# **Chapter 5**

Transportation System Management and Operations

 Introduction
 Transportation Systems Management & Transportation Demand Mangement
 Transportation Safety & Security

4. Transportation System Resiliency

Foley Square Summer Streets, New York Photo Source: NYC DOT



# **1. INTRODUCTION**

The forecasted increased in demand on the transportation system from continued growth described in Chapter 2 will be one of the greatest mobility challenges in the NYMTC planning area during the planning period. Implementing the system enhancement projects recommended in Plan 2045, as well as the projects programmed in the FFYs 2017-2021 TIP, will not be sufficient to offset the increased demand and alleviate congestion on the system. Additionally, there are financial, environmental, regulatory and political constraints on the level of capacity expansion that can reasonably be achieved for the transportation system through the Plan's horizon year. For these reasons in particular, the management and operations of the system to optimize its efficiency and effective-ness are of paramount importance.

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The term *Transportation Systems Management and Operations* (TSM&O) refers to the integrated strategies which 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.

TSM&O enhancements can help provide travelers with real time information about transportation choices in and around the region. TSM&O solutions can offer high returns on lower-cost operational projects and programs which can delay or eliminate the need for capital-intensive infrastructure projects. Additionally, these solutions can help reduce emissions of transportation-related greenhouse gases and other mobile source pollutants by maximizing system efficiency. TSM&O also seeks to improve the safety and security of the transportation system, as well as its resiliency.

The management of demand and congestion and maximizing of capacity and reliability within a safe transportation environment using TSM&O strategies can enhance air quality and the regional environment while improving mobility, system safety and security, system resilience and optimizing travel times and costs for all travelers. The core components of TSM&O are described in the following sections. ហុ ខ

# 2. TRANSPORTATION SYSTEMS MANAGEMENT (TSM) & TRANSPORTATION DEMAND MANAGEMENT (TDM)

TSM and TDM strategies and techniques are key components of TSM&O. Current and planned TSM and TDM projects and programs are recommended in order to:

- Increase the carrying capacity of the transportation system, reduce congestion, and improve safety on existing roads and transit networks;
- > Manage and reduce peak-hour automobile travel; and
- > Improve and promote alternatives to driving.

TSM focuses on projects and programs that use technology and minor infrastructure changes to increase the capacity and efficiency of existing road and transit systems. TDM is a separate set of techniques that focus on modifying travel behavior and encouraging travel on higher-occupancy modes of transportation. The availability of travel and transportation system data has become increasingly important in the effective implementation both TSM and TDM strategies.

#### **TSM STRATEGIES**

TSM strategies are intended to increase the safety, efficiency, and capacity of existing transportation networks by means of physical, operational, and regulatory improvements. TSM strategies are significant in the NYMTC planning area because they are low-cost, localized modifications of existing infrastructure, and generally take little time to implement compared to building new roads or new transit lines.<sup>1</sup> These strategies range from technology and information that help commuters respond efficiently to conditions on the transportation system, to low-scale construction projects that optimize infrastructure ture capacity.

TSM strategies can be grouped into seven categories:

- 1. Intelligent Transportation Systems;
- 2. Traveler Information;
- 3. Roadway Management and Operations;
- 4. Transit/Rail Management and Operations;
- 5. Value/Congestion Pricing;
- 6. Active Transportation Demand Management; and
- 7. Integrated Corridor Management

The transportation system in the NYMTC planning area includes many examples of deployment of TSM strategies:

# A. INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

Intelligent Transportation Systems involve the application of technology (such as wired and wireless communication technologies, advanced sensors, surveillance cameras, computers and electronics) in an integrated manner, in conjunction with effective management strategies. As indicated in Table 5.1, NYMTC's members continue to enhance the transportation system through various ITS investments.

ITS is implemented through an ITS architecture, which is a plan that outlines how specific ITS technologies should be deployed and integrated. In the NYMTC planning there are ITS architectures for each of the three subregions: New York City, Long Island and the Lower Hudson Valley. These architectures are drawn from the National ITS Architecture first promulgated by the USDOT in 1994. Each of the subregional ITS architectures apply a particular method of operation to a specific area where ITS has been and will continue to be deployed.

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The New York City subregional ITS architecture is large and complex and is operated largely by four major owners: NYCDOT, NYSDOT, MTA, and the Port Authority. An update of this architecture is currently near completion. The architecture features a Joint Transportation Management Center (JTMC) located in Long Island City, Queens, where advanced ITS controls and monitoring are undertaken.

TMCs foster a holistic approach by using ITS to create system integration. Through electronic communication with field devices, TMCs can remotely monitor, control and disseminate information related to transportation conditions. The JTMC in New York City is operated by NYCDOT, NYSDOT, the New York Police Department and the New York State Police. It is one of the largest and most complex transportation management centers in the nation. In addition, the MTA and the Port Authority have various other operational centers to manage their bridges and tunnels and their transit operations.

- The Long Island subregional ITS architecture encompasses Nassau and Suffolk counties and is focused on the INFORM (INformation FOR Motorists) system. A TMC coordinates and manages incidents, communicates with other agencies and monitors traffic conditions on major roadways. The major ITS participants include NYSDOT, Nassau County, Suffolk County, MTA, and the municipal police, fire and public works departments.
- > The Lower Hudson Valley subregional ITS architecture integrates ITS information in the Hudson Valley, including Rockland, Westchester, and Putnam counties in the NYMTC planning area. Traffic operations are managed by its TMC located in Westchester County. The major participants are NYSDOT, the New York State Police, and Westchester County, as well as several other agencies.

Another ITS-related resource in the NYMTC planning area is TRANSCOM, which is a coalition of 16 transportation and public safety agencies in the multistate metropolitan region. TRANSCOM was created in 1986 to provide a cooperative, coordinated approach to regional transportation management.

Additionally, the I-95 Corridor Coalition has a major role in the development and maintenance of a megaregional ITS architecture. The Coalition provides regional ITS coordination among its members through ITS infrastructure, which facilitates the sharing of live and archived data and video images for managing traffic operations, incidents, and traveler information.

#### ITS Integration

NYMTC developed an ITS Integration Strategy Report in 2009 that recommended how each of the three subregional ITS architectures described above should work together. The Report proposed three major goals: identification of opportunities where ITS investments can work together toward regional interoperability and provide the desired regional ITS services; enhancement of interagency cooperation in the management and development of ITS; and, targeting of ITS projects and initiatives early in the planning process to facilitate greater integration.

There are more than 260 categories of ITS operations In the NYMTC planning area, included in the inventory of New York Sub-regional ITS Architecture: http://www.consystec.com/nycsraupdate/web/inventory.htm





#### **B. TRAVELER INFORMATION**

Traveler information can broadly be defined as the provision of road or transit information to travelers so that they will be aware of weather conditions, congestion and delays, alternative routes, and service schedules. The availability of this information allows users of the transportation system to make more knowledgeable decisions about routes and travel modes, thereby increasing the efficiency of the transportation system. The two primary components of traveler information are real-time information for traffic and transit, and trip planning.

The quality and effectiveness of traveler information strategies are highly dependent on the availability comprehensive, real-time data relating to system conditions and service status. Different methods of reaching travelers range from low-tech radio broadcasts to the continuously expanding field of personal mobile communications.

The most common technologies used to communicate traffic conditions to motorists include public broadcasting on television or radio, variable message signs (VMS) posted on roadways alerting drivers to current and future conditions, smartphone applications, portable navigation devices that combine global positioning system (GPS) with remote traffic updates to reroute drivers, and trip planning and navigation services that are based on current or average travel conditions and user specified inputs.

In the NYMTC planning area, *511 New York* (511NY) is the most comprehensive Traveler Information system available. This system is available via phone by dialing 511 or on the web at www.511ny.org. It provides information via text and maps regarding current traffic and transit conditions, as well as transit route trip planning and rideshare services. 511NY also provides via additional links travel information related to specific modes of transportation, such as automobile, public transportation, bicycling and air travel. There are various smartphone applications available to travelers that source information from 511NY and other national providers of traffic and transit information.

#### C. ROADWAY MANAGEMENT & OPERATIONS

#### Incident Management

Nonrecurring traffic incidents such as vehicle breakdowns, crashes, or delays due to severe weather are typically responsible for more than half of peakhour traffic congestion in major US cities.<sup>2</sup> They also increase the risk of secondary collisions between uninvolved motorists. In mass transit systems, incidents such as stalled trains, signal malfunctions, sick passengers or police activity cause delays for riders.

Incident management is the response to such events, and it is defined by the Federal Highway Administration as any "planned and coordinated program to detect and remove incidents and restore traffic [and transit] capacity as safely and quickly as possible."<sup>3</sup> Though some incident management strategies involve using traveler information to warn travelers of delays and to suggest alternatives, there are numerous other measures that must be taken to clear incidents as efficiently as possible so that regular operation can be restored.

In the NYMTC planning area, various incident management systems and protocols are already in place, involving transportation, public safety, and emergency agencies. These systems can effectively address transportation as well as security-related incidents. Governmental and nongovernmental bodies work closely to coordinate operations and share information across jurisdictions.

In response to traffic incidents that occur on New York State highways, NYSDOT and the New York State Police have implemented the Highway Emergency Local Patrol (HELP) program. Using a designated fleet of vehicles patrolling major roadways, HELP can locate and assist in the clearance of traffic incidents. Expansion of the HELP system to cover a larger area would successfully reduce system delays in the NYMTC planning area.

#### Work Zone Management

Work zone management encompasses a range of techniques aimed at reducing delays, maintaining worker and traveler safety, ensuring that construction is accomplished on schedule, and maintaining access for businesses and residents over the course of a project. Work zone management on roadways and transit can impact congestion at various levels in regard to both space (local to regional effects) and time (projects that range from one day to several years).



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From the perspective of a traveler, work zones and incidents have similar effects on travel time and the possible need for travel alternatives, which makes traveler information technologies important to work zone management. However, mitigating congestion caused by construction is very different from managing incidents since the work is planned in advance, allowing traffic and transit planners and engineers to collaborate with construction personnel so that steps can be taken to mitigate the anticipated impacts of the work.

Aside from notifying the public through traveler information mechanisms, the following additional methods may be employed as part of a comprehensive work zone management plan: improving alternative routes of travel and advertising them; providing temporary facilities to absorb demand for travel during facility closures; staging work to occur in off-peak hours; providing police officer control in case of unanticipated conditions; and providing proper signage, safety devices, and lighting to ensure the safety of all travelers and construction workers.

#### Access Management

FHWA describes access management as "a set of techniques that State and local governments can use to control access to highways, major arterials, and other roadways. The benefits of access management include improved movement of traffic, reduced crashes, and fewer vehicle conflicts."<sup>4</sup> Access management is a key technique for optimizing roadway capacity and improving the efficiency of roadway operations in the NYMTC planning area, particularly in light of forecasted growth and anticipated land use changes.

Access management includes several techniques that are designed to increase the capacity of these roads, manage congestion, and reduce crashes. These include: Increasing spacing between signals and interchanges; driveway location, spacing, and design; use of exclusive turning lanes; median treatments, including two-way left turn lanes that allow turn movements in multiple directions from a center lane and raised medians that prevent movements across a roadway; use of service and frontage roads; and land use policies that limit right-of-way access to highways.



NYMTC's members can use access management policies to preserve the functionality of their roadway systems. This is often done by designating an appropriate level of access control for each of a variety of facilities. Local residential roads are allowed full access, while major highways and freeways allow very little. In between are a series of road types that require standards to help ensure the free flow of traffic and minimize crashes, while still allowing access to major businesses and other land uses along a road.

#### Managed Use Lanes

Managed use lanes (MULs) are operational strategies for managing the use of roadway segments or lanes in response to changing conditions.<sup>5</sup> In 2014, NYSDOT completed a MUL study that investigated the feasibility of implementing and operating a MUL network within New York City to improve overall mobility on selected corridors on the state highway and local arterial system. The strategies explored included:

- > On limited access highways
  - Transit: high-occupancy vehicle (HOV) lanes; exclusive transitways; queue jumps and bus-only use of roadway shoulder lanes;
  - Pricing: high-occupancy toll (HOT) lanes; and

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- Efficiency: Exclusive/dedicated truck lanes; contra-flow lanes; temporary shoulder use; speed harmonization; queue warning; dynamic rerouting; and junction control.
- > On arterial roadways:
  - Transit: HOV lanes; exclusive transitways; bus rapid transit (BRT) measures; transit signal priority; bus-onshoulders/parking lanes; and queue jumps.
  - Efficiency: Shoulder/parking lane use and dynamic rerouting

#### Localized Bottleneck Reduction (LBR)

The LBR program was initiated by NYSDOT to investigate opportunities and develop measures for the application of operational and low-cost infrastructure improvements to address (a) localized recurring chokepoints on the roadway system, and (b) to implement cost-effective congestion improvements in the short-term or as alternative solutions are being developed. NYSDOT has implemented a number of LBR projects on the Clearview Expressway, and others are being planned.

# C. TRANSIT/RAIL MANAGEMENT & OPERATIONS

While many of the roadway TSM&O measures described above also impact transit operations, there are a number of techniques available to transit operators in the NYMTC planning area to further improve the efficiency, reliability and safety of the transit systems. It should be noted that while the common objective would be improving the efficiency and safety of the regional transportation system, many of these strategies are dependent on the operational objectives of individual transit operators. Among the techniques available to transit operators are:

- Service directness limiting the number and time of transfers;
- Loading standards strategic improvements to match with the busiest point along routes;
- Traveler information described in Section (ii) above;
- Customer service/safety improvements such as increased use of closed-circuit television on vehicles and facilities (also described in the transit enhancements/marketing section below);



- > Transit signal priority identification and prioritization of transit routes for transit signal priority systems. Also collaboration with traffic management agencies to leverage transit signal priority implementation with traffic signal upgrades;
- > Improvements in automated fare collection (also described in the transit enhancements/ marketing section below); and
- > Support for park-and-ride facilities to facilitate better access to transit service

#### D. VALUE/CONGESTION PRICING

Congestion pricing, or value pricing, is a market-based strategy to help manage travel demand whereby travelers are charged a fee for access to and/or travel within a specified region, road, or road segment (lane, bridge, or tunnel). By pricing facilities that experience severe congestion, especially during peak hours, congestion pricing seeks to reduce traffic by diverting peak travel to off-peak periods or less congested routes. The fees charged can be either flat, or set to vary according to the time of the day and the level of traffic.

By dissuading a proportion of travelers from using highly traveled routes, congestion pricing helps reduce traffic flow disruptions that otherwise would have occurred without pricing and as a result maintains a high level of vehicle throughput during peak travel periods.<sup>6</sup> Electronic toll collection technologies such as electronic "passes" and GPS (Global Positioning Systems) can enable congestion pricing by making toll collection possible without the need for toll booths or traffic interruption. The system may be complemented by automated enforcement, whereby video cameras are used to detect violators.<sup>7</sup>

Congestion pricing exists under various forms: variably priced lanes, such as HOT lanes; variable tolls on entire roadways; cordon charges, which are fixed or variable charges to drive within or into an area; and area-wide charges, such as per-mile charges within an area or network that may vary by level of congestion.<sup>8</sup>

By reducing congestion and ensuring higher vehicle throughputs, congestion pricing can help increase vehicle speed and travel time predictability as well as reduce travel delays without the cost of road widening. Congestion pricing also has demand management effects in that it can help shift a portion of travelers to higher capacity modes such as carpooling or transit, or non-motorized modes such as bicycling. In addition, congestion pricing generates revenue that can be used to operate the system and to fund transit or road improvements.<sup>9</sup>



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#### E. ACTIVE TRANSPORTATION DEMAND MANAGEMENT (ATDM) & INTEGRATED CORRIDOR MANAGEMENT (ICM)

ATDM is the dynamic management, control, and influence of travel demand, traffic demand, and traffic flow on transportation facilities. Through the use of available tools and assets, traffic flow is managed and traveler behavior is influenced in real-time to achieve operational objectives, such as preventing or delaying breakdown conditions, improving safety, promoting sustainable travel modes, reducing emissions, or maximizing system efficiency.

Under an ATDM approach, the transportation system is continuously monitored and actions are performed in real-time to achieve or maintain system performance. The ATDM approach combines the use of both TSM and TDM strategies in a corridor in real time in response to changing conditions. It is dependent on coordinated ITS technologies to monitor and respond to congestion and delays using technologies embedded in the transportation system itself to detect traffic and transit flow conditions and respond adaptively to ease congestion. ICM is a particular example of an ATDM approach. ICM analyzes transportation information from a multimodal perspective, allowing, where feasible, technologies for traffic, transit, and other modes to work together in easing overall congestion. The following ICM projects are being planned and/or tested in the NYMTC planning area:

#### I-495 Corridor

In February 2015, USDOT approved a grant for the development of an ICM Concept of Operations for the I-495 Corridor. The proposed corridor includes sections of I-495 and Route 3 in New Jersey and Interstate 495 (the Long Island Expressway or Queens-Midtown Expressway) in New York. The Corridor connects the New Jersey Turnpike (a section of I-95) to Van Wyck Expressway (I-678) and traverses midtown Manhattan and two key regional facilities – the Lincoln Tunnel, which connects New Jersey and Manhattan under the Hudson River, and the Queens Midtown Tunnel, which connects Manhattan and Queens under the East River.



FIGURE 5.1 - PRIMARY CORRIDOR FOR THE I-495 CONCEPT OF OPERATIONS

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The Concept of Operations will be for a full deployment of traditional and innovative Active Transportation Demand Management and Intelligent Transportation System solutions for this multi-modal corridor which already has robust ATDM and ITS solutions in place. It will establish the technical and institutional framework within which the partnering agencies can pursue ATDM initiatives that advance their strategic goals. These initiatives are expected to include: Reducing non-recurring delay and improving situational awareness and incident management by broadening the sources of real-time data about roadway performance; formalizing incident reporting and ICM event definitions; encouraging mode shift by giving travelers better information about their alternatives to driving, and technology to speed up transit; creating data partnerships with private sector freight shippers and receivers; and reducing recurring congestion by using more granular data to target and mitigate congestion hot spots.

#### I-87/I-287 Corridor

The I-87/I-287 Corridor is a critical east-west corridor in the Lower Hudson Valley, including the parallel and connecting arterial roadways within Rockland and Westchester counties. The New New York (NY) Bridge Project is currently constructing a replacement for the Tappan Zee Bridge, which carries I-87/I-287 over the Hudson River between the counties. The Lower Hudson Transit Link (LHTL) is a program of integrated transit-supportive infrastructure projects along the I-287/I-87 corridor being undertaken in conjunction with the New NY Bridge Project. The LHTL program will initiate implementation of a corridor transit plan put forth by the 31-member Mass Transit Task Force (MTTF). The various program elements include new distinctive buses, shelters and modern passenger amenities at a combination of existing and proposed new bus stop locations; pedestrian safety and operational improvements at the bus stop/shelter locations and adjacent intersections



#### FIGURE 5.2 - LOWER HUDSON TRANSIT LINK

along Routes 59/119/9; and an Integrated Corridor Management (ICM) system to maximize efficiencies of the existing traffic and transit networks, integrated into the Hudson Valley Transportation Management Center (HVTMC) see additional details in Chapter 6.

#### Long Island Expressway HOV Contra-Flow Lane Extension/ATDM

The project will extend the existing morning peak period westbound Contra-flow HOV Lane on the Long Island Expressway (LIE), a distance of 3.3 miles from its current terminus to the Grand Central Parkway Interchange. ATDM strategies including variable speeds, buses on shoulder, peak period shoulder use, travel time advisories, queue warning signs, will be deployed to help manage traffic flow and improve safety along this corridor.

The ATDM strategies that would be applied through this project will allow HOVs, taxis, and buses from points east of 97<sup>th</sup> Street to bypass congestion in the existing westbound LIE between Woodhaven Boulevard and Grand Central Parkway. As part of the project, the eastbound roadway right shoulder will be hardened between Queens Boulevard and 108<sup>th</sup> Street to replace the lane taken away for the extended contraflow lane. The objective is to maintain the same or better level of service along the eastbound roadway during the AM/PM peak period as it would be under existing conditions. The project would reduce travel time and improve trip reliability for both buses and carpools with three or more occupants within the project corridor, generating trip diversion from single occupant vehicles (SOVs) to both buses and High Occupancy Vehicle (HOV) modes. The project will result in faster and more reliable bus trips and reduce the severe congestion experienced by westbound Manhattan traffic along the LIE Corridor between the LIRR overpass and GCP.

#### Connected Corridors Pilot Project in the Bronx

This pilot project will provide cooperative traffic management strategies for the mainline, service roads, and major signalized intersections/arterials on the Bruckner Expressway and adjacent highways like the Cross Bronx and Major Deegan expressways. The Connected Corridor system will help transportation agencies to work together to more effectively move vehicles, people and goods on east-west corridors in the Bronx.

The project will employ the use of ATDM strategies to flexibly manage and control traffic based on prevailing conditions, both during typical daily congestion and during congestion that occurs due to accidents, severe weather, construction, stalled vehicles, etc. These strategies may include quick incident response/clearing, speed harmonization (gradually reduced speed advisories as vehicles ap-



#### FIGURE 5.3 - LIE HOV CONTRA-FLOW LANE EXTENSION

proach a traffic backup), queue warning (messages in advance of queues which allow vehicles time to smoothly and safely reduce speed), junction control (providing a better balance of traffic flow at entrance and exit ramps) part-time shoulder use (using the shoulder as a travel lane during congested periods), dynamic re-routing (to help bypass congestion as necessary), and traveler information (to help travelers make informed decisions).

#### ATDM for Incident Response for Gowanus Expressway

The focus of this pilot project is the Gowanus Expressway Corridor from the Brooklyn approach to the Verrazano Narrows Bridge at the south to the Hugh L. Carey Tunnel on the north. The purpose of this project is to provide an integrated, responsive, efficient, and flexible incident response system on the Gowanus Expressway Corridor that will reduce incident clearance times, incident related delays, and secondary incidents. The project will employ the use of ATDM strategies to flexibly manage and control traffic during congestion that occurs due to accidents, severe weather, construction, stalled vehicles, etc. These strategies will ultimately improve mobility and enhance safety by using real-time data, technology, and decision support structures for operating agencies to make informed, performance-driven decisions on how to manage traffic flow.

#### Future ICM Projects

The 2017 Congestion Management Process Status Report identifies a number of critically congested corridors in the NYMTC planning area which are potential targets for ICM projects during the period of *Plan 2045*. These corridors include:

- New York City: the I-95/Cross Bronx Expressway; FDR/Harlem River Drive; Henry Hudson Parkway/Miller Highway; Grand Central Parkway; Belt Parkway; and I-678/Van Wyck Expressway;
- > Long Island: I-495/Long Island Expressway; Northern State Parkway; Sunrise Highway; and Southern State Parkway; and
- Lower Hudson Valley: I-87/NYS Thruway;
   I-95/New England Thruway; and Hutchinson River Parkway.

#### NYSDOT ATDM Framework

In December 2015, NYSDOT developed and published a framework for ATDM (shown in Figure 5.1 below) which describes a vision for managing a safe, multimodal, and reliable transportation system. Under this vision, transportation is seen as a shared responsibility between state, local, and regional transportation agencies. Accompanying the framework was the ATDM Implementation Plan, providing a list of strategies and recommendations for NYSDOT and its agency partners to consider in the near-term to advance components of the ATDM framework. The framework and implementation plan are not meant to be prescriptive, but could provide strategic framework for this system-level active collaboration that supports safe, reliable and sustainable mobility in New York State in the near future.

#### Implications of Emerging Technologies

There are emerging technologies that will impact the way in which TSM/TDM & ATDM/ICM strategies will be implemented in the NYMTC planning area now and in the future. These new technologies might influence investments NYMTC members make in order to realize the full potential of the TSM/TDM & ATDM/ ICM strategies previously described. Some of these emerging technologies such as connected vehicles, on-demand ride services, and smartphone applications were previously discussed in Chapter 2. It is understood that there would be technical, operational challenges and policy issues to overcome before many of these emerging technologies can be fully implemented. Among these emerging technologies are the following:

#### Internet of Things (IoT)

IoT is the network of interconnected, uniquely identifiable computing devices embedded in physical objects or things.<sup>10</sup> The devices can be sensors, actuators, and communications technologies that enable communication and control functions between devices and external operators, external systems, and among devices themselves. Connected vehicle systems (including Vehicle-to-Vehicle [V2V], and Vehicle-to-Infrastructure [V2I]) currently under development represent a potentially transformative application of IoT to transportation. Other application examples include vehicles that coordinate with us-

#### FIGURE 5.4 - STATEWIDE ATDM FRAMEWORK

A. Active Collaboration	
<ul><li>Multi-modal coordination</li><li>Real-time decision support</li></ul>	<ul> <li>Data integration</li> <li>Co-operative planning and operations</li> </ul>
B. Actionable Information	C. Dynamic Management
<ul> <li>Focus on travel markets</li> <li>Actionable information</li> <li>Multimodal information</li> <li>Emphasis on person/goods throughput</li> </ul>	<ul> <li>Focus on choke points</li> <li>Priority for HOV travel</li> <li>Proactive operations</li> <li>Integrated corridor management</li> </ul>
D. Applied to solve various travel markets and cont	exts
<ul> <li>Urban Congested Corridors</li> <li>Emergencies</li> <li>Planned Special Events</li> <li>Construction and Work Zones</li> </ul>	<ul> <li>Tourism/Seasonal Congestion</li> <li>Winter Weather</li> <li>Bottlenecks and Crossings</li> <li>Freight Movement</li> </ul>

ers' calendars and reserve parking at destinations. The ability to monitor and collect data from many new sources through IoT should allow for better asset management and maintenance of the transportation system.

#### **Cashless Tolling**

Cashless tolling is helping to reduce congestion, improve safety, and reduce vehicular pollution. Under this state-of-the-art technology, more specifically referred to as All Electronic Tolling (AET) and Open Road Tolling (ORT), sensors and cameras are suspended over the roadway on structures called "gantries" and tolls are collected as vehicles pass through at highway/facility speeds. Vehicles with E-ZPass are automatically charged. Non-E-ZPass vehicles have their license plate recorded and a bill is mailed to the registered owner of the vehicle; a system known as Tolls by Mail. New York State Governor Andrew M. Cuomo has announced a plan to bring AET/ORT to all MTA Bridges and Tunnels facilities. In February 2017, the Port Authority also implemented cashless tolling at the Bayonne Bridge, in conjunction with its ongoing "Raise the Roadway" project to improve navigational clearance for oceangoing vessels and to modernize and extend the life of the bridge.

#### **Advanced Robotics and Automation**

Given the aging transportation infrastructure in the NYMTC planning area, advances in robotics and automation have the potential to provide vast improvements in the assessment of structural integrity and deterioration of various assets, especially the roadway and bridge networks. Improvements in robotic inspection technologies which use tools such as surface robots, sensors, and 3D imaging could result in a more reliable, safer transportation system and additional longevity of existing infrastructure.

Name of Project/ Operation	Description of Project/Operation	Planned Future Expansion	TSM Category	Related NYMTC/ Regional ITS Architecture Strategy
Transit			1	
MTA New York City Transit Bus Transit Signal Priority (TSP)	To create a wireless and centrally-con- trolled TSP system which could be deployed anywhere in NYC. Within several years 100% of traffic signals will have state-of-the-art controllers connected through a wireless network to the central NYC traffic computer. The MTA will initially equip 200 buses to communicate with the central NYC traffic computer.	Initially 7 bus routes and corre- sponding traffic signals; ultimately the entire bus fleet and applica- ble traffic signals	ITS/ADTM	Advanced Traffic Management and Advanced Public Transportation Systems
Westchester Bee- Line TSP	Westchester County has installed TSP on the Central Avenue Corridor, extending from the Bronx border to White Plains.	Initially 78 buses, with entire fleet and additional corridors under consideration	ITS	Advanced Traffic Management and Advanced Public Transportation Systems
Nassau County Hub Transit Initiative	Nassau County will be installing TSP as part of the Initial Operating Segment (IOS) of the Hub Transit Initiative. The IOS service will run from Hempstead Village to Roosevelt Field via the Nas- sau Hub, and TSP will be an integral component of this new BRT service in Central Nassau.	All new BRT buses will be ordered with TSP, and signalized inter- sections along the IOS will be retrofit with TSP.	ITS	Advanced Traffic Management and Advanced Public Transportation Systems
Bus lane enforcement cameras	This automated enforcement project will record the license plate number of vehicles that violate bus lane regula- tions, and send a summons which is not a moving violation to the owner. The cameras do not capture an image of the people in the vehicle, only the license plate number.	Selected bus route corridors in New York City	ITS	Advanced Public Transportation
Bus Security Cameras	Bus security camera systems are currently being installed in MTA buses. The purpose of these cameras is to serve as a deterrent to criminal activity, thereby improving the effi- ciency and safety of the bus system. In the event of an incident, the video recorded on the cameras can help to explain what transpired and serve as evidence.		ITS	Advanced Public Transportation

#### TABLE 5.1: MAJOR TSM PROJECTS/OPERATIONS IN THE NYMTC PLANNING AREA

Name of Project/ Operation	Description of Project/Operation	Planned Future Expansion	TSM Category	Related NYMTC/ Regional ITS Architecture Strategy
Rail Control Center (RCC) & Automatic Train Supervision (ATS)	Automatic Train Supervision to moni- tor service and route subway trains to the right tracks. The RCC also central- izes the management of subway main- tenance disciplines and customer in- formation systems in stations. Future infrastructure is intended through the installation of advanced signal systems like Communications-Based Train Control or through adoption of new service monitoring technologies.	In the coming years, NYCT is looking to expand ATS-like capabili- ties to additional subway lines (lettered lines and the 7)	ITS	Advanced Public Transportation
Communications- Based Train Control (CBTC)	The computer-based Communica- tions-Based Train Control allows subway trains to safely operate closer together and at higher speeds, resulting in an increase in maximum track capacity by approximately ten percent.	CBTC is now under construc- tion on the 7 and planned for additional lines as they come due for signal moderniza- tion	ITS	Advanced Public Transportation
MTA LIRR and Metro North Positive Train Control Implementation	PTC system is designed to prevent train- to-train collisions, over-speed derailments, incursions into estab- lished work zones limits, and the movement of a train through a switch left in the wrong position. The Rail Safety Improvement Act of 2008 requires implementation of PTC on all commuter railroad main-line tracks.	The system could be expanded as necessary	ITS	Advanced Public Transportation System
PATH Signal System Replacement/ Positive Train Control Implementation	Replacement of the PATH signal system to provide Communications Based Train Control (CBTC) and Pos- itive Train Control is ongoing, with PTC compliance on schedule for 2018 completion and full CBTC project com- pletion by 2022.	The system can be expanded as necessary	ITS	Advanced Public Transportation System
Bus Time	Bus Time is a real-time bus informa- tion system for customers. The system can provide next bus information by bus stop or bus route, using comput- er, handheld or text message. It has the capability to be expanded to offer fixed displays at bus stops. Today the system informs customers how many minutes until the next bus arrives and the distance away.	NYC DOT is in the process of install- ing a fixed display with this informa- tion at many SBS stops	ITS/Automat- ic Vehicle location (AVL) and Traveler Information	Advanced Public Transportation System

Name of Project/ Operation	Description of Project/Operation	Planned Future Expansion	TSM Category	Related NYMTC/ Regional ITS Architecture Strategy
Real time bus information	Westchester County plans to launch real time bus information in 2017 via Google Transit. Static schedule infor- mation is currently available.	Information would initially be available on mobile devices.	ITS/Automat- ic Vehicle Location (AVL) and Traveler Information	Advanced Public Transportation System
Public Address/ Customer Information Screens (PACIS)	Building upon its ATS and CBTC systems, these are variable mes- sage signs which provide real-time train-arrival information to passen- gers waiting on station platforms and mezzanines.	PA/CIS will be installed on other segments of the system as they are outfitted with ATS, CBTC, or oth- er technologies enabling real-time information.	Traveler Infor- mation	Advanced Traveler Information Sys- tems
Vehicular Traffic N	lanagement			
Advanced Solid State Traffic Controllers	The new controllers support complex intersections with phase skipping and real-time traffic responsive operation. The new controllers are able to adapt to the variety of communication me- dia and protocols (fiber, coaxial, twist pairs and wireless) in order to support federal NTCIP standards. The ASTC is capable of being computerized, con- trolled by the TMC and implementing all of the central system timing pat- terns, scheduled by time of day and as holiday's event. The new ASTC's are also capable of implementing various traffic patterns for different traffic situations.	Expansion to include all NYC 12,800 traffic signals	ITS/Incident Management	Advanced Traffic Management Sys- tems
Midtown in Motion	This system optimizes traffic mobility in midtown Manhattan via a set of field sensors and software equipment, which communicate wirelessly (via NYCWiN) with the joint traffic man- agements center (JTMC) and adjust signal timing appropriately in real time. The system utilizes ASTC con- trollers and includes 100 microwave sensors, 32 traffic video cameras and E-ZPass readers at 23 intersections to measure traffic volumes, congestion, and travel times.	The system is be- ing expanded to downtown Flush- ing in Queens and Flatbush Avenue in Brooklyn. If necessary, future expansion of this system could in- clude other areas in NYC.	ITS	Advanced Traffic Management Sys- tems

Name of Project/ Operation	Description of Project/Operation	Planned Future Expansion	TSM Category	Related NYMTC/ Regional ITS Architecture Strategy
Regional Signal Timing and Coordination	This corridor based traffic signal retim- ing project improves traffic mobility and safety. It optimizes arterial traffic flow capacity, discourages speeding, and increases pedestrian walk times at crosswalks.	Future expansion includes addition- al intersections.	ITS	Advanced Traffic Management Sys- tems
Smart Lights (Adaptive Control System)	This pilot project has been implement- ed at the entrance to the Staten Island College at Victory Blvd. This is a good signal timing option for improving traffic flow on limited size local areas, where traffic patterns are inconsis- tent and unpredictable. Smart lights are connected with field sensors to monitor changes in traffic flow and via wireless communication receive signal timing changes from the JTMC almost immediately.	Future expansion could include oth- er NYC areas.	ITS	Advanced Traffic Management Sys- tems
Highway Intelligent Transportation System (ITS)	This system uses traffic cameras and electronic message boards to monitor and improve traffic flows, as well as to inform drivers. The deployment includes fiber and wireless communi- cation to support video traffic cam- eras, variable message signs (VMS), radio (RFID) readers and travel time signs. All NYC major construction projects require Mobil ITS deployment to support maintenance and protec- tion of traffic management. Current implementation includes the Korean Veteran Parkway, Belt Parkway, and Jackie Robinson Parkway. In Nassau County, the Traffic Man- agement Center (TMC) located in Westbury, NY, uses ITS to communi- cate with most of the County's traffic signals, surveillance cameras, travel time signing and eventually, variable message signs along arterial road- ways.	Future expansion could include oth- er NYC areas.	ITS	Advanced Traffic Management Sys- tems and Maintenance and Construction Oper- ations

Name of Project/ Operation	Description of Project/Operation	Planned Future Expansion	TSM Category	Related NYMTC/ Regional ITS Architecture Strategy
Connected Vehicles (CV) Pilot	The goal of the CV Pilot Program is to improve intersection efficiency. Using Dedicated Short Range Communi- cations (DSRC), the Pilot will collect Basic Safety Message data that may negate the need for existing NYC DOT traffic signal system detection. Ap- proximately 250 intersections will be instrumented with roadside equip- ment (RSE) to communicate with up to 10,000 vehicles equipped with af- termarket safety devices (ASD). These devices will monitor communications with other connected vehicles and the infrastructure and provide alerts to drivers/operators.		ATDM/ITS	Advanced Traffic Management; Advanced Traveler Information Sys- tems
INFORM (INformation FOR Motorists)	The system is one of the nation's larg- est and most advanced transportation management systems, and consists of electronic monitoring, communi- cations, signing and control compo- nents, providing motorist information for warning and route diversion, ramp control, and signal control. All opera- tions are monitored and controlled by the TMC in Hauppauge. It includes more than 4000 vehicle de- tectors, 206 overhead and 48 portable variable message signs, 1080 traffic signals (500 under central control), 91 ramp meters, 228 closed circuit tele- vision cameras, managed lanes, and other ITS features.	The Region in- tends on even- tually having approximately 360 centerline miles of instru- mented roadway (see related map following this table).	ITS	Advanced Traffic Management Sys- tems
Freight	1			-
Freight Weight- In-Motion (WIM)	The goal of this research project is to quantify the damage and the corre- sponding cost to NYC's infrastructure caused by heavy vehicles, utilizing WIM sensors placed at strategic loca- tions. The project also obtains data on vehicle speeds, existing axle weights of heavy vehicles and quantifies the annual damage caused by overweight vehicles using PaveDAT, a FHWA soft- ware. The project also examines using WIM and License Place Reader (LPR) technologies along with overview cameras for monitoring compliance with regulations.	Permanent WIM sites have been installed on the Alexander Ham- ilton Bridge, and Van Dam Street and Rockaway Boulevard in Queens. Other WIM sites may be installed at loca- tions on NYC truck routes.	Active Traffic Management	Advanced Traffic Management Sys- tems and Commer- cial Vehicle Opera- tions Systems

Name of Project/ Operation	Description of Project/Operation	Planned Future Expansion	TSM Category	Related NYMTC/ Regional ITS Architecture Strategy
Vehicular Informa	tion and Support	<u> </u>	<u> </u>	
TRANSCOM OpenReach Servers	The TRANSCOM regional architecture is a program that coordinates the col- lection and redistribution of traffic flow, origin-destination, incident, con- struction, equipment status and spe- cial event information data between transportation management centers running the TRANSCOM regional archi- tecture.	The system could be expanded as necessary	ITS/Incident M a n a g e - ment/Traveler Information	Advanced Traffic Management, Public Transporta- tion, Emergency Management and Traveler information Systems Maintenance and Construction Oper- ations
511NY	This system is available via phone by dialing 511 or via the web. It provides information via text and maps for current traffic and transit conditions, transit route trip planning, rideshare and other services. www.511ny.org	The system would include additional travel information elements	Traveler Infor- mation	Advanced Traveler Information Systems
Highway Emergency Local Patrol (HELP)	Patrol Vehicles/Trucks on major roadways provide motorist assistance as necessary. They also communicate with local TMC to coordinate the re- sponse for roadway incidents.	The system would be expanded as necessary to include additional roadways	ITS/Incident Management	Emergency Man- agement Systems
NYSDOT R-11, Regional ITS Deployment	The ITS deployment covers all inter- state highways in NYC, including par- tial coverage along many of the City's Parkways. It includes an extensive electronic monitoring and communi- cations network that provides motor- ist information about traffic incidents, road construction, travel time, and other traffic conditions. It includes 76 variables message signs, 260 closed circuit television cameras, more than 600 vehicular detectors, 8 highway advisory radio frequencies, managed lanes, and other compo- nents.	The system would be expanded in Eastern Queens, Manhattan and southern Brook- lyn. Improve- ments would also include inte- gration via new technologies (i.e., cross-agency via TMCs and vehi- cle-infrastructure communications)	ITS	Advanced Traffic Management Sys- tems
E-ZPass Customer Service Center	This system includes several Customer Service Centers (CSC) linked with var- ious Toll Collection subsystems. The centers manage toll transactions and interface with a Financial Institution.	The system could be expanded as necessary	ITS	Advanced Traffic Management Sys- tems

Name of Project/ Operation	Description of Project/Operation	Planned Future Expansion	TSM Category	Related NYMTC/ Regional ITS Architecture Strategy
Transit Operations	and Emergency Management			
Long Island Municipal/ County Local Traffic Operation Center (TOC)	The center monitors, analyzes and stores traffic data and controls traf- fic conditions. The center exchanges highway-rail intersection information with rail operations centers. Its opera- tions include regional traffic manage- ment, wide area alerts, and work zone management and coordination.	The system could be expanded as necessary	ITS	Advanced Traffic Management and Emergency Man- agement Systems Maintenance and Construction Oper- ations
Mid-Hudson South Municipal/ County Local TMC	The TMC operations include incident dispatch, coordination and communi- cation, and multimodal coordination, including signal coordination along a particular transit route.	The system could be expanded as necessary	ITS	Advanced Traffic Management and Emergency Man- agement Systems Maintenance and Construction Oper- ations
MTA Bridges & Tunnels Operations Central Command and Control (OCCC)	The OCCC's responsibilities include traffic surveillance, commercial vehi- cle operations, emergency manage- ment, regional traffic management, environmental information manage- ment, work zone operations, etc.	The system could be expanded as necessary	ITS/Incident Management	Advanced Traffic Management, Advanced Public Transportation and Emergency Man- agement Systems Maintenance and Construction Oper- ations
MTA LIRR Operations Center Systems	The center operations include rail dispatch operations, vehicle tracking and scheduling systems and emergency management.	The system could be expanded as necessary	ITS	Advanced Public Transportation and Emergency Man- agement Systems Maintenance and Construction Oper- ations
MTA Metro- North Operations Center Systems	The center operations include rail dis- patch operations, vehicle tracking and scheduling systems and emergency management.	The system could be expanded as necessary	ITS	Advanced Public Transportation and Emergency Man- agement Systems Maintenance and Construction Oper- ations

Name of Project/ Operation	Description of Project/Operation	Planned Future Expansion	TSM Category	Related NYMTC/ Regional ITS Architecture Strategy
MTA Bus Command Center (BCC)	An expanded, replacement Bus Com- mand Center (BCC) building is being constructed across from the East New York Bus Depot in Brooklyn, NY. It will include a Console Operating Theater, capable of supporting both voice and data traffic between the BCC and individual buses and non-revenue vehicles. The BCC will also house the infrastructure to operate the new digital Bus Radio System.		Security and ITS	Advanced Public Transportation Security & Commu- nication System
New York City Joint Transportation Management center (JTMC)	The center operations include traf- fic and transit network control and monitoring, emergency management, emissions management, and mainte- nance and construction management.	The system could be expanded as necessary	ITS/Incident Management	Advanced Traffic Management, Advanced Public Transportation and Emergency Man- agement Systems Maintenance and Construction Oper- ations
NYC Emergency Management Watch Command Center	This is the emergency operations center for the City of New York. The command center is responsible for coordinating responses between the various agencies operating within New York City during major incidents and events.	The system could be expanded as necessary	Incident Man- agement	Emergency Man- agement Systems
PANYNJ Airports Communication desk/operations center	This includes central operations for coordination and communication systems as well as facility-based ITS servers. The functional areas include traffic surveillance, incident manage- ment, traffic and transit information services, multi-modal coordination, transit center security, work zone management, etc.	The system could be expanded as necessary	ITS/ Incident Management	Advanced Traffic Management, Advanced Public Transportation and Emergency Man- agement Systems Maintenance and Construction Oper- ations
TRANSCOM OpenReach Servers	The TRANSCOM regional architecture is a program that coordinates the collection and redistribution of traffic flow, origin-destination, incident, con- struction, equipment status and spe- cial event information data between transportation management centers running the TRANSCOM regional architecture.	The system could be expanded as necessary	ITS/Incident Management/ Traveler Infor- mation	Advanced Traffic Management, Public Transporta- tion, Emergency Management and Traveler information Systems Maintenance and Construction Oper- ations

#### FIGURE 5.5 - COMPONENTS OF TDM



#### TDM STRATEGIES

TDM is the demand-side of TSM&O and complements the previously-discussed supply-side or TSM. TDM refers to a host of strategies that expand travel choices while reducing vehicular SOV travel. TDM also enhances the flexibility of the transportation system by encouraging the types of choices shown below,<sup>11</sup> in order to maximize the efficiency and sustainable use of transportation facilities. TDM strategies/measures allow increased access to transportation systems, improve mobility, and minimize negative impacts of vehicular travel such as traffic congestion, vehicular emissions, and an auto-dominated physical environment.

It should be noted, however, that many TDM approaches require travelers' behavior change. Given this, the opportunities for implementation vary across the NYMTC planning area, as they do in most metropolitan areas. Basically, one size does not fit all and the effectiveness of TDM strategies is highly dependent on local conditions.

# A. PROGRAMS PROMOTING ALTERNATIVES TO SOV TRAVEL

#### Rideshare/Carshare Programs

Ridesharing occurs when two or more people share a single vehicle when making trips. In the NYMTC planning area, ridesharing and carsharing services are promoted by the primary ridematching service in the region - 511NY Rideshare. These services include:

> Carpools – Online ridematching service that allows users to search for and be matched with carpool partners for work trips and other trip purposes.

- > Vanpools The van is owned or leased by a vanpool participant or an employer, or contracted on a month-to-month basis from a third-party vendor. One member of the vanpool volunteers to drive, while riders share the cost of operating the vanpool. In most cases, the driver rides free and has personal use of the van during the evenings and on weekends. The other participants pay a low monthly fare.
- > Car-Sharing These are member-based programs offering 24-hour access to a fleet of vehicles within a city or neighborhood. Car-sharing services substitute for private vehicle ownership, enabling households that only occasionally need a vehicle to save on ownership costs and also reducing the overall demand for parking spaces and the vehicle ownership rate. New York City adopted a car share zoning text amendment that allows car share vehicles to park in off-street parking facilities in appropriate locations.<sup>12</sup> One of the more popular programs in the NYMTC planning area is Zipcar.
- > Supporting Programs
  - Park-and-Ride These facilities allow motorists commuting from peripheral areas to leave their vehicle in parkand-ride lots where they can transfer to public transportation, carpools, or vanpools to complete their journey. The NYMTC planning area and surrounding counties feature a number of park-andride locations, some of which require a parking permit.<sup>13</sup>
  - HOV facilities/MULs These facilities support TDM by giving priority to ridesharing and transit. They provide a travel time incentive to travelers involved in vanpooling, carpooling and using transit.

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#### Active Transportation Programs and Infrastructure

Active transportation includes bicycle and pedestrian programs that improve the attractiveness, convenience, comfort, and safety of both bicycling and walking. These are often implemented in tandem with transit enhancements, streetscape improvements, traffic-calming measures, and initiatives which promote public health.

Among the more successful programs implemented in the NYMTC planning area is the CitiBike Program in New York City with over 22.2 million rides in 2015, many of which were commuting trips. NY511 Rideshare provides maps and other information for bicycling and walking, and also has a "buddy matching" function to help find partners for biking to work. See Appendix 2 for more information on specific pedestrian and bicycling programs and infrastructure improvements.

#### Transit Enhancements and Marketing

Transit Enhancement and Marketing helps reduce traffic congestion and increase transit ridership by improving the appeal of mass transit and by offering financial incentives to lower the cost of taking transit.

- Traveler Information: Transit riders are concerned with waiting time or frequency of service, and the reliability of public transportation.<sup>14</sup> Increasing and improving Rider Information Strategies on buses, subways, and commuter railroads at station entrances and on platforms could help to reduce travel stress and enable riders to make better informed decisions about their travel options,<sup>15</sup> that is, whether to walk, take the bus, ride a different train, or run additional errands before the next arrival. Aside from providing arrival time information, the following strategies help to foster a more comfortable experience for riders;
- > Improved payment methods: Prepaid tickets for improved bus boarding speed and fare cards that work for all modes of transit;
- Enhanced smartphone applications: including ticket sales via smartphone and improved customer information;



- Circulator services<sup>16</sup>: Reduced fare transit that has localized service to popular destinations, e.g. downtown, universities, shopping centers;
- > Transit station improvements: Comfortable, covered bus stations, temperature controlled stations, cell service and WiFi access in stations, ramps and elevators for people with disabilities and bicyclists, easy pedestrian access to stations, readable maps and clearly marked entrances;<sup>17</sup> and
- > Security systems: Installing covert microphones, silent alarms, surveillance cameras, and automatic vehicle location (AVL) to bolster the riders' sense of security on transit.<sup>18</sup>
- > Branding is another strategy used to help increase ridership and rider experience. Improving the image of bus services and bus rapid transit has been shown in a study by the American Public Transit Association that it has the potential to increase ridership from 10 to 20 percent, as the public becomes more accepting of riding buses.<sup>19</sup> NYC's Select Bus Service (SBS) provides a good example of the effectiveness of this strategy.

#### Parking Management Programs

Parking management includes a range of strategies that aim to achieve a more economical use of parking resources and encourage more efficient travel patterns by regulating the demand for, and supply of, both on- and off-street parking. NYMTC has conducted numerous parking management workshops in municipalities across the region. Some of the strategies considered for implementation are listed below and will see further application as the CDEAs recommended by *Plan 2045* are developed.

- > Parking pricing and other cost-based measures:
  - Charging vehicle users directly for the use of parking facilities. Optimizing parking availability and cost can reduce vehicle traffic by decreasing "circling" (vehicles searching for an available parking space), recovering parking facility costs, and generating revenues that can potentially be used to fund transit and commercial district improvement projects.
  - Parking spaces near transit stations strategically priced to encourage mass transit usage.
  - Variable rate pricing that can be used to regulate parking demand based on time (weekday, peak hours, or evening), location (residential neighborhood or commercial street), and type of vehicles and/or users (commercial vehicles or owners of residential parking permits).
- Parking supply strategies regulate the availability of on- and off-street parking spaces:
  - On-street parking management addressed by a number of regulations, such as imposing time restrictions for on-street parking spaces, banning overnight parking, requiring permits for certain neighborhoods, or restricting daytime parking on alternate sides of the street and days.
  - Additional parking supply management strategies as well as sustainable development and TOD are discussed in Appendix 4: Pedestrian-Bicycle Plans.
- > Land use and building regulations, particularly local zoning ordinances, to optimize the



supply of off-street parking.<sup>20</sup> Parking standards can be adjusted or made more flexible to reflect contextual factors such as levels of car ownership and use, geographic location, availability of other transportation options, land use mix, building type and function, residential and built density levels, and demographic and socioeconomic characteristics (income, age, and household structure).<sup>21</sup> New York City has made the commitment to evaluate appropriate off-street parking requirements based on these and other variables.<sup>22</sup>

- > Unbundling the costs of parking and housing which can help to eliminate unnecessary parking space and save on construction and housing costs.<sup>23</sup>
- Shared parking, where a parking facility is shared among several neighboring sites or uses, reducing the number of parking spaces needed in places where users have different peak parking demand periods.<sup>24</sup>

Programs to Promote Changes in Work Travel Patterns

Employers can influence the travel choices of their employees by offering flexible work arrangements such as telework, compressed work weeks, and flexible work hours. These programs could contribute to the reduction of SOV travel and congestion.

- > Telework Teleworking allows employees to work at home one or more days per week or as permitted by an employer based on need. Employers who offer telework could benefit from increased employee productivity. Employees' benefits could include less parking and commuting expenses in addition to other personal benefits.
- Compressed and Flexible Work Schedules -Compressed work schedules allow employees to complete their weekly work schedule in 4 days instead of 5 or on a bi-weekly basis in 9 days instead of 10 (e.g. some employees in New York State could work their 75 or 80 hours in 9 days instead of 10). In this way commuters could avoid peak congestion weekday travel times based on their compressed schedules. Alternative or flexible work schedules allow employees to start and end their work days at non-traditional times, thereby avoiding peak travel times.

# *Other Programs to Support the Use of Alternative Travel Modes*

There are several other strategies that can further encourage the use of alternative travel modes or conversely discourage the use of SOVs. Some of these are being implemented in some parts of the NYMTC region.

- > Guaranteed Ride Home programs –providing occasional employer-subsidized rides (usually by carpooling, shuttles, or taxi) for non-driving employees from their workplace in case of emergencies or unexpected circumstances.<sup>25</sup>
- > Pay-As-You-Drive Insurance these programs link insurance premiums to vehicle miles of travel and basically reward low-mileage drivers with lower premiums than traditional flat-rate insurance. This type of insurance is offered by a number of companies in New York State.
- Parking Cash-Out programs, where employees are given the choice to accept a cash payment instead of a free or subsidized parking space at work if they use alternative travel modes instead of driving alone.<sup>26</sup>
- Commuter Tax Benefits to encourage employees to use transit or vanpool, whereby the company either covers the full cost of the benefit offering a "pre-tax" benefit, or shares transportation costs with the employee.<sup>27</sup>



#### Integrated Land Use Planning

TOD is often defined as higher-density, mixed use development within walking distance of transit stations. By locating trip origins and destinations near each other, this compact land-use pattern reduces the demand for motor vehicle travel and facilitates increased transit usage.

#### Emerging Strategies

Chapter 2 describes anticipated changes over the period of *Plan 2045* that will have implications for transportation. A number of these anticipated changes also have TDM implications and in many instances may alter and amplify TDM strategies such as carsharing, bikesharing, ridesharing and parking. These changes include:

Real-time Information: Technology that delivers real-time information to travelers now has significant impact on managing demand for commute and non-commute trips alike. Travelers can now make better decisions about how they travel (mode), when they travel (time), where and whether they travel (location), and which route they travel (path or which way). Real-time capabilities through smartphones etc. are changing the dynamics of carsharing, carpooling, parking and other TDM strategies.

- > Transportation Network Companies (TNCs, also known as ride-hailing services): these companies use smartphone technology to connect passengers with drivers who use their personal vehicles to provide rides for a fee. Two of these companies that operate in the NYMTC planning area are Uber and Lyft.
- > Electric Vehicles: The rapid advance in battery technology is leading to a transformation of the world's vehicle supply. While growth in the region has been slow, battery electric and plug-in hybrid vehicle ownership has been steadily increasing. At this point significant challenges exist surrounding the provision of vehicle charging. The density of New York City makes off street as well as on-street charging a more difficult solution as compared to the lower densities of California and other West Coast and Sun-Belt states. Charger development has potential impacts on the region including electricity supply, land use and curb space policy and parking garage design. Those effects expand to buildings design as the electrification of freight delivery is included in the mix.



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#### Goods Movement

The impact of goods movement is a major issue in the NYMTC planning area, with truck traffic being a major contributor to congestion. TDM can play a vital role in mitigating the interaction between trucks and cars by both managing the demand for goods movement during peak congested periods and by reducing overall personal vehicle demand when and where goods movement is a priority.<sup>28</sup> The linkage between TDM and goods movement and freight is relatively new and continues to be investigated. That said, TDM strategies that remove bottlenecks also benefit freight transportation, but specific approaches that incorporate technology to manage freight transportation and supply chain management continue to emerge.

Following are some related strategies for freight transportation management, many of which are addressed in *Plan 2045*'s Regional Freight element in Appendix 8:

- > Improve rail and marine transportation infrastructure and services to make these modes more competitive with trucking.
- > Organize regional delivery systems so fewer vehicle trips are needed to distribute goods (e.g., using common carriers that consolidate loads, rather than company fleets).
- > Use smaller vehicles and human powered transport, particularly for distribution in urban areas.
- Implement fleet management programs that reduce vehicle mileage, use optimal sized vehicles for each trip, and ensure that fleet vehicles are maintained and operated in ways that reduce external costs (congestion, pollution, crash risk, etc.).
- Change freight delivery times to reduce congestion.
- > Create pricing and tax policies that encourage efficient freight transport.

# TABLE 5.2: MAJOR TRANSPORTATION DEMAND MANAGEMENT PROJECTS IN THE NYMTC PLANNING AREA

Name of Project	Description/Aim of Project	TDM Category
Policy		l
Transit Oriented Development	Various jurisdictions throughout the NYMTC region are promoting TOD initiatives to coordi- nate land use development and transportation, in order to foster growth around transit hubs such as rail and bus stations/stops. TOD programs at railroad stations aim to pro- mote and coordinate TOD initiatives among its operating agencies, to work closely with local land use jurisdictions and to support initiatives at the regional scale to coordinate land use and transportation planning. These efforts are undertaken in conjunction with such efforts to facilitate approaches that address the "last mile" transportation gap.	Bike/ped enhancement
Complete Streets legislation	To "accommodate and facilitate safe travel by pedestrians, bicyclists, and motorists of all ages and abilities and allow pedestrian and motor traffic to easily coexist." Nassau County has already adopted Complete Streets legislation and will be moving into the implementation phase during the first five years of <i>Plan 2045</i> .	Bike/ped enhancement
Paratransit		
<ul> <li>Access-A-Ride (NYC)</li> <li>Able Ride (Nassau County)</li> <li>Suffolk County Accessible Transportation (SCAT)</li> <li>Putnam Area Rapid Transit (PART) Paratransit</li> <li>Bee-Line Paratransit (West- chester County)</li> <li>TRIPS (Rockland County)</li> <li>HART (Huntington Area Rapid Transit) Paratransit</li> </ul>	Special mobility services: adapted multi-pas- senger vehicles provide demand-response transportation for passengers with special needs such as the disabled and the elderly. Services are offered within a designated radius from existing transit routes and can be used as a feeder service to accessible transit service.	Paratransit/Rideshare
• Dial-a-Lift (Long Beach Transit)		

Name of Project	Description/Aim of Project	TDM Category				
Rideshare and Ride Services	Rideshare and Ride Services					
Guaranteed Ride Home	Customers using certain connecting services are provided with a limited number of trans- portation back-up options in case they need to leave work outside of the operating hours of these connecting services	Employer program/ Vehicle Sharing				
511 NY Rideshare	Outreach program to demonstrate the benefits of rideshares and promote alternative travel choices	Rideshare/Marketing				
Vanpool and shuttle services	Region 11 TDM team coordinates with targeted employers to facilitate and establish rideshare services for employees Westchester County's SMART Commute pro- gram performs outreach to employers to facil- itate ridesharing and the use of transit among employees.	Employer Program/Rideshare				
Commuting Options		I				
Regional Commuter Choice Pro- gram (RCCP)	A program that delivers benefits to travelers who use TDM services in the NYMTC planning area.	Employer Program/ Rideshare				
Go Smart NYC Personalized Trav- el Choice Marketing	Neighborhood-based travel choice marketing program that educates residents about sustain- able options and encourages their use through incentive structures	Transit Enhancements and Marketing				
Employer Education	Outreach to promote and educate employers about pre-tax commuter benefit options	Employer program				

Name of Project	Description/Aim of Project	TDM Category
Bicycle Programs		1
Bicycle Locker Program	<ul> <li>Provision of secure bicycle lockers at transit stations. Currently at select LIRR stations in Nassau and Suffolk Counties, administered locally and by NYSDOT. In addition, Stony Brook University, Suffolk State Office Building in Hauppauge, Town of Brookhaven, Riverhead Town Hall, and Rockville Centre have locally administered bicycle locker programs. MTA Metro North also currently has 8 stations with bike lockers. 2 of these stations are administered by the local municipality (Scarsdale &amp; Pawling) and the remaining 6 are administered by MNR's Private Parking Operator at locations owned by the railroad.</li> <li>NYC DOT is also exploring secure bike parking facilities.</li> </ul>	Bike/ped enhancement
Bicycle Share	The CitiBike bike share program will have 12,000 bikes at 700 stations by the end of 2017. The program was designed for conve- nient, quick trips that serve as alternatives to taxis or public transit. Planned expansions will increase the number of bikes and stations in all five boroughs. A bike share program in the City of New Ro- chelle is scheduled to begin in 2017. SoBi bike share in Long Beach City, Nassau County	Bike/ped enhancement

#### **CONGESTION MANAGEMENT PROCESS**

As a federally-designated Transportation Management Area (TMA), NYMTC is required to maintain a Congestion Management Process (CMP), which is a systematic approach for measuring and managing traffic congestion. The CMP is a major component of TSM&O, and provides information on transportation system performance and various strategies for alleviating congestion and enhancing the mobility of people and goods. The 2017 CMP Status Report (which has been developed and prepared in conjunction with Plan 2045) identifies the sources of congestion in the NYMTC planning area; identifies congested corridors and hot spots at the county/borough level; reports on the status of the roadway transportation network using seven performance measures; and identifies congestion management strategies based on a toolbox of strategies. The toolbox of strategies, which is the programmatic source for the TSM and TDM measures and strategies described above, includes:

- Highway Strategies: Increasing the number of lanes without highway widening (use of break-down lanes or medians), creation of more HOV lanes;
- > Transit Strategies: Encouraging transit use by making transit service more attractive, such as reducing or providing discounted fares, increasing bus route coverage and/or frequencies, establishing intelligent bus stops that provide riders with real-time information regarding the location of buses and their arrival times and other enhancements;
- Pedestrian and Bicycle Strategies: Roadway and sidewalk enhancements aimed at increasing pedestrian and bicycle safety and accessibility;
- TDM Strategies:. Alternative work hours, telecommuting, ridesharing and other programs reduce driving;
- ITS and TSM Strategies: A series of technology based strategies/projects that assist in vehicular and pedestrian mobility;
- Access Management Strategies: Vehicular movement restrictions, interchange modifications, and other roadway design changes;

- > Land Use Strategies: Mixed-use and TOD;
- Parking Strategies: Various parking policy plans that aim to decrease VMT and increase the use of non-vehicular transportation modes; and
- > Regulatory Strategies: Trip reduction ordinances, congestion pricing, and truck restrictions.

The CMP performance measures used to assess the effectiveness and efficiency of the roadways system are: demand-to-capacity ratio; vehicle hours of delay; person hours of delay; average travel speed; travel time index; and vehicle miles traveled.

#### **TSM/TDM RECOMMENDATIONS**

*Plan 2045* recommends the following with regard to TSM and TDM over the course of the planning period:

- > A continuation of the TSM and TDM programs and activities described above, as well as their adaptation in light of the anticipated technological changes noted in Chapter 2;
- A continuing build out of the ITS architecture, and
- > Application of ATDM/ICM approaches to the critically congested corridors identified in the 2017 CMP Status Report, including those corridors identified earlier.

Toward these ends, an on-going project is defined among the recommended System Enhancement projects which appear in Chapter 7.



# **3. TRANSPORTATION SAFETY & SECURITY**

Safety is a key measure of the quality of the region's transportation system. In 2005, federal transportation authorization legislation elevated transportation safety to a national priority by re-quiring safety to be a separate planning factor in the transportation planning process and establishing the Highway Safety Improvement Program (HSIP) and other safety-related programs. The emphasis on safety in federal transportation regulations continues, with safety transitioning to a performance and outcome-based program.

In keeping with these requirements, NYMTC continues to promote a safe and secure transportation system as an integral part of its transportation planning process. NYMTC and its member agencies seek to go beyond the fulfillment of federal safety requirements to work constantly to ensure the overall safety of highway infrastructure and transit systems. NYMTC's safety planning work is guided by its Safety Advisory Working Group and is also influenced by other federal, state and local plans, policies and guidelines, which are discussed later in this section.

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#### **DESIRED OUTCOMES**

*Plan 2045*'s strategic goals include the goal to enhance the safety and security of the transportation system for both motorized and non-motorized users. The following desired outcomes have been identified in pursuit this goal:

- Reduced rate of annual serious injuries and traffic fatalities on the region's transportation systems;
- Promulgation of advanced safety and security measures throughout the region;
- Enhanced coordination, data, and information sharing among members and other stakeholders; and
- Promotion of safety and security improvements in all aspects of transportation planning and implementation.

These desired outcomes provide the framework for the Plan's safety & security element. They are designed to help NYMTC and its member agencies target safety projects, programs and funding priorities.

#### TRANSPORTATION SAFETY DATA

Transportation safety data is at the center of the evaluation of safety issues and the planning and implementation of safety programs. Federal transportation legislation emphasizes a data-driven ap-proach to safety planning. This approach involves gathering and analyzing data, identifying needs, and investing safety funds accordingly. The Highway Safety Improvement Program (HSIP) directs funds as the data suggests.

To further incorporate a data-driven approach into its transportation safety planning, NYMTC continues to support New York State's ongoing efforts to collect timely and accurate electronic data. In addition to accuracy, the state's data collection goal includes real-time data transmission. The cooperation of enforcement agencies is important to gathering timely and accurate crash information. A goal of NYMTC's incorporation of a data-driven approach is to transition enforcement agencies to the electronic transmission of crash data from paper copies. The benefit to police agencies of electronic data collection may become clearer as data analysis becomes streamlined and resources such as the Accident Location Information System (ALIS) are made available to participating agencies. Data dissemination is part of NYMTC's strategy to improve data collection.

Crash data and reports of roadway crashes are maintained by appropriate state agencies such as the Department of Motor Vehicles. The primary source of safety data is the crash report, which includes contributing factors, crash location, and driver vehicle and vulnerable road user characteristics. This information is very useful in identifying the characteristics of crashes. All fatal crashes are reported to the National Highway Traffic Safety Administration, another key data source. In the NYMTC planning area, the major sources of data on transit accidents are the transit operators.

Further planning and research is needed to support local governments in prioritizing safety work. Additionally, local governments need information on their roads' traffic volumes in order to compute crash rates so that locations with statistically significant safety issues can be readily identified. There is a need to prioritize region-wide access to information including crash history and traffic volumes. Empirical data should support transportation projects and programs and safety improvement investments.

#### A. NATIONAL CRASH DATA

The National Highway Traffic Safety Administration (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINIS-TRATION) reports that the motor vehicle traffic fatality rate per 100 million VMT increased 3.7 percent, from 1.08 in 2014 to 1.12 in 2015. In terms of actual number of fatalities the increase was from 32,744 in 2014 to 35,092 in 2015 (7.5 percent).<sup>29</sup> This increase represents the largest increase in nearly 50 years, and coincides with the largest increase in VMT since 1992. These trends reverse a general decrease in fatalities and injuries over the past decade. Increases occurred in almost all segments of the population – passenger vehicle occupants, passengers of large trucks, pedestrians, cyclists, motorcyclists, and alcohol-impaired driving fatalities.

The number one cause of deaths and injuries in rail transportation are due to incidents at crossings and trespassing on rail rights-of-way. More than 200 people are killed every year in crossing accidents in the United States according to the Federal Railroad Administration.<sup>30</sup>

#### **B. NYMTC REGION CRASH DATA**

The crash records (Table 5.3 below) show that the number of traffic crashes did not vary significantly between the years 2013 and 2015. However, overall the total number of fatal crashes decreased by 6 percent from 2013 to 2015. Motorcycle fatalities were observed to have the largest decrease during this period with a decrease of 23 percent for motorcyclists, while fatalities among cyclists increased significantly in the NYMTC region by 50 percent from 2013 to 2015.

#### TABLE 5.3: CRASHES IN NYMTC PLANNING AREA

NYMTC Region Totals (10 counties)	2013	2014	2015
Total Crashes	157,078	153,573	150,376
Total Fatal Crashes	679	575	637
Motor Vehicle Fatalities and Injuries			
Motor Vehicle Crashes (excluding pedestrians, bikes and motorcycles)	135,810	134,293	133,186
Motor Vehicle Fatalities - Driver	244	212	231
Motor Vehicle Fatalities - Passengers	59	68	73
Motor Vehicle Injuries - Driver	63,152	59,953	59,857
Motor Vehicle Injuries - Passengers	30,580	29,539	30,164
Pedestrian Fatalities and Injuries			
Pedestrian/Motor Vehicle Crashes	13,888	12,426	10,791
Pedestrian Fatalities	274	188	242
Pedestrian Injuries	13,754	12,427	10,981
Bicycle Fatalities and Injuries			
Bicycle/Motor Vehicle Crashes	4,836	4,498	4,070
Bicycle Fatalities	18	31	27
Bicycle Injuries	4,703	4,365	4,027
Motorcycle Fatalities and Injuries			
Motorcycle Crashes	2,544	2,356	2,329
Motorcycle Fatalities	83	76	64
Motorcycle Injuries	2,478	2,335	2,352

#### C. NYMTC MEMBER ACCIDENT DATA

Given the size and importance of the transit system in the NYMTC planning area, transit safety is also of great importance to NYMTC members. Table 5.4 through 5.9 provide accident data for each member agency's transit system for the period 2013-2016.

#### TABLE 5.4: ANNUAL MTA ACCIDENT RATES

Performance Indicator	12 Month Average			
FRA Reportable Customer Accident Rate per Million Customers	August 2013 - July 2014	August 2014 - July 2015	August 2015 - July 2016	
MNR	2.15	1.76	1.23	
LIRR		4.45	3.34	
<sup>1</sup> Subway	2.60	2.64	2.50	
<sup>2</sup> Bus	1.05	1.10	1.21	
<sup>3</sup> MTA B&T		0.91	1.04	

Source: http://web.mta.info/mta/news/books/pdf/160926 0830 Safety.pdf

<sup>1</sup> 12 month average from July – June; includes SIRTOA

<sup>2</sup> Includes MTA and NYCT Bus

<sup>3</sup> Customer injury collisions rate for bridge customers per million vehicles

#### TABLE 5.5: TOTAL ANNUAL TRANSIT ACCIDENTS: NASSAU COUNTY

	12 Month Total		
	January 1 – December 31 2014	January 1 – December 31 2015	January 1 – December 31 2016
Number of Accidents*	46	44	41

\* Reflects all reported accidents (injuries, fatalities, non-injuries, moving and non-moving vehicles)

#### TABLE 5.6: AVERAGE ANNUAL ACCIDENTS: SUFFOLK COUNTY

	12 Month Average		
	August 2013 - July 2014	August 2014 - July 2015	August 2015 - July 2016
Number of Accidents*	3.3	3.2	3.3

\*Accidents defined as number of moving vehicle accidents where at least 1 injury was sustained and removed from scene.

#### TABLE 5.7: AVERAGE ANNUAL TRANSIT ACCIDENTS: WESTCHESTER COUNTY BEE-LINE

	12 Month Average		
	August 2013 - July 2014	August 2014 - July 2015	August 2015 - July 2016
Number of Accidents*	1.75	1.50	1.75

\*Average number of reported accidents per month involving injuries

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	1	12 Month Average		
	August 2013 - July 2014	August 2014 - July 2015	August 2015 - July 2016	
Number of Accidents*	0.68	1.48	1.58	

#### TABLE 5.8: AVERAGE ANNUAL TRANSIT ACCIDENTS: ROCKLAND COUNTY

\*Accidents defined as number of moving vehicle accidents where at least 1 injury was sustained and removed from scene.

#### TABLE 5.9: AVERAGE ANNUAL TRANSIT ACCIDENTS: PUTNAM COUNTY

	12 Month Average		
	January 2013 -	January 2014 -	January 2015 -
	December 2014	December 2015	December 2016
Number of Accidents*	1.33	1.33	0.83

\* Incidents include preventable and non-preventable accidents, based upon a determination of bus driver responsibility.

#### **SAFETY EMPHASIS AREAS & STRATEGIES**

#### A. PRIORITY EMPHASIS AREAS

*Plan 2045* identifies several transportation safety issues to monitor and address across the region. One of the major guiding forces in identifying these issue areas is the available data. Thus, an overarching priority of the Plan is to cooperatively implement an electronic crash data system among enforcement and transportation agencies to seamlessly provide access to recent crash data.

#### Pedestrians

Pedestrian safety is *Plan 2045*'s first priority emphasis area. A disproportionate number of the crashes involving pedestrians occur in the NYMTC planning area. Based on data from 2011-2015 American Community Survey (ACS) and from the New York State Department of Motor Vehicles, 64 percent of the state residents live in the NYMTC planning area but 83 percent of pedestrian injuries and 75 percent of pedestrian fatalities occur in this area. Although New York City accounts for a large share of the NYMTC planning area's pedestrian activity, many communities within the region have a downtown area with commercial and community uses, where walking is the primary mode of transportation.

In the NYMTC planning area, according to the U.S. Census and the ACS, the population aged 65 and older is estimated to have increased by 13.6 per-

cent from 2000 to 2014 to 1.7 million people. While the older adult population continues to be a vibrant and productive part of the society, seniors face more pedestrian challenges compared to other adults. Therefore, providing safe mobility for older adults is a priority for pedestrian safety. In addition to seniors, younger pedestrians are another priority area for pedestrian safety. Nationally, 207 (or 4 percent) of pedestrian fatalities in the U.S. involved children.<sup>31</sup>

#### Motor Vehicles

Intersections are a planned point of vehicular conflict in the roadway system. A typical two-way road intersection has 56 potential conflicts: 32 vehicle-to-vehicle conflicts and 24 vehicle-to-pedestrian conflicts. With different crossing and entering movements by drivers, pedestrians and bicycles, an intersection is one of the most complex traffic situations encountered by motorists. Dangers are compounded by speeding and distracted motorists who disregard traffic controls.<sup>32</sup>

FHWA has identified roadway departures as one of the three major safety areas (along with intersections and pedestrians) that require a special focus. Nationally, most highway fatalities occur in roadway departure crashes (53 percent), intersection-related crashes (24 percent), and pedestrian crashes (12 percent).<sup>33</sup> New York State's Strategic Highway Safety Plan (SHSP) states that lane departures and intersections represent the highest fatality areas in the state. The 2014 FARS data show that 49 percent of the state's motor vehicle fatalities involved a lane departure, while 36 percent of the state's motor vehicle fatalities involved intersections.

Distracted driving continues to be a national problem. In 2014, 3,179 people nationwide were killed in crashes involving a distracted driver.<sup>34</sup> While 46 states have recently banned text messaging for all drivers,<sup>35</sup> there is a continuing need to better educate and train drivers, bicyclists, and pedestrians to develop better safety awareness and skills. As personal devices continue to increase distraction in pedestrians and drivers alike, inattention and/or distraction are also significant human factors contributing to crashes.

The 2014 crash data show that 78 percent of crashes in New York State are related to human factors.<sup>36</sup> Safety issues related to driver behavior include impaired driving or driving under the influence, speeding and aggressive driving, and inadequate occupant protection (e.g. seatbelts). Most issues in this area are addressed through education and/or enforcement and are currently well-managed by the Traffic Safety Boards within the NYMTC planning area.

While there are many active and alert senior drivers, in 2014, senior drivers comprised 11 percent of all drivers in New York State but were involved in 24 percent of all fatality crashes. As the senior age group grows, senior drivers emerge as an important issue requiring safety planning attention. Just as senior pedestrians can be the victims of many pedestrian crashes, senior drivers can potentially be a hazard to other pedestrians and motorists. Aging can impact a person's visual, cognitive and physical health. Due to medical and technological advances, recent population forecasts predict an increase in the national elderly population, which could lead to higher percentages of senior drivers on the roads. Currently, federal agencies are promulgating guidelines to address this growing segment of the population. These new guidelines will help states develop plans to address the particular needs of older drivers and to address the emerging challenges posed by an increasing population of older drivers.



#### Motorcycles

Over the past decade, motorcycling has become increasingly popular in the NYMTC planning area. Along with the dramatic increase in the number of motorcycle licenses and registrations in the region, the number of motorcycle crashes involving fatalities or injuries remained fairly constant over the past decade, however, there have been steady decreases since 2012. To ensure crashes do not increase along with the increase in motorcyclists, this mode of transportation requires a special focus in relation to roadway safety.

NYCDOT recently completed the New York City Motorcycle Safety Study, a comprehensive study which examined the state of motorcycle safety within the five boroughs. Although only accounting for two percent of motor vehicle registrations in New York City, motorcycles account for 14 percent of all traffic fatalities. Drawing on 5 years of comprehensive motorcycle crash data, this study determined the "who, when, where and why" of motorcycle crashes in the City. In addition, a number of recommendations addressing education, enforcement and policy/legislation will be put forward based on the study findings.

#### **Bicycles**

A livable community provides safe and convenient transportation choices to all, including walking, bicycling, transit, or driving. Bicycle safety is a major concern in the NYMTC planning area. Bicycle safety improvements depend on an integrated approach that involves education, planning, design, and maintenance. NYMTC member agencies use street design, such as traffic calming and Complete Streets principles, to improve safety for bicyclists and all roadway users. Educational programs for drivers, bicyclists, and pedestrians, like Coexist New York State, "Share the Road," and Bike Smart Campaigns, also improve safety. Additional information about bicycle safety is in Appendix 2.

#### Intermodal Connectivity

Safe pedestrian connections at intermodal transfer points, such as bus to rail transfers, are a crucial component of regional intermodal planning. Improved roadway design and wayfinding can greatly improve both safety and connectivity. Intermodal connectivity areas include interface areas between subway and sidewalks, parking lots connecting to commuter rail stations, ferry terminals or airports, and pedestrian paths connecting bus stops with major trip generators, like residential or office complexes, malls, and hospitals.

#### Transit

Various transit providers in the NYMTC planning area have established safety programs to achieve the highest practical level of safety for all modes of transit. In order to protect passengers, employees, revenues, and property, all transit systems are required to develop and implement a proactive system safety program plan. The FTA supports these efforts by developing guidelines and best practices, providing training and by performing system safety analyses and reviews. One program developed and implemented by the FTA is the Safety Management Systems (SMS) and Safety Performance Measurement Systems (SPMS). SMS offer the most promising means of preventing public transportation crashes by integrating safety into all aspects of a transit system's activities, including planning, design, construction, operations, and maintenance.



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#### **B. STRATEGIES**

Various strategies are recommended by *Plan 2045* to address the transportation safety issues described in this section. These include the continuation of those strategies that are currently in place and those described below. The outcomes related to *Plan 2045*'s safety goal, as described in this section's introduction, will likely be improved through implementation of these strategies. One of the focuses of the safety goal is to develop comprehensive access to safety-related data, including an electronic crash data system that will provide vital crash data between enforcement and transportation agencies.

#### Build Partnerships between Agencies and Stakeholders

All transportation agencies in the NYMTC planning area have formed partnerships with other public agencies, including police departments, municipal governments, and Community Boards, to address all aspects of transportation safety, including safety engineering, enforcement, education, and emergency and medical services. Traffic Safety Boards focus on safety education and enforcement in local areas, while other statewide partnerships focus on statewide road safety issues. Agency coordination is especially necessary in multi-jurisdictional areas of the roadway network, such as roadway segments operated by different transportation agencies that connect highway ramps, bridges, and tunnels with the local street network, in order to ensure continuity for roadway safety. NYMTC and its members will continue to foster relationships with other public organizations in order to broaden its approach to improving the safety and efficiency of the entire transportation system.

#### Integrate Safety at All Levels of Planning

Safety should be integrated into all aspects of the transportation planning processes. This entails both dedicating funding to safety-specific research on key safety issues and facilitating multi-agency communication by sharing information and collaboratively generating strategies. Each NYMTC member agency participates in the Safety Advisory Working Group (SAWG) which identifies issues, barriers, and opportunities related to safety integration. In addition to



participation in SAWG, each agency should appoint Pedestrian-Bicycle Coordinators or identify specific staff as needed to assist with pedestrian and bicycle safety issues. Additionally, many regional issues mirror statewide issues. NYMTC will continue to participate in the New York State Association of Metropolitan Planning Organizations' Safety Working Group, where statewide issues are addressed and potentially future issues are identified.

#### Continue Education and Training

Promoting an awareness of safety strategies for all road users, along with improving roadway geometry and operations, are vital components of safety planning. Education and outreach is needed for the public as well as for those who implement improvements to the transportation network. NYMTC agencies will work with their Traffic Safety Boards, who have educational programs in place, to address many issues, such as distracted or impaired driving. Drivers, bicyclists, and pedestrians must understand the traffic regulations and yield to each other appropriately.

*Plan 2045* recognizes that community-based workshops have been particularly effective at bringing together stakeholders around common issues. With the Plan financed of able Com

continued federal and state programming support, the Plan recommends that training workshops be financed on topics such as Complete Streets, Walkable Communities, Safe-Routes-to-School, Designing Streets for Pedestrian Safety, and Road Safety Audits.

# Continue a Focused Approach to Safety (FHWA Focus State Program)

FHWA's Focus State program recognizes that three focus areas account for almost 90 percent of traffic fatalities: intersections, roadway departure, and pedestrian safety. The purpose of the Focus State program is to further decrease the number of fatalities and serious injuries on the nation's highways through the targeted delivery of technical assistance and resources. New York State was identified as a pedestrian focus state and New York City as a pedestrian focus city. When ranked by the number of crashes, 48 percent of the pedestrian crashes between 2009 and 2013 (outside of New York City) occurred in the 20 focus communities located among several New York State counties including Nassau, Suffolk, Westchester, and Rockland counties.<sup>37</sup>

The program also calls for the transportation community to think beyond traditional approaches and to consider low-cost, comprehensive, and/or systematic safety solutions. This approach allows Focus States to demonstrate results and to take advantage of lessons learned across the country by states and localities that have implemented safety improvements on their highways.

#### Support Traffic Safety Boards

Article 43 of the New York State Vehicle and Traffic Law provides for the formation of county traffic safety boards. In the NYMTC region, the counties of Nassau, Suffolk, Westchester, Putnam, and Rockland have these boards. Pursuant to the state law, the boards have the duties and functions listed below:

- Promotion and encouragement of street and highway traffic safety;
- Formulation of county-wide highway safety programs and coordination of efforts of interested parties and agencies engaged in traffic safety education;

- Cooperation with local officials within the county in the formulation and execution of traffic safety programs and activities;
- Study of traffic conditions on streets and highways within the county, study of and analysis of reports of accidents and causes thereof, and making of recommendations to the appropriate legislative bodies, departments or commissions, such changes in rules, orders, regulations and existing law as the board may deem advisable;
- > Obtaining and assembling motor vehicle accident data, and analysis, study of and consolidation of such data for educational and informational purposes; and
- > Coordination of and direction of local activities related to the implementation of the state highway program, as approved by the Governor or his or her designee.

NYMTC member agencies should continue to utilize and to support these boards in their work to improve traffic safety.

#### Road Safety Audits

A Road Safety Audit, or Safety Assessment, is a proactive, low-cost safety tool to assist agencies in addressing problematic locations. Similar processes are used by many agencies under different names. In a safety assessment, an independent multi-disciplinary audit team examines a site and offers solutions. The assessment process emphasizes the connection between the transportation planning process, multimodal considerations, enforcement activities, safety education, and engineering solutions. NYMTC member agencies should consider this tool in its efforts to systematically address safety issues. Both pedestrian and bicycle specific road safety audit guidance are available from FHWA.

#### Crash Reduction / Crash Modification Factor

A crash reduction factor or crash modification factor (CRF or CMF) is the percentage reduction in traffic crashes that might be expected after implementing a given countermeasure at a specific site. CRFs are available for roadway improvements as well as pedestrian measures. Not only can CRFs be used in cost-benefit analysis, they can also serve as a tool in the investment decision-making process.

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#### Establish Asset Preservation Programs

Safety appurtenances such as guiderails, signs, and pavement markings are critical elements in highway safety design. In order to keep these elements functioning as designed, an asset management program must be in place to provide ongoing routine maintenance. Asset preserva-tion may be accomplished through both capital and maintenance efforts.

#### Expand Emerging Strategies

New York City launched Vision Zero in 2014 as a targeted effort to eliminate traffic fatalities involving the coordinated efforts of NYCDOT, New York Police Department, New York City Taxi and Limousine Commission, New York City Department of Health and Mental Hygiene, and other city stakeholders. Vision

Zero initiatives focus on education, enforcement, street design, and legislation. More information on Vision Zero initiatives can be found in Appendix 2.

Another example is automated monitoring for enforcement. Studies indicate that the fatality rate drops to 45 percent when a person is struck by a car going 30 miles per hour, and to 5 percent at 20 miles per hour or less.<sup>38</sup> While red light cameras have been in use for some years, the installation of additional cameras or of speed cameras, would require changes in legislation. Nevertheless, as described in greater detail in Appendix 2, red light cameras are currently used in several counties throughout the NYMTC region.



# NYC's speed limit is 25 MPH, unless otherwise posted.

New York City Vision Zero Initiatives Photo Source: NYC DOT

#### **TOOLS & TECHNIQUES**

#### A. ENGINEERING AND PLANNING

Modern traffic engineering, design, operations and planning techniques are available to counties, regions, and municipalities to inform their road management and planning decisions. These techniques, which include location prioritization, road safety audits, the use of crash reduction and modification factors, and systemic safety approaches, can help inform design decisions and improve evaluations of past projects based on post-completion safety and operational data.

#### Accident Location Information System (ALIS)

NYSDOT has developed ALIS and is working through the Safety Working Group of the New York State Association of Metropolitan Planning Organizations to expand use of this web-based system. ALIS visually displays queried crash data in a GIS format. Feedback from the users of ALIS indicates it is a powerful tool for safety analysis. *Plan 2045* recommends continued support of ALIS and ensuring member agency access and training.

#### Traffic Safety Data Viewer

NYCDOT has 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 are able to display all injury and fatality data on a map of New York City, or can generate their own analysis of the crash history for a given location. Provided with a user's selected geography, the data viewer outputs an automatic analysis of the location, comparing it to the borough as a whole using the KSI (Killed or Severely Injured) rate per mile (based on the latest 5 years of data). The interface allows access to safety data quickly to determine a potential project's priority level. The geographical extents of the project may also be saved and accessed, or modified, at a later date. Additionally, the Safety Viewer application provides functionality for post implementation effectiveness analysis. This allows for a quick safety impact analysis of projects to inform future work. This feature outputs a tailored report which includes comparisons of age, mode, time of day and other crash characteristics.



#### Complete Streets Design Principles

Complete Streets design principles are roadway design features that accommodate and facilitate safe travel by pedestrians, bicyclists, and motorists of all ages and abilities. Several municipalities within the NYMTC planning area adopted complete streets policies prior to the passage into law of New York's Complete Streets Act in August 2011.<sup>39</sup> NYMTC member agencies must consider Complete Streets design principles on all future projects which receive both federal and state funding. More details about the Complete Streets programs of different counties and municipalities of NYMTC are provided in Appendix 2.

#### Safe-Streets-for-Seniors

Safe-Streets-for-Seniors is a pedestrian safety initiative for older New York City residents. This program studies crash data, and then develops and implements mitigation measures to improve the safety of seniors and other pedestrians, as well as all road users. Since launching the program in 2008, NYC-DOT has addressed senior pedestrian safety issues in 37 Senior Pedestrian Focus Areas (SPFAs) citywide, has implemented within the Senior Areas 165 Street Improvement Projects (SIPs) since 2009. A detailed description of this New York City program is provided in Appendix 2.



Additionally the Safe Seniors program, a NYSDOT pilot project, expanded targeted senior pedestri-an initiatives in Smithtown (Suffolk County) and on Hempstead Turnpike (Nassau County), with other municipalities under consideration. As part of its Livable Communities Program, Westchester County is actively involved in the AARP pedestrian needs program. AARP launched a New York State survey in the spring of 2011 that evaluated 530 intersections across more than 30 counties to bring attention to the safety issues that pedestrians face and what needs to be improved in the pedestrian infrastructure. The results of the survey highlighted several poor pedestrian conditions and driving behaviors which are listed in Appendix 2.

#### Safe-Routes-to-School

Safe-Routes-to-School (SRTS) originated in New York City and was adopted nationally as a federally-funded program. Through SRTS, NYCDOT has identified 270 Priority Schools and recommended and implemented several safety improvements citywide. This ongoing project is described in detail in Appendix 2 of the Plan. The program recently received additional funding for capital improvements at locations in priority geographies. Safety improvements at other school locations will be folded into the Street Improvement Projects (SIP) Program for in-house implementation.

In the Lower Hudson Valley and on Long Island, SRTS workshops have been held in many communities and schools. Several Westchester County municipalities and school districts have implemented SRTS programs which involve capital improvements as well as education campaigns and encouragement efforts. Within Rockland County, municipalities and school districts have received SRTS grants for safety education, including surveys of students and parents and programs on safe walking and bicycling to and from school.

#### Transit Safety

Westchester County is examining pedestrian access to bus stops in order to identify improvements which will encourage transit use and minimize safety hazards. Safe-Routes-to-Transit is a New York City initiative to improve pedestrian and motor vehicle movement around subway entrances and bus stops in order to increase the accessibility, safety and convenience of mass transit. The Safe-Routes-to-Transit 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. The three programs comprising the Safe-Routesto-Transit initiative include bus stops under elevated subways structures, subway-sidewalk interface, and sidewalks-to-buses.

#### Safety Studies

NYMTC member agencies are currently investigating intersections and roadway segments within their respective jurisdictions with statistically significant, above-average crash rates. The identified locations are further studied by in-house safety investigators and/or consultant engineers to determine the cause of the safety problems so that appropriate improvements can be implemented. The highway safety investigations will first evaluate implementation of low-cost improvements, such as improved signage, minor paving, sight distance improvements, guiderails, improved pavement markings, adding countdown pedestrian heads, changed signal timing, and others. However, in certain cases, capital investments may be necessary and could be included in large-scale capital projects.

NYCDOT is conducting a crash analysis study that will develop a systematic approach to prioritize locations for safety improvements. Roadway treatments such as chevrons, wet reflective pavement marking, rumble strips, and wider shoulders, can decrease unsafe lane departures. Other similar low-cost systemic treatments should be evaluated for intersection and pedestrian safety. In addition to locations identified by crash statistics, safety investigations may also be completed at locations with perceived safety concerns identified by the public and elected officials.

In 2015, as part of the implementation of USDOT's action plan to increase walking and biking and reduce pedestrian and bicycle fatalities, the National Highway Traffic Safety Administration (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) completed a Roadway Pedestrian Safety Audit in Rockland County. The Audit look at areas along State Route 59 and State Route 45 in the Town of Ramapo and the Village of Spring Valley. As a consequence, NYSDOT initiated a pedestrian safety study in these areas, which identified recommendations that could be implemented, emphasizing engineering, education and enforcement. The resulting Pedestrian Safety Study, published in March 2016, contains an implementation plan with solutions categorized by short, medium and long term goals, with cost estimates.

#### Rail Crossing Safety

Rail crossing safety is receiving increased attention in the NYMTC planning area, in New York State, and nationally. In November 2016, Governor Andrew Cuomo signed two bills aimed at reducing train-motor vehicle incidents at crossings. One will require frequent inspections of traffic control devices at highway-rail crossings; the other will require the state to study rail crossings and make improvement recommendations.



As an outcome of Rockland's Pedestrian Safety Study, Ramapo Town Police conduct pedestrian crosswalk decoy operations, where a decoy officer attempts to cross in a crosswalk. If motorists do not yield, warnings are issued and educational materials are provided.

Below are some of the actions being taken by NYMTC members to address this issue.

- > Rockland County has developed a plan to install supplemental safety measures – primarily four-quadrant gate systems – at 14 roadway-rail grade crossings along the West Shore (River) freight line, where over 40 accidents occurred between 1998 and 2014. Planning and design have been completed for these improvements, which will result in improved safety and the creation of a Train Horn Quiet Zone. The project is utilizing Federal grant funds along with State and County funds and construction is expected to begin in 2017.
- MTA's LIRR and MNR are undertaking grade crossing safety enhancements. LIRR will equip ten public highway grade crossings across LIRR territory with loop activated CCTV cameras and digital video recorders.<sup>1</sup> MNR will be similarly equipping all of their public crossings and one private crossing in the State of New York with cameras and recorders. The equipment will provide valuable information on crossing function and driver behavior for both forensic investigations into specific incidents as well as analysis of crossing/traffic operations for targeted modifications to improve safety.

In addition, the railroads are partnering with local municipalities and NYSDOT to undertake customized safety enhancements at two additional public highway grade crossings within the LIRR territory (Atlantic Avenue in Oceanside, and Executive Drive in Deer Park) and eight public highway grade crossings within the MNR territory to incorporate traffic signal preemption and undertake roadway/ traffic improvements which are targeted to address local traffic conditions. It is LIRR's intention to roll out additional installations of CCTV cameras and other grade crossing safety enhancements at crossing locations with high volumes of train and/or vehicular traffic.

- In updating the State Highway Safety Plan >(SHSP) NYSDOT has identified a number of strategies to address safety across the State. One of these strategies involves upgrading rail grade crossings with a principle strategy of reducing the frequency and severity of accidents involving vehicles and pedestrians at arade crossings through the improvement or elimination of highway-railroad grade crossings. The supporting activities proposed for this strategy are (a) Identification of existing conditions of grade crossing locations to identify needs such as interconnection with traffic signals or geometric issues, and (b) upgrade of warning devices priorities such as standard signs and pavement markings; installation or replacement of active warning devices (flashers and gates); upgrading active warning devices, including track circuitry improvements and interconnections with highway traffic signals; crossing illumination; crossing surface improvements; and general site improvements.
- > NYCDOT has implemented markings refurbishments and signage enhancements at several intersections and at-grade crossings along the LIRR Lower Montauk Branch from Long Island City to Glendale, Queens. NY-CDOT is studying the feasibility of a signal design at the intersection of Maspeth Avenue and Rust Street in coordination with the LIRR crossing gates. The feasibility study, which is locally funded, is expected to be completed by summer 2017. If feasible, implementation and construction of the signal would require capital construction and funding would need to be identified.

<sup>&</sup>lt;sup>i</sup> The ten crossings being improved are distributed among the following branches: the Main Line (four), Far Rockaway (one), Montauk (2), Oyster Bay (one) and Port Jefferson (two).

#### High Crash Corridor Programs

NYSDOT's "corridor approach" identifies systemic improvements to be implemented throughout a study corridor. Current corridor approach projects in the Long Island area include the Hempstead Turnpike Pedestrian Safety Study, the Sunrise Highway Pedestrian Safety Study, and the Southern Parkway Nassau County Lane Departure Crash Analysis.

A current corridor project in Rockland County resulted from the Route 303 Sustainable Development Study, initiated in 1999 by NYMTC, in concert with the Town of Orangetown, Rockland County and NYS-DOT. The objective of the study was to chart a path for future improvements that balanced safety, accessibility, mobility, sustainable land use and community needs. Implementation is ongoing and includes safety and other improvements throughout the corridor. Putnam County is undertaking a Commercial Corridors Feasibility Study for nine commercial corridors. The County is preparing a transportation analysis of each of the corridors, including but not limited to vehicular and pedestrian traffic efficiencies, safety, accessibility and mobility issues, circulation within the corridors, parking management strategies in order to assess and determine transportation infrastructure improvements and efficiencies, zoning changes and future development, growth and transportation needs in the County, both in the short- and long-terms, for all nine commercial corridors.

### **The I-81 Corridor Study**



July 2013

**Prepared by New York State Department of Transportation** In partnership with the Syracuse Metropolitan Transportation Council and Federal Highway Administration





#### **EDUCATION**

FHWA's Pedestrian Safety Campaign is a comprehensive set of materials for local communities to use in implementing their own campaigns. It includes materials designed for use in television, radio, cinema, and print advertising. Forums and other targeted educational programs are used to reach specific groups such as children and seniors. Public Information and Education (PI&E) initiatives in the region include the Vision Zero education programs in New York City, Safe-Routes-to-schools; Safety City and Transit initiatives, as well as ongoing safety education forums focused primarily on children and seniors.

#### Safety City

Programs like Safety City teach children about bicycle and pedestrian safety.

The TRACKS Program (Together Railroads and Communities Keeping Safe) TRACKS is an MNR in partnership with MTA Police designed to educate the community about safe behavior at or around railroad grade crossings and tracks. MNR offers free educational programs tailored to schools (K-12), camps, libraries, community centers, busing and trucking companies, driving schools and more.

#### Vision Zero Education Initiatives

Vision Zero Education Initiatives provides comprehensive traffic safety education to New York City children in grades K-12, older adults, parents of young children, and other at risk populations in target communities with the highest numbers of pedestrian injuries and fatalities. Funded multi-session education programs, which engage students in active participation with hands-on lessons, include: Safer Streets, Stop Think Act, and CSI: City Street Investigators. Pedestrian safety workshops for older adults provide opportunities for identifying and addressing safety issues specific to routes around their senior centers. Vision Zero initiatives also include a data-driven, hard-hitting paid media advertising campaign, public traffic safety community forums hosted by NYCDOT and other agencies, and Street Team outreach on high crash corridors by NYCDOT and the New York Police Department.

#### Safe-Routes-to-School (Non-Infrastructure)

Safe-Routes-to-School (non-infrastructure) funding is used in New York City to provide walking and biking encouragement and education programs including Bike-to-School programs for high school students, school-based *We're Walking Here* activities, and after-school Mileage Clubs.

In Rockland County, this funding is typically used for promoting safe and healthy walking and bicycling to and from elementary and middle schools. Parent surveys, educational events such as student assemblies, special games, display and distribution of printed materials and planning for signage and bike racks are featured.

The City of Long Beach in Nassau County also conducts a Safe-Routes-to-School Program for all children in grades K-5, in addition to after school pedestrian and bicycle safety programs conducted by the Long Beach Police and Fire departments. Nassau County works closely with parents and parents' associations to help promote the Safe Routes to School Program. Parents also assist with community events and bicycle rides such as ones held during Bike-to-School Week.

In Westchester County, many municipalities and school districts have non-infrastructure activities which include encouragement and education campaigns such as letters home to parents, *Golden Sneaker* contests, and student video and poster contests.

#### Other Programs

Westchester County - The Plan4Safety Community Traffic Safety Awareness Grant program, funded by the Governor's Traffic Safety Committee through the National Highway Traffic Safety Administration, is a community outreach program to bring the message of traffic safety and injury prevention to the community. The program is administered by the Westchester County Department of Public Works and Transportation, Traffic Safety office and provides programs to all age groups in the community in an effort to reduce the rate of preventable traffic crashes, injuries and fatalities in Westchester County. Another goal of the program is to promote traffic safety through community partnerships and heighten the public's awareness toward injury prevention. Traffic safety programs are presented to schools, corporations, hospitals, civic groups, senior citizen groups, libraries, etc. Programs are presented in the areas of: mitigating distracted driving and use of electronics while driving, deterring speeding, mitigating aggressive driving, drowsy driving and educational programs on seat belts and child safety seats, school bus, bicycle and pedestrian safety. The program also works in cooperation with local police departments in their traffic safety enforcement efforts.



Nassau County - A program is currently being planned for Nassau County middle school children that, in addition to general pedestrian and bicycle safety best practices, will also include actual footage of the children riding to and from the middle school. This video was shot from a GoPro camera by one of the students who recorded it on his way to and from school. Clips will be used to demonstrate risky behaviors engaged in by the children when no adults are present. There will also be an on-line survey conducted to better understand why children do not regularly wear their bicycle helmets.

>

In addition, the New York Coalition for Transportation Safety continues to conduct pedestrian and bicycle safety education programs/ bicycle rodeos throughout Nassau County at schools, churches, senior centers and at locations requested by local legislators. County staff work with injury prevention specialists at Nassau University Medical Center and Winthrop University Hospital to teach seniors how to prevent falls that they may incur when they are pedestrians.

Westchester and Rockland Counties - The Police Traffic Services Block Grant program, funded by the Governor's Traffic Safety Committee, also funds communities in Rockland County in order to bring the message of traffic safety to residents. In Rockland, individual police departments apply for grants, which are approved by the county's Traffic Safety Board. In 2016, each of the county's five towns, five villages, the County Sherriff's Office and a Community Outreach Center received grants for police traffic services and child passenger safety programs.

In May of each year, the Rockland County Sherriff's Office runs a special program called *Buckle Up New York* and conducts annually two major events for the Child Passenger Safety Program to ensure proper fitting and use of child car seats. In addition, during 2010-2015 a Local IM-PACT grant and a Creating Healthy Schools and Communities grant from the NYS Department of Health supported the initiation of a pedestrian safety education campaign in a number of locations in Summer 2016 in Rockland County. The campaign includes implementation of the State's *See! Be Seen!* pedestrian safety program, and of the education recommendations of the NYSDOT 2016 Routes 45 and 59 Pedestrian Safety Study in the Town of Ramapo and the Village of Spring Valley.

In Westchester, the program 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. This program targets increasing traffic safety enforcement to reduce traffic crashes, associated with speeding, distracted driving, pedestrian and school bus/motor vehicle violations. The program promotes safe driving and works in cooperation with community partnerships. This grant is administered by the Westchester County Department of Public Works and Transportation, Traffic Safety office. A mandatory component of this grant is the highly visible Click it or Ticket seat belt campaign. During this campaign, police focus enforcement efforts on seat belt and child safety seat violations.



#### Rockland County is using NY State's pedestrian safety program materials to enhance local efforts, such as these posters that appear on Transport of Rockland buses in English, Spanish, Yiddish and French Creole.

#### ENFORCEMENT

STOP DWI is an important program in the NYMTC planning area that addresses impaired driving. The comprehensive program consists of five areas: education/public information; enforcement; court-related; rehabilitation; and probation. In addition, several other programs address aggressive driving behavior and occupant protection, including Selective Traffic Enforcement Program (STEP), Buckle Up New York, and Child Passenger Safety. STEP 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.

#### STOP-DWI

STOP-DWI education programs for high school students, including improvisational theater and workshops, provide a forum for discussion of real life situations teens encounter and encourage them to make safer decisions as they become old enough to drive.

- > **New York City -** Funded by a New York State Special Traffic Options Program for Driving While Intoxicated (STOP-DWI) grant, New York City's Choices campaign presents the viewer with two options: a safe trip home or a consequence of drinking and driving. In qualitative testing of this concept, Choices displayed effectiveness due to the personal accountability it places on the driver and the power it gives the viewer in allowing him to make his own choice. The creative elements of the campaign make it attention grabbing, relevant and believable, with the inclusion of New York City specific imagery. Since launch, the campaign had grown to include a mobile app and microsite, as well as media placements on billboards, radio, in bars, cinema previews, and sponsorships at professional sporting events.
- Rockland County Relying on the 1981 State legislation that authorized counties to coordinate local efforts to reduce alcohol and

other drug related traffic crashes, Rockland County implements a STOP DWI program, funded through fines collected from persons convicted of driving while intoxicated.

Program implementation is undertaken through a county STOP DWI and Traffic Safety Coordinator, police officers, probation officers and enforcement actions taken by law enforcement agencies. For students and the general public, a presentation is provided that gives an overview of laws related to driving while intoxicated and describes the arrest process. A second type of presentation is an interactive mock DWI trial that uses audience members for all roles.

The program's presence is maintained in the high schools. The message is further delivered to the public through print and broadcasting methods and at events, Online Drug/Alcohol Education Courses are made available for legal, professional, and employment purposes (https://www.alcoholdrugcourses.com/rockland-county-ny-alcoholdrug). A Facebook page is also maintained for the program: https://www.facebook.com/rcstopdwi. The Traffic Safety Board has recently formed an associated charitable foundation to receive donations for safety education initiatives, which include the purchase of a portable driving simulator for high school students to demonstrate to themselves that texting while driving cannot be done safely.



The Rockland County Traffic Safety Board will use a new Driving Simulator to demonstrate to high school students that texting while driving is unsafe.

#### **RELATED PLANNING PROCESSES**

#### A. STRATEGIC HIGHWAY SAFETY PLAN

New York State's Strategic Highway Safety Plan establishes statewide highway safety goals. The purpose of the Plan is to promote best practices and strategies that if implemented could have a substantial impact on reducing fatal and injury crashes.<sup>40</sup> This important statewide safety planning process directly guides and influences the safety element of Plan 2045.

#### B. THE GOVERNOR'S TRAFFIC SAFETY COMMITTEE'S HIGHWAY SAFETY STRATEGIC PLAN

The Governor's Traffic Safety Committee administers National Highway Traffic Safety Grants, which are referred to as Section 402 funding, from the National Highway Traffic Safety Administration. These federal funds are used to support State and Community Highway Safety programs to reduce deaths and injuries. The GTSC's Highway Safety Strategic Plan (HSSP) is the principal document for setting priorities, directing program efforts, and assigning resources in New York State.

#### C. NEW YORK STATE PEDESTRIAN SAFETY **ACTION PLAN**

The purpose of the Pedestrian Safety Action Plan is to identify the current safety conditions and to recommend a distinct set of engineering, education and enforcement countermeasures that can be accomplished over the next five years to improve safety for pedestrians on both state and local streets. Funding will include Highway Safety Improvement Program (HSIP) funds as well as other state and federal funding sources.

#### D. VISION ZERO BOROUGH PEDESTRIAN SAFETY ACTION PLANS

The Vision Zero Borough Pedestrian Safety Action Plans were released in early 2015 and are NYCDOT's comprehensive plan to address pedestrian fatalities and serious injuries. See Appendix 2 for more details.



NYS Strategic Highway Safety Plan Photo Source: NYS DOT

#### E. COMPLETE STREETS PROGRAMS

As described in greater detail in Appendix 2, NYS-DOT, NYMTC's other members and several local municipalities in NYMTC's planning area are applying Complete Street provisions in each stage of project planning and development to ensure that safety, mobility and accessibility are duly considered. Because NYSDOT and local agencies share the responsibility of implementing Complete Streets, the ability of municipalities to identify opportunities for Complete Streets features, and ultimately to install them, will be critical to achieving safer and more sustainable communities.

#### F. HIGHWAY SAFETY IMPROVEMENT PROGRAM

NYSDOT manages the Highway Safety Improvement Program and solicits proposals for safety projects to be funded through the program. Funding is awarded based on an evaluation in order to maximize investment in the most cost-effective safety projects statewide. Selected projects must be consistent with the strategies and emphasis areas identified in the statewide Strategic Highway Safety Plan. Both targeted and systematic projects are eligible for funding.

#### G. NATIONAL EFFORTS

The National Highway Traffic Safety Administration, FHWA, and Federal Motor Carrier Safety Administration, in conjunction with the National Safety Council, launched a Road to Zero coalition with a goal of ending fatalities on the nation's roads within the next 30 years. USDOT provides grants to organizations working on lifesaving programs such as improving seat belt use, installing more rumble strips, truck safety, behavior change campaigns, and data-driven enforcement. Additionally, USDOT developed two tools - a national definition for serious injuries and State Injury Conversion Tables - to help states get the best information on how and where serious injuries occur by improving the quality of data reported and collected. Using the Conversion Tables, state and local agencies not currently using the new national definition can convert and report their serious injury data in their HSIP reports and their Highway Safety Plans.

#### SAFETY RECOMMENDATIONS

*Plan 2045* recommends the continuation and expansion of the projects, programs and activities described above. Of paramount importance is the on-going coordination and vertical integration of activities and planning processes at the various levels identified; a role which NYMTC is well positioned to play, working with and through the MAP Forum and the New York State Association of Metropolitan Planning Organizations.



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#### TRANSPORTATION SECURITY & EMERGEN-CY PLANNING

Security planning for the NYMTC planning area and for the multi-state metropolitan region is the responsibility of many agencies and institutions. Since security depends on extensive communication and coordination, the planning and execution of security measures are interrelated and responsibilities overlap in some instances. NYMTC members are involved in ongoing and coordinated efforts to protect the overall transportation system and to respond as required to unforeseen natural events and disasters. These efforts include yearly participation in simulation exercises of emergency situations to train personnel for such events. At the regional and local levels, disaster preparedness and emergency response planning is led by county, municipal and local governments that are responsible for developing their own Emergency Management plans for their respective areas, as well as through the New York State Office of Emergency Management.

Emergency events, whether natural or human-made, can impact the entire environment of an area thereby affecting land-based and in-water infrastructure (i.e., buildings, roads, etc.). Securing transportation systems in the New York City metropolitan area continues to be a primary concern for state and federal transportation agencies as well as for each of NYMTC's member agencies. Following recent events. specifically Superstorm Sandy, NYMTC members have been working diligently on understanding and implementing measures to address vulnerabilities in the regional transportation system. The recent unpredictable weather events have only strengthened NYMTC's commitment to the planning and implementation of security procedures and infrastructure improvements appropriate for each county.

Climate change increases the likelihood of extreme weather events, damage to facilities and service disruptions. Superstorm Sandy illustrated the centrality of transportation and resilience within the NYMTC planning areas; assessing the aftermath will be key to composing plans for the future.

According to the Transportation Research Board's 2011 report *Adapting Transportation Impacts of Cli*-



*mate Change State of Practice*,<sup>41</sup> there are a number of operational impacts associate with extreme weather events, including:

- Increase in traffic incident management activities
- > Road lane closures
- > Reduced (and variable) speed limit
- > Disruption of transit service
- > Road and transit diversions
- > Truck restrictions
- Work zone management (to accommodate additional lane closures)
- Flood control infrastructure system management

These impacts became quite evident during Superstorm Sandy and other recent weather-related events that have impacted the NYMTC planning area. Various TSM&O strategies were used by agencies in the region to help mitigate the impacts of these events. In particular, in the NYMTC planning area regional traveler information (511NY) became important during these events. NYMTC members have made adjustments to the planning, designing, operation and maintenance of the regional transportation system to accommodate the impacts of climate changes, and they will continue to make investments in these areas. Incorporating climate change considCHAPTER 5: TRANSPORTATION SYSTEM MANAGEMENT AND OPERATIONS

erations into how agencies plan and execute TSM&O and maintenance programs will help to make the transportation system more resilient to unanticipated shocks.

During an emergency, multi-level coordination is necessary. Depending on the severity and scale of the event, the federal, state and local agencies coordinate their response efforts. Emergency coordination is usually conducted via the emergency operation centers that exist in each region. For major emergencies, coordination with media (i.e., television, radio, and the internet) is used to inform and give instructions to the public.

An excellent recent example of an effective largescale emergency coordination effort was during Superstorm Sandy in October 2012. The coordination for this event and its aftermath involved federal agencies working closely with multiple state and local agencies along with media and many volunteers to effectively address the response efforts. However, Superstorm Sandy also highlighted the need for NYMTC members to focus efforts on adapting the transportation system to increase resiliency to the impacts of climate change, sea level rise and extreme weather.

Looking forward, their planning processes will be expanded in the following ways:

#### A. FEDERAL

At the Federal level, the U.S. Department of Homeland Security (DHS) is an overarching agency whose responsibilities include critical infrastructure protection, and emergency preparedness and response, as well as providing a set of requirements of safety measures to state and regional agencies. The National Incident Management System (NIMS) is an emergency management doctrine used as a guide to facilitate emergency preparation, management and mitigation for public and private sectors nationwide. The provision of transportation security rests with the Transportation Security Administration (TSA) whose mission is to protect the nation's transportation systems to ensure the freedom of movement for people and commerce. The FTA and TSA have developed a list of Security and Emergency Management Action Items to elevate security readiness throughout the public transportation industry. Among the other agencies operating under DHS is the Federal Emergency Management Agency (FEMA), which is responsible for coordinating efforts with state and local governments in order to manage all hazards including natural and man-made disasters. It should also be noted that in addition, each administration within the U.S. Department of Transportation is involved with different aspects of transportation security.

#### **B. STATE & REGIONAL**

New York State Executive Law, Article 2B, enacted in 1978, created the Disaster Preparedness Commission (DPC) and required the development of a statewide Emergency Management Plan. The DPC comprised of the commissioners, directors or chairpersons of 23 state agencies and one volunteer organization – the American Red Cross. The responsibilities of the Commission include: the preparation of state disaster plans; the direction of state disaster operations and coordination with local government



NATIONAL INCIDENT MANAGEMENT SYSTEM

December 2008



National Incident Mangement System Photo Source: U.S.Department of Homeland Security operations; and the coordination of federal, state, and local recovery efforts. The New York State Office of Emergency Management provides administrative and program support to the DPC and plans and coordinates the responses of the state in times of emergency or disaster. The New York State Office of Homeland Security was created after the September 11, 2001 terrorist attacks and by law coordinates the policies, protocols, and counterterrorism strategies for New York State government agencies. NYMTC members refer to the *State Homeland Security Strategy* and *New York's State Preparedness Report* to establish goals and initiatives appropriate to their respective counties.

NYSDOT created the Emergency Transportation Operations (ETO) Program, which is the foundation for preparation, response and recovery for major emergency incidents that occur in New York State. New York State is broken into different regions, each of which has an Emergency Manager who has oversight in the ETO Program, allowing for statewide coordination during emergency events. In the event of a major emergency, NYSDOT responds by implementing the Incident Command System, the command and control system used by state and federal responders.

NYSDOT works with the state Office of Emergency Management (OEM) to create emergency plans that prepare for possible and probable natural or manmade disasters that directly affect the transportation system. One example is the Transportation Infrastructure Branch Annex of the *State Comprehensive Emergency Management Plan*. This annex describes how NYSDOT will respond to emergency events that disable the use of the transportation system, particularly how to restore the system for local customers. Coordination with federal agencies and standards is also outlined in this annex, but the actual coordinating is handled by the state OEM.

At the local level, NYSDOT coordinates with county Emergency Management plans through training and exercises that foster relationships and coordination prior to the occurrence of a disaster. On the state level, NYSDOT works with the New York State Disaster Preparedness Commission, which is a commission of agencies that helps during state wide disaster and disaster recovery.

#### 2014 New York State Hazard Mitigation Plan



New York State Division of Homeland Security and Emergency Services January 2014

2014 New York State Hazard Mitigation Plan Photo Source: NYS Division of Homeland Security and Emergency Services

NYSDOT provided assistance to local governments in response to multiple events in 2014. After severe flooding in western New York from May 13<sup>th</sup>-May 22<sup>nd</sup>, 2014, NYSDOT, using a combination of State assets and contract support, provided more than \$7 million in emergency infrastructure assistance to affected areas. When a 10-county area in western New York experienced a major lake effect snow event in late November 2014, NYSDOT responded by deploying more than 2,200 personnel and 675 pieces of equipment to assist in recovery.

NYSDOT is also undertaking additional efforts to identify critical transportation infrastructure within the region vulnerable to extreme weather events, storm surge, sea level rise and seismic events, and to develop a risk assessment of transportation infrastructure that will assist in future capital and emergency mobility planning. This more detailed assessment will help define critical facilities, corridors, systems, or routes that must remain functional during a crisis or be restored most rapidly. A recent synthesis study undertaken by the agency entitled "Mainstreaming **บ-บ**7



Climate Change Adaptation Strategies into New York State Department of Transportation's Operations," suggests that the agency integrate adaptation to climate change considerations into all aspects of its decision-making. As a result, climate resiliency will be considered a factor for long-term planning and investigated as a criterion for future project selection. In addition, NYSDOT will continue to improve communication among agencies, and is developing plans for system upgrades to improve outreach to the public. Further, the department is developing an asset management planning and replacement schedule for ITS equipment, infrastructure and devices to ensure resiliency and redundancy; plans for integrated corridor management and enhanced signal systems that would facilitate potential evacuation.

The MTA is developing and implementing strategies and projects to protect its infrastructure from the kind of damage that Sandy inflicted. All MTA agencies are coordinating with applicable federal, state, county and city agencies, as well as the real estate community to protect vulnerable zones; harden assets; and capture lessons learned across the organization for better information sharing. Specific infrastructure projects include rebuilding tunnels, developing strategies to harden subway station entrances, vents, manholes, and other means of water intrusion to stations and tunnels. Tracks, signals, line and power equipment are being repaired and hardened against future damage. Yards, shops and depots in vulnerable locations, as well as the headquarters building in lower Manhattan are being hardened as well. New technologies are being developed, tested, and implemented to facilitate creating a stronger more resilient system. In addition to hardware improvements, agencies have strengthened storm-related processes and response plans using upgraded tracking tools to facilitate improved communication and coordination of deployment activities.

The Port Authority is undertaking a wide range of initiatives: intensive review of facility systems to control flooding and anticipate other incidents with potentially dramatic impact, and lessons learned reviews for improving communication with the traveling public and other transportation operators. The agency is redoubling its efforts to apply investment strategies that will reduce the vulnerability of critical infrastructure connections – notably the multi-modal Hoboken transit hub – and improve the resilience of the overall regional transportation network through availability of ferry resources, working closely with both states, federal and regional partners, and host communities.

#### C. COUNTY & LOCAL

#### Nassau County

In preparing for disaster and emergency relief, Nassau County relies on its Office of Emergency Management (OEM), mandated by the Nassau County Charter. The Nassau County OEM is responsible for preparing plans for possible emergency situations. In addition, since emergency response overlaps the jurisdiction of multiple agencies, the Nassau County OEM plans the coordination for multi-department response situations.

The county-specific plans are developed based on the probability of occurrence (moderate to high probability is a priority). These plans are periodically reviewed and updated when necessary.

The following is a non-exhaustive list of emergency plans that have been prepared by the Nassau County OEM:

- > A general, comprehensive county emergency plan.
- > Hurricane Relief: Strategies and an implementation timeline, along with actions that must be taken and resources that will be needed.
- > Coastal Evacuation: Routes and contraflow plans for coastal flooding, especially where evacuation is needed, such as barrier beaches and low lying areas in flood zones.
- > Sheltering: Shelter locations, implementation strategies, and needed resources emergencies.
- > Hazard Mitigation: Strategies and guidelines to deal with specifically identified hazards and risks that are probable within the county infrastructure.
- > Debris Management: Debris mitigation and staging and removal plans for large scale incidents.
- > Mass Fatalities: Strategies to deal with incidents that usually involve numerous deaths.
- > Interoperable Communications: Communication plans to coordinate disparate radio systems.

To ensure rapid response and coordination during emergency events, the Nassau County OEM has formed many Memoranda of Understanding (MOUs) with other local non-county agencies in Nassau County. The NYC Urban Area Work Group and the Regional Catastrophic Planning Team are just two examples of MOUs formed within Nassau County. On the State level, Nassau County ensures coordination with state strategies by following the goals and objectives included in the State Homeland Security Strategy and in the New York's State Preparedness Report. Additionally, Nassau County follows federal security strategies for disaster preparedness by managing a local Citizen Emergency Response Team (CERT). CERT is a community-based organization based on the federal "whole community" approach. where volunteer members are trained in emergency preparations and response. These volunteers are vital resources during and after emergency incidents. Nassau County's coordination strategies were effectively applied during the recent weather events: Hurricane Irene and Superstorm Sandy. In another effort to streamline the communications process during emergencies, when the National Guard is activated to assist with incidents, each vehicle is paired with a member of the Nassau County Police Department so as there are no communication gaps. MOUs between county and non-county agencies, along with 71 volunteer fire departments and other emergency crews make Nassau County's OEM a successful example of a county, non-county, state, and federal agency coordinated response to a regional disaster.

Lessons learned from Sandy include the need for its Department of Public Works to bid new contracts that fully comply with federal requirements to ensure recovery work is eligible for federal reimbursement, and to establish an Emergency Operations Plan related to traffic control infrastructure that addresses roles and responsibilities of personnel and includes emergency procedures for a variety of scenarios. The county will also implement mitigation measures for backup generation and the motor control centers at its two drawbridges, the Long Beach and the Bayville bridges. Backup generation is also being analyzed for traffic control equipment. Additionally, the county will look at hardening measures related to all transportation infrastructure, including tide flex valves on drainage systems in low lying areas, shoreline and bridge scour protection and the types and locations for curbside trees. Finally, the county will look at ways to expand use of its Traffic Management Center cameras, VMS and signals to its evacuation routes and tie those routes to the Center.

#### Suffolk County

In preparing for emergencies, Suffolk County relies on the Office of Emergency Management (OEM) to coordinate the county's response to natural and man-made disasters. OEM personnel are responsible for development of the Comprehensive All-Hazards Emergency Management Plan, the operation of the county's Emergency Operation Center (EOC) and work with local, state, and federal officials in all aspects of shelter management, planning, resource management, and emergency response and recovery activities.

Long Island's southern coastline faces the open waters of the Atlantic Ocean and is vulnerable to numerous coastal hazards, especially the unobstructed path of southern storms traveling up the coast. Eastern Long Island is listed in the top ten areas in the U.S. most vulnerable to hurricanes. Because of this unique geographic location, exposure, and vulnerability, the 1.5 million residents of Suffolk County are susceptible to a variety of coastal events and natural disasters. The following is a non-exhaustive list of emergency plans and directions that were prepared by the Suffolk County OEM:

- > A general, comprehensive county emergency plan.
- > Hurricane Preparedness: Includes information on hurricanes in general, hazards connected with them, how to stay informed and a Family Emergency Plan.
- Mitigation for Natural Disasters: Included among the natural disasters are extreme heat, fires, floods, hurricanes, lightning storm safety, tornado preparedness, winter storms and extreme cold, wild fires and rip current safety.
- > Special Needs Registry and Joint Emergency Evacuation Program (JEEP): JEEP is a database of individuals who require emergency evacuation and special assistance during evacuations. The data base is maintained by the Suffolk County Office of Emergency Management and is activated prior to an impending disaster. Services provided will be based on need and availability.



Included on the Suffolk County Government website is a shelter and storm surge zone mapping tool. The tool was developed by Suffolk County through the efforts of the Department of Information Technology and Fire, Rescue and Emergency Services, to assist with preparations when emergency situations and storm flooding conditions or potential evacuations may occur.

Suffolk County transit will also participate in evacuations from flood prone areas. A separate telephone hotline will be provided which will allow for address specific locations to transport residents to Red Cross designated shelters.

In Suffolk County, initial lessons of Sandy underscore the urgency of some of the plans already being pursued, including Connect Long Island, a Bus Rapid Transit initiative – that will help reduce dependence on automobiles. A less auto-dependent Suffolk County will be less vulnerable to disruptions in the availability of fuel; and innovative transit will enhance Suffolk's resiliency and economy. Suffolk County also seeks to reinvigorate hazard mitigation plans and go beyond previous paradigms to create comprehensive, state-of-the-art flood protection systems that balance "bricks and mortar" such as buildings, roads, waste-water infrastructure and power grids with Suffolk's natural water systems of ocean, bay, sound, rivers and creeks.

#### Westchester County

Westchester County is undertaking various initiatives to adapt services and infrastructure to address the increasing severity and frequency of storms such as Sandy, including identifying detours for bus routes and developing flood mitigation plans to minimize roadway closures and minimize disruptions in bus service. The county will continue to make full use of its Office of Emergency Management (OEM) to facilitate up-to-date communication among transportation agencies, first responders and utility companies, and work with them to direct resources to the areas of greatest need.

Preparing for emergency incidents and recovery within Westchester County is the responsibility of the County OEM, which works regularly with the Westchester County Department of Public Works and Transportation. The Department of Public Works and Transportation frequently meets with other county agencies to discuss training, drills and exercises for relevant emergency situations. The most prominent agencies that the Department of Public Works and Transportation coordinates with are the Westchester County Office of Emergency Management and the Westchester County Emergency Preparedness Group, which is chaired by the county OEM.

The coordination effort between the Westchester County Department of Public Works and Transpor-



tation and other agencies has led to many ongoing emergency related planning projects. The following is a partial list of current emergency preparedness plans in Westchester County:

- > Westchester County Comprehensive Emergency Management Plan: Managed by the Westchester County OEM, the plan details the county's overall preparedness strategies for all hazards and the associated recovery efforts.
- Indian Point Radiological Emergency Preparedness Plan and Procedures: Also maintained by the county OEM, this plan involves nearly all departments of county government and thousands of emergency responders. These resources can be applied to any other emergency response situation. The Indian Point REP is practiced annually.
- > Security Assessment of Westchester County's Bee-Line Bus System: This project includes a security risk assessment for all components of the Bee-Line Bus System, along with recommended security policies and procedures to be undertaken.
- > Security Emergency Preparedness Plan for the Bee-Line System: Details standard procedures for the Bee-Line System and its operators to protect against a terrorist attack.
- > Transit Strike Plan: This plan outlines the Bee-Line Bus System's procedures in the event of a union strike against the MTA or a strike of Bee-Line employees.
- > Emergency Operating System: This project provides snow emergency extended service in case of interruptions to Metro-North Railroad's operations.



The Westchester County OEM is the conduit for regional, state and federal coordination. On the regional and state levels, the county OEM manages Westchester's preparedness and relief plans, working daily with local, county, state, federal and private partners in planning for large-scale, multi-departmental, multi-jurisdictional disasters. On the federal level, the county's Department of Public Works and Transportation is involved with the National Incident Management System (NIMS). NIMS standardizes processes, procedures and systems when addressing a major incident that requires help from neighboring counties, states or the federal government. NIM'S standards allow for the efficient integration of resources and strategies during an emergency. FEMA, the FBI, TSA and NRC (National Response Center) are partners in the planning, training and exercises for a large-scale disaster in Westchester County.

#### Rockland County

A Comprehensive Emergency Management Plan (CEMP) is a framework, developed by Rockland County, for coordinating agency responses to all types of emergencies that occur within Rockland County. The CEMP combines all operation efforts, regional, state wide, and federal, to ensure efficient and effective responses to emergencies.

The CEMP currently has comprehensive strategies and guidelines for the occurrence of the following disasters: hurricane and coastal storms; winter storms; radiological emergency response; bio-terrorism; and hazardous material response.

In an effort to coordinate regionally, Rockland County has established partnerships with the surrounding five townships, 19 villages, and private sectors. With these relationships Rockland County serves as a key player in emergency preparedness, mitigation, response, and recovery. On the state level, Rockland County's Office of Fire and Emergency Services works closely with the New York State Office of Emergency Management to review and improve county preparedness plans on a monthly basis. The current County Plan for Emergency Preparedness is in accord with federal standards and policies, such as the National Response Framework, the New York



State Emergency Operations Plan, the National Incident Management System, the Robert T. Stafford Disaster Relief and Emergency Assistance Act, and the Title III Superfund Amendment and Re-authorization Act of 1986. The Rockland County Department of Public Transportation is an active participant in the County's emergency preparedness plans, training and response activities, including representation from its Transport of Rockland fixed-route and TRIPS paratransit bus operations.

Rockland County plans to step-up efforts to work more closely with utility companies and other agencies to continue establishing a more organized approach to restoring the transportation infrastructure in a timely manner. This will include pursuing more direct communication links between transportation agencies, responders and utilities, as well as more basic efforts like further encouraging that main power lines be secured underground and implementing more vigorous tree monitoring programs to limit future exposure to outages. Plans to define more specific staging areas, improve resources, establish more widespread power redundancies, increase supply levels before a storm and continuing to call for all service stations and food stores to have generators will improve response and recovery time. Continued use and refinement of GIS mapping tools will also ensure Rockland County's ability during future weather events to monitor fast changing conditions and to direct emergency crews more efficiently and effectively.

#### Putnam County

The Bureau of Emergency Services, along with County, Town, and Village representatives are working to create a Putnam County Hazard Mitigation Plan. The plan's main objective is to address and correct current problem areas and mitigate future problems throughout the County. This federally run program plan through FEMA provides federal support and resources for the County and its municipalities. In the event of a disaster this plan aims to provide additional resources and support the affected communities and the County, resulting in long-term community well-being. Without mitigation actions, safety, financial security, and self-reliance are jeopardized.

Putnam County Bureau of Emergency Services (BES) formulates plans for all large-scale emergencies within the county. The BES of Putnam County is in charge of the following emergency preparations:

- > Emergency Equipment Stockpile: The BES can gain access to state emergency equipment, when needed.
- > Weather Alerts: Sends weather alerts for use by schools and public officials.
- > Emergency Management Personnel Training: Trains those involved with Radiological Emergency Response, relating to the Indian Point nuclear plant.

With regards to regional emergency coordination, Putnam County works with the Putnam County Bureau of Emergency Services, which also coordinates with state disaster strategies, and the Sheriff's Of-



fice. Putnam County also works with the Putnam Emergency and Amateur Repeater League (PEARL). the non-county public emergency and information radio station that cooperates with Putnam County during emergencies and drills. While the plans for disaster preparedness in Putnam County are mandated and instituted by the county, the transportation response service is carried out by MV Transportation, the operator of Putnam Area Rapid Transit. Putnam County follows the Federal Transit Administration's Triennial Review, which details the measures to be taken to ensure a safely operated and prepared transit network, and updates to the FTA Safety and Security Plan.

#### New York City

To plan for disaster preparedness and emergency relief, New York City Emergency Management along with NYC DOT meets monthly with various city, state regional and federal agencies, non-profit organizations, and public utility companies to discuss the mitigation, planning, response and recovery for New York City before, during and after an emergency. A large number of agencies and other public associations meet on a regular basis to accomplish these tasks including: American Red Cross, Community Affairs Unit, Con Edison, NYC Department of Citywide Administrative Services, US Department of Environmental Protection, NYC Department for the Aging, US Department of Energy, US Coast Guard, Verizon, NYC Department of Information Technology and Telecommunications, NYC Department of Sanitation, Fire Department of NY, Greater New York Hospital Association, NYC Health and Hospitals Corporation, NYC Department of Correction, NYC Department of Homeless Services, NYC Department of Buildings, New York Police Department, NYC Office of the Chief Medical Examiner, NYC Department of Parks and Recreation, New York State Emergency Management Office, NYC Department of Housing Preservation and Development, NYC Human Resources Administration and Long Island Power Authority.

In preparation for any disaster, City agencies work together to create the following preparedness plans:

> Citywide Health and Safety Plan: A coordinated multi-agency plan that ensures the health and safety of NYC response and recovery teams.

- > Coastal Storm Plan: Strategies focused on sheltering NYC evacuees in case of a major hurricane. This plan targets at risk coastal communities.
- > Commodity Distribution Plan: Guidance to distribute life sustaining commodities to up to 1.2 million New Yorkers in 59 different Community Districts.
- > Continuity of Operations Plans: An overall, all-hazard plan that manages a framework of preparation in the event of a disruption.
- > Evacuation Plan: Regionally situational plan that facilitates rapid, safe, and efficient evacuation of threatened areas.
- > Flash Flood Plan: Entails a coordinated response to flash floods in NYC and pre/post flood mitigation strategies.
- > Maritime Emergency Plan: Coordinates mass maritime transit in the event of an unforeseen surge in demand for over water travel. This could be caused by manmade or natural disasters or a disruption in the transit system.
- > Snow Storm Plan: Planned response to snow advisories issued by the National Weather Service.
- > Transit Strike Plan: Staffing plan of essential personnel, authorized travel advisories, city contingency plans and emergency proclamations from the Mayor and DOT Commissioner.

To further prepare for an emergency event, tabletop exercises and full scale exercises are held yearly. Tabletop exercises are city and state wide emergency exercises that take place in an informal meeting setting. Full scale exercises are operational exercises that are as close to a real event as possible, involving personnel, equipment and a specified location.

NYCDOT meets semi-annually and monthly with different city and regional agencies and authorities to update, discuss and coordinate current plans. Four times a year, NYC DOT meets with New York City Emergency Management and state OEMs to coordinate on a larger scale, in case of a state wide emergency. By following the National Incident Management System (NIMS), the standardized federal emergency management plan, NYC DOT is prepared to coordinate on the federal level.

New York City is also applying lessons learned from Superstorm Sandy recovery to better prepare and respond to any similar disasters in the future. Pedestrian and bicycle access across major bridges was critical to immediate recovery of travel options within the city. Over 16,300 people crossed the four East River bridges on foot or bicycle after the storm, an increase of more than 11,700 above everyday numbers. The temporary ferry service to southern Staten Island provided travel options for residents in areas highly impacted by Superstorm Sandy. The East River Ferry and the "bus bridge<sup>ii</sup>" from Atlantic Station to Manhattan also formed critical parts of the connection between Manhattan, Brooklyn, and Queens in the immediate days after the storm.



<sup>ii</sup> Because the subway tunnels between the New York City boroughs were closed in the immediate aftermath of Superstorm Sandy, New York City Transit deployed buses to connect passengers between boroughs.



There is a strong consensus within the scientific community that human activities (primarily fossil fuel combustion and deforestation) have contributed significantly to climate change. According to the United States Climate Action Report 2014, transportation activities accounted for 33 percent of CO2 emissions from fossil fuel combustion. Transportation emissions dropped by eight percent from 2005 to 2011, in part due to increased vehicle fuel efficiency and a 2.6 percent decrease in annual passenger miles driven. Even so, the United States' prevailing low-density development patterns mean that US commuters still use more energy and generate higher emissions per person than those in other industrialized countries.

These concerns have been underscored by recent extreme weather events that impacted the NYMTC planning area. Since 2011, three significant weather events have affected the NYMTC planning area: Hurricane Irene and Tropical Storm Lee in 2011, and Superstorm Sandy in 2012. Superstorm Sandy caused damaging, high wind speeds and storm surges of up to 17 feet (at Long Beach, the highest recorded

storm surge in the region) and resulted in more than 100 deaths. Tens of billions of dollars in damage were also incurred upon infrastructure, businesses, and residences in several states, particularly New York and New Jersey. Superstorm Sandy exposed inherent vulnerabilities of the New York Metropolitan Area's transportation system. Coastal roadways were submerged, and subway and auto tunnels were flooded. In total, the MTA suffered nearly \$5 billion in damages - most subway lines in New York City were closed for several days and some stations did not re-open for months after the storm.

Photo Source: MTA

There continues to be an urgency around adapting and protecting transportation infrastructure from the effects of future, extreme weather events. This urgency is compounded by leading climate models that indicate that these types of weather events are likely to occur more frequently in the coming decades, and that the NYMTC planning area faces increased flood risks due to climate change and rising sea levels. This is problematic given that New York has the second-highest coastal population of any state in the country, much of which is concentrated in the NYMTC planning area.

There have been multiple efforts to increase the resiliency and redundancy of the transportation system and better prepare for future incidents.

#### NY-NJ-CT POST-HURRICANE SANDY TRANSPORTATION VULNERABILITY AS-SESSMENT AND ADAPTATION ANALYSIS

To better plan and invest in the long-term climate resilience of the nation's transportation infrastructure, FHWA established a vulnerability and risk assessment pilot program in 2010 in partnership with State Departments of Transportation, MPOs and Federal Land Management Agencies (FLMAs). One of these pilot program took place in 2011 in Northern New Jersey. Each pilot program assessed system vulnerabilities to extreme weather events, and identified strategies to protect and improve the resiliency of transportation assets. The program also aimed to improve the FHWA's model for responding to extreme weather events that impact the nation's transportation systems, in the current context of the uncertainties of a changing climate.

In 2014, FHWA launched an initiative to enhance the tri-state region's resiliency to climate change and extreme weather in the longer term, while informing the ongoing Hurricane Sandy recovery process. Building from the aforementioned FHWA-sponsored New Jersey vulnerability assessment pilot performed in 2011, the agency is collaborating with NYMTC and other partners in New York, New Jersey, and Connecticut to survey the damage and disruption wrought by Hurricane Sandy on the region's transportation systems, along with that of Hurricane Irene, Tropical Storm Lee, and Winter Storm Alfred (the Halloween Nor'easter of 2011). The results of this work are anticipated before the end of calendar year 2017 and will be amended into Plan 2045 when available.

#### NEW YORK RISING COMMUNITIES RECON-STRUCTION PROGRAM

New York State continues to invest in strengthening coastlines, repairing infrastructure and other resiliency efforts since Superstorm Sandy's impacts in 2012. In 2013, Governor Cuomo established the Governor's Office of Storm Recovery (GOSR) to oversee the New York Rising Community Reconstruction (NYRCR) program, a \$700 million initiative providing rebuilding and resiliency assistance to communities severely damaged by Superstorm Sandy and other major storms. The program employs community-driven planning in combination with state-level technical expertise to make decisions on what projects should receive funding. The first round of New York Rising communities completed the program in March 2014, and Round 2 communities were announced in early 2015. Numerous locations in the NYMTC planning area have benefitted from the program, including Suffern, Yonkers, Babylon, West Islip, Baldwin, and several New York City neighborhoods.

Another State initiative was the 2014 passage of the Community Risk and Resiliency Act (CRRA). The purpose of this act was to ensure that State funds and permits include consideration of the risks of future extreme weather events and the consequences of climate change. From 2014 through 2017, the State will develop sea level rise projections, mitigation measures for storm surges and flooding, and create comprehensive guidance on the use of natural resiliency measures to reduce the risk of damage from storms. The Act has implications for a wide range of programs, including Department of Environmental Conservation (DEC) permits for wells and sewers, Department of State (DOS) programs for waterfront revitalization, and agriculture and farmland protection initiatives.

The New York State Climate Smart Community grant program began in 2009, and provides communities funding support in the range of \$25,000 to \$100,000 to climate change impact mitigation and adaptation projects in the range of \$100,000 to \$2 million. In 2016, Governor Cuomo appropriated \$11 million to Climate Smart. NYMTC planning area grantees include the Village of Haverstraw in Rockland County to support its Comprehensive Plan Update to include adaptation strategies, and Alley Creek protection and restoration work in Little Neck, Queens.

#### MTA'S CLIMATE ADAPTATION TASK FORCE

In 2014, MTA's then-Chief Executive Officer Thomas Prendergast formally instituted the MTA's Climate Adaptation Task Force and tasked key personnel throughout the organization to coordinate all adaptation and resiliency focused activities to fortify its assets against future adverse climate events. The CHAPTER 5: TRANSPORTATION SYSTEM MANAGEMENT AND OPERATIONS

Task Force organizes forums with relevant local and regional public sector agencies, commercial entities, and with academic and research institutions for continuous information exchange and knowledge sharing.

The MTA currently has a \$6.9 billion post-Sandy recovery and resiliency program, of which \$2.4 billion have been committed to 187 projects to date. In an effort to promote transparency and accountability to stakeholders, the status and description of each project is tracked and reported through an online dashboard portal on the MTA's Capital Program website. Projects include immediate responses such as restoring subway service to the Rockaways soon after Superstorm Sandy. Other projects, like refurbishing the Montague tube with resilient systems and flood-protected electrical rooms, were recently completed, and still others - such as protecting the portals to the Hugh L. Carey and Queens Midtown Tunnels, hardening the power and signal system along Metro-North's Hudson Line, and building walls and improving drainage to protect subway and rail vards - are in advanced stages of planning, design, and procurement. In the near future, the MTA will need to make extensive repairs to the Canarsie Tube carrying the L train between Brooklyn and Manhattan, which could impact up to 300,000 daily riders on the heavily-used route.

#### LOCAL INITIATIVES

In 2015, Mayor de Blasio released OneNYC: "The Plan for a Strong and Just City", a plan to address future challenges in housing, transportation, resiliency, and other areas. The OneNYC vision pledges that "the City will use the best available climate science, as well as robust research, legislative action, advocacy, and regional coordination to adapt the city's infrastructure to be resilient against disruption." The plan lays out municipal investments such as upgrading buildings to be more energy efficient, and continuing to invest in storm-resilient infrastructure.

The Mayor's Office of Recovery and Resiliency (ORR) is spearheading several coastline resiliency projects throughout the City. One project focuses on strengthening Hunts Point, Bronx – an important food distribution center located on a flood plain and

in an impoverished area - against future storm and flooding events.

The New York City Department of Transportation (NYCDOT) is implementing hazard mitigation measures to better protect assets by elevating electrical/ mechanical equipment and flood proofing facilities, hardening street ends in certain vulnerable neighborhoods, and elevating streetlight/traffic signal infrastructure in the Rockaways. NYC DOT is also protecting movable bridge structures and the Battery Park/West Street Underpasses to ensure coastal storm surge doesn't negatively impact those facilities. Also, NYC DOT received funding from the Federal Transit Administration Resiliency grant program to partially fund three new ferry vessels that will be better capable of navigating in increased wind and precipitation events.

Westchester County is undertaking various initiatives to adapt services and infrastructure to address the increasing severity and frequency of storms such as Sandy, including identifying detours for bus routes and developing flood mitigation plans to minimize roadway closures. The county will continue to make full use of its Emergency Operations Center to facilitate up-to-date communication among transportation agencies, first responders and utility companies, and work with them to direct resources to the areas of greatest need.

Rockland County plans to step up efforts to work more closely with utility companies and other agencies to continue establishing a more organized approach to restoring the transportation infrastructure in a timely manner. This will include pursuing more direct communication links between transportation agencies, responders and utilities, as well as more basic efforts like further encouraging that main power lines be secured underground and implementing more vigorous tree monitoring programs to limit future exposure to outages. Plans to define more specific staging areas, improve resources, establish more widespread energy redundancies, increase supply levels before a storm and continuing to call for all service stations and food stores to have generators, will improve response and recovery time.

Post-Superstorm Sandy, Putnam County implemented mitigation strategies as part of its ongoing efforts to address water, wind and other damages resulting from severe weather/storm events. There were significant damages in Putnam County resulting from severe weather/storms, notably at the Mill Road Bridge in the town of Philipstown and at Snake Hill Road in the Village of Cold Spring. Keenly aware that mitigation efforts pertaining to future potential damages caused by such natural disasters are necessary, Putnam County employed specific methodologies county-wide (e.g., hardening) in order to protect infrastructure, equipment and buildings from such natural disasters in the future. Additionally, Putnam County has/continues to engage in emergency planning and preparation in order to improve the County's Incident Command System (ICS) under these types of circumstances.

Since Superstorm Sandy, Nassau County is not only rebuilding, but they are rebuilding bigger and stronger than ever. Nassau County's sanitary sewer system and sewer treatment facilities, particularly along the South Shore, were overwhelmed and severely damaged by the storm surge and key projects, such as the \$28.6 million project to mitigate sanitary sewer overflow, and the \$830 million in ongoing and planned projects to fully rehabilitate the Bay Park Sewage Treatment Plant, are two examples where Nassau has made significant improvements to its sewer facilities infrastructure. In addition, Nassau County has a \$28.2 million construction project to replace and mitigate traffic signals and controls throughout Long Beach and the South Shore that were damaged by Sandy. On the highway side, Nassau County has several post-Sandy rehabilitation projects in the Long Beach Road corridor, including the roughly \$10 million project to replace the Barnum Island Bridge, a key connector in this designated Evacuation Route. On its North Shore, Nassau County has been working on a multi-phase project to restore West Shore Road in Mill Neck, with the first phase focused on emergency repairs and the second to fully rehabilitate this important road that connects Bayville to Oyster Bay and Mill Neck. Regarding transit, the Nassau Inter-County Express (NICE) bus system currently has two post-Sandy resiliency projects in progress. Specifically, NICE has begun the process to replace the current overhead garage doors at all its operating facilities with high-capacity roll up doors to withstand high wind damage as much as possible. In addition, NICE's replacement CNG station has been designed to allow for the ability to fuel its fixed route fleet from its major operating facility in the event of system failure.

In Suffolk County, initial lessons from Sandy underscore the urgency of some of the plans already being pursued, including an initiative to Connect Long Island through Bus Rapid Transit that will help reduce dependence on automobiles. A less auto-dependent Suffolk County will be less vulnerable to disruptions in the availability of fuel; and innovative transit will enhance Suffolk's resiliency and economy. Suffolk County also seeks to reinvigorate hazard mitigation plans, going beyond previous paradigms to create comprehensive, state-of-the-art flood protection systems that balance "bricks and mortar" (such as buildings, roads, waste-water infrastructure and power grids) with Suffolk's natural water systems of ocean, bay, sound, rivers and creeks. In 2013, the County submitted 62 applications for funding through the US Department of Agriculture, Natural Resources Conservation Service, Superstorm Sandy Emergency Watershed Protection Program - Floodplain Easements (EWPP-FPE), to acquire flood prone properties that were inundated or damaged by Superstorm Sandy on the Mastic/Shirley peninsula, to provide coastal resiliency for future storm events. To date. the County has acquired about 60 acres totaling 322 parcels in the Mastic/Shirley Conservation Area. Additionally, New York State owns 90 acres and the Town of Brookhaven owns almost 20 acres. Altogether, over 170 of the 625 acres within the Mastic/Shirley Conservation areas have been protected. Outside of climate adaptation strategies, there are efforts being made to address some of the root causes behind the increasing frequency of extreme weather events. NYMTC members, partners, and beyond have explored strategies to reduce reliance on fossil fuels and reduce carbon emissions.

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