GTC

Genesee Transportation Council

Genesee-Finger Lakes Regional Transportation System Management and Operations (TSMO) Plan

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GTC's Commitment to the Public

The Genesee Transportation Council assures that no person shall, on the grounds of race, color, national origin, disability, age, gender, or income status, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity. GTC further assures every effort will be made to ensure nondiscrimination in all of its programs and activities, whether those programs and activities are federally funded or not.

En Español

El Consejo Genesee del Transporte asegura completa implementación del Título VI de la Ley de Derechos Civiles de 1964, que prohibe la discriminación por motivo de raza, color de piel, origen nacional edad, género, discapacidad, o estado de ingresos, en la provisión de beneficios y servicios que sean resultado de programas y actividades que reciban asistencia financiera federal.

Table of Contents

List of Acronyms

- CCTV – Closed-Circuit Television
- CMP – Congestion Management Process
- CVRIA – Connected Vehicle Reference Implementation Architecture
- DMS – Dynamic Message Sign. Also known as VMS (Variable Message Sign) or CMS (Changeable Message Sign)
- GTC – Genesee Transportation Council
- FAST – Fixing America's Surface Transportation Act
- FHWA – Federal Highway Administration
- FTA – Federal Transit Administration
- ICM – Integrated Corridor Management
- ITS – Intelligent Transportation Systems
- LRTP – Long Range Transportation Plan
- MaaS – Mobility-as-a-Service
- MAP-21 – Moving Ahead for Progress in the 21st Century Act
- MCDOT – Monroe County Department of Transportation
- MPO – Metropolitan Planning Organization
- NITSA – National Intelligent Transportation System Architecture
- NYSDOT – New York State Department of Transportation
- NYSTA – New York State Thruway Authority
- NYSP – New York State Police
- RGRTA – Rochester-Genesee Regional Transportation Authority
- RITSA – Regional Intelligent Transportation Systems Architecture
- RTOC – Regional Traffic Operations Center

- RTS – Regional Transit Service
- TaaS – Transportation-as-a-Service
- TIC – Traffic Incident Committee
- TIP – Transportation Improvement Program
- TMC – Transportation Management Committee
- TSMO – Transportation System Management and Operations
- UPWP – Unified Planning Work Program

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Genesee-Finger Lakes Regional Transportation System Management and Operations (TSMO) Strategic Plan

EXECUTIVE SUMMARY

Overview

The Genesee Transportation Council (GTC), in cooperation with partner agencies in the Genesee-Finger Lakes region, has developed this Transportation System Management and Operations (TSMO) Strategic Plan to guide future investments in and proactive operation of the multi-modal transportation system using Intelligent Transportation Systems (ITS) technology.

Regional stakeholders first developed a plan for the use of advanced transportation technology in 1996 (the *IMAGE Report*). The *IMAGE Report* was replaced by the *Intelligent Transportation System (ITS) Strategic Plan for Greater Rochester* in 2011 to reflect implementation progress, technological advances, national best practices, and regional needs, with an increased emphasis on operational objectives and roles in addition to technology.

This plan, the *Genesee-Finger Lakes Regional Transportation System Management and Operations Strategic Plan*, is intended to guide regional TSMO policies, partnerships, programs, and investments over the next decade.

This plan covers the entire GTC planning region encompassing nine counties, nearly 200 municipalities, 4,700 square miles, and 1.2 million residents. In recent years, the majority of TSMO programs have focused on the Metropolitan Planning Area (MPA) of urbanized Monroe County and this plan continues that emphasis.

The TSMO plan presents a strategy that is multi-agency, multi-jurisdictional, and multi-modal. It addresses:

- The Rationale for TSMO Investment ("Why?")
- Roles & Responsibilities ("Who?")
- Operational Strategies ("What?" and "How?")
- A Ten-Year Implementation Timeframe ("When?")

What is TSMO?

According to the United States Department of Transportation, Transportation System Management and Operations is defined as:

....integrated strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system.

Fixing America's Surface Transportation (FAST Act), 2015

Why is TSMO Important to the Rochester-Genesee Region?

TSMO provides a relatively low-cost alternative to enhance safety, improve access and mobility, reduce congestion, and provide travelers with increased choice. The cost-effectiveness of TSMO is important given the many competing demands for the region's limited transportation funding.

The cost of technological and operational investments in TSMO programs are often a fraction of the cost of conventional infrastructure improvements, and typically TSMO solutions can be delivered in a far shorter timeframe.

Much of the traffic congestion in the Rochester-Genesee region is caused by "non-recurring" events including traffic incidents and weather. Because these events can effect different locations in the regional transportation network at different times, they cannot be cost-effectively solved through capacity expansion alone.

TSMO strategies such as incident management, traffic signal coordination, and traveler information can help mitigate the need for costly infrastructure expansion projects.

Effective use of data and technology also increases the convenience of accessing multi-modal transportation options, improves traveler decision making, and supports performance measurement. In short, TSMO complements the region's overall transportation investment strategy of focused improvements on maintaining and improving the performance and longevity of the region's existing infrastructure.

TSMO in the Rochester-Genesee Region Today

For nearly 20 years, regional agencies having been making investments in ITS technologies and partnerships to realize the benefits of TSMO in the region.

There are diverse examples of TSMO benefits in the Rochester-Genesee Region today, including:

- The **Regional Traffic Operations Center (RTOC)**, a regional traffic management and operations center staffed by personnel from the New York State Department of Transportation-Region 4, the Monroe County Department of Transportation, and the New York State Police.
- Traffic **incident management and response** programs involving transportation and emergency response agencies.
- The **New York State 511 Traveler Information System**, available through a website, mobile devices, and telephone.
- **RGRTA transit management systems** including computer-aided dispatch, real-time traveler information systems, electronic fare collection, and other systems to improve the efficiency, reliability, and convenience of public transportation.

The Rochester-Genesee region has long been recognized for its cooperative approach to transportation operations. The multi-agency Transportation Management Committee (TMC) and Traffic Incident Management (TIM) Committee are two examples of voluntary partnership initiatives to build and maintain an effective regional TSMO program.

Progress since the 2011 Plan

Substantial progress has been achieved in implementing the 2011 *ITS Strategic Plan* initiatives. Examples include:

- Operation and maintenance of core ITS field instrumentation and communications systems
- Infill ITS deployment to improve operational capabilities (e.g., CCTV coverage along the expressway network)
- Traffic and weather incident management programs and interagency coordination
- Traffic signal central system integration and select expansion
- Instrumentation of expressway detour/diversion routes
- Upgrade of the NY511 and other traveler information systems
- Advanced transit management systems, including wayside and online real-time passenger information
- Port of Rochester event management capabilities
- Expansion of communications infrastructure and development of a NYSDOT/MCDOT fiber sharing agreement
- Use of operations data for regional transportation analytics and performance measurement

Regional TSMO Vision

The regional vision for TSMO in the Rochester-Genesee Region was defined by the project Steering Committee as follows:

Transportation System Management and Operations (TSMO) in the Rochester-Genesee region improves the efficiency, safety, and convenience of the multi-modal transportation system through the use of advanced transportation technologies, free flow of information and data, and partnerships among public agencies and other transportation service providers."

The Transformative Impact of Emerging Transportation Technology

Since the *ITS Strategic Plan* was prepared in 2011, there have been significant developments in the public and private sectors related to deployment of advanced transportation technologies, including the emergence of Connected, Automated, Autonomous, Shared (i.e., Transportation Network Companies), and Electric vehicles at unprecedented scale and with increasing commercial viability.

In 2016, the City of Rochester, in partnership with community stakeholders, prepared a proposal in response to the USDOT's *Beyond Traffic* Smart City Challenge—one of 77 national responses to the prestigious competition. The region's proposal highlighted new possibilities and partnerships being forged by the future of mobility, as well as the integration of advanced technology into related smart cities sectors like energy, healthcare, and education.

These emerging technologies are generating a vigorous national dialogue and promise to reshape the transportation sector. Within the five to ten year timeframe of this plan, is it reasonable to anticipate deployment of these transformative technologies in the Rochester-Genesee region.

While the impacts and implications of these emerging technologies are just beginning to be understood, it is important that their potential impacts and benefits are recognized and incorporated into the regional TSMO strategy.
The Rochester-Genesee region has harnessed the opportunities presented by ITS technologies, mobile internet devices, and many other innovations in the past.

Agencies in the region are aware of the need to continue to monitor and embrace these opportunities for the benefit of the region. Doing so requires a willingness to explore new partnerships, infrastructure, policies, and business models.

Other Key Issues and Opportunities

In addition to the challenges and possibilities offered by emerging technologies, Steering Committee members identified other opportunities and challenges the regional TSMO program over the next five to ten years. Some of these issues are longstanding concerns of the region, including sustainable funding sources; other issues like asset management are of increasing importance as existing ITS field instruments reach the end of their useful life.

- **Focus on Core Capabilities and Corridors:** Progress towards the objectives in the 2011 plan was driven by priorities of the implementing agencies within available means and policy frameworks. When preparing this plan, stakeholders recognized the practical benefit of focusing on realistic and attainable strategies that align with agency needs, capacity, and available funding.

- **Asset Management for ITS and Communications:** Other areas of transportation, such as pavement and bridge management, have seen increased use of asset management tools and methods for quantifying and prioritizing needs for capital re-investment. As much of the ITS infrastructure in the region reaches the end of its useful life, there is a recognized benefit of applying an asset management approach for ITS and communications infrastructure to create a more systemic approach to TSMO capital planning. The reinvestment cycle for TSMO must reflect the relatively short lifespan of technology infrastructure (5-15 years) as compared to conventional transportation infrastructure.

- **Need for Sustainable Capital and Operating Funding:** While TSMO programs are relatively low cost compared to infrastructure expansion projects, sustained funding sources for TSMO-related capital and operational investments can by challenging to identify. Quantification of needs and benefits are seen as key to making the regional case for TSMO funding.

- **Performance Measurement:** Federal legislative requirements for transportation system performance measurement are spurring local investment in systems that leverage operations data to better understand regional transportation system performance. One of the greatest benefits of TSMO is addressing the impacts of nonrecurring congestion. There is a virtuous cycle between enhancing the ability to measure and quantify non-recurring traffic events and making the case for investing in TSMO strategies like incident management, improved signal control, and traveler information.

- **Awareness and Advocacy:** There is an ongoing need for efforts to raise awareness of TSMO benefits and needs in the region among decision makers and peer practitioners in the transportation profession. This will require concerted outreach by TSMO stakeholders to ensure that there is broad awareness of the impact of TSMO strategies as a means of cost-effectively meeting regional transportation goals.

Community Engagement

During the planning process, GTC engaged an extended group of community stakeholders representing public, private, and not-for-profit agencies involved in transportation and technology innovation in the region.

Two Community Symposia (December 2016 and June 2017) were held to engage these stakeholders and obtain input on regional issues and opportunities.

Participants in Rochester's application for the 2016 USDOT Smart City Challenge were involved in the outreach process to ensure continuity and cross-fertilization of Smart Cities ideas and innovation. Key feedback from the Community Symposia included:

- Shift focus from individual modes to **integrated mobility across modes**.

- Recognition of the potential of **emerging technologies**, including connected, automated, and autonomous vehicles; ride-sharing and ride-hailing; electric vehicles; big data; the Internet of Things, and Smart Cities.

- The need to develop **new partnerships and approaches** to leverage emerging technologies, including involvement by private sector entities driving standards and service investments.

- The **interconnectedness of smart cities and advanced technology** with other areas of public concern, including economic development, poverty reduction, and environmental stewardship. For example, new mobility solutions may help to address equity issues and access to opportunity.

- The need to **prepare infrastructure for emerging technologies**, such as traffic signals, communications, and data interfaces/standards, and physical infrastructure like autonomous vehicle drop off/pick-up zones.

- Awareness of unsolved challenges and public concerns such as **privacy and data ownership**.

Project Steering Committee

The TSMO Strategic Plan update was guided by an interagency Steering Committee representing multiple transportation modes and emergency management representatives drawn from federal, state, county, and local governments.

The Steering Committee was comprised of representatives of the following organizations:

- Federal Highway Administration (FHWA)-New York
- New York State Department of Transportation (NYSDOT) - Region 4
- New York State Police (NYSP)
- New York State Division of Homeland Security & Emergency Services
- Monroe County Department of Transportation (MCDOT)
- Monroe County Office of Emergency Management (MCOEM)
- Monroe County Sheriff
- Rochester-Genesee Regional Transportation Authority (RGRTA)
- City of Rochester
- Genesee Transportation Council (GTC)

Regional TSMO Objectives

The Steering Committee developed ten Regional TSMO Objectives that express the focus of TSMO activities and investments in the future. Rather than being agency- or modal-specific, they capture broader themes and opportunities for collaboration at the regional scale to address longstanding and emerging challenges and opportunities.

In the TSMO Plan, each of the following Objectives is associated with specific Initiatives to be undertaken in the region, as well as Targeted Outcomes.

1. **Improve the Safety and Efficiency of the Multi-Modal Transportation System through Coordinated Management and Operations**
2. **Maximize Transportation System Performance from the User Perspective**
3. **Implement TSMO as a Low-Cost Solution to Regional Transportation Needs**
4. **Target Investment in New ITS and Communications Infrastructure where Benefits and Value are Greatest**
5. **Prepare for Emerging Technologies with a Potential Transformative Impact on Regional Transportation**
6. **Promote Partnerships and Collaboration to Support Regional Operations**
7. **Integrate TSMO into Regional Planning and Policy Making**
8. **Maximize Program Efficiency through Resource and Cost Sharing**
9. **Support Long Term TSMO Operations and Capital Investments through Sustainable Funding and Asset Management**
10. **Promote Interoperability and Value-Add Services through Shared and Open Data**

Regional TSMO Corridors

The Steering Committee identified multi-modal TSMO corridors across the Rochester-Genesee region based on transportation characteristics (e.g. volume, congestion), available TSMO strategies, and agency capacity for ITS/communications infrastructure investment and sustained ongoing operations.

Regional TSMO Corridors have been categorized as Tier 1 and Tier 2:

- **Tier 1 Corridors** (Figs. ES-1 and ES-2) are priorities for investment based on regional operational significance. They includes regional expressways, major state highways, and key urban arterials. Many of these corridor have significant existing ITS investment, but may be due for renewal or replacement of aging assets or infill of gaps in the network.

- **Tier 2 Corridors** (Figs. ES-3 and ES-4) are corridors targeted for more focused investment based on the capacity of regional agencies to invest and sustain operations in additional corridors. Tier 2 corridors include NYSDOT and MCDOT-operated facilities of growing operational significance. Characteristics may include: multi-modal corridors; congestion, incident, and event management hotspots; localized development and traffic growth; and/or Interstate, Thruway, or expressway diversion routes.

Most of the TSMO corridors are located in the Metropolitan Planning Area (MPA); other key regional corridors, including the New York State Thruway, are region-wide. A notable feature of planned NYDOT growth is an increase in the number of secondary radial highways from Rochester into surrounding Monroe County and beyond, as well as non-radial corridors elsewhere in the region like the U.S. 20 corridor.

All Tier 1 and Tier 2 corridors are regionally significant from a TSMO perspective, and many contain existing ITS and communications infrastructure instrumentation. Future investment or infrastructure replenishment will be guided by demonstrable need, consideration of the cost-benefit of TSMO investment, and the agreement of the agency or agencies involved to support ongoing operation of one or more TSMO strategies.

Regional Implementation Priorities

The plan reflects the participating agencies' desire to focus on realistic and attainable goals that consider limitations in agency capacity and funding. Therefore the recommendations of the plan emphasizes core functions and selected functional and geographic expansions.

Regional implementation priorities over the next 1-3 years are categorized under the following themes:

- **Promoting Regional TSMO Coordination:** The foundation of the Genesee-Finger Lakes region's TSMO program will continue to be voluntary cooperation among transportation and emergency management agencies to plan, fund, implement, and operate TSMO programs that address common goals and fulfill the public's expectation for a seamless and efficient regional transportation system. As in the past, the Transportation Management Committee (TMC) will continue to provide a regional forum for interagency coordination, supplemented by focused working groups as the need arises.

- **Renewing and Expanding ITS Infrastructure:** Emphasis over the next several years will transition from widespread geographic and functional expansion of ITS and communications infrastructure to renewal and maintenance of existing assets. A new asset management approach is recommended to quantify infrastructure re-investment needs to sustain current capabilities and geographic coverage. Limited expansions of the ITS and communications network will be evaluated based on careful consideration of cost/benefit, as well as long-term operations and maintenance obligations incurred by expanded infrastructure.

- **Building New Partnerships for Smart Cities and Emerging Mobility:** Building on the momentum of the Smart Cities Challenge and the TSMO Community Symposia is important for harnessing the opportunities of Smart Cities and emerging mobility technologies. The next step is to continue the dialogue with interested non-traditional TSMO stakeholders working in related areas of government, private industry, and research institutions. Through partnership and coordination, the region will clarify its approach to adapting to these new technologies, and the specific roles that TSMO agencies might play in their implementation and operations.

- **Planning for Operations:** GTC and partner agencies will continue to emphasize TSMO as a potentially low-cost, high-impact transportation strategy through regional planning and policy, project development, and performance measurement.

- **Priority Initiatives Identified by Agencies:** Agencies involved in the TSMO plan development effort identified specific near-term priority efforts from their perspectives, ranging from ITS asset renewal, to improved joint management of expressways and urban arterials, to next-generation transit fare collection and more.

Sustainable Funding for TSMO Capital Investment and Operations

At the local, state, and national levels, Transportation System Management and Operations programs function within a constrained transportation funding environment.

This situation presents both an opportunity and a challenge. While TSMO presents a relatively low-cost opportunity to address many transportation challenges, it requires sustained capital and operational funding for personnel, training, technology deployments and upgrades, and other operational costs to maximize operational capabilities.

This plan emphasizes preservation and replacement of existing ITS and communications assets to maintain the existing operational capabilities of the region, such as expressway incident management and traveler information. Where warranted, system expansion should be based on careful consideration of costs and benefits. In certain cases, divestment of existing programs or assets may be the most appropriate option.

Regional ITS Architecture Update – ARC-IT

In conjunction with the plan update, GTC led the development of an updated Regional ITS Architecture. The purpose of the Regional ITS Architecture is to provide a common framework for multi-agency and multi-jurisdictional implementation of ITS services and infrastructure.

The Regional ITS Architecture is based on the National ITS Architecture (NITSA) developed by USDOT. The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) require that ITS projects implemented with federal transportation funding be consistent with the regional ITS architecture, which itself is consistent to NYSDOT's Statewide ITS Architecture.

Reflecting the increasing role of connected and autonomous vehicles, and the future need for integration with agency ITS systems and information flows, the current version of the NITSA (Version 8) has been rebranded as the Architecture Reference for Cooperative and Intelligent Transportation, or ARC-IT. ARC-IT combines elements of the former NITSA and the stand-alone Connected Vehicle Information Reference Architecture (CVRIA) into a single architecture.

The Regional ITS Architecture will be used going forward by ITS project teams and participating agencies to ensure the consistency of individual ITS deployment projects with the Regional ITS Architecture. As in the past, the Regional ITS Architecture will be maintained and periodically updated by the Genesee Transportation Council through the Transportation Management Committee.

Achieving the Vision

Over the next decade, agencies in the Rochester-Genesee region will face the challenge of maintaining existing TSMO programs within a highly dynamic technological environment.
Just as existing partnerships helped the region maximize the value of public investments in Intelligent Transportation Systems over the past 20 years, a coordinated and cooperative approach to TSMO will position the region to take advantage of the emerging mobility and smart cities opportunities of the future.

Figure ES-1: TSMO Tier 1 Urban Area Implementation Corridors (Monroe County Urbanized Area)

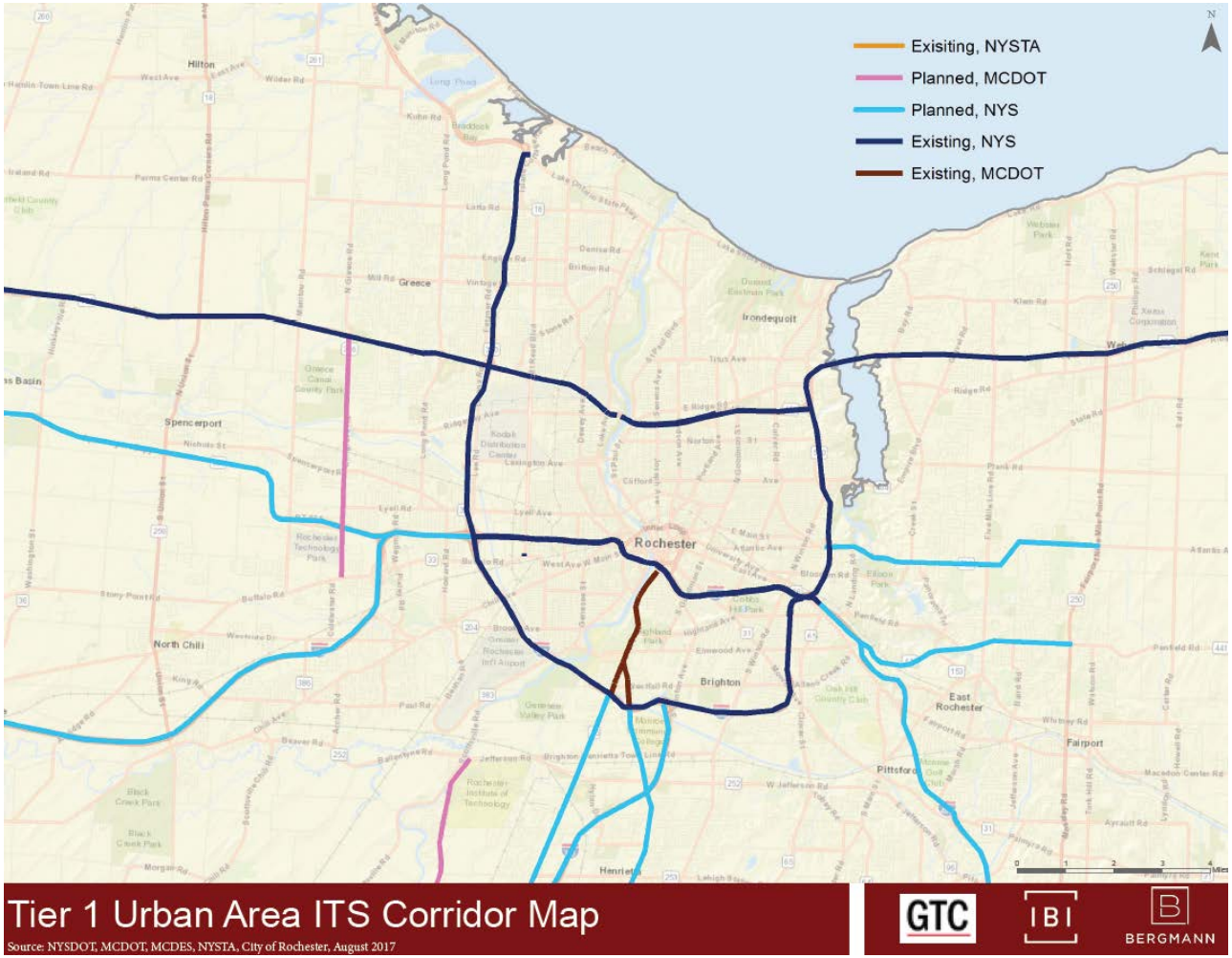


Figure ES-2: TSMO Tier 1 Regional Implementation Corridors (9-County GTC Planning Area)

Figure ES-3: TSMO Tier 2 Urban Area Implementation Corridors (Monroe County Urbanized Area)

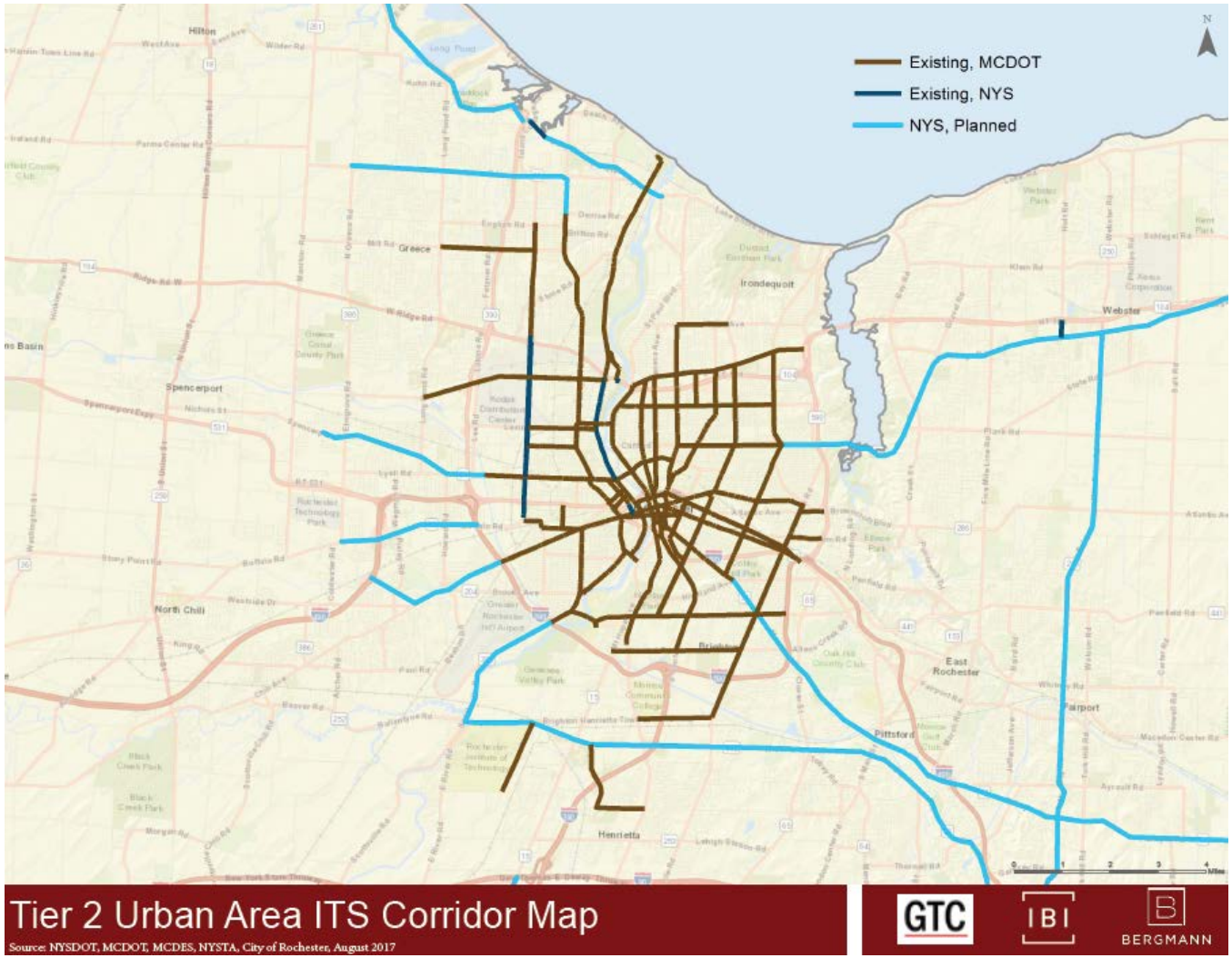


Figure ES-4: TSMO Tier 2 Regional Implementation Corridors (9-County GTC Planning Area)

1. Introduction and Overview

Overview

This report is the Transportation System Management and Operations (TSMO) strategic plan for the nine-county Genesee-Finger Lakes region. The plan's purpose is to provide a strategy for the coordinated implementation of TSMO programs and Intelligent Transportation Systems (ITS) technologies to address regional multi-modal transportation system needs over the next decade.

The Genesee Transportation Council (GTC), the Metropolitan Planning Organization (MPO) for the Greater Rochester area, led the development of this plan in collaboration with a Steering Committee consisting of representatives from transportation, law enforcement, and emergency management agencies in the region.

Due to the rapid pace of technological development, this plan assumes a ten-year planning horizon. This plan replaces the region's prior TSMO strategic plan, also developed by GTC and partner agencies in 2011.

What is Transportation System Management and Operations (TSMO)?

TSMO involves the integration of plans, policies, technology investments, and other resources into a systematic program to improve the real-time operation of the transportation system.

As defined by the U.S. Department of Transportation, Transportation System Management and Operations (TMSO) is "an integrated program to optimize the performance of the existing infrastructure through implementation of multi-modal, cross-jurisdictional systems, services, and projects. These systems, services, and projects are designed to preserve capacity and improve security, safety, and reliability of transportation systems."

In the Genesee-Finger Lakes region, the multi-modal transportation system is actively managed through the cooperative efforts and technology investments of multiple agencies to promote efficiency, reliability, safety, and convenience for users. (Photo: Wikipedia)

Current examples of TSMO at work in the Rochester-Genesee region include:

- Traffic Incident Management
- Traffic Signal Coordination
- Winter Weather Management
- Special Event Management
- Advanced Public Transportation Management
- NY State 511 Traveler Information System

TSMO strategies promotes the integration of operations activities and ITS investments with "mainstream" regional planning, project development, and performance measurement activities." This integration establishes a coordinated approach to addressing the transportation needs of the Genesee-Finger Lakes region.

TSMO is a cost-effective program to maximize the safety and efficiency of the existing transportation system. It complements other low-cost strategies and can help to defer or eliminate the need for more costly conventional capacity expansion projects. TSMO strategies generally promote flexibility, reliability, choice, and resilience of the transportation system for all users.

What are Intelligent Transportation Systems (ITS)?

Intelligent Transportation Systems (ITS) are a set of technology tools that enable real-time management and operation of the regional transportation system.

ITS technologies are applications of advanced technology in the field of transportation, with the goals of improving safety, increasing operational efficiency and capacity, reducing environmental costs, and enhancing personal mobility.

ITS technologies provide a variety of benefits, including:

- Improved safety and security for people and goods;
- Increased system capacity through more efficient use of existing infrastructure and network capacity, particularly in response to non-recurring congestion;
- Providing cost-effective complements, or alternatives, to traditional forms of transportation investment such as capacity expansion;
- Improved real-time system management capabilities, including incident and emergency management;
- Better-informed travelers through the provision of real-time traveler and weather information;
- Better-informed and more responsive transportation agencies with greater understanding needs and conditions at various times of day, under variable conditions, and across locations;

Disruptive technologies like Connected/Autonomous Vehicles (CAVs) have the potential to profoundly influence traveler behavior. New business models like shared mobility, and user-centric mobile applications, are re-shaping the conventional roles of agencies who operate and maintain the transportation system. (Photo: Wikipedia)

- Improved operational performance of multimodal transportation systems, including transit and freight reliability;
- Reduced environmental impacts through decreased vehicle emissions.

ITS provides a powerful toolkit of options to address regional transportation needs, in tandem or in lieu of other strategies such as capacity expansion or transportation demand management.

Non-recurring congestion caused by traffic incidents, inclement weather, and special events is a key example of how ITS can address the region's transportation needs. As documented by the *Long Range Transportation Plan 2040* and the Congestion Management Process, non-recurring congestion is a significant cause of delay and impediment to passenger and freight mobility. Because of the unpredictable nature and location of such incidents, conventional approaches such as capacity expansion are neither effective nor affordable. On the other hand, ITS applications such as video monitoring, incident detection, traffic signal coordination, and traveler information can have a direct impact on the duration and impacts of such events.

Purpose and Use of this Plan

The primary purpose of this plan is to present a unified vision for proactively operating and managing ~~of~~ the regional multi-modal transportation system.

The plan can be used in many ways to implement the regional TSMO vision. The concepts expressed in this plan describe opportunities for partnership and collaboration among agencies by defining common objectives, such as incident management or sharing of fiber optic communications.
The plan describes the objectives, needs and benefits of operational programs in the region, and thereby helps to make the case for investment of capital and operating funding to sustain these initiatives.

The plan can be used to help guide project development, including identifying areas for priority investment, potential project partners, and operational goals for specific agencies and in specific corridors over the next decade.

Finally, the plan highlights a number of topics for ongoing inter-agency coordination and agreement, both formally and informally, to continue the region's

tradition of cooperative approaches to TSMO and ITS implementation. This includes establishing new and expanded partnerships to harness the potential of emerging mobility technologies.

Regional ITS Architecture Update

This plan includes an update of the Regional ITS Architecture for the Genesee-Finger Lakes region. The regional architecture is a model, based on the National ITS Architecture and the New York State ITS Architecture that describes how ITS systems interconnect across agencies and jurisdictions to provide operational services.

ITS deployment projects implemented with federal-aid transportation funds must be consistent with the Regional ITS Architecture. In turn, the Regional ITS Architecture is aligned with this Plan's recommendations to provide seamless policy guidance.

The Regional ITS Architecture has been updated using the new Version 8.0, Architecture Reference for Cooperative transportation (ARC-IT), which combines the concepts of the National ITS Architecture and the Connective Vehicle Information Reference Architecture (CVIRA)

The development and use of the Regional ITS Architecture is discussed further in Section 8 of this document.

Geographic Coverage

The TSMO Plan covers the 4,700 square mile Genesee-Finger Lakes region in Upstate New York. (Figure 1-1). The region encompasses nine counties: Genesee, Livingston, Monroe, Ontario, Orleans, Seneca, Wayne, Wyoming, and Yates.

The region is home to approximately 1.2 million residents, 30,000 businesses, and 540,000 employees. The economic hub of the region is the Rochester metropolitan area including the City of Rochester and its adjacent urbanized municipalities.

The geographic focus of this Plan's recommendations is within the Metropolitan Planning Area (MPA) of Monroe County and adjacent urbanized areas of Livingston, Ontario, and Wayne Counties (Figure 1-2).

TSMO Plan Steering Committee

This plan was developed in consultation with a multi-agency, multi-modal Steering Committee consisting of representatives from the following agencies:

- New York State Department of Transportation (NYSDOT, Region 4)
- New York State Thruway Authority (NYSTA)
- Monroe County Department of Transportation (MCDOT)
- Monroe County Office of Emergency Management (MCOEM)
- Monroe County Sheriff's Office (MSCO)
- City of Rochester, Department of Environmental Services (DES)
- Rochester-Genesee Regional Transportation Authority (RGRTA)
- New York State Police (NYSP)
- Genesee Transportation Council (GTC)
- Federal Highway Administration (FHWA)

Members of the project Steering Committee participated in six Steering Committee meetings, as well as individual one-on-one meetings during the course of the project to review and comment on the work plan, develop the goals and vision statement, inform the needs assessment, formulate recommendations, and review the contents of the final report.

Community Symposia – Future of Transportation Technology

A critical element of the plan development process was public outreach conducted through two Community Symposia held during the course of the project. GTC and the Steering Committee invited public agencies, private companies, and non-traditional partners such as not-for-profits, environmental and social justice advocacy groups, and educational/research institutions.

Previous iterations of this plan focused on the interests of the public agencies responsible for planning, deploying, and operating ITS field instrumentation. Given the rapid spread of advanced transportation technologies and the increasing public interest in Mobility-as-a-Service (MaaS) applications, the Steering

Committee decided to broaden community engagement, seeking input during the process of identifying issues and developing recommendations.

Accordingly, the objective of the symposia was to obtain ideas and feedback from stakeholders beyond the agencies with core ITS/TSMO responsibilities represented on the project Steering Committee. In addition, the committee sought to build on the momentum and collaboration established by the City of Rochester's USDOT Smart City Challenge application in 2016.

By reaching beyond traditional TSMO stakeholders, this outreach helped to build partnerships and lay the groundwork for future collaboration on the implementation of for emerging mobility and smart cities deployment in the coming years.

TSMO Plan Community Symposia – List of Participating Organizations

- Airtight Services, Inc.
- Bergmann Associates
- City of Rochester
- Community Design Center Rochester
- Electrification Coalition
- Federal Highway Administration
- Greater Rochester Clean Communities
- Genesee Transportation Council
- Highland Planning
- IBI Group
- INRIX
- Fisher Associates
- Jobs to Move America
- Monroe County Department of Transportation
- Monroe County Sheriff's Office
- NY State Association of Metropolitan Planning Organizations
- New York State Department of Transportation
- New York State Smart Consortium
- Reconnect Rochester
- Regional Transit Service
- Rochester Downtown Development Corporation
- Rochester Institute of Technology
- Rochester People's Climate Coalition
- Roc City Coalition
- Sierra Club
- Steinmetz Planning Group
- University of Buffalo
- Wyoming County
- Xerox

Community Symposium #1: December 2016

The first Community Symposium was held on Friday, December 2, 2016 at the Kate Gleason Auditorium of the Bausch & Lomb Public Library in Rochester.

The goals of the symposium were to 1.) inform community stakeholders about the project and to 2.) gather stakeholder input on the future of transportation technology in the region.

The first symposium included welcome messages and introductory presentations by GTC, followed by a panel discussion of private sector transportation technology leaders to discuss the impact of transformative emerging transportation technologies: connective vehicles, vehicle electrification, autonomous vehicles, and the sharing economy

A roundtable discussion and breakout groups involving participants explored how the Rochester-Genesee region could prepare for and harness these emerging technologies to improve mobility, the environment, and the social, economic, and physical well-being of the region's citizens.

Participants in the Community Symposia provided insight and perspective on emerging national and regional transportation and smart cities initiatives from the perspectives of private industry, academic institutions, non-profit organizations, and government.

Key themes emerging from the first symposium included:

- Broad community interest among participants about the potential of emerging technologies to improve quality of life and well-being, including social equity and the environment.
- Recognition of the need both for national industry/government leadership, but also local awareness and preparedness.
- Emergence of new public-private partnerships and stakeholder relationships in order to implement emerging technologies.
- Opportunities for partnership of TSMO agencies with a broader set of stakeholders to realize emerging mobility and smart cities benefits.
- An expectation that the existing roles of public sector agencies will evolve as new technologies and business models emerge.
- The need to tackle new challenges, such as the privacy implications of big data.

Community Symposium #2: June 2017

The second Community Symposium was held on Friday, June 23, 2017 at Kate Gleason Auditorium of the Bausch & Lomb Public Library in Rochester.

The goals of the second Symposium were to: 1.) to update attendees on the progress in developing the updated TSMO Plan; and 2.) to discuss participant feedback and comments on proposed Objectives and Strategies.

The second symposium began with introductory presentations by GTC and the project team describing the progress of the plan to date and the draft Objectives and Strategies.

Following the presentation session, participants were invited to participate in a group exercise to view each of five stations, staffed by project team members, to review and comment on draft plan content. The group exercise also allowed participants to rank plan objectives and to leave detailed comment.

Following the group exercise, the group reconvened for a facilitated discussion period to review stakeholder feedback, and to inform participants about the next steps in the planning process.

Key themes emerging from the first symposium included:

- The need to coordinate transportation technology planning with other planning efforts in the region (including efforts beyond transportation, like economic development).
- The need for communication to the public and decision makers about the vision and goals of the plan upon its completion.
- The opportunity to use data to improve access of and awareness of transportation services, such as multi-modal bike share and transit options.
- Recognition that transformative technologies will bring new challenges that are difficult to anticipate.
- The need for a framework, based on community goals and values (e.g. equity), to influence and guide how new technologies are deployed.

Previous Regional TSMO Plans

This document supersedes the previous regional plan, the *Intelligent Transportation Systems (ITS) Strategic Plan for Greater Rochester,* developed by GTC in 2011. However, efforts to promote a coordinated approach to transportation technology in the Rochester-Genesee region date back to the mid-1990s.

IMAGE Report (1996)

The region's first coordinated transportation technology plan, the Improved Mobility Area wide Guidance Evaluation (IMAGE) Report, was developed by a committee led by NYSDOT in 1996.

The IMAGE Report described goals for an Advanced Transportation Management System (ATMS) covering highways and arterials in Monroe County as follows:

> "*The goal of the Advanced Transportation Management System (ATMS) is to manage the transportation system, to reduce traffic congestion, and to improve the efficiency of the incident management process through*

the integrated management of the expressway and arterial roadway network, together with providing information to help efficiently manage the regional transit system."

For fifteen years, the IMAGE report was the guiding strategic document for ITS in the Rochester-Genesee region. The region was successful in accomplishing many of the goals set out in the report, but as the region entered the new millennium, it became increasingly apparent that a more up-to-date plan was needed to advance the regional vision.

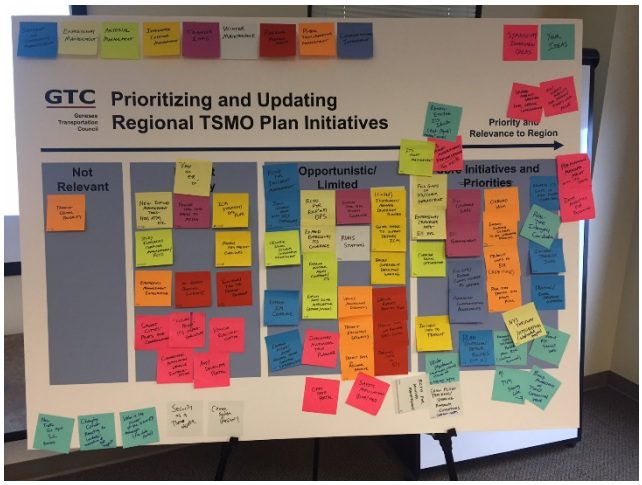
Greater Rochester Transportation Operations and Management Organization Feasibility Study (2006)

The Genesee Transportation Council (GTC) facilitated the development of the *Greater Rochester Transportation Operations and Management Organization Feasibility Study* in 2006. This report examined the effectiveness of the then-current organizational structure for interagency TSMO initiatives.

The study's purpose was to identify the preferred organizational structure to optimize the efficiency, safety, and security of the existing and planning transportation system. The study's four main recommendations included creating a mission statement for the Transportation Management Committee (TMC), strengthening the involvement of GTC, updating the regional ITS Strategic Plan, and development one or more Regional Concepts of Transportation Operations. Since 2006, significant progress has been made on achieving or advancing all of these recommendations.

ITS Strategic Plan for Greater Rochester (2011)

GTC led the regional ITS strategic plan update which was completed in 2011. Leveraging its role as a facilitator and coordinator of regional ITS planning activities through the TMC to engage a range of multi-modal transportation and emergency management agencies in the planning process.



The multi-agency representatives from the project TSMO Plan Steering Committee reviewed operations priorities from the 2011 TSMO plan to discuss changing regional priorities and emerging operational strategies.

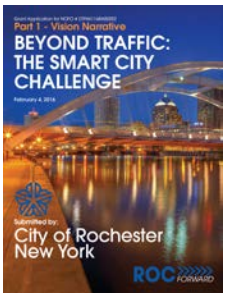
An emphasis in the plan that distinguished it from the IMAGE Report was an increased emphasis on the people, plans, and policies–not just the technologies—that enable effective operations programs. The USDOT concept of Transportation System Management and Operations (TSMO) was embraced in this plan to reflect the broader emphasis.

Additionally, the plan worked to explicitly demonstrate the linkage of TSMO with regional transportation goals and policies, to demonstrate the relevance of TSMO as a low-cost strategy to help meet regional transportation needs, particularly given the challenges posed by non-recurring congestion in the Rochester-Genesee region.

Regional initiatives were defined in operational themes, such as Incident and Emergency Management and Arterial Management, which in turn drove the requirements for regional ITS field instrumentation deployment.

USDOT Smart City Challenge (2016)

In late 2015, the USDOT sponsored a national competition intended to promote innovative approaches to problem-solving and coalition building around Smart Cities technologies. Known as the Smart City challenge, the competition attracted 78 applications from cities around the country, including the City of Rochester.



The Rochester Smart City proposal highlighted ~~the~~ opportunities to leverage transportation and smart cities technology to improve the health and economic wellbeing of some of Rochester's most disadvantaged citizens and neighborhoods. Strategies included urban automation, data analytics, sensor technology, user-focused mobility services, and urban freight and logistics. The coalition included the City of Rochester (lead agency) in collaboration with four other local and state agencies; nine private partners, and eight non-profit/institutional partners.

While Columbus, Ohio was ultimately selected as the winner of the Smart City challenge, the process was valuable nationally and locally in spurring discussion about the opportunities of Smart Cities and the partnerships (and funding) needed to realize them.
In creating this plan, GTC and its partners made an explicit effort to build upon this momentum and include local Smart Cities stakeholders in the process from government, the private sector, institutions, and nonprofits. This represented a departure from prior ITS planning and coordination that was more strictly focused on the transportation sector, but it laid the foundation for future Smart Cities partnerships and technology infrastructure in the years to come.

TSMO Plan Organization

This Plan is organized into eight sections as follows:

- Section 1: Introduction and Overview
- Section 2: Operations Vision for the Rochester-Genesee Region
- Section 3: TSMO in the Greater Rochester Region Today
- Section 4: Needs Assessment
- Section 5: Regional TSMO Objectives and Initiatives
- Section 6: TSMO Implementation Plan for the Rochester-Genesee Region
- Section 7: Implementing the Plan – Recommendations and Next Steps
- Section 8: Regional ITS Architecture Update

Figure 1-1. The Genesee Transportation Council 9-County Planning Area

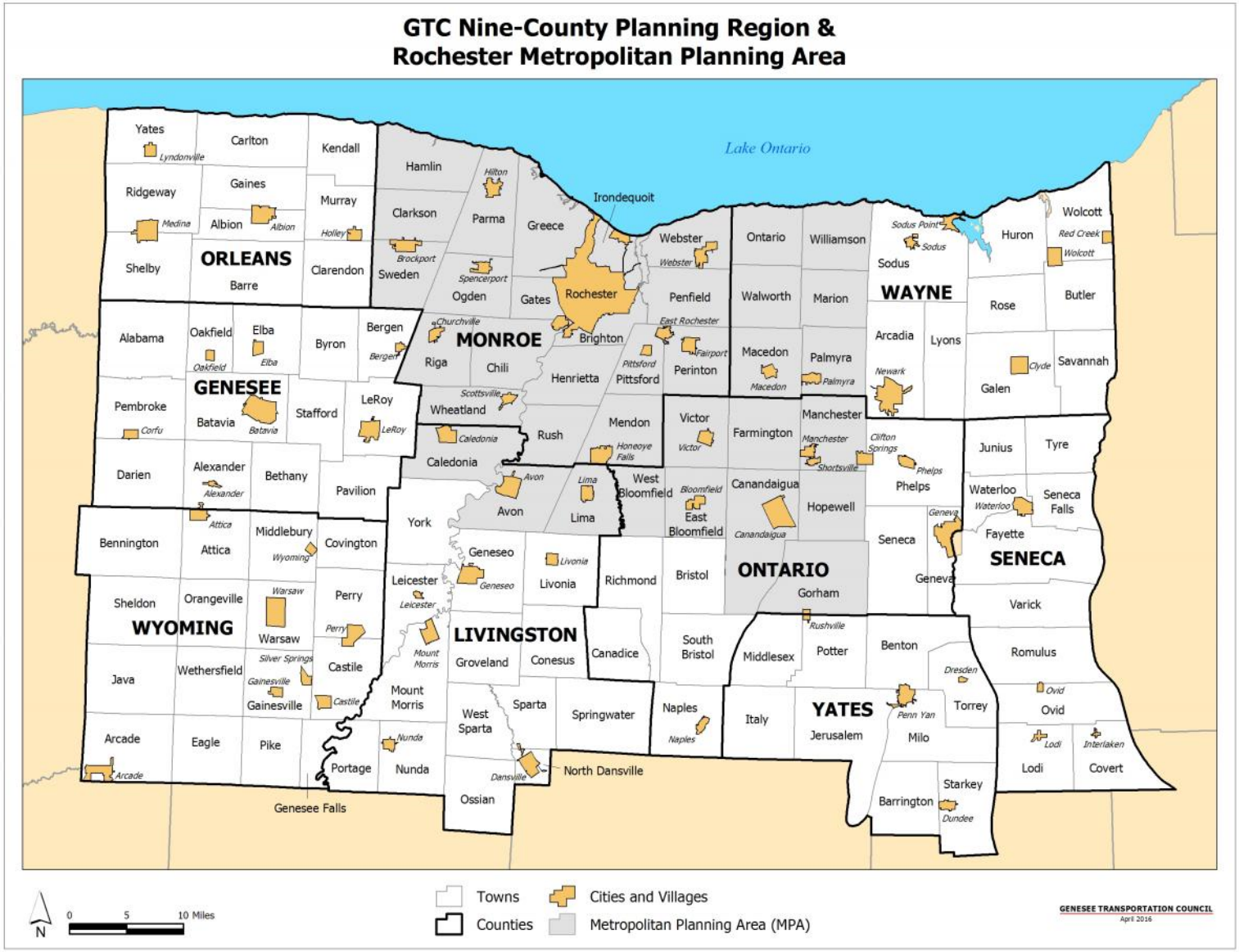
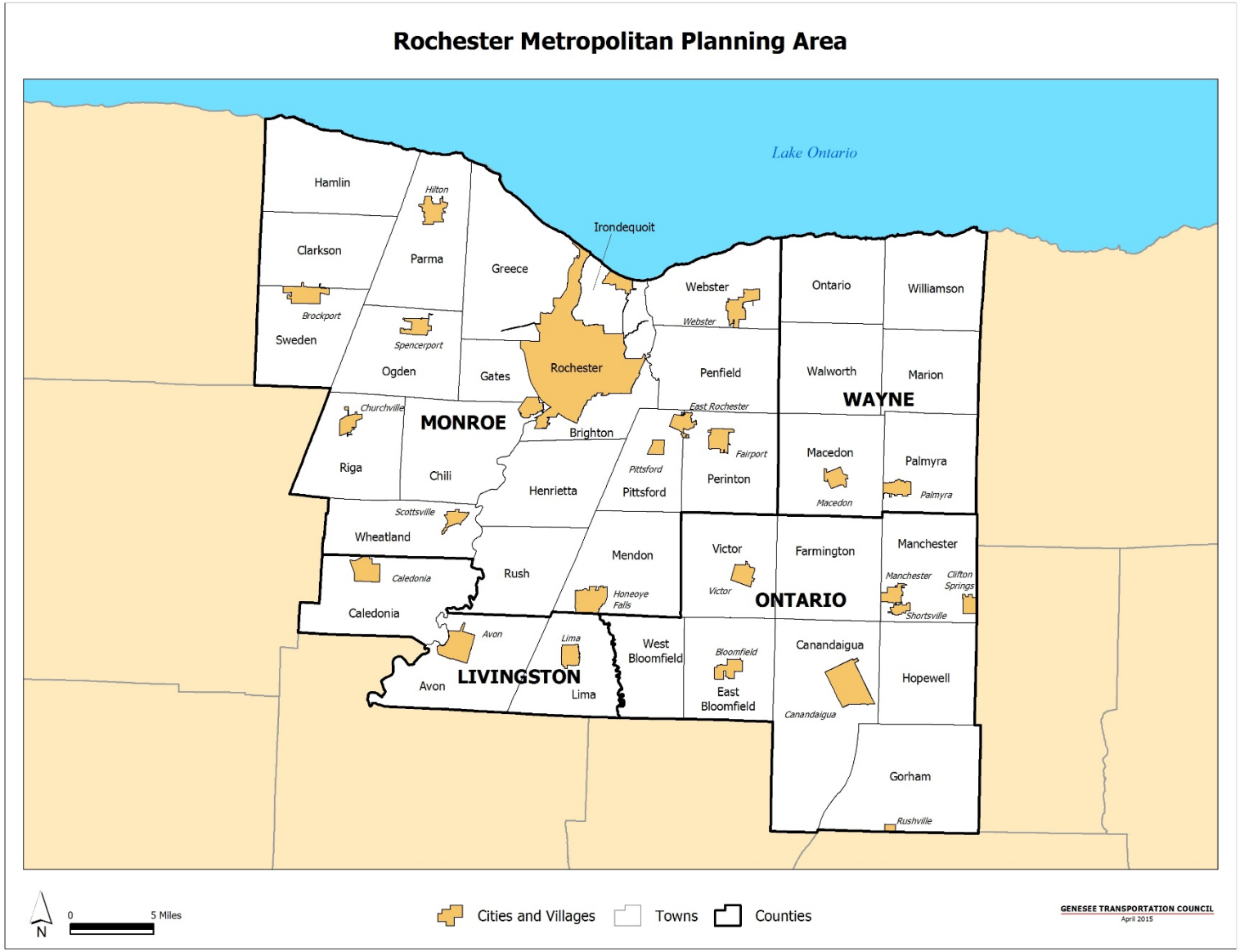


Figure 1-2. The Transportation Management Area (TMA) of Urbanized Monroe County and Adjacent Counties



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2. Operations Vision for the Genesee-Finger Lakes Region

Overview

This section of the plan identifies the Vision Statement developed by the project steering committee and discusses the federal, state, and regional policy foundations for the plan recommendations.

Vision Statement

The Steering Committee established the following operational vision statement for TSMO in the Rochester-Genesee region:

> ***Transportation System Management and Operations (TSMO) in the Rochester-Genesee region improves the safety, efficiency, and convenience of the multi-modal transportation system through the use of advanced transportation technologies, free flow of information and data, and partnerships among public agencies and other transportation service providers***.

Planning for Operations – Policy Foundations

The recommendations in the *Genesee-Finger Lakes Regional Transportation System Management and Operations Strategic Plan* are grounded in federal, state, and regional ITS and operations planning policies.

The following section provides context for the objectives and initiatives presented in Section 5 and the recommendations discussed in Section 7 of this plan by briefly summarizing the salient policy points in federal, state, and regional planning reports.

Federal Policy

In December 2014 the United States Department of Transportation published the *ITS Strategic Plan 2015-2019*, a policy and planning guide for federally-sponsored ITS research and deployment programs.

This plan identified two overarching strategic priorities and five strategic themes to set national priorities and guide ITS research, development, and adoption activities.

Strategic Priorities

- **Realizing Connected Vehicle (CV) Implementation** – This priority emphasizes the benefits of a "connected" vs. an "autonomous" future; i.e., greater benefits in transportation system safety, efficiency, and reliability will be realized with connected vehicles (vehicle to vehicle and vehicle to infrastructure) rather than autonomous vehicles.

- **Advancing Automation** – This priority emphases the benefits of vehicle automation, i.e., the ability of vehicle functions to operate independently of human interaction. Automation combined with connectivity is expected to deliver the greatest benefits in transportation system safety, efficiency, and reliability.

Strategic Themes

- **Enable Safer Vehicles and Roadways** – Develop better crash avoidance systems for all vehicles, performance measures, and other notification mechanisms; commercial motor vehicle safety considerations; and infrastructure-based and cooperative safety systems.

- **Enhance Mobility** – Explore methods and management strategies that increase system efficiency and improve individual mobility.

- **Limit Environmental Impacts** – Better manage traffic flow, speeds, and congestion, and use technology to address other vehicles and roadway operations practices.

- **Promote Innovation** – Foster technology advancement and innovation across the ITS program, continuously pursuing a visionary/exploratory research agenda, and aligning the pace of technology development,

adoption, and deployment to meet future transportation needs.

- **Support Transportation System Information Sharing** – Develop standards and systems architectures, and apply advanced wireless technologies, that enable communications among and between vehicles of all types, infrastructure, and portable devices.

These priorities and themes offer high-level policy guidance to states, regional agencies such as Metropolitan Planning Organizations, counties, and municipalities to draw on when developing and revising their own ITS and operations planning policies. This ensures consistency between national priorities and those at the state, regional, and local levels.

The legislative basis for federal transportation planning programs is the Fixing America's Surface Transportation (FAST) Act, signed into law by President Obama on December 4, 2015.

This legislation identified ten planning factors that metropolitan planning programs must address. While only one of these factors specifically identifies transportation system management and operations (*Promote efficient system management and operation*), inter-agency coordination initiatives and ITS deployment projects can help address the other nine factors through a range of safety and security improvements, economic development, congestion management, environmental protections, mobility and accessibility enhancements, system performance monitoring and measurement, and other activities that collectively enhance a metropolitan area's overall quality of life.

State Policy

The New York State Department of Transportation's statewide planning program is laid out in the agency's master plan, the *Strategies for a New Age: New York State's Transportation Master Plan for 2030*. Published in 2005, this report identifies ITS as a tool to efficiently operate the state's transportation system.

The plan prioritizes demand management and operations strategies over capacity expansion projects as a means of increasing vehicle throughput. The plan identifies a number of potential ITS applications such as coordinated traffic signals and managed lanes, and anticipates connected vehicle technology by noting the safety benefits of compatibility between roadside ITS and in-vehicle safety systems.

Regional Policy

The *Long Range Transportation Plan for the Genesee-Finger Lakes Region 2040* is the strategic plan that guides GTC's planning program.

The plan emphasizes TSMO strategies as a means of improving mobility for both people and freight, increasing transportation system safety and security, and reducing costs for businesses, public agencies, and the general public. The plan groups TSMO-related initiatives into one or more of the following three categories:

- **Technology** – Intelligent Transportation Systems; i.e., the "tools" needed to implement TSMO programs by enabling monitoring and data collection;
- **Coordination** – Multi-modal and multi-jurisdictional interagency coordination activities required to maximize the efficiency of ITS operations and service delivery; and
- **Demand** – Travel information provided to system users enabling them to make informed the transportation system.

The Technology and Coordination categories address supply (i.e., how the transportation system is managed and operated) whereas the Demand category addresses use (i.e., what are community expectations for use of the transportation system).

The TSMO-related recommendations in the *Long Range Plan* are high-level policy statements that provide a guide for many of the activities outlined in the *TSMO Strategic Plan*.

Technology-related recommendations include communications system upgrades; the deployment of ITS field instrumentation; and transit, pedestrian, and bicycle-supportive ITS deployments. Coordination-related recommendations include ongoing federal funding for Regional Traffic Operations Center and Highway Emergency Local Patrol (HELP) operations, interagency operations agreements, and multi-agency Traffic Incident Management coordination and training exercises. Demand-related recommendations include

providing real-time traveler information, traffic signal optimization, and improved wayfinding capabilities.

The objectives and initiatives presented in Section 5 and the recommendations discussed in Section 7 of the *TSMO Strategic Plan* should be viewed as an expansion and refinement of these regional policies.

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3. TSMO in the Genesee-Finger Lakes Region Today

Overview

This section reviews the existing conditions and status of Intelligent Transportation Systems (ITS) deployments within the Genesee-Finger Lakes region. The agency profiles are based on discussions with agency representatives participating in the Transportation Systems Management and Operations (TSMO) Strategic Plan Update development process, either through participation in Steering Committee meetings or through one-on-one stakeholder interviews during the plan development process.

Regional Operations Coordination

The Genesee-Finger Lakes region has a longstanding history of interagency and multi-modal collaboration to support TSMO programs and planning, funding, deployment, and operations of ITS technology.

Traditionally, two committees provided the venue for interagency operations coordination among regional agencies. The Transportation Management Committee (TMC) and the Traffic Incident Management (TIM) Committee served as the means for agency staff to coordinate and collaborate on a range of topics, including ITS deployments, construction projects, and incident management.

In 2018, these committees were combined and reorganized into a single group, the Transportation Operations Coordination Committee (TOCC). The TOCC continues the functions of the TMC and the TIM Committee by providing a forum for the agencies involved in transportation system management and operations activities to discuss common approaches and build awareness and understanding of their respective roles in the TSMO field.

Transportation Management Committee

The Transportation Management Committee (TMC) was the primary regional forum for discussions on interagency operations coordination and updates on ITS deployment and construction projects. This committee was recognized by the USDOT Federal Highway Administration Office of Operations as an outstanding example of regional ITS and transportation operations coordination.

Participation in the TMC was open to all interested agencies but was traditionally focused on the coordination efforts of the Monroe County and New York State Department of Transportation staff of the Regional Traffic Operations Center. In addition, representatives from the New York State Thruway Authority, the City of Rochester, the New York State Police, the Monroe County Sheriff's Office, the Rochester-Genesee Regional Transportation Authority, the Monroe County Town Supervisor's Association, and the Genesee Transportation Council all participated.

The TMC was facilitated by the Genesee Transportation Council (GTC), which was responsible for handling administrative support tasks and retained this role in the TOCC. However, the TMC largely relied

The Regional Traffic Operations Center (RTOC), cooperatively operated by NYSDOT, MCDOT, and the NY State Police, supports coordinated operations of the expressway and arterial systems of Monroe County, including management of traffic incidents, events, and severe weather response.

on the volunteer efforts, self-interest, and personal initiative of key figures in the regional TSMO community.

The origins of the TMC can be traced back to an earlier committee established to coordinate law enforcement and emergency response activities during the reconstruction of the I-490, I-590, and NYS Route 590 (the "Can of Worms") interchange in the late 1980s. The benefits of this committee led participating agencies, including the New York State and Monroe County Departments of Transportation, the New York State Police, and the Monroe County Sheriff, to establish a standing "Expressway Committee" in 1991 following completion of the interchange reconstruction. The Expressway Committee facilitated interagency coordination on ITS planning and deployment projects, major construction updates, incident management and response activities, and other topics of interest.

In 1996, the Expressway Committee renamed itself the "Transportation Management Committee" and identified its objective as the bringing together of community stakeholders with interest and experience in both expressway and arterial road operations to review the operation and management of these facilities and offer input on planned improvements to them. The recast committee would focus on traffic flow management, incident management, safety, upcoming construction project, and the overall impact of transportation operations on businesses and the community.

Over the past twenty years, the TMC periodically revisited and revised its goals and objectives. However, the committee's basic function of serving as a forum for discussions on regional operations planning, construction project updates, and incident response coordination remained the same.

TMC agenda topics typically covered the following topics:

- Review of planned and in-design ITS field instrumentation and communications infrastructure deployment projects;
- Major construction projects, specifically traffic impacts and interagency coordination needs;
- Planning for special event-related traffic impacts;
- Review and debrief of major incident response activities;
- Pertinent Federal and State legislative and policy updates;
- Training and professional capacity building activities; and
- Other special projects, studies, and initiatives.

The TMC's organizational and management structure has been periodically reviewed by participating agencies, but always maintained its ad-hoc organizational structure. This approach contrasted to more formalized structures such as the Niagara International Transportation Technology Coalition (NITTEC) in the Buffalo-Niagara region.

Traffic Incident Management (TIM) Coordination Committee

In recognition of the complexities and challenges facing first responders when responding to traffic incidents, including ensuring the safety of the traveling public while efficiently clearing incident scenes, managing traffic flow around incident closures, and protecting first responder safety, a number of agencies involved in the TMC established a separate TIM Coordination Committee in the fall of 2016.

A Traffic Incident Management (TIM) symposium in 2015 brought together transportation and emergency management personnel to discuss safe and effective response to traffic incidents. Such partnerships are essential to reducing the impacts of non-recurring congestion, preventing secondary crashes, reducing clearance times, and ensuring first responder safety.

The purpose of this committee was to promote and support sustained interagency TIM coordination by building awareness and understanding of the interconnections among the regional agencies involved in incident management. The committee's members sought to achieve this by working towards the following goals: improving the safety of victims, first responders, and the traveling public; facilitating

quick and safe clearance of the incident and restoration of routine traffic operations; and enhancing interagency coordination, cooperation, collaboration, and communication.

Specific activities the committee pursued to achieve these goals included:

- Understanding each member agency's Standard Operating Procedures, capabilities, limitations, and requirements as related to TIM;
- Identifying and cataloging equipment and resources that are available from each agency and clarify agency terminology;
- Identifying key personnel in each agency that can immediately draw upon the agency's resources and facilitate an appropriate response to support regional TIM activities;
- Sharing TIM best practices and lessons learned from previous experiences, including building awareness of Federal and State TIM guidelines and best practices;
- Providing technical support and training activities for all agencies and developing cross-agency Standard Operating Procedures for TIM;
- Promoting and sustaining interagency coordination through developing strong cross-agency relationships and partnerships; and
- Identifying shared projects aimed at improving TIM response and capabilities.

As with the TMC, participation in the TIM committee was open to all interested agencies. Attendees included representatives from the New York State Department of Transportation; the Monroe County Department of Transportation; police agencies including the New York State Police, the Monroe County Sheriff, and municipal police departments; local fire departments and emergency medical service providers; the Monroe County Office of Emergency Management and 911 Emergency Communications Center, and the Genesee Transportation Council.

Transportation Operations Coordination Committee (TOCC)

In 2018, in response to shifting agency needs and interests, the members of the TMC and TIM committees agreed to merge these committees into a new committee, the Transportation Operations Coordination Committee. The TOCC adopted the following purpose statement and associated strategies to guide its work:

- The purpose of the Transportation Operations Coordination Committee (TOCC) is to provide the traveling public with a safe, efficient, and reliable multimodal transportation system by coordinating transportation system management and operations initiatives among member agencies.

- The TOCC will provide a forum for discussions in the following three strategic focus areas:

    1. Intelligent Transportation Systems (ITS): Update member agencies on ITS planning, deployment, and operations initiatives; promote operations solutions for traffic safety and congestion issues.

    2. Construction Coordination: Update member agencies on the status of major construction projects with an emphasis on understanding the impacts of those projects on traffic operations; coordinate project scheduling, planning, and work zone management.

    3. Traffic Incident Management (TIM): Build awareness and understanding of the contributions that member agencies make towards incident response; promote multi-agency TIM training opportunities.

Combining the two committees and increasing the emphasis on coordination between emergency managers and system operators is expected to generate significant benefits for the traveling public in terms of a greater focus on traffic incident management collaboration. In addition, the TOCC will still serve as a venue for updates on major construction projects and ITS deployments, as well as any other transportation operations coordination topics that arise. The TOCC is expected to continue to be a critical element of the regional collaboration infrastructure on TSMO issues.

Agency Profiles

The following are summaries of stakeholder outreach interviews, by agency. During stakeholder outreach, current agency goals, needs, and plans regarding TSMO programs and ITS deployments were discussed.

These profiles provide a snapshot of agencies' current operational initiatives, as well as a look-ahead to their objectives an outlook over the next five to ten years.

New York State Department of Transportation (NYSDOT)

NYSDOT is responsible for the construction, maintenance and operation of the state-wide transportation network, including highways, railroads, mass transit systems, ports, waterways and aviation facilities. In order to effectively manage program and project delivery, the state is organized into 11 DOT "Regions." NYSDOT-Region 4 includes seven Western New York counties: Monroe, Ontario, Livingston, Orleans, Genesee, Wyoming and Wayne. These seven counties cover an area of 4,072 square miles, about 8% of the entire state. Region 4 includes 4,626 lane miles (1,697 centerline miles) of highway, which is 9% of the mileage within the state, and about 1,700 bridges.

NYSDOT-Region 4 is actively involved in TSMO programs and initiatives in the Greater Rochester area, which reflect the state-wide emphasis that NYSDOT places on ITS deployments. Since the mid-1990s when it developed the Improved Mobility Area-wide Guidance Evaluation (IMAGE) Study, NYSDOT has been at the forefront of ITS use in the Greater Rochester area. Managed from the Regional Traffic Operations Center (RTOC), these instruments include closed-circuit television (CCTV) traffic cameras, Dynamic Message Signs (DMS), Road Weather Information Systems (RWIS) stations, Highway Advisory Radio (HAR) beacons and transmitters, and system sensors. NYSDOT also operates its central traffic signal control system from the RTOC.

NYSDOT's Highway Emergency Local Patrol (HELP) vehicles provide assistance to vehicles on regional expressways. Prompt location and response to disabled vehicles, assisted by ITS systems like CCTV surveillance, can reduce delays and safety hazards.

As a region and as a state agency, NYSDOT has implemented significant ITS and operational investments including advanced traffic management, signal coordination and control (implemented using the *Streetwise®* platform), traveler information (including statewide '511' telephone and web-based traveler information), roadway weather information systems, incident management, communications infrastructure, and other technologies that support a proactive stance towards regional transportation system operations and maintenance.

NYSDOT maintains 24/7 operational capabilities from the Regional Traffic Operations Center (RTOC) located on the property of the Greater Rochester International Airport. In addition to operations, NYSDOT coordinates regional roadway maintenance, maintains a regional call center, and dispatches signal maintenance crews from the RTOC.

Being co-located at the RTOC with the Monroe County Department of Transportation (MCDOT), the New York State Police, and the County Airport Authority, offers the region many benefits. In particular, NYSDOT is able to work very closely with these agencies with regard to incident management, construction and maintenance, and speed zones and safety control activities.

During off hours, NYSDOT dispatches Monroe County signal crews. There is no formal agreement between MCDOT and NYSDOT for covering nights and weekends. There is a procedure book that guides these activities. In the future, developing such an agreement for handling after-hours dispatching would benefit both agencies.

NYSDOT's key future priorities for ITS implementation include:

- Increase reliability with Real-time Traveler Information;
- Corridor management through improved signal coordination, including expanded central signal system control and coordination with Monroe County;
- Improved incident and diversion route planning, including expanded partnerships, training, and

tactical coordination with local law enforcement; and
- Integrated regional operations involving other transportation agencies such as Monroe County, NYSTA, RGRTA, and other local jurisdictions.

Other key considerations expressed by NYSDOT pertinent to the TSMO Update include:

- Future Funding Sources – The region recognizes that regular upkeep of the existing ITS infrastructure is vital for running an efficient transportation system. A steady funding source for future maintenance of ITS will provide a better guarantee for the success of the transportation system.
- Skilled Staff – Expand in-house capabilities to be able to better manage rapidly evolving technological changes.
- Identify groups with resources to assist – During a major event, current operators are maxed out. NYSDOT is interested in identifying groups that could provide assistance with their resources.

New York State Police (NYSP)

The New York State Police provide the citizens of New York State with a wide range of law enforcement services, ranging from criminal investigations to counter-terrorism initiatives to forensic analyses. These services include protecting the safety of travelers on the state's transportation network, especially on state, interstate, and other controlled-access highways. State Troopers enforce the Vehicle and Traffic Law, investigate crashes and manage incident scenes, and assist disabled motorists. Specific techniques that the State Police use to improve road safety include community outreach and education programs; sobriety checkpoints; commercial vehicle inspections; patrols dedicated to stopping speeding, driving while intoxicated, and distracted driving; and incident reconstruction. The State Police are organized into 11 "Troops;" the Genesee-Finger Lakes Region includes parts of Troops A (Orleans, Genesee, and Wyoming Counties) and Troop E (Monroe, Livingston, Ontario, Seneca, Yates, and Wayne Counties), as well as Troop T, which patrols the NYS Thruway.

The focus of the State Police in Monroe County is primarily on the expressway network, both for incident response and law enforcement. The Traffic Incident Management (TIM) detail consists of twelve troopers. The State Police devote significant time to DWI enforcement, seatbelt enforcement, speeding enforcement, and curbing aggressive driving. There is significant coordination between the NYSP and the Monroe County Sherriff in order to provide incident response overage and to assist NYSDOT with incident and work zone management.

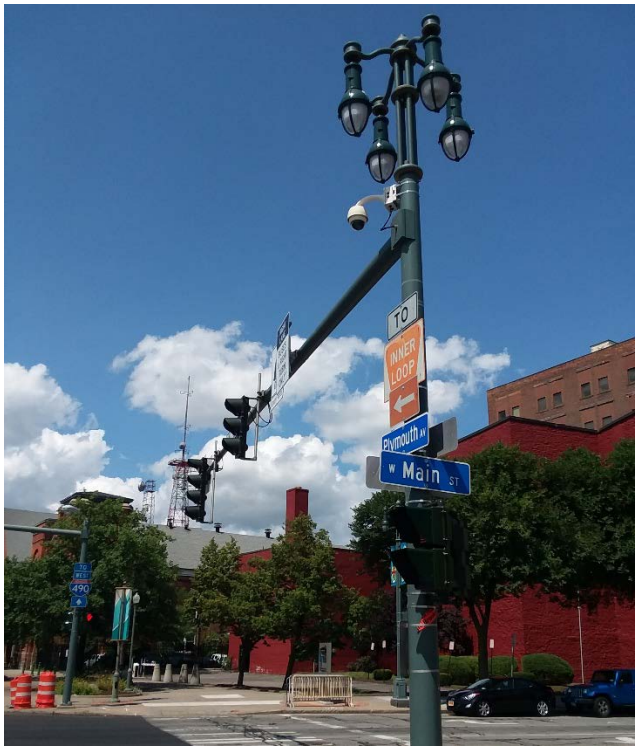
Being co-located with NYSDOT and MCDOT at the RTOC facility has enabled an integrated approach to incident management and relationship building among agencies. The team mentality and willingness to participate in interagency cooperation that this engenders is a valuable asset for the region. The State Police have no infrastructure monitoring capabilities of their own and rely on partner agencies, such as the NYSDOT, for these services.

The State Police view traffic surveillance cameras as an extremely valuable asset. Traffic surveillance cameras have been extremely useful in assessing the situation on-scene and gathering information about an incident, such as how far back-ups extend around an incident. The State Police support extending camera coverage across the regional transportation network.

The State Police's primary focus is towards improving interagency coordination and continue with Traffic Incident Management (TIM) training and seminars. TIM training should be continued and encouraged to all emergency response agencies, so all agencies' priorities are one and the same. Promotion of regional partnerships and coordinated action plans is extremely important to the effectiveness of the NYSP in regional traffic operations.

Monroe County Department of Transportation (MCDOT)

MCDOT is responsible for the construction, operation and maintenance of a safe and efficient county-wide highway, bridge and traffic network. This network includes 1,494 lane miles (662 centerline miles) of county-owned highways, 122 bridges, and 323 major culverts. MCDOT performs a broad range of functions, including traffic, highway and bridge engineering studies and construction projects; pavement marking; installation and maintenance of all traffic control devices on county highways; traffic signal and signage within the City of Rochester (the City is responsible for managing pavement markings), and provides traffic engineering assistance to local towns and villages.



Arterial traffic management is a primary TSMO strategy for both MCDOT and NYSDOT. Critical ITS tools include traffic signal timing and integration, monitored and controlled centrally from the RTOC through fiber optic and wireless communications systems.

Since the 1980s MCDOT has steadily embraced the use of ITS instruments to enhance transportation system operations and has become very active in regional TSMO initiatives and ITS deployments. In the 1980s MCDOT opened the region's original Traffic Control Center and deployed the first centralized traffic signal control system. In the 1990s, MCDOT expanded its capabilities by introducing additional ITS devices and wireless communications technology.

Today, MCDOT is one of the partner agencies that built, owns, and manages the RTOC, the successor to the original traffic control center. It has ITS instruments deployed in strategic locations around the county, including 60 CCTV traffic cameras, over 470 remotely connected traffic signals, 12 sign post mounted speed feedback devices and two speed feedback trailers that are used to educate and increase driver awareness of travel speeds, and two portable DMS that are mainly used for work zone management. MCDOT's close partnerships with NYSDOT and other agencies allow it to benefit from those agencies' ITS investments, just as they benefit from MCDOT's deployment of ITS elements to better manage the regional transportation network.

As with NYSDOT, the safe and efficient movement of traffic is the primary mission of MCDOT. With regards to ITS, they are interested in evaluating what has been successful in the past and building on that success. They view ITS as potential tools for operational improvement that can result in improved traffic conditions. ITS can also help facilitate interagency coordination, helping everyone to work together.
The City of Rochester has adopted a Complete Streets Policy in December, 2011 and with this adoption, MCDOT's needs and priorities have been updated to include bicycle infrastructure, including bicycle detection using cameras along Bike Boulevards. MCDOT and the City recognize the opportunity to coordinate TSMO investments with multi-modal "Complete Streets" improvements in urban arterial corridors.

MCDOT also expressed satisfaction in the cameras it has deployed and extended the count to more than 100 locations, resulting in extensive camera coverage. The digital video format of these cameras allows for short term playback of video and facilitates interagency video sharing.

Being co-located at the RTOC with the New York State Police and NYSDOT also works very well; continuing good interagency relationships and efficient communication. There currently exists a strong working relationship between MCDOT and the NYSDOT. There is potential for improved communication and coordination with the Sheriff's Department and NYSTA, and the co-location at RTOC provides continuing enhanced cooperation and communication.

MCDOT is also focusing on traffic control. MCDOT is in the process of developing pre-planned incident management signal timings based on observed diversion routes as incidents are experienced over time. In developing these incident management signal timings, MCDOT will also use any data provided by others (NYSDOT, GTC, etc.).

An example of an interagency coordination initiative that benefited MCDOT is NYSDOT's microwave data collection initiative that combined state and county traffic signal systems.

MCDOT's key considerations for this TSMO Update includes:

- Moving forward, MCDOT feels that they are saturated with implementation of ITS infrastructure and plan to maintain and operate the existing system with minor signal system upgrades.
- Rehabilitation of the RTOC is a priority, including improved/updated consoles and displays, integration of MCDOT/NYSDOT systems where possible, and minor modifications and improvements to preserve the building and update it to current needs.
- Where NYSDOT's arterial system abuts MCDOT's arterials, MCDOT would like see more coordinated signal systems to improve efficiency. This can be achieved by having a common ATMS signal system for MCDOT and NYSDOT (MCDOT currently uses TransSuite by TransCore and Trafficware ATMS is used statewide by the NYSDOT Traffic Signals Bureau). This would provide for better performance during incident management.
- If MCDOT and NYSDOT cannot have a common ATMS signal system, MCDOT suggests to swap operational responsibilities of signalized intersections where necessary (especially at interchange signals) with NYSDOT to improve efficiency along the arterial corridors.

Monroe County Office of Emergency Management (MCOEM)

The Monroe County Office of Emergency Management (MCOEM) is responsible for safeguarding the lives and property of county residents and businesses before, during, and after a hazard event. OEM works with local governments and non-government agencies to coordinate the preparation for, response to, and recovery from both natural and man-made disasters.

OEM maintains a comprehensive emergency management plan. While OEM does not participate in the emergency response to most traffic incidents, OEM could become involved for a particularly severe incident.

The MCOEM Emergency Operations Center is a specially designed facility where public organizations and private-sector agencies meet to decide and coordinate emergency response to community-wide disasters. The Emergency Operations Center is equipped with communication devices, state-of-the-art electronics, and other tools which facilitate the collaborative effort necessary for response to emergency events.

NYSDOT, MCDOT, RGRTA, and the City of Rochester are among the transportation agencies who participate in regional emergency operations functions alongside Law Enforcement, Fire Service, Health, Human Services, Communications agencies, and other key community partners.

MCOEM does not directly participate in management of most traffic incidents or work zone incidents unless the event escalates to a critical level that impacts the broader community and triggers Incident Command Structure protocols. OEM does use transportation CCTV cameras and DMS through informal agreements with NYDOT and MCDOT.

Monroe County funds the regional 9-1-1 Emergency Communications System, and oversees the operation of the Emergency Communications Department (ECD). The ECD is the point of central reception and response to 9-1-1 dialed calls, dispatch of emergency equipment, and relay or transfer of service calls to the appropriate public service agencies. Over one million dispatches are made to police, fire and emergency services each year. The City of Rochester operates the ECD under contract with the County.

MCOEM would like to have more real-time information and camera feeds provided to them from other agencies during an event to assist them in decision making.

Improved interagency coordination for special event management has also been noted as an opportunity to improve the ability of first responders to reach and manage an incident scene.

City of Rochester

The City of Rochester is in a unique position in that it does not own or operate any of the traffic signals within the City. Rather, the City has an arrangement with Monroe County wherein the County is responsible for all traffic engineering and responsible for all traffic control devices within the City, including traffic signals, signs, and striping. As such, Monroe County owns, operates, and maintains all of the traffic signals and other ITS devices related to traffic flow on City streets. The County took possession of City traffic signals in the early 1970s.

The City of Rochester is active in a range of TSMO activities. The Department of Environmental Services (DES) handles tasks related to the management and operation of the City's transportation network, including street construction, repair, and revitalization projects; fleet vehicle maintenance; parks and trails improvements; and transportation planning initiatives. DES promotes revitalization projects aimed at improving the safety, appearance, and functionality of city streets through techniques such as adding bicycle lanes, upgrading street lighting, reconfiguring intersections including the construction of roundabouts where appropriate, and using technology to better manage the City's infrastructure.

The City of Rochester has made significant recent investments to increase multi-modal transportation options, including bicycle, transit, and pedestrian facilities. TSMO supports multi-modal users and safety, and are another aspect of "complete streets" design in the urbanized area.

The City's Police and Fire Departments play a crucial role in incident scene management. In addition to routine traffic law enforcement, the Rochester Police Department (RPD) manages and investigates traffic incidents and works in cooperation with the Monroe County Sheriff and New York State Police on an as-needed basis. The RPD coordinates with the City's Office of Special Events to manage special event traffic and parking. The Rochester Fire Department (RFD) handles a range of emergency situations in addition to structure fires, including incident scene management and vehicle extrications.

Apart from Rochester Police Department security cameras, which are set up to deter criminal activity, the City does not directly operate CCTV cameras, DMS, or other ITS elements.

In October 2010 the City implemented a red light camera traffic enforcement program. Cameras were installed at selected intersections around the City to identify drivers who violated red lights. This program was discontinued in December 2016.

Over the past five years the City has made significant investments in parking management infrastructure and systems, including multi-space meters in the downtown area, and a Port of Rochester ITS project oriented primarily towards event traffic and parking management. Equipment is operated and maintained in collaboration with MCDOT and NYSDOT.

There are no formal agreements between the City and other agencies regarding the operation of ITS elements, thought the City does have a formal agreement with Monroe County for fiber optic communications sharing.

A current example of long-standing and effective interagency coordination in the region is the City's Traffic Control Board (TCB). TCB members consist of the Police Chief, the Neighborhood and Business Development Commissioner, the Monroe County Director of Transportation, the Corporation Counsel, the Finance Director, and the City Engineer; the Board is chaired by the City Engineer. This board includes a representative from MCDOT, which serves as the City's traffic engineer and handles the implementation of Traffic Control Board decisions. The County owns most traffic control devices within the City and is responsible for operating and maintaining them. The TCB handles issues related to traffic control devices, lane striping, on-street parking, and other topics germane to traffic and parking management. With regards to work zone management, the TCB reviews and approves any detour that will last for longer than ten days.

The City views ITS as essential in keeping the City economically competitive and in providing congestion mitigation. Recently, the City deployed DMS and cameras around the Port of Rochester and O'Rorke Memorial Bridge to alert motorists about delays and provide information about alternate routes. This is important during special events in the Port area.

The City is also interested in coordinating ITS from an economic development perspective. That is, using targeted ITS deployments in conjunction with economic development to make commercial and residential developments more appealing. The City purchased some portable DMS to deploy them for parking management, traffic routing, or other types of traveler information during events near Port of Rochester.

The City adopted a Complete Streets Policy in December 2011 and has been actively investing in providing multimodal transportation facilities within highway infrastructure projects. The City's focus has been shifted from measuring vehicular level of service to multimodal mobility level of service in evaluating transportation impacts of projects.

Future plans for ITS in the City include installing AVL on the Department of Environmental Services (DES) fleet, specifically on snow plows, and procuring weather sensors to track weather conditions around the City. The DES is also very supportive of RGRTA's transit ITS initiatives. Other potential ITS initiatives include using NYS 511 System and DMS for special event parking management. The City also would like to be on the leading edge of newer technologies, City will need to dedicate more resources to evaluate and respond to them.

The City would like to implement the following initiatives in the coming years:

- 0 to 3 years: Implementing Complete Streets policy to accommodate all users of the transportation system; Resources to be on top of current trends in transportation industry.
- 3 to 5 years: Smart City Applications; and Comprehensive Mobility Application.
- 5 to 10 years: Connected Shared Automated Vehicle Shuttles; Connected Vehicles; Intelligent, Sensor-Based Infrastructure; Urban Analytics; User-focused Mobility Services and Choices; and Urban Delivery and Logistics.

Rochester Genesee Regional Transportation Authority (RGRTA)

Established in 1969, RGRTA consists of a number of subsidiary agencies that provide public transit services within the Genesee-Finger Lakes Region. The largest subsidiary is the Regional Transit Service (RTS), which serves the City of Rochester and Monroe County communities. Lift Line (LL) provides paratransit services to those same jurisdictions.

RGRTA has implemented a suite of ITS systems to support its fixed-route and demand response (paratransit) operations, including computer-aided dispatch/automatic vehicle location, fare collection, real-time passenger information, onboard video surveillance, and more.

Regional services include the Batavia Bus Service (BBS), serving Genesee County; the Livingston Area Transit Service (LATS), serving Livingston County; Orleans Transit Service (OTS), serving Orleans County; Seneca Transit Service (STS), serving Seneca County; Wayne Area Transportation Service (WATS), serving Wayne County, and Wyoming Transportation Service (WYTS), serving Wyoming County. The combined fleets of RGRTA's subsidiaries total about 410 buses.

In recent years, RGRTA has invested in a significant transit technology deployment program, the Technology Initiatives for Driving Excellence (TIDE).

RGRTA has two primary goals with respect to its ITS initiatives:

- Customer satisfaction – Establishing a real-time connection to their customers; providing useful information and making transit ridership an attractive discretionary choice.
- Operating efficiencies – Using ITS to inform operational decision making processes and improve resource allocation and operational efficiency.

The RGRTA TIDE program envisions implementing a comprehensive suite of transit applications, including: CAD/AVL, Onboard Systems, Communications, and Traveler Information.

Several of these systems are already operational, with others in various stages of design and implementation. RGRTA has studies the feasibility of implementing transit signal priority (TSP) but the cost for equipment upgrade to accomplish this was found not to be sufficiently beneficial to operations to justify deployment of the technology.

Looking to the future, the RGRTA is interested in following:

- Asset and Maintenance Management;
- Data Warehouse and Business Intelligence;
- Fixed Route and Regional Scheduling and Service Planning;
- Paratransit Scheduling and Dispatch;
- Enterprise Resource Planning;
- Revenue Management;
- Video Monitoring and Security.

The RGRTA does not currently receive information from local agencies with regards to incidents, but would be interested in receiving this information, if available. This would allow the agency to perform real-time rerouting of their vehicles, particularly express routes that typically operate on expressways but could be diverted in the event of an incident. RGRTA also looks to continue its partnership with Monroe County to share fiber and communication resources.

New York State Thruway Authority (NYSTA)

The New York State Thruway Authority operates the 570-mile long Governor Thomas E. Dewey Thruway, the state's principal highway network. It is one of the longest toll superhighway systems in the United States. Thruway Authority facilities include 2,822 lane miles of roadway, 811 bridges, over 300 buildings, 27 service areas, and 281 toll booths. The Authority is organized into four regional divisions (Albany, Buffalo, New York and Syracuse) with its Administrative Headquarters located in Albany.

The Thruway Authority oversees all aspects of the highway's maintenance and operation; ranging from large-scale infrastructure replacement projects to the deployment of ITS elements to incident management. The Thruway Authority works closely with the New York State Police Troop T, whose members are responsible for law and traffic enforcement on the Thruway.

NYSTA is interested in seeing greater operational integration of its facility with adjacent facilities in the Greater Rochester region. This is becoming increasingly important as urbanization in the Thruway corridor lends to greater interaction of the Thruway with NYSDOT feeder routes on a routine basis. However, there are challenges to improved coordination due to the fact that Thruway operations and management decisions are made outside the region, and the Thruway has its own set of operational protocols and management priorities in responding to incidents and communicating with travelers. Addressing these institutional issues will be key to providing more seamless communications and management across the region.
The communication between NYSTA and RTOC has been improved in the recent years, particularly with regard to weather events and Traffic Incident Management (TIM). The Thruway Authority would also be interested in having more frequent meetings of the Transportation Management Committee to discuss operational strategy and other issues.

There is a Standard Operating Guideline between Thruway Authority, the New York State Police, and the New York State Office of Emergency Management that covers expectations of each agency and inter-agency coordination efforts if the Thruway is closed.

Moving forward, NYSTA places a high priority on developing plans for emergency operations. They are also interested in refreshing ATMS, updating CCTV system with IP-based cameras, and identifying opportunities for overall technology refresh as a long term.

NYSTA's general concerns regarding the future maintenance of ITS infrastructure include:

- To be able to keep up with the technological advancements;
- To be able to hire and retain well qualified and trained staffed in network technology and toll equipment technicians; and
- Where possible, improve interagency coordination to improve management of major incidents such as winter Thruway closures, and to improve the seamlessness of management across jurisdictional boundaries.

Genesee Transportation Council (GTC)

As the Metropolitan Planning Organization for the nine-county Genesee-Finger Lakes Region, GTC plays an important role in planning and funding of ITS deployments in the region.

GTC is a planning agency and does not own or operate infrastructure. Historically, GTC has served as a facilitator, promoting regional coordination in ITS deployment and operation, including development of this regional TSMO Strategic Plan Update. GTC also facilitates the Transportation Operations Coordination Committee (TOCC) introduced earlier.

GTC is responsible for developing the regional Long-Range Transportation Plan (LRTP) and Transportation Improvement Plan (TIP). GTC is a vital facilitator and 'gatekeeper' for funding of regional transportation infrastructure projects. From an ITS perspective, this includes both funding of ITS deployments that address identified regional needs as well as promoting transportation system management and operations strategies and technologies as one of the potential solutions to the region's transportation needs. As a facilitator of ITS, GTC maintains the Regional ITS Architecture.

As with its peer agencies across the country, GTC is increasingly seeking tools and metrics for evaluating the performance of the regional transportation system as well as the effectiveness of the region's transportation investments. One example is its federally-mandated Congestion Management Process (CMP), which identifies and monitors congestion hotspots in the region. ITS field devices are one potential source of operational data to support CMP and LRTP monitoring, and could provide a more accurate and cost-effective alternative to existing sampling methods.

Analysis of field data also provides opportunities to monitor other regional transportation and system management performance metrics, particularly those requiring pervasive and continuous 24/7 monitoring due to their unpredictable nature (e.g., incident frequency and the duration of resulting delays).

Existing and Planned ITS Infrastructure

As noted above, agencies in the Rochester-Genesee Region have invested substantially in deployment of ITS equipment and fiber optic communications for over two decades. The legacy of this investment is a substantial network of field equipment across the region.

Existing ITS devices in the region are owned and operated by the following agencies:

- New York State DOT
- New York State Thruway Authority
- Monroe County DOT
- Rochester-Genesee Regional Transportation Authority
- City of Rochester

As part of the update of the Rochester-Genesee TSMO Strategic Plan, the GIS inventory for existing and planned ITS devices and fiber optic communications was reviewed and updated in cooperation with the above agencies. These assets are shown on the following maps:

- Monroe County Urban Traffic Signals (Figure 3-1)
- Monroe County Regional Traffic Signals (Figure 3-2)
- ITS Camera (CCTV) Urban Area Locations (Figure 3-3)
- ITS Camera (CCTV) Regional Locations (Figure 2-4)
- Dynamic Message Sign (DMS) and Highway Advisory Radio (HAR) Urban Area Locations (Figure 3-5)
- Dynamic Message Sign (DMS) and Highway Advisory Radio (HAR) Regional Locations (Figure 3-6)
- Urban Area ITS Fiber Optic Cable Map (Figure 3-7)
- Regional ITS Fiber Optic Cable Map (Figure 3-8)

Figure 3-1: Monroe County Urban Traffic Signals

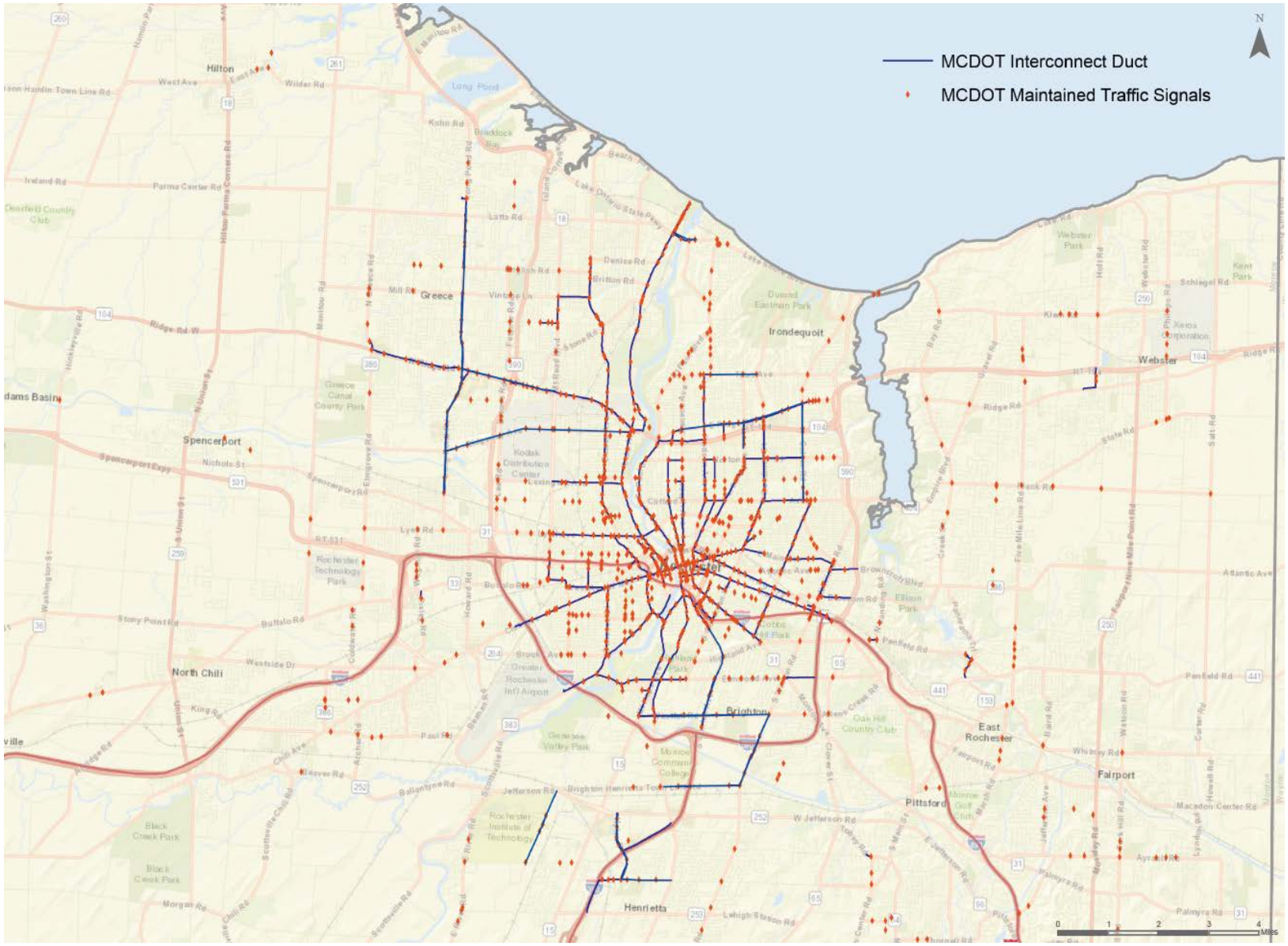


Figure 3-2. Monroe County Regional Traffic Signals

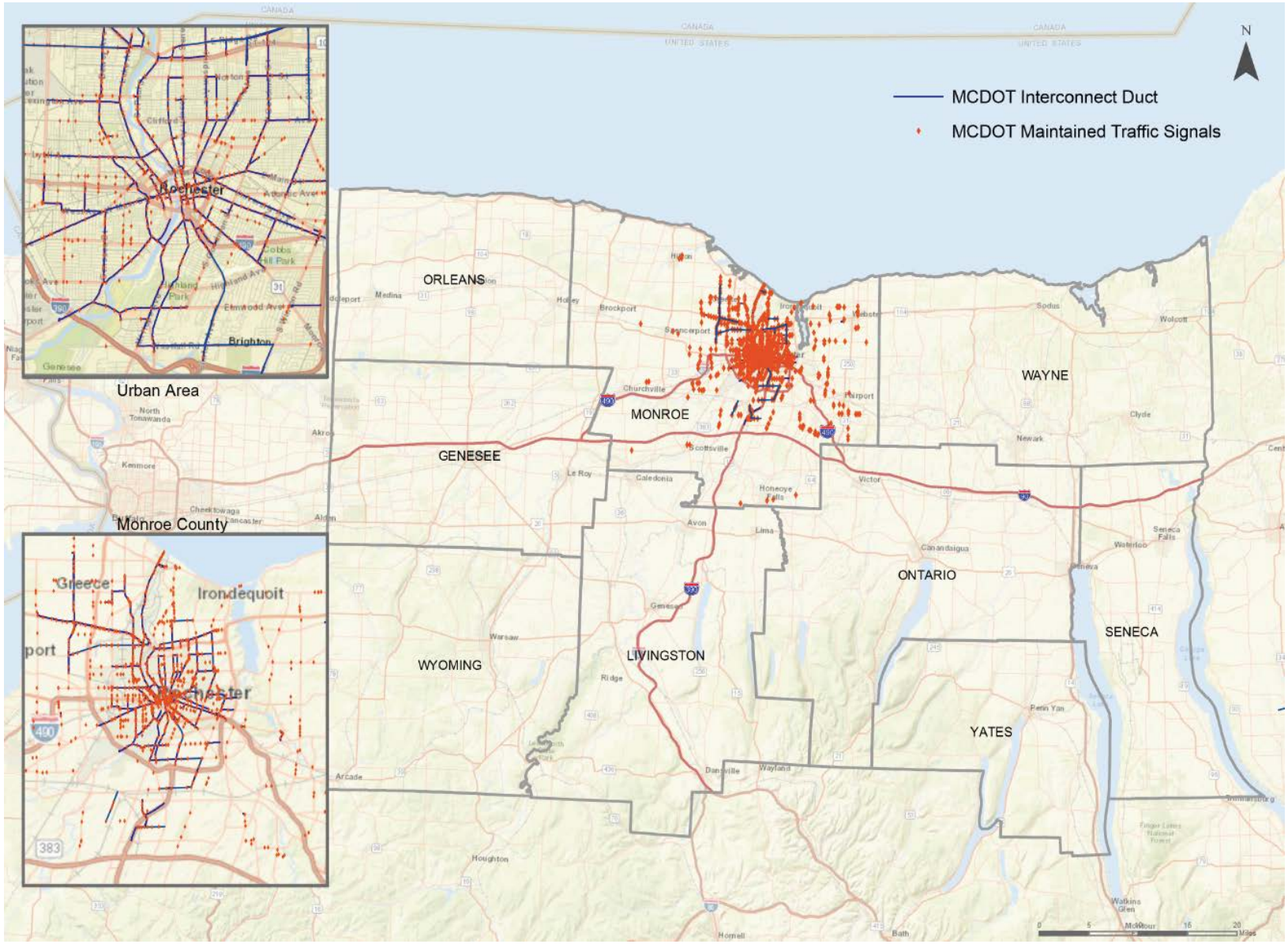


Figure 3-3. ITS Camera (CCTV) Urban Area Locations

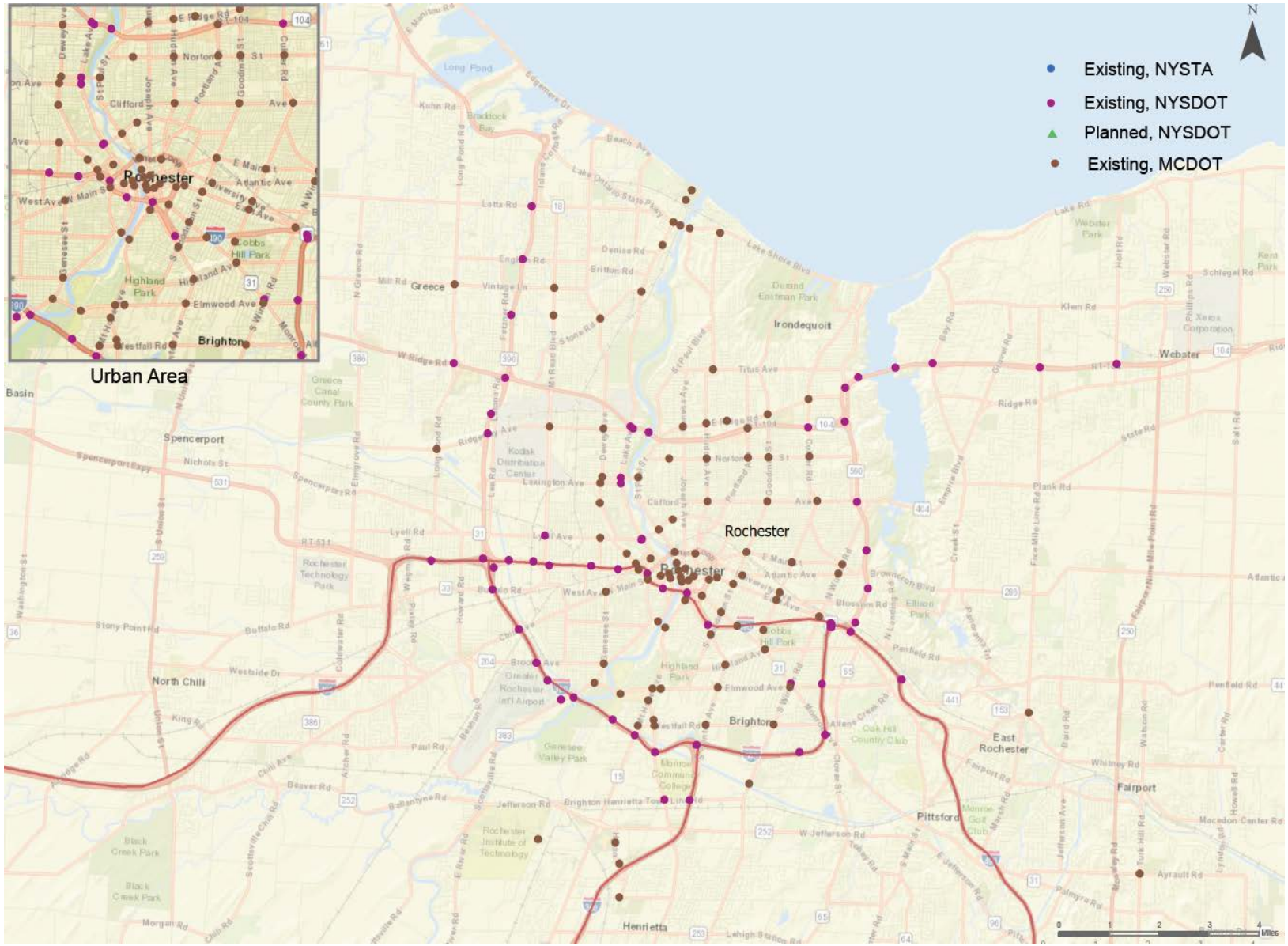


Figure 3-4. ITS Camera (CCTV) Regional Locations

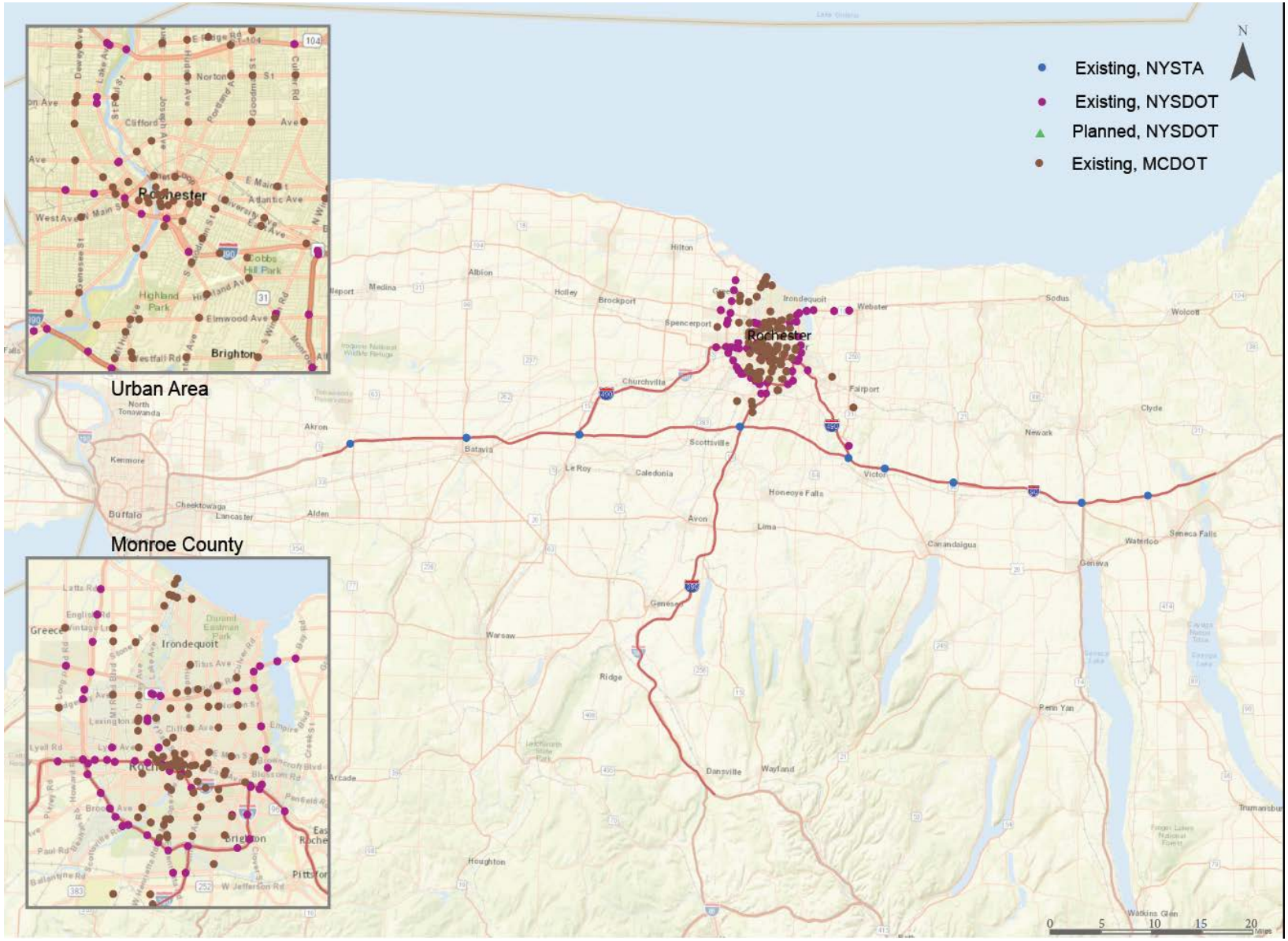


Figure 3-5. Dynamic Message Sign (DMS) and Highway Advisory Radio (HAR) Urban Area Locations

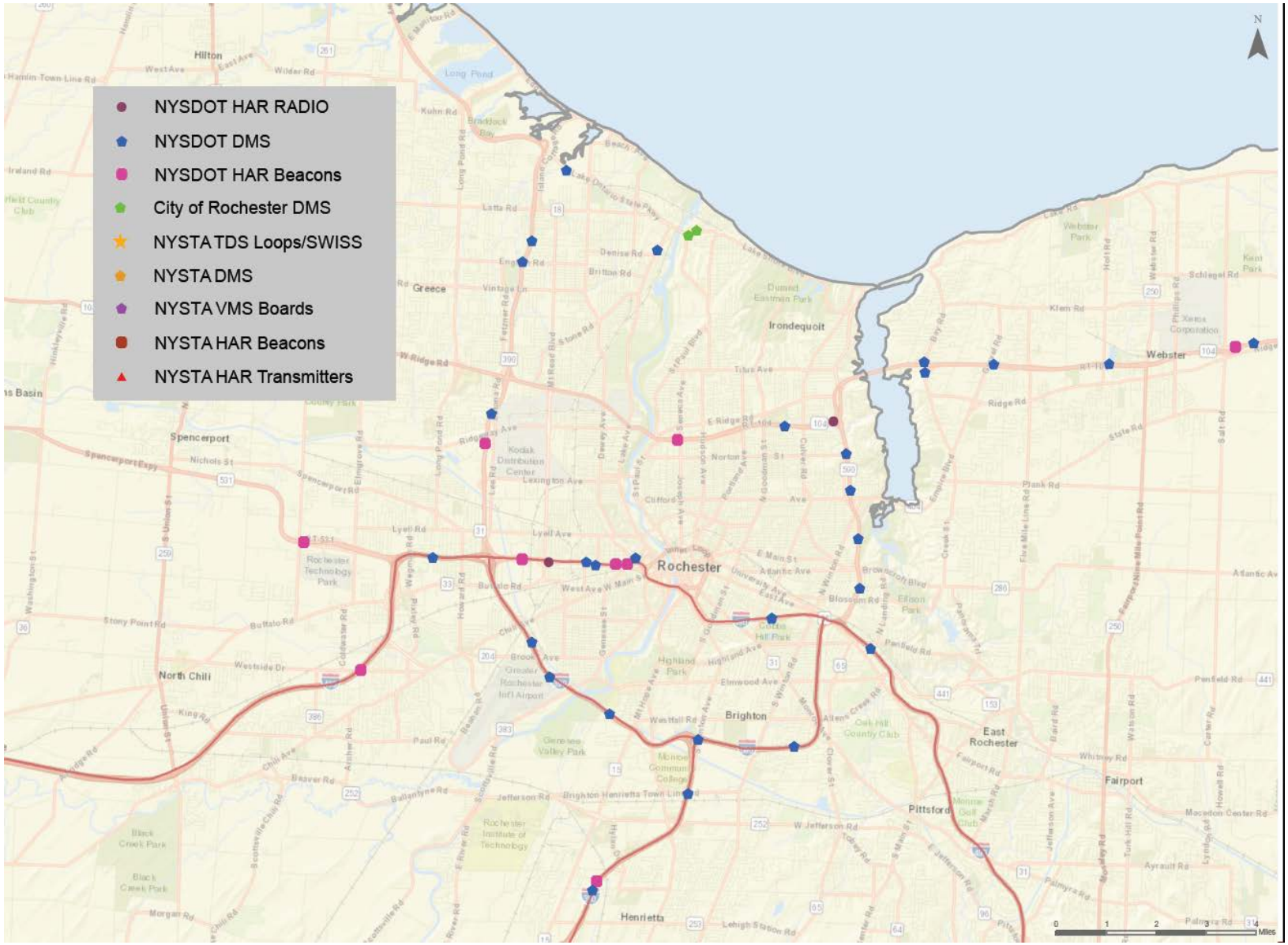


Figure 2-6. Dynamic Message Sign (DMS) and Highway Advisory Radio (HAR) Regional Locations

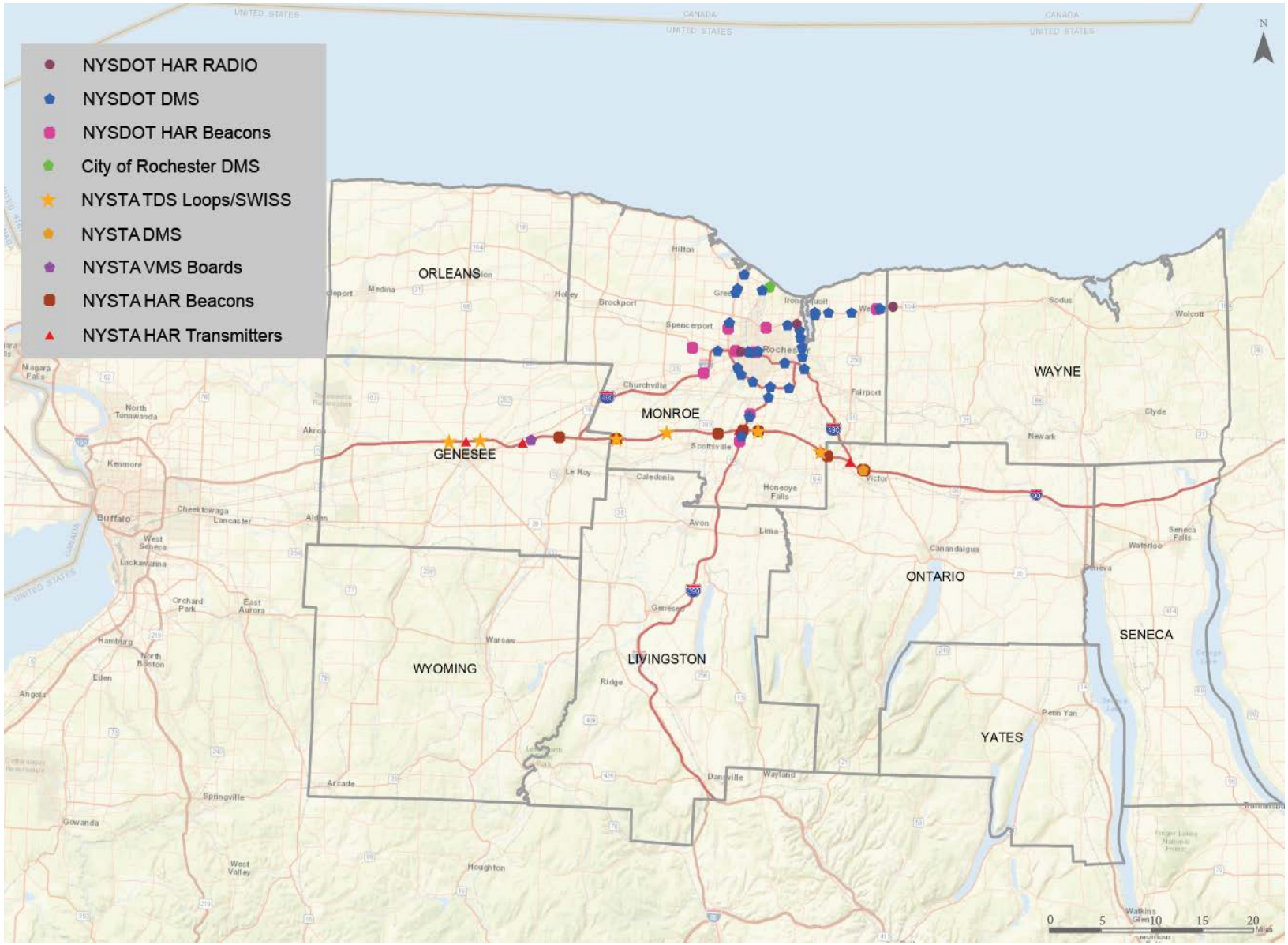


Figure 3-7. Urban Area ITS Fiber Optic Cable Map

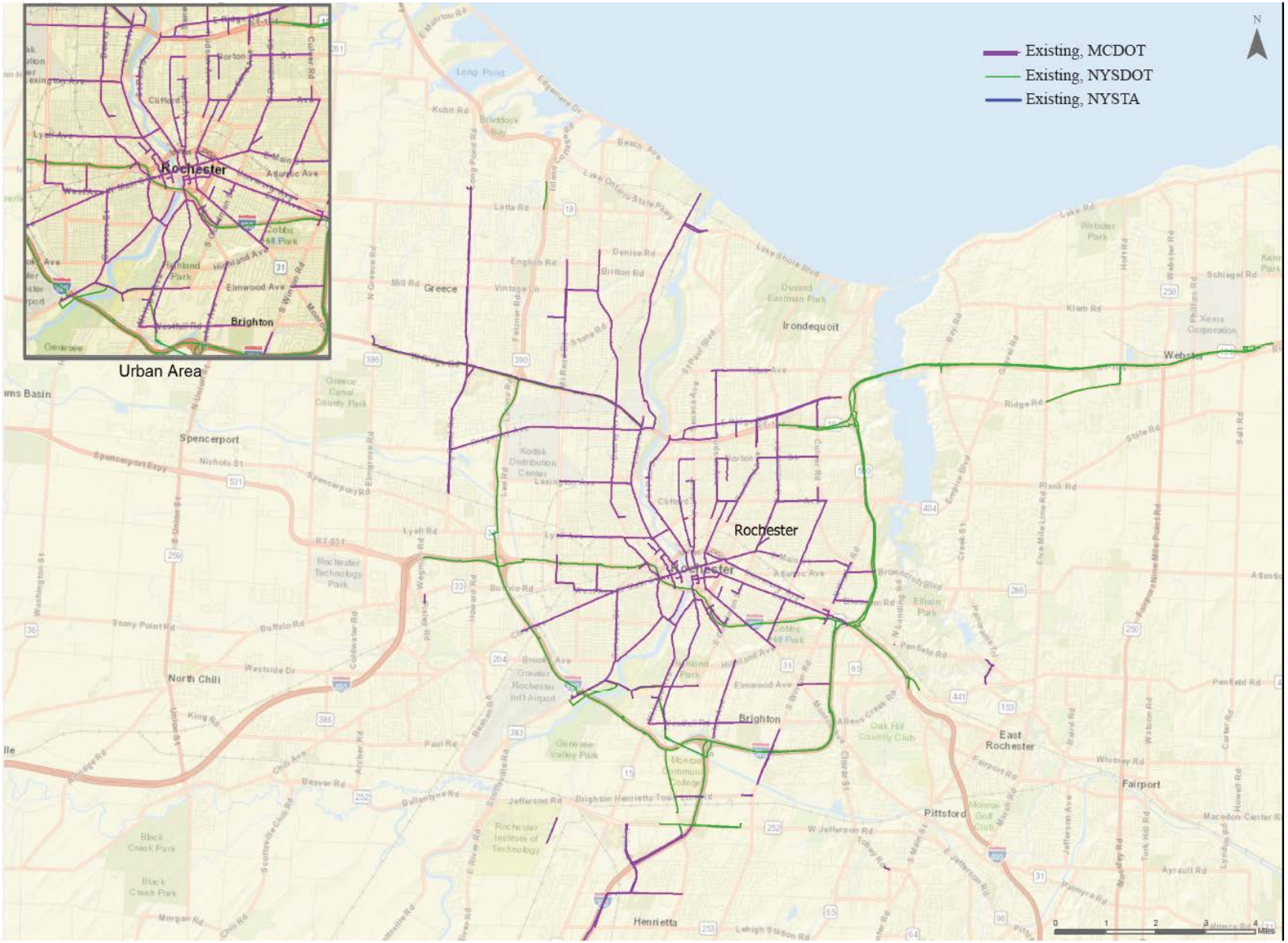
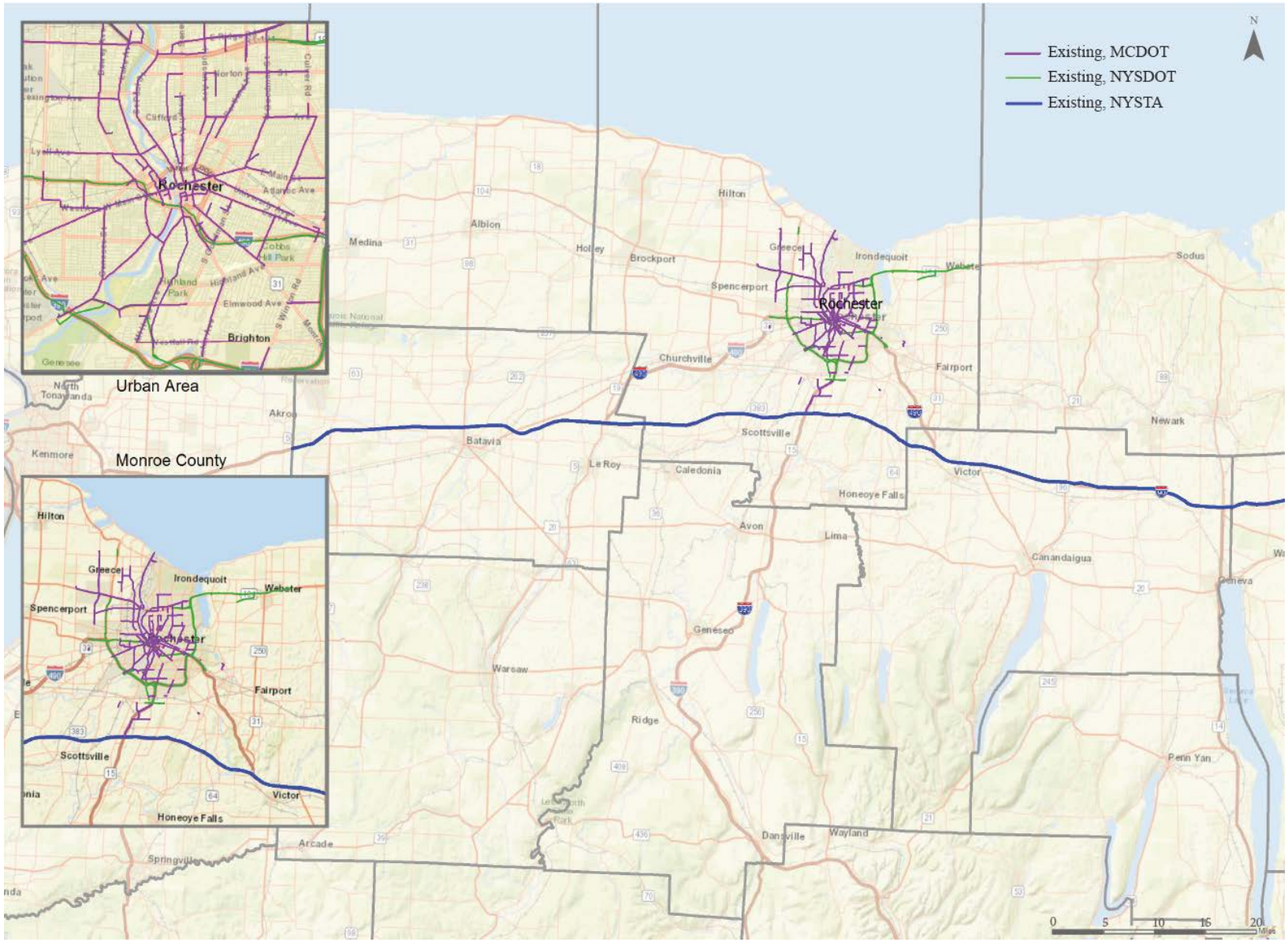


Figure 3-8. Regional ITS Fiber Optic Cable Map



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4. Needs Assessment

Overview

This section summarizes the TSMO needs assessment in the Genesee-Finger Lakes region based on agency interviews, input from the project Steering Committee, and findings from the Community Symposia.
The region is at a transition point for Transportation System Management and Operations. Two different trends are driving strategic planning for TSMO: 1.) maintaining a mature TSMO program in a financially-constrained environment, and 2.) adapting to the potentially transformative changes of emerging mobility technologies.

Theme 1: Maintaining a Maturing TSMO Program

After many years of continual deployment and operations of ITS infrastructure and TSMO programs in the region, much of the core ITS and communications infrastructure in the region is built out over key multimodal corridors. There are opportunities for geographic expansion, but these are likely to be limited to specific areas driven by localized growth or the need to address operational hotspots such as areas of recurring traffic congestion.

The region's core operational programs, like incident management and transit management, have reached a level of maturity and stability based on years of operational experience and multi-agency partnership. Additionally, many of the initial generations of ITS and communications systems are approaching the end of their useful lives. This creates a growing need for re-investment and renewal of existing infrastructure to maintain existing TSMO capabilities, such as expressway incident management.

Agencies also face limited resources for capital and operational investments in TSMO. There is a need to do more with less, justify new investments and expansions, and ensure that management of existing assets and programs is prioritized.

Theme 2: Embracing and Adapting to Emerging Mobility Technologies

In addition to these challenges of maintaining and sustaining a maturing TSMO program, the region is facing the same opportunities and uncertainties as other regions posed by emerging mobility technologies, from the advent of connected and autonomous vehicles to the power of big data and machine learning.

In contrast to maturity and focus of the existing TSMO programs, there is a tremendous amount of uncertainty around these potentially transformative technologies. Much like the early days of ITS implementation, significant experimentation and policy development is occurring as these technologies enter the mainstream.

The challenge for the Genesee-Finger Lakes Region is understand the future role of public agencies in this new ecosystem. The private sector is playing an increasingly prominent role in many emerging technologies, and is likely to be in a lead position for investment and operations of some applications. This creates uncertainty about the role of public agencies as implementers, operators, or regulators.

Despite this uncertainty, emerging mobility technologies are too important of a trend to ignore, even if the region, and the nation, will be working to define the appropriate course of action for public sector transportation agencies for several years to come.

Summary of Regional TSMO Needs Identified

Reflecting the two trends described above, a range of needs were identified through the course of the needs assessment with input from agency staff, Steering Committee members, and Community Symposia participants.

A summary of these needs is presented below.

Sustaining Core Operations Programs

The success of longstanding operations programs, coupled with the realities of limited funding, have led several regional agencies including NYSDOT and MCDOT to conclude that the future priority should be supporting core operations programs such as incident management, winter maintenance, emergency management, transit management, and traveler information.

After years of RTOC operations and other investments, the benefits of a regional TSMO project have been demonstrated. In particular, the management of non-recurring congestion is one of the primary benefits. While there are opportunities for technological innovation and selective expansion (discussed later in this section), agencies understand the need for a pragmatic, realistic, and attainable TSMO vision that supports the high-value functions that agencies are able to deliver best.

Asset Management and Renewal of ITS and Communications Infrastructure

Since the 1990s, transportation agencies in the have deployed ITS infrastructure across the region, beginning with pilot projects and culminating with instrumentation of most of the operationally-significant travel corridors in the region.

The lifecycle for technology infrastructure is significantly shorter than most conventional transportation assets—as short as five to ten years in many cases.

As ITS field equipment ages, there is a need for an increasing proportion of capital funding and program emphasis on renewal and replacement of ITS assets to maintain existing operational capabilities.

For example, CCTV camera coverage of major arterials and expressways support core functions like incident management, traveler information, emergency response, and winter maintenance. Loss of camera equipment functionality or reliability due to aged equipment would quickly debilitate these operations programs if there is not a sustained reinvestment effort.

An Asset Management approach is recommended to help regional agencies track, plan, and qualify capital re-investment needs, similar to precedents set by pavement management and bridge maintenance programs. This information will help regional agencies make the case for funding.

Selective ITS Infrastructure Expansion (Geographic and Functional)

Limited federal-aid funding and competing needs for ITS and operation investments requires a measured approach to the geographic and functional expansion of ITS field instrumentation. Localized growth within the region, such as the increase of employment on the south side of the City of Rochester in the vicinity of the University of Rochester and Strong Memorial Hospital campuses, generate shifts in travel patterns and creates greater demand for access to these locations. In turn, this demand creates a need for expanded ITS and communications infrastructure in these areas.

However, this expansion is likely to be the exception rather than the norm in the future, as there is increased scrutiny of the cost-benefit assessments of new ITS deployments. In recognition of the ongoing costs to plan, build, operate, and maintain ITS field instrumentation, regional agencies are seeking ways to better use existing ITS elements. For example, relocating traffic cameras from one location to another with greater need for monitoring traffic conditions is one way to cost-effectively expand ITS coverage.

Regional agencies also recognize that additional ITS infrastructure deployment creates ongoing operational costs to monitor and maintain that equipment. These ongoing costs must also be considered in the overall analysis of the benefit of infrastructure expansion.

Sustainable Funding for TSMO Infrastructure and Operations

An ongoing TSMO challenge, both regionally and across the country, is obtaining stable capital and operations funding to sustain TSMO programs.

The era of earmarked ITS grant programs for implementation is long gone, and competition for remaining funding sources is increasing.

Securing funding for staffing, equipment maintenance and repair, management center operations, and other operations-related expenses can be even more challenging than obtaining funding for capital projects, which can be achieved thorough a wider array of capital grant dollars. The overall proportion of TSMO funding devoted to operations is likely to grow as emphasis shifts to sustaining mature TSMO programs. It is important that regional agencies can make the case for operations investments through performance metrics, asset management, and advocacy among policy makers, decision makers, and the public.

Furthermore, just as the emergence of ITS programs created new funding sources for pilot projects, model deployments, and technical research in the 1990s and 2000s, a new generation of funding programs focused on multimodal operations, emerging mobility, and smart cities is emerging at the federal and state levels. It is important that TSMO messaging about funding needs and benefits are aligned with the goals and criteria of these new funding sources.

Coordinated Interagency Approach to Operations and Systems Integration

One of the historic strengths of TSMO in the Genesee-Finger Lakes region is the cooperative approach to regional operations challenges. The ability of agencies to coordinate across modes and jurisdictional boundaries—including transportation and emergency management—is embodied in programs and facilities like the Regional Traffic Operations Center.

Stakeholders identified the need to stay the course, and to explore focused opportunities for further interagency integration, such as event management and further sharing of real-time traffic information with RGRTA (building upon the successful expansion of the MCDOT traffic camera system to RGRTA's transit operations center).

The approach to systems integration should be measured and deliberate. For example, NYSDOT and MCDOT recognize that there are benefits to, for example, traffic signal interoperability. However the technical, cost, and staff training challenges to achieve this goal may outweigh the benefits and available staff resources.

Staff and Resource for Cost-Effectiveness and Efficiency

Stakeholders seek to continue to find ways to operate with greater efficiency and flexibility by sharing resources and staff to maintain operations programs. A key existing example is cross-training of RTOC staff, and the ability of NYSDOT staff to perform basic MCDOT functions after hours and on weekends. Another example is the standardization of technology to reduce spare parts requirements and streamline maintenance training.

These efficiencies will help agencies make the most of limited resources, improve services delivery, and demonstrate efforts to improve efficiency in TSMO program delivery.

Timely, Accurate, and Consistent Real-Time Information across All Information Channels

Traveler information systems continue to evolve from closed, agency-led 'push' systems like Dynamic Message Signs to diversified, individualized, and mobile 'pull' channels like 511, mobile device, and vehicle dashboard integration. Additionally, the role of third-party information providers like Google in providing static and real-time traveler information has greatly advanced since the 2011 plan.

Agencies recognize that the public interest is served when travelers can receive timely, accurate, and consistent traveler information on their preferred devices. This speaks to the opportunities to develop open data portals and efforts to ensure the quality of the underlying data that supports these consumer-facing applications, whether agency-led or third-party.

Supporting a Seamless Transportation System

Regional agencies see increasing opportunities, particularly through data sharing and traveler information, to use TSMO strategies to support increased multi-modal integration.

An example is the integration of Rochester's bikeshare system with walking and transit modes for multi-modal trip planning. Another example is the deployment of bicycle detection at traffic signals as part of signal

upgrades and 'complete streets' projects. Other programs are inherently multi-modal, such as incident management programs that improve travel time reliability and reduce travel time for auto, transit, and freight users.

Multi-modal integration of TSMO programs is consistent with regional transportation policy and encourages further cooperation among agencies, and therefore should be encouraged when possible.

Building Open Data Infrastructure

Transportation data systems are rapidly moving from traditional closed, proprietary systems and data to open data standards that allow vendor-agnostic systems integration and use of third-party services such as web apps and reporting dashboards.
An excellent example that has emerged nationally in recent years is the GTFS and GTFS-realtime General Transit Feed Specification. This standard allows for sharing of transit schedule and operational data with third-party apps, websites, and field infrastructure like real-time bus arrival signs. It also supports a growing number of planning and performance analytics based on rapid innovation by many agencies and solutions providers.

Use of open data provides a platform for integration, innovation, performance measurement, analytics, and transparency. An almost infinite number of systems integrations and data combinations can be supported if agencies subscribe to standard data formats and make this information available to users. The emergence of smart cities, shared mobility, and connected and autonomous vehicles will only increase the prevalence of open data and the potential benefits to the region.

Performance Measurement and Planning Data Analytics

The proliferation of data, and the ability to draw ITS system data and third-party data sources together provides increasing opportunity for performance measurement and planning data analytics.
The benefits of TSMO programs in addressing non-recurring congestion, for example, have historically been difficult to quantify through conventional survey methods. The ability to capture the impacts, and the benefits of TSMO programs, on non-recurring congestion is possible when large-scale datasets like traffic flow data can be collected, stored, queried and presented.

There are also many planning applications of data. GTC has adopted purchased third-party data as a means of advancing its regional performance measurement program, in partial response to federal performance requirements. Planners can use data from roadway, transit, and other sources to understand transportation conditions in a particular corridor. The increased availability of commercial tools to aid such analysis have made such analyses more feasible in the region than ever.

"Future Proofing" Infrastructure for Emerging Mobility

Since the 2011 ITS Strategic Plan was completed, the Genesee-Finger Lakes region has seen the introduction of two new modes – bikeshare and rideshare services (i.e., Transportation Network Companies). However, the impacts of these additions to the regional transportation system may pale in comparison to the changes presented by other emerging technologies and services, including Connected and Autonomous Vehicles (CAVs) and Mobility-as-a-Service (Maas)/Transportation-as-a-Service (TasS) capabilities.

Connected Vehicles operate with dynamic two-way communications between vehicles and/or roadside infrastructure. Autonomous Vehicles have many of the same functionality as Connected Vehicles, but operate independently of other vehicles and infrastructure (i.e., autonomously without two-way communications) and are designed to function without public infrastructure enhancements. MasS/TasS refers to the shift from ownership-based vehicle accessibility to subscription-based accessibility. MaaS/TasS foresees a future in which people will access mobility on a demand-basis in lieu of buying their own vehicles, thus freeing consumers from many of the burdens of vehicle ownership and expanding access to vehicle mobility.

As noted previously, future public sector roles associated with emerging technologies and services are difficult to define, yet the potential impacts are too profound to ignore. Therefore, regional agencies need to monitor national, statewide, and local developments over the coming years to identify the most strategic approach for the region—and how new mobility services will be integrated into the current system.

An example is the adoption of ITS deployments to support vehicle-to-infrastructure integration of connected vehicles. Local agencies may reasonably assume that future upgrades to traffic signal controller equipment or communications should be "future proofed" to adopt to this technology. The vendor industry may respond with technologies that meet this need. New funding programs and/or private entities may play a role in funding this infrastructure. While the answers are not currently clear, it behooves stakeholders to monitor these developments.

Many agencies have come to realize that policies, regulations, partnerships, and technologies introduced by the new sharing economy modes like rideshare are a stepping stone towards the changes that will be required to support CAVs. Lessons learned from, for example, managing rideshare pick-up and from-off for large scale events like Port of Rochester concerts and festivals may provide experience in how autonomous vehicle staging, circulation, and loading may one day be handled.

Agencies should look to the examples of national early adopters for lessons learned when charting the Genesee-Finger Lakes region's own course.

Building Public-Private Smart Cities Partnerships

One of the issues that emerged prominently in the Community Symposia was the opportunity to build smart cities partnerships beyond the conventional agencies involved in TSMO operations. Much like the early days of ITS deployment, these partnerships lay the foundation for future technology deployment and operation of the smart city.

The USDOT Smart Cities Challenge provide an opportunity for regional conversations about what Smart Cities means to the region, and also to draw inspiration from other applicant cities.

Through this national effort and the two Community Symposia of the TSMO planning process, regional partners have expressed interest in collaboration to address diverse regional challenges, from job access and equity to energy efficiency and economic competitiveness.

As with emerging mobility, smart cities presents many unanswered questions in the near term, but clearly creates an opportunity for the region to keep an 'ear to the ground' in anticipation of new opportunities. Maintaining the regional dialogue is the most promising investment towards a smart cities future in the near term.

Leveraging Emerging Funding Sources

A key benefit of considering smart cities and emerging mobility in regional TSMO strategy is the likely emergence of new funding sources targeted in these areas for both public and private sources.

Over the years, regional agencies have successfully competed for discretionary grant funding and a share of agency funding based on criteria such as congestion mitigation, air quality, safety, homeland security, etc. As funding programs and policy goals evolve to embrace emerging mobility and smart cities, the region should be prepared to articulate needs and benefits that create a compelling case for investment as measured against these emerging criteria.

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5. Regional TSMO Objectives and Initiatives

Overview

This section describes the ten Objectives and their associated Initiatives that will guide Transportation System Management and Operations activities in the Rochester-Genesee region over the next five to ten years.

The emphasis in developing this plan was on *focus* and *achievability* over the plan's time horizon, rather than comprehensiveness in attempting to anticipate and address every potential TSMO-related initiative, partnership, or infrastructure investment.

The Objectives outlined in this section reflect the evolving nature of TSMO programs and activities. They cover both established programs and ITS field instrumentation as well as the emergence of unknown and potentially transformative new ITS technologies, partnerships, and data applications.

The need to address current operational needs and benefits while anticipating changing agency roles and future opportunities underscores the continued need for the interagency coordination and cooperation that had benefitted the region for the past 30 years.

The Objectives suggest that interagency coordination activities, such as the Transportation Operations Coordination Committee, will continue to be critical for realizing the region's TSMO vision. Additionally, new partnerships, especially with private-sector, not-for-profit, and smart cities stakeholders, are emerging as an increasingly important means of advancing TSMO-related programs and services such as Mobility-as-a-Service applications.

This section includes ten tables, one for each Objective. The tables discuss the Objective's background, identify specific *Regional Strategies* required to achieve the Objective, identify a set of *Activities and Coordination Tasks* required to implement the Strategy, and lastly identifies one or more *Targeted Outcomes* (over a five to ten year period) that identify how regional agencies will determine whether or not an Objective has been successfully implemented. These Objectives provide a framework for member agencies to consider ITS and communications infrastructure investments aimed at supporting regional operations programs.

Regional TSMO Objectives

The Regional TSMO Objectives are as follows:

- **Objective 1:** Improve Safety and Efficiency of the Multi-Modal Transportation System through Coordinated Management and Operations
- **Objective 2:** Maximize Transportation System Performance from the User Perspective
- **Objective 3:** Implement TSMO as a Low-Cost Solution to Regional Transportation Needs
- **Objective 4:** Target New Investment in ITS and Communications Infrastructure in Locations with the Greatest Impact and Value
- **Objective 5:** Prepare for Emerging Technologies with a Potential Transformative Impact on Regional Transportation
- **Objective 6:** Promote Partnerships and Collaboration to Support Regional Operations
- **Objective 7:** Integrate TSMO into Regional Planning and Policy Making
- **Objective 8:** Maximize Program Efficiency through Resource and Cost Sharing
- **Objective 9:** Support Long-term TSMO Operations and Capital Investments Through Sustainable Funding and Asset Management Strategies
- **Objective 10:** Promote Interoperability and Value-Add Services through Shared and Open Data

Objective 1:

Improve the Safety and Efficiency of the Multi-Modal Transportation System through Coordinated Management and Operations

Relevance to the Genesee-Finger Lakes Region: The benefits of Transportation System Management and Operations (TSMO) strategies are reaffirmed with a coordinated response to major winter storms, peak period expressway incident, or visit to the NYSDOT 511 multimodal traveler information website. The agencies jointly responsible for planning, building, operating, and maintaining the regional transportation system have identified TSMO as a policy priority to maximize the safety and performance of the region's transportation system. The regional TSMO program is focused on providing the institutional and technological framework and resources to implement effective operations strategies across all modes and jurisdictions on a daily basis.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
1.1.: Leverage technologies, personnel, partnerships, and policies to proactively manage the regional transportation system.	• **1.1.A.:** Implement a multi-faceted regional TSMO program incorporating the entire lifecycle of activities – planning, design, implementation, operations, maintenance, asset management, and infrastructure renewal.	• Ongoing TSMO program implementation and interagency coordination across jurisdictions, modes, and levels of government.
1.2: Deploy regional ITS infrastructure with sufficient geographic coverage and functional capability to support the region's operations goals.	• **1.2.A.:** Align TSMO infrastructure investments with demonstrable transportation needs based on consideration of cost (including capital, operations, and maintenance expenses) and user benefits. • **1.2.B.:** Use data generated by ITS field instrumentation to analyze the performance benefits of TSMO programs, particularly as related to before-after impacts and the management of non-recurring congestion.	• Refer to subsequent Objectives for specific activities and outcomes.
1.3.: Promote interoperable agency systems and programs to maximize user benefits and performance outcomes.	• **1.3.A.:** Promote integrated planning, deployment, and operations of TSMO programs across jurisdictions and modes to promote a 'seamless' experience for users that maximizes safety, convenience, and choice.	• Refer to subsequent Objectives for specific activities and outcomes.

Objective 2:
Maximize Transportation System Performance from the User Perspective

Relevance to the Genesee-Finger Lakes Region: Like all transportation investment and modes, the regional TSMO program is ultimately driven by the goal of improving the user's experience – directly affecting the public's welfare and the economic and social vitality of the region. Due to technological innovations, including the proliferation of internet-enabled mobile devices, there is an increasing expectation from the public for real-time information and choice. This is particularly important in transportation when congestion, incidents, weather, and other dynamic conditions affect the traveler experience and decision-making. The traveling public also expects a seamless transportation experience across facilities and modes, irrespective of agency or jurisdictional boundaries.

TSMO plays a pivotal role in bringing a user-centric focus to the transportation system through traveler information, trip planning, and integration with end-user devices. Transportation agencies in the Rochester-Genesee region will continue to seek ways to improve the end-user experience and leverage data and information systems to provide greater responsiveness, flexibility, and choice to the travel experience.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
2.1.: Promote system interoperability across jurisdictional boundaries to create more seamless networks and transportation options.	• **2.1.A.:** Provide coordinated traveler information between the NYS Thruway (I-90) and roads that connect to the Thruway for a more seamless experience and improved route choice for system users.	• Coordinate with the NYSTA on the implementation of the Thruway's detour routes in the event of a Thruway closure. • Coordinate with the NYSTA on the periodic review and update of the Thruway's detour plans. • Improve the timeliness of incident and road closure notifications to partner agencies to enhance emergency response, minimize traffic disruption, and maintain situational awareness of road conditions at all times.
	• **2.1.B.:** Identify ITS field instrumentation needs for providing traveler information on arterials and state highways that function as expressway detour routes.	• See Objective 4 for additional details on ITS investments and deployments.
	• **2.1.C.:** Invest in new and upgraded ITS field instrumentation to provide traveler information.	• See Objective 4 for additional details on ITS investments and deployments.
2.2.: Emphasize accurate, accessible, and timely traveler information as a highly-visible outcome of regional TSMO efforts.	• **2.2.A.:** Improve real-time traveler information notification for construction, incidents, and hazard impacts (flooding, heavy rain, hazardous materials spills, etc.).	• See Objective 4 for additional details on ITS investments and deployments.

	• **2.2.B.:** Provide real-time travel-time data to system users.	• Display real-time travel-time data on regional Dynamic Message Signs.
	• **2.2.C.:** Improve the quality, timeliness, and availability of real-time transit information.	• Connect RGRTA real-time transit feed to NYS 511 system. • Provide transit traveler information through the Where's My Bus (WMB) system.
	• **2.2.D.:** Coordinate with NYSDOT on functional enhancements to the 511NY system.	• Provide real-time construction, incident, and weather information for Interstate Highways, regional expressways, and major commuter and freight routes as identified in the *Regional Long Range Transportation Plan*.
	• **2.2.E.:** Continue to provide CCTV traffic camera feeds to the community.	• Determine the optimal technological platform for distributing CCTV traffic camera feeds to the general public, police/fire/first responders, and freight carriers.
2.3.: Support emerging technologies and business models that increase traveler safety, convenience, and mode choice.	• **2.3.A.:** Provide traveler information and services through diverse third-party private sector platforms that provide user choice and value-added services.	• Establish agency data/developer portals so that third parties can access timely and accurate real-time transportation system information. • Promote integration of data and services from public and private transportation providers to support user flexibility and choice (e.g. travel mode).
	• **2.3.B.:** Expand the use of social media to provide travel information to system users.	

Objective 3:
Consider TSMO as a Potential Low-Cost Solution to Regional Transportation Needs

Relevance to the Genesee-Finger Lakes Region: Pressure on available transportation funding and expectations to "do less with more" have been a reality in the region for many years. In addition to responding to congestion and capacity concerns, the region's aging transportation infrastructure demands an increasing share of available transportation dollars for preventative maintenance, rehabilitation, and facility replacement projects. The result is that transportation agencies must investigate the most cost-effective solutions to transportation needs, either as a near-term solution or a permanent alternative to cost-prohibitive conventional infrastructure projects.

TSMO is a valuable contributor to the low-cost "toolkit" of transportation solutions in the Rochester-Genesee region. While TSMO and ITS technology is not a solution for every problem, it can contribute to the increased performance of the transportation system when there are few other viable alternatives. Opportunities to address transportation needs through application of TSMO should always be a consideration in project planning, design, and policy discussions.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
3.1.: Apply appropriate TSMO strategies to transportation infrastructure projects.	• **3.1.A.:** Consider TSMO strategies as potential solutions when identifying and developing transportation infrastructure projects, including new construction, rehabilitation or repair, and preventive and corrective maintenance. • **3.1.B.:** Follow the Systems Engineering (SE) approach to the design of ITS field instrumentation.	• Integrate TSMO considerations into agency capital project planning and design processes and documentation.
3.2.: Encourage TSMO as an alternative, interim, or complementary solution to conventional capacity expansion projects.	• **3.2.A.:** Collaborate with planners and project sponsors to raise awareness of TSMO opportunities to address specific transportation needs. • **3.2.B.:** Propose TSMO as an alternative or interim solution, particularly when capacity expansion alternatives are infeasible, cost-prohibitive, or detrimental to the community.	• Conduct ongoing TSMO planning and interagency coordination through the TMC to promote application of TSMO strategies.
3.3.: Use the regional TSMO plan and other documents to communicate regional operations needs and identify operationally-significant corridors.	• **3.3.A.:** Communicate the location and needs of regionally-significant TSMO corridors to transportation practitioners and policy makers. • **3.3.B.:** Build awareness of the cost-effectiveness of TSMO solutions through before-after studies that quantify costs, benefits, and user outcomes.	• Develop and maintain a map of operationally-significant corridors. • Promote awareness among project proponents, sponsors, and policy makers of the applicability of TSMO solutions to regional transportation needs.

Objective 4:

Target New Investment in ITS and Communications Infrastructure in Locations with the Greatest Impact and Value

Relevance to the Genesee-Finger Lakes Region: In the past, regional planning efforts for ITS and communications infrastructure focused on the deployment of first-generation ITS field instruments and the expansion of capabilities along major corridors to achieve regional coverage. With many major ITS infrastructure components now in place, regional ITS priorities are shifting to selective expansion of ITS capabilities to address key corridors, specific transportation needs, and 'hotspots' such as event venues or isolated intersections.

Going forward, new investments in expanded ITS and communications infrastructure will be focused in areas where there is a demonstrated need for additional TSMO capability and return on investment. Deployment of new ITS infrastructure will continue to be corridor-based for planning purposes, but will be focused on specific corridors of regional significance and driven by specific needs where TSMO can provide an effective solution, such as congestion hotspots, areas of growth in traffic volume, detour/diversion routes, and multimodal corridors.

This objective focuses on the targeted expansion of ITS field instrumentation; it is complemented by Objective 9 which emphases asset management strategies for renewing and replacing current ITS and Communications infrastructure to maintain coverage and functionality in existing TSMO corridors.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
4.1.: Focus ITS investments on key regional corridors, eliminating gaps in existing coverage, and improving the operational effectiveness of existing systems.	• **4.1.A.:** Expand coverage and complete gaps in expressway ITS field instrumentation and associated communications infrastructure to enhance situational awareness and emergency/incident response capabilities.	• Deploy ITS field instrumentation and associated communications infrastructure on regional interstate highways (I-90*, I-390, I-490, and I-590) and non-interstate expressways (NYS Rt. 104, NYS Rt. 390, NYS Rt. 590, NYS Rt. 531). **In Coordination with the NYSTA*.
	• **4.1.B.:** Expand coverage and complete gaps in arterial ITS field instrumentation and associated communications infrastructure to enhance situational awareness and emergency/response capabilities.	• Deploy ITS field instrumentation and associated communications infrastructure on regional TSMO Implementation Corridors (refer to Section 6 of the Plan).
	• **4.1.C.:** Expand the NYSDOT and MCDOT centralized traffic signal control systems to improve the safety and performance of expressway/arterial interchanges and arterial corridor intersections.	• Focus communications system expansion on linking unconnected traffic signals to the RTOC. • Expand the number of traffic signals whose timing plans can be adjusted in real-time to response to changing traffic conditions. • Develop, implement, and update traffic signal timing plans as appropriate.

	• **4.1.D.:** Implement bicycle and pedestrian supportive ITS capabilities (e.g., crossing safety or bicycle signal detection) to improve the safety and efficiency of bicycle and pedestrian movements.	• Deploy bicycle-supportive ITS capabilities in accordance with bicycle and trail planning efforts such as the City of Rochester Bicycle Master Plan. • Deploy pedestrian-supportive ITS instrumentation in urban and village centers, and in appropriate locations along suburban corridors.
	• **4.1.E.:** Implement transit management enhancements to improve dispatch services, situational awareness, and passenger experience.	• Expand computer-aided dispatch capabilities to all RGRTA operating divisions • Provide real-time information traffic information from RTOC to RGRTA dispatch centers to improve situational awareness • Implement onboard wi-fi service to enhance customer experience
4.2: Deploy ITS field instrumentation in accordance with Integrated Corridor Management (ICM) principles.	• **4.2.A.:** Using Integrated Corridor Management techniques, undertake corridor-level design exercises to identify the full range of desired future capabilities in the corridors identified above under Tasks 4.1.A. and 4.1.B. Member agencies will use an Integrated Corridor Management (ICM) approach to planning, designing, and deploying ITS field instrumentation. ICM is the operational coordination of ITS deployments along a corridor, as well as the associated institutional coordination responsible for managing those deployments. The overall goal of ICM is to improve safety and mobility for travelers and goods using all modes of transportation. The benefit of an ICM approach is that it maximizes agency investments in ITS by ensuring that those investments serve broad community goals.	• ITS field instrumentation deployments include, but are not limited to: o Communications infrastructure (fiber optics, conduit, wireless, etc.). o Synchronized Traffic Signals. o Closed Circuit Television (CCTV) traffic cameras. o Dynamic Message Signs (DMS). o Microwave Sensors. o Highway Advisory Radio (HAR). o Road Weather Information System (RWIS). o Bridge height detection and warning systems. o Ramp Metering/Ramp Gates (for select expressway on-ramps). o Parking management systems for Regional and Sub-Regional Urban Cores (including Rochester's Central Business District), Employment Centers, and special event locations. (See GTC *Long Range Transportation Plan 2040*, pages 27-31)
	• **4.2.B.:** Expand communications system coverage to support ITS field instrumentation deployments.	• Infill communications infrastructure to enhance coverage and improve network redundancy.

		• Leverage wireless connections (in appropriate locations) to increase the communications system's reach beyond its current limits.
	• **4.2.C.:** Upgrade or replace existing ITS field instrumentation at the end of its useful life in accordance with an asset management strategy (see Objective 9).	• Replace aging field instrumentation (CCTV traffic cameras, DMS, RWIS, HAR, etc.) with new equipment. • Update CCTV traffic camera central management system and software and integrate all regional traffic cameras onto a single platform.
4.3.: Coordinate with local and regional planning efforts to identify potential TSMO/ITS deployments.	• **4.3.A.:** Deploy ITS field instrumentation in targeted corridors based on consideration of costs and operational value (See Objective 7).	• Consider TSMO/ITS solutions as part of transportation planning efforts at various sub-regional scales (countywide, one or more municipalities, corridors).
4.4.: Invest in improvements to the Regional Traffic Operations Center (RTOC).	• **4.4.A.:** Periodically assess the need for upgrades to the Regional Traffic Operations Center (RTOC); including both hardware and software enhancements as well as improvements to the facility itself.	• Implement hardware and software upgrades at the RTOC to replace aging equipment and increase functionality.
	• **4.4.B.:** Identify the desired capabilities of a backup operations center for the Regional Traffic Operations Center (RTOC).	• Establish a backup operations center in the NYSDOT-Region 4 Headquarters Building.
4.5.: Support programs, policies, and projects that enhance the safety and efficiency of goods movement.	• **4.5.A.:** Consider the operations needs of freight shippers, carriers, and consignees in the planning, design, and deployment of ITS field instrumentation.	• Include TSMO/ITS strategies aimed at enhancing goods movement in local and regional transportation planning reports as appropriate.
	• **4.5.B.:** Participate in relevant national and statewide planning and deployment initiatives aimed at improving freight operations.	

Objective 5:

Prepare for Emerging Technologies with a Potential Transformative Impact on Regional Transportation

Relevance to the Genesee-Finger Lakes Region: Since the region's current TSMO Strategic Plan was completed in 2011, a number of potentially transformative transportation technologies have gained greater prominence in the transportation industry. Arguably the most profound changes will come from the deployment of Connected and Autonomous Vehicles (CAVs) that will reduce or eliminate the roles of human drivers and create new requirements for communications between vehicles and roadside infrastructure like traffic signals. Additionally, the emergence of these technologies and others is expected to be accompanied by an increasingly prominent role of new private sector companies in transportation operations, including vehicle manufacturers, transportation network/rideshare companies, and software/information services providers.

The ripple effects of such disruptive changes are difficult to forecast, and regional agencies are anticipated to accommodate policy and technical decisions made at the national or even international level. Nonetheless, there are similarities between the emergence of CAVs and Smart Cities technologies that mirror the emergence of Intelligent Transportation Systems 15-20 years ago. Monitoring of technological developments and readiness to pursue policy, funding, and infrastructure measures to maximize the benefits to the Rochester-Genesee region is a prudent position even in the face of great uncertainty in how these technological changes will play out. It is highly likely that these changes will impact the role of public agencies in transportation operations, technology infrastructure, safety, and interaction with the travelling public.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
5.1.: Participate in regional, state, and national Smart Cities-related initiatives to plan for and adopt emerging technologies (i.e., Connected and Autonomous Vehicles [CAV]) to the transportation system.	• **5.1.A.:** Monitor developments in emerging technologies, including Connected and Autonomous Vehicles, that are expected to influence future agency roles, policies, and investments. • **5.1.B.:** Participate in statewide activities related to CAV research and development, planning, policy development, and rollout. • **5.1.C.:** Establish partnerships with public, private, not-for-profit, university, and other entities involved in the development and rollout of emerging technologies to identify common interests and to reinforce long-term partnerships.	• Ensure representation from the Rochester-Genesee region in statewide CAV/Smart Cities initiatives • Coordinate with peer agencies involved in the Rochester's bid for the USDOT Smart City Challenge application and others with related interest in the region • Conduct periodic (e.g. quarterly or semi-annual meetings between TSMO agencies and emerging technologies interests to monitor developments and assess the likely timeline for implementation in the Rochester-Genesee region • Engage private-sector providers of technology and mobility services as they enter the Rochester-Genesee market through the Transportation Management Committee and other channels.

5.2.: "Future proof" ITS and communications technologies by adopting emerging industry standards in areas such as vehicle-to-infrastructure communications.	• **5.2.A.:** Monitor developments at the federal level to develop standards and architectures related to vehicle-to-infrastructure communications and other areas that may impact agencies. • **5.2.B.:** Consider CAV-ready infrastructure as part of future ITS system and hardware re-investments.	• Monitor ongoing national and industry CAV developments. • Conduct additional CAV/Smart Cities planning and preparedness activities as federal, state, and industry guidance emerges.
5.3.: Seek early funding and deployment opportunities for pilot projects and catalyzing investments where there is alignment with regional needs and priorities and support from regional stakeholders.	• **5.3.A.:** Position the Rochester-Genesee Region to take advantage of new funding sources (public or private) that incentivize the adoption of CAV-supporting technologies.	• Monitor funding opportunities and pursue funding when warranted and aligned with regional priorities. • Revise project selection criteria for the Transportation Improvement Program to consider CAV-supportive technologies.

Objective 6:
Promote Partnerships and Collaboration to Support Regional Operations

Relevance to the Genesee-Finger Lakes Region: Agencies in the Genesee-Finger Lakes region have a legacy of cooperative approaches to Transportation System Management and Operations, from the early days of the Freeway Management Committee in the 1990s through the Transportation Management Committee to today's Transportation Operations Coordination Committee facilitated by the Genesee Transportation Council. Examples of the many benefits of this approach include: development of coherent regional strategies to address regional transportation issues; collaboration on ITS and communications project funding, planning, design, and implementation; and speaking with a common voice to represent TSMO needs and operations in the region.

Many factors in the current and anticipated operations environment suggest that multi-agency coordination will continue to reap positive benefits for the region. Fiscal pressures on both capital and operations aspects of TSMO programs require both policy advocacy and cooperation to identify resource and cost-sharing opportunities. Many operational needs and opportunities span multiple jurisdictions and require agency collaboration to develop effective solutions. Finally, emerging technologies suggest that growing partnerships with entities not traditionally part of the regional TSMO conversation will be more commonplace in the future.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
6.1.: Promote sustained and continuous coordination among operations agencies.	• **6.1.A.:** Continue to use the Transportation Operations Coordination Committee (TOCC), facilitated by the Genesee Transportation Council, to promote interagency coordination, priority-setting, and joint collaborations for TSMO planning, funding, design, and operations.	• Hold regularly scheduled TOCC meetings. • Conduct periodic updates to the Regional TSMO Strategic Plan and the Regional ITS Architecture. • Periodically conduct assessments of the TOCC's ability to meet member agency needs regarding interagency coordination and modify the TOCC's membership, structure, agenda, and schedule as needed to better serve member needs.
	• **6.1.B.:** Promote integration and interoperability of NYSDOT and MCDOT signal systems as well as cross-training of operations personnel.	• Investigate the feasibility of combining state and county signal systems. • Implement joint operations, training, and operational integration support agreements.
	• **6.1.C.:** Enhance traffic signal coordination at expressway interchanges to improve the safety and efficiency of expressway/arterial interfaces.	• Develop, review, and update signal timing plans for expressway/arterial interchanges.

	• **6.1.D.:** Continue to improve coordination between local expressways and the NY State Thruway, especially for incident, weather, and event management and traveler information services.	• Develop a Continuity of Operations Plan for the Regional Traffic Operations Center in the event of a Thruway closure.
6.2.: Expand and enhance Traffic Incident Management (TIM) coordination, programs, services, and training opportunities.	• **6.2.A.:** Coordinate incident management planning through the Regional Traffic Incident Management (TIM) Steering Committee.	• Periodically review and update regional Diversion Route Plans. • Conduct location-specific interagency tabletop planning exercises for incident management.
	• **6.2.B.:** Consider incident detection, verification, and response capabilities when identifying location for ITS field instrumentation.	• Provide Police and Fire facilities with appropriate access to ITS field instrumentation data feeds.
	• **6.2.C.:** Strengthen center-to-center communications between transportation and emergency management agencies to support effective incident response.	• Identify communications improvements between the RTOC, the back-up RTOC, the Monroe County EOC, the 9-1-1 Center, the NYS Watch Center, and other operations centers.
	• **6.2.D.:** Expand the scope and coverage of regional incident management response programs such as the Highway Emergency Local Patrol (HELP).	• Provide first responders with real-time incident information. • Enhance communication and coordination capabilities between HELP and law enforcement agencies.
	• **6.2.E.:** Provide TIM training opportunities to regional first responders.	• Provide routine opportunities for TIM training to regional stakeholders, including but not limited to: NYS Police, County Sheriffs, Rochester Police Department, Town & Village Police Departments, Fire Departments, Emergency Medical Service providers, tow operators.
	• **6.2.F.:** Improve interagency situational awareness during severe winter weather events.	• Provide snow plow status from plow operators to the Regional Traffic Operations Center during severe winter weather events. • Provide public alerts about road condition status such as closures during severe winter weather events.

6.3.: Clarify and document agency roles and responsibilities.	• **6.3.A.:** Document interagency partnerships through memoranda-of-understanding.	• Formalize interagency agreements for regional communications infrastructure sharing. • Periodically review, reassessing and updating as necessary, formal interagency agreements for communications infrastructure sharing.
	• **6.3.B.:** Develop issue-specific interagency agreements to describe goals, roles, and responsibilities for key operations programs.	• Working through the TOCC, identify key operations–related topics for interagency agreements. These agreements could range from informal partnerships to memoranda-of-understanding.

Objective 7:

Integrate TSMO into Regional Land Use and Transportation Planning and Policy Making

Relevance to the Genesee-Finger Lakes Region: The Genesee Transportation Council and its member agencies recognize the value of TSMO strategies in addressing the regional transportation system's challenges. Proactive transportation operations can be applied to a broad range of challenges, including enhancing safety, efficiency, and mobility for all transportation system users, as well as for addressing both recurring and non-recurring congestion hotspots. In addition, TSMO strategies can be applied to planning efforts of regional significance, such as strengthening transportation infrastructure resiliency and expanding the availability of alternative fuels. The scarcity of transportation funding suggests that TSMO strategies can provide low-cost alternatives to more expensive and intrusive solutions, such as roadway widening projects.

To maximize the impact of the regional TSMO program, it is important that there are strong linkages between TSMO strategies and the regional transportation planning process. This linkage has been made in regional transportation plans as well as agency initiatives such as RGRTA's Technology Investment Driving Excellence (TIDE) program, but it is a connection that should be continually reaffirmed and strengthened. The benefits will include: greater awareness of the role of TSMO in meeting regional transportation goals; awareness of TSMO program funding needs by policy makers; consideration of TSMO in planning studies; and use of operations data to measure and quantify the impacts of TSMO projects and programs on transportation system performance.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
7.1.: Identify and pursue opportunities to integrate TSMO strategies into transportation agency planning and policies.	• **7.1.A.:** Integrate TSMO strategies into regional transportation planning activities.	• Ensure cross-representation of TSMO interests on relevant standing and project steering committees.
	• **7.1.B.:** Integrate TSMO strategies into member agency policy, strategic planning, and project development plans, reports, and procedures.	• Encourage/incentivize consideration of TSMO strategies in project development. • Promote awareness of regionally-significant operations corridors identified in the TSMO plan.
7.2.: Integrate TSMO into the GTC Congestion Management Process, both as a data source and a potential solution to all types of congestion.	• **7.2.A.:** Use TSMO and third-party data to better quantify regional transportation system performance, including the impacts of recurring capacity-related delay, planned event-related delay, and non-recurring incident-related delay.	• Coordinate regional planning tasks between CMP development personnel and TSMO agencies. • Assess the viability of potential TSMO solutions for congested locations identified in the CMP. • Pursue project/funding opportunities based on the assessment of TSMO solutions for congested locations.
	• **7.2.B.:** Consider TSMO strategies as part of the "toolkit" of approaches to address congestion hotspots identified through the CMP.	

7.3.: Leverage TSMO data to support planning analytics and regional transportation performance measurement.	• **7.3.A.:** Use ITS/TSMO operations data to support regional performance measurement activities.	• Apply data generated by TSMO initiatives to monitoring of specific regional performance measures.
	• **7.3.B.:** Use TSMO data to measure performance of operations measure implementation (e.g. before/after studies).	• Identify data collection, storage, and management needs during the design phase of ITS deployments.
7.4.: Integrate TSMO strategies into programs aimed at enhancing the resiliency of the regional transportation system.	• **7.4.A.:** Identify and deploy ITS field instrumentation to enhance infrastructure/traffic monitoring and hazard warning capabilities.	• Include ITS deployments as solutions in resiliency- and hazard-mitigation-related planning projects, such as: o Monitor infrastructure and traffic conditions prior to and during a hazard event. o Alert system operators to hazard impacts. o Provide information on hazard impacts to the traveling public and freight carriers. o Facilitate response and recovery actions.
	• **7.4.B.:** Consider how TSMO strategies and associated ITS deployments can support communications and coordination needs among regional transportation management agencies, transit providers, and first responders.	
7.5.: Integrate TSMO strategies into programs aimed at expanding the availability and accessibility of alternative fuels.	• **7.5.A.:** Consider how TSMO strategies can support alternative fuel infrastructure deployment programs and projects.	• Include representation with a background in TSMO strategies on alternative fuel-related project steering committees. • Expand the availability of and access to alternative fuel sources in coordination with ongoing regional initiatives. • Promote and support wayfinding/navigation services for alternative fuel sources.
	• **7.5.B.:** Identify unique impacts and needs of alternate fuel vehicles that TSMO strategies can address.	
	• **7.5.C.:** Integrate alternative fuel vehicles as part of future TSMO/ITS pilot projects.	

Objective 8:

Maximize Program Efficiency through Resource and Cost Sharing

Relevance to the Genesee-Finger Lakes Region: Through interagency coordination and cooperation, the Genesee-Finger Lakes Region has benefitted from numerous opportunities to improve TSMO program efficiency through resource and cost sharing. Examples include the co-location of NYSDOT and MCDOT traffic management personnel at the Regional Transportation Operations Center (RTOC); the ability of NYSDOT staff at the RTOC to provide after-hours coverage for MCDOT; and the sharing of regional fiber optic communications infrastructure. Furthermore, standardization of technologies and infrastructure can reduce spare part requirements, enable cooperative purchasing, enable cross-training of staff, and promote systems interoperability.

In recognition of the benefits of collaboration and the constraints of the current fiscal environment, TSMO agencies in the Genesee-Finger Lakes Region will continue to seek resource and cost sharing opportunities where possible.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
8.1.: Continue existing partnerships to cross-train operations and maintenance personnel to allow for sharing of duties across agencies.	• **8.1.A.:** Continue the partnership between NYSDOT and MCDOT to provide after-hours RTOC coverage using NYSDOT personnel.	• Maintain ongoing regional operations partnerships for training, resource sharing, and mutual aid (e.g., on-call technicians). • Prepare Memoranda-of-Understanding as-needed to document these partnerships.
	• **8.1.B.:** Review RTOC operations to identify additional opportunities for interagency cross-training and collaboration on service delivery.	
8.2.: Maintain a cooperative approach to deployment and allocation of ITS/communications and implementation of ITS as part of other capital projects.	• **8.2.A.:** Continue successful initiatives to share regional fiber optic communications infrastructure among agencies to provide point-to-point connectivity.	• Periodically review and update interagency fiber sharing agreement for future projects. • Establish interagency cooperative approaches to communications network evaluation and capacity expansion decisions. • Establish redundant center-to-center connections.
	• **8.2.B.:** Leverage partnerships to improve communications system redundancy, resiliency, and security.	
	• **8.2.C.:** Coordinate with capital projects, such as road and bridge improvements, to implement ITS improvements in a coordinated and more cost-effective manner.	• Coordinated ITS/communications implementation as part of capital projects (e.g., install conduit on a new bridge for eventual fiber optic lines).
8.3: Standardize technologies, pool purchasing, and use and other strategies to obtain cost efficiencies.	• **8.3.A.:** Standardize parts and components where possible to promote interoperability, minimize spare parts, and increase purchasing power.	• To be determined on a project by project basis.

Objective 9:

Support Long-term TSMO Operations and Capital Investments Through Sustainable Funding and Asset Management Strategies

Relevance to the Genesee-Finger Lakes Region: Unlike many conventional and capital intensive transportation investments, TSMO programs have a significant operating cost component to their total project lifecycle cost. Even through the total cost may be lower overall, agencies can struggle to find sustainable funding to support engineering, maintenance, and operations through the TSMO program lifecycle. An ongoing commitment of sustainable, predictable funding is required to maintain the existing TSMO capabilities and ITS infrastructure that exists today, let alone to expand capabilities or coverage in response to emerging needs and opportunities. Additionally, many ITS devices and systems have expected useful lives of 5-10 years and must be considered for upgrade or replacement on a fairly regular schedule.

TSMO agencies in the Genesee-Finger Lakes Region recognize the need for sustainable funding to support both capital and operating aspects of TSMO programs. Through regional cooperation, agencies will prioritize activities that raise awareness of funding needs and help to secure sufficient and sustainable funding for ongoing operations programs, infrastructure renewal, and selective geographic and functional expansion of ITS/communications systems. Where possible, interagency/multimodal collaboration will be pursued to demonstrate maximum benefits and improve competitiveness for discretionary grant funding.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
9.1.: Quantify and communicate the budgetary requirements required to support TSMO operations and maintenance, including personnel, maintenance, software licensing, etc.	• **9.1.A.:** Regional interagency coordination and development of a strategic message about future regional TSMO investment/ reinvestment needs (e.g., through the Transportation Operations Coordination Committee).	• Provide presentations/reports to policy makers on TSMO program performance, achievements, future investments, and capital/operations funding needs.
9.2.: Use asset management best practices to identify ITS/communications infrastructure capital reinvestment needs.	• **9.2.A.:** Implement ITS Asset Management best practices to monitor the status of field instrumentation and plan for capital re-investments and maintenance needs that preserve the TSMO capabilities of the existing system. • **9.2.B.:** Consider divestment as an option for obsolete and/or underperforming field instrumentation and systems.	• Develop a Regional ITS Asset Management strategy. • Periodically review ITS field device location and consider relocating devices to maximize their use. • Quantify future ITS investment needs including re-capitalization of existing assets nearing the end of their useful life. • Develop “dashboard” communication materials to convey ITS asset state of repair and future investment needs to policy makers.

Objective 10:

Promote Interoperability and Value-Add Services through Shared and Open Data

Relevance to the Genesee-Finger Lakes Region: Transportation data is an increasingly important asset to be managed and leveraged to achieve public benefits. Operations data can be leveraged for system performance measurement, ITS element asset management, planning analytics, and real-time traveler information. In the future, open data standards may be instrumental for communications between Connected and Autonomous Vehicles and roadside infrastructure. Use of open data also unleashes the power of value-added services created by third parties using agency transportation data, such as mobile applications that integrate real-time trip and cost data into multi-modal trip planning and mapping services.

Agencies in the Genesee-Finger Lakes region will seek opportunities to promote the use of open data standards and to encourage development and innovation by third-party value added service providers. As part of this process, appropriate cyber security measures will be implemented to ensure that hardware, software, and data are protected against threats.

Regional Strategies	Activities and Coordination Tasks	Targeted Outcomes: 5-10 Year Horizon
10.1.: Promote use of open data standards for system interoperability and multi-modal traveler information tools.	• **10.1.A.:** Leverage industry-standard and open data protocols to maximize systems development flexibility, compatibility, and interoperability.	• Continued use of ITS industry standard protocols (e.g. NTCIP) to promote systems interoperability and compatibility across multiple vendors. • Monitor emerging standards such as vehicle-to-infrastructure protocols for CAVs that may impact future investment choices for ITS systems. • Appropriate cyber security policies and systems are implemented and updated.
10.2.: Provide access to agency transportation data available for developers of third-party traveler information tools and services.	• **10.2.A.:** Provide traveler information and services through third-party platforms that provide user choice and value-added services.	• Establish agency data/developer portals so that third parties can access timely and accurate real-time transportation system information. • Promote integration of data and services from public and private transportation providers to support user flexibility and choice (e.g. travel mode). • Provide RGRTA real-time data to third party service provides through data portal.
10.3.: Implement appropriate cyber security measures to safeguard system hardware, software, and data.	• **10.3.A.:** Develop a system-wide inventory of cyber security vulnerabilities and needs.	• Enacted cyber security policies and procedures. • Active monitoring of system assets for cyber security threats. • Coordinate with statewide cyber security initiatives.

6. TSMO Implementation Plan for the Genesee-Finger Lakes Region

Overview

This section describes the how the Objectives identified in Chapter 5 will be implemented by deploying ITS field instrumentation and associated communications infrastructure on a corridor-by-corridor basis over the plan's ten-year timeframe.

For convenience, the Implementation Plan includes corridor maps at two scales: 1.) the Metropolitan Planning Area (MPA) of urbanized Monroe County ("Urban Area"), and 2.) the nine-County GTC planning area ("Regional Corridors"). As in previous plans, the primary focus of TSMO strategies in the region, and therefore of ITS investments in field devices and communications infrastructure, is focused on key corridors in and adjacent to Monroe County.[1] That said, there are noteworthy TSMO corridors and 'hotspots' throughout the nine-County region in key travel corridors and activity centers.

The Implementation Plan reflects the regional priority for reinvestment in ITS in the most operationally-significant corridors. Reinvestment will not necessarily expand the footprint of the regional TSMO network, but will ensure that current capabilities are maintained, existing equipment near the end of its useful life is replaced, and capabilities are selectively enhanced to address the most critical corridors, such as urban and suburban expressways.

Geographic expansion of the ITS network is also reflected in the Implementation Plan, but is a secondary priority compared to maintenance and reinvestment in existing corridors and capabilities. There is recognition that urbanization and traffic growth in specific "hotspots" in the region will require TSMO investment to help manage that growth and maintain operations capabilities. Any geographic expansion will be in response to specific needs based on a cost/benefit assessment and the ability of the implementing agencies to take on capital investment and long-term operations.

[1] The major exception to this is the I-90 corridor, which extends through the region west to east across Genesee, Monroe, Ontario, and Seneca counties.

Tier 1 and Tier 2 ITS Implementation Corridors

The Implementation Plan categorizes regional ITS corridors into two tiers – Tier 1 Corridors and Tier 2 Corridors. This is a recognition that the available resources for capital investment and operations within the plan horizon are limited. This requires agencies to be strategic about ITS and TSMO investments in the locations with the highest potential impact. These corridors are described in the remainder of this section.

ITS and Communications Infrastructure to Support Regional TSMO Corridors

ITS applications include field instrumentation such as CCTV cameras, DMS, and RWIS, along with the associated communications networks required to operate those instruments. These applications are the enabling technologies that allow for the implementation of effective TSMO strategies.

The specific ITS technologies required to support the operation of the TSMO corridors described in this chapter will be determined through project-level design and engineering analysis conducted closer to the deployment or replacement of ITS elements in a specific corridor. In existing corridors, ITS deployments may be primarily replacement or upgrades of existing equipment. In new TSMO corridors, ITS deployments will consist of field devices and supporting communications networks as discussed under Objective 4 in the previous chapter. The region's current inventory of existing and planned ITS and associated communications infrastructure was discussed in Chapter 3 of this report.

Regional transportation management agencies will deploy the following ITS instrumentation and subsystems on TSMO corridors to implement the Objectives discussed in Chapter 5:

1. Operations Center Coordination and Integration: *Communications networks between and among operations centers enabling ITS field device management.*
2. Traffic Signal Management and Synchronization: *Enables proactive traffic signal management, including signal retiming and synchronization along corridors*.
3. Traffic Monitoring, Detection, & Data Collection: *Enables agencies to monitor traffic conditions and collect data about those conditions*.
4. Weather Information Collection: *Enables agencies to collect, analyze, and distribute weather information that impacts traffic*.
5. Traveler Information Provision: *Provides information about road and traffic conditions to travelers, both prior to a trip and enroute.*
6. Travel Time Estimation & Display: *System(s) for calculating estimated travel times and providing them to travelers*.
7. Traffic Incident Management: *Combination of ITS field devices and interagency coordination practices aimed at minimizing the impact of incidents on traffic flow*.
8. Special Event Management: *Combination of ITS field devices and interagency coordination practices to manage the impact of planned special events (i.e., concerts, festivals, etc.) on traffic flow*.
9. Detour/Diversion Route Management: *Facilitates detour and diversion route management; may be a combination of items 1 through 7 above*.
10. Emergency Evacuation Route Management: *Facilitates evacuation route management; may be a combination of items 1 through 7 above.*
11. Transit Corridor Management: *Technical applications to enhance the safety and efficiency of transit services*.
12. Bicycle/Pedestrian Enhancements and Safety: *Technical applications to enhance pedestrian and bicyclist safety and experience*.
13. Other TSMO Strategies: *Miscellaneous ITS deployments customized to a unique location and/or need*.

Tier 1 Regional TSMO Corridors

Tier 1 Corridors in the Genesee-Finger Lakes Region include the following:

- All urban expressways, including Interstate Highways;
- The New York State Thruway (I-90), traversing the region from east to west;
- Primary New York State highways and Monroe County urban arterials as identified by the stakeholder agencies. These arterials are either principal commuting, freight, and/or transit corridors. Many also serve as secondary or detour routes during incident conditions on urban expressways.

Tier 1 Corridors include both existing and planned corridors operated by NYSDOT, NYSTA, and MCDOT. A significant aspect of proposed growth in the Tier 1 corridors are radial NYSDOT corridors reaching outward from urbanized Monroe County into Wayne, Ontario, Livingston, and Genesee Counties.

Most existing NYSDOT corridors are included within Tier 1, reflecting the emphasis on reinvestment and strategic enhancement of the region's existing TSMO corridors at a top priority.

Tier 1 Corridors for the Urban Area and the Region are mapped in Figures 6-1 and 6-2, respectively. Tables 6-1 through 6-11 specify the applicable ITS strategies for each corridor.

Figure 6-1: TSMO Tier 1 Urban Area Implementation Corridors (Monroe County Urbanized Area)

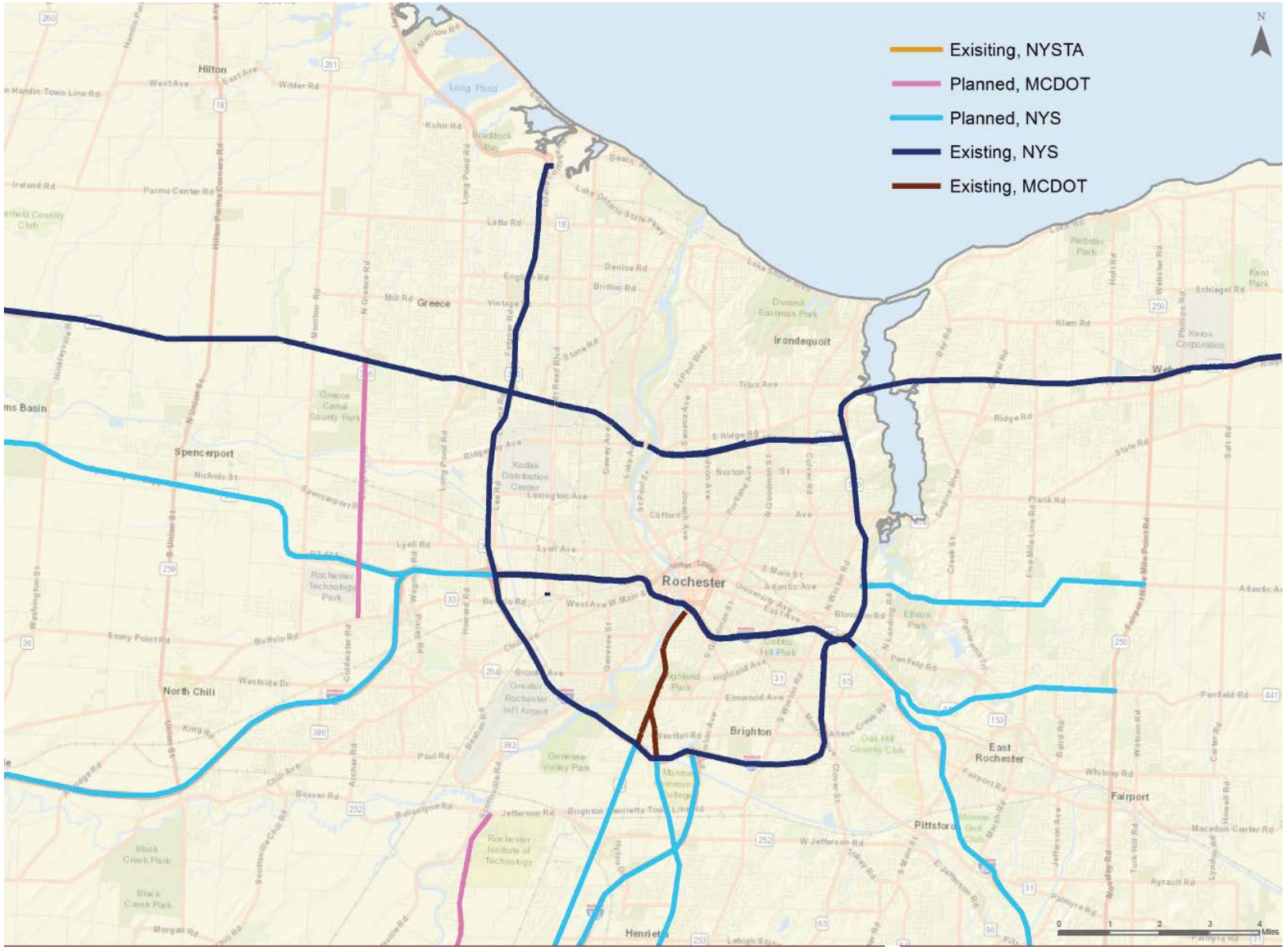

Figure 6-2: TSMO Tier 1 Regional Implementation Corridors (9-County GTC Planning Area)

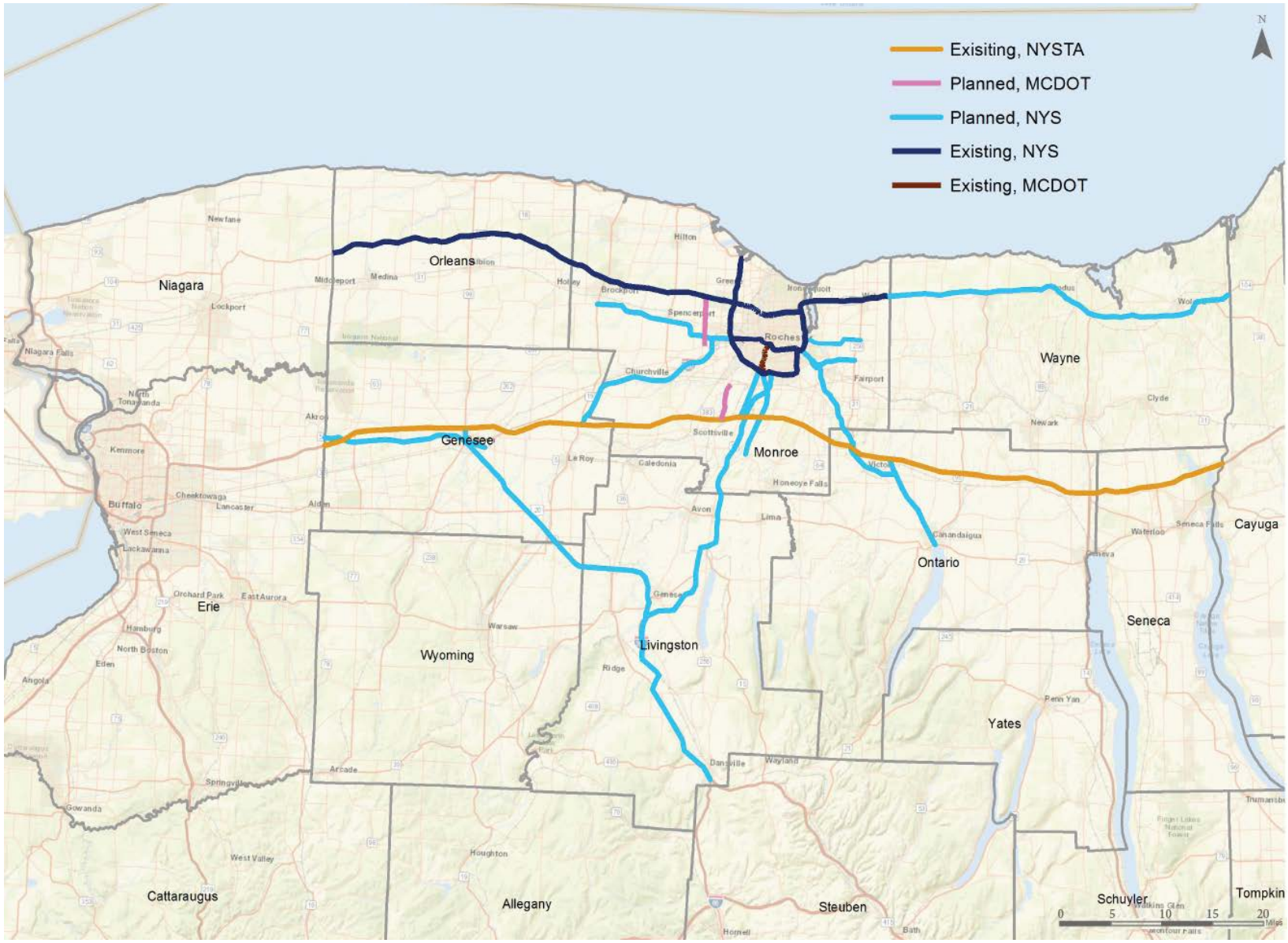

Table 6.1: I-90 (NYS Thruway)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration*	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	■
• Traveler Information Provision (DMS, HAR)	■
• Travel Time Estimation & Display	■
• Traffic Incident Management	■
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	■
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: I-90 is a critical east-west interstate route across the United States. In New York State, it connects the upstate metropolitan areas of Buffalo, Rochester, Syracuse, Utica, and Albany, as well as providing access to Massachusetts to the east and Pennsylvania and Ohio to the west. Management of traffic flow on this corridor is critical to the movement of goods and people across the state and nation.	
Notes: * RTOC will provide real-time traffic information to NYSTA Statewide Operations Center and emergency management centers to improve situational awareness in the event of an incident. Provide cooperative management and traveler information on Interstate approaches to I-90 between NYSDOT and the NYSTA.	

Table 6.2: Interstate Highways (I-390, I-490, I-590)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization*	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	■
• Traveler Information Provision (DMS, HAR)	■
• Travel Time Estimation & Display	■
• Traffic Incident Management	■
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)**	■
Description: The Interstates are critical transportation corridors in the metropolitan area. Deployment of ITS field devices on these corridors will maximize their safety and efficiency, and are expected to have the greatest overall benefit due to the number of vehicles and modes (private auto, transit, freight, etc.) impacted.	

Notes: * Traffic signal coordination at expressway/arterial interchanges is an emphasis on Interstate corridors as a means of improving the safety and efficiency of interchange operations.
** Potential installation of ramp meters at select expressway on-ramp locations.

Table 6.3: Non-Interstate Expressways (NYS 104, NYS 390, NYS 590, NYS 531)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization*	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	■
• Traveler Information Provision (DMS, HAR)	■
• Travel Time Estimation & Display	■
• Traffic Incident Management	■
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)**	■
Description: The non-interstate expressways are critical transportation corridors in the metropolitan area. Deployment of ITS field devices on these corridors will maximize their safety and efficiency, and are expected to have the greatest overall benefit due to the number of vehicles and modes (private auto, transit, freight, etc.) impacted.	
Notes: * Traffic signal coordination at expressway/arterial interchanges is an emphasis on Interstate corridors as a means of improving the safety and efficiency of interchange operations. ** Potential installation of ramp meters at select expressway on-ramp locations.	

Table 6.4: NYS Route 15 (I-490 to I-390/NYS Route 251)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	■
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This north-south route parallels I-390 and provides access to a range of commercial, industrial, residential, and institutional locations. It is an important commuter route. It can serve as an alternate route for I-390.	

Table 6.5: NYS Route 15A (NYS Route 15 to NYS Route 251)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	■
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This north-south route parallels I-390 and provides access to a range of commercial, industrial, residential, and institutional locations. It is an important commuter route. It can serve as an alternate route for I-390.	

Table 6.6: NYS Route 63 (I-90 to I-390)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	■
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This route connects I-390 to I-90 in Batavia and serves as an unofficial freight corridor. ITS deployments can help manage traffic along this road, where there are conflicts between through freight traffic and local traffic/land uses.	

Table 6.7: NYS Route 96 (I-490 to NYS Route 332)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	■
• Travel Time Estimation & Display	■
• Traffic Incident Management	■
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This east-west route is a major corridor serving as a commuter route as well as providing access to residential, commercial, and industrial areas. It can serve as a diversion for I-90.	

Table 6.8: NYS Route 98 (I-90 to NYS Route 33)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	■
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This north-south route connects I-90 to the City of Batavia, NYS Routes 33 and 63, and other important roads. It is a short urban link but important to proactively manage due to its importance to both local and regional traffic operations.	

Table 6.9: NYS Route 286 (NYS Route 590 to NYS Route 250)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	■
• Special Event Management	
• Detour/Diversion Route Management	
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This east-west corridor links the eastern suburbs of Monroe County with Rochester and is an important commuter route.	

Table 6.10: NYS Route 332 (I-90 to Routes 5&20)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	■
• Special Event Management	■
• Detour/Diversion Route Management	
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This is a commuter corridor from the City of Canandaigua to the metropolitan Rochester area. It also serves as a major route for concerts and special events in the Canandaigua area.	

Table 6.11: NYS Route 441 (I-490 to NYS Route 250)	
ITS Deployments:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	■
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This east-west corridor links the eastern suburbs of Monroe County with Rochester and is an important commuter route.	

Tier 2 Regional TSMO Corridors

Tier 2 Corridors in the Rochester-Genesee Region
well as a brief description of each corridor.
include the following:

- New York State highways not identified above as Tier 1 Corridors (primarily future expansion corridors).

- The majority of MCDOT urban arterials, including most MCDOT operated arterials within the City of Rochester.

As Tier 2 corridors, future expansion and investment will be selective based on the ability of the participating agencies to funding capital and operations costs in response to specific needs in these corridors, and in proportion to expected benefits.

The NYSDOT corridors included in Tier 2 are primarily radial and outlying expansion corridors in Monroe County and surrounding counties. This includes expansion of TSMO capabilities to additional radial urban corridors of Monroe County outside of the 390/590 expressway loop. Additionally, Tier 2 includes expansion along the Lake Ontario State Parkway into north-central Orleans County; the U.S. 20 corridor across Genesee, Livingston, and Ontario counties, the NYS Route 15A corridor south from Monroe County; and select additional peripheral arterial routes.

All of the MCDOT arterials included in Tier 2 are existing TSMO corridors, with a focus in reinvestment and strategic enhancement of existing TSMO capabilities. Investment in urbanized Monroe County corridors may occur opportunistically as part of multi-modal “complete streets” initiatives to coordinate investment of ITS/communications infrastructure with safety, pedestrian, bicycle, and transit improvements.

Tier 2 Corridors for the Urban Area and the Region are shown in Figures 6-3 and 6-4, respectively. Tables 6-12 through 6-30 specify the applicable ITS strategies for each corridor.

Figure 6-3: TSMO Tier 2 Urban Area Implementation Corridors (Monroe County Urbanized Area)

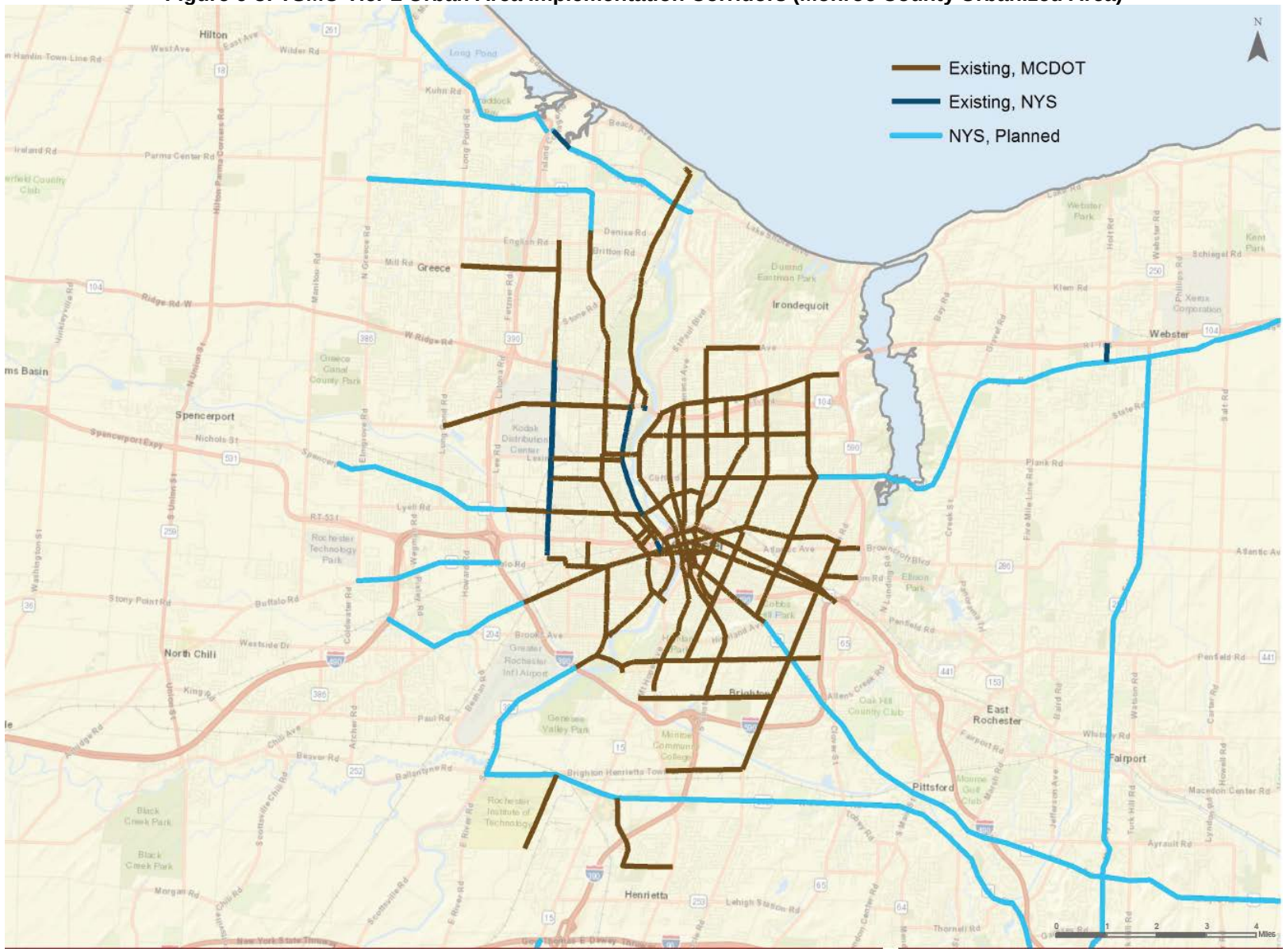

Figure 6-4: TSMO Tier 2 Regional Implementation Corridors (9-County GTC Planning Area)

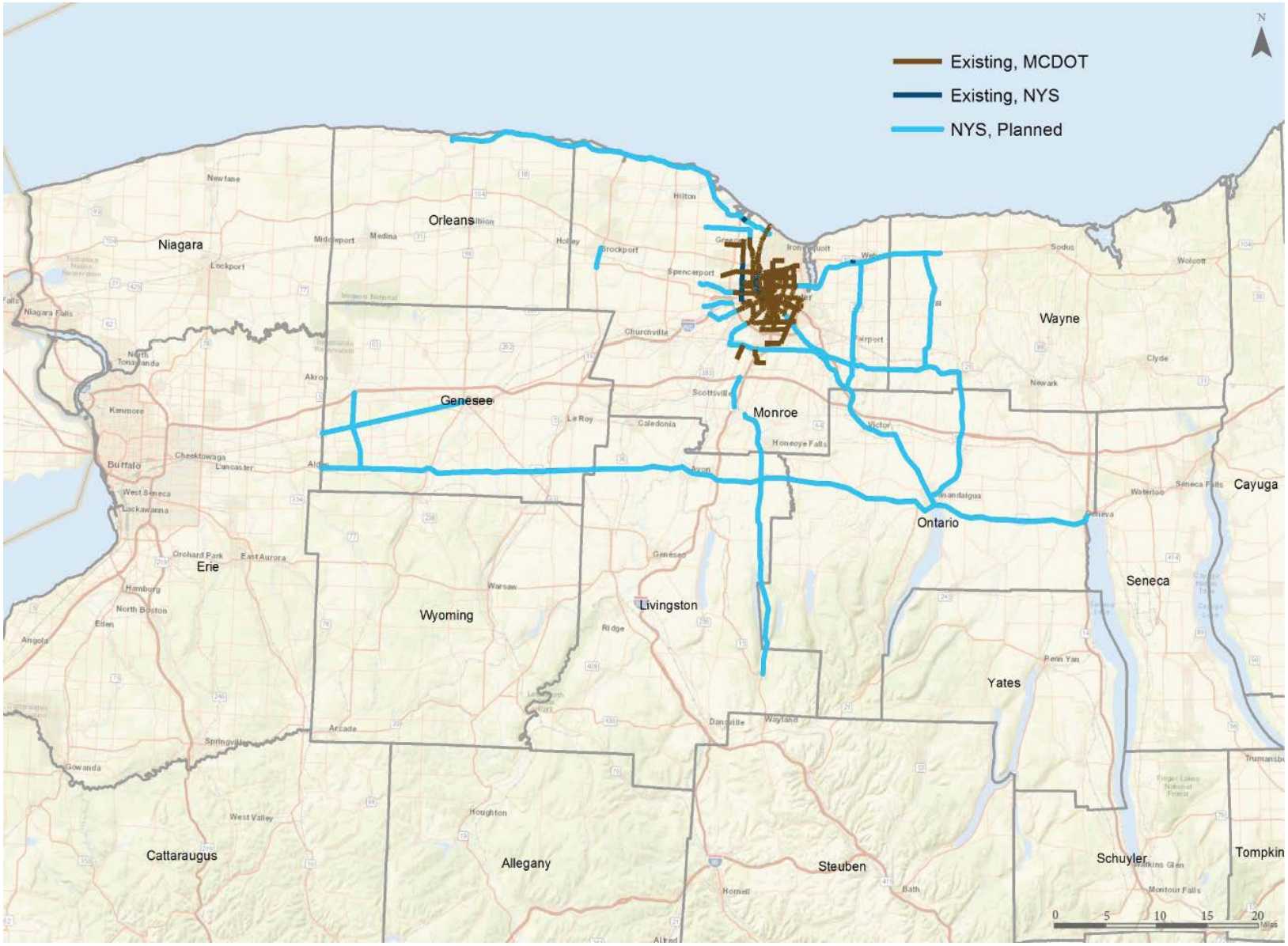

Table 6.12: NYS Route 5/U.S. 20 (through corridor across region)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: Routes 5 & 20 is a statewide corridor that generally parallels I-90 from Buffalo to Albany. It serves both through and local traffic and can serve as an alternate route to I-90.	

Table 6.13: NYS Route 5 (NYS Route 77 to NYS Route 98)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	■
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This east-west route parallels I-90 and can serve as an alternate route in the event of a closure on I-90. It also provides access to NYS Route 77 and the special event venues there.	

Table 6.14: NYS Route 18 (NYS Route 390 to North Greece Road)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This route serves commuters and goods movement on the northwest side of Rochester. It can serve as an alternate route for Routes 104 and 390.	

Table 6.15: NYS Route 21 (NYS Route 31 to NYS Route 96)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	■
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This is a key route on the east side of the metropolitan area, linking I-90 to nearby roads.	

Table 6.16: NYS Route 31 (NYS Route 19 to NYS Route 390)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This east-west corridor links the western suburbs of Monroe County with Rochester and is an important commuter route.	

Table 6.17: NYS Route 31 (I-490 to NYS Route 21)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This east-west corridor links the eastern suburbs of Monroe County with Rochester and is an important commuter route.	

Table 6.18: NYS Route 33 (NYS Route 98 to NYS Route 77)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This east-west route parallels I-90 and can serve as an alternate route in the event of a closure on I-90. It also provides access to NYS Route 77 and the special event venues there.	

Table 6.19: NYS Route 77 (I-90 to US Route 20)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This road links I-90 with U.S. Route 20 and provides access to the Darian Lake Theme Park Resort, a major travel destination and special events venue. Special event coordination can help manage congestion on Route 77 and minimize its impact on I-90.	

Table 6.20: NYS Route 104 (at-grade sections across region)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	■
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This east-west route is a major corridor running across the northern part of the region. It serves both through and local traffic. The section near the Ginna nuclear plant has the potential to be used as an evacuation route in the event of an incident at the plant.	

Table 6.21: NYS Route 250 (NYS Route 104 to NYS Route 96)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	■
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This north-south route links the eastern suburbs of Webster, Penfield, Perinton, Fairport, and Victor, connecting residential and commercial sites.	

Table 6.22: NYS Route 252 (NYS Route 383 to NYS Route 96)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	■
• Other TSMO Strategies (see notes)	
Description: This east-west route is a major suburban commercial corridor serving residential, commercial, industrial, and institutional sites in the Town of Henrietta. It also can serve as a diversion route for I-390 and I-90.	

Table 6.23: NYS Route 350 (NYS Route 104 to NYS Route 31)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	■
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This north-south route is on the eastern edge of the Metropolitan Planning Area. It links the two main east-west routes in Wayne County, Routes 104 and 31.	

Table 6.24: NYS Route 383 (I-390 to NYS Route 252)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	■
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)	
Description: This north-south route links Rochester to the Rochester Institute of Technology (RIT) campus on Route 252. It also provides access to industrial and institutional sites in the area.	

Table 6.25: NYS Route 404 (Culver Road to the Monroe-Wayne County Line)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	■
• Other TSMO Strategies (see notes)	
Description: This east-west route links Rochester with the eastern suburbs of Penfield and Webster. It serves commercial and residential areas in these communities. It can also serve as a diversion route for Routes 104 and 590.	

Table 6.26: Lake Avenue/State Street (Beach Avenue to Main Street)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration*	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	■
• Other TSMO Strategies (see notes)	
Description: This north – south route is a major corridor in the City of Rochester linking downtown to Lake Ontario. It serves businesses and residential area as well as special events at the Port of Rochester/Ontario Beach Park. Extended O'Rorke bridge lifts can occasionally cause the need for diversions along his corridor.	
Notes: * Port of Rochester event coordination between RTOC, event management staff, and Rochester Police Department.	

Table 6.27: Lake Ontario State Parkway (O'Rorke Bridge to western parkway terminus)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration*	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	■
• Traveler Information Provision (DMS, HAR)	■
• Travel Time Estimation & Display	■
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety	
• Other TSMO Strategies (see notes)**	■
Description: The LOSP is a recreational corridor along the southern shore of Lake Ontario. It also serves as a commuter route to the towns to the northwest of Rochester. Inclement weather events can be frequent and severe, especially during the winter months.	
Notes: * Port of Rochester event coordination between RTOC (NYSDOT/MCDOT), on-site event management staff, and Rochester Police Department command center. **Drawbridge management for extended O'Rorke Bridge lifts.	

Table 6.28: Mt. Read Boulevard (NYS Route 104 to NYS Route 33)	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	■
• Travel Time Estimation & Display	■
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	■
• Other TSMO Strategies (see notes)	
Description: This north-south corridor serves industrial sites on Rochester's west side, but also provides access to a range of residential and commercial areas. In addition, it can serve as a diversion route for NY 390.	

Table 6.29: Other MCDOT Urban Arterials	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	■
• Bicycle/Pedestrian Enhancements and Safety	■
• Other TSMO Strategies (see notes)	■
Description: TSMO corridors in urbanized Monroe County are largely equipped with ITS and communications infrastructure. Future enhancements will focus on equipment replacement and upgrades; filling-in gaps in coverage; and multimodal integration. Coordination with multi-modal "complete streets" efforts will be sought when complementary improvements are implemented in specific corridors.	

Table 6.30: Other select intersections and roadways at strategic locations	
ITS Strategies:	**Applicability to Corridor:**
• Operations Center Coordination & Integration	■
• Traffic Signal Management & Synchronization	■
• Traffic Monitoring, Detection, & Data Collection (CCTV, Sensors)	■
• Weather Information Collection (RWIS)	
• Traveler Information Provision (DMS, HAR)	
• Travel Time Estimation & Display	
• Traffic Incident Management	■
• Special Event Management	
• Detour/Diversion Route Management	■
• Emergency Evacuation Route Management	
• Transit Corridor Management	
• Bicycle/Pedestrian Enhancements and Safety*	■
• Other TSMO Strategies (see notes)**	■
Description: Throughout the region there are priority intersections and roadway segments that would benefit from safety and efficiency improvements enabled by TSMO. TSMO strategies should be applied to these locations on a case-by-case based on local operational needs.	
Notes: * Bicycle and pedestrian enhancements as determined by local needs and consistent with relevant regional plans; i.e., the City of Rochester Bicycle Master Plan. ** Other TSMO strategies to be determined based on local operational needs and conditions.	

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7. Achieving the Vision – Recommendations and Next Steps

Introduction

The Regional TSMO Plan provides planning guidance for the implementation and operation of TSMO programs and ITS infrastructure in the Genesee-Finger Lakes Region over the next ten years.

This plan is intended as a living document, recognizing that regional and agency transportation needs and priorities will evolve over the lifespan of this document. In particular, the rapid pace of technological innovation and emergence of new mobility services and solutions, such as Connected and Autonomous Vehicles, may require reconsideration of implementation strategies to respond to conditions that were not foreseen at the time of the writing of the document.

This chapter discusses recommendations and next steps as the region takes initial strides towards the implementation of the TSMO vision outlined in this document.

The focus of these recommendations is on actions that can be advanced within the next one to three years. For longer time frames, refer to the broader objectives and infrastructure deployment needs discussed elsewhere in this document.

For both the regional TSMO program as well as from the perspective of individual agencies, there are opportunities to make tangible and incremental progress in the next few years towards the vision articulated in this plan.

Promoting Regional TSMO Coordination

Since its earliest days focusing on expressway incident management and ITS pilot projects through to today, the strength of the regional TSMO program has been the willingness of multimodal transportation and emergency management agencies in the region to voluntarily collaborate on planning, funding, implementing, and operating TSMO-supportive infrastructure and programs.

A regional approach to TSMO is equally important in the future to promote seamless transportation system operations across jurisdictional and modal boundaries. Such an approach is consistent with the way that the traveling public experiences the transportation system—as a single integrated system—and therefore maximizes choice and benefits for the end users.
The following have been identified as next steps for regional TSMO coordination:

- Continue to use the **Transportation Operations Coordination Committee (TOCC)** as a forum for TSMO coordination among regional agencies.
- Utilize this TSMO plan to renew the mandate of the TOCC and develop a **near-term work plan**, focusing on issues of highest priority and attainable within available resources and budgets.
- Support the **Traffic Incident Management (TIM) Committee** as an example of a collaboration focused on a specific topic of mutual interest to multiple agencies—in this case, transportation agencies and first responders focused on safe and effective management and clearance of major traffic incidents.

Renewing and Expanding ITS Infrastructure

Practical resource limitations, as well as the maturation of the region's Intelligent Transportation Systems and communications infrastructure that support TSMO programs, necessitate a shift away from the past focus on broad geographic and functional expansion of capital infrastructure in the next five to ten years.

Instead, the emphasis in the near term is on sustaining and renewing existing ITS and communications infrastructure to maintain existing capabilities (such as CCTV coverage of the expressways and high-incident corridors). Replacements and upgrades of existing technology assets is anticipated to comprise a major share of TSMO infrastructure investment in the coming years.

Next steps for ITS infrastructure renewal and expansion include the following:

- Develop an **asset management strategy for ITS and communications infrastructure** at the agency level. Use information on device age, function, maintenance costs, and anticipated remaining useful life to quantify ITS re-investment needs over a five- to ten-year period.

- **Maintain and update ITS asset management information** at least annually in order to track asset replenishment progress, growth or reductions in asset investment backlog, and to develop funding requests for asset renewal backed by quantitative data.

- Develop a recurring **Transportation Improvement Program (TIP) project to address the need for ongoing ITS asset expansion and maintenance**. The Steering Committee identified a target budget of approximately $1 million per year for this program, to be verified with additional asset management data once developed.

- Where warranted through consideration of costs, benefits, and long-term operations and maintenance obligations, **implement focused geographic and functional expansion of ITS and communications infrastructure.** Use the regional TSMO objectives, individual agency needs/priorities, and maps of TSMO corridors within this document for guidance in project development.

- When possible, **prioritize projects that fill gaps in existing functionality and coverage** (e.g. CCTV camera blind spots) in mature ITS corridors.

- Where practical, consider opportunities to **support emerging new mobility programs,** including connected vehicle applications and smart cities programs, based upon the best-available technical information and partnerships at the time of project development. Be cautious of investments where technical standards, system architecture approaches, or requirements of public agency infrastructure are not clear to reduce the risk of anticipating the needs of rapidly-evolving emerging technologies.

Building New Partnerships for Smart Cities and Emerging Mobility

A key takeaway from the two Community Symposia conducted during this project was the opportunity to reach beyond the traditional TSMO community to harness the increased interest in Smart Cities and emerging mobility technologies by a wide array of regional stakeholders.

As discussed earlier in this document, the topic of Smart Cities and the region's response to the USDOT Smart Cities Challenge spurred collaboration among a wide variety of non-traditional public, private, and non-profit stakeholders about how these technologies could improve regional mobility, equity, sustainability, and economic competitiveness.

It is anticipated that there will be sustained interest—but also significant uncertainty—surrounding Smart Cities program implementation throughout the ten-year planning horizon of this plan. Among the Smart Cities-related issues being explored regionally and nationally are the appropriate roles of public and private sector entities; technological approaches and standards; and funding sources to build and operate Smart Cities infrastructure.

However, there are immediate and beneficial actions that can be undertaken in the near term to position the region to maximize Smart Cities opportunities:

- **Sustain the regional dialogue among smart cities stakeholders** through periodic meetings (e.g., quarterly) of a smart cities working group that draws together interested stakeholders from a cross-section of government, research, and private sector concerns. The organizations involved in the Smart Cities Challenge as well as the TSMO Community Symposia provide a starting point for identifying potential representatives.

- Conduct **periodic smart cities events with key stakeholders** to review smart cities initiatives under way in the region and to strategize about opportunities to undertake in future years.

- Track and apply for **emerging grant programs and pilot project opportunities** related to smart cities, connected/autonomous vehicles, open data, and other non-traditional funding sources. Use the vision and priorities of the TSMO plan and smart cities partnerships to make the case that the Genesee-Finger Lakes region is a willing and ready adopter of emerging solutions to regional needs.

Ongoing collaboration to explore partnerships and opportunities will help to clarify the role of TSMO agencies as lead or supporting agencies for specific Smart Cities and emerging mobility initiatives. Guidance is also anticipated from efforts at the statewide and national levels.

Much like the early years of Intelligent Transportation Systems deployment in the 1990s and 2000s, an ongoing dialogue to clarify regional objectives and to explore partnerships is the most effective approach in this formative stage of Smart Cities deployment.

Planning for Operations

Regional agencies have embraced the concept of "planning for operations" as an essential element of the regional TSMO program.

Planning for operations encompasses activities that promote operations as a potentially low-cost, high impact solution to regional transportation needs, and also ensures that TSMO is incorporated in to mainstream transportation policy, funding, and project development activities.

GTC has embraced planning for operations in a number or ways, as discussed in Section 3 of this document. For example, TSMO is reflected as a key regional transportation policy objective in the long range transportation plan.

Experience across the country has shown that proactive efforts to incorporate TSMO into mainstream transportation planning and project development builds the understanding and awareness of TSMO benefits that is necessary to secure sustained funding for TSMO capital projects and ongoing operations.

Several specific initiatives in the near term will help to appropriately reflect the role of TSMO in regional transportation planning and policy:

- Obtain **formal adoption of this TSMO Strategic Plan** by the Genesee Transportation Council Board as an official policy document.

- Continue to reflect **TSMO as a priority regional initiative** in regional and agency plans as a potential low-cost, high-impact solution to regional mobility needs such as: non-recurring congestion; incident, weather, and event traffic management; and providing multi-modal choices for travelers.

- Incorporate **TSMO metrics in emerging regional transportation performance measures**, pursuant to the metropolitan planning performance measure requirements in MAP-21 and the FAST Act.

- Continue to **leverage operations data for regional transportation performance measurement and project planning**, whether generated by multi-modal ITS systems or procured from third-party commercial data. In particular, such data can be used to capture the impacts of non-recurring congestion that are difficult to measure through conventional sampling methods.

- **Incentivize use of TSMO solutions or project elements** that are consistent with this TSMO plan in the evaluation of proposed regional transportation projects for funding awards.

- Consider TSMO as a potential response to congestion hotspots identified through the region's **Congestion Management Process**. Work with partner agencies to identify operational programs and ITS infrastructure that may be appropriate at specific hotspot locations to reduce congestion impacts, either as an interim solution or as an alternative to conventional capacity expansion projects.

Priority Initiatives Identified by Agencies

During the course of the TSMO strategic plan development, some participating agencies identified

specific initiatives that they viewed as high priority focus areas in the next one to three years:

- NYSDOT/MCDOT: Improve **joint management of urban arterials that serve as alternatives or diversion route to Interstates and state highways**. Specific strategies may include: traffic signal/ramp signal coordination; providing CCTV surveillance coverage of diversion routes; traveler information systems; and/or transit management for corridors affected by congestion.

- NYSDOT/MCDOT: **Improve interconnections between adjacent MCDOT and NYSDOT signals** where operationally advantageous.

- NYSDOT/NYSTA/MCDOT: **Upgrade/Replace aging ITS field instrumentation**, particularly traffic signals, CCTV cameras, and DMS boards.

- NYSDOT/MCDOT: **Implement focused expansions of ITS infrastructure and TSMO capabilities** to areas experiencing rapid growth in traffic volumes and congestion due to localized development and growth. Refer to Section 6 of this document for a complete list of potential NYSDOT and County expansion corridors identified.

- NYSDOT: Evaluate the feasibility of **ramp gates at expressway entrances**, automatically deployed from the RTOC, to facilitate expressway closures during severe weather or major incidents. This technology would free up NYSDOT and NYSP personnel who otherwise are deployed to ramp locations to implement a closure.

- RGRTA: Implement a **next-generation fare collection system**, building on the successful implementation of its TIDE suite of transit technologies in recent years.

- RGRTA: Consider upgrade or replacement of the agency's **Computer-Aided Dispatch /Automatic Vehicle Location (CAD/AVL)** system in the coming years as this system reaches the end of its useful life.

- RGRTA: Implement technologies to support emerging **flex service/Mobility-as-a-Service (MaaS) partnerships** under consideration.

- NYSTA: Implement **barrier-free electronic tolling** on the NY Thruway (anticipated in 2019).

- GTC: Expand data collection and planning analytics/visualization capabilities to leverage **operations data for regional planning and performance measurement**, using a combination of data from agency-owned ITS systems as well as third-party purchased commercial data.

- GTC: Implement **interagency agreements** to document roles and responsibilities and strengthen coordination among member agencies.

- GTC: Conduct **concept-level corridor planning for future ITS deployments** in accordance with the recommendations in this Strategic Plan (per corridors identified in Chapter 6).

8. Genesee-Finger Lakes Regional ITS Architecture Update

Overview

This section provides an overview of the Genesee-Finger Lakes Regional ITS Architecture Update that was completed as part of the regional TSMO strategic plan update process.

The Genesee Transportation Council, as the region's Metropolitan Planning Organization, developed the Regional ITS Architecture update in cooperation with other regional agencies and stakeholders.

Purpose of the Regional ITS Architecture

The Regional ITS Architecture (RITSA) is a framework for planning and implementing a coordinated technology infrastructure to support TSMO programs and services. A RITSA is comprised of numerous integrated subsystems implemented over many years by multiple stakeholder agencies. An agency's ITS subsystem(s) may integrate with the regional system based on the RITSA (e.g., CCTV cameras), statewide systems (e.g., 511 traveler information), or even with multi-state or national scale systems (e.g., I-95 Corridor Coalition ITS deployments).

The Genesee-Finger Lakes Regional ITS Architecture is based on the National ITS Architecture (NITSA). The NITSA provides a standardized framework for the design and deployment of ITS field instrumentation. It defines the functions and capabilities of ITS deployments and identifies interconnections among system elements.

The Transportation Equity Act for the 21st Century (TEA-21), enacted in 1998, mandated that ITS projects implemented with funds from the Highway Trust Fund conform to the NITSA. This mandate is explained in the Code of Federal Regulations Section 23, Part 940, which states that "ITS projects shall conform to the National ITS Architecture and standards in accordance with the requirements contained in this part." Essentially, this requirement means that ITS projects implemented with federal transportation funding must be included in the RITSA, with the appropriate service packages, stakeholders, standards, and inter-agency communications linkages identified in the RITSA file. All federally-funded ITS projects must also be based on a systems-engineering analysis.

For more information on the ITS planning process and ITS architecture requirements, Part 940 may be accessed here:
https://www.fhwa.dot.gov/legsregs/directives/fapg/cfr0940.htm

The Genesee-Finger Lakes Regional ITS Architecture is intended to be a living document that is used by ITS project development teams and participating agencies to ensure interoperability among individual ITS deployment projects. The ITS Architecture is intended to be periodically updated in response to changing needs, deployment activities, and/or updates to the New York Statewide Services Architecture (created and maintained by NYSDOT) and the National ITS Architecture (created and maintained by USDOT).

Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT)

For this 2018 RITSA update, the legacy Regional ITS Architecture was converted to Version 8.1 of the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT).

ARC-IT is a major new revision of the National ITS Architecture (NITSA) which integrates elements of both the conventional ITS concepts of the National ITS Architecture with the Connected Vehicle Reference Information Architecture (CVRIA). ARC-IT is also sometimes referred to as Version 8 of the National ITS Architecture.

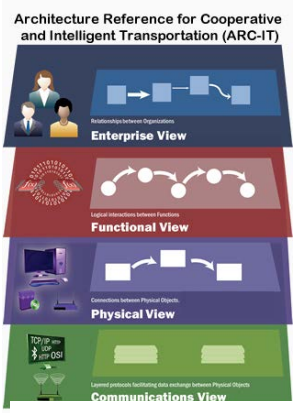

Figure 8-1: ARC-IT "Viewpoints"

Formerly, the NITSA and CVRIA were separate architecture models created by USDOT. The objective of ARC-IT is to integrate related concepts to create the services and infrastructure (including vehicle-to-infrastructure connections) required to support the emergence of connected vehicle technology. ARC-IT incorporates services, interfaces, standards and other concepts that are new to the NITSA to reflect this integrated approach.

Additional background information on ARC-IT, including an overview, technical documentation, and training materials, can be obtained from the National ITS Architecture website at:
https://www.its.dot.gov/research_archives/arch/index.html

Coverage Area of the National ITS Architecture

Like the TSMO Strategic Plan, the Genesee-Finger Lakes Regional ITS Architecture covers the nine-county GTC planning region, encompassing the counties of Genesee, Livingston, Monroe, Ontario, Orleans, Seneca, Wayne, Wyoming, and Yates in Upstate New York.

RAD-IT Software and TurboArchitecture Conversion

Prior to the ARC-IT update, the Genesee-Finger Lakes Regional ITS Architecture was based on the TurboArchitecture database format, using a software platform created by USDOT for development and management of Regional ITS Architectures. The last major update of the Regional ITS Architecture was completed in 2011, concurrent with the previous regional TSMO strategic plan.

Prior to 2011, an earlier version of the Regional ITS Architecture was created on behalf of the New York State Department of Transportation, Region 4, in 2000-2001. This was known as the "Rochester Tier 2 Regional Architecture."

The Turbo Architecture file created for the Rochester Tier 2 Regional Architecture was created using the TurboArchitecture ITS architecture software, version 1.1.9c. This architecture was converted to Turbo Architecture version 5.0.7 for the 2011 update. Subsequent minor updates and revisions were performed by GTC through regular maintenance. The last TurboArchitecture file update was based on Version 6.1 of the National ITS Architecture.

In this 2018 revision, the architecture was converted to the ARC-IT architecture using the Regional Architecture Development (RAD-IT) software (Version 8.1).

RAD-IT is designed to support development of regional and project ITS architectures using ARC-IT. It includes an import function that was used to convert the legacy TurboArchitecture file to RAD-IT format. RAD-IT software, user manuals, and training documents are available free of charge through online downloads at:
https://local.iteris.com/arcit/html/resources/radit.html

A companion tool, the Systems Engineering Tool for Intelligent Transportation (SET-IT), is available to support detailed systems engineering at the project level. This tool is also available free of charge at: *https://local.iteris.com/arc-it/html/resources/tools.html*

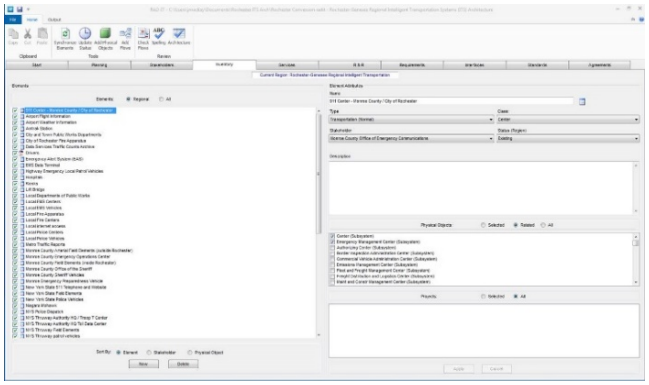

Figure 8-2: Sample RAD-IT User Interface

Key Updates to the Regional ITS Architecture

With the conversion to ARC-IT there are several notable changes from the previous Version 6.1 of the National ITS Architecture. Details can be seen in the RAD-IT database file.

- Update of needs to reflect the goals of the revised Regional TSMO Plan.
- Update of existing service packages (formerly market packages), elements, interfaces, etc. to reflect the new nomenclature used in ARC-IT (e.g., PM3, Parking Electronic Management).
- Selection of relevant new service packages representing new features of contained in ARC-IT that did not exist in in previous architectures (e.g. DM2 – Performance Monitoring, ST5—Electric Charging Station Management).
- Removal of existing services deemed no longer relevant to the region (e.g., PT09—Transit Signal Priority).
- Addition of new and relevant Connected Vehicle services (e.g., VS – Vehicle Safety series), reflecting integration of NITSA and CVRIA concepts in ARC-IT.
- Updates to the stakeholders and ITS inventory elements to reflect new services, changes to regional ITS systems, etc.
- Update of agency roles and responsibilities reflecting the selected services.
- An updated "build" to develop and customize system interconnects and information flows based on the above changes.
- Selection of relevant regional standards.
- Update of metadata – file history, contact information, etc.

Related Using and Maintaining the Regional ITS Architecture

As has been recent practice, GTC will continue to be the lead agency for hosting and maintaining the Regional ITS Architecture.

GTC will make the Regional ITS Architecture available to stakeholder and project proponents in both native RAD-IT database file format as well as HTML format. This allows users to select the format that is most suitable to their needs – RAD-IT for dynamic changes/project architecture development, or a more accessible HTML format that can be browsed without the need for access to or training in the use of the RAD-IT software.

Changes to the Regional ITS Architecture will be coordinated by GTC upon notification by the agency stakeholder or project proponent. Major new releases of the national ARC-IT could also trigger a Regional ITS Architecture update.

Changes affecting multiple agencies or services will be reviewed with the Transportation Operation Coordination Committee, consisting of TSMO agency representatives and facilitated by GTC, to evaluate the repercussions of any proposed change.

Once finalized, GTC will continue to oversee the update of the Regional ITS Architecture maintenance documentation and RAD-IT/HTML architecture files.

A comprehensive review and update of the Regional ITS Architecture is anticipated approximately once every 5 years, commensurate with major updates of the Regional TSMO Plan.