

Resilience Improvement Plan

Addendum to the Regional Transportation Plan

NEW YORK METROPOLITAN TRANSPORTATION COUNCIL

PROGRAM, FINANCE AND ADMINISTRATION COMMITTEE (PFAC)

RESOLUTION #557

RESILIENCE IMPROVEMENT PLAN ADDENDUM TO THE FEDERAL FISCAL YEARS (FFYs) 2022-2050 REGIONAL
TRANSPORTATION PLAN

WHEREAS, the New York Metropolitan Transportation Council (NYMTC) is a regional council of governments which is the metropolitan planning organization (MPO) for New York City, Long Island, and the lower Hudson Valley; and

WHEREAS, pursuant to 23 CFR 450.324, NYMTC is responsible for the development of a Regional Transportation Plan for New York City, Long Island and the lower Hudson Valley; and

WHEREAS, NYMTC's current FFYs 2022-2050 Plan, entitled *Moving Forward*, was adopted by the Council on September 9, 2021, having addressed all federal planning requirements set forth in 23 CFR 450.324; and

WHEREAS, the federal Infrastructure Investment and Jobs Act established a number of new formula grant programs, including the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Formula Program; and

WHEREAS, per 23 U.S. Code § 176 (b)(2), the purpose of the PROTECT program is to provide grants for resilience improvements through (A) formula funding distributed to States; (B) competitive planning grants; and (C) competitive resilience improvement grants; and

WHEREAS, per 23 U.S. Code § 176 (e)(1)(B)(i) the amount of the non-Federal share of the costs of a project carried out with funds apportioned to a State under 23 U.S. Code § 104 (b)(8) or a grant under subsection (d) shall be reduced in the case of a State or an eligible entity that is a State or a metropolitan planning organization, the State or eligible entity has developed a resilience improvement plan and prioritized the project on that resilience improvement plan; and

WHEREAS, per 23 U.S. Code § 176 (e)(1)(B)(ii) in the case of a State or an eligible entity that is a State or a metropolitan planning organization, the resilience improvement plan developed in accordance with this subsection has been incorporated into the metropolitan transportation plan under 23 U.S. Code § 134; and

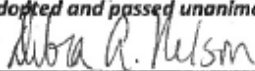
WHEREAS, the attached Resilience Improvement Plan addendum has been developed to address immediate and long-range planning activities and investments with respect to resilience of the surface transportation system. This systemic approach includes a risk-based assessment of vulnerabilities of transportation assets and systems to current and future weather events and natural disasters. It is consistent with and complements the State and local mitigation plans required under section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5165) and meets the requirements of 23 U.S.C 176 (e).

NOW, THEREFORE, BE IT RESOLVED, that PFAC amends *Moving Forward* to include the attached Resilience Improvement Plan addendum.

This resolution shall take effect on the twentieth day of April, two thousand and twenty-three.

ADOPTED: April 20, 2023

"I hereby certify that the above is a true copy of Resolution #557, Resilience Improvement Plan Addendum to the Federal Fiscal Years 2022-2050 Regional Transportation Plan, and was motioned by Jack Schmidt, representing the New York City Transportation Coordinating Committee, and seconded by John Tully, representing the Mid-Hudson South Transportation Coordinating Committee. This Resolution was adopted and passed unanimously."



Debra Nelson, PFAC Chair

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Overview and Purpose

This Resilience Improvement Plan has been developed as an addendum to the Regional Transportation Plan to address the immediate and long-range planning activities and investments of the metropolitan planning organization with respect to resilience of the surface transportation system. This systemic approach includes a risk-based assessment of vulnerabilities of transportation assets and systems to current and future weather events and natural disasters. It is consistent with and complements the State and local mitigation plans required under section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5165) and meets the requirements of 23 U.S.C 176(e).

Role of the Resilience Improvement Plan

This Resilience Improvement Plan addendum 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 climate change, sea level rise, and 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 Resilience Improvement Plan addendum 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.

NYMTC's current Federal Fiscal Years (FFYs) 2022-2050 Regional Transportation Plan, entitled *Moving Forward; Our Region, Connected* (<https://www.nymtc.org/movingforward/>), is built from the NYMTC members' Shared Vision for Regional Mobility. This Shared Vision provides a strategic framework for *Moving Forward's* recommended actions and project selections, as well as its speculative vision proposals. These actions, projects, and proposals provide organizational guidance for NYMTC and a blueprint for federal transportation investments in projects and planning activities.

The Shared Vision features five vision goals. One of those goals envisions:

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

Four objectives support this resiliency goal:

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

This Resilience Improvement Plan addendum is built largely from the section of *Moving Forward* that explores this goal and its objectives, describes recent trends, current conditions, and existing initiatives, and offers recommended strategies and actions.

Current Conditions

ENVIRONMENTAL AND CLIMATE STRESSORS

FHWA launched the Post Hurricane Sandy Transportation Resilience Study for New York, New Jersey and Connecticut (Post Sandy Study) to enhance the multi-state metropolitan region's resilience to climate change, sea level rise, and extreme weather in the longer term, while informing the ongoing recovery process. The results of the study were released in 2017.

The Post Sandy Study compiled information on damage and disruption wrought by Hurricane Sandy in 2012 and Hurricane Irene, Tropical Storm Lee, and the Halloween Nor'easter in 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 climate projections and continuously monitored updates from the scientific community.

With an understanding of these impacts and projected future climate conditions, the Post Sandy Study assessed the exposure of the transportation system to climate 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 the NYMTC planning area. These details appear in Section 4.6.3 of Chapter 4 of *Moving Forward*- (https://www.nymtc.org/movingforward/pdfs/chapter_04.pdf)

HUMAN & PUBLIC HEALTH STRESSORS

Facilities and conveyances that draw people to concentrated locations also make these locations attractive targets for disrupting 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.¹

Additionally, the public health emergency provoked by COVID-19 illuminated the organizational risks and vulnerabilities for transportation agencies and service providers, including organizational impacts and operational vulnerabilities for facilities operators and service providers, as well as supply chain, surface transportation and other modal vulnerabilities. Details on these stressors also appear in Section 4.6.3 of Chapter 4 of *Moving Forward*. - (https://www.nymtc.org/movingforward/pdfs/chapter_04.pdf)

¹ B. M. Jenkins and L. N. Gerten. 2001. Protecting Public Surface Transportation Against Terrorism and Serious Crime: Continuing Research on Best Security Practices. MTI Report 01-07
https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/terrorism_final.pdf

The climate change-related stressors described above also have public health impacts. For example, possibility of power outage in extreme weather impacting the ability of populations to get to cooling, get away from flooding, etc. Extreme heat could also impact health while using transportation services.

Existing Initiatives

ENVIRONMENTAL AND CLIMATE STRESSORS

Climate change, extreme weather events, and the impacts of sea level rise have influenced policy development in a variety of areas in the multi-state New York City metropolitan region to address the wide range of effects associated with storm surge, heavy rainfall, wind, and the resulting erosion and flooding. Communities throughout the NYMTC planning area have undertaken the following in their recovery and resiliency planning:

New York State

- 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 climate risks related to storm surge, rising sea levels, and any other conditions when making certain permitting, funding, and regulatory decisions.
- The NYS2100 Commission, appointed after Hurricane 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 is a New York State program that supports local governments in leading their communities to reduce greenhouse gas emissions, adapt to the effects of climate change, 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, and equitable places to live, work, and play.
- 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 resiliency 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 New York State Department of Transportation (NYSDOT) completed its internal flooding vulnerability assessment update and will complete a system-wide assessment that also includes the local system. NYSDOT is also undertaking an analysis of repetitively repaired/damaged assets from declared emergency events, as required under FHWA's Transportation Asset Management Program rule.
- NYSDOT has updated its design standard for new construction. As part of this policy, culverts are to be upsized by 20% to account for increased runoff events associated with severe storms. NYSDOT will also consider climate change impacts stemming from sea level rise by utilizing guidelines prepared by the New York State Department of Environmental Conservation.
- 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 City

- New York City's Neighborhood Coastal Flood Protection Projects, including:
 - East Side Coastal Resiliency is an integrated flood protection system that would 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.
- New York City's Coastal Zoning for Coastal Flood Resiliency seeks to promote resilient buildings throughout the city's current and future floodplains. Based on the Department of City Planning (NYC DCP)'s experience working with communities throughout the floodplain since Hurricane Sandy in 2012, NYC DCP has drafted a proposal to make zoning more supportive of resilient buildings. This proposal would make permanent zoning provisions that were adopted on a temporary basis in 2013 and improve them in several key areas where the rules do not fully support or may contribute to discouraging resiliency investments in buildings. The proposal would also provide flexibility for grading and shoreline design in waterfront areas to help mitigate flood risk and will prohibit 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 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.

- New York City's Extreme Weather Response Task Force is exploring the City's response to extreme weather events to address a rapidly changing reality in which extreme storms like Hurricane Ida are increasingly common. It is addressing 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. The resilient design will be an integral part of the project planning process for the city agencies and designers. All new projects and substantial improvements will assess risks to climate hazards in the 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.
- The 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.
- New York City is also proposing new neighborhood-scale stormwater infrastructure systems to keep stormwater from backing up and flooding the area behind the new coastal flood defense infrastructure. 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.
- The New York City Department of Transportation (NYC DOT) has been working on a broad array of resiliency-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 and 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 exacerbated by climate change. The Master Plan is estimated to cost between \$5 to \$7 billion and take 15 to 20 years to fully complete. The Master Plan will ensure that Lower Manhattan withstands rising sea levels and increasingly intense coastal storms.

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 our city's coastline through efforts like the Lower

Manhattan Coastal Resiliency Projects, working to create 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

- The Metropolitan Transportation Authority (MTA) has undertaken a Fix & Fortify program to repair damaged infrastructure and install flood protection measures and other measures to make the subway system more resilient to future storm events. MTA's new standards evolved with structural designs to adapt to this new normal we were now facing. One design standard stands out: the Design Flood Elevation – the height that flood waters are expected to rise to in a future storm, and therefore the height against which the facilities must be defended.
- MTA is updating emergency contingency plans for service resiliency for flooding, storm surge, heat, and snow. MTA also plans for deploying service during evacuation to the vulnerable population by coordinating with the New York City Office of Emergency Management.
- MTA is undertaking a climate vulnerability assessment by mapping various transit assets and addressing vulnerability during the development of capital projects and state-of-good-repair projects.
- The Port Authority of New York and New Jersey (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.

Local Communities

- Suburban counties in the NYMTC planning area have updated their hazard mitigation plans to include resilience measures, as well as their evacuation plans through county offices of emergency management. Through county planning commissions, counties have also worked with their local municipalities on coordinated resilience planning and zoning changes and have also pursued revisions and updates of the resilience elements of their county comprehensive plans.

- All of the 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 in part on resilience issues. Putnam County has participated in storm water management through its Soil and Water Conservation District and Highway Department.
- 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.

HUMAN & PUBLIC HEALTH STRESSORS

- The United States Department of Transportation (USDOT) has several research programs dedicated to ensuring a secure connected transportation environment.
- USDOT's Transportation Security Administration has developed a cybersecurity toolkit for surface transportation operators. The toolkit is a collection of documents designed to provide cyber risk management information to surface transportation operators who have fewer than 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 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.
 - The Transportation Security Administration'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, USDOT provides information related to transportation permits, waivers, and other regulations and authorities that are applicable to public mobility and emergency response. USDOT modal administrations also have defined roles.

- The Federal Transit Administration provides guidance for transit operators and administers emergency funding appropriated by Congress.
- Similarly, the Federal Highway Administration 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.

Planned Improvements and Recently Launched Planning Activities

Beyond the existing initiatives described above, which are either completed or on-going, several significant resilience improvements and planning activities have launched more recently or are planned for initiation in the near- and long-term.

LONG ISLAND

- The South Shore Sea Gate Study proposes a layered defense system to protect low-lying coastal communities from conditions similar to the unprecedented flooding experienced during Superstorm Sandy. The study has been funded through a grant by the New York State Department of Environmental Conservation.
 - 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 long-term costs behind wetland sites.

- 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.
- In an effort 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

- The U.S. Army Corps of Engineers 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 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 climate hazards impacting the City and its shoreline. *AdaptNYC* is New York City's plan to adapt to climate change.
- The U.S. Army Corps of Engineers 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.

Manhattan

- The South Battery Park City (BPC) Resiliency Project, which contemplates creation of 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 & West BPC Resiliency Project, inclusive of --

- The North BPC perimeter project area, which will span BPC's North Esplanade and entail a deployable barrier crossing of West Street/Route 9A, extending to an assigned elevation point in Tribeca. This area represents one of BPC's (and Lower Manhattan's) most vulnerable points for storm surge inundation and flooding.
- The West BPC perimeter project area, which 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 Battery Park City.

Staten Island

- Through the U.S. Department of Housing and Urban Development (HUD) Rebuild by Design program, the Staten Island Living Breakwaters Project which proposed a layered resiliency approach to promote risk reduction through erosion prevention, wave energy attenuation, and enhancement of ecosystems and social resiliency, was one of the selected projects. As a result, New York State has been allocated funding to help implement the project along the Tottenville section of the South Shore of Staten Island. Construction on-site began in August 2021.
- The South Shore of Staten Island Coastal Storm Risk Management Project area is located along the south shore of the New York City borough of Staten Island from Fort Wadsworth to Oakwood Beach. The project is in close partnership with the New York State Department of Environmental Conservation and City of New York. The estimated start of construction is 2023.

LOWER HUDSON VALLEY

- Putnam County developed a countywide Hazard Mitigation Plan in 2021 through funding from the Federal Emergency Management Agency. The Plan includes resilience-related strategies and policies, including evacuation planning and assessment of community assets.
- 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.
- Westchester County is also engaging in a county comprehensive plan update which will include both resilience and sustainability components. This will include the use of natural infrastructure in flood plains.

Recommended Strategies and Actions

Moving Forward recommends strategies and actions related to the resilience Vision Goal that provide organizational guidance for NYMTC and a blueprint for federal transportation investments in projects and planning activities. These strategies and actions are outlined below:

PLANNING AND RESEARCH INITIATIVES

- Inventory all areas included in the U.S. Department of Housing and Urban Development Rebuild by Design Program and the New York Rising Community Reconstruction Program and related community imperatives and transportation related proposals.
- Inventory specific technologies related to system protection and fortification.

- Inventory/benchmark resiliency and adaptation practices for all sectors.
- Inventory relevant funding programs at all levels to include programs, sources, and private sector options relevant to system protection and fortification.
- Support the development of detailed transportation contingency plans.
- Revisit the FHWA risk analysis and monitor risk on an ongoing basis as part of the enhanced planning process.

DATA COLLECTION, FORECASTING, AND PERFORMANCE ASSESSMENT

- Identify and monitor vulnerable transportation assets throughout the planning area using the most recent available climate and sea level rise forecasts.
- Develop an annual report of regional coordination.

PLANNING PROCESS RECOMMENDATIONS

- Coordinate transit agencies and jurisdictions in developing procedures and plans to respond to emergency events.
- Support multi-agency planning and design efforts for coastal protection systems.
- Develop an enhanced resiliency planning process through the Metropolitan Area Planning (MAP) Forum.
- Explore improved travel options and redundancies through the MAP Forum's newly established Multi-State Resiliency Working Group.
 - Promote modal redundancy.
 - Use information from the Congestion Management Process and socioeconomic and demographic forecasts to inform the Multi-State Resiliency Working Group's exploration of travel options and redundancies.
 - Explore specific technologies related to travel options and redundancies.
- Share risk analysis results with local municipalities throughout the planning area.
- Establish a working group of NYMTC's member agencies to review and enhance emergency and long-term responses to climate impacts.
 - Enhance project funding mechanisms for system protection and fortification through project selection.
 - Enhance project funding mechanisms for travel options and redundancies through project selection.

PROGRAM RECOMMENDATIONS

- Complete a broad range of resiliency projects, including retrofits to bridges, streets, traffic signals, yards, and facilities.

- Ensure Safe Routes to Community Facilities in the form of protected, accessible pedestrian and non-motorized routes (bike routes, bike share, etc.) to designated community and emergency facilities and public parks, plazas and open space in case public transit or vehicular routes are not accessible or unsafe due to public health or other emergencies. Designated facilities should be in every neighborhood accompanied with wayfinding and signage and clearly marked in multiple languages.
- Make bike share or other micro-mobility share programs free and accessible to all during times of emergency when transit options are unsafe or non-operational.
- Utilize street infrastructure as public space (i.e., open streets) during emergencies.

Programmed and Speculative Projects

NYMTC's FFYs 2023-2027 Transportation Improvement Program and *Moving Forward's* recommended project selections, as well as its speculative vision proposals, program a number of resilience-specific and resilience-related transportation improvement projects. In addition, various vision projects are proposed based on both NYMTC's planning process and the individual planning processes of NYMTC's member agencies. These projects enable the use of federal transportation funding to improve the resilience of the transportation system in NYMTC's planning area. These projects appear in Tables A and B below.

Resilience projects are broadly defined in the tables as "resilience-specific" and "resilience-related". They include any projects that may have elements related to resilience even though that is not their primary purpose. The tables are sorted by anticipated year of completion. Table A includes projects programmed in the FFYs 2023-2027 Transportation Improvement Program. Table B includes projects from the fiscally constrained and speculative "vision" elements of the FFYs 2022-2050 Regional Transportation Plan.

Taken together, these tables, along with the Recommended Strategies and Actions above, constitute both a plan of action and an investment plan that can guide future programming of PROTECT formula funding.

Table A: Resilience-Specific and Resilience -Related Projects in the Federal Fiscal Years (FFYs) 2023-2027 Transportation Improvement Program

<u>Plan No.</u>	<u>Subarea</u>	<u>PIN No.</u>	<u>Short Description</u>	<u>Implementation Year</u>	<u>Estimated Total Cost (Millions)</u>
NSSC1122C	Long Island	301400	NY454 drainage: Feuereisen to Johnson Avenue	2022	\$ 13.831
NSNC5337C	Long Island	NC0004	Bayville Avenue drainage improvements and resurfacing	2022	\$ 15.500
NSSC5111C	Long Island	822000	Improvements to South Ferry Dock at NY114	2023	\$ 3.450
NSNC3324C	Long Island	076065	Bayville Bridge rehabilitation	2023	\$ 25.624
NSSC2215C	Long Island	080838	Highway runoff mitigation	2023	\$ 4.213
MHSRC3490C	Lower Hudson Valley	875458	Congers Road reconstruction: Brewery Road-Strawtown Road	2023	\$ 9.294
MHSMC5177C	Lower Hudson Valley	Multiple	Stormwater management MBC	2023	\$ 1.340
NYCM5580C	New York City	X07159	FDR Drive viaduct rehabilitation	2023	\$ 31.200
NYCMB5115C	New York City	X76426	Williamsburg Bridge reconstruction	2023	\$ 42.590
NYCM5612C	New York City	X77415	Hudson River esplanade	2023	\$ 6.250
NYCBX6011C	New York City	XM2360	Retaining walls repairs	2023	\$ 16.800
NSC5986C	Long Island	0LC101	NY27A over Amityville Creek culvert repair	2024	\$ 8.945
NSNC5877C	Long Island	Multiple	Drainage enhancements	2024	\$ 8.350
MHSPC5505C	Lower Hudson Valley	812748	Taconic State Parkway wall repair	2024	\$ 4.200
MHSWC5875C	Lower Hudson Valley	839209	US Route 6, Annsville Circle-Camp Smith: flood mitigation	2024	\$ 32.700
MHSPC3495C	Lower Hudson Valley	875609	Fair Street: Route 52-John Simpson Road improvements	2024	\$ 28.205
NYCMB4468C	New York City	Multiple	Movable bridges construction & maintenance contracts	2024	\$ 60.501
NYCBK2589C	New York City	X02173	Belt/Shore Parkway bridges	2024	\$ 142.078
NYCMB5882C	New York City	X73180	Flood control projects at various locations on the State highway system	2024	\$ 31.588

Table A: Resilience-Specific and Resilience -Related Projects in the Federal Fiscal Years (FFYs) 2023-2027 Transportation Improvement Program

<u>Plan No.</u>	<u>Subarea</u>	<u>PIN No.</u>	<u>Short Description</u>	<u>Implementation Year</u>	<u>Estimated Total Cost (Millions)</u>
NSSC1122C	Long Island	301400	NY454 drainage: Feuereisen to Johnson Avenue	2022	\$ 13.831
NSNC5337C	Long Island	NC0004	Bayville Avenue drainage improvements and resurfacing	2022	\$ 15.500
NSSC5111C	Long Island	822000	Improvements to South Ferry Dock at NY114	2023	\$ 3.450
NSNC3324C	Long Island	076065	Bayville Bridge rehabilitation	2023	\$ 25.624
NSSC2215C	Long Island	080838	Highway runoff mitigation	2023	\$ 4.213
MHSRC3490C	Lower Hudson Valley	875458	Congers Road reconstruction: Brewery Road-Strawtown Road	2023	\$ 9.294
MHSMC5177C	Lower Hudson Valley	Multiple	Stormwater management MBC	2023	\$ 1.340
NYCM5580C	New York City	X07159	FDR Drive viaduct rehabilitation	2023	\$ 31.200
NYCMB5115C	New York City	X76426	Williamsburg Bridge reconstruction	2023	\$ 42.590
NYCM5612C	New York City	X77415	Hudson River esplanade	2023	\$ 6.250
NYCBX6011C	New York City	XM2360	Retaining walls repairs	2023	\$ 16.800
NSC5986C	Long Island	0LC101	NY27A over Amityville Creek culvert repair	2024	\$ 8.945
NSNC5877C	Long Island	Multiple	Drainage enhancements	2024	\$ 8.350
MHSPC5505C	Lower Hudson Valley	812748	Taconic State Parkway wall repair	2024	\$ 4.200
MHSWC5875C	Lower Hudson Valley	839209	US Route 6, Annsville Circle-Camp Smith: flood mitigation	2024	\$ 32.700
MHSPC3495C	Lower Hudson Valley	875609	Fair Street: Route 52-John Simpson Road improvements	2024	\$ 28.205
NYCMB4468C	New York City	Multiple	Movable bridges construction & maintenance contracts	2024	\$ 60.501
NYCBK2589C	New York City	X02173	Belt/Shore Parkway bridges	2024	\$ 142.078
NYCMB5882C	New York City	X73180	Flood control projects at various locations on the State highway system	2024	\$ 31.588

Table A: Resilience-Specific and Resilience -Related Projects in the Federal Fiscal Years (FFYs) 2023-2027 Transportation Improvement Program

<u>Plan No.</u>	<u>Subarea</u>	<u>PIN No.</u>	<u>Short Description</u>	<u>Implementation Year</u>	<u>Estimated Total Cost (Millions)</u>
NYCBX28C	New York City	X77363	Shore Road Bridge	2027	\$ 269.750
NYCMB5972C	New York City	XM2701	Regional drainage cleaning on highways and bridges	2027	\$ 10.062
MHSMCS352C	Lower Hudson Valley	882396	Haverstraw-Ossining ferry service	2028	\$ 11.130
NYCBK5616C	New York City	X77417	Brooklyn Queens Expressway rehabilitation	2024	\$ 440.000
NYCMC2714V	New York City	X82358	Flood mitigation & resiliency measures at existing Staten Island Ferry facilities	Design	\$ 14.000

Table B: Resilience-Specific and Resilience -Related Projects in the Federal Fiscal Years (FFYs) 2022-2050 Regional Transportation Plan

<u>Plan No.</u>	<u>PIN No.</u>	<u>County/Borough</u>	<u>Short Description</u>	<u>Implementation Year</u>	<u>Estimated Total Cost (m\$)</u>
MHSMC3611C	881373	Lower Hudson Valley	Bridge rehabilitation on various state highways	2025	\$ 16.50
NSNC1860C	80906	Nassau	NY101 (Port Washington Boulevard) Drainage	2025	\$ 0.46
NYCBK2530C	n/a	Brooklyn	Ash Street (Brooklyn Waterfront Greenway)	2026	\$ 11.97
NYCBK5376C	X73171	Brooklyn	Gowanus Expressway (I-278) Viaduct Bridges Corrective Repairs and Preventive Maintenance	2026	\$ 64.25
NYCMB613C	n/a	New York City	MTA Bus Systemwide Upgrade of Depots and Engineering Improvements	2026	\$ 439.80
NYCQ1014C	X82329	Queens	Construction of Ferry Landing at LaGuardia Airport	2026	\$ 48.50
NYCQ330C	n/a	Queens	Reconstruction and Resurfacing of Belt Parkway at Cross Island Parkway	2026	\$ 24.82
NSSC1853C	001767	Suffolk	Rehabilitate the Robert Moses Causeway Bridge over Fire Island Inlet	2026	\$ 31.62
NYCBX18C	n/a	Bronx	Reconstruct Pelham Parkway Bridge over Hutchinson River Parkway	2027	\$ 48.52
NSMC1865C	0T1474	Long Island	Bridge Improvements (locations TBD) on various State Highways and Parkways	2027	\$ 23.99
NYCMB1572C	n/a	New York City	Jamaica Bay Greenway Non-Motorized and Multimodal Improvements	2027	\$ 2.50
MH5WC1404C	876118	Westchester	Route 9 Drainage Improvements	2027	\$ 0.24
NYCQ331C	n/a	Queens	Reconstruction and Resurfacing of Sunrise Highway Westbound over Belt Parkway Westbound	2028	\$ 33.30
NYCQ333C	n/a	Queens	Long Island City/Hunters Point Area-Wide Reconstruction	2028	\$ 46.67
NYCBX28C	X77363	Bronx	Rehabilitation of the Shore Road Bridge over Hutchinson River	2029	\$ 308.73

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<u>Plan No.</u>	<u>PIN No.</u>	<u>County/Borough</u>	<u>Short Description</u>	<u>Implementation Year</u>	<u>Estimated Total Cost (m\$)</u>
NYCBK128C	n/a	Brooklyn	Reconstruction of Union Street Bridge over Gowanus Canal	2029	\$ 110.00
NYCM2663C	n/a	Manhattan	MTA NYCT Second Avenue Subway Phase 2	2029	\$ 4,550.00
NYCMB123C	X72046	New York City	Reconstruction of the Grand Street Bridge over the Newtown Creek	2029	\$ 138.75
NYCBX31C	X02707	Bronx	Rehabilitation of Westchester Avenue Bridge	2030	\$ 35.00
NYCMC2714C	n/a	New York City	Hudson Tunnel Project: Construction of new Hudson Tunnel, rehabilitation of the existing North River Tunnel	2030	\$ 12,700.00
NYCBX12C	X72032	Bronx	Major Deegan Expressway Bridge Rehabilitation from 160th Street to 232nd Street	2036	\$ 65.00
NYCM2664C	n/a	Manhattan	MTA NYCT Second Avenue Subway Phases 3 and 4	2050	\$ 29,929.00
NYCBX2034V	n/a	Bronx	Harlem River East Shore Greenway	Vision	n/a
NYCBX2691V	n/a	Bronx	Hutchinson River Parkway Greenway	Vision	n/a
NYCBX47V	n/a	Bronx	Major Deegan Expressway Corridor Bridge Rehabilitation	Vision	n/a
NYCBX51V	n/a	Bronx	Rehabilitation of Henry Hudson Parkway	Vision	n/a
NYCBK145V	n/a	Brooklyn	Construct Penny Bridge at Manhattan Avenue/Newtown Creek	Vision	n/a
NYCBK162V	n/a	Brooklyn	Shore Parkway Waterfront Greenway	Vision	n/a
NYCBK170V	n/a	Brooklyn	Coney Island to South Brooklyn Ferry	Vision	n/a
NYCBK186V	Study	Brooklyn	Cross Harbor Goods Movement Program - Tier II Environmental Impact Statement (EIS)	Vision	n/a

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NYCBK2074V	n/a	Brooklyn	Coney Island Creek Waterfront	Vision	n/a
NYCBK2076V	n/a	Brooklyn	Shore Parkway Greenway 69th Street to Bay Parkway	Vision	n/a
NYCBK2366V	n/a	Brooklyn	Brooklyn Queens Expressway; Atlantic Avenue to Sands Street	Vision	n/a
NYCBK2531V	n/a	Brooklyn	Kent Avenue Build Out (Brooklyn Waterfront Greenway)	Vision	n/a
NYCBK2532V	n/a	Brooklyn	Valentino Pier (Brooklyn Waterfront Greenway)	Vision	n/a
NYCBK2704V	n/a	Brooklyn	Bush Terminal Connector (Brooklyn Waterfront Greenway)	Vision	n/a
NYCBK2705V	n/a	Brooklyn	DUMBO (Brooklyn Waterfront Greenway)	Vision	n/a
NYCBK876V	n/a	Brooklyn	Brooklyn Waterfront Greenway	Vision	n/a
NSMC1896V	n/a	Long Island	Stormwater Run-off Improvements: Improved access to fishing areas, restore wetland areas and clean drainage structures	Vision	n/a
NYCM2093V & NYCM2461V	n/a	Manhattan	Hudson River Greenway	Vision	n/a
NYCM2095V	n/a	Manhattan	East Midtown Waterfront Project	Vision	n/a
NYCM2098V & NYCM2094V	n/a	Manhattan	Manhattan Waterfront Greenway	Vision	n/a
NYCM2099V	n/a	Manhattan	Harlem River Esplanade	Vision	n/a
NYCM2536V	n/a	Manhattan	Coenties Slip	Vision	n/a
NYCM2537V	n/a	Manhattan	Water Street/ Whitehall Plaza	Vision	n/a

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NYCM273V	n/a	Manhattan	Miller Highway Relocation	Vision	n/a
NYCM277V	n/a	Manhattan	Ferry Access Planning - 125th Street Area	Vision	n/a
NYCM278V	n/a	Manhattan	Ferry Access Planning - West 69th Street Area	Vision	n/a
NYCM279V	n/a	Manhattan	Midtown West Intermodal Ferry Terminal Improvements	Vision	n/a
NSNC1797V	Study	Nassau	Climate Change Impacts on County Transportation Assets and Infrastructure	Vision	n/a
NYCMB2006V	n/a	New York City	Address Access and Performance Issues for the Howland Hook Marine Terminal, South Brooklyn Marine Terminal, and Red Hook Marine Terminal	Vision	n/a
NYCMB2018V & NYCMB282V	n/a	New York City	Staten Island Ferry Terminals and Vessels	Vision	n/a
NYCMB2021V	n/a	New York City	Trans-Hudson Bus System Improvements	Vision	n/a
NYCMB2022V	n/a	New York City	Amtrak Gateway Project	Vision	n/a
NYCMB2023V	n/a	New York City	Advance the Recommendations of the Amtrak Northeast Corridor Futures Study	Vision	n/a
NYCMB2032V	n/a	New York City	Hudson River Greenway from Inwood Hill Park to the Westchester County Line	Vision	n/a
NYCMB2384V	n/a	New York City	Harlem River Bridges Access	Vision	n/a
NYCMB2459V	n/a	New York City	Jamaica Bay Greenway/Shore Parkway Greenway Improvements	Vision	n/a
NYCMB45V	n/a	New York City	Harlem River Bridges Major Rehabilitation	Vision	n/a
NYCMB612V	n/a	New York City	MTA Systemwide Upgrade of Fleet, Passenger Stations, Track, Line Equipment, Line Structures, Signals, Communications, Traction Power, Shops, Yards and Depots	Vision	n/a

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<u>Plan No.</u>	<u>PIN No.</u>	<u>County/Borough</u>	<u>Short Description</u>	<u>Implementation Year</u>	<u>Estimated Total Cost (m\$)</u>
NYCMC5239V	n/a	New York City	Outerbridge Crossing Replacement	Vision	n/a
MHSMC5599V	Study	Putnam	Southeast (NY) to Danbury (CT) Feasibility Study (Beacon Line)	Vision	n/a
MHSPC5590V	Study	Putnam	Interstate 684 and Interstate 84 Transportation Corridor Study	Vision	n/a
NYCQ19V	n/a	Queens	Reconstruction of Borden Avenue Bridge over Dutch Kills	Vision	n/a
NYCQ2692V	n/a	Queens	Laurelton/Cross-Island Greenway (Brookville Park-Long Island Sound)	Vision	n/a
NYCQ2693V	n/a	Queens	Southern Parkway/Conduit Boulevard Greenway	Vision	n/a
NYCQ5584V	n/a	Queens	Develop JFK On-Airport Freight Infrastructure and Logistics Facilities	Vision	n/a
MYMTCMC5539V	Study	Regionwide	Coordinate Transit Agencies and Jurisdictions in Developing Procedures and Plans to Respond to Emergency Events	Vision	n/a
MYMTCMC5540V	Study	Regionwide	Identify and Monitor Vulnerable Transportation Assets Throughout the Planning Area, Using the Most Recent Available Climate and Sea-Level Rise Forecasts	Vision	n/a
NYCMC2453V	n/a	Regionwide	Advance the Port Authority's Goods Movement Action Program Initiatives	Vision	n/a
NYMTCMC5527V	n/a	Regionwide	Continue Development of Regional Marine Highway Services	Vision	n/a
NYMTCMC5531V	n/a	Regionwide	Develop Potential Freight Village Locations, Inland Port Sites, and Similar Development Models	Vision	n/a
NYMTCMC5533V	n/a	Regionwide	Develop Greater Freight Transportation System Resiliency	Vision	n/a
NYMTCMC5534V	n/a	Regionwide	Complete a Broad Range of Resiliency Projects, Including Retrofits to Bridges, Streets, Traffic Signals, Yards and Facilities	Vision	n/a
NYMTCMC5535V	Study	Regionwide	Inventory all Areas Included in HUD Rebuild by Design Program and the New York Rising Community Reconstruction Program and Related Community Imperatives and Transportation-Related Proposals	Vision	n/a

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NYMTCMC5536V	Study	Regionwide	Explore Specific Technologies Related to System Protection and Fortification	Vision	n/a
NYMTCMC5537V	Study	Regionwide	Inventory/Benchmark Resiliency and Adaptation Practices for All Sectors	Vision	n/a
MHSMC2007V	n/a	Rockland	CSX River Line 2nd Track	Vision	n/a
MHSRC1923V	n/a	Rockland	New Monsey Trails Bus Facility	Vision	n/a
MHSRC1931V	n/a	Rockland	Hudson River Esplanade	Vision	n/a
MHSRC1935V	n/a	Rockland	Mahwah River Greenway	Vision	n/a
MHSRC721V	n/a	Rockland	Recommendations of the Route 59 Area Transportation and Land Use Study	Vision	n/a
NYCSI2005V	Study	Staten Island	MTA Staten Island Railway Corridor Sustainable Development Study	Vision	n/a
NYCSI2065V	n/a	Staten Island	Staten Island North Shore Rail Trail	Vision	n/a
NYCSI495V	n/a	Staten Island	St. George Terminal Improvements	Vision	n/a
NYCSI5371V	n/a	Staten Island	Construction of Two New Ferry Landings and Modification of Existing Ferry Landing at the St. George Terminal	Vision	n/a
NSSC660V	n/a	Suffolk	CR 46 (William Floyd Parkway) over Narrow Bay Bridge Replacement	Vision	n/a
NSSC675V	n/a	Suffolk	Huntington/Port Jefferson Branch Electric Train Storage Yard	Vision	n/a
NSSC677V	n/a	Suffolk	Babylon/Montauk Branch Electric Train Storage Yard	Vision	n/a
MHSWC1967V	n/a	Westchester	Hutchinson River Pathway Extension	Vision	n/a

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MH5WC5381V	Study	Westchester	New Haven Yard Study	Vision	n/a
MH5WC783V	n/a	Westchester	Long Island Sound Waterborne Service Emphasis Area	Vision	n/a
n/a	n/a	Westchester	Completion of the Westchester Riverwalk	Vision	n/a