condition on National Highway System (NHS) roads:

1. Percent of Interstate pavements in good condition.
2. Percent of Interstate pavements in poor condition.
3. Percent of non-Interstate NHS pavements in good condition.
4. Percent of non-Interstate NHS pavements in poor condition.
5. Percent of NHS bridges (by deck area) classified as in good condition.
6. Percent of NHS bridges (by deck area) classified as in poor condition.

NYSDOT and other State or local agencies are required to measure pavement and bridge condition on an ongoing basis to assess their condition and report the data to FHWA. The agencies use this data to determine when the pavement and bridges need repair or replacement. Pavement and bridges in good condition suggests that no significant investment is needed in the near term. Pavement or bridges in poor condition are safe to drive on; however, they are nearing a point where substantial reconstruction or replacement is needed.

ASSESSMENT OF PROGRESS IN ACHIEVING TARGETS

NYSDOT established statewide pavement and bridge condition targets for 2023 and 2025. NYMTC has agreed to support the statewide targets. By doing so, NYMTC plans and programs Federal transportation funding for projects and activities that help to achieve these targets. Table 3.2 presents statewide performance for the measures from 2018 through 2023 as well as the 2023 and 2025 statewide targets established by NYSDOT and supported by NYMTC.1

Table 3.2 Pavement and Bridge Condition Statewide Performance and Targets

Performance Measure	2018	2019	2020	2021	2022	2023	*2023 Target*	*2025 Target*
Percent of Interstate pavements in good condition	53.0%	51.1%	45.5%	45.3%	36.9%	50.7%	*53.2%*	*48.2%*
Percent of Interstate pavements in poor condition	1.2%	1.1%	0.7%	1.1%	1.8%	1.0%	*1.4%*	*1.6%*
Percent of non-Interstate NHS pavements in good condition	N/A	13.4%	18.3%	18.9%	16.3%	20.3%	*22.3%*	*18.6%*
Percent of non-Interstate NHS pavements in poor condition	N/A	7.5%	7.3%	7.6%	7.5%	7.1%	*9.3%*	*8.4%*
Percent of NHS bridges (by deck area) in good condition	24.4%	26.0%	25.3%	25.3%	24.7%	24.1%	*24.1%*	*21.1%*
Percent of NHS bridges (by deck area) in poor condition	10.2%	9.6%	10.9%	11.3%	11.2%	13.0%	*12.5%*	*12.8%*

Source: NYSDOT.

On the NY Interstate system, the percentage of pavement in good condition decreased from 2018 to 2022 and then increased in 2023. The percentage in poor condition has fluctuated slightly over this time period but remains low. On the non-Interstate NHS system, the percentage of pavement in good condition has increased from 2019 to 2023, while pavement in poor condition has decreased by a slight amount. For bridges on the NHS, the percentage of deck area in good condition decreased by a small amount from 2018 to 2023, while the percentage in poor condition increased.

System preservation is a major focus of both *Moving Forward 2055* and of NYMTC's TIP, as described in the financial forecasts contained in Chapter 5 and as evidenced by the proportion of funding proposed for this purpose. To support progress toward the pavement and bridge targets, *Moving Forward 2055* forecasts a total of $685 billion to address system preservation during the planning period, an average of approximately $22.8 billion per year in year-of-expenditure dollars (refer to *Moving Forward 2055*, Chapter 5 for more detail).

3.2.2 SYSTEM PERFORMANCE, FREIGHT, AND CONGESTION, MITIGATION, AND AIR QUALITY IMPROVEMENT PROGRAM PERFORMANCE

FHWA established the following performance measures to assess system performance, freight reliability, and Congestion Mitigation and Air Quality Improvement Program (CMAQ) projects. The performance measures include:

1. Percent of person-miles on the Interstate system that are reliable.[1]
2. Percent of person-miles on the non-Interstate NHS that are reliable.
3. Truck Travel Time Reliability (TTTR) Index.
4. Annual hours of peak-hour excessive delay (PHED) per capita.
5. Percent of non-single-occupant vehicle (Non-SOV) travel.
6. Cumulative two-year (2019 and 2023) and four-year (2021 and 2025) reduction of on-road mobile source emissions for CMAQ funded projects (CMAQ Emission Reduction).

ASSESSMENT OF PROGRESS IN ACHIEVING TARGETS

NYSDOT established statewide system performance, freight reliability, and CMAQ performance targets for 2023 and 2025. NYMTC has formally agreed to support the statewide targets. By doing so, NYMTC plans and programs Federal transportation funding for projects and activities that help to achieve these targets.

Table 3.3 presents annual performance for each measure from 2018 through 2023, as well as the 2023 and 2025 targets established by NYSDOT and supported by NYMTC. The figures represent statewide performance, except for the Peak Hour Excessive Delay Measure (PHED) per capita and the non-SOV travel measures, which represent performance only in the full New York-Newark, NY-NJ-CT Urbanized Area (UZA). NYMTC worked with agencies located in the vicinity of the UZA, including NYSDOT, New Jersey DOT, and Connecticut DOT, to establish the PHED and non-SOV travel targets.

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[1] Reliability is defined as the ratio of longer travel times (80th percentile) to a normal travel time (50th percentile) over all applicable roads. Travel times are analyzed for each highway segment. A level of travel time reliability (LOTTR) is calculated for each segment for four time periods that cover the hours of 6:00 a.m. to 8:00 p.m. each day:

- AM Peak 6:00 a.m.–10:00 a.m. Monday through Friday
- Mid-day 10:00 a.m.–4:00 p.m. Monday through Friday
- PM Peak 4:00 p.m.–8:00 p.m. Monday through Friday
- Weekends 6:00 a.m.–8:00 p.m. Saturday and Sunday

A segment is reliable if its LOTTR is less than 1.5 during all four time periods. If one or more time periods has a LOTTR of 1.5 or above, that segment is unreliable. The two measures are expressed as the percent of person-miles traveled on that are reliable. Person-miles consider the number of people traveling in buses, cars, and trucks over these roadway segments. The length of each segment is multiplied by its AADT and average occupancy factor for all vehicles, which results in person-miles. This calculation is done for reliable segments and for all segments. The sum of reliable segment person-miles is divided by the sum of all segment person-miles to calculate the measure.

Table 3.3 System Performance, Freight, and CMAQ Performance and Targets

Performance Measure	2018	2019	2020	2021	2022	2023	*2023 Target*	*2025 Target*
Percent of person-miles on the Interstate system that are reliable	80.7%	78.8%	86.9%	81.6%	80.1%	79.0%	*75.0%*	*75.0%*
Percent of person-miles on the non-Interstate NHS that are reliable	N/A	80.3%	86.8%	85.7%	85.4%	84.0%	*70.0%*	*70.0%*
Truck Travel Time Reliability index	1.43	1.47	1.33	1.39	1.41	1.40	*2.00*	*2.00*
Total on-road emission reductions, PM2.5 (kg/day)	5.480	89.576	N/A	96.148	N/A	2.181	*2.015*	*2.643*
Total on-road emission reductions, PM10 (kg/day)	12.885	179.441	N/A	N/A	N/A	N/A	*3.097*	*5.395*
Total on-road emission reductions, VOC (kg/day)	32.452	602.290[1]	N/A	636.770[1]	N/A	12.605[1]	*12.605*	*23.165*
Total on-road emission reductions, NOx (kg/day)	83.606	925.308[1]	N/A	1,015.504[1]	N/A	52.664[1]	*40.295*	*72.603*
Total on-road emission reductions, CO (kg/day)	611.939	15,117.4[1]	N/A	16,141.420[1]	N/A		*258.263*	*484.920*
Peak Hours of Excessive Delay per Capita (New York-Newark UZA only)	N/A	22.3	14.0	20.9	20.9	19.8	*22.0*	*22.0*
Percent Non-SOV Travel, (New York-Newark UZA only)	51.7%	51.6%	51.7%	52.4%	53.4%	53.4%	*52.4%*	*52.4%*

Source: NYSDOT.

[1] 2019 and 2023 represent two-year cumulative statewide emission reductions. 2021 represents four-year cumulative statewide emission reductions (as will 2025 data).

As shown in Table 3.3, the percentage of person-miles on the Interstate system that are reliable decreased slightly from the 2018 baseline to 2023. For the non-Interstate NHS, reliability increased notably from 2019 to 2023. TTTR performance improved slightly from 2019 to 2023. Total on-road emission reductions from CMAQ projects for applicable criteria pollutants fluctuated from year to year, which is to be expected as the mix of CMAQ-funded projects change annually.

Performance for the PHED measure improved from 2019 to 2023, decreasing from 22.3 to 19.8 hours. Performance for the percent of non-SOV travel measure increased from 51.7 percent in 2018 to 53.4 percent in 2023.

Moving Forward 2055 includes projects, programs, strategies, and actions to address system performance, freight reliability, mobile source emissions, and traffic congestion. The Plan identifies funding for targeted improvements in these areas. NYMTC supports the statewide third performance management rule (PM3) targets and will continue to monitor and track the current performance of the roadway network.

3.2.3 TRANSIT ASSET MANAGEMENT

FTA's Transit Asset Management (TAM) regulations apply to recipients and subrecipients of Federal transit funding that own, operate, or manage public transportation capital assets. The regulations require that public transportation providers develop and implement TAM plans and establish state of good repair standards and performance targets for the performance measures presented in Table 3.4.

Table 3.4 FTA TAM Performance Measures

Asset Category	Performance Measure and Asset Class
Rolling Stock	Percentage of revenue vehicles within a particular asset class that have either met or exceeded their Useful Life Benchmark (ULB)
Equipment	Percentage of non-revenue, support-service and maintenance vehicles within a particular asset class that have met or exceeded their ULB
Infrastructure	Percentage of track segments with performance restrictions
Facilities	Percentage of facilities within an asset class rated below condition 3.0 on the Transit Economic Requirements Model (TERM) scale

Source: FTA, TAM Final Rule, 49 CFR Parts 625 and 630.

Transit agency assets used by these providers for public transit services are expected to be included in the TAM plan asset inventory. Agencies need to include condition assessments and targets only for assets for which they have direct capital responsibility.

Under the TAM requirements, FTA defines two tiers of public transportation providers based on number of vehicles and operating mode parameters. Tier I transit agencies, which are generally larger providers, establish their own TAM targets, while Tier II providers, generally smaller agencies, may establish their own targets or participate in a group plan where targets are established by a plan sponsor (NYSDOT) for those agencies in this group. NYSDOT's 2023 Group TAM Plan is available online.

A variety of transit service providers receiving FTA funding serve the NYMTC planning area. These include:

- Metropolitan Transportation Authority (MTA), including New York City Transit, Staten Island Railway, MTA Bus, MTA-Long Island Rail Road (LIRR), and MTA Metro-North Railroad (MNR).
- Nassau Inter-County Express (NICE)
- Suffolk County Transit (SCT)
- Westchester County Bee-Line System
- Staten Island Ferry, New York City Department of Transportation (NYC DOT)
- City of Long Beach Transit (LBT)
- Huntington Area Rapid Transit (HART)
- Putnam Area Rapid Transit (PART)
- Transport of Rockland (TOR)

LBT, HART, PART, and TOR are Tier II providers and are included in NYSDOT's group TAM plan. The other providers listed above are Tier I providers.

Each provider and group TAM plan sponsor is required to establish and report TAM targets annually for the following fiscal year and must share its targets and asset condition information with NYMTC. In turn, NYMTC is required to establish TAM targets within 180 days after the providers established their first targets and must update its targets when it adopts a new regional transportation plan. When establishing TAM targets, NYMTC can either agree to program projects that will support the transit provider targets or establish separate regional TAM targets for its planning area.

ASSESSMENT OF PROGRESS IN ACHIEVING TARGETS

The public transportation providers in the NYMTC planning area have established the TAM targets listed in the following Table 3.5 through Table 3.12. NYMTC is supporting the providers' individual TAM targets for each of the transit providers in the NYMTC planning area.

Table 3.5 MTA Selected Systems

Performance Measure	Asset Class	NYCT		Staten Island Railway		MTA Bus	
		ULB (years)	2024 Target	ULB (years)	2024 Target	ULB (years)	2024 Target
Rolling Stock Age - % of revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)	Articulated Bus	12	31.23%	N/A	N/A	12	0%
	Over-the-road Bus	12	17.48%	N/A	N/A	12	49.9%
	Bus	12	17.63%	N/A	N/A	12	28.45%
	Cutaway	10	13.2%	N/A	N/A	N/A	N/A
	Heavy Rail Passenger Cars	40	15.52%	40	33.63%	N/A	N/A
	Sports Utility Vehicle	8	100%	N/A	N/A	N/A	N/A
	Van	10–13	25%	N/A	N/A	N/A	N/A
Equipment Age - % of non-revenue vehicles that have met or exceeded their ULB	Trucks and other Rubber Tire Vehicles	7–11	29.72%	7–11	68.75%	7–11	58.68%
	Steel Wheel Vehicles	Various	65.45%	15-35	55.56%	N/A	N/A
	Automobiles	7–11	50.89%	7–11	100%	7–11	76.19%
Infrastructure % of track segments with performance restrictions	HR—Heavy Rail	N/A	0.63%	N/A	0%	N/A	N/A
Facilities Condition - % of facilities with a condition rating below 3.0 on the FTA TERM Scale	Administrative/ Maintenance Facilities	N/A	66.98%	N/A	62.5%	N/A	37.5%
	Passenger/Parking Facilities	N/A	34.81%	N/A	76%	N/A	N/A

Source: FTA National Transit Database, 2023 Annual Database Performance Measure Targets.

Table 3.6 MTA Long Island Railroad

Performance Measure	Asset Class	ULB (years)	2024 Target
Rolling Stock Age - % of revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)	RL—Commuter Rail Locomotive	39	0%
	RP—Commuter Rail Passenger Coach	39	0%
	RS—Commuter Rail Self-Propelled Passenger Car	39	7.9%
Equipment Age - % of non-revenue vehicles that have met or exceeded their ULB	Automobiles	8	100%
	Steel Wheel Vehicles	25	68.8%
	Trucks and other Rubber Tire Vehicles	14	14.4%
Infrastructure % of track segments with performance restrictions	CR—Commuter Rail	N/A	6.16%
Facilities Condition - % of facilities with a condition rating below 3.0 on the FTA TERM Scale	Administrative/Maintenance Facilities	N/A	28.85%
	Passenger/Parking Facilities	N/A	15.3%

Source: FTA National Transit Database, 2023 Annual Database Performance Measure Targets.

Table 3.7 MTA Metro-North Railroad

Performance Measure	Asset Class	ULB (years)	2024 Target
Rolling Stock Age - % of revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)	BU—Bus	12	36.25%
	RL—Commuter Rail Locomotive	35	67.35%
	RP—Commuter Rail Passenger Coach	35	27.23%
	RS—Commuter Rail Self-Propelled Passenger Car	35	21.9%
Equipment Age - % of non-revenue vehicles that have met or exceeded their ULB	Automobiles	8	100%
	Steel Wheel Vehicles	35	61.87%
	Trucks and other Rubber Tire Vehicles	14-18	29.13%
Infrastructure % of track segments with performance restrictions	CR—Commuter Rail	N/A	2.96%
Facilities Condition - % of facilities with a condition rating below 3.0 on the FTA TERM Scale	Administrative/Maintenance Facilities	N/A	38.1%
	Passenger/Parking Facilities	N/A	28.57%

Source: FTA National Transit Database 2023, Annual Database Performance Measure Targets.

Table 3.8 NICE Bus

Performance Measure	Asset Class	ULB (years)	2024 Target
Rolling Stock Age - % of revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)	AB—Articulated Bus	14	0%
	AO—Automobile	8	0%
	BU—Bus	14	5%
	CU—Cutaway	10	5%
Equipment Age - % of non-revenue vehicles that have met or exceeded their ULB	Automobiles	6-8	13%
	Trucks and other Rubber Tire Vehicles	10-13	15%
Facilities Condition - % of facilities with a condition rating below 3.0 on the FTA TERM Scale	Administrative/Maintenance Facilities	N/A	15%
	Passenger/Parking Facilities	N/A	50%

Source: FTA National Transit Database, 2023 Annual Database Performance Measure Targets.

Table 3.9 Suffolk County Transit

Performance Measure	Asset Class	ULB (years)	2024 Target
Rolling Stock Age - % of revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)	BU—Bus	14	10%
	CU—Cutaway	10	10%
Equipment Age - % of non-revenue vehicles that have met or exceeded their ULB	Trucks and other Rubber Tire Vehicles	10–13	0%

Source: FTA National Transit Database, 2023 Annual Database Performance Measure Targets.

Table 3.10 Westchester County Bee-Line System

Performance Measure	Asset Class	ULB (years)	2024 Target
Rolling Stock Age - % of revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)	AB—Articulated Bus	14	0%
	AO—Automobile	8	100%
	BU—Bus	14	37%
	CU—Cutaway	10	42%
	MV—Minivan	8	0%
	SV—Sports Utility Vehicle	8	20%
Equipment Age - % of non-revenue vehicles that have met or exceeded their ULB	Trucks and other Rubber Tire Vehicles	8–10	32%
Facilities Condition - % of facilities with a condition rating below 3.0 on the FTA TERM Scale	Administrative/Maintenance Facilities	N/A	0%
	Passenger/Parking Facilities	N/A	0%

Source: FTA National Transit Database, 2023 Annual Database Performance Measure Targets.

Table 3.11 New York City Department of Transportation Ferry

Performance Measure	Asset Class	ULB (years)	2024 Target
Rolling Stock Age - % of revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)	FB—Ferry Boat	42	33%
Equipment Age - % of non-revenue vehicles that have met or exceeded their ULB	Trucks and other Rubber Tire Vehicles	8–10	65%
	Automobiles	8–10	85%
Facilities Condition - % of facilities with a condition rating below 3.0 on the FTA TERM Scale	Administrative/Maintenance Facilities	N/A	0%
	Passenger/Parking Facilities	N/A	0%

Source: FTA National Transit Database 2023, Annual Database Performance Measure Targets.

Table 3.12 NYSDOT Group TAM Plan Providers (Includes PART, TOR, HART, and LBT)

Performance Measure	Asset Class	ULB (years)	2024 Target
Rolling Stock Age - % of revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)	Bus-Heavy Duty Large/Trolley	12	10%
	Bus-Heavy Duty Small	10	25%
	Bus-Medium Duty	7	55%
	Small Passenger Vehicle	5	65%
Equipment Age - % of non-revenue vehicles that have met or exceeded their ULB	All Equipment (Section 5311)	Varies	20%
	All Equipment (Section 5307)	Varies	60%
Facilities Condition - % of facilities with a condition rating below 3.0 on the FTA TERM Scale	Admin & Maintenance (Section 5307)	N/A	20%
	Admin & Maintenance (Section 5310)	N/A	50%
	Admin & Maintenance (Section 5311)	N/A	0%
	General Purpose (Section 5310)	N/A	0%
	General Purpose (Section 5311)	N/A	0%
	Maintenance (Section 5307)	N/A	25%
	Maintenance (Section 5311)	N/A	0%

Source: NYSDOT, Group TAM Plan for FTA Grantees, August 2023 Update.

Moving Forward 2055's vision includes a goal that infrastructure is maintained and improved in a sustainable and fair manner, with an accompanying objective to rebuild, replace and/or modernize needed transportation assets for passengers and freight. As part of the ongoing coordination efforts to fulfill TAM requirements, the progress of the transit providers toward achieving their TAM targets will be monitored and reported. Additionally, Federal funding will be programmed toward achieving the TAM targets of the transit providers.

Moving Forward 2055 forecasts the cost of transit system preservation over the life of the Plan at approximately $*525* billion, or roughly *77* percent of the Plan's total projected system preservation costs for the entire transportation system in the NYMTC planning area (refer to *Moving Forward 2055*, Chapter 5 for more detail). The Plan estimates that most of these costs will be met through a combination of Federal, state, and local resources.

3.2.4 TRANSIT SAFETY

FTA's Public Transportation Agency Safety Plan (PTASP) regulation requires public transportation system operators that receive Federal financial assistance under 49 U.S.C. Chapter 53 to develop and implement a PTASP based on a Safety Management Systems approach. The PTASP must include performance targets for the following performance measures:

- Total number of reportable fatalities by mode.
- Reportable fatality rate per total vehicle revenue miles by mode.
- Total number of reportable injuries by mode.
- Rate of reportable injuries per total vehicle revenue miles by mode.
- Total number of reportable safety events by mode.
- Rate of reportable safety events per total vehicle revenue miles by mode.
- System reliability measured as the mean distance between major mechanical failures by mode.

When a public transportation provider establishes targets, it must make the targets available to NYMTC. In turn, NYMTC is required to establish PTASP targets within 180 days after the providers established their first targets and must update its targets when it adopts a new regional transportation plan. When establishing PTASP targets, NYMTC can either agree to program projects that will support the transit provider targets or establish separate regional targets for its planning area.

The targets set by transit operators in the NYMTC planning area are displayed in Table 3.13 through Table 3.15. It should be noted that the PTASP Rule states that agencies that operate passenger ferries regulated by United States Coast Guard, or rail fixed guideway public transportation service regulated by Federal Railroad Administration (FRA) are not required to develop safety plans for those modes of service. As a result, targets for MTA LIRR, MTA MNR, and ferries are not reported here.

Table 3.13 MTA Bus Systems Targets

Provider	Fatalities (total)	Customer Accident Injury Rate (per million customers)	Collisions with Injury Rate (per million vehicle miles)	System Reliability: Mean Distance Between Failures (miles)	System Reliability (% of trips completed)
MTA NYC Transit	0.00	1.19	6.47	6,413.0	99%
MTA Bus Company	0.00	1.06	5.51	6,880.0	99%

Source: NYMTC.

Table 3.14 MTA Subway Targets

Category	Fatalities	Injuries	Safety Events	System Reliability (Average Miles Between Failure)
Employee Safety	Reduction by 5%	Reduction by 5%	Reduction by 5%	146,681
Customer Safety	Reduction by 3%	Reduction by 3%	Reduction by 3%	N/A

Source: NYMTC.

Table 3.15 Remaining Transit System Targets

Mode	Fatalities (total)	Fatalities (rate)	Injuries (total)	Injuries (rate)	Safety Events (total)	Safety Events (rate)	System Reliability (miles between major failures)
Westchester County Bee-Line System Fixed Route Bus	0	0	63	8.2	48	6.2	3,600
Westchester County Bee-Line System Paratransit	0	0	4	1.15	4	1.15	40,000
City of Long Beach/ Long Beach Bus Fixed Route Bus	0	0	0	0	0	0	0 failures
City of Long Beach/ Long Beach Bus Paratransit	0	0	0	0	0	0	0 failures
Nassau Inter-County Express Fixed Route Bus	1	0.01	61	0.62	41	0.42	6,902
Nassau Inter-County Express Paratransit	0	0	7	0.34	6	0.29	29,480
Huntington Area Rapid Transit Fixed Route Bus	0	0	0	0	1	0.264	0 failures
Huntington Area Rapid Transit Paratransit	0	0	0	0	0	0	0 failures
Transport of Rockland Fixed Route Bus	0	0	7	0.35	3	0.15	12,396
Transport of Rockland Paratransit	0	0	0	0	0	0	16,117
Putnam Area Rapid Transit Fixed Route Bus	0	0	0	0	0	0	27,820
Putnam Area Rapid Transit Paratransit	0	0	0	0	0	0	99,805
Suffolk County Transit Fixed Route Bus	0	0	14.6	20.6	9.9	14	9,052
Suffolk County Transit Paratransit	0	0	8.6	10.5	7	8.7	133,900.6

Source: NYMTC.

Moving Forward 2055's vision includes maximizing safety and security for people and goods across all uses and modes. As part of the ongoing coordination efforts to fulfill the PTASP requirements, the progress of the transit providers toward achieving their safety targets will be monitored and reported. Additionally, Federal funding will be programmed toward achieving the safety targets of the transit providers.

3.3 FORECASTS THROUGH 2055

3.3.1 FORECASTING OVERVIEW AND ASSUMPTIONS

NYMTC's socioeconomic and demographic (SED) forecasts establish the likelihood that the multistate metropolitan region will experience growth in population, jobs, and economic activity over the planning period. This likelihood presents a challenge to the regional transportation system and highlights the importance of accommodating future growth while safeguarding the quality of life and health of residents and visitors.

The following sections describe the wide range of historical and current SED trends for the region, with a focus on the NYMTC planning area. As applicable, these forecasts contextualize the data within a broader 31-county forecasting region drawn from New York City's multistate metropolitan area. Typically, NYMTC uses U.S. Census data to describe historical trends and forecast them through the Plan's horizon year. Additional technical detail on the forecasting process is provided in Appendix B.

The current SED forecast produces metrics including population, employment, labor force, and number of households, in five-year intervals projected out to the Plan's horizon year. The forecasting region comprises 31 counties in the multistate metropolitan region, consisting of the subregions and their respective counties shown in Table 3.16. Although the SED forecast produces data for the entire forecasting region, much of this chapter focuses on the 10-county NYMTC planning area, which is disaggregated into the New York City, Long Island, and Lower Hudson Valley subregions. A map of the 31-county forecasting region and the NYMTC planning area is also shown in Figure 3.1. NYMTC's Moving Forward 2055 Interactive Map visualizes the results of the SED forecasting.

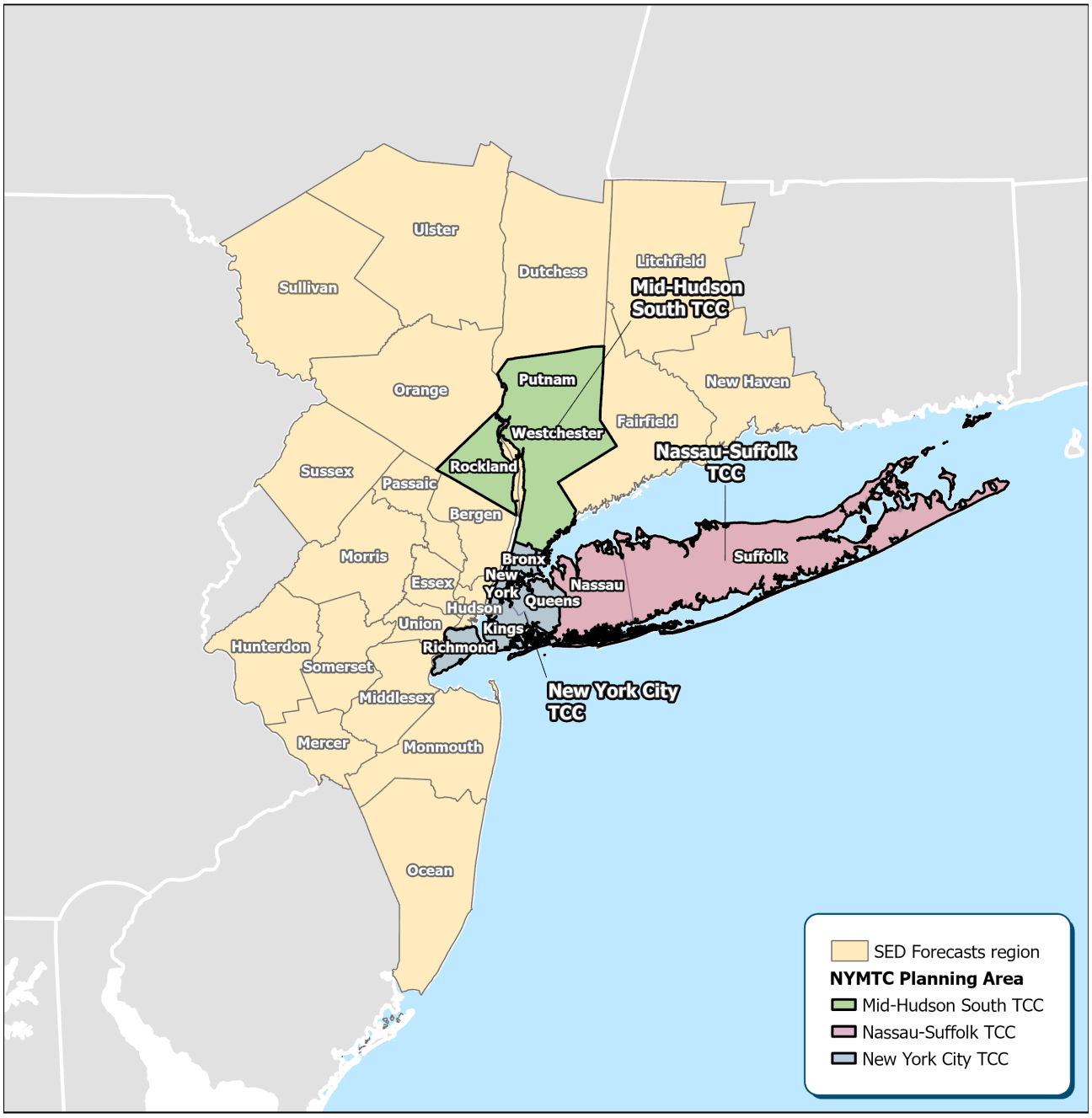
Table 3.16 Subregions of the 31-County Forecasting Region

Larger Subregion	Smaller Subregion	Counties
New York City	New York City[1]	Bronx, Kings (Brooklyn), New York (Manhattan), Queens, Richmond (Staten Island)
Long Island	Long Island[1]	Nassau, Suffolk
Hudson Valley	Lower Hudson Valley[1]	Putnam, Rockland, Westchester
	Mid-Hudson Valley	Dutchess, Orange, Sullivan, Ulster
Northern New Jersey	Northern New Jersey	Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union, Warren
Southwestern Connecticut	Southwestern Connecticut	Fairfield, Litchfield, New Haven

Source: NYMTC.

[1] Included in the NYMTC Planning Area.

Figure 3.1 31-County Forecasting Region and NYMTC Planning Area



Source: NYMTC.

Because of the interdependencies between the NYMTC planning area and the larger multistate metropolitan region, forecasting for a broader 31-county region is important for understanding the NYMTC planning area's prospective SED trends and future transportation needs. In addition, understanding potential regional growth patterns can strengthen integrated transportation and development planning and provide opportunities for more balanced growth. Housing production and capacity play a critical role in these forecasts, as they influence where and how population growth can occur. Limitations in housing supply can constrain projected growth in certain areas, while increases in housing capacity—through zoning changes

or new development—can shift future demographic and transportation patterns. Forecasts in this plan are disaggregated by subregion and county as needed to describe these trends and patterns.

At the time of the development and adoption of NYMTC's previous long-range Plan, *Moving Forward*, in 2020 and 2021, the direct effects of the COVID-19 pandemic were still being felt. The NYMTC planning area, like the rest of the United States, was emerging from stringent lockdowns, mandates, and business capacity restrictions. However, there were still concerns over new and emerging COVID variants, in addition to supply chain disruptions. Especially significant as a result of these events were major shifts in work patterns, such as the widespread adoption of remote work and hybrid work schedules and shifts in housing demand and preferences. These changes at that time signaled a possible trend for living in lower density areas and increased migration outside of the metropolitan cores.

Taken together, these broad impacts, along with restrictions on immigration during the COVID-19 pandemic, contributed to a slight decline in population for the NYMTC region, compared to 2019 pre-pandemic figures. Despite this drop in population, much of the forecasting through 2055 assumes that each subregion will recover to its 2019 levels of population and resume some degree of pre-pandemic growth trend established in the late 2010s. Since 2022, population, employment, and overall traffic levels have rebounded. Depending on the metric and location, certain figures have neared, matched, or surpassed 2019 figures, indicating an overall recovery in relation to key transportation planning metrics discussed in this chapter.

By 2055, the region is expected to be home to a population of 26.1 million people, representing a population gain of 3.1 million over the 2022 base year, and 14.2 million jobs, an increase of 1.8 million from 2022.

HOUSING DEVELOPMENT AND CAPACITY

The Plan's forecasts were developed in the context of new Federal requirements included in the Infrastructure Investment and Jobs Act (IIJA) for MPOs to include housing development and capacity in population and employment projections. To comply, NYMTC staff and stakeholders cross-checked population and employment projections with estimates of required housing units for forecasted households and—forecasts of annual residential building permits.

This analysis found that the number of new housing units needed was greater than the average annual number of residential building permits issued in the last 10 years in four counties within the NYMTC forecasting region. These include Nassau and Suffolk Counties on Long Island; Rockland County, NY; and Passaic County, NJ. In the case of Rockland and Passaic, the number of permitted housing units is much higher than the estimated future local demand. This surplus could help offset housing shortages elsewhere in the region. The Long Island subregion shows an overall deficit of more than 1,300 units per year. Discussions with regional stakeholders in Nassau and Suffolk counties determined that future development should still keep up with the forecasted growth given current information.

This data informed a consensus on the 2055 projections based on comparisons of housing unit development trends, local permitting data, and future housing demand. This approach is in line with the regulations and helps to further ensure the reasonableness of future population and employment forecasts. More information is included in Table 3.17 and Appendix B.

Table 3.17 Comparison of Housing Forecasts, Trends, and Demand

	Adjusted SED Households		New Housing Units Needed			
Subregion/County	2022	2055	Net 2022–2055	Annual Demand	Annual Building Permits Issued (10-Year Average *U.S. Census Building Permit Data*)	Difference Between New Housing Units Needed and Building Permit Survey (New Units)
Non-NYC Region Total[1]	5,400,584	6,057,044	+656,460		36,183	+15,829
Nassau County	456,149	510,927	+54,778	+1,660	1,103	-557
Suffolk County	511,964	574,537	+62,573	+1,896	1,133	-763
Long Island Total	968,113	1,085,464	+117,351	+3,556	2,236	-1,320
Dutchess County	117,028	121,975	+4,947	+150	460	+310
Orange County	139,757	176,538	+36,781	+1,115	1,144	+29
Putnam County	36,104	38,515	+2,411	+73	79	+6
Rockland County	104,003	130,448	+26,445	+801	431	-370
Sullivan County	32,758	36,029	+3,271	+99	335	+236
Ulster County	75,187	75,065	-122	N/A	303	N/A
Westchester County	373,505	387,742	+14,237	+431	1,757	+1,326
Mid-Hudson Total	878,342	966,312	+87,970	+2,669	4,509	+1,840
New Jersey Total	2,789,616	3,182,046	+392,430	+11,892	26,281	+14,389
Connecticut Total	764,513	823,222	+58,709	+2,237	3,157	+920

Source: NYMTC.

[1] The Non-New York City region total includes Long Island, Mid-Hudson, New Jersey, and Connecticut subregion totals within the 31-county forecasting region.

REGIONAL GROWTH

In line with key assumptions from *Moving Forward*, the forecasts show a modest reversion to balanced regional growth between New York City and the surrounding suburban counties. Throughout the second half of the 20th century, population and employment growth in the forecasting region heavily favored suburbs where low-density housing and auto-oriented office campuses were prevalent. During the last decade, population and employment growth concentrated disproportionately in New York City, and to a lesser extent, in close-in suburban areas such as Nassau, Westchester, Bergen, and Essex Counties in New York and New Jersey. A combination of housing and transportation constraints in the urban core,

combined with planned land use and market improvements in other areas, results in forecasts that anticipate more even splits of growth within and outside New York City.

With the COVID-19 pandemic in the past, the NYMTC planning area and forecasting region will continue to experience population and employment growth through the planning period, a key indication of the region's overall resilience. However, the rate of growth is expected to slow slightly over time, as a result of various growth constraints, including an aging population. As a mature region, new population and jobs will be absorbed into built out areas, slowing their rates of growth, particularly in the later years of the forecasting period. Despite slowing growth rates, there are still large absolute gains, indicating the continued importance of proactive and informed transportation planning. Key figures associated with these forecasts and takeaways are described in the following subsections.

3.3.2 AGGREGATE FORECASTS FOR THE REGION

Within the 10-county NYMTC planning area, total population is expected to grow by approximately 13 percent between the 2022 base year and 2055, representing an additional 1.7 million residents. Growth rates for employment, referring to the number of jobs, is expected to be approximately 15 percent. Growth in the civilian labor force, referring to the number of people who are 16 or older, not in the military, and either employed or actively looking for work, is expected to be approximately 11 percent. The breakdown of these metrics for the NYMTC planning area and their forecasts for 2022 through 2055 is shown in Table 3.18.

Table 3.18 Aggregate SED Forecasts for the NYMTC Planning Area

Statistic	2022 Value	2055 Value	Absolute Change	Percent Change from 2022–2055
Population	12.67 million	14.33 million	1.66 million	+13.1%
Employment	7.22 million	8.32 million	1.10 million	+15.2%
Civilian Labor Force	6.63 million	7.39 million	0.76 million	+11.4%
Average Household Size	2.52	2.52	No change	0.0%

Source: NYMTC.

Among the NYMTC subregions, as shown in Table 3.19, New York City is expected to have the highest population growth rate, at just under 14 percent. Through 2055, New York City's population is expected to reach nearly 9.5 million, comprising two-thirds of the NYMTC planning area total population, in line with current trends. Long Island's population growth rate is expected to reach 13 percent, with a total population of just under 3.3 million through 2055. The Lower Hudson Valley's population is expected to grow the slowest at approximately 10 percent. The Lower Hudson Valley is also the smallest subregion by measure of population, with an expected 2055 value of slightly below 1.6 million.

By measure of employment, New York City is also expected to have the highest growth rate at nearly 17 percent, exceeding the subregion's population growth rate. In comparison, the growth rate of employment for Long Island and the Lower Hudson Valley subregions is expected to amount to just over

11 percent. At a total figure of 5.9 million, New York City's employment comprises over 70 percent of the entire NYMTC planning area's employment.

The growth rates of the civilian labor force for each subregion are expected to range from 10.7 percent (Long Island) to 11.9 percent (Lower Hudson Valley). Through 2055, New York City's civilian labor force is expected to rise to just over 4.8 million, at a growth rate of just under 12 percent. Overall, the New York City subregion's civilian labor force comprises approximately 65 percent of the entire NYMTC planning area's civilian labor force.

Average household sizes are expected to grow very slightly in the Long Island (an increase of 0.3 percent) and Lower Hudson Valley (an increase of 1.1 percent) subregions and held constant in New York City. The largest average household sizes are expected in Long Island at 2.97, compared to 2.74 for the Lower Hudson Valley. By comparison, New York City's average household size is held constant at 2.37 for the forecast period.

Table 3.19 SED Forecast for the NYMTC Planning Area by Subregion

Statistic	NYMTC Subregion	2022 Value	2055 Value	Absolute Change	Percent Change from 2022–2055
Population (millions)	New York City	8.336	9.471	1.135	+13.6%
	Long Island	2.909	3.286	0.377	+13.0%
	Lower Hudson Valley	1.427	1.570	0.143	+10.1%
Employment (millions)	New York City	5.056	5.903	0.847	+16.8%
	Long Island	1.479	1.651	0.172	+11.6%
	Lower Hudson Valley	0.685	0.764	0.079	+11.5%
Civilian Labor Force (millions)	New York City	4.327	4.831	0.504	+11.6%
	Long Island	1.568	1.735	0.167	+10.7%
	Lower Hudson Valley	0.733	0.820	0.087	+11.9%
Average Household Size	New York City	2.37	2.37	0	0.0%
	Long Island	2.96	2.97	0.01	+0.3%
	Lower Hudson Valley	2.71	2.74	0.03	+1.1%

Source: NYMTC.

When considering the broader 31-county forecasting region, growth rates in northern New Jersey are expected to be the most robust, particularly by measure of population and civilian labor force. From 2022 to 2055, northern New Jersey population is forecasted to grow by 15 percent, labor force by 12 percent, and employment by 14 percent. Southwestern Connecticut's population is expected to grow more slowly, with the region's population increasing by 8 percent, labor force increasing by 10 percent, and employment increasing by 13 percent over the planning period.

3.3.3 POPULATION AND EMPLOYMENT TRENDS AND FORECASTS

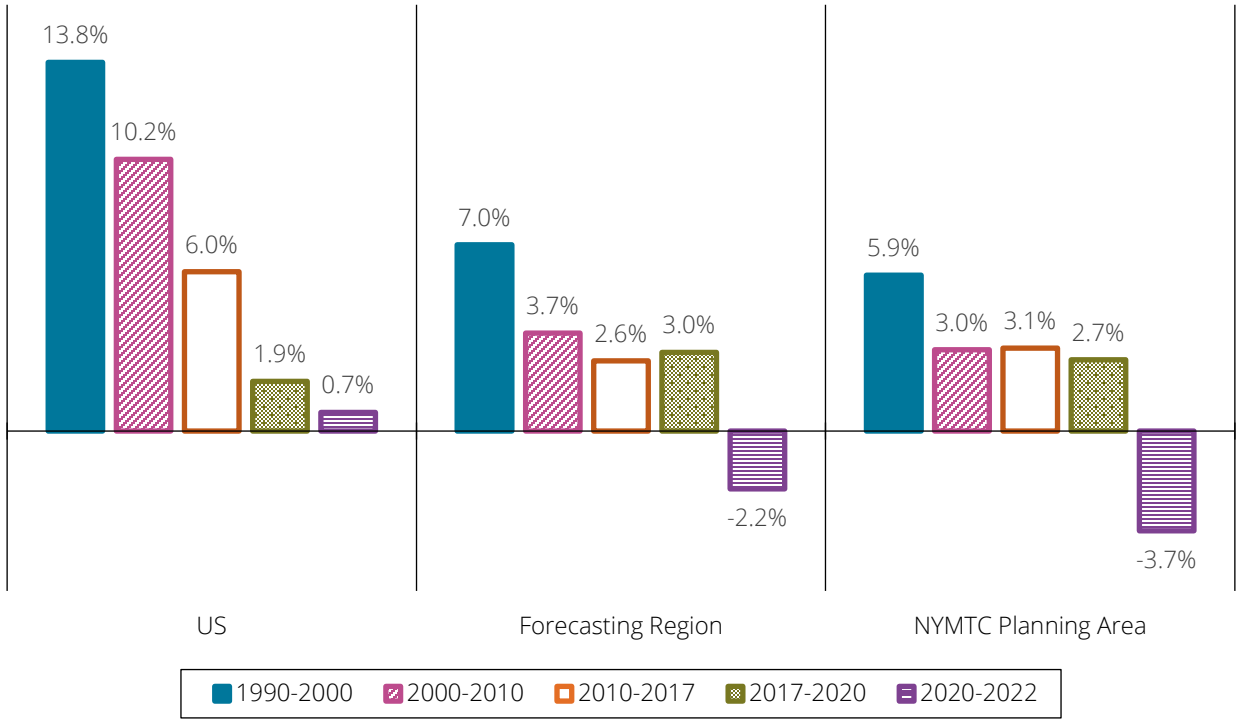
Historical trends provide a context and a basis for the SED forecasts. Trends in population and employment are assessed through the 2022 base year of the forecasts and projected to the Plan's horizon year of 2055. Most of this section focuses on historical trends and forecasts for the NYMTC planning area, with reference to larger patterns within the 31-county region, as necessary.

POPULATION

Between 1990 and 2022, the NYMTC planning area population grew approximately 0.6 percent annually. As shown in Figure 3.2, for the NYMTC planning area, this included an overall trend of slowing growth across much of this period. The NYMTC planning area observed the largest increase in growth between 1990 and 2000, at nearly 6 percent. The rate of growth decreased to approximately 3 percent over each trend period through 2020. From 2020 through 2022, the NYMTC planning area's population declined by nearly 4 percent.

In comparison to the NYMTC planning area, the 31-county forecasting region experienced a slightly greater increase in population between 1990 and 2020. The entire forecasting region also saw a more subdued population decline between 2020 and 2022. Both the core NYMTC planning area, as well as the 31-county forecasting region grew at a slower rate compared to the entire United States. While the United States has followed a similar trend of decreasing rate of growth, the population of the entire United States still managed to grow between 2020 and 2022.

Figure 3.2 Relative Growth in Total Population, 1990–2022



Source: NYMTC.

The disparities in growth in the NYMTC planning area compared to the 31-county forecasting region and the United States can be attributed to multiple factors. One of the most impactful factors is that the NYMTC planning area functions as a mature and nearly built-out region. As indicated by the dense street grid that characterizes much of the NYMTC planning area geography, there are relatively few undeveloped tracts of land where new population growth could occur. Many of those lower density portions of the NYMTC planning area, such as Putnam County, northern Westchester County, and western Rockland County are also characterized by challenging topographies or are already protected as state parks and nature preserves.

Furthermore, while the region has sufficient housing capacity to accommodate projected growth, zoning ordinances—governed at the municipal level— still pose challenges to new residential development. Concerns over aging infrastructure, vehicular traffic levels, and impacts on schools may lead local governments to impose limits on building heights and the ratio of total building floor area to the size of each lot, as well as minimum parking requirements. Although efforts to loosen these restrictions are underway in New York City and other parts of the region, the extent to which these changes will facilitate housing production remains uncertain.

Although these trends can also be found across the larger 31-county forecasting region, the availability of larger areas of undeveloped and underdeveloped land has provided increased opportunities for residential growth. Examples of this can be found in Orange County in New York, as well as Ocean County in New Jersey, which have experienced increases in population—on the magnitude of over 50 percent growth—over the span of recent decades.[2]

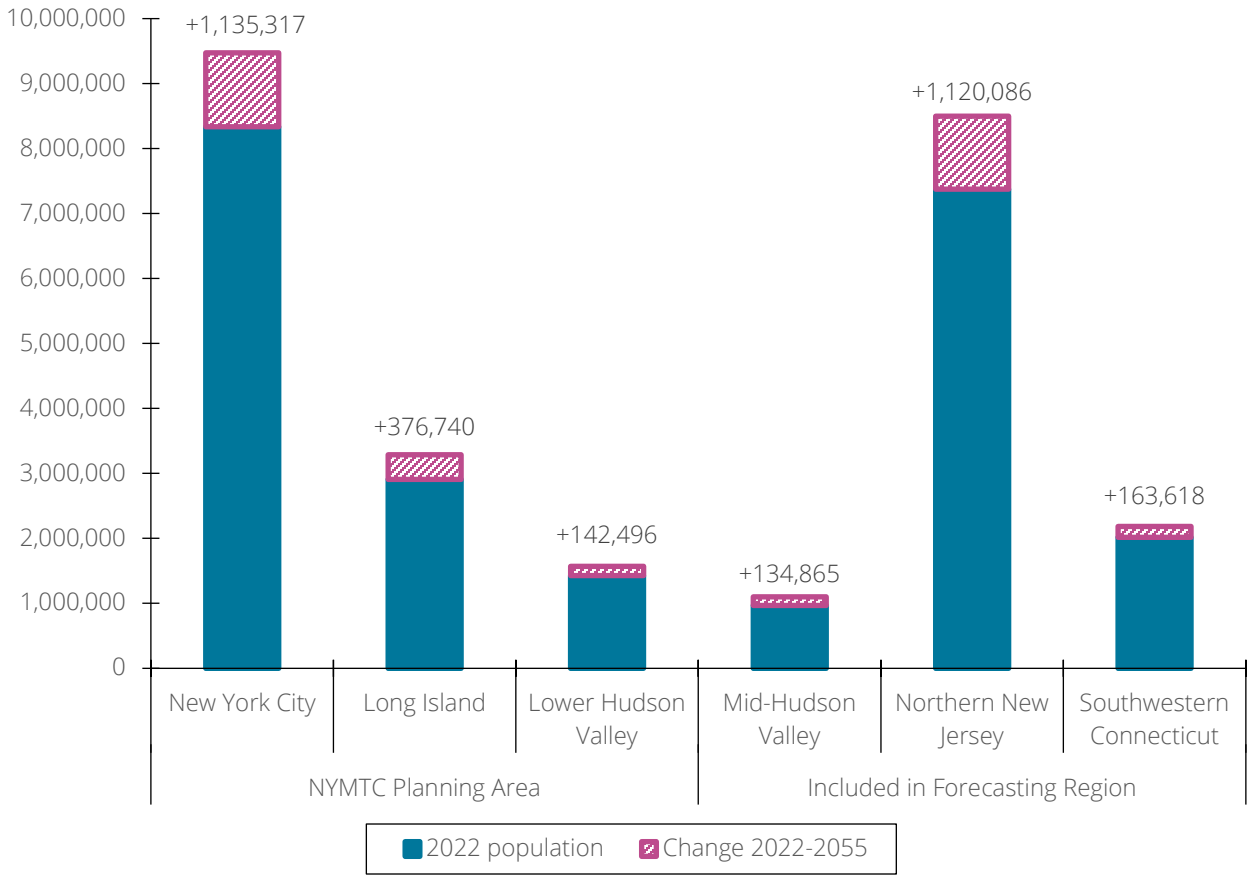
Despite factors which have restricted population growth, the NYMTC planning area has seen increases in population across multiple geographies. Trends of increased development in and around central business districts and train stations have continued, providing opportunities for new multifamily housing developments. For example, high-density development has continued to occur in locations such as New Rochelle, White Plains, and Yonkers in addition to multiple locations across New York City. Additional recent examples of increased residential development in the form of mid-to-high density housing units can be found across the NYMTC planning area in locations such as Tarrytown, Patchogue, Wyandanch, Riverhead, and other locations.

As expected, the COVID-19 pandemic greatly impacted population in the planning area, forecasting region, as well across the entire United States at a scale that could not be fully illustrated in the previous Plan. New York City and surrounding areas were some of the first and hardest hit from the surge of COVID-19. In New York City alone, nearly 36,000 people died of COVID-19 from 2020 through 2021, resulting in a directly related population loss of 0.2 percent per year.[3] Concerns over the contagious nature of the virus, and social distance requirements contributed to domestic migration trends favoring lower density communities. For example, 8 out of 10 counties within the NYMTC planning area and all five boroughs of New York City lost population from 2020 through 2021 due to domestic migration. By comparison, Dutchess County, to the north of the NYMTC planning area, gained approximately 4,000 residents during this timeline.

The COVID-19 pandemic also contributed to a rise in remote work (see more details in Section 3.4.1), allowing many white-collar employees to work in locations away from their anchor office. This contributed to significant growth in traditionally lower cost states and regions, especially in the Sun Belt, and away from larger traditionally higher cost locations, including New York City, and other Northeast and Midwest cities such as Boston, Philadelphia, Chicago, and Washington, D.C.

The forecasting of future population totals must be considered against the backdrop of population losses from the COVID-19 pandemic, but also those trends which have followed. Through 2025, initial estimates indicate that migrations away from the region's most UZAs within New York City have largely dissipated and even reversed, indicating that the NYMTC planning area will resume growth in the upcoming decades. As shown in Figure 3.3, the NYMTC planning area's population is projected to increase by 13 percent, or by almost 1.65 million people from 2022 to 2055. Within this area, the New York City subregion is expected to grow by just over 13 percent, adding 1,135,000 people in the next three decades. The population on Long Island is expected to grow by 13 percent, or by about 377,000 people. The Lower Hudson Valley subregion is expected to grow by 10 percent, or by almost 143,000 people. By comparison, the entire forecast region is expected to grow at a similar pace, with northern New Jersey adding the newest residents, at an increase of approximately 16 percent through 2055.

Figure 3.3 Population Growth by Subregion, 2022–2055



Source: NYMTC.

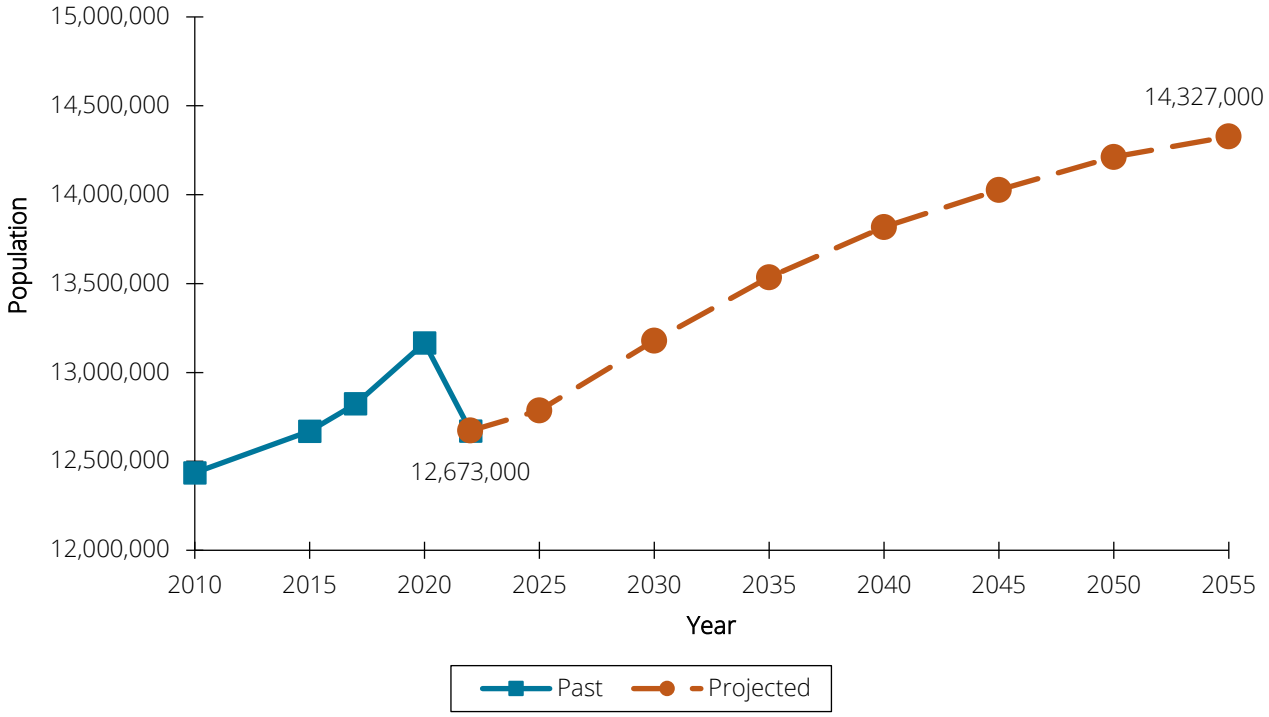
As shown in Table 3.20, projected population growth rates in Long Island and the Lower Hudson Valley are expected to exceed recent historical averages. New York City's population, however, is expected to grow at a decreasing rate, especially through the latter portion of the forecasted time period. As further illustrated in Figure 3.4, the NYMTC planning area as a whole is expected to grow at a decreasing rate, reflecting the trends of New York City, which comprises the majority of the NYMTC planning area's population. As a whole, the NYMTC planning area is expected to exceed its pre-pandemic population by around 2030 according to forecasts. As noted earlier in this section and presented in Table 3.17 NYMTC staff and stakeholders cross-checked population forecasts with estimates of required housing units for forecasted households and forecasts of annual residential building permits.

Table 3.20 Population Trends and Forecasts by County/Borough and Subregion (Thousands)

Area	2010	2015	2020	2022	2025	2030	2035	2040	2045	2050	2055
New York City Total	**8,243**	**8,426**	**8,804**	**8,336**	**8,429**	**8,763**	**8,964**	**9,136**	**9,295**	**9,418**	**9,471**
Bronx County	1,385	1,423	1,473	1,380	1,430	1,495	1,536	1,574	1,608	1,634	1,647
Kings County	2,553	2,594	2,736	2,591	2,612	2,723	2,792	2,853	2,910	2,957	2,980
New York County	1,586	1,637	1,694	1,596	1,604	1,674	1,714	1,745	1,772	1,791	1,797
Queens County	2,250	2,295	2,405	2,278	2,291	2,376	2,423	2,462	2,499	2,529	2,537
Richmond County	469	478	496	491	491	495	499	502	505	508	510
Long Island Total	**2,833**	**2,856**	**2,922**	**2,909**	**2,923**	**2,963**	**3,079**	**3,157**	**3,191**	**3,238**	**3,286**
Nassau County	1,340	1,355	1,396	1,384	1,389	1,409	1,466	1,505	1,518	1,546	1,573
Suffolk County	1,493	1,501	1,526	1,525	1,534	1,554	1,613	1,652	1,673	1,693	1,713
Lower Hudson Valley Total	**1,361**	**1,387**	**1,440**	**1,427**	**1,434**	**1,454**	**1,494**	**1,525**	**1,542**	**1,556**	**1,570**
Putnam County	100	99	98	98	98	100	103	106	107	107	108
Rockland County	312	321	338	339	345	357	374	390	404	419	435
Westchester County	949	967	1,004	990	991	997	1,017	1,030	1,031	1,029	1,028
NYMTC Planning Area Total	**12,436**	**12,669**	**13,166**	**12,673**	**12,786**	**13,180**	**13,536**	**13,818**	**14,027**	**14,213**	**14,327**

Source: NYMTC.

Figure 3.4 Population Forecast for the NYMTC Planning Area



Source: NYMTC.

HOUSEHOLDS

The number of households in the NYMTC planning area is projected to increase by approximately 13 percent between 2022 and 2055, resulting in approximately 641,000 new households. Household growth in New York City is anticipated to be the strongest, at 14 percent, compared to Long Island and the Lower Hudson Valley projected growths of approximately 12 percent and just over 8 percent, respectively. In absolute terms, New York City is expected to add approximately 481,000 households (Table 3.21), comprising the majority of new households across the NYMTC planning area.

Table 3.21 Total Number of Households by County/Borough and Subregion (In Thousands)

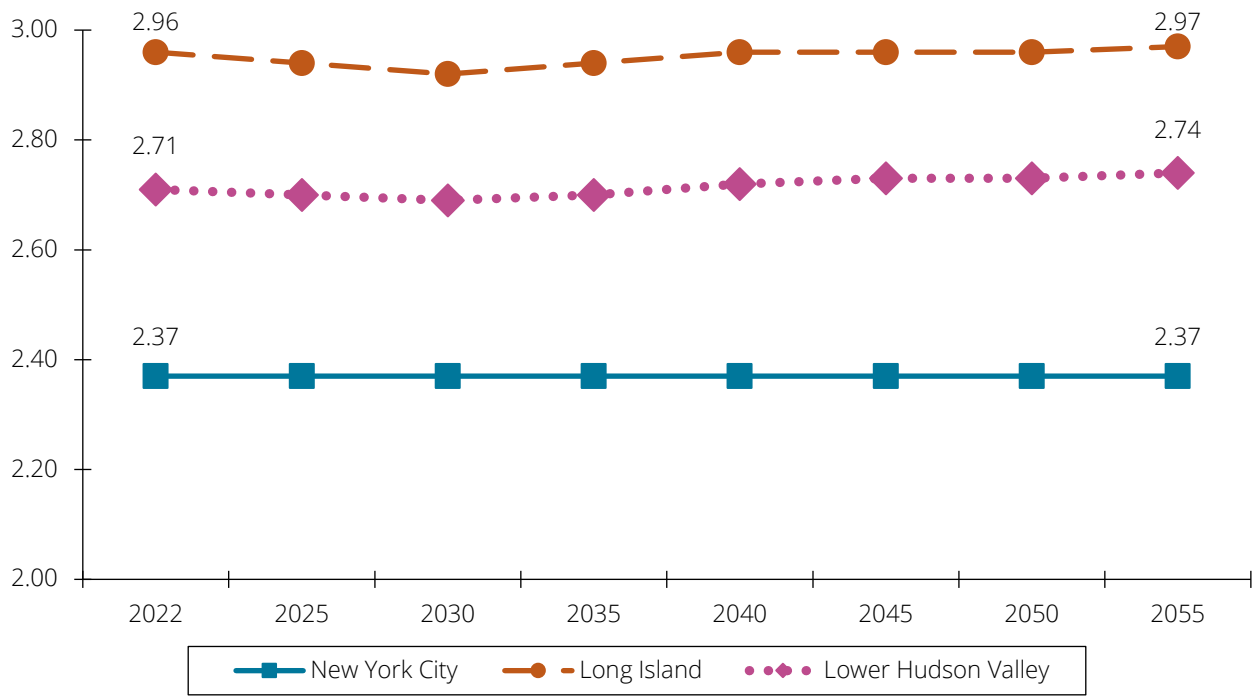
County & Subregion	2022	2025	2030	2035	2040	2045	2050	2055
New York City Total	3,427	3,465	3,608	3,694	3,767	3,834	3,886	3,908
Bronx	533	553	579	596	611	625	635	640
Kings	1,032	1,041	1,085	1,114	1,138	1,162	1,181	1,190
New York	826	830	869	890	907	922	932	935
Queens	862	867	899	918	933	947	958	961
Richmond	174	174	175	177	178	179	180	181

County & Subregion	2022	2025	2030	2035	2040	2045	2050	2055
Long Island Total	968	976	995	1,026	1,047	1,055	1,070	1,085
Nassau	456	459	466	480	489	492	502	511
Suffolk	512	517	528	546	558	563	569	575
Lower Hudson Valley Total	514	517	524	536	544	548	552	557
Putnam	36	36	37	38	38	39	39	39
Rockland	104	105	108	113	118	121	126	130
Westchester	374	375	379	385	388	388	388	388
NYMTC Planning Area	4,909	4,958	5,127	5,256	5,357	5,437	5,508	5,550

Source: NYMTC.

NYMTC's previous long-range plan (*Moving Forward*), projected a greater average household size for 2022 than what actually occurred. This discrepancy is particularly evident in New York City, where household size was previously projected at 2.58 persons but is currently at 2.37 persons per household, due to the post-2020 decline. This represents a notable decrease of 8 percent in household size between 2017 (the *Moving Forward* base year) and 2022 (*Moving Forward 2055's* base year). Given the uncertainty in the trajectory, average household size for the New York City subregion was held constant for the forecast period, with minor fluctuations anticipated in the other two subregions. By 2055, Long Island will continue to have the largest household size among the subregions, averaging 2.97 persons per household, as shown in Figure 3.5.

Figure 3.5 Average Household Size by Subregion

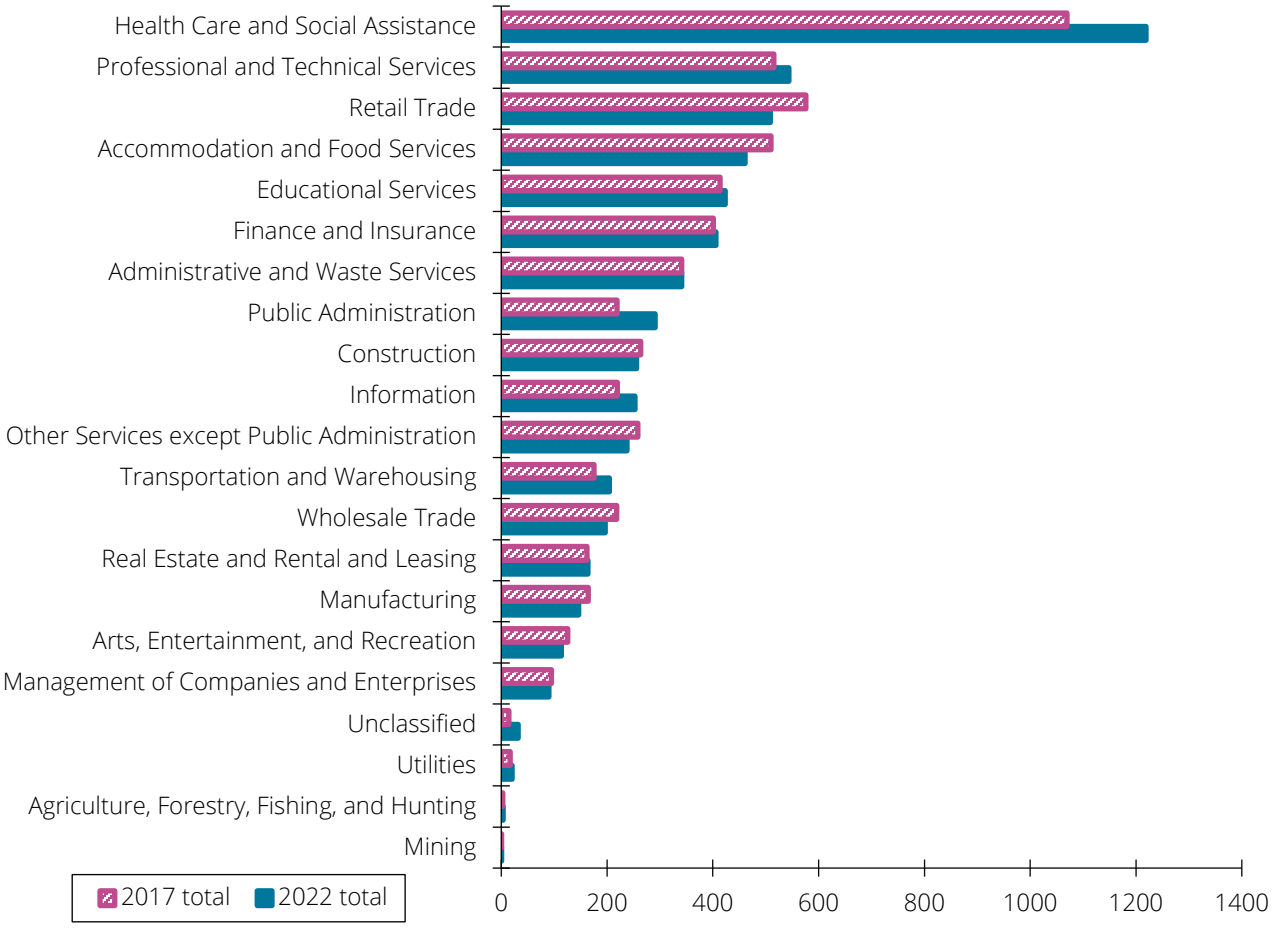


Source: NYMTC.

EMPLOYMENT

In 2022, approximately 7.2 million jobs were located within the NYMTC planning area, an increase of roughly 137,000 jobs, or just under 2 percent, compared to 2017 employment levels. As shown in Figure 3.6, the largest gains in employment across the NYMTC planning area occurred in the healthcare and social assistance sector, which already constituted the highest number of jobs. Between 2017 and 2022, healthcare and social assistance jobs increased by nearly 150,000 to just over 1.2 million. Notable increases in total jobs were also recorded across the public administration (increase of approximately 70,000 jobs), professional and technical services (increase of approximately 29,000 jobs), information (increase of approximately 33,000 jobs), transportation and warehousing (increase of approximately 29,000 jobs), educational services (increase of approximately 10,000 jobs), and finance and insurance (increase of approximately 5,000 jobs) sectors. By comparison, decreases in employment were observed in the retail trade (decrease of approximately 67,000 jobs), accommodation and food services (decrease of approximately 50,000 jobs), wholesale trade (decrease of approximately 22,000 jobs), other services except public administration (decrease of approximately 20,000 jobs), manufacturing (decrease of approximately 18,000 jobs) and construction (decrease of approximately 7,000 jobs) sectors.

Figure 3.6 Total Number of Jobs by Major Industry in the NYMTC Planning Area, 2017–2022 (Thousands)

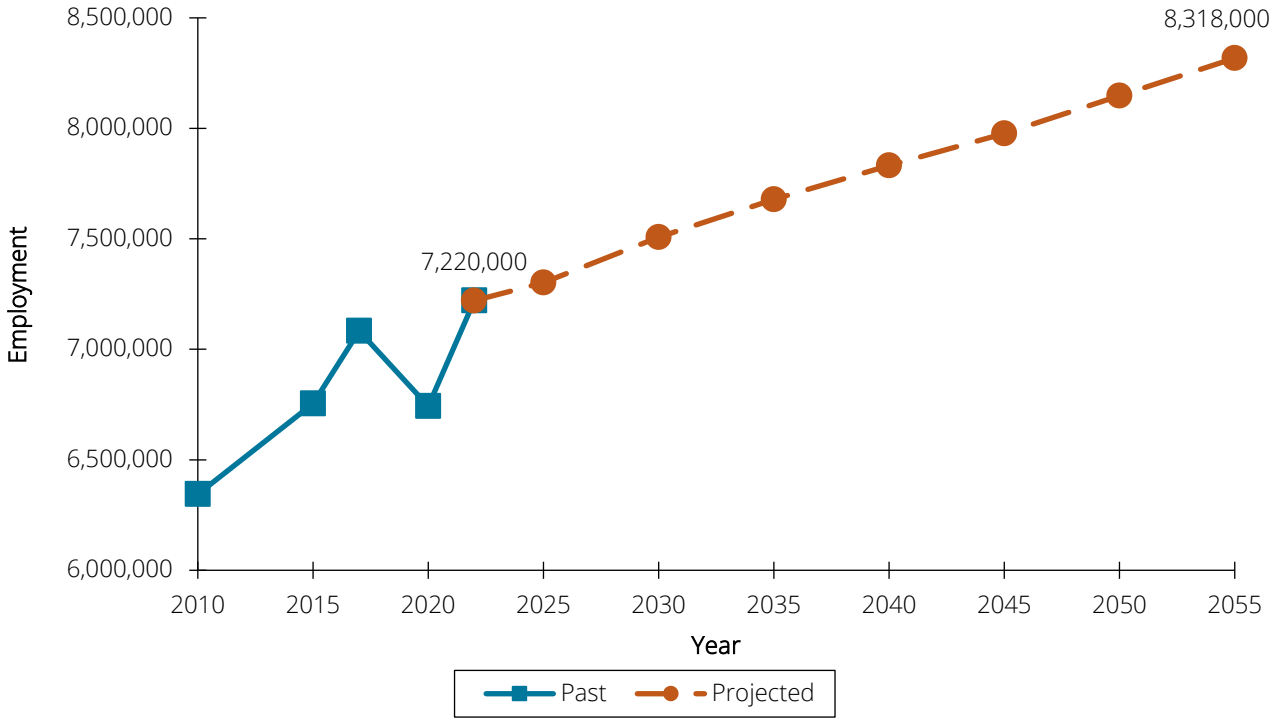


Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (2017–2022).

Over the six-year period, the fluctuations in employment by sector largely reflected the trends associated with the COVID-19 pandemic. This included widespread increases in demand for healthcare services, which contributed to the sector's pronounced growth, and such demand may grow further with the aging of the population in the NYMTC region. By comparison, the retail trade, as well as accommodation and food service sectors experienced drops in employment, reflecting reduced tourism and entertainment spending, as well as the challenging environment for restaurants and entertainment venues. At the same time, the professional and business services, as well as finance and insurance sectors both recorded slight increases, reflecting the overall economic resilience of the NYMTC planning area. Combined, both sectors constitute a substantial portion of the NYMTC planning area's white-collar employment, including within key financial hubs across NYMTC's urban and suburban areas.

Through 2055, employment growth is forecasted to continue over the planning period in a slower and more balanced pattern than seen in the past, as broadly shown in Figure 3.7. Overall, the forecasting region had a compound annual growth rate of 1 percent from 2010 through 2022 (1.6 percent from 2010 through 2017), although this is expected to moderate further over the planning period to 0.4 percent per year through 2055, factoring in assumptions of several economic cycles over the next three decades along with the recent effects of the COVID-19 pandemic. This annual growth results in a total increase of just over 14 percent, or 1.79 million jobs, over the time period of 2022 through 2055.

Figure 3.7 Employment Forecast for the NYMTC Planning Area



Source: NYMTC.

Detailed employment forecasts by geography shown in Table 3.22 and visualized in Figure 3.8. Employment in the New York City subregion is forecast to grow by 847,000 between 2022 and 2055, an increase of approximately 16 percent. This constitutes the majority of added jobs in the NYMTC planning area. Within

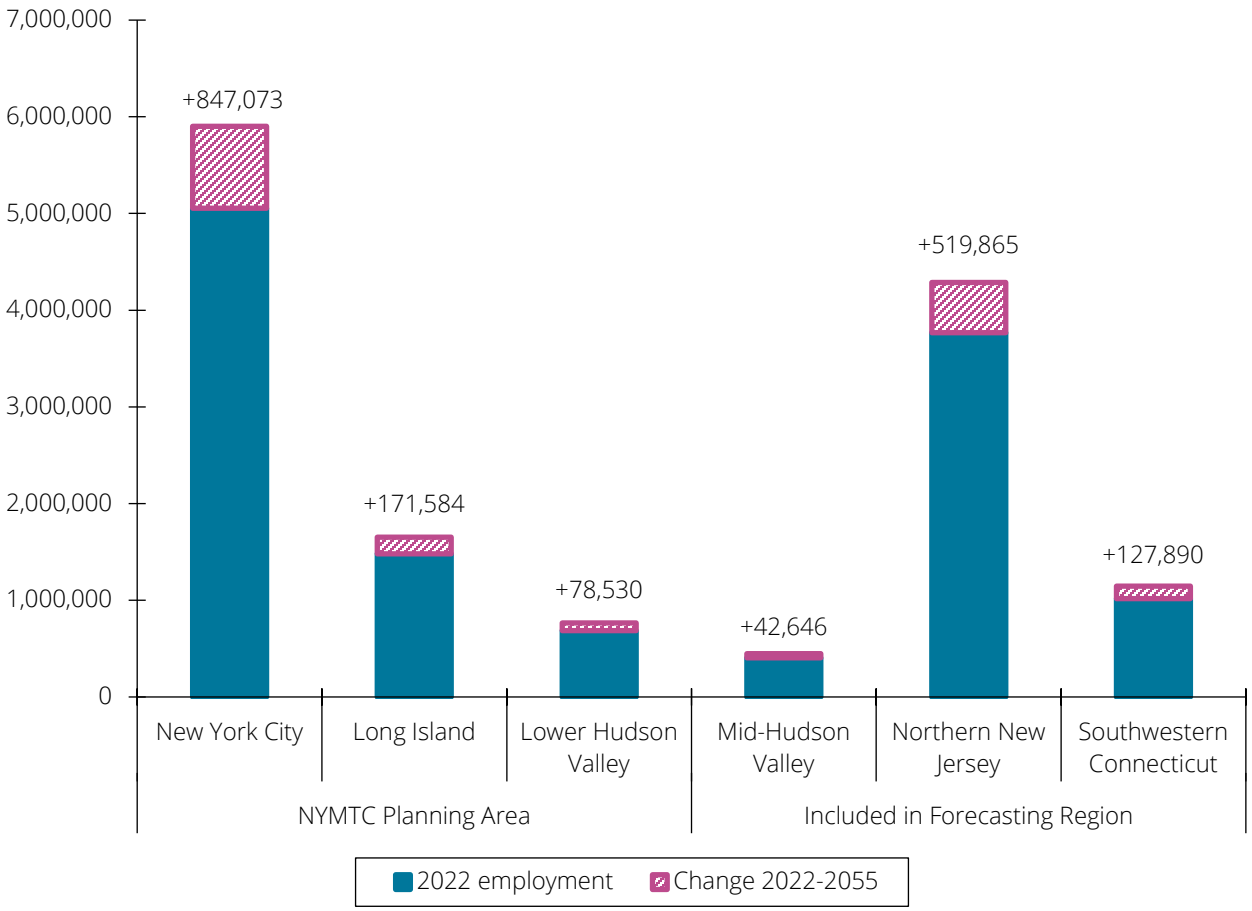
New York City, the centralization of job growth in the Manhattan core is anticipated to moderate, although Manhattan will continue to see the largest total increase in jobs. Employment growth in the outer boroughs is expected to continue as Brooklyn and Queens grow as regional job centers, outpacing Manhattan's growth. By 2045, employment in New York City's outer boroughs will be higher than those totals of Manhattan. Similarly, employment in those counties outside of New York City is expected to continue, with Nassau County expected to overtake Suffolk County as the largest employment hub. Both counties are expected to have over 800,000 jobs each, beginning in 2045. In the Lower Hudson Valley, Westchester County is expected to have approximately 557,000 jobs through 2055, an increase of approximately 53,000 over 2022, making it the largest employment hub in the subregion.

Table 3.22 Employment Trends and Forecasts by County/Borough and Subregion (Thousands)

Area	2010	2015	2017	2020	2022	2025	2030	2035	2040	2045	2050	2055
New York City Total	**4,527**	**4,850**	**5,115**	**4,733**	**5,056**	**5,114**	**5,267**	**5,392**	**5,513**	**5,624**	**5,763**	**5,903**
Bronx County	380	401	413	382	398	407	422	437	450	462	483	503
Kings County	823	903	941	922	1,021	1,040	1,080	1,115	1,151	1,182	1,215	1,248
New York County	2,489	2,654	2,832	2,497	2,626	2,644	2,696	2,737	2,765	2,793	2,821	2,849
Queens County	709	754	788	788	853	864	902	930	973	1,006	1,059	1,112
Richmond County	126	138	141	145	158	160	167	172	176	180	185	189
Long Island Total	**1,227**	**1,285**	**1,324**	**1,368**	**1,479**	**1,494**	**1,534**	**1,566**	**1,586**	**1,607**	**1,629**	**1,651**
Nassau County	591	613	631	666	728	737	762	781	794	807	821	835
Suffolk County	637	672	692	702	751	758	772	784	792	800	808	816
Lower Hudson Valley Total	**590**	**619**	**645**	**641**	**685**	**693**	**707**	**721**	**732**	**746**	**755**	**764**
Putnam County	28	29	30	31	34	34	35	35	36	36	36	36
Rockland County	117	122	129	136	148	150	154	158	161	164	167	170
Westchester County	445	467	486	473	504	509	518	527	536	546	552	557
NYMTC Planning Area Total	**6,344**	**6,754**	**7,083**	**6,743**	**7,220**	**7,302**	**7,507**	**7,678**	**7,831**	**7,977**	**8,147**	**8,318**

Source: NYMTC.

Figure 3.8 Employment Change by Subregion, 2022–2055



Source: NYMTC.

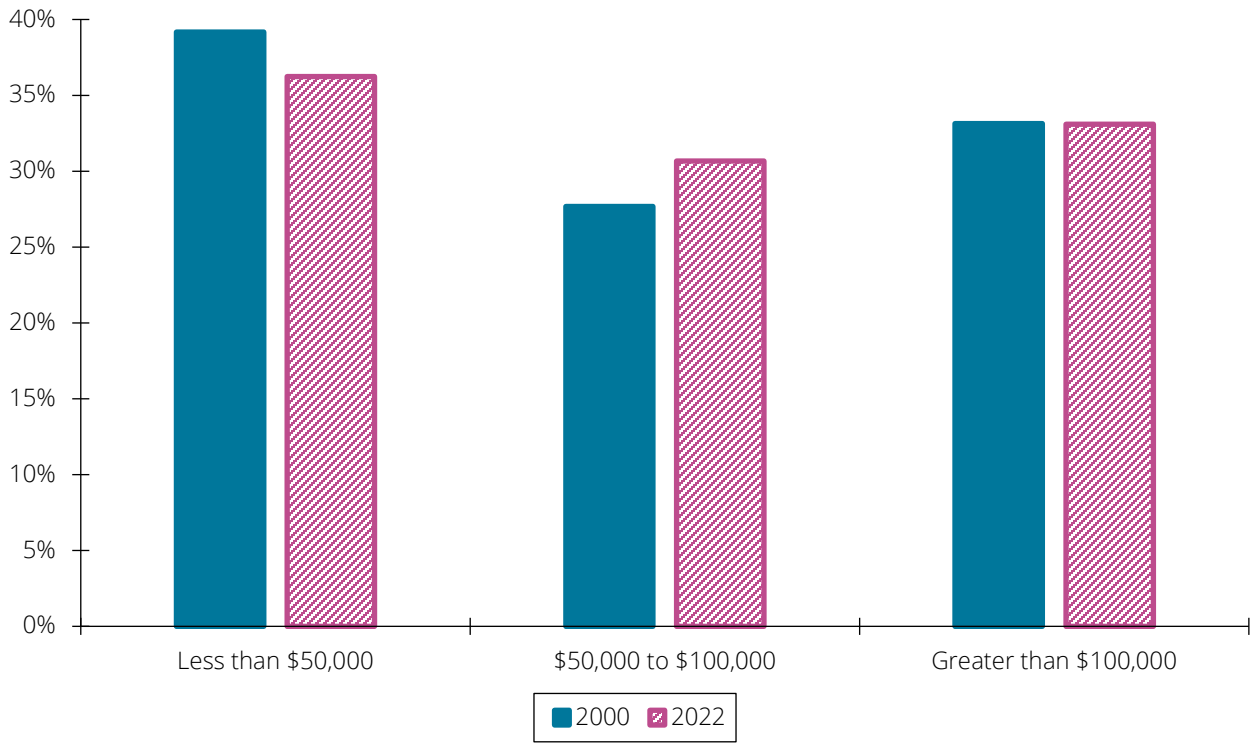
Outside of the NYMTC planning area, from 2022 to 2055, northern New Jersey's population is expected to grow as much as New York City's, although job growth will occur at a lower rate. This reflects a growing imbalance between residents and jobs within the subregions, with more residents in northern New Jersey and more jobs in New York City, potentially adding strain to the region's transportation system as more people need to commute longer distances.

In 2022, approximately 70 percent of all the jobs in the NYMTC planning area were in New York City. Roughly 2.6 million jobs were in Manhattan, constituting more than the rest of New York City combined, approximately 35 percent of jobs in the NYMTC planning area, and approximately 20 percent of jobs in the broader forecasting region. The employment forecast anticipates a rebalancing of growth throughout the NYMTC planning area with continued strong employment growth outside of New York City. From 2022 through 2055, employment is expected to grow in suburban Long Island and the Lower Hudson Valley by approximately 11.5 percent in each of those subregions, in the Mid-Hudson Valley by 10.5 percent, and in Southwestern Connecticut by 12.5 percent. Among subregions outside of New York City, northern New Jersey is expected to see the largest numerical and proportional increase in jobs, with nearly 14 percent growth between 2022 and 2055.

INCOME

In 2022, the real median household income in the NYMTC planning area was approximately $104,000, nearly 140 percent of the U.S. average of just below $75,000. Consistent with national trends, the median household income for the NYMTC planning area has been on the rise since 2013. Among the three subregions, Long Island had the highest median household income in 2022 at approximately $128,000, followed by the Lower Hudson Valley at approximately $106,000, and New York City at nearly $78,000. At the county level, Nassau County had the highest median household income at nearly $137,000, while the Bronx had the lowest at just under $46,000. It is notable that from 2017 to 2022, counties in Long Island experienced the most substantial income growth (approximately 30 percent), while counties in Lower Hudson Valley had the smallest increase, around 15 percent (note all income trend statistics are inflation-adjusted to 2022 dollars). Between 2000 to 2022, there has been a notable shift in the distribution of household income within the planning area. When looking at three income brackets—less than $50,000; between $50,000 and $100,000; and greater than $100,000—the data shows a 3 percent decrease in the share of lower-income households (earning less than $50,000). Conversely, the share of middle-income households (earning between $50,000 and $100,000) grew by approximately the same margin (3 percent), indicating an upward shift of households into the middle-income bracket. The proportion of households earning more than $100,000 has remained relatively stable over this period, suggesting limited but steady growth in the highest income category (Figure 3.9).

Figure 3.9 Percentage of Households in Each Income Bracket



Source: U.S. Census Bureau, 2000 Census; 2022 American Community Survey (ACS) 1-Year Estimates.

The New York City subregion continues to have the highest share of households with incomes of less than $50,000. In 2022, Long Island became the subregion with the greatest share of households with incomes greater than $100,000 at 46 percent (Table 3.23). The Long Island subregion is also home to the greatest share of households within the $50,000 to $100,000 income bracket. These variations suggest that the migratory and economic impacts of COVID-19 may have differentially influenced the growth and distribution of household income distribution across the subregions, although further analysis is required to examine the magnitude of each impact, and the degree to which this is the case.

Table 3.23 Percent Share of Household Income by Subregion

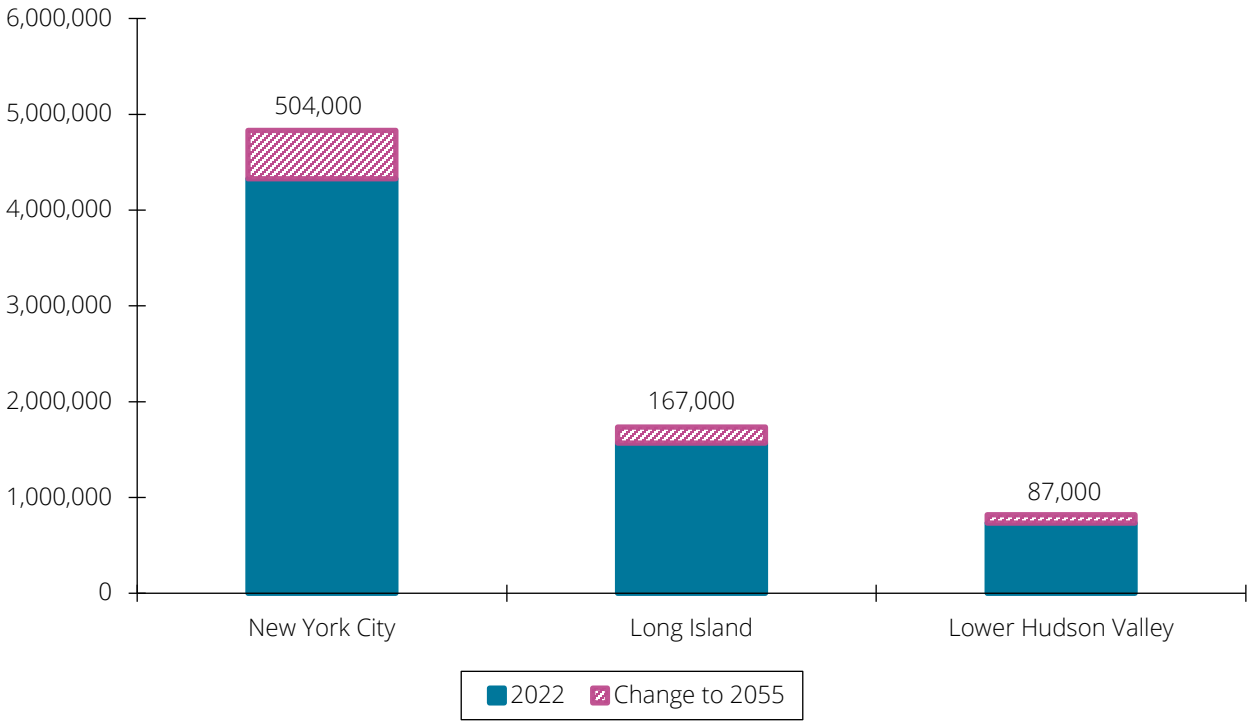
Year	Subregion	< $50,000	$50,000–$100,000	> $100,000
2000	New York City	38%	38%	24%
	Long Island	27%	39%	34%
	Lower Hudson Valley	21%	32%	48%
2022	New York City	42%	30%	28%
	Long Island	21%	33%	46%
	Lower Hudson Valley	28%	30%	41%

Source: U.S. Census Bureau, 2000 Census; 2022 ACS 1-Year Estimates.

LABOR FORCE

Overall, the number of eligible workers in the NYMTC planning area is projected to grow to about 7.4 million by 2055, an approximately 11 percent increase from 2022, as seen in Figure 3.10 and Table 3.24 . From 2022 to 2055, the Lower Hudson Valley is projected to experience the highest growth rate at nearly 12 percent, while Long Island is expected to have the lowest at just under 11 percent. Although New York City's labor force growth rate at 11.6 percent is slightly lower than Lower Hudson Valley's, the City is expected to contribute about two-thirds of all labor force additions within the area, translating to approximately 504,000 additional eligible workers. Across the region, the growth of the labor force is also supported by an increase in the participation of older adults who may delay retirement or re-enter the workforce, due to rising costs of living and an increase in jobs more suitable for these demographics. Moreover, policies supporting flexible work arrangements and part-time opportunities for older adults may help sustain a larger labor force.

Figure 3.10 Labor Force Change by Subregion, 2022–2055



Source: NYMTC.

Table 3.24 Labor Force Trends and Forecasts by County/Borough and Subregion (Civilian Labor Force Size in Thousands)

County & Subregion	2022	2025	2030	2035	2040	2045	2050	2055
New York City Total	**4,327**	**4,338**	**4,472**	**4,573**	**4,676**	**4,759**	**4,805**	**4,831**
Bronx	624	651	673	689	709	726	738	744
Kings	1,338	1,284	1,330	1,367	1,401	1,424	1,435	1,447
New York	925	969	1,003	1,028	1,054	1,074	1,082	1,085
Queens	1,198	1,202	1,236	1,258	1,280	1,298	1,311	1,315
Richmond	242	231	230	231	233	237	239	240
Long Island Total	**1,568**	**1,517**	**1,516**	**1,587**	**1,637**	**1,668**	**1,710**	**1,735**
Nassau	739	724	730	776	804	817	838	853
Suffolk	829	794	786	811	832	851	872	882
Lower Hudson Valley Total	**733**	**738**	**747**	**765**	**783**	**798**	**814**	**820**
Putnam	53	52	52	53	54	55	56	57
Rockland	158	169	175	184	193	202	211	219
Westchester	522	517	520	528	536	541	546	545
NYMTC Planning Area Total	**6,628**	**6,593**	**6,735**	**6,925**	**7,096**	**7,225**	**7,328**	**7,386**

Source: NYMTC.

3.3.4 WHERE GROWTH WILL LIKELY OCCUR

NYMTC uses the forecasting data to improve long-term transportation planning including which areas may grow by population or work force, increasing the need for further transportation investment. This effort is guided by the objective to produce fair, sustainable, and safe recommendations for meeting the region's evolving growth needs, which is found under *Moving Forward 2055's* Shared Vision Resiliency goal.

The NYMTC planning area is forecasted to continue to experience population and employment growth throughout the planning period. After a rapid post-pandemic recovery, the population in the NYMTC planning area is expected to slightly surpass 2020 levels by 2030. Afterwards, however, growth is expected to slow down over time. This longer-term deceleration in growth is in line with previous analyses and mainly comes from likely growth constraints across the planning area. The forecast also assumes more geographically balanced longer-term population and employment growth, compared to the last 10 years of more centralized growth in the core of the planning area, implying greater medium-term growth in the suburban subregions of the NYMTC planning area compensating for greater short-term growth in New York City.

SUBREGIONAL GROWTH PATTERNS

At the subregional level, the New York City subregion will likely experience the most growth in employment, while northern New Jersey will see the largest growth in population, civilian labor force, and total households during the planning period. All regions will see their respective job numbers increase by at least 10 percent from 2022 to 2055. Outside of New York City however, the largest relative growth in both population and employment—by measure of percentage increase, and absolute growth, will be in northern New Jersey.

COUNTY/BOROUGH GROWTH PATTERNS

At the county/borough level in New York City, Kings County (Brooklyn) is projected to lead all counties/boroughs in population growth, total household growth, and civilian labor force growth during the planning period, while Manhattan is projected to lead employment growth. Brooklyn and Queens County are projected to continue to grow as centers of regional employment, with each borough gaining more than 200,000 jobs through 2055. The Bronx (Bronx County) is projected to experience the highest proportional increases in population, total households, and civilian labor force in the New York City subregion through 2055.

Within the Long Island subregion, Nassau County will likely experience more absolute and relative (percentage) growth in population, employment, and the civilian labor force, while Suffolk County will experience more growth in total households. In the long term, Long Island counties will see steadily rising job growth through 2055. In the Lower Hudson Valley, Rockland County will experience the highest proportional increase in population, total households, and average household size through 2055. It will also experience a large proportional increase in job growth, with only the four outer boroughs of New York City experiencing greater proportional growth. Westchester County is forecasted to add the most jobs through 2055 in the Lower Hudson Valley.

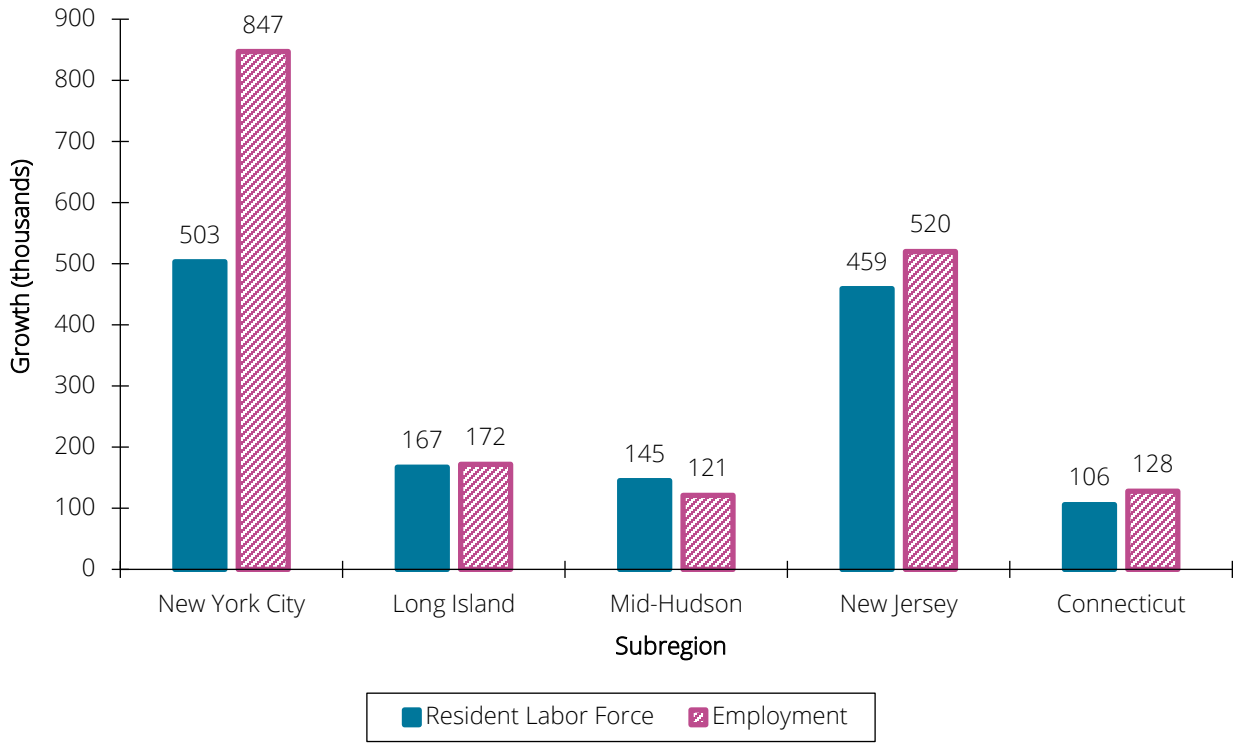
Outside the NYMTC planning area and considering the counties of the multistate metropolitan region, for northern New Jersey, Hudson County is expected to have the largest population and employment growth, both by numerical and percentage change. The county, adjacent to New York City, is expected to add over 200,000 people (29 percent growth), and nearly 80,000 jobs (24 percent growth). Among counties in southwestern Connecticut, Fairfield County is expected to have the largest absolute population growth, adding nearly 151,000 people (16 percent growth), while adding nearly 67,000 jobs. Both Fairfield and New Haven Counties will experience the largest relative employment growth among NYMTC counties in Connecticut at 13 percent.

EMPLOYMENT AND LABOR FORCE GROWTH BALANCE

Comparing the forecasted growth in employed residents (labor force) versus employment (number of jobs) can provide insights into how commuting patterns might change in the region (Figure 3.11). New York City job growth is expected to outpace the number of employed residents; Long Island and the Lower Hudson Valley are expected to see resident labor force growth nearly match or exceed that of employment through 2055 (see Appendix B).

In addition to changes in labor force and job growth, other factors—such as increases in labor force participation rates, residents staying in the workforce longer, and increases in the rates of residents holding multiple jobs—will play a role in filling workforce demand.

Figure 3.11 Labor Force Growth vs. Employment Growth in the Forecasting Region, 2022–2055 (In Thousands)



Source: NYMTC.

3.4 TRAVEL DEMAND TRENDS AND FORECASTS

SED trends and forecasts are critical inputs for the modeling of travel demand in the NYMTC planning area. The SED projections described in Chapter 3.3 (and in more detail in Appendix B) are inputs into the New York Best Practice Model (NYBPM), the travel demand simulation model used to generate forecasts of travel demand. NYMTC uses the NYBPM to predict and simulate detailed travel patterns for every household in the 28-county study area, over a 24-hour weekday period, based on their travel behavior. NYMTC projects travel for people and goods in the multistate metropolitan region using complex algorithms that predict the travel and modal choices made by each household and consequently each person who resides in the NYBPM coverage area. The model also forecasts auto trips coming from outside the coverage area or passing through, as well as all truck and commercial vehicle trips. Projections of travel, average travel time, travel origins and destinations, and modal choice are aggregated for the NYMTC planning area as a whole and then by subregion and county/borough. NYMTC's Moving Forward 2055 Interactive Map also visualizes vehicular and truck traffic as a component of overall travel demand trends and forecasting.

3.4.1 IMPACTS OF THE COVID-19 PANDEMIC

The COVID-19 pandemic dynamically shifted travel patterns in 2020. While travel patterns have gradually trended toward pre-COVID conditions since 2021, significant differences still remain. Significant shares of the workforce continue to work remotely for some or all days of the week (also known as work from home, telecommute, or telework), decreasing travel demand to workplaces. As a result, transit ridership in the NYMTC region as a whole remains lower than pre-COVID levels, even as some transit agencies have actually started to see increases. Total vehicle travel, conversely, has recovered to pre-COVID levels and was not as affected by the increase in remote work. SED forecasts try to account for many of these changes by incorporating new employment and population data, as well as updated labor force projections, to better understand future travel demand. The SED forecasts do not directly incorporate the impacts of remote work trends on future locations of households and employment.

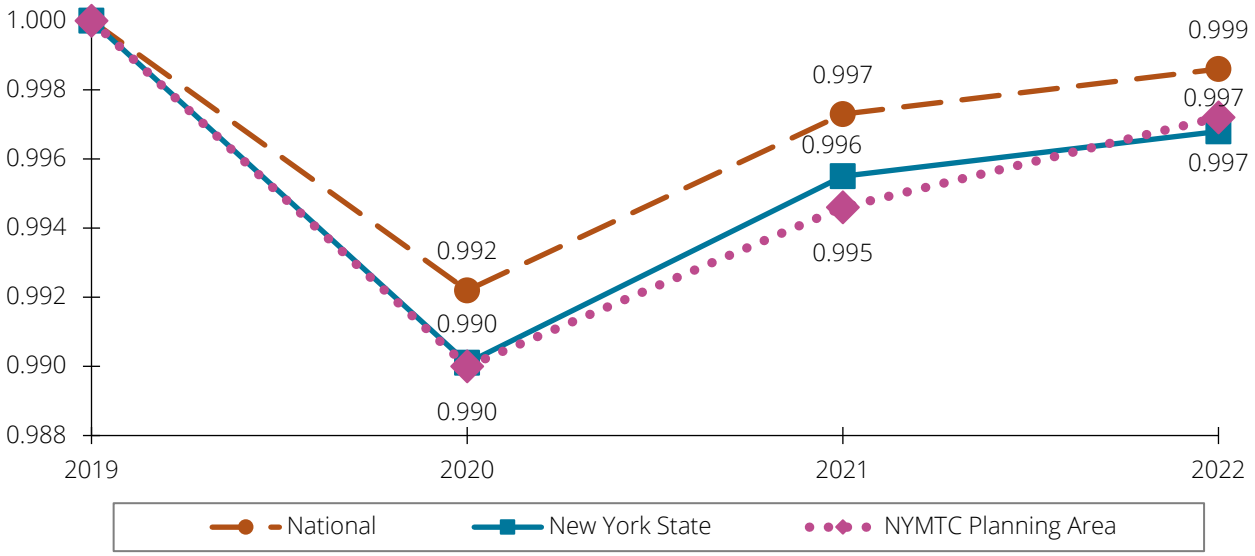
TRAVEL PATTERNS

Since the onset of the COVID-19 pandemic in 2020, travel patterns and trends have shifted throughout the NYMTC planning area and larger multistate New York metropolitan region. The pandemic impacted the level and type of travel in the NYMTC planning area. Available data indicates that a significant portion of the workforce continues to work remotely during a typical week, leading to a decrease in work-related travel. The pandemic outbreak resulted in comprehensive lockdowns that began in earnest in mid-March 2020 and lasted for several months. These were followed by expanded work from home policies and various social distancing measures that remained in effect at varying levels through 2022.

Pandemic impacts on short-term vehicular travel can be illustrated through trends in VMT at the national and state levels, as well as for NYMTC's planning area. Figure 3.12 presents those trends for 2019 through 2022. Although all three trends (national, state, region) show the same general pattern—VMT reduction in 2020 followed by gradual recovery in the subsequent years—the comparative trends shown in Figure 3.12

demonstrates that VMT in New York State and the NYMTC planning area saw a slightly greater relative reduction than was seen nationally and a slightly slower recovery. Logarithmic transformations of the data values are used in the figure, since logarithmic scaling provides a clearer view of data given the large variances in the scale of the VMT values at the national and state and regional levels.

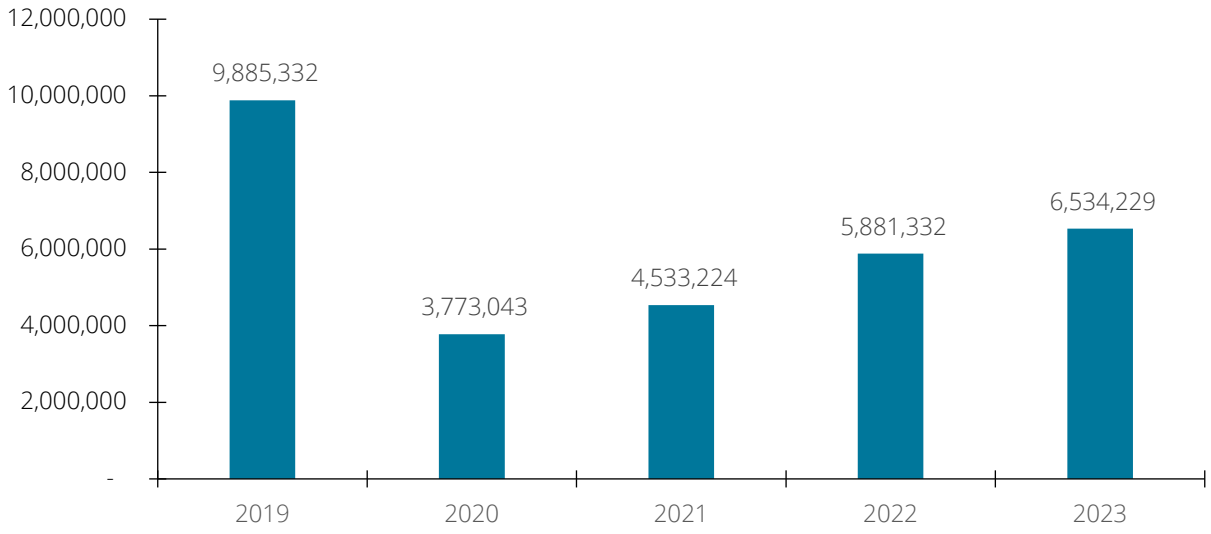
Figure 3.12 Comparative VMT Trends (in Log Values)



Source: FHWA; NYSDOT.

The pandemic also resulted in a decline in transit ridership in the NYMTC planning area. Although ridership remains below pre-pandemic levels, it has increased gradually since 2020. Figure 3.13 presents average weekday transit ridership in the NYMTC planning area from 2019 through 2023. The transit ridership figures are a compilation of MTA rail and bus services, trans-Hudson rail via Port Authority Trans Hudson (PATH) and NJ TRANSIT, airport rail access and suburban bus systems.

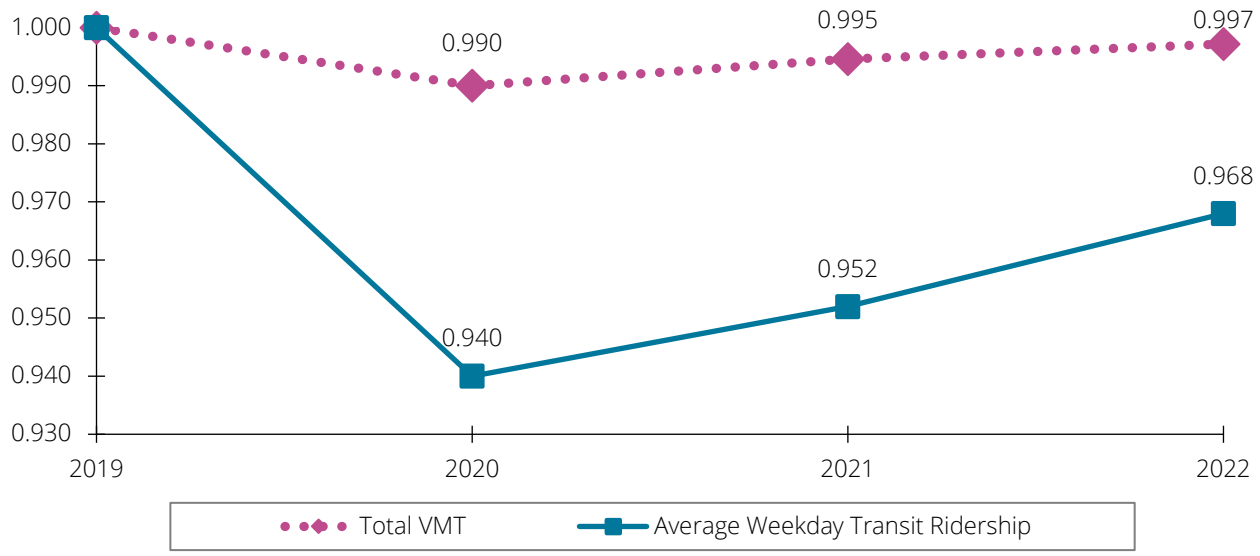
Figure 3.13 Average Weekday Transit Ridership in the NYMTC Planning Area



Source: NYMTC *Travel Patterns.*

As can be seen in Figure 3.14, although the transit ridership trend is similar to that for VMT in form, the transit ridership decrease in the pandemic year was significantly deeper than that for VMT and the recovery significantly slower. Logarithmic scaling is again used to provide a clearer view of data given the large variances in the scale of the VMT values and average transit ridership.

Figure 3.14 Comparative Trends—VMT and Transit Ridership (in Log Values)

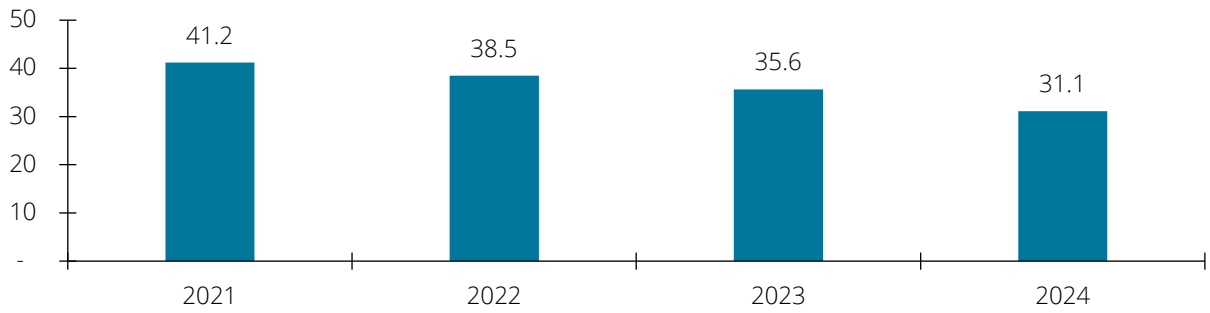


Source: NYMTC *Travel Patterns*; NYSDOT.

WORK FROM HOME

Data on work from home is fragmented, with multiple sources and various methods of assessment. The Survey of Working Arrangements and Attitudes (SWAA), a monthly online survey run jointly by the University of Chicago, Autonomous Technological Institute of Mexico (ITAM), Massachusetts Institute of Technology (MIT), and Stanford University, began in May 2020 in response to the dramatic impact of COVID-19 on working arrangements. SWAA defines cities using Combined Statistical Areas (CSA) to delineate metropolitan regions. This survey produced time series data on the percentage of full paid work days that were work from home. Figure 3.15 presents average monthly work from home days as a percent of full paid days for the New York City CSA, demonstrating the downward trend of this percentage.

Figure 3.15 Average Monthly Work From Home Percentage by Year (New York CSA)

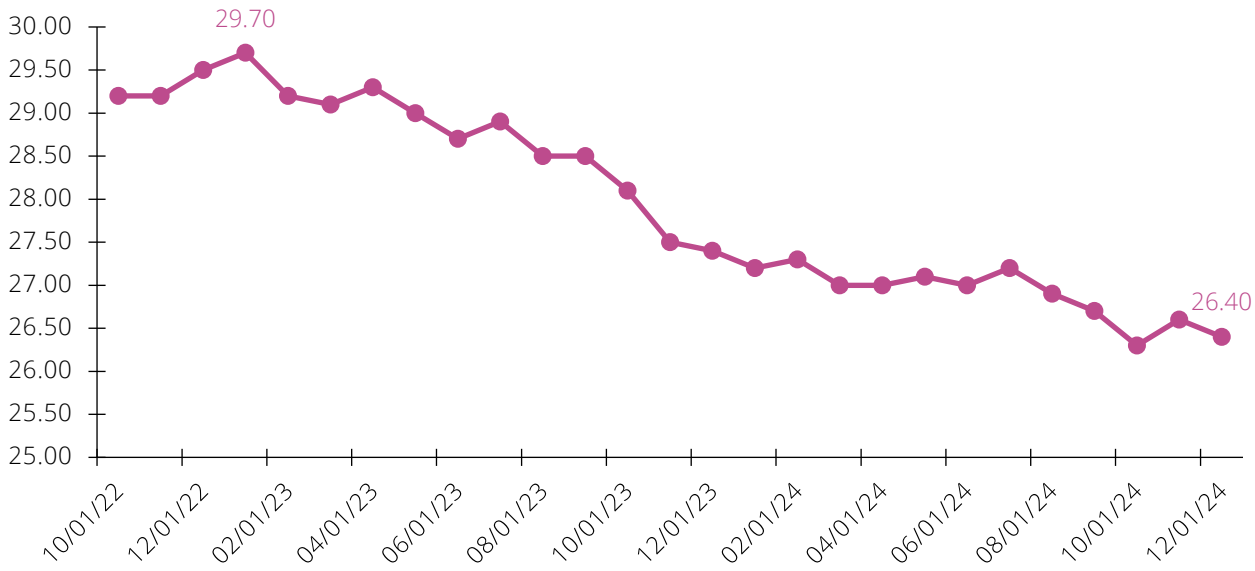


Source: Survey of Working Arrangements and Attitudes.[4]

The Current Population Survey (CPS) from the U.S. Bureau of Labor Statistics provides information on the nation's labor force, including data on the employed, unemployed, and those not in the labor force. The survey was redesigned for telework data collection in October 2022 with questions on whether people had teleworked or worked at home for pay in the survey reference week and the number of hours teleworked. In the resulting analyses, telework or work at home for pay is frequently referred to simply as "telework."

Figure 3.16 shows the national average of weekly telework hours beginning in October 2022. The trend presented in the figure shows a decreasing trend in the average hours teleworked, which is generally consistent with the SWAA results for the New York CSA. The CPS does not present data by city or region.

Figure 3.16 Average Weekly Hours Teleworked (Oct 2022–Dec 2024)



Source: U.S. Bureau of Labor Statistics—Current Population Survey[5]

The New York City Department of City Planning (DCP) used the 2023 American Community Survey (ACS) from the U.S. Census Bureau and determined that roughly 13 percent of the resident workforce in the NYMTC planning area worked from home at some level of frequency; this translates to roughly 855,000 workers. However, since these data did not distinguish between fully home-based workers or those who telecommute on various days, it is difficult to quantify the impacts on weekday travel demand.

Determining how the work from home estimates described above impact overall transportation demand is difficult to say for certain given the data limitations, different units of measure, and unknown factors. However, these trends are still critical for anticipating the longer-term impacts of remote work on travel demand, if any. While work from home is not new, the pandemic and technological advances expanded it on a larger scale, resulting in higher rates of remote work. Available data suggests those rates have not been stable in the short-term and are falling in the aftermath of the pandemic. Given that, forecasting impacts in the longer-term is difficult both from a technical perspective and because of uncertainties surrounding the reasons for current trends and future work rules and labor practices. Translating data into measurable impacts on travel and transportation demand is challenging due to these limitations and uncertainties. Continued monitoring will be required to establish any future projections.

3.4.2 HISTORICAL TRENDS

VEHICLE ACCESS

In 2022, almost 2.88 million households in the NYMTC planning area had regular access to a vehicle, which was about 59.3 percent of all households in the planning area (or an aggregate number of about 4.8 million vehicles accessible to households in the NYMTC planning area). Compared to 2010, the proportion of households with vehicle access has decreased from 60 percent of all households. The reason for this decrease is primarily driven by the decrease in the proportion of households in New York City that have access to a vehicle (see Table 3.25). On Long Island, alternatively, the percentage of households with vehicle access increased from 94.0 percent to 94.3 percent. The share of total vehicles available for each subregion has not changed substantially: 43 percent of vehicles are associated with households in New York City, 40 percent are in suburban Long Island, and the Lower Hudson Valley has 17 percent of all vehicles in the region. Additionally, automobiles are the predominant commuting mode choice for all counties in the NYMTC planning area except for Manhattan, the Bronx, Queens, and Brooklyn.

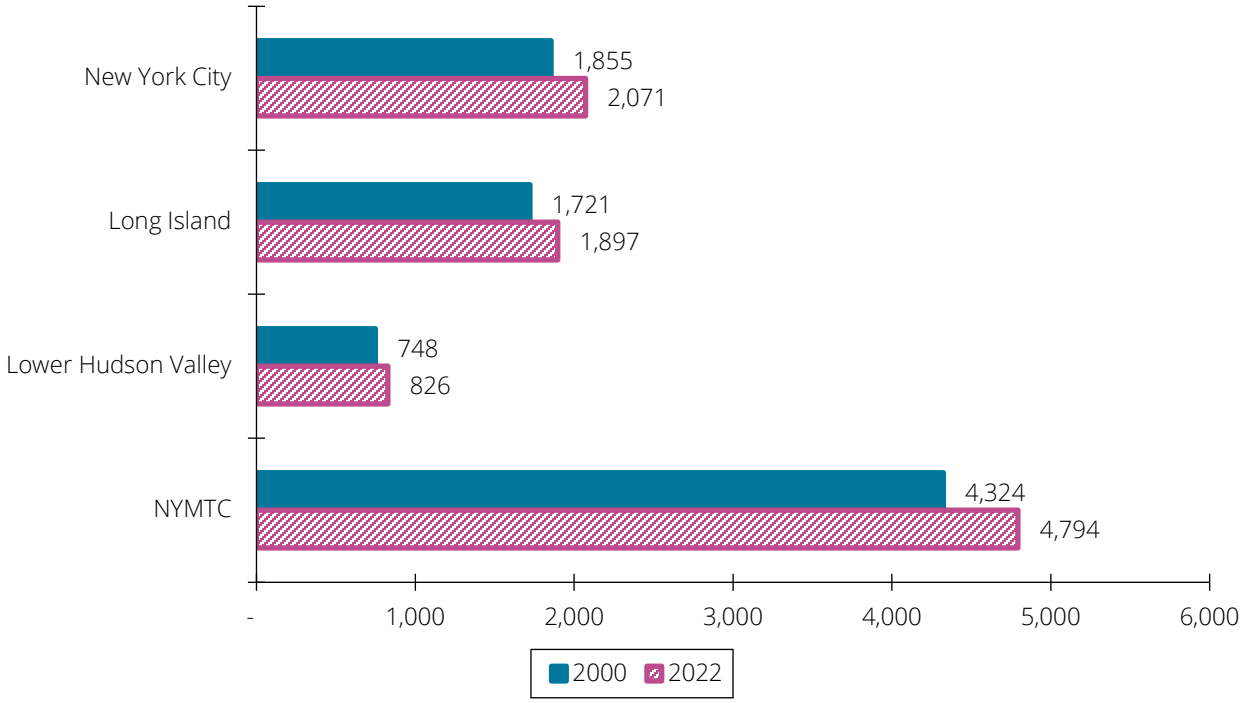
Table 3.25 Percent of Households with Vehicle Access by Subregion, 2000–2022

Subregion	2000	2010	2022
New York City	44.3%	45.4%	45.0%
Long Island	93.5%	94.0%	94.3%
Lower Hudson Valley	86.9%	87.5%	87.4%
NYMTC Planning Area	59.0%	60.1%	59.3%

Source: U.S. Census Bureau, 2000 Census, 2006–2010 ACS 5-year estimates, 2022 ACS 1-year estimates.

Despite the slight decrease regionwide in the proportion of households with vehicle access, the aggregate number of vehicles for all households has increased over the past two decades as the number of households and people has increased (see Figure 3.17). The number of households with vehicle access increased by 7 percent, or by an additional 195,000 households. The aggregate number of vehicles in the planning area increased by 6 percent, or an additional 257,700 vehicles.[6] While the number of households with regular access to a vehicle have increased, there has been little change in the proportion of households with such access.

Figure 3.17 Aggregate Number of Vehicles in the NYMTC Planning Area by Subregion (Values in Thousands)



Source: U.S. Census Bureau, 2000 Census, 2022 ACS 1-year estimates.

As described earlier, the NYMTC planning area is forecasted to have a modest increase in the total number of households and jobs, which will contribute to an increased number of vehicles being used in the region This is especially true for the Lower Hudson Valley and Long Island subregions, which have a higher proportion of household vehicular access.

PUBLIC TRANSIT USAGE

Up until the onset of the COVID-19 pandemic, the NYMTC planning area had experienced a steady increase in public transit ridership. From 2010 to 2018, the number of people using public transit to commute to work increased by 11 percent or nearly 247,000 people according to U.S. Census figures. This is the largest increase for all travel modes used for work during this time period. In 2019, based on the five-year average (2015-2019) from the U.S. Census ACS, public transit reached a 42 percent commute mode share, nearly equaling commuting by private vehicle (see Table 3.26). New York City residents' accessibility to various job centers by public transit is a significant contributor to the continued growth in public transit usage in the NYMTC planning area.

Public transit ridership (rather for commute trips or non-commute trips) has not fully recovered to pre-pandemic levels. Nonetheless, public transportation does remain an important mode of transportation for residents and workers in the region. In 2023, ridership on New York City Transit's subways was more than 1.15 billion, reflecting how the subway system is still used by hundreds of thousands of riders daily.[7] MTA bus ridership was more than 426 million in 2023. Long Island Rail Road and Metro-North Railroad also

continue to see increasing ridership year over year since 2020, with the former surpassing 65 million trips in 2023[8] and the latter reaching over 60 million trips in the same year.[9]

Table 3.26 Means of Transportation to Work for the NYMTC Planning Area, 2010–2023

Year	Car, Truck, or Van	Public Transportation	Walked	Taxicab, Motorcycle, Bicycle, or other Means	Worked from Home
2010	46%	40%	7%	2%	4%
2019[1]	44%	42%	7%	3%	4%
2022	42%	32%	6%	4%	16%
2023	41%	35%	7%	4%	13%

Source: U.S. Census Bureau: 2010 Census, 2015–2019 ACS 5-year estimate, 2022 and 2023 ACS 1-year estimates.

[1] The 2019 estimates are a 5-year estimate representing average commuting characteristics from 2015–2019.

COMMUTING PATTERNS

U.S. Census Bureau data provides a snapshot of commuting patterns (Table 3.27). In 2020, in the five boroughs of New York City, approximately 74 percent or more of workers commuted within their home county or to/from Manhattan (ranging from a low of 74 percent for Staten Island to a high of 90 percent for Manhattan). In Manhattan, approximately 86 percent of resident-workers commuted within the borough. Outside of the boroughs of New York City, the commute patterns are different. For example, in Long Island, 88 percent of resident-workers in Suffolk County commute within the county or to Nassau County. In Nassau County, 58 percent of resident-workers commute within the county and another 15 percent commute to Manhattan. In the Lower Hudson Valley, the pattern in each county is unique, for example in Putnam County only 39 percent of resident-workers commute within the county while in Westchester County, 63 percent of resident-workers commute within the county.

In addition to workers from within the NYMTC planning area, a significant number of travelers from other areas in the forecasting region commute to New York City each day. For example, in 2020, approximately 9 percent of New Jersey workers and 8 percent of workers from the Western Connecticut Planning Region, were employed in New York City.[10]

Table 3.27 Top Work Location by Residence, 2020

Residence (County / Borough)	Work Location	Share of Total Workers
Bronx	Bronx	44%
	Manhattan	37%
Kings/Brooklyn	Brooklyn	51%
	Manhattan	38%
New York / Manhattan	Manhattan	86%
	Bronx	3%
Queens	Queens	45%
	Manhattan	34%
Richmond / Staten Island	Staten Island	51%
	Manhattan	23%
Nassau	Nassau	58%
	Manhattan	15%
Suffolk	Suffolk	77%
	Nassau	11%
Putnam	Westchester	33%
	Putnam	39%
Rockland	Rockland	62%
	Manhattan	10%
Westchester	Westchester	63%
	Manhattan	20%

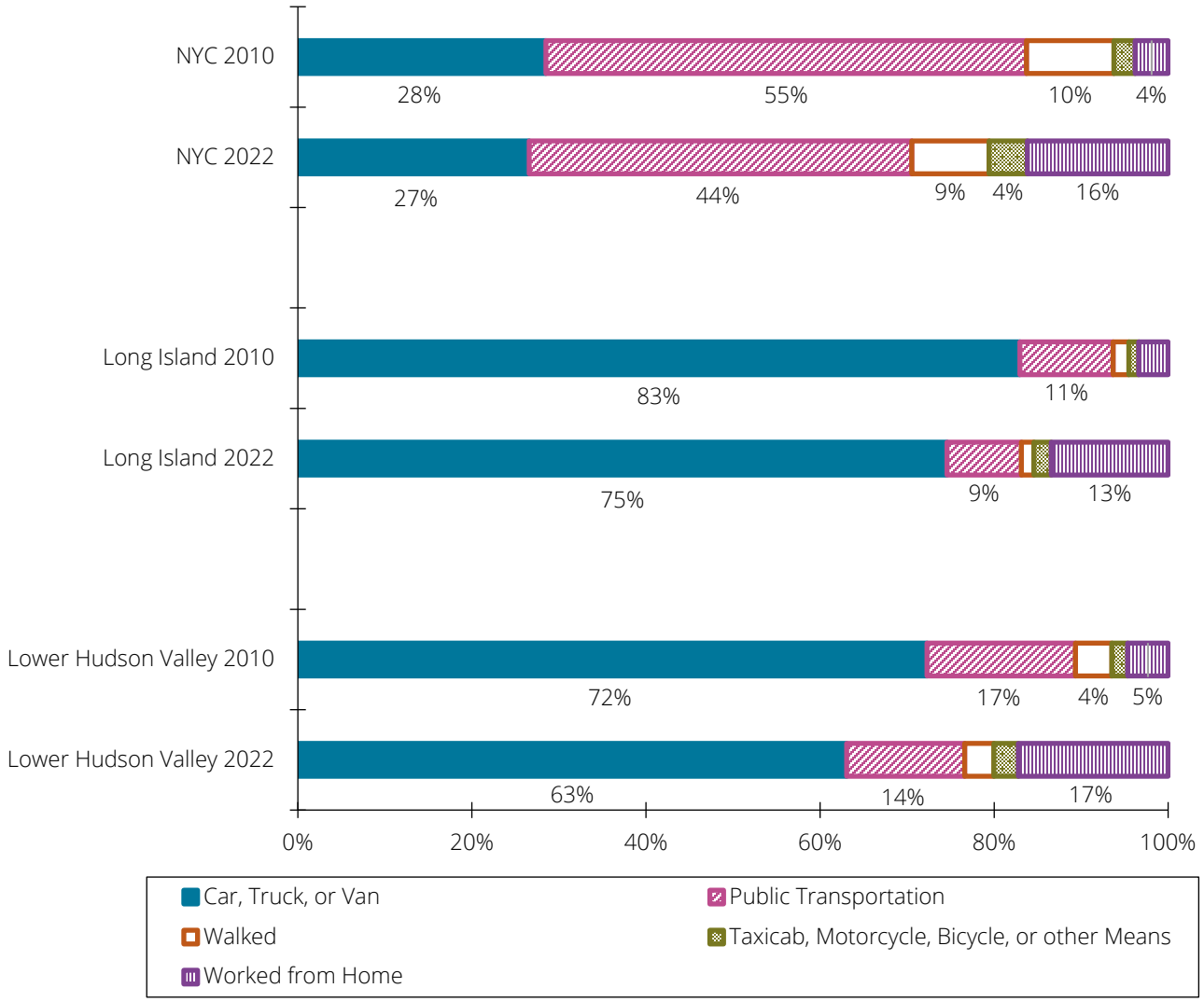
Source: U.S. Census Bureau, 2016–2020 ACS 5-year estimates.

A notable trend has been the increase in the number of people working from home. As described in Section 3.4.1, the COVID-19 pandemic dynamically shifted travel patterns in 2020. While those travel patterns have gradually trended toward pre-COVID conditions since 2021, substantial differences remain through 2025. Significant shares of the workforce continue to work remotely for some or all days of the week, decreasing travel demand to workplaces. As a result, transit ridership in the NYMTC region as a whole remains lower than pre-COVID levels, even as some transit agencies have started to see ridership increases. Total vehicle travel, conversely, has recovered to pre-COVID levels and was not as affected by the increase in remote work.

Between 2019 and 2022, the NYMTC planning area saw a fourfold increase (2015–2019 ACS 5-year estimates compared to the 2022 ACS 1-year estimates) in commuters working from home (see Table 3.26). With an increase in the proportion of remote workers, there has been a noticeable decrease in the number of workers who take public transit to work. Figure 3.18 compares mode choice for daily commuting by subregion between 2010 and 2022. In New York City, the increase in work from home is primarily offset by

a decline in transit commuting. In Long Island and the Lower Hudson Valley, the increase in work from home is primarily offset by a decline in commuting by private vehicle (car, truck, or van) and to a far lesser extent a decline in transit.

Figure 3.18 Transportation Mode Choice for Daily Commuting Trips by Subregion



Source: U.S. Census Bureau, 2006–2010 ACS 5-year estimates, 2022 ACS 1-year estimates.

Despite an increase in the number of workers who work from home, there is still a significant number of NYMTC planning area workers that travel long distances and/or face substantive congestion on a daily basis and thus have commutes greater than 60 minutes each way. In 2022, 32 percent of workers employed in New York City and 37 percent of Manhattan workers commuted longer than 60 minutes in each direction.[11] These commuting patterns are evidence of the continued imbalance between the locations of the NYMTC planning area's labor force and its employment opportunities (Table 3.27

Table 3.27). In turn, these imbalances further highlight regional transit infrastructure and housing needs.

As described in Section 3.4.1 and this section, available data suggests that work from home rates have not been stable in the short-term and are falling in the aftermath of the pandemic. Given that, forecasting impacts in the longer-term is difficult both from a technical perspective and because of uncertainties surrounding the reasons for current trends and future work rules and labor practices. Translating existing data into measurable impacts on travel and transportation demand is challenging due to these limitations and uncertainties.

3.4.3 TRAVEL FORECASTS

TRAVEL DEMAND

Table 3.28 displays NYBPM travel forecasts for the NYMTC planning area. Growth in travel is expected to occur in the NYMTC planning area and its subregions across the modes of auto travel and transit. Total daily trips are projected to reach approximately 30 million by 2050, an increase of 11 percent from 2019. Daily auto trips are expected to grow by 13 percent, while daily transit trips are forecast to grow by 7 percent. Similarly, growth in daily VMT and vehicle hours traveled (VHT) is expected to continue, as more trips taken on the transportation system add to vehicle use and congestion. The increase in VMT of 12 percent is commensurate with the increase in daily auto trips of 13 percent, as more vehicles directly lead to higher VMT.

Table 3.28 Travel Forecasts for the NYMTC Planning Area

Travel Forecast	2019	2050	Percentage Change 2019–2050
Total Daily Trips	26,323,088	29,190,509	11%
Daily Auto Trips	17,741,882	20,027,492	13%
Daily Transit Trips	8,581,206	9,163,017	7%
Daily VMT	123,660,640	138,532,952	12%
Daily VHT	3,781,828	4,821,593	27%

Source: NYMTC.

Table 3.29 and Table 3.30 show the daily auto trip origins (columns) and destinations (rows) of the counties in the NYMTC planning area. As the tables demonstrate, most of the vehicle trips are taken within the counties of their origin. This indicates that most of the trips are for local purposes such as commuting to work or school or traveling for errands. This also means that the local road networks are heavily used and are mostly well-suited for short, intra-county trips.

Table 3.29 Daily Auto Trip Origins and Destinations (2019)

County	Manhattan	Queens	Bronx	Kings	Staten Island	Nassau	Suffolk	Westchester	Rockland	Putnam	Total
Manhattan	876,634	163,242	140,099	104,316	17,153	21,392	7,534	80,842	5,220	844	1,417,276
Queens	141,556	1,384,633	29,416	210,623	8,790	403,764	35,889	15,259	3,991	1,531	2,235,452
Bronx	131,447	28,698	701,304	18,354	4,100	11,199	2,858	124,851	4,214	1,352	1,028,377
Kings	86,245	211,855	18,817	1,911,609	23,985	80,968	16,554	3,997	2,886	690	2,357,606
Staten Island	16,052	12,152	4,620	26,031	373,002	5,152	2,339	1,979	643	160	442,130
Nassau	13,417	347,754	12,908	75,946	4,899	2,794,613	395,016	3,578	988	519	3,649,638
Suffolk	4,292	45,793	3,480	19,694	2,897	381,938	3,295,407	2,085	667	382	3,756,635
Westchester	63,538	16,803	112,170	5,369	2,146	3,862	2,226	1,904,231	48,282	15,588	2,174,215
Rockland	2,869	4,187	4,277	3,021	611	729	498	58,508	417,088	1,313	493,101
Putnam	455	1,715	1,310	794	171	403	348	16,056	1,579	164,619	187,450
Total	**1,336,505**	**2,216,832**	**1,028,401**	**2,375,757**	**437,754**	**3,704,020**	**3,758,669**	**2,211,386**	**485,558**	**186,998**	**17,741,880**

Source: NYMTC.

Table 3.30 Daily Auto Trip Origins and Destinations (2050)

County	Manhattan	Queens	Bronx	Kings	Staten Island	Nassau	Suffolk	Westchester	Rockland	Putnam	Total
Manhattan	982,001	165,534	160,400	105,123	15,147	21,217	10,274	83,595	4,985	836	1,549,112
Queens	138,954	1,559,372	32,238	259,883	9,729	415,905	40,180	16,800	3,085	1,494	2,477,640
Bronx	158,057	32,326	831,815	22,723	4,384	9,482	3,134	142,752	3,404	1,211	1,209,288
Kings	87,467	264,616	23,742	2,254,807	24,885	84,743	18,959	4,423	2,069	653	2,766,364
Staten Island	14,520	13,852	5,199	28,895	400,740	5,477	2,568	2,277	621	186	474,335
Nassau	12,569	358,036	10,480	80,140	4,720	3,240,543	437,533	4,343	781	486	4,149,631
Suffolk	5,257	49,888	3,522	21,904	3,118	425,533	3,796,911	2,466	736	364	4,309,699
Westchester	65,828	19,177	129,781	6,001	2,305	4,409	2,606	1,960,801	53,308	16,411	2,244,216
Rockland	2,712	3,098	3,003	2,009	566	674	555	62,784	553,283	1,456	630,140
Putnam	431	1,751	1,153	730	199	399	313	16,933	1,716	177,028	200,653
Total	1,467,796	2,467,650	1,201,333	2,782,215	465,793	4,208,382	4,313,033	2,297,174	623,988	183,714	20,011,078

Source: NYMTC.

VEHICULAR USAGE

Daily VMT in the NYMTC region is expected to rise by approximately 12 percent during the planning period (Table 3.31). At the subregional level, Long Island is projected to have the highest percentage growth in VMT at 14 percent, whereas the increase for New York City and Lower Hudson Valley are both 11 percent by 2050.

Table 3.31 Daily VMT by County/Borough and Subregion

County & Subregion	2019	2050	Change
New York City Total	**46,139,383**	**51,073,290**	**11%**
Bronx	6,920,705	7,810,373	13%
Brooklyn	11,893,196	13,522,297	14%
Manhattan	7,523,708	8,121,836	8%
Queens	16,309,627	17,723,477	9%
Staten Island	3,492,148	3,895,307	12%
Long Island Total	**50,907,228**	**57,799,612**	**14%**
Nassau	24,576,191	27,579,455	12%
Suffolk	26,331,037	30,220,157	15%
Lower Hudson Valley Total	**26,614,029**	**29,660,049**	**11%**
Putnam	2,516,629	2,695,225	7%
Rockland	5,625,222	6,763,655	20%
Westchester	18,472,178	20,201,169	9%

Source: NYMTC.

VHT reflects the congestion and reliability of vehicular travel, primarily in terms of travel speed. In the NYMTC planning area, VHT is projected to rise by 27 percent by 2050. Among the subregions, Long Island will experience the greatest percentage growth in VHT, increasing by nearly 20 percent by 2050, compared to 19 percent for the Lower Hudson Valley and 37 percent for New York City (Table 3.32).

Table 3.32 Daily VHT by County/Borough and Subregion

Subregion	2019	2050	Change
New York City Total	**1,733,176**	**2,371,980**	**37%**
Bronx	198,651	265,492	34%
Brooklyn	515,354	746,287	45%
Manhattan	389,716	568,043	46%
Queens	528,244	659,384	25%
Staten Island	101,210	132,773	31%
Long Island Total	**1,437,951**	**1,724,660**	**20%**
Nassau	750,948	898,330	20%
Suffolk	687,003	826,330	20%

Subregion	2019	2050	Change
Lower Hudson Valley Total	610,701	724,953	19%
Putnam	50,300	53,775	7%
Rockland	126,617	168,304	33%
Westchester	433,784	502,873	16%

Source: NYMTC.

COMMODITY FLOWS

The NYMTC planning area is a key region for goods movement. In 2021, approximately 438 million tons of goods valued at $715 billion moved into, out of, and through the region by truck, rail, water, air, and pipeline (Table 3.33). Most of the goods—43 percent of the total tonnage—are traveling into the region, to residents and businesses within the planning area. Trucks are the primary transportation mode, accounting for 94 percent of regional volume and 96 percent of value. By 2055, the freight tonnage and value will increase marginally, 1.1 percent and 1.9 percent respectively (Table 3.34). While trucks will remain the predominant transportation mode, increases in tonnage of freight traveling by pipeline, air, water, and rail modes are also expected.[2]

Table 3.33 NYMTC Planning Area Freight Movement by Direction (2021)

Direction	Tons 2021 (Million)	Tons 2021 Percent	Value 2021 ($Billion)	Value 2021 Percent
Inbound	188	43%	297	41%
Internal	57	13%	81	11%
Outbound	61	14%	89	12%
Through	133	30%	249	35%
Total	438	100%	715	100%

Source: Cambridge Systematics analysis of S&P Global Transearch, 2021.

[2] Commodity flow data is provided by S&P Global Transearch tool which tracks historic U.S. supply chain freight flows and provides forecasts out by origin, destination, commodity, and transportation mode.

Table 3.34 NYMTC Planning Area Forecast Freight Movement by Direction (2021–2055)

Direction	Tons 2055 (Million)	Tons Compound Annual Growth Rate (2021–2055)	Value 2055 ($Billion)	CAGR 2021–2055)
Inbound	273	1.1%	548	1.8%
Internal	83	1.1%	140	1.6%
Outbound	86	1.0%	161	1.8%
Through	204	1.3%	504	2.1%
Total	**646**	**1.1%**	**1,353**	**1.9%**

Source: Cambridge Systematics analysis of S&P Global Transearch, 2021.

According to analysis of Transearch data, the primary commodities in the NYMTC planning area include chemicals and allied products, secondary traffic, and food and kindred products, all of which are expected to have continued growth through 2055. Electrical equipment is projected to grow the fastest, with tonnage increasing by 4 percent annually and value by 3.8 percent from 2021 to 2055.

By far the largest trading partners for inbound and outbound tonnage and value are the states of New York, New Jersey, and Pennsylvania, which is expected to remain true in 2055. By tonnage, inbound from Pennsylvania and outbound to the rest of the New York area are anticipated to grow faster. By value, freight inbound from New Jersey is estimated to be doubled in 2055 compared to 2021, at a 2 percent annual growth rate.

The Regional Freight Element of *Moving Forward 2055* is contained in Appendix D and contains a detailed discussion of recent trends and forecasts for commodity flows during the planning period.

TOURISM

Tourism plays a significant role in the regional and subregional economies by contributing tax revenues, driving purchases at businesses, and helping create or sustain jobs that support the tourism industry. It also significantly impacts mobility patterns such as trip generation, or the frequency and disbursement of transportation trips within a region. Tourism-related travel can lead to congestion, for both vehicles and pedestrians, near major attractions or as a result of events such as Fashion Week or the Thanksgiving Day Parade and is often influenced by peak season travel. Tourism also fuels the travel of workers in supporting industries such as hospitality and retail as well as regional ripple effects in neighboring areas such as New Jersey, Long Island, and the Hudson Valley.

In 2023, visitors to New York state spent $88 billion, and generated a total economic impact of $137 billion, the third consecutive year of double-digit percentage growth.[12] Visitor volumes appear to have fully recovered since pandemic-era declines; visitor volumes in 2023 increased 5 percent from the previous year, a total of 306.2 million visitors. The increasing number of tourists has many benefits, but it also places additional strain

on the transportation network as more people use the airways, roadways, and transit infrastructure to travel to and within the region.

SUBREGIONAL TRAVEL IMPACTS

The NYMTC planning area draws some of the largest tourist volumes in the world with implications for local transportation spending, seen in Table 3.35. Most of the region's tourism and local transportation spending is concentrated in New York City. In fact, some of New York City's iconic transportation infrastructure and services are tourist destinations themselves, including the Staten Island Ferry and Grand Central Terminal. Various tour bus operators offer "hop-on, hop-off" tours for visitors and make curbside stops throughout Manhattan. Tourists also join commuters on subway, buses, ferries, and commuter rail systems, in addition to taxis and ride-hailing services. Some international travelers to New York City take regional rail or bus service to attractions in other parts of the multistate metropolitan region.

Table 3.35 Visitors' Local Transportation Spending by County

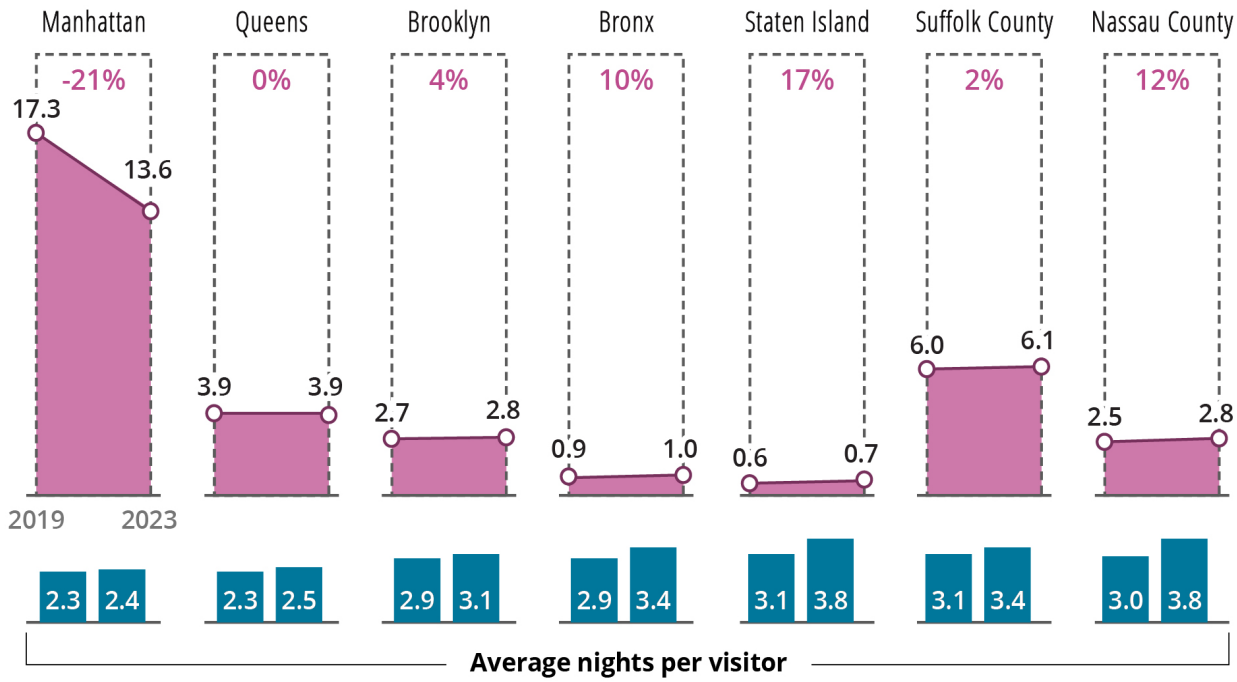
Counties	Local Transportation Spending by Visitors in 2023
New York City (encompassing the five boroughs)	$10.1 billion
Nassau County	$372 million
Putnam County	$2 million
Rockland County	$31 million
Suffolk County	$607 million
Westchester County	$223 million
Total	**$11.335 billion**

Source: New York State Tourism Industry Association.

While New York City is a key draw for visitors, travel outside of Manhattan is growing with complementary impacts to transportation. From 2019 to 2023, annual visits to Manhattan declined by 21 percent (Figure 3.19). Conversely, visits to Staten Island, Nassau County, and the Bronx increased by 10 percent or more. Some of these may be day trips but average nights per visitor in these areas have also increased with the longest stays in Staten Island and Nassau County.

Figure 3.19 Annual Visits to the New York City Region, 2019–2023

Annual visits to New York City and Long Island, million visitors[1]



Source: Placer Labs via McKinsey & Company.

[1] Visitors with a mobile "home" location >50 miles away.

One of the main impacts of tourism on Long Island was an increase in vehicular traffic and rail and bus ridership. Many of Long Island's attractions are dispersed, and private vehicles were the preferred mode of travel to these locations. In the warmer months, LIRR and ferry services experience increased ridership for access to popular beaches and barrier islands. In 2023, visitors spent $7.643 billion on Long Island, up from $6 billion in 2018.[13] There are more than 60 wineries on Long Island's North and South Forks, drawing more than 1.3 million annual visitors to the region, 45 licensed craft breweries, parks, wildlife, and a 300-year-old history of farming and fishing.

The Lower Hudson Valley continues to grow as a major tourist destination. According to Tourism Economics, traveler spending in 2023 for the Hudson Valley was $5 billion, an increase of 8 percent compared to the previous year with the strongest growth in Putnam County. Westchester represents 43 percent of the Lower Hudson Valley's tourism sales.[14] The Lower Hudson Valley is well known for its hiking trails, historic estates and sites, State Parks, national historical sites, farms and farmers markets, and the fine arts. Westchester County has seen significant growth in its agritourism sector. The 17-mile "Westchester-Grown" Farm Trail is a New York State designated route that provides visitors with a chance to explore more than a dozen farms in Westchester County.

3.5 ASSUMPTIONS ON TRANSFORMATIVE CHANGE

Moving Forward 2055 seeks to highlight and navigate complexities and uncertainties that will affect transportation system planning and development and system utilization by people and goods over the long-term. This plan acknowledges that the transportation landscape is undergoing significant changes driven by technological advancements, evolving societal needs, and global trends. By assessing these transformative factors, *Moving Forward 2055* caveats its future forecasts to anticipate the possible impacts these factors may present.

The long-term impacts of these complexities and uncertainties are dependent on assumptions about global and regional changes over the next 30 years. These assumptions may enhance or diminish the scale and probability of the transformative changes identified in the plan. Figure 3.20 presents these assumptions.

Figure 3.20 *Moving Forward 2055* Assumptions on Transformative Change

Technological Advancements

- Emerging technologies such as autonomous vehicles, electric vehicles, on-demand and shared services, and intelligent transportation systems will fundamentally alter how people and goods move.

Economic and Land Use Patterns

- Changing workforce needs and consumers' mobility preferences affect travel demand, as well as transportation and land use needs.

Environmental Imperatives

- Extreme weather, sea level rise, and environmental sustainability will drive the adoption of green infrastructure and alternative energy sources.

Demographic Changes

- Aging populations, migration patterns, growing housing demand, and shifting mode preferences will require adaptable and inclusive land use and transportation solutions.

Policy and Regulatory Evolution

- The regulatory landscape will need to evolve to accommodate new transportation needs, technologies, and strategies.

Source: Cambridge Systematics.

It is important to note the risks of both overestimating and underestimating future transformational changes, particularly because there is little consensus on the pace of that change among researchers, planners, technology experts, and policy makers. However, there is a significant degree of certainty that transformative changes will alter the demand for transportation and the way transportation services are provided during the planning period. This section will explore those potential impacts.

3.5.1 FUTURE TRENDS AND DISRUPTORS FRAMEWORK

Moving Forward 2055 identifies two types of transformative changes—Trends and Disruptors. Trends are predictable patterns in the development of these changes that will likely affect how the transportation system operates into the future. Conversely, Disruptors are sudden changes that impact how the transportation system operates, but their timing and impact can vary. In some cases, the Trends and Disruptors may become interconnected, and even overlap. For example, the COVID-19 pandemic was a Disruptor that affected how people work, travel, spend money, and interact in public spaces almost overnight. While the pandemic accelerated some habits, such as telecommuting, this mode of working has existed for decades, and researchers can predict how remote work will evolve based on historic and current demographic data, which makes it a Trend. *Moving Forward 2055* identifies several Trends and Disruptors that will shape transportation over the next several decades, as seen in Table 3.36 and Table 3.37.

Trends highlight the drivers of transformative change. These trends are more predictable, follow economic patterns, and impact mobility over longer timeframes.

Table 3.36 Summary of Long-Term Impacts of Trends

Virtual Economy	Shared Mobility	Technological Advancements	Distribution Innovations and Goods Movement
» Reduced VMT and emissions » Reduced transit ridership » Less predictable travel patterns » Changes in land use » Mixed effects on underserved groups » Increased congestion related to last-mile deliveries	» Mixed effect on emissions reductions » Increases transportation options » Increases transportation access for underserved groups » Opportunities to improve transit through on-demand service, and payment and scheduling	» Potential to reduce emissions and VMT » Mixed effect on safety and security » Concerns about fairness and bias » Changes in land use » Integration of ground and air travel modes » Lack of consistency in regionwide implementation of technological advancements	» Increase in last-mile deliveries and related congestion » Increase in industrial land uses in residential areas » Public health and fairness concerns » Increased demand for curb and parking management practices » Opportunities to integrate intermodal freight

Disruptors are less predictable both in timing and impact, vary in intensity, and can lead to sudden changes in mobility.

Table 3.37 Summary of Long-Term Impacts of Disruptors

Sea Level Rise, Extreme Heat, and Extreme Weather Events	Energy Transformation	Changing Demographics and Lifestyles	Changing Land Use Patterns	Cybersecurity
» Cost of damage to infrastructure » Disruptions to movements of people and goods » Reduced life cycles for bridges and pavement » Uncertainty in long-range financial planning » Policy impacts on long-term planning	» Infrastructure Development » Impact of policies » Uncertainty of long-term financial planning and the Gas Tax replacement » Disruptions to utility grids » Safety concerns for new energy alternatives	» Aging populations and reliance on transit » Accessibility/ knowledge gaps » Rise in gig economy and shifting travel patterns » Shifting mode preferences » In-and-out migration shifting population and transit needs	» Shifting land uses with warehousing boom and updated zoning policies » Adaptive reuse and shifting travel patterns » Housing affordability and urban sprawl » TODs as affordable housing solutions	» Disruptions to travel » ITS/CAV vulnerabilities » Workforce upskilling to meet cybersecurity needs » Safety concerns as barrier to technology adoption

The Trends and Disruptors are analyzed using three overarching lenses, including:

- Feedback—Incorporates public and stakeholder interpretations of priorities and potential impacts.
- Fairness—Recognizes that not all the impacts will be felt equally and identifies opportunities to mitigate unique burdens when they exist.
- Uncertainty—Acknowledges the inherent unpredictability in planning for the future.

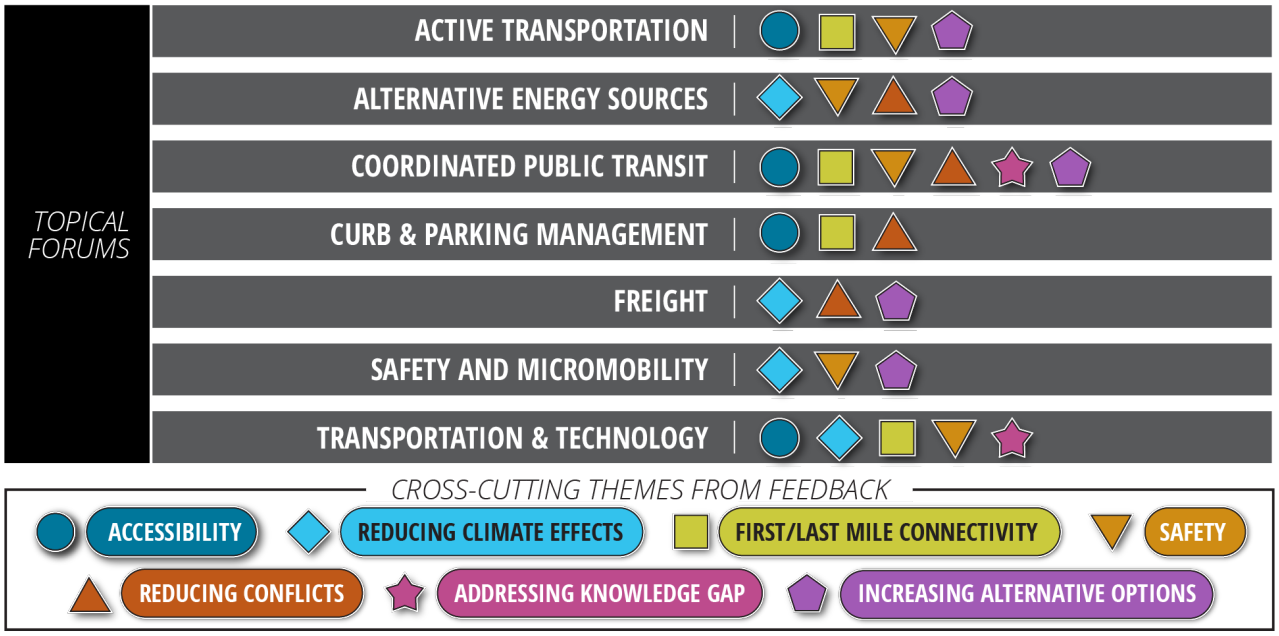
These lenses are applied throughout the Trends and Disruptors section and detailed below. The risks and opportunities of the Trends and Disruptors are also further explored to better understand how possible scenarios may impact the Region's ability to achieve its Vision and Goals.

3.5.2 FEEDBACK

During the development of *Moving Forward 2055*, NYMTC solicited public feedback to better understand the public's interest, concerns, and overall sentiment on a variety of transportation topics in the region. This was completed using (1) an online interactive survey tool, which received nearly 3,000 responses across the study area; (2) Focus Groups addressing Human Services Transportation and Environmental Justice, located in each of the three subareas within the NYMTC planning area); and (3) seven topical forums, as shown in Figure 3.21, covering a wide range of topics relevant to the Plan's development.

Across the topical forums, there were a few cross-cutting themes that continuously came up during discussions. *Moving Forward 2055* strives to incorporate that public feedback into the assessment of different Trends and Disruptors, recognizing there is a wide range of interest, enthusiasm, and concern for the future of transportation in the region. Feedback from stakeholders has been weaved throughout the chapter, including context about how it was received and where it came from in the region.

Figure 3.21 Summary of Cross-Cutting Themes from Topical Forums



Source: Cambridge Systematics.

3.5.3 FAIRNESS IN TRANSPORTATION DECISION MAKING

NYMTC endeavors to ensure that traditionally underserved groups, including socioeconomically vulnerable individuals and people of color, are not disproportionately burdened by mobility trends and disruptors, consistent with the agency's Title VI / Non-Discrimination Program. Accordingly, Fairness and Accessibility are integral to *Moving Forward 2055's* vision and framework, aiming to establish and maintain a transportation system that advances fairness and improves access to opportunities for all communities. *Moving Forward 2055* identifies the risks and opportunities associated with how fairness among transportation system users is impacted by the Trends and Disruptors, as discussed above, and highlights variances in how the Trends and Disruptors impact different groups of people. For example, as innovations in transportation introduce more options, change costs, and potentially create knowledge gaps, uncertainties remain about who will benefit and how those benefits will be distributed.

3.5.4 UNCERTAINTY

Various efforts by public agencies, academic institutions, and private and non-profit organizations are predicting how transformative changes might influence future travel patterns and volumes. Even with this recent insight and research it remains difficult to fully assess how these changes will impact the SED

forecasts outlined in *Moving Forward 2055*, as well as the operation of the transportation system in the NYMTC planning area. Early predictions indicate that these transformations will likely alter both the demand for transportation and the methods by which transportation services are delivered.

The emerging futures brought about by these transformational changes will continue to shape the future of transportation globally, nationally, regionally, and within the NYMTC planning area. NYMTC and its members will continue to monitor these changes and respond as needed to make the regional transportation system safer, more sustainable, more fair, and more efficient as *Moving Forward 2055* and subsequent plans are developed and implemented. Transportation planning as practiced through the NYMTC process and individually by NYMTC's members will itself be transformed, as data, technical tools, and staff expertise are enhanced in response to changing technological and operational needs.

3.6 TRENDS SHAPING TRANSPORTATION

Transportation has been, and will continue to be, shaped by technological, behavioral, economic, and environmental trends that affect how people and goods move throughout the region. Anticipating the scale, probability, and timing of these changes is crucial to the NYMTC planning process and can pose opportunities or threats to achieving NYMTC members' goals of a safe, efficient, resilient, sustainable, and fair transportation system. *Moving Forward 2055* has identified several trends that may impact the region's long-term mobility.

3.6.1 VIRTUAL ECONOMY

The virtual economy, or economic activity that occurs primarily through digital platforms and remote technologies rather than a physical presence, exploded during the pandemic and continues to expand today. Although some of this was already happening before the pandemic, when the world shut down, many people's lives abruptly shifted from in-person to remote. There was an increase in jobs becoming remote and groceries ordered online as opposed to being shopped for in-person. Telehealth replaced many doctor's visits, and some residents moved away from cities into suburbs and rural areas. The virtual economy produced two key changes that impact long-term mobility in the region—work from home patterns and on-demand access to goods and services.

WORK FROM HOME

Work from home rates vary significantly by community, industry, and age group, leading to complex and often mixed effects on long-term mobility patterns. These variations complicate transportation planning, as some areas experience reduced commuting demand, while others see new patterns emerge due to hybrid work models. This is further explored in Section 3.4.1 regarding the impacts of the COVID-19 pandemic and Section 3.4.2 regarding historical travel trends.

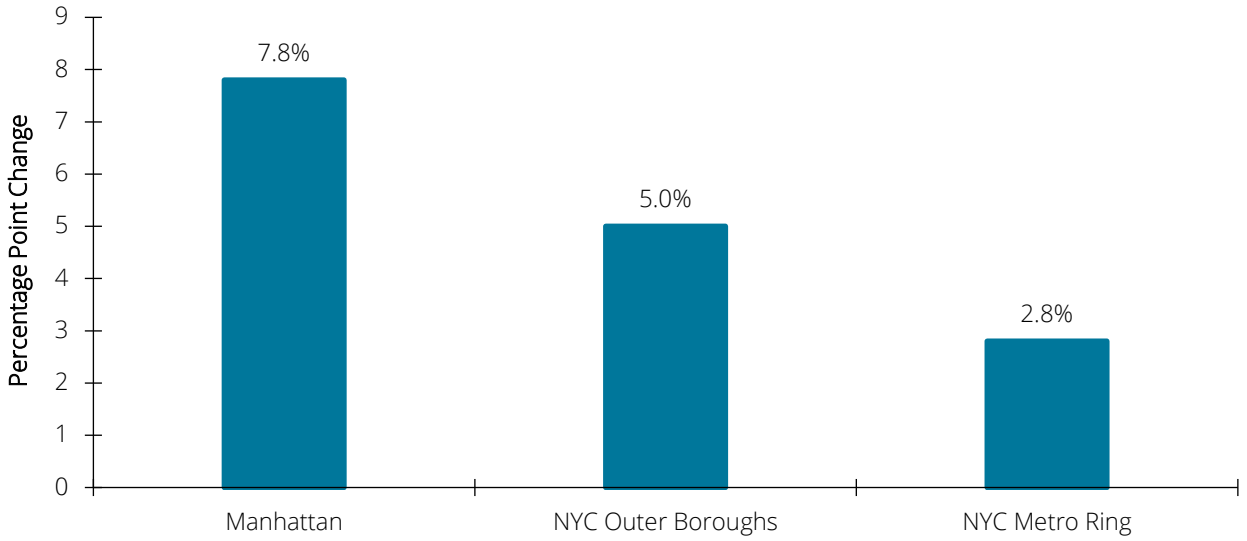
Remote work reduces the need for some workers to commute daily, potentially reducing emissions from passenger vehicles (private autos, trucks, and vans) due to overall less fuel consumption and less congestion. For example, in the New York–Newark NY/NJ/CT urban area (as defined by the U.S. Census

based on population density), traffic delays in 2023 were 23 percent lower than pre-pandemic levels in 2019, suggesting that remote work has played a role in reshaping commuting patterns and reducing roadway congestion.[15] However, while remote work has reduced some peak-period commuter traffic, this is offset by an increase in midday travel for errands such as grocery shopping or childcare. In fact, from 2019 to 2022, the number of short trips (less than three miles) taken between 11:00 a.m. and 1:00 p.m. by work from home employees in the U.S. surged by more than 400 percent.[16] These patterns suggest that while telecommuting can reduce longer-distance commutes, it may lead to more frequent short-distance trips. The long-term transportation and environmental impacts of widespread remote work will likely depend on how travel behaviors continue to evolve and how transportation systems adapt to these changing patterns.

Remote work is also reshaping land use patterns as many residents have moved from the urban core to suburban communities within the region, while others have left the state entirely. A review of the U.S. Census Bureau's ACS by *The New York Times* revealed that the New York metropolitan area experienced a net migration loss of 116,000 remote workers from 2020-2021, although this was undoubtedly influenced by the pandemic.[17] The increased flexibility in workplace arrangements has made it easier for employees to visit the office occasionally or not at all, driving population growth in suburban and exurban areas where housing is more affordable and spacious. This shift is changing both residential trends and the demand for local infrastructure, services, and transportation in these outer regions. However, this trend has moderated, and even reversed, in recent years. According to NYMTC's population forecasts, the planning area, comprised of both urban and suburban counties, did lose less than 1 percent of its population from 2020 to 2022, but the region is expected to grow through 2055—regardless of trends in remote work.

The rise in remote work has significantly impacted office space utilization in the region. Office vacancy rates have doubled from 6 percent in 2020 to 12 percent as of spring 2024, with Manhattan experiencing even higher rates of up to 15 percent. [18] As seen in Figure 3.22, Manhattan has experienced the biggest increase in office vacancy rates since 2020 compared to neighboring communities in the outer boroughs and the metropolitan ring surrounding the city (including parts of New Jersey, Long Island, and as far as the Lower Hudson Valley). In response to the continued growing surplus of office space, also driven in part by a 'flight to quality' away from older and more outdated facilities, some buildings are being converted into residential units. This shift presents several potential implications, including alterations in travel patterns and new opportunities to integrate affordable housing into central business districts. Ultimately, it is unclear how persistent remote work will be. By some measures, for example, office occupancy rates have returned to 80 percent of their pre-pandemic levels.[19] In the New York metropolitan area, office occupancy rates in December 2024 ranged from 30 percent to 68 percent depending on the day, reflecting the variability of office occupancy by day, season, and industry.[20] It is important to note however, that even prior to the pandemic, office occupancy was not at 100 percent, reflecting these key factors.

Figure 3.22 Percentage Point Change in Office Vacancy Rate (Q1 2020–Q1 2024)



Source: New York City Comptroller.

Finally, if remote work continues to grow, not all groups benefit. Occupations which are at the highest risk of being left behind in a remote work boom include food service, hospitality, retail, and jobs in the transportation, warehousing, and logistics sector. These jobs tend to be staffed by already vulnerable groups and are likely to be negatively impacted should remote work continue to grow.[21]

ON-DEMAND ACCESS

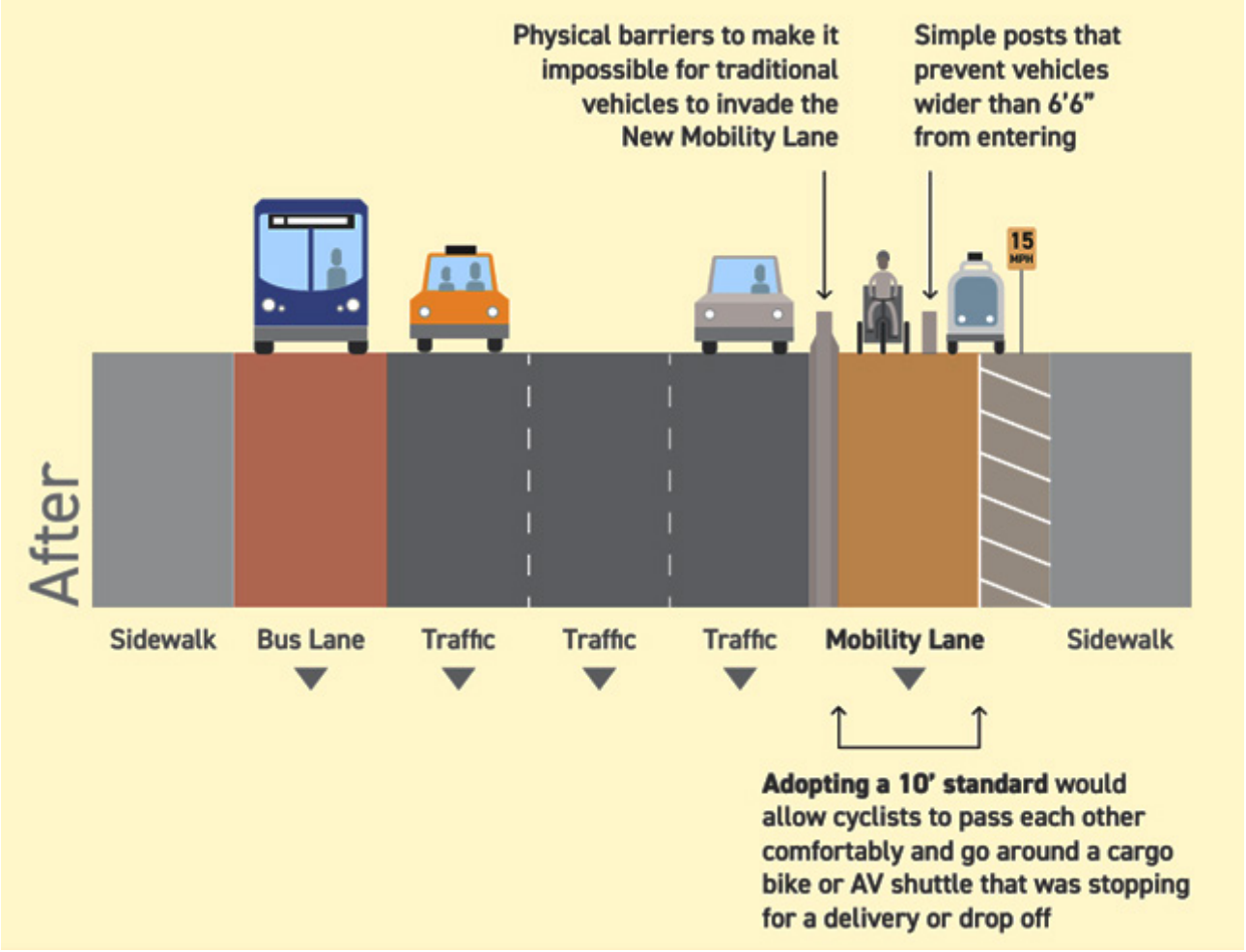
On-demand access includes all economic activities that are technology-enabled and offer the consumer access to the product or service shortly after they request it; it may also be referred to as "just-in-time" delivery in freight planning. Like work from home, the pandemic accelerated the demand for near instant access to everyday essentials and non-essentials such as grocery and meal delivery, transportation, doctor's appointments, movies, shopping, and more. What began as a safer alternative to in-person visits has become an entire economic sector. Facilitated by technology solutions for payment and location tracking, as well as growing demand for gig employment, on-demand consumers enjoy greater convenience, speed, and simplicity in their goods and services. The NYMTC region has become a testing ground for on-demand companies, an extension of the growing e-commerce market. This market is expected to grow, with cascading implications for long-range transportation planning.

The on-demand economy threatens to upend traditional consumer behavior, potentially leading to the closure of movie theaters, grocery stores, retail establishments, and brick and mortar banks. This creates opportunities for redevelopment, such as affordable housing in commercial districts. This may then affect transportation needs with reduced trips for errands and entertainment—creating an opportunity for sustained VMT reduction but potentially harmful to transit or bikeshare revenues. Additionally, the shift to on-demand access has changed the geographic distribution of warehousing and fulfillment centers. Speedy delivery requires a network of urban and suburban micro-fulfillment centers, shifting freight traffic from long-haul freight routes to local streets. For example, third-party delivery services like Instacart, DoorDash,

and UberEats have opened "dark" stores in the region that resemble mini warehouses stocked with groceries. Workers then transport these items to the customer via truck or bicycle.[22]

On-demand services have prompted a shift in the types of vehicles used for delivery, especially in denser districts within the NYMTC region. The uptick in deliveries has resulted in an increasing reliance on smaller, faster modes of delivery like e-bikes, scooters, and drones. Smaller vehicles like bikes or scooters can reduce road congestion, but their sheer volume increases clutter in bike lanes and pedestrian areas. They can also pose safety concerns when they do not follow traffic rules. A proposal by Cornell Tech offered a solution to the evolving landscape of miniature cargo delivery vehicles—converting bicycle lanes into "mobility lanes" that are wider than bike lanes to accommodate a wider range of non-vehicular transport, with physical barriers from traffic (Figure 3.23).[23] As seen in other trends, the effects of on-demand access, micromobility, distribution innovations, and shared mobility are forcing transportation agencies to rethink traditional street design, potentially making space for new and emerging modes of urban goods delivery.

Figure 3.23 Illustration of "New Mobility Lanes"



Source: Rebooting NYC: An Urban Technology Agenda for the Next Administration., 2021.

An attendee at the *Moving Forward 2055* Curb and Parking Management Forum noted that the most important use case of curb management is "neighborhood loading zones in NYC—[which are] important post-COVID as 1 in 5 New Yorkers receive a package each week."

One potential upside is that on-demand services, particularly in food and grocery sectors, reduce personal vehicle trips. A study by Argonne National Laboratory found that while e-commerce (a large component of the on-demand economy) has generated an increase in parcel truck delivery trips, e-commerce still reduces VMT and fuel consumption due to an overall decrease in shopping trips.[24] Even with less fuel-efficient freight vehicles, the mileage saved in the economies of scale associated with goods delivery still produces net reductions in emissions compared to personal vehicle trips. In the longer term, more fuel efficient, or fossil-fuel-free freight vehicles can multiply the environmental benefits of the on-demand economy.

On-demand access is an important transportation alternative for people who may find travel difficult, such as those with special needs or mobility impairments. On-demand access to goods and services can supplement paratransit. However, a study of telehealth usage in New York City during the pandemic found that older adults (over 65 years) and ethnic minorities (specifically African Americans and Non-white Hispanic residents) were more likely to use the Emergency Room and doctor's office visits over telehealth, reflective of national trends in groups affected by the digital divide.[25] Increased promotion of telehealth and other on-demand services can better support historically underserved populations by providing more convenient access to services such as preventative healthcare, as well as alleviate the burden on human service transportation systems.

3.6.2 SHARED MOBILITY

Shared mobility refers to transportation services and resources that are shared among multiple users as part of a multimodal transportation network that offers on-demand, integrated services. Shared mobility is part of the new mobility marketplace, offering consumers flexible, tech-driven, and user-centered mobility solutions. The field of shared mobility is rapidly evolving and quickly gaining in the mobility marketplace. Automobile manufacturers, rental car companies, venture-backed start-ups, and government-sponsored programs have sprung up with new solutions ranging from large physical networks to mobile applications designed to alter routes, fill empty seats, and combine fare media with real-time arrival and departure information. Over 92 percent of attendees at the Transportation and Technology Topical Forum indicated that they use shared mobility, with 61 percent noting that they use shared mobility regularly.

MOBILITY ON DEMAND

Mobility on demand, or MOD, is a component of the on-demand economy. Users can book transportation services such as ride-hailing, ridesharing, carsharing, bikeshare, or transit in some cases, as they need them.

Ride-hailing is one of the most visible types of MOD; customers can order and pay via mobile app for a car ride from an Uber or Lyft driver. Uber and Lyft are the most popular types of ride-hailing services in

New York City, comprising 71 percent of licensed vehicles.[26] Ride-hailing supplements, or in some cases, replaces traditional taxi services, transit or active transportation, or personal vehicle usage. At its best, ride-hailing is sustainable and fair, facilitating carpools (or rideshares) and reducing pollution through a fleet of zero-emission vehicles while connecting users to mobility opportunities they may not have otherwise had.

A 2018–2019 study of ride-hailing trips taken in metropolitan regions in California found that 47 percent of the trips replaced a more sustainable mode such as public transit, carpool, walking, or cycling. An additional 5.8 percent of trips represented "induced travel", meaning that the person would not have taken the trip if an Uber or Lyft had not been available.

However, several studies show that in most cases, ride-hailing worsens pollution more than the status quo.[27] This is attributed to increased traffic congestion, especially in urban environments. One study found that the entrance of transportation network companies (TNC) such as Uber and Lyft increased road congestion by almost 1 percent and the duration of congestion rose by almost 5 percent.[28] Initiatives such as New York City's Green Rides aim to reduce ride-hailing related emissions by requiring that all rideshare trips be either zero-emission or wheelchair accessible by 2030.[29]

Carsharing is another form of MOD for short-term vehicle rentals, facilitated through a membership-based system where users can reserve a vehicle online or via an app, access it at designated parking locations, and pay only for the time they use it. In 2018, NYC DOT launched a pilot program to expand carsharing into communities that had less access to carsharing systems. A study of the program found that roundtrip carsharing in New York City mostly served as a substitute for traditional car rental, ridesharing, personal vehicle ownership and transit.[30] Compared to ridesharing, carsharing may be more effective at reducing VMT and emissions. Across the membership base, VMT was reduced by 7 percent and key pollutants were reduced by 6 percent; an additional 7 percent of carsharing members in the program avoided a car purchase. In this capacity, carsharing has the potential to advance the region's sustainability goals.

MOD has extended into public transit through the rise of "microtransit." Microtransit blends traditional public transit with ridesharing by offering shared rides, often facilitated by mobile app or a phone request, along dynamic routes that respond to real-time demand rather than sticking to fixed schedules or stops. Using smaller vehicles like vans or shuttles, microtransit has expanded within the NYMTC region, both as a complement to traditional transit services and as a supplement to paratransit. This demand-response model provides a cost-effective solution for areas where fixed-route services are not viable, such as offering on-demand trips within specific zones or transfers to nearby transit hubs. Its integration with paratransit has proven particularly valuable, as the proportion of older adults increases, and the cost of operating paratransit rises. In fact, a review of several transit agencies that implemented paratransit services using Uber/Lyft and taxis found that these options were more cost-effective than traditional paratransit trips.[31] This highlights the potential for microtransit to improve service and reduce costs for both users and transit agencies:

- In 2017, MTA launched a pilot program called "E-Hail", an on-demand service that offers participating Access-A-Ride paratransit customers the opportunity to book trips in real-time through five taxi or for-

hire vehicle services.[32] The program has since been expanded multiple times, most recently in July 2024 which increased the trip subsidy to $60 for the 1,600 current customers.[33]

- The SCT On-Demand program offers two zones for transit on-demand rides in South and East Hampton, operating seven days a week, all year long from 6:00 a.m. to 8:00 p.m.[34] Riders can travel anywhere within their zone for $2.25 or less, identical to the fixed route transit system.

There seems to be continued interest in MOD as a strategy for improving and expanding transit systems, with reservations. For example, one survey respondent from Suffolk County indicated that they would like a solution such as "direct shuttle pick-up" in areas where transit does not operate, improving their access to public transportation. Another respondent from Nassau County, however, said that their biggest concern is replacing bus service with rideshare, especially for disabled and low-income riders.

MOBILITY AS A SERVICE

Mobility as a Service (MaaS) is the integration of various forms of transport services into a single mobility service accessible on demand.[35] Users can plan, book, and pay for multiple types of mobility services (such as public transit, bike sharing, carsharing, ride-hailing, and more) through a unified interface, typically via a mobile app. Experts generally consider there to be four levels of integration as shared in Figure 3.24.[36]

Figure 3.24 Levels of MaaS Integration

LEVEL 1 Integration of Information

- Travel information is provided through (multimodal) travel planners, which may or may not include information on routes and costs.

LEVEL 2 Integration of Finding, Booking, and Payment

- MaaS facilitates the finding, booking, and payment of individual trips. The added value of level 2 is that users can find, book, and pay for their trip at a single service point (e.g., through an app with a pre-registered credit card).

LEVEL 3 Integration of Transportation Services into Passes and Bundles

- The service meets the full daily mobility needs of individuals and families by offering different means of transport through bundles and/or passes such as a universal mobility pass for bikeshare, rail, bus, and carsharing. This level better meets the needs for individuals replacing personal car ownership.

LEVEL 4 Integration of Societal Goals

- MaaS extends beyond liaising between the demand for and supply of mobility. Supply and demand are now combined with goals such as reducing the use of cars or promoting livability in the cities. This may constitute tiered pricing for economically underserved individuals or prioritizing the most eco-friendly modes of transportation in trip planning.

Source: Netherlands Institute for Transportation Policy Analysis.

MaaS is still an evolving concept, and most mobile applications are still at Level 1 or 2, but this could change rapidly over the next 20 years. The NYMTC region, like much of the country, does not currently have a fully integrated MaaS solution. MTA offers OMNY, a contactless fare payment system available on smart phones, smart watches, the OMNY card, and contactless credit or debit cards.[37] MTA is currently working on solutions for combining fare payments and ticketing across subways, buses, paratransit, and commuter rail, while simultaneously phasing out MetroCards.[38]

Moving Forward 2055 respondents were interested in incorporating MaaS into OMNY as a singular payment mechanism and as a method for improving paratransit. Participants suggested that a fully integrated app that allows users to book their rides, track ride progress, and communicate with dispatch and drivers would be a huge benefit.

The widescale implementation of MaaS could significantly affect how community members travel in the region. MaaS makes it easier for residents to access a growing and diverse range of transportation options, from on-demand options to public transit, which facilitates a car free or car-light lifestyle. MaaS will also create new data for transportation providers that can be used to better understand travel patterns and help agencies to adjust services in response to dynamic needs. This will enable more efficient use of transportation resources and may lead to demand-responsive transit systems that adapt in real time to user needs. However, many agencies and MaaS providers will need to be mindful of data and user privacy concerns.

MICROMOBILITY

Micromobility is any small, low-speed, human- or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles, electric scooters (e-scooters), and other small, lightweight, wheeled conveyances. In 2020, New York State and New York City legalized the use of Class 1, Class 2, and Class 3 ebikes and standing escooters, as seen in Table 3.38 (note: these devices were in use prior to legalization by delivery drivers and other users).[39] Since then, escooters and ebikes (both shared and personally owned) have proliferated across the NYMTC study area. Growth in micromobility usage will impact the region's sustainability goals, transportation safety, and access in underserved communities.

Table 3.38 Ebike Classifications

Class 1 EBike	Class 2 EBike	Class 3 EBike
Electric Bike with Pedal Assist	Electric Bike, Throttle up to 20 mph with Operable Pedals	Electric Bike, Throttle up to 25 mph with Operable Pedals

Note: Permitted in bike lanes and streets with speeds no greater than 30 miles per hour (mph).

Source: NYC DOT.

Micromobility devices facilitate a car-free or car-light lifestyle, and because they are either electric or human-powered, they are one of the cleanest modes of transportation. Ebikes and escooters are used as a first and last-mile connection to public transit as well as a substitute for shorter car trips. One study

estimated that a 5 percent increase in trips made by bicycle and electric micromobility instead of cars globally would reduce CO_2 emissions by 7 percent —the equivalent of taking more than 134 million cars off the road by 2030.[40] Shared systems (like Bethpage Ride, the Suffolk County bikeshare program seen in Figure 3.) expand access to micromobility devices for residents who cannot afford one, fostering multimodal transportation environments.

Figure 3.25 Bethpage Ride, Long Island's Regional Bike-Sharing Program

Source: Connect Long Island, 2024.

While largely beneficial for the environment, electric micromobility devices have been contested throughout the region for their potential safety risks, including high speeds, conflicts with other cyclists and pedestrians, and unsafe device operation. In their Electric Micromobility Action Plan, New York City highlighted risky behaviors of e-micromobility operators, including running red lights and stop signs or traveling on sidewalks, as well as the usage of legal and illegal electric mopeds.[41] These concerns were echoed by *Moving Forward 2055* survey respondents:

- *New York City Environmental Justice Focus Group participants expressed their safety concerns with the expansion of scooter and moped use in the City in bike lanes and on sidewalks.*
- *"I am very concerned about bicycles and scooters in the city. They are a huge hazard because many riders do not follow basic traffic rules, and they need to be enforced." –Survey respondent from Manhattan*
- *"Improve vehicular classification for the dozens of emerging micromobility devices in NYC. Legislation/enforcement around electric mopeds, e-scooters, pedal assist ebikes, and others often get lumped together due to anemic classification. A focus on top speeds and weight would be useful metrics for better disaggregating the different kinds of electric bikes/scooters than just the blanket label "ebike". –Survey respondent from Manhattan*

One respondent, however, noted that these dangers are likely concentrated within a handful of users. They said, "I think that it's created an excuse for people to be against micromobility and micromobility infrastructure because they see delivery people, they see teenagers on skateboards and scooters, and they lump bicycles all with that to make the argument that it's the real traffic hazard in New York City."

While there are dangers associated with micromobility usage, it is still seen as a crucial component of the micromobility ecosystem and a way to expand transportation access for zero car households. Micromobility can serve as a lower-cost alternative to traditional modes of transport in areas where public transit is limited, particularly in low-income neighborhoods or areas with poor connectivity. In 2021, New York City sponsored a shared escooter pilot program in the Bronx. The Bronx program was highly successful; users recorded 3.8 million trips among more than 157,000 accounts. In May 2024, the City announced that they would be expanding the program to eastern Queens.[42]

Moving Forward 2055 community members shared that micromobility's impact would be even greater with public sector investment in microhubs (small, strategically located facilities that serve as points where people can access shared mobility options like bikes, e-scooters, or e-bikes), safe charging for e-bikes, expansion of bike sharing programs, and improved networks for non-vehicular travel. However, many respondents also noted that active transportation requires enhanced facilities for users such as off-road trails and protective barriers. These amenities also support micromobility usage and are especially important for less experienced riders who may be more likely to engage with a shared micromobility system. Ultimately, a safe, accessible micromobility network supports a less car-centric transportation eco-system that has the potential to advance multiple *Moving Forward 2055* goals.

3.6.3 TECHNOLOGICAL ADVANCEMENTS

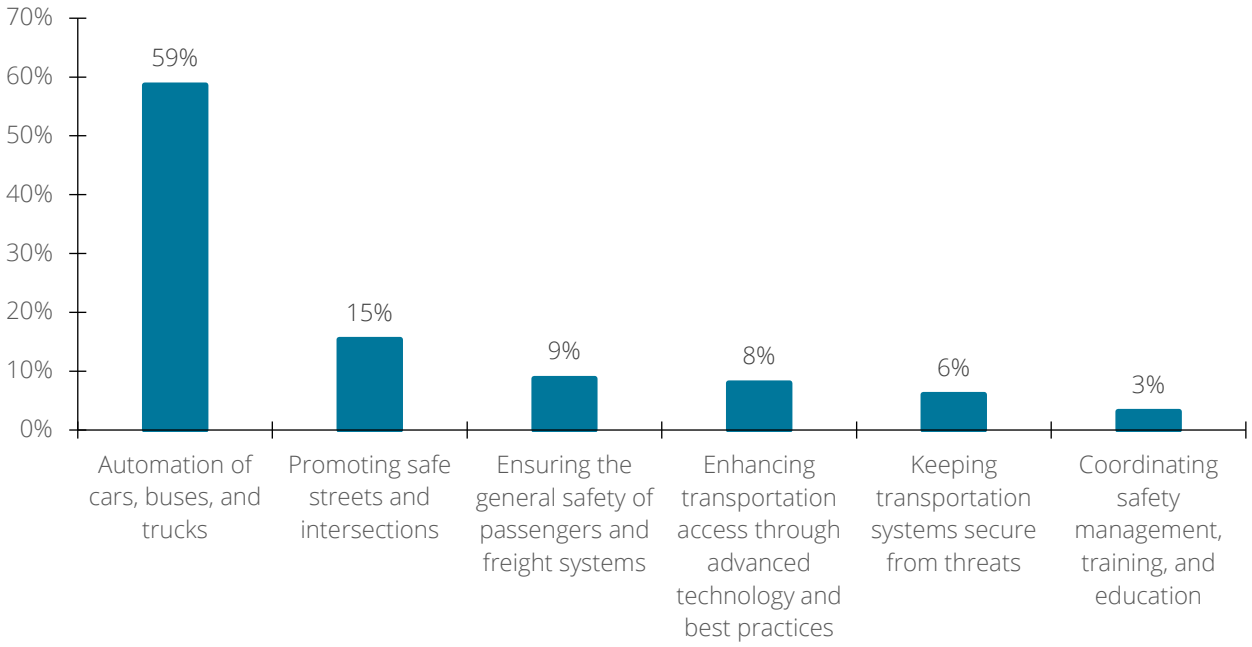
Advancements in transportation technology have huge implications for the efficiency, safety, sustainability, and accessibility of the transportation system. They also have the potential to impact the labor force, both positively and negatively. The scale and scope of these advancements are yet to be determined, but the current and maturing landscape of technologies such as autonomous vehicles, connected and intelligent transportation systems (ITS), urban air mobility (UAM), high-speed rail (HSR), and artificial intelligence (AI) are a peek into future mobility patterns.

AUTONOMOUS VEHICLES

Autonomous vehicles (AVs) are modes of personal or shared transportation in which some aspects of control are automated by the car itself.[43] There are multiple applications for AVs, including personal vehicles, freight, transit, and robotaxis. Many personal vehicles today offer a low level of automation, such as adaptive cruise control, lane keeping, or parking assistance. Higher level automation where a driver is not needed—often referred to as autonomous, self-driving, driverless, or robotic—is currently limited only to carefully controlled environments. Widescale adoption of autonomous passenger vehicles depends on a lot of factors, including state and Federal standards for vehicle manufacturers, the progress of technological development, and consumer interest and affordability. Assuming vehicle manufacturers meet their target dates for AV launches, with a medium level of customer adoption despite higher costs, experts estimate

that 12 percent of vehicles sold by 2030 will have autonomous driving systems.[44] By 2037, this will grow to nearly 40 percent of vehicle sales. In areas like the NYMTC region, with higher incomes and longer commutes, AV adoption may surpass typical expectations. In fact, over 50 percent of respondents to the NYMTC *Moving Forward 2055* Survey chose automation of cars, buses, and trucks as the highest funding priority for advancing transportation safety and security in the region, seen in Figure 3.26.

Figure 3.26 Survey Respondents Priorities for Advancing Transportation Safety and Security in the Region



Source: NYMTC.

Currently, AV testing is largely focused within New York City, but there is potential for it to expand into the outer regions in the future as infrastructure, regulations, and needs evolve. The Port Authority of New York and New Jersey (PANYNJ), for example, has been testing self-driving technology since 2022. The agency started with automated bus platooning and lane-keeping technology and in 2024 introduced an autonomous shuttle for customers at JFK Airport, following a successful demonstration at Newark Airport.[45] Other AV tests have occurred on private roads in New York City, and in 2024 New York City announced a new permitting system for AV testing on public roads, including the testing of "robotaxis" with safety drivers.[46,47] New York City has one of the largest taxi markets in the country, potentially ripe for the introduction of self-driving cabs, but the development, testing, and regulatory environment is extremely complex. Furthermore, the expansion of AV technology into suburban and rural areas within the NYMTC area will require significant updates to infrastructure, including smart roadways, communication networks, and safety regulations.

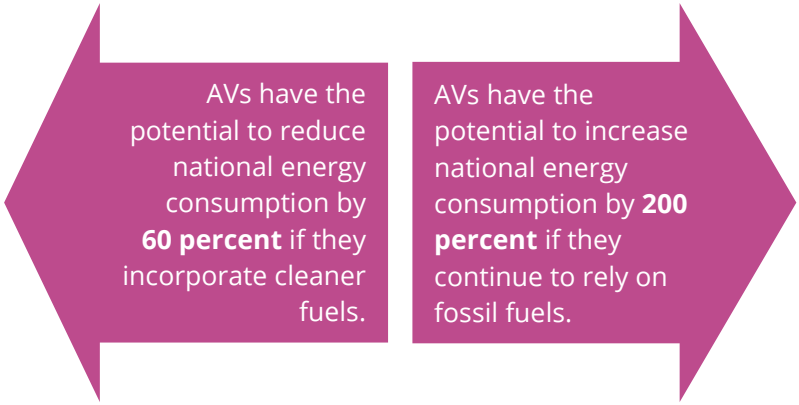
The NYMTC region—particularly urban environments—represents one of the most challenging street networks in the world, complicating the landscape for future AV operation.

A study of AV crash data revealed that vehicles with advanced driving systems have a lower crash rate than their human operated counterparts—but not in all conditions. AVs were over five times more likely to crash during dawn or dusk, and nearly twice as likely when making a turn.

While AVs have a significant road ahead before they are ready for mass adoption, there are opportunities for NYMTC and member agencies to improve the safety environment for future AV usage. This includes infrastructure upgrades and maintenance such as clear lane demarcations and consistent road signage; redesigning urban roadways to be more AV-friendly such as the usage of roundabouts; introducing intelligent and connected infrastructure such as smart traffic signals; and providing dedicated lanes for AVs and protected space for vulnerable road users when in mixed traffic.

In addition to safety, AVs have significant potential impacts on the region's pollutant reduction goals. A U.S. Department of Energy study estimated that widescale adoption of AVs could reduce energy consumption by 60 percent nationwide or increase it by 200 percent, depending on the assimilation of cleaner fuel sources into light-duty AV fleets, illustrated in Figure 3.27.[48] This wide range reflects the variability in how AVs can influence vehicle efficiency and use through changes in vehicle design, travel behavior, and external policies. While most of the policies will be developed at the state and Federal level, there are opportunities to advance the Shared Regional Vision at the local level. For example, requirements that robotaxi operators be pollution-free (similar to New York City's Green Rides program) can advance local sustainability efforts.

Figure 3.27 Potential Impacts of AVs on Pollution Reduction



Source: U.S. Department of Energy

There is also huge potential for the introduction of self-driving technology in freight applications; some pilot demonstrations are currently underway across the country. Industry experts estimate that the current truck driver shortage, estimated at approximately 80,000 drivers nationwide, will double by 2030 due to aging driver demographics and increased freight demands.[49] AVs tend to perform better in relatively uncomplicated traffic situations, such as Interstates, which make them a prime candidate for long-haul trucking. The optimal truck routes for AV freight applications are over 200 miles long to and from the region and are generally located in testing-friendly states. Once close to the destination, a human driver could take over for the last few miles to better navigate more complex urban environments. With capacities for alternative fuels, platooning and other vehicle efficiency measures, autonomous trucks can also improve sustainability in the region. While there are numerous opportunities for self-driving trucks, it is ultimately

the decision of the private sector—primarily freight shippers—if they would like to integrate autonomous technologies into their transportation operations. Further, many members of the public still feel reticence at the expansion of self-driving trucks.

61 percent of attendees at the Transportation and Technology Public Forum answered that they would not feel safe sharing the road with driverless trucks.

EMERGING TRANSPORTATION MODES AND SERVICES

AVs may receive a lot of public attention, but there are numerous other emerging transportation modes that can change how residents and visitors to the region travel in the future. Emerging transportation modes encompass new modes, technologies, and systems that integrate advanced technologies, improve efficiency, and foster sustainable practices. For the purposes of *Moving Forward 2055*, this will primarily focus on connected and ITS, high-speed and advanced rail systems, and UAM.

ITS uses technology to make travel safer, more efficient, and more convenient. NYSDOT and many member agencies currently employ ITS in-traffic signals, automated toll collection, and advanced transit systems. Current usage of ITS varies across the NYMTC area. New York City, for example, introduced a wireless infrastructure network in 2020 that supports communications for all the city's ITS devices, including traffic cameras, variable messaging systems, vehicle detection devices, and traffic signals.[50] Rockland County's TOR buses on State Route 59 utilize Traffic Signal Priority technology to help speed transit trips along this congested corridor, and all TOR buses are equipped with both onboard and exterior cameras and technology that will enable real-time information in a future ITS project. In 2024, Westchester County began its project to install new software and technologies on the Bee-Line system that support planning and scheduling, dispatch, garage management, and store security video footage.[51] In *Moving Forward 2055* feedback sessions, community members from across the region voiced their particular interest in technology-driven improvements for transit.

Participants in the Lower Hudson Valley Coordinated Human Services Focus Group wanted to see more electronic signage used to provide real-time information on bus and train schedules, and the Long Island Coordinated Human Services Focus Group participants called for the use of app technology to provide real-time information about elevator availability at transit stations and to track paratransit drivers.

HSR is a type of passenger train transportation that uses specialized rolling stock and dedicated tracks to travel at much faster speeds than traditional rail. On dedicated passenger tracks, such as Amtrak's Acela service in the Northeast, trains can reach speeds of up to 150 mph but typically travel closer to 70 mph. By comparison, HSR reaches speeds over 200 mph. Advocates in the NYMTC region have long called for an HSR system that would better connect the Northeast. The Northeast High Speed Rail Coalition, for example, has called for a line to transport passengers between New York City and Boston in under two hours.[52]

Community members in the region have expressed their support for faster, more efficient rail options; one respondent from Westchester County called for agencies to standardize and modernize long-range transit. They emphasized, "You can't over-invest in this." However, previous HSR plans have been delayed by a lack of funding (the proposal is estimated to cost over $50 billion), environmental concerns, and the difficulties in procuring right of way.

UAM is the use of small, highly automated aircraft to carry passengers or cargo in urban and suburban areas. UAM includes traditional helicopters, uncrewed aerial vehicles (unmanned aerial vehicles (UAV), commonly known as drones), and short and vertical take-off and landing (VTOL) aircraft. While NYMTC is only responsible for surface transportation planning, UAM has potential applications in passenger usage, freight, and as a substitute for traditional taxis. New York City has explored UAM infrastructure and applications including commercial heliports on buildings. In 2023, New York City announced that it would enhance infrastructure at the Downtown Manhattan heliport that would support electric-powered aircraft that would take off and land vertically, advancing the administration's vision of an aerial sustainable transportation hub[53], as early as 2025 with private sector support.[54] And in 2024, the City piloted drones equipped with loudspeakers to warn residents of potential flash flooding.[55]

While UAM can be leveraged for personal and public sector applications, it also has significant potential to improve freight logistics. UAM complements other trends explored in this chapter, including on-demand access and distributed manufacturing. The PANYNJ tested using a drone to carry goods across the Hudson River between Brooklyn and New Jersey, part of a strategic vision to establish fixed drone routes that could be used to deliver high-value cargo across the region (Figure 3.28).[56] UAM, using small drones or cargo-specific aerial vehicles, could revolutionize last-mile delivery by bypassing congested road networks and delivering goods directly to customers or distribution centers. UAM could also improve freight delivery in areas that are difficult to access by traditional vehicles, such as remote locations or highly dense urban environments with limited road infrastructure.

Figure 3.28 PANYNJ Drone Test

Source: PANYNJ, 2024.

Collectively, these transportation modes impact congestion, infrastructure, sustainability, land use, and safety—encompassing many of the plan's goal areas. HSR represents a transformative alternative to traditional rail, personal vehicle travel, and even commercial flights for longer-range trips. Similarly, UAM has great potential at transforming shorter range trips; one air taxi provider estimated that they could transport passengers from Manhattan to JFK Airport in seven minutes, compared to a 50-75 minute car ride.[57] With more transportation options, typical roadway traffic can be more diffused across the entire transportation network, reducing congestion and improving the region's overall resilience. Alongside expanded mobility

choices, ITS can be a solution for persistent roadway traffic, monitoring traffic conditions and potentially responding in real-time through managed lanes, signal timing, and in-vehicle route recommendations. To better support multimodal integration, cities may explore building transportation hubs—supported by ITS—that facilitate fast, easy transfers between rail, urban air, and ground modes. In this type of multimodal ecosystem, the region is likely to benefit from reductions in transportation-related pollution.

More mobility choices and technologies may also shape land use and infrastructure investment decisions—from the roadway to the track to the air. ITS and AV integration require substantial investments in infrastructure, including sensor networks, communication systems, and advanced traffic management technologies. Long-term, transportation planners will need to prioritize the development of HSR corridors that connect major urban centers, especially as a sustainable alternative to congested highways or short-haul flights. This requires significant coordination between municipalities, regions, and state authorities. UAM, such as flying taxis, requires new types of infrastructure, including vertiports and air traffic management systems for low-altitude airspace. Planners must identify potential sites, navigate regulatory challenges, and ensure integration with ground transportation. Additionally, faster rail and air mobility may lead to the growth of exurban areas as people can live farther from work or urban centers, reducing central business district density. This creates more distributed patterns of travel, increasing demand for regional transportation systems. Roadways could be repurposed for transit or active transportation infrastructure, as could parking lots.

The next era of transportation is undoubtedly technology driven, with cascading impacts for cybersecurity. With increased connectivity comes greater vulnerability to cyberattacks. Transportation networks must safeguard against breaches that could disrupt connected and AVs, rail systems, or air mobility infrastructure. Similarly, community members may not be able to opt out of ITS integrated transportation modes, which may compromise their privacy preferences. Further, with the growth of UAM, low-altitude airspace must be carefully regulated, and cities will need new protocols for managing air traffic safety, particularly in dense urban areas.

ARTIFICIAL INTELLIGENCE

AI powers many of the innovations already discussed, including AVs, MaaS, and freight and transit efficiencies. AI uses algorithms and computational models that allow machines to process information, make decisions, and execute actions that improve operational efficiency. Member agencies in the NYMTC region have used AI in multiple capacities, primarily transit, safety, and traffic analytics:

- MTA expanded Automated Camera Enforcement (ACE) for bus lanes on 14 routes across Brooklyn, Queens, Manhattan, and the Bronx.[58] The ACE program captures vehicles violating bus lane, double parking, and bus stop rules in real-time. The test phase of the project resulted in a 5 percent increase in bus speeds, 20 percent decrease in collisions, and up to a 10 percent reduction in certain pollutants. The program also averted repeat offenders. ,
- Dutchess County and MTA use AI to track bus maintenance, helping to reduce costs.[59, 60]
- MTA has also begun using AI for preventative maintenance on its bus fleet.[61]

- The PANYNJ has explored the use of AI to better understand traffic conditions related to Hudson River crossings such as traffic congestion, pollution, and safety hazards.[62]

Like many of the trends discussed in this chapter, AI is part of a complex and interdependent ecosystem of transportation innovations; AI powers MOD, MaaS, AV, and ITS, magnifying its impact. As a component of ITS, AI can analyze real-time data from traffic sensors, cameras, and connected vehicles to predict congestion patterns and optimize traffic signals, predict and respond to incidents such as crashes or road closures, dynamically adjusting traffic and signals to improve traffic flow. Managed lanes can maximize the capacity of the roadway network to dynamically respond to traffic conditions and driver needs. Over time, this can reduce congestion, improve travel times, and decrease fuel consumption.

Similar to its usage in transit systems, AI can also be used to monitor transportation infrastructure, such as roads, bridges, and railways, by detecting early signs of wear and tear. Predictive maintenance powered by AI can prioritize repairs before infrastructure failures occur, improving safety and reducing long-term repair costs. By improving the efficiency of roadway networks and averting expensive and time-consuming road repairs, AI improves asset management and system resiliency, advancing regional goals.

Additionally, AI can be leveraged to improve route planning for transit systems and freight. AI can analyze transit demand in real-time and adjust schedules, routes, and fleet sizes accordingly. This approach is especially valuable in mixed-service systems that incorporate microtransit or other demand-response services, minimizing the labor cost of on-demand service. This would make public transit more responsive to fluctuations in demand, reducing wasted capacity and providing a more efficient service. Similarly, AI can be used in freight planning to optimize routes and minimize delivery times. For example, with digitally connected urban loading zones powered by in-vehicle AI interfaces, a truck driver may be able to optimize their route to time drop-offs when the loading zone is free—minimizing time spent idling and potentially backing up traffic. With autonomous buses and trucks, the power of AI expands even further.

AI has a lot of potential for transportation applications, but this is mitigated by concerns about cost, scalability, agency familiarity, and long-term obsolescence. To be fully utilized, AI would necessitate a fully digital network management system, connected infrastructure and vehicles, and staff capable of managing the system. In the NYMTC region, member agencies have varying levels of interest and integration of AI systems; inconsistent adoption of AI across the region has created disparities in transportation management and efficiency. This reflects the different priorities at agencies; overcoming this would require upscaling resources, new requirements in the employment market, and supporting the build out of internal and external infrastructure to support new innovations in AI—effectively future-proofing a rapidly evolving technology. Many of these may be beyond the agency's control to implement.

An attendee at the Transportation and Technology Public Forum echoed that a main risk or barrier for infrastructure or traffic control impacted by automation or AI is that "system complexity can make automation/AI training more difficult." Another noted that conventional "ITS investments [are] quickly becoming obsolete."

AI also prompts significant concerns regarding personal privacy, fairness,, and cybersecurity risks. AI systems, particularly in transit, rely on large amounts of data, including real-time tracking and passenger behavior. While this data enhances efficiency and safety, it raises significant concerns about personal privacy. The collection and analysis of sensitive data could lead to potential misuse, surveillance, or data breaches if not managed with strict privacy protections.

Similarly, AI has come under fire for biases in the algorithms or models used. AI biases can lead to unequal service provision, reinforcing existing socioeconomic disparities. This occurs when AI models rely on incomplete or skewed data, prioritize cost efficiency, or reflect historical biases. As a result, underserved communities, such as low-income or rural populations, may receive fewer services or slower responses. For example, ride-hailing algorithms like those used by Uber or Lyft have been criticized for contributing to "algorithmic redlining," where certain neighborhoods receive fewer or slower services based on historical demand. Addressing these concerns requires intentional efforts to ensure that AI-driven transit systems are fair, transparent, and designed with broader social goals in mind.

Broadly, AI is also at risk of cyberthreats. Hackers could target AI algorithms, disrupt services, or manipulate data, potentially causing widespread transit delays or safety hazards. Additionally, breaches of sensitive rider data can compromise personal privacy. To mitigate these risks, transit agencies must invest in robust cybersecurity measures, continuously update software, and ensure strong encryption and authentication protocols are in place. This issue is explored further in the Disruptors section.

3.6.4 DISTRIBUTION INNOVATIONS / GOODS MOVEMENT

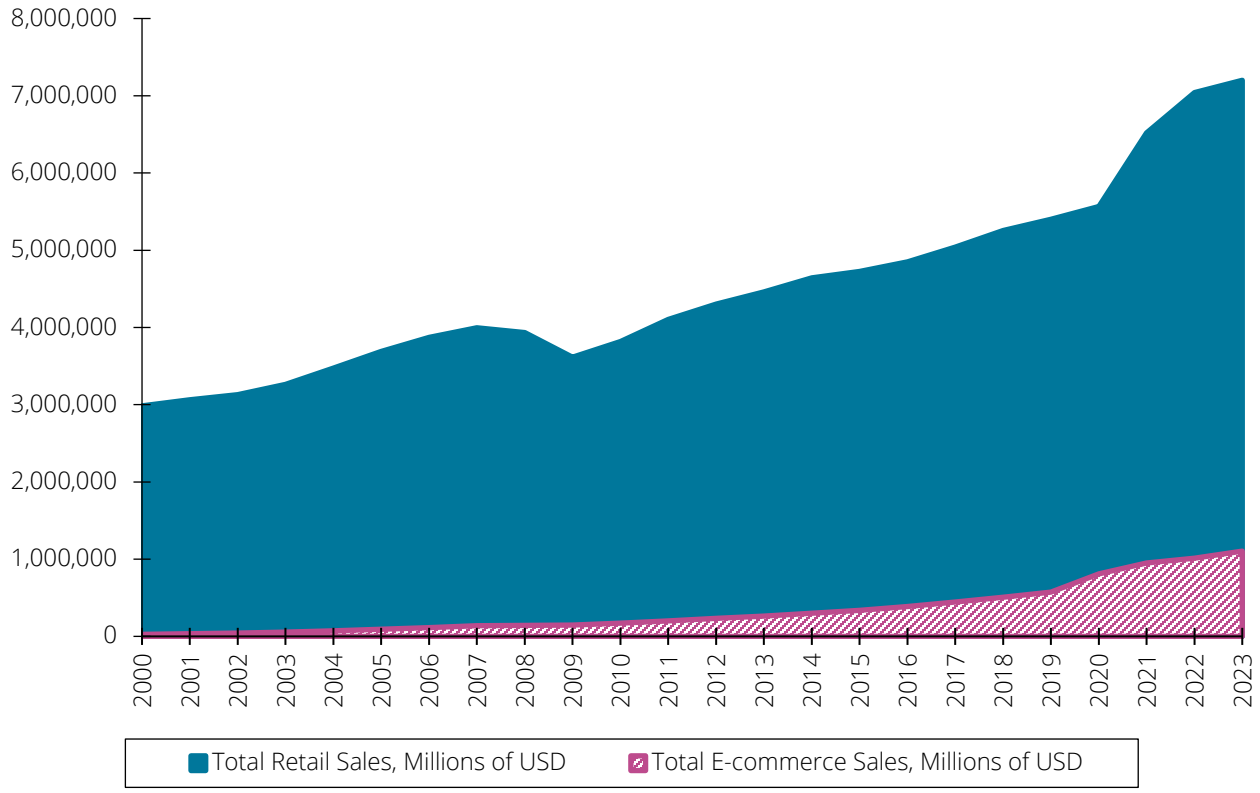
Supply chains and commodity movements are being revolutionized by economy-wide transformations in data availability and connectivity. These trends will continue to affect the NYMTC planning area as businesses deploy new technologies and processes to improve the efficiency of goods movement, reduce costs, comply with regulatory or customer-driven demands, and improve profitability. Distributed manufacturing and e-commerce represent a blend of both new business models and a revamping of traditional practices that help companies capitalize on opportunities that technological developments (such as secure online payment portals, real-time inventory management, and 3D printing) create. The extent to which such technologies and processes are adopted and implemented and the potential effects on goods movement demand and travel patterns within the NYMTC planning area are difficult to gauge. Additionally, disruptive events like the COVID-19 pandemic can accelerate—or stall—the adoption of new techniques and innovations, making it essential to understand trends in distribution innovation.

E-COMMERCE

E-commerce, the buying and selling of goods online, has experienced remarkable growth in the U.S. over the past few decades. Since the early 2000s, unadjusted e-commerce sales have surged from $27.6 billion in 2000 to $1.1 trillion in 2023, representing a 40-fold increase (Figure 3.29).[63] This expansion has far outpaced the growth of traditional brick-and-mortar sales, with quarterly e-commerce sales rising by an average of 18.3 percent year-over-year, compared to just 4 percent for total retail sales. Consequently, e-commerce's share of total U.S. retail sales has grown dramatically, from less than 1 percent in 2000 to

over 15 percent in 2023. The onset of the COVID-19 pandemic in 2020 further accelerated this trend, driving a 93 percent increase in total e-commerce sales between 2019 and 2023.

Figure 3.29 Growing E-Commerce Sector (2000–2023)



Source: U.S. Census Bureau, 2024.

E-commerce has significantly reshaped the way consumers order, purchase, and receive goods (Table 3.39) with far-reaching implications for transportation, especially in areas such as last-mile delivery, intermodal transportation, and consolidation in fulfillment centers. Now, there is high demand for faster and more flexible delivery options, which puts pressure on logistics networks and increases the volume of smaller direct-to-consumer (D2C) deliveries. The rise of D2C e-commerce, where products are sold directly to consumers without third-party retailers or wholesalers, has driven substantial growth, with D2C e-commerce sales more than doubling from $76.7 billion in 2019 to $175 billion in 2023.[64] The shift away from traditional brick-and-mortar retail has driven massive increases in shipping demands, especially in last-mile logistics. Many retailers, for instance, now rely on shippers like USPS, UPS, and FedEx, or, in some cases, build their own delivery networks, such as Amazon.

Table 3.39 Traditional Commerce versus E-Commerce

Potential Impacts	Traditional Commerce	E-Commerce
Delivery	Consumers typically drive to stores to purchase goods and take them home, reducing the need for direct delivery to individual residences.	Consumers order goods online. The goods are then delivered directly to their home. Consumers typically expect quick delivery, ranging from 15 minutes to two days.
Warehouse & Fulfillment Centers	Inventory is stored at retail locations, and goods are delivered to these stores in bulk via freight. Customers make the final transportation leg themselves.	Requires large-scale fulfillment centers located near urban areas or strategically along transportation corridors to fulfill orders quickly. These centers receive bulk shipments from manufacturers and distribute smaller packages to consumers.
Frequency and Volume of Shipments	Bulk deliveries are made less frequently to centralized retail locations. Individual customers handle the transportation of goods from the store, reducing the frequency of professional deliveries.	Requires smaller, more frequent shipments to individual customers. These smaller parcels demand a higher number of delivery vehicles, including trucks, vans, and even bikes in some urban areas.
Curbside and Parking Needs	Customers visiting physical stores require ample parking, particularly in suburban and mall environments. However, these trips are less likely to require curbside management outside of high-density urban areas.	With home delivery becoming the standard, there is a greater need for curbside management in cities to accommodate delivery vehicles. Cities may need to allocate space for quick pick-up and drop-off to reduce traffic disruption.
Supply Chain Complexity	Supply chains are more linear and stable, with goods moving from manufacturer to retail store with fewer intermediary steps.	Requires an intricate, technology-driven supply chain that focuses on speed, flexibility, and customization. Goods may pass through multiple warehouses, distribution centers, and delivery networks before reaching the customer.

Source: Cambridge Systematics.

The volume of e-commerce shipments and pressure to provide quick deliveries has increased the demand for last-mile delivery services, particularly in urban areas. And in the dense and congested NYMTC planning area, the surge of vehicles related to last-mile delivery has significantly increased congestion and gridlock.

> One attendee of the Curb and Parking Management Forum stated that the most important use case of curb management is "neighborhood loading zones in NYC—important post-COVID as 1 in 5 New Yorkers receive a package each week."

Personal vehicles, scooters, and ebikes used for deliveries contribute to rising traffic volumes and create traffic patterns that deviate from historical norms. This shift in traffic patterns, combined with the high volume of delivery vehicles can increase the likelihood of crashes and congestion, especially when delivery vehicles park in unauthorized locations such as bus lanes or bike lanes.[65] These conflicts may require municipalities to retrofit or re-engineer roadway design to accommodate competing curb and lane usages

for delivery, transit, active transportation users, trash pick-up, and pedestrians. Insufficient design for the sidewalk, curb, and roadway could lead to issues for persons with mobility impairments. Curb management practices can respond to this new reality with policies such as requiring dynamic curb use to reserve space for delivery vehicles during peak times. Greater collaboration between firms and NYMTC could enable more efficient planning for both. For instance, sharing data on shipping routes and delivery schedules may improve curb management practices like implementing dynamic parking pricing and establishing dedicated loading zones for deliveries.

An attendee at the Curb and Parking Management Public Forum noted that curb data specifications vary depending on land use and time of day, which makes it more difficult to work with curb data and potentially harder to do effective curb management.

E-commerce depends on two key factors: a global supply chain relying on high-volume, low-cost products and an intermodal logistics model that prizes efficient, cost-effective, and flexible transportation solutions with quick shipping times. Intermodal transportation refers to the movement of goods using multiple modes of transport, such as trucks, trains, ships, and planes, without handling the goods themselves when changing modes. The rise of intermodal logistics requires better coordination between air, rail, ports, and road infrastructure, adding pressure on the region's multimodal hubs such as the Port of New York and New Jersey.

An attendee at the Transportation and Technology Public Forum noted, "for us in NYC, we may need to pay more attention to technologies and information systems (and funding) to optimize the use of our 500+miles of shorelines and waterways."

New York City is already exploring opportunities to capitalize on waterways for goods movement through the "Blue Highways" project. This initiative focuses on the best practices to modernize marine infrastructure, expand access to the waterfront, and facilitate last-mile deliveries using marine vessels (see example in Figure 3.30).[66]

The NYMTC region may also explore the feasibility of freight villages that can help to alleviate pressure on existing infrastructure. Freight villages are designated logistics hubs that bring together multiple transportation modes (road, rail, and air) and integrate warehousing and distribution facilities in a single location. In the NYMTC region, expanding these hubs outside the most congested urban areas could allow for more efficient transfer of goods and alleviate inner-city congestion. By situating freight villages in strategic locations, such as at the intersections of major highways or near rail corridors, planners could reduce the number of trucks entering the city, consolidating shipments for more efficient last-mile delivery.

Figure 3.30 Example of Integrated Marine and Last-Mile Freight in London

Source: Streetsblog NYC, 2022.

E-commerce's global supply chain has added impacts on the region's ability to withstand disruptions in trade such as political disputes, natural disasters, or as seen most recently, pandemics. Many industries such as high-tech manufacturing and automotive goods were forced to a standstill when they were unable to import materials and products from overseas. The reliance on long-distance shipping for sourcing and delivering goods creates bottlenecks when any part of the supply chain is disrupted, leading to delays in delivery times and inventory shortages. This lack of resiliency exposes e-commerce businesses to risks like port congestion and transportation delays, which may highlight the need for more localized or diversified supply chains to improve reliability and efficiency in the long term.

Commerce has traditionally relied on consolidated fulfillment centers located on the outskirts of metropolitan areas or in industrial zones to organize and ship inventory. Nowadays, e-commerce's predominance and increasing customer expectations for delivery speed have made it necessary for firms to hold massive stocks of inventory closer to population centers. The growing encroachment of industrial fulfillment needs in residential and mixed-use areas has significant transportation, environmental, and public health impacts on these communities; these effects are further explored in the Distributed Manufacturing section below.

DISTRIBUTED MANUFACTURING

Distributed manufacturing is a production model where the manufacturing process is decentralized and carried out at multiple smaller-scale facilities, typically closer to the end consumer, rather than at a single, large, centralized facility as seen in e-commerce. Distributed manufacturing is often used by industries and businesses that rely on localized, flexible, and on-demand production—in contrast to the global e-commerce model. It often includes the creation of different components or entire products in various smaller facilities, leveraging advanced technologies like 3D printing to manufacture products locally and quickly, reducing the need for long-distance shipping. Distributed manufacturing is a key feature enabling just-in-time inventory management, a popular supply chain paradigm in which a producer receives materials for production exactly when production begins and keeps as little stock as possible.[67]

Distributed manufacturing often involves placing smaller, localized production and warehousing facilities closer to consumer markets, rather than in sparsely populated areas further from residential communities as often seen in consolidated fulfillment centers. Huge investments have been made to build and lease warehouses in the NYMTC planning area. The warehouse availability rate in New York City and New Jersey is under 2 percent, lower than every other municipal area besides Los Angeles, reflecting the demand for warehousing space in the region.[68]

Because of the heightened economic demand in the NYMTC planning region, many of the commodities shipped to customers in the region originate from manufacturing and distribution centers located outside of the region. Namely, these areas are New Jersey, the upper Hudson Valley in New York, western Connecticut, and eastern Pennsylvania, especially the Lehigh Valley. Known for its farmland, the Lehigh Valley's first distribution center was a 100,000 square foot Nestle facility, built in 1994.[69] Since the late 2000s housing crisis, development in the valley has accelerated, culminating in 44 million approved square feet of industrial and warehouse space since 2015 in Lehigh and Northampton counties. This square footage is equal to over 1000 acres.

Further, the PANYNJ lists 62 warehousing and distribution partners outside of the NYMTC planning region on its website ranging from Carlisle, Pennsylvania to Lodi, New Jersey.[70] This is a fraction of the true total as New Jersey has over 3,000 warehouses that are responsible for 380,000 daily truck trips. These warehouses comprise 527 million square feet, a figure that has grown by 35 percent during the last two decades.[71] Connecticut has 8 Amazon facilities located west of the Connecticut River, while New Jersey and Pennsylvania have more than 40 each.[72]

The presence of these warehouses is a strain on surrounding communities: heavy vehicle traffic, including trucks, truck parking needs, requirements for access to Interstate highways, and transportation needs for employees who staff the facilities. In New York City, the addition of several warehouses has produced multiple concerns from local residents regarding pollution, pedestrian safety, and other hazards.[73] Air pollution has worsened dramatically in the Lehigh Valley to the point that the Asthma and Allergy Foundation of America named Allentown, PA the most challenging city in the United States to live with asthma.[74] Local advocates point to pollution caused by diesel trucks as a key cause of this development[75,76] and multiple campaigns have emerged in the Lehigh Valley to lessen truck pollutants.[77,78]

Policy recommendations to address the twin issues of warehouse scarcity and their impact include repurposing parking garages for use as fulfillment centers or New York City's plan to shift truck freight onto barges with waterfront shipping hubs.[79] NYMTC member agencies may experience localized traffic impacts in their communities and can explore improved access to these centers by optimizing roadways, such as dedicated truck lanes, or intersection improvements, as well as leveraging intermodal options.[80] Additionally, the clustering of fulfillment centers may require zoning adjustments and collaboration with freight and logistics operators to mitigate environmental and noise impacts in surrounding communities, especially in underserved areas that disproportionately house these types of land uses.

Distributed manufacturing also increases the demand for truck parking in residential and mixed-use areas. Due to a lack of authorized truck parking—particularly in urban areas—trucks often resort to parking on streets designed for local traffic rather than designated loading zones, leading to congestion, noise, and safety hazards. Residents may find it challenging to access their homes, and there can be increased wear and tear on local infrastructure. In 2023, due to resident concerns, New York City launched a citywide crackdown on illegally parked trucks, especially in Queens and Staten Island.[81,82] As a result, the New York City Council passed a bill to develop three or more locations for off-street commercial parking by 2025.[83] As goods movement increases, NYMTC member agencies may need to explore the creation of truck parking lots as well as other solutions such as street parking near fulfillment centers.

Figure 3.31 Residents Living Within a Half Mile of Warehouse in the Region

Five Boroughs
- 3 million residents total
- Black residents are 17% more likely; Hispanic/Latino residents are 13% more likely
- Low-income residents are 19% more likely

South Bronx
- 233,000 residents total
- Asthma-related emergency room visits among children ages five-17 years old are three times higher than across the five boroughs

Long Island
- 2.5 million residents total
- Black residents are 30% more likely; Hispanic/Latino residents are 26% more likely
- Low-income residents are 29% more likely

Hudson Valley
- 457,000 residents total
- Black residents are 101% more likely; Hispanic/Latino residents are 66% more likely

Source: Environmental Defense Fund.

There are also known health consequences of warehouses in densely populated areas and vulnerable groups, including people of color and low-income residents are disproportionately affected by the health consequences, including asthma.[84] Nearly three million people (see Figure 3.31) live within half a mile of a warehouse within the five boroughs of New York City, and low-income residents are 19 percent more likely to live in a warehouse district than higher-income peers. With the e-commerce boom unlikely to subside, member agencies may explore opportunities for delivery fleets to transition to cleaner fuels..

In contrast to e-commerce's global supply network, distributed manufacturing fosters shorter, more localized supply chains, increasing resilience to global disruptions such as those caused by pandemics or natural disasters. Transportation infrastructure may need to support a higher number of regional routes,

shifting focus from long-haul freight to more localized delivery systems. This change would likely demand investments in regional transportation networks, such as rail freight terminals, intermodal hubs, and improved highways connecting urban centers.

Finally, as manufacturing is spread across more locations, workers may no longer commute to large central factories but instead to smaller, more distributed facilities. This shift would require transportation planning to accommodate a more dispersed commuter network. Public transit options may need to be expanded into suburban or previously underserved areas, or incentivize alternatives like ridesharing, biking, or microtransit solutions that connect to employment hubs. Planners may also need to rethink how to manage peak commuting periods, which could become more diffused across regions and times of day.

3.7 DISRUPTORS CHANGING TRANSPORTATION

Disruptors, unlike trends, are less predictable forces that can drive transformative change. While trends tend to follow more gradual patterns, disruptors can cause sudden shifts in economies and mobility. For instance, unexpected population losses could drastically alter who is traveling, how they travel, and when. This inherent uncertainty complicates long-term planning. By recognizing the potential impacts of these disruptive changes, NYMTC's planning area and the wider multistate metropolitan region can better assess future challenges and understand how uncertainty may shape their transportation goals.

3.7.1 SEA LEVEL RISE AND EXTREME WEATHER

Since 1980, the U.S. has sustained at least 323 disasters where overall damages/costs reached or exceeded $1 billion (including Consumer Price Index adjustment to 2021). The total cost of these 323 events exceeds $2.195 trillion.[85] In the NYMTC region, Hurricane Sandy is estimated to have caused $65 billion in damages and economic loss, with the Department of Transportation receiving $12.4 billion, the second largest portion of recovery funds (behind Department of Housing and Urban Development in 2013 to rebuild.[86,87]

As the fifth U.S. National Climate Assessment underscores, it is assumed that there will continue to be an increase in extreme weather events over the course of the planning period. This assumption is especially significant to the NYMTC planning area, given (1) its location along several coastlines; (2) the configuration and topography of the New York coastline; and (3) the topography of islands and river valleys throughout the planning area. The New York City Mayor's Office identified four extreme weather hazards impacting the region, including coastal surge flooding, chronic tidal flooding, extreme rainfall, and extreme heat.[88]

The impacts of these hazards on the transportation system and everyday life include inaccessible roadways and transit systems due to flooding and storm surges, damage to infrastructure from flooding and extreme heat, and increased maintenance frequency/reduced lifecycles due to flooding and extreme heat.[89] Bridges are one such transportation infrastructure that are particularly vulnerable to damage and erosion from these hazards, according to a 2019 study. The expedited damage to asphalt, steel, bridge joints, and pavement also exhausts agency funding and resources.

Federal funding programs such as the Bridge Improvement Program through IIJA provide $10 billion of competitive grant funding annually for bridge replacement, rehabilitation, preservation, and protection projects and can help relieve some of the cost to create more resilient transportation infrastructure, but these funds are available in the short-term. Long term impacts for bridge and pavement management costs are still uncertain.[90] Other resilience funding through the IIJA includes the Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT) Grant program which programs $848 million annually towards supporting planning activities, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure.

Extreme weather can also impede the movement of people and goods, limiting access to certain roadways, ports, and railways, as well as making traveling alternative transportation modes (walking/biking/transit) more hazardous for individual health. The New York Climate Impacts Assessment identifies three main ways extreme weather events impact the movement of people, including:

- Impeding safe vehicle operation (through poor visibility and reduced traction);
- Creating delays by cutting off travel routes and increasing congestion; and
- Slowing emergency response and repair efforts.[91]

According to data from TRANSCOM, between 2022 and 2024, weather-related incidents caused 2,122 roadway delays or closures and 520 transit service disruptions.[3] On roadways, the most frequent issues were downed trees (49 percent) and flooding (33 percent). Similarly, on transit lines, half of all disruptions were weather-related, including track, equipment, signal, and switch problems. Prolonged incidents were more common for transit, with nearly 8 percent of disruptions lasting over a day, compared to 3.5 percent for roadways. Geographically, 37 percent of the weather-related roadway delays or closures occurred in Westchester County, while 39 percent of transit disruptions were concentrated in New York County, reflecting the density of transit lines there. Such closures can cause congestion due to bottlenecks and rerouting, leading to longer travel times and travel delays. This has a costly impact especially on goods movement and the supply chain, where traffic congestion in New York cost the trucking industry $4.9 billion in 2021, and 89 percent of New Yorkers depend exclusively on trucks to transport their goods.[92,93]

Extreme weather events have a more significant and prolonged impact on both roadway safety and efficiency, as well as transit service. According to the Hurricane Sandy Rebuild Strategy Report, "Hurricane Sandy was the worst disaster for public transit systems (e.g., bus, subway, commuter rail) in the nation's history." Commute times to New York City pre- and post-Sandy almost tripled for Transit (Subway and Bus) and Drive Only modes from around 40 minutes to over 120 minutes. Before Sandy, 46 percent of workers used the Subway to commute, where only 11 percent did in the days following the storm.[94] This was attributed in part to a number of subway stations being flooded in Lower Manhattan immediately following the storm. While storms are a major concern to the region's mobility, extreme heat also poses a concern. In July 2024, the Third Avenue Bridge connecting the Bronx and Manhattan was stuck halfway open for almost

[3] TRANSCOM roadways include major highways, local streets, bridges, and tunnels. Transit encompasses buses, subways, and commuter trains. Ferries did not have any reported weather-related disruptions during this time period.

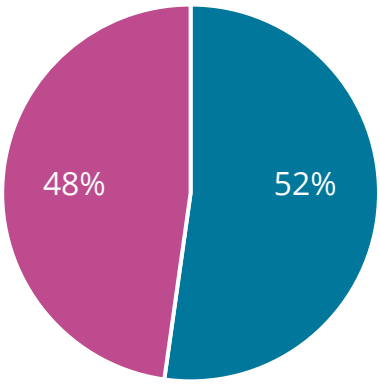
four hours due to overheating machinery and the heat expansion of its steel.[95,96] Heatwaves have also been an issue for the NYMTC planning area's transit infrastructure, with the MTA's railroad tracks experiencing buckling and overhead wire issues.[97]

Would you be able to complete your typical daily tasks if your preferred mode (car, bus, bike, etc.) was not available?

Figure 3.32 *Moving Forward 2055* Responses

No

- I typically need public transit to get to places outside of walking.
- I rely upon the train. If the train isn't working, I'm stuck.
- The only way I can get to work in New Jersey from my home in New York is to drive my car. If I did not have access to my car I could not get to my job.



Yes

- The overground only subway service does not always work during snow and there aren't enough alternatives that run long enough like buses. I am lucky that I am able to bicycle in these situations, but not everyone can—especially without safe, protected bike lanes.
- Improving education about how to use the transportation network during a major emergency event.

Source: NYMTC.

Overall, extreme weather events, increased temperature, and sea level rise will continue to present threats despite ongoing policy efforts.. It is assumed that the cost and damage caused by these threats will continue to increase the costs of maintaining the transportation system in NYMTC's region. Agencies can plan for more resilient communities and use technologies to forecast impacts, but there is still a high level of uncertainty impacting transportation programming and planning over the next 30 years. This includes an increase in capital costs to maintain the system, cost to repair damage from extreme events, and a potential shift in mode share for people and goods movement as communities adapt.

POLICIES

During the decade of the 2010s, extreme weather events increased consideration of resiliency and adaptation at all levels of planning, changing the way system-wide transportation planning is being conducted as transportation agencies look for ways to better prepare for extreme events. Both Federal, state, and local governments are enacting policies to build more resilient transportation and land use. The fifth U.S. National Climate Assessment notes the raising national actions being taken to adapt to employ mitigation strategies, such as land management strategies and expanding renewable energy options.[98] The NYMTC Region has taken on many efforts to adapt and mitigate the impacts of extreme weather events. The impacts of these policies may change the way people live and move throughout the region:

- New York City identified strategies in the report: The New Normal: Combating Storm-Related Extreme Weather in New York City (2021). This includes creating better partnerships and communication

channels between departments, emergency response agencies, and the traveling public. The City has also incorporated new technologies such as the Flood Sensor Network that would provide early warning detection and feed into the ITS system sharing variable signage to notify drivers of roadway hazards and reduce risk of congestion and safety risks caused by extreme weather.

- The NYC Stormwater Resiliency Plan (2021) is a 10-year plan aimed at short-term initiatives and investments to accelerate preparation for possible near-term emergencies. This includes $2B of investment in southeast Queens in comprehensive drainage system improvements and $200M in the roadway network, as well as over 10,000 green infrastructure assets in construction or constructed.
- In January 2022, Mayor Adams established the MOCEJ to prepare for the impacts of extreme weather disruptors and address remediation efforts from a fairness perspective.[99] Their work includes focusing on transforming the electrical grid to 100 percent clean energy by 2040, improve energy efficiency in buildings and remediate flooding and heat risks, increasing access to carbon-neutral and sustainable transportation modes (80 percent by 2050), and investing in social justice.
- The Long Island Sound Comprehensive Conservation and Management Plan (2015) aims to improve water quality and restore and protect the Sound's ecological balance, as well as build sustainable and resilient communities. Progress has been made in improving the health of the Sound but new threats like sea level rise are affecting it. Advancing regional partnerships, implementing more complete knowledge/testing of contaminants, and developing watershed-based planning are all strategies proposed to help meet these regional goals.

Additional key policies include the use of technology and the fair implementation of adaptation and mitigation strategies. Land use and transportation decisions have a long history of disproportionately impacting certain communities and demographics. Despite recent efforts to mitigate these negative impacts, sea level rise, increased heat, and extreme weather events can exacerbate this disparity. According to the New York Climate Assessment:

> "Climate-related disruptions to roadways also disproportionately impact economic sectors and industries that rely on an on-site workforce to provide services or perform physical labor. Sectors and industries in New York that rely on an on-site workforce include health care, childcare, agriculture, construction, utilities, transportation, manufacturing, and hospitality."

Each year there are an estimated approximately 350 heat-related deaths on average in New York City.[100] The lack of green space, limited access to air conditioning, poor housing related to health effects from heat are all issues disproportionately impacting underserved communities.

Online tools, such as those created by New York City MOCEJ provide environmental data such as flood inundation risk, hazardous materials, etc. at the census block level to help visualize risk to disproportionately burdened communities and provide the opportunity to make fair and informed decisions.[101]

Attendees at the Transportation and Technology Public Forum noted that extreme weather trends should be a consideration when planning for smart systems for transportation, including consideration of how increased storms, lack of water, etc. impact technology.

Like MOCEJ's Mapping tool, technological development can help enhance the resiliency of the transportation system in the NYMTC planning area to extreme weather events and improve emergency response, infrastructure robustness, and redundancy in extreme weather situations. Techniques to harden or equip transportation infrastructure against weather effects such as inundation, flooding, and extreme heat are becoming available or are being developed to protect the region's transportation assets. Additionally, simulation modeling technology will continue to enable planners to identify vulnerabilities in the transportation system, target infrastructure and equipment for hardening, and develop emergency plans in response to extreme events.

3.7.2 ENERGY TRANSFORMATION

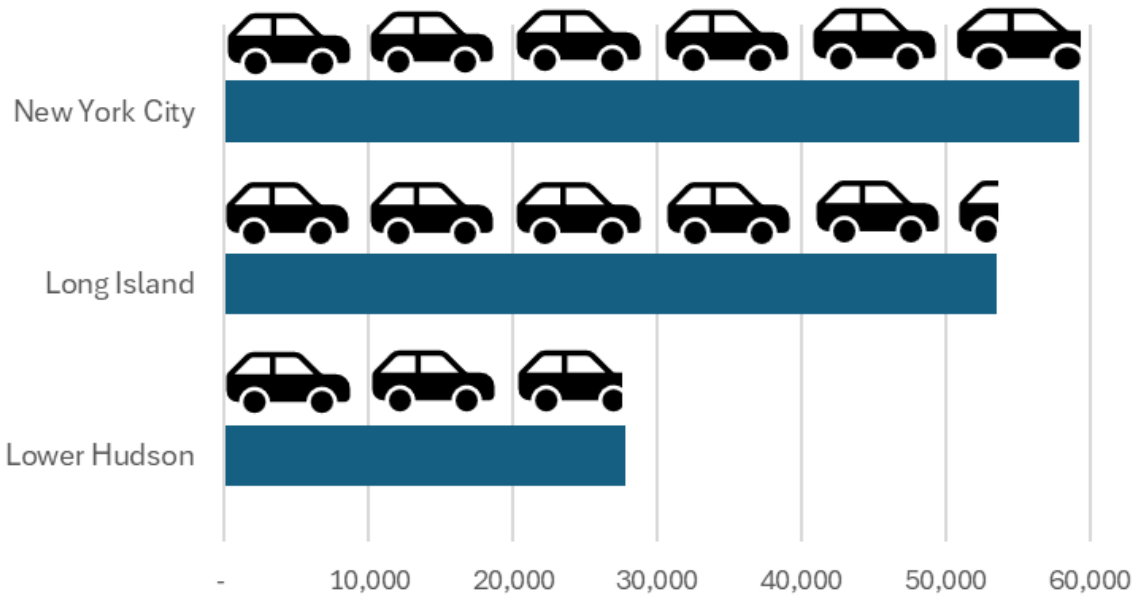
Energy transformation is a key strategy to reduce the multitude of harmful impacts of air pollution.For transportation, this energy transformation is seen in the systematic shift from the reliance on fossil fuels (such as gasoline and diesel) to alternative and renewable energy sources (such as electricity, hydrogen, biofuels, natural gas, propane, and renewable biodiesel) in powering various modes of transport. Energy prices, often impacted by geopolitical conflict, have also varied over the last decade, with periods of consistently high prices placing more onus on fuel-efficiency. According to USEPA, average real-world fuel economy for all vehicle types reached a record high 26.0 miles per gallon (mpg) for the 2022 model year, up from 25.4 mpg for the 2018 model year.[102]

Participants in the Lower Hudson Valley Environmental Justice Focus group, Lower Hudson Valley Coordinated Human Services Focus Group, and New York City Coordinated Human Services Focus Group noted the need to move the transportation system away from dependency on oil, expressed interest in seeing more electric buses and other less energy-intensive transportation options in their communities, and called for cleaner and more environmentally friendly transportation options.

Due to the increased emphasis on supporting cleaner energy opportunities, alternative fuel and energy sources have begun to increase. These include Electric (EV), Compressed Natural Gas (CNG), Liquid Natural Gas (LNG), Liquified Propane (LPG), Hydrogen (HYD), and BioDiesel (BIO). Electric micro-mobility options are another opportunity to replace shorter SOV trips, though there are some barriers to education and safety that limit overall adoption and use.

Electric vehicles (EV) and hybrid electric vehicles (HEV) have emerged as a desired alternative to gas and diesel engine vehicles. In 2023, New York State had approximately 131,250 registered light-duty EVs, making it one of the leading states for EV adoption.[103] EVs can be charged from standard electricity sources, while HEVs combine an internal combustion engine with an electric motor. EVs and HEVS have gained presence in the NYMTC planning area: the first hybrid electric buses and taxis entered service in New York City in 2004 and 2005, respectively. Both EVs and HEVs also convert energy from coasting and braking into electricity, which is stored in the batteries. Compared to regular vehicles, EVs have greater energy efficiency, produce less pollutants, and cost less to operate.

Figure 3.33 Electric Vehicle Registrations in 2023

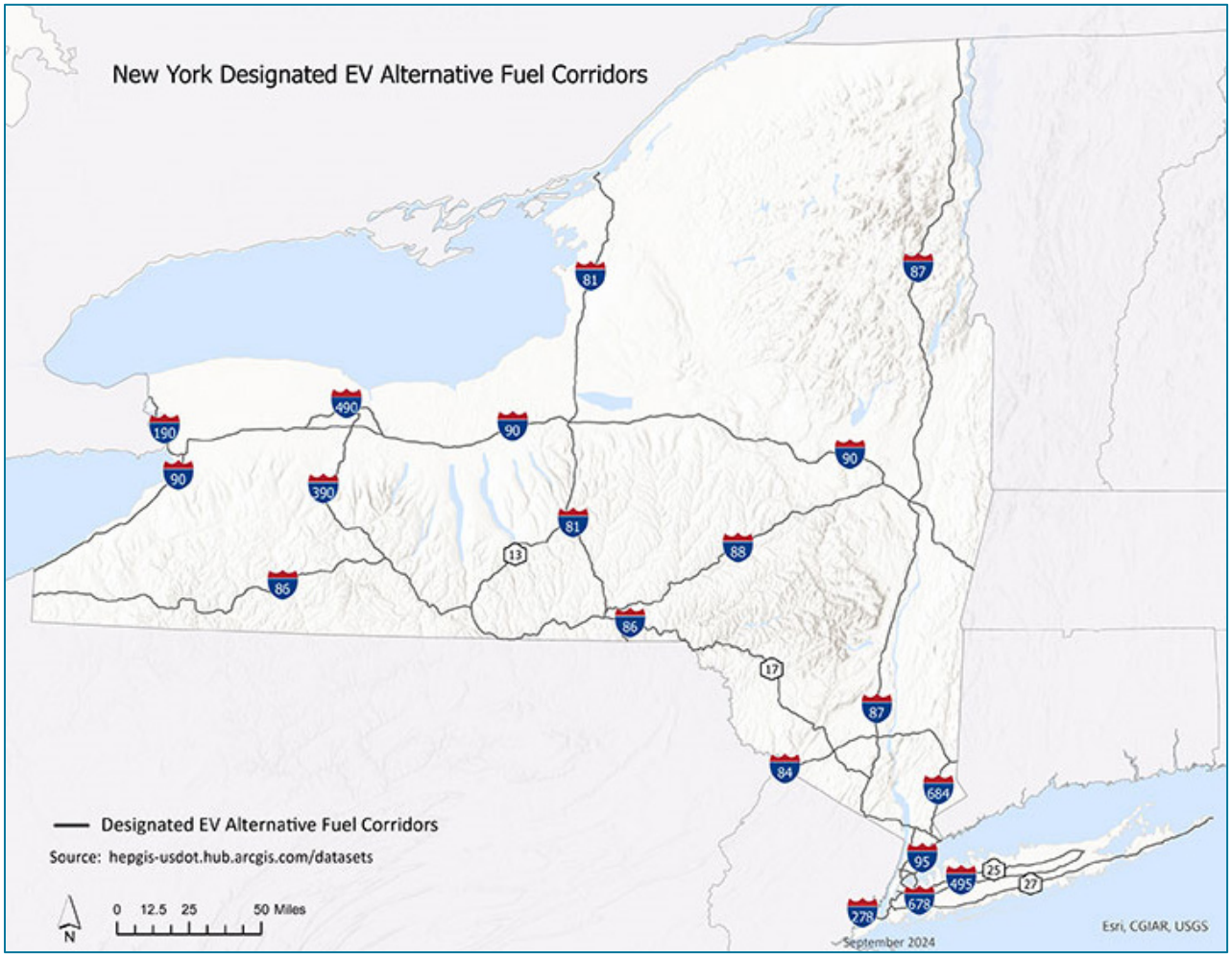


Source: NYSERDA, 2023.

There are still issues with the range, commonly referred to as "range anxiety," that many consumers feel limits an EV's practicality. Constrained infrastructure development for charging has been a barrier to the emerging EV market, though there are national efforts to improve EV charging infrastructure through planning and funding implementation. In September 2022, NYSDOT submitted the state's National Electric Vehicle Infrastructure (NEVI) Plan, a requirement for receiving Federal funding for EV charging infrastructure. The state received approximately $175 million over five years to fund and construct EV charging stations along the state's most-traveled Interstate and state highways that make up the Alternative Fuel Corridors (AFCs) (see Figure 3.34). In the New York City Metro Area, AFCs include Interstates 84, 684, 95, 495, 278, 678, 287, and NY routes 25 and 27.[104] In December 2023, the state opened New York's first NEVI-funded EV fast charger in the Hudson Valley. The NEVI Plan is part of the state's larger Clean Transportation Roadmap, overseen by the New York State Energy Research and Development Authority (NYSERDA), which explores options for reducing pollution and highlights barriers, rates of technology adoption, and policy impacts.[105]

The National Renewable Energy Laboratory, part of the U.S. Department of Energy, estimates that the U.S. will need 182,000 fast chargers for EVs by 2030. There are currently fewer than 40,000, according to the DOE, with about a quarter of those in California.[106]

Figure 3.34 New York Designated EV Alternative Fuel Corridors



Source: NYSERDA, 2023.

With the rise of EV and HEV popularity, as well as increasing fuel efficiency, revenue from Federal and state gas taxes are decreasing, impacting capital planning budgets. One study in California estimated a $4.4 billion or a 31 percent decrease in revenues over the next decade.[107] Many states are looking into alternative revenue streams such as road or cordon pricing, battery taxes on EV registration, VMT fees (also known as road user charges), and dedicating a portion of sales taxes for transportation funds to fill the gap.

An attendee at the afternoon Alternative Energy Public Forum noted that the most important projects/initiatives to them included converting public transit vehicles to cleaner fuels or electricity, converting school buses and vans to cleaner fuels or electricity, and converting public (i.e., agency/municipal) vehicle fleets to cleaner fuels or electricity.

In addition to AFVs for consumers, there are also opportunities to integrate alternative fuels into freight applications for light, medium, and heavy-duty vehicles. Companies like Amazon and FedEx are investing in electric delivery vans, a trend particularly visible in urban centers like New York City. EVs offer the dual benefits of zero tailpipe pollutants and quieter operation, making them ideal for densely populated areas where air quality and noise pollution are critical concerns. However, for larger freight vehicles, battery weight and range limitations remain significant barriers, especially for long-haul operations. Other potential fuel types such as natural gas, propane, hydrogen, and biodiesel are also relevant and have great potential for reducing freight-related pollution but are limited by a lack of refueling infrastructure. As the latter expands, however, the rise in alternative fuel freight vehicles has significant capacity to advance the region's vision for a more sustainable transportation system, including goods movement.

POLICIES

Alternative energy fuels are seen as a strategy to reduce transportation pollution, improving air quality and public health, along with additional environmental benefits. In 2019 New York State signed the Climate Leadership and Community Protection Act (Climate Act) into law. The Climate Act requires New York to "reduce economy-wide GHG emissions 40 percent by 2030 and 85 percent by 2050 from 1990 levels."[108] This policy has set a direction for New York's future invest priorities within the green economy. Other related policies and key targets are presented in Table 3.40.

Communities across New York State are implementing new policies, largely focused on vehicle procurement and infrastructure programs for charging and fueling, to help meet these targets in the transportation sector. Within the NYMTC area, these efforts include:

- Promoting alternative modes of transportation to help diversify the network to move goods and people.
- Advancing high-efficiency, low-emission alternative transportation technologies in the region's freight fleet as outlined in NYMTC's Clean Freight Corridors Planning Study.
- Installing charging infrastructure along major corridors and promoting installation at multifamily homes and businesses.
- Helping accelerate electric car sales to over 30,000 since 2011 through the ChargeNY program.
- The Town of Hempstead installed the first hydrogen fueling station on Long Island.

Table 3.40 Energy Policies and Goals

Policy	Goal
New York State Transportation Energy Policy	» 100% of all car, truck, and bus sales are zero-emission vehicles by 2045.
NYC Clean Fleet Plan	» Goal: all on-road vehicles in the fleet will be all-electric or plug-in electric models by 2040.
Westchester County Bee-Line hybrid and electric bus fleet	» As of 2024, the County aims to replace its remaining 21 diesel buses with hybrid or EVs within the next two years.
Department of Energy, Alternative Fuels Data Center	» For state agencies, fleet decarbonization plans must meet the following schedule: » All state light-duty vehicles must be zero emission vehicles (ZEV)s by December 31, 2035. » All state medium/heavy duty vehicles must be ZEVs by December 31, 2040. » 100% of new passenger vehicles sold in New York must be ZEVs by 2035. » All sales or leases of new light-duty passenger vehicles in New York must be ZEVs by 2035, and all sales or leases of new medium- and heavy-duty vehicles must be ZEVs by 2045. All new off-road vehicle and equipment purchases must be zero emission by 2035. » Beginning July 1, 2027, school districts may only purchase or lease zero emission school buses when entering new purchase or lease contracts.
New York MTA Climate Policy	» Reduce operational pollution in alignment with aggressive 2040 targets(from a 2015 operational baseline) by converting nearly 5,800 buses to zero-emissions, retrofitting existing facilities, investing in energy-saving technologies, and more. » The MTA has committed to transition 100% of its bus fleet to zero-emission models by 2040; light-duty non-revenue fleets to 100% zero-emissions by 2035, and medium- and heavy-duty non-revenue fleets by 2040. » Reducing pollution from locomotives on Metro-North and Long Island Rail Road, and replacing diesel non-revenue locomotives in the subway with hybrids.

New alternative energy solutions also bring new challenges. One emerging barrier that impacts the implementation of these policies, especially the increased shift in EVs, includes concerns surrounding the sustainability and risk of reliance on the antiquated electric grid. EV's growing impact is estimated to require $2 trillion of investments to the nation's electric infrastructure in order to support the transition to EV and clean energy.[109] The risk to the grid is largely caused by widespread EV adoption creating a huge surge in power demand, the reliability of which is already at risk from extreme weather. Additionally, the extraction of lithium, and the manufacturing and recycling of EV batteries is extremely toxic and water intensive. As resource extraction, EV production and operation, and battery development and disposal methods continue to evolve, so does the total sustainability impact of EVs. A 2022 study by the Department of Energy analyzed the lifecycle pollution of EVs (also known as "well to wheel") and affirmed that battery EVs, with both current and future tech, as well as an assessment of electric grid mixes, are still among the most sustainable option for light-duty motor vehicles.[110] There are also additional costs to investing in re-training to ensure an adequate workforce for maintenance of both EVs and the charging infrastructure.

Another potential risk to the shift to clean and alternative energies includes political support on the national and local scale. This is also impacted by overall public opinion on the safety and efficacy of emerging energy

alternatives. With so many policies offering financial support and incentives to build out necessary infrastructure improvements, a lack of investments and support could greatly impact the private market's role of innovation and the development of alternatives. These risks increase the uncertainty in long-term planning, especially as it relates to project selection and future investments in the transportation system.

3.7.3 CHANGING DEMOGRAPHICS AND LIFESTYLE/WORKSTYLE EXPECTATIONS

Demographic changes over the past decade have altered the way people travel, resulting in the emergence of new patterns and demands. These patterns can significantly alter transportation and the way people and goods move in the region. While *Moving Forward 2055* addresses population trends through forecasts and assumptions, there are levels of uncertainty in the impacts of these shifts that can greatly impact transportation planning for the future.

Aging populations create generational differences in transportation needs and preferences. The emergence of new generations in the workforce introduces new technologies and preferences, as seen through the rise of the gig-economy, or economic activity of typical service sector jobs performed by temporary or freelance workers (ex: Uber, Lyft, Doordash, Instacart, etc.). It can also generate new concerns, such as the upscaling of job requirements and resources, leaving knowledge and skill gaps in the workforce. The geographic population shifts of in-and-out migration also creates new nodes for network connectivity, putting pressure on transit and transportation agencies to shift and expand service areas. These unforeseen challenges are hard to predict when conducting long-range planning, but transit and transportation agencies still must adapt to these shifts as they arise.

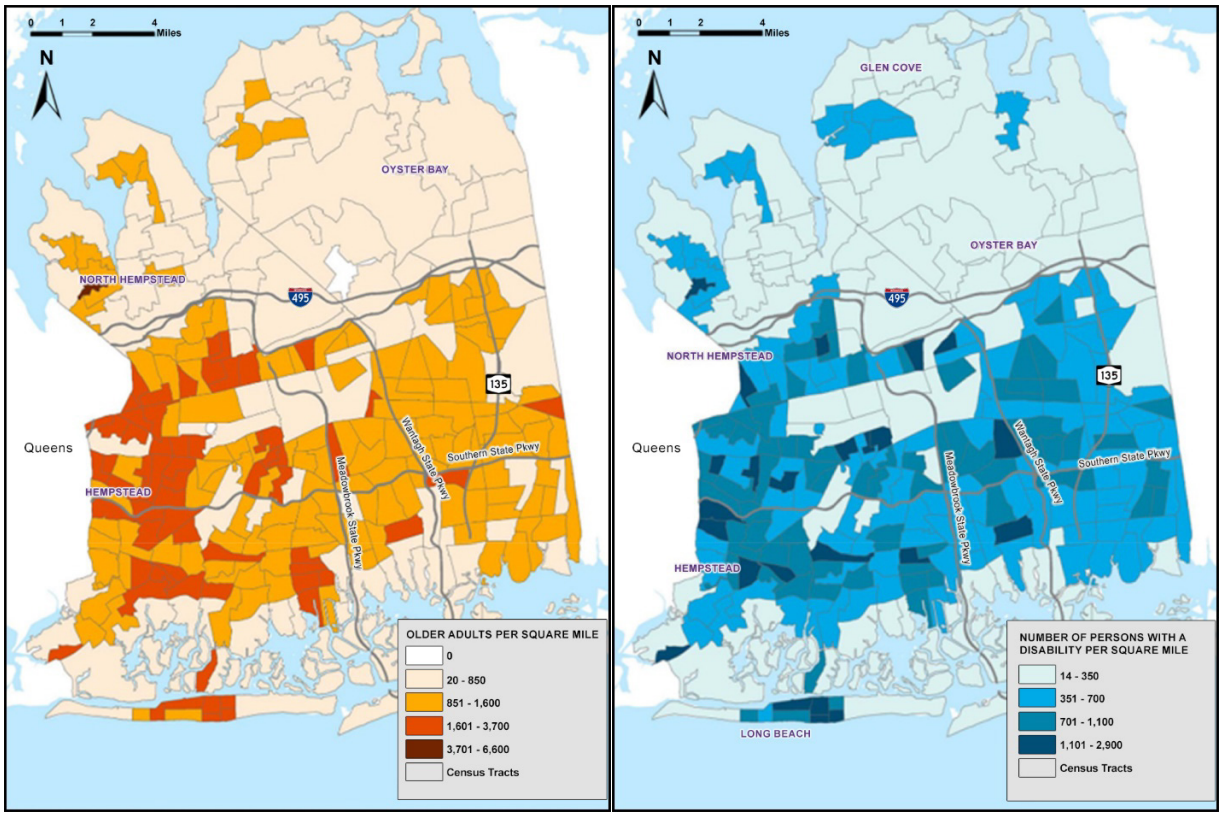
AGING POPULATION

One of the most prominent demographic trends during the period of *Moving Forward 2055* will be the aging of the population in NYMTC's planning area. This trend is colloquially known as the "Silver Tsunami" and has been more significant in recent generations with the growing success of healthcare and medicine that extend human lifespans. Aging populations are found in both high- and low-density areas within the state. In the NYMTC region, Manhattan, Nassau, and Putnam counties have the highest proportion of seniors; Putnam County had the greatest increase in elderly adults from 2000 to 2022. According to Hudson Valley Pattern for Progress' report, the median age in the United States has been steadily trending upwards since the 1970s and has increased every year for the last 10 years. New York State and the NYMTC planning area have an average median age around 40 years old, while more suburban counties are trending well above the regional average (Nassau, Suffolk and Westchester Counties are around 42 years old, while Putnam is 44.3 years old).[111] In 2023, the population 65 years and older living in the NYMTC planning area was 2.2 million or 18 percent of the population, up from 1.9 million or 15 percent of the total residential population.[112] This figure is expected to continue to increase with the continued aging of the Baby Boom generation and advancements in medicine and healthcare.

Long Island Coordinated Human Services Focus Group participants raised concerns about the accessibility of transportation services for older individuals and individuals with disabilities, particularly the distance between subway stations and the need for more escalators and elevators at busy stations.

Changes to the age structure of the population influence travel patterns in the region. One report estimated the demand for medical services and shifting housing needs as two potential impacts affecting the population and employment sectors.[113] In general, older adults have a higher incidence of disabilities and a lower rate of workforce participation, which results in an overall reduction in travel and a higher demand for assisted and accessible transportation. In the NYMTC region, many of the counties that have high proportions of elderly adults overlap with higher rates of persons with disabilities. Figure 3.35 illustrates the overlap in older adults and persons with disabilities, as well as the breadth across the county. In 2013, AARP reported that more than 20 percent of adults over the age of 65 do not drive and do not have good access to public transit facilities, although earlier reports found that they are using public transit more and more.[114] According to FHWA, the percentage of licensed drivers who were 65 and older in 2022 in New York was just over 23 percent, up from 21 percent in 2018.[115] In the United States, 51.5 million licensed drivers were 65 and older in 2022, up from 45 million in 2018. The proportion of licensed drivers 65+ has risen from 14 percent in 2001 to 21 percent in 2021.[116]

Figure 3.35 Older Adults and Persons with a Disability in Nassau County



Source: U.S. Census Bureau, 2014–2018 ACS 5-Year Estimates.

Measures that can accommodate an aging population's mobility needs include more specialized transportation designs, such as "Complete Streets," that are designed and operated to enable safe use and support mobility for all users. These include people of all ages and abilities, older driver safety measures, and accessible design at public transportation stations.

Generational changes will also likely affect the acceptance and use of new technologies, which in turn can affect travel patterns. Two emerging trends that may impact older drivers include the rise of AVs and the integration of technology in scheduling transportation services. The National Highway Traffic Safety Administration (NHTSA) explored the impact of older drivers and self-driving technology, specifically as it relates to the potential safety benefits. Currently, the impact is not fully known given the lack of access to AVs to the general public, though reports suggest the potential additional cost of purchasing self-driving vehicles will make them unaffordable for aging populations. Another hurdle to general adoption of driverless technologies for older drivers is trust in these new systems. Research did find safety benefits of intuitive in-vehicle information systems, though there is a negative impact to driver safety as the number of systems increases.[117]

The continued development of application-based, demand-responsive transportation services will continue to be influenced by their acceptance by younger generational cohorts. Taken as a whole, these technologies have and will continue to change Americans' travel behavior. It also creates concerns as technologies are embedded into transportation demand through trip scheduling software and the rising popularity of mobile ticketing and payments. The use of these technologies creates accessibility issues due to knowledge gaps for aging populations that rely on these services. The NYS Office of Aging identified "Technology Access and Development" as an organizing pillar to their Master Plan for Aging (2023), specifically calling out the need to "enhance meaningful access to technology through training and technical assistance for older adults on how to use common devices such as tablets and smart phones.[118] An emphasis on education with new technologies will be a key determinant for adaptability for older generations.

SHIFTING MODE CHOICE

Another trend distinguishing younger Americans is their preference for transit and active transportation, such as walking and biking. Research shows that Millennials (those born between 1980 and 1996 tend to drive less, take transit more, bike and walk more, and seek out places to live in cities and walkable communities that encourage walking and biking. Generation Z, those born between 1997 and 2012, are getting their driver's licenses at lower rates than their predecessors—25 percent and 45 percent for 16- and 17-year-olds, respectively, compared to 43 and 62 percent for teens in 1997.[119]

Other research has found that Millennials, although they rode fewer vehicles than Baby Boomers (those born between 1946 and 1964), had greater vehicle miles traveled. The results suggest that while Millennial vehicle ownership and use may be lower early on in life, these differences are only temporary and, in fact, lifetime vehicle use is likely to be greater.[120]

Multiple survey respondents emphasized the need to plan for and invest in alternative modes of public transportation and move away from prioritizing cars.

Generation Z, also known as Zoomers and iGen, (born between 1997 and 2012) tend not to have the same connection as older generations to vehicles. They are starting to try different modes of transportation, including shared mobility like Millennials. A working paper published by Econstor showed that:[121]

Millennials and those in the younger cohort of Gen Z are more than twice as likely than Gen X (1964-80) and Boomers to question whether they need to own a vehicle going forward and are less willing to buy a car than other generations (Vitale et al., 2019). Only 64 percent of Millennials said that their preferred mode of transport was the car they own, in comparison to 81 percent of consumers from other generations.

A report by Allison & Partners based on a 2019 online survey of 1,035 people in the United States over the age of 16 also showed that:

70 percent of Gen Z respondents do not have their driver's licenses and 30 percent of those who do not currently possess their driver's license have no intention or desire to get one. This decline in driving sentiment points to evidence that alternatives to personal transportation have gained momentum. In fact, nearly one-third of those surveyed (31 percent) reported regular use of rideshare services as an alternative method of transportation, and more than half (56 percent) used public transit.

In terms of work styles, the 2018 Future of Jobs Report of the World Economic Forum included the following relevant findings for employers: technological change drivers and accelerated technology adoption; a changing geography of production, distribution, and value chains; changing employment types due to automation; and a reskilling imperative.[122]

One impact of new technologies includes the rise of the gig-economy.[123] Internal Revenue Service 1099 tax forms show a 250 percent growth in the total number of people collecting money from platform gig work between 2017 and 2021.[124] Pew Research Center surveyed U.S. adults in August 2021 and found that 16 percent of Americans have ever earned money through an online gig platform, 30 percent of which were ages 18 to 29.[125] One appeal of the gig-economy is setting your own schedule and working more flexible hours outside the traditional "work hours". For ride-hailing platforms, the largest volume of activities happens during evening off-peak hours (8:00 p.m. to 9:00 p.m.), a shift from the traditional morning and evening peaks, while almost 50 percent of all completed trips occur between Tuesday and Thursday.[126]

Employment and productivity have a significant impact on the transportation network because demand is determined in large part by the number of people who need to travel for work, the volume of goods that need to be transported, and where those goods originate and are destined.

Changes in methods and locations of production will affect travel demand. Similarly, changes in the form of employment that may be brought about by evolving technologies will affect where, when, and how people are employed and perform their work, thus affecting their mobility needs and when mobility demand occurs. Related economic factors that would be affected include tax rates and bank regulations, which influence business location decisions and thus where general economic activity and population growth occur.

MIGRATION PATTERNS

With natural birth rates declining across the NYMTC planning area, the increasing cost of living, and older generations leaving the area for warmer climates, migration patterns have a significant impact on the overall growth of populations and the economy in the region. During the pandemic, suburban and rural areas within the greater New York City metro region saw a significant increase in inflow migration from New York City residents. According to NYMTC's 2055 adjusted forecasts, the Mid-Hudson subregion is assumed to have a greater growth than anticipated through 2055, partially due to Pandemic relocations. The Hudson Valley gained a majority (82 percent) of its inflow between 2019 and 2021 from New York City counties (approximately 94,500 residents).[127] This trend is also supported by the uptick in remote/hybrid work models that allow for longer, less frequent commutes. The inflow migration out of New York City into the surrounding suburban counties also increased the demand, and cost, for housing in those areas.

Extreme weather and geopolitical conflict in other parts of the world have caused large displacements of populations seeking refugee status. According to a recent story in the New York Times, 210,000 migrants have arrived in New York City since 2022, with a majority arriving from the U.S.-Mexico border.[128] The increase in asylum seekers has increased the need for housing and transportation, particularly public transit and its role to facilitate immigrants' access to employment and critical social services. impact to new housing means higher demand for connections to these temporary housing facilities to immigration services. Due to policies and language barriers, many migrants must rely on transit to access these services and often settle in cities that have robust transit networks. In 2019, immigrants comprised 14 percent of the US population and 32 percent of its transit commuters.[129] The article describes the role of transit as a tool for integration, stating:

> Immigrants' ability to connect to city services and access available resources is key to their integration. Public transit systems that are reliable, safe, and accessible have a role to play, particularly by facilitating immigrants' access to employment and critical social services. Conversely, poor transit systems may inhibit an immigrant's integration experience.

As noted in the Trends section, the volume of transit trips has increased since 2022 but is still about 32 percent less than what it was in 2019, before the pandemic. Understanding and addressing migrant needs may also be beneficial for transit agencies looking to recover ridership from their services. The lack of

permanent housing makes the origin-destination for travel patterns uncertain. Migrants are also more likely to work in the service industry with hours outside the traditional 9:00 a.m. to 5:00 p.m. work schedule, making longer service hours necessary. This is less apparent in areas with robust systems like New York City, but in more rural and suburban regions in the Lower Hudson Valley and Long Island, gaps in services limit accessibility. Regional and local support for more robust alternative transportation networks like multi-use and bicycle infrastructure, as well as the growing popularity in micromobility could fill this gap.

"Reducing costs even further for those unable to pay e.g., disabled, retirees, refugees and low-income groups. Reducing isolation, utilizing transport better and helping with cost of living." –Survey respondent from Manhattan

3.7.4 CHANGING LAND USE PATTERNS

Various factors, including continued regional growth, local land use preferences, real estate market conditions, the development of transportation technologies and services, and the impacts of sea level rise and extreme weather events will likely influence land development patterns, which in turn influence the type and amount of travel demand by determining where people live, and where and how they travel.[130]

The NYMTC region experienced a shift of people moving from cities to suburbs, consistent with broader trends in metropolitan areas across the country. In the 2010s, population growth in New York City slowed significantly to under 1 percent. At the same time, suburban areas in the larger New York-Newark-Jersey City metropolitan area were growing at a modest rate (0.15 percent), which was consistent with their growth at the start of the decade. Since the pandemic, counties within the region have experienced population shifts, making it difficult to be certain of the direction of population trends based on the last five years. However, population decreases between 2019 and 2023 in Bronx, New York, and Queens counties paired with increases in Nassau, Rockland, Suffolk, and Westchester counties suggest the beginnings of a reversal of the previous period of significant growth in New York City and the re-emergence of a level of suburbanization. Based on variation of population loss and gain across urban and suburban counties and between time periods within the same counties, (2019 to 2021 compared to 2021 to 2023), it remains to be seen whether the underlying trend since 2019 will turn out to be growth of the urban core versus suburbanization and whether the COVID-19 pandemic will have affected this trend in ways that are discernable beyond 2030.

WAREHOUSING

The advent of shared mobility and e-commerce is beginning to affect land use patterns and may continue to do so. NYMTC's Regional Freight Land Use Study (2021) Literature Review found, "Perennial issues of traffic and congestion, coupled with the continued growth of e-commerce and the associated pressure for faster delivery times, have led to intensified demand for urban warehouse space and last-mile distribution centers."[131] The Port of New Jersey and New York is the second busiest port in the US. post-pandemic, making the NYMTC area and surrounding region a key node on the global supply chain. The pandemic and

subsequent lockdowns caused major disruption to the global market chain. Post-pandemic, supply chain fluidity and resilience has become a key goal for the region.

Information and communication technologies, as well as vehicle technologies, could significantly influence future locations and distribution of residential, commercial, and industrial land uses. This includes warehouse automation, distributive manufacturing such as 3D printing, and autonomous delivery vehicles.[132] This is particularly true given the growth of e-commerce, which is altering commercial land use at various locations in New York City's multistate metropolitan region through siting of intermodal centers, warehouses, and distribution centers, as well as industrial properties. Many of these warehouses are replacing agricultural land uses.

SEA LEVEL RISE AND EXTREME WEATHER

The impacts of sea level rise and extreme weather events are also beginning to impact land use patterns, particularly in the wake of Hurricane Sandy in 2012 and Hurricane Irene and Tropical Storm Lee in 2011. Taken together, these extreme storms subjected the NYMTC planning area and the multistate metropolitan region to a wide range of weather impacts from storm surge, heavy rainfall, wind, and resulting erosion and flooding. Communities throughout the NYMTC planning area have been considering land use patterns in their recovery and resiliency planning:

- New York State's Community Risk Reduction and Resiliency Act requires decision-makers to use the best available science to proactively consider sea level rise, storm surge, and flooding when issuing certain state funding and permits. State agencies are required to assess potential future risks related to storm surges, rising sea levels, and any other conditions when making certain permitting, funding, and regulatory decisions.
- New York City has undertaken zoning text amendments and neighborhood rezonings in areas of high-risk flooding. The DCP created special zoning rules for the floodplain to allow for recovery and promote rebuilding. It has also undertaken several neighborhood and citywide studies to understand specific resiliency issues relating to residential, commercial, and industrial areas.
- New York City's Waterfront Revitalization Program establishes New York City's policies for waterfront planning, preservation, and development projects to ensure consistency over the long term.
- Under the auspices of the New York State Governor's Office of Storm Recovery, two projects—on Long Island and on Staten Island—were funded under the U.S. Department of Housing & Urban Development's innovative Rebuild by Design competition.
- The New York State Governor's Office of Storm Recovery also administers New York Rising Communities Reconstruction and its Buyout and Acquisition Program. The Buyout Program improves the resiliency of the larger community by transforming parcels of land into wetlands, open space, or stormwater management systems, creating a natural coastal buffer to safeguard against future storms. The coastal buffer areas are intended to address those who live in areas that regularly put homes, residents, and emergency responders at high risk due to repeated flooding.

- To prevent its sewer system from being overwhelmed, New York City has begun to incorporate "green infrastructure" alongside its transportation infrastructure. The South Battery Park City Resiliency Project, for example, would result in the installation of a continuous flood barrier in the Battery Park area.

Incorporating extreme weather in future land use planning may reduce housing options in flood-prone and vulnerable areas, replacing them with open space. This can help reduce the cost of damage during extreme weather events, but it can also exacerbate the demand for building new housing, especially affordable options.

HOUSING COSTS

Residents in the NYMTC region face higher costs for housing than the rest of the state and many parts of the country. New York City residents, in particular, suffer from rents that outpace incomes and a significant lack of supply for extremely low-income housing.

- New York City has a 30 percent homeownership rate compared to the nearly 66 percent national average.
- From 2010 to 2022, rent costs have increased by 32 percent and home ownership costs have increased by 74 percent in New York City.
- The median rent in 2021 was around $1500, with a growing portion of rents now above $4,000.[133]

The overall high cost of housing for both renters and homeowners, coupled with a lack of vacancies and slow growth of inventory, has caused housing costs to rise in the NYMTC region. Based on the ALICE Wage tool (that identifies households that are Asset Limited, Income Constrained, and Employed), the average adult would need to make an hourly wage of $24.67 to support a survival budget in the NYMTC region. In New York State, 82 percent of the counties can support a survival budget from an $18 hourly wage for a single adult. None of the counties are within the NYMTC region.[134]

The demand for housing and home ownership is evident in the increasing growth of the suburban counties. Between 2019 and 2023, population decreases were recorded in Bronx, New York, and Queens counties (within New York City), while Nassau, Rockland, Suffolk, and Westchester counties (outside the city) experienced population growth, signaling a shift toward suburbanization. Residents are seeking housing, particularly home ownership, further from the urban core where housing demand and prices are the highest. This increases sprawl and impacts VMT and congestion, especially in areas where there is less connectivity through transit. Most single-family homes available are out-of-reach for first time homebuyers. The "missing middle" housing stock is not only desired by first-time homebuyers, but also older generations looking to age in place. The demand for this housing also increases prices, and with newer housing being built at higher prices, entering the housing market is seen as "unattainable" for some.

In Nassau and Suffolk Counties, however, population growth has been faster than the increase in households, indicating that zoning rules and financial challenges might be limiting new housing construction in those suburban areas. For renters, new zoning regulations such as allowing—or even

encouraging—accessory dwelling units (ADUs) can help increase the rental stock and regulate rental prices, but not all communities are supportive of expanding/building multifamily dwelling units. In December 2024, New York City amended zoning regulations that would permit the construction of new residential units to provide more housing stock.[135] With New York being a Home Rule state, communities have authority over local zoning. Both "Not in my backyard" and "Yes in my backyard" trends make long-term housing development patterns uncertain.

ADAPTIVE REUSE

Community developers are looking for solutions to site new businesses in urban areas without much undeveloped space remaining and are looking at infill. This process of repurposing old/underutilized buildings or other infrastructure for new uses is known as adaptive reuse. Key areas of adaptive reuse include office buildings in New York City, warehouses in suburban malls and box stores, and housing/mixed use development in underutilized malls. New York City's Local Law 43 established the Office Adaptive Reuse Task Force, whose purpose is to explore opportunities to convert outdated office space to other potential uses, especially housing. In its 2023 study, the Task Force found allowing most office buildings constructed in 1990 or before to convert could enable new homes for as many as 40,000 New Yorkers in the next 10 years.[136] Recommendations also included tax incentives to support affordable housing options and retrofitting space for childcare facilities. By converting office space, which is normally busy 9:00 a.m. to 5:00 p.m. Monday through Friday, to mixed-use space, Central Business Districts are becoming the "24-hour city", changing the way residents, commuters, and visitors travel to and around the space.[137]

In suburban areas, malls are a key focus of adaptive reuse. Many malls, developed at the height of consumer spending in the 1980s through 2000s, were the center of suburban life. The advent of e-commerce decreased the need for brick-and-mortar stores, with the demand switching to warehousing space. While this phenomenon was occurring before the pandemic, e-commerce popularity sped up the decline of shopping malls. Given the large footprint and access to utilities, malls have begun to diversify uses beyond retail. In an analysis of 135 mall redevelopment projects, JLL found that 53.6 percent include housing, while less than 34 percent convert to office and 85 percent of projects retain retail on the site.[138]

Incorporating newer, denser mixed land-uses at former mall centers may significantly shift travel patterns. Overall VMT may be reduced by replacing shorter SOV commercial trips with multimodal or transit trips (based on density/proximity), though it may increase the total frequency and duration of trips to the area. It may also relieve housing demand and the warehousing boom, connecting employment opportunities with alternative housing options. Major mall conversion efforts in the NYMTC region include the Palisades Mall in Rockland County.

TRANSIT-ORIENTED DEVELOPMENT

New York has a long history of developing around transit. From the suburban towns that grew along streetcar and rail lines in the late 1800s to the "Terminal City" neighborhood build alongside Grand Central in the early 1900s, the region has prospered by taking advantage of the symbiotic relations between development and transit. In the NYMTC planning area, significant transit-oriented development (TOD)

initiatives have been undertaken or are under development by New York State, New York City, suburban counties and municipalities, MTA, and private developers as a way to achieve more sustainable development patterns. Examples on Long Island include Wyandanch Rising, which has transformed one of Long Island's most economically distressed communities into a transit-oriented downtown with excellent access to the MTA LIRR, affordable housing units, and commercial uses offering daily amenities. Similar concepts are in progress or under study in East New York and the east Bronx in New York City, and around MTA MNR stations in the Lower Hudson Valley suburban cities of Yonkers, Mount Vernon, and New Rochelle.

Moving Forward 2055 Survey respondents from Nassau County, Suffolk County, Westchester County, and Brooklyn all commented on the need for affordable housing near transit and voiced their support for more transit oriented development.

Dedicated funding and policies are incentivizing TOD. The IIJA continues the competitive TOD planning program, providing $50 million in funding over five years for efforts associated with an eligible transit project.[139] Suffolk County was awarded planning funding through the Pilot Program for TOD Planning (2022) for Route 110 Transit-Oriented Development Corridor Comprehensive Plan: Huntington Section. Other notable TOD projects include development around MTA stations in Bayshore, Babylon (Wyandanch Station development boasts 300 residential units, a park, and a YMCA) and the Village of Westbury in Long Island. Outside of Long Island, along the Hudson River and Metro-North Railroad's Hudson Line, multiple higher density developments have been also developed in recent years or are in the works in Yonkers and points north.

Overall, land use patterns are determined by many factors, including generational preferences, changing business models, regional transportation infrastructure, and real estate cost trends. They are especially impacted by local zoning regulations which are put in place at the municipal level, which produce varying results in terms of development patterns and corresponding housing affordability. Nevertheless, it is clear that land use patterns are important drivers of change by determining where people live, and where and how they travel.

3.7.5 CYBERSECURITY

The Cybersecurity & Infrastructure Security Agency (CISA) defines cybersecurity as "the art of protecting networks, devices, and data from unauthorized access or criminal use and the practice of ensuring confidentiality, integrity, and availability of information."[140] Cyber threats include attacks to a network's software, firmware, or hardware that can erase or alter programming or steal key information for ransom. According to the FBI, cyberattack complaints in New York State increased 53 percent between 2016 and 2022, jumping from 16,426 incidents in 2016 to 25,112 in 2022. Estimated losses in New York from cyberattacks in 2022 totaled over $775 million, while losses nationwide totaled $10.3 billion.[141]

Much of the transportation network and critical infrastructure rely on connectivity and software to function, whether ITS systems, electric grid, connected vehicle, or scheduling software. This connectivity leaves

systems with multiple vulnerabilities, including emerging systems like Connected and AVs (CAV). Possible impacts for CAVs include impacts to vehicle safety functions, disrupt vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2I) communications, or breach confidential data. For ITS, cyber-attacks can disrupt traffic management, public transit operations, and vehicle navigation. A cyber-attack in April 2024 shut down all KC Scout systems in the Kansas City metro area in Missouri, leaving traffic cameras, tracking systems and message boards down for months.[142]

Governments, public agencies, and civic institutions are often targeted by cyberattacks. Cybersecurity policies help protect systems against attacks. The Federal government created a new State and Local Cybersecurity Grant Program (SLCGP), committing $1 billion over four years to help states, local governments, rural areas, and territories address cybersecurity risks and improve their critical infrastructure resilience through the BIL. Each state or territory that applies must establish a Cybersecurity Planning Committee and a Cybersecurity Plan. The 2023–2024 enacted NYS Budget included $42.6 million to expand the State Police Cyber Analysis Unit and create a new specialized Industrial Control System (ICS) Assessment Team within DHSES.[143] New York City also adopted a new policy to standardize cyber security.

The risks of cyber-attacks are impacting more than system security measures. The system complexity required to withstand attacks can make automation/AI more difficult, in addition to the difficulties of upscaling resources and workforce skills. This gap in skills may become an issue for the future workforce. Other issues include the public distrust in relying on AI systems because of safety and security risks.

Attendees at the Transportation and Technology Public Forum noted that a main risk or barrier for travelers using new apps/utilities was "concerns over hacking, "data storage and management," and "trust."

3.8 INFORMING MOVING FORWARD 2055

MPOs are required to follow a performance-driven, outcome-based approach to transportation decision-making, which can be heavily influenced by their understanding of the future trends and disruptors. The assessment of trends and disruptors affects NYMTC's performance-based planning and programming process in numerous ways:

- Proactively identifying trends and disruptors helps NYMTC to adjust their long-term goals and develop performance measures that are forward-looking. For instance, as AVs become a part of mainstream consumer behavior, the Council may set new safety and infrastructure targets tailored to accommodate AVs.
- This can be supplemented by scenario planning, which will help the region to explore how possible ranges or impacts of trends and disruptors affect key planning factors such as travel demand, mode choice, and population and employment growth.

» The exploration of trends and disruptors may prompt NYMTC to explore a reshuffling of priorities for system preservation and enhancements. For example, member agencies could invest further in pavement resiliency measures to mitigate the damage of extreme weather events.

3.8.6 RISKS AND OPPORTUNITIES

Transformational changes and the future of mobility will influence *Moving Forward 2055's* strategic framework. Some possible outcomes will likely influence how NYMTC as an organization and its members individually seek to fulfill the goals of their Shared Vision for Regional Mobility. Other potential outcomes, such as evolving forms of shared mobility, will affect the way these goals are pursued. *Moving Forward 2055* attempts to lay the groundwork for anticipating these developments and formulating approaches. However, greater attention will be needed going forward to better understand current trends, potential futures, and possible outcomes, as outlined in Table 3.41.

Table 3.41 *Moving Forward 2055* Goals: Risks and Opportunities Matrix

Goal	Trend & Disruptor Risks	Trend & Disruptor Opportunities
SAFETY AND SECURITY We seek to establish and maintain a transportation system for which safety and security are maximized for people and goods across all uses and modes	» Cybersecurity procedures not keeping pace with tech advancements, leaving systems vulnerable. » Shared mobility services, e-commerce, and other technological advancements may not protect personal data, rider privacy, or security of digital transportation infrastructure. » Legislature is slow to regulate emerging technologies, leading to potential safety concerns. » "Silver Tsunami" of older transportation users leads to increased vehicle accidents, pedestrian fatalities, etc. » Transportation agencies are not prepared for the costs of cybersecurity upgrades or ransomware attacks. » Threats to individual safety and national security if digital transportation infrastructure is not protected.	» Incorporate, scale, and future-proof cybersecurity measures into infrastructure and smart technology systems. » AI and connected/autonomous vehicles (C/AV) can improve passenger and pedestrian safety by reducing driver error.

Goal	Trend & Disruptor Risks	Trend & Disruptor Opportunities
INFRASTRUCTURE We seek to establish and maintain a transportation system for which infrastructure is maintained and improved in a sustainable manner.	» Cost of repairing Infrastructure damaged by extreme weather events. » Budget prioritization of maintaining systems vs implementing new technologies. » Increased competition for curb space and truck parking due to increased freight traffic. » Micromobility usage outpaces development of safe, protected infrastructure. » Difficulty integrating emerging transportation and technologies with existing infrastructure.	» Infrastructure and services that support first and last mile connectivity can complement public transit and shared mobility services. » Use AI to reduce maintenance frequency and cost, improve safety, and efficiency in infrastructure, public transit, and other modes.
RESILIENCY We seek to establish and maintain a transportation system for which resiliency is supported through mitigating, adapting to, and responding to chronic and acute stresses and disruptions.	» Supply chains are vulnerable to weather, workforce disruptions, etc. impacting goods movement. » Extreme weather events can damage infrastructure, increasing repair and maintenance costs. » Extreme weather events disrupt transportation services and network. » Charging/fueling infrastructure for alternative fuel vehicles is hindered by a limited number of locations, and grid capacity or reliability.	» Distributed production and 3D printing can mitigate supply chain vulnerabilities and improve efficiency. » Green infrastructure can improve resiliency to extreme weather events and sea level rise.
CONGESTION We seek to establish and maintain a transportation system for which congestion is mitigated through investments and technology in support of healthier communities, more seamless travel, improved quality of life, and regional economic competitiveness.	» Decreased transit ridership leads to increased congestion. » Increased e-commerce and localized production leads to increased freight traffic, especially in residential areas. » On-demand transportation options such as Uber or Lyft have been shown to increase congestion. » AVs can contribute to congestion by increasing the ease of driving and reducing usage of other modes.	» Reduced congestion and vehicle miles traveled due to virtual economy, technological advancements. » Scooter and bikeshare can support first and last mile travel options, supplementing public transit. » Technological advancements such as C/AVs, AI, and ITS can improve safety, efficiency, and optimization of travel. » Changing demographic patterns may increase usage of flexible and on-demand transportation options that mitigate the need for a personal vehicle. » Road pricing may impact trip timing and mode decisions, leading to changes in congestion locations and severity.

Goal	Trend & Disruptor Risks	Trend & Disruptor Opportunities
LAND USE We seek to establish and maintain a transportation system for which land use decisions are encouraged in support of strategic transportation enhancements and improving modal choices.	» Conflicts between residential, commercial, and industrial land uses and local, regional, and state land use policies. » Increasing sprawl due to rise in housing costs, work from home opportunities, and technological advancements that improve long-distance travel; may result in limiting transit-oriented development (TOD). » Reduced demand for commercial real estate due to an increase in telework. » Increase in warehousing in residential areas due to rise in e-commerce and distributed manufacturing.	» Potential for adaptive reuse of unused brick-and-mortar retail and service spaces. » Shared mobility services support denser land uses and reduced parking demand. » C/AVs can reduce parking demand, especially in dense areas, with self-parking and pick-up options. » Promote TOD to reduce sprawl. » Preserve green spaces and incorporate green infrastructure. » Encourage investment and redevelopment in city centers. » Smart growth and TOD can reduce the need for long commutes, decrease traffic congestion, and improve the safety of vulnerable road users.
FAIRNESS & ACCESS We seek to establish and maintain a transportation system for which fairness in transportation is advanced and access to opportunities is improved for all communities.	» Uneven distribution of burdens across transportation investments and policies. » Knowledge gaps in new technology impacting accessibility. » Some labor roles cannot work from home, increasing their transportation burden and cost. » Emerging transportation modes cannibalize public transit, impairing fiscal sustainability for transit system. » Underserved communities may not have reliable access to emerging transportation modes. » Micromobility devices impair safe, accessible sidewalk usage. » Low-income residents are more likely to be affected by extreme weather events. » Older adults unable to access transportation services. » Bias in AI models can lead to unjust decisions, prejudice, unequal access	» Opportunity to introduce a fairness-based framework into decision-making processes. » Improving transportation services and infrastructure for vulnerable groups such as older adults improves safety and accessibility for all users. » Expanding remote work options offers better access to employment opportunities for individuals in remote or underserved areas. » Virtual telehealth services can bridge gaps in access to quality healthcare for marginalized communities. » Expanding shared mobility options in underserved areas can improve access to essential services and employment opportunities, reducing transportation disparities, especially for zero and one car households. » Investing in resilient infrastructure in low-income and under-served communities can reduce the disproportionate impact of extreme weather on these groups.

Goal	Trend & Disruptor Risks	Trend & Disruptor Opportunities
ENVIRONMENT We seek to establish and maintain a transportation system in which environmental impacts—including harmful air pollutants—are significantly reduced through technology applications, increased use of greener travel options, and improved efficiency.	» Increasing air pollution from freight travel. » Increasing air pollution from AVs and other emerging transportation modes. » Increase in noise pollution in residential areas from truck traffic, warehouses, and truck parking. » Increase in toxicity and water consumption related to the extraction of resources, production, and disposal of lithium batteries for EVs.	» Lower pollution levels due to travel changes related to virtual economy and travel patterns of younger adults. » Lower pollution levels if shared mobility vehicles are alternative fuel. » Technological advancements such as C/AVs can reduce pollution through improved fuel economy, even more so if they are alternative fuels. » Distributed production and 3D printing reduces freight travel and pollutions. » Introduce environmental framework into decision-making processes. » Potential for Federal, state, or local funding to support environmental impact mitigation and adaptation projects. » Public education campaigns can support the adoption of greener transportation modes. » Shared mobility services, the virtual economy, the rise in alternative fuel vehicles, and technological advancements can reduce the number of fossil fuel powered vehicles, reducing pollution and improving public health.

3.8.7 CONCLUSION

The assessment of trends and disruptors is critical to long-term transportation planning, particularly in a dynamic and continually evolving region like NYMTC's. Trends provide a framework for understanding gradual and predictable changes, while disruptors introduce uncertainty and rapid shifts that can dramatically alter transportation needs. Both forces must be considered to develop resilient transportation systems that can adapt to population shifts, technological advances, and environmental challenges. By analyzing these factors, planners can better anticipate emerging challenges, identify opportunities, and make informed decisions that align with regional goals, ensuring the transportation network remains functional and fair in the face of both gradual and transformative changes.

ENDNOTES

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4 WHAT WE PLAN TO DO—PLANS, PROGRAMS, PROJECTS

4.1 INTRODUCTION

Moving Forward 2055 is built around NYMTC's Shared Vision for Regional Mobility as described in Chapter 1. This Shared Vision provides a strategic framework for the Plan's recommended strategies and actions. It also provides a framework for the proposed transportation improvement projects in the Plan, both within the Plan's forecast financial envelope as well as its speculative *vision* element. These strategies, actions, and project proposals provide organizational guidance for NYMTC to invest Federal transportation resources in improvement projects and planning activities.

This chapter provides a detailed description of the Shared Vision's seven goals and related objectives in detail. It also presents strategies and tactics (actions) that are intended to execute the goals and objectives. This framework can be described as follows:

- **Goals** are outcomes one aims to achieve.
- **Objectives** are measurable steps to achieve goals.
- **Strategies** are plans or approaches designed for the successful execution of objectives.
- **Tactics** or **Actions** are small actionable tasks within strategies.

The chapter is organized in modules related to each goal and its objectives. The modules include a description of the goal; and the existing conditions, relevant trends and related existing programmatic initiatives related to the goal and its objectives. This information guides the short- and medium-term strategies and actions that the Plan recommends for the goal and its objectives, which in turn provides a framework for NYMTC's planning activities, technical studies, and improvement project selections. The guiding principles that are part of the Shared Vision also frame the recommended strategies and actions in each goal module.

4.2 VISION GOAL—SAFETY

We seek to establish and maintain a transportation system for which safety and security are maximized for people and goods across all uses and modes.

4.2.1 DESCRIPTION

This goal seeks to enhance the transportation system's safety and security in NYMTC's planning area. According to U.S. DOT:

- Safety is defined as freedom from harm, resulting from unintentional acts or circumstances.
- Security is defined as freedom from intentional harm and tampering that affects both motorized and non-motorized travelers and may also include natural disasters.

Transportation safety and security are also national priorities: planning factors defined in Federal transportation legislation call for developing transportation system projects through a long-range transportation plan to increase the transportation system's safety and security for motorized and non-motorized users.

The transportation system's safety and security are integral to NYMTC's Shared Vision for Regional Mobility, as well as to NYSDOT's Strategic Highway Safety Plan, which is a major component of the Federal Highway Safety Improvement Program (HSIP). Understanding safety and security issues, conditions and trends is critical to the future quality and effectiveness of the transportation system.

4.2.2 OBJECTIVES

- Ensure that investments in transportation assets enhance the safety and security of passengers and freight systems.
- Prioritize safe streets, intersections, railroad grade crossings and shared-use rights-of-way and establish road safety initiatives that follow a Safe System approach.
- Coordinate safety management, training, and safety education for all who share our streets across jurisdictional borders.

- Improve operational safety and security, incorporating the changing nature of transportation and technology so that transportation facilities safely accommodate all travelers.
- Strengthen connected vehicle programs and policies and champion driver assist programs and other technologies that contribute to overall system and individual user safety.
- Improve in-person and automated safety enforcement procedures.
- Prioritize the safety of transportation system operators, workers, and contractors through planning and coordinated management of work zones.

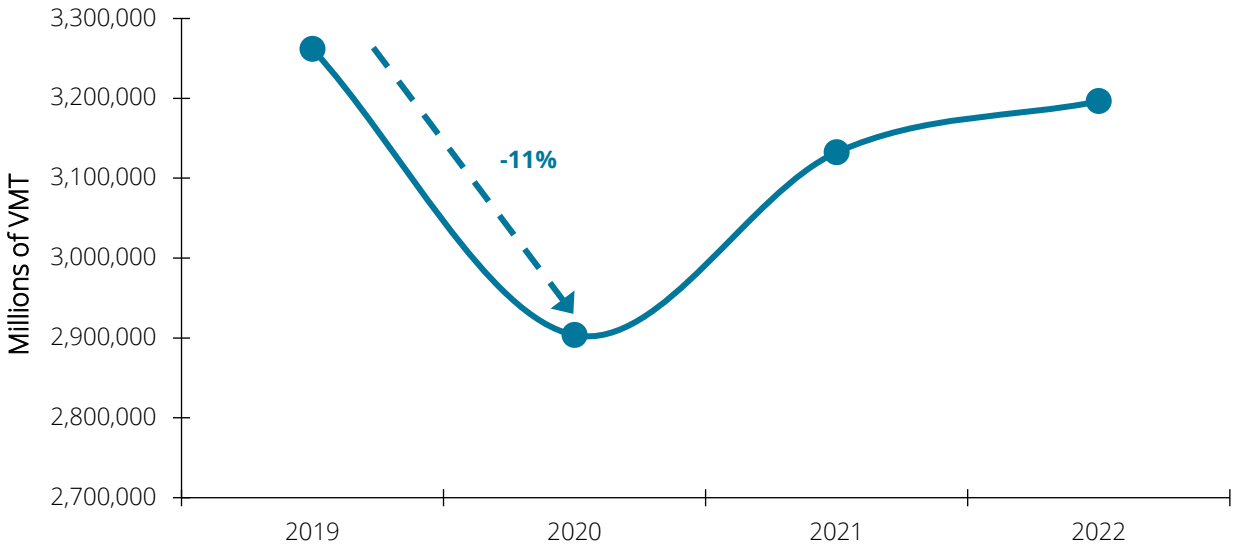
4.2.3 RECENT TRENDS, CURRENT CONDITIONS, AND EXISTING INITIATIVES

RECENT TRENDS AND CURRENT CONDITIONS

The COVID-19 pandemic impacted the level and type of travel in NYMTC's planning area. Comprehensive pandemic lockdowns, which began mid-March 2020 and lasted for several months, limited travel and were followed by expanded work-from-home (WFH) policies, various restrictions, and other requirements for social distancing through 2021. In turn, these widespread changes also affected transit and traffic safety.

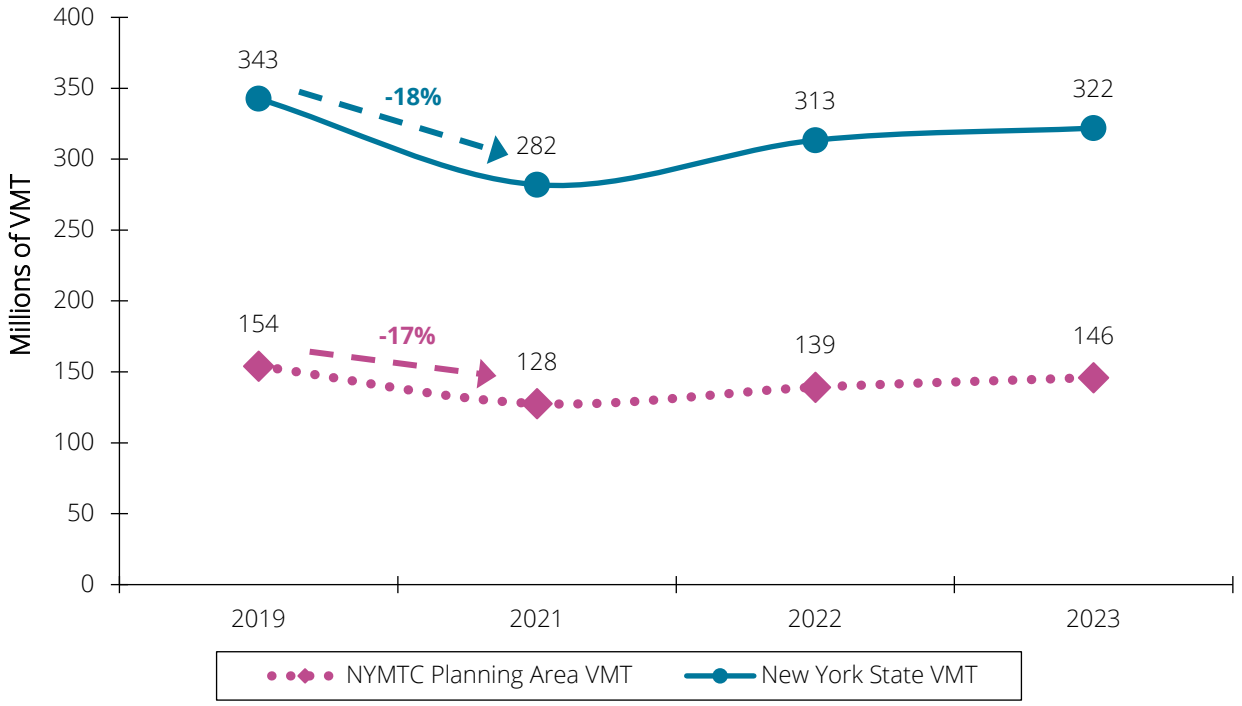
Pandemic impacts on highway travel can be defined through trends in vehicle miles traveled (VMT) at the national and state levels, as well as for NYMTC's planning area. Figure 4.1 and Figure 4.2 present those trends for 2019 through 2022. Although all of the trends at the three levels show the same general pattern—VMT reduction in 2020 followed by gradual recovery in the subsequent years—the comparative trends in Figure 4.2 demonstrate that highway travel in New York State and the NYMTC planning area saw a slightly greater relative reduction in VMT than was seen nationally and a slightly slower recovery.

Figure 4.1 National VMT (Millions)



Source: NHTSA; Traffic Safety Facts Annual Report Portal, August 2024.

Figure 4.2 NYMTC Planning Area and New York State VMT (Millions)



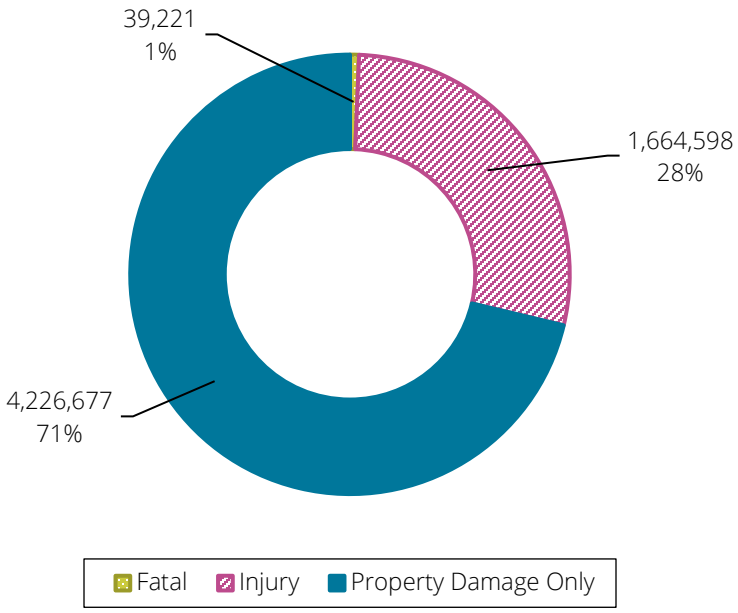
Source: NYSDOT.

As a result of this public health situation, metrics used to assess transportation safety conditions and trends were also affected during the two years of the greatest pandemic impacts. Given that, as with the VMT trends presented above, the safety trends described below are a comparison to pre-pandemic conditions in 2019 in contrast to metrics from 2020 through 2022 or 2023.

MOTOR VEHICLE FATALITIES AND INJURIES

According to the National Highway Traffic Safety Administration (NHTSA), an estimated 5,930,496 police-reported traffic crashes took place across the country in 2022. Of these crashes, 39,221 (0.66 percent) involved fatalities in which 42,514 people were killed. Crashes involving injuries totaled 1,664,598 (28 percent), in which 2,382,771 people were injured. The remainder of the crashes, 4,226,677 (71 percent), resulted in property damage only.

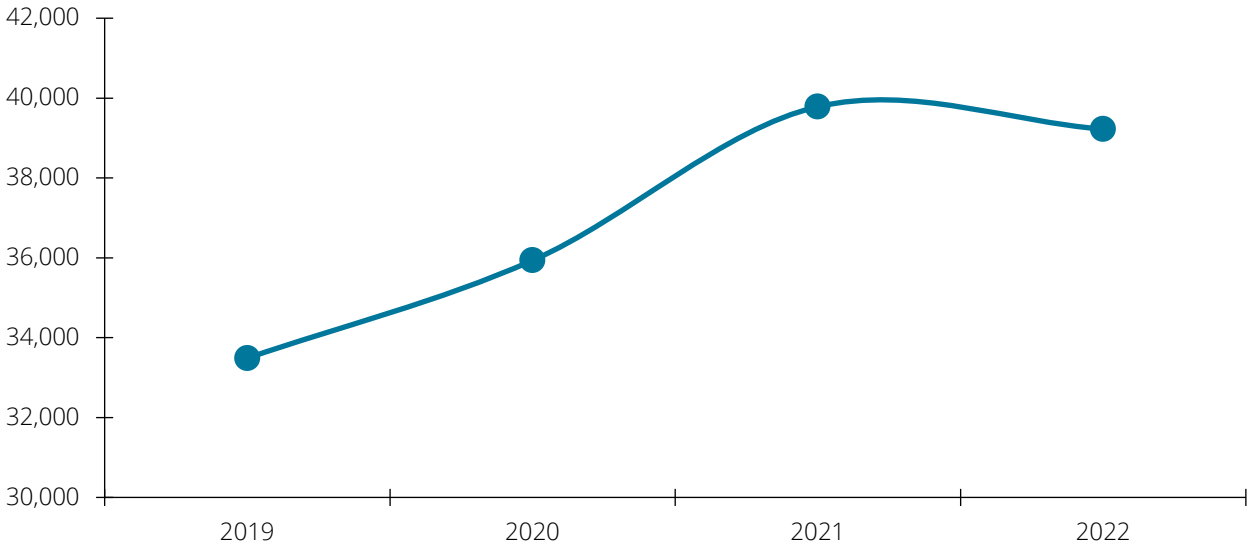
Figure 4.3 2022 Police-Reported Motor Vehicle Traffic Crashes



Source: NHTSA National Statistics

Fatal crashes have run counter to the national, state, and regional trends in vehicle travel described above. Whereas national VMT dropped 11 percent in the pandemic year of 2020 and was still 2 percent below the 2019 level in 2022, NYS VMT dropped 18 percent in 2022 and was 6 percent below the 2019 level in 2022, and VMT in NYMTC's planning area dropped 17 percent in 2020 and was still 5 percent below the 2019 level in 2022, fatal crashes increased over 7 percent in 2020 and again in 2021 to 19 percent above the 2019 level. Fatal crashes decreased in 2022 but were still 17 percent above the 2019 level.

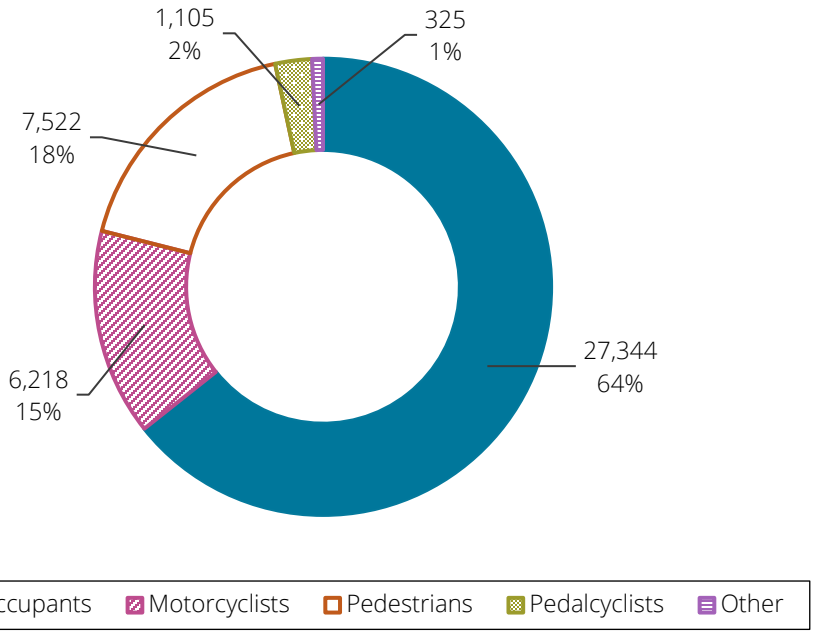
Figure 4.4 National Fatal Motor Vehicle Crashes



Source: NHTSA National Statistics.

As a result of these trend differences, the rates of fatalities increased over the period in question, jumping from 1.11 fatalities per million vehicle miles to 1.34 in 2020 and 1.38 in 2021, before moderating to 1.33 in 2022. The victims of fatal traffic crashes included vehicle occupants, pedestrians, motorcyclists, and cyclists. In 2022, 64 percent of fatalities in motor vehicle crashes were occupants of vehicles, 18 percent were pedestrians, 15 percent were motorcyclists and 2 percent cyclists.

Figure 4.5 National Traffic Crash Victims—Fatalities



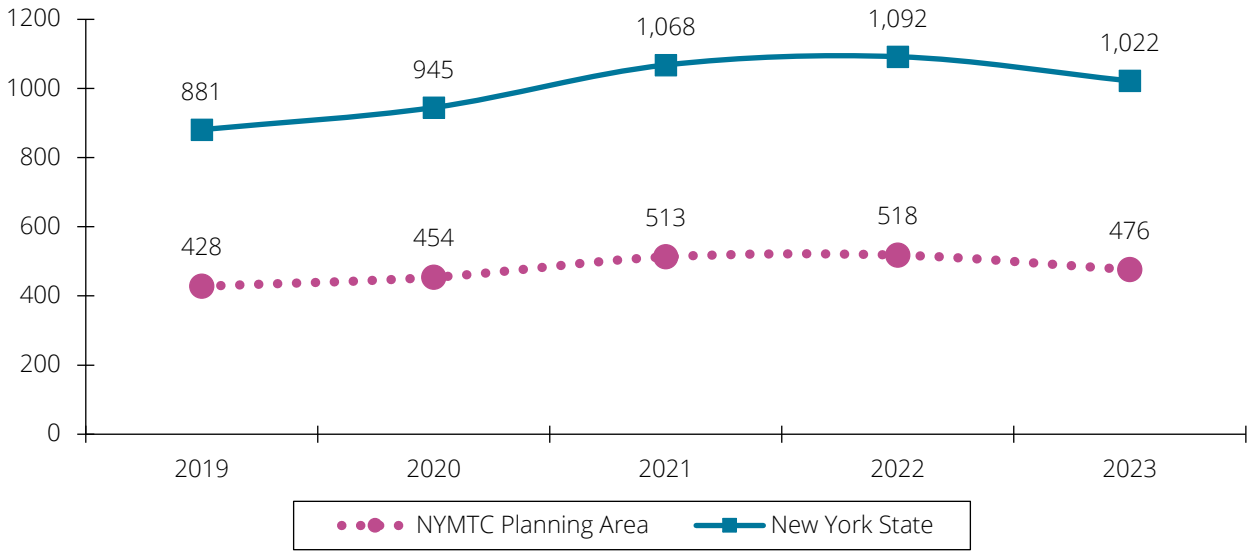
Source: NHTSA National Statistics.

State trends in traffic fatalities mirrored the national trends. According to the Institute for Traffic Safety Management & Research (ITSMR), 881 fatalities occurred in traffic crashes statewide in 2019, roughly 2 percent of the national total. Of these, 428 occurred in NYMTC's planning area, representing 49 percent of the state's total fatalities. In 2020, state traffic crash fatalities jumped to 945, an increase of just over 7 percent. Of those, 454 occurred in NYMTC's planning area, an increase of 6 percent over those in 2019.

By 2021, 1,068 fatalities took place statewide, a 21 percent increase over 2019 fatalities, even though statewide VMT decreased by 8.7 percent from 2019 levels. Of these, 513 fatalities, or 48 percent of statewide fatalities, occurred in NYMTC's planning area. In 2022, statewide fatalities increased to 1,092, a 24 percent increase over 2019 levels, despite a decrease of 6.1 percent from 2019 VMT levels. 518 of the 2022 fatalities took place in NYMTC's planning area, accounting for 47 percent of statewide fatalities. These totals decreased in 2023 statewide and NYMTC's planning area, with 1,022 fatalities statewide, a decrease of 6.4 percent from 2022, 476 of which took place in NYMTC's planning area, a decrease of 6.1 percent from 2022.

Overall, despite significant statewide and NYMTC planning area reductions in travel, fatalities increased over three consecutive years (2020–2022) and in 2023 decreased slightly, however still remain above pre-pandemic levels (even as VMT remains below pre-pandemic totals).

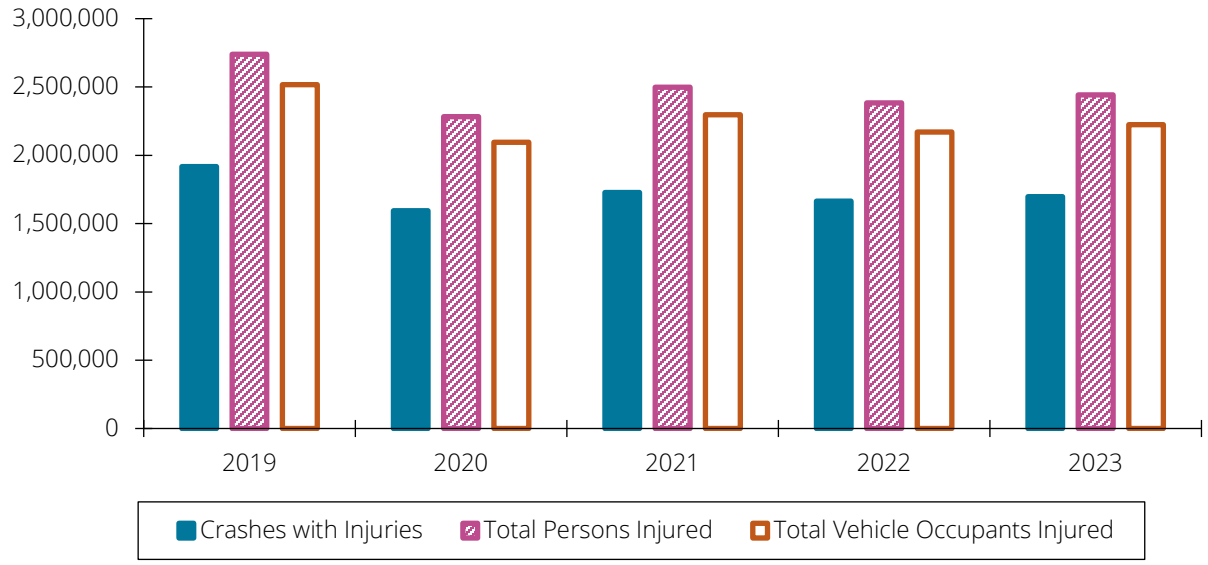
Figure 4.6 NYMTC Planning Area and New York State Fatal Crashes



Source: Institute for Traffic Safety Management & Research.

In terms of injuries due to traffic crashes, in 2019 approximately 1.9 million traffic crashes involved injuries, in which 2.7 million people were injured, 2.5 million of which were vehicle occupants. During 2020, figures dropped 16 percent to 1.6 million crashes, in which 2.3 million people were injured. In 2021, traffic crashes resulting in injuries increased 9 percent to 1.72 million, which still represented a decrease of 9 percent from 2019. Crashes injured 2.5 million people but decreased in 2022 by 13 percent to 1.66 million, injuring 2.4 million people, 1.6 million of which were vehicle occupants. Injury crashes in 2022 show a 13 percent decrease from 2019 and with 11 percent fewer injuries than in 2019. Injury crashes slightly increased again in 2023 to nearly 1.7 million, resulting in over 2.44 million people injured.

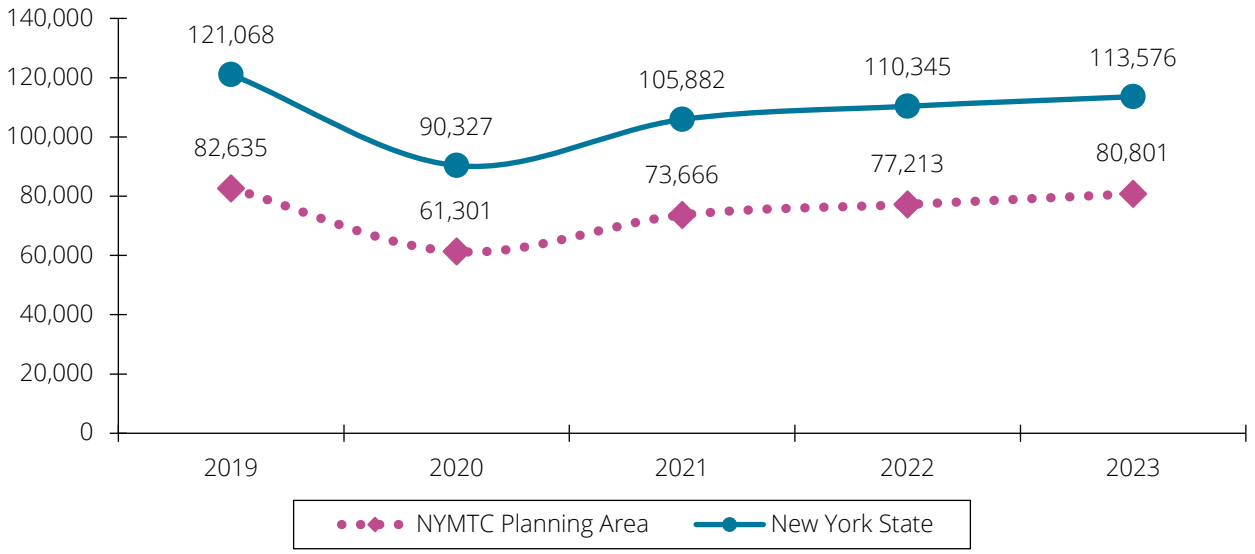
Figure 4.7 National Injury Statistics for Traffic Crashes



Source: NHTSA, Traffic Safety Facts Annual Report Tables.

Injury crashes across NYS and NYMTC's planning area followed national trends. As seen in Figure 4.8, crashes dropped by roughly 25 percent in the 2020 pandemic year both statewide and in NYMTC's planning area and increased each year thereafter. By 2023, the number of crashes had not returned to the 2019 level for either the entire state or for NYMTC's planning area. For NYS, 2023 injury crashes were 6 percent less than 2019, while for NYMTC's planning area, 2023 injury crashes were 2 percent less than 2019. In 2019, injury crashes in NYMTC's planning area accounted for 68 percent of the statewide total. By 2023, NYMTC planning area injury crashes were 71 percent of the statewide total.

Figure 4.8 NYMTC Planning Area and New York State Injury Crashes



Source: Institute for Traffic Safety Management & Research.

Several underlying factors or risks are responsible for most motor vehicle crashes leading to fatalities and serious injuries in NYMTC's planning area. Although advancements in vehicle and roadway design have continued to improve motor vehicle safety, statistics show human behavior continues to be the biggest factor for motor vehicle crashes.

Road user behaviors that pose safety risks include:

- Impaired Driving—Associated behaviors include operating vehicles while under the influence of drugs and/or alcohol or while impaired due to medical conditions such as sleep apnea.
- Distracted Driving—NHTSA defines distraction as a specific type of inattention that occurs when drivers divert their attention away from the task of driving to focus on another activity. Distractions can be technological, such as using navigation systems and cell phones, or behavioral, such as interacting with passengers and eating.
- Vehicle operation—The greater the rate of speed at which a vehicle is operated, the greater the chances for death or serious injury resulting from a crash. Higher vehicle speeds also mean an increase in stopping distance. Speed-related fatalities and injuries result from crashes where a driver was either driving over the posted speed limit or at an unsafe speed for conditions.

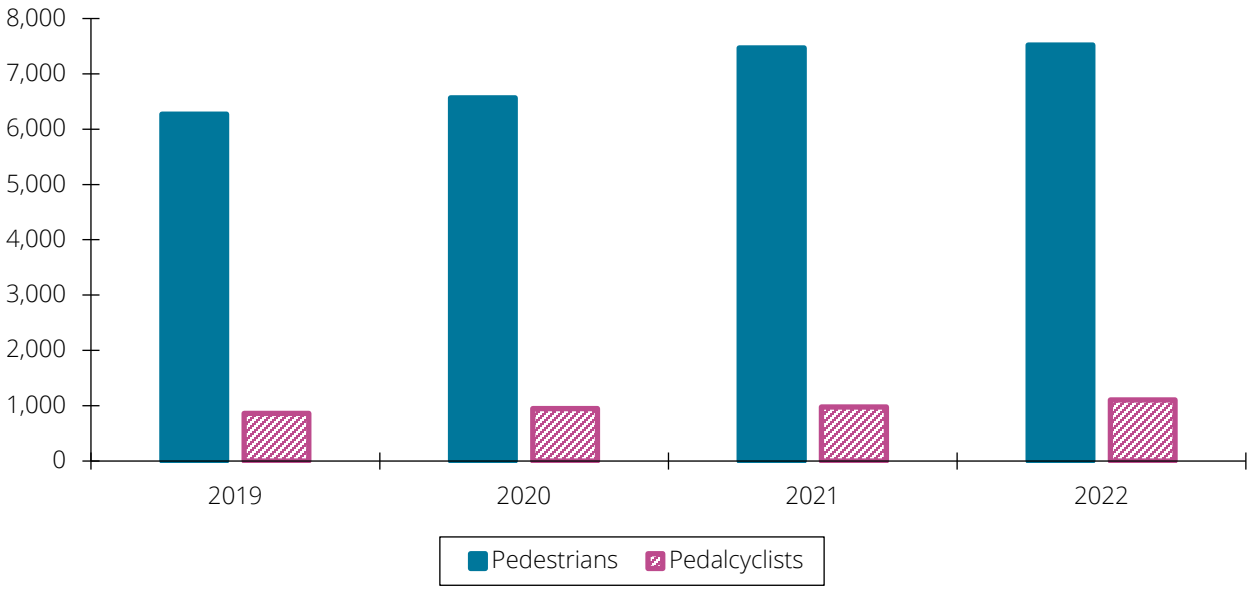
» Age-Related Risks—NYS' Strategic Highway Safety Plan (SHSP) defines young drivers as those 20 years old and younger. Drivers 65 and older represent the older driver group. Nationally, older and younger drivers have higher crash rates per VMT. For young drivers, higher rates of crash involvement are often attributed to inexperience and/ or an increased propensity for risk taking. For older drivers, diminishing abilities and crash survivability are key factors to consider.

PEDESTRIAN AND BICYCLIST FATALITIES AND INJURIES

As shown in Figure 4.5 above, in 2022, 20 percent of motor vehicle crash fatalities nationally involved pedestrians (18 percent of total) or cyclists (2 percent of total) as victims. According to NHTSA, cyclists are bicyclists and other cyclists including riders of two wheel, nonmotorized vehicles, tricycles, and unicycles powered solely by pedals. 2022 fatalities in these categories totaled 8,627 victims.

NHTSA reported 6,205 pedestrian and 859 cyclist fatalities in traffic crashes nationwide in 2019. Totals increased in the 2020 pandemic year to 6,565 pedestrians and 948 cyclists, increases of 5 percent and 10 percent, respectively, despite lower VMT that year. 2021 saw a further 14 percent increase over 2020 pedestrian fatalities to 7,470 and 3 percent increase in cyclists killed to 966. By 2022, 7,522 pedestrians were killed nationally, less than 1 percent increase over 2021 and 1,105 cyclists killed, just over 13 percent higher than in 2021. In 2022, pedestrian traffic crash fatalities were 20 percent higher than those in pre-pandemic 2019 and cyclist fatalities were 29 percent higher than 2019 levels.

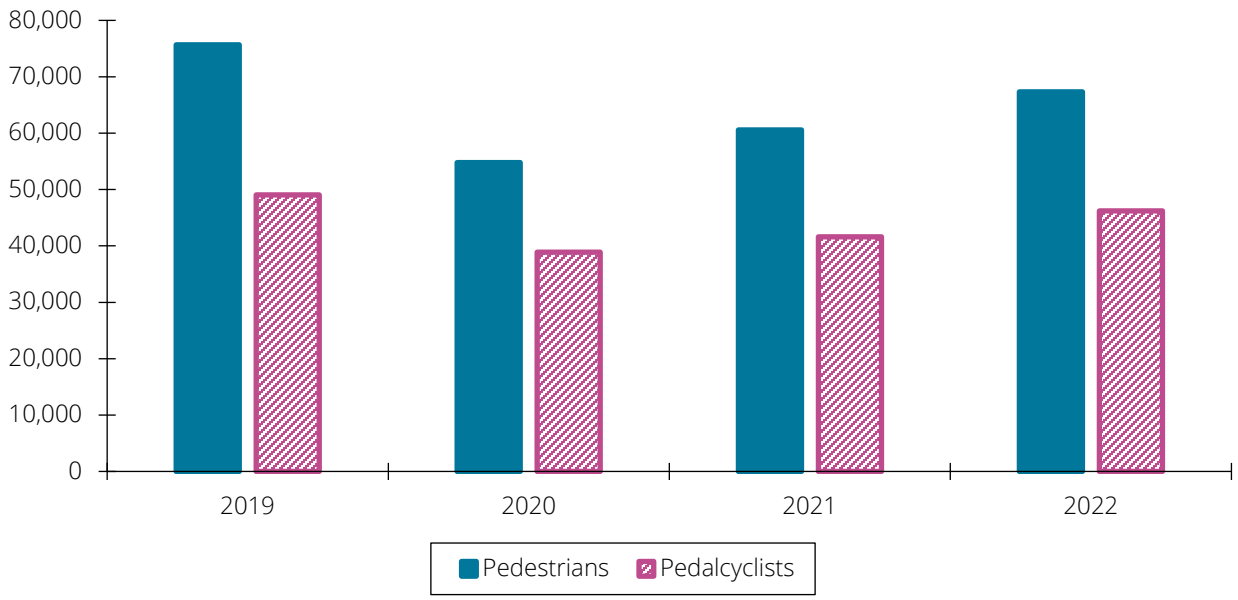
Figure 4.9 National Pedestrian and Cyclist Fatalities



Source: NHTSA National Statistics.

In 2019, 75,650 pedestrians were injured in traffic crashes while 49,057 cyclists were injured. The 2020 pandemic year saw these numbers decrease to 54,771 pedestrians injured, a drop of 28 percent, and 38,886 cyclists injured, a decrease of 21 percent. 2021 saw a 10 percent increase to 60,579 pedestrians injured and a 7 percent increase to 41,615 cyclists injured. Finally, in 2022, injured pedestrians numbered 67,336, an increase of 11 percent, while injured cyclists rose 11 percent to 46,195. However, despite the increases, 2022 pedestrian injuries were 11 percent below pre-pandemic levels in 2019, while 2022 cyclist injuries were 6 percent below the number in 2019.

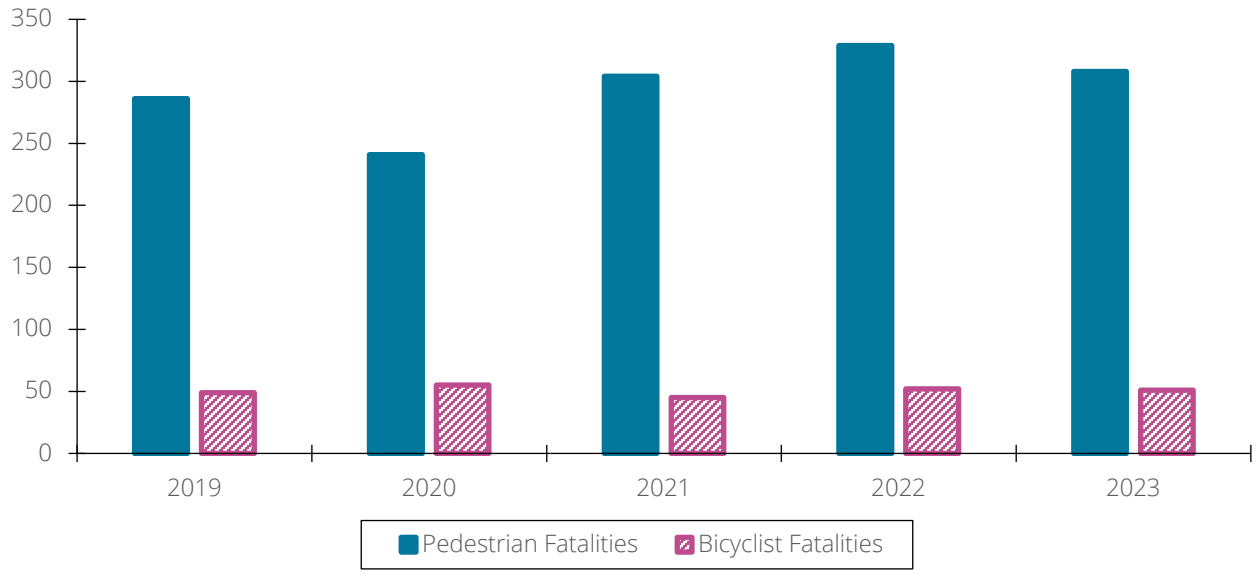
Figure 4.10 National Pedestrian and Cyclist Injuries



Source: NHTSA National Statistics.

Figure 4.11 shows NYS pedestrian and bicyclist fatalities, and crash patterns differ somewhat from those for the country. Pedestrian fatalities dropped in the pandemic year by 16 percent and bicyclist fatalities increased in the pandemic year by 12 percent. Nationally, pedestrian fatalities increased in the pandemic year. Unlike the increasing trend in fatalities after the pandemic year nationally for both pedestrians and cyclists, NYS these levels saw both increases and decreases during the period 2021–2023. Nationally, cyclist injuries dropped 21percent in the pandemic year and increased every year thereafter, although in 2022 they were still 6 percent lower than the pre-pandemic level in 2019.

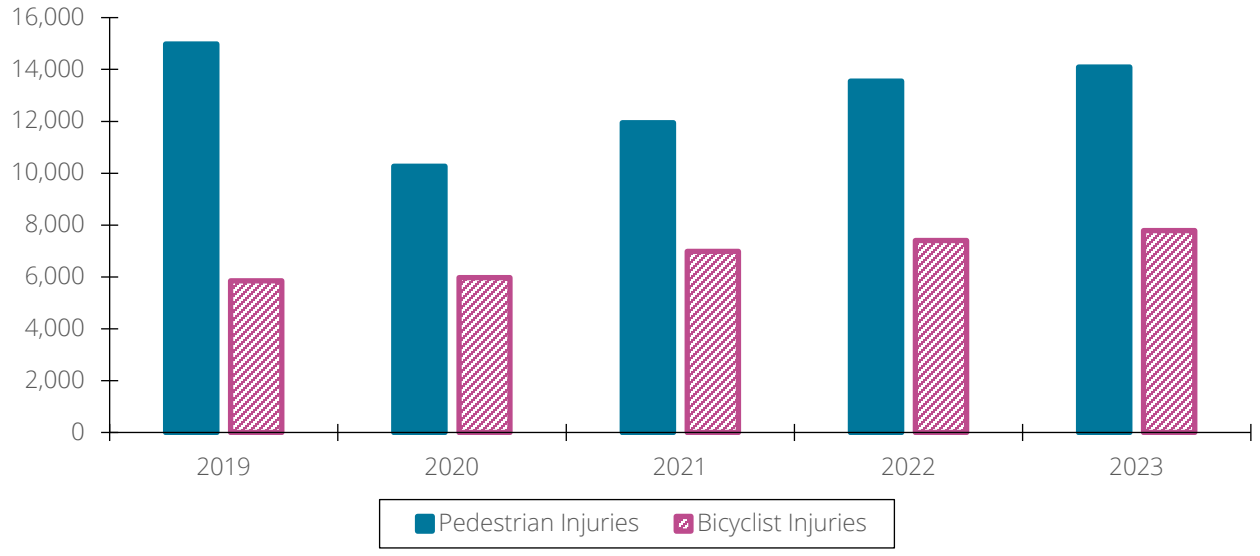
Figure 4.11 New York State Pedestrian/Bicyclist Fatalities



Source: Institute for Traffic Safety Management & Research.

Looking at NYS pedestrian and bicyclist injuries, Figure 4.12 below presents these trends, which again show variance with the national trends presented above. Pedestrian injuries decreased in the pandemic year by nearly 32 percent, mirroring the national 28 percent drop in pedestrian injuries in the pandemic year. NYS pedestrian injuries increased every year thereafter until in 2023 they were only 6 percent less than the level in 2019. In contrast, NYS bicyclist injuries increased over 2019 levels in every subsequent year, including the pandemic year. By 2023, bicyclist injuries were 33 percent higher than in 2019.

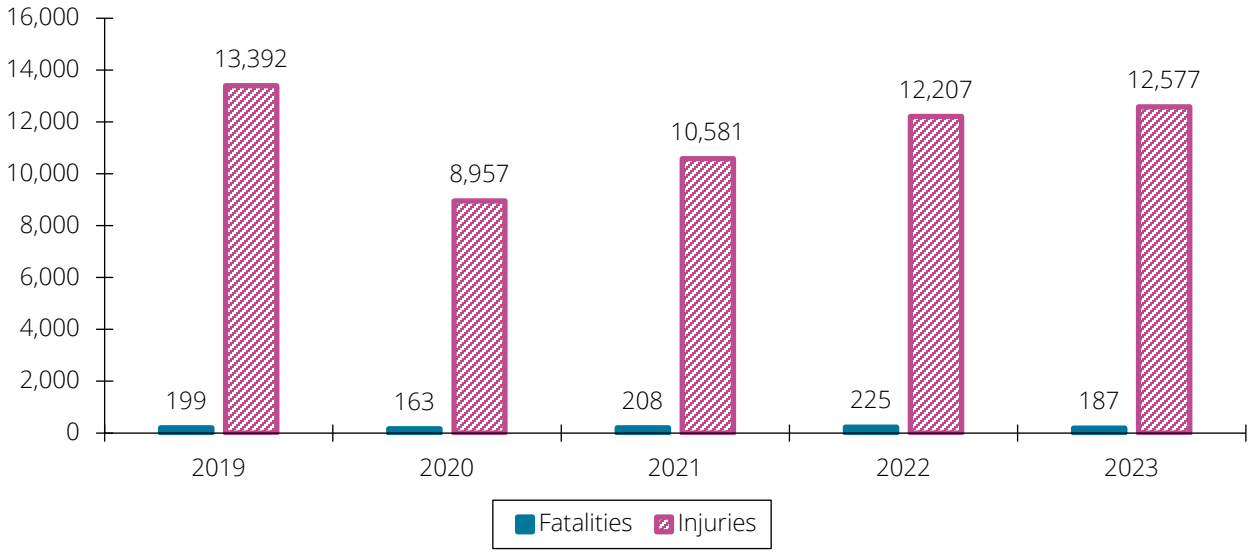
Figure 4.12 New York State Pedestrian/Bicyclist Injuries



Source: Institute for Traffic Safety Management & Research.

In 2019, NYMTC's planning area saw 199 pedestrian fatalities, while 13,392 pedestrians were injured. The pandemic year of 2020 saw these levels drop significantly, by 18 percent to 163 pedestrian fatalities and by 33 percent to 8,957 pedestrian injuries. Pedestrian fatalities increased in both 2021 and 2022 by 28 percent and 8 percent, respectively, before falling again in 2023 by 17 percent. Pedestrian injuries increased in all three subsequent years by 18 percent, 15 percent, and 3 percent respectively (Figure 4.13).

Figure 4.13 NYMTC Planning Area Pedestrian Fatalities and Injuries



Source: Institute for Traffic Safety Management & Research.

PEDESTRIAN AND BICYCLIST SAFETY FACTORS

Total crashes involving cyclists and pedestrians in the NYMTC planning area reached a 10-year low in 2020 following mandatory stay at home orders at the onset of the COVID-19 pandemic but quickly surged back up reaching a 10-year high in 2022. As discussed in the Active Transportation Plan, Appendix C, the vast majority (88 percent) of all bicycle and pedestrian crashes, and nearly three quarters (73 percent) of fatal bicycle and pedestrian crashes in the NYMTC planning area, occurred at or near an intersection. This is a strong indication of a broad design context that presents significant safety challenges for walkers, bikers, and micromobility users in the roadway. Specifically, lack of visibility at crossings, poor state of good repair, limited lighting, wide crossings with no median refuge, and other factors can all contribute to conflicts between motorized vehicles (cars, trucks, buses) and active modes.

The emergence of micromobility technologies and conveyances across the NYMTC planning area has expanded the scope and scale of active transportation, contributing to the increasing crash trends. The FHWA broadly defines micromobility as any small, low-speed, human- or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles, electric scooters (e-scooters), and other small, lightweight, wheeled conveyances that do not require a license or registration like cars, motorcycles, or mopeds. Many micromobility trips are taken as part of shared systems run by private operators, and rider familiarity may vary. Additionally, these conveyances often use bicycle lanes given travel speeds upwards of 20 miles per hour, which is too fast to comfortably share space with pedestrians. Insufficient regulation,

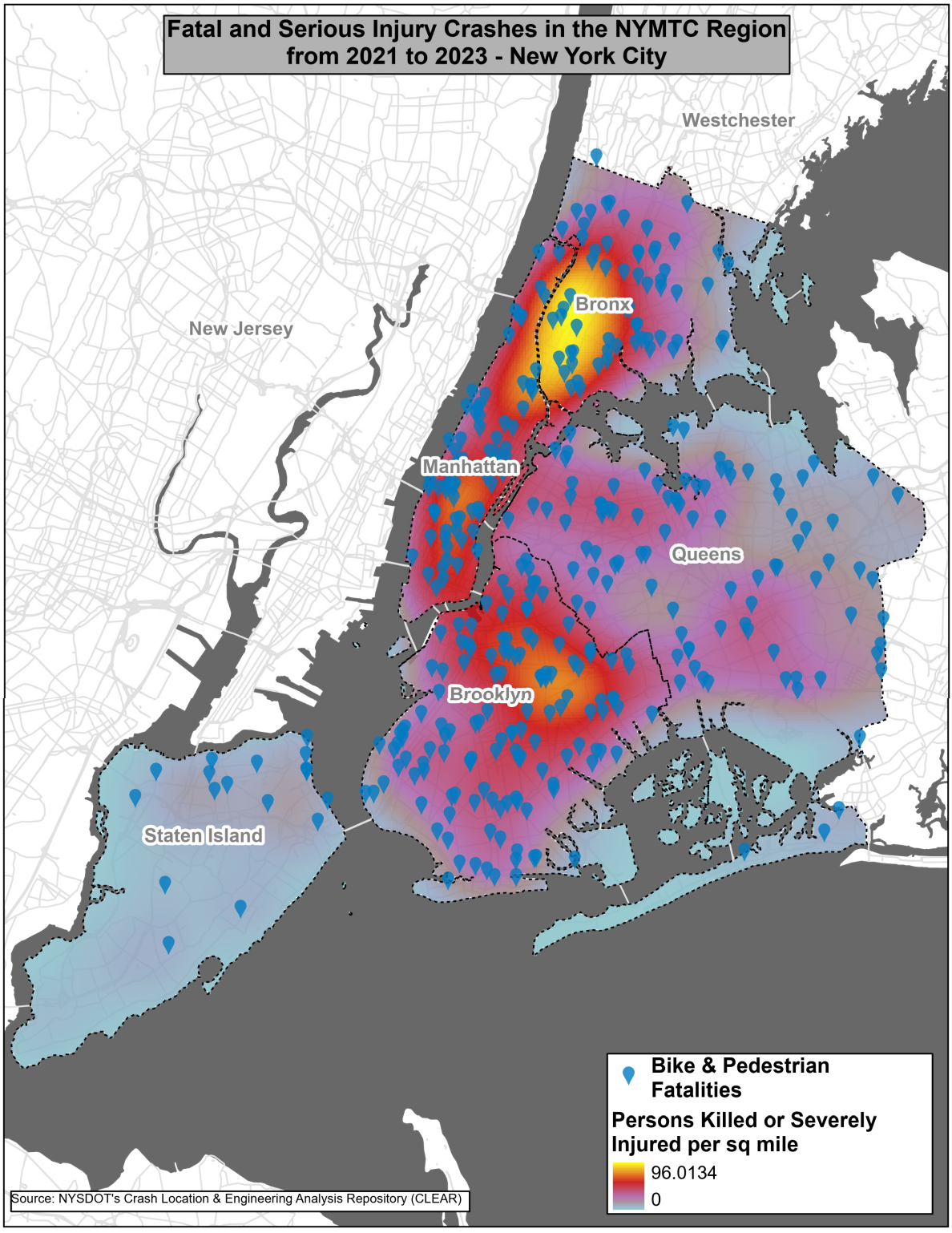
difficulty, and inconsistency in enforcement, differing modal speeds, varying micromobility familiarity, driver education and attention, infrastructure design and operation, user visibility, and unsafe user behavior are causing further conflicts.

MOTOR VEHICLE, BICYCLE, AND PEDESTRIAN SAFETY ANALYSIS

In addition to the trend assessments and descriptions of current conditions for traffic crashes provided in the sections above, a supplemental analysis for geospatial identification of higher-risk locations using New York State DOT's Crash Location & Engineering Analysis & Reporting (CLEAR) system is shown in Figure 4.14, Figure 4.15, and Figure 4.16. These maps depict all fatal and serious injury crashes as a heat map showing the highest risk locations over three years (2021–2023) compared to unique locations of fatal and serious injury bicycle and pedestrian crashes.

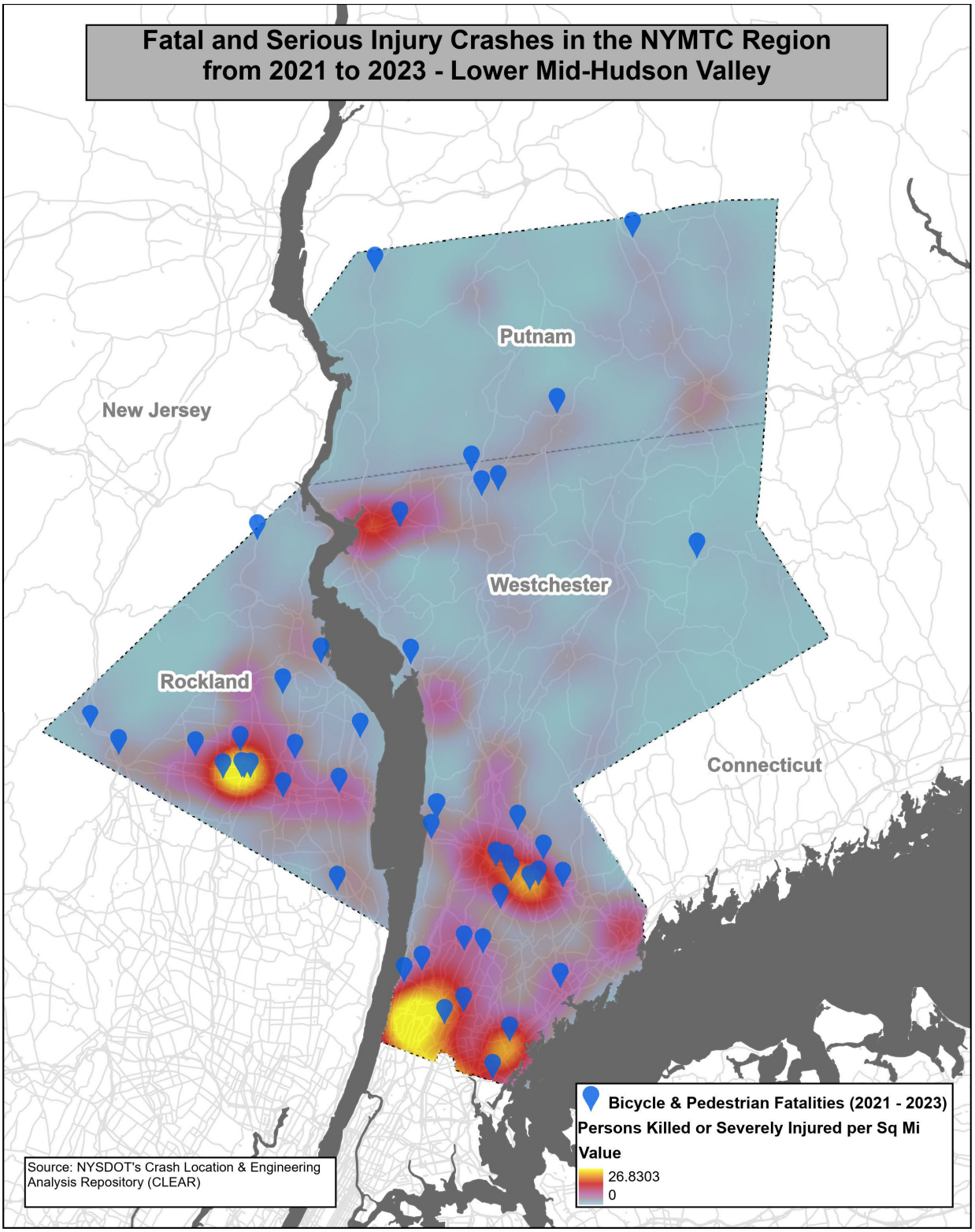
Data from the ITSMR was used to identify the frequency and severity of crash-related deaths and injuries in NYMTC's planning area by contributing factor. Outside of fatalities caused by the "other" factor (which is a combination of different factors or unmarked), unsafe speed, pedestrian/bicyclist error/confusion, and driver distraction contribute to nearly 62 percent of remaining fatalities.

Figure 4.14 Fatal and Serious Injury Crashes in the NYMTC Region from 2021 to 2023—New York City



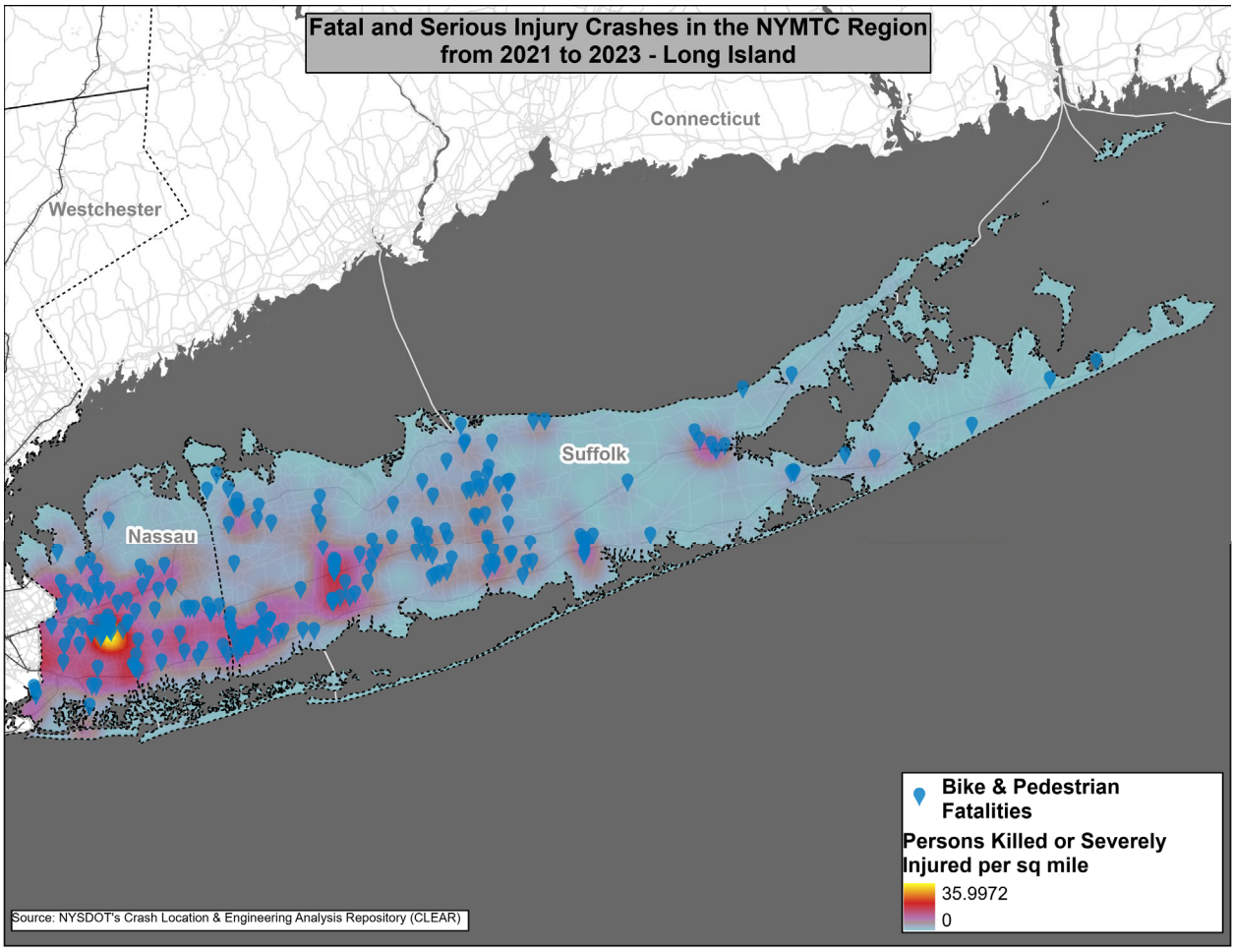
Source: NYSDOT's CLEAR.

Figure 4.15 Fatal and Serious Injury Crashes in the NYMTC Region from 2021 to 2023—Lower Mid-Hudson Valley



Source: NYSDOT's CLEAR.

Figure 4.16 Fatal and Serious Injury Crashes in the NYMTC Region from 2021 to 2023—Long Island



Source: NYSDOT's CLEAR.

Table 4.1 presents total fatality and injury rates per 10,000 population by county and borough from 2019 through 2023.

Table 4.1 NYMTC Planning Area—County/Borough Fatality and Injury Rates per 10,000 Population

County/Borough	2019	2020	2021	2022	2023
New York City					
Bronx	97.53	80.34	89.95	95.06	98.97
Kings	85.80	68.97	80.58	83.49	89.23
New York	61.03	46.07	57.23	59.63	62.99
Queens	100.35	72.68	82.70	88.18	100.41
Richmond	80.61	50.60	59.86	67.90	72.08
Long Island					
Nassau	116.63	82.64	96.73	107.90	108.68
Suffolk	110.67	80.80	95.71	91.54	99.15
Lower Hudson Valley					
Putnam	77.50	54.09	67.60	77.72	73.63
Rockland	85.55	62.35	69.13	80.38	85.62
Westchester	80.99	54.77	65.39	69.53	72.15

Source: Institute for Traffic Safety Management & Research.

PUBLIC TRANSPORTATION

As described in detail in Chapter 2, an immense, interrelated system of bus and rail services provides public transportation in NYMTC's planning area across multiple providers and jurisdictions. The safety and security of passengers using these services are the responsibility of these service providers and the counties and municipalities that contract for the service. These services are policed by relevant local municipal departments, as well as by the New York State Police. The FTA's National Public Transportation Safety Plan, published in 2024, noted that transit fatalities and injuries remain a significant concern despite comprising less than one percent of total fatalities and injuries across the country's surface transportation network. Over the last six years, there has been a general national increase in the number and rate of major transit safety events and fatalities reported to FTA's National Transit Database (NTD).

Transit providers operating within NYMTC's planning area report to the NTD. These providers are also required to develop and submit Public Transportation Agency Safety Plans (PTASPs), which are FTA-required safety plans for transit providers receiving Federal funds. The plans include the processes and procedures to implement a Safety Management System (SMS), which is a systematic approach to managing safety. The plans also report on safety events as a basis for adopting safety-related performance targets. Table 4.2 presents a compilation of available public transportation safety data.

Table 4.2 NYMTC Planning Area: Public Transportation Safety Events and Fatalities

	Fixed Route		Paratransit	
Year	Major Events	Fatalities	Major Events	Fatalities
2019	211	3	16	0
2020	134	3	13	0
2021	134	3	7	0
2022	145	5	11	0
2023	192	1	12	0

Source: NYSDOT Public Transportation Bureau.

Note: Major events include incidents (including accidents and derailments) meeting reporting thresholds for transit rail, bus, and paratransit. These events may occur on transit right-of-way or infrastructure, or at a transit revenue facility, maintenance facility, or rail yard. They may take place during a transit-related maintenance activity or otherwise involve a transit revenue vehicle. Examples of these events include collisions, fires, derailments (mainline and yard) including non-revenue vehicles; hazardous materials spills; and acts of God.

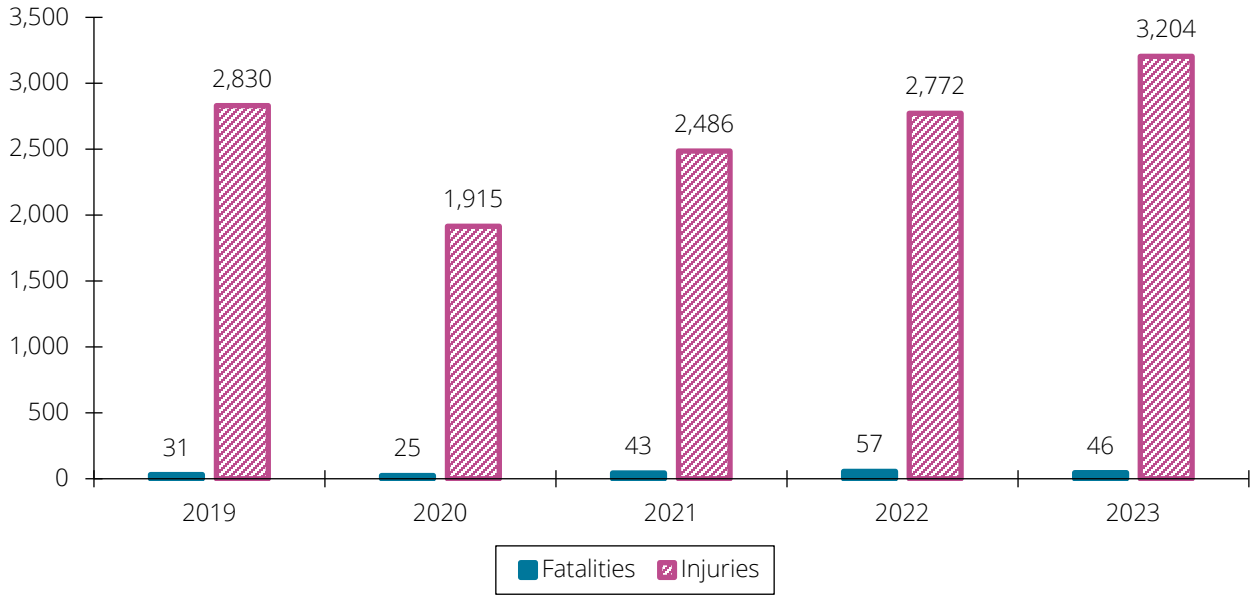
FREIGHT TRANSPORTATION

In 2023 across NYMTC's planning area, 3,250 traffic crashes involving large trucks resulting in fatalities or injuries took place with 46 of which resulting in fatalities and represented 10 percent of traffic crashes involving fatalities. The remainder, 3,204 crashes, resulted in injuries, represented 4 percent of all traffic crashes resulting in injuries that year.

The 31 large truck crashes causing fatalities in 2019 were roughly 33 percent lower than injury crashes in 2023. This level dropped to 25 large truck crashes leading to fatalities in the 2020 pandemic year, after which there was a 39 percent increase over the pre-pandemic 2019 level to 43 crashes in 2021 and an 83 percent increase over 2019 levels in crashes involving fatalities to 57 crashes in 2022. The number of crashes moderates to 46 in 2023, which is still 48 percent higher than the number of crashes in 2019.

Regarding large truck crashes resulting in injuries, the pre-pandemic 2019 level of crashes (2,830 crashes) was 12 percent lower than those in 2023. The pre-pandemic crash level dropped 32 percent to 1,915 crashes causing injuries in the pandemic year. The pandemic year was followed by three years of annual increases above the previous year, 30 percent in 2021, 12 percent in 2022 and finally a 16 percent increase in 2023. Figure 4.17 presents these trends for both crashes involving fatalities and those involving injuries.

Figure 4.17 NYMTC Planning Area—Large Truck Crashes



Source: Institute for Traffic Safety Management & Research.

TRANSPORTATION SECURITY

Transportation security in the NYMTC planning area and the multi-state metropolitan region is the responsibility of many agencies and institutions. At the regional and local levels, disaster preparedness and emergency response planning are led by county, municipal, and local governments responsible for developing their own emergency management plans for their respective areas, and through New York State's Office of Emergency Management (OEM).

EXISTING INITIATIVES

NYMTC as an organization, as well as its members, have various initiatives in place to address issues of safety and security in the NYMTC planning area. These initiatives address existing risks and consider the recommendations of various Federal agencies, including the NHTSA.

STATEWIDE AND REGIONAL SAFETY PLANNING

- Strategic Highway Safety Plan—New York State's SHSP promotes best practices and strategies that have a substantial impact on reducing fatal and serious injury crashes. The SHSP is a major component of the Federal Highway Safety Improvement Program (23 USC Section 148) and is developed through a collaborative process involving public and private sector safety partners. The SHSP is intended to complement the other strategic planning processes undertaken in the state to meet Federal eligibility requirements for funding in specific program areas.
- Vulnerable Road User (VRU) Safety Assessment—NYS was the first state in the Nation to complete a VRU Assessment, which identifies communities that will benefit most from targeted interventions to improve road safety outcomes for VRUs. According to the National Road Safety Strategy, VRUs are

road users not in a car, bus, or truck, generally considered to include pedestrians, motorcycle riders, cyclists, children seven years and under, the elderly, and users of mobility devices. In the event of a crash, these users have little to no protection from crash forces.

- Regional Transportation Plan Safety and Security Goal Module—NYMTC's Safety and Security Goal Module in its RTP contains the enhancements needed for the existing applicable sections of the RTP to comprise a regional Safety Action Plan aimed at preventing roadway fatalities and serious injuries in a locality, Tribe, or region. Federal planning grant awards have also been made for more localized safety actions plans on Long Island (Nassau County, City of Long Beach, towns of Brookhaven and Huntington, and villages of Sea Cliff and Upper Brookville) and in the Lower Hudson Valley (cities of Mount Vernon, White Plains and Peekskill, Town of Kent, villages of Airmont, Mamaroneck and Pleasantville) at the time of this writing.

PEDESTRIAN AND BICYCLE SAFETY

- Pedestrian Safety Workshops—NYMTC has hosted FHWA workshops on designing for pedestrian safety for local officials in its planning area. Workshop participants have learned about effective solutions and best practices in roadway design and operations for pedestrian safety, as well as the role that planning and street design play in providing safe pedestrian environments. Workshop participants have included engineers, planners, traffic safety and enforcement professionals, public health, and injury prevention professionals and, decision-makers looking for ideas and solutions for making changes to the physical environment that improve pedestrian safety.

- New York City Pedestrian Safety Study and Action Plan is a comprehensive analysis of over 7,000 pedestrian crash records in NYC that resulted in serious injuries or fatalities, aiming to pinpoint the primary causes of these incidents and develop strategies to improve pedestrian safety across the city by implementing targeted interventions based on the identified issues.
- New York City's Vision Zero Pedestrian Safety Action Plans—First released in early 2015 and updated in February 2023 with newer data. The plans describe the Vision Zero program and outline a framework for improving pedestrian safety. They also present a toolkit of engineering interventions and is NYC DOT's comprehensive approaches to address pedestrian fatalities and serious injuries in New York City.
- Pedestrian and Bicycle Safety in Nassau County—This program teaches middle school children about general pedestrian and bicycle safety best practices. In addition, the New York Coalition for Transportation Safety (NYCTS) conducts pedestrian and bicycle safety education programs and events throughout Nassau County at schools, churches, senior centers; as well as at locations requested by elected officials.
- Pedestrian and Bicycle Safety in Queens, Nassau, and Suffolk Counties—This program teaches school children K-12, adults, older adults, and people with disabilities about New York State Vehicle and Traffic Laws, traffic signs, roadway striping and the correct use of traffic control devices, and best practices for pedestrian and bicycle safety. Bicycle lanes, protected bicycle lanes, and bicycle routes are all defined, and examples of their usage are provided. Programs are conducted at

schools, churches, senior centers, business organizations, health, and wellness facilities in conjunction with trauma coordinators at all local hospitals.

» Safe-Streets-for-Seniors—This pedestrian safety initiative is focused on older residents. Programs examine crash data and other variables such as senior trip generators, concentrations of senior centers, and senior housing locations, and develop and implement mitigation measures to improve the safety of seniors and all road users. NYC DOT has developed several Senior Pedestrian Focus Areas for implementation of safety projects; NYS DOT has several initiatives in Nassau and Suffolk counties; and Westchester County has a Livable Communities Collaborative for Aging Services that works on addressing senior pedestrian issues.

TRAFFIC SAFETY

» National Highway Traffic Safety Grants—Federal grants to support state and community highway safety programs to reduce deaths and injuries. The Governor's Traffic Safety Committee Highway Safety Strategic Plan sets priorities, directs program efforts, and assigns NYS resources.

» New York State's Strategic Highway Safety Plan—NYSDOT published the SHSP 2023–2027 update to continue to promote best practices and strategies that if implemented could have a substantial impact on reducing fatal and injury crashes.

» Wet Night Reflective Pavement Markings—These pavement markings will be required on urban interstate highway segments to be treated within the next several years.

» New York City Vision Zero—Implemented in 2014, New York City's Vision Zero initiative is based on the premise that traffic deaths and severe injuries are preventable and can be systematically addressed rather than regarded as unavoidable "accidents." Led by a coalition of New York City agencies, Vision Zero involves a comprehensive program of engineering, enforcement, and education. Current initiatives include:

» Speed Management—New York City has implemented the largest automated speed enforcement program in the United States. The citywide default speed limit was lowered to 25 miles per hour in 2014 in conjunction with the retiming of traffic signals to encourage following this limit. As of 2024, over 2,500 speed cameras are in operation in 750 school speed zones. Starting in 2022, speed cameras now operate 24 hours a day, seven days a week, year-round. In May 2024, Governor Kathy Hochul signed "Sammy's Law," allowing New York City to further lower the speed limit to 20 mph.

» Street Improvement Projects—NYC DOT has expanded capacity to make design interventions, including bicycle lanes, pedestrian islands, sidewalk and curb expansions, speed bumps and cushions, and left turn traffic calming installations that reduce the likelihood of crashes happening or the severity of those that do take place. NYC DOT installs about 100 of these projects per year.

» Expansion of the Bicycle Network—NYC DOT has built more than 500 lane miles of bicycle lanes since the start of Vision Zero.

- Focused Enforcement—Vision Zero is a data focused initiative. As a result, the New York City Police Department has concentrated its traffic enforcement efforts on the offenses shown to injure and kill the most pedestrians and cyclists: speeding, failure to yield, disobeying stop signs and signals, cell phone usage (including texting), and improper turns.
- Schools-Based Safety Education—These specialized programs for all ages of students teach safe pedestrian behavior and responsible motor vehicle operation and include "Alive at 25," a partnership with the National Safety Council for new teenage drivers.
- Vision Zero Street Teams and High-Visibility Enforcement—A partnership between NYC DOT and the New York City Police Department (NYPD), this initiative engages the public in areas around priority high crash corridors.
- Dusk and Darkness Driver Outreach—This education and enforcement campaign addresses increased crash rates during evenings in the fall and winter months.
- For-Hire Vehicle Safety—The New York City Taxi and Limousine Commission (NYC TLC) provides comprehensive safety training for its licensed drivers and enforcement of traffic laws by its team of officers. The Commission also provides annual recognition for the safest for-hire vehicle drivers, including those who have worked for multiple years without any violations or collisions.
- City Fleet Safety—The New York City Department of Citywide Administrative Services (NYC CAS) provides defensive driving training to employees whose job responsibilities include driving a city-owned vehicle. The Safe Fleet Transition Plan has set out requirements for the purchase of safer vehicles for the New York City fleet. The fleet also has the country's largest program of side guard installations and telematics systems to monitor and address dangerous driving behaviors.

- Freight Safety Program—The Freight Safety Program coordinates multiple data driven initiatives aimed at increasing the safety of the NYC freight sector. The program coordinates street improvements and educational interventions in areas of high numbers of truck crashes with large populations of VRUs. The program also supports task force meetings, media campaigns, and the distribution of educational literature, videos, and related resources aimed at increasing truck driver compliance within NYC and the region. The program oversees and advises on outreach initiatives about the dangers of large vehicle blind spots for the public. The program has also supported NYC efforts to promote safety technologies such as truck side guards through regulations, procurements, and education. As urban freight transport becomes more multimodal, the Freight Safety Program studies safety for other freight modes.
- Motorcycle Safety Program—Similarly, the program includes educational outreach to motorcyclists and other road users to help improve motorcycle safety.
- Other Vision Zero programs include safety education for senior citizens and commercial cyclists, bike helmet distribution programs, print media and radio communications campaigns targeting dangerous driving behavior, a truck safety task force, improved safety standards for trade waste vehicles licensed by or registered with the Business Integrity Commission, training for MTA bus drivers, collaborative public health research and data releases related to vehicle crashes, and targeted seizures of vehicles subject to outstanding judgments by the Office of the Sheriff.

- Westchester County's Community Traffic Safety Program—The program educates the public and promotes safe driving behaviors to reduce the number of injuries and fatalities. The County's Plan4Safety Community Traffic Safety Awareness grant program, funded through the Governor's Traffic Safety Committee and NHTSA, is a community outreach program to bring the message of traffic safety and injury prevention to the community. The Police Traffic Services Block Grant provides funds to local Westchester police agencies and Westchester County Police to conduct traffic law enforcement for motorist violations based on agency jurisdictions' traffic and crash data.
- Police Traffic Services Block Grant Program—Underwritten by the Governor's Traffic Safety Committee, this program funds communities in Rockland County to bring the message of traffic safety to residents. In May of each year, the Rockland County Sherriff's Office runs a special program called Buckle Up New York and conducts two major events annually for the Child Passenger Safety Program to ensure proper fitting and use of child car seats.
- STOP-DWI and Other State Programs—These programs address impaired driving in five areas: education/public information, enforcement, court related, rehabilitation, and probation. In addition, several other programs address aggressive driving behavior and occupant protection, including the Selective Traffic Enforcement Program, Buckle Up New York, and Child Passenger Safety. Selective Traffic Enforcement Program encourages jurisdictions to use local data to identify problem areas and to develop enforcement countermeasures that reduce crashes, injuries, and fatalities. Buckle Up New York grants are for seat belt enforcement and compliance. Child Passenger Safety grants support child passenger fitting stations, training, and child restraint education.

MULTIMODAL PROGRAMS

- High Crash Corridor Programs—NYSDOT's "corridor approach" identifies systemic improvements to be implemented throughout a study corridor. Current corridor approach projects in Long Island include the Town of Brookhaven Pedestrian Safety Signal Improvements project. This project will include the implementation of Rectangular Rapid Flashing Beacon (RRFB), pedestrian signal upgrades, pavement markings, and the construction of ADA-compliant pedestrian ramps.
- Intersection Improvement Projects—These range from adjusting the timing of traffic signals to reconstruction. Locations are evaluated considering such issues as accident history and pedestrian and vehicle traffic volumes to determine the best treatment to maximize pedestrian safety. Treatments include retiming traffic signals; adding crosswalks or upgrading existing crosswalks for higher visibility; restricting parking near the intersection; installing pedestrian signals; installing new signage; adding pavement markings in advance of a crosswalk; and adding pedestrian refuge islands and/or curb extensions.
- Safe-Routes-to-Transit—A New York City initiative to improve pedestrian and motor vehicle movement around subway entrances and bus stops to increase access, safety, and convenience of mass transit. The program identifies high-priority locations through crash data analysis and transit rider counts. At high-priority locations, NYC DOT implements safety and accessibility improvements such as curb extensions, bus boarding islands, and sidewalk construction.

- Rail Crossing Safety—According to the Federal Railroad Administration, a highway-rail grade crossing is a location where a public or private road, street, sidewalk, or pathway, intersects railroad tracks at the same level. At-grade rail crossings present a significant safety challenge. Current initiatives include:
  - Rockland County is pursuing a plan to install supplemental safety measures—primarily four quadrant gate systems—at 13 railroad grade crossings between Railroad Avenue and Andre Avenue along the West Shore (River) freight line where several accidents have occurred over the years. This project will improve safety and enable the County to pursue a Railroad Quiet Zone in this corridor.
  - MTA's Long Island Railroad (MTA LIRR) and Metro-North Railroad (MTA MNR) have been working at either eliminating or improving the safety of at-grade crossings. As of 2024, MTA LIRR has 289 grade crossings throughout its system, all of which have safety delineators. A total of seven grade crossings have been eliminated or closed as part of the MTA LIRR Expansion Project.
  - MTA MNR's and MTA LIRR's TRACKS Programs are safety education community outreach programs designed to promote safe behaviors at or around railroad grade crossings and tracks. The objective of these programs is to educate as many drivers, passengers, pedestrians, and individuals that live and/or work in or around the communities that MTA railroads serve.
  - NYSDOT manages the Railway Highway Crossings Program, which provides Federal funds to eliminate hazards at grade crossings. The program focuses on improving safety at existing grade crossings primarily through the installation of warning devices, including installation or replacement of active warning devices (flashers and gates), track circuitry improvements, interconnections with highway traffic signals, and crossing surface improvements.
- Complete Streets—On October 2011, Governor Andrew Cuomo signed the Complete Streets Law. The Complete Streets Law requires state, county, and local agencies to consider the needs of all roadway users when planning transportation projects that receive state and Federal funding.

PUBLIC TRANSPORTATION SAFETY

Transit providers in the NYMTC planning area have established safety programs to protect passengers, employees, revenues, and property.

- Public Transportation Agency Safety Plans—According to the FTA, the Public Transportation Agency Safety Plans (PTASP) regulation (49 CFR Part 673) requires public transportation operators receiving Federal funds under the FTA Urbanized Area Formula Grants (Section 5307), and rail transit agencies subject to the FTA State Safety Oversight (SSO) program, to develop an Agency Safety Plan (ASP) that includes the processes and procedures to implement a Safety Management System (SMS). SMS is a comprehensive, collaborative, and systematic approach to managing safety.

COMMERCIAL VEHICLE SAFETY

As part of its Vision Zero safety programs, New York City hosts a truck safety task force with private industry fleets and holds an annual Fleet Safety Forum that brings together private and public fleet operators with safety advocates and technology providers to work together to improve fleet safety. New York City also maintains a Truck Safety Toolkit for vehicle operators and fleet owners. NYS Motor Carrier Safety Assistance Program promotes highway safety and reduces commercial vehicle related crashes and hazardous materials incidents by removing unsafe trucks, unsafe loads, and unqualified drivers from the highways.

TRANSPORTATION SECURITY

NYMTC members are involved in ongoing and coordinated efforts to protect the overall transportation system and respond as required to unforeseen natural events and disasters. Efforts include yearly participation in emergency simulations to train personnel. At the regional and local levels, disaster preparedness and emergency response planning are led by county, municipal, and local governments responsible for developing local emergency management plans as well as through the NYS OEM.

TRANSPORTATION SAFETY DATA

Transportation safety data is at the center of the evaluation of safety issues as well as planning and implementation of safety programs. Federal transportation legislation emphasizes a data-driven approach to safety planning, gathering and analyzing data, identifying needs, and investing safety funds accordingly.

Some of NYMTC's major tools/data systems used in safety planning include:

- CLEAR Crash Data Viewer is an application provided by NYSDOT that is available to authorized users for the visualization, query, and analysis of crash data. The application provides users with pre-configured dashboards and reports, as well as robust query functionality allowing users to locate, search, visualize, and analyze crashes using both a tabular grid and interactive map display.
- NYC DOT developed the Traffic Safety Data Viewer to allow easy access to detailed data by planners, analysts, and project managers in a user-friendly interactive map format. Users can display all injury and fatality data on a map of New York City or generate an analysis of the crash history for a given location. The Safety Data Viewer application provides functionality for post-implementation effectiveness analysis to allow a quick safety impact analysis of projects to inform future work. This feature outputs a tailored report that compares age, mode, time of day, and other crash characteristics.
- The Governor's Traffic Safety Committee funded the Institute for Safety Management and Research to design and develop a traffic safety repository that is publicly accessible via the Internet. The Institute then built a system known as the Traffic Safety Statistical Repository that captures crash and police ticket data.

4.2.4 RECOMMENDED STRATEGIES AND ACTIONS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan and contain the following requirement:

> *The transportation plan shall include both long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system (including accessible pedestrian walkways and bicycle transportation facilities) to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand.*

Several categories of short- and medium-range strategies and actions recommended in pursuit of this vision goal are described below. Additionally, specific projects, programs and studies recommended for funding in the fiscally constrained element of *Moving Forward 2055*, as well as those recommended for future consideration in the speculative vision element of the Plan, appear in Appendix A.

PLANNING AND RESEARCH INITIATIVES

- Assess the Federal Aid roadway system using CLEAR and identify safety focus locations.
- Review security-related funding requirements, programs, and funding sources.
- SAWG to recommend prioritization approach for safe streets, intersections, railroad grade crossings and shared-use right-of-ways, and to establish road safety initiatives.
- Undertake benchmarking research from other regions on safety management, training, education, and enforcement.
- Undertake benchmarking research from other regions on operational safety and security; connected vehicle programs and policies; and driver assistance programs.
- Gather input from members' operational staff and undertake an operational safety review as a discretionary study.
- Consider a comprehensive assessment of connected vehicle programs and policies, and driver assistance programs based in part on New York City's pilot program.
- Inventory current and developing technology that can be used to improve safety-related enforcement.

DATA COLLECTION, FORECASTING, AND PERFORMANCE ASSESSMENT

- Coordinate safety data collection through the MAP Forum.
- SAWG to develop recommendations on the enhancement of the safety data program.
- SAWG to develop a research approach to gathering safety input from the public.
- SAWG to develop recommendations on the collection of grade crossing safety data.
- Collect operational safety data from all NYMTC members.

PLANNING PROCESS RECOMMENDATIONS

- SAWG to develop recommendations for considering safety and security in project selection.
- SAWG to develop a more coordinated process for Highway Safety Improvement Program project selection.
- SAWG to identify multi-agency safety initiatives.
- SAWG to identify other relevant safety, security and enforcement agencies, and operational units, to bring into the process.

PROGRAM RECOMMENDATIONS

- Implement the recommendations of the safety coordination study for the suburban counties and the safety aspects of the transit service coordination study.

4.2.5 PERFORMANCE MEASURES

23 CFR 450.324 governs the development and content of the metropolitan transportation plan. These regulations contain the following requirements:

> *The transportation plan shall include a description of the performance measures and performance targets used in assessing the performance of the transportation system.*

The performance measures designated for NYMTC's System Performance Report are detailed in Chapter 3 of *Moving Forward 2055*.

4.3 VISION GOAL—INFRASTRUCTURE

We seek to establish and maintain a transportation system for which infrastructure is maintained and improved in a sustainable manner.

4.3.1 DESCRIPTION

The infrastructure goal focuses on promoting measures that support safety, durability, resilience, environmental sustainability, and effective asset management. It also targets fostering a fair approach of the maintenance and improvement of the transportation system, increasing productivity, and maintaining competitiveness through contributions to improved mobility and accessibility.

4.3.2 OBJECTIVES

- Maximize environmental/fiscal sustainability and minimize carbon intensity when maintaining, improving, modernizing, and/or replacing transportation infrastructure.
- Reimagine and repurpose the assets that comprise the region's transportation infrastructure to reconnect communities and improve accessibility across all modes.
- Rebuild, replace, and/or modernize needed transportation assets for passengers and freight.
- Invest in the integration of the region's multimodal transit network.
- Create efficient and environmentally sound freight networks, systems, and facilities.
- Plan and manage work zones and Maintenance and Protection of Traffic programs to efficiently advance infrastructure upkeep.
- Plan for the development and use of advanced technologies and materials.

4.3.3 RECENT TRENDS, CURRENT CONDITIONS, AND EXISTING INITIATIVES

RECENT TRENDS AND CURRENT CONDITIONS

Section 2.3 of Chapter 2 of *Moving Forward 2055* provides a detailed description of the transportation system in NYMTC's planning area as one of the most complex and heavily used global systems with critical components of regional and national transportation networks moving both people and goods. The share of these public transportation passenger trips is much higher than in other U.S. metro regions. More detail on the region's multimodal transportation system is available for viewing in the *Moving Forward 2055* Interactive Map.

SYSTEM PRESERVATION

The extensive transportation infrastructure in NYMTC's planning area must be continuously maintained and modernized. As infrastructure continues to age, preserving the transportation system is an ongoing challenge that includes:

- Pavement maintenance, rehabilitation, and reconstruction.
- Bridge maintenance, rehabilitation, and replacement.
- Replacement of public transportation buses, vans, and rail cars.
- Maintenance and preservation of other transit amenities, facilities, and equipment.
- Preservation of other elements of the transportation system (including active transportation facilities).

In the longer term, Chapter 5 of *Moving Forward 2055* forecasts that preservation of the transportation system during the period of the Plan will absorb 89 percent of the funding expected to be reasonably available through the Plan's 2055 horizon year ($684 billion of an available $770 billion). This enormous need to preserve an extensive, aging, and complex network of transportation facilities and equipment in effect constitutes an overhead cost for the provision of mobility to people and goods. In addition, the fact that this infrastructure is spread out over three islands and a substantial section of the mainland—an area that is bisected by a large harbor and a major river—yields a web of water crossings that add substantially to system preservation needs.

SYSTEM ENHANCEMENTS

As described in Section 2.2.4 of Chapter 2 of *Moving Forward 2055*, due to the continued regional growth across population, employment, and travel, several regionally significant improvements to the transportation infrastructure are needed despite the overarching system preservation costs. As represented in Chapter 5 of *Moving Forward 2055*, major New York City-focused projects include the second phase of the Second Avenue Subway in Manhattan, the Hudson Tunnel and various other trans-Hudson River rail and vehicular crossing improvements, the Interborough Express in Brooklyn and Queens, and commuter rail improvements involving Penn Station. Other system enhancements under consideration include several key north-south corridors on Long Island and east-west corridors in the lower Hudson Valley.

TECHNOLOGICAL DEVELOPMENTS

Recent shifts in technology within transportation are potential game-changers revolutionizing how people travel through a region, and infrastructure must adapt to meet new needs of future travelers.

DECARBONIZATION

Decarbonization is the process of significantly reducing or eliminating certain harmful pollutants from the atmosphere that pose public health and environmental risk. The term "decarbonization" generally captures

pollutants such as carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, nitrogen trifluoride, perfluorocarbons, and hydrofluorocarbons.

ELECTRIFICATION

Electrification converts an energy-consuming device, system, or sector from non-electric sources of energy to electricity. It is an emerging economy-wide decarbonization strategy. Electrification is not necessarily the goal, rather a means to achieving a community goal such as reducing pollution or lowering energy costs.[1]

Electric vehicle adoption is increasing as the technology evolves and costs diminish. Continued growth will require attention to supporting charging infrastructure for vehicles propelled fully or partially by electric motors powered by battery packs. Compared to fossil fuel vehicles, EVs have greater energy efficiency, produce less pollution, and cost less to operate. However, there are still issues with the range of EVs, although technological evolution is gradually addressing the range issue.

In addition to personal vehicles, the first hybrid electric buses and taxis entered service in New York City in 1998 and 2005, respectively, while the first all-electric buses entered service in 2019.[2] As part of New York State's initiative to get more electric cars and trucks on the road. the Charge Ready NY program has supported the installation of over 4,000 charging stations.[3] New York State has also revised regulations to clarify charging station ownership rules and supported research and demonstration projects on new EV technologies and policies.[4]

EXISTING INITIATIVES

There are several initiatives that are geared towards either maintaining or rehabilitating current transportation infrastructure throughout the NYMTC region. Examples of such programs follow.

- NYMTC Transportation Improvement Program (TIP)—The majority (71 percent, $15.958 billion) of Federal funding programmed in the FFYs 2026–2030 TIP is targeted to the preservation of the existing transportation system. Note, this percentage and amount does not account for unprogrammed Federal fund balances for system preservation or enhancement.
- MTA Capital Program—The 2025–2029 Capital Plan is the largest capital investment of state of good repair in the MTA's history, with over 90 percent dedicated to rebuilding and improving the system.
- NYSDOT Five Year Capital Plan—The infrastructure investments made through the Capital Plan are intended to create jobs while maintaining safety of the system; manage State infrastructure assets so that New York remains competitive; leverage State resources to generate billions in new construction and economic growth; and mitigate the impacts that future extreme weather events may have on New Yorkers and the State's economy.[5]
- New York City Ten-Year Capital Strategy—The City's strategy over the next 10 years highlights its intention to make substantial investments in capital projects to advance fairness and account for neighborhood and citywide needs, and fiscally-responsible adaptation to City budget changes.[6]

- County Capital Programs—Each of the suburban counties in NYMTC's planning area provides funding for county-owned facilities and equipment, including county-owned roadways and bridges, as well as transit facilities and equipment.
- BridgeNY Program—NYS makes Federal and state funding available for local governments to rehabilitate and replace bridges and culverts statewide. These strategic infrastructure investments provide unprecedented support for making the State's communities more resilient to the impacts of extreme weather events, which not only enhances the safety and reliability of these structures but also facilitates regional and global economic competitiveness.[7]
- Suffolk County Bridge Preventative Maintenance—Suffolk County has an overarching bridge preventive maintenance program that aims to extend the useful life of its current transportation infrastructure. The program includes repainting and corrective repairs, cyclical cleaning, and other measures to extend the useful life of its existing roadway infrastructure.
- Charge Ready NY 2.0—Charge Ready NY 2.0 offers rebates to public, private, and not-for-profit organizations to install Level 2 EV charging stations at workplaces, multi-unit dwellings (multifamily properties) or public facilities owned and operated by municipal or state Government entities.[8]
- Westchester County Vehicle Charging Stations—Westchester County is in the process of establishing vehicle charging stations at county-owned facilities. The County currently has electric charging locations at roughly 75 locations, but the number will rise in the near-term future. Westchester County also has a capital project that supports its municipalities by providing funding for electric vehicle charging locations.
- Rockland County has various municipal and private charging stations throughout the County, most recently installed at the new Monsey Park and Ride Lot and Exit 14 Park and Ride. Future installations at county and state owned park and ride lots are being considered.

4.3.4 RECOMMENDED STRATEGIES AND ACTIONS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan and contains the following requirement:

> *The transportation plan shall include both long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system (including accessible pedestrian walkways and bicycle transportation facilities) to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand.*

Several categories of short- and medium-range strategies and actions recommended in pursuit of this vision goal are described below. Additionally, specific projects, programs, and studies recommended for funding in the fiscally constrained element of *Moving Forward 2055*, as well as those recommended for future consideration in the speculative vision element of the Plan, appear in Appendix A.

PLANNING AND RESEARCH INITIATIVES

- Research less carbon-intensive sources of asphalt, tarmac, and concrete.
- Perform benchmarking research of other reconnecting community projects across the country.
- Research techniques and technologies for improving seamless integration between transit services.
- Research techniques and technologies for improving freight systems efficiency and environmental sustainability.
- Research techniques and technologies for improving work zone and maintenance and protection of traffic programs

DATA COLLECTION, FORECASTING, AND PERFORMANCE ASSESSMENT

- Compile a central database of infrastructure conditions to use as a basis for system preservation projects.
- Compile a database of active work zones in the planning area.

PLANNING PROCESS RECOMMENDATIONS

- Incorporate environmental/fiscal sustainability considerations into project selection.
- Identify candidate infrastructure components and communities for repurposing.
- Consideration of infrastructure conditions by the transportation coordinating committees.
- Pursue the recommendations of the Transit Service Coordination Needs Assessment.
- Pursue the recommendations of the Clean Freight Corridors Planning Study and the Regional Waste Movement Study.

PROGRAM RECOMMENDATIONS

- Continue lifecycle replacement of existing transit fleets with low or zero-emission vehicles.
- Utilize available Federal discretionary funding sources to address candidate infrastructure.
- Maintain system preservation emphasis within project selection for relevant Federal fund sources.
- Explore additional service integration opportunities through the Transportation Systems Management and Operations (TSMO) Working Group and Metropolitan Mobility Network.
- Explore additional freight system integration opportunities through the PFAC Freight Subcommittee and Multi-State Freight Working Group.

4.3.5 PERFORMANCE MEASURES

PERFORMANCE METRICS

In Chapter 3 of *Moving Forward 2055*, a System Performance Report, required by Federal law through 23 CFR 450.324, describes the condition and performance of the transportation system, identifies relevant performance targets, and reports on current progress in meeting the targets. It addresses the federally required performance measures and targets for highway safety, bridge condition, pavement condition, highway system performance, freight reliability, congestion and emissions, transit asset management, and transit safety. The infrastructure-related performance measures identified in Chapter 3 will be used to measure progress toward this Infrastructure goal and its objectives.

4.4 VISION GOAL—RESILIENCE

We seek to establish and maintain a transportation system for which resiliency is supported through mitigating, adapting to, and responding to chronic and acute stresses and disruptions.

4.4.1 DESCRIPTION

This goal seeks to enhance the transportation system's resilience to stressors and disruptions that will have a growing impact across the region in the longer term. These include sea level rise, and more frequent extreme weather; related impacts such as power outages and transportation disruptions; human-caused stressors such as cyberattacks and acts of terrorism; and public health emergencies. The goal also seeks to inform the ongoing recovery process from past and current stresses and disruptions through feasible, cost-effective strategies to reduce and manage vulnerabilities, advance the state of knowledge, and develop methods to assist agencies in the region to plan and invest for long-term, "all hazards" resilience.

4.4.2 OBJECTIVES

- Protect and fortify major transportation assets.
- Invest in extreme weather vulnerability analyses and material solutions for transportation assets.
- Improve regional coordination on emergency and long-term responses to systemwide extreme weather impacts and sea level rise.
- Enhance the transportation network's resiliency by increasing travel options and redundancies.
- Collaborate on resiliency projects that have significant transportation implications.
- Coordinate across jurisdictions to advance resiliency and sustainability.
- Prioritize resiliency and sustainability in a manner that considers the needs of designated Communities of Concern.
- Invest in future energy infrastructure to minimize the impact of grid events and supply chain disruptions on the transportation system and its users.
- Promote resiliency strategies that account for environmental determinants of health and their impact on vulnerable communities.

4.4.3 RECENT TRENDS, CURRENT CONDITIONS, AND EXISTING INITIATIVES

RECENT TRENDS AND CURRENT CONDITIONS

ENVIRONMENTAL AND EXTREME WEATHER STRESSORS

The transportation assets in the NYMTC planning area have differing levels of protection from environmental and extreme weather stressors and disruptions. A defining extreme weather event took place in October 2012, when a "post-tropical" Hurricane Sandy, also known as "Superstorm Sandy," caused catastrophic damage to transportation assets in the multi-state metropolitan region. Sandy's storm surge, which coincided with the highest tide of the month, caused sea levels along the New Jersey coast, on Staten Island and in Brooklyn and lower Manhattan, and on Long Island's south shore to rise higher than recorded history. Many critical transportation facilities were inundated, transit services were suspended, and roadway facilities were shut down. The storm impacted the reliability of the region's multimodal transportation system.

Since that time, the fortification of transportation facilities and equipment has become a particular focus of owners and operators of transportation services and facilities. New York State, New York City, suburban counties, local municipalities and public authorities such as the MTA, New York State Thruway Authority, and the Port Authority of New York and New Jersey (PANYNJ) have all expended resources to address vulnerabilities laid bare by Sandy and other extreme weather events.

In recent years, additional extreme weather stressors have impacted the transportation system. Remnants of Hurricane Ida dropped over 3.1 inches of rain in an hour in 2021, causing flash flood emergencies and significantly inundating portions of the New York City subway system. Highways and rail lines across the NYMTC planning area were also flooded. Beyond rainfall, the storm brought wind damage that downed trees and blocked roadways and rail lines. Other recent intense storm events have had similar impacts, including tropical storms Elsa and Ophelia, as well as instances of severe thunderstorms bringing torrential rain to portions of the region. Most recently, severe thunderstorms created significant roadway damage in Suffolk County on Long Island.

These examples of severe weather events over the last two decades created different stressors for the transportation system in the multi-state metropolitan region. Taken together, these storms illustrate a range of environmental and climate resiliency issues that have significantly altered the transportation planning process.

EXTREME WEATHER AND SEA LEVEL RISE RISK ANALYSIS

The FHWA joined with NYMTC, the North Jersey Transportation Planning Authority (NJTPA), and the South Western Region Metropolitan Planning Organization (SWRMPO) as well as the Greater Bridgeport and Valley Metropolitan Planning Organization (GBVMPO) of southwestern Connecticut to undertake the Post Hurricane Sandy Transportation Resilience Study, known as the Post Sandy Study, for New York, New Jersey, and Connecticut. This study was intended to enhance the multi-state metropolitan region's resilience to/sea level rise and extreme weather in the longer term, while informing the ongoing recovery process from Superstorm Sandy. The results of the study were released in 2017.

The Post Sandy Study compiled information on damage and disruption brought by Sandy in 2012 and Hurricane Irene, Tropical Storm Lee, and the Halloween Nor'easter of 2011 on the region's transportation system. The impacts of these four extreme weather events varied across the region and considering them together provided a wide range of potential extreme weather-related consequences for the transportation system. The study also compiled future projections and continuously monitored updates from the scientific community.

With an understanding of these impacts and projected future weather conditions, the Post Sandy Study assessed the exposure of the transportation system to extreme weather stressors at a regional scale, developing information that can be used by transportation agencies to advance more detailed vulnerability and risk assessments. These stressors included storm surge, wind, rainfall, and snowfall. Transportation system vulnerability experienced for each of these stressors was detailed throughout NYMTC's planning area.

COORDINATION ACROSS JURISDICTIONS

The MAP Forum is a consortium of ten metropolitan planning organizations and councils of Government—including NYMTC—in New York, Connecticut, New Jersey, and Pennsylvania which seeks to better coordinate planning activities in the multi-state metropolitan region. Since the disruptions brought by Superstorm Sandy, the MAP Forum has maintained a Multi-State Resilience Working Group which builds on *The Post Sandy Study* in the multi-state metropolitan region.

ENERGY INFRASTRUCTURE AND TRANSPORTATION

Major power generating stations, electrical substations, emergency backup generators, oil refineries, fuel storage facilities, and other critical components of the region's electrical and fuel distribution system have been disrupted by the extreme weather described above, with associated impacts on the transportation system. Disruptions to energy provision and availability have impacted traffic control, vehicle charging and fueling, communications with the traveling public, and the provision of transportation services.

HUMAN AND PUBLIC HEALTH STRESSORS

Facilities and conveyances that draw people to concentrated locations also make these locations attractive targets for disruptive cyberattacks and acts of terror aimed at mass casualties. As noted by the Mineta Transportation Institute:

> *Open to relatively easy penetration, trains, buses, and light rail systems offer an array of vulnerable targets to terrorists who seek publicity, political disruption, or high body counts. High concentrations of people in crowded quarters are inviting fodder for those who would cause mayhem and death. The massive amounts of explosives needed for truck bombs are unnecessary in crowded train stations, bus depots, carriages, or coaches. Even without large numbers of casualties, disruptions to transit can seriously impact a region's economy and the public's faith in the Government's ability to provide basic protections to its citizens.*

Additionally, the public health emergency provoked by the COVID-19 pandemic revealed the organizational risks and vulnerabilities for transportation agencies, facilities operators, and service providers, i, as well as supply chain, surface transportation and other modal vulnerabilities.

The extreme weather-related stressors described above also have public health impacts. For example, the possibility of power outages in extreme weather can impact the ability of populations to access cooling, get away from flooding, in addition to other urgent, yet vital needs. Extreme heat could also have health impacts for users of transportation services. Public health impacts are often not uniform across society or across the planning area. Vulnerable communities are Communities of Concern (CoC) based on their socioeconomic and demographic characteristics and have been found to experience greater public health impacts based on location, available transportation and financial services, as well as surrounding land uses. *Moving Forward 2055* Appendix G, Title VI Assessment, defines and identifies CoC's in the NYMTC planning area.

CYBERSECURITY

As the transportation system and its components become increasingly automated and interconnected through the Internet, new potential stressors related to cyber manipulation emerge which will affect the operation of those components. Further, the ongoing technological development and transformation of the transportation system and the way people and goods move around heighten the potential for cyber manipulation of the system and of various conveyances.

Transportation is becoming more connected and dependent on advanced computing systems and software. Exciting next generation communications technology will soon be deployed on the Nation's roads and highways. Using connected vehicles to exchange information in real time with nearby vehicles and infrastructure will make travel safer, cleaner, and more efficient.

The U.S. DOT has identified the vital role of cyber security across exploring the potential of connected vehicles and other advanced technologies. U.S. DOT has focused on protecting systems, devices, components, and communications from malicious attacks, unauthorized access, damage, or anything else that might interfere with safety functions.

EXISTING INITIATIVES

ENVIRONMENTAL AND EXTREME WEATHER STRESSORS

Frequent extreme weather events, and the impacts of rising sea levels have influenced policy development across the multi-state region to address the wide range of effects associated with storm surge, heavy rainfall, wind, and the resulting erosion and flooding. The following examples show diversity across recovery and resiliency planning efforts led by communities throughout the NYMTC planning area:

NEW YORK STATE

- New York State's OEM has standardized categories for hazard mitigation to serve as a foundation for strategy assessment.

- New York State's Community Risk Reduction and Resiliency Act (CRRA) requires decisionmakers to use the best available science to proactively consider sea level rise, storm surge, and flooding when issuing certain state funding and permits. State agencies are required to assess potential future risks related to storm surge, rising sea levels, and any other extreme weather conditions when making certain permitting, funding, and regulatory decisions.
- The NYS2100 Commission, appointed after Superstorm Sandy, released its report in early 2013. The Commission's report includes recommendations on strengthening and increasing the resiliency of the state's infrastructure through short- and long-term strategies. The sectors addressed include transportation, land use, energy, insurance, and infrastructure financing. The report also includes cross-cutting recommendations that are common to these sectors.
- Climate Smart Communities (CSC) is a New York State program that supports local governments in leading their communities to reduce pollution, adapt to the effects of extreme weather events, and thrive in a green economy. The benefits of participating include leadership recognition, free technical assistance, and access to grants. Local governments participate by signing a voluntary pledge and using the CSC framework to guide progress toward creating attractive, healthy, secure, and livable communities..
- Under the auspices of the New York State Office of Resilient Homes and Communities (formerly the Governor's Office of Storm Recovery), two projects—one on Long Island and one on Staten Island—were funded under the U.S. Department of Housing and Urban Development's innovative Rebuild by Design competition. Other Rebuild by Design funded projects in New York City include The BIG U in Lower Manhattan and Hunts Point Lifelines in the Bronx.
- The New York State Office of Resilient Homes and Communities also administers the New York Rising Community Reconstruction Program which covers housing and small business recovery, community reconstruction, and infrastructure components. The housing recovery initiatives include a Buyout and Acquisition Program. The Buyout Program improves the resilience of the larger community by transforming parcels of land into wetlands, open space, or stormwater management systems to create a natural coastal buffer to safeguard against future storms. The coastal buffer areas are intended to address those who live in areas that regularly put homes, residents, and emergency responders at high risk because of repeated flooding.
- The NYSDOT has updated its design standard for new construction. As part of this policy, culverts and bridges in the Eastern half of New York State are being designed to handle 20 percent increases in streamflow from runoff events associated with severe storms. NYSDOT will also consider potential impacts stemming from sea level rise by utilizing guidelines prepared by the New York State Department of Environmental Conservation (NYSDEC).[9]
- NYSDOT has refined its emergency responses and incorporated lessons learned into many practices, from maintenance management to programming, project selection, and managing assets.
- New York State's Climate Leadership and Community Protection Act goals include cultivating healthy and resilient communities.

NEW YORK CITY

- New York City's Neighborhood Coastal Flood Protection Projects, including:
  - East Side Coastal Resiliency is an integrated flood protection system that will span 2.4 miles along the east side of the Lower Manhattan waterfront, from Montgomery Street north to E. 25th Street. The project combines floodwalls, the elevation of East River Park, floodgates, and interior drainage infrastructure improvements.
  - The Battery Coastal Resilience is a project to rebuild and elevate the wharf promenade in the Battery to protect it from sea level rise in the year 2100.
  - Brooklyn Bridge-Montgomery Coastal Resiliency will provide critical flood protection in the Two Bridges neighborhood with a series of deployable flip-up gates and floodwalls, while also maintaining access and visibility to the waterfront.
  - Red Hook Coastal Resiliency aims to reduce flood risk due to coastal storm surge and sea level rise along Red Hook's waterfront while also integrating flood protection into the neighborhood fabric.
  - Battery Park City Resiliency is a set of interrelated resiliency projects being implemented by the Battery Park City Authority. These integrated coastal flood risk management systems aim to protect the Battery Park City area from more severe and frequent storms while integrating into the urban fabric through berms, elevated park areas, passive flood barriers, and deployable barriers where necessary.
  - Living Breakwaters, implemented by New York State Resilient Homes and Construction, is a coastal green infrastructure project along the Tottenville section of the South Shore of Staten Island that provides risk reduction through erosion prevention, wave energy attenuation, and enhancement of ecosystems and social resiliency.
  - Along the shorefront of the Rockaway Peninsula, the U.S. Army Corps of Engineers is constructing a reinforced dune system, new and extended tapered groins to help trap sand and keep it in place, and extensive sand replenishment to protect communities from future storms.
  - In three neighborhoods, Arverne, Edgemere, and Hammels, along the bayside of the Rockaway Peninsula, the U.S. Army Corps of Engineers is in the design phase of a project to protect from high frequency, lower elevation flood events through a system of berms, floodwalls, road ramps, pump stations, revetments, and nature-based features.
- New York City's Zoning for Coastal Flood Resiliency (ZCFR) seeks to promote resilient buildings throughout the city's current and future floodplains. Based on the New York City Department of City Planning (NYC DCP)'s experience working with communities throughout the floodplain since Hurricane Sandy in 2012, NYC DCP developed a proposal to make zoning more supportive of resilient buildings. ZCFR, approved by the NYC City Council in 2021, makes permanent zoning provisions that were adopted on a temporary basis in 2013 and improves them in several key areas where the rules did not fully support or may have contributed to discouraging resiliency investments in buildings. ZCFR provides flexibility for grading and shoreline design in waterfront

areas to help mitigate flood risk and prohibits the construction of new nursing homes in high-risk areas given the negative health consequences associated with evacuating nursing home residents.

- New York City's PlaNYC 2023 initiatives to increase resilience to climate change impacts. These initiatives include green roofs, curbside electric vehicle charging and weatherized bike storage, upgraded office space in retrofitted buildings, increased tree canopy, rooftop solar panels, residential electric storage and heat pumps, rain gardens, active greenways, and resilient waterfronts. It also recommends a multilayered strategy for flood resilience and the development of minimum flood resilience standards for shoreline assets.
- New York City's Panel on Climate Change (NPCC) is an independent advisory body that regularly publishes assessment reports that synthesize several years of scientific research and analysis on climate change and advises City policy-makers on local resiliency and adaptation strategies to protect against rising temperatures, increased flooding, and other hazards. New York City's Panel on Climate Change is exploring a range of policies, social programs, engineering projects, and ecosystem-based solutions. Tools and methods include a focus on extreme heat, recent and long-term observations, projection methods, community engagement, indications, and mapping.
- Following Hurricane Ida, New York City convened an Extreme Weather Response Task Force. The group explored the City's response to extreme weather events to address a rapidly changing reality in which extreme storms like Hurricane Ida are more common. The Task Force released a report called "The New Normal: Combating Storm-Related Extreme Weather in New York City" which included recommendations and actions to be implemented that address areas such as short-term infrastructure, long-term infrastructure, basement apartments, homeowner and landlord investments, flood insurance and outreach, preparation and emergency planning, and subway flooding.
- New York City's Climate Resilience Design Guidelines (CRDG) are going beyond the building code and standards, which are informed by historic climate data, by also looking at specific, forward-looking climate data for use in the design of city facilities. Resilient design will be an integral part of the project planning process for city agencies and designers. All new projects and substantial improvements will assess risks to climate hazards in context of the project's purpose, asset type, site location, and funding, and then determine the appropriate resilient design strategies using the Guidelines. Multiple agencies are currently implementing 40 pilot projects using the CRDG.
- New York City is also proposing new neighborhood-scale stormwater infrastructure systems. A combination of both traditional, or "grey" infrastructure, as well as green infrastructure, will help manage "cloudburst" stormwater runoff, limiting the additional stress placed on the sewer system during heavy rain and coastal storm events. Four neighborhoods have been selected to date.
- New York City Department of Transportation (NYC DOT) has been working on a broad array of resilience-related projects and policies, including the Raised Shorelines portfolio that is raising the elevation of roadways and bulkheads, and flood-proofing ferry terminals.
- The New York City Economic Development Corporation (NYC EDC) and the Mayor's Office of Climate Resiliency, now the Mayor's Office of Climate and Environmental Justice, released the Financial District and Seaport Climate Resilience Master Plan, a sweeping framework that aims to shield a

nearly one-mile swath of the Lower Manhattan waterfront from the Battery to the Brooklyn Bridge from rising sea levels and future coastal storms. The Master Plan is estimated to cost between $5 to $7 billion, take 15 to 20 years to fully complete, and will ensure that Lower Manhattan withstands rising sea levels as well as increasingly intense coastal storms.

- NYC EDC is also advancing the Seaport Coastal Resilience project, which is currently in schematic design, on a shorter time horizon and with a smaller geographic focus than the Financial District and Seaport Climate Resilience Master Plan to provide more immediate protection to the neighborhood's most vulnerable areas. Seaport Coastal Resilience plans to raise the elevation at the water's edge to 11 feet above sea level, which will help the area withstand and recover from regular flooding events and provide protection from sea level rise.

U.S. ARMY CORPS OF ENGINEERS

- New York City has partnered with the U.S. Army Corps of Engineers (USACE) on initiatives like the Rockaways Atlantic Shorefront Resiliency Project to protect shoreline communities most vulnerable to storms and reimagine coastline through efforts like the Lower Manhattan Coastal Resiliency (LMCR) Project, creating a continuous line of protection against rising sea levels and storms.
- USACE has conducted various coastal storm risk management studies in the New York region, including the following:
  - East Rockaway Inlet to Rockaway Inlet, Queens, and Nassau County
  - Coney Island, Brooklyn
  - Bayside, Queens
  - New York and New Jersey Harbor Tributaries
  - South Shore of Staten Island
  - Spring Creek South, Queens
  - Fire Island Inlet to Montauk, Suffolk County
  - Hashamomuck Cove in Southold, Suffolk County
  - Lake Montauk Harbor, Suffolk County

PUBLIC AUTHORITIES

- MTA has undertaken a systemwide $7.6 billion program, Fix and Fortify, to repair infrastructure damaged during Superstorm Sandy and install coastal storm surge flood protection measures. These include:
  - Entrances protected at underground subway stations, subway tunnel portals outfitted with flood logs, bus depots protected with flood logs, subway yards with perimeter flood protection or external wall hardening, elevating railroad substations above the coastal surge floodplain,

protecting critical railroad signals and communications equipment, and massive marine doors for the Hugh L. Carey and Queens Midtown Tunnels.

- The MTA has also undertaken measures to make the subway system more resilient to flooding during torrential rainfall events, including installing passive stormwater mitigations, such as raised subway entrance steps and raised street vents. MTA's design standards have evolved to adapt to new challenges the transportation system faces such as the MTA's Design Flood Elevation standards for coastal storm surge that defines the minimum elevation to which a building or asset should be elevated or floodproofed, within a flood hazard area.
- In April 2024, the MTA released a Climate Resilience Roadmap that includes a multi-hazard Climate Vulnerability Assessment to understand the magnitude and timing of extreme weather impacts on MTA infrastructure, 10 goals with a series of short- and long-term actions to boost resilience across the MTA's system, and a multi-pronged implementation framework.
- MTA also engages in emergency preparedness for extreme weather, including coastal surge, torrential rainfall, extreme heat, and winter weather. Even before an extreme weather event occurs, the MTA begins intensive internal coordination and proactive meteorological tracking. Additional coordination protocols are deployed when severe weather approaches, including activation of the MTA's central incident command center.
- PANYNJ has developed guidance that uses an asset-specific approach that considers the life expectancy of each asset and the risk of agency-specific events happening during that life span. PANYNJ also examines the need for improving reliability when undertaking major repairs and reconstruction and has documented significant cost savings.
- Several key resilience and flood abatement projects that have been implemented in some of the hardest-hit PANYNJ facilities include:
  - At the World Trade Center, a $150 million program features a three-tier flood protection system, starting with a deployable flood wall around the perimeter. A second ring provides at-grade protections at all entrances and vent shafts, with sub-grade protections for critical equipment, coupled with a high-capacity pumping system.
  - LaGuardia Airport's new Pump Station 6 substation powers one of six high-capacity airfield pumps, together capable of evacuating more than 400,000 gallons of water per minute. The substation was rebuilt on 10-foot stilts to reduce susceptibility to flooding.
  - Hoboken Port Authority Trans-Hudson (PATH) resilience projects include constructing a water-tight, stainless steel and aquarium glass headhouse, with deployable flood planks designed to secure entrances before storms. Heavy steel flood doors have been installed to seal off the station from street-level flooding.

LOCAL COMMUNITIES

- Suburban counties in NYMTC's planning area have updated hazard mitigation plans with resilience measures and evacuation plans through county offices of emergency management. Through

county planning commissions, counties have also worked with local municipalities on coordinated resilience planning and zoning changes and have also pursued revisions and updates of the resilience elements of county comprehensive plans.

- All suburban counties, as well as a variety of their local municipalities, participate in New York State's Climate Smart Communities program. Nassau and Suffolk counties have engaged with the Governor's Office of Storm Recovery on disaster recovery and placemaking.
- Both Nassau and Suffolk counties have participated in the HUD Rebuild by Design and New York Rising Communities programs. Westchester County has participated in stormwater management and flood mitigation for the Bronx River flood plain. Rockland County has participated with Hudson Riverfront Communities on resilience issues. Putnam County has participated in storm water management through its Soil and Water Conservation District and Department of Public Works.
- Communities at risk of flood peril have the regulatory authority to address local land use, zoning, and building codes to avoid development in floodplains. Communities participating in the National Flood Insurance Program must incorporate flood-resistant construction standards into building codes. Local ordinances have been established in some municipalities to reduce impervious surfaces such as driveways and parking areas, promote uniform bulkhead elevations, and require relevant buildings standards.

EXTREME WEATHER AND SEA LIVEL RISE RISK ANALYSIS

- The Multi-State Resilience Working Group has compiled a list of data topics and sources to support resilience work being done by the MAP Forum's members MPOs and COGs to share data resources on resilience.
- The PANYNJ's Flood Product Library assists design teams, line departments, and facilities to quickly identify potential flood resilience solutions with information for nearly 200 flood control devices, searchable by over a dozen key attributes and characteristics.
- PANYNJ's systemwide Climate Risk Assessment is an ongoing program to assess the full portfolio of assets to identify residual and emerging flood vulnerabilities to strategically mitigate highest priority risks. Phase 1, a preliminary scan of flood-related risks across all PA facilities, was completed in 2020. Phase 2, a multi-year program initiated in 2021, entails the application of rigorous, engineering-based assessment techniques on a facility-by-facility basis.
- MTA completed a multi-hazard Climate Vulnerability Assessment included in the April 2024 Climate Resilience Roadmap, to understand the magnitude and timing of extreme weather impacts on MTA infrastructure.
- NYSDOT is in the process of updating its' internal vulnerability assessment process. NYSDOT also tracks and maps repetitively repaired/damaged assets from declared emergency events, as required under FHWA's Transportation Asset Management Program rule.

COORDINATION ACROSS JURISDICTIONS

- As discussed earlier, the MAP Forum maintains a Multi-State Resilience Working Group which builds on the FHWA's Post-Sandy Study to expand the MAP Forum's resiliency work to include vehicle electrification, pollution mitigation, and transportation impacts from health-related events. Participants include representatives of the constituent MPOs and councils of Government.
- PANYNJ collaborates with regional and national science, Government, and industry partners to develop innovative solutions to our most pressing resilience challenges. In addition, the agency develops resources to facilitate smart, resilient decision-making.

ENERGY INFRASTRUCTURE AND TRANSPORTATION

- NYS has committed to installing 3000 MW of energy storage by 2030 to provide flexibility and streamline the delivery of intermittent renewable resources. Investment in electricity transmission and distribution systems will increase grid flexibility and resilience.
- Clean Path NY is an innovative investment in clean energy infrastructure to deliver reliable clean power to New York communities that currently rely on fossil fuel power generation. Comprised of over 20 renewable energy generation projects and an approximate 175-mile underground in-state transmission line, the project will generate 3,800 MW of new wind and solar power and deliver almost 8 million megawatt-hours of pollution-free energy.
- The Town of Brookhaven will construct a 1.9 MW battery storage facility in Patchogue.

HUMAN AND PUBLIC HEALTH STRESSORS

- U.S. DOT has several research programs dedicated to ensuring a secure, connected transportation environment. The Transportation Security Administration (TSA) developed a cybersecurity toolkit with cyber risk information guiding surface transportation operators with under 1,000 employees.
- Other cybersecurity developments at the Federal level include the following:
  - On May 15, 2019, the White House issued a new national security executive order focused on information and communications technology and the services supply chain, which impacts all modes within the transportation sector.
  - The U.S. Department of Homeland Security's (DHS) new National Critical Functions list highlights those functions in the United States most at risk for a cybersecurity attack and includes every mode of transportation.
  - TSA's Cybersecurity Roadmap makes clear that it has the statutory authority to regulate the transportation sector for cybersecurity.
- Countering potential threats has required innovative and extraordinary levels of coordination between transportation providers, emergency preparedness and response organizations, and law enforcement and intelligence at all levels. The January 2019 release of New York State's Counterterrorism Advisory Panel report underscores these needs for the transportation sector.

- During emergency situations, U.S. DOT provides information related to transportation permits, waivers, and other regulations and authorities that are applicable to public mobility and emergency response. U.S. DOT modal administrations also have defined roles.
- The FTA provides guidance for transit operators and administers emergency funding appropriated by Congress.
- Similarly, FHWA oversees emergency funding, serves as a clearinghouse for road closure information, and administers emergency permits.
- At the state level, the New York State Department of Health (NYSDOH) oversees community preparedness for public health emergencies in cooperation with local health departments.
- NYSDOH's Office of Health Emergency Preparedness is responsible for the coordination and management of all activities for public health and healthcare facility preparedness. These activities include preparedness planning and making sure that emergency plans work in drills, exercises, and real life. NYSDOH also tracks the incidence of infectious disease.
- Each of NYMTC's local member agencies' jurisdictions—New York City, Long Island, and the lower Hudson Valley—work closely with NYSDOH in preparing for, addressing, and recovering from public health emergencies.

4.4.4 PLANNED IMPROVEMENTS AND RECENTLY LAUNCHED PLANNING ACTIVITIES

Beyond the existing initiatives described above, which are either completed or ongoing, several resilience improvements and planning activities have launched recently or are planned for initiation.

LONG ISLAND

- The Long Island Regional Planning Council (LIRPC) has partnered with LiRo GIS Services to create a comprehensive database to quantify the economic flood risk threatening Long Island communities in terms of estimated number of businesses, employees, and sales volume.
- The South Shore Sea Gate Study proposes a layered defense system to protect low-lying coastal communities from conditions like unprecedented flooding experienced during Superstorm Sandy. The study has been funded through a NYSDEC grant. The preferred option calls for the installation of sea gates, which would be activated only before major storms, at the East Rockaway, Jones, Fire Island, Moriches, and Shinnecock inlets. The plan also calls for the installation of "cross bay baffles"—dividers with lifting panels used to direct and slow the flow of water—near the Meadowbrook and Robert Moses parkways, as well as in Amityville, Bayport, and Smith Point.

SUFFOLK COUNTY

- Suffolk County's nature-based resilience study will be looking at road elevation, hardening infrastructure, offshore reefs, coastal retreat, and beach replenishment. Project goals are to create

site-specific recommendations, a handbook to guide evaluations, and a capital financing plan. Assets will be categorized for risk assessments and implementable concepts and solutions for up to ten priority assets. The study will also conduct three benefit-cost analyses to assess wave attenuation benefits over the wetlands, with a focus on reducing costs behind wetland sites.

- The Suffolk County Department of Economic Development and Planning and a Project Advisory Committee (PAC) made up of elected officials, County staff, environmentalists, and other key stakeholders will identify resiliency enhancements. VAn interactive, a web-based geodatabase tool will illustrate County-owned properties most at risk from sea level rise or flooding. The Suffolk County Coastal Resilience Initiative will install sewers in communities that are in unsewered, low-lying areas along the County's south shore that had been inundated by Superstorm Sandy. The sewer projects mark the largest investment in water quality infrastructure in the County in more than 40 years and will eliminate over 7,000 cesspools and septic systems.
- A task force on coastal resiliency will identify how frequent flooding, heavy rains and storm surge would impact homes, roads and storm water infrastructure and will recommend related resilience projects. Various local municipal waterfront revitalization plans will also address coastal resiliency.
- To encourage growth in appropriate locations, mitigate single-occupancy vehicle use and make efficient use of existing infrastructure, various municipalities have undertaken rezonings, overlays, or other strategies to re-focus growth to existing downtowns and rail corridors.

NASSAU COUNTY

- USACE released a draft report for the Nassau County Back Bays Coastal Storm Risk Management Study. The report outlines a "Tentatively Selected Plan" framework, which includes the elevation of more than 14,000 residential structures and dry flood proofing of more than 2,500 industrial/commercial properties to reduce the risk of flood damages associated with storm surge. The potential measures under consideration from the studies are flood walls, storm surge barriers, bulkheads, non-structural measures, and natural and nature-based features.
- The Nassau County Planning Commission has coordinated local municipal zoning changes and undertaken multi-municipal drainage and watershed studies.
- An update of Nassau County's hazard mitigation plan has incorporated various resilience measures.

NEW YORK CITY

- Local Law 2021/122 requires the Mayor's Office of Long-Term Planning and Sustainability, or their designee, in consultation with other City agencies, to develop and post on its website a climate adaptation plan that considers and evaluates various extreme weather hazards impacting the city and its shoreline. AdaptNYC is New York City's long term adaptation plan.
- USACE has laid out a plan to protect a New York Harbor from flooding, under which 900 miles of coastal area will be protected by installing nine storm surge gates in Jamaica Bay, Coney Island Creek, Newtown Creek, the Gowanus Canal, Sheepshead Bay, Gerritsen Creek, Flushing Creek, and between New Jersey and Staten Island.

- USACE proposed a $52.6 billion plan to install sea walls, breakwaters, levees and flood walls around New York City's harbor and its tributaries. USACE supported an option featuring 12 storm surge gates that would close during storms. They would be in Jamaica Bay, Coney Island Creek, Newtown Creek, the Gowanus Canal, Sheepshead Bay, Gerritsen Creek, Flushing Creek, and between New Jersey and Staten Island.
- The USACE plan incorporates smaller solutions as well. Measures on land include floodwalls, levees, elevated promenades and raised roads to boost coastal protection, as well as nature-based solutions such as wetland restoration and "living shorelines," which use plants and organic materials to manage erosion and buffer a coast.
- The Build It Back program is funded by $2.2 billion in Federal Community Development Block Grant Disaster Recovery (CDBG-DR) and overseen by Mayor's office of Housing Recovery Office in coordination with the New York City Department of Housing Preservation and Development (HPD) and the New York City Department of Design and Construction (DDC) to support recovery from Superstorm Sandy. The program assists applicants through either a reimbursement check, construction services, or acquisition of their home. FloodHELPNY is funded through the New York Governor's Office of Storm Recovery and New York Rising, as well as FEMA through the Mayor's office of Climate and Environmental Justice/Housing Preservation Development. FloodHELPNY.org is a platform for engaging and informing New York City homeowners about protecting their homes and finances from flooding that is expected to worsen with rising sea levels.
- Flood Net seeks to understand the frequency, severity, and impacts of flooding in New York City, offering residents data and knowledge by bringing together innovative sources of information on street flooding impacts in neighborhoods that are vulnerable to high tides, storm surge, and stormwater runoff. Researchers, city agencies, and others use this information to reduce flood risk.

MANHATTAN

- The South Battery Park City (BPC) Resiliency Project explores creating a continuous flood barrier from the Museum of Jewish Heritage, through Wagner Park, across Pier A Plaza, and along the northern border of Historic Battery Park, to a designated elevation point just west of State Street. The Combined North and West BPC Resiliency Project will span BPC's North Esplanade and entail a deployable barrier crossing of West Street/Route 9A as one of BPC's (and Lower Manhattan's) most vulnerable points for storm surge inundation and flooding. The West BPC perimeter project area will encompass a new line of flood protection to be woven into the neighborhood along or adjacent to the waterfront at the western edge of BPC.

STATEN ISLAND

- Through HUD's Rebuild by Design program, the Staten Island Living Breakwaters Project was selected which proposed a layered resiliency approach to promote risk reduction through erosion prevention, wave energy attenuation, and enhancing ecosystems and social resiliency. The project is in close partnership with NYSDEC and City of New York, and state funding will help implement the project along the Tottenville section of the South Shore of Staten Island. The South Shore of Staten

Island Coastal Storm Risk Management Project area is located along the south shore of Staten Island from Fort Wadsworth to Oakwood Beach.

LOWER HUDSON VALLEY

- Putnam County developed a countywide Hazard Mitigation Plan in 2021 through funding from FEMA. The Plan includes resilience-related strategies and policies, including evacuation planning.
- Rockland County is undertaking a study to develop a Continuity of Operations Plan for county Government, as well as a county comprehensive plan update which will include countywide resilience strategies. There are four flood mitigation and resilience report studies available for Rockland County: Hackensack River, Mahwah River, Minisceongo Creek, and Sparkill Creek. These analyses were conducted as part of the Resilient New York Program, an NYSDEC initiative. The county's 2024 Hazard Mitigation plan has been developed and is currently in public review.
- Westchester County is also updating their comprehensive plan which will include both resilience and sustainability components as well as the use of natural infrastructure in flood plains.

4.4.5 RECOMMENDED STRATEGIES AND ACTIONS

PLANNING AND RESEARCH INITIATIVES

- Identify the vulnerable transportation assets throughout the NYMTC planning area.
- Benchmarking research on protection/fortification techniques and methodologies.
- Update previously performed extreme weather risk analyses.
- Perform a redundancy assessment for the transportation system.
- Evaluate vulnerable transportation assets in Communities of Concern.
- Perform an energy vulnerability assessment for the transportation system.
- Perform an assessment of public health impacts and relevant resilience strategies.

DATA COLLECTION, FORECASTING, AND PERFORMANCE ASSESSMENT

- Fully develop the MAP Forum resilience data portal.
- Update sea level rise and inundation data from the Post-Sandy Study.
- Assess available data sources and predictive tools.
- Assess transportation systems to identify primary redundancy needs.

PLANNING PROCESS RECOMMENDATIONS

- Convene a NYMTC Resiliency Working Group.
- Pursue multi-state coordination through the Multi-State Resilience Working Group.

- Develop an ongoing risk analysis report for the NYMTC planning area.
- Plan appropriate public workshops and municipal meetings through the NYMTC Resiliency Working Group and Multi-State Resilience Working Group.
- Through the Multi-State Resilience Working Group, consider key vulnerable transit interfaces in the multi-state region.
- Address redundancy improvements though the NYMTC Resiliency Working Group and the Multi-State Resilience Working Group.
- Engage impacted Communities of Concern through the Thriving Communities Network.
- Develop various types of energy investment strategies for transportation.

PROGRAM RECOMMENDATIONS

- Integrate resilience considerations into the project evaluation/selection process.
- Program redundancy improvements as appropriate.

4.4.6 PERFORMANCE MEASURES

23 CFR 450.324 governs the development and content of the metropolitan transportation plan. These regulations contain the following requirement.

> *The transportation plan shall include a description of the performance measures and performance targets used in assessing the performance of the transportation system.*

The performance measures listed below will assist in measuring progress toward this vision goal and its objectives, and in informing investment decisions:

- Number of lane miles of Federal-aid roadways in the designated vulnerable transportation system and percent hardened to resist flooding events.
- Number of Federal-aid bridges/culverts in the designated vulnerable transportation system and percent hardened.
- Number of miles of trailways/bikeways/ greenways in the designated vulnerable transportation system and percent hardened.
- Number of miles of grade separated bus facilities in the designated vulnerable transportation system and percent hardened.
- Number of transit and freight track miles in the designated vulnerable transportation system and percent hardened.
- Number of transit terminals/transfer stations in the designated vulnerable transportation system and percent hardened.

- Number of rapid transit/commuter rail stations in the designated vulnerable transportation system and percent hardened.
- Number of transit yards/facilities in the designated vulnerable transportation system and percent hardened square footage of port/intermodal facilities in the designated vulnerable transportation system and percent hardened.

4.5 VISION GOAL—CONGESTION

We seek to establish and maintain a transportation system for which congestion is mitigated through investments and technology in support of healthier communities, more seamless travel, improved quality of life, and regional economic competitiveness.

4.5.1 DESCRIPTION

Chapter 3 and Appendix B of *Moving Forward 2055* describe forecasted growth in population, employment, and the amount of goods moving into, within and through NYMTC's planning area. This goal seeks to enhance the efficiency of the transportation system by identifying and funding to the extent possible, feasible and cost-effective investments in programs, projects and services that will mitigate transportation congestion. Additionally, greater efficiency and measurable reduction in travel time can be achieved through the implementation of requisite TSMO strategies. The application of NYMTC's Congestion Management Process (CMP) will also be important in seeking a transportation system that efficiently serves the projected growth of people and goods. More detail on the region's multimodal transportation system and congestion on key roadways is available for viewing in the *Moving Forward 2055* Interactive Map.

4.5.2 OBJECTIVES

- Sustainably manage current or future demands, with an emphasis on expanding active transportation, and transit.
- Support mobility for all users by encouraging active transportation, micromobility, complete streets, and other strategies.
- Modernize local freight networks to efficiently plan for growth in the volume of and change in product deliveries.
- Expand the reach of the system to emerging markets, addressing access to and incentivizing employment, social and recreational opportunities.

- Incorporate emerging and innovative technologies, transportation services and tools into efficient network design, operations, and monitoring.
- Coordinate with governing bodies for clearer accountability, funding, and panning arrangements.

4.5.3 RECENT TRENDS, CURRENT CONDITIONS, AND EXISTING INITIATIVES

RECENT TRENDS AND CURRENT CONDITIONS

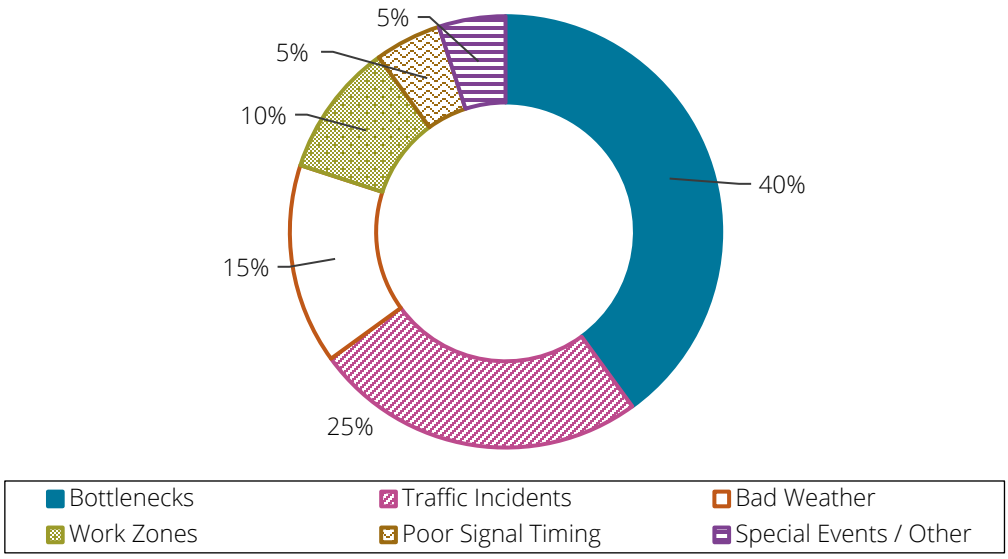
TYPES OF TRAFFIC CONGESTION

FHWA categorizes the causes of traffic congestion as follows:

- Physical Bottlenecks—Where demand exceeds capacity due to geometry along roadways or at intersections, interchanges, transit facilities, etc.
- Traffic Incidents—Nonrecurring event that causes a reduction of roadway capacity or an abnormal increase in demand (e.g., crashes, disabled vehicles).
- Weather—Events such as snowstorms or flooding due to rainfall.
- Work Zones—Construction activities on the roadway that temporarily reduce capacity, including lane reductions, lane shifts, and detours.
- Special Events—Events that create a surge in traffic beyond normal traffic patterns such as sporting events, concerts, street festivals, and visiting dignitaries.
- Traffic Demand and Flow Fluctuations—Day-to-day variability in traffic and peaking of demand that can be as much as 15 to 20 percent on an individual roadway depending on the day of the week.
- Traffic Operations—Disruption of traffic flow due to non-optimized or non-integrated signals and/or insufficient intersection capacity.

The national averages in Figure 4.18 provide insights regarding the sources of traffic congestion in the context of these categories. Bottlenecks (40 percent) are the greatest source of congestion, followed by traffic incidents, which account for 25 percent of congestion.

Figure 4.18 National Distribution of Sources of Congestion



Source: The Sources of National Congestion Summary, FHWA.

Several specific factors and characteristics contribute to traffic congestion in the NYMTC planning area, including the following:

- Size and Scale—The patterns of land development and size of the population have resulted in peak vehicular demand outstripping transportation capacity in many locations.
- Topography—NYMTC's planning area includes three large islands (Staten Island, Manhattan Island, and Long Island) that, along with the Hudson River and Long Island Sound, create the need for numerous water crossings for roadways, rail lines, and waterborne services. Limitations to the capacity at these crossing facilities are a major cause for congestion. Additionally, north-south oriented ridges and smaller rivers in the Hudson Valley and east-west oriented glacial moraines on Long Island have influenced the location of transportation infrastructure and resulted in more limited east-west (in the Hudson Valley) and north-south (on Long Island) transportation capacity.
- Major transportation hubs, regional and international airports in and around the NYMTC planning area, as well as major rail and bus stations and transfer locations, and port facilities. Many of these locations are significant interconnections between transportation modes and services.
- Large event venues, such as stadiums, arenas, and convention centers that generate considerable vehicle, transit, and foot traffic.
- Tourist and recreational attractions, generating considerable travel from residents and visitors.
- Major movement of goods, particularly by truck, driven by the planning area's and multi-state region's large population and level of economic activity, which results in goods moving into, out of, within, and through NYMTC's planning area. Additionally, an underutilization of existing waterways for goods movement within the planning area.
- Lack of direct transit connections between and within outer boroughs and suburban counties incentivizes travel by personal vehicle.

URBAN AREA COMPARISONS

As defined by the U.S. Census Bureau, the New York-Jersey City-Newark Urban Area (UA) is the largest in the country by population, with more than 7 million more residents than the next largest Los Angeles-Long Beach-Anaheim UA. Among peer UAs, New York-Jersey City-Newark has the lowest daily VMT per capita but a higher-than-average travel time index (TTI), which is the ratio of the travel time during the peak period to the time required to make the same trip at free-flow speeds. The lower VMT per capita is likely due to the greater availability and use of public transportation throughout the UA and the dense urban form of portions of the UA. Comparison data are presented in Table 4.3.

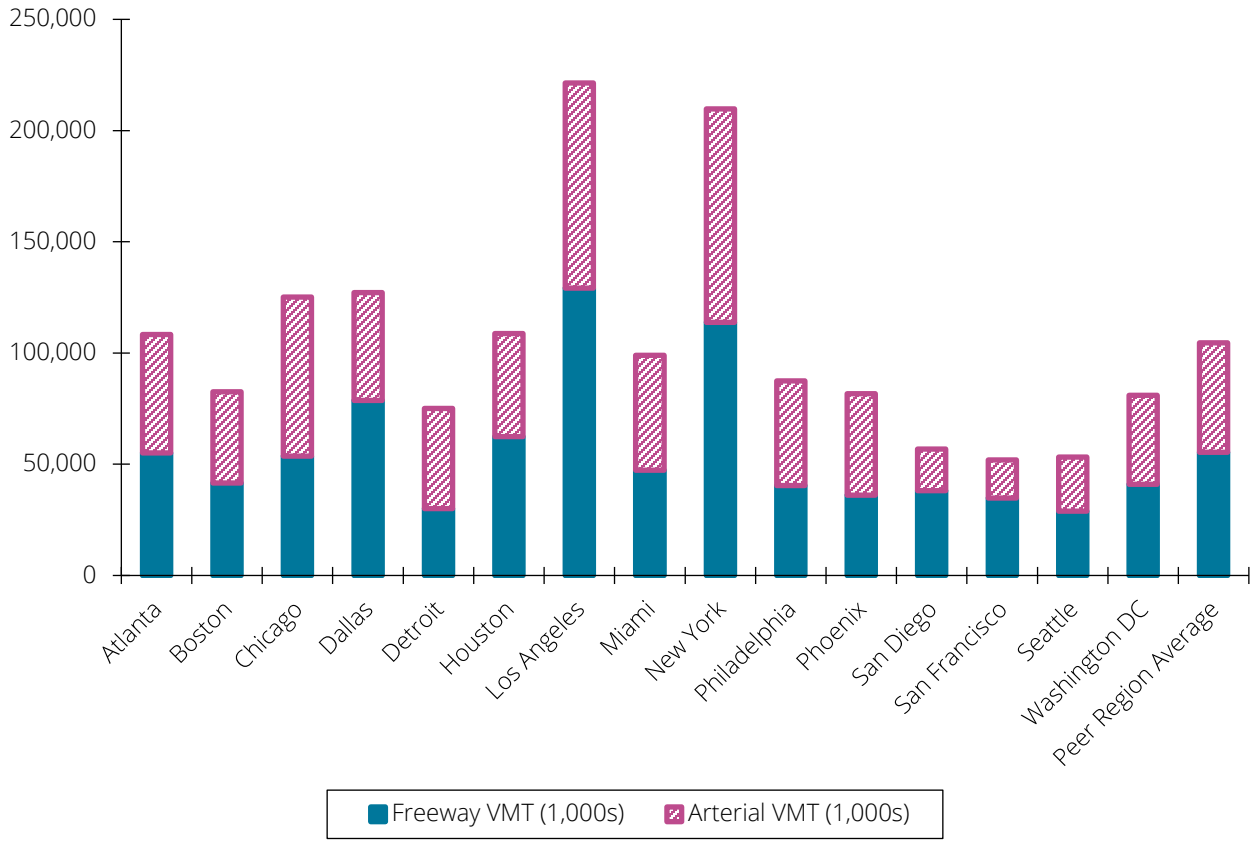
Table 4.3 Urbanized Area Comparisons

Metropolitan Area	Population(million)	Daily VMT per Capita (Freeway + Arterial)	Travel Time Index
Boston	4.57	18.09	1.22
New York City	19.20	10.92	1.32
Philadelphia	5.62	15.56	1.23
Washington D.C.	5.07	15.99	1.25
Atlanta	5.20	20.62	1.25
Miami	6.09	16.25	1.34
Detroit	3.78	19.86	1.20
Chicago	8.69	14.39	1.30
Houston	5.60	19.42	1.27
Dallas	5.93	21.45	1.23
Phoenix	4.18	19.56	1.22
San Diego	3.19	17.80	1.29
Los Angeles	12.45	17.79	1.50
San Francisco	3.53	14.72	1.48
Seattle	3.55	15.01	1.32
Peer Region Average	**6.45**	**17.16**	**1.29**

Source: Texas A&M Transportation Institute, 2023 Urban Mobility Scorecard.

In terms of overall travel, only the Los Angeles-Long Beach-Anaheim UA exceeds the volume of travel experienced in the New York-Newark-Jersey City NY-NJ UA, as measured in VMT. See Figure 4.19.

Figure 4.19 Average Daily VMT Comparison

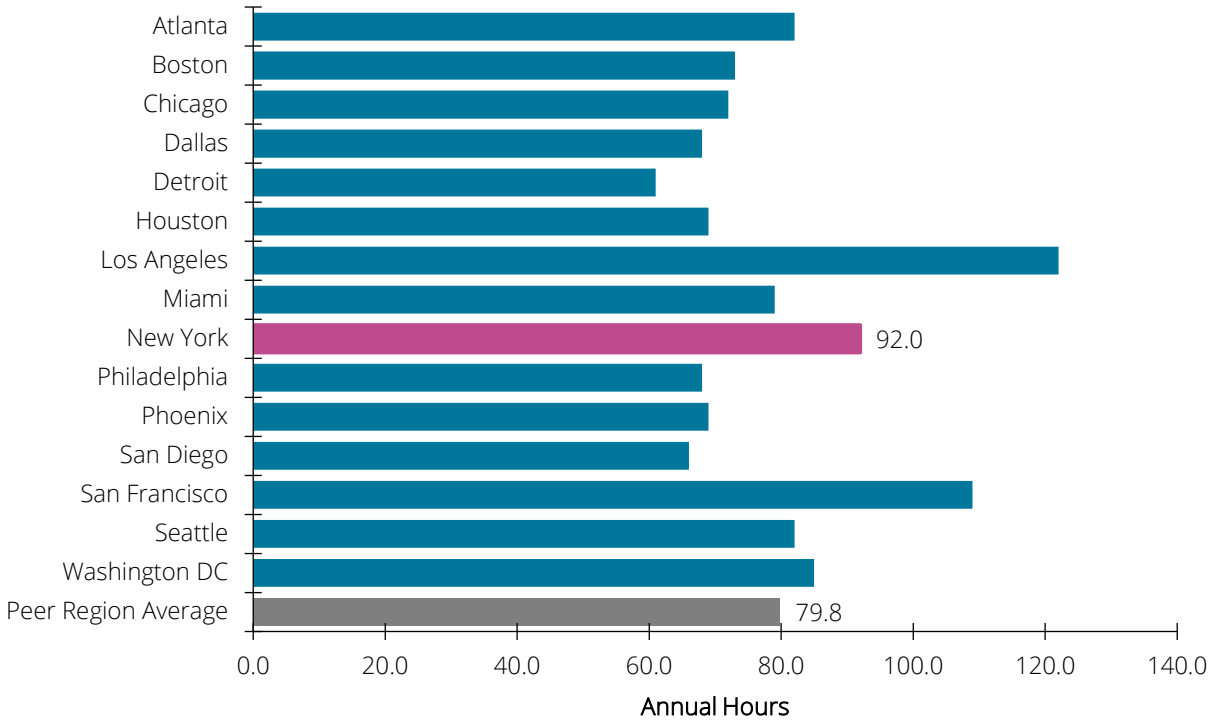


Source: Texas A&M Transportation Institute, 2023 Urban Mobility Scorecard

On a per commuter basis, the New York-Jersey City-Newark UA experiences the third highest level of annual travel time delay per year (roughly 90 hours) with only the Los Angeles and San Francisco UAs exceeding these levels (Figure 4.20).

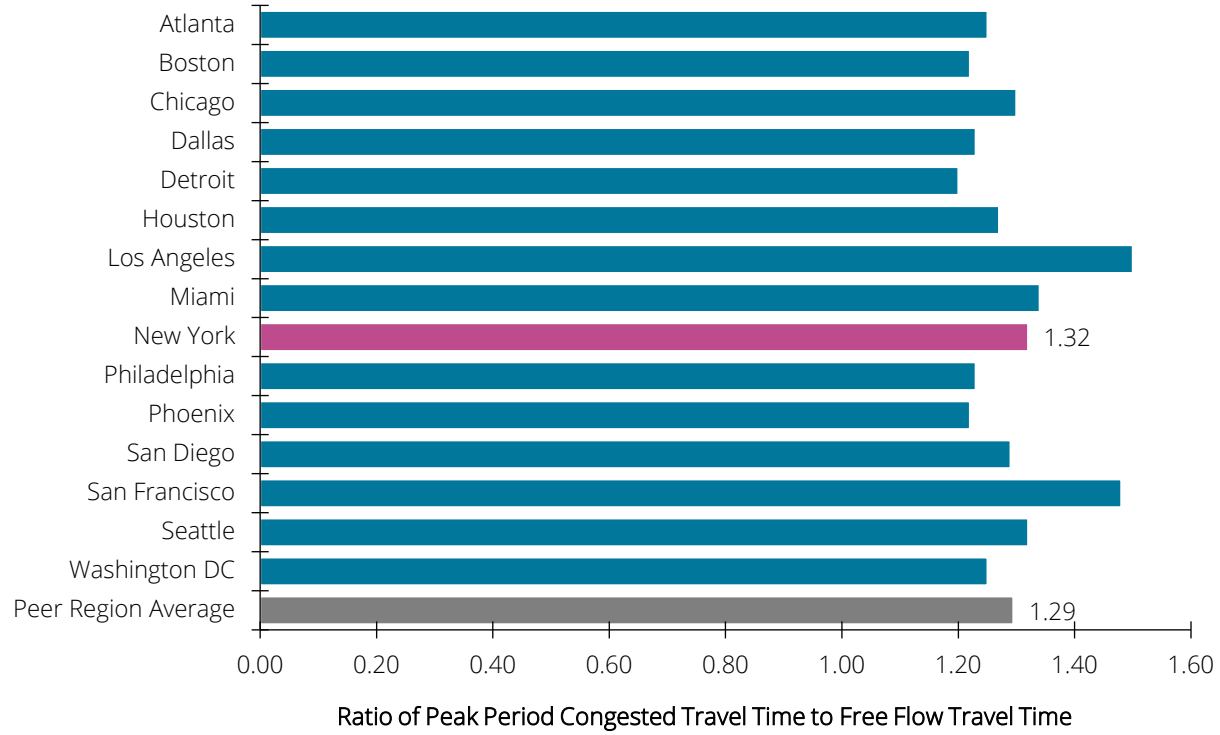
TTI comparisons are shown in Figure 4.21. TTI is the ratio of travel time in the peak period to travel time at free-flow conditions. A TTI of 1.30 indicates a 20-minute free-flow trip takes 26 minutes in the peak period. TTI for the New York UA is slightly higher than the average for peer UAs and well below TTIs for the two most congested UAs, Los Angeles (1.50) and San Francisco (1.48).

Figure 4.20 Annual Hours of Delay Per Commuter



Source: Texas A&M Transportation Institute, 2023 Urban Mobility Scorecard

Figure 4.21 Travel Time Index



Source: Texas A&M Transportation Institute, 2023 Urban Mobility Scorecard.

CHANGING TRAVEL PATTERNS

As described in Chapter 3 of *Moving Forward 2055*, peak travel periods have been changing, even before the COVID-19 pandemic, and this change has accelerated and grown post-pandemic. Nationally, the weekday morning peak travel period (6:00 AM-10:00 AM) volumes are down about 12 percent in 2023 compared to 2019. The weekday afternoon/evening peak (3:00 PM-6:00 PM) is down just 9 percent in 2023 compared to 2019. However, average hourly traffic during the weekday midday is up 23 percent, and per hour nearly the same number of trips start during the midday as the evening commute period, typically the most congested period of the day.[10]

Some factors contributing to travel trends include workforce changes due to increased telework and flexible hours, resulting in more combined trips throughout the day as individuals make trips for multiple purposes. There has also been a pronounced shift to e-commerce resulting in deliveries of goods "to the door." Since the pandemic, an increase in telecommuting, which began during the pandemic lockdown periods, has "flattened the peaks" of both road congestion and transit ridership, while off-peak and weekend traffic and transit ridership has increased beyond pre-COVID levels. Telecommuting has been the largest contributor to these changes, but single occupant vehicle use is higher than pre-pandemic levels.[11]

CHANGING DEMAND

VMT and VHT are expected to increase by 11.9 percent and 14.4 percent, respectively, through the Plan horizon year across NYMTC's planning area. As described in Chapter 3, the population is expected to grow by 13 percent during this same period, to 14,327,000. Total labor force and employed labor force are expected to grow by 11.4 percent and 12.7 percent, respectively. Population and employment growth, with commensurate changes in economic activity and travel will significantly impact transportation demand.

TRUCK DEPENDENCE

As described in the Regional Freight Plan Element of *Moving Forward 2055* (see Appendix D), NYMTC is at the center of a large, complex, and multi-state metropolitan cluster that generates goods moving into, out of, through and within the planning area. Moving goods by truck is the predominant freight mode in NYMTC's planning area, accounting for 94 percent of all tonnage moved by volume. All freight modes are expected to show growth in both tonnage and value through 2055, except for waterborne. However, it should be noted that New York City is actively working to increase waterborne cargo.

EXISTING INITIATIVES

Several initiatives have been undertaken in and around the NYMTC planning area to address pervasive and growing traffic and transit congestion, including the following:

CONGESTION MANAGEMENT PROCESS (CMP)

23 CFR 450.322(a) states the following:

> *The transportation planning process in a Transportation Management Area (TMA) shall address congestion management through a process that provides for safe and effective integrated management and operation of the multimodal transportation system, based on a cooperatively developed and implemented metropolitan-wide strategy, of new and existing transportation facilities eligible for funding under title 23 U.S.C. and title 49 U.S.C. Chapter 53 through the use of travel demand reduction (including intercity bus operators, employer-based commuting programs such as a carpool program, vanpool program, transit benefit program, parking cash-out program, shuttle program, or telework program), job access projects, and operational management strategies.*

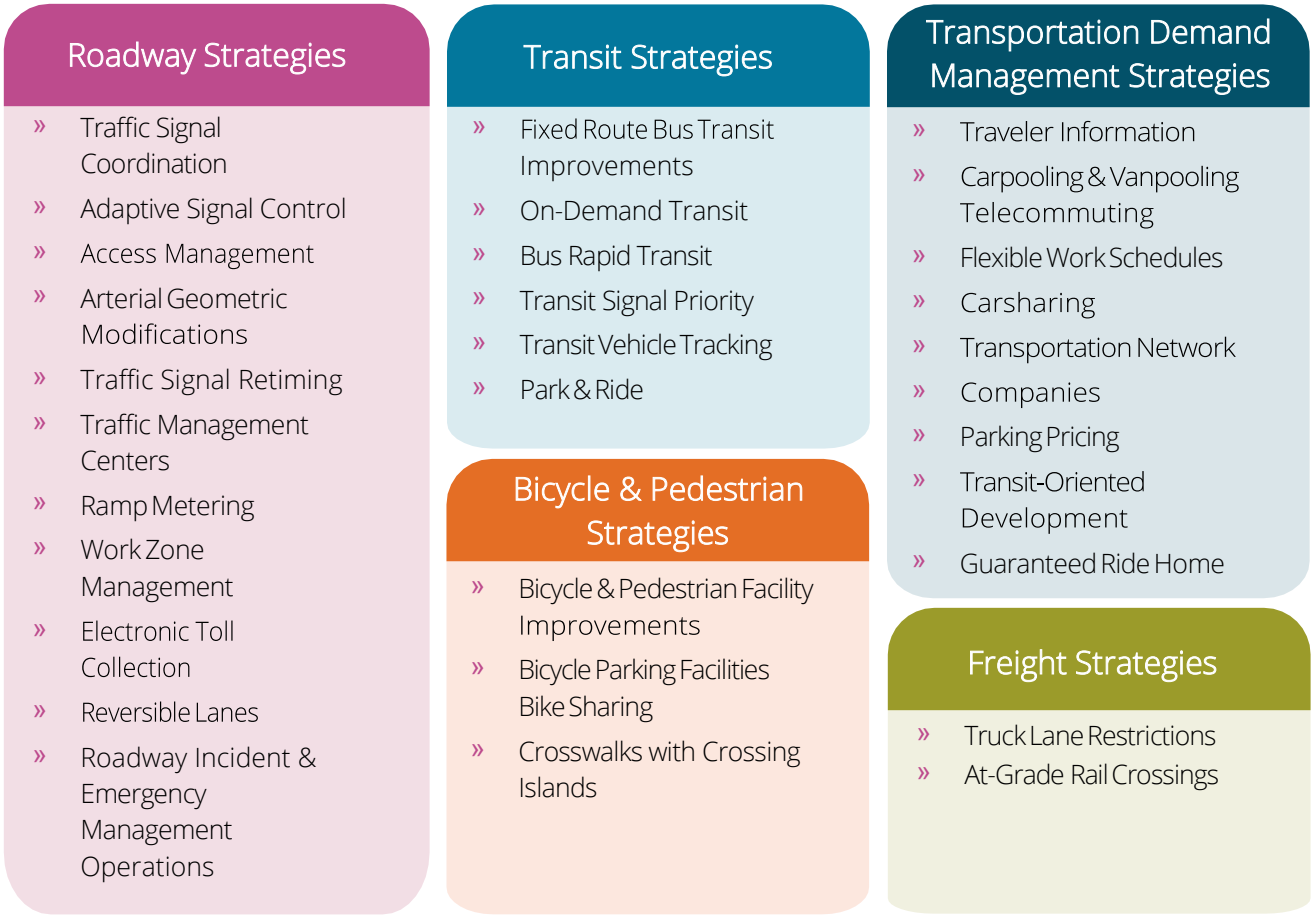
Per this regulatory requirement, NYMTC's CMP recognizes congestion can and should be eased by increasing capacity to move more people and freight across the multimodal transportation system, while managing future demand for vehicular travel. Congestion can be mitigated by implementing supportive policies and strategies such as those described in the CMP toolbox, including improving traffic management; more efficient use of existing highway system capacity; and implementing various transit strategies as well as alternatives to driving alone. NYMTC's CMP monitors and evaluates congestion mitigation strategies and related projects across the metropolitan transportation planning process through publishing a CMP Status Report which accompanies each newly adopted Regional Transportation Plan.

TRANSPORTATION SYSTEM MANAGEMENT AND OPERATIONS (TSMO)

TSMO strategies, programs, and improvements are a major component of NYMTC's CMP leading to safer roads, reduced vehicular travel demand, less traffic congestion, and higher transit utilization. TSMO refers to integrated strategies to optimize the performance of transportation infrastructure through projects and programs designed to operationally maximize capacity and improve the safety and reliability of the transportation system.

TSMO measures improve transportation system efficiency to move more people and goods and offer high returns on lower cost operational and demand management projects and programs. Additionally, strategies can help reduce transportation sector pollution by maximizing system efficiency. TSMO also seeks to improve the safety, security, and resiliency of the transportation system, and to optimize travel times and costs for all travelers. The full range of TSMO strategies and actions are shown in Figure 4.22.

Figure 4.22 TSMO Strategies and Actions



Source: NYMTC.

TRANSPORTATION DEMAND MANAGEMENT (TDM)

Coordinated regional and subarea Transportation Demand Management (TDM) programs which provide travelers with a more integrated, convenient, and accessible transportation network. TDM programs in the NYMTC planning area are built around 511NY, which provides transportation information and programmatic alternatives to driving alone. Under the umbrella of 511NY, outreach is undertaken to employers, commuters, and members of the public with information on carpooling, vanpooling, workplace commuter benefits, public transportation, guaranteed ride home, bicycling, walking, and teleworking.

Active Transportation and Demand Management (ATDM) and Integrated Corridor Management (ICM)[12] are two TSMO approaches that attempt to manage demand in specific areas and corridors through use of information and operational integration that encourage those in these areas and corridors to use alternative routes or services based on existing conditions. Examples in the NYMTC planning area include I-287 in Rockland and Westchester counties and the I-495 ICM project in Manhattan and Queens.

SHARED MOBILITY

Shared mobility programs, which include services such as bikeshare, car-share and other micromobility conveyances; and ride hailing services through transportation network companies. Bikeshare programs started in New York City in May 2013 with the CitiBike program. Similar programs also exist in suburban counties and are expected to grow in the future. These programs have been expanding to include e-bikes and other micromobility conveyances.

Micromobility is defined as any small, low-speed, human or electric-powered transportation device. Micromobility includes bicycles, scooters, electric bicycles (e-bikes), electric scooters (e-scooters), and other small, lightweight, wheeled conveyances. Micromobility includes privately owned and shared-use station-based or dockless fleets (bikeshare and scooter-share).[13]

CORDON PRICING

Cordon pricing introduces a surcharge for entering a certain geographical area, usually the dense core of a city. Tolls can be flat-fee or variable based on time of day, vehicle type, and other parameters. Cordon pricing has been implemented across many global cities including London, Stockholm, and Milan, lowering congestion and pollution, while raising transit travel speeds and a significant amount of revenue.

MANHATTAN CENTRAL BUSINESS DISTRICT (CBD) TOLLING

Manhattan CBD Tolling was initiated on January 5, 2025. Under this program, vehicles are charged a toll to enter the Congestion Relief Zone in Manhattan south of and including 60th Street but excluding peripheral limited access roadways. Tolls are levied based on vehicle type, time of day, with discounts or exemptions available under certain conditions. Manhattan CBD Tolling is the first such program initiated in the United States to manage congestion and raise revenue for transit services.

TRANSIT IMPROVEMENTS AND INNOVATIONS

Recent and planned transit improvements and innovations are designed to help provide alternatives to vehicular travel, reduce congestion, and improve the efficiency of the transportation system.

MICROTRANSIT SERVICES

Microtransit is an on-demand publicly available service using app-enabled trip request and fare payment functions. Microtransit is generally used as a complement to fixed route service, providing transportation during time periods or in geographic regions poorly served by regular fixed route service. While microtransit is more expensive to operate than fixed route transit and often charges a premium fare, flexibility provides a good customer experience in hard-to-serve areas.[14]

Microtransit services are currently planned or operating in NYMTC's planning area. Both Suffolk Transit in Suffolk County and Nassau Inter-County Express (NICE) Bus in Nassau County currently offer microtransit

services. Additionally, Putnam County's microtransit service (Putnam On-Demand) launched in May 2025 and Westchester County's Mobility and Transit Plan identifies several proposed microtransit zones in the county.

BUS PRIORITY MEASURES

Continued expansion and implementation of bus priority measures in NYMTC's planning area, including busways, transit and truck priority streets, offboard fare payment, and bus rapid transit (BRT) aim to increase transit service speeds and reliability. These measures include transit signal priority (TSP) to enable buses to travel faster by adjusting traffic signals along their route in real time to minimize delays.

FARE COLLECTION

MTA has introduced One Metro New York (OMNY) a new *tap- and -pay* fare collection system. OMNY accepts contactless bank cards (credit or debit) or smart devices to pay transit fares along with a dedicated OMNY stored value card. OMNY will be gradually expanded to three MetroCard Affiliate bus systems in the NYMTC planning area: Westchester County Department of Transportation Bee Line System; NICE Bus System, and Hudson Rail Link. PANYNJ introduced a similar contactless payment system called TAPP for PATH service from New Jersey to/from Manhattan.

TRANSIT SERVICE COORDINATION NEEDS ASSESSMENT

Per the recommendations of previous planning cycles, this needs assessment of transit service coordination across jurisdictional lines is evaluating service integration needs. The assessment's relevant objective is to improve the integration of the multimodal transit network in NYMTC's planning area. The assessment is evaluating intermodal connections in identified priority service needs areas, including, but not limited to, consideration of information, service, fare policies and passenger facilities. Recommendations will be considered by NYMTC's Transportation Coordinating Committees.

FREIGHT INITIATIVES

Several programs are underway to reduce truck dependence in the planning area. Delivering New York is New York City's strategic freight management plan, offering a comprehensive policy framework for a safe, sustainable, fair, and efficient last-mile freight delivery system. The plan emphasizes the importance of transforming the "last mile"—the final stage of delivery.[6] Among the plan's recommended programs are:

- Commercial Cargo Bicyclist Pilot Program—This pilot program encourages the use of cargo bicycles for commercial purposes in New York City and is open to any business interested in utilizing cargo bicycles for last-mile freight delivery.[7]
- Blue Highways Program—This program seeks to encourage the use of waterways to move goods into and around New York City.[8]
- Off-Hour Deliveries (OHD) Program—This program encourages goods delivery during the off-peak hours (7:00 p.m.to 6:00 a.m.) to decrease congestion and truck pollution. It is customized to help develop the most efficient delivery method for each business.[9]

Various projects are also in active development to improve the rail freight system in the NYMTC planning area. These include advancing the Cross Harbor Freight Program Tier II Environmental Impact Statement; addressing grade crossing issues and needs; and protecting the rail freight capacity of the Bay Ridge Line in conjunction with improvement at the 65th Street Yard in Brooklyn.

4.5.4 RECOMMENDED STRATEGIES AND ACTIONS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan and contain the following requirement:

> *The transportation plan shall include both long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system (including accessible pedestrian walkways and bicycle transportation facilities) to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand.*

Several categories of short- and medium-range strategies and actions recommended in pursuit of this vision goal are described below. Additionally, specific projects, programs and studies recommended for funding in the fiscally constrained element of *Moving Forward 2055*, as well as those recommended for future consideration in the speculative vision element of the Plan, appear in Appendix A.

PLANNING AND RESEARCH INITIATIVES

- Assess the impact of micromobility conveyances on existing bicycle lanes and greenways from an efficiency perspective.
- Identify new mobility technologies and concepts within micromobility, Mobility-as-a-Service (MaaS), complete streets.
- Assess the enhancement of 511NY to a complete MaaS platform.
- Prioritize grade crossing needs in the suburban subareas of the NYMTC planning area.
- Explore connected vehicle technologies and determine feasibility of deployment in congested corridors and areas.
- Evaluate employer-based alternative transportation incentive programs.
- Monitor critical freight corridors throughout the planning area.
- Assess integration of fare/toll payment for all modes of transportation.

DATA COLLECTION, FORECASTING, AND PERFORMANCE ASSESSMENT

- Monitor the effectiveness of CBT tolling in mitigating traffic congestion over time.
- Expand the Regional Freight Data portal.
- Monitor designated critical freight corridors and bottlenecks.
- Expand the data program to include microtransit and micromobility.

PLANNING PROCESS RECOMMENDATIONS

- Develop guidance on Complete Streets implementation and curb management.
- Continue use of the CMP Status Report to inform planning through the TSMO working Group.
- Review Intelligent Transportation Systems (ITS) architectures through the TSMO Working Group.
- Advance programs and initiatives for the multistate region through the Metropolitan Mobility Network.

PROGRAM RECOMMENDATIONS

- Initiate micromobility pilots in suburban communities and/or activity centers.
- Expand off-hours delivery program within and outside of New York City to minimize conflict with high volume hours for passenger vehicle traffic and ped/bike traffic.
- Implement the recommendations of the Transit Service Coordination Needs Assessment.
- Seek funding to support Transit Oriented Development, Complete Streets and micromobility services.
- Program projects to remediate bottlenecks identified during data collection and performance assessments.

4.5.5 PERFORMANCE MEASURES

23 CFR 450.324 governs the development and content of the metropolitan transportation plan. These regulations contain the following requirement:

> *The transportation plan shall include a description of the performance measures and performance targets used in assessing the performance of the transportation system.*

The performance measures listed below will assist in measuring progress toward this vision goal and its objectives, and in informing investment decisions:

- Performance measures designated for NYMTC's CMP and detailed in the 2025 CMP Status Report.

4.6 VISION GOAL—LAND USE

We seek to establish and maintain a transportation system for which land use decisions are encouraged in support of strategic transportation enhancements and improving modal choices.

4.6.1 DESCRIPTION

Land use and transportation are inextricably linked. Optimizing this relationship requires collaboration and alignment at all levels of Government. Strategic and sustainable development can be encouraged by undertaking land use planning, zoning, and transportation planning in tandem, thus encouraging land use planning and decision-making reinforcing and supporting transportation investments and services to move people and goods more efficiently throughout NYMTC's planning area. Doing so will decrease community impacts, improve accessibility to services, support healthy living conditions, and reinforce economic vitality.

4.6.2 OBJECTIVES

- Encourage TOD as well as parking, curb, and property management, micro-mobility pathways and other long-term sustainable land use strategies that support passenger and goods movement while reducing pollution.
- Encourage strategic distribution of growth throughout the region by prioritizing density over less dense development near transit, and by prioritizing transit investments where development is occurring.
- Help create/sustain vibrant communities through placemaking.
- Leverage land use mechanisms to improve access to destinations.
- Manage the First-Mile, Last-Mile planning process through collaboration with transportation and land use planning officials and affected stakeholders.
- Consider the impacts that transportation policies and projects will have on land values and proactively mitigate negative effects on existing communities.

4.6.3 RECENT TRENDS, CURRENT CONDITIONS, AND EXISTING INITIATIVES

RECENT TRENDS AND CURRENT CONDITIONS

NYMTC's planning area encompasses 189 local municipalities, including the City of New York, resulting in a region that is exceptionally complex in terms of land use planning and decision-making. NYS constitution grants municipalities and/or counties the ability to pass laws to govern themselves as they see fit (so long as

the laws do not conflict with the state and Federal constitutions), and specifically on matters related to land use and zoning. Thus, local land use planning is the domain of the local municipalities—cities, towns and villages—in NYMTC's planning area. Five suburban counties in the planning area each have charters governing land use responsibilities, which are generally advisory to the local municipalities within their borders. Their direct land use responsibilities are usually limited to land and facilities that they own.

According to New York State's online information on Land Use Planning and Regulation:

> *Police power is the power Government has to provide for public order, peace, health, safety, morals and general welfare. It resides in the sovereign state but may be delegated by the State to its municipalities. Land use controls are an exercise of the police power long recognized by the United States Supreme Court. In New York, the power to control land use is granted to each municipal Government by reference in Article IX, section 2, of the State Constitution and by the various state enabling statutes.*
>
> *With few exceptions, the exercise of the police power to control land use is a city, town or village function in New York State. This includes the decision whether to control land use, and, if so, to determine the nature of the controls. When exercised, the power to control land use is governed by the state enabling statutes which have granted the power to local governments. The General City Law, the Town Law, the Village Law, the General Municipal Law, the Municipal Home Rule Law and its companion Statute of Local Governments.*
>
> *New York's counties have the statutory power to create planning boards (General Municipal Law section 239-c). The county legislative body may prepare a county comprehensive plan or delegate its preparation to the county planning board or to a "special board" (General Municipal Law section 239-d). Prior to adopting or amending a county official map, the county legislative body must refer the proposed changes to the county planning board and other municipal bodies (General Municipal Law section 239-e). In addition, the county legislative body may authorize the county planning board to review certain planning and zoning actions, including certain subdivision plats, by municipalities within the county (General Municipal Law section 239-c(3)).*
>
> *State laws require that any city, town or village located in a county possessing a "county planning agency" or "regional planning council" must refer to that agency certain zoning matters before taking final action on those matters. In addition, where authorized by the county legislative body, certain subdivision plats must be referred to the county by the town, village or city planning board before taking final action. Generally, referral must be made where a proposed zoning matter or subdivision plat affects real property within 500 feet of one or more enumerated geographic features, such as a municipal boundary. Referral to the county planning agency or regional planning council is an important aid to the local planning and zoning process. It provides local planning and zoning bodies with advice and assistance from professional county and regional staff and can result in better coordination of zoning actions among municipalities by interjecting inter-community considerations. In addition, it allows other planning agencies (county, regional and state) to better orient studies and proposals for solving local as well as county and regional needs.*

Land use planning is focused on how land is used now and in the future. Zoning is the exercise of the police power to control land use by determining the usage and development of a specific area.

The Comprehensive Plan (also called a Master Plan) forms the basis, the blueprint, for all municipal planning and development. These plans have a multi-decade horizon and may be updated periodically. They provide overall guidance for zoning ordinances and actions and provide land use recommendations. These plans also address planned infrastructure projects in water supply & sewage; housing; recreation and open spaces; commercial development; natural resources management and land use in general, as well as transportation infrastructure.

For all municipalities in NYMTC's planning area, the Comprehensive Plan and/or zoning ordinance form the basis of local land use planning and control. For the counties in the planning area, except for Putnam County, in keeping with the provisions of New York State's General Municipal Law, legislative bodies have directed county planning boards to prepare a county comprehensive plan. Under the law, these county comprehensive plans establish the following:

- All county land acquisitions and public improvements, including those identified in the county official map adopted or amended pursuant to this article, shall be in accordance with a county comprehensive plan, if one exists.
- All plans for capital projects of a municipality or state governmental agency on land included in the county comprehensive plan adopted pursuant to this section shall take such plan into consideration.

The City of New York relies on its Zoning Resolution as a comprehensive set of zoning regulations. It defines the rules for land use, building sizes, setbacks, open space, and more. The resolution is regularly updated and amended by city agencies, and it includes regulations for various types of development. Major land use changes, such as rezonings and large development projects, go through the Uniform Land Use Review Procedure, which involves multiple stages of public review, including input from community boards, borough presidents, city agencies, and the City Council.

Land use planning coordination at a more regional level is undertaken in NYMTC's planning area through two regional planning councils formed at the agreement of their constituent county jurisdictions. The Hudson Valley Regional Council includes seven counties in the Hudson Valley, there of which are NYMTC members—Westchester, Rockland and Putnam counties. The Long Island Regional Council is comprised of Nassau and Suffolk counties.

Taken together, these land use planning and zoning mechanisms control and coordinate land uses in the NYMTC planning area in a decentralized, fragmented fashion. The land use planning and zoning decisions which are the purview of 189 municipalities form the de facto regional land use plan for the planning area. Except for the City of New York, NYMTC's members exercise only advisory influences over these land use and zoning decisions.

Although transportation can be a component of municipal and county comprehensive plans, mechanisms for transportation planning fall under jurisdictional structures which are both similar and different. Local

municipalities are responsible for the transportation infrastructure or services—including streets and roadways—that they own or operate. That is true for counties, also. NYS also owns or has responsibility for arterial roadways and limited-access highways, as well as various public transportation services. Finally, public authorities also own transportation facilities and services within NYMTC's planning area, including the MTA, PANYNJ, New York State Thruway Authority and New York State Bridge Authority.

Planning for the preservation, operation and expansion of these facilities and services is undertaken initially on a jurisdictional basis, each jurisdiction being responsible for planning for their facilities and services. Regional coordination of these planning activities takes place through an MPO such as NYMTC. Comprised of the owners and operators of transportation facilities and services, MPOs exist to plan for the use of Federal transportation funding. MPOs are required by the Federal legislation which authorizes the availability of this funding nationally. MPOs have no formal jurisdiction over land use planning within their planning areas, although Federal regulations require that land use plans be accounted for in the mandated regional transportation planning process.

LAND COVER

Land cover data documents how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types, while land use refers to how people use the landscape—whether for development, conservation, or mixed uses. The result of the decentralized structure of land use planning in the NYMTC planning area can be illustrated using the National Land Cover Database for NYMTC's planning area.

Table 4.4 presents land cover classes and their gain/loss over the period 2001—2021. For each county/borough in NYMTC's planning area, the table presents percentages of developed land classified as high intensity (HI), medium intensity (MI) and low intensity (LI); along with developed open space (DOS) and undeveloped land (UL).

- Developed—High Intensity: Highly developed areas where impervious surfaces account for 80 to 100 percent of land cover.
- Developed—Medium Intensity: Mixture of constructed areas and vegetation where impervious surfaces account for 50 to 79 percent of land cover.
- Developed—Low Intensity: Mixture of constructed areas and vegetation where impervious surfaces account for 20 to 49 percent of land cover.
- Developed—Open Space: Mixture of some constructed materials, but mostly vegetation typically including large-lot single family housing, parks, and golf courses where impervious surfaces account for less than 20 percent of land cover.
- Undeveloped: Includes barren land, forests, shrubland, herbaceous, planted/cultivated, and wetlands.

Table 4.4 demonstrates that counties and boroughs have experienced an increase in the percentage of high and medium intensity developed land over the last two decades; combined in most cases with a decrease in low intensity developed land and developed open space. Figure 4.23 compares the total

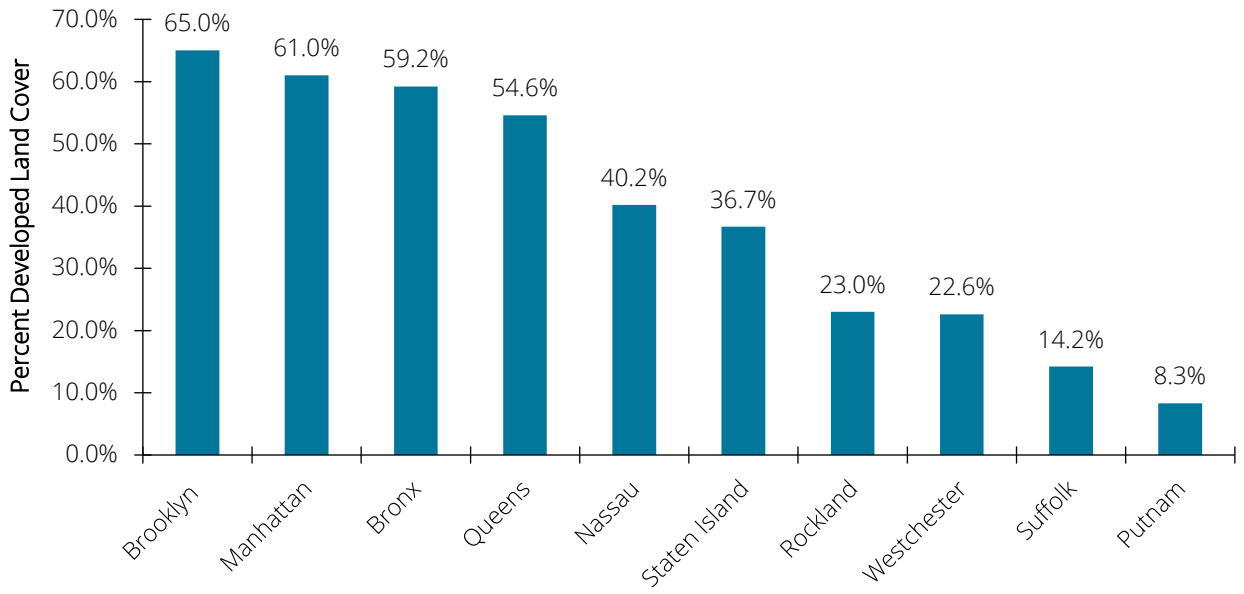
percentage of high, medium, and low intensity developed land percentage for each borough/county. Brooklyn and Manhattan are both above 60 percent developed land cover, while counties in the Lower Hudson Valley range from 8.3 percent (Putnam) to 23 percent (Rockland) developed land cover.

Table 4.4 Land Cover Classes by County/Borough

	2021 Land Cover Share					2001–2021 Change			
Borough/ County	High Intensity (HI) %	Medium Intensity (MI) %	Low Intensity (LI) %	Developed Open Space (DOS) %	Undeveloped Land (UL) %	HI % Change	MI % Change	LI % Change	DOS % Change
New York City									
Brooklyn	47.3%	13.8%	3.9%	2.1%	32.9%	1.3%	2.5%	-11.8%	-13.5%
Manhattan	44.2%	12.2%	4.6%	4.9%	34.1%	2.8%	11.0%	-9.1%	-7.7%
Bronx	33.1%	18.8%	7.3%	6.2%	34.6%	3.7%	5.1%	-6.8%	-1.1%
Queens	28.8%	19.9%	5.9%	2.4%	43.0%	1.4%	2.0%	-6.7%	-10.6%
Staten Island	8.6%	20.3%	7.8%	4.9%	58.4%	7.6%	5.4%	-4.2%	-9.2%
Suburban Counties									
Nassau	7.1%	21.1%	12.0%	11.3%	48.5%	3.3%	2.9%	-0.3%	-2.8%
Westchester	3.3%	7.8%	11.5%	18.7%	58.7%	9.5%	14.2%	5.6%	1.9%
Rockland	2.2%	7.7%	13.1%	16.7%	60.3%	21.6%	21.4%	6.7%	3.2%
Suffolk	1.5%	4.9%	7.8%	7.8%	78%	13.6%	10.9%	2.2%	-1.1%
Putnam	0.5%	2.6%	5.2%	9.3%	82.4%	29%	22.3%	9.4%	2.7%

Source: National Land Cover Database.

Figure 4.23 Comparison of Developed Land Cover



Source: National Land Cover Database.

EXISTING INITIATIVES

Several overarching land use and transportation planning initiatives relevant to this shared goal are outlined below:

COORDINATED DEVELOPMENT EMPHASIS AREAS AND HOUSING GROWTH AREAS

Moving Forward 2055 identifies a variety of Coordinated Development Emphasis Areas (CDEA) and Housing Growth Areas (HGA) across NYMTC's planning area. These are geographic areas where land development and transportation investment planning are or will be established to create linkages to further integrating planning for transportation, housing, and development. CDEAs and HGAs have the potential to shape future growth and the way the transportation system accommodates that growth. They are important to achieving the Plan's Shared Vision for Regional Mobility by creating stronger linkages between land use decisions made at the local level and transportation investment decisions made at the planning area level.

By encouraging investments in development and transportation in a coordinated fashion, CDEAs and HGAs also provide a framework that can foster more efficient, sustainable growth, and help mitigate environmental pollution while conserving land and strengthening economic vitality. See Appendix A of *Moving Forward 2055* for the Plan's CDEA and HGA maps.

COMMUNITY PLANNING WORKSHOP PROGRAM

Using the CDEAs and HGAs as a targeting mechanism, NYMTC funds a continuing program of community planning activities that:

- Encourage "compact" development in centers and downtowns to reinforce walkable, aesthetically pleasing, and transit-accessible environments, while managing vehicular access and parking.
- Encourage consideration of local transportation issues in comprehensive/master planning and community visioning processes.
- Make walking and biking safer and more convenient through safety and streetscape improvements, hiking and mixed-use paths, bike lanes, etc.
- Support downtown development/redevelopment.
- Repurpose available unused / underused real estate (office spaces); parking lots, etc.
- Consider first mile/last mile transit station and/or service access.

MTA FIRST-MILE/LAST-MILE (FMLM) TOOLKIT

MTA developed this toolkit as a resource for regional communities and other interested parties to encourage implementation of improved, fair, and environmentally friendly ways for travelers to access MTA LIRR and MTA MNR commuter rail stations in New York suburbs, providing users with a step-by-step guide for identifying and developing potential FMLM strategies to implement or test as a pilot program.[15]

TRANSIT ORIENTED DEVELOPMENT (TOD) INITIATIVES

TOD aims to develop commercial hubs and neighborhoods near transit stations and/or services. Denser, mixed-use neighborhoods near transit also tend to be more cost- and maintenance-efficient due to the type of housing and development. Downtown cores of smaller municipalities, in lower density areas, can benefit as well, by incorporating TOD principles in their planning to create mixed-use, walkable, more active, and somewhat denser centers. Notable TOD programs currently underway include:

- MTA TOD Program—MTA plans and advocates for compact, mixed-use communities around MTA train stations and works to make sure our stations are well-integrated and accessible by foot, bike, and personal wheeled vehicles. As part of the MTA's efforts to make system access fairer and more sustainable, the TOD Program makes use of the FMLM Toolkit described above. The TOD Program also works closely with municipal planners to innovate and administer zoning tools that leverage private development into critical station access and circulation improvements.
- Bronx Metro-North Area Plan—Associated with a major transportation improvement project to establish MTA MNR access to Penn Station on the west side of Manhattan, four new MTA Metro-North stations will be constructed in the east Bronx communities of Parkchester/Van Nest, Morris Park, Hunts Point, and Co-op City. Stations will connect East Bronx to both southwestern Connecticut and to Penn Station. Land development around these new stations will create nearly 7,000 residential units, as well as 10,000 jobs, all of which will be close to public transit.
- Wyandanch Rising, Suffolk County—The Wyandanch Rising revitalization initiative aims at addressing longstanding issues in Wyandanch in the Town of Babylon. The Town acquired more than 70 properties for the project site and built out the infrastructure necessary for the

development. Affordable housing development is ongoing. Other facilities include a new park, a newly opened MTA LIRR station house, and a 500-car commuter parking garage.

- Nanuet Hamlet Center, Rockland County—This TOD project around the Nanuet train station is intended to develop a traditional "main street" neighborhood that provides the opportunity for mixed-use development and a variety of multi-generational housing options for residents seeking to live near, and utilize, transit service. Improved sidewalks and parking infrastructure, green spaces, connectivity to transit, emphasis on bicycle and walking, infill development, aim to preserve the "small-town feel" and identity of the hamlet, yet also create a vibrant, diverse neighborhood.
- Brewster Main Street, Putnam County—Development in the Village of Brewster near its MTA Metro-North station will add over 408 new housing units and include businesses, municipal offices, parking spaces, etc. Completion of the first phase is expected by 2027.

SIGNIFICANT REZONINGS

- City of Yes Zoning Initiatives—Between 2023 and 2025, New York City's zoning resolution underwent a substantial overhaul to support small businesses, facilitate greater housing production, and promote sustainability. These changes included several initiatives to support transit-orientated development, including removing parking requirements and allowing denser buildings in transit-rich areas.
- Atlantic Avenue Mixed Use Plan (AAMUP), Brooklyn—This rezoning, which passed the City Council in the Spring of 2025, was a community-led planning process geared toward supporting an inclusive, mixed-use stretch of Atlantic Avenue and neighboring blocks in Crown Heights and Bedford-Stuyvesant. The plan supports new and affordable housing, new space for jobs and services, safer, more pedestrian-friendly streets and investments in neighborhood improvements.
- Jamaica Neighborhood Plan, Queens—Jamaica is a major transportation hub for the borough of Queens. Zoning changes are being considered that would help Jamaica grow and thrive, with up to 12,000 new homes including around 4,000 permanently income-restricted affordable homes in a 230-block area of Jamaica. These changes would also create more opportunities for businesses, bringing new jobs to residents and economic growth to the area. Beyond these zoning changes, the plan would include strategic investments to enhance infrastructure, transit access, open space, and more.
- Long Island City Neighborhood Plan, Queens—The City of New York seeks to increase the supply of permanently affordable housing, expand open space opportunities and waterfront access, promote job growth, address critical infrastructure capacity issues and plan for the future resiliency of the neighborhood.
- Midtown South Mixed Use Plan (MSMX), Manhattan—This neighborhood plan is designed to foster vibrant, 24/7 mixed-use neighborhoods across 42 blocks of Manhattan's Midtown South by expanding housing, bolstering economic activity, and enlivening the public realm. The plan would map new high-density residential districts to generate around 9,700 homes, up to 2,800 of them permanently income-restricted, in areas with excellent transit access and where housing today is not permitted.

- Connect Long Island, Suffolk County—Suffolk County's transportation and development plan to support TOD and create an innovation economy and sustainable growth alongside open space preservation. The Long Island I-Zone is a component of Connect Long Island which seeks to integrate major innovation and transportation assets in and around the County Route 97/Nicolls Road corridor and linking three MTA LIRR lines in a north-south direction. Connect Long Island also includes the Ronkonkoma Hub TOD, Ronkonkoma South, and connectivity to MacArthur Airport.
- District Galleria, Westchester County—Proximate to the White Plains TransCenter, District Galleria is one of the largest enclosed shopping mall conversions in the tri-state area with a cost near $2.5 billion. Zoning is to align with the City of White Plains' TOD goals. The mall is to be demolished to make way for the construction of a mixed-use complex of seven residential towers, retail and commercial spaces, pocket parks, and open space.
- Southwest Yonkers, Westchester County—The City of Yonkers has been actively redeveloping its downtown with projects like Saw Mill Lofts and riverfront housing aimed at leveraging proximity to MTA MNR stations and Bee-Line System buses. Yonkers adopted the Ludlow Street Transit-Oriented Development Plan Adoption and Zoning Amendments in 2020, to revive a brownfield area that had not seen improvements in decades. Various development sites have reshaped Yonkers neighborhoods and have attracted investments.

4.6.4 RECOMMENDED STRATEGIES AND ACTIONS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan and contains the following requirement:

> *The transportation plan shall include both long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system (including accessible pedestrian walkways and bicycle transportation facilities) to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand.*

Several categories of short- and medium-range strategies and actions recommended in pursuit of this vision goal are described below. Additionally, specific projects, programs and studies recommended for funding in the fiscally constrained element of *Moving Forward 2055*, as well as those recommended for future consideration in the speculative vision element of the Plan, appear in Appendix A.

PLANNING AND RESEARCH INITIATIVES

- Benchmarking research on best practices for aligning land use policies with transportation investments from other metropolitan regions.
- Identify resources and funding programs available for advancing TOD and housing development.
- Research linkages between transportation investments/services and land values.

DATA COLLECTION, FORECASTING, AND PERFORMANCE ASSESSMENT

- Update the regional land use database.
- Develop and maintain a repository for county and municipal comprehensive/master plans as input for the regional land use database and for the disaggregated socio- economic/demographic (SED) forecasts.
- Maintain an inventory of development projects for the three NYMTC subareas.
- Produce an annual report of TOD project status.
- Establish Key Performance Indicators that can be used to evaluate TOD progress.
- Track zoning changes, development trends, and land use patterns in areas along transit corridors.

PLANNING PROCESS RECOMMENDATIONS

- Through the Community Planning Workshops (CPW) program, engage local communities and other stakeholders to identify potential TOD sites and projects using CDEAs and HGAs identified in Appendix A as a strategic guide.
- Use MTA's FMLM Toolkit for TOD projects undertaken through the CPW program.
- Monitor the status and development of the CDEAs and HGAs identified in Appendix A through the PFAC Land Use Subcommittee.
- Expand the PFAC Land Use Subcommittee to include local municipality representatives and mobility service providers.
- Collaborate with the local governments to ensure that transportation systems align with land use decisions.
- Explore visioning initiatives and Planning and Environmental Linkages studies to explore alternatives for targeted TOD projects.

PROGRAM RECOMMENDATIONS

- Develop illustrative zoning incentives for higher-density development near transit nodes.
- Develop placemaking and community design guidance for local municipalities.

4.6.5 PERFORMANCE MEASURES

PERFORMANCE METRICS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan. These regulations contain the following requirements:

The transportation plan shall include a description of the performance measures and performance targets used in assessing the performance of the transportation system.

The performance measures listed below will assist in measuring progress toward this vision goal and its objectives, and in informing investment decisions:

- At the county/borough level, the percentage in each of the land cover classes and relative gain/loss.
- Percent of commercial and residential development within one-half mile of a transit stop.
- Number of active TOD projects.
- Key Performance Indicators recommended above that can be used to evaluate TOD progress.

4.7 VISION GOAL—FAIRNESS AND ACCESS

We seek to establish and maintain a transportation system for which fairness in transportation is advanced and access to opportunities is improved for all communities.

4.7.1 DESCRIPTION

The transportation system in NYMTC's planning area functions to provide mobility and access for residents and goods, defining mobility as the ability or capacity to move about the planning area, and defining access the ability to obtain or make use of various services or activities for those living in and visiting the area. However, the system does not provide these important capabilities equally for all communities given topography, distance, existing infrastructure, and resource constraints. As outcomes of NYMTC's planning process, this goal seeks to advance the levels of mobility and improve access to social, economic, recreational, and medical services for communities within NYMTC's planning area to improve overall access to opportunities for every member of the traveling public.

Additionally, this goal seeks to incorporate the policies of NYMTC's Title VI/Non-Discrimination Program in its metropolitan planning process, as well as in the execution of that process and the plans, programs, and projects which result. The Title VI/Non-Discrimination Program establishes NYMTC's commitment to non-discrimination to ensure that all plans, programs, procedures, policies, and activities do not have disproportionate adverse effects on minority and low-income populations. It is also the policy of NYMTC that minority and low-income communities will be engaged to facilitate their full and fair participation in the metropolitan transportation planning process. More detail on the region's communities of concern and other socioeconomic characteristics are available for viewing in the *Moving Forward 2055* Interactive Map.

4.7.2 OBJECTIVES

- Improve first- and last-mile access to transit.
- Improve accessibility to the transportation system for users of all abilities.
- Provide more frequent and reliable transit service.
- Strategically expand transportation services and information to enhance mobility in communities with the greatest mobility needs.
- Improve access to social and economic opportunities for all populations, regardless of age, ability, race, ethnicity, or income.

4.7.3 RECENT TRENDS, CURRENT CONDITIONS, AND EXISTING INITIATIVES

RECENT TRENDS AND CURRENT CONDITIONS

Understanding the mobility characteristics of the NYMTC planning area is essential to shaping a transportation system meeting needs of a diverse and evolving population. Recent social, economic, and technological developments are influencing how transportation is designed, provided, and consumed in NYMTC's planning area. Developments provide context for this vision goal and its objectives to respond effectively to current challenges and opportunities.

NYMTC's planning area encompasses a highly diverse population, including individuals of numerous racial, ethnic, income, and language backgrounds with diverse mobility characteristics. According to the 2023 American Community Survey (ACS) from the U.S. Census Bureau, 41 percent of planning area households—over 1.9 million households—do not have access to a private vehicle. Another 32 percent have access to one private vehicle. Of planning area workers 16 years old and older who did not work from home, 37 percent traveled over 45 minutes to work, with another 25 percent traveling 30 to 44 minutes to work.

The 2023 ACS also indicates 38 percent of the 12.8 million people residing in the planning area fall in age ranges with significant mobility limitations: 17 years old and younger (21 percent) and 65 years old and older (17 percent), with 11 percent of planning area residents having a disability.

The planning area's minority population—as defined through 2023 ACS—totaled 7.7 million residents and 60 percent of the planning area's total population. New York City had the largest percentage of minority population, with 69 percent or nearly 5.9 million people. Long Island's minority population totaled 1.2 million people or 41 percent of its total population, and the Lower Hudson Valley had a minority population of 658,470, approximately 46 percent of its total population. Approximately 40 percent of NYMTC's planning area residents were non-Hispanic white, 26 percent were Hispanic or Latino, 17 percent were non-Hispanic Black or African American, and 12 percent were non-Hispanic Asian. The remaining 5 percent were American Indian and Alaska Native, Native Hawaiian and Other Pacific Islander, and other or mixed race.

Regarding household income, approximately 14 percent (1.8 million people) of the planning area's population lived in households at or below the defined poverty level, according to the 2023 ACS. Long Island had the lowest proportion of population at or below the poverty level with 6 percent (approximately 168,000 people), followed by the Lower Hudson Valley with 10 percent (approximately 145,000) and New York City with 17 percent (approximately 1.5 million).

As described in Appendix G to *Moving Forward 2055*, low-income and minority populations in the planning area have significantly different mobility characteristics due to limitations in mobility options and information that present challenges to reaching employment centers, healthcare facilities, education centers, and other essential destinations. Because of mobility challenges, these areas, among others, are identified as Communities of Concern (CoC) in the NYMTC planning process from the perspective of transportation fairness and access to opportunity. A full description of CoCs appears in Appendix G to *Moving Forward 2055*.

As described in Chapter 3 of *Moving Forward 2055*, regional population is expected to continue to grow and diversify, with new demands on the transportation system and challenges in the context of this vision goal, such as:

- Increases in the number and proportion of senior citizens will continue to drive greater demand for accessible transit options, demand-responsive and paratransit services, and pedestrian-friendly transportation facilities and infrastructure.
- Due to increases in cost-of-living and housing costs, lower income households will continue to face limitations in their mobility options.
- As immigrant populations and multilingual households grow, language barriers will continue to limit access to transportation information and mobility options.
- Advances in technology and transportation innovations are transforming the transportation system, but not all communities are benefiting equally from these innovations. For example:
- CoCs often experience barriers to real-time transportation information about available mobility options and opportunities for employment, training, healthcare, etc.
- Cleaner transportation technologies reduce vehicular pollution, but economic characteristics limit access to these advancements, as well as their benefits in CoCs.
- Rapid expansion of shared micromobility conveyances and services involving bicycles, e-bikes, and scooters, etc., has resulted in uneven access in CoCs to these conveyances and related services.

Additionally, frequent extreme weather is placing new stresses on the transportation system and impacting communities based on their location. CoCs often experience greater disruptions given their locations, mobility limitations, and a lack of access to emergency transportation information.

EXISTING INITIATIVES

Numerous initiatives in NYMTC's planning process are aimed at fair transportation and access across NYMTC's planning area through the inclusive planning process. By embedding access considerations into planning, funding, and implementation, NYMTC is working to create a fairer transportation network that provides greater access to opportunity for all of the traveling public. Initiatives are outlined below:

- Transit Service Coordination Needs Assessment—As recommended in *Moving Forward 2055's* predecessor Plan, this project is assessing transit service coordination needs across jurisdictional lines to evaluate intermodal connections with the objective of improving the integration of the multimodal transit network in the NYMTC planning area.
- Community Planning Workshops—This project enables NYMTC's members agencies to develop community workshops whose locations are consistent with the Coordinated Development Emphasis Areas identified in Appendix A. The workshops will provide planning assistance to local municipalities and community boards and will facilitate discussions enabling participating communities to develop, evaluate and implement improvements consistent with the Shared Vision for Regional Mobility presented in Chapter 1.

- MTA's First Mile Last Mile (FMLM) Toolkit—Developed as a resource for communities and other interested parties (users) to encourage implementation of improved, fair, and environmentally friendly ways for travelers to access commuter rail services.[16]

- Overcoming Information Barriers—MaaS is a type of service that enables users to plan, book, and pay for multiple types of mobility services through an integrated platform.[17] Transportation services from public and private transportation providers are combined through a unified gateway, usually via an app or website. 511 New York (511NY) is a free, one-stop, all-encompassing telephone and Web service offering information on transportation services and conditions throughout New York State. The service offers trip-planning resources, information on traffic conditions, weather updates and alternative transportation information.

- Assessing Patterns of Mobility and Investment—NYMTC is responsible for programming transportation projects which will make use of Federal funding. When assessed geo-spatially, programmed projects form a pattern of intended investment in transportation facilities and equipment that can be assessed relative to the CoCs. This assessment is presented in Appendix A and Appendix G.

- Inclusive Public Engagement—Multilingual and culturally sensitive outreach is advanced through NYMTC's Language Access Operating Procedures and Public Involvement Plan. NYMTC's Thriving Communities Network increases involvement from CoCs and their representatives in the metropolitan transportation planning process. Through the Network, partnerships with community organizations and advocacy groups working in or with CoCs have strengthened inclusive engagement. Additionally, community inclusion is an important consideration in the development of public outreach activities for NYMTC's required planning projects and specific subarea, corridor and technical studies undertaken by NYMTC and/or its individual member agencies.

- Information Sharing for Project Solicitations and Funding Availability—Through mechanisms such as the Thriving Communities Network and lists of non-profit organizations and human services transportation providers developed for the Coordinated Public Transportation/Human Services Transportation Plan that is Appendix E, NYMTC is sharing information related to relevant project solicitations and funding availability with many organizations that operate in or support CoCs.

- Advisory Working Groups and Study Advisory Committees—Using information channels previously described, NYMTC has also expanded community access to the regional planning process through participation with topical Advisory Working Groups and advisory committees for specific subarea, corridor and technical studies undertaken by NYMTC and/or its individual member agencies.

- Universal Design—Universal design is usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.[3] Consideration of universal design and access has become more prominent, with agencies adopting policies that go beyond legal compliance in some cases.

4.7.4 RECOMMENDED STRATEGIES AND ACTIONS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan and contain the following requirement:

> *The transportation plan shall include both long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system (including accessible pedestrian walkways and bicycle transportation facilities) to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand.*

Several categories of short- and medium-range strategies and actions recommended in pursuit of this vision goal are described below. Additionally, specific projects, programs and studies recommended for funding in the fiscally constrained element of *Moving Forward 2055*, as well as those recommended for future consideration in the speculative vision element of the Plan, appear in Appendix A.

PLANNING AND RESEARCH INITIATIVES

- Inventory all potential funding sources for first mile/last mile services and for accessibility.
- Inventory current and developing technology that can be used to improve first- and last-mile services, information, and accessibility.
- Target community planning workshop offerings to key system interfaces established in Transit Service Coordination Needs Assessment.
- Assess the level of accessibility for all transit services in the planning area.
- Perform benchmarking research on mobility assessments in peer regions.
- Develop a mobility index for all communities in the planning area.
- Assess service levels relative to the Mobility Index.

DATA COLLECTION, FORECASTING, AND PERFORMANCE ASSESSMENT

- Annually update data for indices related to mobility and update CoC designation and assessment with each new Regional Transportation Plan.
- Monitor the key system interfaces established through the Transit Service Coordination Needs Assessment.
- Establish an annual scorecard of the level of accessibility for all transit services in the planning area.
- Quantify service levels by census tract throughout the planning area.

PLANNING PROCESS RECOMMENDATIONS

- Plan and implement the service accessibility assessment through the DRs' Working Group.
- Consider the findings of the Transit Service Coordination Needs Assessment at the transportation coordinating committees.

PROGRAM RECOMMENDATIONS

- Implement recommendations of the Transit Service Coordination Needs Assessment.
- Continue relevant project selections through the Section 5310 funding program.

4.7.5 PERFORMANCE MEASURES

PERFORMANCE METRICS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan. These regulations contain the following requirement:

> *The transportation plan shall include a description of the performance measures and performance targets used in assessing the performance of the transportation system.*

The performance measures listed below will assist in measuring progress toward this goal and its objectives, and in informing investment decisions:

- On-time performance overall for transit service and for key interfaces as determined through the Transit Service Coordination Needs Assessment.
- Transit ridership overall and for key interfaces as determined through the Transit Service Coordination Needs Assessment.
- Non-Discrimination Index as defined in Appendix G.
- Mobility Index indicating relative mobility characteristics across the planning area.
- Accessibility scorecard for transit services throughout the planning area.
- Investment assessment as defined in Appendix A and Appendix G.

4.8 VISION GOAL—ENVIRONMENT

We seek to establish and maintain a transportation system for which environmental impacts—including harmful air pollutants—are significantly reduced through technology applications, increased use of greener travel options, and improved system efficiency.

4.8.1 DESCRIPTION

This goal focuses on long term environmental stewardship and reducing harmful pollutants from the operation, preservation, and enhancement of the transportation system. The goal seeks to minimize the transportation system's environmental impacts through land use measures, environmental stewardship, managing vehicular travel, promoting lower impact vehicle technologies, and mitigating community impacts. NYMTC's member agencies have individual policies for addressing the impacts of transportation on the environment and have established this goal to continue and amplify those efforts when they come together as NYMTC. More detail on various critical environmental assets within the NYMTC planning area are available for viewing in the *Moving Forward 2055* Interactive Map.

4.8.2 OBJECTIVES

- Support land use sustainability through improved and efficient transportation services and facilities, which enable more efficient land use.
- Practice environmental stewardship to maintain and enhance the transportation system.
- Promote and improve public transportation and active transportation modes, such as walking and cycling, to reduce pollution, improve air quality and support public health.
- Support lower- and zero-emission alternatives to current trucking through vehicle technology and greater modal balance.
- Modernize public vehicle fleets to lower- and zero-emission vehicles and support the conversion of private vehicles.
- Efficiently manage limited roadway capacity to mitigate congestion and vehicular pollutants.
- Address the unequal impacts of transportation sector pollution on certain communities.

4.8.3 RECENT TRENDS, CURRENT CONDITIONS, AND EXISTING INITIATIVES

RECENT TRENDS AND CURRENT CONDITIONS

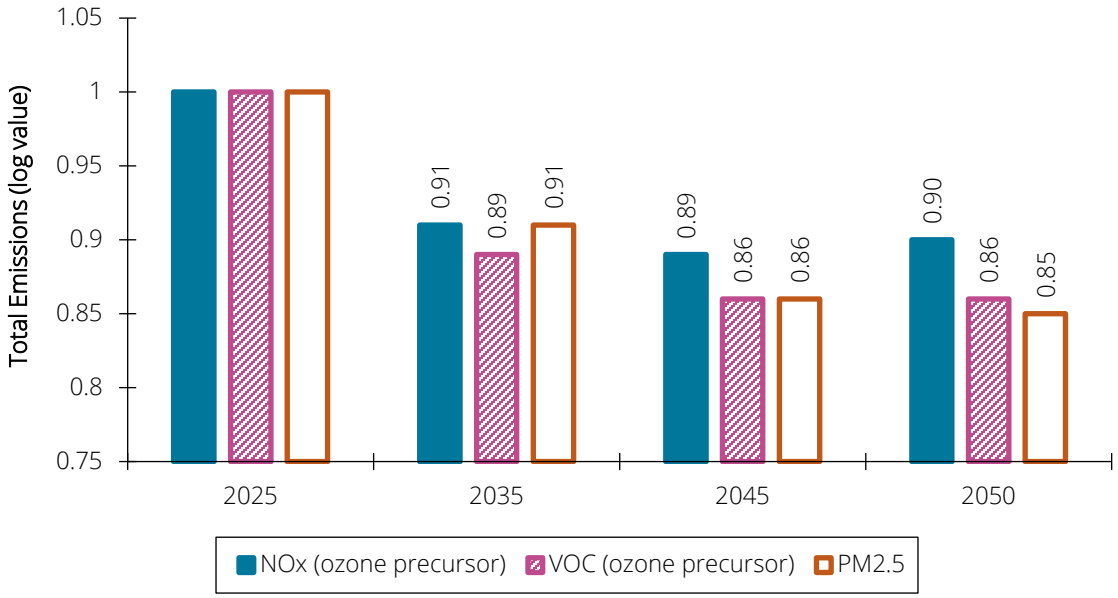
Over the last several decades, some environmental effects from transportation have been mitigated through regulation, technological advances, and system improvements made over time using Federal, state, and local funding. These efforts are related to the ultimate achievement of the National Ambient Air Quality Standards (NAAQS) set under the Clean Air Act Amendments of 1990 (CAAA90) and the mitigation of the transportation system's contributions to pollution and overall environmental impact.

Criteria pollutants defined by CAAA90 can harm human health and the environment, and cause property damage.[18] Pollutants include Carbon Monoxide, Lead, Nitrogen Dioxide (a pollutant emitted by cars, trucks, buses, power plants), Ozone, Particulate Matter, and Sulfur dioxide a pollutant that is a combustion product released by burning fossil fuels. Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for a NAAQS is in non-attainment.[19] CAAA90 stipulates state governments must establish several types of State Implementation Plans (SIP) to address non-attainment areas at different spatial scales and detail how a state plans to maintain and meet the National Ambient Air Quality Standards (NAAQS) in those areas.[20] The NYS SIP contains regulations and documents used to reduce air pollution in areas not meeting NAAQS required by CAAA90 and set by the U.S. Environmental Protection Agency (EPA) for criteria pollutants.[21]

NYMTC prepares Transportation Conformity Determinations that ensure that the transportation projects and programs in its Transportation improvement Program and Regional Transportation Plan do not exceed the motor vehicle emissions budgets[22] set by the NYS SIP in relation to relevant nonattainment areas and maintenance areas, which are former nonattainment areas that are demonstrating maintenance of the NAAQS, that impact NYMTC's planning area.

Figure 4.24 below presents forecasted trends for key criteria pollutants from the most recent NYMTC Transportation Conformity Determination. Logarithmic transformations of the data values are used in the figure.

Figure 4.24 Comparative Pollution Forecasts (in log values)



Source: 2024 NYMTC Transportation Conformity Determination.

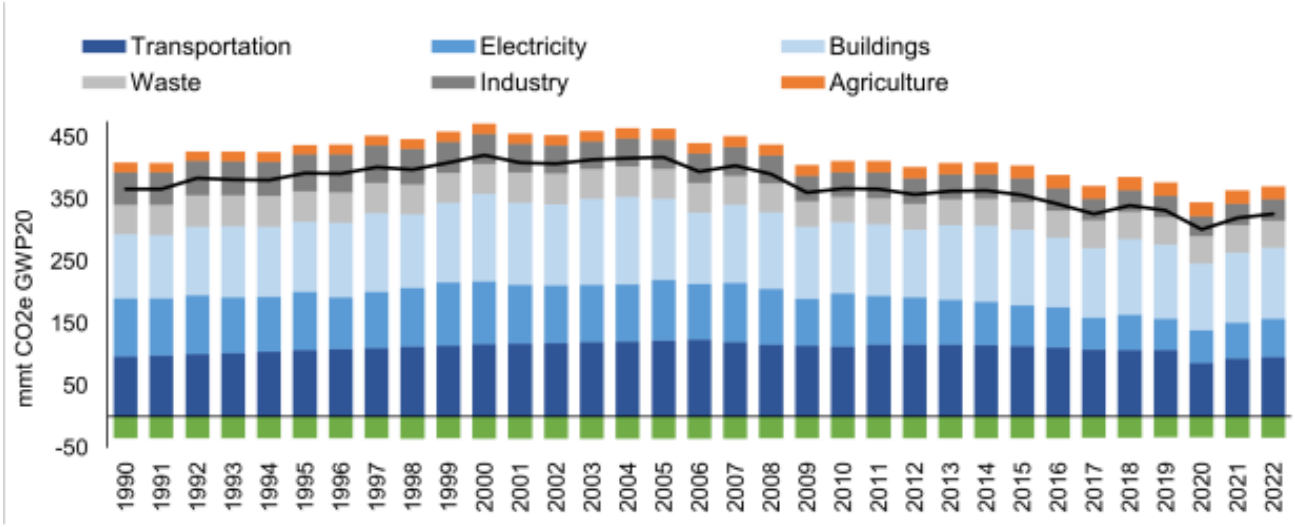
SOURCES OF POLLUTANTS

Pollutants in the atmosphere can create negative public health impacts and environmental damage. Examples of notable pollutants include carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Carbon dioxide from human activity such as the burning of fossil fuels for electricity, heat, and transportation, comprises the largest share of these pollutants.[23]

Sources of the aforementioned six pollutants in New York State include vehicle fuel combustion in the transportation sector (19 percent) followed closely by fuel combustion in the residential, commercial, and industrial sectors (18 percent). Fuel combustion for electricity generation (including net imports) represents 7 percent. Other sources (e.g., industrial process, agriculture, and waste) combine for 25 percent statewide, while fugitive, or unintentional, emission, leakage, or discharge of gases or vapors from various sources, account for 4 percent.. Out of state sources also contribute to pollution in New York State.[24]

As illustrated in Figure 4.25, levels of carbon dioxide in NYS increased from 1990 and peaked in 2005, but have since declined. Since 1990, there has been a substantial decrease in carbon dioxide generated by fuel combustion for electricity generation as well as a decrease in fuel combustion for industrial purposes. Pollution from all other energy sources was slightly lower in 2022 compared to 1990.

Figure 4.25 New York State Notable Pollutants by Economic Sector



Source: 2024 Statewide GHG Emissions Report, NYSDEC.

EXISTING INITIATIVES

- Climate Leadership and Community Protection Act—New York State's 2019 Climate Leadership and Community Protection Act (CLCPA) aims to achieve economy-wide carbon neutrality. The CLCPA works alongside other State efforts to reduce the financial impact and increase the quality of life for residents of the state of New York, with a focus on affordability, justice, and grid reliability. The CLCPA established a CLCPA Council responsible for developing a scoping plan to help meet the law's requirements. This includes aggressive pollution reduction and electrification goals for the years 2030, 2040, and 2050.
- Transportation Conformity—Conformity is defined as "*a Clean Air Act (42 U.S.C. 7506(c)) requirement that ensures that Federal funding and approval are given to transportation plans, programs and projects that are consistent with the air quality goals established by a State Implementation Plan (SIP). Conformity to the purpose of the SIP means that transportation activities will not cause new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS or any required interim emission reductions or other milestones in any nonattainment or maintenance area. The transportation conformity regulations (40 CFR part 93, subpart A) sets forth policy, criteria, and procedures for demonstrating and assuring conformity of transportation activities.*"[25]
- TSMO—TSMO strategies, programs, and improvements can lead to safer roads, reduced vehicular travel demand, less traffic congestion, and higher transit utilization. TSMO refers to the integrated strategies to optimize transportation infrastructure through projects and programs designed to operationally maximize capacity and improve the safety and reliability of the transportation system.
- TSMO measures are intended to improve the efficiency of the transportation system in moving people and goods and can offer high returns on lower cost operational projects and programs. Additionally, these strategies can help reduce transportation pollution by maximizing system

efficiency. TSMO also seeks to improve the safety, security, and resiliency of the transportation system, and to optimize travel times and costs for all travelers.

- Among the TSMO measures implemented in NYMTC's planning area are various types of ITS, web-based traveler information and trip planning services, better integrated roadway and transit management and operations, various forms of transportation demand management programs that promote alternatives to single-occupant vehicle (SOV) travel (e.g., transit, ridesharing, parking management programs, telework). Highlights of current TSMO measures active or under development in the NYMTC planning area include:
  - Transportation Demand Management (TDM) programs provide a more integrated, convenient, and accessible transportation network for travelers. TDM programs in the NYMTC planning area are built around 511NY, which provides transportation information and alternatives to driving alone. Under the umbrella of 511NY, outreach is undertaken to employers, commuters, and members of the public to provide information on carpooling, vanpooling, workplace commuter benefits, public transportation, guaranteed ride home, bicycling, walking, and teleworking.
  - ATDM and ICM initiatives which attempt to manage demand in specific critical areas and corridors through use of information and other techniques that encourage those in these areas and corridors to use alternative routes or services based on existing conditions. Examples in the NYMTC planning area include I-287 in Rockland and Westchester counties and the I-495 ICM project in Manhattan and Queens.

- Shared Mobility Programs—Bikeshare, car share, and other micromobility as well as ride hailing through transportation network companies offer demand-responsive microtransit with related initiatives in the NYMTC planning area. Demand-responsive transportation services (microtransit) provide first/last mile connections to other services or commuting directly from an agency or in partnership with a ride hailing/transportation network company; and bikeshare programs, with CitiBike in New York City since May 2013 and similar programs in suburban counties.
- New York City's Active Design Guidelines provide a set of evidence-based design guidelines for how the design of buildings, streets, and neighborhoods can be leveraged to prevent noncommunicable diseases and promote overall health, particularly physical activity.
- Transportation Systems Management (TSM) Programs—Programs seeking to improve the operational efficiency of transportation facilities and services. TSM programs in the NYMTC planning area include Traffic Management Centers, TRANSCOM's regional operational coordination, roadway signalization programs across the NYMTC planning area, the development and enhancement of pedestrian, bicycle and micromobility facilities, and incident response through the Highway Emergency Local Patrol system.
- Congestion Management/Air Quality (CMAQ) Improvement Program—Federal CMAQ program funding provides flexible Federal for transportation projects and programs which reduce congestion and pollution for areas that do not meet the NAAQS known as air quality control areas or nonattainment areas, as well as for former nonattainment areas that are now in compliance (maintenance areas). NYMTC's current CMAQ Performance Plan, adopted in 2024, identifies 29

CMAQ-funded projects obligated—i.e., receiving Federal commitment—in whole or in part since the 2022 Plan, totaling $229 million in obligated funds. Additionally, the performance plan lists 52 unobligated CMAQ-funded projects programmed in the FFYs 2023-2027 TIP, totaling $533 million. The following excerpt from the performance plan provides an assessment of the impacts of these obligated and programmed funds:

- Obligated CMAQ projects include fourteen projects which enhance or expand transit service levels and/or access to transit services; and programs that manage demand and encourage mode shifts and/or non-SOV modes of travel. In total, just over $160 million have been obligated for these projects. Also included are obligations of $3.6 million for four projects which will enhance pedestrian facilities and pedestrian safety. These projects generally contribute to auto diversions and increases in transit ridership and non-motorized modes.
- Unobligated CMAQ projects programmed in the FFYs 2023-2027 TIP include seventeen projects to encourage transit use and/or improve access to transit services; and/or fund demand management programs. Additionally, five projects provide facilities for non-motorized transportation modes. These projects together facilitate increases in market share for non-SOV modes of travel. In total, just over $218 million have been programmed for these projects.
- CMAQ-funded demand management programs encourage shared mobility and transit use, as well as strategies such as telework that have been amplified by the COVID-19 pandemic. Examples of CMAQ-funded projects that improve transit and facilitate demand management include Employee Commute Options Programs in Westchester and Rockland counties and microtransit zones in the Lower Hudson Valley.

» Carbon Reduction Program (CRP)—The Carbon Reduction Program provides Federal funds for projects designed to reduce transportation pollution from mobile sources, defined as carbon dioxide pollution from on-road highway sources. The program requires each State to develop a carbon reduction strategy with projects and strategies for safe, reliable, and cost-effective options.[26] As of this writing, NYMTC has programmed approximately $84 million in CRP funds for eligible projects throughout the NYMTC planning area.

» NYMTC Members' and Related Agencies' Clean Energy Initiatives—NYMTC's member agencies, as well as related agencies, individually undertake many energy-related initiatives, including the following:

- Transit fleets—Initiatives include purchasing battery electric transit equipment, including buses, vans and non-revenue trucks and automobiles; purchasing and testing of bus fuel cell equipment; upgrading to diesel locomotives; expanding vehicle charging infrastructure and enroute vehicle charging infrastructure; evaluating microgrid use; specialized workforce training; or purchasing either hybrid or all-electric vehicles and ferries that run with cleaner engines in transit life-cycle replacement programs.

» Other transportation fleets—Electrification of school buses, taxis, and for-hire vehicles; installing electric vehicle fast-charging hubs; offering incentives for alternative fuel vehicles and electric vehicle ownership.

- Public-facing charging/fueling infrastructure—Expanded fast charging network; curbside charge points and charging locations in municipal public parking lots and garages; private parking garage/lot electric vehicle charging; electric vehicle fast-charging hubs and incentivizing electric vehicle charging stations at centers of employment; and expedited permitting for private installation of alternative fuel and electric vehicle charging infrastructure.
- Other agency-owned facilities—Incentivized solar, energy efficiency, decarbonization and waste management best practices by tenants; replacement of fossil fuels and pairing with renewables where possible; expanded photovoltaics and distributed energy resources, as well as reduced and reclaimed building energy use and energy conservation measures; best-in-class building operation practices and innovative technology; as well as installing co-generation systems and various permanent generators with backup power sources at specified critical facilities.
- Freight movement—Incentivizing zero-emission port drayage trucks and increased intermodal rail and marine freight transportation; expanding sustainable transportation access to facilities; upgrading locomotives and shared charging depots; New York City Clean Trucks Program and NYMTC Clean Freight Corridors recommendations; more access and availability of electric vehicle charging stations and other alternative fuels to support clean freight goals; and using cargo bikes for deliveries.
- Aviation—Support for emerging zero-emission aircraft technologies and reduction of pollution from aircraft movements. Support for the transition to sustainable aviation fuel.

- Maritime—Support for research and implementation of alternative fuels and other clean technology across the maritime industry to reduce carbon and particulate pollutants from vessels; strengthening ferry landings as neighborhood hubs to link other forms of transportation and for emergency response use; using bicycle racks and expanded mobility options, such as bikeshare and scooters, adjacent to ferry landings to connect the ferry system more effectively with nearby neighborhoods; improving connectivity of ferry landings as hubs for buses and other forms of mass transit; and exploring intermodal freight opportunities at ferry landings to improve freight deliveries and further enhance the marine highway.
- Transportation management—Developing a car-sharing network and community-wide bicycle network, including a bike rental network; providing incentives for carpooling/vanpooling; offering next-gen bicycle lanes and facilities with secure bicycle parking, dockless e-scooter and e-bike share systems; rolling out bicycle, pedestrian, and Vision Zero infrastructure; developing trails, greenways, open space and natural areas; further Active TDM and Integrated Corridor Management; full BRT networks; and offering employer commuting programs to encourage alternatives to SOV travel.
- Vehicles and traffic regulation—Reducing unlawful truck idling; charging congestion pricing across low-emission zones; offering alternative fuel vehicles/electric vehicle ownership incentives; and using information sharing across local municipal vehicle fleets through existing Clean Cities programs where feasible.
- Transportation System Enhancements—Chapter 5 of *Moving Forward 2055* describes the system enhancements during the period of *Moving Forward 2055*.

4.8.4 RECOMMENDED STRATEGIES AND ACTIONS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan and contains the following requirement:

> *The transportation plan shall include both long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system (including accessible pedestrian walkways and bicycle transportation facilities) to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand.*

Several categories of short- and medium-range strategies and actions recommended in pursuit of this vision goal are described below. Additionally, specific projects, programs and studies recommended for funding in the fiscally constrained element of *Moving Forward 2055*, as well as those recommended for future consideration in the speculative vision element of the Plan, appear in Appendix A.

PLANNING AND RESEARCH INITIATIVES

- Identify core markets, emerging markets, activity centers, and underserved communities using the CDEAs, SED forecasts, and Title VI assessment to develop multimodal plans for the identified areas.
- Identify the most efficient ways to serve emerging markets and underserved communities, particularly those in areas of low-density development where fixed-route bus service may not be effective.
- Assess transit service coordination needs across jurisdictional lines and evaluate intermodal connections.
- Explore technologies related to environmental stewardship.
- Develop pilot e-bike incentive programs to lower the cost barrier to e-bike use and ownership.
- Investigate opportunities for better integrating shared mobility and micromobility in the transportation system.
- Explore incentives for alternative fuel vehicles/electric vehicle ownership.
- Continue to address congested links and bottlenecks identified by the CMP through multimodal planning studies.
- Identify opportunities for new technology to improve congestion management solutions.
- Assess the distribution of bicycle lanes, bicycle facilities, and bike sharing opportunities throughout the NYMTC planning area in terms of fairness.
- Explore feasibility and infrastructure needs related to implementing new technologies in communities most impacted by transportation pollution.

DATA COLLECTION, FORECASTING, AND PERFORMANCE ASSESSMENT

- Report on pollution forecasts with each Transportation Conformity Determination.

- Establish a regionwide active transportation infrastructure inventory.
- Develop forecasts for active transportation infrastructure preservation.
- Identify areas to target electrical grid infrastructure upgrades to accommodate future heavy-duty vehicle chargers.
- Collect data on the number of cleaner fuel vehicles within fleet.
- Encourage sharing of data to better manage truck movements throughout the region.
- Collect data to track communities with highest concentrations of transportation pollution and related impacts, including health-related outcomes.

PLANNING PROCESS RECOMMENDATIONS

- Use Coordinated Development Emphasis Areas and Housing Growth Areas identified in Appendix A of *Moving Forward 2055* as a targeting mechanism for a continuing program of community planning activities.
- Include alternatives to SOV trips in the program of community planning activities.
- Convene interagency workgroups through the Transportation Coordinating Committees to identify and address priority multimodal corridors, including exploring technological options.
- Develop and adopt environmental stewardship guidelines for project selection.
- Encourage suburban municipalities to adopt Complete Streets policies to accommodate transit, walking, and biking to reduce vehicle congestion and associated pollution.
- Continue convening relevant agencies and private sector interests through the Multi-State Freight Working Group to improve the efficiency of freight delivery.
- Develop multi-agency approaches for benchmarking and sharing low and zero-emission vehicle specification information for public fleet procurement.
- Continue and expand a program of information sharing for local municipal vehicle fleets, through existing Clean Cities programs where feasible.

PROGRAM RECOMMENDATIONS

- Develop an Active Transportation Education Program.
- Explore reduction of commute times and improve transit speeds in low- and moderate-income communities underserved by transit.
- Encourage development in centers and downtowns to reinforce walkable, aesthetically pleasing, and transit-accessible environments.
- Develop innovative methods of mitigating the negative environmental externalities of maintaining and/or enhancing the existing transportation infrastructure.
- Test permeable pavement and concrete; install green infrastructure on streets.

- Encourage the continued development of pedestrian and cycling facilities throughout the NYMTC region, including the expansion of charging infrastructure for e-bikes and e-scooters.
- Promote the development of microhubs and freight consolidation centers. Expand cargo-hub programs, and other programs that move truck freight onto other modes of transport, including smaller electrified vehicles and water-based options like barges.
- Develop fare payment integration mechanisms between shared mobility systems and public transit services.
- Increase access and availability of electric vehicle charging stations and other alternative fuels to support clean freight goals.
- Procure either hybrid or all-electric vehicles and ferries that run with cleaner engines in transit life-cycle replacement programs.
- Undertake initiatives that encourage use of public transit; encourage seniors to sign up for reduced fare transit services.
- Continue and enhance model programs for use at developments such as office parks, medical facilities, and college campuses that include emerging and innovative transportation services such as shared mobility and micromobility.
- Enhance the public visibility of the 511NY service and its various components and its use for MaaS.

4.8.5 PERFORMANCE MEASURES

PERFORMANCE METRICS

23 CFR 450.324 governs the development and content of the metropolitan transportation plan. These regulations contain the following requirement:

> *The transportation plan shall include a description of the performance measures and performance targets used in assessing the performance of the transportation system.*

The performance measures listed below will assist in measuring progress toward this vision goal and its objectives, and in informing investment decisions:

- Criteria Mobile Source Pollution Levels—NYS DEC measures levels of outdoor air pollution at stations throughout NYMTC's planning area.
- Criteria Mobile Source Pollutant Forecasts included in each NYMTC Transportation Conformity Determination using NYMTC's Post Processor Software for air quality.
- Pollutant Inventory Levels—The NYS Energy Research and Development Authority compiles an inventory of statewide pollutants including hydrofluorocarbons (HFC), carbon dioxide (CO2), methane (CH4), and sulfur hexafluoride (SF6).

- Community-Level Transportation Pollutions—Track communities with highest concentrations of transportation pollutants and related impacts.
- Number of Stations with EV Charging Capabilities—The United States Department of Energy[27] has compiled an inventory of stations with EV charging capabilities throughout the United States, including within the NYMTC region.
- Cleaner Fuel Vehicles—Number within the public vehicle fleet.
- Performance Metrics required for the CMAQ Performance Plan.

ENDNOTES

1 https://www.energy.gov/electricity-insights/what-electrification.

2 MTA Zero-Emission Bus Fleet Transition.

3 Installing a Charging Station—NYSERDA.

4 Alternative Fuels Data Center: New York Laws and Incentives.

5 5 Year Transportation Capital Program.

6 NYC Ten Year Capital Strategy.

7 BridgeNY.

8 Charge Ready NY 2.0—NYSERDA.

9 https://dec.ny.gov/environmental-protection/climate-change/new-york-response/crra.

10 Texas A&M Transportation Institute, 2023 Urban Mobility Scorecard.

11 Need source.

12 Integrated Corridor Management and Traffic Incident Management: A Primer—FHWA Office of Operations.

13 Active Transportation Resource Center website.

14 National Center for Applied Transit Technology website.

15 MTA website.

16 MTA First and Last Mile Toolkit.

17 Smith, Göran. "Making Mobility-as-a-Service: Towards Governance Principles and Pathways."

18 Criteria Air Pollutants | U.S. EPA.

19 Ozone Designation and Classification Information | U.S. EPA.

20 Infrastructure State Implementation Plan (SIP) Requirements and Guidance | U.S. EPA.

21 State Implementation Plans and State Plans—NYSDEC.

22 40 CFR 93.118.

23 New York State Greenhouse Gas Inventory: 1990–2022.

24 2024 Statewide GHG Emissions Report, New York State Department of Environmental Conservation.

25 23 CFR 450.104.

26 Infrastructure Investment and Jobs Act—Carbon Reduction Program (CRP) Fact Sheet | Federal Highway Administration.

27 United States Department of Energy.

5 FINANCIAL PLAN

5.1 INTRODUCTION

The purpose of this chapter is to demonstrate how the federal requirements for fiscal planning and constraint are met and how *Moving Forward 2055* can be implemented. Federal regulations require that the financial plan include the following:

- System-level estimates of the costs and revenues reasonably expected to be available to adequately operate and maintain Federal-aid highways and public transportation
- Estimates of funds that will be available for the implementation of the Plan; and
- Additional financing strategies for the implementation of the Plan.

5.1.1 FINANCIAL PLANNING REQUIREMENTS

This chapter is intended to meet the financial requirements for *Moving Forward 2055*. According to 23 CFR 450.324, this Plan is required to contain the following:

(11) A financial plan that demonstrates how the adopted transportation plan can be implemented.

(i) For purposes of transportation system operations and maintenance, the financial plan shall contain system-level estimates of costs and revenue sources that are reasonably expected to be available to adequately operate and maintain the Federal-aid highways (as defined by 23 U.S.C. 101(a)(5)) and public transportation (as defined by title 49 U.S.C. Chapter 53).

(ii) For the purpose of developing the metropolitan transportation plan, the MPO(s), public transportation operator(s), and State shall cooperatively develop estimates of funds that will be available to support metropolitan transportation plan implementation, as required under §450.314(a). All necessary financial resources from public and private sources that are reasonably expected to be made available to carry out the transportation plan shall be identified.

(iii) The financial plan shall include recommendations on any additional financing strategies to fund projects and programs included in the metropolitan transportation plan. In the case of new funding sources, strategies for ensuring their availability shall be identified. The financial plan may include an assessment of the appropriateness of innovative finance techniques (for example, tolling, pricing, bonding, public-private partnerships, or other strategies) as revenue sources for projects in the plan.

(iv) In developing the financial plan, the MPO shall take into account all projects and strategies proposed for funding under Title 23 U.S.C., Title 49 U.S.C. Chapter 53 or with other Federal funds; State assistance; local sources; and private participation. Revenue and cost estimates that support the metropolitan transportation plan must use an inflation rate(s) to reflect "year of expenditure dollars," based on reasonable financial principles and information, developed cooperatively by the MPO, State(s), and public transportation operator(s).

(v) For the outer years of the metropolitan transportation plan (i.e., beyond the first 10 years), the financial plan may reflect aggregate cost ranges/cost bands, as long as the future funding source(s) is reasonably expected to be available to support the projected cost ranges/cost bands.

(vi) For nonattainment and maintenance areas, the financial plan shall address the specific financial strategies required to ensure the implementation of TCMs in the applicable SIP.

(vii) For illustrative purposes, the financial plan may include additional projects that would be included in the adopted transportation plan if additional resources beyond those identified in the financial plan were to become available.

(viii) In cases that the FHWA and the FTA find a metropolitan transportation plan to be fiscally constrained and a revenue source is subsequently removed or substantially reduced (i.e., by legislative or administrative actions), the FHWA and the FTA will not withdraw the original determination of fiscal constraint; however, in such cases, the FHWA and the FTA will not act on an updated or amended metropolitan transportation plan that does not reflect the changed revenue situation.

5.1.2 COST AND REVENUE CATEGORIES

In keeping with the federal financial planning requirements, *Moving Forward 2055's* financial chapter is built around the following activity categories:

- Operations and Maintenance (O&M). This chapter contains current systems-level estimates of costs and revenues for O&M that are reasonably expected to be available to operate and maintain the federally supported transportation system as defined by federal legislation [23 U.S.C. 101 (a)(6) and 49 U.S.C. Chapter 53].
- System Preservation is broadly defined as costs related to the life-cycle replacement, refurbishment, rehabilitation, reconditioning, or reconstruction of components of the federally supported transportation system (i.e., equipment and facilities).
- System Enhancement refers to extensions and/or improvements to the existing transportation system or new segments or services added to the transportation system to improve capacity and/or throughput.

5.1.3 KEY STEPS IN THE DEVELOPMENT OF FINACIAL FORECASTS

The costs and revenue forecasts associated with transportation-related projects in *Moving Forward 2055* have been developed using the multi-step process outlined below:

- Defining the Federally Supported Transportation System. The transportation system that moves people and goods in the NYMTC planning area is a complex network of services and facilities under a variety of jurisdictions. Some of these facilities are operated and maintained by fiscally self-supporting public authorities that generally do not access federal transportation funding. Others are owned and operated by local municipalities and not Federal-aid eligible.

  Given these distinctions, this chapter first defines the Federal-aid eligible (i.e., federally supported) portions of the transportation system as a basis for forecasting the long-range costs and resources. The federally supported component is a subset of the overall transportation network in NYMTC's planning area. This chapter assumes that the fiscal needs of those system components owned, operated, and maintained by self-financed public authorities (described below) and local municipalities are met by those authorities and municipalities as demonstrated in their board/council-approved capital and operating budgets, plans, and programs.
- Inventorying System Components. The condition of the facilities and equipment that are determined to be part of the federally supported transportation system have been inventoried as a step toward defining long-term system preservation needs. This includes existing system components and planned future components within the fiscally constrained element of the Plan.

- Forecasting Costs. Based on the inventory of the federally supported transportation system components, forecasts of O&M, system preservation, and system enhancements costs were developed through the Plan's horizon year. The forecasts are aggregated modally for roadways (including pavements, bridges, and non-motorized facilities) and transit (including facilities and equipment).
- Forecasting Revenues. Resources that are reasonably expected to be available from all sources to support the Plan's implementation are forecasted through the Plan's horizon year.

5.1.4 CAUTIONS IN FORECASTING LONG-RANGE COSTS AND REVENUES

Forecasting costs and revenues over such a long period presents risks and significant challenges for New York State and for NYMTC. For example, forecasting federal resources is complicated by the perennial threat to the financial solvency of the Highway Trust Fund, which partially supports federal highway and transit programs. These factors introduce a risk and uncertainty into long-range resource and cost forecasts.

5.2 SYSTEM-LEVEL ESTIMATES OF COSTS AND REVENUE SOURCES

Federal Regulatory Language: *For purposes of transportation system operations and maintenance, the financial plan shall contain system-level estimates of costs and revenue sources that are reasonably expected to be available to adequately operate and maintain the Federal-aid highways (as defined by 23 U.S.C. 101(a)(5)) and public transportation (as defined by title 49 U.S.C. Chapter 53)*

5.2.1 THE FEDERALLY SUPPORTED TRANSPORTATION SYSTEM

In Chapter 2, *Moving Forward 2055* presents an inventory of the various components of the transportation system in NYMTC's planning area. As noted in Chapter 2, the multistate metropolitan area has one of the oldest, most complex, and highly used transportation networks in the world. On a typical weekday, the region's multimodal transportation network handles millions of passenger trips and thousands of tons of freight shipments. Notably, public transit mode share on this network is the highest in the United States, accounting for nearly 40 percent of all transit trips taken in the country, which is a testament to the scale of the public transit components of the network.

The federally supported transportation system is a subset of this overall transportation network that is defined through Federal-aid eligibility. Transportation system components that fall within this threshold are eligible for federal funding and/or require a federal action to proceed. Table 5.1 provides details of the general parameters of the federally supported transportation system.

Table 5.1 Major Parameters of the Federally Supported Transportation System

More than 19,000 lane miles of interstates, freeways, parkways, expressways, arterial and collector roadways.
More than 2,400 roadway bridges of all types under the ownership of the state, counties, and local municipalities.
Nearly 1,300 track miles of commuter rail and 665 mainline track miles of subway tracks in passenger service, plus hundreds of miles of local, express, commuter, and intercity bus routes and an aerial tramway.
An extensive network of passenger hubs, transit stations and stops, bus terminals and subway transfer facilities, ferry landings, and bus stops.
More than 1,300 miles of bicycle facilities, ranging from shared-use bike trails to on- road bike lanes, in addition to pedestrian sidewalks, trails, and paths.
Supporting infrastructure such as rail yards and highway maintenance facilities, highway rest areas, parking lots and garages, bus depots and transit storage yards, bicycle parking areas, toll plazas, signage, signals, electronics, and other equipment.

Local roadways that are not part of the Federal-aid highway system and whose costs are borne by the locality, regardless of ownership, are not included in the federally supported system. Similarly, any transportation system components that are financed exclusively with non-federal funds through state, local, or private means are not included in the federally supported system, regardless of eligibility. In the NYMTC planning area, five self-financed public authorities have jurisdiction over significant system components that are not considered part of the federally supported system. Brief descriptions of these five authorities and the system components that are under their jurisdictions are provided below.

- Port Authority infrastructure assets include the George Washington Bridge and Bus Station; the Lincoln and Holland Tunnels; the Bayonne Bridge, Goethals Bridge, and Outerbridge Crossing; the Port Authority Bus Terminal in midtown Manhattan; the PATH rapid transit system and World Trade Center transportation hub; rail freight and car float operations, and the World Financial Center Ferry Terminal. In addition, the Port Authority has taken the lead in financing infrastructure at its airports (JFK, LaGuardia, Newark-Liberty, and Stewart) and marine terminals, including on-dock rail freight service at the container terminals and the Air-Train-JFK and AirTrain-Newark transit links.
- MTA Bridges and Tunnels (legally, the Triborough Bridge and Tunnel Authority) is one of the component operating authorities of the MTA. MTA Bridges and Tunnels operates seven bridges (the Robert F. Kennedy, Throgs Neck, Verrazzano-Narrows, Bronx- Whitestone, Henry Hudson, Marine Parkway-Gil Hodges Memorial, and Cross Bay Veterans Memorial) and two tunnels (Hugh L. Carey Tunnel and the Queens-Midtown Tunnel) that connect the five boroughs of New York City over and under various water bodies. The other operating authorities that compose MTA (i.e., MTA NYCT, MTA MNR, MTA LIRR, MTA Staten Island Railway, and MTA Bus) operate facilities and services that are defined as part of the federally supported transportation system. In addition to funding the operating and capital budgets of MTA Bridges and Tunnels, toll revenue from MTA Bridges and Tunnels helps support other MTA-operated transit services.
- The New York State Thruway Authority operates the New York State Thruway (I-87), the New England Thruway (I-95), and the Cross Westchester Expressway (I-287) within the NYMTC

planning area; it also operates the Governor Mario M. Cuomo Bridge, which carries the New York State Thruway over the Hudson River between Westchester and Rockland counties.

- The New York State Bridge Authority operates the Bear Mountain Bridge that carries U.S. 202 and U.S. 6 over the Hudson River between the northern Westchester and Rockland counties.
- The Nassau County Bridge Authority operates the Atlantic Beach Bridge that connects the Nassau Expressway with Atlantic Beach across the Reynolds Channel.

Other transportation facility owners and services that are not included in the financial forecasts for the federally supported transportation system are described below:

- The National Railroad Passenger Corporation, otherwise known as Amtrak, provides intercity rail services in the NYMTC planning area but does not program its federally funded projects through NYMTC's metropolitan transportation planning process. Amtrak owns Penn Station and the Moynihan Train Hall, as well as the trans-Hudson rail tunnels accessing Penn Station.
- NJ Transit and Connecticut Transit are public benefit corporations operating transit services in the states of New Jersey and Connecticut; they provide services that terminate in Manhattan and in the City of White Plains in Westchester County. Although these carriers are eligible for and make use of federal transportation funding through other MPOs, they do not program federally funded projects through NYMTC's metropolitan transportation planning process.
- Privately owned and operated ferry systems, rail freight systems, and intercity and interstate bus systems that provide services in the NYMTC planning area.
- Municipally owned streets, sidewalks, and/or bridges within their jurisdictions.

5.2.2 COSTS AND RESOURCE FORECASTS

System-level forecasts of costs to O&M infrastructure and services are based on the current operating budgets of NYMTC's member agencies, as well as any longer-range operational plans they maintain. Entities generally have annual operating budgets approved by their respective legislatures or boards, while a capital program may have a longer term. New York State and local municipal sponsors have historically demonstrated both a commitment and record of accomplishment to match federal capital funding and provide enough funds to balance operating budgets. The O&M costs of system enhancements are included in these estimates in cases where planned enhancements add new components to the system. System enhancements that are included in the fiscally constrained element of the Plan are described in detail in subsequent sections of this chapter.

O&M COST FORECAST

More than $975 billion in year of expenditure (YOE) dollars (an average of roughly $33 billion per year) will likely be needed through the 2055 horizon year to operate and maintain the federally supported transportation system. These O&M cost forecasts are detailed in Table 5.2. Figure 5.1 and Figure 5.2 provide a modal and agency breakdown of these projected O&M costs for the federally supported

transportation system. An estimated 89 percent of the NYMTC planning area's forecast O&M costs are related to the operation & maintenance of transit services.

Table 5.2 Projected O&M Costs (In Millions of YOE Dollars)

Owner	Category	Forecasted Costs	Inflation Factor
Suburban NYMTC Counties	Transit	$25,501.25	Multiple
	Roadways	$2,179.15	2.6%
New York City	Transit	$7,559.69	2.6%
	Roadways	$46,644.86	2.3%
New York State	Transit	$541.97	2.6%
	Roadways	$21,055.84	2.2%
MTA	Transit	$871,903.27	Multiple, based on Regional/National CPI projections
	Roadways		
All NYMTC Agencies	Non-Motorized	$409.86	2.6%
TOTAL		$975,795.89	

Figure 5.1 O&M Costs by Mode, Federally Supported Transportation System (In Millions of YOE Dollars)

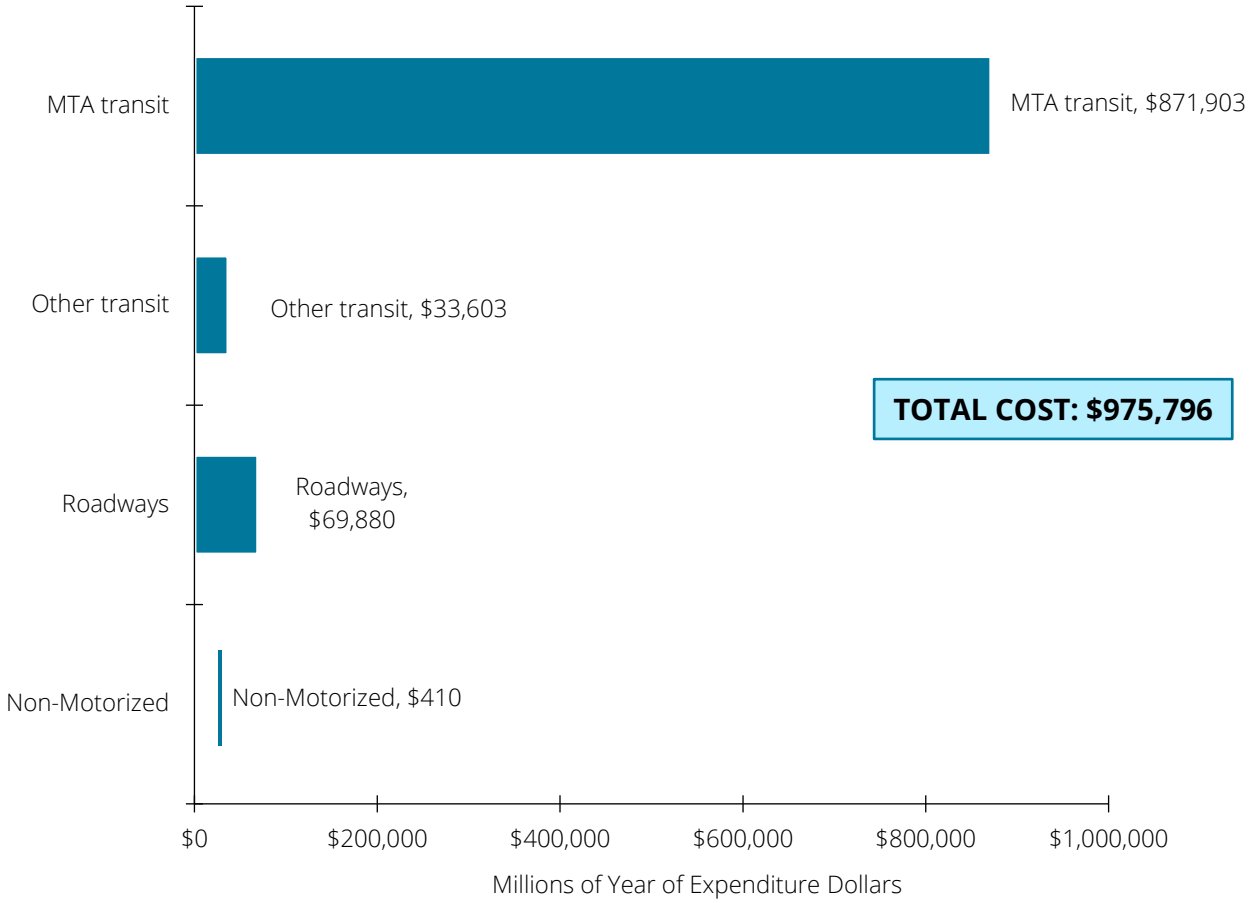
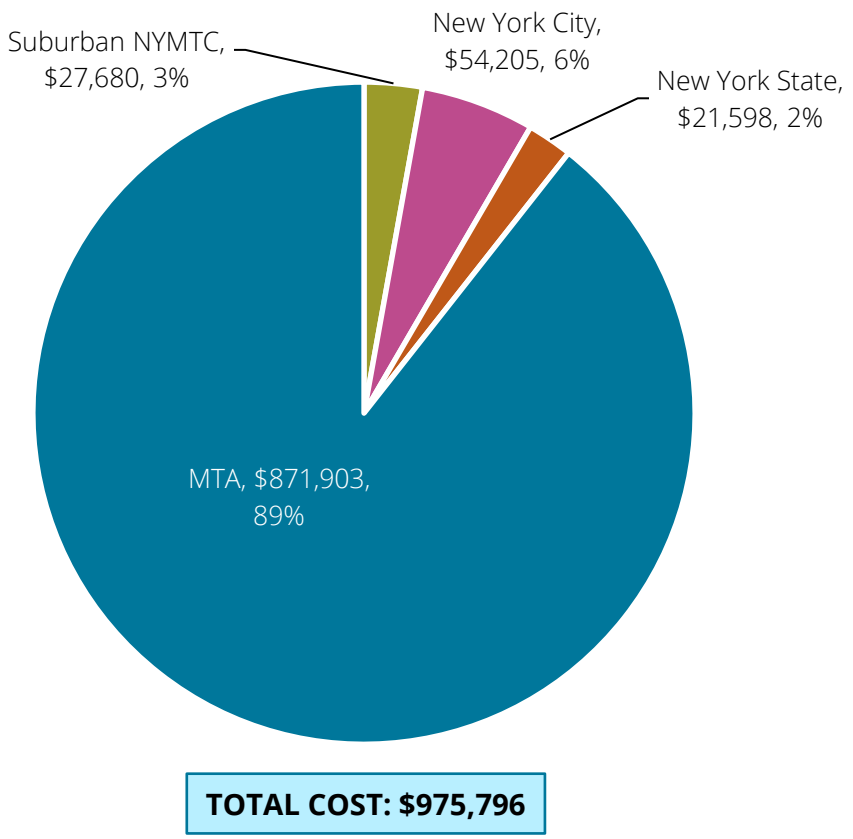


Figure 5.2 O&M Costs by Agency, Federally Supported Transportation System (In Millions of YOE Dollars)



O&M REVENUE FORECAST

Forecasts of revenue sources that will be reasonably expected to be available to operate and maintain the federally supported transportation system are based on revenues from all sources. These funding sources were projected into the future using the assumptions of local tax receipts, user fees, and/or budget allocations that underlie the individual agency operating budgets of NYMTC's member agencies. A forecast of roughly $993 billion in YOE dollars, or approximately $33 billion annually, is expected to be reasonably available through the 2055 horizon year for operating and maintaining the federally supported transportation system. Roughly 93 percent of the revenues are related to the operation and maintenance of transit services. Table 5.3 presents the forecasted resources by agency.

Table 5.3 Projected O&M Revenues (In Millions of YOE Dollars)

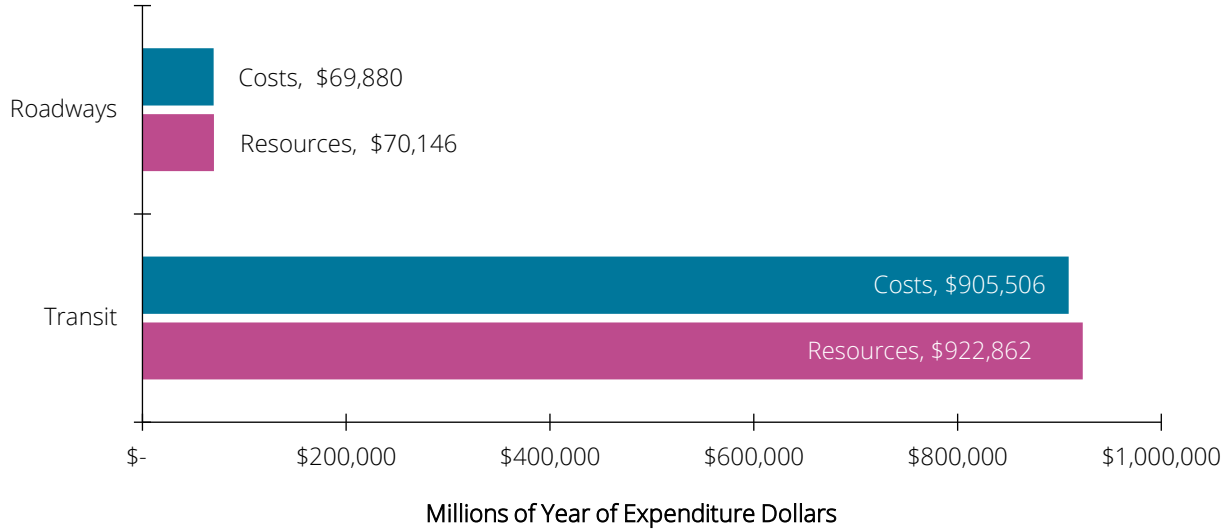
Owner	Category	Forecasted Revenue	Escalation Factor
Suburban NYMTC Counties	Transit	$25,558.28	2.4%
	Roadways[1]	$2,035.02	2.4%
New York City	Transit	$8,484.00	2.6%
	Roadways[1]	$46,644.86	2.3%
New York State	Transit	$541.97	2.4%
	Roadways[1]	$21,055.84	2.2%
MTA	Transit	$888,277.45	Multiple, based on Regional CPI/Other
	Roadways[1]	–	
TOTAL		**$993,007.29**	

[1] Non-motorized assumed to be included in roadways.

State, public authority, and municipal operating budgets are assumed to address most of the O&M costs. Figure 5.3 visualizes the forecasted O&M revenue that is detailed in Table 5.3. As Table 5.3 demonstrates, the projected revenue sources that can reasonably be expected to be available to NYMTC's members from all sources to address the forecasted O&M costs will be adequate in comparison to the forecasted costs.

Through these forecasts, *Moving Forward 2055* meets the federal regulatory requirement for a financial plan that contains system-level estimates of costs and revenue sources that are reasonably expected to be available to operate and maintain Federal-aid highways (as defined by 23 U.S.C.101(a)(6)) and public transportation (as defined by title 49 U.S.C. Chapter 53).

Figure 5.3 O&M Revenue Sources, Federally Supported Transportation System (In Millions of YOE Dollars)



5.3 PROJECTS AND STRATEGIES PROPOSED FOR FUNDING

Federal Regulatory Language: In developing the financial plan, the MPO shall take into account all projects and strategies proposed for funding under title 23 U.S.C., title 49 U.S.C. Chapter 53 or with other Federal funds; State assistance; local sources; and private participation. Revenue and cost estimates that support the metropolitan transportation plan must use an inflation rate(s) to reflect "year of expenditure dollars," based on reasonable financial principles and information, developed cooperatively by the MPO, State(s), and public transportation operator(s).

The projects and strategies proposed for funding through *Moving Forward 2055* fall into two broad categories:

- System Preservation includes project and program costs related to the life-cycle replacement, refurbishment, rehabilitation, reconditioning, or reconstruction of the components (i.e., equipment and facilities) of the federally supported transportation system under the jurisdiction of NYMTC's member agencies.
- System Enhancements include project and program costs related to the expansion of the federally supported system's capacity through the addition of new components or the significant expansion of the capacity of existing components to move, people, vehicles, and/or goods.

5.3.1 SYSTEM PRESERVATION

System preservation needs are forecast through the Plan's 2055 horizon year to be responsive to the regulatory requirement of considering all projects and strategies proposed for funding under title 23 U.S.C., title 49 U.S.C. Chapter 53 or with other Federal funds; State assistance; local sources; and private participation.

The forecasts of system preservation needs incorporate several regional and local assumptions and policies, such as pavement treatment costs and strategies as well as transit fleet life-cycle replacement cycles. The unit costs for the preservation of individual system components, such as lane miles of roadway or track miles of rail, are assumed to include costs of peripheral infrastructure, such as signage, lighting, and fencing.

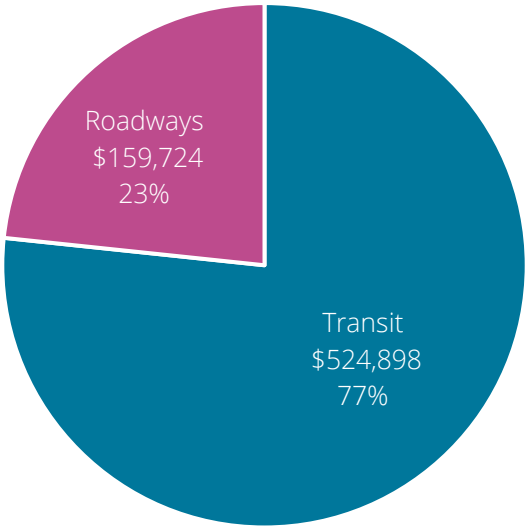
Inflation rates are applied to unit cost estimates to represent YOE dollars, using either local inflation data for planning and programming estimates, or, in the absence of such data, applying default inflation rates of 2.6 percent, compounded annually, to their cost estimates. The default inflation rate was arrived at through a trend analysis of ten years of Consumer Price Index data.

Based on the forecasts of the member agencies' costs to preserve the various components of the federally supported transportation system under their jurisdiction (see Table 5.4 for details), approximately $685 billion in YOE dollars ($23 billion annual average) in system preservation projects and strategies will likely need to be funded through the 2055 horizon year. Figure 5.4 provides a modal breakdown of these projected system preservation costs for the federally supported transportation system.

Table 5.4 Projected System Preservation Costs by NYMTC Subregion (in millions of YOE dollars)

Subregion	Costs
Lower Hudson Valley Counties	$4,459
Long Island Counties	$16,172
New York City	$107,964
New York State (all subregions)	$32,987
MTA (all subregions)	$523,040
TOTAL	**$684,623**

Figure 5.4 Projected System Preservation Costs by Mode (In Millions of YOE Dollars)



TOTAL COST: $684,623

5.3.2 SYSTEM ENHANCEMENT

System enhancement includes forecasted costs and resources related to projects and strategies proposed to be funded to expand the capacity of the federally supported transportation system through the addition of new components or services, or by expanding the capacity of existing components or services. These include both major system enhancement projects—defined through NYMTC's operating procedures as transportation projects or programs that meet this definition with an estimated cost of $100 million or greater and/or those of regional scope or impact—and minor system enhancements with lower estimated costs and/or lesser scope or impact. Generally, major system enhancement projects included in the fiscally constrained Plan and/or FFYs 2026–2030 TIP are derived from the Shared Vision for Regional Mobility described in Chapter 1.

The system enhancement projects and strategies proposed for funding as part of the fiscally constrained Plan and FFYs 2026–2030 TIP are itemized in Table 5.5 and total r$63 billion in YOE dollars through the 2055 horizon year.

Table 5.5 Major System Enhancement Projects and Programs (In billions of YOE Dollars)

Category/ Project	PLAN ID, PIN #	Funding category	Pre-2026	TIP (2026-2030)	PLAN (2031-2055) 31-35	36-40	41-45	46-50	51-55	Total
Minor Projects (from TIP & Plan)										
FFYs 2026–30 TIP		Formula Federal	$0.19	$0.46						$0.46
		Project-specific: Federal		$0.03						$0.03
		Project-specific: State/local	$0.90	$2.34						$2.34
FFYs 2026–2055 Plan		Formula federal			$0.04	$0.04				$0.08
		Project-specific: Federal								$0.00
		Project-specific: State/local			$0.01	$0.01				$0.02
Major Projects (Itemized)										
1	NY Route 347 Safety, Mobility and Environmental Improvements									
	PLAN ID: NSSC650C	Formula Federal				$0.26				$0.26
		Project-specific: Federal								$0.00
		Project-specific: State/local				$0.07				$0.07
2	MTA NYCT Second Avenue Subway Phase 2									
	PLAN ID: NYCM2663C	Formula Federal								$0.00
		Project-specific: Federal			$3.40					$3.40
		Project-specific: State/local			$4.29					$4.29
3	MTA NYCT Second Avenue Subway Phase 3-4									
	PLAN ID: NYCM2664C	Formula Federal								$0.00
		Project-specific: Federal					$2.90	$7.38	$4.69	$14.96
		Project-specific: State/local					$2.90	$7.38	$4.69	$14.96
4	Transportation Systems Management & Operations Programs									
	PLAN IDs: MHSDM708C, NYCDM2304C, NSDM2305C	Formula Federal		$0.56	$0.65	$0.74	$0.84	$0.96	$1.09	$4.85
		Project-specific: Federal		$0.14	$0.16	$0.19	$0.21	$0.24	$0.27	$1.21
		Project-specific: State/local								$0.00
5	Woodhaven Boulevard Select Bus Service - Capital Improvements									
	PLAN ID: NYCQ386C	Formula Federal								$0.00
		Project-specific: Federal								$0.00
		Project-specific: State/local			$0.24					$0.24

Category/ Project	PLAN ID, PIN #	Funding category	Pre-2026	TIP (2026-2030)	PLAN (2031-2055) 31-35	36-40	41-45	46-50	51-55	Total
6	Interborough Express									
	PLAN ID: NYCMB12190C	Formula Federal			$0.07					$0.07
		Project-specific: Federal			$4.34					$4.34
		Project-specific: State/local			$1.09					$1.09
7	Rehabilitation/Replacement of 5 Cross Bronx Expressway Bridges from Boston Road to Rosedale Avenue									
	PLAN ID: NYCBX2206C	Formula Federal		$0.71						$0.71
		Project-specific: Federal								$0.00
		Project-specific: State/local		$0.18						$0.18
8	ADA Accessibility at Subway Stations									
	PLAN ID: NYCMB5127C	Formula Federal			$7.15					$7.15
		Project-specific: Federal								$0.00
		Project-specific: State/local			$1.79					$1.79
9	Great Streets Vision Zero – Queens Boulevard									
	PIN: X77338 PLAN ID: NYCQ2361C	Formula Federal	$0.02							
		Project-specific: Federal								
		Project-specific: State/local	$0.19							
10	Penn Station Access: New Haven Line via Amtrak's Hell Gate Line									
	PLAN ID: MHSMC767C	Formula Federal	$0.07							
		Project-specific: Federal								
		Project-specific: State/local	$1.76							
11	Hunts Point Interstate Access Improvement									
	PLAN ID: NYCBX2162C	Formula Federal	$0.33							
		Project-specific: Federal								
		Project-specific: State/local	$1.43							
Subtotals		Formula Federal	$0.60	$1.73	$7.91	$1.04	$0.84	$0.96	$1.09	$13.58
		Project-specific: Federal	$0.00	$0.17	$7.91	$0.19	$3.11	$7.62	$4.96	$23.95
		Project-specific: State/local	$4.29	$2.52	$7.41	$0.08	$2.90	$7.38	$4.69	$24.97
TOTALS			$4.89	$4.42	$23.23	$1.31	$6.85	$15.96	$10.74	$62.50
PROJECTED REVENUES			$4.89	$4.42	$23.23	$1.31	$6.85	$15.96	$10.74	$62.50

5.3.3 TOTAL PROJECTS AND STRATEGIES COSTS

In total, the projects and strategies proposed for funding in the fiscally constrained Plan and the FFYs 2026–2030 TIP are forecast to cost $747 billion in YOE dollars ($25 billion annual average) to preserve and enhance the federally supported transportation system through the planning period.

5.4 ESTIMATES OF AVAILABLE FUNDS

Federal Regulatory Language: For the purpose of developing the metropolitan transportation plan, the MPO(s), public transportation operator(s), and State shall cooperatively develop estimates of funds that will be available to support metropolitan transportation plan implementation, as required under §450.314(a). All necessary financial resources from public and private sources that are reasonably expected to be made available to carry out the transportation plan shall be identified.

5.4.1 FEDERAL FUNDING FORECASTS

The strong federal partnership that has characterized transportation funding in the NYMTC planning area is assumed to continue during the planning period and to play a significant role in the preservation and enhancement of the federally supported transportation system. As of this writing, the Infrastructure Investment and Jobs Act (IIJA) is the current transportation act that authorizes funds for Federal-aid highways, highway safety programs, and transit programs, and for other purposes. The IIJA authorizes funding through the first year of this Plan – federal fiscal year 2026.

In order to forecast reasonably expected federal resources, six successor authorization acts to the IIJA are assumed to begin in FFY 2027. Each successor act is assumed to be five years in duration, with federal funding authorizations in each act escalating per the historical trend derived from all predecessor authorization acts starting with the Intermodal Surface Transportation Efficiency Act (ISTEA) (see Table 5-7 and Table 5-7. State and local funds are assumed to escalate at the same rate as the authorized federal funding.

Table 5.6 Federal Authorization Historical Trend Analysis (In Millions of $)

Authorization	Years Authorized	Number of Years	Average $/Year (millions)	Average $/Year Change from Predecessor
ISTEA	1992-1997	6	$25,833.33	N/A
TEA-21	1998-2003	6	$33,032.50	27.9%
SAFETEA-LU	2005-2009	5	$48,829.00	47.8%
MAP-21	2013-2014	2	$52,000.00	6.5%
FAST	2017-2021	5	$60,935.00	17.2%
IIJA	2022-2026	5	$136,321.44	123.7%
Average % Change				44.6%
Median % Change				27.9%

Table 5.7 Assumed Future Federal Authorization Acts
(In Millions of $, Historical Escalation Rate: 27.9% Per Successor in Total)

Federal Act	Federal Fiscal Years	Average Annual NYMTC Formula Federal Planning Target	Assumed Duration in Years	Total NYMTC Formula Federal Planning Target
IIJA	2026	$3,031.40	N/A	$3,031.40
Successor Act #1	2027–2031	$3,877.17	5	$19,385.83
Successor Act #2	2032–2036	$4,958.89	5	$24,794.47
Successor Act #3	2037–2041	$6,342.43	5	$31,712.13
Successor Act #4	2042–2046	$8,111.96	5	$40,559.82
Successor Act #5	2047–2051	$10,375.20	5	$51,876.01
Successor Act #6	2052–2055	$13,269.88	4	$53,079.53
TOTAL				$224,439.20

5.4.2 STATE AND LOCAL FUNDING FORECASTS

New York State-authorized revenues for transportation purposes were projected from base year funding levels using the same approach as the forecast of federal funding (under the assumption that the relationship of state and local funding to federal funding would be maintained during the forecast period). Under this assumption, state and local revenues are assumed to grow, as necessary, to address the forecasted non-federal share. NYMTC's members have a long-standing and demonstrated history of providing the non-federal share necessary to leverage any additional funds that are apportioned/allocated to the region.

5.4.3 ESTIMATED FUNDS FOR PLAN IMPLEMENTATION

Funds reasonably expected to be available for the implementation of the fiscally constrained Plan are $770 billion in YOE dollars from all sources, an annual average of $26 billion. Table 5.8 and Figure 5.5 detail reasonably expected revenues during the planning period.

Table 5.8 Resource Forecasts (In Millions of $)

Fund Source	Forecast
Federal Formula	$224,439.20
Federal Non-Formula (MTA)	$3,821.27
Federal Project-Specific	$25,125.85
New York State	$71,397.96
Local Match/Overmatch	$166,550.41
MTA Supplemental Local	$279,159.45
TOTAL RESOURCES	**$770,494.13**

Figure 5.5 Estimated Funds for Plan Implementation (In Millions of $)

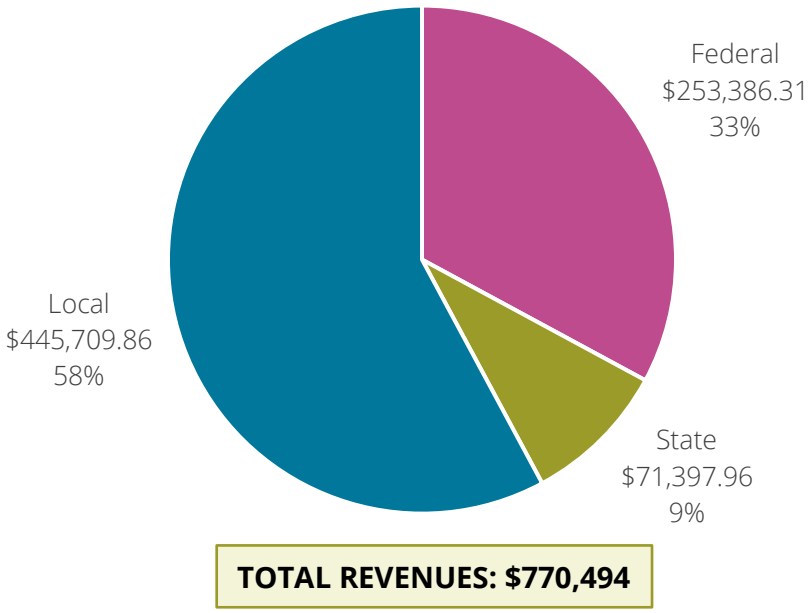
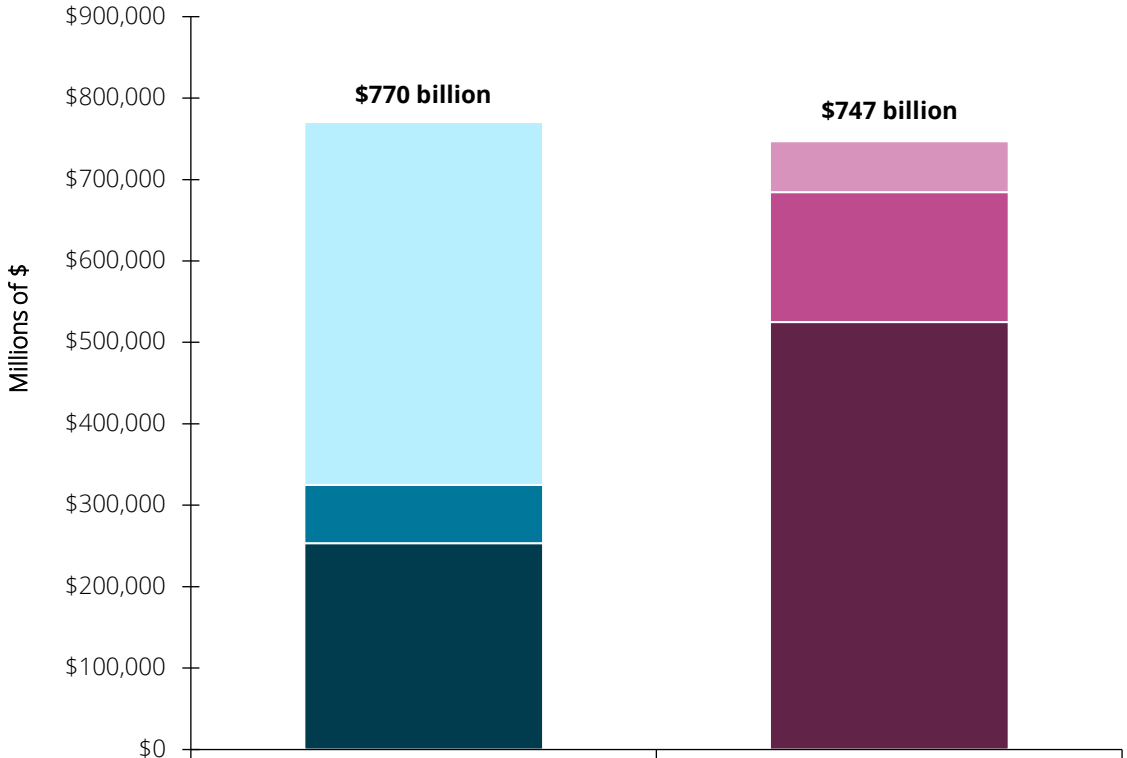


Figure 5-6 compares the forecasts of reasonably expected revenues to the forecasts of the estimated costs to implement the projects and strategies proposed for funding in the fiscally constrained Plan and FFYs 2026–2030 TIP. Broadly speaking, the reasonably expected revenues will address the projected costs of Plan implementation.

Figure 5.6 Revenues versus Costs (In Millions of $)



	Revenues	Costs
System Enhancement		$62,500.95
Roadway Preservation		$159,724.33
Transit Presrvation		$524,898.42
Local	$445,709.86	
State	$71,397.96	
Federal	$253,386.31	

5.5 ADDITIONAL FINANCING AND FUNDING STRATEGIES

Federal Regulatory Language: The financial plan shall include recommendations on any additional financing strategies to fund projects and programs included in the metropolitan transportation plan. In the case of new funding sources, strategies for ensuring their availability shall be identified. The financial plan may include an assessment of the appropriateness of innovative finance techniques (for example, tolling, pricing, bonding, public-private partnerships, or other strategies) as revenue sources for projects in the plan.

Moving Forward 2055 identifies project-specific federal, state, and local financing and funding strategies organized in nine categories across five areas (Debt Financing, Grant Funding, Consumer Activity, Capturing Value, and Partnerships). Accessing, adopting, and implementing any of these strategies is subject to government legislative action as well as budgeting and policy decisions outside of NYMTC's statutory authority and the metropolitan transportation planning process. Table 5.9 lists these strategies and the attached Chapter 5 Appendix summarizes each strategy in more detail.

Additionally, non-transportation financial sources are potentially available to address transportation needs, particularly in cases where they help leverage other federal, state, or local transportation (or other sources) as funds typically address transportation across various topics like electrification, clean energy and sustainability, developing rural areas, and building affordable communities as well as housing. Examples include sources at the Joint Office of Energy and Transportation, the Department of Energy (DOE), the Department of Environmental Protection (DEP), the Department of Commerce (DOC), the Department of Housing and Urban Development (HUD), and the US Department of Agriculture (USDA).

Table 5.9 Summary of Additional Financing and Funding Strategies

#	Financing Option	Type	Description
1	*Debt-Financing Municipal Bond*	Debt	Raise funds through selling bonds to build or buy equipment repaid with interest over time at market interest rates.
2	*Debt-Financing Federal Loan*	Debt	Raise funding at lower than market interest rates & pay less in interest.
3	*Discretionary Federal Grant*	Grant	Receive one-time discretionary funding for specific project &/or system upgrade.
4	*Purchase-Based Tax*	Consumer Activity (Tax)	Receive funding from portion(s) of consumer purchases.
5	*Purchase-Based Fee*	Consumer Activity (Fee)	One-time &/or annual fee specific to purchase &/or credential.
6	*Usage Based Fee*	Consumer Activity (Fee)	Directly charge system users to use system &/or geographic area.
7	*Value Capture*	Capturing Value	» Tax Increment Financing (TIF) revenues fund transportation through projected increased tax revenues resulting from higher property values following infrastructure improvements. » Payments in lieu of Taxes (PILOTs) are payments made to governments to offset property tax losses from tax-exempt properties. » Tax Assessment Districts (TADs) empower a municipality to charge a tax or surcharge in a specific area to improve infrastructure bringing new development. » Tax Development Districts (TDDs) raise funds for specific costs of a project like developing or improving transit services.
8	*Public Private Partnerships*	P3	Contracts between governmental entity or public authority & private company to finance, build, operate, &/or maintain a new or existing piece of infrastructure or program sometimes involving user fees to compensate the private entity. Terms vary by project whether a DBOM, DBFOM, etc.
9	*Corporate Partners & Sponsorships*	Private Partnership	Employers or businesses like casinos levy taxes on gross payroll or revenues within transit districts to generate revenue, administered by a state revenue agency on behalf of transit district. Lease &/or sale of transportation asset to an external public or private partner to generate additional revenues for transportation agency.

5.5.1 PROJECT-SPECIFIC FINANCING AND FUNDING STRATEGIES

Project-specific funding opportunities expected to be available for Moving Forward 2055 projects are explained below based on studying feasibility and credibility alongside existing examples in local and national markets and project financing plans from NYMTC's planning area.

DEBT FINANCING

Debt financing is useful for improving infrastructure that generates a revenue stream. Borrowers receive funds for construction or purchasing equipment from selling bonds, applying for federal credit assistance, or soliciting government infrastructure banks which are repaid over time with accrued interest. A federal infrastructure bank currently does not exist, but local state infrastructure banks (SIBs) like in Ohio[1] offer interest-free or lower-rate loans not available through the private market. SIBs are run by state government offering loans for highway construction projects, transit capital projects, and railroad projects receiving matching state funds to help attract private investors.

MUNICIPAL BONDS

Bonds are common financing tool used to improve infrastructure across the country. Projects generating user fees[2] like tolls are strong candidates for bond financing because user fee revenues can be used to secure debt. Selling bonds generates proceeds directly for projects but requires issuers to maintain strong credit ratings and stable revenue source(s) to repay borrowed funds. Until the debt is repaid, issuers must meet strict debt covenants prescribed in bond documents while paying usually over 30 years of debt service, including interest. Debt service payments also tend to "rank senior" and must be paid before other expenses. Bond sales are generally quick after securing municipal approvals and credit ratings and offer borrowers various repayment options depending on repayment revenue projections.

Types of bonds include General Obligation (GO) Bonds, Build America Bonds (BAB), and Private Activity Bonds (PAB), among others. GO Bonds are issued by governments to raise general funds to finance various projects which are repaid through general tax revenues. BABs are issued by governments through the U.S. Treasury to raise funds to finance surface transportation projects before January 1, 2011. PABs are issued through the U.S. Department of Transportation (U.S. DOT) on behalf of a private entity involved in a Public Private Partnership (P3). State DOTs in a P3 apply for PABs to finance P3 surface transportation projects with the private developer(s) responsible to repay the debt.

The recently completed MTA LIRR East Side Access (ESA)[3] project is a local example of using bond funding. ESA was partially funded through the 2005 Rebuild and Renew Transportation Bond Act where New York State issued $2.9 billion of bonds to fund transportation projects, with $450 million dedicated to ESA.

FEDERAL LOANS

Securing a loan usually requires a long and competitive administrative process in addition to the borrower maintaining strong credit ratings and stable revenue sources(s) to repay debt. Funds are usually more restricted and also paid back over 30 years with interest. Borrowers must still meet strict requirements prescribed in loan documents and pay loan expenses first. Types of loans include Transportation Infrastructure Finance and Innovation Act (TIFIA) Loans, Railroad Rehabilitation and Improvement Financing (RRIF) Loans, State Infrastructure Bank (SIB) Loans, and Section 129 Loans, among others. Section 129 (S.129) Loans provide state governments with low interest loans to fund transportation projects with fewer

requirements than SIB loans and negotiable interest rates, but funds must be repaid through a dedicated revenue stream.

Transportation Infrastructure Finance and Innovation Act (TIFIA) Loans provide government entities with low interest government loans to fund shovel-ready transportation projects which must be repaid by a secure and committed revenue source. The federal government offers competitive TIFIA loans at a lower-than-market interest rate to cover up to 33 percent of project costs (or up to 49 percent for certain projects), reducing overall project costs, but applicants must identify a stable and dedicated repayment source like tolls or taxes. TIFIA loans were used to build the Governor Mario M. Cuomo Bridge, replacing the Goethals Bridge,[4] build the Moynihan Train Hall[5], and purchase three new ferry boats alongside rebuilding Staten Island Ferry terminals.[6]

Railroad Rehabilitation and Improvement Financing (RRIF) Loans provide railroads and government entities low interest government loans to fund railroad infrastructure projects across track, facilities, planning, and capital projects or refinance existing debt. A RRIF Loan was used to help fund the Gateway Tunnel Project[7] across the Hudson River.

GRANT FUNDING

Numerous local projects have used grants as a funding source for transportation. NYMTC should continue to seek grants to assist various needs, keeping in mind funding availability and eligibility criteria are subject to change over time.

FEDERAL GRANTS

The Federal Highway Administration (FHWA), Federal Transit Administration (FTA), and the U.S. DOT administer common discretionary federal funding programs to fund transportation projects as authorized and appropriated by Congress. As discretionary funding programs, these offerings follow a criteria-based rubric to evaluate awarding funding to proposed projects. Competitive grant applications are usually long administrative processes for a one-time award, usually requiring a local match and restricting fund use. Eligibility and competitiveness for these programs depends on the funding program and nature of the project. Applications can require innovative practices, certain project budgets and spending plans, as well as other terms and conditions like focusing on improving active transportation.

Federal grants are offered through the Multimodal Project Discretionary Grant (MPDG) program, the Rural Surface Transportation Program (RTSP), the Regional Infrastructure Accelerators (RIA) program, the Carbon Reduction Program (CRP), the Capital Investment Grants (CIG) program, the Better Utilizing Investments to Leverage Development (BUILD)[8] program, the Nationally Significant Multimodal Freight and Highway Projects program, and the Consolidated Rail Infrastructure and Safety Improvements (CRISI) program.

MEGA Grants are awarded to government entities through the MPDG program to fund surface transportation projects across federal highways, bridges, ports, intercity rail, freight rail, and public transportation. RTSP Grants are awarded to government entities to fund surface transportation projects across federal highways, bridges, ports, intercity rail, freight rail, and public transportation, including

highway safety projects, agricultural access roads, and various transportation demand management systems. The RIA Program provides additional grant funding to governments for technical resources, planning, and project development to expedite regional transportation infrastructure P3 projects through the same requirements as TIFIA loans.

CRP provides governments grants to assist achieving state carbon reduction strategies and fund projects to reduce transportation CO_2 emissions across traffic management, public transit, pedestrian facilities, alternative fuels, and port electrification. CRISI grants are awarded to government or academic entities or private railroads from the FRA to help fund railroad projects across capital improvements, safety enhancements, congestion relief, road crossings, corridor studies, workforce training programs, or environmental mitigation work.

CIG[9] through Section 5309 are grants awarded to government entities from the FTA to fund transit capital investments across heavy rail, commuter rail, light rail, streetcars, and bus rapid transit (BRT) while Section 5339 Buses and Bus Facilities grants are given specifically for buses and bus facilities. Both Section 5309 and 5339 grants have been used to finance the Second Avenue Subway on Manhattan's East Side and for Select Bus Service (SBS)[10] projects across New York City in Nassau County's Para-Transit Vehicle Replacement Program, Rockland County's Bus Facilities Program, and the Westchester County Electric Bus Program.

BUILD[11] program grants are awarded to government entities from U.S. DOT to fund surface transportation infrastructure projects with significant local or regional impact. INFRA Grants are awarded to government entities from U.S. DOT through the Nationally Significant Multimodal Freight and Highway Projects program to fund nationally significant multimodal freight and highway projects that improve safety, efficiency, and reliability across freight and people movement in and across rural and urban areas. BUILD and INFRA grants were used to help fund the Brooklyn Bridge Approach Arches and Towers Rehabilitation program in addition to Phase I of Moynihan Station,[12] numerous Vision Zero safety improvements,[13] Fordham Plaza in the Bronx,[14] Hunts Point freight improvements in the Bronx,[15] various greenway improvements, and the Cross-Harbor Freight Program.[16]

CONSUMER ACTIVITY

Transportation funds can be generated from levying a surcharge like a tax or a fee on certain consumer-based chosen activities including consumer purchases and travel patterns and/or choices. Revenues from taxes or fees can be used for general transportation funding, securing debt, or towards specific projects.

PURCHASE-BASED TAXES

Purchased-based taxes fund transportation projects based on a percentage portion of consumer purchases and usually require public legislative approval to administer and/or change. Tax revenues also depend on steady population levels showing signs of growth with trackable and stable purchase patterns. Reliable transportation funds from purchase-based taxes come from taxes with a fixed annual increase usually tied to or above inflation. Types of purchase-based taxes used to fund transportation include Sales

Taxes, Fuel Taxes, Hotel Taxes, Property Taxes, Cigarette Taxes, Marijuana Taxes, Car Rental Taxes, and Real Estate Transfer Taxes, most of which are already in use across the NYMTC region.

Sales Taxes are a surcharge on general everyday consumer purchases including clothing, food, supplies, and other goods with Cigarette Taxes and Marijuana Taxes as an additional charge placed on top of these specific items. Fuel Taxes are levied on top of vehicle fuel purchases while Car Rental Taxes are a special one-time charge placed on vehicle renters. Property Taxes charges real estate owners while Real Estate Transfer Taxes are special surcharges applied to real estate sales where the property title is transferred. Hotel Taxes are a surcharge guests pay when booking a hotel stay.

PURCHASE-BASED FEES

Like purchase-based taxes, purchase-based fees generate funding for transportation from portions of consumer purchases usually tied to specific to vehicle activity. These fixed fees generate funds from a one-time vehicle purchase or activity and also usually require public legislative administrative approval. Reliable fee revenue again depends on a stable population with strong purchase patterns and fees annually increased to keep up with inflation. Types of purchase-based fees in use to fund transportation projects include Electric Vehicle (EV) Fees, License Fees, Registration Fees, and Car Rental Fees, again with some like License and Registration Fees already in use across the NYMTC region.

Electric Vehicle (EV) Fees are a charge to owners or renters of electric vehicles at time of vehicle purchase or rental. License Fees charge drivers seeking to apply for and/or renew a driver's license while Registration Fees are charged to vehicle owners upon registering a vehicle. Car Rental Fees, like Car Rental Taxes, are a special one-time charge placed on vehicle renters.

USAGE-BASED FEES

Usage-based fees produce funds for transportation projects by directly charging system users to use a specific system or travel across a certain geographic area. Usually more restrictive than purchase-based taxes or fees, fixed or variable usage-based fees have limited fee escalation as income considerations restrict increases from being tied to/above inflation. Additionally, existing capital infrastructure like a transit system, bridge, or tollway must be present and matched to existing strong travel patterns showing growth alongside administrative resources to collect fees, address fee evasion. Types of usage-based fees include Vehicle Miles Traveled (VMT) Fees, Truck Ton Mile Fees, Tolls, Transit Fares, Utility Fees, Congestion/Cordon Pricing, Amusement Fees, and Parking Fees and are already in use across NYMTC's region across Manhattan, the New York City Subway, MTA Bridges and Tunnels, NJ TRANSIT, PATH trains, and the NJ Turnpike except for VMT Fees, Utility Fees, and Amusement Fees. Congestion/Cordon pricing introduces a surcharge for entering a certain geographical area, usually a city's densest area, with flat or variable tolls based on time of day, vehicle type, and other parameters to reduce congestion and pollution, increase transit speeds, and generate significant revenues for transportation. New York State legislation has allowed New York City to be first US city to implement congestion/cordon pricing and now charges motorists $9 to enter Manhattan with expectations of generating below 60th Street between 5:00 a.m. and 9:00 p.m. on weekdays and from 9:00 a.m. to 9:00 p.m. on weekends.[17]

CAPTURING VALUE

VALUE CAPTURE

Upgrading transportation increases nearby property values by making surrounding areas more desirable for current and potential users benefiting from improved travel and access. Capturing the increase in property values in advance, or Value Capture, is a financing tool commonly used to fund transportation improvements. Revenues from Value Capture can be used for general transportation funding, securing debt, or towards specific projects but often take time to implement. Public buy-in and specific legislative approvals must be met along with conducting extensive forecasting and planning work to map out districts and estimate revenues. Furthermore, districts are usually limited to specific zones surrounding a project or area and can expire within a certain timeframe. Dedicated administrative resources are also usually needed for ongoing management.

Types of Value Capture include Tax Increment Financing (TIF), Payments In Lieu Of Taxes (PILOTs), Tax Assessment Districts (TADs), and Transportation Development Districts (TDDs), all varying in complexity and implementation timeframe. TADs do not require acquiring land while TIFs and PILOTs do, along with rezoning and creating special legal entities. Additionally, increased tax revenues from raises in property values also take time and depend on growing market demand, further complicated by phased development.

TIF's fund transportation through projected increased tax revenues resulting from higher property values following infrastructure improvements while PILOTs are a certain type of TIF where payments are made to governments to offset property tax losses from tax-exempt properties. TIF's are usually established by creating a development entity to manage TIF-financed projects within TIF districts who raises project funds by selling bonds paid back from TIF revenues. Often, all tax amounts exceeding existing taxes in the TIF district are used to pay back bonds. Revenue is generated from measuring the increase from property's existing tax amounts, which makes TIF districts work best across undeveloped or under-developed areas. New York State only authorizes PILOTs as TIF financing which were used to extend the MTA NYCT's No. 7 Subway Line west to Hudson Yards.[18] New York City was permitted to issue bonds to finance the extension which are partially being paid back by PILOTs from Hudson Yard developers of new commercial buildings receiving 40 percent tax breaks for 19 years.

TADs empower a municipality to charge a tax or surcharge in a specific area to improve infrastructure bringing new development while TDDs raise funds for specific costs of a project like developing or improving transit services.

PARTNERSHIPS

PUBLIC-PRIVATE PARTNERSHIPS

Public-private partnerships (P3) are used to privatize or pay for public transportation projects by establishing a contract (concession) between a private company and public authority or government

(forming a consortium) to fund, build, operate, or maintain new or existing infrastructure, program, or system. P3s require local legislation and available private as well as municipal partner(s) alongside coordinating multiplayers to finance and administer the concession. Ongoing public/legislative approval is also usually necessary during political turnover through construction and operations. P3 legislation does not exist in New York State, and P3 projects usually take multiple years to complete given lengthy bid negotiations for private partner(s).[19] Across the NYMTC region, only the MTA, NJ TRANSIT, PANYNJ, and NJDOT can implement a P3 (Table 5-10).

Successful P3s have clear payment incentives established from the beginning to ensure private partner(s) meet the public's project goals. Concessions usually last around 30 years with fixed availability payments as debt service usually from user fees, and terms vary by project whether solely a design-build (DB), design-build-operate-maintain (DBOM), design-build-finance-operate-maintain (DBFOM), or solely operations-maintenance (OM) of existing infrastructure. In a DB P3, public partner(s) fund and operate projects with private partner(s) completing design and construction. Public partner(s) also provide funding for DBOMs while private partner(s) cover all design, construction, operations, and maintenance, with private partner(s) also responsible for financing in DBFOMs. Public partner(s) assume revenue risks in DBs and DBOMs while private partner(s) are liable in DBFOMs. OM P3s pass operations and maintenance risks onto the private partner while the public entity retains ownership, with the private partner financing public improvements through beneficial lease agreements.

Table 5.10 Examples of Current Public-Private Partnerships[20]

Project	Description	P3 Type	Public Partner(s)
LaGuardia Airport Terminal B	A new 840,000-square-foot Terminal B at LaGuardia Airport created in partnership with LaGuardia Gateway Partners LLC, entitled to develop, design, construct, operate, and maintain new Terminal B facilities and to charge, collect, and retain revenues from the operation of such facilities through a 35-year lease that will expire in December 2050.	Design-Build-Finance- Operate-Maintain	Port Authority
TWA Hotel at JFK Airport	Creating a commercial hotel from redeveloping JFK Airport's TWA Flight Center.	Design-Build-Finance- Operate-Maintain	Port Authority
Hudson-Bergen Light Rail	Light Rail lines connecting Bayonne, Jersey City, Hoboken, Weehawken, Union City, and North Bergen.	Design-Build-Operate-Maintain	NJ Transit, NJ DOT, U.S. DOT FTA
Goethals Bridge Replacement[21]	A new bridge to replace the 85-year old Goethals Bridge operated and tolled by the Port Authority operates who annually pays the concessionaire $56.6 million in availability payments using pooled Port Authority revenues separate from bridge tolls.	Design-Build-Finance- Maintain	Port Authority
Port Newark Container Terminal	Container operations at the Port Authority's Port Newark Container Terminal uses a concession to govern Ports America's operations at the terminal. Ports America agreed to invest over $500 million in Port infrastructure to receive a long-term 50-year lease, bringing port rail infrastructure investments and modern Terminal facilities since 2011.	O&M	Port Authority

CORPORATE PARTNERS AND SPONSORSHIPS

Specific to corporations, public agencies can form partnerships or establish sponsorships with companies without official P3 legislation, most often seen through retail concessions and/or advertising agreements to advertise and/or sell products to transportation system users. Companies like OutFront Media and Hudson News lease space within New York City's subway system and rail terminals to advertise and/or sell products to transit customers.

Other types of corporate partnerships can result in capturing revenue from taxes or fees to fund transportation projects or improve existing infrastructure. Corporate partners can levy a tax or fee on employer payroll or business earnings, reserving a portion of staff salaries or corporate earnings for transportation. Businesses like casinos in New Jersey levy taxes on gross payroll or revenues within transit districts to generate revenue, administered by the New Jersey Treasury on behalf of transit district. New Jersey also recently passed the Corporate Transit Fee requiring companies with over $10 billion of taxable net income to pay 2.5% towards transportation.[22]

Companies can also sponsor specific transportation systems, purchasing "naming rights" to advertise across certain transportation assets, like with Citibike, New York City's public bikeshare system, but federal funds are not used for public/private city-run bikeshare systems. Like formal P3 agreements, establishing corporate partners and sponsorships requires local approval and available private as well as municipal partner(s) alongside coordination with ongoing public approval during any political turnover.

5.5.2 STRATEGIES FOR ENSURING THE AVAILABILITY OF ADDITIONAL FINANCING

Moving Forward 2055 assumes a reasonable amount of future local, state, and federal funding through the planning period based on historical trends and the budget assumptions of the NYMTC member agencies. Alternative financing and funding strategies detailed above present project-based and regionwide opportunities to fund regional transportation which can expand the potential revenue base to meet additional future transportation needs through 2055. The strategic basis for the additional financing and funding strategies identified above is found in *Moving Forward 2055's* Shared Vision for Regional Mobility as stated in Chapter 1. Specifically, the guiding principles identified by NYMTC's members as part of their approach to the shared vision include the following:

» **We will seek to use funding for transportation efficiently, no matter its source.**

NYMTC's members and other regional elected officials must think about regional transportation needs, solutions, strategies, and investment priorities. In developing a Shared Vision for Regional Mobility, NYMTC's members support the position that these investments and actions are a shared priority and are strategically important to this region and to the nation. Increasing available federal sources while efficiently and effectively leveraging local resources will require collaboration to fully use these numerous methods to improve transportation. *Moving Forward 2055* explores additional funding opportunities from the strategic planning framework with existing uses seen across fiscally-constrained components of the planning process—the TIP and the constrained element of the Plan—demonstrating NYMTC and its members are already using some of these sources to advance system enhancement projects.

ENDNOTES

[1] https://www.fhwa.dot.gov/ipd/finance/innovation_profiles/state_infrastructure_banks.aspx

[2] User fees themselves are a financing and funding strategy and are explained further below.

[3] MTA East Side Access Project Profiles https://www.transit.dot.gov/foia/metropolitan-transportation-authority-east-side-access.

[4] The Governor Mario M. Cuomo Bridge also utilized a DBFM P3 project delivery structure and Private Activity Bonds (PABs) as part of the project's financing. https://www.transportation.gov/buildamerica/projects/project-highlights/goethals-bridge-replacement-project-staten-island-nynj.

[5] The Moynihan Train Hall was also financed through developer payments as well as contributions from the PANYNJ, MTA, and Amtrak. https://www.fhwa.dot.gov/ipd/project_profiles/ny_moynihan_train_hall.aspx

[6] Staten Island Ferry Terminals Project Profile https://www.fhwa.dot.gov/ipd/project_profiles/ny_staten_island.aspx.

[7] Gateway Tunnel Project Profile https://www.transportation.gov/buildamerica/projects/hudson-river-tunnel-project-between-new-york-and-new-jersey.

[8] Formerly the Rebuilding American Infrastructure with Sustainability & Equity (RAISE) program. https://www.transportation.gov/BUILDgrants

[9] Funded through the FTA, Section 5309 Capital Improvement Grants (CIG) under the IIJA provides discretionary funds for transit capital investments across heavy rail, commuter rail, light rail, streetcars, and bus rapid transit. Eligible CIG projects fall under one of three types: 1) New Starts, 2) Small Starts, and 3) Core Capacity, each with unique requirements. State governments, local governments, and transit agencies may apply for CIG funding upon completing a series of multi-year steps for each project. The FTA analyzes the justification and financial commitment alongside requirements according to statutory criteria.

Projects seeking Small Starts Grants must cost less than $400 million to build, seek under $150 million, and complete Project Development before receiving any CIG funds. New Starts Grants can fund projects exceeding $400 million and provide over $150 million of CIG funds. Projects along existing fixed guideways can apply for Core Capacity Grants to increase corridor capacity by at least 10 percent if the corridor is currently at capacity or will reach capacity in 10 years. New Starts and Core Capacity Projects must complete Project Development and Engineering before receiving any CIG funds.

To be awarded a CIG grant, a project must get a "Medium" or better rating in both Project Justification and Local Financial Commitment categories. The Project Justification rating consists of measures for mobility improvements, cost effectiveness, congestion relief, environmental benefits, land use, and economic development. The Local Financial Commitment rating is based on the project sponsor's current financial condition, the commitment of capital and operating funds, and the reasonableness of the financial plan.

[10] MTA SBS Project Profile https://www.transit.dot.gov/funding/grant-programs/capital-investments/woodhaven-boulevard-select-bus-service-capital-investme-0.

[11] The U.S. DOT Better Utilizing Investments to Leverage Development (BUILD) discretionary grant program provides money for investments across road, rail, transit, and port projects with goals aligned with national objectives. Surface transportation, intermodal, and/or stormwater runoff projects are also eligible. Transportation planning projects may seek funding for planning, preparation, or design across environmental and/or demographic analyses, community engagement, feasibility studies, benefit cost analysis (BCA), and other pre-construction activities.

Any public entity may apply for BUILD funding, including municipalities, counties, port authorities, tribal governments, or MPOs owning and/or operating transportation infrastructure. Federally owned facilities cannot seek BUILD funding, but funds can be used for non-Federal capital and/or planning projects across roads, bridges, and public

transit. Amounts differ depending on whether funding capital or planning projects and whether projects are in urban or rural areas.

BUILD is more flexible discretionary grant program as funds can be used towards multi-modal and multi-jurisdictional projects but relies on strict merit-based evaluation criteria and projects must demonstrate superior local and regional benefits. Application requirements and processes vary between BUILD Planning or Capital grants. Merit Criteria are used to evaluate projects which includes assessing a project's impact on safety, environmental sustainability, quality of life, mobility and community connectivity, economic competitiveness and opportunity, state of good repair, innovation, and partnership and collaboration. Project benefits are rated "high, "medium," "low," or "non-responsive" depending on data-driven responses.

U.S. DOT also evaluates certain projects through an Economic Analysis and Project Readiness to assess Technical Capacity, conduct a full Environmental Risk Assessment, and assess Financial Completeness. The Economic Analysis assesses the estimated benefit-cost ratio (BCR) and net quantifiable benefits for each project. The Environmental Risk Assessment analyzes likelihood of environmental approvals affecting project obligation. The Financial Completeness Assessment reviews the full funding package for a project to make sure money outside of the BUILD program is committed. The Technical Capacity Assessment evaluates whether applicable Federal Requirements will be satisfied when the project is being implemented.

[12] Phase 1 Moynihan Station Funding and Financing. https://railroads.dot.gov/sites/fra.dot.gov/files/fra_net/16927/02%20-%20Moynihan%20Station%20Funding%20and%20Financing.pdf

[13] Vision Zero Safety Improvements. https://www.nyc.gov/office-of-the-mayor/news/975-23/mayor-adams-nearly-30-million-federal-funding-queens-boulevard-safety-improvements

[14] Fordham Plaza in the Bronx Press Release. https://www.nyc.gov/html/dot/html/pr2016/pr16-004.shtml.

[15] Hunts Point Terminal https://www.nyc.gov/office-of-the-mayor/news/670-22/mayor-adams-110-million-federal-grant-hunts-point-terminal-produce-market.

[16] Cross-Harbor Freight Program grants. https://brooklynreporter.com/2016/07/port-authority-grants-over-10-6-million-to-cross-harbor-freight-program/.

[17] New York State website. April 1, 2019. "Governor Cuomo announces highlights of FY 2020 budget." https://www.governor.ny.gov/news/governor-cuomo-announces-highlights-fy-2020-budget

[18] Hudson Yard Developers could exceed floor-area-ratio restrictions and build higher if contributing to the infrastructure improvements fund, and these additional density bonuses also helped fund the extension. Density bonuses require strong market conditions to support building more than zoning allows, but these conditions exist across the New York City region, both New York City's boroughs and some suburban municipalities, particularly near transit.

[19] Currently, 37 states have enacted P3 legislation. U.S. DOT FHWA. State P3 Legislation. https://www.fhwa.dot.gov/ipd/p3/legislation/.

[20] Dentons. "US Infrastructure: Maximizing the benefits of private participation." https://impactnyc.org/wp-con- tent/uploads/2019/08/PPP-Infrastructure-whitepaper.pdf

U.S. DOT FHWA. Project Profile: Hudson-Bergen Light Rail. https://www.fhwa.dot.gov/ipd/project_profiles/nj_hudson_bergen.aspx

U.S. DOT FHWA. Project Profile: Goethals Bridge Replacement. https://www.fhwa.dot.gov/ipd/project_profiles/ny_goethals.aspx

[21] The Goethals Bridge also utilized a TIFIA loan as part of the project's financing. https://www.transportation.gov/buildamerica/projects/project-highlights/goethals-bridge-replacement-project-staten-island-nynj

[22] New Jersey Division of Taxation. https://www.nj.gov/treasury/taxation/cbt/corporatetransitfee.shtml

ADDITIONAL FINANCING AND FUNDING STRATEGIES

#	Financing Option	Type	Description	Revenue Source(s)	Ideal Use(s)	Limitations
1	*Debt-Financing Municipal Bond* GO Bonds *i* BABs *ii* PABs *iii*	Debt	Raise funds through selling bonds to build or buy equipment repaid with interest over time at market interest rates.	Capital Markets	Capital Projects & Revenue-generating assets	Requires issuer with strong credit rating & stable revenue source to secure debt; repay debt over 30+yrs with interest.
2	*Debt-Financing Federal Loan* TIFIA *iv* RRIF *v* SIBs *vi* S. 129 *vii*	Debt	Raise funding at lower than market interest rates & pay less in interest.	Federal Gov.	Capital Projects	Long & competitive process; issuer with strong credit & stable revenue source to secure debt; repay debt over 30+yrs with interest.
3	*Discretionary Federal Grant* MEGA *vii* RSTP *ix* RIA *x* CRP *xi* CIG *xii* BUILD *xiii* INFRA *xiv* CRISI *xv*	Grant	Receive one-time discretionary funding for specific project &/or system upgrade.	Federal &/or Local Gov.	Capital Projects	Lengthy & competitive administrative process to receive funding; limited usage of funds; one-time receipt; local match.
4	*Purchase-Based Tax* Sales Tax Fuel Tax Hotel Tax Property Tax Cigarette Tax Marijuana Tax Car Rental Tax Real Estate Transfer Tax	Tax	Receive funding from portion(s) of consumer purchases.	Consumer Purchases	General Financing &/or Bond Security	Requires public / legislative approval to administer &/or change; tied to & depends on steady / increasing population & purchase patterns; best to have fixed annual increase at least tied to inflation.

#	Financing Option	Type	Description	Revenue Source(s)	Ideal Use(s)	Limitations
5	*Purchase-Based Fee* EV Fee License Fee Registration Fee Car Rental Fee	Fee	One-time &/or annual fee specific to purchase &/or credential.	Consumer Purchases	General Financing	Requires public / legislative approval to administer &/or change; depends on steady / increasing population & purchase patterns; fixed annual increase equal to or above inflation.
6	*Usage Based Fee* Tolls or VMT Fee Truck Ton Mile Fee Transit Fare Utility Fee Congestion Pricing Cordon Pricing Amusement Fee Parking Fee	Fee	Directly charge system users to use system &/or geographic area.	System &/or Area Users	General Financing &/or Bond Security	Limited fee escalation due to income considerations limit increases from being tied to / above inflation; capital infrastructure to implement; ongoing administration necessary to collect fees & address fee evasion; requires steady / increasing travel patterns.
7	*Value Capture*	Capturing Value		Local District Businesses/ Residents	Capital Projects &/or Bond Security	Requires public / legislative approval to administer and/or change as well as extensive forecasting; limited to specific zones / districts.
	Tax Increment Financing (TIF)		TIF revenues fund transportation through projected increased tax revenues resulting from higher property values following infrastructure improvements.			
	Payments In Lieu Of Taxes (PILOTs)		PILOTs are payments made to governments to offset property tax losses from tax-exempt properties.			
	Tax Assessment Districts (TADs)		TADs empower a municipality to charge a tax or surcharge in a specific area to improve infrastructure bringing new development.			
	Transportation Development Districts (TDDs)		TDDs raise funds for specific costs of a project like developing or improving transit services			

#	Financing Option	Type	Description	Revenue Source(s)	Ideal Use(s)	Limitations
8	*Public-Private Partnerships*	P3	Contracts between governmental entity or public authority & private company to finance, build, operate, &/or maintain a new or existing piece of infrastructure or program sometimes involving user fees to compensate the private entity. Terms vary by project whether a DBOM, DBFOM etc.	Debt & Financial Equity	Capital Projects &/or General Financing	Requires local legislation & available private & municipal partner(s) with consortium to finance & administer concession; need ongoing public / legislative approval amidst political turnover during construction & operations; concessions usually over 30+yrs with fixed availability payments as debt service; no NY P3 legislation, only MTA, NJT, PANYNJ, & NJDOT can do P3s.
9	*Corporate Partners & Sponsorships* Employer Payroll Tax Business Tax Corporate Transit Fee Corporate Earnings Tax Concessions Advertising	Private Partnership	Employers or businesses like casinos levy taxes on gross payroll or revenues within transit districts to generate revenue, administered by a state revenue agency on behalf of transit district. Lease &/or sale of transportation asset to an external public or private partner to generate additional revenues for transportation agency.	Financial Equity	Capital Projects, New Assets for Existing Systems	Requires local approval & available private as well as municipal partner(s) alongside coordination with ongoing public / legislative approval amidst political turnover; Citibike is an example of naming rights with a private corporate sponsor, but federal funds are not used for public / private city run bikeshare systems.

i GO Bonds – General Obligation (GO) Bonds are issued by governments to raise general funds to finance various projects which are repaid through general tax revenues.

ii BABs – Build America Bonds (BABs) are issued by governments through the US Treasury to raise funds to finance surface transportation projects before January 1, 2011.

iii PABs – Private Activity Bonds (PABs) are issued through USDOT on behalf of a private entity involved in a P3. State DOTs in a P3 apply for PABs to finance P3 surface transportation projects with the private developer(s) responsible to repay the debt.

iv TIFIA – Transportation Infrastructure Finance & Innovation Act (TIFIA) Loans provide government entities low interest government loans to fund shovel-ready transportation projects which must be repaid by a secure dedicated revenue source.

v RRIF – Railroad Rehabilitation & Improvement Financing (RRIF) Loans provide railroads & government entities low interest government loans to fund railroad infrastructure projects across track, facilities, planning, & capital projects or refinance existing debt.

vi SIB – State Infrastructure Banks (SIBs) are run by state governments to provide low interest loans & credit assistance for highway construction projects, transit capital projects, & railroad projects receiving matching state funds to help attract private investors.

vii S.129 – Section 129 Loans provide state governments low interest loans to fund transportation projects with fewer requirements than SIB loans & negotiable interest rate terms but funds must be repaid through a dedicated revenue stream.

viii MEGA – MEGA Grants are awarded to government entities through the Multimodal Project Discretionary Grant (MPDG) program to fund surface transportation projects across federal highways, bridges, ports, intercity rail, freight rail, & public transportation.

ix RTSP – Rural Surface Transportation Program (RTSP) Grants are awarded to government entities to fund surface transportation projects across federal highways, bridges, ports, intercity rail, freight rail, & public transportation, including highway safety projects, agricultural access roads, & various transportation demand management systems.

x RIA – Regional Infrastructure Accelerators (RIA) Program provides additional funding to governments for technical resources, planning, & project development to expedite regional transportation infrastructure P3 projects using the same requirements as TIFIA loans.

xi CRP – Carbon Reduction Program (CRP) provides governments funding to assist achieving state carbon reduction strategies & fund projects to reduce transportation CO2 emissions, including traffic management, public transportation, pedestrian facilities, alternative fuels, & port electrification.

xii CIG – Capital Investment Grants (CIG) are awarded to government entities from the FTA to fund transit capital investments across heavy rail, commuter rail, light rail, streetcars, & BRT.

xiii BUILD- Better Utilizing Investments to Leverage Development (BUILD) Grants are awarded to government entities from USDOT to fund surface transportation infrastructure projects with significant local or regional impact.

xiv INFRA - INFRA Grants are awarded to government entities from USDOT through the Nationally Significant Multimodal Freight & Highway Projects program to fund nationally significant multimodal freight & highway projects that improve safety, efficiency, & reliability across freight & people movement in & across rural & urban areas.

xv CRISI - Consolidated Rail Infrastructure & Safety Improvements (CRISI) Program grants are awarded to government or academic entities or private railroads from the FRA to help fund railroad projects across capital improvements, safety enhancements, congestion relief, road crossings, corridor studies, workforce training programs, or environmental mitigation work.