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1. INTRODUCTION

Systems Management and Operations (SM&O) in the context of the regional transportation system outlined in Plan 2040, is an integrated program designed to optimize the performance of existing and future programmed transportation operational and physical infrastructure. The program involves implementing multimodal, intermodal, and often cross-jurisdictional systems, services, and projects intended to preserve capacity and improve security, safety and reliability. SM&O is to be distinguished from infrastructure “operations and maintenance,” which focuses on maintaining and operating the transportation assets of operating agencies.

All of the SM&O improvements included in the following sections support the Shared Goals and Outcomes of Plan 2040 as described in Chapter 1. The management of traffic congestion within a safe transportation environment by Transportation Systems Management (TSM) and Transportation Demand Management (TDM) strategies aims to enhance air quality and the regional environment. Efficient transportation operations improve mobility and minimize travel times and travel costs, and support a highly competitive regional economy. The NYMTC planning area’s transportation system is very extensive and includes all transportation modes. Enhancements to the multi-modal transportation system provide travelers with additional transportation choices in the region. These improvements, combined with convenient access and flexible options are intended to serve commuters and recreational travelers equally and help lead to higher-quality communities with improved quality of life. While rehabilitation and modernization of the existing transportation infrastructure requires continued investment, funding is not always available for implementing all of the needed improvements. Therefore, implementation of major projects needs to be prioritized through long-term planning and agency coordination. All transportation improvement strategies described in this chapter seek to provide a safe environment for the public and preserve the security of the entire transportation network.

NYMTC’s members work to fully protect the region’s investments in the transportation system and to support a platform for future investment through the management of day-to-day Operations and Maintenance (O&M) by ensuring the structural integrity and proper performance for all transportation assets.
These assets consist of public transit equipment, roadways, bridges, and non-motorized transportation infrastructure such as walkways, trails, shared use paths, and greenways.

As a Transportation Management Area (TMA), NYMTC is required to develop a Congestion Management Process (CMP), which is a systematic approach for managing traffic congestion. The CMP provides information on transportation system performance and various strategies for alleviating congestion and enhancing the mobility of people and goods. The operation efficiency strategies outlined in this chapter are part of the multi-faceted CMP. These strategies include TSM, of which Intelligent Transportation Systems (ITS) is a major part, and TDM. The regional transportation network is difficult to expand because of the density, sprawl, current land use, and built environment of urban areas in the NYMTC planning area, so it is important to make use of management and operations strategies that maximize the use of existing infrastructure and the environment. An additional description of the CMP is found in Section 3 of this chapter and in the CMP 2014 Status Report (available at the NYMTC website, www.nymtc.org).

Along with optimizing operational system mobility, NYMTC members have collectively identified transportation safety and security for both motorized and non-motorized uses as prime concerns of the transportation planning process. The goal of NYMTC’s members is to ensure safe and secure transportation operations at all times, which can be achieved by monitoring the safety and security performance of transportation networks and implementing necessary improvements. The effectiveness of the safety improvements can be measured by a reduction in annual transportation-related injuries and fatalities, a decrease in the number of crashes on roadways, and a reduction in the incidence of rail crashes and security issues. Safety improvements can also lead to economic benefits due to reduced transportation incident-related costs and delays.

To better address the complexity of transportation efficiency, safety, and security in the NYMTC planning area, enhanced multiagency coordination is necessary for sharing data and information regarding current needs and planned improvements. The integration of federal, state, and local emergency plans can be vital during emergency events and security procedures need to be addressed and updated periodically. Furthermore, all transportation improvements should include elements to provide information and education for the general public.
2. Transportation Systems Management & Transportation Demand Management

To move the NYMTC planning area beyond system preservation, TSM and TDM strategies are targeted to help alleviate congestion, improve safety, and improve the efficiency of the regional transportation system. The following section discusses TSM and TDM strategies and highlights the current and planned projects to be undertaken by the operating agencies in the NYMTC planning area.

With the use of TSM and TDM strategies, the regional transportation network will be better able to:

- Increase capacity, reduce congestion, and improve safety on existing roads and transit networks (TSM);
- Manage and reduce peak-hour automotive travel (TDM); and
- Improve and promote alternatives to driving (TDM).

TSM is a category of strategies that focuses on generally low-cost, small-scale projects that use new technologies and minor infrastructure changes to increase the capacity and efficiency of existing road and transit systems. TSM strategies tend to be effective, short-term solutions to congestion problems.¹

TDM is a set of strategies that focuses on modifying travel behavior. TDM strategies encourage traveling on multimodal and high occupancy modes, as well as managing and reducing peak-hour congestion. TDM seeks to reduce the total number of automobile trips by directing attention to moving a higher volume of people and goods rather than vehicles.³ These strategies can be implemented either voluntarily through carpools and other measures, enforced through regulations, or incentivized through pricing. By encouraging the use of carpools and mass transit and discouraging single occupancy vehicles (SOVs), TDM strategies can improve air quality and congestion, increase mobility on arterial roadways, and ease the morning and afternoon rush hours.⁴

As TSM strategies focus on improving efficiency and TDM strategies focus on modifying behavior, it is often beneficial to use both strategies simultaneously. ²

**TRANSPORTATION SYSTEMS MANAGEMENT**

Transportation Systems Management 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 widely used in the NYMTC planning area because they are generally low-cost, localized modifications of existing infrastructure, and they generally take less time to implement than building new roads or new transit lines.⁵ These strategies range from technology and information that help commuters make timely and wise transportation decisions to low-scale construction projects that expand the capacity of existing infrastructure.

Traditionally, TSM strategies were exclusively used as solutions for improving roadway congestion. However, with a growing population in the outer boroughs of New York City⁶ that requires access to Manhattan’s central business district⁷ and declining federal and state investment in the transportation network,⁸ TSM strategies are becoming increasingly applicable to improving transit capacity and efficiency. TSM strategies applied to transit are implemented in a similar fashion and for similar reasons as traditional usage, focusing primarily on transit priority improvements to increase transit speed,⁹ automatic transit fare systems, and traveler information. Instead of spending billions to construct and plan new lines, applying small physical or operational improvements, can significantly improve efficiency relative to the amount of capital and time invested. Intelligent Transportation Systems (ITS) refer to systems that reduce congestion, improve safety, and mitigate environmental impact through the use of communication, control, electronic, and computer technologies. Due to constant improvements in technology along with the increasing use of ITS in monitoring and analyzing TSM strategies, the distinction between the two categories, ITS and TSM, becomes arbitrary. Consequently, this Chapter merges the discussion of ITS with TSM.

The various TSM strategies are grouped into seven categories: Intelligent Transportation Systems, Traveler Information, Incident Management, Work Zone Management, Access Management, Congestion Pricing, and Active Transit and Traffic Management. Each of these categories is discussed in the following section with examples of TSM strategies and methods currently underway or planned in the NYMTC planning area.


**Intelligent Transportation Systems (ITS)**

The ITS Integration Strategy, developed by NYMTC in 2009, represents a shared vision of how each of the three subregional ITS Architecture systems (New York City, Long Island, Hudson Valley) should work together to share information and resources. The NYMTC ITS Integration Strategy, which was developed out of the National ITS Architecture, has three major goals: 1) to identify opportunities where ITS investments can work together toward regional interoperability and provide the desired regional ITS services; 2) to enhance interagency cooperation in the management and development of ITS; and 3) to identify and target ITS projects and initiatives early in the planning process which will facilitate integration. The ITS Integration Strategy identifies various ITS transportation needs organized by functional area:

- Advanced traffic management;
- Advanced public transportation systems;
- Advanced traveler information systems;
- Archived data management systems;
- Commercial vehicle operations;
- Emergency management systems;
- Maintenance and construction operations.

The ITS Architecture is a set of information flow plans that outline how specific ITS technologies should be deployed to and integrated with all relevant stakeholders representing different jurisdictions and their missions. ITS Architectures are frameworks that guide the integration of Intelligent Transportation Systems to improve traffic flows and transit services over a specific geography. ITS Architectures allow for coordinated planning, defining, and integrating information and operations involved in ITS. Integrated technology systems allow for a quick response to emergencies and an overall more efficient flow of traffic. The ITS Integrated Strategy is based on three subregional ITS architectures: the New York City ITS Architecture; the NYSDOT Region 10 ITS Architecture; and the Hudson Valley ITS Architecture, including NYSDOT Region 8.

Each of the regional ITS architectures apply a particular method of operation to a specific region where various ITS systems are implemented, such as how operational agencies manage highway signals, respond to incidents, react to weather and road conditions, post variable message signs, meter ramps, and conduct other traffic and transit management operations. As ITS development expands to address regional and technological changes, all ITS architectures will require periodic updates in the future.

The New York City subregional ITS Architecture includes the five boroughs of New York City. It is a very large and complex ITS architecture and includes four major stakeholders and owners, the New York City Department of Transportation (NYCDOT), the New York State Department of Transportation (NYSDOT), the New York City Metropolitan Transit Authority (MTA), and the Port Authority of New York and New Jersey (PANYNJ). These agencies work closely with more than 70 other agencies to advance ITS integration and information sharing across New York City. Its recent update began in 2007 and is currently near completion. Most traffic and some transit operations in the five NYC boroughs are managed by a joint Transportation Management Center (TMC) located in Long Island City, Queens, where advanced ITS systems control and monitor traffic conditions continuously. Transportation Management Centers focus on a holistic approach by using ITS to create a complete system integration by compiling data to distribute in an integrated format. Through electronic communication with field devices, TMCs can remotely monitor, control and disseminate...
information related to transportation conditions. The TMC is operated by NYCDOT, NYSDOT Region 11, and the New York City Police Department and New York State Police. It is one of the largest and most complex transportation management centers in the nation. In addition to the joint TMC, the MTA and PANYNJ have various other operational centers to manage their bridges and tunnels and their operations by both rail and bus.

The Region 10 ITS Architecture encompasses the two most populated counties outside of New York City: Nassau and Suffolk. The ITS Architecture revolves around the program, INFORM (INformation FOR Motorists), that manages ITS operations in the region by its TMC located in Hauppauge in Suffolk county. The major ITS stakeholders in this region include the NYSDOT, MTA, and the police, fire, and public works departments, along with more than 20 other agencies.

The Hudson Valley ITS Architecture integrates ITS information in the Hudson Valley, including Rockland, Westchester, and Putnam counties. Traffic operations are managed by its TMC located in Hawthorne in Westchester County. The major stakeholders involved include the NYSDOT, New York State Police (NYSP), Hudson Valley Police Department (HVPD), Westchester County Parkway Police Department, and the Westchester County Department of Public Works and Transportation.

In addition to the transportation operation agencies, the I-95 Corridor Coalition via its communication center TRANSCOM, has a major role in the development and maintenance of the regional ITS architecture. In the NYMTC planning area, the I-95 Corridor Coalition consists of 16 transportation and public safety agencies that cover New York State, New Jersey, and Connecticut. The I-95 Corridor Coalition provides a 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.

Though TSM strategies vary in the level of technology involved, most strategies are dependent upon system monitoring, data sharing, and coordination between systems and agencies. Further, as ITS technologies expand, so too does the potential to improve efficiency. Previously fragmented information can currently be shared across agencies and aggregated to provide a complete view of problems in the road and transit networks. NYMTC members are committed to multi-agency cooperation and developing a seamless multi-modal transportation system in the region.

**Traveler Information**

Traveler Information strategies can broadly be defined as any system that provides road or transit condition information to travelers so that they will be aware of weather conditions, congestion and delays, alternative routes, and transit schedules. These strategies provide content on the overall system performance, such as daily congestion, incidents, and work zones, compiled from a variety of information sources. Based on the information that travelers receive, they are able to make more knowledgeable decisions about routes and travel modes, thereby increasing the efficiency of the road or transit network.

The two primary aspects of Traveler Information strategies are real-time statistics for traffic and transit and trip planning. The quality and effectiveness of these strategies are highly dependent on comprehensive and real-time data relating to system conditions and the information network that connects these data sources to a centralized location. A robust Traveler Information system allows users to trust that they are accessing the most current and comprehensive information possible. Different methods of reaching drivers used by Traveler Information systems 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, portable navigation devices that combine GPS with remote traffic updates to route drivers, and trip planning services, such as trip routing, based on current or average travel conditions and user specified inputs. Various methods for getting information to motorists are accessible by almost any user regardless of available resources.

Compiling roadway information from a multitude of data sources is the most significant challenge that must be addressed by Traveler Information providers to ensure that users trust that they are accessing the most current and comprehensive information possible.

In the NYMTC planning area, real-time traveler information is available through systems like 511 New York (511NY), the state’s official traffic and travel information source. This system covers the states of New York, New Jersey and Connecticut and 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, transit route trip planning and rideshare services. 511NY also provides via additional links travel information related to specific modes of transporta-
Incident Management

According to most traffic experts, non-recurring traffic incidents such as vehicle breakdowns, crashes, or severe weather, are typically responsible for more than half of peak-hour traffic congestion in major US cities. These incidents also increase the risk of secondary collisions between uninvolved motorists. In mass transit systems, incidents such as signal malfunctions or sick passengers can cause delays for riders. Incident Management is the response to such incidents, 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.”

Though some Incident Management strategies involve using Traveler Information to warn travelers of delays and to suggest detours, there are numerous other measures that must be taken to clear incidents as efficiently as possible so that regular traffic flow can be restored.

Many emergency vehicles first responding at the scene of the incident are equipped with advanced in-vehicle communication devices, providing live voice, data, and video communications connected to appropriate TMCs. This technological capability assists TMC staff to efficiently recognize the type of incident and to dispatch appropriately emergency crews and equipment to address and clear the incident.

The majority of traffic incidents are vehicle breakdowns, most of which do not directly block road lanes. A relatively small proportion of incidents involve serious crashes or spills from commercial trucks that block travel lanes however, these are responsible for the majority of delays on the road system. Still, Incident Managers must be able to effectively respond to incidents that range in severity.

To do so, governmental and nongovernmental bodies work closely to coordinate operations and share information across jurisdictions. In the NYMTC planning area, various Incident Management systems are already in place, including transportation, public safety, and emergency agencies. These systems can effectively address transportation as well as security-related incidents.

Incident Management works by following these basic steps that apply to incidents on roadways as well as transit systems:

- Incidents are detected using a range of methods, many of which involve ITS technologies that monitor general system conditions. Automatic monitoring is supplemented by telephone hotlines or roadside/transit system telephones for travelers to use in reporting incidents. Detection can further occur on roads using patrol vehicles and in transit systems by train and bus operators.
- Appropriate responders are contacted and dispatched according to the type of incident.
- Drivers/passengers are diverted away from the incident if travel lanes/transit routes are expected to be blocked for a sufficiently long period of time.
- Data relating to past incidents are collected and evaluated to determine the effectiveness of different Incident Management techniques in varying circumstances.

In response to traffic incidents that occur on New York State highways, NYSDOT along with the New York State Police and NYMTC agencies have implemented the Highway Emergency Local Patrol (HELP) strategy. 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, typically planned prior to a project. These techniques aim to reduce delays, maintain worker and traveler safety, ensure that construction operates on schedule, and maintain access for businesses and residents over the course of the project. For instance, in Region 8 contractors may only close a specified number of travel lanes and Maintenance staff must report lane closures to TCM in advance. 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).

The ‘Drivers First’ initiative is a new approach by NYSDOT to prioritize the convenience of motorists and ensure that disruptions are as minimal as possible to drivers at highway and bridge projects across the state. The vision is to review and analyze current best practices used regionally and determine how to implement these best practices across the State given regional budget, legal and traffic volume differences while not compromising safety. NYSDOT will utilize expanded communications options already available to New York State road travelers to provide up-to-date roadwork and travel time information that will enable travelers to make informed decisions.
on departure time, alternate routes and mode choices.

From the perspective of a traveler, work zones and incidents have similar effects on travel time and the possible need for rerouting, which makes Traveler Information technologies important to Work Zone Management. However, from the perspective of TSM operators, mitigating congestion caused by construction is very different from managing incidents since work is planned in advance, allowing traffic and transit engineers to collaborate with construction personnel so that steps can be taken to mitigate anticipated effects of the work. Aside from notifying the public through Traveler Information strategies, the following additional methods may be employed as part of a comprehensive Work Zone Management plan:

- Modifying the network to reroute demand;
- 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**

Access Management describes a set of physical design and regulatory roadway options aimed at limiting and managing conflict points along a corridor. It is typically considered when roads are reconstructed and as part of Highway work permit process for new or revised access to a state highway by a developer or property owner. It is typically considered when roads are reconstructed and as part of Highway work Permit process for new or revised access to a state highway by a developer or property owner. Access Management strategies can be applied to all road types, whether local, collector, arterial, or highway, and are implemented in order to balance mobility and access on a given roadway. Access Management strategies are effective on major roadways and on local roads. On arterial roads and highways which primarily facilitate long-distance through traffic, the strategies that limit access on interchanges and regulate on- and off-ramps can increase mobility and safety. On local roads, which primarily enable vehicles to access specific destinations, the strategies that regulate the placement of curb cuts and turning lanes can improve safety.

Techniques for Access Management, many of which are identified by the Federal Highway Administration (FHWA), include:

- **Access spacing**: Increasing the distance between traffic signals to improve the flow of traffic on major arterials.

- **Driveway spacing**: Permitting fewer driveways that are spaced further apart to allow for the more orderly merging of traffic and to present fewer challenges to drivers.

- **Safe turning lanes**: Creating dedicated left- and right-turn lanes, indirect left-turns and U-turns, and roundabouts to keep through traffic flowing.

- **Median treatments**: Creating two-way left-turn lanes and nontraversable, raised medians to regulate access and reduce crashes.

  - **One-way streets**: Restricting traffic flow to one direction on a street to present fewer challenges to drivers and to reduce crashes.

  - **Prohibit certain types of vehicles** (i.e., commercial vehicles on parkways).

**Value / Congestion Pricing**

Congestion pricing, or value pricing, is a market-based strategy to manage traffic flows whereby motorists are charged a fee for access to and/or travel within a specified region, road, or road segment (lane, bridge, or tunnel). By pricing roads that experience severe congestion, especially during peak hours, congestion pricing seeks to reduce traffic by diverting discretionary rush hour vehicle 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 drivers from using highly traveled roadways during peak travel times, congestion pricing helps reduce traffic flow disruptions that otherwise would have occurred without pricing and as a result promotes a high level of vehicle throughput during rush hours. Electronic toll collection technologies such as electronic “passes” and Global Positioning Systems (GPS) can enhance congestion pricing by making toll collection possible electronically 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. Congestion pricing exists under various forms:

  - Variably priced lanes, such as high-occupancy toll (HOT) lanes;

  - Variable tolls on entire roadways;
• Variable parking prices;

• Cordon charges: fixed or variable charges to drive within or into an area; and

• Area-wide charges: per-mile charges within an area or network that may vary by level of congestion.17

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 TDM implications in that it can help shift a portion of motorists to more sustainable travel modes such as carpooling, transit, or bicycling. In addition, congestion pricing can provide revenues that can be used to operate the system and to fund transit or road improvements.18

Two congestion- or value-pricing toll structures already have been implemented in the NYMTC planning area. In March of 2001, the Port Authority of New York and New Jersey implemented a toll structure that incorporated higher tolls during weekday AM and PM and weekend peak hours at all six of its bridges and tunnels between New York City and New Jersey. This system has been refined in subsequent toll actions, also including lower per-axle tolls for trucks during overnight hours. The initial implementation of time-of-day incentive tolling came at the Tappan Zee Bridge the preceding year where there is a higher toll rate on commercial vehicles during the morning rush hours (6:30 AM to 9:30 AM).

In New York City, a plan to implement a cordon charge system was revealed in 2007 as part of PlaNYC 2030. Under the plan, motorists entering, leaving, or driving within the Manhattan Central Business District would have been charged a flat rate between 6AM and 6PM on weekdays. Fee exemptions would have been provided for emergency and transit vehicles, automobiles with a handicapped license plate, and taxis. The fees would have been collected with a combination of existing EZ Pass readers and other technologies, and the revenues would have been dedicated to transportation investments.19 In 2008, the New York State Legislature rejected New York City’s cordon pricing plan.20 Since then, discussions over congestion pricing have shifted to reviewing the pricing of the city’s bridges and tunnels. For example, the Equitable Transportation Formula suggested in 2012 by Sam Schwartz Engineering called for a new pricing plan that would readjust existing tolls more equitably and would charge motorists for using the four remaining toll-free East River bridges. Under the plan, the fees collected from motorists would have been used to fund bus, truck, and highway improvements, as well as the construction of three new pedestrian and bicycling bridges to the Manhattan CBD across the East and Hudson rivers proposed in the plan.21

Active Traffic and Transit Management

Active Traffic and Transit Management is an emerging field that uses coordinated ITS technologies to monitor for and respond to congestion and delays. Unlike other TSM categories, which function mainly to prevent congestion, Active Traffic and Transit Management works by creating technologies embedded in the transportation network that can detect traffic and transit flow conditions and respond adaptively to ease congestion, without necessarily requiring input by human operators. In doing so, roadway or transit systems can immediately ease congestion by reactively changing access or signal settings in response to varying conditions.

In the past, traffic and transit management strategies were based on technology, such as signal control systems, that had limited capabilities and responded primarily to local operational conditions. With new emerging technologies, older systems are being phased out and replaced with advanced systems that have become the basis of Active Traffic and Transit Management strategies and the leading technology in the integration of traffic and transit systems. An example of this approach is Integrated Corridor Management (ICM). ICM development analyzes transportation information from a multimodal perspective, allowing where feasible technologies for traffic, transit, and other modes to work together in easing overall congestion.

Two elements must be in place before any Active Traffic and Transit Management system can be effective: 1) comprehensive and integrated electronic monitoring and control of major roadways via TMCs; and 2) traveler information systems. Once these two elements are deployed, the following Active Traffic and Transit Management strategies can be used:

Active Traffic Management strategies:

• Temporary shoulder use: Based on real-time traffic detection, dynamic roadside signs instruct drivers when using the shoulder as a travel lane is permitted to improve flow.

• Self-adaptive and coordinated traffic signals: Communication between traffic lights and traffic sensors allows signal systems to automatically optimize traffic flow.

• Automated enforcement: Surveillance systems record moving violations linked to a vehicle’s license plate to enforce traffic laws remotely.

• Dynamic message signs: Roadside signs display information regarding real-time or planned downstream conditions so that drivers may ar-
range detours or be warned of upcoming congestion.

- **Queue warning**: Based on real-time traffic detection, dynamic roadside signs warn drivers of downstream congestion or hazards in order to reduce the risk of collisions.

- **Speed harmonization**: A specific type of queue warning in which dynamic speed limit signs post a lower speed limit to prepare drivers for traffic ahead.

- **Dynamic merge**: Traffic signals and signs are used to regulate or close lanes ahead of a merge point based on real-time traffic conditions to improve traffic flow and reduce merge conflicts.

- **Adaptive dynamic ramp metering**: Traffic signals are used to regulate entry onto limited-access highways depending on existing traffic volumes.

- **Dynamic rerouting**: Dynamic message signs are used to channel traffic from congested routes to parallel underutilized routes.

- **Dynamic lane markings**: Lights embedded in road pavement change the lane markings and the road layout in response to traffic conditions in order to improve flow.

Active Transit Management strategies:

- **Rail control centers**: By monitoring the locations of trains and by controlling train movements through track signals, centralized control centers are able to optimize train spacing and increase system capacity.

- **Bus automatic vehicle location (AVL)**: Real-time updates on fleet vehicle locations are collected by central software and used to improve the system performance by means of schedule adherence monitoring, onboard mobile data terminals, and/or real-time passenger information.

- **Transit priority**: Wireless communications between buses or streetcars and traffic signals allow transit vehicles to receive priority when passing through an intersection.

In the NYMTC planning area, many of these strategies are already in place and integrated with local TMCs, primarily network monitoring and control, incident management, traveler information and security. Multiagency coordination along with modernization, integration and expansion of all the technological systems that support these strategies are key elements for an efficient transportation system.
Table 4.1

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Planned Future Expansion</th>
<th>TSM Category</th>
<th>Related NYMTC / Regional ITS Architecture Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic signal priority (TSP) for buses</td>
<td>To create a 100% wireless centrally-controlled 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.</td>
<td>Initially 200 buses; ultimately the entire bus fleet.</td>
<td>Active Traffic and Transit Management</td>
<td>Advanced Traffic Management and Advanced Public Transportation Systems</td>
</tr>
<tr>
<td>Bus Security Cameras</td>
<td>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 efficiency 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. Bus security cameras have been installed on most of Westchester County’s Bee-Line buses, and there are plans to equip the entire fleet.</td>
<td></td>
<td>Active Transit Management</td>
<td>Advanced Public Transportation</td>
</tr>
<tr>
<td>Bus lane enforcement cameras</td>
<td>This automated enforcement project will record the license plate number of vehicles that violate bus lane regulations, 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.</td>
<td>All SBS bus operations.</td>
<td>Active Transit Management</td>
<td>Advanced Public Transportation</td>
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<tr>
<td>Rail Control Center (RCC) &amp; Automatic Train Supervision (ATS) Communications-Based Train Control (CBTC)</td>
<td>Automatic Train Supervision to monitor service and route subway trains to the right tracks. The RCC also centralizes the management of subway maintenance disciplines and customer information 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.</td>
<td>In the coming years, NYCT is looking to expand ATS-like capabilities to additional subway lines (lettered lines &amp; the 7). CBTC is now under construction on the 7 and planned for additional lines as they come due for signal modernization.</td>
<td>Active Transit Management</td>
<td>Advanced Public Transportation</td>
</tr>
<tr>
<td>Bus Time</td>
<td>Bus Time is a real-time bus information system for customers. The system can provide next bus information by bus stop or bus route, using computer, handheld or text message. It has the capability to be expanded to offer fixed displays at bus stops. Today the system informs customers where the next bus is (i.e. two stops away); currently there is no predictive algorithm to inform that a bus is three minutes away.</td>
<td>To be expanded system wide by the end of 2013. Also in development would be an expansion of the Bus Time system to offer customers on board a bus both a variable message sign and audio announcement of the next bus stop.</td>
<td>Automatic Vehicle location (AVL) and Traveler Information</td>
<td>Advanced Public Transportation</td>
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<tr>
<td>Automatic Train Supervision (ATS)</td>
<td>This system transmits train location information to the Central Rail Control Center. The ability to see where all trains in the system are located assists train dispatchers with identifying delays and managing incidents that impede train service.</td>
<td>The B-Division (lettered) subway lines and the 7 line.</td>
<td>Incident Management</td>
<td>Advanced Public Transportation and Emergency Management</td>
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<tr>
<td>Public Address/ Customer Information Screens (PACIS)</td>
<td>Building upon its ATS and CBTC systems, these are variable message signs which provide real-time train-arrival information to passengers 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 other technologies enabling real-time information.</td>
<td></td>
<td>Traveler Information</td>
<td>Advanced Traveler Information Systems</td>
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<td>Name</td>
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<td>Planned Future Expansion</td>
<td>TSM Category</td>
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<tr>
<td><strong>Advanced Solid State Traffic Controllers</strong></td>
<td>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 media and protocols (fiber, coaxial, twist pairs and wireless) in order to support federal NTCIP standards. The ASTC is capable of being computerized, controlled by the TMC and implementing all of the central system timing patterns, 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.</td>
<td>Expansion to include all NYC 12580 traffic signals. NYS DOT has also a program to replace old traffic controllers.</td>
<td>Active Traffic Management</td>
<td>Advanced Traffic Management Systems</td>
</tr>
<tr>
<td><strong>Midtown in Motion</strong></td>
<td>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 management center (JTMC) and adjust signal timing appropriately in real time. The system utilizes ASTC controllers and includes 100 microwave sensors, 32 traffic video cameras and E-Z Pass readers at 23 intersections to measure traffic volumes, congestion, and travel times.</td>
<td>If necessary, future expansion of this system could include other areas in NYC.</td>
<td>Active Traffic Management</td>
<td>Advanced Traffic Management Systems</td>
</tr>
<tr>
<td><strong>Regional Signal Timing and Coordination</strong></td>
<td>This corridor based traffic signal retiming project improves traffic mobility and safety. It optimizes arterial traffic flow capacity, discourages speeding, and increases pedestrian walk times at crosswalks.</td>
<td>If necessary, it could be expanded to other arterials in the future.</td>
<td>Active Traffic Management</td>
<td>Advanced Traffic Management Systems</td>
</tr>
<tr>
<td><strong>Smart Lights (Adaptive Control System)</strong></td>
<td>This pilot project has been implemented 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 inconsistent 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.</td>
<td></td>
<td>Active Traffic Management</td>
<td>Advanced Traffic Management Systems</td>
</tr>
<tr>
<td><strong>Highway Intelligent Transportation System (ITS)</strong></td>
<td>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 communication to support video traffic cameras, variable message signs (VMS), radio (RFID) readers and travel time signs. All NYC major construction projects require Mobil ITS deployment to support maintenance and protection of traffic management. Current implementation includes the Korean Veteran Parkway, Belt Parkway, FDR Dr., and the East River bridges. Construction projects using ITS deployment included all East River Bridges and the 2nd Avenue Subway and Lower Manhattan projects.</td>
<td>Future expansion could include other NYC areas.</td>
<td>Active traffic Management</td>
<td>Advanced Traffic Management Systems and Maintenance and Construction Operations</td>
</tr>
<tr>
<td><strong>Freight Weight-In-Motion (WIM)</strong></td>
<td>The goal of this research project is to quantify the damage and the corresponding cost to NYC’s infrastructure caused by heavy vehicles, utilizing WIM sensors placed at strategic locations. The project also obtains data on existing axle weights of heavy vehicles and quantifies the annual damage caused by overweight vehicles using PavéDAT, a FHWA software. The project also examines using WIM and License Plate Reader (LPR) technologies along with overview cameras for enforcement.</td>
<td>One permanent WIM site will be installed on the Alexander Hamilton Bridge. Three other temporary WIM sites will be established at selected locations on NYC through-truck routes.</td>
<td>Active traffic Management</td>
<td>Advanced Traffic Management Systems and Commercial Vehicle Operations Systems</td>
</tr>
<tr>
<td><strong>511NY</strong></td>
<td>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. <a href="http://www.511ny.org">http://www.511ny.org</a></td>
<td>The system would include additional travel information elements.</td>
<td>Traveler Information</td>
<td>Advanced Traveler Information Systems</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
<td>Planned Future Expansion</td>
<td>TSM Category</td>
<td>Related NYMTC/Regional ITS Architecture Strategy</td>
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<tr>
<td><strong>INFORM (Information FOR Motorists)</strong></td>
<td>The system is one of the nation’s largest and most advanced transportation management systems, and consists of electronic monitoring, communications, signing and control components, providing motorist information for warning and route diversion, ramp control, and signal control. All operations are monitored and controlled by the TMC in Hauppauge. It includes more than 4000 vehicle detectors, 206 overhead and 48 portable variable message signs, 1080 traffic signals (500 under central control), 91 ramp meters, 228 closed circuit television cameras, managed lanes, and other ITS features.</td>
<td>The Region intends on eventually having approximately 360 centerline miles of instrumented roadway. (see Figure 4-1)</td>
<td>Active Traffic Management</td>
<td>Advanced Traffic Management Systems</td>
</tr>
<tr>
<td><strong>Highway Emergency Local Patrol (HELP)</strong></td>
<td>Patrol Vehicles/Trucks on major roadways provide motorist assistance as necessary. They also communicate with local TMC to coordinate the response for roadway incidents.</td>
<td>The system would be expanded as necessary to include additional roadways.</td>
<td>Incident Management</td>
<td>Emergency Management Systems</td>
</tr>
<tr>
<td><strong>NYSDOT R-11, Regional ITS Deployment</strong></td>
<td>The ITS deployment covers all interstate highways in NYC, including partial coverage along many of the City’s Parkways. It includes an extensive electronic monitoring and communications network that provides motorist 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 components.</td>
<td>The system would be expanded in Eastern Queens, Manhattan and southern Brooklyn. Improvements would also include integration via new technologies (i.e., cross-agency via TMCs and vehicle-infrastructure communications).</td>
<td>Active Traffic Management</td>
<td>Advanced Traffic Management Systems</td>
</tr>
<tr>
<td><strong>E-ZPass Customer Service Center</strong></td>
<td>This system includes several Customer Service Centers (CSC) linked with various Toll Collection subsystems. The centers manage toll transactions and interface with a Financial Institution.</td>
<td>The system could be expanded as necessary.</td>
<td>Active Traffic Management</td>
<td>Advanced Traffic Management Systems</td>
</tr>
<tr>
<td><strong>Long Island Municipal/Cou Long Island Municipal/Cou Local Traffic Operation Center (TOC)</strong></td>
<td>The center monitors, analyzes and stores traffic data and controls traffic conditions. The center exchanges highway-rail intersection information with rail operations centers. Its operations include regional traffic management, wide area alerts, and work zone management and coordination.</td>
<td>The system could be expanded as necessary.</td>
<td>Active Traffic Management, Incident Management</td>
<td>Advanced Traffic Management and Emergency Management Systems, Maintenance and Construction</td>
</tr>
<tr>
<td><strong>Mid Hudson South Municipal/County Local TMC (Hudson Valley TMC)</strong></td>
<td>The TMC operations include incident dispatch, coordination and communication, and multimodal coordination, including signal coordination along a particular transit route.</td>
<td>The system could be expanded as necessary. Future ITS instrumentation would cover the I-84 from Route 17 in Middletown to I-684.</td>
<td>Active Traffic Management, Incident Management</td>
<td>Advanced Traffic Management and Emergency Management Systems, Maintenance and Construction Operations</td>
</tr>
<tr>
<td><strong>MTA Bridges &amp; Tunnels Facility Operation Centers</strong></td>
<td>The center operations include traffic surveillance, commercial vehicle operations, emergency management, regional traffic management, environmental information management, work zone operations, etc.</td>
<td>The system could be expanded as necessary.</td>
<td>Active Traffic and Transit Management, Incident Management</td>
<td>Advanced Traffic Management, Advanced Public Transportation and Emergency Management Systems, Maintenance and Construction Operations</td>
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Table 4.1 continued

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<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Planned Future Expansion</th>
<th>TSM Category</th>
<th>Related NYMTC / Regional ITS Architecture Strategy</th>
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<tbody>
<tr>
<td>MTA LIRR Operations Center Systems</td>
<td>The center operations include rail and bus dispatch operations, vehicle tracking and scheduling systems and emergency management.</td>
<td>The system could be expanded as necessary.</td>
<td>Active Transit Management and Incident Management</td>
<td>Advanced Public Transportation and Emergency Management Systems, Maintenance and Construction Operations</td>
</tr>
<tr>
<td>MTA Metro-North Operations Center Systems</td>
<td>The center operations include rail and bus dispatch operations, vehicle tracking and scheduling systems and emergency management.</td>
<td>The system could be expanded as necessary.</td>
<td>Active Transit Management and Incident Management</td>
<td>Advanced Public Transportation and Emergency Management Systems, Maintenance and Construction Operations</td>
</tr>
<tr>
<td>New York City Joint Transportation Management Center (JTMC)</td>
<td>The center operations include traffic and transit network control and monitoring, emergency management, emissions management, and maintenance and construction management.</td>
<td>The system could be expanded as necessary.</td>
<td>Active Traffic, Transit Management, Incident Management</td>
<td>Advanced Traffic Management, Advanced Public Transportation and Emergency Management Systems, Maintenance and Construction Operations</td>
</tr>
<tr>
<td>NYC Office of Emergency Management (OEM) Watch Command Center</td>
<td>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.</td>
<td>The system could be expanded as necessary.</td>
<td>Incident Management</td>
<td>Emergency Management Systems</td>
</tr>
<tr>
<td>PANYNJ Airports Communication desk/operations center</td>
<td>This includes central operations for coordination and communication systems as well as facility-based ITS servers. The functional areas include traffic surveillance, incident management, traffic and transit information services, multi-modal coordination, transit center security, work zone management, etc.</td>
<td>The system could be expanded as necessary.</td>
<td>Active traffic and transit management, and Incident Management</td>
<td>Advanced Traffic Management, Advanced Public Transportation and Emergency Management Systems, Maintenance and Construction Operations</td>
</tr>
<tr>
<td>TRANSCOM OpenReach Servers</td>
<td>The TRANSCOM regional architecture is a program. It coordinates the collection and redistribution of traffic flow, origin-destination, incident, construction, equipment status and special event information data between transportation management centers running the TRANSCOM regional architecture.</td>
<td>The system could be expanded as necessary.</td>
<td>Active traffic and transit management, Incident Management, and traveler information</td>
<td>Advanced Traffic Management, Public Transportation, Emergency Management and Traveler Information Systems, Maintenance and Construction Operations</td>
</tr>
</tbody>
</table>

There are more than 260 categories of ITS operations in the NYMTC planning area that are included in the inventory of New York Sub-regional ITS Architecture: [http://www.consystec.com/nycraupdate/web/inventory.htm](http://www.consystec.com/nycraupdate/web/inventory.htm).
TRANSPORTATION DEMAND MANAGEMENT (TDM)

TDM strategies attempt to decrease the total number of auto trips, especially trips in single-occupant vehicles (SOVs), by encouraging high-occupant vehicle (HOV) travel such as carpools, public transportation, and active transportation which is any form of human-powered transportation such as walking and bicycling. TDM is different from TSM in that it requires in most cases less funding or physical modifications of the transportation network. Instead, TDM relies on voluntary, regulatory, or incentivized use of public transportation and other alternative travel modes. TDM strategies encompass a broad range of methods, such as employer provided pre-tax transportation vouchers, alternative work hours, and telecommuting to significantly reduce the number of rush-hour commuters. Pricing can also be used to manage congestion by charging different toll rates at different times of the day; variable pricing can consist of charging vehicle users for the use of parking facilities in order to discourage commuters from driving alone or from driving at all. As TDM strategies rely on supplying alternative transit to individuals, there must be a range of choices available to the public so that the individual may choose a suitable option. The TDM strategies are categorized into six groups: Parking Management, Bicycle and Pedestrian Enhancements, Transit Enhancements and Marketing, Vehicle Sharing, Para-transit Services, and Employer-Based Programs. Each of these categories is discussed in the following section with examples of TDM strategies and methods that are currently underway or planned for the NYMTC planning area. By implementing multiple strategies from the six categories, the NYMTC planning area could see an increase in commuter volume while at the same time experiencing a reduction in traffic congestion and air pollution.

Parking Management

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. Parking management strategies can include various components including time of day and day of week regulations, parking pricing plans, regulations concerning the quantity of parking that should be provided at particular locations, recommendations of where shared parking would be appropriate and guidelines for parking design. Where it is deemed applicable to implement, the key to a successful parking management initiative is to have it formulated to meet the specific needs of the area where it is to be applied. Some strategies are more successful in high density population and employment areas while other strategies could be appropriate for a village center or suburban strip corridor.

Land and parking policies should balance the need for vehicle parking with development that encourages the use of alternate modes of travel such as taking transit, walking or bicycling. Studies
Parking management can also be used to shape development patterns. As an example, strategies that include shared parking arrangements or flexibility regarding minimum parking requirements can reduce the amount of land dedicated to parking. Reducing the amount of parking that developers have to provide can lower the cost of development, and allow greater density of development, which can help foster a greater market for transit services. Less surface parking can also decrease the distance among developed sites, thereby encouraging a more walkable environment.

Parking pricing and other cost-based measures consist of 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 transportation improvement projects. Driving is still heavily subsidized in the form of free and underpriced parking at most locations. The amount of available parking can affect commuters’ choice of travel mode, and can contribute to single-occupancy driving and automobile congestion. In some areas, limiting the amount of free parking and increasing the cost of existing parking near highly solicited destinations may encourage motorists to consider alternative travel options that may be available in the area. Parking spaces near transit stations can also be priced strategically to encourage people to take the bus, bike, walk, carpool, car share, or vanpool to the station.

Variable rate pricing 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). Adjusting pricing to variations in parking demand increases turnover rates and the availability of parking spaces, thus reducing congestion, “circling” and emissions, especially in dense urban areas. Peak-rate pricing, also known as time-variable rate pricing, can be an effective strategy in areas where the demand for parking exceeds physical parking capacities.

Parking supply strategies regulate the availability of on- and off-street parking spaces. On-street parking management is 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. In addition to balancing parking supply and demand, on-street parking regulations are used to address aspects of transportation management such as traffic safety, vehicle speed and traffic volumes, street maintenance and cleaning, and the prioritization of certain types of vehicles. Additional parking supply management strategies as well as Smart Growth and Transit Oriented Development (TOD) are discussed in Appendix 2: Pedestrians and Bicycles.

Land use and building regulations, particularly local zoning ordinances, can be used to optimize the supply of off-street parking. 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 typology and function, residential and built density levels, and demographic and socioeconomic characteristics (income, age, and household structure). New York City has made the commitment to evaluate appropriate off-street parking requirements based on these and other variables. In areas with viable transit options or low car ownership rates, unbundling the costs of parking and housing can help eliminate unnecessary parking space and save on construction and housing costs. Another way to limit the excess supply of parking spaces consists of using shared parking, whereby 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.

In Westchester County, individual municipalities have held parking management workshops to identify an appropriate quantity of parking and suitable parking fees for a particular area. The workshops have also looked at opportunities for shared and unbundled parking and alternatives to minimum parking requirements. On Long Island, where land use and transit are less densely distributed, the design of parking management strategies should consider the feasibility
of limiting parking when trip distances and the distribution of transit stops may preclude the use of human-powered transportation and require multi-modal journeys such as driving to a train or bus stop.

One particular parking supply management strategy consists of encouraging motorists commuting from peripheral areas to leave their vehicle in park-and-ride lots where they can transfer to public transportation, carpools, or vanpools to complete their journey. Park-and-ride lots are usually located next to regional transit stations and freeway on-ramps in urban fringes for easier intermodal transfers. When appropriately priced, park-and-ride lots can increase the use of transit and rideshare and moderate the number of single-occupancy vehicles entering the city center. The NYMT planning area and surrounding counties feature a number of park-and-ride locations, some of which require a parking permit. Throughout the tri-state area, 511NY Rideshare provides information on park-and-ride lots and carpooling/vanpooling services. MTA Metro-North Railroad and Staten Island Railway also maintain a number of park-and-ride facilities adjacent to railway stations. Ancillary park-and-ride lots can be leased temporarily to meet excess demand for parking spaces near existing lots; ancillary lots are in use in various locations in Putnam County.

Pedestrian and Bicycle Enhancements

Bicycle and Pedestrian Enhancements encompass all strategies 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. For more information on specific pedestrian and bicycling improvement initiatives in Plan 2040, see Appendix 2: Pedestrians and Bicycles.

Strategies that affect land use, zoning, and urban design are not specifically transportation enhancement measures and their effects can only be measured in the long term, as opposed to most other TDM strategies. However, the combination of different land use factors, such as density, land use mix, street connectivity, accessibility to transit, and site design are very important determinants of walking and bicycling levels. Strategies that promote compact mixed use neighborhoods, such as TOD and Smart Growth, are crucial tools to making a greater number of destinations within walking and biking distance of one another.

Improving the convenience and safety of walking and bicycling can be achieved by making more destinations accessible by bicyclists and pedestrians of all abilities, through measures such as: 1) improving the quantity, quality, and connectivity of sidewalks, bikeways, and greenways; 2) providing secure bicycle storage facilities and parking; 3) improving bicycle and disabled access to buildings and transit; 4) applying Complete Streets and Universal Design standards; 5) developing a pedestrian- and bicycle-friendly wayfinding system; and, 6) providing greater access to bicycles through bike-sharing programs.

Bicycle sharing is a transit system that is run or authorized by government agencies or public-private partnerships and provides publicly available bicycles intended for commuting to and from work, or similar short-distance trips, as an alternative or complement to other forms of public transit or private vehicles. Bicycle sharing increases the convenience of bicycling and has been shown to increase ridership.

Other measures that directly improve the safety of pedestrians and bicyclists include designing safer intersections, providing adequate pedestrian crossing time, installing physically protected bikeways, adding bike boxes before intersections, and improving traffic safety education and enforcement. Making walking or bicycling to and from transit more convenient is an important way to promote both active transportation and transit ridership. For example, bicycle-transit integration can be improved by allowing bicycles on transit vehicles and by providing bicycle parking and lockers in or near stations. Planning for active transportation can also address equity issues by increasing mobility and accessibility options for those who do not have access to an automobile, and people with disabilities, the elderly, and children. Initiatives to reduce vehicle traffic level can also increase the safety of walking and bicycling. Improvements to the visual attractiveness of public spaces through better landscaping and urban design can also help increase the appeal of walking and bicycling.

Transit Enhancements and Marketing

Many TSM strategies used to improve the efficiency and capacity of roads can also promote ridership, thereby increasing transit use. Transit enhancements and marketing help to 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. Enhancing mass transit and attracting travelers to these modes is a fundamental step in reducing the number of vehicles on the road.

Transit riders are concerned with the reliability of public transportation, particularly waiting time and frequency of service. Increasing and improving Rider Information Strategies at bus stops, station entrances, and on subway

Transportation System Operations and Management
or rail platforms could help to reduce travel stress and permit riders to make informed decisions about their travel options; such as whether to walk, take the bus, ride a different train, or run additional errands before the next arrival. In addition to providing arrival time information, the following strategies help to foster a more comfortable experience for riders:

- **Improved payment methods**: Pre-paid tickets for improved bus boarding speed and fare cards that work for all modes of transit;

- **Circulator services**: 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 Wi-Fi access in stations, ramps and elevators for people with handicaps and bicyclists, easy pedestrian and bicycle access to stations, readable maps and clearly marked entrances;

- **Passenger notifications**: Announcing upcoming stops on trains and buses and alerting passengers to any delays or service changes; and

- **Security systems**: Silent alarms, surveillance cameras, and automatic vehicle location (AVL) to bolster riders’ sense of security on transit.

An example of a Transit Enhancement and Marketing strategy to improve payment methods is Westchester County’s introduction of MetroCard on the Bee-Line Bus System in 2007, which enabled free transfers between Bee-Line buses and between MTA New York City Transit buses and subways.

A study by the United States Public Interest Research Group (USPIRG) shows that, due to changes in lifestyle, technology, and policies, younger generations tend to prefer transit over driving. Between 2001 and 2009, people aged 16 to 34 showed a 23 percent decline in vehicle miles traveled, from 10,300 miles to 7,900 miles per capita. Communicating, whether in person or over text and social media, is easier and safer if done on transit as compared to vehicles. Transit and communication companies are presented with an opportunity to capitalize off of this trend by installing cell towers underground and by offering wireless hotspots at stations and on buses. More riders will be attracted to transit and are prospective customers to the company offering these services. Various marketing strategies can also be employed to promote the use of transit instead of vehicles. Financial incentives, financial disincentives, branding, and social marketing are all helpful in discouraging vehicle use and encouraging transit use.

Using financial incentives to promote transit is another strategy often used to help manage road congestion and improve the appeal and use of alternative modes. Offering incentives not only saves riders money, but also adds to transit’s appeal as an affordable, accessible alternative. Examples of financial incentives are travel allowances, commuter tax benefits, and cash-out programs, which are all discussed further in the section under Employer-Based Programs. Financial disincentives to driving, such as a fuel tax, congestion pricing, parking management, etc., can also help to encourage transit use while improving transit infrastructure by reinvesting the gains back into the transit network.

Branding is another strategy that can help increase ridership and improve the rider experience. A study by the American Public Transit Association showed that improving the image of bus services and bus rapid transit (BRT) has the potential to increase ridership by 10 to 20 percent. Strategies for branding are: finding the target demographic and assessing their concerns and needs, adjusting the physical image of the service (color and style), applying memorable names to the services and lines, scheduling logical routes and creating intuitive map design, and ensuring a proper station design that is comfortable, safe, and novel. Social marketing is another strategy commonly used to inspire a sense of civic duty to minimize car-related pollution and encourage transit ridership. The social marketing strategy uses traditional commercial marketing techniques to influence individuals to commit actions that improve their personal welfare and that of society. The DriveSmart program, initiated by NYCDOT, invites interested vendors to submit information about ways to provide driver customized information and benefits via in-vehicle communication technologies and help them make better use of the City’s extensive multimodal transportation systems.

Marketing strategies can also be targeted to different segments of the population. An example of this approach is Westchester County’s Be Educated About Transit (B.E.A.T.) Program. B.E.A.T. is part of Westchester’s overall SMART Commute Program, which provides outreach to commuters and employers regarding the benefits of transit and alternatives to driving. B.E.A.T. provides outreach to school-aged children to teach them about the Bee-Line System. Senior B.E.A.T. was launched in 2012, and is oriented towards encouraging seniors to ride the bus and sign up for reduced fare MetroCards.

**Vehicle Sharing**

Different types of vehicle sharing strat-
Ridesharing consists of driving with one or more passengers (as opposed to driving alone), either in a privately owned car (carpooling) or a van (vanpooling). Carpooling and vanpooling may also improve the mobility of travelers who do not drive or have convenient access to viable non-motorized travel options. Ridesharing can be enhanced by other TDM and TSM strategies such as high-occupancy vehicle (HOV) lanes, park-and-ride facilities, as well as rider-matching services and software.\textsuperscript{\textdegree} Ridesharing and rider-matching can be complemented by certain employer-based programs like those coordinated by 511NY Rideshare. In addition, transportation agencies can offer incentives for ridesharing. The Port Authority of New York and New Jersey (PANYNJ) offers E-ZPass toll discounts for carpools on its bridges and tunnels, and the Tappan Zee Bridge Carpool Commuter Plan offers discounts to vehicles with three or more occupants.

Car-sharing is another type of vehicle sharing strategy that bears many similarities with bike-sharing in that a fleet of vehicles is made available for use by members on a short-term basis at unstaffed, self-serving locations. Vehicles are typically available 24 hours a day and geographically dispersed in proximity to existing members. 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. In 2010, 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.\textsuperscript{\textdegree} Car sharing services are offered, for example, by educational institutions like SUNY Purchase in Westchester County and Hofstra University in Nassau County. Car sharing programs have been implemented at Metro-North stations for reverse commuters traveling from New York City to corporate parks in Westchester County;

**Paratransit and Rideshare Services**

A number of passenger transportation services consist of flexible or demand-responsive transportation options provided by using small buses, vans, or shared taxis, rather than fixed routes and schedules that characterize regular mass transit. These services, which can be grouped under the umbrella of paratransit, can complement regular transit when the latter would be too costly and inefficient to operate, such as in areas of low passenger demand or population density, or during off-peak hours. Paratransit can make alternatives to driving more viable in underserved areas. Although paratransit may usually refer to transportation for passengers with special mobility needs, such as the disabled and the elderly, in this discussion it includes a wide spectrum of transportation options that fill the gap between the private automobile/taxi and conventional buses that serve regular transit routes.\textsuperscript{\textdegree} Depending on the type of service, vehicles are reserved and scheduled either in advance or on an ad hoc basis, run on predefined routes or provide door-to-door service, and cater to particular types of passengers (individuals with disabilities, company employees, or low-income commuters) or to the general public. Paratransit can exist in the form of:

- Local circulator buses and vans that provide local service to popular destinations such as universities, shopping centers, and dense concentrations of employment outside of urban centers;
- Reverse commute shuttles that offer access to jobs in areas not easily served by transit;
- Special mobility services using adapted vehicles to provide demand-response transportation for passengers with special needs such as the disabled and the elderly; and
- Privately operated bus lines, dial-a-ride vans, and shared-ride taxis.

**511NY Rideshare**

The most comprehensive source for rideshare services in the NYMTC planning area can be found in the 511NY traveler information system, under 511NY Rideshare. Many TDM strategies are implemented through the efforts of 511NY Rideshare, which is a regional, multi-agency partnership that offers a suite of programs, services and information for commuters, travelers and employers. 511NY Rideshare is fully supported and funded by NYMTC members. Even if members have their own commute alternatives program (i.e, Rockland and Westchester counties), they do leverage the work of 511NY Rideshare. By accessing this service, commuter and travelers can access a wealth of information on ride-matching services, transit, walking and bicycling options, educational material and other TDM information. 511NY Rideshare staff work with employers across the region to establish commuter benefit programs.

These programs include ride-matching services, vanpools, transit trip planning support, bike/walk-to-work programs, shuttles to/from nearby train stations, telework, flextime, compressed work week programs, relocation services, parking management and guaranteed ride home programs. They also provide technical assistance, with emergency preparedness planning, marketing, support,
and in some instances offer grant programs to eligible employers for implementing workplace commuter programs.

**Employer-Based Programs**

Employer-based programs encompass a variety of strategies that individual employers use to encourage employees to switch from driving alone to more efficient commuting alternatives, including adjusting work or delivery schedules (departure time strategies) or reevaluating their need to travel (trip reduction strategies).  

Several government programs allow employers to provide various financial incentives or tax-free transportation benefits to their employees to encourage the use of more efficient travel modes to and from work. With parking cash-out programs, 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. Travel allowances, a related employer-based initiative, are financial incentives provided to employees instead of parking subsidies. Employers may also use commuter tax benefits to encourage employees to use transit, vanpool, or bike, whereby the company either covers the full cost of the benefit, offers a “pre-tax” benefit, or shares transportation costs with the employee.  

Some employers who face problems of limited parking or congestion partner with vanpool and shuttle services to facilitate and establish vanpools or shuttles for employees who choose not to drive. For example, employers may use guaranteed ride home (GRH) programs, which consist of 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. Employer-paid vanpools and shuttles can also provide supplemental transportation and connections to transit on an everyday basis. For example, employer shuttles connect workplaces to Metro North stations in Westchester County and to LIRR stations in Nassau and Suffolk Counties.  

Many employer programs are coordinated through 511NY discussed in the previous section. 511NY Rideshare coordinates with targeted employers to facilitate and establish vanpool, shuttle, and rideshare services for employees. 511NY Rideshare’s Employer Education Program promotes and educates employers about pre-tax commuter benefit options.  

Other employer-based transportation demand management measures consist of departure time and trip reduction strategies. Firms can adopt alternative or variable work schedules in the form of flextime (allowing more flexibility in arrival and departure times to and from work), staggered shifts, and compressed workweeks (working fewer but longer days). These measures aim at redistributing a portion of peak-hour trips to off-peak periods to reduce costly delays associated with rush hour road and/or transit congestion and help accommodate ridesharing and transit use. A related measure to fight peak-hour road congestion is to encourage businesses to shift truck deliveries to off-peak hours, which can also help reduce the costs associated with delivery delays. Strategies also exist to reduce the number of work-related trips altogether through telework or telecommuting whereby work is conducted from home or a location other than the employer’s usual work site and information technology is used to substitute communication and accessing information for physical travel. Several companies in the region, including IBM and Empire Blue Cross Blue Shield, offer telework programs. Other trip reduction strategies include distance learning, video conferencing and internet-shopping.
Table 4.2

<table>
<thead>
<tr>
<th>Name</th>
<th>Description/Aim</th>
<th>TDM Category</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access-A-Ride</strong></td>
<td>Special mobility services: adapted vehicles provide demand-response transportation for passengers with special needs such as the disabled and the elderly.</td>
<td>Paratransit</td>
<td><a href="http://www.mta.info/nyct/paratransit/">http://www.mta.info/nyct/paratransit/</a></td>
</tr>
<tr>
<td><strong>Guaranteed Ride Home</strong></td>
<td>Non-driving employees are provided with a transportation back-up option in case they need to leave work outside of regular hours in areas served by MetroNorth. This program is funded by NYSDOT-Region 8 and is offered via 511 NY Rideshare for usage for up to four times a year.</td>
<td>Employer Program</td>
<td><a href="http://www.mta.info/mnr/html/guaranteed/guaranteed.htm">http://www.mta.info/mnr/html/guaranteed/guaranteed.htm</a></td>
</tr>
<tr>
<td><strong>MTA Transit Oriented Development Office</strong></td>
<td>“To promote 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.”</td>
<td>Bike/Pedestrian</td>
<td><a href="http://www.mta.info/sustainability/pdf/MTA20Smart20Growth-TOD201020292008.pdf">http://www.mta.info/sustainability/pdf/MTA20Smart20Growth-TOD201020292008.pdf</a></td>
</tr>
<tr>
<td><strong>Employer Preferred Parking</strong></td>
<td>Several employers in Long Island, Westchester and Putnam counties provide parking benefits for their staff.</td>
<td>Employer Programs</td>
<td></td>
</tr>
<tr>
<td><strong>Westchester SMART Commute Program</strong></td>
<td>This program informs commuters and employers of various strategies to increase the use of transit alternatives in order to reduce congestion and improve air quality.</td>
<td>Marketing/Employer Programs</td>
<td><a href="http://transportation.westchestergov.com/commuter-services/smart-commute">http://transportation.westchestergov.com/commuter-services/smart-commute</a></td>
</tr>
<tr>
<td><strong>PARK Smart Pilot</strong></td>
<td>Performance-based parking pricing (pilot project). Parking prices have been increased. The goal is to optimize parking availability, increase turnover rates, and reduce “cruising” in order to reduce traffic volumes. Currently in 2-3 NYC neighborhoods.</td>
<td>Parking Management</td>
<td><a href="http://www.nyc.gov/html/dot/html/motorist/parksmart.shtml">http://www.nyc.gov/html/dot/html/motorist/parksmart.shtml</a></td>
</tr>
<tr>
<td><strong>Ancillary Park&amp;Ride Lots</strong></td>
<td>In Putnam County, Temple Beth Elohim and Carmel Bowl&amp;Temple Beth Shalom lease parking spaces to supplement parking supply near existing Park&amp;Ride lots.</td>
<td>Parking management</td>
<td></td>
</tr>
<tr>
<td><strong>511 NY Rideshare</strong></td>
<td>Outreach program to demonstrate the benefits of rideshares and promote alternative travel choices. Outreach to promote and educate employers about pre-tax commuter benefit options.</td>
<td>Paratransit/Marketing/Employer Programs</td>
<td><a href="http://www.511nyrideshare.org">www.511nyrideshare.org</a></td>
</tr>
<tr>
<td><strong>Regional Commuter Choice Program (RCCP) Bicycle Racks</strong></td>
<td>A program that delivers benefits to travelers who use TDM services in the NYMTC planning area. Bike racks exist throughout the NYMTC planning area, including train stations, business centers, and areas with significant share of bicycle use.</td>
<td>Paratransit</td>
<td><a href="http://www.mta.info/bike/">http://www.mta.info/bike/</a></td>
</tr>
<tr>
<td><strong>Vanpool and shuttle services</strong></td>
<td>511 NY Rideshare TDM team coordinates with targeted employers to facilitate and establish rideshare services for employees. NYSDOT-Region 8 coordinates with Rockland and Westchester counties to facilitate rideshare and other transportation services for employees. Over 20 Metro-North station shuttles are supported by employers in Westchester County. Several employers in Long Island and Westchester provide employer paid vanpools and shuttles to LIRR and Metro-North stations. SUNY Purchase, Hofstra University, Bard, Marist and Vassar colleges offer ridesharing programs.</td>
<td>Paratransit/Marketing/Vehicle sharing/Employer programs</td>
<td><a href="http://www.511ny.org/rideshare/ridesharesub.aspx?contentID=238">http://www.511ny.org/rideshare/ridesharesub.aspx?contentID=238</a></td>
</tr>
</tbody>
</table>

Transportation System Operations and Management  4-22
### Table 4.2 continued

<table>
<thead>
<tr>
<th>Name</th>
<th>Description/Aim</th>
<th>TDM Category</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Telework</strong></td>
<td>Many employers across the NYMTC planning area offer formal and informal telework programs. Some of the large programs include IBM in Westchester and Putnam counties and Empire Blue Cross &amp; Blue Shield, CA Technologies, and Aer Lingus in Long Island.</td>
<td>Employer Programs</td>
<td></td>
</tr>
<tr>
<td><strong>Other employer related financial incentives</strong></td>
<td>The New York City Commute Enhancement Grant (NYCCE) is available to organizations in NYC to help fund work site transportation related projects designed to reduce congestion and improve air quality. The Long Island Region Improving Commuting Grant (LIRIC) is a public service to help employers in LI to promote commuting alternatives to driving alone, including carpooling, teleworking, etc.</td>
<td>Employer Programs</td>
<td></td>
</tr>
<tr>
<td><strong>Toll Pricing</strong></td>
<td>The Port Authority of New York and New Jersey offers E-Z Pass toll discounts for carpools on its bridges and tunnels. Overnight toll discounts area also offered for trucks.</td>
<td>Marketing/Vehicle Sharing</td>
<td></td>
</tr>
<tr>
<td><strong>Complete Streets Legislation</strong></td>
<td>To “accommodate and facilitate safe travel by pedestrians, bicyclists, and motorists of all ages and abilities and allow pedestrian and motor travel to easily coexist.”</td>
<td>Bike/Pedestrian Enhancement</td>
<td><a href="http://www.nysenate.gov/press-release/senate-passes-complete-streets-legislation">http://www.nysenate.gov/press-release/senate-passes-complete-streets-legislation</a></td>
</tr>
<tr>
<td><strong>Commuter Tax Benefit</strong></td>
<td>Many employers across the NYMTC planning area provide various financial incentives or tax-free transportation benefits to their employees to encourage the use of more efficient travel modes to and from work.</td>
<td>Employer Program Incentives</td>
<td></td>
</tr>
<tr>
<td><strong>Bike Share Programs</strong></td>
<td>Bicycles are made available for shared use to individuals on a short term basis in to supplement public transit and automobile transport. CitiBike, the New York City Bike Share program, launched in May of 2013 with 6,000 bikes at 330 locations throughout the city. On Long Island, the City of Long Beach and SUNY Stony Brook have already launched bike share programs.</td>
<td>Bike/Pedestrian Enhancement</td>
<td><a href="http://decobikelbny.com/">http://decobikelbny.com/</a></td>
</tr>
<tr>
<td><strong>Ferry services to Metro-North stations</strong></td>
<td>Region 8 and Metro-North finance ferry companies that provide ferry services to Ossining and Beacon Metro-North stations.</td>
<td>Paratransit</td>
<td><a href="http://www.citibikenyc.com/">http://www.citibikenyc.com/</a></td>
</tr>
<tr>
<td><strong>Suburban Express Bus</strong></td>
<td>Region 8 Express Bus routes include OWL (Middletown - White Plains), Tappan Zee Express, Poughkeepsie-White Plains Express, IBus (Stamford – White Plains), Route 77 (Putnam – White Plains). The Suffolk County Clipper provides express bus service between the Long Island Expressway Park &amp; Ride lots at exit 63, exit 58, the Hauppauge Industrial Park, exit 49 Park &amp; Ride lot, the Route 110 corridor and SUNY Farmingdale.</td>
<td>Paratransit/Marketing/Vehicle Sharing/Employer programs</td>
<td></td>
</tr>
<tr>
<td><strong>Railroad Station Shuttles</strong></td>
<td>Danbury, CT to Brewster, NY; Ridgefield CT to Katonah, NY; Mahopac, NY to Croton Falls, NY; White Plains, NY to Westchester Ave; Newburgh, NY to Beacon, NY</td>
<td>Paratransit/Marketing/Vehicle Sharing/Employer programs</td>
<td></td>
</tr>
</tbody>
</table>
3. CONGESTION MANAGEMENT PROCESS

As defined in federal regulations, the Congestion Management Process (CMP) is intended to serve as a systematic process that provides for safe and integrated management and operation of the multimodal transportation system. It is required in metropolitan areas such as the NYMTC planning area and is considered an integrated part of the metropolitan transportation planning process. The CMP is the application of strategies to improve transportation system performance and reliability by reducing the adverse impacts of congestion on the movement of people and goods.

The need to address traffic congestion throughout the NYMTC planning area is a significant transportation issue given that the region’s transportation network is considered one of the largest in the world. It includes more than 50,000 lane-miles of roads, streets and highways, 34 major bridges and vehicular tunnels over/under navigable waters, 480 route-miles of commuter rail, 225 route-miles of subway lines, hundreds of miles of various bus service, more than 1,100 miles of bicycle route facilities, ferry service, and an aerial tramway. This transportation network is vital for the movement of people and goods in the region.

As contained in NYMTC’s Congestion Management Process procedures, the objectives of the CMP are to:

• Improve the mobility of people and goods by reducing vehicle hours of delay and person hours of delay;
• Improve the reliability and convenience of the transportation system, ensuring ease of use, acceptable travel times, and reasonable costs;
• Manage the transportation system efficiently to accommodate existing and anticipated demand for movement of people and goods; and
• Provide information on system performance and alternative strategies for alleviating congestion.

The procedures also include a toolbox of strategies to address congestion including Transportation System Management (TSM) and Transportation Demand Management (TDM). The NYMTC planning area benefits from a broad range of these TSM and TDM strategies; through the CMP process, members are able to consider a variety of alternative transportation options as described in the TSM and TDM sections above, when planning and implementing projects that are congestion-related. Examples include:

• Highway Strategies: Increasing the number of lanes without highway widening, creation of more HOV lanes;
• Transit Strategies: Encouraging transit use by making transit service more attractive, such as reducing 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;

- Transportation Demand Management Strategies: Alternative work hours, telecommuting, ridesharing and other programs reduce driving;
- Intelligent Transportation Systems and Transportation System Management 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 Transit-Oriented Development;
- Parking Strategies: Various parking policy plans that aim to decrease VMT and increase the use of non vehicular transportation modes;
- Regulatory Strategies: A trip reduction ordinance, congestion pricing, and truck restrictions.

Several of the above strategies were described in the previous section, Transportation System Management and Transportation Demand Management, and are related to the same Shared Vision goals and outcomes.

**PERFORMANCE MEASURES**

The CMP procedures contain a performance measures framework that is reported in a CMP Status Report prepared with each RTP cycle. Traffic congestion on the region’s roadways results when the vehicle volumes carried by the roadways exceed the capacity which the roadways were designed to accommodate. Traffic congestion can be categorized as recurring, caused by predictable increases in daily traffic, or non-recurring, caused occasionally by traffic accidents, road closures, weather conditions and other atypical events.

Performance measures are used in the CMP to assess the effectiveness and efficiency of the roadway system. When measuring congestion, it is important to consider several performance measures that assist in quantifying and providing an overview of the level of congestion. Some of the most commonly used measures are:

- Demand-to-Capacity Ratio (a ratio that reflects the quality of travel of a roadway section)
- Vehicle Hours of Delay (the sum total of delay experienced by all vehicles on the network)
- Person Hours of Delay (vehicle hours of delay multiplied by the average person occupancy rate per vehicle)
- Average Travel Speed (miles per hour)
- Lane-Miles of Congestion (length of roadway lanes that functions at less than acceptable speeds during the peak travel hours)
- Travel Time Index (a ratio of peak period travel time to free-flow travel time)

To measure existing and future congestion within the NYMTC planning area, the New York Best Practice Model (BPM) and a CMP Post-Processor are used as the analysis tools. Two types of analysis are performed to forecast traffic congestion within the planning area: a regional level analysis and a county-borough level analysis. The regional level analysis is performed to assess traffic congestion and the performance of the entire transportation system on a regional scale. It allows a means for assessing the effectiveness of major transportation improvements in addressing regional traffic congestion. The county-borough analysis is a subset of the regional analysis, which focuses on congestion and system performance in each county-borough in the planning area. The county-borough analysis can identify in more detail local areas of congestion within each of the region’s ten counties, as well as the effect of local transportation improvements for addressing local congestion.

Based on NYMTC’s most recent CMP analysis results (2014 Status Report), it was estimated that in the year 2014, 176.9 million vehicle miles of travel (VMT) would take place daily on the roadway network. This daily VMT is projected to increase by 12.3 percent, to 198.8 million by the year 2040. Comparing other results from the same report between 2014 and 2040, the travel time index for the AM and PM peak periods will remain stable at 1.3 and 1.1 respectively; the lanes miles of congestion would increase from 4,130 to 5,299 for the AM peak period and from 2,140 to 3,021 for the PM peak period. Similarly, the daily vehicle hour of delay would increase from 4.4 million hours to 6.1 million hours.

Population and employment growth in the NYMTC planning area may also contribute to higher congestion on the roadway network. Apart from capital initiatives, congestion improvement strategies and policy programs should be implemented in advance to prevent this from happening. These strategies previously mentioned in this chapter, can di-
rectly improve the operation and management of the congested segments of the transportation system. They can also improve congestion indirectly by promoting and directing travel demand to nonvehicular transportation modes. The improvements could range from major regional capital projects to local roadway enhancements and include all modes of transportation, as well as other land use and marketing strategies.

At a later date NYMTC will be working to address the performance measures requirements included in MAP-21 as discussed below.

**MAP-21 PERFORMANCE MEASURES AND STANDARDS**

The current federal legislation, Moving Ahead for Progress in the 21st Century Act (MAP-21) contains major changes to the metropolitan transportation planning process including the establishment of a performance-based planning and performance management for both highways and public transportation. MPOs and States are required to establish performance targets that address national performance measures established by the Secretary based on seven national goals. These targets must be set in coordination with the state and public transportation providers, within 180 days after the relevant state or public transportation provider sets performance targets.

The national goals and performance measures outlined in MAP-21 are to:

1. Safety: Achieve reduction in fatalities and serious injuries on all public roads.

2. Infrastructure Condition: Maintain highway infrastructure assets in state of good repair.


4. System Reliability: Improve the efficiency of the surface transportation system.

5. Freight Movement and Economic Vitality: Improve freight networks, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.

6. Environmental Sustainability: Enhance the performance of the transportation system while protecting and enhancing the environment.

7. Reduced Project Delivery Delays: Reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies’ work practices.

Performance Measures/Standards:

- Minimum standards for bridge and pavement management systems to be used by states
- Performance measures for pavement condition on the Interstate system
- Performance measures for pavement condition on the non-Interstate
- Performance measures for bridge conditions on the NHS
- Performance measures for the performance of the Interstate System
- Performance measures for performance of the non-Interstate NHS
- Minimum levels for pavement conditions on the Interstate System (which may be differentiated by geographic regions of the United States)
- Performance measures to assess serious injuries and fatalities per VMT
- Performance measures to assess the number for serious injuries and fatalities
- Performance measures for traffic congestion
- Performance measures for on-road mobile source emissions, and
- Performance measures to assess freight movement on the Interstate System

The performance measures and standards are based on the national goals and aligned to various program and policy areas including the National Highway Performance Program (NHPP), Highway Safety Improvement Program (HSIP), and the Congestion Mitigation and Air Quality Improvement Program (CMAQ), and Freight Policy.
Pedestrian safety is the first priority for the Safety Advisory Working Group (SAWG) and the NYMTC planning area.

Chapter 4

Plan 2040: NYMTC Regional Transportation Plan

4. Transportation Safety

INTRODUCTION

Safety is a key measure of the quality of the region’s transportation system. In 2005, the federal legislation “Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users” (SAFETEA-LU) elevated transportation safety to a national priority by requiring 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 guidance continued with MAP-21, which was signed into law in 2012. In keeping with this legislation, 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. The Council’s safety planning work is guided by its Safety Advisory Working Group (SAWG). NYMTC’s safety planning is also influenced by other federal, state and local plans, policies and guidelines, which are discussed later in this section. Plan 2040 establishes a new goal for the NYMTC planning area: to enhance the safety and security of the transportation system for both motorized and non-motorized users. The following outcomes have been identified to meet this goal:

- Reduced rate of annual injuries and 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 outcomes guide the core concepts of Plan 2040’s safety element. They are designed to help NYMTC and its member agencies target safety programs and funding priorities. The measures and strategies outlined in this section are also incorporated into NYMTC’s annual priorities, the Transportation Improvement Program (TIP), and will be carried forward into future Regional Transportation Plans (RTPs).

SAFETY DATA EVALUATION

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 approach 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 more clear as data analysis becomes streamlined and resources such as 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 and vehicle 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.

**TRANSPORTATION SAFETY TRENDS**

The National Highway Traffic Safety Administration (NHTSA) reports that in 2011, 32,367 people died in motor vehicle traffic crashes in the United States, the lowest number of fatalities since 1949, and a 1.9 percent reduction in such fatalities from 2010 (32,999). There was also a 1 percent reduction in injuries from motor vehicle crashes, from 2.24 million in 2012 to 2.22 million in 2011. Motorcyclist fatalities increased from 4,518 in 2010 to 4,612 in 2011, or 2.1 percent. Pedestrian fatalities also increased 3 percent, from 4,302 to 4,432, and bicyclist fatalities increased 8.7 percent, from 623 in 2012 to 677 in 2011. Motorcyclist, pedestrian, and bicyclist injuries decreased by 1.2 percent, 1.4 percent, and 7.7 percent, respectively, over the same time period.

Table 4.3: Crashes in the NYMTC Planning Area, 2009-2011

<table>
<thead>
<tr>
<th>Category</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Crashes</td>
<td>163,377</td>
<td>163,348</td>
<td>161,489</td>
</tr>
<tr>
<td>Total Fatal Crashes</td>
<td>529</td>
<td>544</td>
<td>534</td>
</tr>
<tr>
<td>Total Number of Motor Vehicle only Crashes*</td>
<td>144,042</td>
<td>142,501</td>
<td>141,245</td>
</tr>
<tr>
<td>Motor Vehicles Fatalities - Driver</td>
<td>231</td>
<td>238</td>
<td>212</td>
</tr>
<tr>
<td>Motor Vehicle Fatalities - Passenger</td>
<td>76</td>
<td>81</td>
<td>87</td>
</tr>
<tr>
<td>Motor Vehicle Injuries - Driver</td>
<td>70,249</td>
<td>69,382</td>
<td>66,384</td>
</tr>
<tr>
<td>Motor Vehicle Injuries - Passenger</td>
<td>34,993</td>
<td>33,330</td>
<td>33,330</td>
</tr>
<tr>
<td>Total Number of Pedestrian/Motor Vehicle Crashes</td>
<td>12,974</td>
<td>13,576</td>
<td>13,157</td>
</tr>
<tr>
<td>Pedestrian Fatalities</td>
<td>235</td>
<td>225</td>
<td>222</td>
</tr>
<tr>
<td>Pedestrian Injuries</td>
<td>12,655</td>
<td>13,365</td>
<td>12,986</td>
</tr>
<tr>
<td>Total Number of Bicycle/Motor Vehicle Crashes</td>
<td>4,036</td>
<td>4,649</td>
<td>4,592</td>
</tr>
<tr>
<td>Bicycle Fatalities</td>
<td>22</td>
<td>26</td>
<td>43</td>
</tr>
<tr>
<td>Bicycle Injuries</td>
<td>3,879</td>
<td>4,478</td>
<td>4,452</td>
</tr>
<tr>
<td>Total Number of Motorcycle Crashes</td>
<td>2,325</td>
<td>2,622</td>
<td>2,495</td>
</tr>
<tr>
<td>Motorcycle Fatalities</td>
<td>57</td>
<td>75</td>
<td>63</td>
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<tr>
<td>Motorcycle Injuries</td>
<td>2,042</td>
<td>2,292</td>
<td>2,190</td>
</tr>
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</table>

Source: New York State Department of Motor Vehicles (NYSDMV).
* These crashes do not not include pedestrians, bicyclists, or motorcycles.
The crash records show that the number of traffic crashes did not vary significantly between the years 2009 and 2011. However, comparing the number of crashes for the year 2011 and the average of 2009 and 2010, the total number of crashes decreased slightly, by 1.1 percent, but there was a 5.7 percent increase in bicycle crashes.

Both New York State and the NYMTC planning area followed the same safety trends from 2010 to 2011, although at varying rates. 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 4.4 shows accident data for the Metropolitan Transportation Authority (MTA) system for the period 2009-2011.

### Table 4.4: MTA Transit Accidents, 2009-2011

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bus Transit†</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>40</td>
<td>53</td>
</tr>
<tr>
<td>Fatalities</td>
<td>6</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Injuries</td>
<td>143</td>
<td>114</td>
<td>155</td>
</tr>
<tr>
<td><strong>Rail Rapid Transit‡</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
<td>153</td>
<td>165</td>
</tr>
<tr>
<td>Fatalities</td>
<td>51</td>
<td>51</td>
<td>54</td>
</tr>
<tr>
<td>Injuries</td>
<td>65</td>
<td>90</td>
<td>88</td>
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<tr>
<td><strong>Suburban Rail§</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>Fatalities</td>
<td>6</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>Injuries</td>
<td>11</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Transit Accidents</strong></td>
<td>184</td>
<td>200</td>
<td>253</td>
</tr>
</tbody>
</table>

Source: New York State Public Transportation Safety Board

† MTA/NYCT, MTA Long Island Bus, and MTA Bus
‡ MTA/NYCT and MTA/Staten Island Railway
§ MTA/Metro-North Railroad and MTA/Long Island Railroad
* Includes bus, rapid transit and suburban rail.

**Transportation Safety Efforts**

### Engineering and Planning Initiatives

Modern traffic engineering 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, and the use of crash reduction factors, can help inform design decisions and improve evaluations of past projects based on post-completion safety and operational data.

**Accident Location Information System (ALIS)**

NYMTC member agencies need improved access to data. Currently, accessing data is time-consuming and requires navigating several hurdles. The NYSDOT has developed ALIS and is working through the New York State Association of Metropolitan Planning Organizations (NYSMPO) Safety Working Group to expand MPO use of this web-based system that visually displays a crash data query in a GIS format. Feedback from the initial users of ALIS indicates it is a powerful tool for safety analysis. NYMTC will continue to support the use of ALIS and to ensure member agency access and training.

**Traffic Safety Data Viewer**

The NYCDOT 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. NYCDOT hopes to make this tool accessible to more NYMTC member and NYC agencies in the future.

**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. These features include sidewalks, paved shoulders suitable for use by bicyclists, bicycle lanes, share-the-road signage, crosswalks, pedestrian control signalization, bus pull-outs, curb cuts, raised crosswalks, ramps, and traffic calming measures designed to allow pedestrian and motor traffic to easily co-exist. 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. NYMTC agencies must consider complete streets design principles on all future projects which receive both federal and state funding.
Safe Streets for Seniors

NYC Safe Streets for Seniors is a mayoral pedestrian safety initiative for the elderly population in New York City. Along with the office of the Mayor of New York City, the NYCDOT and the Department for the Aging launched this program to improve elderly pedestrian safety. Through crash data analysis, 25 city neighborhoods were identified that have both a high density of senior citizens and a high number of crashes involving pedestrians. The Safe Streets for Seniors program identifies the main contributing factors to senior fatalities and injuries and implements appropriate safety improvements.

The SafeSeniors, a NYSDOT Pilot Program expanded targeted senior pedestrian initiatives to two areas in Nassau and Suffolk counties. The program focused on improvements for pedestrian safety that could be implemented quickly and at low cost. The intent of the program is to incorporate feedback to improve the program and expand statewide.

As part of its Livable Communities Program, Westchester County is actively involved in the AARP pedestrian needs program. A survey was launched in New York State by AARP to bring attention to the safety issues that pedestrians face and what needs to be improved in the pedestrian infrastructure. The survey evaluated 530 intersections across more than 30 counties throughout the state in the spring of 2011. The results of the survey highlighted several poor pedestrian conditions and driving behaviors which are listed in Appendix 2: Pedestrians and Bicycles.

Safe Routes to School (SRTS)

Safe Routes to School (SRTS) originated in New York City and was adopted nationally as a federally-funded program. SRTS is administered by NYSDOT and guides local projects throughout the state that relate to providing a safe environment for students to walk or cycle to school. Through SRTS, some agencies have identified “priority schools” and created safety improvement recommendations. In New York City, programs like Safety Town and Safety City that teach students about bicycle and pedestrian safety were noted as model programs. In Westchester County and in Long Island, SRTS workshops have been held in many communities and schools. NYMTC members should continue to focus safety improvements on schools with the highest crash rate and educational programs.

New York City Safe Routes to Transit

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 and convenience of mass transit. The three programs comprising the Safe Routes to Transit initiative are 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 will be 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, guardrails, 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. Where crashes tend to be randomly dispersed, a systemic approach should be utilized at locations that have specific safety issues. 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.

High Crash Corridor Programs

Consistent with newly enacted Complete Streets legislation, NYSDOT considers the entire transportation network when planning projects. NYSDOT also makes efforts to incorporate the Federal Highway Administration’s philosophy that data driven analysis should be used when deciding where to target limited funds. The “corridor approach” identifies systemic improvements to be implemented throughout the 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.

NYCDOT’s High Crash Corridors program, established by the 2010 NYC Pedestrian Safety Study & Action Plan, includes redesigns of at least 20 miles of High Crash Corridors annually, and upgrades (e.g. with signals or markings) of at least 40 additional miles of High Crash Corridors. High Crash Corridors are defined as the highest-ranked 1/3 of street mileage in each borough, in persons killed or severely injured (KSI) per
mile. The program's objectives have been exceeded in both years since it was initiated. The agency's goal, to which the program contributes, is a 50 percent reduction in citywide traffic fatalities from 2007 to 2030.

New York City's high crash corridor programs complement NYSDOT’s network screening process. NYSDOT performs an analysis each year to identify locations where an unusually high number of crashes occur. Each year a portion of these sites, called Priority Investigation Locations, or PILs, are studied to identify cost-effective safety measures. Improvements are implemented by maintenance forces or through capital construction projects.

**Education**

The FHWA's Pedestrian Safety Campaign is a comprehensive set of materials for local communities to use in implementing their own Pedestrian Safety Campaign. 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 Safe Routes to Schools and Transit initiatives, as well as ongoing safety education forums focused primarily on children and seniors.

**Enforcement**

STOP DWI is an important program implemented 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 (BUNY), 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. BUNY grants are for seat belt enforcement and compliance. Child Passenger Safety grants support child passenger fitting stations, training, and child restraint education. NYMTC will continue to monitor new trends and participate in emerging focus areas.

**PRIORITY AREAS AND STRATEGIES**

**Priority Areas**

The Council has identified 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. It is a NYMTC priority 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 the first priority for the Safety Advisory Working Group (SAWG) and the NYMTC planning area. A disproportionate number of the crashes involving pedestrians occur in the NYMTC planning area: based on 2010 Census and the three-year average (2009-2011) New York State Department of Motor Vehicles (NYSDMV) data, while only 64 percent of the state residents live in the NYMTC planning area, 83 percent of pedestrian injuries and 73 percent of pedestrian fatalities occur in the region. However, the NYMTC planning area is one of the safest places in the United States to walk. Among 52 metropolitan areas with populations over one million, New York-Long Island-Northern New Jersey was the third-safest in pedestrian fatality rates, controlling for walk-to-work rates. Although New York City accounts for a large share of the NYMTC planning area's pedestrian activity, every community within the region has a central 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, the population aged 65 and older increased by 7.8 percent from 2000 to 2010, from 1,478,220 to 1,593,012. Between 2005 and 2007, 255 pedestrians aged 65 years and older were killed on the NYMTC area roads. Though they comprised less than 12 percent of the area's population, people aged 65 and older accounted for 30 percent of the total pedestrian fatalities during the three-year period. While the older adult population continues to be a vibrant and productive part of the society, its walking ability due to age is more challenging compared to other adults. Therefore, providing safe mobility for older adults is a priority in the region. The key components to safety and mobility would be to eliminate barriers to pedestrian activity for all ages and to prioritize a list of short- and long-term pro-pedestrian safety improvements.

In addition to seniors, child pedestrians are a priority area for safety. Each week in New York State, 20 children age five to nine years are treated at a hospital because of a pedestrian-related injury; four of them are injured severely enough to require hospitalization. These injuries are the second leading cause of unintentional injury hospitalization and death among this age group.

**Motor Vehicles**

Intersections are a planned point of 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. Despite increased emphasis on intersection safety with improved intersection design and more sophisticated applications of traffic engineering measures, the annual toll of human loss due to motor vehicle crashes has not substantially decreased in more than 10 years (from 1998 to 2007).74

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 (21 percent), and pedestrian crashes (11 percent).75

The New York State Strategic Highway Safety Plan (SHSP) states that lane departures and intersections represent the highest fatality areas in the state. Lane departures represent 34 percent of all the state’s fatal crashes, while 36 percent of the state’s fatal crashes occurred at intersections.

Distracted driving continues to be a national problem. In 2011, 3,331 people were killed in crashes involving a distracted driver and 387,000 people were injured.76 While 39 states have recently banned text messaging for all drivers,77 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 2011 NYSDMV crash data show that more than 77 percent of crashes in New York State are related to human factors.78 Safety issues related to driver behavior include impaired driving or driving under the influence,79 speeding and aggressive driving, and occupant protection. 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 (age 65 and above), according to NYSDMV, in 2011, senior drivers comprised 10 percent of all drivers in New York State but were involved in 13.6 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 has also increased. With more motorcycles on the road than ever before and increasing crash rates this mode of transportation requires a special focus in relation to roadway safety.

**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, to improve safety for bicyclists and all roadway users. Educational programs for drivers, bicyclists, and pedestrians, like Coexist New York States, Share the Road, and Bike Smart Campaigns, also improve safety. Additional information about bicycle safety is in Appendix 2: Pedestrians and Bicycles.

**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 offices complexes, malls, and hospitals.

**Transit**

Various transit systems in the NYMTC
Building Partnerships between Agencies and Stakeholders

All transportation operating agencies in the NYMTC planning area have formed partnerships with other public agencies, including police departments 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 of the agencies within 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 could 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 should continue to participate in the New York State Association of Metropolitan Planning Organizations (NYSMPO) Safety Working Group, where statewide issues are addressed and future issues are identified.

Continue Education and Training

Promoting an awareness of safety strategies for all road users, along with improving roadway geometry, 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.

NYMTC recognizes that community-based workshops have been particularly effective at bringing together stakeholders around common issues. With continued federal and state programming support, NYMTC will continue to sponsor training workshops on 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 85 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. The program also calls for the transportation community to think beyond traditional approaches and to consider low cost,

Although the above areas are elevated in importance, the transportation planning process addresses other safety issues as well. These include motor carrier safety for large trucks, emergency medical vehicles (these issues are addressed by other agencies), and trucks mistakenly driving onto parkways and striking overpasses with low height clearance.

Strategies

Several strategies will be used together 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 2040’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.

The transportation planning process addresses other safety issues as well. These include motor carrier safety for large trucks, emergency medical vehicles (these issues are addressed by other agencies), and trucks mistakenly driving onto parkways and striking overpasses with low height clearance.

Plan 2040: NYMTC Regional Transportation Plan
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. Studies show a 12 percent to 19 percent fatality reduction in Focus State areas from 2002 to 2008.\(^8\)

**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 agencies should consider this tool in its efforts to systematically address safety issues.

**Crash Reduction / Crash Modification Factor (CRF / CMF)**

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.

**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 preservation may be accomplished through both capital and maintenance efforts.

**Explore and Expand Emerging Strategies**

Explore emerging strategies such as “Vision Zero” and expand Automated Enforcement. The Swedish Parliament introduced a new approach to road safety called “Vision Zero” in 1997 that focuses on prioritizing human life and health over mobility through speed reduction and design. Vision Zero is based on a refusal to accept human deaths or lifelong suffering as a result of road traffic accidents. Sweden reduced fatalities and serious injuries by nearly 50 percent since 1997. Included in the reduction are the decrease in the number of overall deaths from 541 in 1997 to 319 in 2011; a decrease in pedestrian deaths from 72 in 1997 to 53 in 2011, and a decrease in cyclist deaths from 42 in 1997 to 21 in 2011.

Although red light cameras have been in use for some years, an expansion of automated enforcement strategies would place additional cameras and explore the use of speed cameras. Cameras are currently placed in a few counties throughout the region; the installation of additional cameras or of speed cameras would require changes in legislation. Studies indicate that the fatality rate drops to 45 percent when a person is struck by a car going 30 miles per hour compared to higher speeds and to 5 percent at 20 miles per hour or less.\(^9\)

**OTHER PROGRAMS AND PLANS IMPACTING TRANSPORTATION SAFETY PLANNING**

**Strategic Highway Safety Plan (SHSP)**

The Strategic Highway Safety Plan (SHSP) is New York State’s plan that establishes highway safety goal areas. NYMTC is working with other New York State stakeholders toward achieving the statewide goals and efforts promulgated within the SHSP. The SHSP feeds into the safety element of Plan 2040, which provides input back into the SHSP.

**The Governor’s Traffic Safety Committee’s (GTSC) Highway Safety Strategic Plan (HSSP)**

The Governor’s Traffic Safety Committee (GTSC) administers the National Highway Traffic Safety Administration’s (NHTSA) Section 402 funds. 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.

**New York City Pedestrian Safety Study and Action Plan**

The first New York City Pedestrian Safety Report and Action Plan examined over 7,000 records of crashes that have caused serious injuries or fatalities to pedestrians, identified underlying crash causes, and recommended safety improvements. NYCDOT used this data to inform the public about the agency’s work to reduce traffic fatalities and make New York City...
streets safe for everyone. The report concludes that pedestrian fatalities occur disproportionately along multi-lane streets and avenues, and that speeding, driver inattention, and failure to yield are the major underlying factors behind most of pedestrian fatalities or serious injury crashes. The report recommends a series of actions to continue to reduce pedestrian crashes, including pilot programs to reduce speed limits to 20 mph and street redesigns to increase pedestrian safety. The Action Plan also called for NYCDOT to launch an anti-speeding ad campaign to improve safety for pedestrians, motorists, and cyclists throughout the city.

Complete Streets Programs

NYSDOT is currently applying Complete Street provisions on a statewide basis in its project planning, programming, and delivery processes. The applicability of Complete Street features is considered at each stage of project development. A framework has been developed to guide this process for state- and federally-funded projects. An important component of this framework is the Pedestrian Generator Checklist, which is routinely used by planners and designers to identify a need for current or future pedestrian accommodations in a given project. Guidelines are also being developed for projects funded by municipalities. Because NYSDOT and local agencies share the responsibility of implementing Complete Streets, the ability of municipalities to identify opportunities for Complete Street features, and ultimately to install them, will be critical to achieving safer and more sustainable communities.

Highway Safety Improvement Program (HSIP)

NYSDOT manages the Highway Safety Improvement Program (HSIP) using a collaborative approach. In addition to administering regional transportation safety projects, NYSDOT solicits proposals for safety projects through initiatives selected by the Statewide Safety and System Optimization Team. This centrally managed portion of the program allows NYSDOT to support safety-specific projects that direct safety funds to locations, corridors, and areas that demonstrate the highest benefit-cost ratios to reduce fatal and severe injury crashes. 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 New York State Strategic Highway Safety Plan (SHSP). Both targeted and systematic projects are eligible for HSIP funding. NYMTC will continue to work with New York State to identify future projects appropriate for this program.
5. TRANSPORTATION SECURITY

NYMTC members adhere to the guidelines of federal and state emergency plans, such as the Federal Transit Administration (FTA) Safety & Security Plan, State Homeland Security Strategy, and New York’s State Preparedness Report, to create their own emergency procedures as they see fit. They also participate in meetings with other agencies and regional authorities to periodically review their planning, response and mitigation measures and to make refinements as necessary. The regional agencies, led by the NYS Division of Homeland Security & Emergency and the NYC Office of Emergency Management, take responsibility for educating residents in their areas in emergency procedures before, during and after an event. Furthermore, these agencies devise plans for disaster preparedness and emergency relief for all possible situations, e.g., coastal storms, flash floods, snow storms, as well as planning for the distribution of commodities, continuity of operation, evacuation, sheltering and mass fatalities.

Emergency events, whether natural or man-made, can impact the entire environment of an area thereby affecting land based and in-water infrastructure. 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 Hurricane Sandy, NYMTC members have been working diligently on understanding and implementing measures to address vulnerabilities in the regional transportation system. The recent extreme weather events have only strengthened NYMTC’s commitment to the planning and implementation of security procedures and infrastructure improvements appropriate for each county.

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 the NYMTC planning area. For major emergencies, coordination with media (i.e., television, radio, and the internet) is used to inform and give instructions to the public. A recent example of an effective large-scale emergency coordination effort was that which occurred during Hurricane Sandy in October, 2012. The coordination for this disaster involved federal agencies working closely with multiple state and local agencies along with media and many volunteers to address effectively the response efforts. However, Sandy also highlighted the need for NYMTC members to focus efforts on adapting the transportation system to order to increase resiliency to the impacts of climate change and weather.
Looking forward, their planning processes will be expanded in the following ways:

• The MTA will re-examine its infrastructure to try to prevent the kind of damage that Sandy inflicted. For example, MTA New York City Transit is well underway with plans to enhance operations planning response; coordinate with federal, state and city agencies and the real estate community to protect vulnerable zones; investigate concepts to harden assets; and capture lessons learned across the organization for better information sharing.

• 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.

• The New York State Department of Transportation (NYSDOT) is 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 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 would facilitate potential evacuation.

• New York City is applying lessons learned from the storm recovery to better prepare and respond to any similar disasters in the future. In terms of immediate recovery of travel options within the city, pedestrian and bicycle access across major bridges was critical. Over 18,000 people crossed the four East River bridges on foot or bicycle after the storm, an increase of more than 13,000 above everyday numbers. The temporary ferry service to southern Staten Island gave planners a sense of latent demand for such a service in the future. The East River Ferry and the “bus bridge” from Atlantic Station to Manhattan also formed critical parts of the connection between Manhattan, Brooklyn, and Queens in the immediate days after the storm.

• 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 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 the county’s new GIS tool 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.

• In Suffolk County, initial lessons of Sandy underscore the urgency of some of the plans already being pursued, including an initiative to Connect Long Island through innovative mass transit – 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 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.

- In Nassau County, 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 to 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 and signals to its evacuation routes and tie those routes to the Center.

Climate change increases the likelihood of passenger discomfort, service disruptions, and pavement damage. While preparation is essential to the security of our regions, it is also important to reduce our contributions to climate change by decreasing the production of greenhouse gas emissions caused by the transportation sector. Hurricane Sandy illustrated the importance of a resilient transit system within the NYMTC planning area; assessing the aftermath will be key to developing plans for the future. By educating both the residents who depend on a secured transportation system and the operations and maintenance staff on whom the network relies, NYMTC members are working to develop a transportation network that is safer and better prepared for emergencies. NYMTC’s involvement in these activities is described below at the federal, state and regional levels.

**FEDERAL LEVEL**

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) with the mission to protect the nation’s transportation systems, ensuring the freedom of movement for people and commerce. 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 each administration within the U.S. Department of Transportation is involved with different aspects of transportation security.

**STATE LEVEL**

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 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 counter-terrorism 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.

*The New York State Department of Transportation (NYSDOT)*

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 state-wide 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.

REGIONAL LEVEL

Security planning for the NYMTC planning area and for the region-wide transportation system is the responsibility of many agencies and institutions. Since security depends on extensive communication and coordination, 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.

One regional preparedness and emergency response planning effort by the Department of Homeland Security is the Regional Transit Security Working Group, whose members include various transit operators: the MTA, NYCDOT, Westchester County; NJTransit, PA-NYNJ, Amtrak, Connecticut DOT; and CTTransit.

The Department of Homeland Security also funds a regional catastrophic planning initiative across New York, New Jersey, Connecticut, and Pennsylvania. This program is led by the Regional Catastrophic Planning Team (RCPT), which directs the work of its operational arm, the Regional Integration Center (RIC). The focus of this initiative is to improve regional security and resilience through a “fix, build, and resource” process and includes fixing shortcomings in existing plans, building regional planning processes and planning communities, and linking operational needs identified in plans to resource allocation.

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 contra flow plans for coastal flooding.
- 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 hurricanes Irene and Sandy. 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.

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.

Putnam County

The plans for disaster preparedness in Putnam County are mandated and instituted by the county, but carried out by Transit First, the operator of Putnam 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. As for general emergency preparedness, Putnam County OEM formulates plans for all large-scale emergencies within the county. The OEM of Putnam County is in charge of the following emergency preparations:

• Emergency Equipment Stockpile: The OEM 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.^{83}

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 Office. 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 exercises.^{84} Similar to Rockland County, Putnam County facilitates a coordinated framework on the federal level by following the FTA’s Triennial Review requirements and using these requirements to update the FTA Safety and Security Plan.

Westchester County

Westchester County’s preparedness and relief plans and activities are managed by the Westchester County Office of Emergency Management (OEM), which works with local, county, state, federal and private sector partners in emergency management to plan and prepare for large-scale, multi-jurisdictional responses to all natural or man-made disasters. The Westchester County Department of Public Works & Transportation (WCDPW&T) participates regularly in activities coordinated by the County OEM including:

• Meetings, training, drills and exercises coordinated by the OEM. Other participating agencies include nearly all departments of county government, local government and many non-governmental organizations.
• Westchester County Emergency Preparedness Group – Chaired by the County OEM, all departments of County government participate. Monthly meetings focus on current, relevant topics related to County preparedness for future disaster events, and includes analysis of the management of past events.

• Meetings and other activities of the U.S. Department of Homeland Security Regional Transit Security Working Group. Other participating agencies include the MTA, NYCDOT, NJTransit, PANYNJ, Amtrak, Connecticut DOT and CTTransit.

The Westchester County Department of Public Works & Transportation also adheres to procedures in following county-wide plans:

• Westchester County Comprehensive Emergency Management Plan. Managed by the County OEM, this plan provides an overarching framework for the County’s preparedness response in relation to all types of hazards and their associated recovery efforts.

• Indian Point Radiological Emergency Preparedness (REP) Plan and Procedures for Westchester County. A plan maintained, updated and coordinated by the County OEM, involving the participation of nearly every department of county government, as well as of thousands of potential emergency responders. Most of the resources and expertise developed to deal with an emergency at Indian Point can be readily applied to respond to most other major emergencies. The Indian Point REP Plan is exercised annually and evaluated alternately by the Federal Emergency Management Agency (FEMA) or by the New York State Emergency Management Office.

• Coastal Storm Annex Plan. Delineates Westchester County’s preparedness, response and recovery efforts before, during and after hurricanes or other coastal storms. In the event of a hurricane or coastal storm threat, it is the goal of the County to support local jurisdictions in protecting lives and minimizing property losses; coordinating the rapid resumption of operations and services; and facilitating post-disaster cost recovery activities.

The Westchester County Department of Public Works & Transportation has been and continues to be involved in the following emergency related planning efforts and in any ongoing updates as needed:

• Security Assessment of Westchester County’s Bee-Line Bus System – Includes security risk assessments for all components of the Bee-Line System and recommended security policies, procedures and measures to be undertaken.

• Security Emergency Preparedness Plan for the Bee-Line System – Outlines a program of standard procedures for the Bee-Line System and its operators to have in place to protect against terrorist attack.

• Transit Strike Plan – Outlines Bee-Line System procedures in relation to a union strike against the Bee-Line System.

• Emergency Operating Procedures for the Bee-Line System including: a Snow Emergency Plan; Service Plan in the Event of the Interruption of Service on MTA Metro-North Railroad; and Indian Point Emergency Procedures and Plan.

On the federal level, WCDPW&T 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.

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 database 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.

{}\textit{New York City Department of Transportation (NYCDOT)}

To plan for disaster preparedness and emergency relief, the NYCDOT and New York City Office of Emergency Management meet 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, NYCDOT has worked with multiple agencies 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 the NYCDOT 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, NYCDOT meets with the city 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, NYCDOT is prepared to coordinate on the federal level.
ENDNOTES


2 Ibid.


10 Ibid.


70  Metropolitan statistical areas (metro) are geographic entities delineated by the Office of Management and Budget for use by Federal statistical agencies. A metro area contains a core urban area of 50,000 or more population and consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties that are integrated (as measured by commuting to work) with the urban core. The New York City region is within the New York-Northern New Jersey-Long Island, NY-NJ-PA Metropolitan Statistical Area. http://t4america.org/resources/dangerousbydesign2011/states/worst-metros/.


72  http://www.health.ny.gov/prevention/injury_prevention/children/fact_sheets/older_children_5-9_years/pedestrian_safety_5-9_years.htm


74  http://safety.fhwa.dot.gov/intersection/resources/fhwas10005/brief_2.cfm

75  http://safety.fhwa.dot.gov/fas/guidebook.cfm#eligibility


77  Ibid.


79  In New York State in 2010, there were 365 alcohol impaired driving fatalities and 36,578 people were arrested for driving under the influence. http://www.centurycouncil.org/state-facts/new-york. Website accessed January 31, 2013.

80  http://safety.fhwa.dot.gov/fas/factsheet.cfm

81  http://www.nytimes.com/2013/03/10/nyregion/after-a-spate-of-vehicular-deaths-is-it-safe-to-cross-the-road.html?_r=1&


84  http://www.pcbes.org/emergencymanagement/index.htm