Syracuse Metropolitan Area
(Onondaga County)

Intelligent Transportation Systems Strategic Plan

Prepared for
New York State Department of Transportation
Syracuse Metropolitan Transportation Council

Prepared by
PB Farradyne
In association with
Clough, Harbour & Associates, LLP
Howard/Stein-Hudson Associates, Inc.
July 2003

Syracuse Metropolitan Area

Intelligent Transportation Systems
Strategic Plan

Final Report
EXECUTIVE SUMMARY

Prepared for

New York State Department of Transportation
&
Syracuse Metropolitan Transportation Council

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EXECUTIVE SUMMARY

Syracuse Metropolitan Area Intelligent Transportation Systems Strategic Plan

The New York State Department of Transportation (NYSDOT) has retained PB Farradyne (PB) to develop a strategic plan for the deployment of Intelligent Transportation Systems (ITS) for the Syracuse Metropolitan Area (Onondaga County). PB Farradyne, in its efforts to develop the plan, is being assisted by Clough, Harbour & Associates, LLP and Howard/Stein-Hudson Associates, Inc.

In addition to providing recommendations for the NYSDOT, the study also included recommendations for the City of Syracuse Department of Public Works (DPW), the Onondaga County Department of Transportation (OCDOT), the New York State Thruway Authority and the Central New York Regional Transportation Authority (CNYRTA).

Since the detailed analysis of emergency service provider's overall ITS needs were not part of this study, a comprehensive section of the Project listed all available technology related equipment that could improve their performance in responding to transportation incidents without being specific.

The study's regional ITS architecture framework also included recommendations, intended to be advisory, for key regional transportation agencies in the spirit of developing integrated ITS in the region. This Executive Summary provides an overview of the findings and recommendations of the study.

Product of the Study

The detailed results of this study are presented in this Final Report consisting of the following Technical Memoranda:

- Technical Memorandum # 1 - ITS Concept Plan
- Technical Memorandum # 2 - ITS Regional Architecture
- Technical Memorandum # 3 - ITS Implementation Plan

ITS Opportunities in the Region

Intelligent Transportation Systems (ITS) refers to the application of electronics, communications, hardware, and software that support various services and products to address the transportation challenges. When deployed in an integrated fashion, ITS allows the surface transportation system to be managed as an intermodal, multi-jurisdictional entity, appearing to the public as a seamless system. The United States Department of Transportation (U.S. DOT) has been advancing the development and deployment of ITS through various programs including the National ITS Architecture and Standards development efforts.

Onondaga County, with an area of approximately 800 square miles, contains the fourth largest upstate city (Syracuse) in New York. Onondaga County and the City of Syracuse occupy a central position within the local, regional, and national transportation system. The region's roadways, public transportation, rail, and airport provide outstanding access to services and employment. In Onondaga County, two major interstates (Interstate 81, which provides connections to the north and south and the New York State Thruway - Interstate 90, which provides access to the east and west) meet and provide access to all of the Northeast and Canada. In addition, I-690 runs through the City connecting the east to the west. There are approximately 3,100 miles of roadway and almost 500 bridges in Onondaga County. However, in some cases, connections among these facilities, and between these facilities and the local road network, is limited. There are some gaps in the transportation system, and some facilities have reached capacity. Implementation or expansion of Intelligent Transportation System (ITS) strategies/elements can improve the overall safety and mobility of Onondaga County as well as of the region.

ITS Stakeholder Coalition

In order to build consensus to deploy ITS in an integrated manner, major ITS stakeholders in the region were identified and coalitions among them forged through monthly meetings, workshops and seminars. The core group of the stakeholders which met monthly for the duration of the project, included representatives from the New York State Department of Transportation (NYSDOT), the New York State Thruway Authority (NYSTA), the Syracuse Metropolitan Transportation Council (SMTC), the City of Syracuse Department of Public Works (DPW), the Onondaga County Department of Transportation (OCDOT), the Central New York Regional Transportation Authority (CNYRTA), the New York State Police (NYSP), the City of Syracuse Police Department, the Onondaga County Sheriff's Office, the City of Syracuse Fire

Department, and the Onondaga County Department of Emergency Communications, 911 Center.

ITS Vision & Goals

The vision for the ITS strategic plan for the Syracuse Metropolitan Area depicts the future regional transportation system in a 20-year horizon. The ITS goals have been developed in view of the deficiencies identified in the region's existing transportation system as well as the long-term vision of the future regional transportation system. The process of identification of vision, goals, and of selection and prioritization of the appropriate ITS service options was accomplished via the participation of a wide coalition of ITS stakeholders. A series of seminars/meetings/workshops were held to develop a consensus and understanding of the ITS goals and service needs for the area. The visioning process, including the final vision statement as well as the goals, was presented in the Technical Memorandum # 1.

Market Packages

The market packages are comprised of specific ITS services. A market package is defined as a collection of equipment capabilities that satisfy a market need (or an objective) and are likely to be deployed as a group. The market packages were prioritized for the following participating stakeholders: NYSDOT Region 3, NYSTA, NYSP, SMTC, CNYRTA, City DPW, City Police, City Fire, County DOT, County Sheriff and County 911 Center. The deployment of an integrated and seamless ITS in the region would require cooperation and coordination among these agencies. The market packages were evaluated to one of the four levels of priority -- *high, medium, low, or not rated* -- in view of the region's ITS goals and objectives. The results are presented in Technical Memorandum # 1.

The market package definitions and priorities serve as an entry point into the National ITS Architecture program in order to develop the Regional ITS Architecture.

ITS Architecture

In the context of ITS, an "architecture" describes what a system does and, from a high-level perspective, how it does it. It provides the overall framework for system design and deployment; identifying the functions and operations to be performed, the basic subsystems and elements that make up the system and what functions each performs, and the flows of information between these components. In essence, an ITS architecture defines how system elements interact and work together to achieve system goals. From a regional perspective, an ITS architecture is concerned with what types of information are exchanged between transportation related agencies and their respective transportation management systems and centers, how the center-to-center connections are accomplished, and the additional functionality this integrated information provides to users (e.g., travelers, system operators, transportation managers, information service providers).

The Syracuse Metropolitan Area ITS architecture was developed based on the guidelines provided in the National ITS Architecture (NITSA) program materials.

The importance of developing and subsequently deploying a regional ITS architecture cannot be overemphasized. The real-time sharing of information between transportation agencies and emergency management agencies and their respective systems promotes interagency coordination and enables an area-wide view of the transportation network. Such synergy between multiple systems is absolutely necessary to achieve the vision of an efficient, effective, and seamless transportation network throughout the Syracuse metropolitan region.

Assumptions Made for Study Purposes

For simplifying the complexities involved in the development of the Regional Architecture, the following assumptions were made.

1. Voice & Data Communication media such as telephone, fax and pagers are excluded from the architecture. This means only electronic communication handled through a computer on a wide area network (WAN) and/or a local area network (LAN) are included in this architecture.

2. Some of the statewide databases and informational networks represented in the Statewide Architecture such as NY State DMV Accident Reporting System are not included in this architecture as they were already addressed in detail in the New York Statewide ITS Architecture developed by NYSDOT and NYSTA. Also excluded in this architecture is the Commercial Vehicle Operation (CVO) issue, since it has been already addressed in the statewide ITS Architecture.

The study recommended the general concept of a centralized center (network) that collects and dissipates Transportation related information between regional agencies. This recommendation will require fewer interconnects eliminating the complexity of establishing a comparatively expensive network that crisscrossed the study area connecting individual agencies to a multitude of other agencies.

Further discussions on the establishment of such centralized network revealed “sensitivity” of certain Emergency/Enforcement related data exchanged among the Regional emergency service providers (State Police, County Sheriff, etc) that are not apt for a network which contains other non-enforcement agencies. It was recommended that the “sensitive” emergency data exchange between emergency service providers be handled through a separate network called “**SY**racuse **R**egional **E**mergency **N**etwork (SYREN)”.

Theoretically, SYREN will be an integrated network of emergency information that is also connected to all emergency Computer Aided Dispatch systems and ultimately to all emergency vehicle mobile data terminals and will facilitate the exchange of emergency data among agencies. Examples of non-transportation related emergency data are; verification of criminal records, license data, fire incidents in city/county etc, while transportation related emergency data exchanged through SYREN would include transportation incident management/response data that directly impact the regional transportation operations.

Conceptually similar to that of SYREN, the **ME**tropolitan **T**ransportation **CO**mmunication **N**etwork (METCON) was recommended for the transportation agencies. This network will integrate all of the regional transportation agencies, including the emergency service providers, and help exchange the transportation related data (including incident management data). The METCON interface at the agency user will be a simple Internet based browser that provides access to regional transportation related information. During the initial stages, METCON will be functionally designed to exchange basic operation information such as each agency’s construction activities and manually inserted incident information, and will later be expanded to include automated exchange of real-time traffic data such as video images, traffic conditions (detector data), etc.

Once operational, a data interface will be developed between the two networks (SYREN & METCON) to share the needed information. For example, a transportation incident related cellular 911 call will be received at the 911 Center with the approximate location. The entry of such information in to SYREN will either be manual or automated. Once the incident is verified, the information will automatically be transmitted to METCON via the data interface and from there to all other agencies (transportation service providers and others).

At all of the Emergency Service Provider centers, there will be two separate interfaces for METCON and SYREN where the dispatchers will be able to verify the transportation related incidents reported on one network by using the other network . For example, an accident on the highway reported from a cellular call on the scene through SYREN can be verified and magnified by monitoring the video/detector data exchanged through METCON. Thus the reported incident can be confirmed and appropriate response can be initiated from all the needed agencies in the region.

The METCON interface will not be available to the field vehicles connected through the SYREN network. Thus the needed information exchanged through METCON will be transmitted to field personnel/vehicles through the SYREN network.

In contrast to SYREN, since the nature of data exchanged though METCON is usually “non-sensitive”, entities such as local media can be linked to METCON to gain access to various information exchanged through this network such as live video feeds from traffic cameras in the region or traffic conditions on the roadways.

Provided below in Figure 1 are the various stakeholder agencies and their grouping under these two networks.

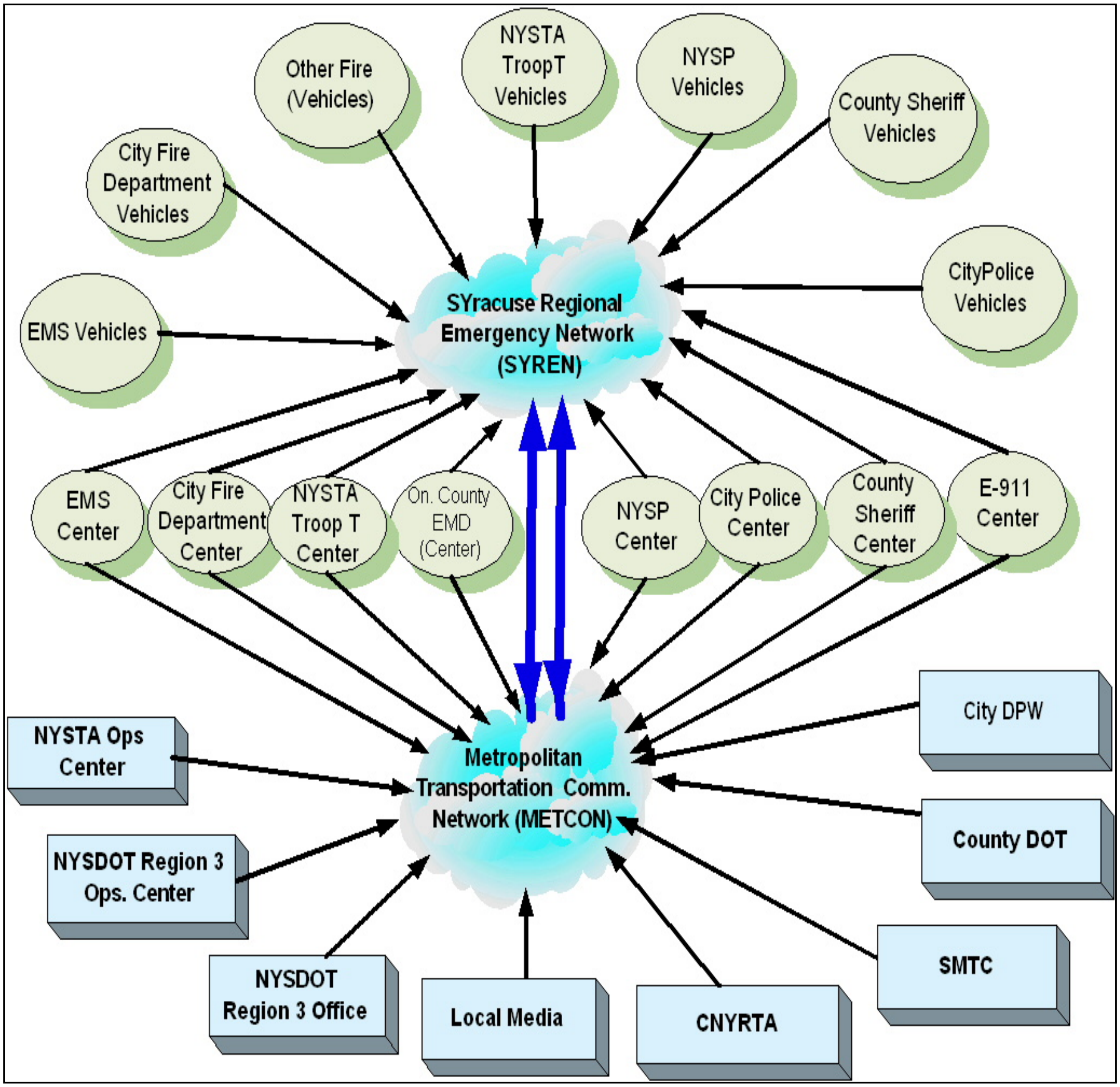

Figure 1 – Schematic Representation of Regional Data Exchange Networks, SYREN & METCON

ITS Standards

Deploying ITS technologies by conforming to widely accepted standards permit the agencies to use different vendors for the same element and help to ensure compatibility with future products and services. Major ITS standards development efforts that are currently in progress include the National Transportation Communications for ITS Protocol (NTCIP), Transit Communications Interface Protocol (TCIP), and Location Reference Message Specifications (LRMS). Initial versions of many ITS standards have been released but will be subject to refinement based on operational experience. In the near term it is recommended to consider the application of ITS standards on a case-by-case basis for ITS project design specifications. Over the long-term, specification of mature NTCIP standards is strongly recommended as they have the potential to greatly reduce the cost of ITS deployment as well as help achieve the National ITS Architecture vision of deploying compatible, inter-operable and integrated systems.

ITS Implementation Plan

The final product of this ITS study is an overall ITS implementation plan in the form of individual projects to be deployed over a period of time. The projects were identified considering all of the preceding topics discussed in this Executive Summary. The primary focus of the implementation plan is to provide recommendations to the NYSDOT Region 3. However, as ITS deployments will normally require cooperation among other agencies that are involved, directly or indirectly, in the operations and management of the regional transportation system, the ITS projects are also identified for the City of Syracuse Department of Public Works, the New York State Thruway Authority, the Onondaga County Department of Transportation, and the Central New York Regional Transportation Authority.

Each project identified in the implementation plan was defined with a time frame for implementation, the required components/technologies, locations of deployment, and costs of deployment and operations. With regard to defining a project's implementation time frame, the following criteria were used:

- "Early Action" projects are critical to the operations of the region's transportation infrastructure, and they are recommended for immediate deployment.
- "Short-term" projects are recommended for deployment in one through five years time horizon. These projects are intended to serve the region's immediate transportation needs.

- “Mid-term” projects are recommended for deployment in the six through ten years time horizon. These mid-term projects will build on the short-term projects and provide enhanced functionality and coverage.

- “Long-term” projects are recommended for deployment in the eleven through twenty years time horizon. The long-term projects are intended to expand on the short-term and mid-term projects to complete the comprehensive ITS deployment in the region.

Overall, the Project Implementation Plan is intended to serve as a road map for the ITS deployment program for the Onondaga County area and in particular the Syracuse Metropolitan Area.

With regard to costs, the implementation plan has provided planning level estimates of “capital costs” to deploy systems, and “annual operating and maintenance (O&M) costs”. The former two categories together comprise the total capital cost. The cost summaries were prepared providing a range (+/- 25%) of costs to account for uncertainties within the estimates for factors including rapid changes and innovations in technologies. Table 1 provides a summary of costs for the recommended projects.

Table 1 - Summary of Project Costs

Agency	Deployment Time Frame	Number of Projects	Capital Costs	Annual O&M costs
NYSDOT Region 3	Early Action	3	$2.2 M	Included in short term
	Short Term	14	$ 11 M	$1.1 M
	Mid Term	9	$16.2 M	$1.8 M
	Long Term	8	$9.3 M	$2.2 M
	TOTAL	**34**	**$38.7 M**	**$5.1 M**
City of Syracuse DPW	Short Term	11	$ 8.7 M	$0.66 M
	Mid Term	9	$6.9 M	$1.1 M
	Long Term	4	$10.2 M	$1.5 M
	TOTAL	**24**	**$25.8 M**	**$3.26 M**
Onondaga County DOT	Short Term	10	$5.6 M	$0.53 M
	Mid Term	8	$3.5 M	$0.85 M
	Long Term	3	$0.97 M	$1.1 M
	TOTAL	**21**	**$10.1 M**	**$2.48 M**
New York State Thruway Authority	Early Action	3	$1.6 M	Included in short term
	Short Term	3	$ 1.35 M	$0.31 M
	Mid Term	3	$1.9 M	$0.63 M
	Long Term	2	$0.79 M	$0.67 M
	TOTAL	**11**	**$5.6 M**	**$1.61 M**
	Short Term	12	$5.4 M	$0.7 M

	Short Term	12	$5.4 M	$0.7 M
	Mid Term / Long Term	9 / 11	$5.7 M / $7.7 M	$1.2 M / $1.4 M
	TOTAL	**32**	$18.1 M	**$3.3 M**

Finally, it should be recognized that the long-term implementation plans would change over time. Therefore, it is important to periodically revisit the plan and revise the implementation strategies accordingly.

Many projects recommended in this study can be implemented through inter-agency cooperation and thus, economies of scale can be achieved in deployment, operations and management.

Recommended Interagency Projects

The National ITS Architecture attempts to promote the integration and share of resources among agencies. This has been the basis for the recommendations made and ITS projects defined in this study.

The first and most important step in provision of integration and share of information is to build an electronic communication network among the agencies where the regional construction activities, incidents and special events can be shared across the boundaries. The Regional Information Sharing Network, known to some as the METCON, has been defined as the first early action project to build the basis of all future integration and information sharing needs. It is recommended to use the available ITS standards for future ease of integration and compliance with the National Architecture. By using the approved ITS standards, all current and future local systems can translate their data into the same format via various data interfaces for integration using the METCON system. Even though this is considered an interagency project, NYSDOT has assumed the Champion role, has acquired the needed funds and will lead this effort on behalf of the region.

The architecture of the METCON system should provide for future integration with ITS systems as well as dissemination of real-time information among agencies. As such, the next phase of the METCON project will provide integration with the I-81 Freeway Management System to collect real time traffic conditions along the I-81 corridor. This integration will take place via a Data Interface (DI) and will provide real time traffic condition on the State facilities to other agencies. Upon further expansion of the NYSDOT Region 3 freeway coverage (i.e., I-690, I-481, etc.) the DI will automatically share additional traffic conditions with all agencies.

It is also recommended that NYSTA, the City of Syracuse, the CNYRTA and Onondaga County will provide similar DIs from their existing and future system to the METCON for the benefit of all other agencies.

The existing and future planned expansion of the NYSDOT Weather monitoring system will provide the region with a wealth of weather information. The study recommends the integration and sharing of this information via the METCON system.

METCON will be a multi-modal, multi-agency system. Various information from the CNYRTA will be integrated into this system. It is also recommended to integrate METCON and future transit trips itinerary system to provide travelers with a single point of access to the regional information.

The study also recommends deployment of the SYracuse Regional Emergency Network (SYREN) under the 911 Center's authority. This network will upgrade the existing network and will provide additional functionalities such as the E911 system, upgraded GIS, AVL, etc. A direct data interface is recommended between SYREN and METCON to assure timely and real-time share of information.

The National ITS Architecture emphasizes, to the extent possible, sharing of each other's resources. The NYSDOT is about to deploy ITS along the I-81 freeway within the Syracuse Metropolitan area. There will be a minimum of eight cameras at the major interchanges. The City of Syracuse can benefit from video feeds from these cameras to enhance its operations. Both, the NYSP and City of Syracuse Police can use this real-time video feeds to better manage traffic conditions and incidents along the roadways. The 911 Center can take advantage of real time information to better dispatch the needed resources to an accident scene. The study recommends future expansion of the METCON system to provide interagency video sharing ability across all facilities.

The development of a regional 511 system is another recommended interagency project that will take advantage of the METCON system to provide travelers with unified, seamless transportation information. In July of 2000, the FCC at the request of the USDOT and various state and local agencies, designated the 3 digit phone number "511" as the national traveler information number. The 511 traveler information service will be used in much the same way as the existing 411 telephone information system. A traveler will be able to call 511 and receive real-time traffic information (incidents, closures, special events, weather, travel time, etc.) for the roadways that the traveler requests.

It is also recommended to share CENTRO's Automated Vehicle Locater (AVL) infrastructure with the City of Syracuse, Onondaga County and the NYSDOT to provide the AVL functionalities to each agency's fleets.

The CNYRTA has funds on the Transportation Improvement Program (TIP) to deploy two Kiosks. It is recommended to use this opportunity to integrate with METCON and provide multi-agency, multi-modal information to the users.

Each agency can either develop or enhance their web-site and provide individual transportation information. It is recommended to use the METCON database for a regional transportation website to provide comprehensive information to the travelers.

The study recommends co-location of Transportation Management Centers to the extent possible to assure proper and needed integration of information and resources as well as minimize the cost of remote connections/integrations within agencies.

NYSDOT, City of Syracuse DPW and County DOT do not believe there is a need for coordination of interagency signal systems. The study recommends further discussion on this issue. In particular, there are NYSDOT signals at the bottom of off ramps from major interchanges that need to be integrated with the existing City signal system.

The study recommends as a Short-Term project, the creation of an incident management group that includes all emergency service providers and transportation facility operators that will be responsible for the development of a regional incident management plan. The plan will be comprehensive, multi-agency and multi-modal.

The study recommends for the continuation of ITS coordination activities as well as for revisions of the ITS Strategic Plan on a regular basis (every three to five years). This could take the form of a "Syracuse Regional ITS Policy Committee" or other formal (or informal) body that meets periodically to discuss issues and problems, and to plan for maintenance and continued upgrade of the region's ITS.

Intelligent Transportation Systems are widely recognized as the most cost effective way to improve traffic flow. Increasing infrastructure is a timely and cost intensive undertaking, with only a temporary benefit. These reports speak to many different projects that will benefit the Syracuse Metropolitan Area. As mentioned, all agencies/stakeholders that will be affected by any changes should be involved to the greatest extent possible. We firmly believe that if the recommendations put forth are followed the improvement to the area will far out way any costs associated with the upgrades.

Syracuse Metropolitan Area (Onondaga County)

Intelligent Transportation Systems Concept Plan

Prepared for
New York State Department of Transportation
Syracuse Metropolitan Transportation Council

Prepared by

PB Farradyne

In association with
Clough, Harbour & Associates, LLP
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July 2003

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1. Introduction

1.1 General Background

The New York State Department of Transportation (NYSDOT) has retained PB Farradyne to develop a strategic plan for deployment of Intelligent Transportation Systems (ITS) for the Syracuse Metropolitan Area (Onondaga County). PB Farradyne, in its efforts to develop the plan, is being assisted by Clough, Harbour & Associates, LLP and Howard/Stein-Hudson Associates, Inc. This technical memorandum is one of a series of reports being prepared for the strategic plan which will document the established goals, assess operational deficiencies, analyze the existing conditions of transportation facilities, prioritize those facilities for potential ITS deployment, and prioritize the ITS Market Packages needs of each involved agency and the region. This effort considers the near, mid and long term needs of the area.

Onondaga County, with an area of approximately 800 square miles, contains the fourth largest upstate city (Syracuse) in New York. Onondaga County and the City of Syracuse occupy a central position within the local, regional, and national transportation system. The region's roadways, public transportation, rail, and airport provide outstanding access to services and employment. In Onondaga County, two major interstates (Interstate 81, which provides connections to the north and south and the New York State Thruway - Interstate 90, which provides access to the east and west) meet in Onondaga County and provide access to all of the Northeast and Canada. In addition, the I-690 runs through the City connecting east to the west. There are approximately 3,100 miles of roadway and almost 500 bridges in Onondaga County. However, in some cases, connections among these facilities, and between these facilities and the local road network, is limited. There are some gaps in the transportation system, and some facilities have reached capacity. Implementation or expansion of Intelligent Transportation System (ITS) strategies/elements can improve the overall safety and mobility of Onondaga County as well as of the region.

1.2 Improving Transportation Through Technology: An Overview of Intelligent Transportation Systems (ITS)

The current Long-Range Transportation Plan forecasts that travel times will increase extensively in the next several years. Therefore, the demand for more traffic capacity will continue to increase. In addition, more traffic volume translates into an increase in accidents. Accidents not only cause personal injuries and property damage, but also result in long traffic delays.

Traffic delays and other related problems are not new to the Syracuse Metropolitan area. Like other metropolitan areas have learned in the past few decades, transportation officials realized that they could not simply build their way out of congestion. New approaches were needed. In addition to traditional roadway improvements, the NYSDOT responded to the need to improve regional transportation services by providing funds to develop a Regional ITS Strategic Plan to set the stage for regional implementation of ITS, coordination among agencies and sharing of information.

The concepts of ITS incorporate a broad range of technologies that, when integrated, can help solve many of our transportation problems. ITS technology elements include information processing, communications, control systems, and electronic field equipment. Applying these technologies to our transportation system will save lives, save time, and save money. ITS technology and the application of management and operations strategies allow transportation system managers to not only respond to capacity issues, but to improve the overall delivery of transportation services. Some of the types of service improvements ITS enables include:

- Minimizing response time to incidents and accidents through the use of incident management programs.
- Providing real time traffic information to help motorists avoid congestion.
- Reducing weather related traffic incidents by using Road-Weather Information Systems (RWIS) to sense and respond to snow and icing more quickly.
- Improving emergency management communications and providing real-time traffic information to improve emergency vehicle routing.
- Improving on-time performance and security for transit users through the use of automatic vehicle location systems.

In addition, ITS can promote inter-agency communication, cooperation and data distribution. Through ITS, agencies in different jurisdictions can work together to manage the regional transportation network as a seamless whole. An integrated transportation system, managed and operated more efficiently through the use of ITS, enhances quality of life through improvements to motorist safety, promotion of a strong and growing economy and enhancement and protection of environmental quality. Last, ITS can address the public's expectations and demands for service from their government agencies. Technology is now in the hands of the public, and their expectations for technology to improve all aspects of their daily lives, including travel, has increased.

1.3 ITS Architecture

A planning-level architecture (as is provided in this report) describes the planned connections between diverse computerized systems. The connections are defined by the data that flows between the systems. In addition, standards required to ensure that each computerized system can understand and communicate data in a uniform fashion are also included in the ITS architecture.

ITS architectures are important when ITS elements/systems are implemented in an incremental fashion by multiple agencies. Computer systems are very difficult to modify once they have been implemented. Extraction of data from a system that is not designed for that purpose can be very costly. It is often less costly to replace an entire system than it is to reconfigure it for specific data extraction. With architecture, systems can be designed up front to accommodate future connections to other computer systems.

The Syracuse ITS Strategic Plan is simply a plan that describes how local agencies will connect, communicate and coordinate with each other, and also describes how to enhance the efficiency of various types of transportation systems, and to determine what types of data will flow across those connections. Where applicable, communications standards for the data are identified. In addition, the Syracuse ITS architecture contained within the Strategic Plan describes how the regional partners will use the transmitted data to improve the delivery of services. Development of this Strategic Plan and ITS Architecture meets Federal requirements for ITS project funding.

On January 8, 2001, the Federal Highway Administration (FWHA) rule and Federal Transit Authority (FTA) policy on ITS Architecture and Standards were published to implement section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21). The FTA and FHWA have different processes and procedures for project development. Therefore, the FHWA has issued a Regulation, and FTA has issued a Policy. The policy language in each document is consistent and will be carried out in a coordinated fashion, as applicable under FTA and FHWA project management and oversight procedures. This final rule/policy requires that ITS projects funded by the Highway Trust Fund and the Mass Transit Account conform to the National ITS Architecture, as well as to the United State Department of Transportation's (USDOT) adopted ITS Standards.

The final rule/policy requires that:

- Regions *currently* implementing ITS projects must have a regional ITS architecture in place in four years from the effective date or before April 8, 2005. Regions *not currently* implementing ITS projects must develop a regional ITS architecture within four years from the date their first ITS project advances to final design.
- ITS projects funded by the Highway Trust Fund and the Mass Transit Account must conform to a regional ITS architecture.
- Major ITS projects should move forward based on a project level architecture that clearly reflects consistency with the National ITS Architecture. A major ITS project is any ITS project that impacts regional integration or national interoperability. In other words they are those ITS projects in a region which are critical to future integration and therefore must be developed within the framework of an architecture.
- Projects must use USDOT adopted ITS standards as appropriate. To date, the USDOT has not adopted any ITS standards, and a formal rulemaking process will precede any USDOT ITS standard adoption. The proposed rule does not require replacement of existing systems or equipment. Applicable ITS standards would be used as new features and system upgrades are planned with the use of the National ITS Architecture.

  Standards are mandated only when they become officially adopted by the USDOT; at this point the USDOT has not adopted any ITS standards. The USDOT encourages the use of applicable ITS standards prior to their official adoption, however, as appropriate.
- Compliance with the regional ITS architecture will be in accordance with USDOT oversight and Federal-aid procedures, similar to non-ITS projects.

The rule includes requirements for both the ITS planning stage, and the project implementation stage. This report focuses on the planning stage. Per the rule, the regional ITS plan and architecture shall include, at a minimum, the following:

1. A description of the region;
2. Identification of participating agencies and other stakeholders;
3. An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture;
4. Any agreements (existing or new) required for operations, including at a minimum those affecting ITS project interoperability, utilization of ITS related standards, and the operation of the projects identified in the regional ITS architecture;
5. System functional requirements;
6. Interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture);
7. Identification of ITS standards supporting regional and national interoperability;
8. The sequence of projects required for implementation; and,
9. The agencies and other stakeholders participating in the development of the regional ITS architecture shall develop and implement procedures and responsibilities for maintaining it, as needs evolve within the region.

This plan is consistent with the requirements of the ITS Architecture rule.

Due to the importance of Regional ITS Architectures, the USDOT invested a significant amount of money to develop a National ITS Architecture. The National ITS Architecture includes a broad array of potential ITS applications and data flows. It can be thought of as the “full menu” of ITS. Each region can start to create an architecture using the National ITS Architecture, by selecting or modifying the applications and data flows appropriate to their region. In addition, applications and data flows not on the National menu can be added.

1.4 Purpose of The ITS Strategic Plan

Incorporating the ITS plans developed in the past and the ITS infrastructure now implemented in the region, this plan updates past efforts, establishes an integrated/coordinated/multi-agency Regional Architecture and agency-based ITS implementation plan and responds to two key factors:

1. Technology changes- Technology is changing at a rapid pace, and will continue to do so in the foreseeable future. These changes present certain opportunities to the region for improving the delivery of transportation services. Long-term changes in technology cannot be predicted. However, short-term innovations, particularly those tested and proven elsewhere in the U.S., can be specifically incorporated as they meet local needs. ITS plans must be frequently updated to reflect changes in technology, including changes that affect cost.
2. Integration- It has always been the intent of the agencies in the region to develop an integrated ITS infrastructure. That is, each agency should be able to share data with other agencies that need it, and operations should be accomplished without regard to jurisdictional boundaries. This plan addresses how systems can be connected to one another.

1.5 Organization of Chapters:

Chapter 2 details the stakeholder involvement in the project until the development of this report and also provides an insight of the institutional issues that were identified. Chapter 3 enlists the vision and goals of this project while Chapter 4 provides the inventory of existing conditions in the study area. In Chapter 5, the market packages from the National ITS Architecture were explained in detail along with the process adopted by the Steering Committee (SC) to utilize them in developing the ITS Architecture. Discussions in Chapter 6 are focused on identifying the performance criteria for various ITS elements and Chapter 7 exclusively covers the funding issues and opportunities that are present.

2. Stakeholder Involvement

2.1 Outreach Plan

The elements of the Outreach Plan are designed to promote a dialog among the various stakeholders to ensure reaching a consensus for the implementation of ITS projects in the Syracuse Metropolitan area. The Plan includes:

- Steering Committee
- Stakeholders Database
- Stakeholders Interviews
- Workshops
- Fact Sheets

Steering Committee: The Steering Committee (SC) is comprised of representatives of all key agencies that are responsible for the implementation of ITS in the Syracuse Metropolitan area. The responsibilities of the SC include reviewing and commenting on deliverables, establishing policy guidance for implementing ITS region wide, and maintaining liaison with other stakeholders.

The core group of the SC, which meets monthly for the duration of the project, includes representatives from the New York State Department of Transportation, the New York State Thruway Authority, the Syracuse Metropolitan Transportation Council, the City of Syracuse, Onondaga County, the New York State Police, the City of Syracuse Police, the Onondaga County Sheriff's Office, the County Fire Department, Onondaga County Emergency 911. The current listing of the Steering Committee members is provided below:

Table 1 - Outreach Participants

Name	Agency	Phone	Fax	E-mail
Mary Rowlands	SMTC – Syracuse	315-422-5716	315-422-7753	Mrowlands@smtcmpo.org
Jim Lawler	NYSDOT - Syracuse	315-428-4312	315-428-4311	Jlawler@gw.dot.state.ny.us
Bruce Trexler	Onondaga – DOT	315-435-3205	315-428-5744	Trbtrex@nysnet.net
Eugenia Urman	NYSDOT – Albany	518-457-0089	518-457-5933	Eurman@gw.dot.state.ny.us
Frank DeGennaro	NYS Police	315-455-2850	315-455-2944	Fdegena@troopers.state.ny.us
Mike Hartman	NYSDOT – Albany	518-457-2384	518-457-1960	Mhartman@gw.dot.state.ny.us
Shannon Trice	Syracuse Police	315-442-5130	315-422-5147	Asti0116@aol.com
Andrew Sapoznikov	Syracuse Fire Department	315-473-5525x602		SPOZ182@hotmail.com
Barry Stevens	NYSDOT - Syracuse	315-428-4381	315-428-4311	Bstevens@gw.dot.state.ny.us
Tony DiGregorio	OCHO EMS	315-435-6964		hltdigr@nysnet.net
Stephen Wisely	Emergency Comm.	315-435-7911	315-435-8620	eqwise@emi.com
Richard Landerkin	CNYRTA	315-442-3381	315-442-3337	Rlanderkin@CNYRTA.org
John Foland	NYSTHA	315-437-2741	315-461-0765	John_Foland@thruway.state.ny.us
William Nurk	City of Syracuse-PD	315-442-5203	315-442-5249	nurk@syracusepolice.org
Robin Palmer	NYS Police	315-455-2850	315-455-2944	Rpalmer@troopers.state.ny.us
Pete O'Conner	Syracuse DPW	315-448-8576	315-448-8531	PROJECTCO@yahoo.com
Jerry Zell	FHWA	518-431-4124	518-431-4121	Jerome.F.Zell@fhwa.dot.gov
Frank Kobliski	CNYRTA	315-442-3344	315-442-3337	fkoblisk@CNYRTA.org
Warren Darby	Onondaga County Sheriff's Office	315-435-3044	315-435-3043	darbyny@aol.com
Peter Alberti	Onondaga County Office of Emergency Management	315-435-2525	315-435-3309	fcpalbe@nysnet.net
John Harvey	City of Syracuse-DPW	315-448-8518	315-448-8531	Jharvey1@twctny.rr.com

The consultant performs the following activities:

- prepares and distributes meeting notifications,
- prepares materials and handouts,
- facilitates the meetings, and
- records meeting activities and distribute summaries.

Stakeholders Database: The Syracuse Metropolitan Transportation Council's ITS list serves as the core for the project mailing list. The database also includes other public, private and institutional entities. The mailing list will be revised and expanded as other interested and affected individuals and organizations are identified. The consultant maintains the database.

Stakeholders Interviews: A series of interviews were held with key stakeholders in the Syracuse Metropolitan area to get everyone on board for the study and to gather information on the existing and future transportation system conditions, safety related issues, current and planned ITS projects, information sharing, funding, stakeholder needs, institutional barriers, policy issues, jurisdictional issues, expectations of the study, etc.

The consultant drafted a discussion guide for review by the SC. Once the discussion guide was finalized it was distributed prior to the interviews to facilitate the discussion. The consultant facilitated the interviews, summarized the results and distributed to appropriate team members for review and approval.

Workshops: Four workshops were scheduled during the course of the study to involve the stakeholders on specific ITS issues. The workshops are:

Workshop #1: This workshop was held early in the study in conjunction with the Regional ITS Strategic Plan. The full day workshop covered an overview of ITS, the benefits and process. During the workshop a vision statement and goals and objectives was presented and discussed.

Workshop #2: The second workshop was held approximately 2 months after the first workshop. This workshop was executed in two separate days and focused on the Market Packages Needs of the region. The first day focused on the definition of all market packages. Once all agencies determined and rated their market packages needs, there was another workshop to review the ratings.

Workshop #3: The first half of third workshop was held to discuss the initial concept of the Regional Architecture and to review some possible alternatives. The second half focused on the initial results of Turbo-Architecture and an agency interconnects and data flow needs.

Workshop #4: The final workshop will be held at the end of the study to discuss the executive summary of the Final Strategic Plan and address any outstanding issues. This is a one-day workshop.

The consultant is responsible for; preparation and distribution of all invitations, preparation of the presentation materials and, documentation of all workshop activities.

Fact Sheets: Two fact sheets are scheduled for this study. The first fact sheet discussed general ITS concepts, introduced the project and detailed the projects goals and objectives. The second fact sheet will be produced in conjunction with the Draft ITS Strategic Plan and will discuss the recommendations of the study.

The fact sheets are produced as a tri-fold for easy reference. They are printed on high quality paper in four-color format.

2.2 Documentation of Interviews

The Consultants met with the stakeholders in the region to perform an initial assessment of their operational needs, to assess future developments, and to identify the issues that are of concern to them with regard to regional transportation enhancement. Prior to the meeting, stakeholders were provided with a “discussion guide” that was aimed at introducing the stakeholders to the various issues associated with the implementation of an ITS network in the Syracuse area and to serve as a guide for the interview process. The discussion guide and a cover letter accompanying that were mailed to the stakeholder agencies before the interviews were conducted. The agencies interviewed include:

- New York State Department of Transportation (Region 3 and Albany)
- Syracuse Metropolitan Transportation Council
- Onondaga County Department of Transportation
- City of Syracuse, Department of Public Works, Transportation
- Onondaga County Sheriff’s Office
- City of Syracuse Police Department
- New York State Thruway Authority
- New York State Police
- Onondaga County, Division of Emergency Management
- Onondaga County Department of Emergency Communications
- Central New York Regional Transportation Authority

All of the interviews were conducted one-on-one. Draft minutes of the interviews were sent to the interviewees to allow them the opportunity to add comments. The actual notes from the interviews, as well as the list of interviewees can be found at the end of the report, Appendix A.

2.3 Initial Evaluation of Institutional Issues

One of the early tasks in developing the institutional issues for the “Intelligent Transportation Systems (ITS) Strategic Plan for the Syracuse Metropolitan Area” study involves an inventory of current regional ITS activities. As part of this effort, a series of interviews were held with relevant current or potential ITS users in the region. Through the interviews, an understanding was gained of the various agencies’ perspectives, roles and priorities related to the implementation of ITS in the study area. This section summarizes the interviews and highlights some of the issues that will need to be addressed during this study. Interview content focused on the region’s institutional structure (relationship between agencies, government and other stakeholders), as well as what the area’s agencies and potential users of a regional system see the ITS providing.

- Everyone interviewed agreed that the Syracuse Metropolitan area does not yet have extensive congestion problems, but they want to have the ability to avoid traffic congestion, especially during special events.

- Almost all those interviewed were in agreement on most of the issues related to ITS. There were a few differences of opinion, such as the need for a centralized or co-located Traffic Operations Center and who should “champion” ITS in the region. Everyone agreed that a “champion” is important.

- There is need for improved communications between various agencies and to the public. This communication should be in the form of real-time traffic and incident information with special emphasis given to incident management and construction detours. Motorists need to be able to make choices at points in both time and location to allow them to make intelligent decisions. The expansion and sharing of regional communication systems in both the public and private sector is important.

- Currently, there are several different communications systems in use in the Syracuse area including cellular phones, landline, radio, Nextel and fiber optics. Every agency appears to be going in its own direction with their communications systems.

- The same protocols should be used by all agencies for notification of emergencies to ensure rapid and proper response and to avoid duplication of services.
- Everyone is interested in sharing information. While there currently is some sharing of information, not all agencies are involved. Information needs vary by agency. All the interviewees want information on; weather conditions, roadways and lane closures, traffic data, construction schedules, incidents, and special events.
- The amount of data that is necessary to do the job correctly and its cost effectiveness need to be determined.
- All the agencies interviewed are using some form of ITS. ITS elements in use include Highway Advisory Radio (HAR), Variable Message Signs (VMS), various types of communication systems, signal systems, Roadway Weather Information System (RWIS), Automatic Vehicle Location (AVL-in progress), signal pre-emption (Syracuse Fire Department only), loop detectors, and E-ZPass.
- There exist different levels of fiber optics coverage. Some agencies are well covered, while others have limited access to fiber optics or none at all.
- The ITS needs vary greatly by agency. All interviewees want better communications. The Central New York Regional Transportation Authority is in the process of implementing an AVL system. The Onondaga County Department of Transportation is investigating how it can use the AVL system. The importance of video cameras is recognized by most of the agencies although requirements vary. RWIS is considered important by all agencies.
- Coordination is a major issue. While there is little coordination among agencies within the Syracuse area, there is some coordination on services such as snow plowing and between the various police departments.
- Everyone uses separate base maps, depending on their needs. This makes the sharing of GIS data very difficult.
- Potential barriers to the implementation of ITS in the Syracuse area include lack of a “champion”, funding, privacy issues and different agency requirements.

2.4 Responsibility for Facility Operations

The City and County have different regulatory norms regarding the operational responsibility of roads and highways. These responsibilities are important to understand, as they play a part in the design of the regionally integrated intelligent transportation system. The system must respond to the institutional framework created by these laws.

The New York State DOT and Thruway are responsible for the all freeway operations in the study area. The freeways operated by these two agencies serve interstate passenger and freight traffic. The State owns and operates the traffic control devices on its arterials and freeways and the New York State Police are responsible for law enforcement. Commercial Vehicle enforcement is a major role on the freeways undertaken by the State Police and they operate a separate division that maintains commercial vehicle enforcement.

The City of Syracuse is responsible for the operation of the City arterial network that handles the majority of the region's traffic. Several extremely large traffic generators are located in the City limits, such as Syracuse University, that contribute significantly to the region's everyday traffic throughput. The City Department of Public Works is responsible for the operation and control of all the traffic signals, and several traffic control and monitoring devices such as cameras, on the city arterials. In addition to traffic management responsibilities, the DPW controls some of the parking areas within the city limits. Enforcement in the city limits is carried out by the Syracuse City Police. Outside of the city limits, Onondaga County owns, maintains and operates the county road networks. The County Sheriff's Office is responsible for the Law Enforcement in the County region.

All emergency operations within the City and County limits are carried out from the E-911 Center that is responsible for all law enforcement and emergency response. The E-911 center receives most emergency telephone calls (including landline and cell phone calls) that are then directed to appropriate agency personnel, who in turn will contact appropriate internal staff to take a report on the incident. Some emergency calls from cell phones are occasionally received by the NY State Police are also diverted back to the E-911 center for dispatch.

This decentralization of operations responsibility requires a flexible approach to regional ITS design that can accommodate varying local needs. Plus, the design must overcome the barrier of jurisdictional boundaries, and enable the system to be operated as a seamless whole, if the local jurisdictions agree to operate in that fashion.

For example, there are several principal arterials in the County and City and each agency is responsible for owning and operating traffic signals located in their jurisdiction. Each jurisdiction may have installed equipment that is incompatible with their neighboring jurisdiction's equipment, and may have a different operational philosophy that results in signal timing patterns that could create discontinuities in the flow on the principal arterial. To implement changes on such an arterial, not only must a system design enable operations that disregard jurisdictional boundaries, but also the affected jurisdictions must coordinate and agree on an operational philosophy that balances the local jurisdiction's goals with the regional needs. The technology can only enable improved operations – people must agree to implement new operations plans.

2.5 Inter-Agency Communication/Coordination

The regional multimodal transportation system is not managed as an integrated whole, because multiple agencies are responsible for managing only portions of the system. Increased jurisdictional coordination and communication could be enabled using ITS – but only if the various agencies' systems can be electronically connected.

In the past, the only systems that were available for traffic signal control, for automated vehicle location, and even for freeway management were proprietary products that did not allow for open data exchange with other systems. Today, we are coming into an era of national open data and communications standards for all ITS. However, we are early in the standards development stage. Agencies that have been on the "bleeding" edge of standards implementation have found it costly, and have found that there are several problems with the new standards that can only be worked out given more installations and time. As standards mature, more and more manufacturers will adopt them, and they will become more and more reliable.

New systems should enable open data exchange on a system-to-system basis. These standards are early in the development and adoption stages. However, all new projects being considered for regional integration (e.g. computer aided dispatch, automated vehicle location, centralized signal systems) should be implemented using the latest version of the national data and communications standards for transfer of data between systems (the National Transportation Communications for ITS Protocol (NTCIP) center-to-center standard).

Where needed, on-street (field) equipment should meet the same data and communications protocol standard. Some integration will occur in the field, rather than between centralized computer control systems. For example, coordinated signal operations can readily be implemented in the field by connecting compatible signal controllers. At locations where coordination should occur in the field, the affected agencies should evaluate whether it is appropriate to replace existing equipment with NTCIP compliant equipment.

New regional systems, and changes to the existing systems, should be developed recognizing the “home rule” environment that exists in the region. That is, they should enable integration for willing jurisdictions, but not require it or “lock out” potential partners.

3. ITS Vision

The vision for the Syracuse Metropolitan Area ITS Strategic Plan depicts the future regional transportation system in a 20-year horizon. The project goals have been developed in view of the deficiencies identified in the region's existing transportation system as well as the long-term vision of the future regional transportation system.

3.1 Vision Statement

Intelligent Transportation Systems (ITS) will create an efficient, effective, safe, and seamless transportation network for the movement of people and goods in the Syracuse Metropolitan Area. ITS will promote public and private partnerships by increasing private sector participation in ITS projects. ITS will enhance interagency coordination and cooperation and provide a flexible transportation system that can accommodate shifts between facilities. These streamlined partnerships will greatly enhance emergency and transportation planning efforts. Table 2 shows the visioning process established for the Syracuse Metropolitan area.

Table 2 - Visioning Process
Definitions
The term Intelligent Transportation Systems (ITS) refers to technological and management advances to address the overall needs of the region, the travel requirements of the transportation network users, and the development, operation, management, and maintenance needs of the transportation system providers, both public and private. **The Metropolitan Area Transportation Network** is defined as an integrated set of transportation and communication systems and services located within and/or serving the Syracuse Metropolitan area. The network includes facilities and services that support roadway (for both passengers and freight), transit, and multimodal passenger travels. **Transportation Network Users** include vehicle drivers, public transportation riders, passengers, commercial/freight vehicle drivers and operators, pedestrians, bicyclists, and users of other modes. **Transportation Service Providers** include those public and private entities that plan, develop, supply, maintain, manage, and operate the regional transportation network.
Why ITS Is Needed
The Syracuse Metropolitan area can no longer build itself out of its transportation problems. In the next 20 years the region will be challenged by growing traffic congestion in the context of funding, environmental, physical, and other constraints that limit the ability to expand the transportation infrastructure in the City and its vicinity.

3.2 Goals and Objectives

The members of Steering Committee formulated the outcome of the project in terms of its Goals, and the Objectives that must be met through these goals. Table 3 lists the goals along with the objectives.

Table 3 - Goals and Objectives
Goal #1 - Improve Safety Reduce the frequency of incidents Reduce the severity of incidents Reduce emergency response time
Goal #2 - Increase Operational Efficiency and Mobility Increase throughput of the transportation services Reduce delay due to incidents Improve travel time and service level reliability Improve intermodal facilities and operations
Goal #3 - Increase Productivity Increase cost savings Reduce acquisition, maintenance and life cycle costs
Goal #4 - Reduce Environmental and Energy Impacts Reduce harmful emissions Reduce energy consumption
Goal #5 - Enhance Customer Satisfaction Increase traveler benefits of the transportation services Increase provider benefits of the transportation services
Goal #6 - Improve Traveler Information Increase dissemination of real-time information Provide alternate route information during emergencies Enhance Roadway/Weather Information System (RWIS) and use to provide information to key users and the general public

4. Existing Conditions / Problems / ITS Elements

4.1 Introduction

The objective of this report is to document the established goals, assess operational deficiencies, analyze the existing conditions of transportation facilities, and prioritize those facilities for potential ITS deployment. Available data were gathered and summarized in order to identify the current status of the city and county's transportation system.

Section 4.2 presents the roadway system while Section 4.3 provides an overview of the transit and air system in Onondaga County. Priority locations and issues relating to each mode of transportation are identified if applicable. An inventory of existing and proposed ITS elements within the study area is presented in Section 4.4.

4.1.1 Methodology and Criteria for Selection of Priority Locations

ArcView GIS, a Geographic Information System, was used to array and analyze available data. The GIS provides significant capabilities for base mapping, analyzing and displaying project data and for producing high quality output in the form of maps and tables.

For highway corridors, the priority locations are identified based on recurring congestion. Recurring congestion occurs during peak commuting times whenever the volume of traffic trying to use a roadway segment approaches or exceeds its traffic carrying capacity. Information provided by the Syracuse Metropolitan Transportation Council's (SMTC) *Congestion Management System 2000-2001 Final Report* provided the basis for the locations of recurring congestion. Congested locations were defined as having a volume to capacity (V/C) ratio of 0.90 or greater.

Additional priority locations were identified through consultation with the ITS Strategic Plan Steering Committee and through the analysis of a variety of data including the following:

- Traffic patterns and congestion during special events;
- State and local highway system accidents;

- Low clearance bridges;
- Highway-rail grade crossings;
- Critical ramp locations;
- Truck routes;
- Locations that experience weather related transportation issues; and
- Transit and air travel availability and accessibility.

4.1.2 Study Area

The study area is comprised of Onondaga County, which includes the City of Syracuse (see Figure 4.1). Based on the 2000 U.S. Census, Onondaga County has a population of 458,336. Residents within the City limits account for 147,306 of the total County population.

Centrally located within Onondaga County, the City of Syracuse serves as the focus for commercial and business activity. Land uses within the City include commercial, governmental (federal, state, county, and city), institutional (education, medical, cultural, and religious), retail, residential, and industrial.

Onondaga County offers a variety of high-quality educational, cultural, and recreational opportunities. Major colleges and universities include Syracuse University, the State University of New York College of Environmental Science and Forestry, Lemoyne College, the State University of New York's Upstate Medical University, and Onondaga Community College.

In addition to the colleges and universities, the County has a variety of cultural assets. These include the Onondaga County Public Library System, the Everson Museum, Syracuse Stage, the Syracuse Symphony Orchestra, the Museum of Science and Technology (MOST), the New York State Fair, the Erie Canal, the Landmark Theater, the Onondaga County Convention Center and the Carrier Dome.

Recreational facilities within the County include P&C Stadium, home of the Syracuse SkyChiefs Triple-A baseball team, the Onondaga County War Memorial, home of the Syracuse Crunch minor league hockey team, the Carrier Dome which hosts a variety of Syracuse University sports teams and the Onondaga County Parks system.

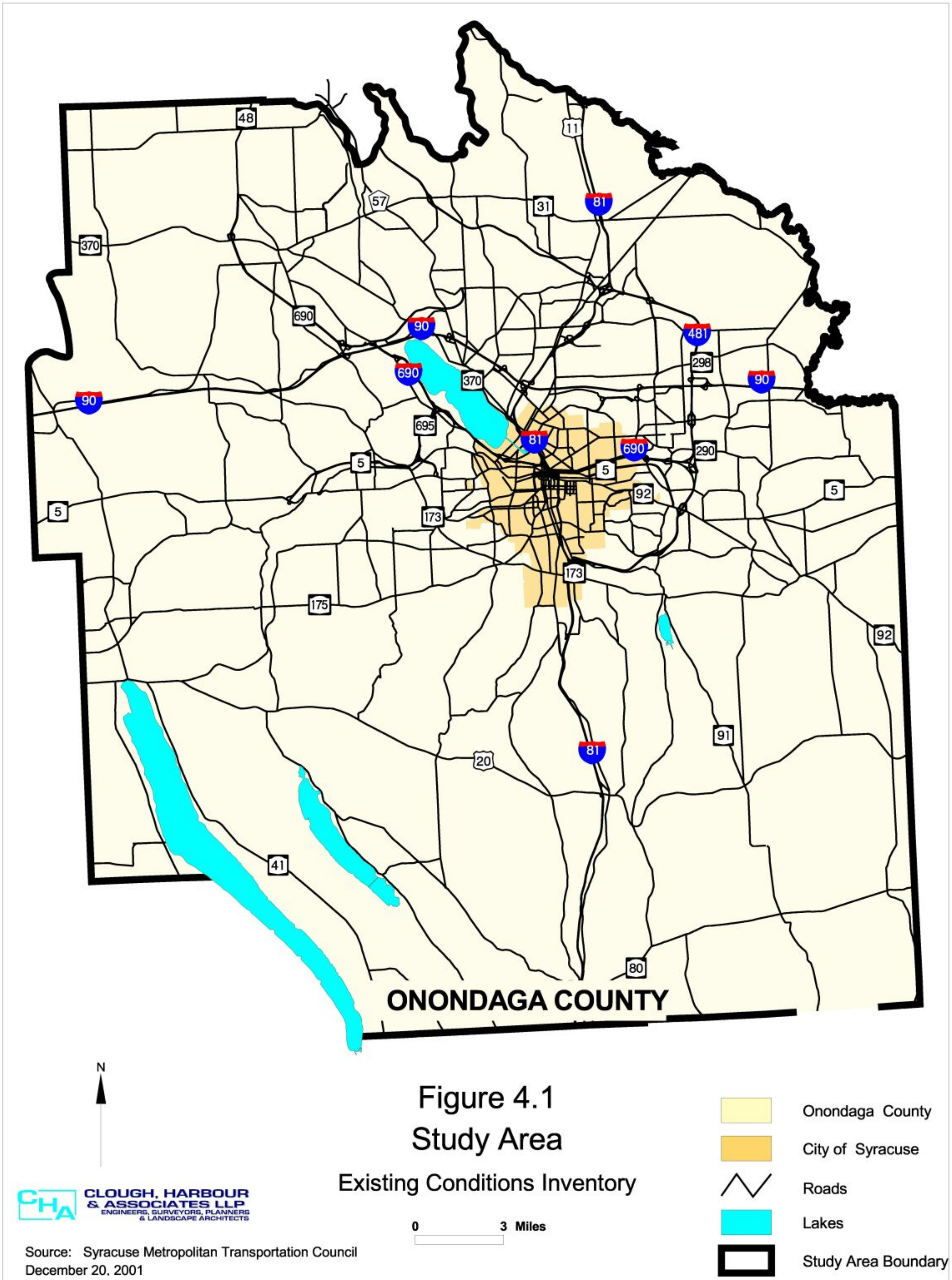


Figure 4.1
Study Area
Existing Conditions Inventory

Source: Syracuse Metropolitan Transportation Council
December 20, 2001

Base Year and Data Sources

The year 2001 was selected as the base year for the analysis. The Syracuse Metropolitan Transportation Council (SMTC) was the primary source of traffic data and ArcView GIS files. The base year for traffic data contained in the SMTC database for its Congestion Management System (the source of congested locations identified in this report) ranges between 1998 and 2000. Additional data was obtained from the Onondaga County and New York State Departments of Transportation, the City of Syracuse, and the Central New York Regional Transportation Authority (CNYRTA).

Accident data for the local highway system was obtained from the SMTC, the original source of which was the NYSDOT. The accident data covers the years 1997 through 1999, which was the most recent data available. State highway accident data was obtained directly from the NYSDOT and covers the two-year period from September 1997 through August 1999.

Additional information was provided by the ITS Strategic Plan Steering Committee and from interviews held with regional ITS stakeholders.

4.2 Roadway Systems

4.2.1 Roadway Network

The highway network within the county and city, including functional classification, are shown in Figure 4.2 and 4.2a, respectively. Onondaga County is primarily laid out in a radial pattern with most of the major roadways and arterials leading to and from the City of Syracuse. The highway network consists of interstate highways (I-81, I-90 (New York State Thruway), I-481, I-690), freeways (Route 481, Route 690, Route 695), state highways (Route 5, Route 31, Route 80, Route 92, Route 173, Route 175, Route 257, Route 290, Route 298, and Route 370), US highways (US 11, US 20), and other major arterials.

The north-south traffic in Onondaga County is primarily served by Interstate 81 and to a lesser degree, Interstate 481 and US 11. In addition, major arterials such as Route 57, Morgan Road, John Glenn Boulevard, Henry Clay Boulevard, Buckley Road, Thompson Road, and Northern Boulevard also serve north-south traffic in the northern portion of the county.

East-west traffic within Onondaga County is primarily served by Interstate 690 and State Routes 5 and 92. Other major east-west corridors in Onondaga County include Route 370, Onondaga Lake Parkway, Route 31, Taft Road, Route 173, Route 175 and Route 290. Interstate 90 (New York State Thruway) is a limited access toll highway that typically serves traffic passing through or traffic from outside Onondaga County. There is very little use of Interstate 90 for trips within Onondaga County.

As shown in Figure 4.2a, the City of Syracuse is primarily laid out in a grid street pattern and consists of a variety of functional classifications. The roadway network consists of two interstate highways (I-81 and I-690), state routes (Route 5, Route 80, Route 92, Route 173, Route 175, and Route 290), one US highway (US 11), and major arterials (Erie Boulevard, Genesee Street, Salina Street and Almond Street). In addition, there are numerous local streets that are critical to the circulation patterns within the City of Syracuse.

The north-south traffic into and out of the Syracuse Central Business District (CBD) is primarily served by Interstate 81 and the following four major arterials: Salina, Clinton, West, and Almond Streets. Other significant north-south roadways in the City include Franklin, Geddes, and State Streets and Teall Avenue.

East-west traffic within the CBD is primarily served by Genesee Street, Erie Boulevard and Adams Street. Other major east-west corridors in the City include Washington Street, Fayette Street, Harrison Street, and Jefferson Street.

4.2.2 General Roadway Congestion

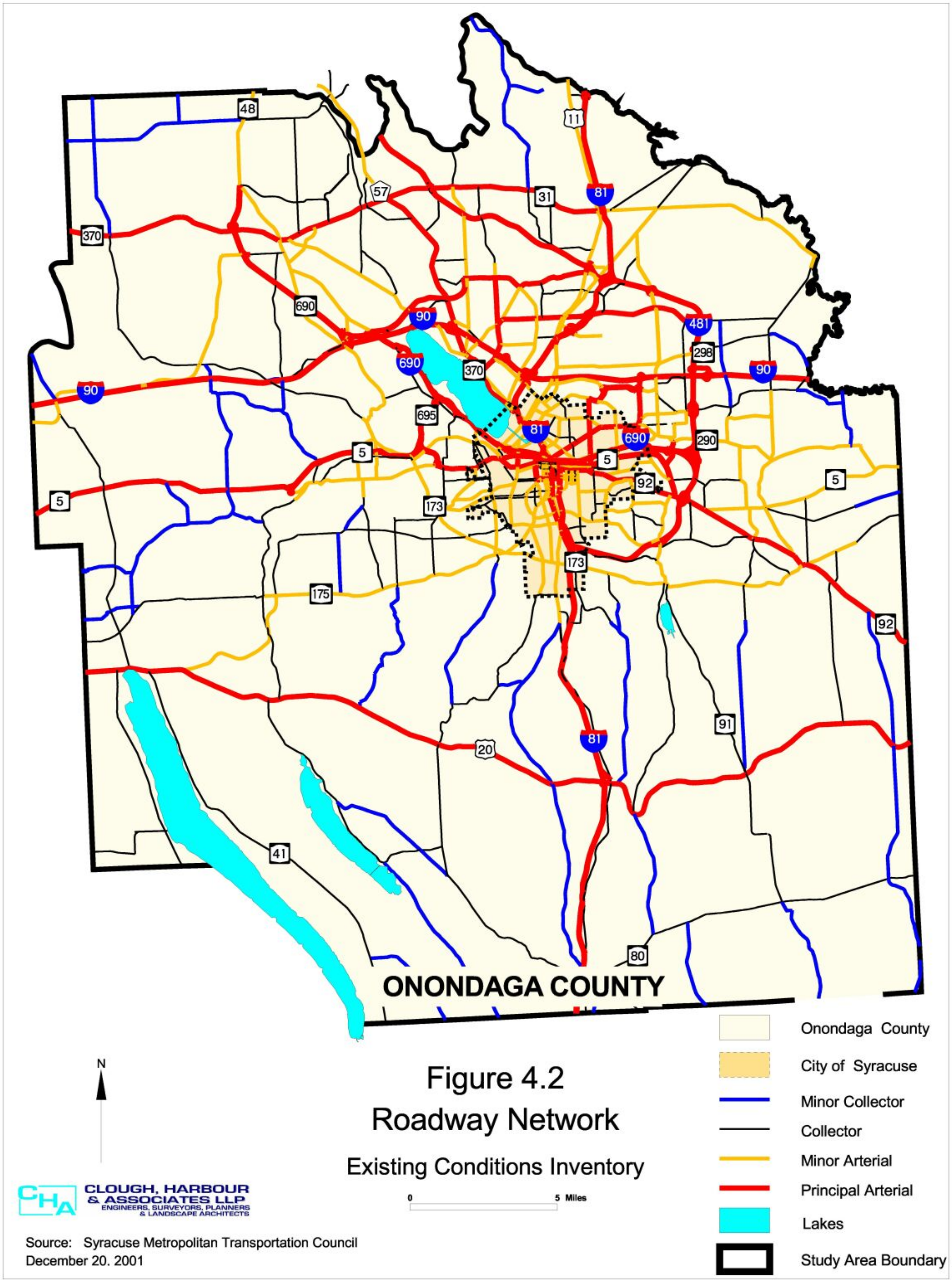
Traffic in Onondaga County is typically concentrated during rush hours. The peak periods typically last from 7:00 AM to 9:00 AM in the morning, and from 4:00 PM to 6:00 PM in the evening. Outside of these times, traffic flow is generally good. Workers commuting in to the city from the surrounding suburbs are the main cause of congestion. City of Syracuse residents and businesses contribute relatively little to these volumes.

With the exception of the streets that flow directly into the CBD, the University Hill area and streets that intersect with an interstate system ramp, traffic flow during peak hours within the city is better than average.

4.2.3 Recurring Congestion

4.2.3.1 Congested Road Segments

Information provided by the Syracuse Metropolitan Transportation Council's (SMTC) *Congestion Management System 2000-2001 Final Report* provided the basis for the locations of recurring congestion. Congested locations were defined as having a volume to capacity (V/C) ratio of 0.90 or greater. Twenty-five locations were identified that had a v/c ratio > 0.90 for the PM peak hour. The PM peak hour was used since a majority of the locations had higher volumes during this time. Table 4 lists the twenty-five locations and Figure 4.3 displays the locations of these road segments.



ONONDAGA COUNTY
N
Figure 4.2
Roadway Network
Existing Conditions Inventory
0
5 Miles
Onondaga County
City of Syracuse
Minor Collector
Collector
Minor Arterial
Principal Arterial
Lakes
Study Area Boundary
CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS
Source: Syracuse Metropolitan Transportation Council
December 20. 2001

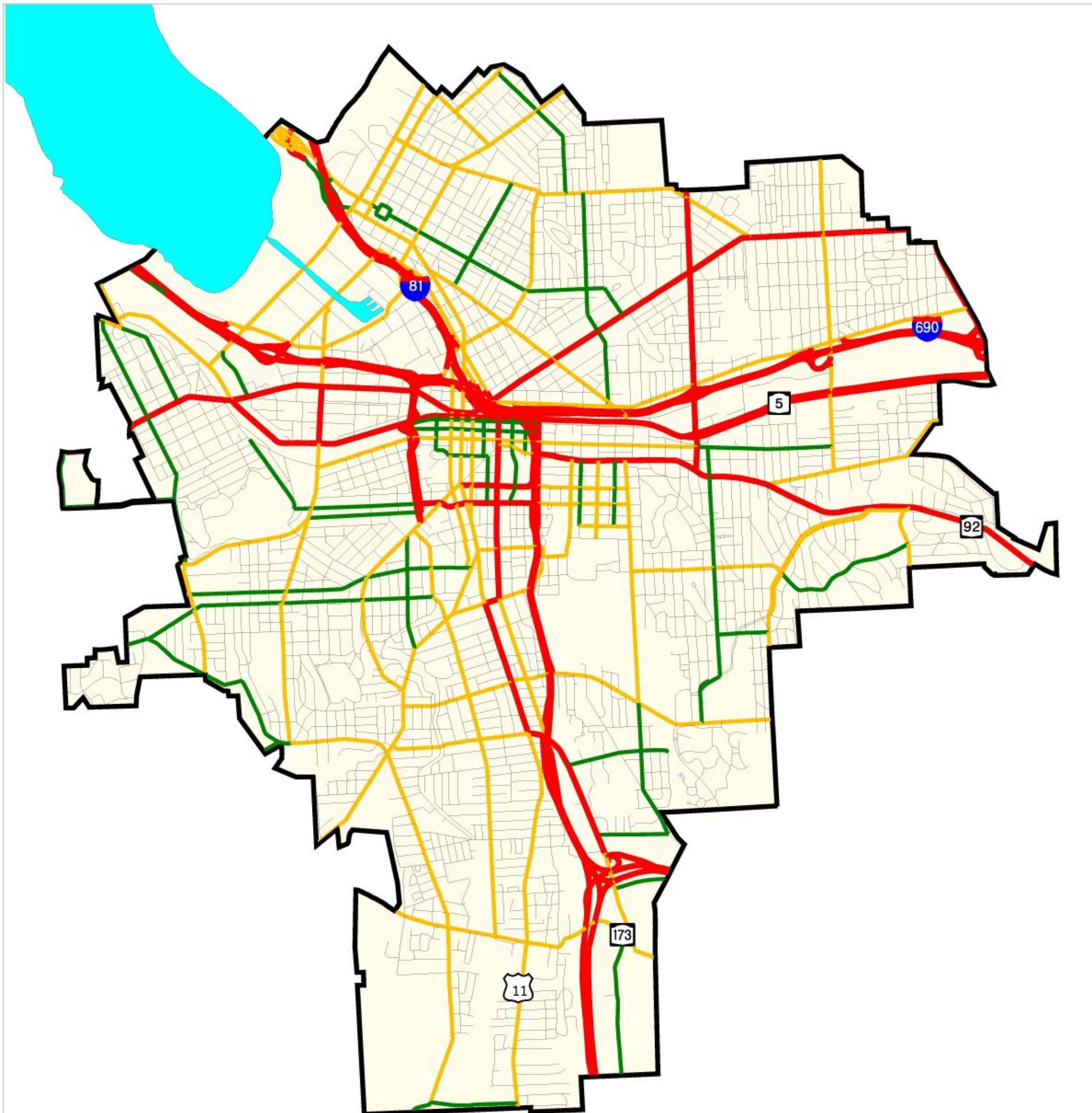


Figure 4.2A
City of Syracuse
Roadway Network

Existing Conditions Inventory

0 1 Miles

City of Syracuse
Local Road
Collector
Minor Arterial
Principal Arterial
Lakes

CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: Syracuse Metropolitan Transportation Council
December 20. 2001

Table 4 - Congested Road Segment Locations

REFERENCE NUMBER	ROAD	FROM/TO	SEGMENT LENGTH	PM PEAK V/C RATIO
1	I481	Acc Rts 5 92/Acc Rt 690I	1.26	0.92
2	I690	Jct Rt 695/Syracuse W City Ln	1.99	1.27
3	I690	Acc Geddes St Half Int/Acc West St	0.64	1.19
4	I690	Acc Midler Av/Syracuse E C L Rt 635	1.06	1.50
5	I690	Acc 81I NB/Acc McBride St EB	0.22	1.66
6	I81	Jct Taft Rd/Jct Rt 481	1.30	1.00
7	I81	Jct Rt 90I/Jct Rt 11	1.79	1.04
8	I81	Jct Colvin St/Jct E Adams St	0.97	1.04
9	I81	Jct E Adams St/Acc 690I	0.66	2.21
10	I81	Jct Rt 298 Bear St/Rt370	0.30	1.81
11	SR173	Genesee St Fairmount/Split Rock	1.82	0.95
12	SR290	Bridge St/Fremont Rd	1.87	1.44
13	SR31	End Rt 370 OLP/CR 91 Old Rt 57	3.62	1.31
14	SR370	River Rd Cold Springs/John Glenn Blvd	0.77	1.17
15	SR370	Rt 931 G Old Rt 57/Syracuse N City Ln	2.22	1.05
16	I481	Acc Kirkville Rd/Acc Rt 90I	1.13	0.99
17	SR5	Acc 481I/End Rt 92 OLP Lyndon	0.77	1.71
18	SR5	Rt 290 Mycenae/Madison County Line	0.85	0.91
19	SR695	Rt 5/690I End 695	2.30	0.92
20	SR92	End Rt 5 OLP/Woodchuck Hill Rd	1.73	1.57
21	SR92	End Rt 173 OLP/Pompey Ctr Rd	0.98	1.19
22	SR173	City of Syracuse/Rt 80 Valley Dr	0.43	1.15
23	W Fayette St	Geddes St/West St	0.64	1.12
24	Teall Ave	James St/Grant Blvd	0.48	0.92
25	CR 57	I90/Tulip St	0.75	1.17

Source: *SMTC Congestion Management System 2000-2001 Final Report*

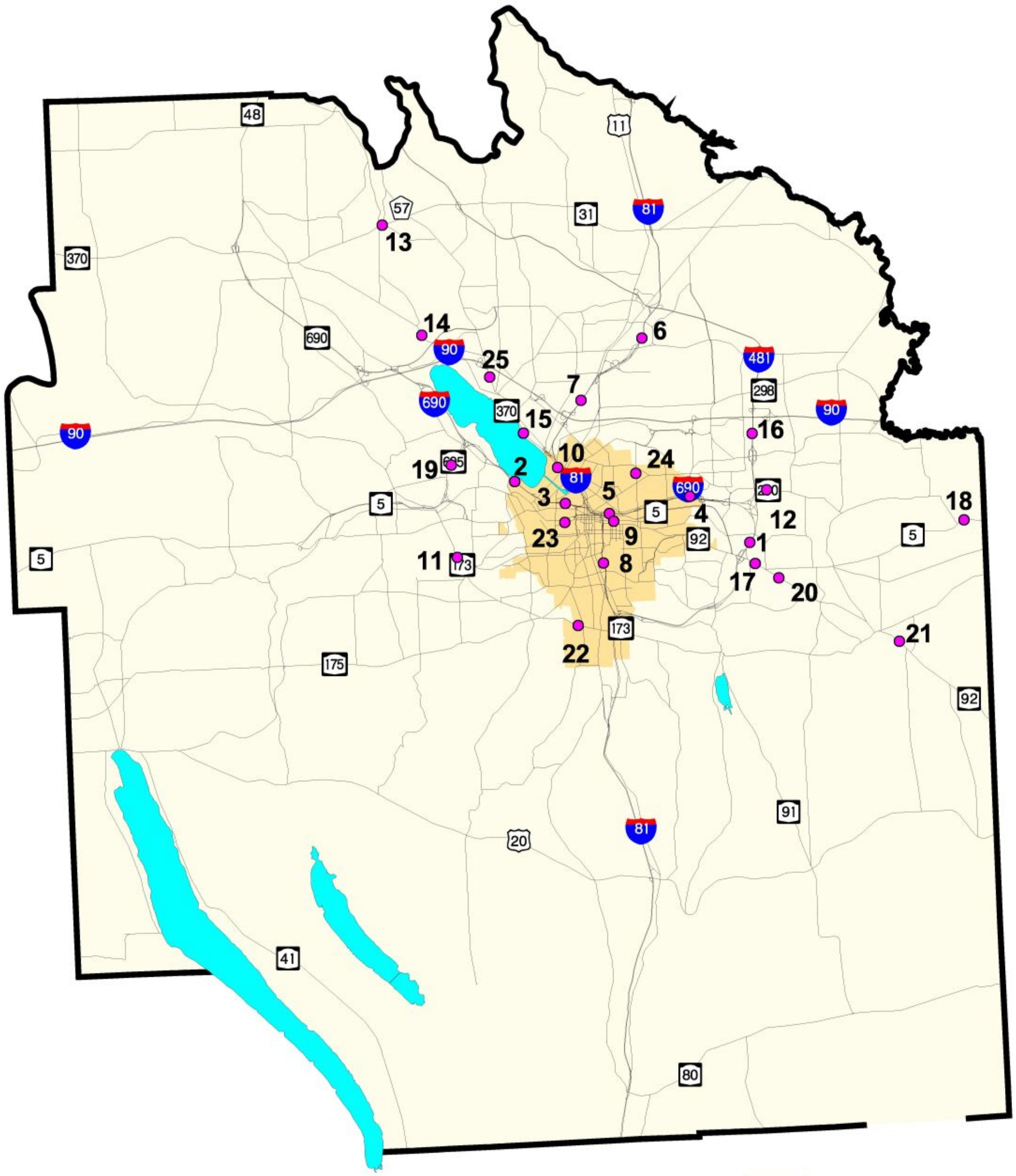


Figure 4.3
Congested Road Segment Locations

Existing Conditions Inventory

N

0 3 Miles

Onondaga County
City of Syracuse
Roads
Lakes
Congested Road Segments
Study Area Boundary

CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: Syracuse Metropolitan Transportation Council
December 20, 2001

4.2.3.2 Congested Intersections

In addition to the twenty-five road segments identified in the *SMTC Congestion Management System 2000-2001 Final Report*, seven congested intersections were identified where at least one approach had a v/c ratio that was greater than 1.0. The intersections are listed below and the locations are shown in Figure 4.4.

- SR 370/CR 57/Old Liverpool Rd
- CR 57 at Tulip St
- Midler Ave at James St
- Butternut at Lodi St
- Genesee St at Erie Blvd West
- SR 173 (East) at SR 175
- Colvin St at Comstock

4.2.4 Special Event Access Roadways

Based on input from the ITS Strategic Plan Steering Committee there are a number of locations that experience significant traffic increases due to special events. The special event traffic generators and access roadways are discussed below and are shown in Figure 4.5.

4.2.4.1 New York State Fairgrounds

The New York State Fairgrounds is a 375 acre site located adjacent to Interstate 690 west of the City of Syracuse. The site accommodates parking and shuttle service for 23,000 vehicles and hosts over two million visitors annually. The following locations experience significant traffic increases during special events at the New York State Fairgrounds:

- Interstate 690
- State Route 695
- State Fair Boulevard
- State Route 297 – Bridge Street

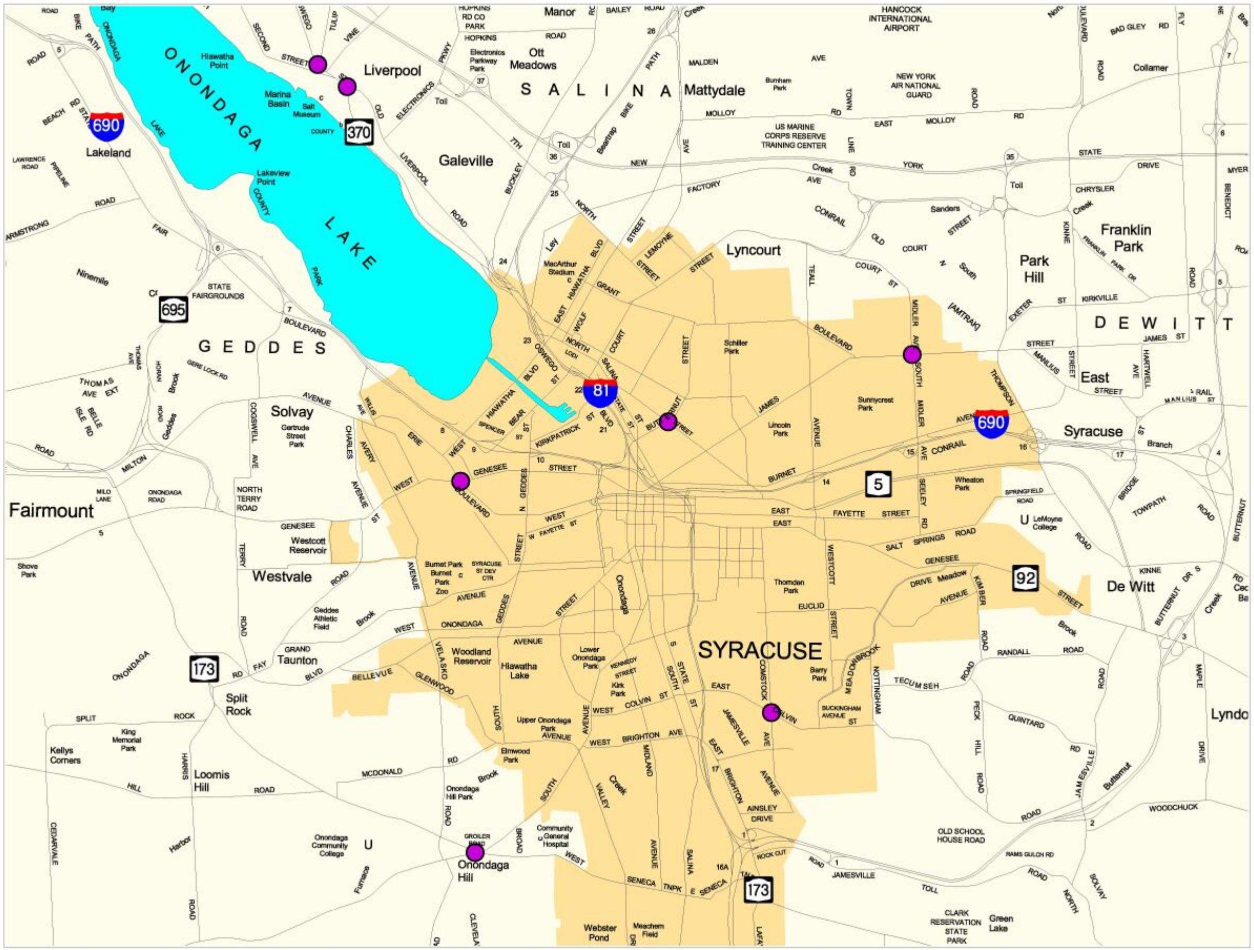


Figure 4.4
Congested Intersection Locations

Existing Conditions Inventory

N

0 — 2 Miles

- Onondaga County
- City of Syracuse
- Roads
- Lakes
- Congested Intersections

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Source: Syracuse Metropolitan Transportation Council
December 20. 2001

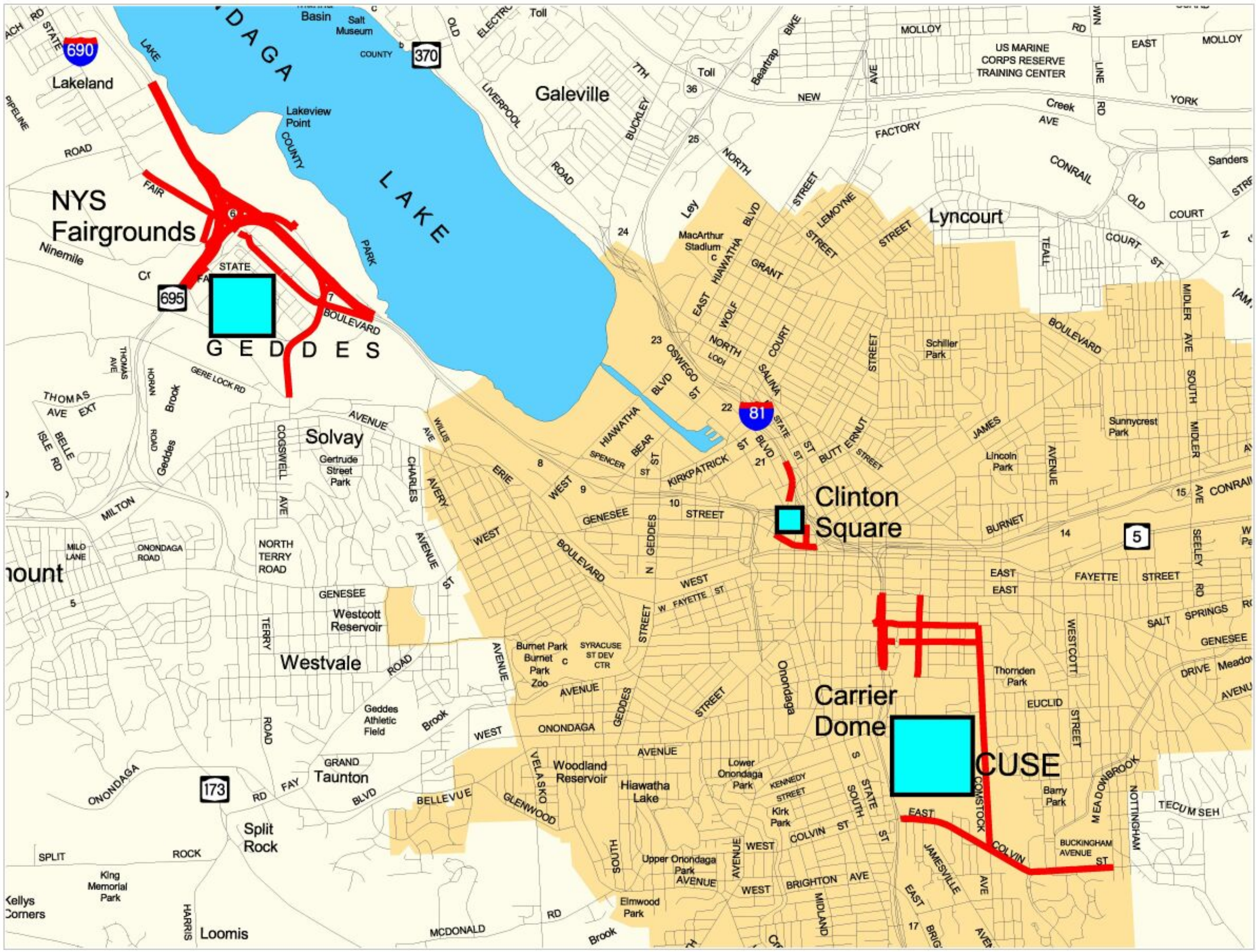

Figure 4.5
Special Event
Access Roadways

Existing Conditions Inventory

0 1 Miles

Onondaga County
City of Syracuse
Roads
Special Event Traffic Locations
Lakes
Special Event Locations

CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: Syracuse Metropolitan Transportation Council
December 20, 2001

4.2.4.2 Carrier Dome

The Carrier Dome is a 50,000 seat multi-purpose facility and is the only major domed stadium on a college campus. Both sporting and entertainment events are held here year-round. The facility is located on the campus of Syracuse University, adjacent to Interstate 81, but is only served by city streets. The following locations experience significant traffic increases during special events at the Dome:

- Interstate 81 northbound and southbound – mainline
- Interstate 81northbound off ramp at Adams Street
- Interstate 81 southbound off ramp at Harrison Street
- Adams Street
- Harrison Street
- Almond Street
- Irving Avenue
- Colvin Street
- Comstock Avenue

4.2.4.3 Clinton Square

Clinton Square, located in the CBD of the City of Syracuse, is a civic plaza designed for year-round use. The recently renovated space will host festivals, the farmers market, concerts and lunchtime activities. The square is home to an ice skating rink during the winter months. The following locations experience significant traffic increases during special events in Clinton Square:

- Interstate 81 southbound off ramps at Salina/Clinton Streets
- West Genesee Street
- Salina Street

4.2.5 Regional Traffic Generators

Over the next three years, it is anticipated that the existing Carousel Center Mall, which is located north of the City of Syracuse CBD adjacent to Interstate 81, will be transformed into a multi-million dollar tourism center called DestiNY USA. It is projected that DestiNY USA will include a five million square foot facility on 800 acres of land (an area seven times larger than Magic Kingdom). The plans indicate that the facility will house 400 retailers, 30 restaurants and cafes, and 4,000 hotel rooms. With 75 million people within a one-day drive, it is anticipated that the development will have a significant impact on the local and regional transportation network.

Figure 4.6 shows the location of the Carousel Center Mall and identifies major access routes.

4.2.6 High Accident Locations

Data regarding high accident locations on both the state highway and local highway systems has been included in this report. The information for the state highway system was provided by the NYSDOT based on their Priority Investigation Location System (PILS) and for the local highway system based on their Safety Information Management System (SIMS).

4.2.6.1 State Highway System

Table 5 lists the top twenty high accident locations on the state highway system and provides a summary of accident types and action taken or proposed. The locations were selected based on accident rates and severity by the NYSDOT for the two-year period September 1997 through August 1999. The locations are numbered for referencing purposes only and are not intended to indicate ranking (see Figure 4.7).

Figure 4.6
Carousel Center Mall Access

Existing Conditions Inventory

N

0 800 Feet

Onondaga County

City of Syracuse

Roads

Special Event Traffic Locations

Lakes

Special Event Locations

CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: Syracuse Metropolitan Transportation Council
December 20. 2001

Table 5 - State Highway Priority Accident Locations

#	RT	LOCATION	LENGTH (miles)	FATAL	INJURY	PDO	TOTAL	ACCIDENT TYPES	ACTION
1	11	Bailey Rd	0.1	0	23	40	63	Pattern of left turn/head on collisions at signal	Traffic signal adjustments; no projects planned
2	31	Crabtree-Pardee Rd	0.2	0	24	55	79	Patterns of left turn/head on collisions at signalized I-81 ramp intersections and at gas station convenience stores west of Crabtree and east of Pardee Rd	Project to restore skid resistance scheduled for 2002
3	11	E. Circle Drive-Hogan	0.3	0	39	65	104	Pattern of left turn/head on collisions at E. Circle Drive signal	Adjusted traffic signal to protected only phase; considering reducing skew angle of slip ramp from E. Circle Drive to address rear end collisions
4	298	Carrier Circle	0.5	0	44	118	162	Patterns of rear end, merging collisions on all approaches, heaviest recently on 298 EB approach	Project (PIN 310413) scheduled to reduce skew angle and to channelize EB approach
5	11	Elbow Rd	0.1	0	11	17	28	Patterns of rear end collisions at signal	Project completed that reallocated Rt 11 to two lanes with left lanes at intersection; associated sign work included
6	11	Malden-South Bay Rd	0.6	0	67	131	198	Most accidents in Mattydale Circle; right angles at I-81NB/Rt 11 SB, I-81 NB/Rt 11 NB; rear end collisions at Rt 11 SB/N Concourse and S. Bay Rd	Project completed that included lane additions /reallocations and associated sign work
7	I-81	Salina St-Spencer	0.3	0	31	71	102	Congestion related accidents at/near downtown ramps (mostly rear end and sideswipe collisions)	Ramp metering being considered for NB
8	31	Walmart-Soule Rd	0.5	0	32	62	94	Patterns of congestion related rear end collisions	Recent project created 5-lane section from Belgium to Walmart area; right lane constructed on Rt 31 EB at Soule Rd; upcoming Target and Home Depot development will require additional pavement widening to mitigate generated traffic

Table 5 - State Highway Priority Accident Locations (cont.)

#	RT	LOCATION	LENGTH (miles)	FATAL	INJURY	PDO	TOTAL	ACCIDENT TYPES	ACTION
9	290	Bridge-BJ's	0.2	0	11	33	44	Patterns of rear end collisions on slip ramps	Project under consideration to reduce skew angles
10	I-81	Adams-I-690	0.6	0	37	98	135	Patterns of sideswipe, rear end collisions at/near ramps and merge areas (I-81 NB to I-690 EB near Almond St on ramp); barrier hits.	No projects anticipated
11	298	GM Circle – Ridings Rd	0.3	0	13	22	35	Sideswipe accidents on GM Circle while exiting to 298 WB and left turn/head on collisions at the signalized Ridings Rd intersection	Project scheduled to realign left turn lanes at Ridings Rd; GM Circle to be resurfaced with upgrades to signs and markings
12	I-81	Court St – Bear Rd	0.3	0	26	56	82	Congestion related accidents near ramps	No projects planned for this area, however Carousel Mall expansion will impact operations along this section
13	930C (Adams St Art)	Clinton St – Almond St/ I-81	0.5	0	21	81	102	Patterns of left turn/head-on collisions at S. Salina St; left turn related sideswipes at S. State St; right angle, left turn related sideswipes and left turn/head-on collisions at Townsend St; and right angle, right turn, related rear end and sideswipe accidents at Almond St/I-81.	Recent improvements include brighter signal indications; a double left turn with protected only phasing for SB Townsend St; resurfacing and new pavement markings along the entire section
14	I-81	I-690 – Salina St	0.3	0	20	41	61	Patterns of rear end and sideswipe collisions at/near ramp junctures and several rail/barrier collisions	Recent project to clean scuppers, downspouts, and underground drainage system to minimize ponding related accidents
15	I-690	Thompson Rd – Bridge St	0.9	0	50	136	186	Recent study shows accidents on the collector/distributor roads, particularly at ramp junctures (mostly rear end and merging collisions); pattern of fixed object accidents on the WB exit to Thompson Rd NB	Countermeasures currently being considered for ramp accidents

Table 5 - State Highway Priority Accident Locations (cont.)

#	RT	LOCATION	LENGTH (miles)	FATAL	INJURY	PDO	TOTAL	ACCIDENT TYPES	ACTION
16	635	Carrier Circle – Route 298	0.3	0	18	33	51	Past studies showed patterns of rear-end collisions at the signalized carrier driveways; a right angle collision pattern at the McDonald's entrance, and rear end and merging collisions at Carrier Circle	A recent project on Thompson Rd established a 5-lane section with exclusive left turn lanes at the noted signals; a raised median eliminated left turns out of McDonald's
17	I-81	Liverpool Interchange	0.3	1	17	49	67	Concentrations of rear-end and sideswipe collisions on I-81 NB at/near the Liverpool exit and rear end collisions on I-81 SB near the 370/Old Liverpool Rd merges, mainly during peak periods; some icy pavement related accidents on ramp sections	Icy pavement signs in place, and pavement/weather monitor system installed in 1995 No future projects planned, however Carousel Mall expansion will impact this area
18	92	Jamesville Rd – Route 5	0.2	0	8	25	33	Recent study showed patterns of left turn/head on collisions at some of the commercial driveways; previous study showed a left turn/head on pattern at the Jamesville Rd signal.	An upcoming project (PIN 301016) will not include pavement widening on Rt 92
19	930W	Westlind – Route 5	0.3	1	15	38	54	Patterns of rear end collisions on Rt 5 slip ramp to 930W WB, right angle collisions at Rt 5 Bypass exit signal, and rear-end and left turn/head-on collisions at Westlind signal.	Work completed includes conversion of yield control on slip ramp to 930W to a stop control, and signal, marking, and lane allocations completed related to Wegmans
20	I-690	I-81/Onondaga Interchange	0.3	0	18	42	60	Patterns of rear-end and sideswipe collisions at/near exit and entrance ramps	Measures to relieve peak hour congestion at I-81 SB/I-690 EB merge have been considered but no projects planned for this section at this time

Source: NYSDOT

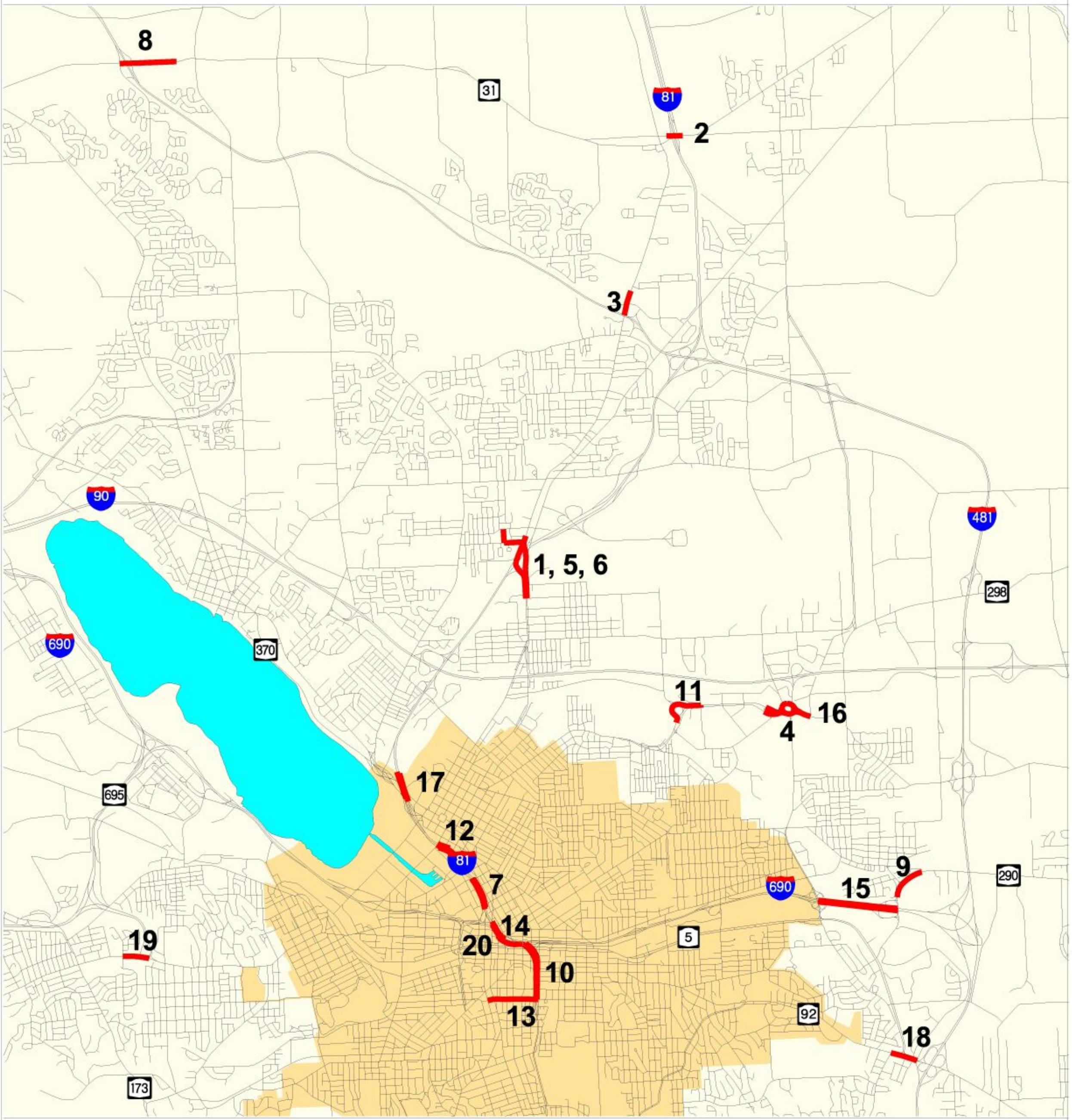

Figure 4.7
State Highway
High Accident Locations
(for the period 9/97 - 8/99)
Existing Conditions Inventory

CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: NYSDOT
December 20. 2001

4.2.6.2 Local Roadway System

Table 6 lists and Figure 4.8 displays those locations on the local roadway system that had more than 40 accidents during the years 1997 through 1999. The locations are sorted by the total number of accidents and do not take in to consideration accident rate or severity. The locations are numbered for referencing purposes only and are not intended to indicate ranking.

Table 6 - Local Roadway Priority Accident Locations

REFERENCE #	LOCATION	INJURY	PDO	TOTAL
1	East Adams St/I-81 Underpass	22	55	77
2	Harrison St/I-81 Underpass	19	51	70
3	W Fayette St/West Street Arterial	18	49	67
4	Grant Blvd/Teall Ave	29	37	66
5	N & S Geddes St/Erie Blvd W	24	41	65
6	N Salina St/E & W Genesee St	22	43	65
7	Burnet Ave/Teall Ave	17	48	65
8	N Townsend St/NY 5	19	43	62
9	S Salina St/E & W Seneca Tnpk	18	44	62
10	W Taft Rd/Buckley Rd	17	42	59
11	S Geddes St/W Fayette St	19	37	56
12	E Adams St/Comstock Ave	14	41	55
13	N Geddes St/W Genesee St	19	36	55
14	James St/N State St/E Genesee St	16	35	51
15	Lodi St/James St	23	27	50
16	N McBride St/Erie Blvd E	18	32	50
17	Midland Ave/W Brighton Ave	18	30	48
18	S Salina St/Brighton Ave E & W	18	29	47
19	Butternut St/Lodi St	19	27	46
20	W Hiawatha Blvd/Solar St	17	28	45
21	W Hiawatha Blvd/State Fair Blvd	13	31	44
22	Seymour St/S Geddes St	16	28	44
23	N Geddes St/W Belden Ave	20	23	43
24	Burnet Ave/S Midler Ave	8	34	42
25	James St/Teall Ave	16	26	42
26	E Colvin St/S State St	14	27	41

Source: SMTC, NYSDOT

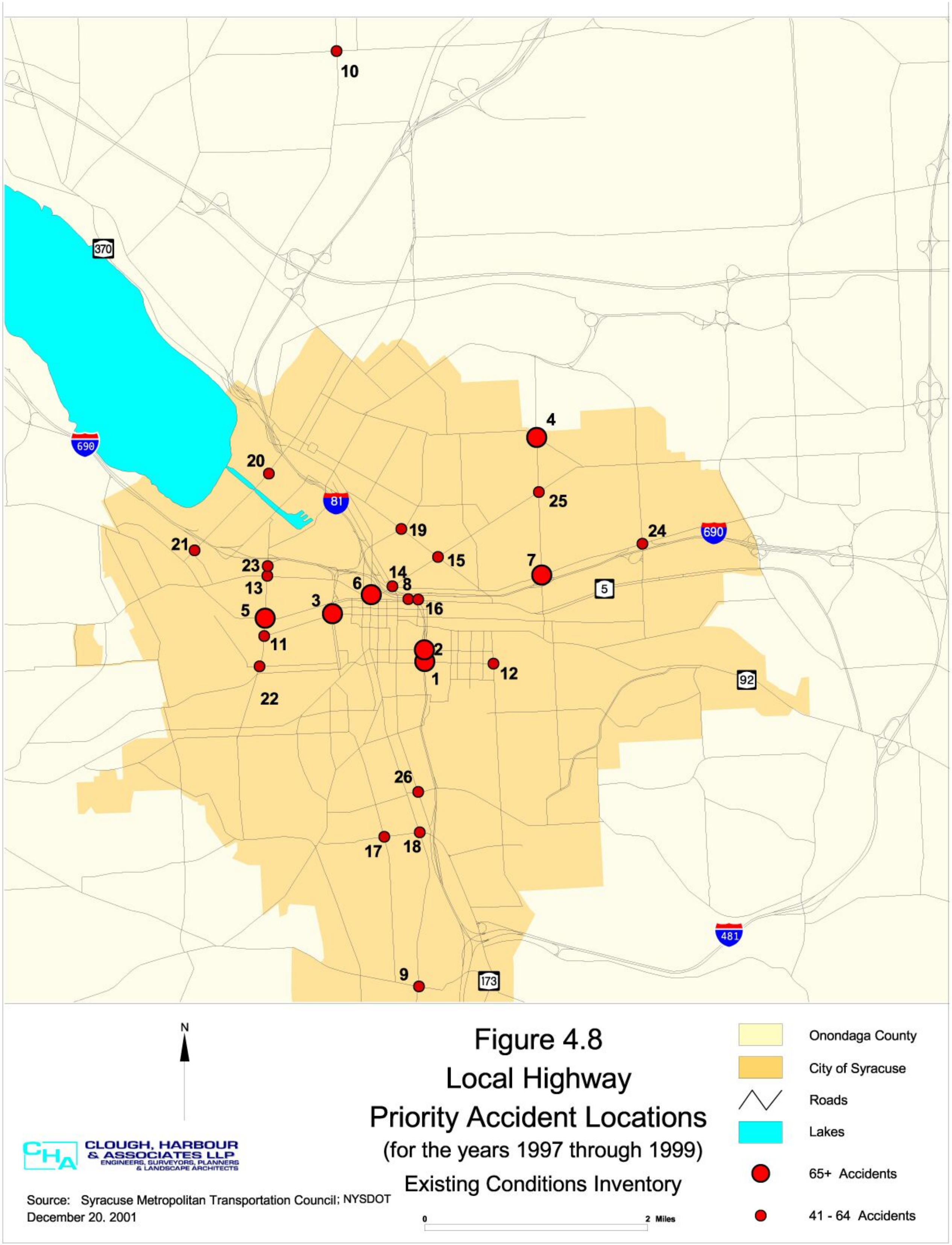

Figure 4.8
Local Highway
Priority Accident Locations
(for the years 1997 through 1999)
Existing Conditions Inventory

4.2.7 Critical Ramp Locations

Based on input from regional stakeholders there are six off-ramps from interstate highways that have a significant traffic impact on the local streets. The locations are listed in Table 7 and are shown in Figure 4.9.

Table 7 - Critical Ramp Locations

Interstate	Ramp
I-690	Eastbound off ramp at W. Genesee Street
I-81	Southbound off ramp at Clinton Street/Salina Street
I-690	Westbound off ramp at Townsend Street
I-81	Southbound off ramp at Harrison Street
I-81	Northbound off ramp at Adams Street
I-481	Southbound off ramp at exit 3E (Routes 5 and 92)

The off ramps at Clinton Street, Harrison Street, and Adams Street were also identified as experiencing significant traffic increases during special events at the Carrier Dome and Clinton Square.

4.2.8 Overhead Bridges with Low Clearances

The NYSDOT considers overhead bridges with a vertical clearance of less than 14 feet to be substandard. Table 8 identifies sixteen bridges in Onondaga County that are posted for substandard vertical clearance. The locations are shown in Figure 4.10.

The Route 20 bridge over Route 11A, referenced as number 1, is currently being reconstructed and will not have substandard vertical clearance when completed.

Based on local knowledge, the CSX railroad bridge over Route 370 and the NYS&W railroad bridge over W. Genesee Street, referenced as numbers 8 and 15, respectively, are hit most frequently.

Figure 4.9
Critical Ramp Locations

ITS Existing Conditions Inventory

N

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0 — 0.5 Miles

City of Syracuse
Roads
Critical Ramp Locations

Source: Syracuse Metropolitan Transportation Council
December 20. 2001

Table 8 - Low Clearance Bridges

REFERENCE NUMBER	FEATURE CARRIED	FEATURE CROSSED	ACTUAL CLEARANCE
1	Route 20	Route 11A	13’ 6”
2	Interstate 81	Webb Road	13’ 6”
3	SB West Street Arterial	West Genesee	13’ 9”
4	NB West Street Arterial	West Genesee	13’ 9”
5	Ramp to Route 690 EB	Catherine Street	13’ 9”
6	Finger Lakes Railway	Genesee Street	12’ 8”
7	CSX Transport/Amtrak	Route 11	13’ 9”
8	CSX Transport	Route 370	12’ 03”
9	CSX Transport	Route 370/Park Street	11’ 09”
10	NYS&W	Eager Road CR 232	12’ 02”
11	Allied Chemical	County Road 6/North Street	12’ 00”
12	NYS&W	Route 5	12’ 02”
13	NYS&W	W Fayette Street	13’ 04”
14	NYS&W	S Geddes Street	13’ 08”
15	NYS&W	W Genesee Street	13’ 03”
16	NYS&W Siding	W Fayette Street	13’ 08”

Source: NYSDOT

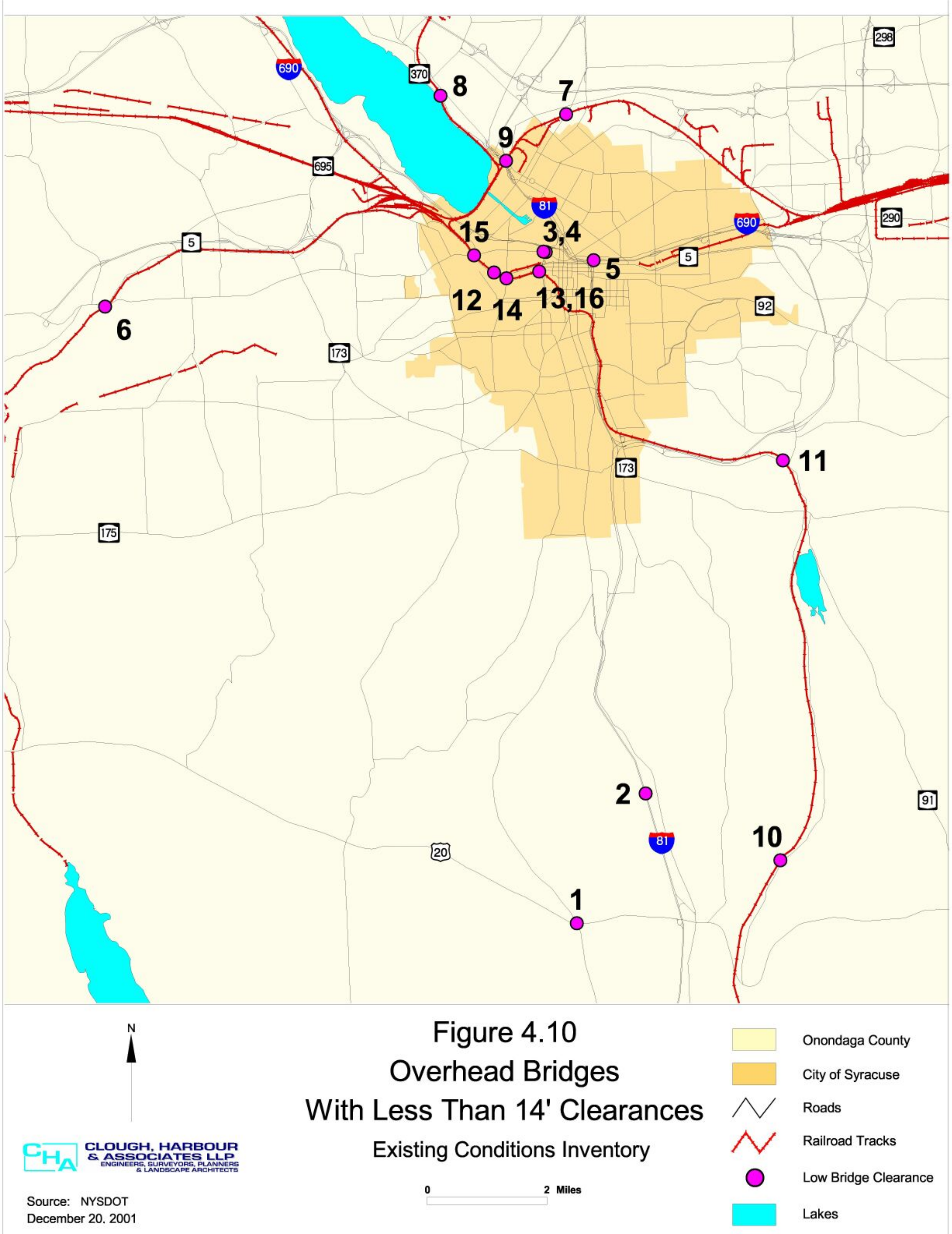

Figure 4.10
Overhead Bridges
With Less Than 14' Clearances
Existing Conditions Inventory

4.2.9 Highway-Rail Grade Crossings

Table 9 lists and Figure 4.11 displays nine priority highway-rail grade crossing locations. The first four locations listed are on the Chicago Main Line and were selected due to the frequency and speed of trains at the crossings. All four locations have a frequency of 70 trains per day with a maximum train speed of 79-Miles per Hour (MPH). If the state implements high-speed rail as proposed, these sites will require an additional track for that purpose.

The remaining five sites each have Average Annual Daily Traffic (AADT) volumes greater than 5,000, have a frequency of between five and eight trains per day and a maximum train speed of 40 MPH.

All nine locations are equipped with gates and flashers. The only accident recorded at any of the sites during the past ten years was a fatality in June of 2000 at the Herman/DeVoe grade crossing. Motorists driving around lowered gates have been identified as an issue at some of these locations.

Table 9 - Priority Highway-Rail Grade Crossings

REFERENCE NUMBER	STREET NAME	AADT	TRAIN FREQUENCY/ DAY	MAX. TRAIN SPEED (MPH)	ACCIDENTS
1	Kirkville Road	2,807	70	79	
2	Bennetts Corners Road	889	70	79	
3	Pottery Road	762	70	79	
4	Herman Road/DeVoe Road	700	70	79	Fatality, 6/11/00
5	Vine Street	13,955	8	40	
6	Old Liverpool Road	13,566	8	40	
7	State Route 31	10,607	5	40	
8	Henry Clay Boulevard	8,038	5	40	
9	Wetzel Road	6,358	5	40	

Source: SMTC

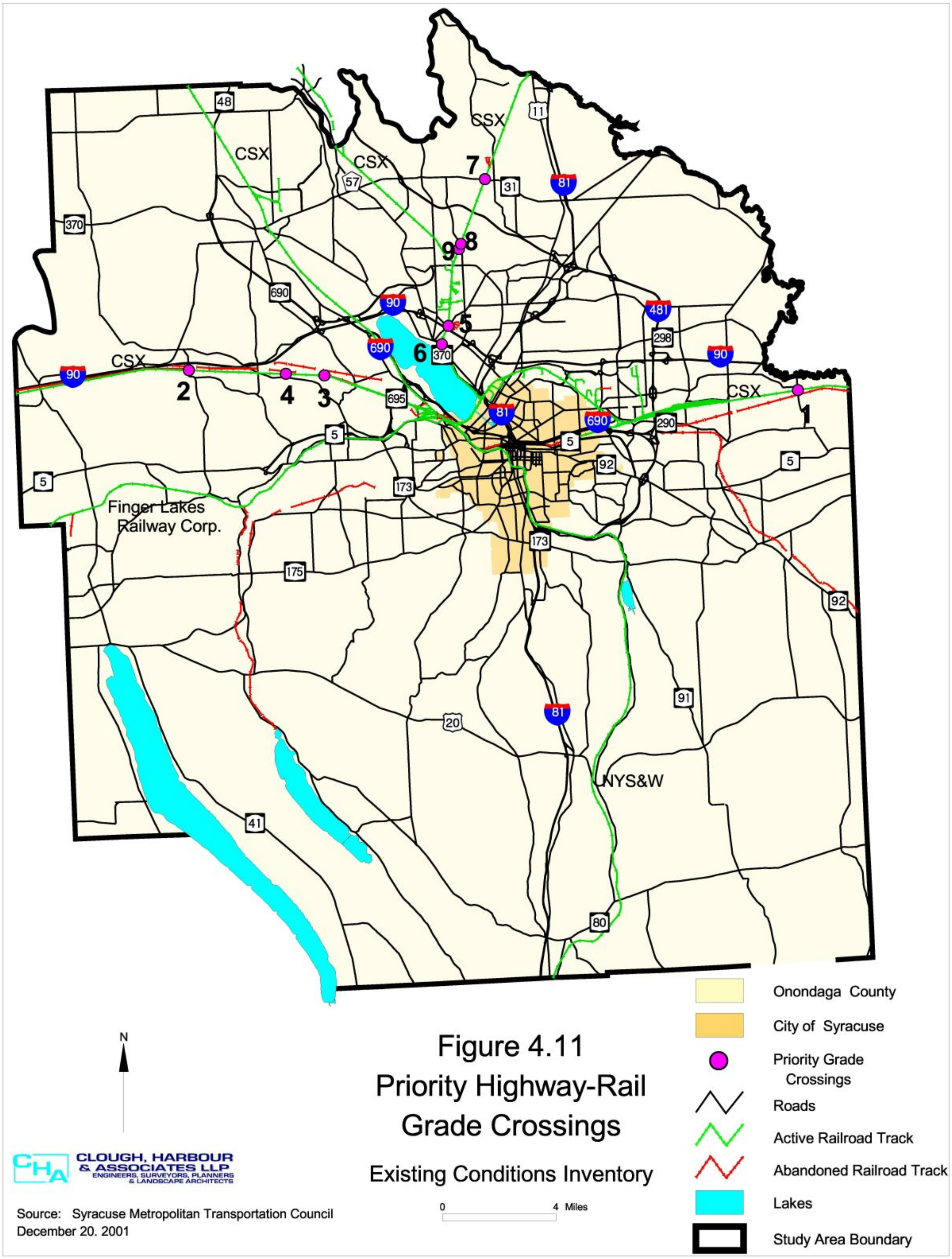

Figure 4.11
Priority Highway-Rail
Grade Crossings

Existing Conditions Inventory

Source: Syracuse Metropolitan Transportation Council
December 20. 2001

4.2.10 Major Truck Routes

The *City of Syracuse Truck Route Study* completed by the SMTC in May 2000 documented existing truck routes within the City of Syracuse and made recommendations for creating one new route while eliminating others. Figure 4.12 shows the existing truck routes within the City and displays the changes recommended in the *City of Syracuse Truck Route Study*. All highways in Onondaga County owned by the NYSDOT are open to all legal vehicles.

The Onondaga County Department of Transportation cannot legally post truck routes. The County can post “No Truck” signs; however, since the towns have the authority to post truck routes, it is the County’s policy to defer to the towns in the placement of “No Truck” signs.

The SMTC requested information from towns in Onondaga County regarding truck routes and posted weight-restricted routes. The information that was received is summarized below.

Town of Camillus

Restricted Routes

Table 10 lists streets within the Town of Camillus that have weight limit restrictions:

Table 10 - Town of Camillus Weight Limit Restrictions

Name of Street	Weight Limit (tons)
Vanida Drive (between West Genesee Street and Sanderson Drive)	4
Sunnybrook Drive, Garland Road, Wilmont Road, Myron Road, Sherry Drive, Gifford Drive, Cotton Street, Sawyer Street, Jones Street and James Avenue	4
Cotton Street	5
Germania Avenue	5
Jones Street	5
Knowell Road	5
Male Avenue	5
Mackay Avenue	5
Myron Road	5
Myrtis Road	5
Sawyer Street	5
Sidney Street	5
Sunnybrook Drive	5
Semloh Drive	5
Lyons Road Extension	5
Gifford Drive	5
Hinsdale Road (between West Genesee Street and Milton Avenue)	5
DeVoe Road	5
VanAlstine Road	5
Thompson Road	5
Whedon Road	5/per axle
Oakridge Drive	5/per axle

Source: Town of Camillus

Town of Dewitt

Permitted Routes

The following roads are designated truck routes:

- Cedar Bay between Kinnie Road and Towpath Road
- Kinnie Road west from Agway Drive to Erie Boulevard
- Lapage Place from Walter Drive to Leo Avenue to James Street

Restricted Routes

Table 11 lists streets within the Town of Dewitt that have weight limit restrictions:

Table 11 - Town of Dewitt Weight Limit Restrictions

Name of Street	Weight Limit (tons)
Ambergate Road	4
Bradford Drive	5
Bradford Heights Road	5
Butternut Drive (from East Genesee Street to Kinne Road)	4
Canterbury Road	4
Collamer Drive	4
Cross Road	5
DeWittshire Road	4
Franklin Park Drive	4
Grover Street	4
Hobson Avenue	8
Kinne Road (from Mapleview Road to Butternut Drive)	5
Kittel Road	8
Loucks Road	5
Lyndon Road (from East Genesee Street to Kinne Road	4
Orville-Jamesville Road No. 7 (from East Genesee to County Jamesville-Dewitt Interstate Route 281	4
Orvilton Drive (from Thompson Road to East Genesee Street	5
Peck Hill Road (from Nottingham Road to Tecumseh Road	5
Radcliffe Avenue (from Thompson Road to Syracuse City line)	4
Randall Road (from Kimber Road to Jamesville Road	5
Roby Avenue (from James Street to Grover Street)	4
Russell Lane	5
Schuyler Road	5
Scott Avenue	5
Syracuse-Dewitt County Road No. 6 (from Ogle Road to Rams Gulch Road)	5
Tecumseh Road (from Nottingham Road to Kimber Road)	5
Temple Drive	5
Thompson Road (from Kinne Road to Orvilton Drive	5
Warwick Road	4
Wellington Road (from 198 feet south of East Genesee Street south to its terminus)	4
Winchester Road (from Kinne Street to Franklin Park Drive	4
Woodchuck Hill Road (from Marmot Circle east to the Town of Manlius line)	5

Source: Town of Dewitt

Town of Salina

Permitted Routes

Trucks in excess of five tons may travel on Factory Avenue East from US Route 11 (Brewerton) to Town Line Road.

Restricted Routes

Many of the local streets within the Town of Salina have a weight limit restriction of 3 or 5 tons. The following table lists six of the more significant streets and their associated weight limit restrictions.

Table 12 - Town of Salina Weight Limit Restrictions

Name of Street	Weight Limit (tons)
Bailey Road	5
Buckley Road (from 7th North Street to north boundary of the Town of Salina)	5
East Molloy Road (from US Route 11 to Town Line Road)	5
Hopkins Road (from Electronics Parkway to Buckley Road)	5
Malden Road (from US Route 11 to Town Line Road)	5
West Molloy Road (from Biltmore Street and McAlpine Street)	3

Source: Town of Salina

Village of Liverpool

Permitted Routes

Trucks weighing greater than three tons are permitted to travel on the following roadways within the Village of Liverpool:

- First Street between Tulip Street and Oswego Street
- Fourth Street between Vine Street and Cypress Street; Cypress Street from Fourth Street to its intersection with Cleveland Street; Cleveland Street from Cypress Street to its end.
- North Willow Street
- Old Liverpool Road
- Onondaga Lake Parkway
- Oswego Street
- Pearl Street
- Route 370 – Second Street
- Salina Street

- Tulip Street
- Vine Street

Restricted Routes

Trucks weighing greater than three tons are excluded from all other village streets and all trucks are excluded from Brow Street between Sycamore Street and Tulip Street.

Minor Town and Village Route Restrictions

Table 13 presents the remaining information that was received from towns and villages regarding route restrictions.

Table 13 - Minor Town and Village Route Restrictions

Town/Village	Name of Roadway	Weight Limit
Village of Fayetteville	Sheffield Lane	7,000 pounds
Village of Manlius	All non-state highways and roads	5 tons
Village of Marcellus	South Street	5 tons
Village of Tully	Railroad Street; Lincoln Street	No through truck traffic
Town of Cicero	East West Road (between Route 11 and East Circle Road); Lombardi Manor development tract	8,000 pounds
Town of Clay	Soule Road	4 tons
Town of Spafford	All town roads	No restrictions

Source: Towns and Villages identified in table

4.2.11 Weather Related Transportation Issues

Due to Onondaga County's geographic location, it is impacted by severe weather conditions during the winter months including Lake Effect snow. The ITS Strategic Plan Steering Committee identified the entire county as being subject to weather related transportation issues.

The following four sites were identified by the NYSDOT as locations where the weather has a significant impact on transportation (see Figure 4.13):

1. Interstate 690 westbound ramp to Auburn
2. Route 695 over the railroad near the New York State Fairgrounds
3. Interstate 81 over Park Street
4. Interstate 81 over Route 80 in Tully

The NYSDOT has installed Road Weather Information Systems (RWIS) at these locations. A RWIS is a system developed from a combination of technologies that uses historic and current climatological data to develop road and weather information to aid in roadway-related decision making.

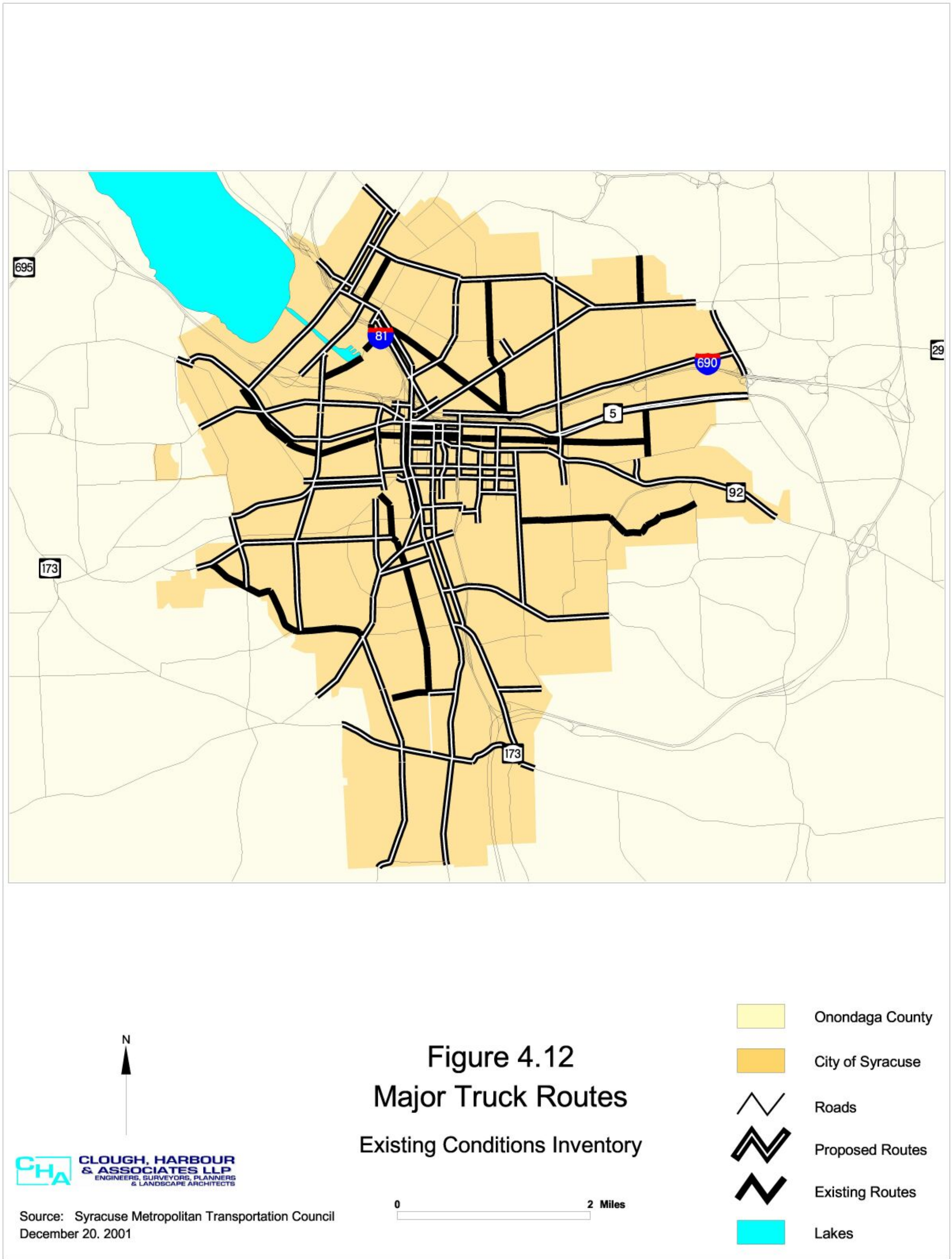

Figure 4.12
Major Truck Routes
Existing Conditions Inventory

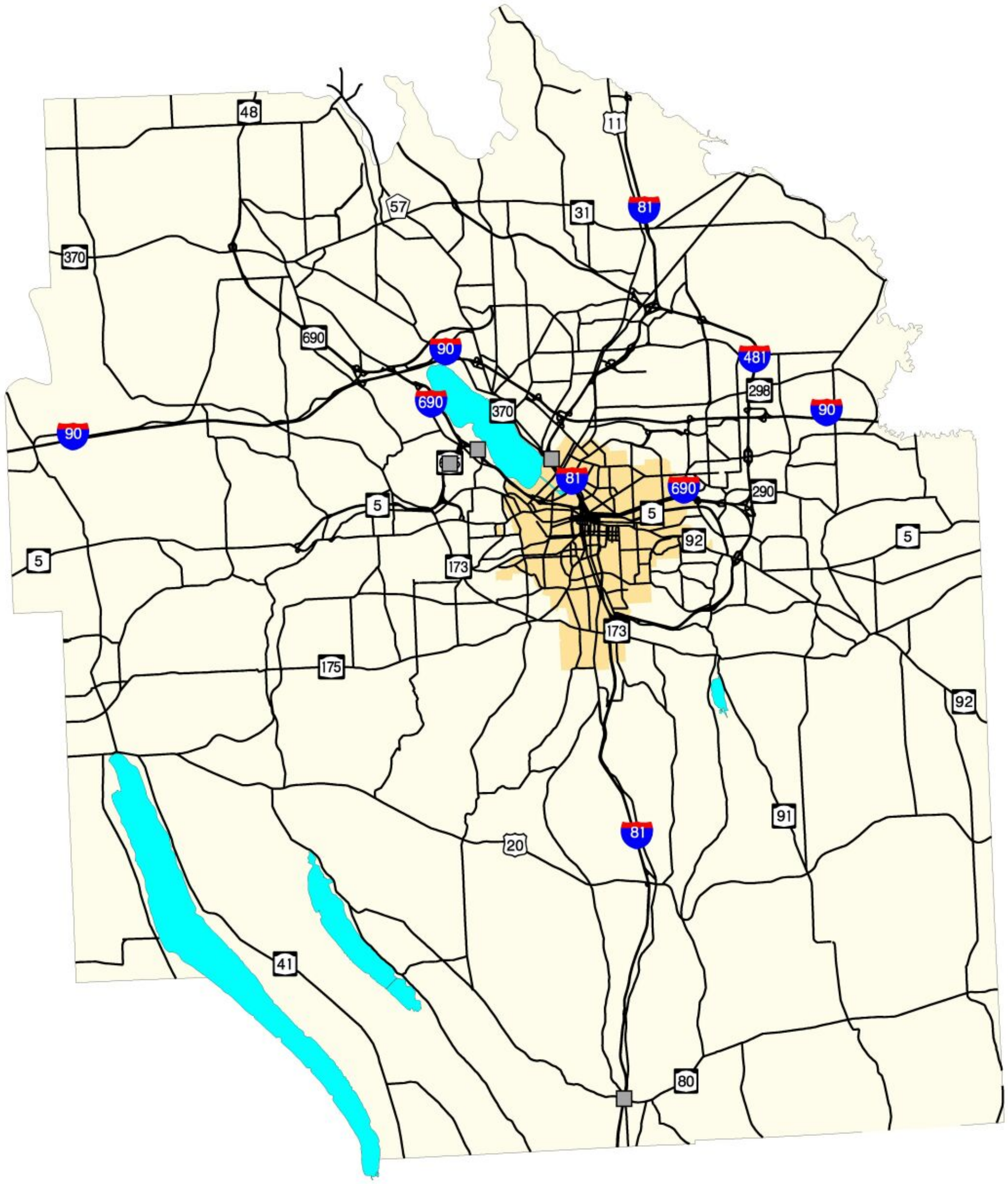

Figure 4.13
Locations With Weather Related Transportation Issues

Existing Conditions Inventory

N

Onondaga County

City of Syracuse

RWIS

Roads

Lakes

0 8 Miles

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ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: Syracuse Metropolitan Transportation Council
December 20. 2001

There are three components to a RWIS including an environmental sensor system to collect data, a model or processing system to develop forecasts and provide the information in an understandable format, and a dissemination platform to display the information.

4.3 TRANSIT AND AIR SYSTEM

Public transportation services in Onondaga County are primarily provided by the following:

- Centro- a subsidiary of the Central New York Regional Transportation Authority (CNYRTA) providing fixed route local, express and regional bus service
- OnTrack - local passenger rail service

In addition to the local service, Greyhound and Amtrak provide intercity bus and rail services. The transportation hub for the intercity services is located at the William F. Walsh Regional Transportation Center (RTC) shown on Figure 4.14.

4.3.1 Rail Network

The study area passenger rail network consists of the Chicago Main Line owned by CSX Transportation and the New York Susquehanna & Western Railway (NYS&W) of which OnTrack is a subsidiary. The overall rail network for the county and the boarding platform locations for OnTrack are shown in Figure 4.14.

OnTrack provides passenger rail service between Carousel Center Mall and the University area with additional boarding platforms located at Armory Square and East Colvin Street. There are also boarding platforms located south of the City in the Town of Jamesville and Jamesville Beach. These sites are used seasonally for special events such as fall foliage trips.

An additional boarding platform is located at P&C Stadium just beyond the RTC, but service to this location has been delayed due to the need for a new rail bridge over Park Street. It is anticipated that this situation will be remedied within the next few years which will allow OnTrack to provide service to the RTC and P&C Stadium.

OnTrack service is divided into three categories that consist of City Express, Orange Express, and Special Events with a total annual ridership of 25,000. City Express is the regularly scheduled service that runs between Carousel Center Mall and the University area and accounts for approximately 50 percent of annual ridership. The Orange Express provides service between Carousel Mall and the University for special events at the Carrier Dome. The

Orange Express combined with other Special Event service accounts for the remaining 50 percent of ridership.

The City Express service operates Wednesday through Sunday from September through May. The service provides eight daily round trips between 11:00 AM and 7:00 PM. During the summer months when the Universities are not in session, the City Express only operates Friday through Sunday. The fair for the City Express is $1.50 per boarding. The Orange Express service that runs for special events at the Carrier Dome cost $3.00 round trip from Armory Square and $4.00 round trip from Carousel Center Mall.

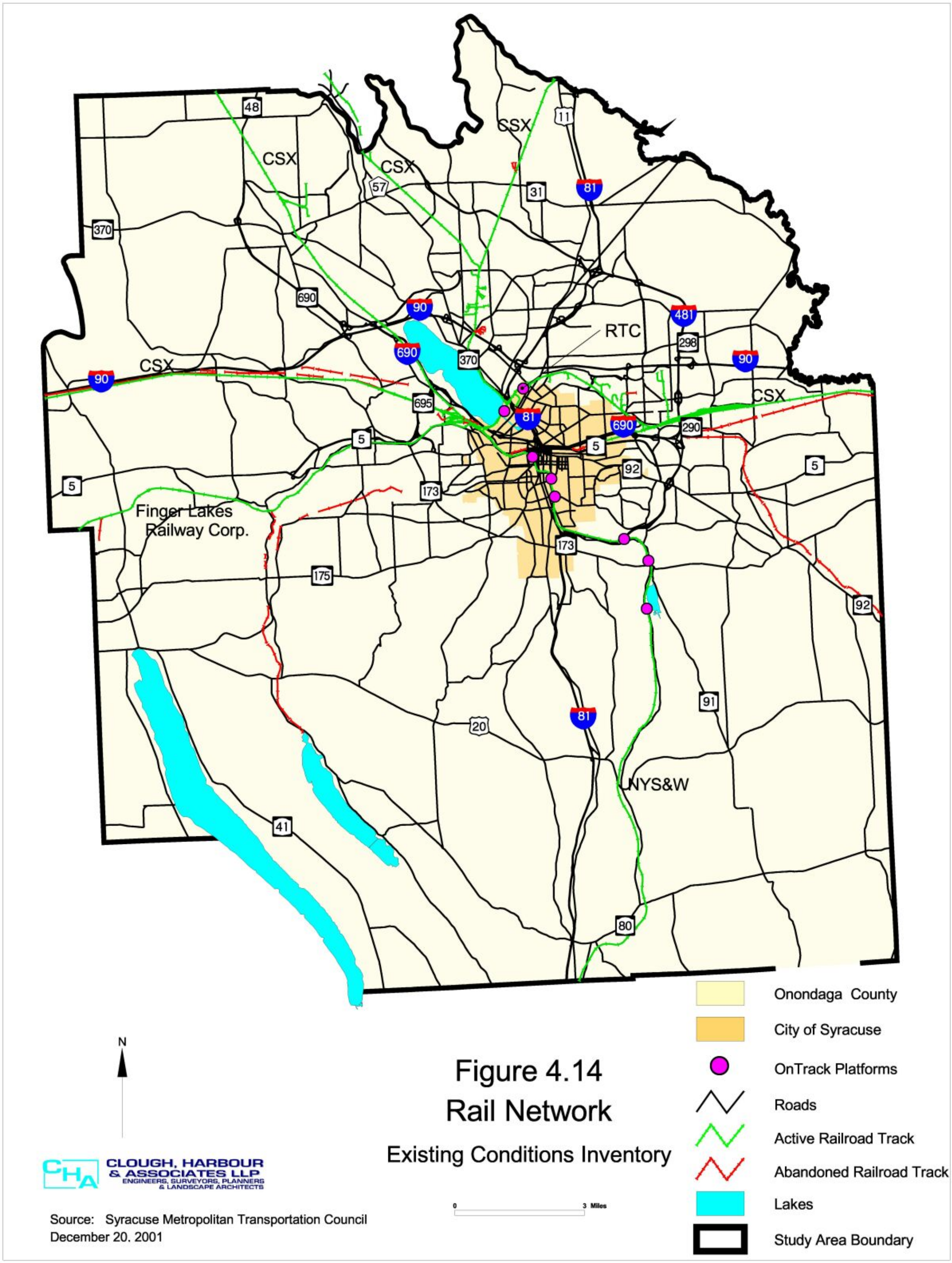

Figure 4.14
Rail Network
Existing Conditions Inventory

Source: Syracuse Metropolitan Transportation Council
December 20. 2001

4.3.2 Bus Service

The Central New York Regional Transportation Authority (CNYRTA) serves Onondaga, Cayuga, and Oswego Counties. The CNYRTA has a fleet size of 207 vehicles and serves an area with a population of 657,715. Approximately 4,000 daily trips are generated with a daily ridership of 41,000 people. Annual passengers total 13,316,428.

The CNYRTA provides for a number of transportation services including:

- Local, handicap accessible service
- Shopper shuttles
- Paratransit services
- Inter-city services between the cities of Auburn, Oswego, Fulton, and Syracuse
- Parking
- Carpool program
- Carrier Dome special events services
- Syracuse and SUNY Oswego shuttle services

A subsidiary of the CNYRTA commonly known as Centro, operates 12 numbered route groups providing local and express bus service in Onondaga County. With the exception of route group 12, which provides service within the Syracuse University vicinity, all routes converge at Common Center in downtown Syracuse where transfers can be made conveniently.

As a result of ReMAP (Regional Mobility Action Plan), a recently completed comprehensive strategic plan for restructuring its public transportation services in Onondaga County, Centro recently implemented two new routes, the Suburban East Loop and the Suburban West Loop. The goal is to serve employment, shopping and activity centers while providing convenient transfers to bus lines serving downtown Syracuse and other locations. Figure 4.15 shows the areas served by current Centro routes.

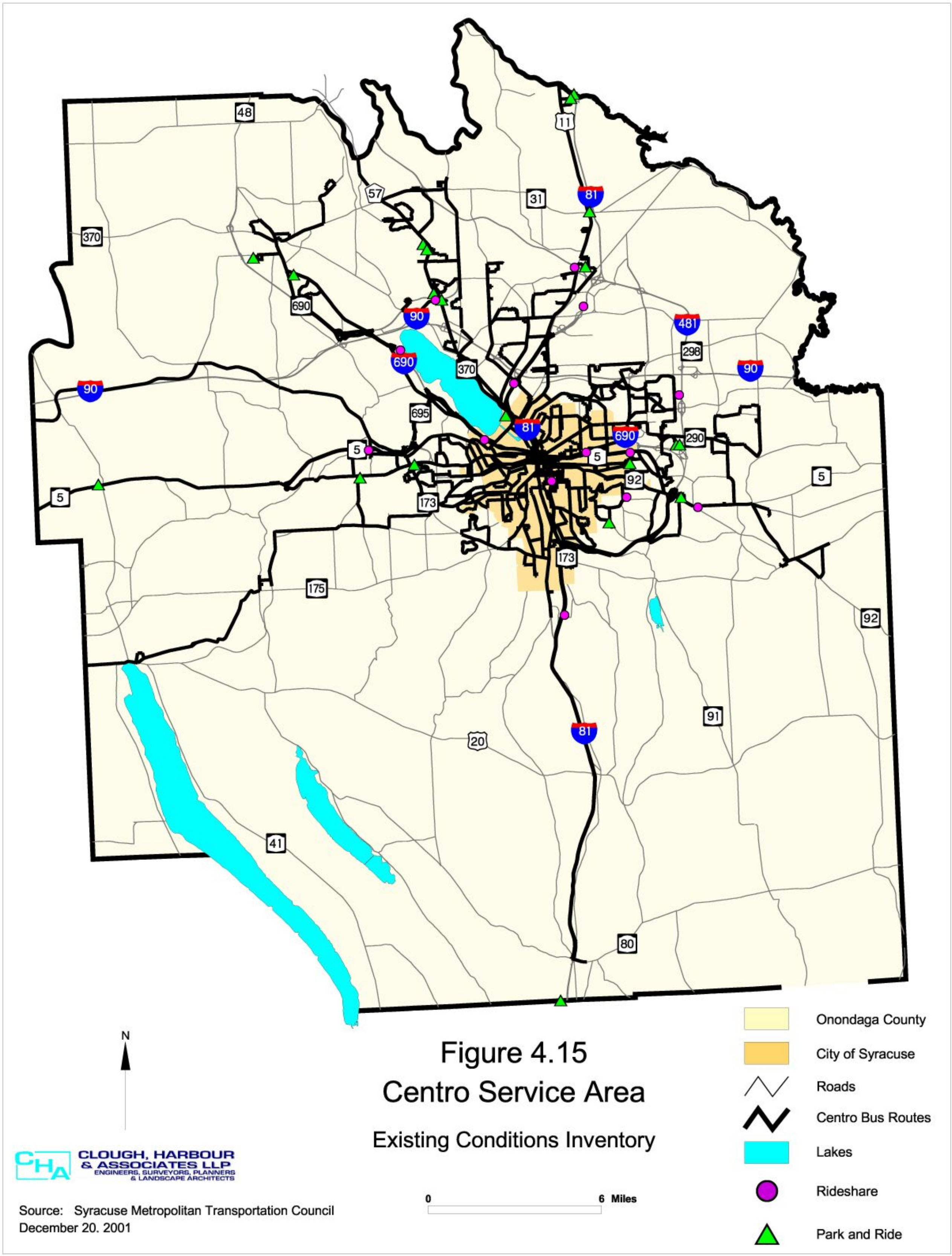

Figure 4.15
Centro Service Area
Existing Conditions Inventory

Source: Syracuse Metropolitan Transportation Council
December 20. 2001

4.3.3 Air Service

Syracuse Hancock International Airport, owned and operated by the City of Syracuse, is the only major airport within the study area. In 1997, Hancock International Airport handled 152,000 flights and serviced 2.1 million people. Six major airlines and seven commuter airlines provide air passenger service. In addition, six major air cargo carriers serve the County.

Syracuse Hancock International Airport is within a fifteen-minute drive of the City of Syracuse Central Business District (CBD) and within five minutes of the crossroads of Interstates 81 and 90. Access to the airport, shown in Figure 4.16, is obtained via Interstate 81 and South Bay Road. Access for commercial operations is also displayed.

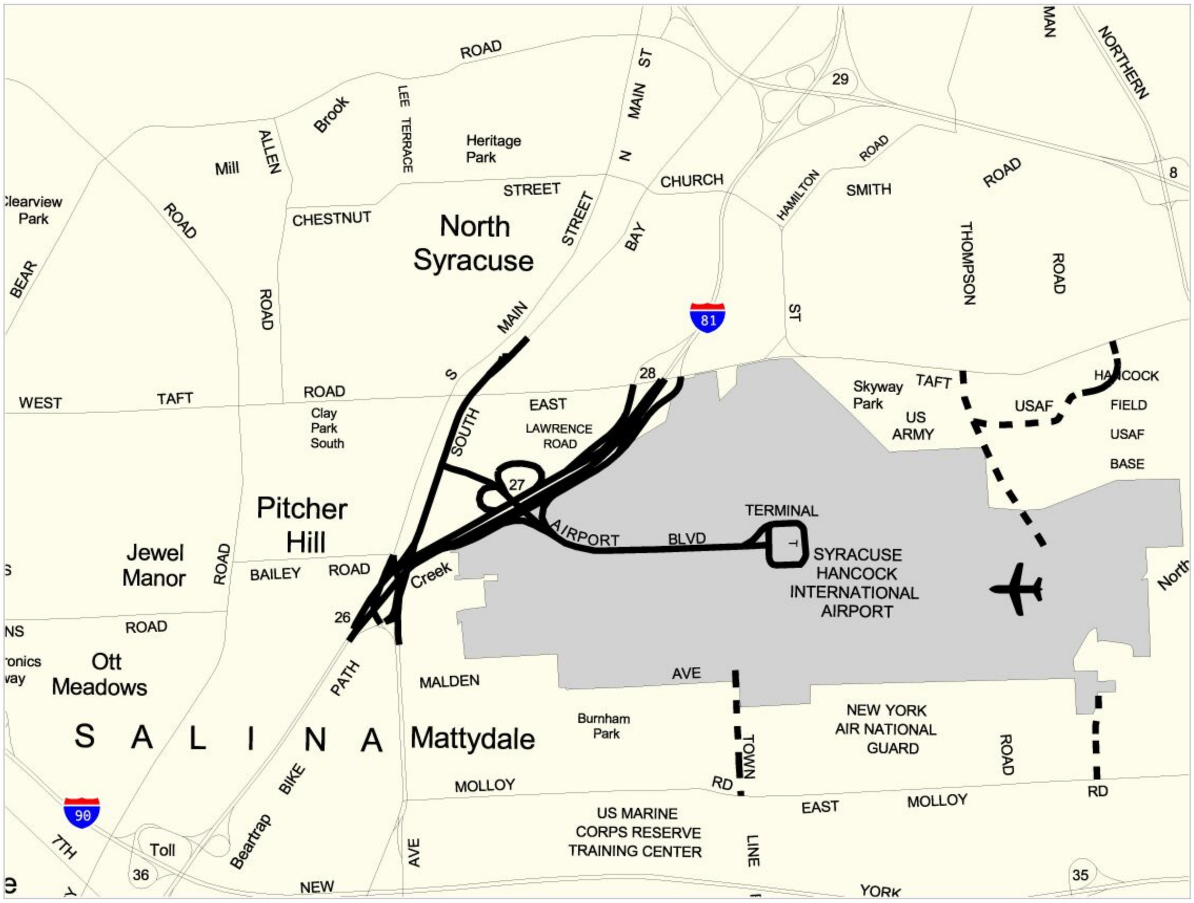

Figure 4.16
Airport Access

ITS Existing Conditions Inventory

N

0 — 1 Miles

Onondaga County

City of Syracuse

Hancock Airport

Roads

Airport Access Road

Commercial Access Road

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ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: Syracuse Metropolitan Transportation Council
December 20. 2001

4.4 EXISTING AND PLANNED ITS INVENTORY

This chapter provides an inventory of existing and planned ITS devices/systems based on information available from various reports as well as information provided by the regional stakeholders.

4.4.1 City of Syracuse

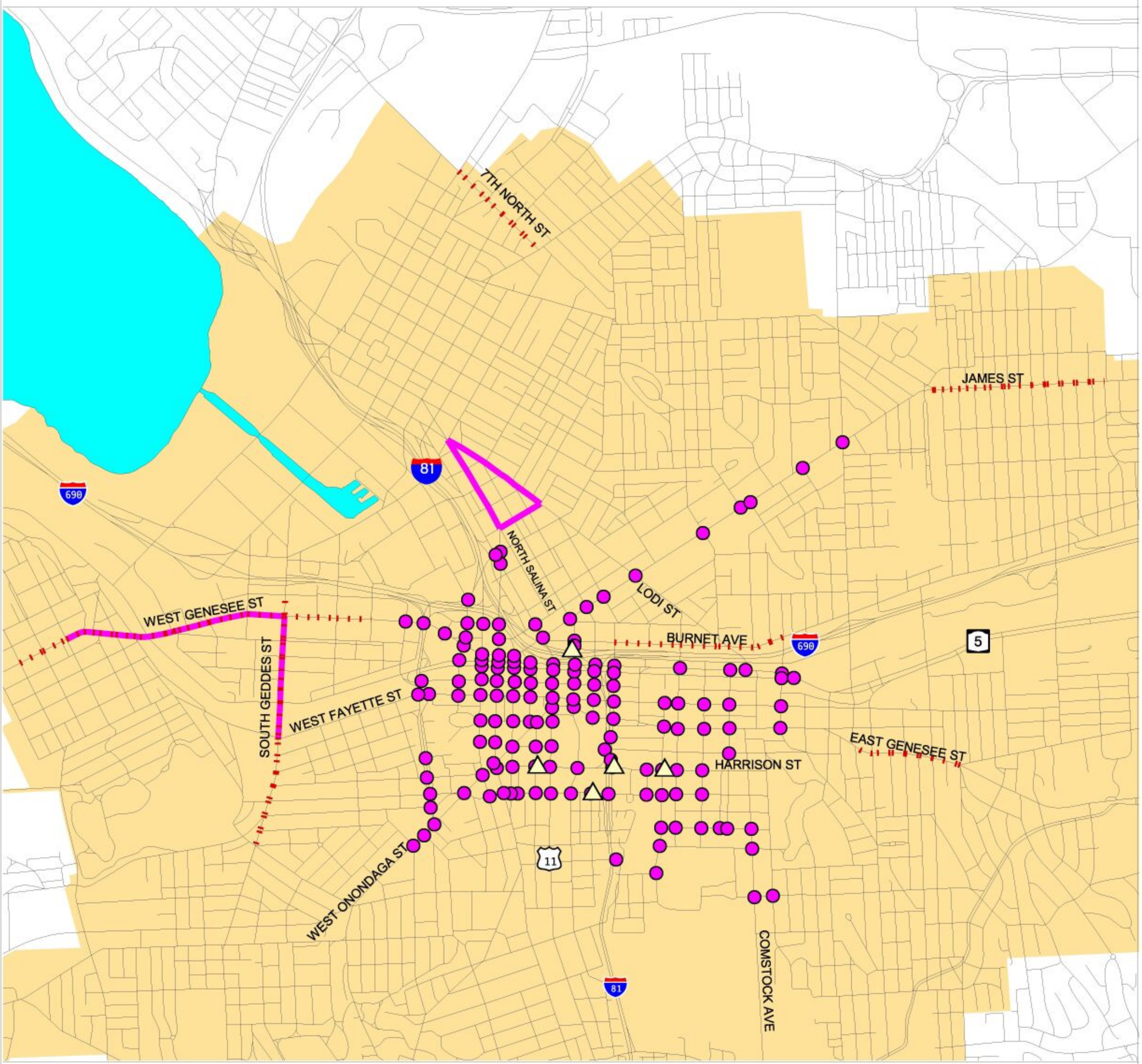
4.4.1.1. Existing ITS Elements

The City of Syracuse has implemented the following ITS projects (see Figure 4.17):

- **Closed Loop Traffic Signal Systems**
  1. East Genesee Street from Columbus Avenue to Salt Springs Road
  2. James Street from Shotwell Avenue to the City line
  3. Seventh North Street from Court Street to Crouse Hinds parking lot (just past Hiawatha Boulevard
  4. Burnet Avenue from Catherine Street to Beech Street
  5. West Genesee Street from Leavenworth to Avery Avenue
  6. Geddes Street from Belden to Delaware Street

- **Computer Controlled Traffic Signal Interconnect System:** 143 intersections within the City of Syracuse are currently under computer control. These signals are operated by the City of Syracuse and connected to the Traffic Control Center (TCC) at the Department of Public Works using multi-mode fiber optic cable. Figure 4.17 displays the locations of intersections that are part of the traffic signal interconnect system.

- **CCTV (Closed Circuit Television):** The City currently has CCTV cameras installed at the five intersections listed below. The CCTVs allow the City to visually monitor traffic conditions at these locations from the TCC.



N

Figure 4.17
City of Syracuse
Existing and Proposed
ITS Elements

Existing Conditions Inventory

0 0.5 Miles

City of Syracuse
Roads
Signal Interconnect System
Closed Loop Signals
CCTV Locations
Interconnect System Expansion
Lakes

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ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: Syracuse Metropolitan
December 20. 2001

1. I-690 westbound off ramp / Townsend Street
2. Harrison Street / Irving Avenue
3. Harrison Street / Almond Street
4. Harrison Street / Montgomery Street
5. Adam Street / McBride Street

4.4.1.2 Proposed ITS Elements

The City of Syracuse has scheduled the following ITS improvements:

- **Computer Controlled Traffic Signal Interconnect Project:** Expansion of the traffic signal interconnect system to include the Geddes Street - West Genesee Street loop which includes 23 intersections is scheduled to begin design in 2004/2005. In addition, the design for the inclusion of 15 additional intersections in the vicinity of N. Salina Street and Lodi Street is scheduled for 2004/2005. The locations of the traffic signal interconnect system expansion are shown in Figure 4.17. The City plans to have all of the traffic signals in the City included in the interconnect system within the next ten years.

4.4.2 Onondaga County

4.4.2.1 Onondaga County Department of Transportation Proposed ITS Elements

The Onondaga County Department of Transportation currently does not own or operate any ITS devices. However, the County does have plans to implement the following ITS system in 2002 (see Figure 4.18):

- A closed loop traffic signal system on Route 57 between the Interstate 90 (Thruway) interchange and Gaskin Road (south of Route 31).

4.4.2.2 Onondaga County Dept. of Emergency Communications Proposed ITS Elements

The Onondaga County Department of Emergency Communications (911 Center) recently contracted to upgrade their equipment in order to accept Phase 1 and 2 wireless communications service (enhanced wireless 911 system). The equipment upgrade is scheduled for completion in the spring of 2002. Phase 1 wireless service would present 911 workers with digital and graphic information regarding the distressed callers wireless phone numbers, what tower the signal is coming from and from which direction the signal hit the tower. Phase 2 wireless service would provide the longitude and latitude of the calling party and display the information graphically. Currently, there is no anticipated time frame in which phase 2 wireless service will be available.

In addition, the 911 Center has recently agreed to participate in trials for Automatic Crash Notification (ACN) which uses wireless communication to send emergency information directly to emergency centers.

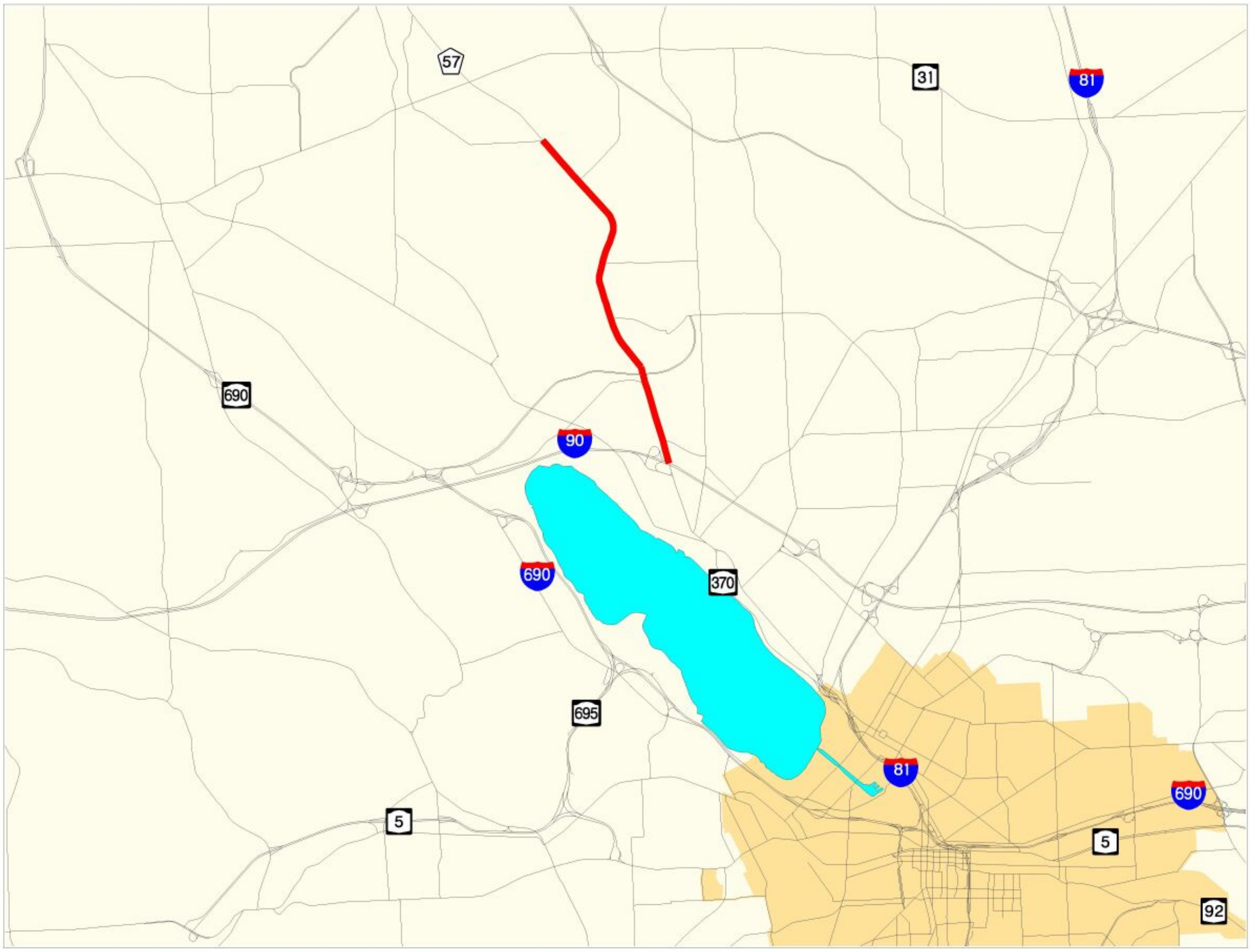


Figure 4.18
Onondaga County
Proposed ITS

Existing Conditions Inventory

N

0 2 Miles

Onondaga County
City of Syracuse
Roads
Closed Loop Signal System
Lakes

CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

Source: Syracuse Metropolitan Transportation Council
December 20, 2001

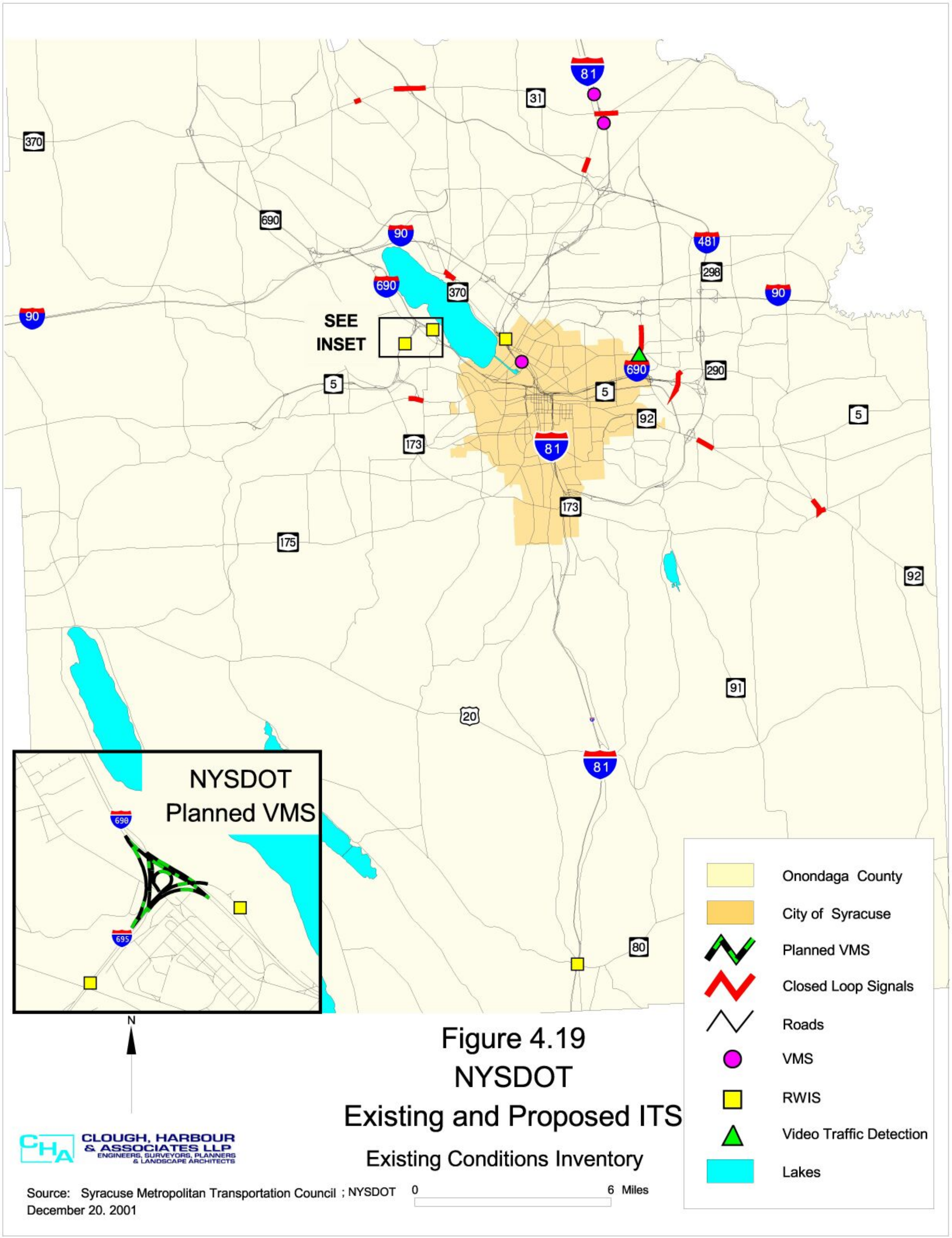
4.4.3 New York State Department of Transportation (NYSDOT)

4.4.3.1 Existing ITS Elements

The NYSDOT currently owns and operates the ITS devices listed below (see Figure 4.19):

- **Permanent Variable Message Signs (VMS)**
  1. I-81 NB north and south of Route 31
  2. I-81 SB north of Court Street
- **Portable Variable Message Signs (VMS)**
  - The Onondaga East and West Maintenance Residencies have a total of ten portable Variable Message Signs (VMS).
- **Video Traffic Detection**
  1. Intersection of Routes 635 & 290 (Thompson Road/James Street)
- **Closed Loop Signal Systems**
  1. Routes 5/92 – Lyndon Corners – Three signals
  2. Route 11 – North Syracuse – Four signals
  3. Route 31/Route 57 – Moyers Corners – Two Signals
  4. Route 31 – Great Northern Mall – Eight Signals
  5. Bridge Street – East Syracuse – Six Signals
  6. Thompson Road – Dewitt – Eight Signals
  7. Fairmount – Four Signals
  8. Liverpool – Six Signals*
  9. Manlius – Six Signals*
  10. Route 5 at Fay Road – 1 Signal
  11. Route 31 – Cicero – Six Signals*

*Spread Spectrum Radio Installations


SEE
INSET
NYSDOT
Planned VMS
N
Onondaga County
City of Syracuse
Planned VMS
Closed Loop Signals
Roads
VMS
RWIS
Video Traffic Detection
Lakes
Figure 4.19
NYSDOT
Existing and Proposed ITS
Existing Conditions Inventory
CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS
Source: Syracuse Metropolitan Transportation Council ; NYSDOT
December 20. 2001
0
6 Miles

- **Road Weather Information System (RWIS)**
  1. I-690 WB Ramp to Auburn
  2. Route 695 over railroad near State Fairgrounds
  3. Interstate 81 over Park Street
  4. Interstate 81 over Route 80 – Tully

- **Induction Loop Sites:** The NYSDOT has a number of induction loop sites that are used to obtain traffic volume counts on a three year cycle for their Traffic Volume Report (TVR). The sites are listed in Table 14. The induction loops are primarily installed at high volume locations and eliminate the need to manually place tubes across the roadway to obtain traffic volumes.

  Five of the sites (noted in Table 14) are continuous count (CC) locations that provide traffic volume counts 24 hours a day 365 days a year. In addition to these five locations, the Rt. 370 site has been equipped to be, and is used as, a seasonal CC location. A seasonal restriction to travel speed has been imposed for safety reasons and therefore the NYSDOT monitors traffic speed at this location during the winter months.

Table 14 - NYSDOT Induction Loop Sites in Onondaga County

ROUTE	DESCRIPTION
5	Bennets Corners – Rt 174
5	Rt 174 Camillus – Jct Newport Road
5	Jct Newport Rd – Jct Knowell Rd
5	Jct Knowell Rd – Jct Hinsdale Rd
5	Jct Hinsdale Rd – Acc Rt 173
5	Acc Rt 173 – Acc Rt 695
5	West St Arterial – Rt 11
5	Rt 11 – Rt 635 Syracuse E City Line
5	Rt 635 Syracuse E City Line – Rt 930P Bridge St (CC)
5	Rt 930P – St Rt 92 OLAP Dewitt
5	St Rt 92 OLAP Dewitt – Acc 481I
5	Acc 481I – End Rt 92 OLAP
11	Lemoyne Av – Jct 81I
31	Start 690 OLAP – End 690 OLAP (CC)
41	Rt 174 Borodino – Rt 20 Skaneateles (End of Rt) (CC)
81I	Cortland Co Ln – Jct Rt 80 (CC)
81I	Acc 481I – Jct Brighton Av
81I	Jct Brighton Av – Jct Colvin Av
81I	Jct Colvin Av – Jct E Adams St
81I	Acc 690I – Jct Rt 298 Bear St
81I	Jct Rt 298 Bear St – Rt 370
81I	Rt 370 – Syracuse N City Line (CC)
81I	Syracuse N City Line – Jct 7th North St
81I	Jct Rt 90I – Jct Rt 11
81I	Jct Rt 11 – Jct Airport Rd
81I	Jct Airport Rd – Jct Taft Rd
81I	Jct Taft Rd – Jct Rt 481I
81I	Jct 481I – Jct Rt 31

81I	Jct Rt 31 – Jct Bartell Rd
81I	Jct Bartell Rd – Oswego County Line
298	Midler Av Ext – Rt 635 Acc 90I
370	Rt 931G Old Rt 57 – Syracuse N City Line (seasonal CC)
481	Rt 81I Onon Co – Rt 11 Conn
481I	Acc Rts 5 & 92 - Acc Rt 690I
481I	Acc Kirkville Rd – Acc Rt 90I
635	Rt 5 Erie Blvd – Acc 690I
690I	Int 39 90I Rt 690 – Rt 90I Under
690I	Rt 90I Under – Jct State Fair Blvd
690I	Jct State Fair Blvd – Jct Rt 695
690I	Syracuse W Cty Ln – Acc Hiawatha Blvd
690I	Acc Hiawatha Blvd – Acc Rt 298
690I	Acc Rt 298 – Acc Geddes St Half Int
690I	Acc Geddes St Half Int – Acc West St
690I	Acc West St – Acc 81I SB
690I	Acc 81I SB – Acc McBride St EB
690I	Acc McBride St – Acc 81I EB
690I	Acc 81I EB – Acc Teall Av
690I	Acc Teall Av – Acc Midler Av
690I	Acc Midler Av – Acc Rt 635
690I	Acc Rt 635 – Acc Rt 290 Bridge St
690I	Acc Rt 290 – Acc 481I End 690I
695	Rt 5 – Acc Rt 690I End 695
930B	Acc Rt – Acc 690I Ramps
930C	Adams St
930P	Rt 5 – End 930P at Rt 290

Source: New York State Department of Transportation

- **Long-Term Pavement Performance (LTPP) Study Site:** The Federal Highway Administration (FHWA) has a LTPP site on I-481 between the interchanges at Route 298 and Northern Boulevard. This test site is under the Strategic Highway Research Program (SHRP). Some of the features of the research site include the following:

- Weigh-in-motion scales
- Temperature sensors for pavement research
- Induction loops to measure speeds and volume
- Piezo strips for axle detection to classify vehicles

The station currently functions as a TVR station to be counted on a three-year cycle. The bending plates that allow the weigh in motion scales to function will be removed. The new piezo strips have the ability to weigh vehicles in motion, and can identify vehicle classification.

4.4.3.2 Proposed ITS Elements

The NYSDOT plans on implementing the ITS devices listed below (see Figure 4.19):

- Five or six fixed VMS are proposed to be added within the Interstate 690 and Route 695 interchange near the New York State Fairgrounds to address icy pavement conditions during the winter months, and assist the State Police in managing traffic during the State Fair. Sensors will be installed in targeted locations, and may tie into the existing RWIS located nearby.

In addition to the VMS, there is a proposed statewide contract for a statewide RWIS that would tie the existing RWIS together. This project may result in an additional five RWIS in NYSDOT Region 3 within the next five years. The NYSDOT also anticipates that five new closed loop traffic signal systems will be added per year within Region 3.

Region 3 is also working with the Onondaga County Department of Emergency Communications (911 center) to implement the enhanced wireless 911 system.

4.4.4 Central New York Regional Transportation Authority (CNYRTA)

4.4.4.1 Existing ITS Elements

The CNYRTA currently has Automated Fare Collection (AFC) boxes on their buses.

4.4.4.2 Proposed ITS Elements

The CNYRTA is in the process of implementing a Mobile Data Acquisition System. The purpose of implementing the system is to improve transit service control and to improve service reliability. The CNYRTA expects the system to become an integral part of its evolving management information system.

Currently, the CNYRTA operates three dispatch centers including the Syracuse facility and two remote locations in Cayuga and Oswego Counties. A primary goal of the system is to have the ability to dispatch to all three counties out of the Syracuse facility.

The intended system will provide CNYRTA management with on-line real time management control of the fleet and a management reporting/information system. One component of the system is an Automatic Vehicle Location (AVL) system that will provide the CNYRTA with better knowledge of where their buses are at any given time. In addition to allowing for better fleet management and greater customer satisfaction, it will also provide data on the location of recurring problem areas.

Eventually, 30 buses will be equipped with Automatic Passenger Counters (APC) to allow for the collection of ridership information.

The CNYRTA is aware of two additional issues that may be improved by the implementation of ITS devices and are currently considering options. Bus and bus stop security could be enhanced by the use of cameras and information kiosks located at transit hubs could provide real time information regarding route changes and bus availability.

4.4.5 Existing Traffic Management Centers

Figure 4.20 identifies the locations of the main public safety facilities (including answering points and dispatch centers) and the City of Syracuse Traffic Control Center. The numbering system below coincides with the numbering system shown on Figure 4.20.

1) New York State Police Headquarters
2) City of Syracuse Traffic Control Center, Department of Public Works
3) Onondaga County Sheriff’s Headquarters Building
4) City of Syracuse Police Department Headquarters
5) Onondaga County Department of Emergency Communications (911 Center)

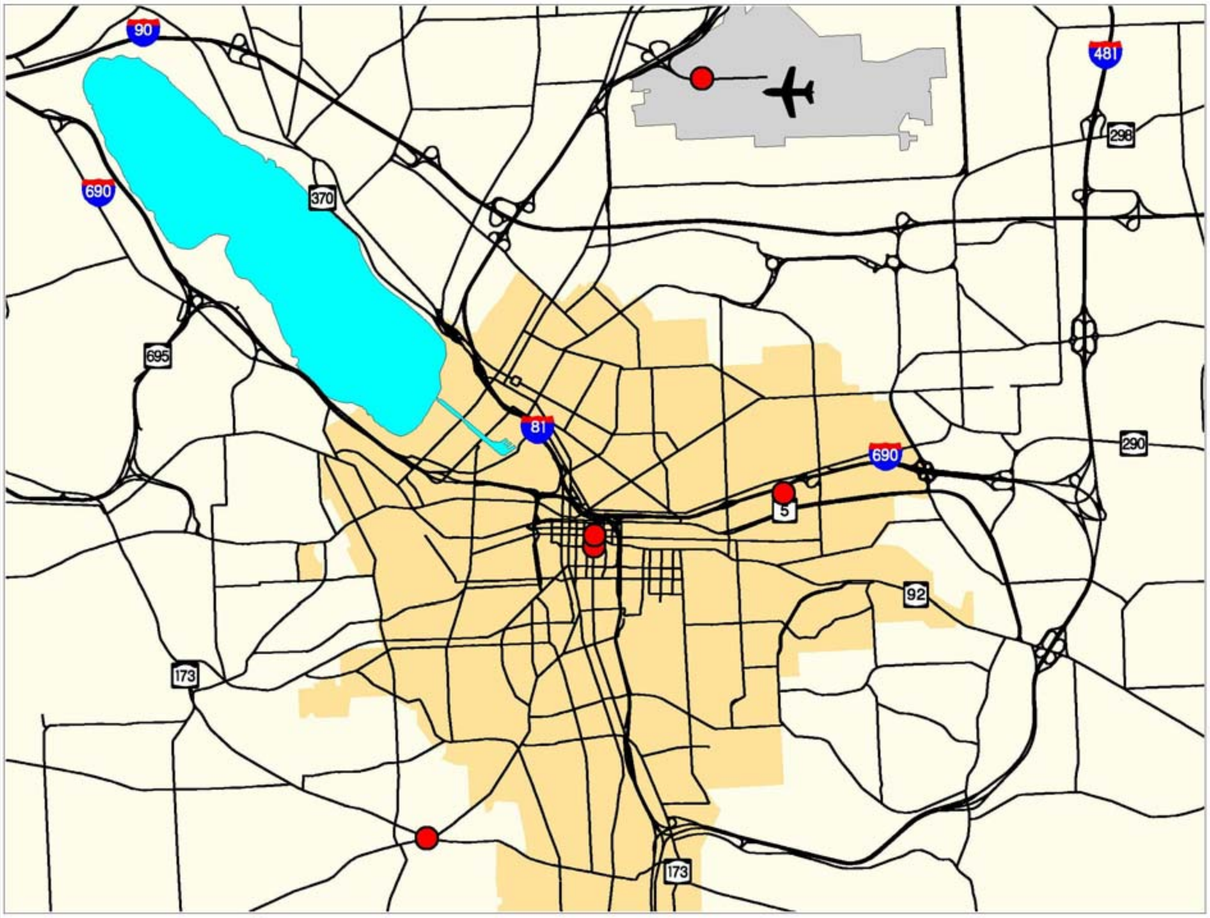


Figure 4.20
Locations of Traffic Managment Centers

Existing Conditions Inventory

- Onondaga County
- City of Syracuse
- Hancock Airport
- Roads
- Lakes
- Emergency Buildings

N

0 — 1 Miles

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Source: Syracuse Metropolitan Transportation Council
December 20, 2001

4.4.6 Existing Communication System

This inventory focuses on the existing communication infrastructure, and services, used by the agencies in the Syracuse Metropolitan Area. It is based solely on the information provided by each agency.

To create the inventory, a communications inventory questionnaire was developed and distributed to all agencies. The results are summarized, by agency, below:

Onondaga County Department of Transportation

This department does not own any communications infrastructure and does not yet have an ITS communication network in operation. The closed-loop signal system on Old Route 57 from just South of New York State Route 31 to the New York State Thruway interchange is the only ITS project under construction in the department. The closed-loop system will use the local communications system to interconnect intersections. .

New York State Police Department

The Police Department has a T1 Frame Relay leased data network for data sharing between its buildings. The Frame Relay service is working at a sub rate of 384 KB/S.

New York State Thruway Authority

The Authority, in exchange for use of its right of way, has received a duct system with inner-duct conduit and a fiber optic network across its entire length. The fiber optic network, equipped with a SONET OC-3 system, is for the sole use of the Authority.

The Authority has a plan to upgrade this network for more capacity. As part of an agreement with the private sector, the use of this network is limited to the Authority application. It is anticipated that all field ITS elements will use this network to connect to the Thruway Traffic Operation Center.

In addition, there are T1 leased services, which are used for video transmission. ISDN and low speed dial-up connections are also used by the Authority for exchanging data with the buildings that are not connected to the fiber optic network.

The Authority does not utilize CDPD or other wireless data systems for accessing ITS elements.

New York State Department of Transportation

NYSDOT does not own any communications infrastructure in the region. There are a large number of fiber optic and cable duct systems in the area, which the department does not have agreements or rights to use.

The State has an ISB WAN expansion project that will connect more than 85 locations statewide. As part of this project, eight State office buildings in the Syracuse area will be connected to that network. Communication links in this network are leased Frame Relay service. A Video Tele-Conferencing Project is another data network under development that includes 11 locations statewide. This network uses ISDN leased services from Verizon.

NYSDOT has closed-loop traffic signal control systems and Variable Message Signs in the region. The closed-loop systems use dial-up links for connection between slave and master controllers. Also, dial-up links are used for connection between VMSs and the NYSDOT computer.

City of Syracuse Department of Public Works

The Syracuse Downtown Interconnect Project includes a centralized signal system, a CCTV surveillance system and a fiber optic communication network.

The duct system for this communication network is combination of NMPC Conduit, the city duct, the state-owned conduit, streetscape conduit and some overhead cable. .Figure 4.21 shows the existing City fiber optic cable plan.

The Syracuse Downtown Interconnect fiber optic communications network uses multi mode fiber optic cable for intersection interconnection data channels.
Each intersection is equipped with a “drop and insert” fiber optic modem assigned to a specific channel. The several channels have a common multiplexing point. A multiplexing point is a location where data channels are connected to a T1 multiplexer and transmitted to the city Traffic Operations Center. There are three multiplexing points in the network. The communications link between multiplexing points and TOC are fiber optic single mode cables.

The video surveillance system is an analog based system. The video and PTZ signals are transmitted to the Operations Center, point-to-point, over one fiber optic strand.

The single mode cables have 24 fiber optic strands. The current load on the communications network utilizes about half of the available capacity, and the remaining capacity can be used for future expansion.

The city has multiple analog radio systems in the Public Works Department. These systems operate at 453.15, 458.15, 453.225 and 458.225 MHz frequencies. The city has licenses for these frequencies.

Central New York Regional Transportation Authority (CNYRTA)

CNYRTA is currently in the process of deploying a Mobile Data Acquisition System (MDAS). The MDAS is a wireless data communications network that has the capability of Automatic Vehicle Identification (AVI) and two-way data and voice transmission. The MDAS system works on 450 MHz frequency, for which the Authority has a license. The network coverage is provided via three base stations. Two of the base stations located at Rose Hill and Pompey are connected to the CNYRTA operation center via Microwave links. The third site at Oswego provides auxiliary coverage for the area and it is connected to the Operation Center via T1 leased service.

Presently more than 200 of the Authority's buses are equipped with Mobile Data Units (MDU). This communications infrastructure has potential for the following expansion and other uses.

a) Provision of services to other agencies.
b) Integration of other ITS elements with this network as a communication media.
c) Utilization of the radio tower structures for installation of other radio systems.

Onondaga County 911, Emergency Communications Center

This Center is responsible for dispatching emergency services in the County. It operates and maintains the County-wide radio system, utilizing a number of VHF LoBand (12 channels in range of 39.46 to 47.58 MHz), VHF HiBand (14 channels in range of 153.370 to 159.060), UHF Band (18 channels from 453.100 to 466.775) and 800 MHz (28 channels) simplex and duplex radio channels. The Center also operates 15 microwave links in the County.

The County recently produced a Radio Communications Analysis and Development Master Plan. As part of that study, a 9 site and 15 channels in 800 MHz trunked digital simulcast (APCO 25 compliant) were recommended.

Metro Net Network Project

This project is designed based on the Verizon and Telergy network. The goal of this project was to create a communications network among; City of Syracuse, Syracuse University, Onondaga County, County Library, Curse/ Community Hospital, SUNY HSC, Workforce Development, BOCES, Oswego Schools, Syracuse Schools and Saint Joseph’s Hospital. Telergy Company has recently filed for Bankruptcy protection. Therefore, the future of the Syracuse Metro Net project is not clear. Verizon communications may take over the entire project; however, this is not confirmed.

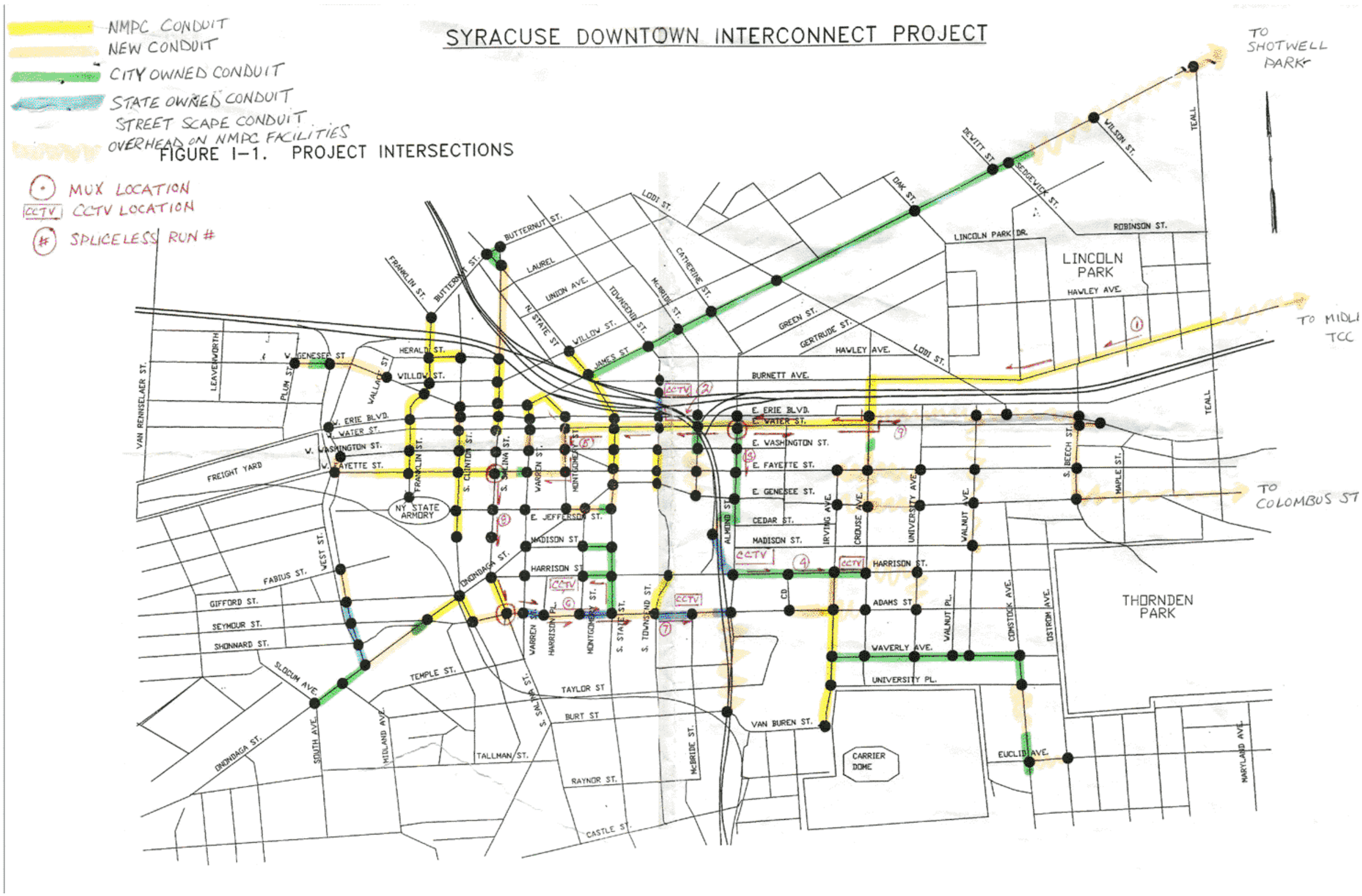

Figure 4.21: City of Syracuse Fiber Optic Cable Plan

5. Market Packages

Market Packages are comprised of specific ITS services. A market package is defined as a collection of equipment capabilities that satisfy a market need (or an objective) and are likely to be deployed as a group. Market Packages are physical entities that, later in the process, will become a framework for projects that are actually implemented.

Market Packages are tailored to fit real-world transportation problems and needs. They are technology-independent, can accommodate current and future technologies, and are flexible enough to allow an implementer to develop a system by using existing resources and enhancing it with maturing ITS capabilities.

This section provides a brief introduction to the National ITS Architecture Market Packages, followed by a description of the prioritization process used to distinguish the various Market Packages, along with a list of prioritized Market Packages by stakeholder agencies.

5.1 NATIONAL ITS ARCHITECTURE MARKET PACKAGES

To illuminate the deployment options that must be considered by the ITS implementer, the developers of the National ITS Architecture have defined a set of Market Packages. To promote ease of implementation, the Market Packages were defined to support specific benefits analysis, and with clear ties to transportation problems. There are currently sixty-three Market Packages identified in the National ITS Architecture Implementation Strategy (www.iteris.com/itsarch as of 3/13/01). They are broadly classified under the following transportation application scenarios:

- Archived Data (AD)
- Advanced Public Transportation Systems (APTS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Traffic Management Systems (ATMS)
- Advanced Vehicle Safety Systems (AVSS)
- Commercial Vehicle Operations (CVO)
- Emergency Management (EM)

Several different Market Packages are defined in each of these application areas. The complete set of Market Packages is identified in Table 15. Each market package is given an abbreviation indicating the general class of stakeholder and an index (e.g., **atms01** - Network Surveillance is a market package that primarily relates to Advanced Traffic Management Systems and is of interest to transportation managers).

Table 25: National ITS Architecture Market Packages Summary

List of Market Packages	
Archived Data	
ad1	ITS Data Mart
ad2	ITS Data Warehouse
ad3	ITS Virtual Data Warehouse
Advanced Public Transportation Systems (APTS)	
apts1	Transit Vehicle Tracking
apts2	Transit Fixed-Route Operations
apts3	Demand Response Transit Operations
apts4	Transit Passenger and Fare Management
apts5	Transit Security
apts6	Transit Maintenance
apts7	Multi-modal Coordination
apts8	Transit Traveler Information
Advanced Traveler Information Systems (ATIS)	
atis1	Broadcast Traveler Information
atis2	Interactive Traveler Information
atis3	Autonomous Route Guidance
atis4	Dynamic Route Guidance
atis5	ISP Based Route Guidance
atis6	Integrated Transportation Management/Route Guidance
atis7	Yellow Pages and Reservation
atis8	Dynamic Ridesharing
atis9	In Vehicle Signing
Advanced Traffic Management Systems (ATMS)	
atms01	Network Surveillance
atms02	Probe Surveillance
atms03	Surface Street Control
atms04	Freeway Control
atms05	HOV Lane Management
atms06	Traffic Information Dissemination
atms07	Regional Traffic Control
atms08	Incident Management System
atms09	Traffic Forecast and Demand Management
atms10	Electronic Toll Collection
atms11	Emissions Monitoring and Management
atms12	Virtual TMC and Smart Probe Data
atms13	Standard Railroad Grade Crossing
atms14	Advanced Railroad Grade Crossing
atms15	Railroad Operations Coordination
atms16	Parking Facility Management
atms17	Reversible Lane Management
atms18	Road Weather Information System
atms19	Regional Parking Management
Advanced Vehicle Safety Systems (AVSS)	
avss01	Vehicle Safety Monitoring
avss02	Driver Safety Monitoring

avss03	Longitudinal Safety Warning
avss04	Lateral Safety Warning
avss05	Intersection Safety Warning
avss06	Pre-Crash Restraint Deployment
avss07	Driver Visibility Improvement
avss08	Advanced Vehicle Longitudinal Control
avss09	Advanced Vehicle Lateral Control
avss10	Intersection Collision Avoidance
avss11	Automated Highway System
Commercial Vehicle Operations (CVO)	
cvo01	Fleet Administration
cvo02	Freight Administration
cvo03	Electronic Clearance
cvo04	CV Administrative Processes
cvo05	International Border Electronic Clearance
cvo06	Weigh-In-Motion
cvo07	Roadside CVO Safety
cvo08	On-board CVO Safety
cvo09	CVO Fleet Maintenance
cvo10	HAZMAT Management
Emergency Management (EM)	
em1	Emergency Response
em2	Emergency Routing
em3	Mayday Support

Source: The National ITS Architecture Implementation Strategy, Appendix A

(The shaded text indicates the Market Packages that are identified as not applicable/beneficial to the development of regional architecture and these market packages will be excluded from consideration. CVO issues were perceived more as a statewide issue than as a regional issue, especially for the Syracuse Metropolitan area due to low volume of freight movement across the study area. AVSS applications, on the other hand are primarily aimed at the automobile manufactures that build vehicle control systems with limited or absolutely no control from a regional standpoint. These packages will be discussed in detail in the following pages though they will not take part in the development of regional Architecture. For more information about these market packages please refer to www.iteris.com/itsarch)

The developers of the National ITS Architecture stress that the Market Packages are illustrative rather than prescriptive. The actual implementation variations that are possible across the country are myriad and cannot be enumerated through a finite set of packages. The Market Packages are tools that allow discussion of an incremental deployment of ITS services in a manner consistent with the underlying architecture definition. Detailed descriptions of each of these national architecture Market Packages can be found in Appendix A of the National ITS Architecture Implementation Strategy (Federal Highway Administration, 1998).

5.2 Syracuse Metropolitan Area ITS Strategic Plan Market Package Definitions

While the Market Packages identified in the national ITS architecture provides a general framework for developing ITS solutions to transportation problems, their application in a regional architecture is influenced by the nature of local transportation needs and supporting infrastructure. Therefore, in adopting the packages in response to the multi-jurisdictional transportation needs of the Syracuse Metropolitan Area, some revisions to the definition and service options of some of the national architecture packages were deemed necessary. The National ITS Architecture is periodically updated with new Market Packages and architecture flows. This often mandates that agencies revise their regional architectures to keep abreast with the change in the contents and other core changes mandated by the USDOT. The Architecture helps ensure that regional ITS deployments are in harmony with national standards.

The pedestrian issues in the Syracuse Metropolitan area were initially suggested for placement in a new, user-defined market package exclusively to address this issue. After discussions with the National ITS Architecture experts, it was understood that there is no need to develop an exclusive market package since there exists an architecture flow in the Physical Architecture to address the pedestrian needs. The pedestrians are also included as a “terminator”, a component of the physical architecture in the National ITS Architecture. All of the 63 Market Packages from the National ITS Architecture were initially considered for the development of the Syracuse Metropolitan Area ITS Strategic Plan.

Certain Market Packages were found to have no relevance to the regional needs, and hence were dropped from the finalized list of Market Packages. Except for the following, the core Market Packages specified by the National ITS Architecture were used to develop this strategic plan. The revisions are classified as follows:

- **Not Used** – The Advanced Vehicle Safety Systems (AVSS) Market Packages are not being considered within this ITS Strategic Plan context because they are not applicable to the study area’s transportation network goals and they do not fall within the realm of the public agencies. These Market Packages are shown shaded in the above listed table (Table 5.1).

- **Fundamental** - the market package is recognized as a fundamental building block for implementation of ITS in the study area. The services offered by the package are prerequisites to successful and effective operations of many other packages. All affected agencies shall strive to make funding available for implementation of this package.

  Three Market Packages were identified to belong to this category: the Network Surveillance (atms01) and the Probe Surveillance (atms02) for traffic management; and the Transit Vehicle Tracking (apts01) for transit management.
- **Modified** - the market package cvo01, Fleet Administration, is modified to address the tracking of maintenance and supervisory vehicles of stakeholder agencies. This market package is actually devised to track the movement of commercial vehicle fleet. But due to the inadequacies of the current version of the National ITS Architecture in addressing this issue, some user-defined flows are created exclusively for this market package to define tracking of vehicles (snow plows) during emergencies, especially relating to weather. A new market package called Maintenance and Construction Operations (MCO) is already recommended for inclusion into the National ITS Architecture and will find a place in the future updates/revisions of this architecture.

As stated in the National ITS architecture document, the deployment oriented Market Packages can be traced to the interface-oriented architecture definition. Once a particular market package is selected for implementation, the required subsystems, equipment packages, and interface requirements are readily identified due to this traceability. This approach allows the implementer (and this Implementation Strategy) to first consider service needs and later concentrate on those pieces of the architecture necessary to provide the selected service.

The following list presents the ITS Strategic Plan deployment Market Packages as they have been defined to reflect the characteristics of the Syracuse Metropolitan Area.

5.2.1 Archived Data

1. ***ITS Data Mart (ad1)***

This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides the basic data quality, data privacy, and meta-data management common to all ITS archives and provides general query and report access to archive data users.

2. ***ITS Data Warehouse (ad2)***

This market package includes all of the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional metadata management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this market package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

3. ***ITS Virtual Data Warehouse (ad3)***

This market package provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse Market Package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

5.2.2 Advanced Public Transportation Systems

4. ***Transit Vehicle Tracking (apts1)***

This market package provides for an Automated Vehicle Location System to track the transit vehicle's real time schedule adherence and updates the transit system's schedule in real-time. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider Subsystem via a wire line link.

5. ***Transit Fixed-Route Operations (apts2)***

This market package performs automatic driver assignment and monitoring, as well as vehicle routing and scheduling for fixed-route services. This service uses the existing AVL database as a source for current schedule performance data, and is implemented through data processing and information display at the transit management subsystem. This data is exchanged using the existing wire line link to the information service provider where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules.

6. ***Demand Response Transit Operations (apts3)***

This market package performs automatic driver assignment and monitoring as well as vehicle routing and scheduling for demand response transit services. This package uses the existing AVL database to monitor current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. The Transit Management Subsystem provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. The Information Service Provider Subsystem may be either be operated by transit management center or be independently owned and operated by a separate service provider. In the first scenario, the traveler makes a direct request to a specific para-transit service. In the second scenario, a third party service provider determines the para-transit service is a viable means of satisfying a traveler request and uses wire line communications to make a reservation for the traveler.

7. ***Transit Passenger and Fare Management (apts4)***

This market package allows for the management of passenger loading and fare payments on-board vehicles using electronic means. The payment instrument may be either a stored value or credit card. This package is implemented with sensors mounted on the vehicle to permit the driver and central operations to determine vehicle loads, and readers located either in the infrastructure or on-board the transit vehicle to allow fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem using existing wireless infrastructure.

8. *Transit Security (apts5)*

This market package provides for the physical security of transit passengers. An on-board security system is deployed to perform surveillance and warn of potentially hazardous situations. Public areas (e.g. stops, park and ride lots, stations) are also monitored. Information is communicated to the Transit Management Subsystem using the existing or emerging wireless (vehicle to center) or wire line (area to center) infrastructure. Security related information is also transmitted to the Emergency Management Subsystem when an emergency is identified that requires an external response. Incident information is communicated to the Information Service Provider.

9. *Transit Maintenance (apts6)*

This market package supports automatic maintenance scheduling and monitoring. On-board condition sensors monitor critical system status and transmit critical status information to the Transit Management Subsystem. Hardware and software in the Transit Management Subsystem processes this data and schedules maintenance activities.

10. *Multi-modal Coordination (apts7)*

This market package establishes two-way communications between multiple transit and traffic agencies to improve service coordination. Intermodal coordination between transit agencies can increase traveler convenience at transfer points and also improve operating efficiency. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network. More limited local coordination between the transit vehicle and the individual intersection for signal priority is also supported by this package.

11. *Transit Traveler Information (apts8)*

This market package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.

5.2.3 Advanced Traveler Information Systems

12. ***Broadcast Traveler Information (atis1)***

This market package provides the user with a basic set of ATIS services; its objective is early acceptance. It involves the collection of traffic conditions, advisories, general public transportation, toll and parking information, incident information, air quality and weather information, and the near real time dissemination of this information over a wide area through existing infrastructures and low cost user equipment (e.g., FM subcarrier, cellular data broadcast). Different from the market package ATMS6--Traffic Information Dissemination--which provides the more basic HAR and DMS information capabilities, ATIS1 provides the more sophisticated digital broadcast service. Successful deployment of this market package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.

13. ***Interactive Traveler Information (atis2)***

This market package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, transit services, ride share/ride match, parking management, and pricing information. A range of two-way wide-area wireless and wireline communications systems may be used to support the required digital communications between traveler and the information service provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en-route to include phone, kiosk, Personal Digital Assistant, personal computer, and a variety of in-vehicle devices. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, probe vehicles or other means.

14. ***Autonomous Route Guidance (atis3)***

This market package relies on in-vehicle sensory, location determination, computational, map database, and interactive driver interface equipment to enable route planning and detailed route guidance based on static, stored information. No communication with the infrastructure is assumed or required. Identical capabilities are available to the traveler outside the vehicle by integrating a similar suite of equipment into portable devices.

15. ***Dynamic Route Guidance (atis4)***

This market package offers the user advanced route planning and guidance which is responsive to current conditions. The package combines the autonomous route guidance user equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information which is considered by the user equipment in provision of route guidance.

16. ***ISP Based Route Guidance (atis5)***

This market package offers the user advanced route planning and guidance which is responsive to current conditions. Different than the Dynamic Route Guidance Market Package, this market package moves the route planning function from the user device to the information service provider. This approach simplifies the user equipment requirements and can provide the infrastructure better information on which to predict future traffic and appropriate control strategies to support basic route planning with minimal user equipment. The package includes both turn-by-turn route guidance as might be used in a vehicle, as well as pre-trip routes. The package includes two-way data communications and optionally also equips the vehicle with the databases, location determination capability, and display technology to support turn-by-turn route guidance.

17. ***Integrated Transportation Management/Route Guidance (atis6)***

This market package allows a traffic management center to continuously optimize the traffic control strategy based on near-real time information on intended routes for a proportion of the vehicles within their network while offering the user advanced route planning and guidance which is responsive to current conditions. It would utilize the individual and ISP route planning information to optimize signal timing while at the same time providing updated signal timing information to allow optimized route plans. The use of predictive link times for this market package is possible through utilizing the market package ATMS9--Traffic forecast and Demand Management--at the traffic management center.

18. ***Yellow Pages and Reservation (atis7)***

This market package enhances the Interactive Traveler Information package by making infrastructure provided yellow pages and reservation services available to the user. The same basic user equipment is included. This market package provides multiple ways for accessing information either while en-route in a vehicle using wide-area wireless communications or pre-trip via wireline connections.

19. ***Dynamic Ridesharing (atis8)***

This market package enhances the Interactive Traveler Information package by adding an infrastructure provided dynamic ridesharing/ride matching capability. In terms of equipment requirements, ATIS8 is similar to ATIS7.

20. ***In Vehicle Signing (atis9)***

This market package supports distribution of traffic and travel advisory information to drivers through in-vehicle devices. It includes short-range communications between roadside equipment and the vehicle and wire line connections to the Traffic Management Subsystem for coordination and control. This market package also informs the driver of both highway-highway and highway-rail intersection status.

5.2.4 Advanced Traffic Management Systems

21. ***Network Surveillance (atms01)***

This market package includes traffic detectors, other surveillance equipment, the supporting field equipment, and wire line communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Subsystem). The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.

22. ***Probe Surveillance (atms02)***

This market package provides an alternative approach for surveillance of the roadway network. Two general implementation paths are supported by this market package: 1) wide-area wireless communications between the vehicle and Information Service Provider is used to communicate current vehicle location and status, and 2) dedicated short range communications between the vehicle and roadside is used to provide equivalent information back to the Traffic Management Subsystem. The first approach leverages wide area communications equipment that may already be in the vehicle to support personal safety and advanced traveler information services. The second approach utilizes vehicle equipment that supports toll collection, in-vehicle signing, and other short range communications applications identified within the architecture. The market package enables traffic managers to monitor road conditions, identify incidents, analyze and reduce the collected data, and make it available to users and private information providers. It requires one of the communications options identified above, roadside beacons and wire line communications for the short range communications option, data reduction software, and utilizes wire line links between the Traffic Management Subsystem and Information Service Provider Subsystem to share the collected information. Both "Opt out" and "Opt in" strategies are available to ensure the user has the ability to turn off the probe functions to ensure individual privacy. Due to the large volume of data collected by probes, data reduction techniques are required in this market package which includes the ability to identify and filter out-of-bounds or extreme data reports.

23. *Surface Street Control (atms03)*

This market package provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management. A range of traffic signal control systems are represented by this market package ranging from static pre-timed control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Additionally, general advisory and traffic control information can be provided to the driver while en-route. This market package is generally an intra-jurisdictional package that does not rely on real-time communications between separate control systems to achieve area-wide traffic signal coordination. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would be represented by this package. This market package is consistent with typical urban traffic signal control systems.

24. *Freeway Control (atms04)*

This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways. Coordination and integration of ramp meters are included as part of this market package. This package is consistent with typical urban traffic freeway control systems. This package incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option. This market package also includes the capability to utilize surveillance information for detection of incidents. Typically, the processing would be performed at a traffic management center; however, developments might allow for point detection with roadway equipment. For example, a CCTV might include the capability to detect an incident based upon image changes. Additionally, this market package allows general advisory and traffic control information to be provided to the driver while en-route.

25. ***HOV Lane Management (atms05***

This market package manages HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals. Preferential treatment is given to HOV lanes using special bypasses, reserved lanes, and exclusive rights-of-way that may vary by time of day. Vehicle occupancy detectors may be installed to verify HOV compliance and to notify enforcement agencies of violations.

26. ***Traffic Information Dissemination (atms06)***

This market package allows traffic information to be disseminated to drivers and vehicles using roadway equipment such as dynamic message signs or highway advisory radio. This package provides a tool that can be used to notify drivers of incidents; careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), transit management center, emergency management center, and information service provider.

27. ***Regional Traffic Control (atms07)***

This market package advances the Surface Street Control and Freeway Control Market Packages by adding the communications links and integrated control strategies that enable integrated Inter-jurisdictional traffic control. This market package provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Surface Street Control and Freeway Control Market Packages and adds hardware, software, and wireline communications capabilities to implement traffic management strategies which are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of control between traffic management centers.

28. ***Incident Management System (atms08)***

This market package manages both predicted and unexpected incidents so that the impact to the transportation network and traveler safety is minimized. Requisite incident detection capabilities are included in the freeway control market package and through the regional coordination with other traffic management and emergency management centers, weather service entities, and event promoters supported by this market package. Information from these diverse sources are collected and correlated by this market package to detect and verify incidents and implement an appropriate response. This market package provides Traffic Management Subsystem equipment that supports traffic operations personnel in developing an appropriate response in coordination with emergency management and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications and presentation of information to affected travelers using the Traffic Information Dissemination market package. The same equipment assists the operator by monitoring incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other field service personnel.

29. ***Traffic Forecast and Demand Management (atms09)***

This market package includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the Traffic Management Subsystem itself as well as other traffic management centers and forecasted traffic loads derived from route plans supplied by the Information Service Provider Subsystem. In addition to short-term forecasts, this market package provides longer-range forecasts that can be used in transportation planning. This market package provides data that supports the implementation of TDM programs, and policies managing both traffic and the environment. Information on vehicle pollution levels, parking availability, usage levels, and vehicle occupancy are collected by monitoring sensors to support these functions. Demand management requests can also be made to Toll Administration, Transit Management, and Parking Management Subsystems.

30. ***Electronic Toll Collection (atms10)***

This market package provides toll operators with the ability to collect tolls electronically and detect and process violators. Variations in the fees that are collected enable implementation of demand management strategies. Dedicated short-range communication between the roadway equipment and the vehicle is required as well as wire line interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Vehicle tags of toll violators are read and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable regional and ultimately national interoperability for these services. The population of toll tags and roadside readers that these systems utilize can also be used to collect road use statistics for highway authorities. This data can be collected as a natural by-product of the toll collection process or collected by separate readers that are dedicated to probe data collection.

31. ***Emissions Monitoring and Management (atms11)***

This market package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the emissions management subsystem for processing. Both individual detection and identification of vehicles that exceed emissions standards and general area-wide monitoring of air quality are supported by this market package. For area wide monitoring, this market package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this market package measures tail pipe emissions and identifies vehicles that exceed emissions standards. The gathered information can be used to implement environmentally sensitive TDM programs, policies, and regulations.

32. ***Virtual TMC and Smart Probe Data (atms12)***

This market package provides for special requirements of rural road systems. Instead of a central TMC, the traffic management is distributed over a very wide area (e.g., a whole state or collection of states). Each locality has the capability of accessing available information for assessment of road conditions. The package uses vehicles as smart probes that are capable of measuring road conditions and providing this information to the roadway for relay to the Traffic Management Subsystem and potentially direct relay to following vehicles (i.e., the automated road signing equipment is capable of autonomous operation). In-vehicle signing is used to inform drivers of detected road conditions.

33. ***Standard Railroad Grade Crossing (atms13)***

This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the traffic management subsystem. Similar interfaces and services are provided for other types of multimodal crossings (e.g., draw bridges).

34. *Advanced Railroad Grade Crossing (atms14)*

This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This market package includes all capabilities from the Standard Railroad Grade Crossing Market Package and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems supported by this market package include positive barrier systems which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this market package, additional information about the arriving train is also provided by the wayside interface equipment so that the train's direction of travel, its estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This market package also includes additional detection capabilities which enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

35. *Railroad Operations Coordination (atms15)*

This market package provides an additional level of strategic coordination between rail operations and traffic management centers. Rail operations provide train schedules, maintenance schedules, and any other forecast events which will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations which may be used in advanced traffic control strategies or to enhance the quality of traveler information.

36. ***Parking Facility Management (atms16)***

This market package provides enhanced monitoring and management of parking facilities. The included equipment assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This is performed by sensing and collecting current parking facilities status, sharing the data with information service providers and traffic operations, and automatic fee collection using short-range communications with the same in-vehicle equipment utilized for electronic toll collection.

37. ***Reversible Lane Management (atms17)***

This market package provides for the management of reversible lane facilities. In addition to standard surveillance capabilities, this market package includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. The package includes the field equipment, physical lane access controls, and associated control electronics that manage and control these special lanes. This market package also includes the equipment used to electronically reconfigure intersections and manage right-of-way to address dynamic demand changes and special events.

38. ***Road Weather Information System (atms18)***

This market package monitors current and forecast road and weather conditions using a combination of weather service information and data collected from environmental sensors deployed on and about the roadway. The collected road weather information is monitored and analyzed to detect and forecast environmental hazards such as icy road conditions, dense fog, and approaching severe weather fronts. This information can be used to more effectively deploy road maintenance resources, issue general traveler advisories, and support location specific warnings to drivers using the Traffic Information Dissemination Market Package.

39. ***Regional Parking Management (atms19)***

This market package supports coordination between parking facilities to enable regional parking management strategies.

5.2.5 Advanced Vehicle Safety Systems

40. ***Vehicle Safety Monitoring (avss01)***

This market package will diagnose critical components of the vehicle and warn the driver of potential dangers. On-board sensors will determine the vehicle's condition and performance, determine on-board safety data, and display information.

41. ***Driver Safety Monitoring (avss02)***

This market package will determine the driver's condition, and warn the driver of potential dangers. On-board sensors will determine the driver's condition and performance, determine on-board safety data, and display information.

42. ***Longitudinal Safety Monitoring (avss03)***

This market package allows for longitudinal warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas in front of and behind the vehicle and present warnings to the driver about potential hazards.

43. ***Lateral Safety Monitoring (avss04)***

This market package allows for lateral warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas to the sides of the vehicle and present warnings to the driver about potential hazards.

44. ***Intersection Safety Monitoring (avss05)***

This market package will determine the probability of a collision in an equipped intersection (either highway-highway or highway-rail) and provide timely warnings to drivers in response to hazardous conditions. Monitors in the roadway infrastructure assess vehicle locations and speeds near an intersection. Using this information, a warning is determined and communicated to the approaching vehicle using a short-range communications system. Information can be provided to the driver through the market package ATIS9--In-Vehicle Signing.

45. ***Pre-Crash Restraint Deployment (avss06)***

This market package provides in-vehicle sensors to monitor the vehicle's local environment determine collision probability and deploy a pre-crash safety system. It will include on-board sensors to measure lateral and longitudinal gaps and together with weather and roadway conditions will determine lateral and longitudinal collision probability. It will have the mechanism to deploy a pre-crash safety system.

46. ***Driver Visibility Improvement (avss07)***

This market package will enhance driver visibility using an enhanced vision system. On-board display hardware is needed.

47. ***Advanced Vehicle Longitudinal Control (avss08)***

This market package automates the speed and headway control functions on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the throttle and brakes. It requires on-board sensors to measure longitudinal gaps and a processor for controlling the vehicle speed.

48. ***Advanced Vehicle Lateral Control (avss09)***

This market package automates the steering control on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the steering. It requires on-board sensors to measure lane position and lateral deviations and a processor for controlling the vehicle steering.

49. ***Intersection Collision Avoidance (avss10)***

This market package will determine the probability of an intersection collision and provide timely warnings to approaching vehicles so that avoidance actions can be taken. This market package builds on the Intersection Collision Warning infrastructure and in-vehicle equipment and adds equipment in the vehicle that can take control of the vehicle in emergency situations. The same monitors in the roadway infrastructure are needed to assess vehicle locations and speeds near an intersection. This information is determined and communicated to the approaching vehicle using a short-range communications system. The vehicle uses this information to develop control actions which alter the vehicle's speed and steering control and potentially activate its pre-crash safety system.

50. ***Automated Highway System (avss11)***

This market package enables "hands-off" operation of the vehicle on the automated portion of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control, and Automated Highway System check-in and checkout. This market package currently supports a balance in intelligence allocation between infrastructure and the vehicle pending selection of a single operational concept by the AHS consortium.

5.2.6 Commercial Vehicle Operations

51. ***Fleet Administration (cvo01)***

This market package keeps track of vehicle location, itineraries, and fuel usage at the Fleet and Freight Management Subsystem using a cell based or satellite data link and the pre-existing wireless infrastructure. The vehicle has a processor to interface to its sensor (e.g., fuel gauge) and to the cellular data link. The Fleet and Freight Management Subsystem can provide the vehicle with dispatch instructions, and can process and respond to requests for assistance and general information from the vehicle via the cellular data link. The market package also provides the Fleet Manager with connectivity to intermodal transportation providers using the existing wireline infrastructure.

52. ***Freight Administration (cvo02)***

This market package tracks cargo and the cargo condition. This information is communicated with the Fleet and Freight Management Subsystem via the existing wireless infrastructure. Interconnections are provided to intermodal shippers and intermodal freight depots for tracking the cargo from source to destination.

53. ***Electronic Clearance (cvo03)***

This market package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration subsystem over wireline to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This package allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and dedicated short-range communications to the roadside. The roadside check facility may be equipped with AVI, weighing sensors, transponder read/write devices, and computer workstation processing hardware, software, and databases.

54. ***CV Administrative Processes (cvo04)***

This market package provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in the electronic clearance program provided by a separate market package which allows commercial vehicles to be screened at mainline speeds at commercial vehicle check points. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration Subsystem and snapshots of this database are made available to the commercial vehicle check facilities at the roadside to support the electronic clearance process.

55. ***International Border Electronic Clearance (cvo05)***

This market package provides for automated clearance specific to international border crossings. This package augments the electronic clearance package by allowing interface with customs related functions and permitting NAFTA required entry and exit from the US to Canada and Mexico.

56. ***Weigh-In-Motion (cvo06)***

This market package provides for high speed weigh-in-motion with or without AVI attachment. Primarily this market package provides the roadside with additional equipment, either fixed or removable. If the equipment is fixed, then it is thought to be an addition to the electronic clearance and would work in conjunction with the AVI and AVC equipment in place.

57. ***Roadside CVO Safety (cvo07)***

This market package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at the Commercial Vehicle Check roadside element. The capabilities for performing the safety inspection are shared between this market package and the On-Board CVO Safety Market Package which enables a variety of implementation options. The basic option, directly supported by this market package, facilitates safety inspection of vehicles that have been pulled in, perhaps as a result of the automated screening process provided by the Electronic Clearance Market Package. In this scenario, only basic identification data and status information is read from the electronic tag on the commercial vehicle. The identification data from the tag enables access to additional safety data maintained in the infrastructure which is used to support the safety inspection, and may also inform the pull-in decision if system timing requirements can be met. More advanced implementations, supported by the On-Board CVO Safety market package, utilize additional vehicle safety monitoring and reporting capabilities in the commercial vehicle to augment the roadside safety check.

58. ***On-board CVO Safety (cvo08)***

This market package provides for on-board commercial vehicle safety monitoring and reporting. It is an enhancement of the Roadside CVO Safety Market Package and includes roadside support for reading on-board safety data via tags. This market package uses the same communication links as the Roadside CVO Safety Market Package, and provides the commercial vehicle with a wireless link (data and possibly voice) to the Fleet and Freight Management and the Emergency Management Subsystems. Safety warnings are provided to the driver as a priority with secondary requirements to notify the Fleet and Freight Management and Commercial Vehicle Check roadside elements.

59. ***CVO Fleet Maintenance (cvo09)***

This market package supports maintenance of CVO fleet vehicles through close interface with on-board monitoring equipment and AVLS capabilities with in the Fleet and Freight Management Subsystem. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.

60. ***HAZMAT Management (cvo10)***

This market package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Subsystem. The Emergency Management subsystem is notified by the Commercial Vehicle if an incident occurs and coordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Subsystem. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.

5.2.7 Emergency Management

61. ***Emergency Response (em1)***

This market package provides the computer-aided dispatch systems, emergency vehicle equipment, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Subsystems supports emergency notification and coordinated response between agencies. Existing wide area wireless communications would be utilized between the Emergency Management Subsystem and an Emergency Vehicle to enable an incident command system to be established and supported at the emergency location. The Emergency Management Subsystem would include hardware and software for tracking the emergency vehicles. Public safety, traffic management, and many other allied agencies may each participate in the coordinated response managed by this package.

62. ***Emergency Routing (em2)***

This market package supports dynamic routing of emergency vehicles and coordination with the Traffic Management Subsystem for special priority on the selected route(s). The Information Service Provider Subsystem supports routing for the emergency fleet based on real-time traffic conditions and the emergency routes assigned to other responding vehicles. In this market package, the Information Service Provider Subsystem would typically be integrated with the Emergency Management Subsystem in a public safety communications center. The Emergency Vehicle would also optionally be equipped with dedicated short-range communications for local signal preemption.

63. ***Mayday Support (em3)***

This package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Emergency Management Subsystem to locate the user and determine the appropriate response. The Emergency Management Subsystem may be operated by the public sector or by a private sector provider. The request from the traveler needing assistance may be manually initiated or automated and linked to vehicle sensors. The data is sent to the Emergency Management subsystem using wide area wireless communications with voice as an option. Providing user location implies either a location technology within the user device or location determination within the communications infrastructure.

5.3 Potential Benefits of Market Packages

Benefits of these Market Packages have been recorded by the USDOT over the years, and were listed in National ITS Architecture Market Package Analysis document (1999). The following table 16 identifies the benefits of the different Market Packages grouped under their area of applicability such as transit management, traffic management, etc. With the exception of Vehicle Safety Market Packages, all others are designed predominantly to involve/aid the public agencies in executing their roles in the regional transportation operations. In contrast, the vehicle safety Market Packages are predominantly aimed at the private sector entities such as automobile manufacturers who contribute to the development and refinement of new technologies that aid in the safety of vehicles on road.

Table 16 – Potential Benefits of ITS Market Packages

Market Packages	**Likely Benefits**	**Context Where Benefits May Occur**
Traveler Information Market Packages		
Broadcast Traveler Information	• Possible benefits as high as other interactive ATIS services (see below), depending on capability of in-vehicle devices	• Primary value for incident-related (accidents, weather, special events, etc.) traffic delays, across all geographic areas • Higher benefits to travelers with long trips, multiple mode and route alternatives
Interactive Traveler Information	• Reduction in travel time for equipped travelers • Increases in speeds, decrease in number of stops for equipped travelers • Some benefits for non-equipped travelers • Higher benefits for pre-trip versus on route information • Decreasing benefits with higher market penetrations	• Primary value for incident-related (accidents, weather, special events, etc.) traffic delays, across all geographic areas • Higher benefits to travelers with long trips, multiple mode and route alternatives • Decreasing benefits with higher network loadings (i.e. higher congestion)
Autonomous Route Guidance Dynamic Route Guidance ISP Based Route Guidance Integrated Transportation Management/Route Guidance	• Reduction in travel time for equipped travelers • Increases in speeds, decrease in number of stops for equipped travelers • Some benefits for non-equipped travelers • Higher benefits for pre-trip versus en-route information • Decreasing benefits with higher market penetrations	• Primary value for incident-related (accidents, weather, special events, etc.) traffic delays, across all geographic areas • Higher benefits to travelers with long trips, multiple mode and route alternatives • Higher benefits for visitor's and other unfamiliar travelers
Yellow Pages and Reservation	• Potential reduction of VMT spent searching for trip destinations	• Benefits highest for visitors and other unfamiliar travelers • Familiar travelers benefit from parking reservation
Dynamic Ridesharing	• Increased vehicle occupancy and use of HOV modes • Improved individual mobility	• Significant density of related trips is necessary to ensure ride matching
In Vehicle Signing	• Reduction in search time and excess VMT • Reduction in accidents	• Anticipated benefits in congested areas, night driving, rural areas • Aid to visually challenged drivers

Market Packages	Likely Benefits	Context Where Benefits May Occur
Benefits of Transit Management Market Packages		
Transit Vehicle Tracking	• Improvement in vehicle on-time performance • Reductions in field supervision	• Higher benefits to areas with significant transit service reliability problems
Fixed-Route Operations	• Improved productivity of vehicles, labor	• All transit scenarios
Demand-Responsive Transit Operations	• Improved productivity of vehicles, labor • Efficiencies in routing and trip scheduling	• All transit scenarios
Transit Passenger and Fare Management	• Passenger convenience of common fare instrument • Reduction in cash handling losses • Reduction in costs of data collection and fare processing	• Benefits clearest where multiple agencies share services, transfers, etc.
Transit Security	• Faster response to incidents • Record of security incidents	• High benefits in less secure areas (e.g. large urban areas)
Transit Maintenance	• Effective scheduling of maintenance activities • Reduction in maintenance and system repair costs	• All transit scenarios
Multi-modal Coordination	• Reduction in transit travel times from signal priority	• Good institutional cooperation between traffic and transit managers is necessary • Level of benefits depends on ambient traffic volumes and cross traffic in selected corridors or in area-wide systems
Transit Traveler Information	• Improved individual mobility • Enhanced attractiveness of transit as alternative to SOV use • Reduced travel stress due to knowledge of real time schedules and ability to generate custom itineraries	• Areas with unpredictable system route times and complex service.
Benefits of Traffic Management Market Packages		
Network Surveillance	• Indirect benefits only • Data support for other ATMS services	• Essential component for incident detection and sometimes for signal control • Higher value for regions where traffic pattern are transient and unpredictable

Market Packages	Likely Benefits	Context Where Benefits May Occur
Probe Surveillance	• Indirect benefits only • Data support for other ATMS services	• Essential component for incident detection and sometimes for signal control • Higher value for regions where traffic pattern are transient and unpredictable
Surface Street Control	• Reduction in travel time • Reduction in queue time • Increase in speeds • Reduction in stops • Reduction in fuel consumption • Reductions in VMT • Reductions in HC and CO emissions • Reduction in intersection-related accident rates, with higher reductions possible for left-turn accidents • Significant benefit-to-cost ratio	• Most surface street systems will benefit from this Market Package • Cities with major traffic generators such as theme park or stadium will benefit more • It is expected that signal coordination tailored to specific local traffic patterns can have significantly higher benefits.
Freeway Control	• Increase in freeway speed (before-after) during congested peak hours, depending on level of congestion • Increase in freeway throughput • Reduction in travel time • Reduction in queue time • Reduction in fuel consumption • Reduction in emissions	• Most freeway systems will benefit from this market package • Essential component for HOV Lane Management and Reversible Lane Management Market Packages • Capacities of freeway on and off ramps may be diminished by ramp metering
HOV Lane Management	• Reduction in travel time • Increase in lane carrying capacity • Increase in use of transit and HOV modes • Reduction in number of stops (HOV priority at ramp meters)	• Benefits will be greatest in areas with high levels of congestion, concentrated residential and employment land uses, and limited route options. • Improved service on HOV lanes could induce more HOV travelers and improve flow on non-HOV facilities.
Traffic Information Dissemination	• Positive value but quantitative estimates have yet to be determined	• Regions where travelers respond to traffic information by changing departure time, route choice, etc. • Regions that have alternate routes, mode choices, etc.
Regional Traffic Control	• Uncertain level of benefits, but can be significant in many instances	• High benefits in regions with many cities or jurisdictions
Incident Management System	• Reduction in incident response times for large urban areas • FSP programs report significant reductions in incident-related vehicle hours of delay • Significant benefit to cost ratio	• Regions with high frequency of incidents • Regions where incident delays constitute a substantial part of delays

Market Packages	Likely Benefits	Context Where Benefits May Occur
Traffic Forecast and Demand Management	• Reductions in data collection cost • Benefits depend heavily on current surveillance and analysis activities	• Regions that have TDM programs • Regions that have traffic management plans responding to performance evaluation
Electronic Toll Collection	• Reduce peak hour congestion • Reduction in toll plaza operating costs • Reduced incidents and emissions	• Regions that have TDM programs or existing manual toll collection systems • Toll collection infrastructure can be leveraged to provide traffic surveillance capabilities
Emissions monitoring and management	• Improve air quality	• High value in geographic areas in air quality non-attainment
Virtual TMC and Smart Probe	• Reduction in incident notification time • Reduction in infrastructure operating costs • Support traffic management and traveler information services	• Assumed value in rural and inter-urban areas with low capital
Standard Railroad Grade Crossing Advanced Railroad Grade Crossing	• Some grade crossing accidents may be avoided • Condition of rail roadside equipment can be monitored	• Requires institutional cooperation between rail operators and traffic managers
Railroad Operations Coordination	• Further contribution to benefits identified under Surface Street Control. Level of benefits unknown	• Larger traffic networks with significant highway-rail intersection closures.
Parking Facilities Management	• Reduction in administrative costs • Reduction in queues at parking entrances and exits • Can support use of HOV and transit modes	• Can leverage electronic toll collection equipment • Most effective when coupled with other urban traveler information services
Reversible Lane Management	• Reduction in travel time • Increase in lane carrying capacity • Mitigate safety risks with existing reversible lanes	• Viable in corridors with clear directional patterns or to respond to dynamic demand changes and special events
Road Weather Information System	• Improved safety via valuable pre-trip and en-route information • Enhanced facility maintenance efficiency	• Especially relevant in rural areas with diverse terrain and variable weather patterns.
Regional Parking Management	• Improved facility utilization • Reduced travel time, fuel use, and emissions associated with traveler parking services	• Regional (i.e., Mutli-jursidictional / multi-agency) parking environments
Benefits of Commercial Vehicle Market Packages		
Fleet Administration	• Improvements in vehicle and driver productivity • Increase in loaded miles	• Local and long-haul systems

Market Packages	**Likely Benefits**	**Context Where Benefits May Occur**
Freight Administration	• Largely unknown level of benefits	• Hazardous materials and other sensitive cargo
Electronic Clearance	• Reduction or elimination of border clearance times • Reductions in commercial and public administrative costs • Improvements in vehicle and driver productivity	• Highest benefits for long-haul carriers
Commercial Vehicle Administrative Processes	• Significant cost savings for commercial vehicle operators and regulatory agencies • Reduced HAZMat incidents • Reduced tax evasion	• Most effective when implemented across jurisdictions.
International Border Electronic Clearance	• Reduction or elimination of border clearance times • Reductions in commercial and public administrative costs • Improvements in vehicle and driver productivity	• Highest benefits for long-haul carriers
Weigh-In-Motion	• Reduction in vehicle weighing times • Reductions in commercial and public administrative costs • Improvements in vehicle and driver productivity	• Highest benefits for long-haul carriers
Roadside CVO Safety	• Reduction in safety inspection times • Reduction in commercial vehicle accidents	• The capabilities for performing the safety inspection are shared between this market package and the On-Board CVO Safety Market Package which enables a variety of implementation options
On-board CVO Safety	• Reduction in commercial vehicle accidents	• The capabilities for performing the safety inspection are shared between this market package and the Roadside CVO Safety Market Package which enables a variety of implementation options
CVO Fleet Maintenance	• Improvement in vehicle productivity • Reduction in commercial vehicle accidents	• All CVO scenarios
HAZMAT Management	• Faster and more appropriate response to HAZMAT incidents • Reduction in number of accidents	• Requires coordination between fleet administration, traffic management, and emergency management officials.
Benefits of Archived Data Market Package		

Market Packages	Likely Benefits	Context Where Benefits May Occur
ITS Data Mart	• Largely unknown level of benefits; rarely measured in quantitative terms, however the Archived Data Market Packages improved system planning by reducing sampling biases and providing more detailed data • Potential reduction in effort required for data collection and analysis for system planning	• Agencies and analysts engaged in detailed modeling / simulation • Agencies with significant data reporting responsibilities
ITS Data Warehouse	• Largely unknown level of benefits; rarely measured in quantitative terms, however the Archived Data Market Packages improved system planning by reducing sampling biases and providing more detailed data • Potential reduction in effort required for data collection and analysis for system planning • Support data integration and multi- variable analyses	• Data standards efforts will have a significant impact on ease of data sharing and integration • Agencies and analysts engaged in detailed modeling / simulation • Agencies with significant data reporting responsibilities
ITS Virtual Data Warehouse	• Largely unknown level of benefits; rarely measured in quantitative terms, however the Archived Data Market Packages improved system planning by reducing sampling biases and providing more detailed data • Potential reduction in effort required for data collection and analysis for system planning • Support data integration and multi-variable analyses	• Institutional relationships at a regional level must be sufficient to facilitate cooperation between different agencies and jurisdictions
Benefits of Emergency Management Market Packages		
Emergency Response	• Assumed reduction in response times through system-coordinated response	• Higher level of benefit realized in areas with multiple jurisdictions and independent response agencies
Emergency Vehicle Routing	• Unknown level of benefits	• Effectiveness can be enhanced with local signal preemption capabilities
Mayday Support	• Anticipated faster routing of calls, shorter response times	• Higher level *of* benefit realized in areas with multiple jurisdictions and independent response agencies • High benefits in rural areas
Benefits of Vehicle Safety Market Packages *The following Market Packages are primarily aimed towards the private sector (especially automobile manufacturers) and are considered of relatively low applicability to the public sector agencies.*		
Vehicle Safety Monitoring	• Lower vehicle maintenance costs • Lower accident and vehicle breakdown rates	

Market Packages	Likely Benefits	Context Where Benefits May Occur
Driver Safety Monitoring	• Lower accident rates due to driver impairment	
Longitudinal Safety Warning	• Reduction in backing and rear-end accidents	
Lateral Safety Warning	• Reduction in lane departure accidents	
Intersection Safety Warning	• Difficult to estimate level of reduction of intersection-based accidents • Some intersection-related accidents may be avoided	• Higher possible value at unsignalized intersections
Pre-Crash Restraint Deployment	• Reduction in accident severity	
Driver Visibility Improvement	• Reduction in accidents due to driver vision impairment • Reduction in night vision impairment accidents	• Higher benefits in night driving, inclement weather • Significant benefits for visually challenged drivers
Advanced Vehicle Longitudinal Control	• Improvement in highway lane capacity • Reduction in rear-end and backing accidents with other automobiles • Reduction in rear-end and backing accidents with fixed objects	• Applications most likely on freeway and other restricted-access roads
Advanced Vehicle Lateral Control	• Reduction in lane departure accidents	• Applications most likely on freeway and other restricted-access roads
Intersection Collision Avoidance	• Unknown level of benefits, difficult to quantity	• Possible high value at unsignalized intersections
Automated Highway System	• Significant improvements in highway lane capacity • Broad range possible safety and environmental benefits, depending on system design	• Likely scenarios still under discussion

5.4 Agency Market Package Plans

The Market Package plan for an agency consists of a set of prioritized ITS services carefully selected with a view to alleviating the existing problems and to achieving overall long-term objectives of the agency. The importance of the agency-specific market package plan is stressed by the fact that while the desired functional capabilities of the plan satisfy the agency's needs, the plan's technological interface establishes the framework for the subsequent task of developing the ITS system architecture for the agency. It allows the agency to concentrate on those pieces of the architecture necessary to provide the required services. This section develops market package plans for the transportation related agencies in the study area. These agencies include:

- New York State Dept. of Transportation (NYSDOT Region 3)
- New York State Thruway Authority (NYSTA)
- New York State Police
- Syracuse Metropolitan Transportation Council (SMTC)
- Central New York Regional Transportation Authority (CNYRTA)
- City of Syracuse Department of Public Works (DPW)
- City of Syracuse Police Department
- City of Syracuse Fire Department
- City of Syracuse Emergency Management Services
- Onondaga County Department of Transportation
- Onondaga County Sheriff's Office
- Onondaga County 9-1-1

5.4.1 Potential Applications of Market Packages

In subsection 3, a generic description was provided for each market package; however no real-world applications were discussed. This sub-section simplifies the understanding of each market package by providing examples of potential applications in terms of deployable projects.

As shown in Table 17, the Network Surveillance **(atmsS01)** market package will include deployment of electronic devices such as Close Circuit Television (CCTV), Video Image

Detectors (VID), and other detectors/sensors on the roadway network for measuring various performance measures (e.g. speed, volume, vehicle classification, etc.). Similarly the other Market Packages have potential applications that may relate to transit, commercial vehicles operations, pedestrian, emergency management and so on. Sometimes two or more Market Packages are required to achieve a desired function. Table 17 will be used in the subsequent analyses to identify the priority Market Packages for each agency in the City of Syracuse region.

5.4.2 Priority Rating Definitions

The market package plans for the agencies were developed by assigning a priority rating to each package. With the exception of fundamental/mandatory Market Packages mentioned earlier, the following priority ratings were used for other Market Packages:

High - the market package offers services that are fundamental to agency's existing as well as perceived future operations; a high priority candidate for funding. The agency will actively pursue financing and implementation of the market package.

Medium - the market package offers services that are only complementary to agency's existing as well as perceived future operations; a medium priority candidate for agency funding. The agency will consider financing it to the extent required to complement the services of a high priority package.

Low - the market package offers services that are only remotely related to agency's existing as well as perceived future operations; a low priority candidate for agency funding.

Not Rated - the market package offers services that are not related to the agency operations. It is not a candidate for agency financing.

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Table 17 - Potential Applications of ITS Market Packages[1]

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
ATMS01	Network Surveillance	• Install close circuit television (CCTV) cameras, video image detectors (VID), and other detectors for data collection along major City arterials. • Install close circuit television (CCTV) cameras, video image detectors (VID), and other detectors for data collection along freeways. • Install road and weather sensors for monitoring ice, snow and rain conditions. Purpose: to measure volume, speed, and travel time; and to detect incidents in real time	City of Syracuse, Onondaga County, adjacent city/ county jurisdictions, NYSDOT, NYSTA
ATMS02	Probe Surveillance	• Install readers along the toll roads and freeways that use E-ZPass tags for toll collection. • Extend readers to non-toll roads and freeways, provided there are sufficient vehicles with E-ZPass tags. • Use buses as probes along non-tolled freeways. • Use buses as probes along major City and County arterials. Purpose: to measure volume, speed, and travel time; and to detect incidents in real time.	NYSDOT, NYSTA, County and City
ATMS03	Surface Street Control	• Install advanced signal controllers and computer controlled signal systems; apply traffic progression and coordination principles along signalized arterials. • Install adaptive signal control systems, where appropriate, especially at major arterials with sudden surges in traffic pattern. • Ensure inter-jurisdiction coordination to maintain signal coordination along arterials that traverses multiple jurisdictions. Purpose: to provide central control of surface street signals; to reduce delay and vehicle emissions; to increase average travel speed by maintaining traffic flow and to increase throughput by utilizing optimum capacity.	City of Syracuse, County arterials,

[1] This table is intended to simplify the understanding of ITS Market Packages by providing examples of potential applications. It should be noted that an agency might have already deployed some of the applications listed here. This table might have included those applications too (for the agency, see last column) to make this a comprehensive list. However, this table should not be treated as an all-inclusive list of applications as with innovations in technology there would always be new applications in every group of Market Packages.

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
ATMS04	Freeway Control – Ramp Control	• Install ramp metering at freeway ramps and interchanges, and coordinate ramp control signals with local street signals Purpose: to maintain optimum traffic flow on freeway and ensure safe merging of on-ramp vehicles.	NYSDOT, NTSYTA
ATMS05/ ATMS17	HOV and Reversible Lane Management	• Install cameras/detectors to monitor and enforce bus-HOV lanes on freeways • Install vehicle occupancy detectors along HOV lanes • Install cameras/detectors to monitor and enforce bus lanes on the arterials • Install cameras/detectors on reversible lane facilities and provide provisions for the Traffic Management Center (TMC) to dynamically mange these facilities, especially during special events or other events that cause traffic surges. • Install variable speed limit signs along HOV and reversible lanes, as appropriate. Purpose: to increase throughput by effectively managing buses, HOVs, and reversible lanes, especially during peak hours of travel and special events. Ensure safe merging of on-ramp vehicles.	NYSTA-Reversible lanes only at Toll Collection Facilities. No HOV Lanes in the study area.
ATMS06	Traveler Information Dissemination	• Install variable message signs (VMS) at critical decision points in the freeway and arterial network. • Install highway advisory radios (HAR) along freeway/arterial networks and at major destinations (e.g. airports) Purpose: to provide basic traveler information so that the travelers can make an intelligent choice for their travel route and avoid locations of incidents.	NYSDOT, NYSTA, City of Syracuse, Onondaga County.
ATMS07	Regional Transportation Control	• Install communication links and coordination between traffic control centers of multiple jurisdictions so that: a) Integrated signal control can be established for the arterials that traverse multiple jurisdictions. b) A single traffic control center can manage the facilities of multiple jurisdictions during off-peak hours, or during other hours of need. Purpose: to manage transportation more efficiently through sharing/transferring some of the traffic control functions among two or more jurisdictions.	NYSDOT, NYSTA, City of Syracuse, Onondaga County, Emergency Service Providers
ATMS08	Incident Management System	• Install surveillance and data collection systems (see packages ATMS1, ATMS2, ATMS3) to detect and verify incidents • Install effective communication channels among traffic, police, fire, and emergency	NYSDOT NYSTA, City of Syracuse &

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
		management • Establish an effective site management mechanism for quick response to remove incidents (with on-call tow trucks, strategically located multipurpose help-vehicles or tow trucks, etc.) • Install strategies to disseminate traveler information about the occurrence of an incident, about expected delays, and to suggest alternate routes (if necessary) via VMS, HAR (see ATMS06), via broadcast radio/television and any other suitable means. Purpose: to restore traffic flow at optimum level as quickly as possible, and to provide appropriate guidance to travelers so that the impact of the incident is minimized.	Onondaga County – Police, Fire, and Emergency Management Departments, NYSP
ATMS09	Traffic Forecast and Demand Management	• Establish a planning process for dynamic modeling of traffic and transit networks to measure demand, capacity and travel speed, to the extent possible, in real-time, and to forecast network performance (travel time, speed, capacity, etc.) by incorporating anticipated demand. The source data are available from traffic/transit management centers, and anticipated route/mode plans may be supplied by information-service-providers (ISP) or MPOs. The network performance evaluation may require the use of advanced algorithms to process a huge amount of data. • Establish travel demand management (TDM) programs based on the network performance evaluation. Purpose: to optimize throughput at near real time or for future conditions by devising appropriate Transportation Demand Management (TDM) programs.	MPOs, Agency planning departments, City and County traffic operations centers.
ATMS10	Electronic Toll Collection	• Expand the E-ZPass, the electronic toll collection system currently in use at parts of the metropolitan area, to all tolled highways in the area. Purpose: to increase throughput and reduce congestion at roadway and bridge toll plazas, facilitate fee payment at the parking toll collection booths.	NYSTA, Parking facility operators (airport, municipal, private)
ATMS11	Emissions Monitoring and Management	• Install vehicle-emission-sensing detectors at major intersections and at selected highway locations where there is a potential for exceeding the ambient air quality threshold. It may include machine-vision-based equipment to identify potential violators' license plates for appropriate action. Purpose: to improve air quality and thus quality of life.	NYSDOT, NYSTA, City of Syracuse, Onondaga County.
ATMS12	Virtual TMC and Smart Probe Data	No mature application is available at this time	

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
ATMS13/ ATMS14	Standard/Advanced railroad grade crossing	• Installation of track and road surface sensors and wayside control equipment to detect presence of vehicles on grade crossing. • Coordinated control between Highway and Railroad operations to avoid any accidents.	City, County and Railroad companies.
ATMS16	Parking Facility Management	• Install equipment to assist the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. • Provide availability information to travelers through guide signs and coordinated traveler information through ISPs message boards. Purpose: to facilitate parking availability information and faster electronic toll collection.	City owned and private parking lots.
ATMS18	Road Weather Information	• Install sensors to monitor the road surface conditions • Installation of de-icing equipment at bridge and accident prone areas • Install weather sensors that monitor atmospheric weather conditions such as wind speed, wind chill, direction, etc and can forecast hazardous weather patterns. Purpose: to provide real-time weather information to traffic control centers to manage hazardous weather conditions and propel appropriate response by planning and controlling the inventory of manual labor and materials.	City of Syracuse, Onondaga County, NYSDOT and NYSTA.
ATMS19	Regional Parking Management	• Install electronic toll/fare collection system at park-n-ride lots, airport parking lots/garages, and major parking lots/garages in urban areas. • Install directional signs and post parking availability information (in real-time) at major intersections and/or decision points in the city, near park-n-ride lots, and in the vicinity of major destinations. Purpose: to facilitate parking fee payment at the pay-booth, and to reduce congestion by eliminating vehicles wandering in search of a parking place.	City of Syracuse, Hancock Int'l. Airport.
APTS01	Transit Vehicle Tracking	• Install advanced train tracking systems to identify <u>train</u> locations in real-time. The technology may involve Global Positioning Systems (GPS), Communications Based Track Circuits (CBTC), and/or others. • Install automatic vehicle location (AVL) systems for buses. GPS based systems are the preferred system at the present time. Purpose: These applications are fundamental to any transit ITS. Real-time tracking of transit vehicles will enable the transit agency to manage the system more effectively and to provide traveler information about arrival/departure time, delays, service disruptions, and incidents in real-time.	CNYRTA
APTS02	Transit Fixed-	• Establish a dynamic system for automatic driver assignment, monitoring, routing, and	CNYRTA

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
	Route Operations	scheduling for fixed-route transit operations using the real-time transit tracking information (see APTS1) and traffic information data. The Information Service Providers (ISP) may integrate the fixed-route transit operations data with the data from connecting modes (e.g. ferry, train, air) to provide the public with integrated and personalized information. Purpose: to achieve optimal use of the fixed-route transit fleet	
APTS03	Demand Response Transit Operations	• Establish a dynamic system for automatic driver assignment, monitoring, routing, and scheduling for demand-responsive transit services using the real-time bus tracking information (see APTS1). The information service providers (ISP) may integrate the flexible-route transit operation data with the data from connecting modes (e.g. ferry, train, and air) for providing the public with integrated and personalized information. • Enable the flexible-route-transit and para-transit services to entertain travelers' requests for pick-up/drop-off through real-time monitoring and flexible routing of the transit vehicles. Purpose: to achieve optimal use of the demand-responsive transit fleet	CNYRTA
APTS04	Transit Passenger and Fare Management	• Install fare collection devices at rail stations to enable the passengers to pay fares electronically (i.e. by a quick-contact or contact-less means, as the available technology permits) via a debit or smart card. • Provide ticket vending machines at stations and bus terminals for buying tickets and electronic fare cards (e.g. a debit or smart card). • Install devices on-board buses for electronic payment of fares via a debit or smart card. • Install automatic passenger counters (APC) for counting passengers on-board transit vehicles, especially buses, to improve passenger management by initiating appropriate actions (e.g. dispatching an additional bus to avoid crowding at a peak-load point on the route) by the Transit Management Center. APCs are useful in increasing operating efficiency by planning better services and by providing real-time passenger data needed by Traffic/Transit Management Center to initiate bus priority at traffic signals. As an example: provide priority to a bus only when the bus is not only delayed bust also carries the number of passengers on board that exceeds a certain minimum threshold. Purpose: Efficient fare and passenger management.	CNYRTA
APTS05	Transit Security	• Install CCTV at rail/bus stations for surveillance and security and to warn of potentially dangerous situations.	CNYRTA

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
		• Install cameras on buses/rail cars to monitor/record dangerous conditions, and a silent-alarm system to initiate a help-request by the driver. Purpose: to provide physical security to passengers at stations and on board.	
APTS06	Transit Maintenance	• Install devices on buses and rail cars to enable the Transit Management Center to automatically monitor the vehicle component conditions of vehicles (such as high engine temperature, low oil pressure, etc.) and the schedule for maintenance. Purpose: Efficient transit fleet maintenance.	CNYRTA
APTS07	Multi-modal Coordination	• Install a workstation that depicts real-time train schedule at the bus control center so that arrival/departure of trains and buses are coordinated at rail stations. A bus may be allowed to wait at an en-route rail station to pickup passengers from a delayed train without substantially degrading the bus schedule. • Provide provisions for bus priority at traffic signals along selected routes. Purpose: Coordinate services/operations among multiple modes (e.g., bus, train, and auto-traffic) to optimize passenger throughput (as in bus priority at signals), to optimize travel time (as in bus-train coordination).	CNYRTA
APTS08	En-Route Transit Customer Information Dissemination	• Install display monitors, variable message signs at rail/bus stations/terminals, and on-board vehicles. • Install public address systems on-board vehicles and at stations/terminals Purpose: to disseminate up-to-date and real-time (to the extent possible) basic traveler information to transit passengers on-board vehicles and at stations/terminals.	CNYRTA
APTS09	Integrated Fee/Fare Payment	• Establish inter-agency coordination and devise a means for paying fee/fare at multiple modes/facilities (e.g. rail, bus, tolled highways, bridges and parking facilities) via a single interoperable electronic device (e.g. smart card). Establish an integrated financial clearinghouse (back-office operations) for fee/fare processing and distribution among operating agencies. Purpose: Easy, efficient, and integrated way of fee/fare payment and management irrespective of mode and facility-ownership.	NYSDOT, NYSTA, CNYRTA, City of Syracuse, Private Operators of Parking facilities.
ATIS01	Broadcast Traveler Information	• Provide multi-modal traveler information via local broadcast radio/TV stations, cable TV or via dedicated channel for traffic/transit information. The source of information can be Traffic and Transit Management Centers, individual initiatives by TV stations (chopper in	Private sector, and ISP-based.

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
		NY metro area) and Information Service Providers (ISP, such as Metro Traffic, Smart Route in the New York area). Usually, the data synthesis and the information dissemination are done by a private sector. Purpose: to provide multi-modal traveler information for a wider audience.	
ATIS02	Interactive Traveler Information	• Install interactive kiosks with traveler information data at major trip origins/destinations such as transit stations and terminals, office parks, business centers, shopping malls, hospitals, rest areas, stadiums, etc. • Provide traffic/transit information via telephone and en-route emergency phones. • Provide personalized traveler information via fax and pager services. • Provide traveler information via Internet web pages. Purpose: to provide traveler information via an interactive means in which a customer has to request and receive the information via a two-way interactive communication medium.	CNYRTA, City, NYSDOT, Onondaga County, private sector and ISPs,
ATIS03	Autonomous Route Guidance	• Install in-vehicle sensory devices for current location determination (e.g. GPS) and use electronically stored data/map and other relevant static information for route guidance. As an example, a driver stuck in a congested roadway can quickly identify his current location on an electronically stored static map and then can find an alternate route by searching a possible electronically stored diversion-map. Communication with infrastructure is not required, nor is real-time information included for autonomous route guidance. Purpose: Route guidance by using electronically accessible in-vehicle static information.	Private sector (ISP-based).
ATIS04/05	Dynamic Route Guidance	• Install in-vehicle digital receivers capable of receiving information about current (real-time) traffic and transit conditions, and integrating that information with stored data/map for route guidance. • Subscribe to the services of an Information Service Provider (ISP) to receive dynamic turn-by-turn route guidance, or to receive real-time information (congestion status, directional help) on routes through an in-vehicle audio and/or visual device. Purpose: to receive advanced route guidance that is responsive to current conditions via in-vehicle electronic audio/visual device.	Private sector, ISP-based
ATIS06	Integration of Transportation Management &	• Establish predictive route guidance models at the Traffic Management Center by using the real-time route conditions and ISP-based planned/anticipated trips. The model suggests optimized routes for near-future travel conditions. The predictive model can be	MPOs, Planning Department at agencies @ City,

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
	Route Guidance	used by the Traffic Management Center to change the progression of traffic signals along certain route based on near-future anticipated conditions. A Transit Management Center can plan for diverting an express bus along a less congested route based on the predictive model. The dynamic route guidance based on the predictive model can be disseminated by an ISP in coordination the Traffic Management Center Purpose: to manage traffic control systems, as well as, provide dynamic route guidance based on predictive models that use real time route conditions and planned/anticipated travel in near-future.	County, NYSDOT, NYSTA, City and ISPs.
ATIS07	Yellow Pages and Reservation	• Advance the use of the interactive traveler information devices (e.g. telephone, kiosk, Internet, etc. See ATIS2) by adding electronically accessible yellow-page information and enabling the travelers to make reservations (for a hotel, ticket, restaurant, etc.) at interactive Kiosks and on Internet. Purpose: to provide yellow-page information and reservation services as well as interactive traveler information at the same time.	ISP-based.
ATIS08	Dynamic Ridesharing	• Advance the use of the interactive traveler information devices (e.g. telephone, kiosk, Internet, etc. See ATIS2) by adding ridesharing information in near real-time. An ISP may be involved in providing the information on ridesharing opportunities and the customer requests for ridesharing in near real-time. Purpose: to integrate real-time ridesharing opportunities/requests as part interactive traveler information.	Private sector lead, in association with traveler information department of public agencies
ATIS09	In Vehicle Signing	• Provide information to drivers, via in-vehicle electronic device/display, about the static signs along the route or about the messages displayed on en-route variable message signs, or about intersection safety warning. It requires dedicated short-range communications between roadside signs and the vehicle, as well as, wire-line communication between roadside signs and Traffic Management Center. The service may be offered by the Traffic Management Center, or by an Information Service Provider (ISP) in cooperation with Traffic Management Center. Purpose: to provide the driver with in-vehicle information on the regulatory/advisory signs along the route.	Private sector lead, in association with public agencies (NYSDOT, NYSTA, City and County)
AVSS01	Vehicle Safety Monitoring	No mature application is available at this time.	Auto industry lead
AVSS02	Driver Safety	No mature application is available at this time.	Auto industry lead

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
	Monitoring		
AVSS03	Longitudinal Safety Warning	No mature application is available at this time.	Auto industry lead
AVSS04	Lateral Safety Warning	No mature application is available at this time.	Auto industry lead
AVSS05	Intersection Safety Warning	• Install sensors, detectors at or near intersection/grade-crossing to measure speed, and identify vehicle locations, pedestrian/bicycle presence, and then assess the potential for any impending collision or dangerous condition. Use the information to warn the drivers by triggering an in-vehicle alarm and the pedestrians/bicyclists by an onsite safety warning. The mechanism may require sophisticated data/video processing at the Traffic Management Center. Purpose: to increase safety at intersections and grade crossings.	City of Syracuse, CNYRTA, County, other local jurisdictions and private automobiles.
AVSS06	Pre-Crash Restraint Deployment	No mature application is available at this time.	Auto industry lead
AVSS07	Driver Visibility Improvement	No mature application is available at this time.	Auto industry lead
AVSS08	Advanced Vehicle Longitudinal Control	No mature application is available at this time.	Auto industry lead
AVSS09	Advanced Vehicle Lateral Control	No mature application is available at this time.	Auto industry lead
AVSS10	Intersection Collision Avoidance	No mature application is available at this time.	Auto industry lead
AVSS11	Automated Highway System (AHS)	• Equip the highway and vehicle with advanced detectors/sensors so that it allows a driver "hands-off" operation of his vehicle. Purpose: to increase capacity/throughput by enabling shorter headway between vehicles, increase safety, reduce monotony of driving, plus scores of other associated benefits. Caveat – the concept may not be fully realistic, though it has potential for innovations in traffic safety by increasing the intelligence of vehicle. Since August 1997, the USDOT has abandoned the research support for AHS program and directed its focus on passenger safety	Lead by public-private partnerships with USDOT support. A futuristic concept.

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
		and Safer vehicles starting a new program named as Intelligent Vehicle Initiative (IVI).	
CVO01	Fleet Administration	• Install a vehicle location identification system using a cell based (or satellite) data link and the existing wireless infrastructure. • Establish a system for central monitoring of itineraries using the cellular-data-link based vehicle location information • Establish a system for central monitoring of fuel usage of vehicles via an in-vehicle processor with an interface to its fuel gauze and the cellular data link. • Establish a system that allows the Management Center to process dispatch instructions and to respond to requests for assistance/information via cellular data link Purpose: to facilitate administration and increase efficiency of CVO fleet	Private sector based
CVO02	Freight Administration	• Install electronic identification tags on cargo (national standards are not yet available). • Install an electronic cargo monitoring system at the cargo Administration Center through wireless communication between the cargo tags and the Administration center. Purpose: to facilitate remote tracking of cargo in real-time.	Private operators, Public cargo carriers – Hancock Intl' Airport
CVO03	Electronic Clearance	• Install transponders on the commercial vehicle • Install electronic credential-checking system at the roadside checkpoints so that checkpoint staff can retrieve the snapshot of critical data of the carrier, vehicle and driver. The roadside checking can b e equipped with automatic vehicle identification system, transponder read/write devices and other data processing equipment. Purpose: Allow a good driver/carrier/vehicle to pass checkpoints at highway speed. It allows time saving for truckers and cost savings for regulators.	Regulators such as NYSDOT/DMV, NYSTA
CVO04	CV Administrative Processes	• Establish a system of electronic application/processing/fee collection and issuance/distribution of CVO credential. Store the credential data to be available at roadside checking facility. This package is a pre-requisite for the Electronic Clearance (CVO3) or both packages should be simultaneously deployed. Purpose: Efficiency in commercial vehicle credential checking and cost savings for both regulator and operators.	Regulators such as NYSDOT/DMV, NYSTA
CVO05	International Border Electronic Clearance	• Establish International credential checking system. For these agreements on International Credential is required. • Establish electronic processing of customs fees. International Customs agreements are required.	Regulators such as NYSDOT/DMV, NYSTA

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
		• Establish international standards for electronic clearance and CVO administrative process. Purpose: Time saving for truckers and cost savings for regulators.	
CVO06	Weigh-In-Motion	• Install roadside fixed or removable roadside equipment for high speed weigh-in-motion. This package will work in conjunction with electronic clearance / CVO administrative process for identifying violators and recording the data. Purpose: Time saving for truckers and cost savings for regulators.	Regulators such as NYSDOT/DMV, NYSTA
CVO07/08	CVO Safety	• This package will be supported by Electronic Clearance and CVO Administrative Process for the critical vehicle safety data stored in the infrastructure so that a pulled-in decision can be made for safety check. The required systems are being researched. • Install on-board safety checking mechanism that will indicate the critical safety parameters, and that data can be accessed by the Management Center for alerting the driver. The required systems are being researched Purpose: to increase safety	Regulators such as NYSDOT/DMV, NYSTA
CVO09	Fleet Maintenance	• Establish a system for storing vehicle records such as mileage, repair history, safety violations. Install on-board monitoring equipment for checking safety parameters with close interface with management center via automatic vehicle location system. The driver can be warned of possible safety violations and the vehicle can be programmed for timely maintenance. Purpose: to increase reliability and reduced costs due to timely maintenance	Private sector
CVO10	HAZMAT Management	• Establish a system for tracking of HAZMAT and other sensitive cargo as it travels through the region. The electronic clearance package facilitates the procedure of tracking. If an incident occurs, the Incident Management System (ATMS08) and Emergency Response (EM1) packages support the clearance/removal/clean-up of HAZMAT Purpose: Rapid and safer cleanup of hazardous spills.	NYSDOT, NYSTA, City, County, EMS and City and County Police.
CVO11	Commercial Vehicle Traveler Information Dissemination	• Establish a system to tailor the data collected as part of ATMS (Traffic Management) and ATI S (Traveler Information) so that specific needs for commercial vehicle operators can be met. Purpose: To provide truckers with the needed information on various travel conditions	Private Sector, NYSDOT and NYSTA.

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
		(congestion/weather/pavement etc.)	
EM1	Emergency Response	• Establish a system for automatic notification of emergency vehicles after an incident has been checked and verified. • Establish a system for tracking emergency vehicles so that the nearest emergency vehicle can respond to an emergency. • Establish a system for effective coordination (by better algorithms) between, police, fire and emergency response team as each of these agencies develop their tracking systems. Purpose: to provide quicker response to accident victims.	State, City, County police, fire and emergency management departments;
EM2	Emergency Routing	• Establish a signal priority for emergency vehicles. • Establish a system for dynamic routing of emergency vehicles based on real-time traffic conditions in coordination with Traffic Management Center. Purpose: Reduced delay and easier access to emergency vehicles	State, City, County emergency management departments and traffic departments.
EM3	Mayday Support	• Equip the infrastructure and the vehicle so that the location of vehicle requesting Mayday support can be automatically determined. • Install in-vehicle devices and sensors so that requests from the traveler can be manually initiated or the request can be automatically transmitted via sensors with wireless communication. Purpose: To provide faster attention to medical emergencies and hazards to vehicle and people.	Current regulations prohibit automatic May Day request to 911. Initially private sector will take lead
AD1	ITS Data Mart	• Archiving own agency data for future developmental/planning needs. • Can be shared with individual agencies upon request.	City, County, EMS, Emergency Agencies, NYSDOT, NYSTA, MPO
AD2	ITS Data Warehouse	• Similar to ITS Data Mart with an enhanced feature of being a regional warehouse to collect and disseminate the required, archived information. • Can be automated when several agencies are involved and the transfer can be made upon request or without one.	NYSDOT, MPO, NYSTA.
AD3	ITS Virtual	• Establish better planning methods using real-time data, which will be available from	City and County

Market Package	Market Package Name	Examples Of Potential Application	Jurisdictions For Potential Application
	Data Warehouse	implementation of various, previously described packages. Purpose: Better estimation of effect and cost of future transportation improvements.	and State Planning Departments.

5.5 Market Package Plan Development

The identification of Market Packages for developing the ITS Architecture began with an introductory workshop held with participation of all agencies/stakeholders in the region. It involved a series of phases, as detailed below.

Phase1: The stakeholders in the region were invited to attend a workshop on Market Packages and were educated on the various Market Packages that are prescribed by the USDOT's National ITS Architecture. Depending on the operational characteristics of the stakeholder agency, these Market Packages were classified under different categories/aspects of Transportation Operation such as Traffic Management, Transit Management, Emergency Management, etc. To aid the presentation, handouts were given to the attendees. During the workshop, participating agencies were asked to choose the set of Market Packages, based on their agencies current and future needs that would be in the best interest of the region's transportation system. The participants were asked to rate the selected Market Packages as High, Medium and Low. Those Market Packages that didn't reflect the functional vision of any agency were rated as Not Applicable (N/A).

Phase2: These selected Market Packages were tabulated to identify any discrepancy in the selection process between different members of the same agency. The results were then validated with other agencies in the region that have similar operational characteristics. This process helped identify the differences in the needs of various agencies in the region, which may have the same mission, but with a different level of priority. For example, NYSDOT wishes to share traffic camera Images with the NYSTA, which already has a few traffic cameras located within the NYSTA study area. This was rated as a high priority. But for the NYSTA, this might not be a top priority, as they might prefer to direct Immediate/short-term investments to Traveler Information, since they have a large volume of commuter traffic on their road network.

Further, it was found that in a few instances, the Market Packages selected and rated by representatives of the same agency varied. To avoid this, the Market Packages survey was sent to the stakeholder agencies for further verification, and they were asked to come to consensus among themselves and provide a unified selection. The completed surveys were sent in by mail to the agency representatives who were asked to consult with their decision makers, to validate and verify the information provided initially.

Phase3: The re-evaluated Market Packages surveys were tabulated yet again and compared against other agencies with similar operational characteristics. Meeting with the agencies face-to-face further validated the results and helped fine–tune the selected Market Packages so that that they will be mutually beneficial to each other while benefiting the region as a whole. The meetings held were dedicated to agencies that perform different categories of transportation operation such as freeway management (NYSDOT and NYSTA), Arterial Street Control (City and County), and Emergency Management (City Police, County Sheriff, Fire, County Emergency Communication Center, EMS personnel and New York State Police).

Thus, an agency or a group of similar agencies identified a set of prioritized ITS Services. The goal of this exercises was to alleviate the existing problems and to achieve overall long-term goals of the agency/group and the region.

The Market Packages selection process was interactive and in-depth in nature. The consultant team's experts on ITS explained the potential application of each market package (Table 4.1). The agency representatives evaluated each market package (and the associated technologies) based upon their understanding of how the packages help satisfy the current needs and achieve future goals.

5.6 Process of Market Package Prioritization

While a quantitative (goal weighting) process is considered as unique and probably a more accurate reflection of an agency's ITS needs and direction, the approach preferred for this study is "qualitative" evaluation. It is a quick and easy to understand process wherein the stakeholder agencies in the Market Package workshop developed their market package plan based solely on their qualitative judgment and their agency goals. Each agency/group applied its qualitative judgment directly by understanding how each market package application (see Table 15) satisfies its needs and helps achieve its future goals. Accordingly, the agency applied the ratings of **Fundamental/ Mandatory, high (H), medium (M), low (L), not applicable (N/A) and not rated (NR)** for each market package. The summarized results of the market packages survey are presented in Table 18.

Market Packages			City of Syracuse	County DOT	NYSTA	NYSDOT	911 Onondaga County	NYSP	Syracuse Fire Dept.	City Police	City Police	SUNY Upstate Medical University	County Sheriff	CNYRTA	SMTC
Network Surveillance	**ATMS01**	**mandatory**	H	H	H	H	H	H	H	H	M	H	H	H	H
Probe Surveillance	**ATMS02**	**mandatory**	H	M	H	M	M	L	L	H	M	H	L	H	H
Surface Street Control	**ATMS03**		L	H	L	M	H	H	H	H	L	M	H	H	H
Freeway Control - Ramp Control	**ATMS04**		H	M	L	M	H	L	H	M	L	L	L	L	L
HOV Lane Management	**ATMS05**		L	NR	L	NR	L	NR	N/A	N/A	NR	NR	N/A	NR	NR
Traffic Information Dissemination	**ATMS06**		H	H	H	H	M	H	M	H	L	H	H	L	L
Regional Traffic Control	**ATMS07**		M	H	H	H	H	L	M	M	L	H	H/M	H	H
Incident Management System	**ATMS08**		H	H	H	H	H	H	H	H	M	H	H	M	L
Traffic Forecast and Demand Management	**ATMS09**		M	L	M	L	H-N/A	H	H	H	L	M	M	L	L
Electronic Toll Collection	**ATMS10**		H	NR	L	L	H	L	L	H	L	L	L	L	NR
Emissions Monitoring and Management	**ATMS11**		L	L	L	L	H	H	M	L	L	M	L	L	L

Market Packages			City of Syracuse	County DOT	NYSTA	NYSDOT	911 Onondaga County	NYSP	Syracuse Fire Dept.	City Police	City Police	SUNY Upstate Medical University	County Sheriff	CNYRTA	SMTC
Virtual TMC and Probe Data	**ATMS12**	**Not Applicable**	L	NR	L	NR	M	L	N/A	M	L	NR	L	L	L
Standard Railroad Grade Crossing	**ATMS13**		L	L	L	H	M	L	M	H	L	L	M	L	M
Advanced Railroad Grade Crossing	**ATMS14**		L	NR	M	M	M	L	M	M	L	L	M	L	L
Railroad Operations Coordination	**ATMS15**		L	NR	M	L	M	L	L	M	L	L	L	L	L
Parking Facility Management	**ATMS16**		L	NR	L	L	L	H	M/L	L	L	H	M	L	NR
Reversible Lane Management	**ATMS17**		H	NR	L	L	N/A	H	L	L	NR	L	L	L	NR
Road Weather Information System	**ATMS18**		H	H	H	H	M	H	M	H	M	H	L	L	M
Regional Parking Management	**ATMS19**		L	NR	L	L	L	H	M	L	L	H	M	M/L	NR
Transit Vehicle Tracking	**APTS1**	**mandatory**	L	NR		M	H	L	L	H	L	H	H		
Transit Fixed-Route Operations	**APTS2**		L	NR	L	L	H	L	L	L	L	H	L	L	NR
Demand Response Transit Operations	**APTS3**		L	NR	L	L	H	L	M	L	L	H	L	L	NR
Transit Passenger and Fare Management	**APTS4**		NR	NR	L	L	M	L	L	L	L	H	H	L	NR

Market Packages			City of Syracuse	County DOT	NYSTA	NYSDOT	911 Onondaga County	NYSP	Syracuse Fire Dept.	City Police	City Police	SUNY Upstate Medical University	County Sheriff	CNYRTA	SMTC
Transit Security	**APTS5**		NR	NR	M	M	M	H	H	M	L	H	L	L	L
Transit Maintenance	**APTS6**		L	NR	L	L	H	L	L	M	L	M	L	L	NR
Multi-modal Coordination	**APTS7**		NR	NR	H	L	H	M	L	H	L	H	L	L	L
Transit Traveler Information	**APTS8**		L	NR	M	L	M	L	L	H	L	H	L	L	NR
Broadcast Traveler Information	**ATIS01**		H	L	H	H	M	H	L	H	L	M	L	M	L
Interactive Traveler Information	**ATIS02**		H	L	H	L	M	M	L	H	L	H	L	M	M
Autonomous Route Guidance	**ATIS03**		L	NR	L	L	H	L	L	L	L	L	L	L	L
Dynamic/ISP Based Route Guidance	**ATIS04/05**		L	NR	M	L	M	L	L	M	L	L	L	L	L
Integrated Transportation Management/ Route Guidance	**ATIS06**		L	NR	M	L	M	L	L	M	L	L	L	L	L
Yellow Pages and Reservation	**ATIS07**		L	L	L	L	L	H	L	L	L	L	L	L	L
Dynamic Ridesharing	**ATIS08**		NR	NR	L	L	L	L	L	L	L	M	L	L	L

Market Packages			City of Syracuse	County DOT	NYSTA	NYSDOT	911 Onondaga County	NYSP	Syracuse Fire Dept.	City Police	City Police	SUNY Upstate Medical University	County Sheriff	CNYRTA	SMTC
In Vehicle Signing	**ATIS9**		NR	L		L	L	L	L	L	L	L	L	L	M
Intersection Safety Warning	**AVSS05**		NR	M	L	NR	L	H	M	H	L	M	L		
Automated Highway System	**AVSS11**		NR	NR	M	NR	L		L	H	L	L	L		NR
Fleet Administration	**CVO01**	**modified**	H	M	L	L	L	H	L	L	L	L	L	H	H
Freight Administration	**CVO02**		L	NR	L	L	L	H	L	L	L	L	L	L	L
Electronic Clearance	**CVO03**		M	L	L	L	L	H	L	L	L	L	L	L	L
CV Administrative Processes	**CVO04**		M	NR	L	L		M	L	L	L	L	L	L	NR
International Border Electronic Clearance	**CVO05**		L	NR	L	L	L	L	L	H	L	L	L	L	NR
Weigh-In-Motion	**CVO06**		M	L	L	L	N/A	H	L	L	L	L	L	L	L
Roadside CVO Safety	**CVO07**		L	NR	L	L		H	L	L	L	L	L	L	L
On-board CVO Safety	**CVO08**		L	NR	L	L		H	L	L	L	L	L	L	L

Market Packages			City of Syracuse	County DOT	NYSTA	NYSDOT	911 Onondaga County	NYSP	Syracuse Fire Dept.	City Police	City Police	SUNY Upstate Medical University	County Sheriff	CNYRTA	SMTC
CVO Fleet Maintenance	**CVO09**		L	L	L	L		L	L	L	L	L	L	L	L
HAZMAT Management	**CVO10**		L	L	H	M	H	H	L	H	M	L	L	L	L
Emergency Response	**EM1**		H	L	H	H	H	H	M	H	H	H	L	L	L
Emergency Routing	**EM2**		H	M	H	M	H	H	M	H	H	H	L	M	L
Mayday Support	**EM3**		L	L	H	L	H	L	M	H	M	H	L	L	L
ITS Data Mart	**AD1**		M	M	M	L		H	L	H	M	M	H	H	H
ITS Data Warehouse	**AD2**		M	M	M	M		H	L	H	M	H	H	M	M
ITS Virtual Data Warehouse	**AD3**		M	L	M	H		H	L	M	L	H	H	L	L

5.7 Summary of the Market Packages Ratings

The compilation of results from several meetings provided a clear insight into what the regional needs are. Overall results emphasized the need for better inter-agency coordination among the regional stakeholders in order to perform their roles at a broader level as well to improve their own operating efficiencies. This effort demonstrated that agencies recognized the need for the increased use of technology to effectively manage the transportation system, and to provide high-quality service to transportation system “customers.”

Workshops and interviews indicated a lack of coordination among the major role players of this architecture effort. Issues brought forward by the agencies were often prioritized by own needs and seldom were found to contribute to the region as a whole. Policy roadblocks, along with a lack of a regional vision, were often the obstacles in achieving transportation goals, even though in many cases required infrastructure to meet these goals is already in place. Agencies participating in this architecture effort must make cooperation a priority. Adoption of policies that favor the regional integration and coordination will support the framework of future transportation operations in the region.

Freeway Management agencies in the region such as the NYSDOT and the NYSTA, emphasized their need for traffic management systems on their road network. The discrepancies found in the earlier versions of the survey were solved when the agencies met to discuss their needs. Advanced Traveler Information and Emergency Management were two areas of common need. Sharing of real time/ near real time traffic images between the City of Syracuse and the NYSDOT was identified as a top priority. Integration of all nearby regional freeway traffic management centers was also seen as important. Market Packages

The CNYRTA has opted for most of the APTS packages. Among the selections made, Transit Vehicle Tracking (apts1) was already identified as a mandatory market package since the agency has realized the benefits of vehicle tracking for its operational enhancements. Also traffic signal prioritization was important, given the significance increasing transit ridership as a means to combat traffic congestion in the study area.

As expected, Emergency Management Agencies in the region, including New York State Police, Syracuse City Police, Onondaga County Sheriff, City and County Fire Departments along with the E-911 Center officials rated all of the Emergency Market Packages, except for Mayday Support as High, reiterating the need for enhancement of existing operations and coordination of effort. Most of these agencies stressed the need for exchange of traffic images from the City of Syracuse and the NYSDOT to help improve the response times. The E-911 Center is stepping up its operations and is moving in directions that favor the involvement of advanced technologies such as Mayday Support for drivers through partnerships with private industry (General Motors OnStar).

The City and County's choices were very similar. Once again, the exchange of traffic images was of importance for both agencies, especially during special events. The University, located in the heart of the study area, generates a large volume of traffic during special events such as sporting events and concerts. Exchange of information, including current traffic conditions, parking situations, etc. during such events becomes mission-critical coordination and is essential to manage the high influx in traffic volumes. Also favored is the tracking of maintenance vehicles, which will be addressed through a separate market package during the second phase of this study (development of ITS Architecture). Currently this issue is addressed through the Fleet Administration Market package categorized under Commercial Vehicle Operations (cvo01).

SMTC has emphasized their need for data archiving.

5.8 Next Steps

Task 5.5 of this chapter has identified the agency priorities based on the Market Packages. In the subsequent tasks of the project, the Syracuse Metropolitan Area ITS architecture will be developed so that, as a minimum, the architecture supports at least the **fundamental, high** and **medium** priority Market Packages. The final ITS Implementation Plan, to be developed in a later stage of the project, will identify the deployable ITS projects to meet the agencies' needs in order to achieve the vision and goals defined in this technical memorandum.

6. PERFORMANCE CRITERIA

Performance criteria are meant to measure the effectiveness of the intelligent transportation systems to be deployed. This section presents the recommended performance criteria, and the applicability of these performance criteria to the project goals and ITS Market Packages. Three potential benefits can be realized through the use of performance criteria to evaluate ITS strategies: the results can be used in making better decisions concerning the selection and prioritization of ITS strategies yet to be implemented; the data can be used to improve the accuracy and responsiveness of models and analytical techniques that are used to conduct ITS planning, and; the results can be used to refine and improve current operations.

The performance criteria are generally quantitative, and useful in gauging the “before” and “after” effects of alternative proposals. Data measured by performance criteria are expected to be easy to collect and store, and the results are relevant to the goals of the project. The performance criteria identified in this report are meant for use in the future to evaluate the results that are achieved by implementing ITS Market Packages and relevant ITS projects in the Syracuse Metropolitan Area.

Subtask 1 of this step identifies and describes the performance criteria recommended for this project. Since the performance criteria discussed in this report measure the ability of project actions to satisfy the goals of the study, these performance criteria are discussed with respect to their relevance to each of the project goals. Subtask 1 also presents the recommended performance criteria for both traffic and transit. Subtask 2 describes the applicability of the selected performance criteria to the ITS Market Packages, and subtask 3 reviews the relationship of the recommended performance criteria and the related data needs. The conclusion is presented in subtask 4.

6.1.1 Recommended Performance Criteria

The recommended performance criteria are quantitative in nature, so that they can be calculated based on numeric data. This reduces the need for subjective reasoning. Qualitative investigations could be used when appropriate. A further reason for selecting these criteria is their ability to measure the effectiveness of ITS Market Packages in meeting project goals. As with all transportation improvements, it is important to account for other improvements that have been made. This is especially important when evaluating ITS. Therefore, care should be taken to account for benefits received from ITS and non-ITS improvements.

The recommended performance criteria are divided into two sections: those that are most relevant to roadways and those that are most relevant to transit.

The roadway criteria are:

- Average travel speed
- Travel time reliability
- Throughput
- Vehicle occupancy
- Delay
- Congestion
- Accident rate
- Incident related delay

The transit criteria are:

- Throughput (frequency/capacity)
- On-time performance
- Transit/ridership
- Fare operating ratio
- Average travel time
- Number of crime incidents
- Incident related delay
- Public perception
- Bus route/services

Two performance criteria are applicable to both roadways and transit:

- Effective use of traveler information
- Operations and maintenance costs

6.1.2 Recommended Roadway Performance Criteria

This subchapter summarizes characteristics of the final recommended performance criteria for roadways, including the measurement of the performance criteria, the means to obtain data/information for measuring the criteria and the data/information requirements. Table 19 summarizes the information presented.

Average travel speed

Average travel speed is measured in miles per hour and is obtainable by field observation. It can be measured using floating car runs, by license plate matching, or by computing travel time using traffic volumes and roadway capacities. Average travel speed at a fixed point on a roadway can be measured by the network surveillance market package. The travel speed of tagged vehicles along a roadway link can be measured by the probe surveillance market package.

Average travel speed also indicates congestion, with congestion and delay occurring when average travel speeds fall below satisfactory levels. Average travel speed also indicates ease of movement for roadway users. Chapter 11 of the Highway Capacity Manual defines arterial level of service based upon average travel speed.

Travel time reliability

Travel time reliability is expressed as the percentage of times that a trip is made within the standard travel time for that trip. Travel times can be measured using field measurements or traffic/transportation planning models. ITS can measure travel time reliability through network surveillance or probe surveillance.

This performance criterion measures the reliability of travel time for people and goods to move from one location to another. It assumes that measurement of the percentage of instances when travel time from point to point in the designated network of facilities is within some datum or standard. A low percentage, which indicates that travel times are often higher than the standard, indicates congestion and delay. This provides a good measure of ease of movement for roadway users. Improvements to roadway traveling conditions should be clearly reflected by improved travel time reliability.

Table 19 - Characteristics of Recommended Roadway Performance Criteria

Performance Criteria	Units of Measurement	Data Requirements	Potential Data Sources
Average travel speed	Miles per hour (mph)	Previous, current, and future measurements of average travel speed	Field measurement; ITS network and probe surveillance
Travel time reliability	Travel time, measured in hours and minutes; reliability measured in the percentage of times that a trip is made within the standard travel time for that trip	Manually, use floating car runs over specified facilities, or other techniques; with models, extract travel times from data for specified origin-destination pairs; standard travel time can be estimated from averaging manual data or from model	Can be measured manually or with models; ITS network and probe surveillance
Throughput	Vehicle flow per hour	Previous, current, and future measurements of throughput by vehicles per hour	Measured with models; ITS network and probe surveillance
Average vehicle occupancy	Average number of occupants per private vehicle	Manually obtained measurement, using roadside observations, of previous, current, and future average vehicle occupancy	Field measurement
Delay	Minutes or hours of delay; delay can also be measured by queue length at entrance/exit ramps; ton hours (freight)	Direct measurement of previous, current, and future delay; alternatively, delay can be estimated from traffic counts combined with travel time measurements	Field measurement for delay (by time period) and queue length (by number of vehicles); ITS network and probe surveillance

Performance Criteria	Units of Measurement	Data Requirements	Potential Data Sources
Congestion	Six levels of service: LOS A (best operating condition) to LOS F (worst operating condition), travel time	Previous, current, and future LOS analyses; requirements include traffic volumes, vehicle classifications, and roadway geometry	LOS analyses according to the Highway Capacity Manual
Accident rate	Accidents per million vehicle miles; fatalities per million vehicle miles; accidents per year(pedestrians/bicyclists)	Traffic accident data including accident location, type, time of day, weather conditions, vehicle classification, and contributing factors; usually measured for the most recent consecutive three-year period for which data is available	Police Department, Department of Motor Vehicles
Incident related delay	Incident response time and incident clearance time measured in hours and minutes	Previous, current, and future measurements of incident response time and incident clearance time	Field measurement; ITS network and probe surveillance

Throughput

Throughput is expressed as the flow of traffic per hour. This performance criterion can be measured manually or with models. ITS data can be collected to measure throughput using network surveillance.

Throughput measures the efficiency of travel by showing how effective a transportation facility is in moving vehicles. It is also possible to determine person throughput by using data gathered for vehicle throughput and vehicle occupancy. By multiplying throughput by occupancy, the number of persons per hour traveling on a facility is obtained.

Throughput is one possible measure of congestion, since it reflects how many vehicles the system is moving per unit of time. It also reflects regional mobility. If a roadway facility is well managed, throughput is high.

Average vehicle occupancy

Average vehicle occupancy - a count of all persons in automobiles including the driver and passenger - indicates the number of travelers per vehicle in non-transit modes. It is usually measured by roadside observation.

Average vehicle occupancy is a useful performance criterion for environmental assessments because it influences air quality and can, therefore, are used to demonstrate efficiency. Lower average vehicle occupancies generally equate to more traffic.

Delay

Delay is stated in terms of minutes or hours of delay. It can be measured using manually obtained data or it can be computed from traffic counts combined with travel time measurements. Floating car runs or license plate matching can be used to determine travel times, which can be combined with traffic counts to estimate delay. Alternatively, delay can be measured by queue length at entrance/exit ramps. ITS data can be collected to measure delay using network or probe surveillance.

Delay is a vehicle-oriented measurement of roadway performance that reflects time losses/savings to people due to recurring congestion. It is measured in minutes or hours of delay (ton hours of delay for freight) experienced by system users. It provides a sound measure of congestion on roadway links or systems, although it does not give any insight as to the cause. Delay measurements also provide information about restricted flow and travel at sub-optimal speeds. The delays at signalized intersections are based on average stopped delay per vehicle and can be estimated by various transportation software tools.

Congestion

Level Of Service (LOS) is a qualitative measure describing traffic conditions in terms of factors such as speed, travel time, maneuverability, and safety. Density, expressed in unit of passenger car per mile per lane (pc/mi/ln), is the parameter used to define levels of service of basic freeway sections. For example, Chapter 3 of the Highway Capacity Manual defines six expressway levels of service from LOS A to LOS F where LOS A represents the best operating condition and LOS F the worst operating condition.

LOS designations indicate the amount of congestion and delay that a driver experiences along roadways. Delay occurs when traffic volumes exceed the roadway capacity. AASHTO (the American Association of State Highway Transportation Officials) suggests roadways should be designed to at least LOS C, but LOS D is acceptable in urban areas. Roadway sections or ramps where the LOS falls into E or F ranges operate at unacceptable conditions.

Accident Rate

Accident analyses are used to identify and evaluate high accident locations, assess contributing factors, and suggest mitigation measures. The process can include the determination of accident frequency, accident rate, and accident cost.

Average accident rates, expressed in terms of accidents or fatalities per million vehicle miles traveled, are developed from this data and compared to statewide averages for similar facilities. High average accident rates may reflect the influence of nonstandard roadway features, a high degree of use, and frequent roadway congestion. Accidents and fatalities involving pedestrians and bicyclists will be considered in addition to accidents and fatalities involving only vehicles.

Incident related delay

Incident delay is measured in terms of incident response time and incident clearance time expressed in hours and minutes. ITS data can be collected to measure incident delay using roadside network surveillance, probe surveillance, or incident management Market Packages.

Toll plaza throughput

Delay at toll plazas is measured by length of queue in minutes from field observations. ITS data can be collected to measure congestion and delay using network or probe surveillance. Roadway capacity decreases sharply at toll plazas, resulting in congestion and delay. Queues often form where traffic flow is unstable.

Operations/maintenance costs

This performance criterion is expressed in terms of the operation and maintenance costs (in dollars) per passenger mile of travel. The costs incurred are available from transportation agencies. This performance criterion provides a measure of the efficiency of an agency in providing basic services.

6.1.3 Recommended Transit Performance Criteria

This subchapter summarizes the characteristics of the final recommended performance criteria for transit, including the measurement of the performance criteria, the means to obtain data/information for measuring the criteria, and the data/information requirements. Table 19 summarizes the information presented.

Throughput (frequency/capacity)

Throughput measures the efficiency of travel by showing how effectively transportation facility capacity is moving people and freight. It is measured in number of transit passengers per hour and number of transit vehicles per hour. The data required could be collected using manual counts. Alternatively, ITS data can be collected to measure throughput using transit vehicle tracking and transit passenger and fare management Market Packages and freight tracking. ITS technology can be utilized to increase throughput.

This performance criterion reveals traveler options and the degree to which transit modes are used. Throughput also gives a direct measurement of travelers using alternatives to automobiles.

On-Time Performance

On-time performance is measured by the percentage of transit that meets scheduled departure and arrival times. ITS data can be collected to measure on-time performance using transit vehicle tracking information. Weather conditions, incidents, accidents, congestion, operator error, mechanical failure, and/or combinations of these factors can delay transit operations. On-time performance gives an indication of overall transit system efficiency.

Ridership

Passenger ridership is measured in the number of riders per year. Alternatively, passenger ridership can be measured as a percentage of all travelers using transit modes. ITS data can be collected to measure ridership using transit passenger and fare management. Ridership presents a quantifiable performance criterion that indicates the ability of transit to attract riders. Improvements to transit system operation may be reflected in increased ridership over time.

Revenue

Transit agency revenue is measured by an increase in fare operating ratio (i.e., the ratio of fare collected to operating costs). Increased revenue can be the result of changes in subsidy levels, as well as improved system efficiency, which can be accomplished by incorporating new technology.

Effective use of traveler information

Improvements in real-time information dissemination can be measured by the percentage of passengers who use real-time information. This performance criterion can also be measured by a count of the number of times passengers access real-time information. It can also quantify how the public used the data to determine changes in route, time and mode. This performance criterion can also quantify the availability of information to transit service providers for possible use in day-to-day operations adjustments. This information gives an indication of the extent to which infrastructure is in place for real-time information and the extent to which passengers are able to use it. This performance criterion is an accurate way to gauge the impact of real-time traveler information dissemination because passengers will not bother to access the information if they do not believe that it is up to date or useful. They must also be aware that the information exists.

Table 20 - Characteristics of Recommended Transit Performance Criteria

Performance Criteria	Units of Measurement	Data Requirements	Potential Data Sources
Throughput	Transit passengers per hour transit vehicles per hour	Previous, current, and future measures of transit vehicles throughput	Field observations or surveys; ITS network surveillance and passenger loading
On-time performance	Percentage of transit that meets scheduled departure and arrival times	Previous, current, and future scheduled and actual transit arrival and departure times	Field observations; ITS transit vehicle tracking
Transit/ferry ridership	Passenger ridership measured in number of riders per year, or percentage of all travelers using transit modes	Previous, current, and future passenger ridership figures	Field observations, surveys, models, toll counts; ITS passenger loading
Fare operating ratio	Transit system fare operating ratio	Previous, current, and future fare operating figures	Operator accounting figures
Effective use of traveler information	Percentage of transit passengers that use real-time information	Previous, current, and future numbers of passengers using/accessing real-time information	Operators; user surveys
Average travel time	Travel time measured in hours and minutes	Previous, current, and future measures of multi-modal passenger travel times	Field observation or regional transportation models; ITS transit vehicle tracking
Operations/ maintenance costs	Cost of operations and maintenance per passenger mile	Previous, current, and future operations and maintenance costs	Operators; ITS transit maintenance

Number of crime incidents	Number of incidents per passenger mile	Previous, current, and future numbers of crime incidents	Police Department
Incident related delay	Delay measured in hours and minutes per passenger mile	Previous, current, and future amounts of incident delay	Operators; ITS transit vehicle tracking
Customer satisfaction rating	Passenger approval rating	Previous, current, and future approval ratings from passenger surveys	Operators

Average travel time

The most effective method to measure average travel time for trips is from door to door, which is complicated because it may involve more than one mode of travel. Alternatively, regional transportation models can estimate travel times for trips that use more than one mode of travel. ITS data can be collected to measure average travel time on a link of the trip using transit vehicle tracking information.

Less travel time for trips involving transit means less congestion and better service. It evaluates ease of movement of travelers by all modes. Because this performance criterion measures all forms of transit, it gives insight into alternative modal opportunities.

Operations/maintenance costs

This performance criterion is expressed in terms of the operation and maintenance costs (in dollars) per passenger mile of travel. The costs incurred are available from transit agencies. This performance criterion provides a measure of the efficiency of agency operations.

Number of crime incidents

The number of crime incidents provides a performance criterion that measures passenger security. The number and nature of reported crime incidents are available from the Syracuse City Police Department.

Incident related delay

Incident delay is measured in terms of hours and minutes per passenger mile of travel. It provides a measure for gauging delay due to incidents such as atypical congestion, mechanical failure, adverse weather conditions, and passenger disturbances, among others. Data concerning delay is available from the agencies themselves. Alternatively, delay measurements can be obtained manually by transit system observation. ITS data can be collected to measure incident delay using transit vehicle tracking information.

Customer satisfaction rating

Approval ratings give an indication of passenger satisfaction with transit systems. They are available from passenger surveys conducted by the operators themselves.

6.1.4 Recommended Performance Criteria & ITS Market Packages

Recommended performance criteria are intended to evaluate future ITS projects. By associating performance criteria with Market Packages the most effective performance criteria for evaluating a specific ITS project can be identified.

In this section, the recommended performance criteria are discussed with respect to the ITS Market Packages discussed in the previous chapter. The Market Packages are arranged according to groups:

- ATMS: Advanced Transportation Management Systems,
- APTS: Advanced Public Transportation Systems,
- ATIS: Advanced Traveler Information Systems,
- AVSS: Automated Vehicle Safety Systems,
- CVO: Commercial Vehicle Operations, and
- EM: Emergency Management.
- AD: Archived Data Management

Table 18 summarizes the recommended roadway and transit performance criteria as sources for evaluating ITS Market Packages. The transit performance criteria detail how each of the Market Packages can be measured for bus operations. The Market Packages are listed in the rows, and the columns list the recommended performance criteria. A recommended performance criterion that can be used to evaluate that particular market package can be developed to address specific issues. In some cases, more than one performance criterion may be useful to evaluate a market package.

The following three Market Packages are not rated, as these elements are required prior to other Market Packages being deployed:

- ATMS01: Network Surveillance
- ATMS02: Probe Surveillance (Applicable only to NYSTA)
- APTS01: Transit Vehicle Tracking

In addition, a few Market Packages are not appropriate for evaluation performance criteria. Transportation Forecast and Demand Management (ATMS09) is an evaluation element and ITS Data Mart (ad01), ITS Data Warehouse (ad02) and ITS Virtual Data Warehouse (ad03) are the packages solely aimed at data gathering, analysis and dissemination for planning purposes of any individual agency or between several agencies.

6.1.5 Recommended Performance Criteria and Data Needs

This section discusses the recommended performance criteria in terms of current and projected data collection needs. Table 21 is intended to be used as an aid to the data collection efforts by various agencies involved in deploying ITS in the City of Syracuse.

Table 21 - Recommended Performance Criteria Data Requirements

Mode	Performance Criteria	Data Requirements
Roadways	Average travel speed	Average travel speed
	Travel time reliability	Floating car runs; origin-destination pairs; standard travel time from manual data or from model; probe data
	Throughput	Throughput by vehicles per hour
	Average vehicle occupancy	Average vehicle occupancy
	Delay	Delay
	Congestion	LOS analyses, which require traffic volumes, vehicle classifications, and roadway geometry
	Accident rate	Traffic accident data including accident location, type, time of day, weather conditions, vehicle classification, and contributing factors
	Incident related delay	Incident response time and incident clearance time
	Toll plaza throughput	Delay at toll plazas
	Effective use of traveler information	Number of drivers using/accessing real-time information; public's use of information
	Operations/maintenance costs	Operations and maintenance costs
Transit – Bus	Throughput (frequency/capacity)	Persons throughput,
	On-time performance	Scheduled and actual bus arrival and departure times
	Transit ridership	Bus ridership
	Fare operating ratio	Revenue
	Effective use of traveler information	Number of transit passengers using/accessing real-time information; publics' use of information.
	Average travel time	Average bus passenger travel times
	Operations/ maintenance costs	Bus operations and maintenance costs
	Number of crime incidents	Number of crime incidents on buses and at bus stations and bus stops
	Incident related delay	Bus incident delay

Performance criteria discussed in this technical memorandum are meant to evaluate the benefits of ITS projects quantitatively after they are deployed. This section focused on the project goals to select performance criteria. The characteristics, including data requirements, have been reviewed for each of the recommended performance criteria. The memorandum has presented a relationship of the selected performance criteria to the ITS Market Packages so that an evaluation of ITS projects can be made in compliance with the National ITS Architecture guidelines

7 Funding

The institutional framework and division of responsibilities within each state also affect funding for management and operations. For example, in each state the agency responsible for interstate highway management and operations also has budget authority to fund those activities. The activities and the funding source are integrated. . In many states, however, the responsibility for incident management activities and the funding sources for those activities are not integrated. While a state agency may be broadly responsible for incident management on its interstates, entities such as private towing companies, law enforcement, fire departments and emergency medical services providers are all critical to effective incident management, and, all have their own sources of funding.

This does not mean that a state will not fund ongoing operations, and improvements to those operations, related to incident response. Indeed, one of the key functions of the Syracuse Metropolitan Area ITS Architecture is incident management. However, the blurring of boundaries as described above can make funding decisions related to incident management more difficult.

One example of an unclear boundary is funding for sharing data and video images between public safety and traffic management agencies. Emergency response to incidents can be improved using data and video available from traffic management agencies. Traditionally, highway funds have not been used to fund improvements to emergency response. However, because improved data provided to emergency response agencies translates to improved incident management, a region may find it appropriate to apply highway funds to this type of project.

The Syracuse Metropolitan Area ITS Architecture does not specifically identify funding sources to support proposed ITS deployments. However, one of the objectives of the plan is to begin a dialogue on new approaches to funding that may not have been considered in the past. For example, the New York State Thruway Authority and state agencies such as the NYSDOT might form partnerships to share wireless and wireline resources.

7.1 Capital Funding for ITS

Given the diffuse nature of transportation operations and decision making, where does the burden for financing ITS projects fall? Across the country, regionally-integrated ITS is largely being funded by Federal Highway program funds including Surface Transportation Program (STP) funds, special Federal Operational Tests and Model Deployment Initiatives, and the Congestion Mitigation and Air Quality (CMAQ) program.. State DOT and MPO projects are also eligible to compete for the use of these funds. In the Syracuse metropolitan area, the CMAQ program can be tapped to fund the congestion mitigation projects that also benefit the region through reducing emissions. FTA funds transit ITS projects through their standard grant programs. One example of a state making maximum use of Federal sources is Kentucky, which will use only Federal grant money in 2002 to fund ITS.

The Federal Highway Administration is currently funded via the Transportation Equity Act for the 21st Century (TEA –21). Under TEA-21, a separate "line item" for ITS, was created, in addition to STP and CMAQ monies. Within TEA-21's ITS line item, specific projects are "earmarked" for Federal support. Money is also made available to the states for projects of their choosing.

A portion of the ITS budget was set aside to fund projects that focus on integrating multi-modal ITS components in a variety of settings, including large regional areas or metropolitan areas. These funds are allocated, or earmarked, in congressional transportation budget committees.

An additional Federal funding source for ITS projects that integrate emergency responders and transportation agencies is available through the Department of Justice (DOJ). The DOJ has indicated that they are prepared to be a funding partner in projects that integrate emergency responders with ITS. No specific funding amounts or limits have been identified by DOJ for these projects.

In New York State, a mix of Federal, state, and local funds have been used for ITS programs such as TRANSCOM, centralized traffic signal systems, AVL and weather information systems.

7.2 Operations and Maintenance Funding for ITS

Federal highway and transit funds may also be used for operations and operational improvements of ITS, subject to certain restrictions. USDOT policy stipulates that long-term, ongoing operations and operational improvements of ITS shall not be federally funded. However, this situation may change in the near future as the importance of operations continues to be highlighted at the Federal level. However, nearly all ITS operations and operational improvements are funded by the State and local agencies using State and local dollars.

7.3 Private Sector Funding

Across the US, including New York State, the private sector and public sector have partnered to deliver ITS. Two key areas have been of interest to the private sector: traveler information and communications infrastructure provision. However, changes in technology, costs, and other market factors have recently stimulated private sector interest in other ITS opportunities, including providing traveler security services. The key for the public sector is to remain open to private sector partnership opportunities as they arise in the future.

Both capital and operations/maintenance funds for ITS must compete with other needs for scarce funding. The best way to acquire and retain project funding is to clearly demonstrate benefits deriving from the investment. Key steps to accomplish this include:

- Ensure that performance is continuously monitored to ensure that benefits are derived.
- Develop means to reduce capital costs to all ITS projects
- Develop means to keep operations costs low.

In summary, a variety of funding sources are available for planning, deployment, and on-going operations of ITS. The Federal sector is a strong source of funds for project deployment and startup. However, the private sector, in partnership with state agencies, is increasingly playing a role in funding projects and this presents unique opportunities for the ITS owner/operator. Creative thinking in securing funding sources, and careful documentation of benefits to retain funding, are keys to successful financial management of ITS

Syracuse Metropolitan Area (Onondaga County)

Intelligent Transportation Systems

Strategic Plan

Draft Technical Memorandum # 2

“Regional Architecture”

Prepared for

New York State Department of Transportation

Syracuse Metropolitan Transportation Council

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Table of Contents

1. Introduction

At present, all state and some local members of the Syracuse Metropolitan Area (SMA) are utilizing ITS. The intent of these systems is to provide better information and services to the traveling public and to provide operations and management of special events, congestion, and incident response. Most of the work is proceeding independently and, to date, there are limited capabilities for sharing available information electronically across jurisdictions in the Syracuse Metropolitan Area

1.1 PROJECT GOALS

The goal of this project is to examine regional ITS application interface alternatives and provide specific actions that could facilitate electronic exchange on National ITS Architecture data elements among Syracuse Metropolitan Area member ITS applications. To that end, an ITS architecture that is in conformance with the United States Department of Transportation's National ITS Architecture has been developed to advance the status of electronic exchange of regional ITS information in this area. This Report documents the processes and provides for a Syracuse Metropolitan Area ITS Architecture as developed by PB Farradyne

1.2 PROJECT OBJECTIVES

Project objectives include the development of a regional architecture, examination of regional ITS application interface, and the development concepts.

- ITS Regional Architecture – The regional architecture defines interconnects and data flows required to facilitate operations and management issues in the Syracuse Metropolitan Area
- Examination of regional ITS application interface alternatives - National ITS Architecture provides a framework of standards and approaches for electronic information exchange. The standards requirements of the National Architecture will provide a starting point in defining the standards to be used in the Syracuse Metropolitan Area Regional Architecture. As the architecture is defined, the standards based electronic information

exchange will be applied to ensure that all participants are aware of the targeted framework for planning, defining and integrating their individual applications.

1.3 PROJECT AREA AND JURISDICTIONS

As shown in Figure 1, the regional architecture focus has been on larger agencies with known ITS programs and on-going initiatives. The project area focus is the SMA region. Participating jurisdictions involved in the development of the regional architecture include:

- City of Syracuse
- Onondaga County
- New York State

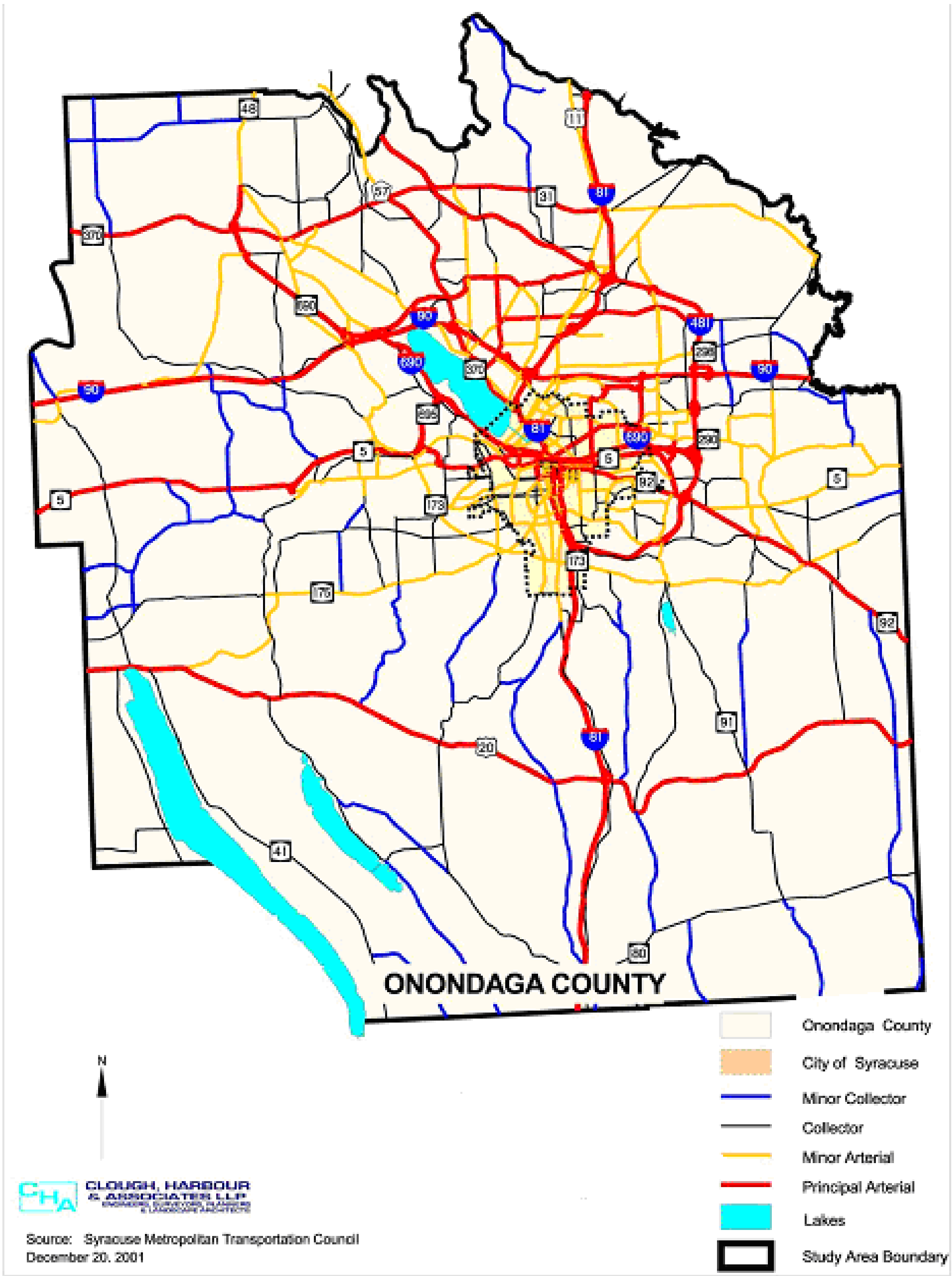


Figure 1 Onondaga County

1.4 FORMAT OF THIS REPORT

Following this introductory section, the document is comprised of four additional sections. Section 2 – Background, defines “architecture” and associated terminology, discusses the regional operations and stakeholders. The National ITS Architecture is also addressed. Section 3 – Development of Architectures, discusses the procedure of how to build the ITS Architecture. Section 4 – Introduction SMA ITS Architecture discusses the analysis and recommendations of SMA Regional Architecture. Section 5 – Standards to Consider addresses the fundamental to the establishment of nationally compatible and interoperable ITS deployments. A conceptual architecture for the Syracuse metropolitan area, and associated implementation considerations, are also presented in this final section.

2. Background

ITS Architecture definition and associated terminology, Architecture Rule and Conformity is discussed in this section.

2.1 ARCHITECTURE DEFINITION

In the context of ITS, an “architecture” describes what a system does and, from a high-level perspective, how it does it. It provides the overall framework for system design and deployment; identifying the functions and operations to be performed, the basic subsystems and elements that make up the system and what functions each performs, and the flows of information between these components. In essence, an ITS architecture defines how system elements interact and work together to achieve system goals. From a regional perspective, an ITS architecture is concerned with what types of information are exchanged between transportation agencies and their respective transportation management systems and centers, how the center-to-center connections are accomplished, and the additional functionality this integrated information provides to users (e.g., travelers, system operators, transportation managers, information service providers).

National ITS Architecture - The National ITS Architecture provides a common framework for planning, defining, and integrating intelligent transportation systems. That framework consists of the following:

> **Systems/Subsystems** – Subsystems describe parts of the physical world and include traffic management centers, vehicles, roadside field equipment, and other physical property. The National ITS architecture defines 21 subsystems that correspond to four larger classes: Centers, Vehicles, Roadside and Travelers. Figure 2, below shows how the subsystems are grouped and connected in the National ITS Architecture.

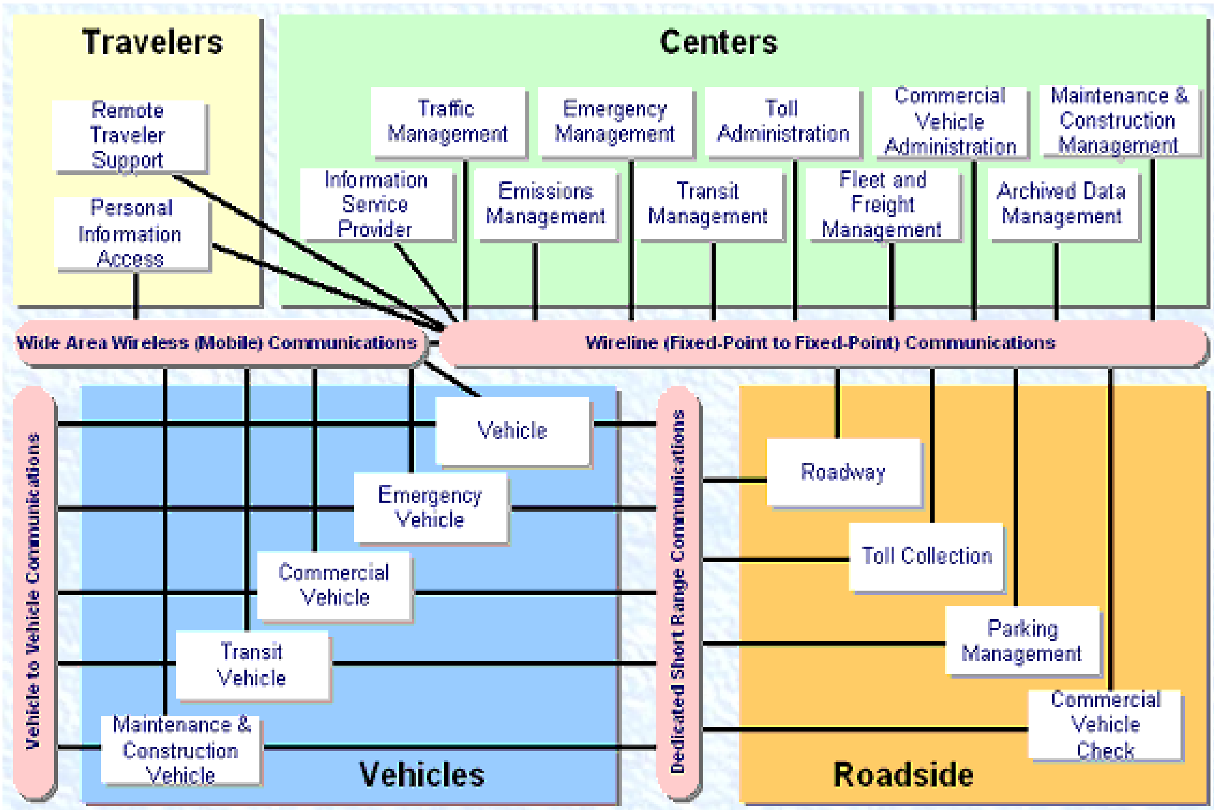


Figure 2 National ITS Architecture - Physical Architecture

For example, City of Syracuse DPW, when described in the terms in the National ITS Architecture, consists of six subsystems:

- Traffic Management. Syracuse DPW processes data to manage traffic on the road network system.
- Information Service Provider. The National ITS Architecture describes this subsystem as providing traveler information and alerts via telephone, Internet and other means.
- Archived Data Management. Syracuse DPW stores traffic volume, speed and occupancy data, as well as some data on incidents.
- Emergency Management
- Maintenance and Construction Management.
- Parking Management.

Interconnects – Interconnects are communication links between subsystems, which enable data flows between the subsystems. As shown in Figure 2, there are four types of communications interconnections used between subsystems; wire line, wide area wireless, dedicated short range, and vehicle-to-vehicle. These are the most typical media used for the communications links between the subsystems shown in the National ITS Architecture. However, these links can be modified to reflect actual conditions in a particular region. For example, some of the communications from the field devices (roadway subsystem) to the Syracuse DPW (traffic management subsystem) may be accomplished wirelessly or via wire line media such as fiber optic cable.

The National ITS Architecture is not a system design nor is it a design concept. it does define the framework around which multiple design approaches can be developed, each one specifically tailored to meet the individual needs of the user.

Within each subsystem, the architecture defines the functions (e.g., gather traffic information, or a traveler requests for transit route information) provided, depicts all of the communications necessary to transfer information and data among transportation entities, traveler information and emergency service providers, and other service providers such as towing and recovery and identifies the information flows between the physical subsystems that contribute to accomplishment of the function. The information flows are defined as architecture flows:

Architecture Flows – Architecture flows (often referred to as data flows) detail the type of information that is communicated between subsystems. For instance, *traffic image* is an architecture flow that may occur between the Roadway Subsystem and the Traffic Management Subsystem. An interconnection between subsystems may be comprised of one or more architecture flows.

The architecture defines these flows in terms of the connections between the equipment required to provide the service and the subsystem that collects and/or processes the data. This set of equipment and data flows are called equipment packages. Within each subsystem, several equipment packages may be needed. The National ITS Architecture defines market packages as typical groups of equipment packages used to accomplish particular groups of functions.

Market Packages - Market packages consist of physical equipment needed to deliver a given transportation service and the data flows that connect them with other important external systems. In other words, they identify the pieces of the physical architecture required to implement a particular transportation service. Market packages are alternative groupings of ITS subsystems that support diverse ITS implementations. Market packages address specific sets of users, service levels, regional needs, and incremental deployment scenarios. A market package provides an accessible, deployment-oriented perspective to the national ITS architecture. Each package is tailored to address, separately or in combination, real world transportation problems and needs.

Equipment Packages – Equipment packages was used in the National ITS Architecture development effort to group like functions (P-specs) of a particular subsystem together into an "implementable" package of hardware and software capabilities.

Each subsystem can have architecture flows directed to/from it to accomplish the functions required. The sum of those flows is called an interface:

Interface – An interface is a description of the connection to a subsystem defining the architecture flows to and from the subsystem. The architecture interface specifications determine the nature of the communications links needed between subsystems, which gives the technical community the data they need to develop meaningful communication standards for these interconnections/interfaces.

Standards - Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics for the interchange of data. A broad array of ITS standards are currently under development that will specifically define the interfaces identified in the National ITS Architecture. Although no standards have been officially adopted by the USDOT to date, it is believed that standards will be adopted in the future. Once adopted, federally funded ITS projects will be required to use standards. Standards are identified in the SMA Regional ITS Architecture to prepare the region for their future adoption by USDOT. Some standards are reasonably mature, and should be considered for application to ITS projects today. Others are only beginning development, and should not be considered for use today. The Regional ITS Plan describes the standards that should be considered by implementers in the SMA region for use today.

The SMA Regional ITS Architecture was developed within the framework of the National ITS Architecture, as described above. The SMA Regional ITS Architecture tailors the National ITS

Architecture to meet the SMA region's needs and plans for subsystems, data flows and interfaces.

2.2 STAKEHOLDERS & ELEMENTS

Table 1 summarizes and provides a brief description of the stakeholders represented in the Syracuse Metropolitan Area ITS Architecture.

Table 1 Syracuse Metropolitan Area ITS Architecture Stakeholder

Syracuse Metropolitan Area ITS Architecture Stakeholder	Syracuse Metropolitan Area ITS Architecture Stakeholder Description
Syracuse Metropolitan Transportation Council (SMTC)	Regional Transportation Planning Agency-- Local MPO district
Onondaga County 911 Emergency Communications (ECD)	County Emergency Dispatch Center
Central New York Regional Transportation Authority (CNYRTA)	Regional Transit Agency
New York State Police	State Police Authority responsible for law enforcement along the state freeway corridors.
Onondaga County Dept. of Transportation	County agency responsible for transportation operations in the study area
Onondaga County Sheriff	County Sheriff Enforcement
City of Syracuse Dept. of Public Works	City agency responsible for design, development and implementation of public welfare projects. This constitutes the field devices such as parking meters, Cameras, Detectors, etc.
City of Syracuse Police Department	City of Syracuse Law enforcement agency.
Onondaga County Emergency Management Division (EMD)	County Emergency Management Agency that operates only during declared emergencies.
NYSDOT Region 3 Operations Center	State DOT's Central Command
Traveler PC/Info. Appliance	General population's electronic data used for information access
Financial Institutions	Regional toll collection and administration (parking fee management, etc)
City of Syracuse Fire Department	Local Fire Department
Local Transit Vehicles	CENTRO transit vehicles in the study area
Local Media	Newspapers, Radio and Television Stations
Pedestrian	Public pedestrian/bicyclist
City of Syracuse Fire Vehicles	Local Fire Service - response vehicles
City of Syracuse Police Vehicles	Local Police Response Vehicles
NYSDOT Region 3 Field Equipment	Field Equipment to monitor maintenance and operating conditions. Includes Scales and Inspection Facilities.
NYSTA Traffic Operations Center	Traffic Management Division
NYSTA Field Equipment	Field Data Collection sensors and other equipment such as scales and weigh-in-motion.

NYSTA Maintenance and Supervisory Vehicles	Vehicles providing supervision and maintenance .. ITS and Non-ITS functions such as snow removal.
NYSTA Statewide Operations Center Troop T Dispatch	This statewide operations center element dispatches all emergency services for the Thruway (exclusively for NYSTA) including Troop of the NY State Police.
NYSDOT Region 3 Maintenance and Supervisory Vehicles	State DOT vehicles responding to maintenance and supervisory missions. Both ITS and Non-ITS activities are included.
EZPASS TAG	EZ Pass Tags used for Automatic Toll Collection.
City of Syracuse Maintenance Vehicles	Snow Lows and Other supervisory and maintenance vehicles
Onondaga County Maintenance Vehicles	Snow Plows and Other maintenance/supervisory vehicles owned by the county.
Metropolitan Transportation Communication Network (METCON)	This will be the regional server for all the local agencies (including NYSDOT R3 and NYSTA Division Office) to exchange their information.
City of Syracuse Field Equipment	Field Equipment such as Traffic Cameras, Detectors, Traffic Signals, etc.
Onondaga County DOT Field Equipment	County Field Equipment includes traffic control devices such as traffic signals, detectors, roadway sensors, VMS, HAR, etc..
NYSTA State Police Troop T Vehicles	NYSTA police force exclusively operated on thruway right of ways.
Syracuse Regional Emergency Network (SyREN)	A regional Emergency Communication network that collects and distributes emergency related information.
NYSDOT Region 3	NYSDOT Region 3 Non-Operational Functions - Planning, Design, Traffic Safety.
Other Fire Vehicles (excluding the city fire vehicles)	This element includes all fire Vehicles located outside the city limits.
Onondaga County Sheriff (Police) Vehicles	County Police vehicle
New York State Police (Troop D) Vehicles	NY State Police vehicles that are operated on the State Highway Networks. This entity EXCLUDES the exclusive operations on Thruway facilities by Troop T.
Other EMS Dispatch	Ambulance Dispatch Services
Other EMS Vehicles	Ambulance vehicles...

2.3 FINAL ARCHITECTURE RULE AND CONFORMITY

On January 8, 2001, the FWHA rule and FTA policy on ITS Architecture and Standards were published to implement section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21). The final rule/policy requires that:

- Regions currently implementing ITS projects must have a regional ITS architecture in place in four years.
- ITS projects funded by the Highway Trust Fund and the Mass Transit Account must conform to a regional ITS architecture.

- Major ITS projects should move forward based on a project level architecture that clearly reflects consistency with the National ITS architecture. A major ITS Project is any ITS project that impacts regional integration or national interoperability.
- Projects must use USDOT adopted ITS standards as appropriate. To date, the USDOT has not adopted any ITS standards, and a formal rulemaking process will precede any USDOT ITS standard adoption. The proposed rule does not require replacement of existing systems or equipment. Applicable ITS standards would be used as new features and system upgrades are planned with the use of the National ITS Architecture.

The final rule on the ITS Architecture and Standards requires the development of a local implementation of the National ITS Architecture referred to as a regional ITS Architecture. The regional ITS architecture should be tailored to meet local needs, meaning that it does not need to address the entire National ITS Architecture.

The regional ITS architecture shall contain a description of the region; identification of the participating agencies and other stakeholders; the roles and responsibilities of the participating agencies and other stakeholders; any agreements (existing or new) needed for operations, including at a minimum those affecting ITS project interoperability; system functional requirements; interface requirements and information exchanges with planned and existing systems; identification of applicable standards; and the sequence of projects necessary for implementation. Any changes made in a project design that impacts the regional ITS architecture shall be identified and the appropriate revisions made and agreed to in the regional ITS architecture.

Any region that is currently implementing ITS projects shall have a regional ITS architecture by April 8, 2005. In this context, a region is a geographic area that is based on local needs for sharing information and coordinating operational strategies among multiple projects. A region can be specified at a metropolitan, statewide, multi-state, or corridor level. Within a metropolitan area, the metropolitan planning area should be the minimum area that is considered when establishing the boundaries of a region for purposes of developing a regional ITS architecture.

2.4 ROLE OF SMA ARCHITECTURE WORKING GROUP

SMA Architecture Working Group is comprised of representatives from NYDOT Region 3, NYSDOT Main Office and FHWA in addition to the study team. The Steering Committee (SC) is comprised of representatives of all key agencies that are responsible for the implementation of ITS in the Syracuse Metropolitan area. The committee advises on architecture issues. As such, the committee has been tasked with overseeing the development of the Syracuse Metropolitan Architecture.

The committee provided critical guidance and direction in the development of the regional architecture, and reviewed and approved deliverables and content that went into the development of the architecture. Several meetings were held with the committee between 2001 and July 2002. Key issues discussed and agreed upon at these meetings include:

- Turbo Architecture, a software package that supports development of regional and project ITS architectures using the National ITS Architecture as a starting point, was used in developing the Syracuse Metropolitan Area ITS Architecture.
- Interviews were re-instituted as identified in the original work plan and conducted with targeted agencies / stakeholder groups to obtain additional information, priorities, and input for use in validating the regional architecture
- The regional architecture will be a “living document” requiring on-going update and maintenance. Furthermore, a sequence of projects required for implementation and a process whereby changes made in a project’s design that impacts the regional architecture must be identified by January 8, 2005 in order to achieve full conformity with the Final Architecture Rule.
- Reviewed and commented upon proposed subsystems, market packages, interconnects and data flows in the regional architecture
- The regional architecture will reflect current and planned architecture flows defined by stakeholders

3. Development of Architecture

The Syracuse Metropolitan Area ITS Architecture was developed using the following process:

- A number of reports and documents were reviewed to identify existing and planned ITS for the purpose of identifying ITS subsystems
- ITS Market Packages that support the subsystems were identified
- Subsystems and market packages were programmed into the Turbo Architecture software package to develop a Strawman Architecture. The Strawman Architecture represents an initial draft of the regional architecture and identifies interconnects and architecture flows required to facilitate the subsystem processes among stakeholders.
- The Strawman Architecture was reviewed, revised and validated by reaching out to targeted stakeholders and working closely with the Syracuse Metropolitan Area ITS Architecture teams.

3.1 IDENTIFICATIONS OF SUBSYSTEMS

In the context of the National ITS Architecture, the physical architecture provides stakeholders with a physical representation via a high-level structure (though not a detailed design) of important ITS interfaces and major system components.

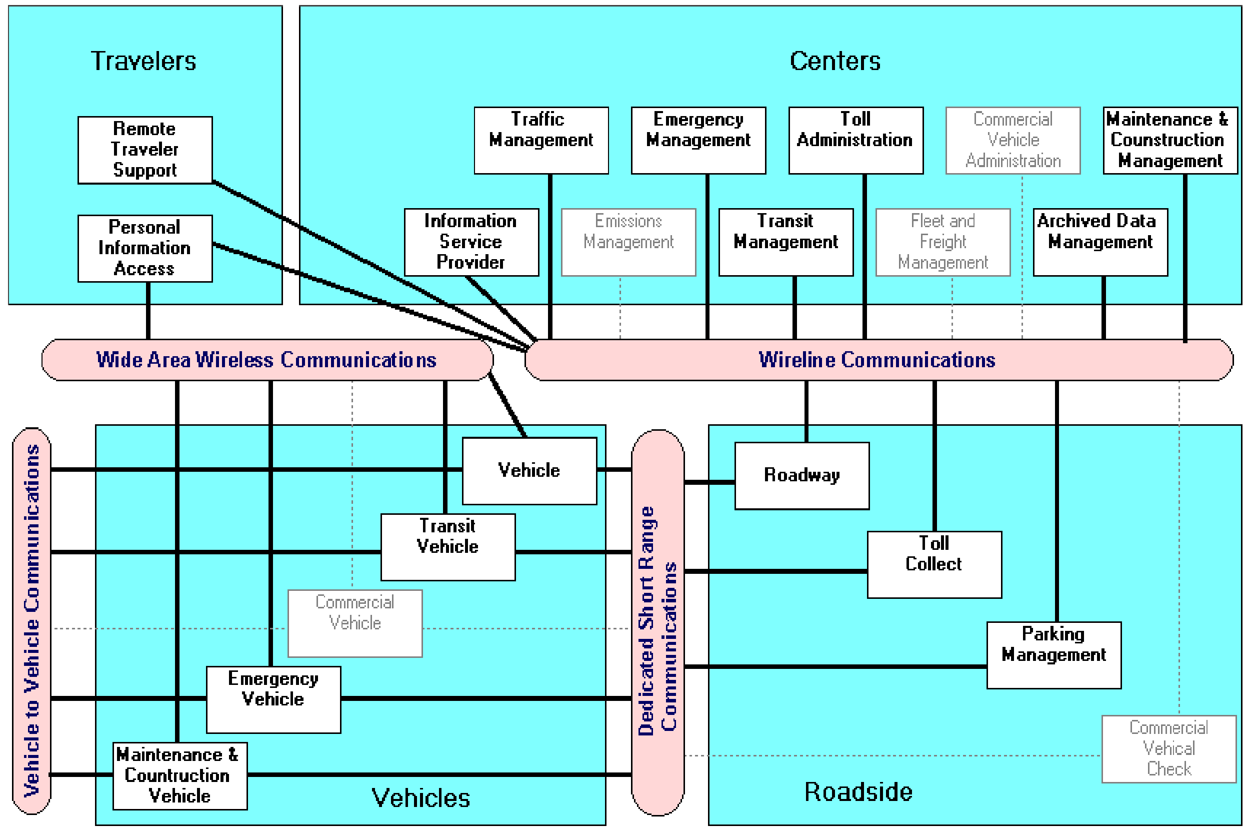


Figure 3 Principal Elements in the Physical Architecture

As shown in Figure 3, the principal elements in the physical architecture are the 21 subsystems and architecture flows that connect these subsystems, as well as 30 external terminators, into an overall structure. The 16 subsystems contained in the Syracuse Metropolitan Area ITS Architecture are highlighted for reference.

Table 2 assigns these 16 subsystems and 30 terminators to each of the Syracuse Metropolitan Area ITS Architecture stakeholders. Definitions of the 16 subsystems and 30 terminators are set forth in Appendix A.

Table 2 Syracuse Metropolitan ITS Architecture Physical Entity – Stakeholder Traceability

Subsystem/Terminator	Stakeholder
Archived Data Administrator	
	NYSDOT Region 3
Archived Data Management Subsystem	
	City of Syracuse Dept. of Public Works
	City of Syracuse Police Department
	Central New York Regional Transportation Authority (CNYRTA)
	Syracuse Metropolitan Transportation Council (SMTC)
	NYSDOT Region 3 Operations Center
	NYSDOT Region 3
	NYSTA Traffic Operations Center
	Onondaga County Sheriff
	Onondaga County Dept. of Transportation
	Metropolitan Transportation Communication Network (METCON)
Archived Data User Systems	
	Central New York Regional Transportation Authority (CNYRTA)
	Onondaga County 911 Emergency Communications (ECD)
	Syracuse Metropolitan Transportation Council (SMTC)
	NYSDOT Region 3
	NYSTA Traffic Operations Center
Emergency Management	
	City of Syracuse Fire Department
	City of Syracuse Dept. of Public Works
	City of Syracuse Police Department
	Onondaga County 911 Emergency Communications (ECD)
	NYSDOT Region 3 Operations Center
	New York State Police
	NYSTA Statewide Operations Center Troop T Dispatch
	NYSTA Traffic Operations Center
	Onondaga County Dept. of Transportation
	Onondaga County Emergency Management Division (EMD)
	Onondaga County Sheriff

	Other EMS Dispatch Syracuse Regional Emergency Network (SyREN) Metropolitan Transportation Communication Network (METCON)
Emergency Personnel	
	City of Syracuse Police Department Onondaga County 911 Emergency Communications (ECD) New York State Police Onondaga County Sheriff
Emergency System Operator	
	Onondaga County 911 Emergency Communications (ECD) New York State Police
Emergency Telecommunications System	
	City of Syracuse Police Department Onondaga County 911 Emergency Communications (ECD) Syracuse Regional Emergency Network (SyREN)
Emergency Vehicle Subsystem	
	City of Syracuse Fire Vehicles City of Syracuse Police Vehicles Other Fire Vehicles (excluding the city fire vehicles) New York State Police (Troop D) Vehicles New York State Police NYSTA State Police Troop T Vehicles Onondaga County Sheriff (Police) Vehicles Other EMS Vehicles
Emissions Management	
	Metropolitan Transportation Communication Network (METCON)
Enforcement Agency	
	City of Syracuse Police Department City of Syracuse Fire Department New York State Police NYSTA Statewide Operations Center Troop T Dispatch Onondaga County Sheriff

Financial Institutions	Financial Institutions
Government Reporting Systems	Syracuse Metropolitan Transportation Council (SMTC)
Information Service Provider	City of Syracuse Dept. of Public Works Syracuse Metropolitan Transportation Council (SMTC) NYSDOT Region 3 Operations Center NYSTA Traffic Operations Center Onondaga County Dept. of Transportation Metropolitan Transportation Communication Network (METCON)
Location Data Source	NYSDOT Region 3 Maintenance and Supervisory Vehicles NYSTA Maintenance and Supervisory Vehicles Onondaga County Maintenance Vehicles
Maintenance and Construction Management	City of Syracuse Dept. of Public Works NYSDOT Region 3 Operations Center NYSTA Traffic Operations Center Onondaga County Dept. of Transportation Metropolitan Transportation Communication Network (METCON)
Maintenance and Construction Vehicle	NYSDOT Region 3 Maintenance and Supervisory Vehicles City of Syracuse Maintenance Vehicles NYSTA Maintenance and Supervisory Vehicles Onondaga County Maintenance Vehicles
Map Update Provider	Syracuse Metropolitan Transportation Council (SMTC)
Media	Local Media
Multimodal Crossings	Syracuse Metropolitan Transportation Council (SMTC)

Multimodal Transportation Service Provider	
	Onondaga County Dept. of Transportation
Other Archives	
	City of Syracuse Police Department
	City of Syracuse Dept. of Public Works
	Central New York Regional Transportation Authority (CNYRTA)
	Syracuse Metropolitan Transportation Council (SMTC)
	NYSDOT Region 3 Operations Center
	NYSDOT Region 3
	Onondaga County Dept. of Transportation
	Onondaga County Sheriff
	Metropolitan Transportation Communication Network (METCON)
Other EM	
	City of Syracuse Dept. of Public Works
	City of Syracuse Fire Department
	City of Syracuse Police Department
	Onondaga County 911 Emergency Communications (ECD)
	NYSDOT Region 3 Operations Center
	New York State Police
	NYSTA Statewide Operations Center Troop T Dispatch
	Onondaga County Emergency Management Division (EMD)
	Onondaga County Dept. of Transportation
	Onondaga County Sheriff
	Other EMS Dispatch
	Syracuse Regional Emergency Network (SyREN)
	Metropolitan Transportation Communication Network (METCON)
Other ISP	
	City of Syracuse Dept. of Public Works
	Syracuse Metropolitan Transportation Council (SMTC)
	NYSDOT Region 3 Operations Center
	Onondaga County Dept. of Transportation
	Metropolitan Transportation Communication Network (METCON)

Other Parking	
	Metropolitan Transportation Communication Network (METCON)
Other TM	
	City of Syracuse Dept. of Public Works
	NYSDOT Region 3 Operations Center
	Onondaga County Dept. of Transportation
	Metropolitan Transportation Communication Network (METCON)
Other TRM	
	Central New York Regional Transportation Authority (CNYRTA)
	Metropolitan Transportation Communication Network (METCON)
Other Vehicle	
	EZPASS TAG
Parking Management	
	City of Syracuse Dept. of Public Works
	Metropolitan Transportation Communication Network (METCON)
Payment Instrument	
	NYSTA Field Equipment
Pedestrians	
	Pedestrian
Personal Information Access	
	Traveler PC/Info. Appliance
Remote Traveler Support	
	City of Syracuse Field Equipment
	NYSDOT Region 3 Field Equipment
	NYSTA Field Equipment
	Onondaga County DOT Field Equipment
	Traveler PC/Info. Appliance
Roadway Environment	
	NYSTA Field Equipment
Roadway Subsystem	
	City of Syracuse Field Equipment
	NYSDOT Region 3 Field Equipment
	NYSTA Field Equipment
	Onondaga County DOT Field Equipment

Toll Administration	
	NYSTA Traffic Operations Center
	Metropolitan Transportation Communication Network (METCON)
Toll Administrator	
	NYSTA Traffic Operations Center
Toll Collection	
	NYSTA Field Equipment
Traffic Management	
	City of Syracuse Dept. of Public Works
	NYSDOT Region 3 Operations Center
	NYSTA Traffic Operations Center
	Onondaga County Dept. of Transportation
	Metropolitan Transportation Communication Network (METCON)
Traffic Operations Personnel	
	NYSDOT Region 3 Operations Center
Transit Maintenance Personnel	
	Central New York Regional Transportation Authority (CNYRTA)
Transit Management	
	Central New York Regional Transportation Authority (CNYRTA)
	Metropolitan Transportation Communication Network (METCON)
Transit System Operators	
	Central New York Regional Transportation Authority (CNYRTA)
Transit User	
	Pedestrian
Transit Vehicle Subsystem	
	Local Transit Vehicles
Traveler	
	Pedestrian
Vehicle	
	EZPASS TAG
Weather Service	
	NYSDOT Region 3 Operations Center

3.2 IDENTIFICATION OF MARKET PACKAGES

Market Packages provide an accessible, deployment oriented perspective to the National ITS Architecture. They are tailored to fit, separately or in combination, real world transportation problems and needs. Market packages collect together one or more subsystem processes that must work together to deliver a given transportation service and the architecture flows that connect them and other important external systems. In short, market packages identify the pieces of the physical architecture that are required to implement subsystems.

33 of the 63 market packages set forth in the National ITS Architecture have been included in the Syracuse Metropolitan Area ITS Architecture. (The remaining 30 market packages support and facilitate the other seven subsystems not included in the regional architecture). Appendix C traces each of the 33 market packages to the 16 subsystems/30 terminators and Syracuse Metropolitan Area ITS stakeholders market packages have been further broken out to reflect their existing or planned nature. Please refer Technical Memo # 1 for the Definitions of the 33 market packages.

3.3 IDENTIFICATION OF INTERCONNECTS

In the context of the National ITS Architecture, interconnects represent communication transfers between stakeholders required to implement one or more subsystem processes. To that end, the Turbo Architecture software package is an ideal tool to quickly identify the various combinations of interconnects between the 16 subsystems and 38 stakeholders in the Syracuse Metropolitan Area ITS Architecture as it automatically identifies the desired interconnects based upon the programmed subsystems and market packages.

The software, however, also automatically assumes many things. For example, the Syracuse Metropolitan Area ITS Architecture contains 5 stakeholders that support the traffic management subsystem and as such, the Turbo Architecture assumes 16 interconnects (each stakeholder is assumed to be connected to the other 4 stakeholders). In reality, however, an interconnect between the City of Syracuse, NYSDOT Region 3 and the NYSTA is not required by either stakeholder since METCON , introduced in Syracuse Metropolitan Area ITS Architecture, functions like the information center to collect and distribute the information with each of the participated stakeholders directly. As such, the interconnects have been customized to reflect the realities of the region.

Appendix C summarizes Syracuse Metropolitan Area ITS Architecture interconnects for each of the 38 stakeholders. The Appendix also notes which of the 16 subsystems/30 terminators are facilitated by the interconnects.

3.4 IDENTIFICATION OF ARCHITECTURE FLOWS

In the context of the National ITS Architecture, architecture flows represent information that is exchanged between subsystems and terminators in the physical architecture. The architecture flows and their communication requirements define the interfaces which form the basis for much of the ongoing standards work in the ITS program. More importantly, identification of the Syracuse Metropolitan Area ITS Architecture flows is an essential element to successfully fulfilling the last two objectives of this project -- examination of regional ITS application interfaces alternatives and the development of a proof of concept.

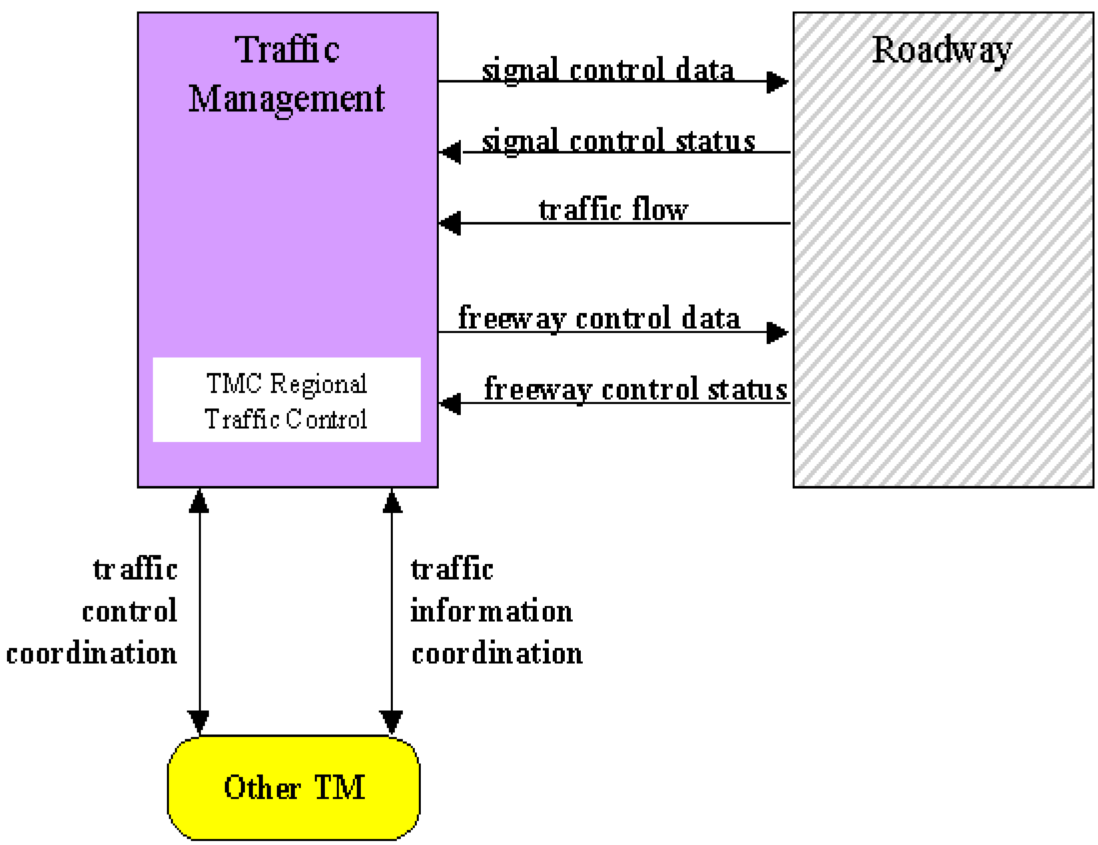


Figure 4 Regional Traffic Control Market Package

The Regional Traffic Control market package is mapped in Figure 4. The figure shows the relevant portions of the National ITS Architecture for this market package, including relevant architecture subsystems (Traffic Management and Roadway), equipment packages (TMC Regional Traffic Control), system terminators (Other Traffic Management Centers) and architecture flows that are the most important to the operation of the market package (signal control data, traffic control information, etc.). The figure clearly shows that the architecture flows for traffic control coordination and traffic information coordination architecture flows are required to facilitate regional traffic control between two traffic management centers. As such, these two architecture flows are included in the regional architecture as they support the Traffic Management Subsystem function that many stakeholders require.

177 of the 331 architecture flows (including 22 defined flows to represent the construction and maintenance) in the National ITS Architecture are contained in the Syracuse Metropolitan Area ITS Architecture. (The remaining 154 architecture flows support and facilitate the subsystems not included in the regional architecture, or they do not reflect the realities of the region). Definitions of the 177 architecture flows are also set forth in Appendix D. Architecture flows and diagram for each stakeholders are set forth in Appendix E.

4. Syracuse Metropolitan Area (SMA) ITS Architecture

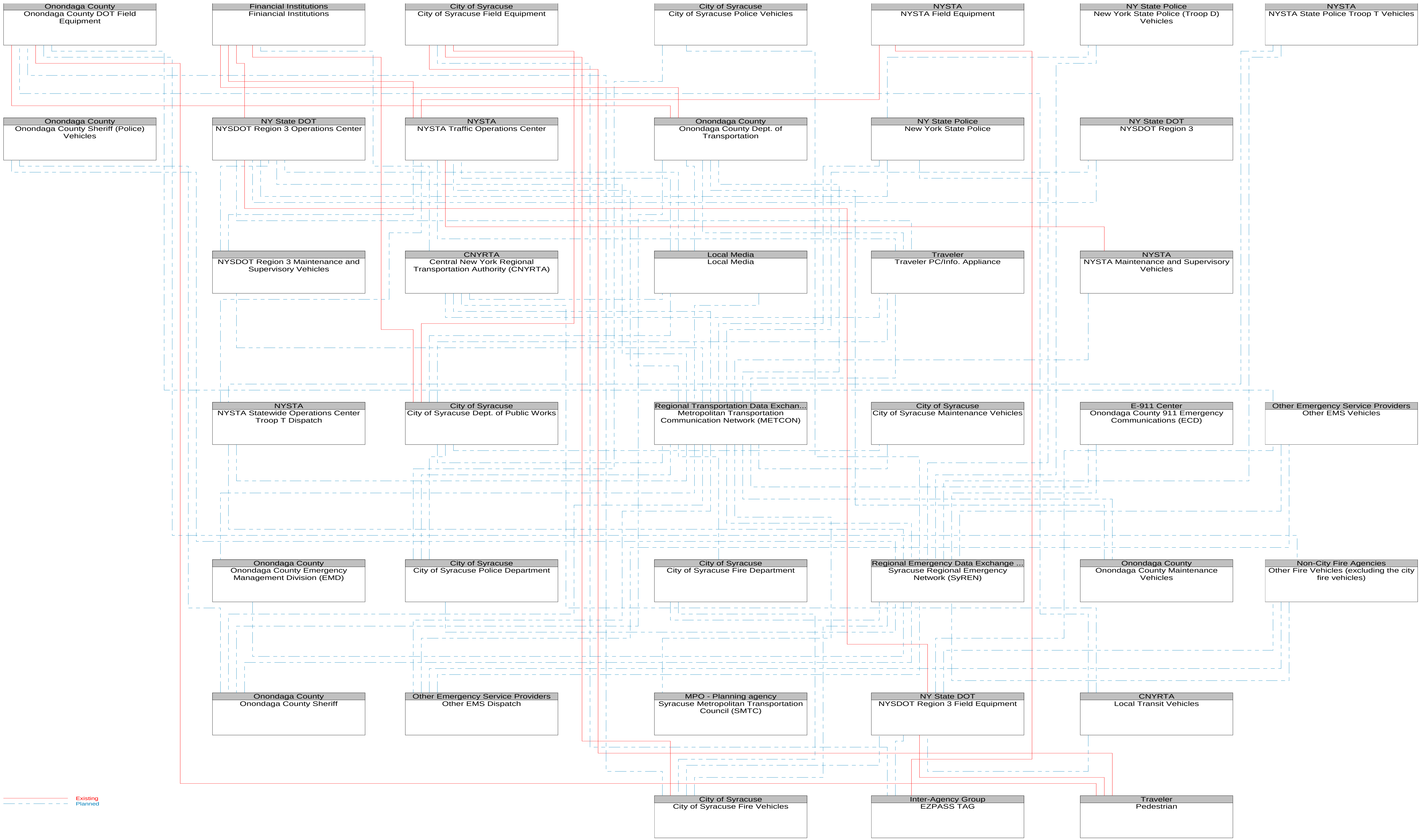
The Syracuse Metropolitan Area ITS Architecture is presented as follows:

- A printout of all existing and planned interconnects between all 38 stakeholders is included on the next page in the report. Existing interconnects assume fiber optic cable or advanced wireless communications media, and exclude the ad hoc use of the telephone, two-way radio, e-mail, facsimile and pagers. Planned interconnects represent potential interconnects between stakeholders that would support the electronic exchange of information. Furthermore, planned interconnects do not imply that resources and funding have been allocated to deploy the interconnects.
- In Appendix C, diagrams illustrating existing and planned interconnects for each of the 38 stakeholders are provided.

4.1 ANALYSIS AND RECOMMENDATIONS

In the context of ITS, an “architecture” describes what a system does and, from a high-level perspective, how it does it. It provides the overall framework for system design and deployment; identifying the functions and operations to be performed, the basic subsystems and elements that make up the system and what functions each performs, and the flows of information between these components. In essence, an ITS architecture defines how system elements interact and work together to achieve system goals. From a regional perspective, an ITS architecture is concerned with what types of information are exchanged between transportation related agencies and their respective transportation management systems and centers, how the center-to-center connections are accomplished, and the additional functionality this integrated information provides to users (e.g., travelers, system operators, transportation managers, information service providers).

The importance of developing and subsequently deploying a regional ITS architecture cannot be overemphasized. The real-time sharing of information between transportation agencies and emergency management agencies and their respective systems promotes interagency coordination and enables an area-wide view of the transportation network. Such synergy between multiple systems is absolutely necessary to achieve the vision of an “efficient, effective, and seamless transportation network throughout the Syracuse metropolitan region. In fact, the definition of the word “synergy” aptly describes the goal of an integrated regional ITS architecture—from the Greek word *“synergos”* (working together), it refers to the interaction of discrete agencies such that the total effect is greater than the sum of the individual effects.


Onondaga County
Onondaga County DOT Field Equipment
Financial Institutions
Finiancial Institutions
City of Syracuse
City of Syracuse Field Equipment
City of Syracuse
City of Syracuse Police Vehicles
NYSTA
NYSTA Field Equipment
NY State Police
New York State Police (Troop D) Vehicles
NYSTA
NYSTA State Police Troop T Vehicles
Onondaga County
Onondaga County Sheriff (Police) Vehicles
NY State DOT
NYSDOT Region 3 Operations Center
NYSTA
NYSTA Traffic Operations Center
Onondaga County
Onondaga County Dept. of Transportation
NY State Police
New York State Police
NY State DOT
NYSDOT Region 3
NYSDOT Region 3 Maintenance and Supervisory Vehicles
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
Local Media
Local Media
Traveler
Traveler PC/Info. Appliance
NYSTA
NYSTA Maintenance and Supervisory Vehicles
NYSTA
NYSTA Statewide Operations Center Troop T Dispatch
City of Syracuse
City of Syracuse Dept. of Public Works
Regional Transportation Data Exchan...
Metropolitan Transportation Communication Network (METCON)
City of Syracuse
City of Syracuse Maintenance Vehicles
E-911 Center
Onondaga County 911 Emergency Communications (ECD)
Other Emergency Service Providers
Other EMS Vehicles
Onondaga County
Onondaga County Emergency Management Division (EMD)
City of Syracuse
City of Syracuse Police Department
City of Syracuse
City of Syracuse Fire Department
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
Onondaga County
Onondaga County Maintenance Vehicles
Non-City Fire Agencies
Other Fire Vehicles (excluding the city fire vehicles)
Onondaga County
Onondaga County Sheriff
Other Emergency Service Providers
Other EMS Dispatch
MPO - Planning agency
Syracuse Metropolitan Transportation Council (SMTC)
NY State DOT
NYSDOT Region 3 Field Equipment
CNYRTA
Local Transit Vehicles
City of Syracuse
City of Syracuse Fire Vehicles
Inter-Agency Group
EZPASS TAG
Traveler
Pedestrian
Existing
Planned

Assumptions Made for Study Purposes

For simplifying the complexities involved in the development of the Regional Architecture some safe assumptions were made. The following are a few of the assumptions that are considered vital for the project.

1. Voice & Data Communication media such as telephone, fax and pagers are excluded from the architecture. This means only electronic communication handled through a computer on a wide area network (WAN) and/or a local area network (LAN) are included in this architecture.

2. Some of the statewide databases and informational networks represented in the Statewide Architecture such as NY State DMV Accident Reporting System are not included in this architecture as they were already addressed in detail in the New York Statewide ITS Architecture developed by NYSDOT and NYSTA. Also excluded in this architecture is the Commercial Vehicle Operation (CVO) issue, since it has been already addressed in the statewide ITS Architecture. If needed for your reference, please refer to the statewide ITS Architecture located on the NYSDOT website.

Development Process

The solutions to handle the provision of a regional network in the Architecture development process were explored. Holding the above-mentioned assumptions along the lines of developing a Regional ITS Architecture, the study team identified a potential solution to address the regional data exchange needs. The solution can be simply described as two independent regional networks, connected to each other handling two different types of data, i.e. Emergency Data (SYREN) and Transportation Related Data (METCON), to achieve a cost-effective and efficient information exchange among the regional stakeholder agencies.

Continued discussions on how to handle the inclusion of such networks pointed to the versatility offered by the Nat'l architecture that presented two different options to resolve the complexity in presenting these Regional Data Exchange Network(s) in SMA Regional Architecture. Option 1 was to consider that as a "Center" that will someday be facilitating the data exchange amongst the regional players. Option 2 was to assume this Network as a "System" that will be inherent and virtually present under the communication layers of National ITS Architecture.

Solutions

In a meeting convened in NYC on April 11-12, the two options were presented to the select group of Steering Committee members from NYSDOT and FHWA to obtain their consensus in selecting one. Option 1 was unanimously selected as it provided a centralized center (network) that collects and dissipates Transportation related information between regional agencies. This is preferred because it provides fewer interconnects eliminating the complexity of establishing a comparatively expensive network that crisscrossed the study area connecting individual agencies to a multitude of other agencies as recommended by Option 2.

Birth of METCON and SYREN Networks

<u>SYREN</u>

Further discussions on the establishment of two such a centralized networks revealed “sensitivity” of certain Emergency/Enforcement related data exchanged among the Regional emergency service providers (State Police, County Sheriff, etc) that are not apt for a network which contains other non-enforcement agencies. It was recommended that the “sensitive” emergency data exchange between emergency service provider be handled through **SY**racuse **R**egional **E**mergency **N**etwork (SYREN).

Theoretically, SYREN will be an integrated network of emergency information that is also connected to all emergency Computer Aided Dispatch systems and ultimately to all emergency vehicles mobile data terminals and will facilitate the exchange of emergency data among agencies. Examples of non-transportation related emergency data are; verification of criminal records, license data, fire incidents in city/county etc, while transportation related emergency data exchanged through SYREN would include transportation incident management/response data that directly impact the regional transportation operation. Summarizing the functions of SYREN, as shown in Figure 5, it will be a network that enables all the regional emergency service providers, located in the centers such as 911 Center or police dispatch central stations and field vehicles such as police cars, to exchange electronic data pertaining to emergency incidents that are of transportation and non-transportation nature.

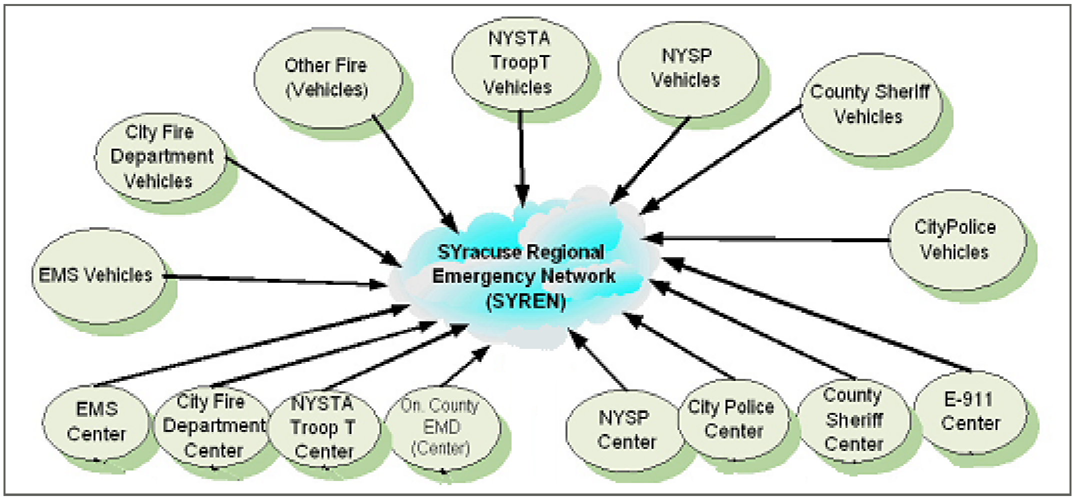


Figure 5 Function Summary of SYREN

METCON

Conceptually similar to that of SYREN, **ME**tropolitan **T**ransportation **CO**mmunication **N**etwork (METCON) will integrate all the regional transportation agencies, including the emergency service providers, and help exchange the transportation related data (including incident management data). The METCON interface at the agency user will be a simple workstation that provides access to regional transportation related information. During the initial stages, METCON will be functionally designed to exchange basic operation information such as each agency's construction and manually inserted incident information, and will later be expanded to include exchange of real-time traffic data such as video images, traffic conditions (detector data), etc. Figure 6 shows a schematic of METCOM.

Once operational, a data interface will be developed between the two networks (SYREN & METCON) to share the needed information. For example, a transportation incident related cellular 911 call will be received at the 911 Center with the approximate location. The entry of such information in to SYREN will either be manual or automated. Once the incident is verified, the information will automatically be transmitted to METCON via the data interface and from there to all other agencies (transportation service providers and others).

At all the Emergency Service Provider centers, there will be two separate workstations for METCON and SYREN where the dispatchers will be able to verify the transportation related incidents reported on one network by using the other workstation. For example, an accident on the highway reported from a cellular call on the scene through SYREN can be verified and magnified by monitoring the video/detector data exchanged through METCON. Thus the reported incident can be confirmed and appropriate response can be initiated from all the needed agencies in the region.

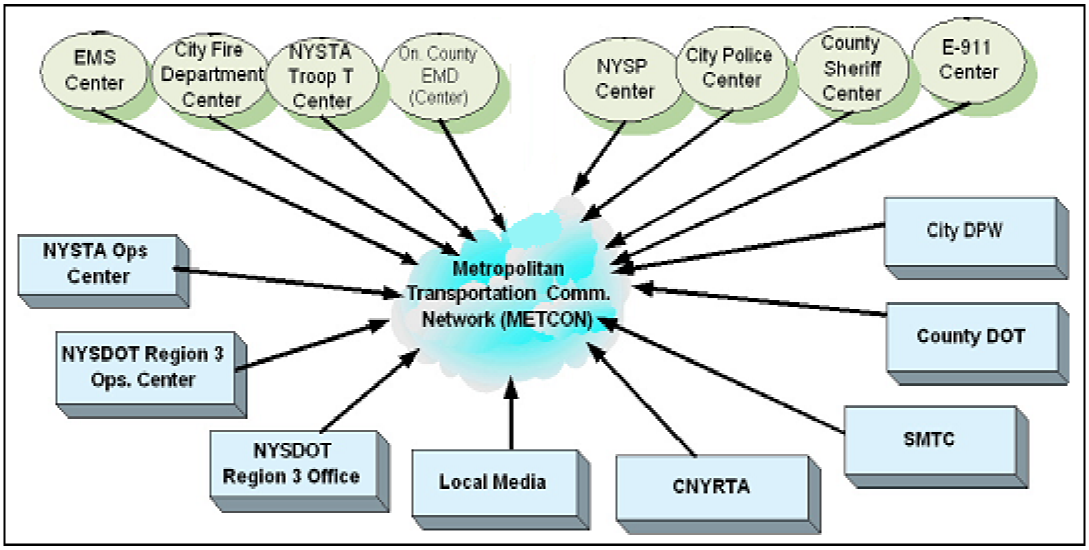


Figure 6 METCON Schematic

METCON workstations will not be available to the field vehicles connected through the SYREN network. Thus the needed information exchanged through METCON will be transmitted to field personnel/vehicles through the SYREN network.

In contrast to SYREN, since the nature of data exchanged though METCON is usually “non-sensitive”, entities such as local media can be linked to METCON to gain access to various information exchanged through this network such as live video feeds from traffic cameras in the region or traffic conditions on the roadways.

Provided below in Figure 7 are the various stakeholder agencies and their grouping under these two networks.

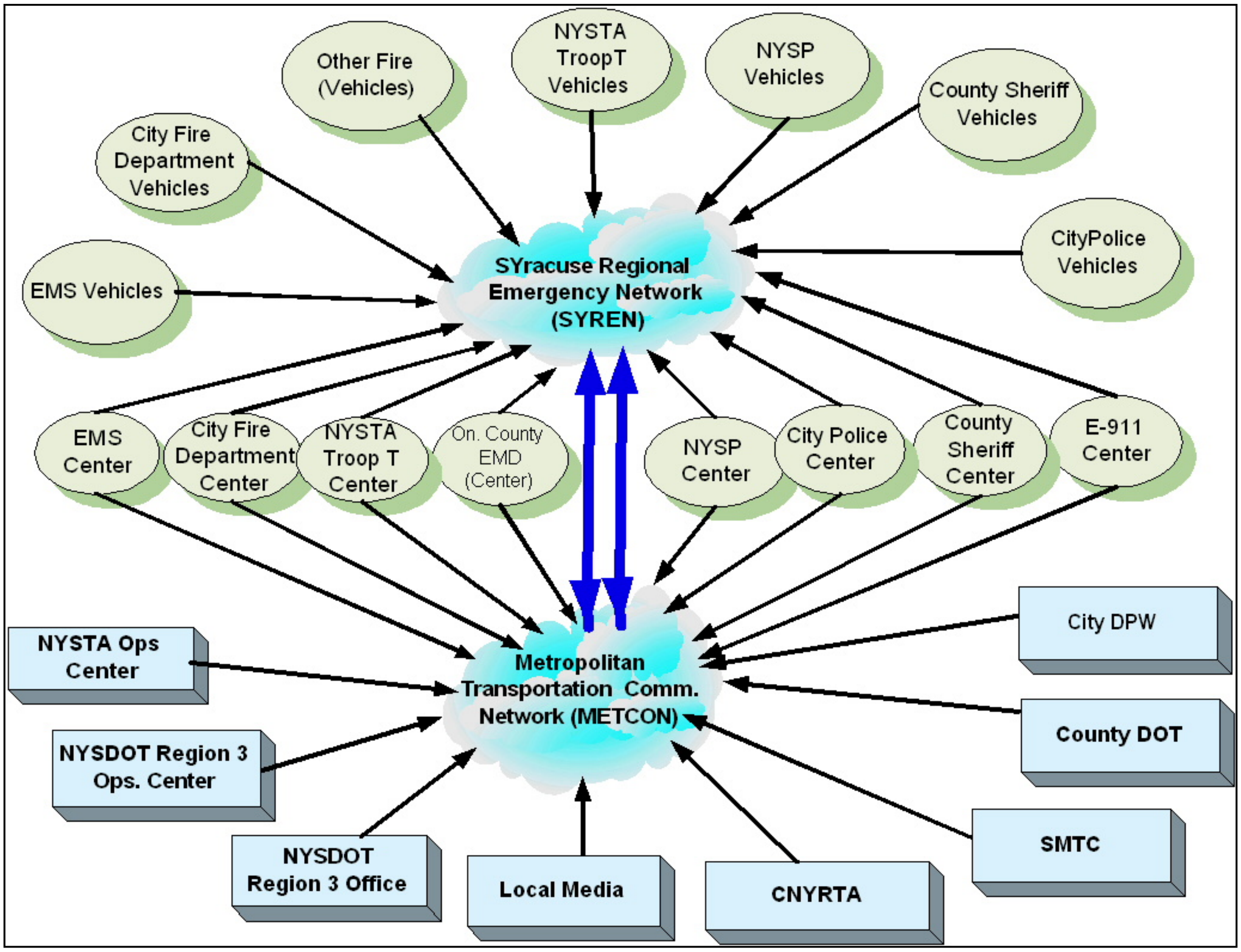


Figure 7 Various Stakeholder Agencies in the Networks

4.2 USE OF ARCHITECTURE

Architecture is a term used by systems engineers to describe and set forth planned interconnects between diverse stakeholders and their computerized systems. Interconnects are defined by the data that flows between the systems. In addition, standards required to ensure that each computerized system can understand and communicate data in a uniform fashion are also included in an ITS architecture.

ITS architectures are important when ITS elements/systems are implemented in an incremental fashion by multiple lead agencies. Computer systems are very difficult to modify once they have been implemented. Extraction of data from a system that is not designed for that purpose can be very costly. It is often less costly to replace an entire system than it is to reconfigure it for specific data extraction. An architecture allows systems to be designed up front to accommodate future connections to other computer systems.

The Syracuse Metropolitan Area ITS Architecture is simply a plan that describes how regional stakeholders can connect their computerized systems, and what types of data will flow across those connections to facilitate functions such as traffic management, transit management, etc. The architecture can be used by stakeholders as follows:

- It allows stakeholders to review and understand what other regional stakeholders have implemented and have planned.
- Stakeholders can refine, prioritize, or re-prioritize their ITS program goals, objectives, and projects as needed.
- The regional architecture provides a guideline and framework for stakeholders who plan to implement ITS regionally
- Identify existing, planned, or new architecture flows required to support specific projects and/or subsystems

5. Standards to Consider

Defined standards are fundamental to the establishment of nationally compatible and interoperable ITS deployments. Standards will enable deployment of consistent, non-interfering, reliable systems on local, regional and national levels. Open standards will further benefit the consumer by enhancing competition for the range of products necessary to implement the ITS user services. Larger markets for specific products will reduce production costs through economy of scale. Producers benefit from standards because they assure a wide market over which the product can be sold.

Standard is the bridge for information sharing and inter-agencies incorporation also. They are categorized into two types of standards in SMA ITS architecture: center-to-center standard and center-to-field standard. This section summarizes the standards need to be implemented in SMA region.

5.1 CENTER-TO-CENTER STANDARDS

NTCIP - Application Profile for File Transfer Protocol (FTP) - AASHTO
Application: ARTIMIS interface with all other centers

NTCIP - Applications Profile for Common Object Request Broker Architecture (CORBA) – AASHTO
Application: ARTIMIS interface with other centers

NTCIP - Applications Profile for Data Exchange ASN.1 (DATEX) – AASHTO
Application: ARTIMIS interface with other centers

NTCIP - Base Standard: Octet Encoding Rules (OER) – AASHTO
Application: ARTIMIS interface with other centers

NTCIP - Data Collection & Monitoring Devices – AASHTO
Application: ARTIMIS interface with other centers

NTCIP - Global Object Definitions – AASHTO
Application: ARTIMIS interface with other centers

NTCIP - Internet (TCP/IP and UDP/IP) Transport Profile - AASHTO
Application: ARTIMIS interface with other centers

NTCIP - Subnetwork Profile for Ethernet – AASHTO
Application: ARTIMIS interface with other centers via Ethernet

Standard for Common Incident Management Message Sets (IMMS) for use by EMCs - IEEE
Application: ARTIMIS interface with Regional Emergency Management Centers

Standard for Functional Level Traffic Management Data Dictionary (TMDD) - ITE
Application: ARTIMIS interface with other centers

Data Radio Channel (DARC) System – EIA/CEA
Application: ARTIMIS interface with News Media

Subcarrier Traffic Information Channel (STIC) System – EIA/CEA
Application: ARTIMIS interface with News Media

Message Set for External TMC Communication (MS/ETMCC) – ITE
Application: ARTIMIS interface with other centers

TCIP - Common Public Transportation (CPT) Business Area Standard – ITE
Application: ARTIMIS interface with Regional Transit Dispatch Center

TCIP - Control Center (CC) Business Area Standard – ITE
Application: ARTIMIS interface with Regional Transit Dispatch Center

TCIP - Incident Management (IM) Business Area Standard – ITE
Application: ARTIMIS interface with Regional Emergency Management Center

TCIP - Spatial Representation (SP) Business Area Standard - ITE

Application: ARTIMIS interface with Regional Transit Dispatch Center

Advanced Traveler Information System (ATIS) Data Dictionary – SAE
Application: ARTIMIS interface with other centers

Advanced Traveler Information System (ATIS) Message Set – SAE
Application: ARTIMIS interface with other centers

On-Board Land Vehicle Mayday Reporting Interface – SAE
Application: Local 911 Dispatch to ARTIMIS

5.2 CENTER-TO-FIELD STANDARDS

NTCIP - Application Profile for Simple Transportation Management Framework (STMF) - AASHTO
Application: ARTIMIS interface with field devices

NTCIP - Application Profile for Trivial File Transfer Protocol – AASHTO
Application: ARTIMIS interface with filed devices

NTCIP - Base Standard: Octet Encoding Rules (OER) – AASHTO
Application: ARTIMIS interface with field devices

NTCIP - Class B Profile – AASHTO
Application: ARTIMIS interface with field devices

NTCIP - Data Collection & Monitoring Devices – AASHTO
Application: ARTIMIS interface with field devices

NTCIP - Data Dictionary for Closed Circuit Television (CCTV) – AASHTO
Application: ARTIMIS interface with roadside video equipment

NTCIP - Global Object Definitions – AASHTO

Application: ARTIMIS interface with field devices

NTCIP - Internet (TCP/IP and UDP/IP) Transport Profile - AASHTO
Application: ARTIMIS interface with field devices

NTCIP - Object Definitions for Actuated Traffic Signal Controller Units
Application: ARTIMIS interface with field controllers

NTCIP - Object Definitions for Dynamic Message Signs – AASHTO
Application: ARTIMIS interface with dynamic message signs

NTCIP - Object Definitions for Environmental Sensor Stations & Roadside Weather Information System – AASHTO
Application: ARTIMIS interface with field weather data collection systems

NTCIP - Object Definitions for Video Switches – AASHTO
Application: ARTIMIS interface with video systems

NTCIP - Point to Multi-Point Protocol Using RS-232 Subnetwork Profile – AASHTO
Application: ARTIMIS interface with field devices

NTCIP - Ramp Meter Controller Objects – AASHTO
Application: ARTIMIS interface with ramp meter devices

NTCIP - Simple Transportation Management Framework (STMF) - AASHTO
Application: ARTIMIS interface with field devices

NTCIP - Simple Transportation Management Protocol (STMP) - AASHTO
Application: ARTIMIS interface with field devices

NTCIP - Subnetwork Profile for Ethernet – AASHTO
Application: ARTIMIS interface with field devices via Ethernet

NTCIP - Subnetwork Profile for Point-to-Point Protocol using RS 232 – AASHTO

Application: ARTIMIS interface with field devices

NTCIP - Transportation System Sensor Objects – AASHTO
Application: ARTIMIS interface with field devices

Standard Specification for DSRC - Data Link Layer – ASTM
Application: ARTIMIS interface with field devices

Standard Specification for DSRC - Physical Layer 902-928 MHz – ASTM
Application: ARTIMIS interface with field devices

APPENDIX A DEFINITION OF SUBSYSTEMS/TERMINATORS

APPENDIX A

Entity	Name	Entity Description
ADMS	Archived Data Management Subsystem	The Archived Data Management Subsystem collects, archives, manages, and distributes data generated from ITS sources for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. The data received is formatted, tagged with attributes that define the data source, conditions under which it was collected, data transformations, and other information (i.e. meta data) necessary to interpret the data. The subsystem can fuse ITS generated data with data from non-ITS sources and other archives to generate information products utilizing data from multiple functional areas, modes, and jurisdictions. The subsystem prepares data products that can serve as inputs to Federal, State, and local data reporting systems. This subsystem may be implemented in many different ways. It may reside within an operational center and provide focused access to a particular agency's data archives. Alternatively, it may operate as a distinct center that collects data from multiple agencies and sources and provides a general data warehouse service for a region.
EM	Emergency Management	The Emergency Management Subsystem operates in various emergency centers supporting public safety including police and fire stations, search and rescue special detachments, and HAZMAT response teams. This subsystem interfaces with other Emergency Management Subsystems to support coordinated emergency response involving multiple agencies. The subsystem creates, stores, and utilizes emergency response plans to facilitate coordinated response. The subsystem tracks and manages emergency vehicle fleets using automated vehicle location technology and two way communications with the vehicle fleet. Real-time traffic information received from the other center subsystems is used to further aide the emergency dispatcher in selecting the emergency vehicle(s) and routes that will provide the most timely response. Interface with the Traffic Management Subsystem allows strategic coordination in tailoring traffic control to support en-route emergency vehicles. Interface with the Transit Management Subsystem allows coordinated use of transit vehicles to facilitate response to major emergencies.

Entity	Name	Entity Description
EVS	Emergency Vehicle Subsystem	This subsystem resides in an emergency vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient emergency response. The Emergency Vehicle Subsystem includes two-way communications to support coordinated response to emergencies in accordance with an associated Emergency Management Subsystem. Emergency vehicles are equipped with automated vehicle location capability for monitoring by vehicle tracking and fleet management functions in the Emergency Management Subsystem. Using these capabilities, the appropriate emergency vehicle to respond to each emergency is determined. Route guidance capabilities within the vehicle enable safe and efficient routing to the emergency. In addition, the emergency vehicle may be equipped to support signal preemption through communications with the roadside subsystem.
ISP	Information Service Provider	This subsystem collects, processes, stores, and disseminates transportation information to system operators and the traveling public. The subsystem can play several different roles in an integrated ITS. In one role, the ISP provides a general data warehousing function, collecting information from transportation system operators and redistributing this information to other system operators in the region and other ISPs. In this information redistribution role, the ISP provides a bridge between the various transportation systems that produce the information and the other ISPs and their subscribers that use the information. The second role of an ISP is focused on delivery of traveler information to subscribers and the public at large. Information provided includes basic advisories, real time traffic condition and transit schedule information, yellow pages information, ridematching information, and parking information. The subsystem also provides the capability to provide specific directions to travelers by receiving origin and destination requests from travelers, generating route plans, and returning the calculated plans to the users. In addition to general route planning for travelers, the ISP also supports specialized route planning for vehicle fleets. In this third role, the ISP function may be dedicated to, or even embedded within, the dispatch system. Reservation services are also provided in advanced implementations. The information is provided to the traveler through the Personal Information Access Subsystem, Remote Traveler Support Subsystem, and various Vehicle Subsystems through available communications links. Both basic one-way (broadcast) and personalized two-way information provision is supported. The subsystem provides the capability for an informational infrastructure to connect providers and consumers, and gather that market information needed to assist in the planning of service improvements and in maintenance of operations.

Entity	Name	Entity Description
MCMS	Maintenance and Construction Management	This entity provides overall maintenance and resource monitoring and allocation functions within the statewide architecture.
MCVS	Maintenance and Construction Vehicle	This entity represents the maintenance vehicles that are dispatched for scheduled and unscheduled maintenance of the highway systems (Both ITS and Non-ITS infrastructure)
PIAS	Personal Information Access	This subsystem provides the capability for travelers to receive formatted traffic advisories from their homes, place of work, major trip generation sites, personal portable devices, and over multiple types of electronic media. These capabilities shall also provide basic routing information and allow users to select those transportation modes that allow them to avoid congestion, or more advanced capabilities to allow users to specify those transportation parameters that are unique to their individual needs and receive travel information. This subsystem shall provide capabilities to receive route planning from the infrastructure at fixed locations such as in their homes, their place of work, and at mobile locations such as from personal portable devices and in the vehicle or perform the route planning process at a mobile information access location. This subsystem shall also provide the capability to initiate a distress signal and cancel a prior issued manual request for help.
PMS	Parking Management	The Parking Management Subsystem provides electronic monitoring and management of parking facilities. It supports a DSRC communications link to the Vehicle Subsystem that allows electronic collection of parking fees. It also includes the instrumentation, signs, and other infrastructure that monitors parking lot usage and provides local information about parking availability and other general parking information. This portion of the subsystem functionality must be located in the parking facility where it can monitor, classify, and share information with customers and their vehicles. The subsystem also interfaces with the financial infrastructure and broadly disseminates parking information to other operational centers in the region. Note that the latter functionality may be located in a back office, remote from the parking facility.

Entity	Name	Entity Description
RS	Roadway Subsystem	This subsystem includes the equipment distributed on and along the roadway which monitors and controls traffic. Equipment includes highway advisory radios, dynamic message signs, cellular call boxes, CCTV cameras and video image processing systems for incident detection and verification, vehicle detectors, traffic signals, grade crossing warning systems, and freeway ramp metering systems. This subsystem also provides the capability for emissions and environmental condition monitoring including weather sensors, pavement icing sensors, fog etc. HOV lane management and reversible lane management functions are also available. In advanced implementations, this subsystem supports automated vehicle safety systems by safely controlling access to and egress from an Automated Highway System through monitoring of, and communications with, AHS vehicles. Intersection collision avoidance functions are provided by determining the probability of a collision in the intersection and sending appropriate warnings and/or control actions to the approaching vehicles.
RTS	Remote Traveler Support	This subsystem provides access to traveler information at transit stations, transit stops, other fixed sites along travel routes, and at major trip generation locations such as special event centers, hotels, office complexes, amusement parks, and theaters. Traveler information access points include kiosks and informational displays supporting varied levels of interaction and information access. At transit stops, simple displays providing schedule information and imminent arrival signals can be provided. This basic information may be extended to include multi-modal information including traffic conditions and transit schedules along with yellow pages information to support mode and route selection at major trip generation sites. Personalized route planning and route guidance information can also be provided based on criteria supplied by the traveler. In addition to traveler information provision, this subsystem also supports public safety monitoring using CCTV cameras or other surveillance equipment and emergency notification within these public areas. Fare card maintenance, and other features which enhance traveler convenience may also be provided at the discretion of the deploying agency.

Entity	Name	Entity Description
TAS	Toll Administration	The Toll Administration Subsystem provides general payment administration capabilities and supports the electronic transfer of authenticated funds from the customer to the transportation system operator. This subsystem supports traveler enrollment and collection of both pre-payment and post-payment transportation fees in coordination with the existing, and evolving financial infrastructure supporting electronic payment transactions. The system may establish and administer escrow accounts depending on the clearinghouse scheme and the type of payments involved. This subsystem posts a transaction to the customer account and generates a bill (for post-payment accounts), debits an escrow account, or interfaces to the financial infrastructure to debit a customer designated account. It supports communications with the Toll Collection Subsystem to support fee collection operations. The subsystem also sets and administers the pricing structures and includes the capability to implement road pricing policies in coordination with the Traffic Management Subsystem. The electronic financial transactions in which this subsystem is an intermediary between the customer and the financial infrastructure shall be cryptographically protected and authenticated to preserve privacy and ensure authenticity and auditability.
TCS	Toll Collection	The Toll Collection Subsystem provides the capability for vehicle operators to pay tolls without stopping their vehicles using locally determined pricing structures and including the capability to implement various variable road pricing policies. Each transaction is accompanied by feedback to the customer which indicates the general status of the customer account. A record of the transactions is provided to the Toll Administration subsystem for reconciliation and so that the customer can periodically receive a detailed record of the transactions.

Entity	Name	Entity Description
TMS	Traffic Management	The Traffic Management Subsystem operates within a traffic management center or other fixed location. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow. Incidents are detected and verified and incident information is provided to the emergency Management Subsystem, travelers (through Roadway Subsystem Highway Advisory Radio and Dynamic Message Signs), and to third party providers. The subsystem supports HOV lane management and coordination, road pricing, and other demand management policies that can alleviate congestion and influence mode selection. The subsystem monitors and manages maintenance work and disseminates maintenance work schedules and road closures. The subsystem also manages reversible lane facilities, and processes probe vehicle information. The subsystem communicates with other Traffic Management Subsystems to coordinate traffic information and control strategies in neighboring jurisdictions. It also coordinates with rail operations to support safer and more efficient highway traffic management at highway-rail intersections. Finally, the Traffic Management Subsystem provides the capabilities to exercise control over those devices utilized for AHS traffic and vehicle control.
TRMS	Transit Management	The transit management subsystem manages transit vehicle fleets and coordinates with other modes and transportation services. It provides operations, maintenance, customer information, planning and management functions for the transit property. It spans distinct central dispatch and garage management systems and supports the spectrum of fixed route, flexible route, and paratransit services. The subsystem's interfaces allow for communication between transit departments and with other operating entities such as emergency response services and traffic management systems. This subsystem receives special event and real-time incident data from the traffic management subsystem. It provides current transit operations data to other center subsystems. The Transit Management Subsystem collects and stores accurate ridership levels and implements corresponding fare structures. It collects operational and maintenance data from transit vehicles, manages vehicle service histories, and assigns drivers and maintenance personnel to vehicles and routes. The Transit Management Subsystem also provides the capability for automated planning and scheduling of public transit operations. It furnishes travelers with real-time travel information, continuously updated schedules, schedule adherence information, transfer options, and transit routes and fares. In addition, the monitoring of key transit locations with both video and audio systems is provided with automatic alerting of operators and police of potential incidents including support for traveler activated alarms.

Entity	Name	Entity Description
TRVS	Transit Vehicle Subsystem	This subsystem resides in a transit vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient movement of passengers. The Transit Vehicle Subsystem collects accurate ridership levels and supports electronic fare collection. An optional traffic signal prioritization function communicates with the roadside subsystem to improve on-schedule performance. Automated vehicle location functions enhance the information available to the Transit Management Subsystem enabling more efficient operations. On-board sensors support transit vehicle maintenance. The Transit Vehicle Subsystem also furnishes travelers with real-time travel information, continuously updated schedules, transfer options, routes, and fares.
VS	Vehicle	This subsystem resides in an automobile and provides the sensory, processing, storage, and communications functions necessary to support efficient, safe, and convenient travel by personal automobile. Information services provide the driver with current travel conditions and the availability of services along the route and at the destination. Both one-way and two-way communications options support a spectrum of information services from low-cost broadcast services to advanced, pay for use personalized information services. Route guidance capabilities assist in formulation of an optimal route and step by step guidance along the travel route. Advanced sensors, processors, enhanced driver interfaces, and actuators complement the driver information services so that, in addition to making informed mode and route selections, the driver travels these routes in a safer and more consistent manner. Initial collision avoidance functions provide “vigilant co-pilot” driver warning capabilities. More advanced functions assume limited control of the vehicle to maintain safe headway. Ultimately, this subsystem supports completely automated vehicle operation through advanced communications with other vehicles in the vicinity and in coordination with supporting infrastructure subsystems. Pre-crash safety systems are deployed and emergency notification messages are issued when unavoidable collisions do occur.
X02	Multimodal Transportation Service Provider	This terminator provides the interface through which Transportation Service Providers can exchange data with ITS. They are the operators of non-roadway transportation systems (e.g. airlines, ferry services, passenger carrying heavy rail) . This two-way interface enables coordination for efficient movement of people across multiple transportation modes. It also enables the traveler to efficiently plan itineraries which include segments using modes not directly included in the ITS User Services.

Entity	Name	Entity Description
X13	Emergency Telecommunications System	This terminator represents the telecommunications systems that connect a caller with a Public Safety Answering Point (PSAP). These systems transparently support priority wireline and wireless caller access to the PSAP through 9-1-1 and other access mechanisms like 7 digit local access numbers, and motorist aid call boxes. The calls are routed to the appropriate PSAP, based on caller location when this information is available. When available, the caller's location and call-back number are also provided to the PSAP by this interface.
X14	Emergency System Operator	This terminator represents the human entity that monitors all ITS emergency requests, (including those from the E911 Operator) and sets up pre-defined responses to be executed by an emergency management system. The operator may also override predefined responses where it is observed that they are not achieving the desired result. This terminator includes dispatchers who manage an emergency fleet (police, fire, ambulance, HAZMAT, etc.) or higher order emergency managers who provide response coordination during emergencies.
X15	Emergency Personnel	This terminator represents personnel that are responsible for police, fire, emergency medical services, towing, and other special response team (e.g., hazardous material clean-up) activities at an incident site. These personnel are associated with the Emergency Vehicle Subsystem during dispatch to the incident site, but often work independently of the Emergency Vehicle Subsystem while providing their incident response services. Emergency personnel may include an Officer in Charge (OIC) and a crew. When managing an incident following standard Incident Command System practices, the on-site emergency personnel form an organizational structure under the auspices of an Incident Commander.
X21	Financial Institution	This terminator represents the organization that handles all electronic fund transfer requests to enable the transfer of funds from the user of the service to the provider of the service. The functions and activities of financial clearinghouses are subsumed by this entity.
X23	Map Update Provider	This terminator represents a third-party developer and provider of digitized map databases used to support ITS services. It supports the provision of the databases that are required exclusively for route guidance (navigable_map) as well as those that are used exclusively for display by operators and at traveler information points, e.g. kiosks (display_map).

Entity	Name	Entity Description
X26	Location Data Source	This terminator represents an external entity which provides accurate position information. External systems which use GPS, terrestrial trilateration, or driver inputs are potential examples. This terminator contains sensors such as radio position receivers (e.g. GPS) and/or dead reckoning sensors (e.g. odometer, differential odometer, magnetic compass, gyro, etc.). This external implies that some additional functionality associated with developing an absolute position is outside the system and will not be directly modeled by the logical or physical architecture representations of the system.
X27	Media	This terminator represents the information systems that provide traffic reports, travel conditions, and other transportation-related news services to the traveling public through radio, TV, and other media. Traffic and travel advisory information that are collected by ITS are provided to this terminator. It is also a source for traffic flow information, incident and special event information, and other events which may have implications for the transportation system.
X29	Multimodal Crossings	This terminator represents the control equipment that interfaces to a non-road based transportation system at an interference crossing with the roadway. The majority of these crossings are railroad grade crossings that are more specifically addressed by the "Wayside Equipment" terminator. This terminator addresses similar interface requirements, but for other specialized intersections like draw bridges at rivers and canals. Like highway-rail intersections, these other multimodal crossings carry traffic that may take priority over the road traffic at the intersection. The data provided will in its basic form be a simple "stop road traffic" indication. However more complex data flows may be provided that give the time at which right-of-way will be required and the duration of that right-of-way requirement.

Entity	Name	Entity Description
X30	Other EM	Representing other Emergency Management centers, systems or subsystems, this terminator provides a source and destination for ITS data flows between various communications centers operated by public safety agencies as well as centers operated by other allied agencies and private companies that participate in coordinated management of highway-related incidents. The interface represented by this terminator enables emergency management activities to be coordinated across jurisdictional boundaries and between functional areas. In the Physical Architecture this terminator is a reciprocal Emergency Management Subsystem (EM) implying the requirements for general networks connecting many allied agencies. The interface between this terminator and the EM supports coordination of incident management information between many different centers providing Public Safety Answering Point (both public or private sector implementations), Public Safety Dispatch, Emergency Operations, and other functions that participate in the detection, verification, response, and clearance of highway incidents. This terminator also supports interface to other allied agencies like utility companies that also participate in the coordinated response to selected highway-related incidents.
X31	Other ISP	Representing other distinct Information Service Providers, this terminator is intended to provide a source and destination for ITS data flows between peer information and service provider functions. It enables cooperative information sharing between providers as conditions warrant. In the Physical Architecture this terminator is a reciprocal Information Service Provider (ISP) Subsystem.
X33	Other TRM	Representing another Transit Management center, system or subsystem, this terminator is intended to provide a source and destination for ITS data flows between peer (e.g. inter-regional) transit management functions. It enables traffic management activities to be coordinated across geographic boundaries or different jurisdictional areas. In the Physical Architecture this terminator represents a reciprocal Transit Management Subsystem (TRMS).
X34	Other Vehicle	This terminator represents a vehicle (of any 4 vehicle types) that is neighboring the Basic Vehicle, where the Basic Vehicle is equipped to support vehicle-to-vehicle communication and coordination. These features are associated with advanced vehicle safety User Service implementations. These high-end vehicle control services may involve vehicles coordinating their activities.

Entity	Name	Entity Description
X35	Other TM	Representing another Traffic Management center, system or subsystem, this terminator is intended to provide a source and destination for ITS data flows between peer (e.g. inter-regional) traffic management functions. It enables traffic management activities to be coordinated across different jurisdictional areas. In the Physical Architecture this terminator is a reciprocal Traffic Management Subsystem (TMS).
X38	Pedestrians	This terminator provides input (e.g. a request for right of way at an intersection) from a specialized from of the Traveler, who is not using any type of vehicle (including bicycles) as a form of transport. Pedestrians may comprise those on foot and those in wheelchairs.
X41	Roadway Environment	This terminator represents the physical conditions surrounding the roadway itself. These may include emissions, fog, ice, snow, rain, etc. which will influence the way in which a vehicle can be safely operated on the roadway.
X44	Toll Administrator	The Toll Administrator is the human entity that manages the back office payment administration systems for a electronic toll system. This terminator monitors the systems that support the electronic transfer of authenticated funds from the customer to the system operator. The terminator monitors customer enrollment and supports the establishment of escrow accounts depending on the clearinghouse scheme and the type of payments involved. The terminator also establishes and administers the pricing structures and policies.
X46	Traffic Operations Personnel	This terminator represents the human entity that directly interfaces with vehicle traffic operations. These personnel interact with traffic control systems, traffic surveillance systems, incident management systems, work zone management systems, and travel demand management systems to accomplish ITS services. They provide operator data and command inputs to direct systems' operations to varying degrees depending on the type of system and the deployment scenario. All functionality associated with these services that might be automated in the course of ITS deployment is modeled as internal to the architecture.
X49	Transit System Operators	This terminator represents the human entities that are responsible for all aspects of the Transit subsystem operation including planning and management. They actively monitor, control, and modify the transit fleet routes and schedules on a day to day basis. The modifications will be to take account of abnormal situations such as vehicle breakdown, vehicle delay, etc. These personnel may also be responsible for demand responsive transit operation and for managing emergency situations within the transit network.

Entity	Name	Entity Description
X50	Transit User	This terminator represents the human entities using Public Transit vehicles. They may be in the act of embarking or debarking the vehicles and are thus sensed for the purpose of determining passenger loading and fares, or on the vehicles and able to request and receive information.
X53	Transit Maintenance Personnel	The terminator represents the human entity that is actively responsible for monitoring, controlling, and planning the schedules for the maintenance of transit fleets.
X56	Traveler	This terminator represents any individual (human) who uses transportation services. At the time that data is passed to or from the terminator the individual is neither a driver, pedestrian, or transit user. This means that the data provided is that for pre-trip planning or multi-modal personal guidance and includes their requests for assistance in an emergency. Subsequent to receipt of pre-trip information, a Traveler may become a vehicle driver, passenger, transit user, or pedestrian.
X58	Weather Service	This terminator provides weather, hydrologic, and climate information and warnings of hazardous weather including thunderstorms, flooding, hurricanes, tornadoes, winter weather, tsunamis, and climate events. It provides current and forecast weather data that is collected and derived by the National Weather Service, private sector providers, and various research organizations. The interface provides formatted weather data products suitable for on-line processing and integration with other ITS data products as well as Doppler radar images, satellite images, severe storm warnings, and other products that are formatted for presentation to various ITS users.
X61	Payment Instrument	This terminator represents the entity that enables the actual transfer of funds from the user of a service to the provider of the service. This terminator can be as abstract as an account number in the Logical Architecture, or as real as the electronic tag in the Physical architecture.
X62	Enforcement Agency	This terminator represents an external entity which receives reports of violations detected by various ITS facilities, e.g. individual vehicle emissions, toll violations, CVO violations, etc.
X68	Other Archives	This terminator represents distributed archived data systems or centers whose data can be accessed and shared with a local archive. The interface between the Other Archives Terminator and the Archived Data Management Subsystem allows data from multiple archives to be accessed on demand or imported and consolidated into a single repository.
X69	Archived Data User Systems	This terminator represents the systems users employ to access archived data. The general interface provided from this terminator allows a broad range of users (e.g. planners, researchers, analysts, operators) and their systems (e.g. databases, models, analytical tools, user interface devices) to acquire data and analyses results from the archive.

Entity	Name	Entity Description
X70	Archived Data Administrator	This terminator represents the human operator who provides overall data management, administration, and monitoring duties for the ITS data archive. Unlike the manager of the operational databases, the archive data administrator's role is focused on the archive and covers areas such as establishing user authentication controls, monitoring data quality, and initiating data import requests.
X72	Government Reporting Systems	This terminator represents the system and associated personnel that prepare the inputs to support the various local, state, and federal government transportation data reporting requirements (e.g. Highway Performance Monitoring System, Fatal Analysis Reporting System) using data collected by ITS systems. This terminator represents a system interface that would provide access to the archived data that is relevant to these reports. In most cases, this terminator would manually combine data collected from the ITS archives with data from non ITS sources to assemble and submit the required information.
X73	Other Parking	Representing another parking facility, system or subsystem, this terminator provides a source and destination for information that may be exchanged between peer parking systems. This terminator enables parking management activities to be coordinated between different parking operators or systems in a region. In the Physical Architecture this terminator is a reciprocal Parking Management Subsystem.

Appendix B List of Market Package

Market Package Name	Market Package	System Involved
Autonomous Route Guidance	ATIS3	
		Traveler PC/Info. Appliance
Broadcast Traveler Information	ATIS1	
		Central New York Regional Transportation Authority (CNYRTA)
		City of Syracuse Dept. of Public Works
		Local Media
		Metropolitan Transportation Communication Network (METCON)
		NYSDOT Region 3 Operations Center
		NYSTA Traffic Operations Center
		Onondaga County Dept. of Transportation
		Traveler PC/Info. Appliance
Demand Response Transit Operations	APTS3	
		Central New York Regional Transportation Authority (CNYRTA)
		Local Transit Vehicles
Electronic Toll Collection	ATMS10	
		City of Syracuse Dept. of Public Works
		EZPASS TAG
		Financial Institutions
		NYSTA Traffic Operations Center
Emergency Response	EM1	
		City of Syracuse Dept. of Public Works
		City of Syracuse Fire Department
		City of Syracuse Fire Vehicles
		City of Syracuse Police Department
		City of Syracuse Police Vehicles
		New York State Police
		New York State Police (Troop D) Vehicles
		NYSDOT Region 3 Operations Center
		NYSTA State Police Troop T Vehicles

		NYSTA Statewide Operations Center Troop T Dispatch
		NYSTA Traffic Operations Center
		Onondaga County 911 Emergency Communications (ECD)
		Onondaga County Dept. of Transportation
		Onondaga County Emergency Management Division (EMD)
		Onondaga County Sheriff
		Onondaga County Sheriff (Police) Vehicles
		Other EMS Dispatch
		Other EMS Vehicles
		Other Fire Vehicles (excluding the city fire vehicles)
		Syracuse Regional Emergency Network (SyREN)
Emergency Routing	EM2	
		City of Syracuse Dept. of Public Works
		City of Syracuse Fire Department
		City of Syracuse Fire Vehicles
		City of Syracuse Police Department
		City of Syracuse Police Vehicles
		New York State Police
		New York State Police (Troop D) Vehicles
		NYSDOT Region 3 Operations Center
		NYSTA State Police Troop T Vehicles
		NYSTA Statewide Operations Center Troop T Dispatch
		Onondaga County 911 Emergency Communications (ECD)
		Onondaga County Dept. of Transportation
		Onondaga County Sheriff
		Onondaga County Sheriff (Police) Vehicles
		Other EMS Dispatch
		Other EMS Vehicles
		Other Fire Vehicles (excluding the city fire vehicles)

		Syracuse Regional Emergency Network (SyREN)
Freeway Control	ATMS04	
		NYSDOT Region 3 Field Equipment
		NYSDOT Region 3 Operations Center
		NYSTA Field Equipment
		NYSTA Traffic Operations Center
HAZMAT Management	CVO10	
		City of Syracuse Dept. of Public Works
		City of Syracuse Fire Department
		City of Syracuse Police Department
		New York State Police
		NYSDOT Region 3 Operations Center
		NYSTA Traffic Operations Center
		Onondaga County 911 Emergency Communications (ECD)
		Onondaga County Dept. of Transportation
		Onondaga County Sheriff
		Syracuse Regional Emergency Network (SyREN)
Incident Management System	ATMS08	
		City of Syracuse Dept. of Public Works
		City of Syracuse Fire Department
		City of Syracuse Police Department
		Local Media
		New York State Police
		NYSDOT Region 3 Operations Center
		NYSTA Field Equipment
		NYSTA Statewide Operations Center Troop T Dispatch
		NYSTA Traffic Operations Center
		Onondaga County 911 Emergency Communications (ECD)
		Onondaga County Dept. of Transportation
		Onondaga County Emergency Management Division (EMD)
		Onondaga County Sheriff
		Other EMS Dispatch
		Syracuse Regional Emergency Network (SyREN)

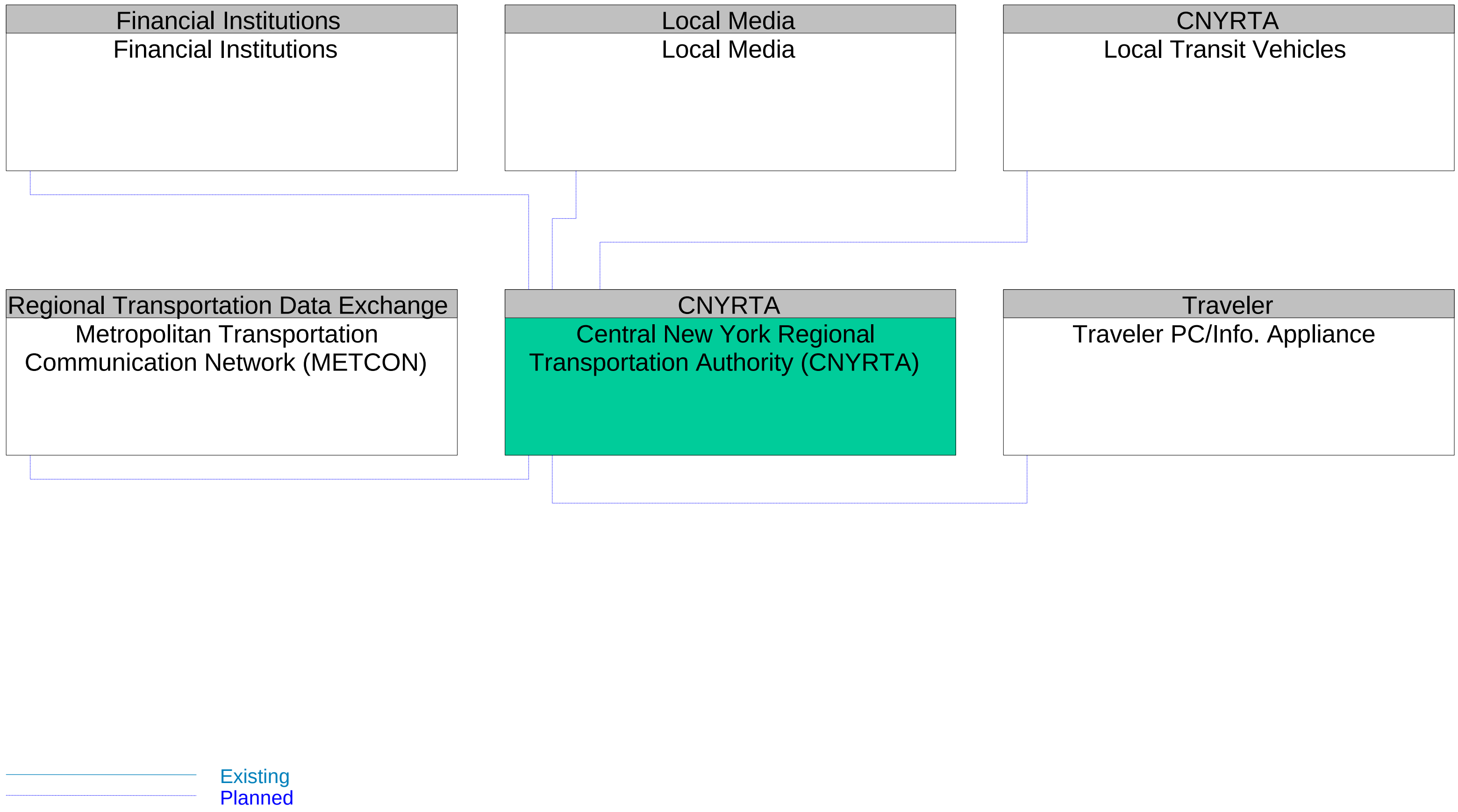
Integrated Transportation Management/Route Guidance	ATIS6	
		City of Syracuse Dept. of Public Works
		NYSDOT Region 3 Operations Center
		Onondaga County Dept. of Transportation
		Traveler PC/Info. Appliance
Interactive Traveler Information	ATIS2	
		Central New York Regional Transportation Authority (CNYRTA)
		City of Syracuse Dept. of Public Works
		Local Media
		NYSDOT Region 3 Operations Center
		Onondaga County Dept. of Transportation
		Traveler PC/Info. Appliance
ITS Data Mart	AD1	
		Central New York Regional Transportation Authority (CNYRTA)
		City of Syracuse Dept. of Public Works
		City of Syracuse Police Department
		New York State Police
		NYSDOT Region 3
		NYSDOT Region 3 Operations Center
		NYSTA Statewide Operations Center Troop T Dispatch
		NYSTA Traffic Operations Center
		Onondaga County 911 Emergency Communications (ECD)
		Onondaga County Dept. of Transportation
		Onondaga County Sheriff
ITS Data Warehouse	AD2	
		Metropolitan Transportation Communication Network (METCON)
		Syracuse Metropolitan Transportation Council (SMTC)
ITS Virtual Data Warehouse	AD3	
		Metropolitan Transportation Communication Network (METCON)

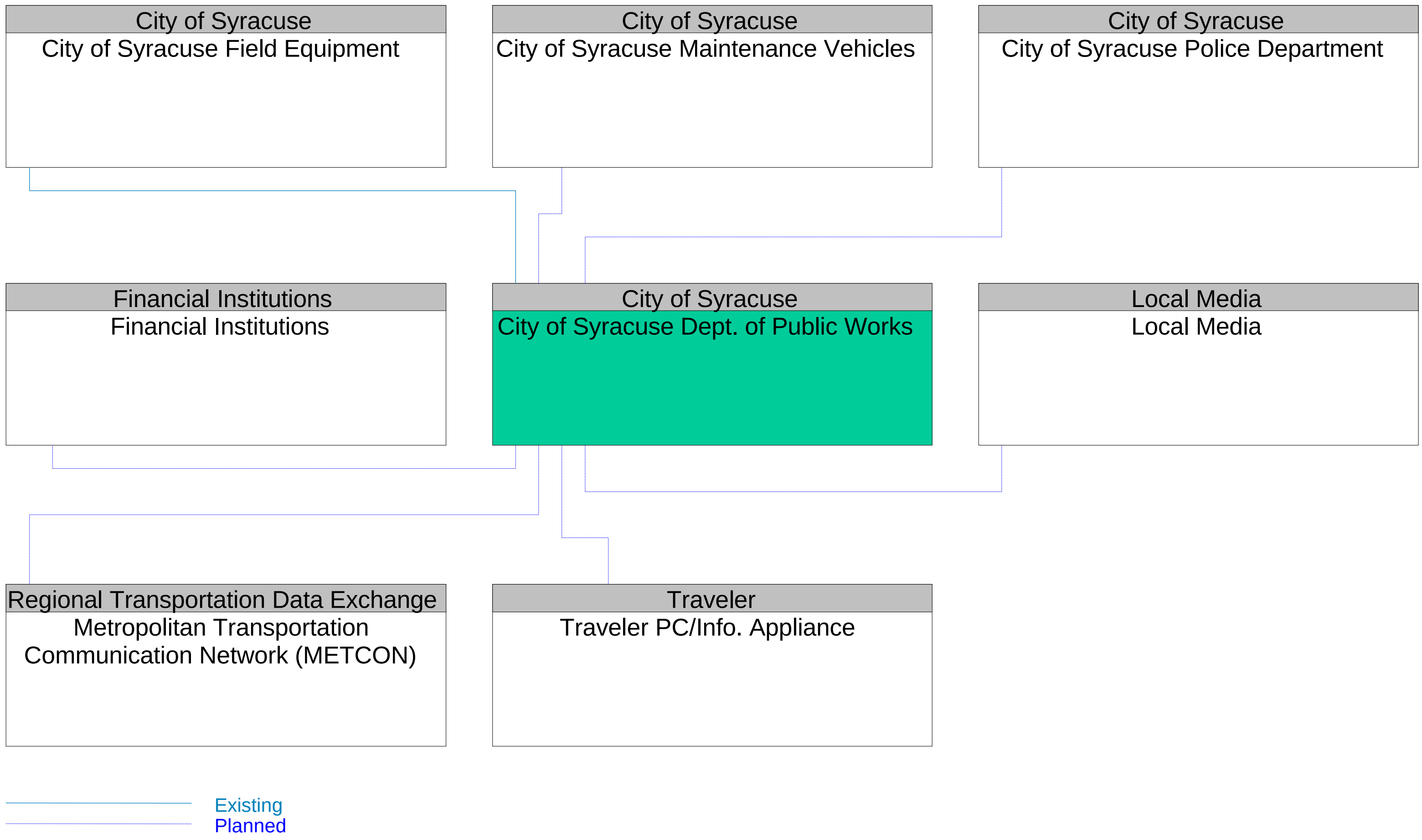
		Syracuse Metropolitan Transportation Council (SMTC)
Mayday Support	EM3	
		Onondaga County 911 Emergency Communications (ECD)
		Syracuse Regional Emergency Network (SyREN)
Multi-modal Coordination	APTS7	
		Central New York Regional Transportation Authority (CNYRTA)
		Local Transit Vehicles
Network Surveillance	ATMS01	
		City of Syracuse Dept. of Public Works
		City of Syracuse Field Equipment
		NYSDOT Region 3 Field Equipment
		NYSDOT Region 3 Operations Center
		NYSTA Field Equipment
		NYSTA Traffic Operations Center
		Onondaga County Dept. of Transportation
		Onondaga County DOT Field Equipment
Parking Facility Management	ATMS16	
		City of Syracuse Dept. of Public Works
		Financial Institutions
Probe Surveillance	ATMS02	
		City of Syracuse Dept. of Public Works
		EZPASS TAG
		NYSDOT Region 3 Field Equipment
		NYSDOT Region 3 Operations Center
		NYSTA Field Equipment
		Onondaga County Dept. of Transportation
Railroad Operations Coordination	ATMS15	
		City of Syracuse Dept. of Public Works
Regional Parking Management	ATMS19	
		City of Syracuse Dept. of Public Works
		Onondaga County Dept. of Transportation
Regional Traffic Control	ATMS07	

		City of Syracuse Dept. of Public Works
		City of Syracuse Field Equipment
		NYSDOT Region 3 Field Equipment
		NYSDOT Region 3 Operations Center
		NYSTA Field Equipment
		NYSTA Traffic Operations Center
		Onondaga County Dept. of Transportation
		Onondaga County DOT Field Equipment
Road Weather Information System	ATMS18	
		City of Syracuse Dept. of Public Works
		NYSDOT Region 3 Operations Center
		NYSTA Traffic Operations Center
		Onondaga County Dept. of Transportation
Standard Railroad Grade Crossing	ATMS13	
		City of Syracuse Dept. of Public Works
		Onondaga County Dept. of Transportation
Surface Street Control	ATMS03	
		City of Syracuse Dept. of Public Works
		City of Syracuse Field Equipment
		NYSDOT Region 3 Field Equipment
		NYSDOT Region 3 Operations Center
		Onondaga County Dept. of Transportation
		Onondaga County DOT Field Equipment
Traffic Forecast and Demand Management	ATMS09	
		City of Syracuse Dept. of Public Works
		NYSDOT Region 3 Operations Center
		Onondaga County Dept. of Transportation
Traffic Information Dissemination	ATMS06	
		City of Syracuse Dept. of Public Works
		City of Syracuse Field Equipment
		Local Media
		Metropolitan Transportation Communication Network (METCON)
		NYSDOT Region 3 Field Equipment

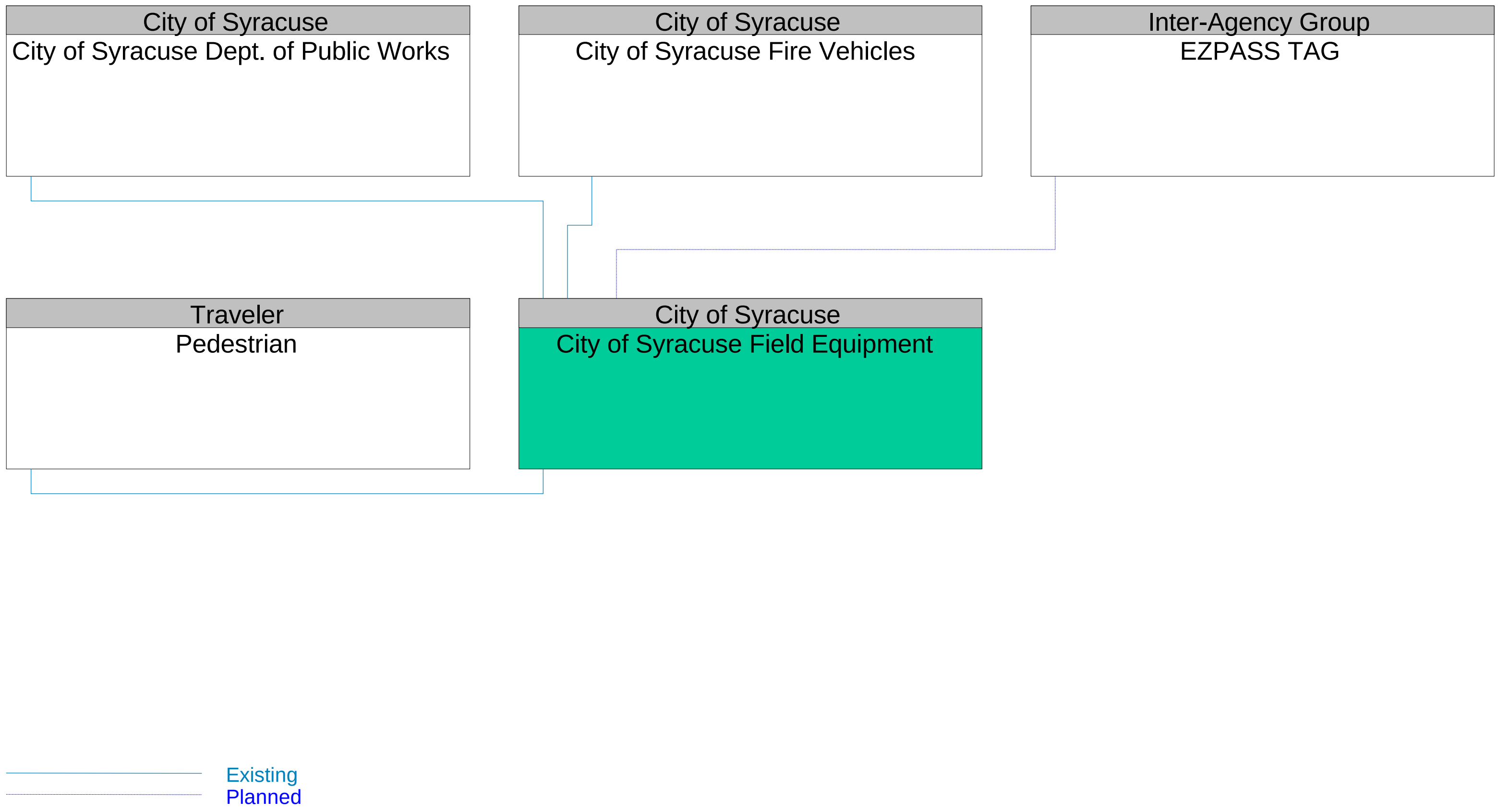
		NYSDOT Region 3 Operations Center
		NYSTA Field Equipment
		NYSTA Traffic Operations Center
		Onondaga County Dept. of Transportation
		Onondaga County DOT Field Equipment
Transit Fixed-Route Operations	APTS2	
		Central New York Regional Transportation Authority (CNYRTA)
		Local Transit Vehicles
Transit Maintenance	APTS6	
		Central New York Regional Transportation Authority (CNYRTA)
		Local Transit Vehicles
Transit Passenger and Fare Management	APTS4	
		Central New York Regional Transportation Authority (CNYRTA)
		Local Transit Vehicles
Transit Security	APTS5	
		Central New York Regional Transportation Authority (CNYRTA)
		Local Transit Vehicles
		Onondaga County 911 Emergency Communications (ECD)
Transit Traveler Information	APTS8	
		Central New York Regional Transportation Authority (CNYRTA)
		Local Transit Vehicles
		Metropolitan Transportation Communication Network (METCON)
Transit Vehicle Tracking	APTS1	
		Central New York Regional Transportation Authority (CNYRTA)
		Local Transit Vehicles

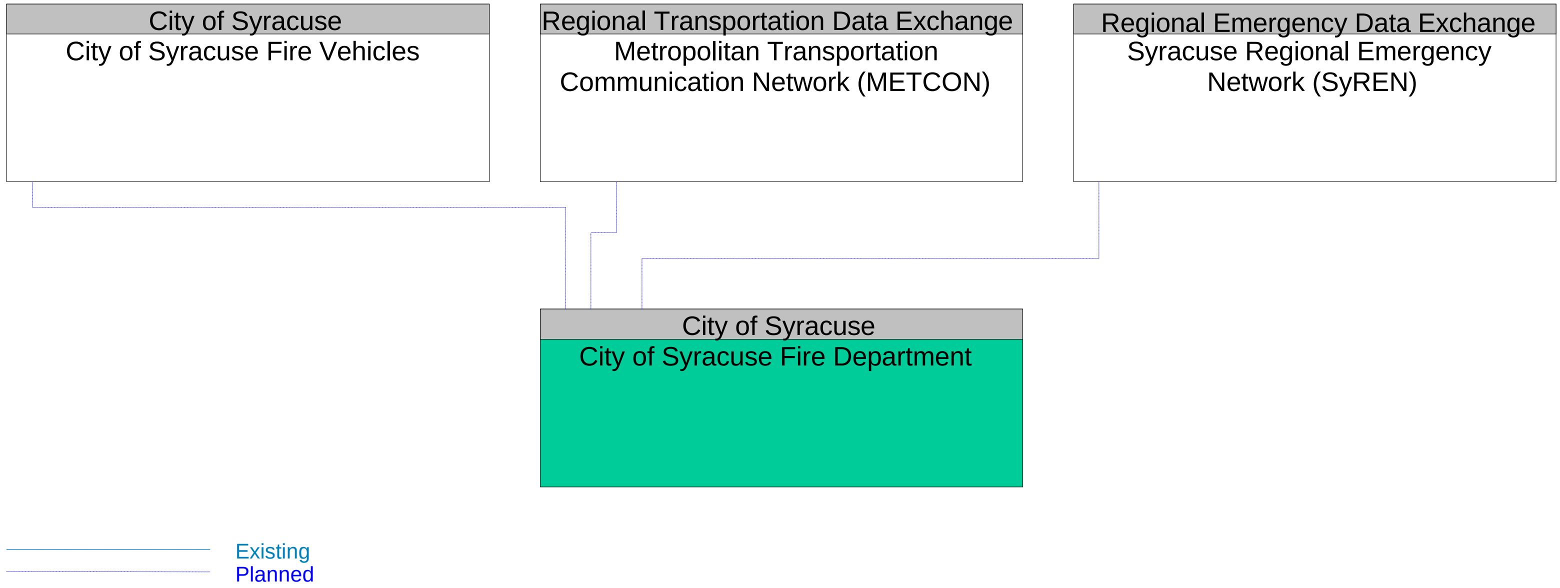
Appendix C Interconnect Diagrams

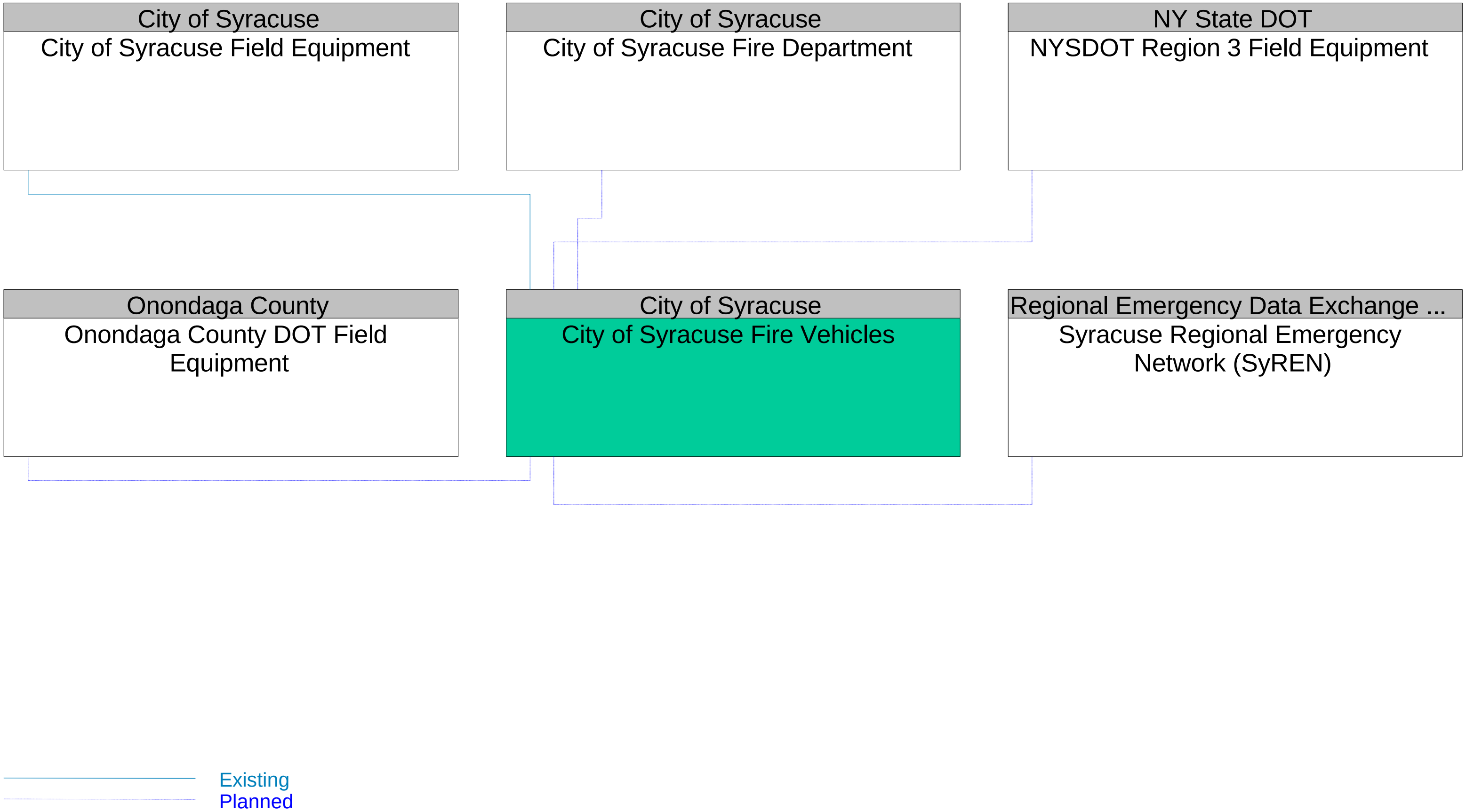

Financial Institutions
Financial Institutions
Local Media
Local Media
CNYRTA
Local Transit Vehicles
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
Traveler
Traveler PC/Info. Appliance
Existing
Planned

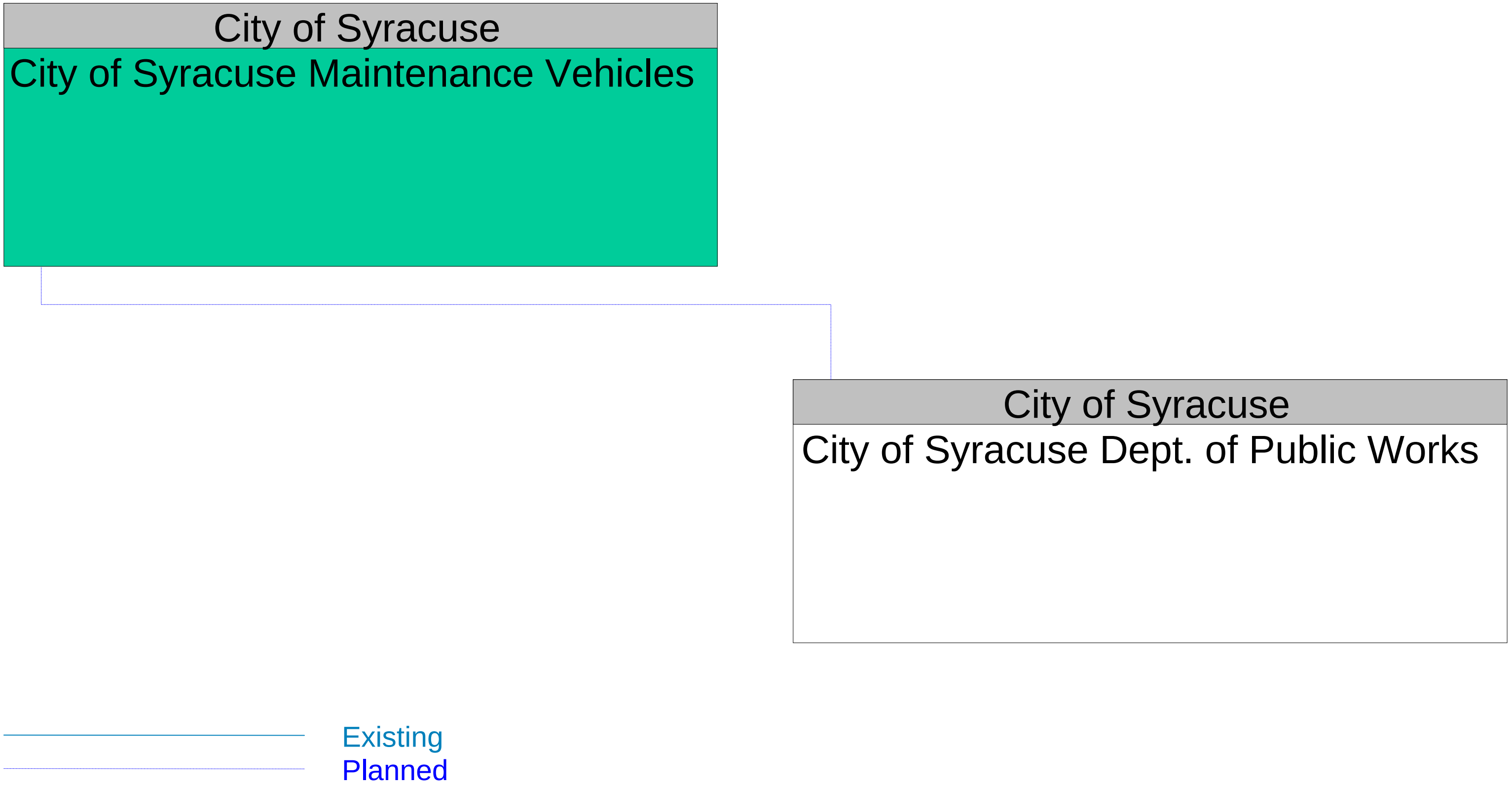


City of Syracuse
City of Syracuse Field Equipment
City of Syracuse
City of Syracuse Maintenance Vehicles
City of Syracuse
City of Syracuse Police Department
Financial Institutions
Financial Institutions
City of Syracuse
City of Syracuse Dept. of Public Works
Local Media
Local Media
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Traveler
Traveler PC/Info. Appliance
Existing
Planned

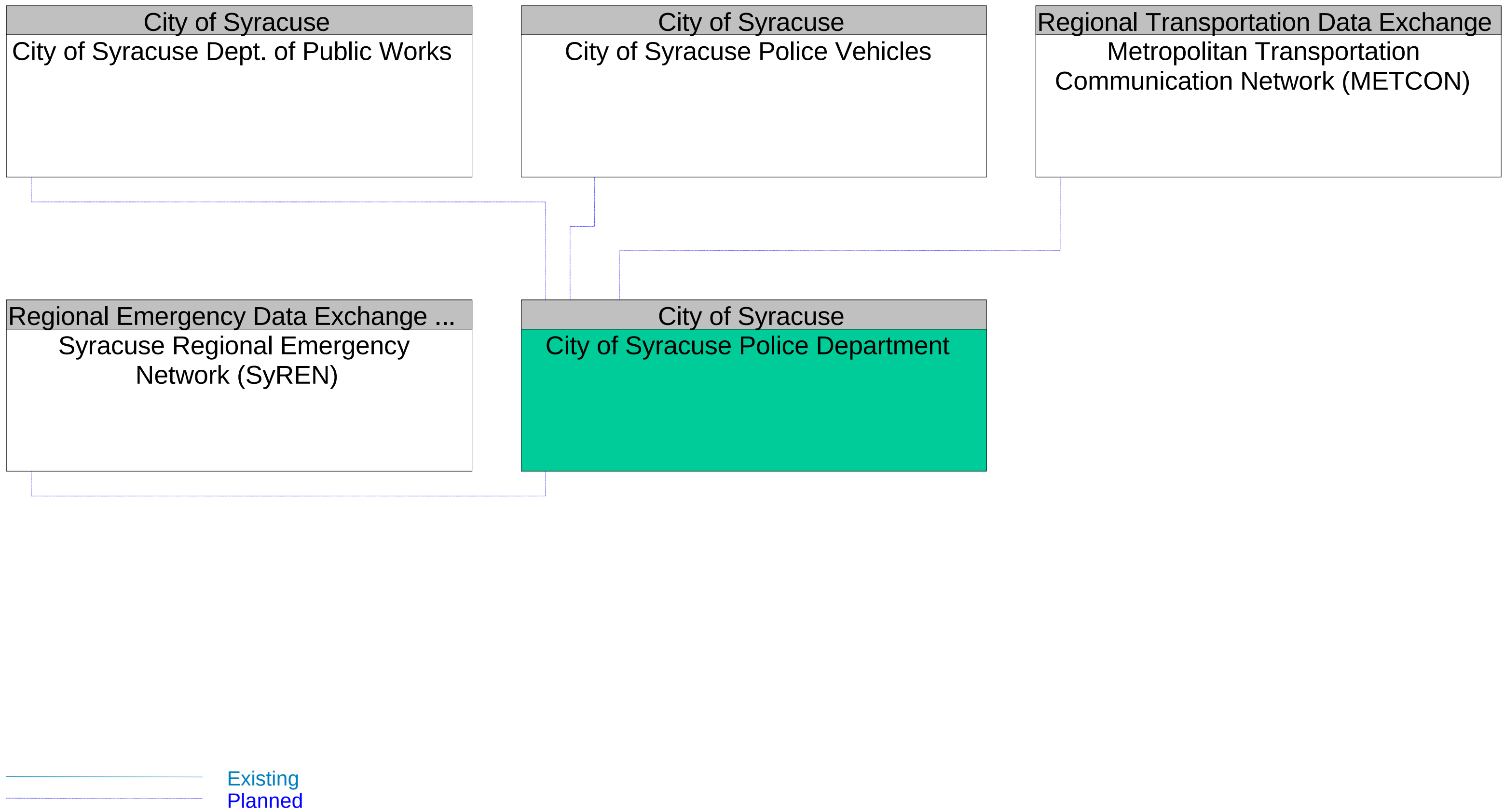

City of Syracuse
City of Syracuse Dept. of Public Works
City of Syracuse
City of Syracuse Fire Vehicles
Inter-Agency Group
EZPASS TAG
Traveler
Pedestrian
City of Syracuse
City of Syracuse Field Equipment
Existing
Planned


City of Syracuse
City of Syracuse Fire Vehicles
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
City of Syracuse
City of Syracuse Fire Department
Existing
Planned

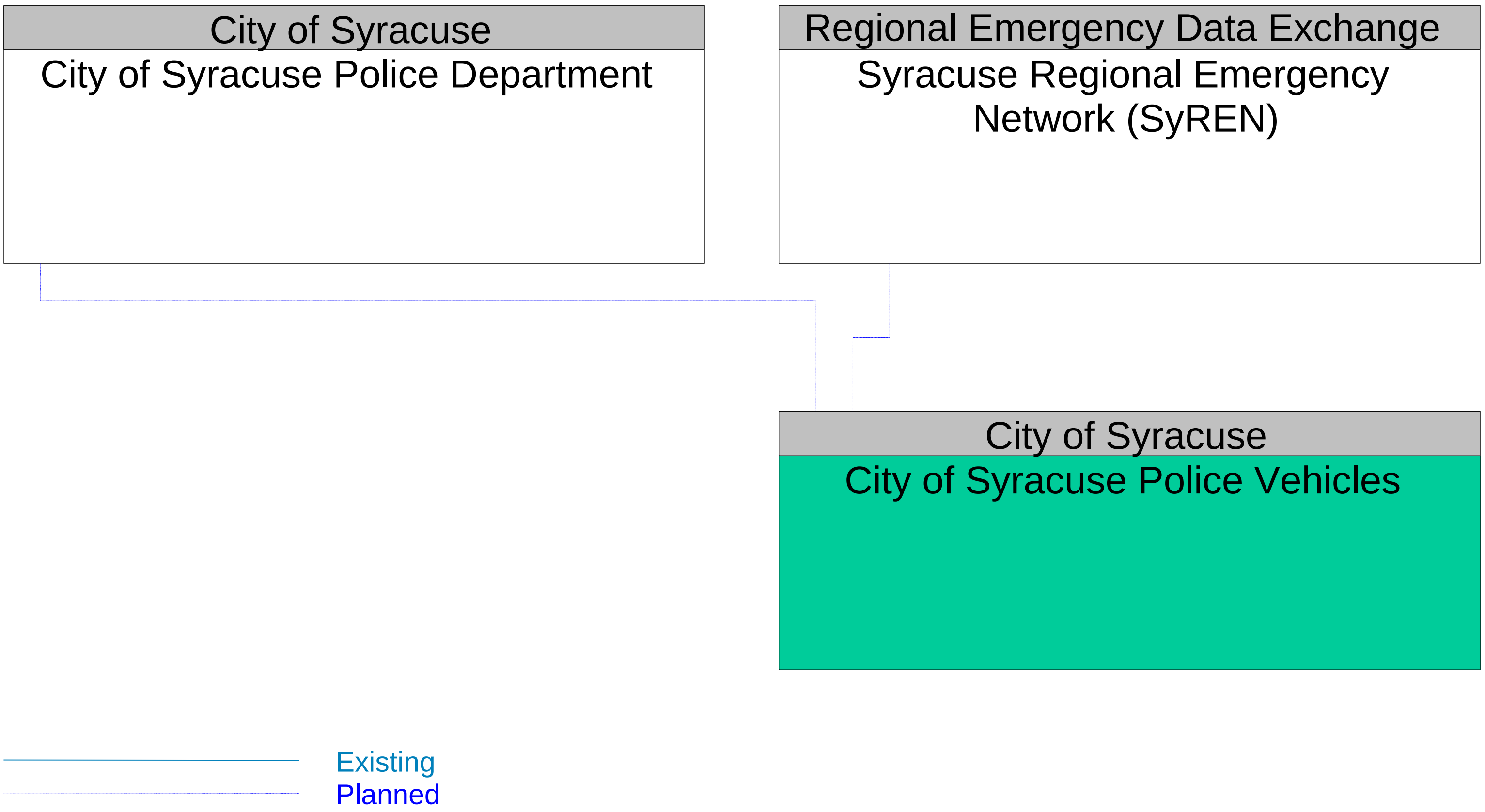

City of Syracuse
City of Syracuse Field Equipment
City of Syracuse
City of Syracuse Fire Department
NY State DOT
NYSDOT Region 3 Field Equipment
Onondaga County
Onondaga County DOT Field Equipment
City of Syracuse
City of Syracuse Fire Vehicles
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
Existing
Planned

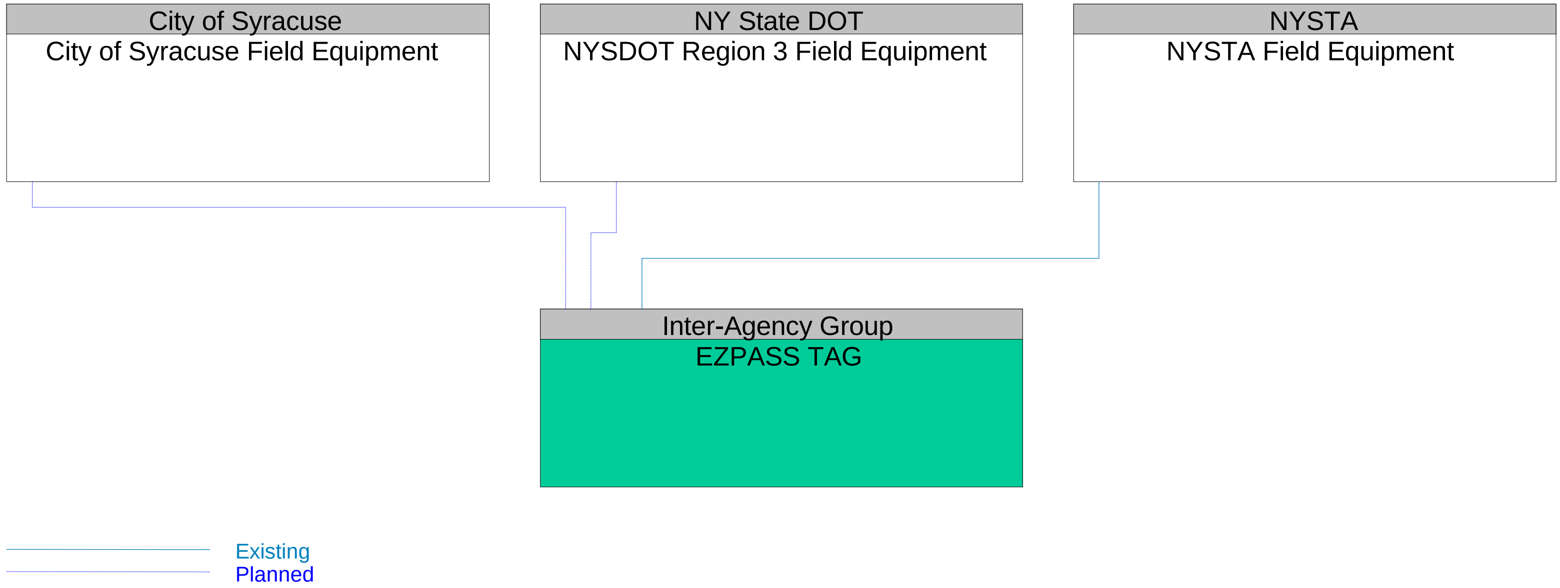


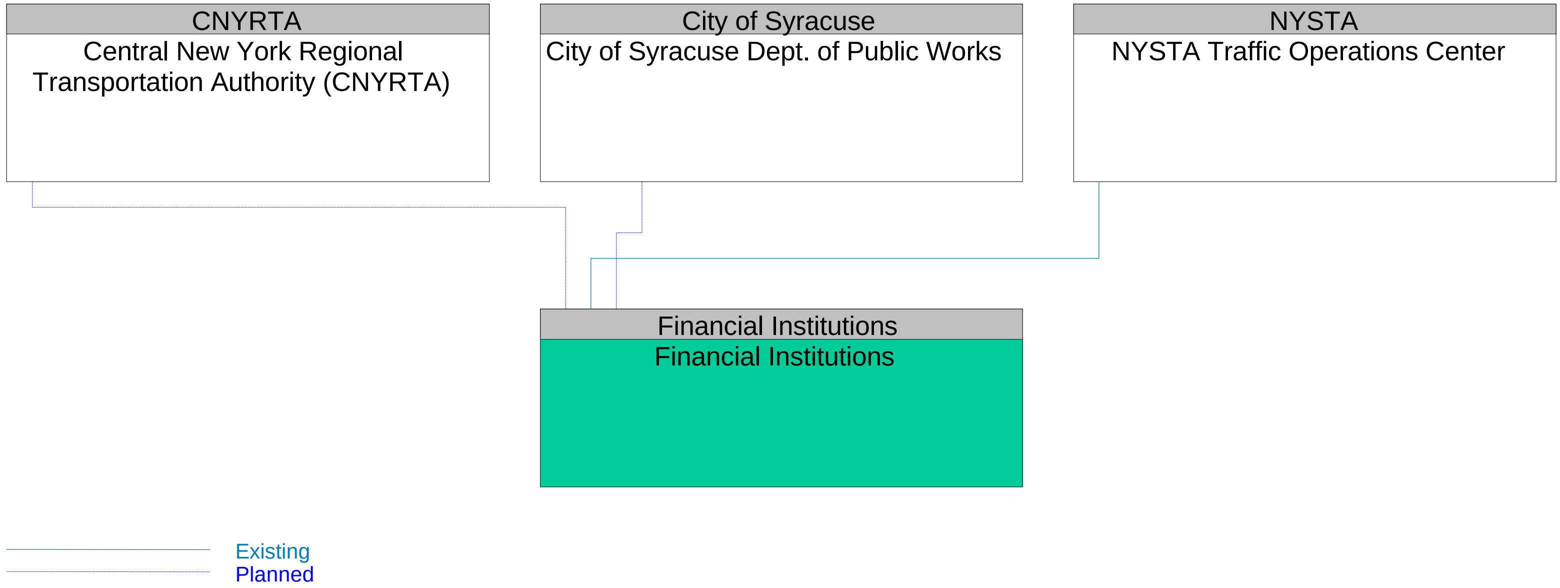
City of Syracuse
City of Syracuse Maintenance Vehicles
City of Syracuse
City of Syracuse Dept. of Public Works
Existing
Planned

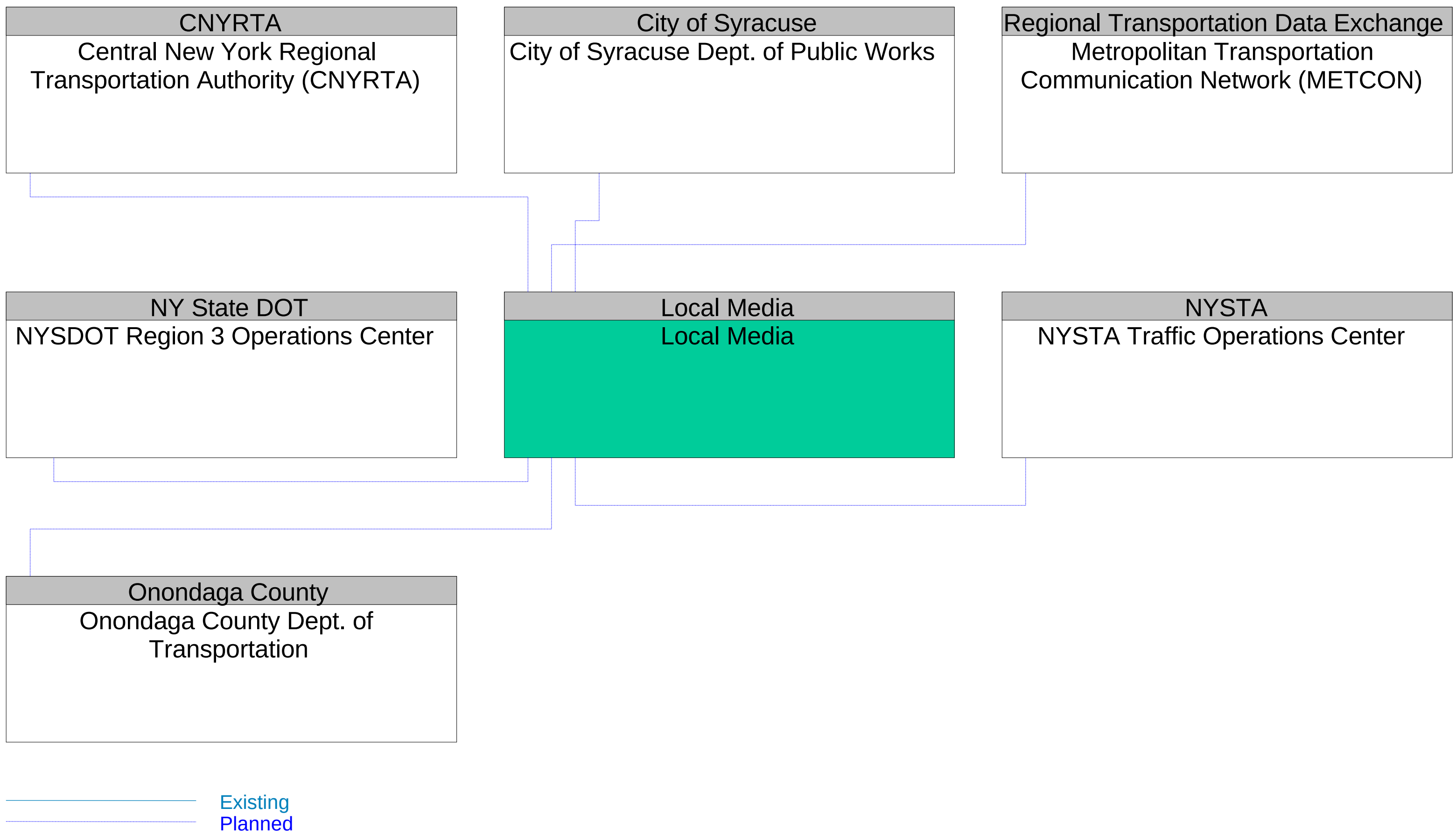


City of Syracuse
City of Syracuse Dept. of Public Works
City of Syracuse
City of Syracuse Police Vehicles
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
City of Syracuse
City of Syracuse Police Department
Existing
Planned

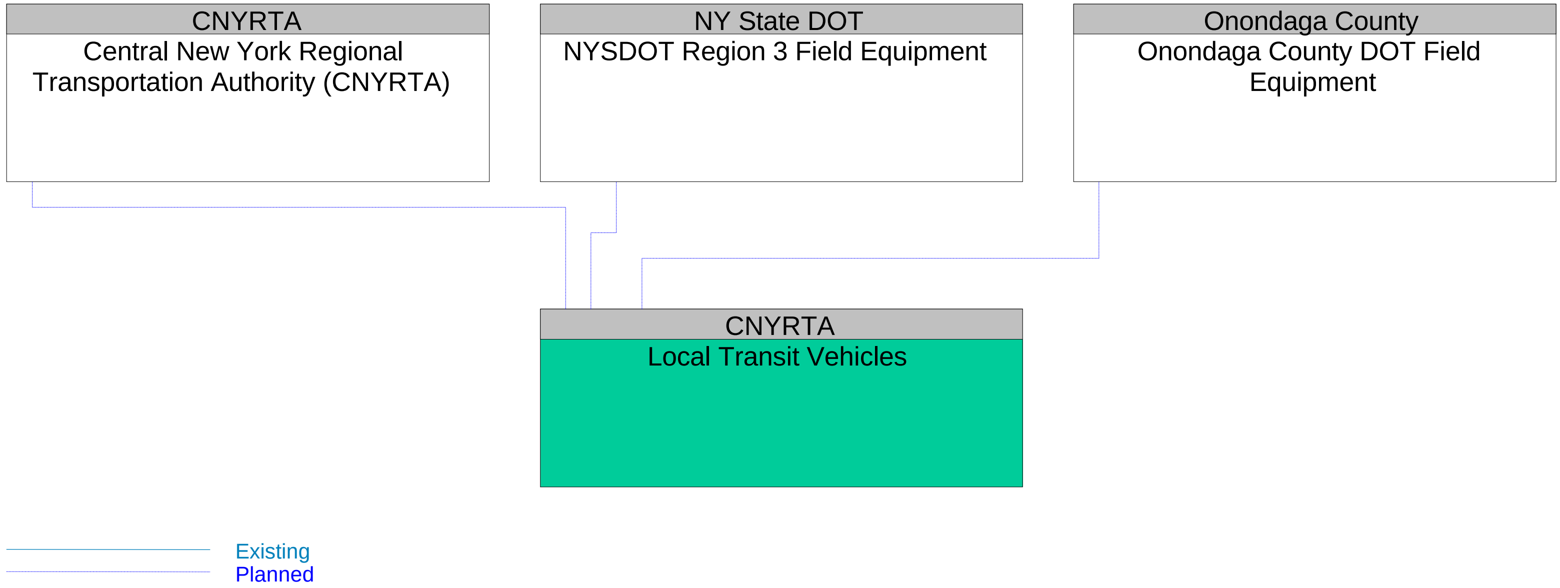

City of Syracuse
City of Syracuse Police Department
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
City of Syracuse
City of Syracuse Police Vehicles
Existing
Planned


City of Syracuse
City of Syracuse Field Equipment
NY State DOT
NYSDOT Region 3 Field Equipment
NYSTA
NYSTA Field Equipment
Inter-Agency Group
EZPASS TAG
Existing
Planned

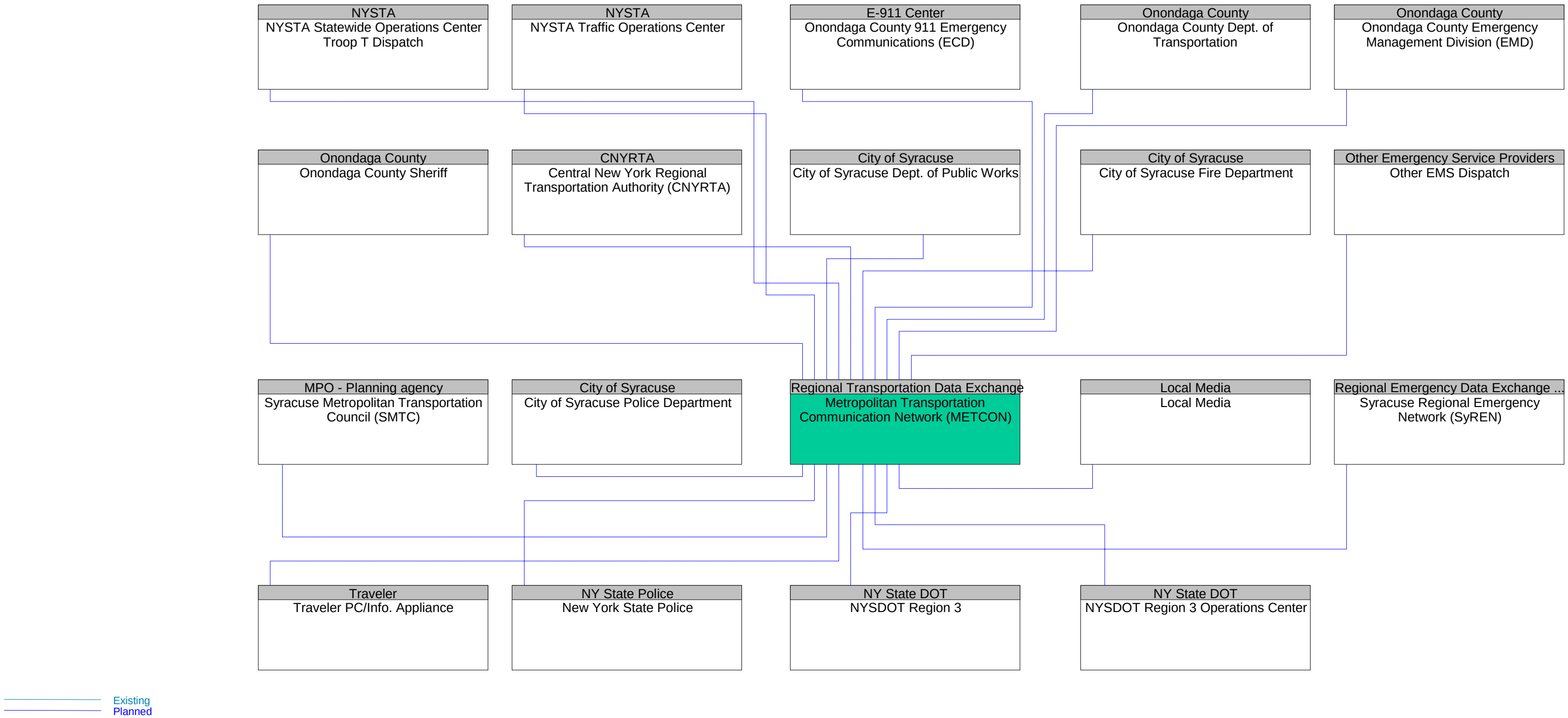

CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
City of Syracuse
City of Syracuse Dept. of Public Works
NYSTA
NYSTA Traffic Operations Center
Financial Institutions
Financial Institutions
Existing
Planned



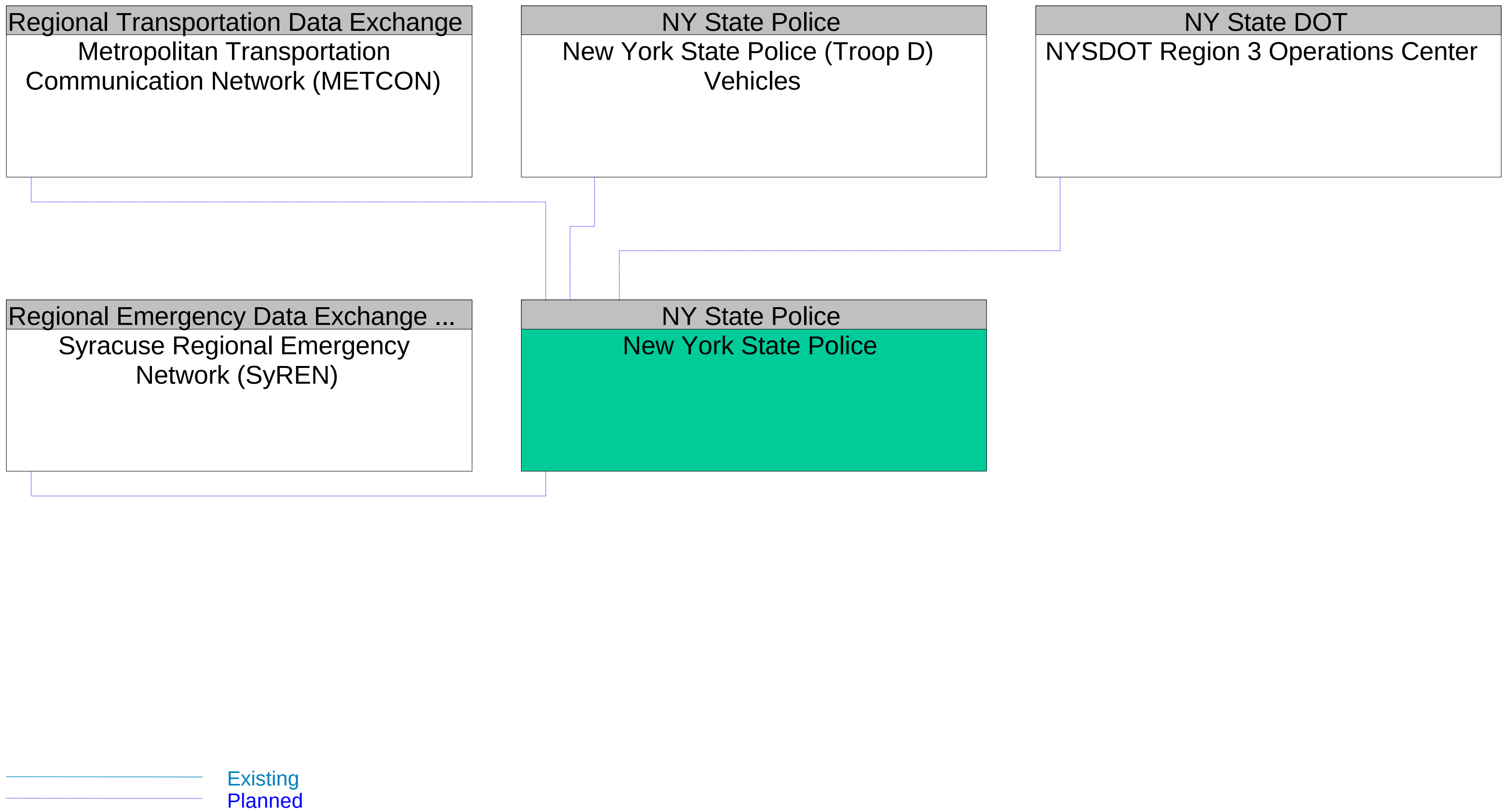
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
City of Syracuse
City of Syracuse Dept. of Public Works
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
NY State DOT
NYSDOT Region 3 Operations Center
Local Media
Local Media
NYSTA
NYSTA Traffic Operations Center
Onondaga County
Onondaga County Dept. of Transportation
Existing
Planned

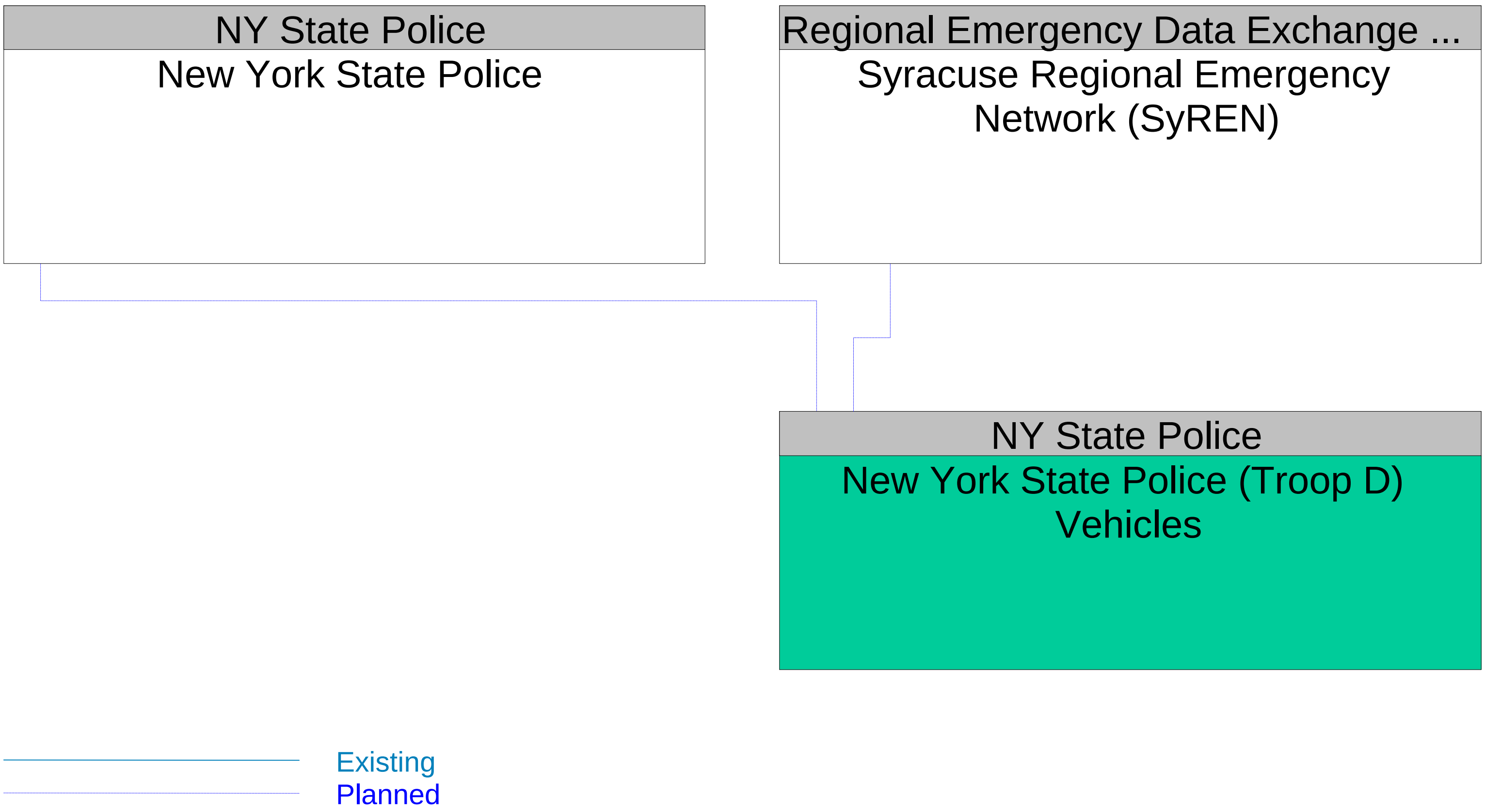


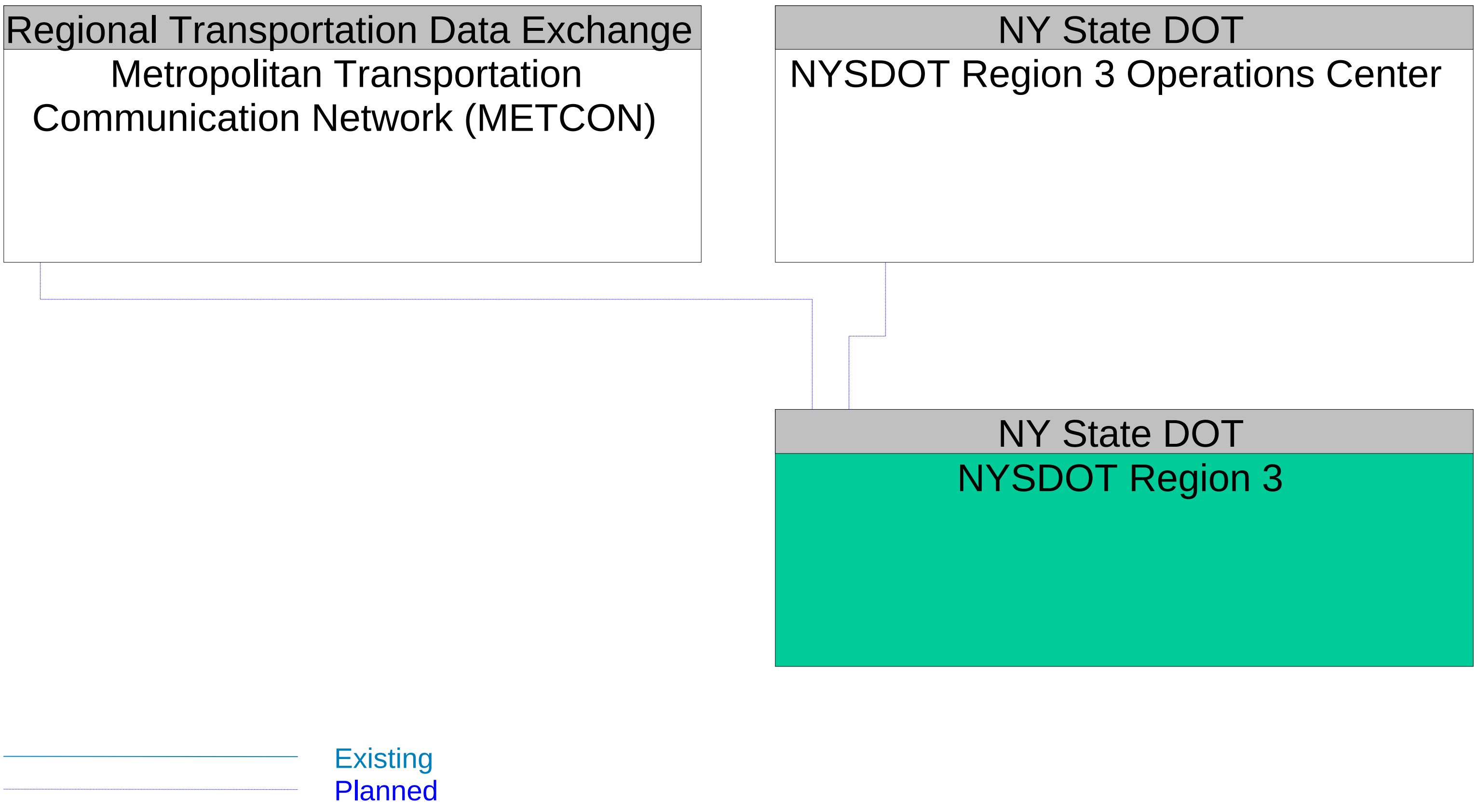
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
NY State DOT
NYSDOT Region 3 Field Equipment
Onondaga County
Onondaga County DOT Field Equipment
CNYRTA
Local Transit Vehicles
Existing
Planned

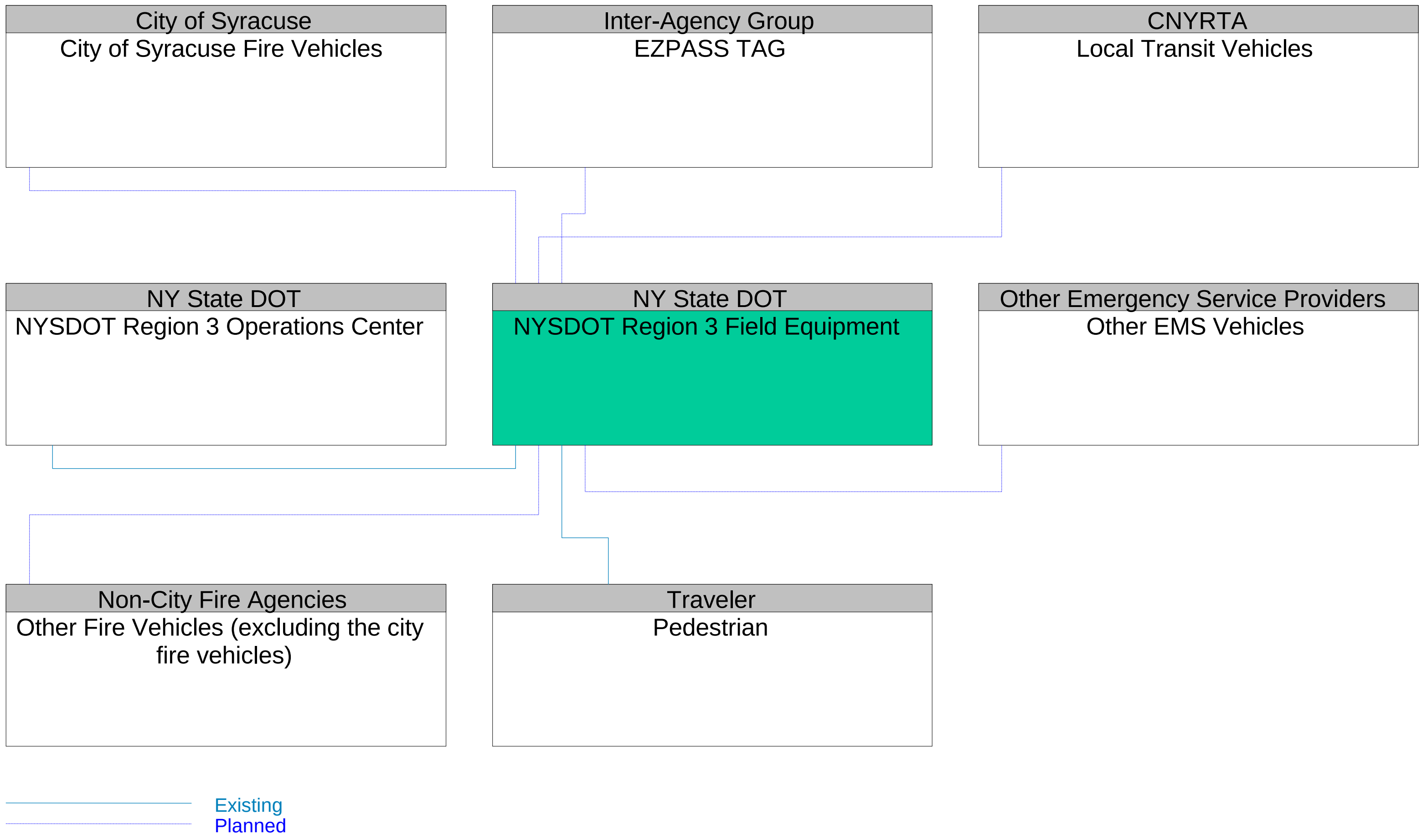


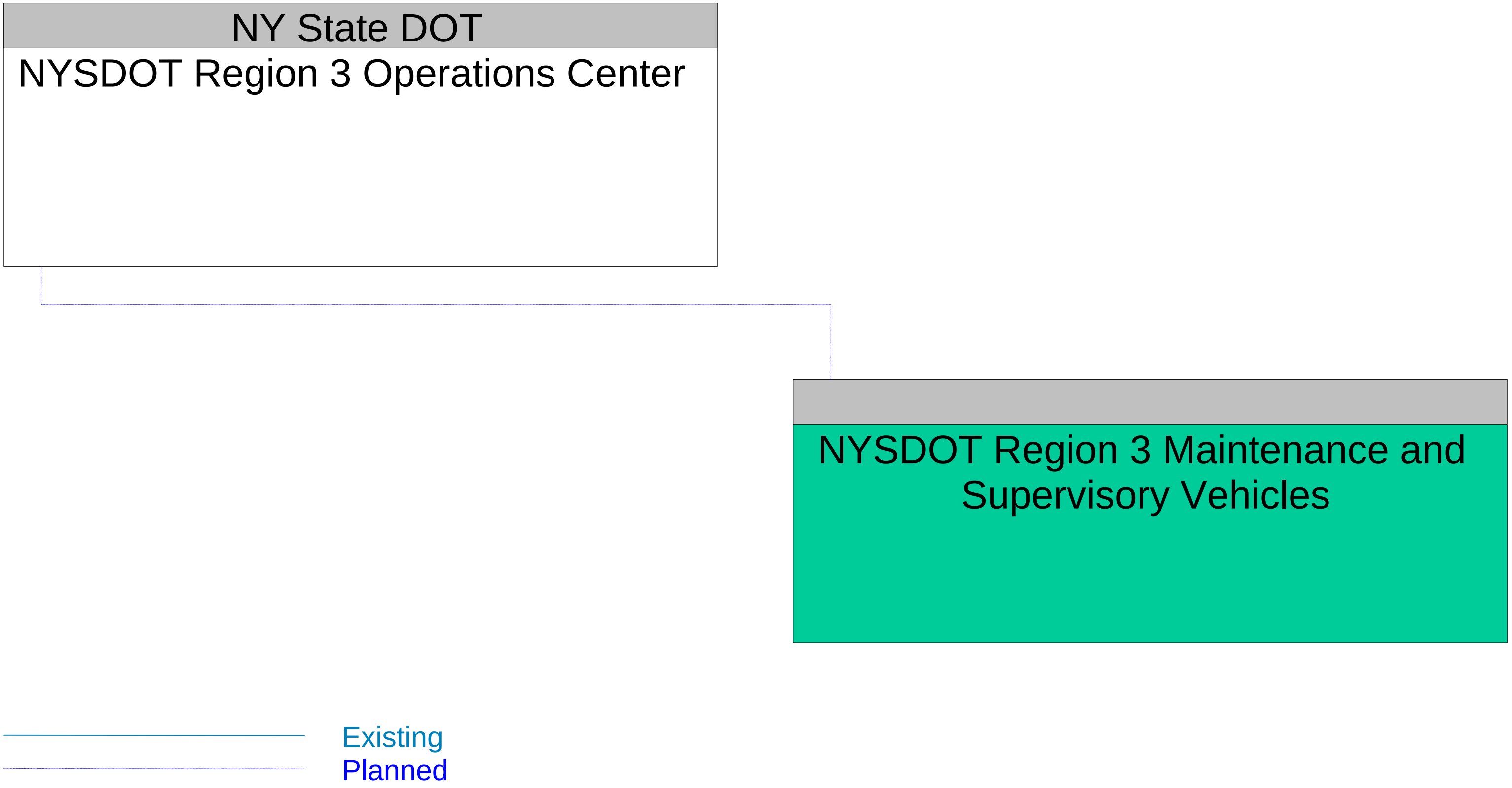
NYSTA
NYSTA Statewide Operations Center Troop T Dispatch
NYSTA
NYSTA Traffic Operations Center
E-911 Center
Onondaga County 911 Emergency Communications (ECD)
Onondaga County
Onondaga County Dept. of Transportation
Onondaga County
Onondaga County Emergency Management Division (EMD)
Onondaga County
Onondaga County Sheriff
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
City of Syracuse
City of Syracuse Dept. of Public Works
City of Syracuse
City of Syracuse Fire Department
Other Emergency Service Providers
Other EMS Dispatch
MPO - Planning agency
Syracuse Metropolitan Transportation Council (SMTC)
City of Syracuse
City of Syracuse Police Department
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Local Media
Local Media
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
Traveler
Traveler PC/Info. Appliance
NY State Police
New York State Police
NY State DOT
NYSDOT Region 3
NY State DOT
NYSDOT Region 3 Operations Center
Existing
Planned

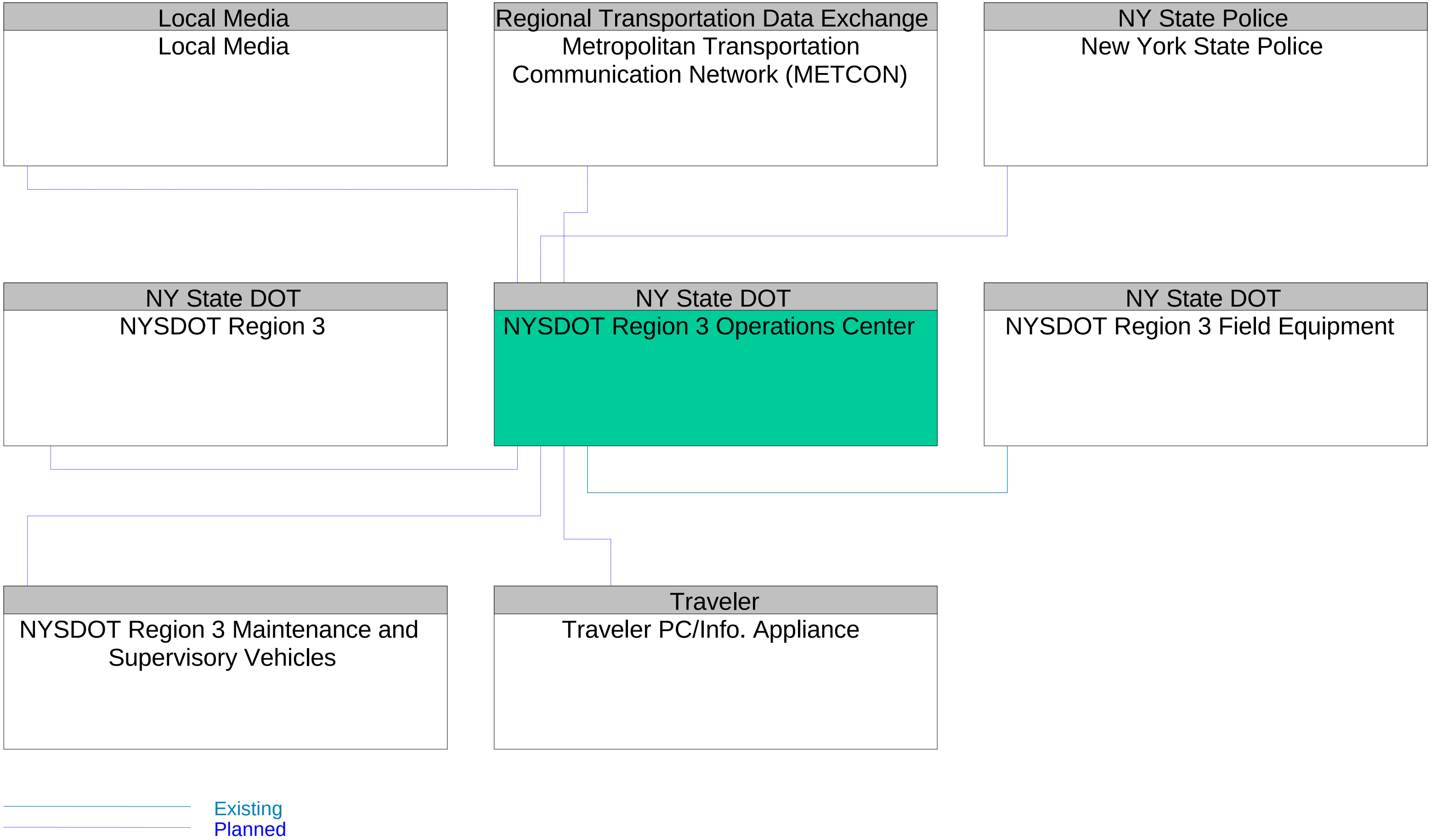

Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
NY State Police
New York State Police (Troop D) Vehicles
NY State DOT
NYSDOT Region 3 Operations Center
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
NY State Police
New York State Police
Existing
Planned

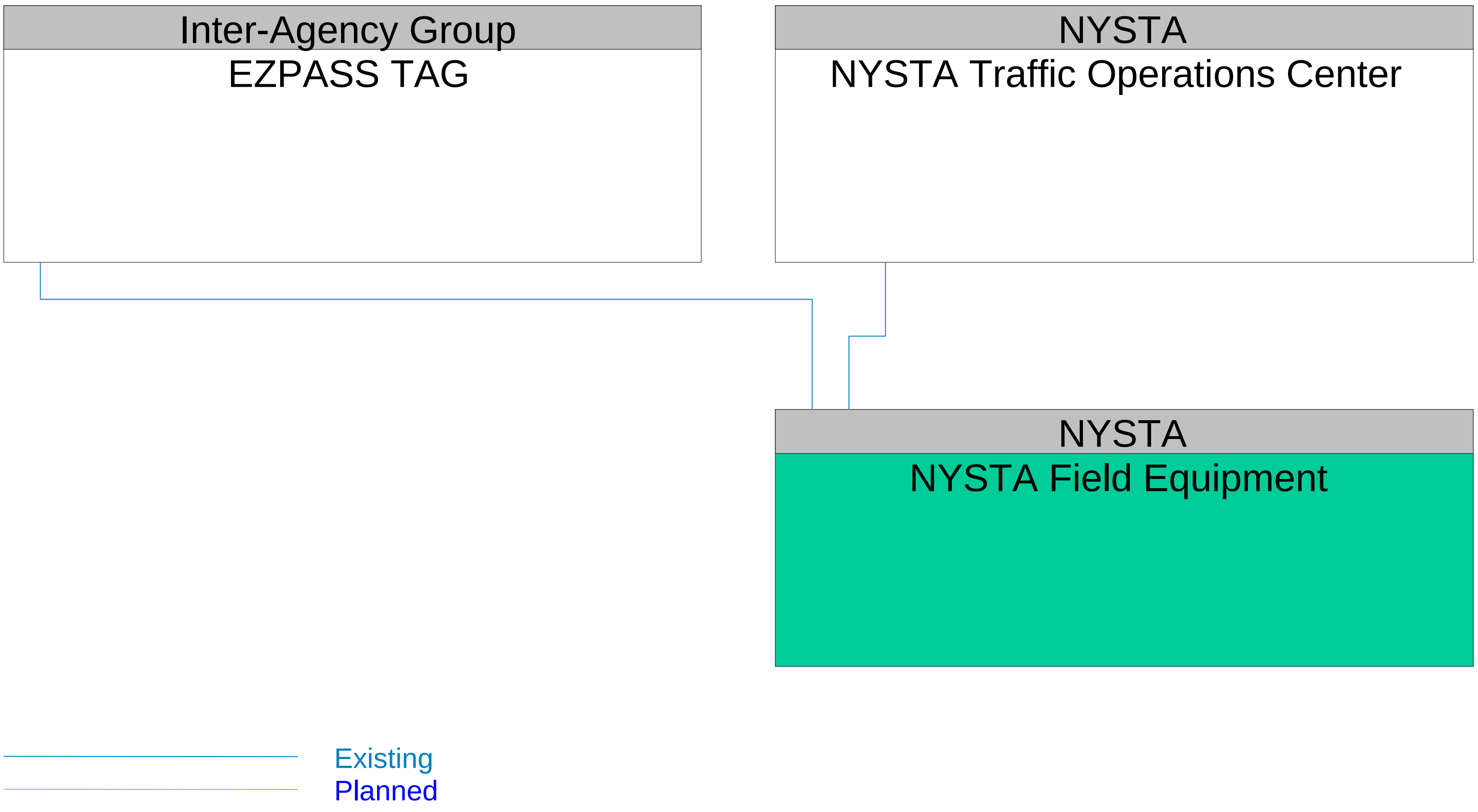

NY State Police
New York State Police
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
NY State Police
New York State Police (Troop D) Vehicles
Existing
Planned

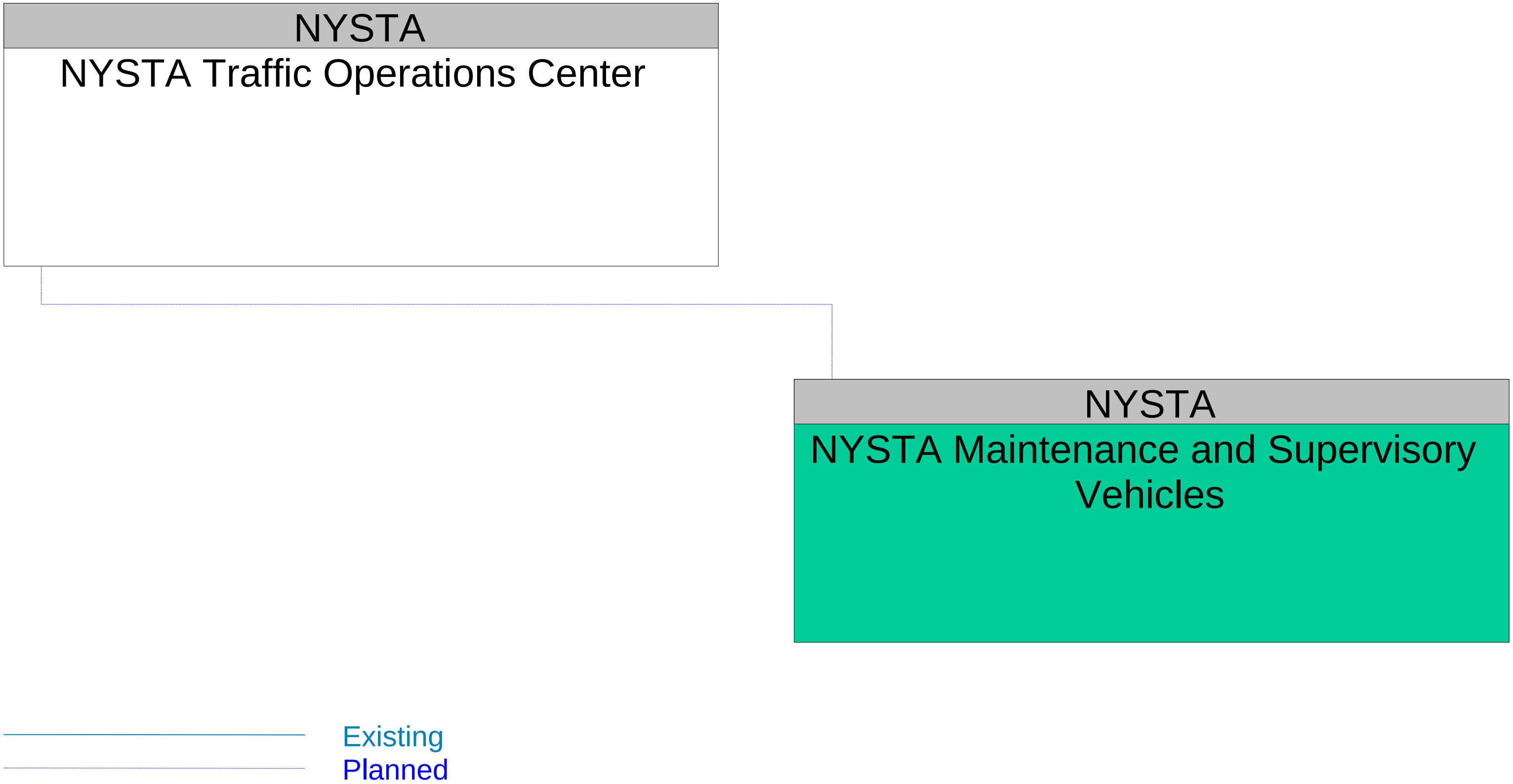

Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
NY State DOT
NYSDOT Region 3 Operations Center
NY State DOT
NYSDOT Region 3
Existing
Planned

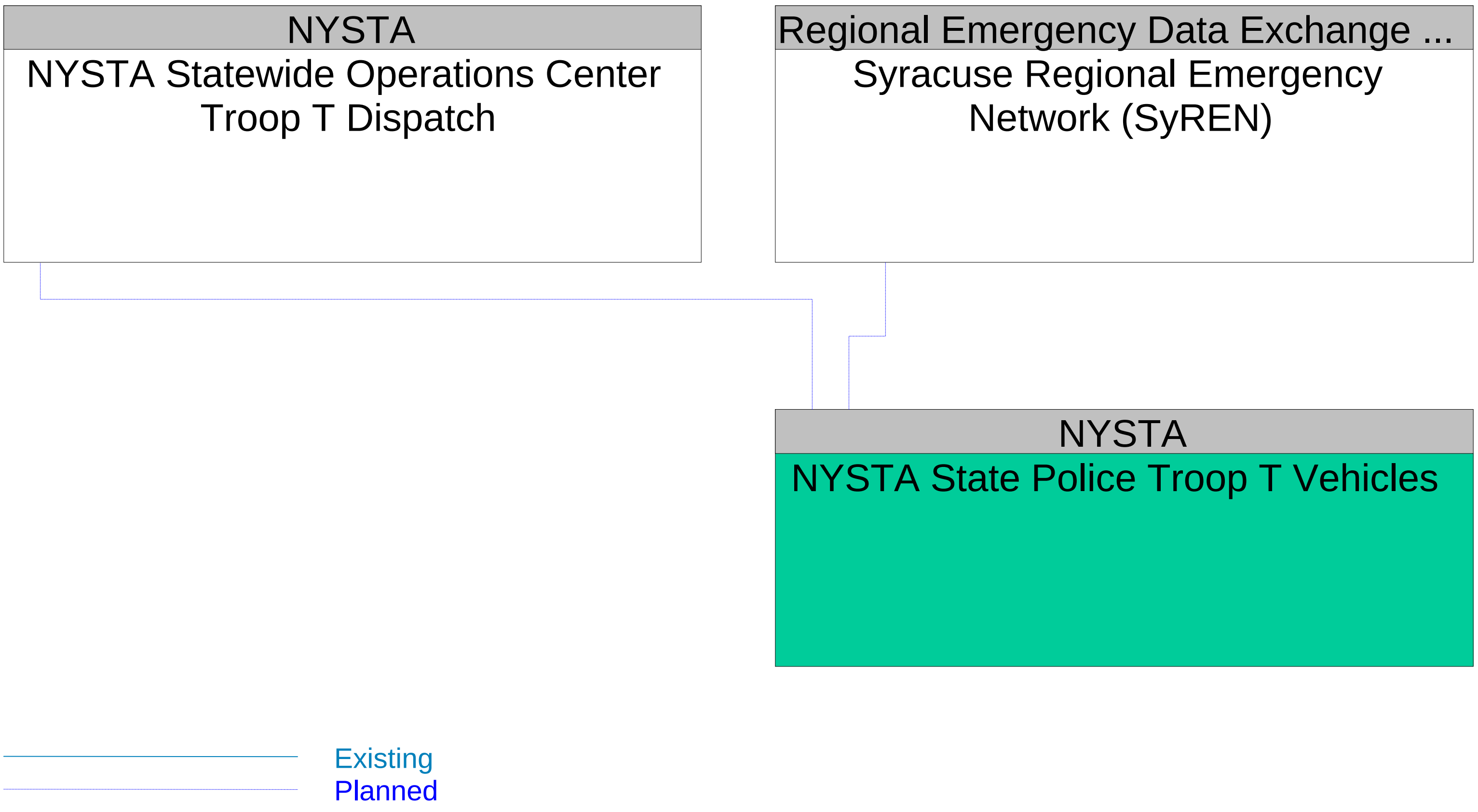

City of Syracuse
City of Syracuse Fire Vehicles
Inter-Agency Group
EZPASS TAG
CNYRTA
Local Transit Vehicles
NY State DOT
NYSDOT Region 3 Operations Center
NY State DOT
NYSDOT Region 3 Field Equipment
Other Emergency Service Providers
Other EMS Vehicles
Non-City Fire Agencies
Other Fire Vehicles (excluding the city fire vehicles)
Traveler
Pedestrian
Existing
Planned

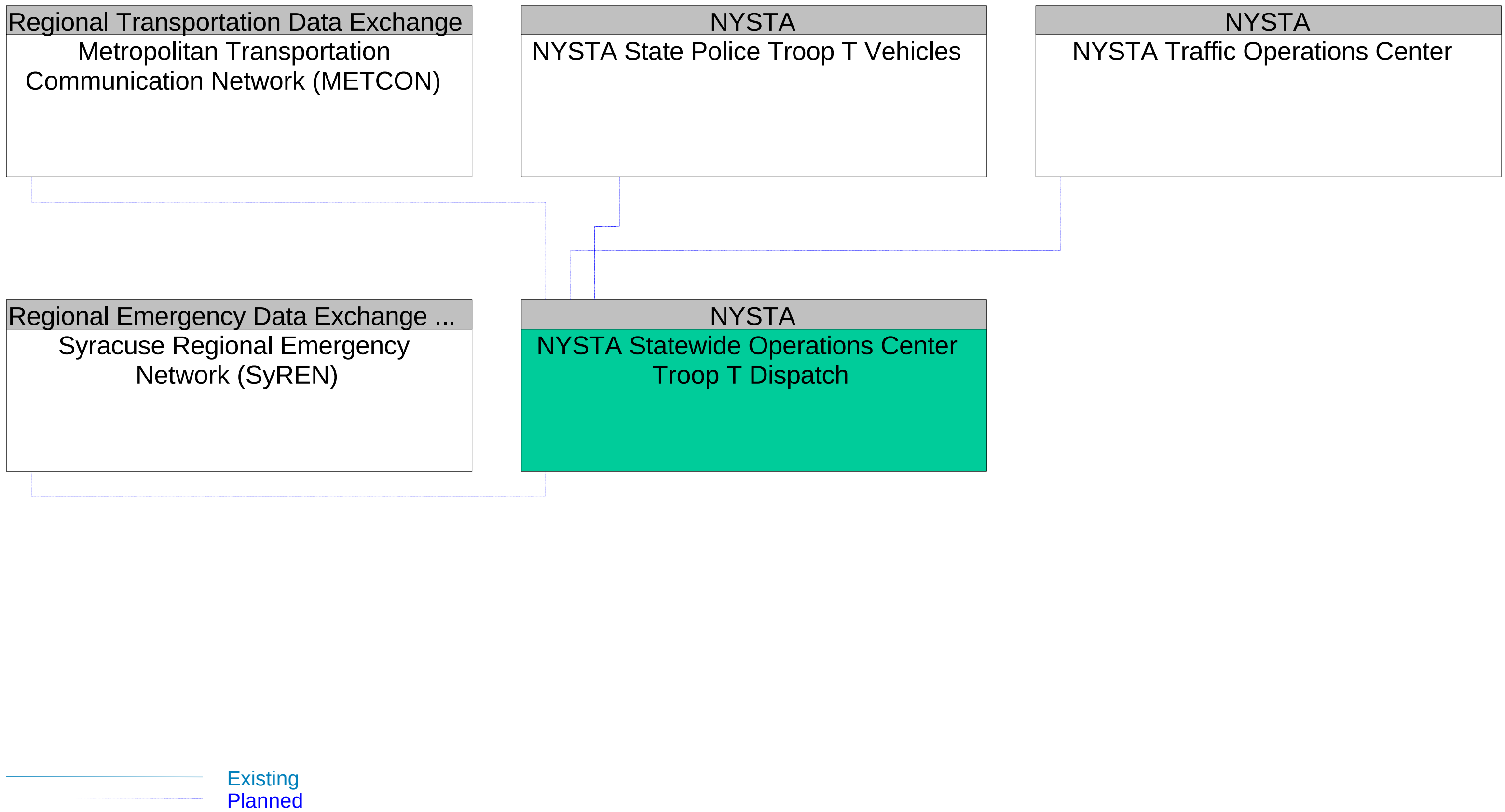

NY State DOT
NYSDOT Region 3 Operations Center
NYSDOT Region 3 Maintenance and Supervisory Vehicles
Existing
Planned

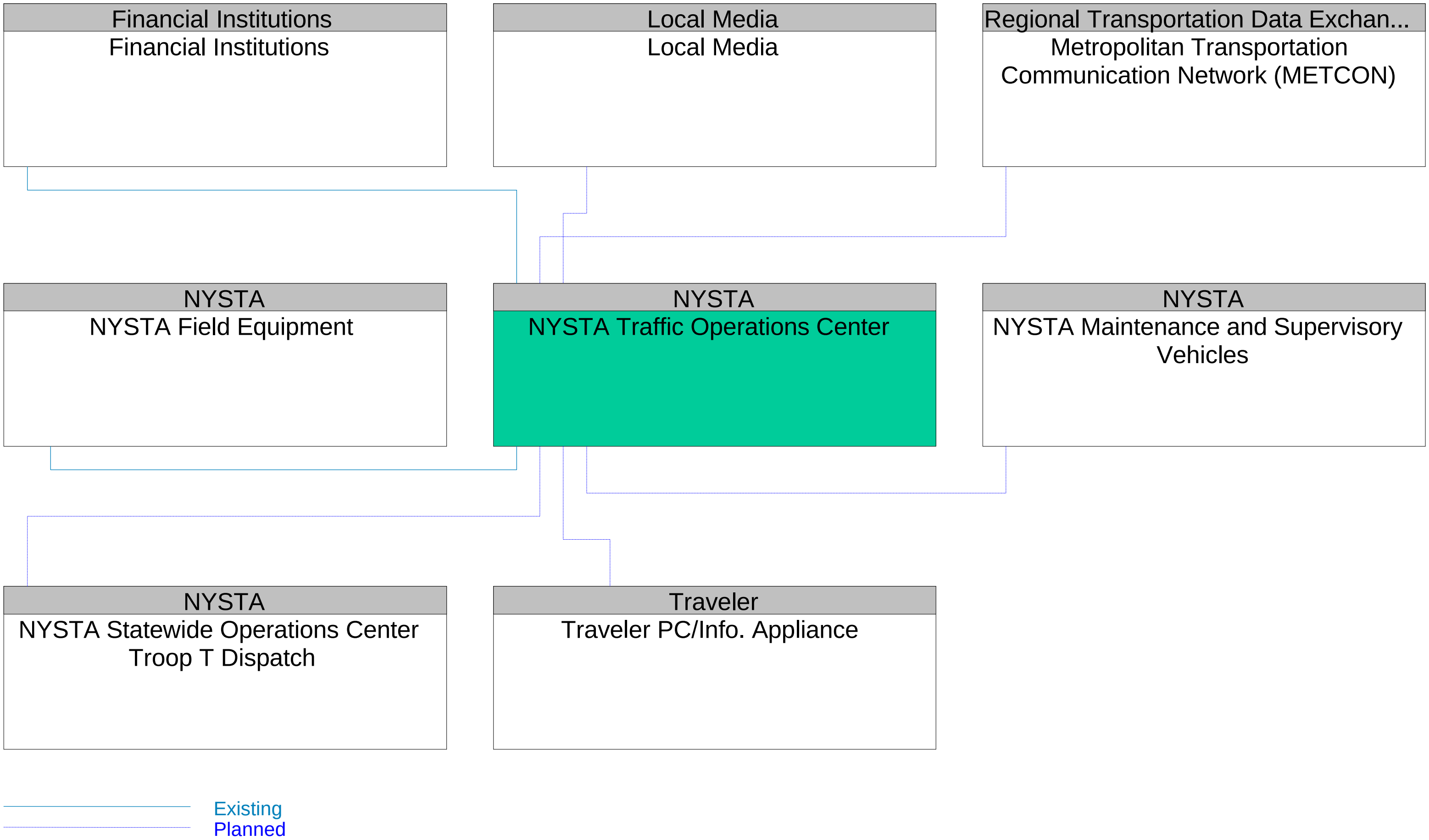

Local Media
Local Media
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
NY State Police
New York State Police
NY State DOT
NYSDOT Region 3
NY State DOT
NYSDOT Region 3 Operations Center
NY State DOT
NYSDOT Region 3 Field Equipment
NYSDOT Region 3 Maintenance and Supervisory Vehicles
Traveler
Traveler PC/Info. Appliance
Existing
Planned


Inter-Agency Group
EZPASS TAG
NYSTA
NYSTA Traffic Operations Center
NYSTA
NYSTA Field Equipment
Existing
Planned

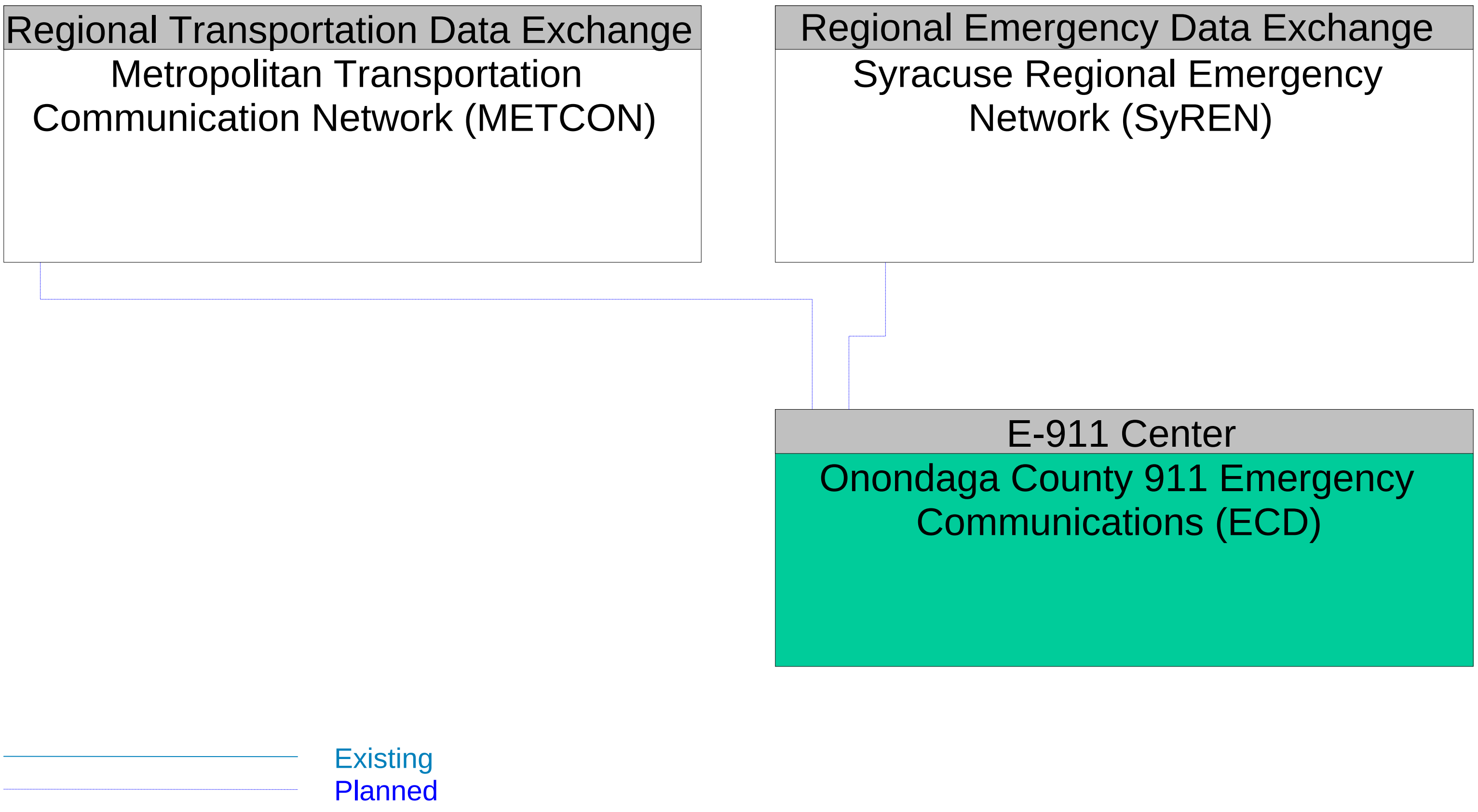

NYSTA
NYSTA Traffic Operations Center
NYSTA
NYSTA Maintenance and Supervisory Vehicles
Existing
Planned

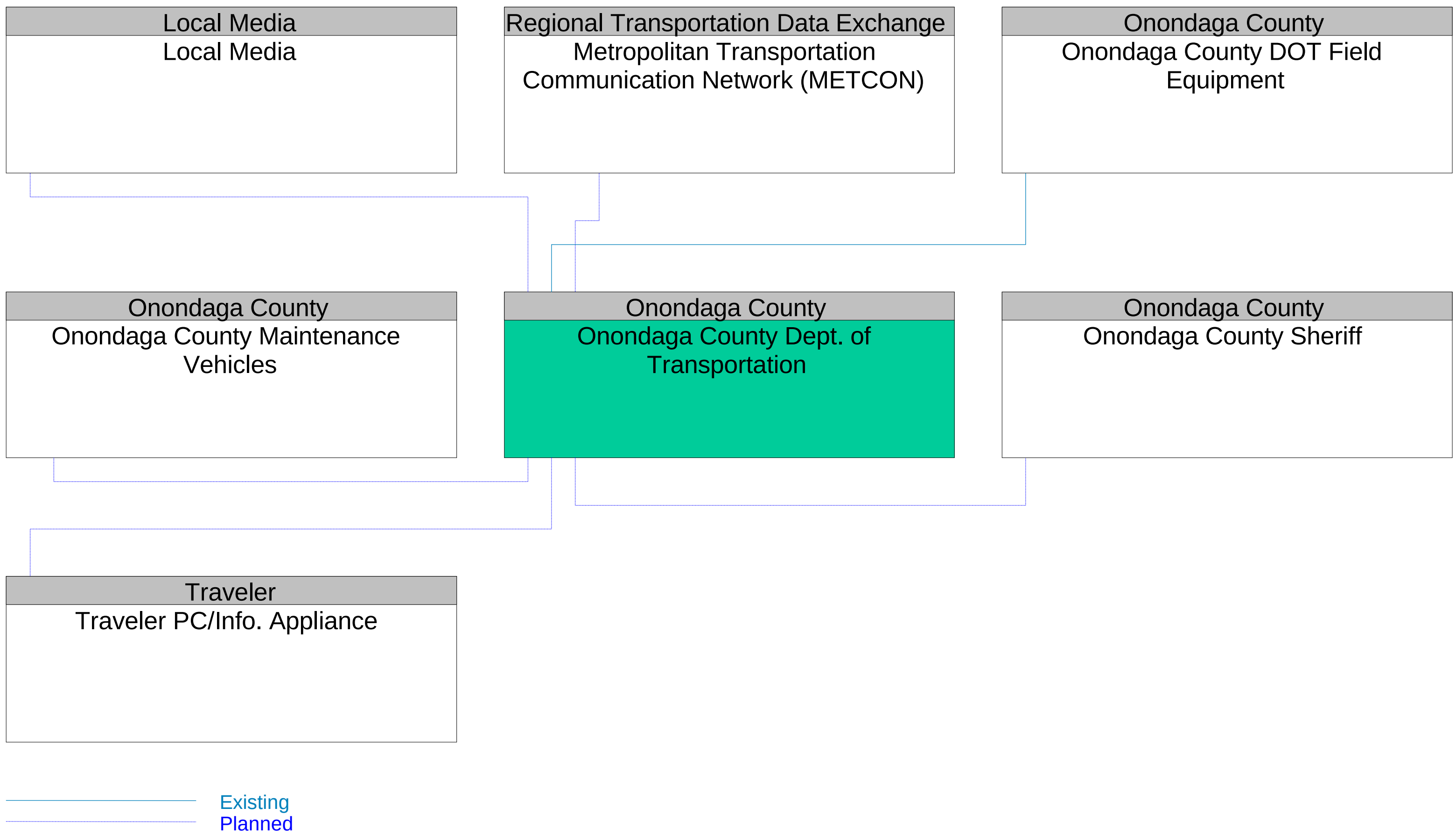

NYSTA
NYSTA Statewide Operations Center Troop T Dispatch
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
NYSTA
NYSTA State Police Troop T Vehicles
Existing
Planned

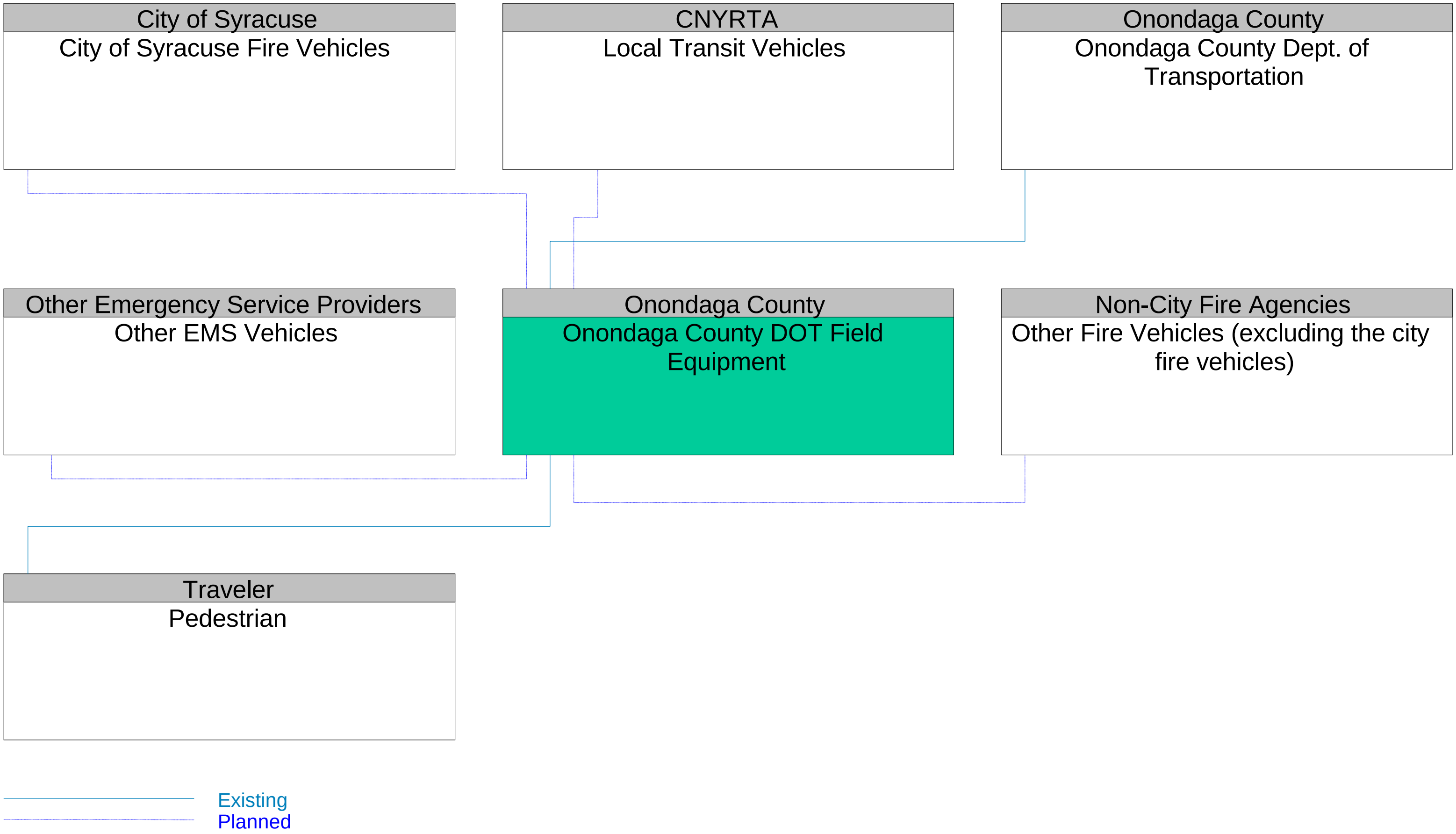

Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
NYSTA
NYSTA State Police Troop T Vehicles
NYSTA
NYSTA Traffic Operations Center
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
NYSTA
NYSTA Statewide Operations Center Troop T Dispatch
Existing
Planned



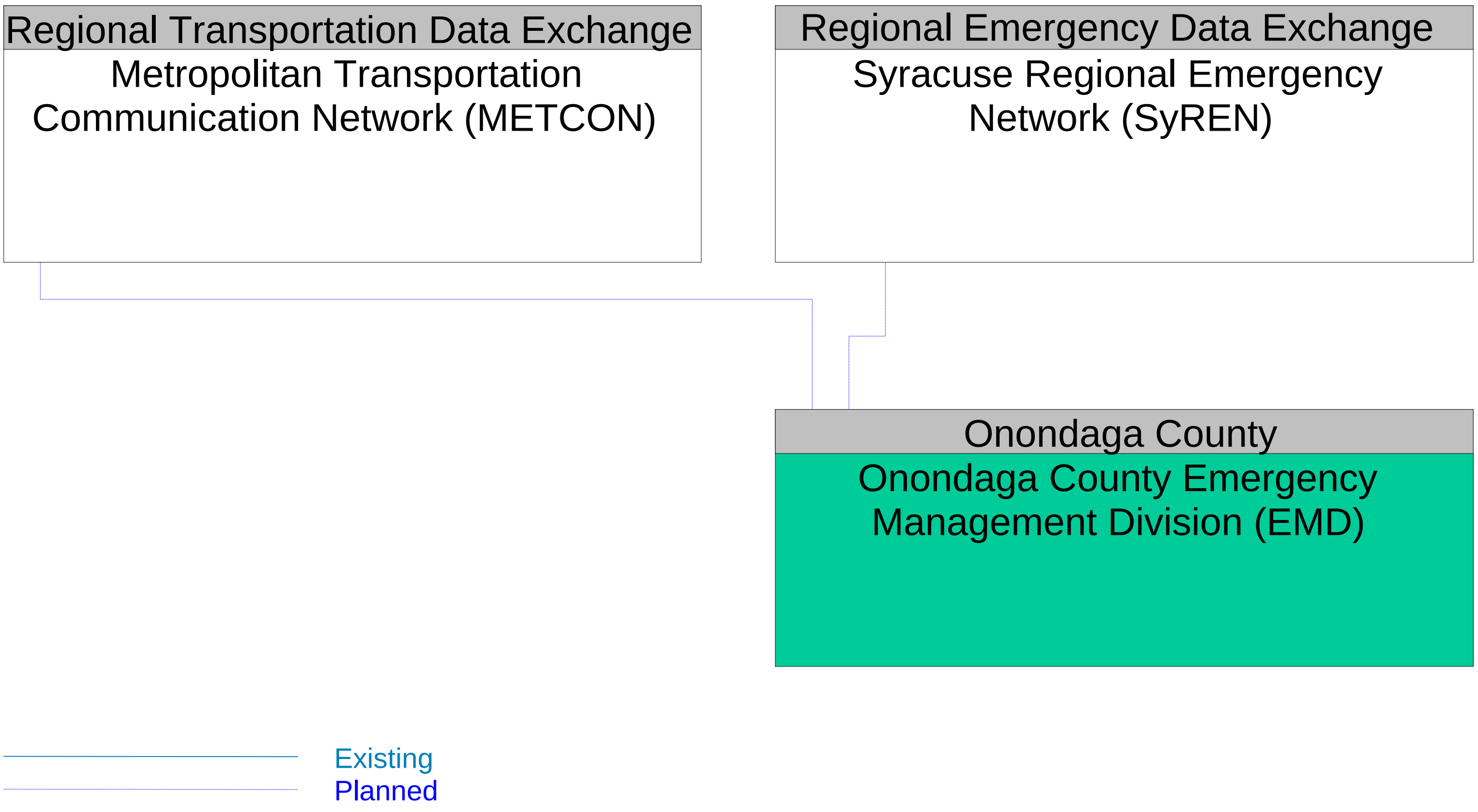
Financial Institutions
Financial Institutions
Local Media
Local Media
Regional Transportation Data Exchan...
Metropolitan Transportation Communication Network (METCON)
NYSTA
NYSTA Field Equipment
NYSTA
NYSTA Traffic Operations Center
NYSTA
NYSTA Maintenance and Supervisory Vehicles
NYSTA
NYSTA Statewide Operations Center Troop T Dispatch
Traveler
Traveler PC/Info. Appliance
Existing
Planned


Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
E-911 Center
Onondaga County 911 Emergency Communications (ECD)
Existing
Planned

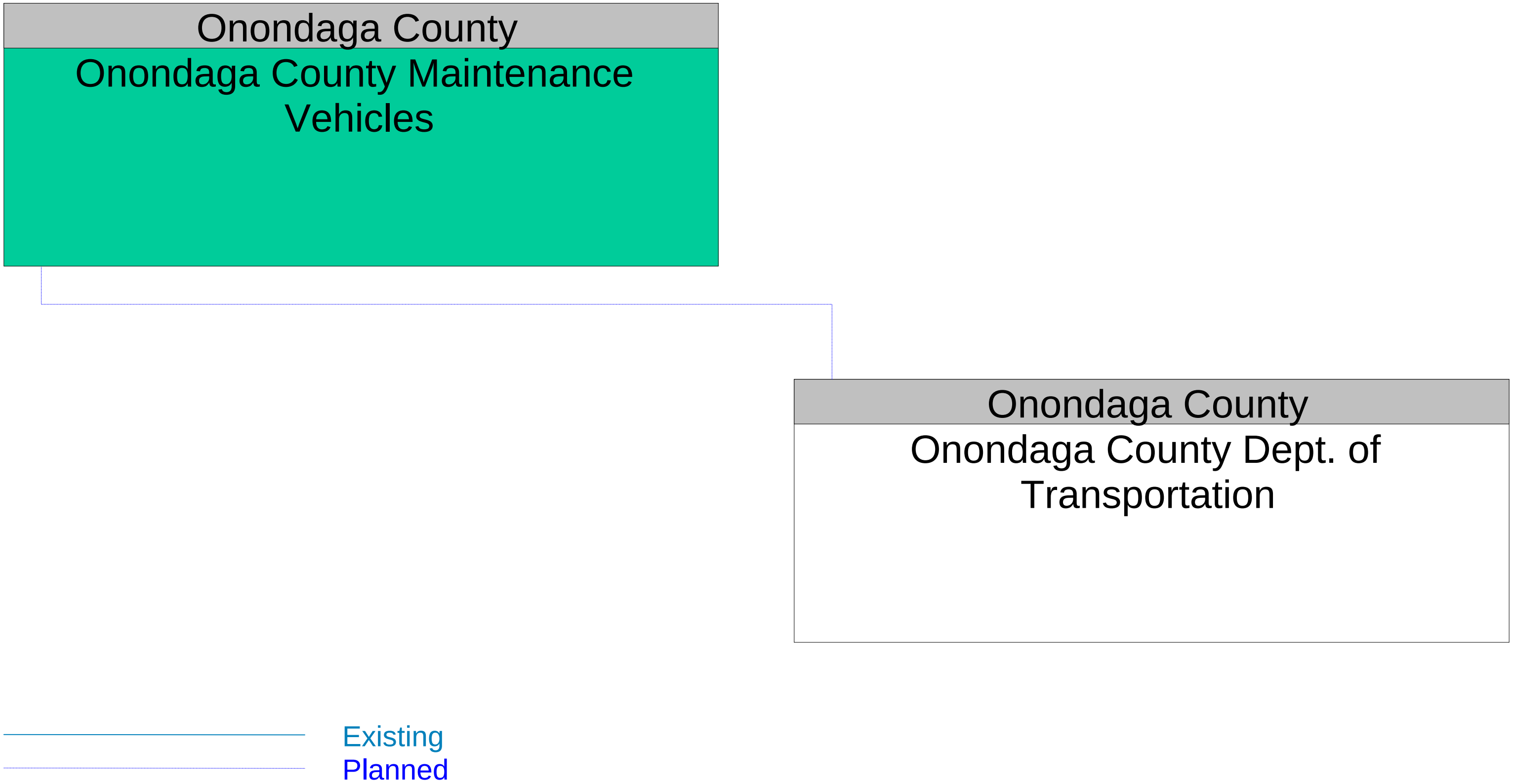

Local Media
Local Media
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Onondaga County
Onondaga County DOT Field Equipment
Onondaga County
Onondaga County Maintenance Vehicles
Onondaga County
Onondaga County Dept. of Transportation
Onondaga County
Onondaga County Sheriff
Traveler
Traveler PC/Info. Appliance
Existing
Planned

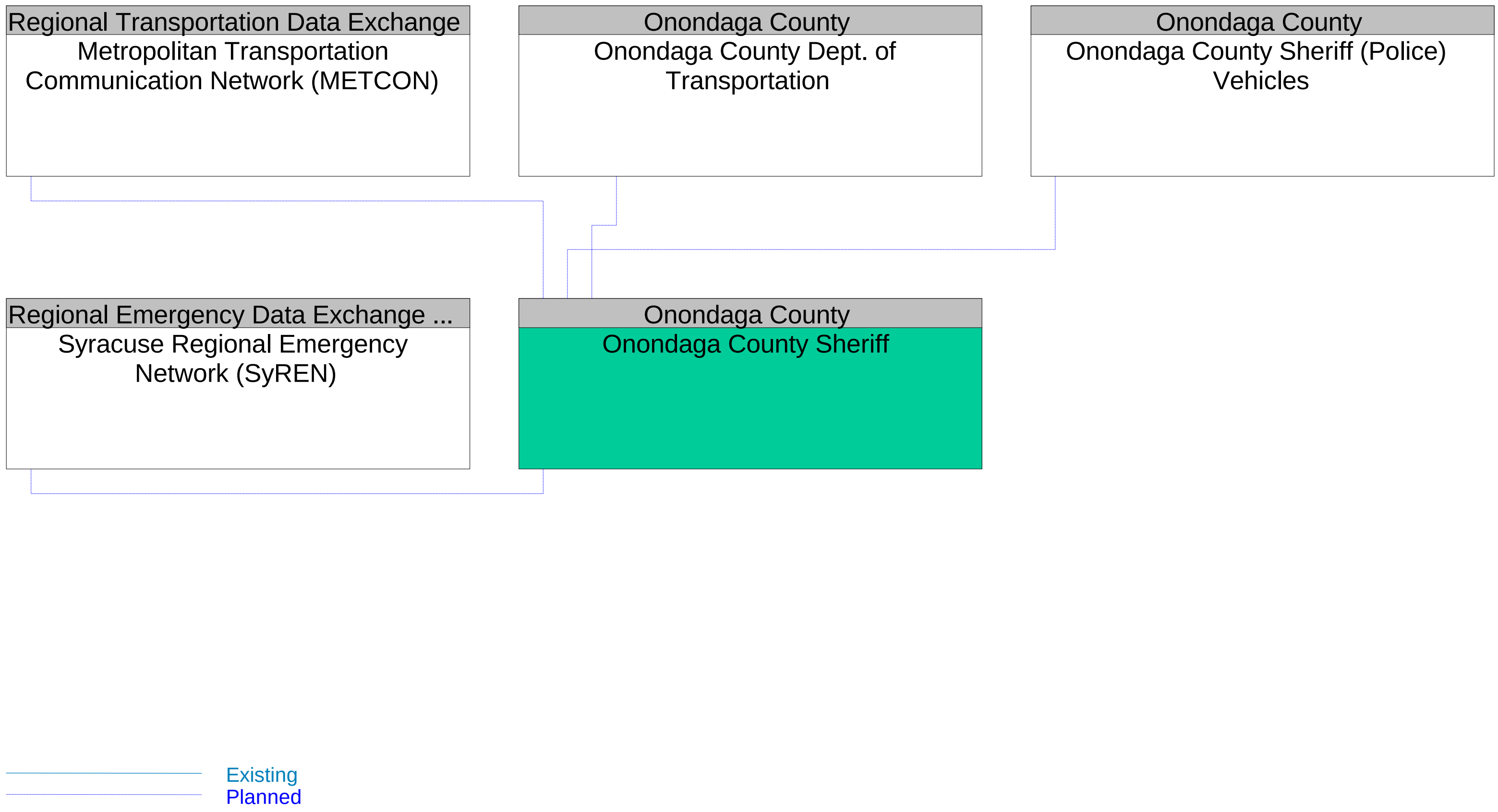


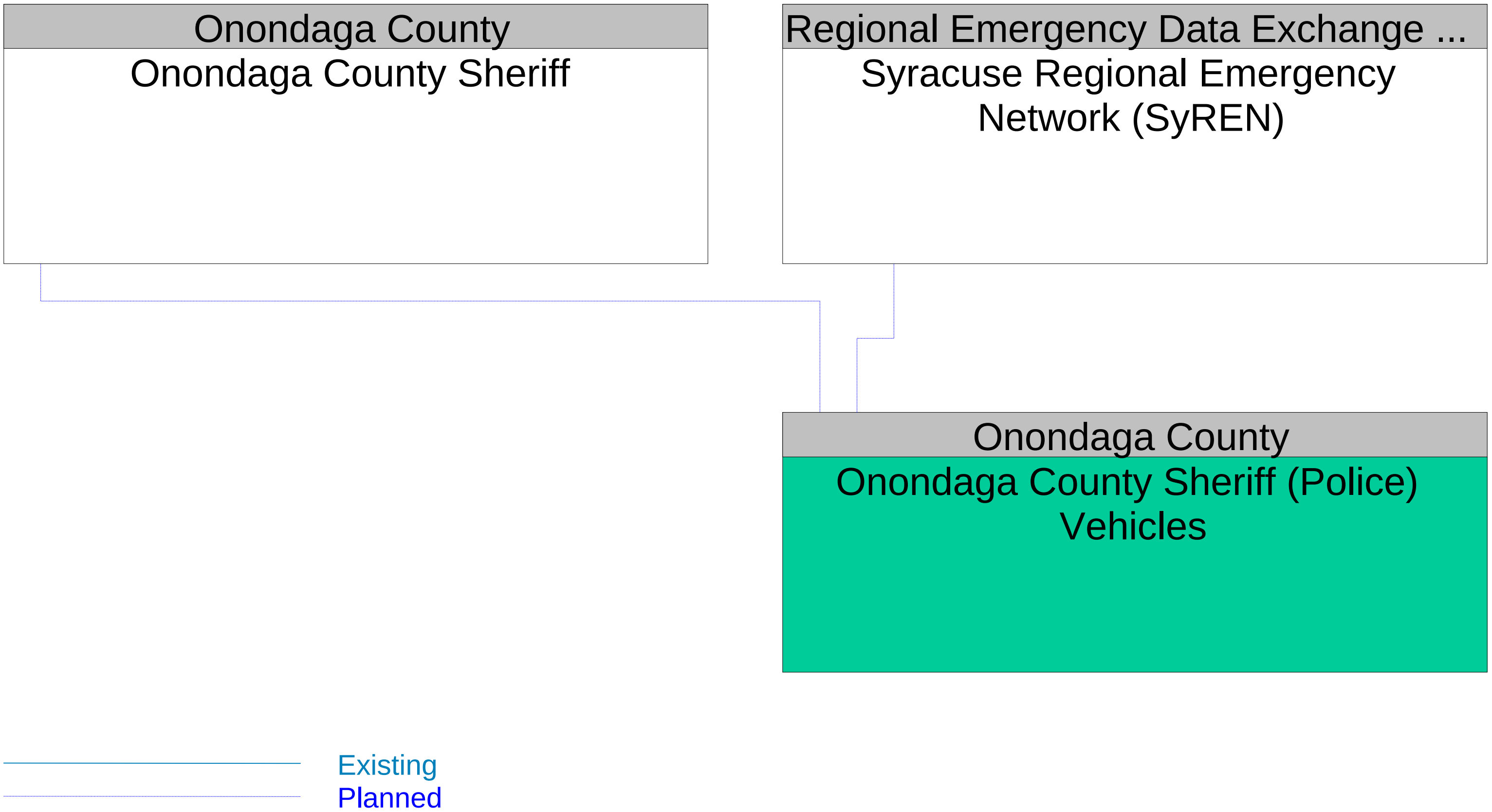
City of Syracuse
City of Syracuse Fire Vehicles
CNYRTA
Local Transit Vehicles
Onondaga County
Onondaga County Dept. of Transportation
Other Emergency Service Providers
Other EMS Vehicles
Onondaga County
Onondaga County DOT Field Equipment
Non-City Fire Agencies
Other Fire Vehicles (excluding the city fire vehicles)
Traveler
Pedestrian
Existing
Planned



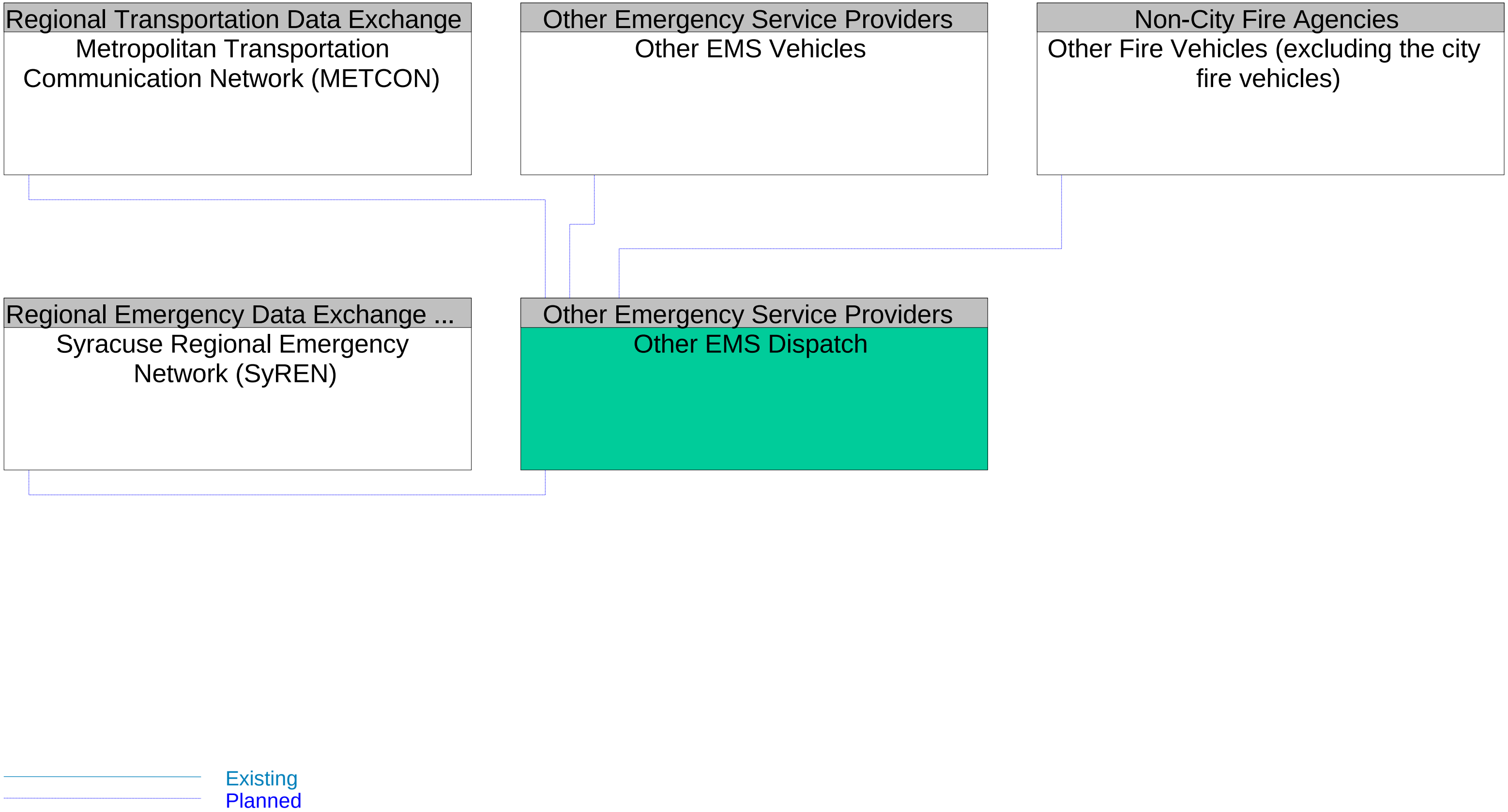
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
Onondaga County
Onondaga County Emergency Management Division (EMD)
Existing
Planned


Onondaga County
Onondaga County Maintenance Vehicles
Onondaga County
Onondaga County Dept. of Transportation
Existing
Planned

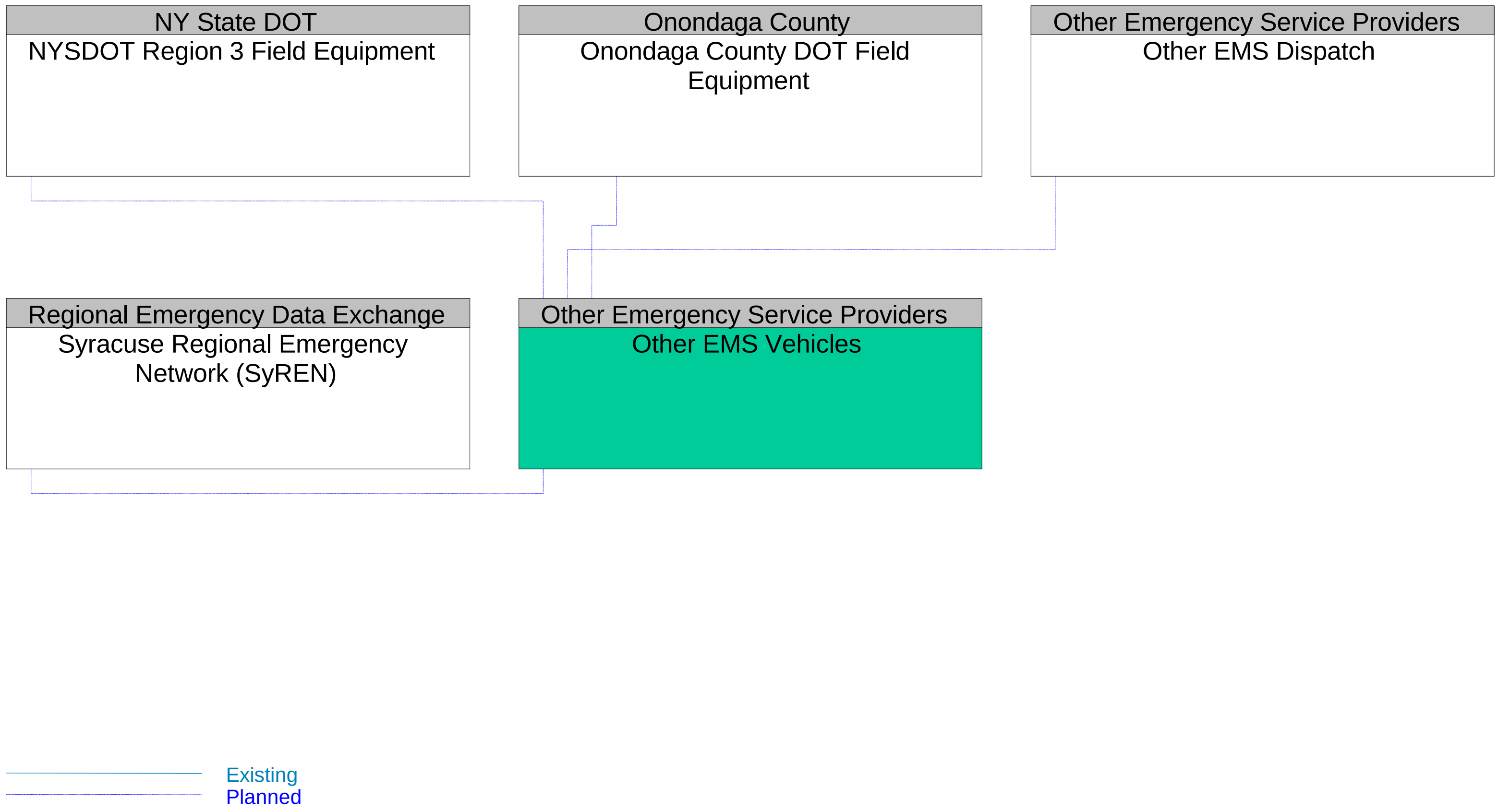

Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Onondaga County
Onondaga County Dept. of Transportation
Onondaga County
Onondaga County Sheriff (Police) Vehicles
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
Onondaga County
Onondaga County Sheriff
Existing
Planned



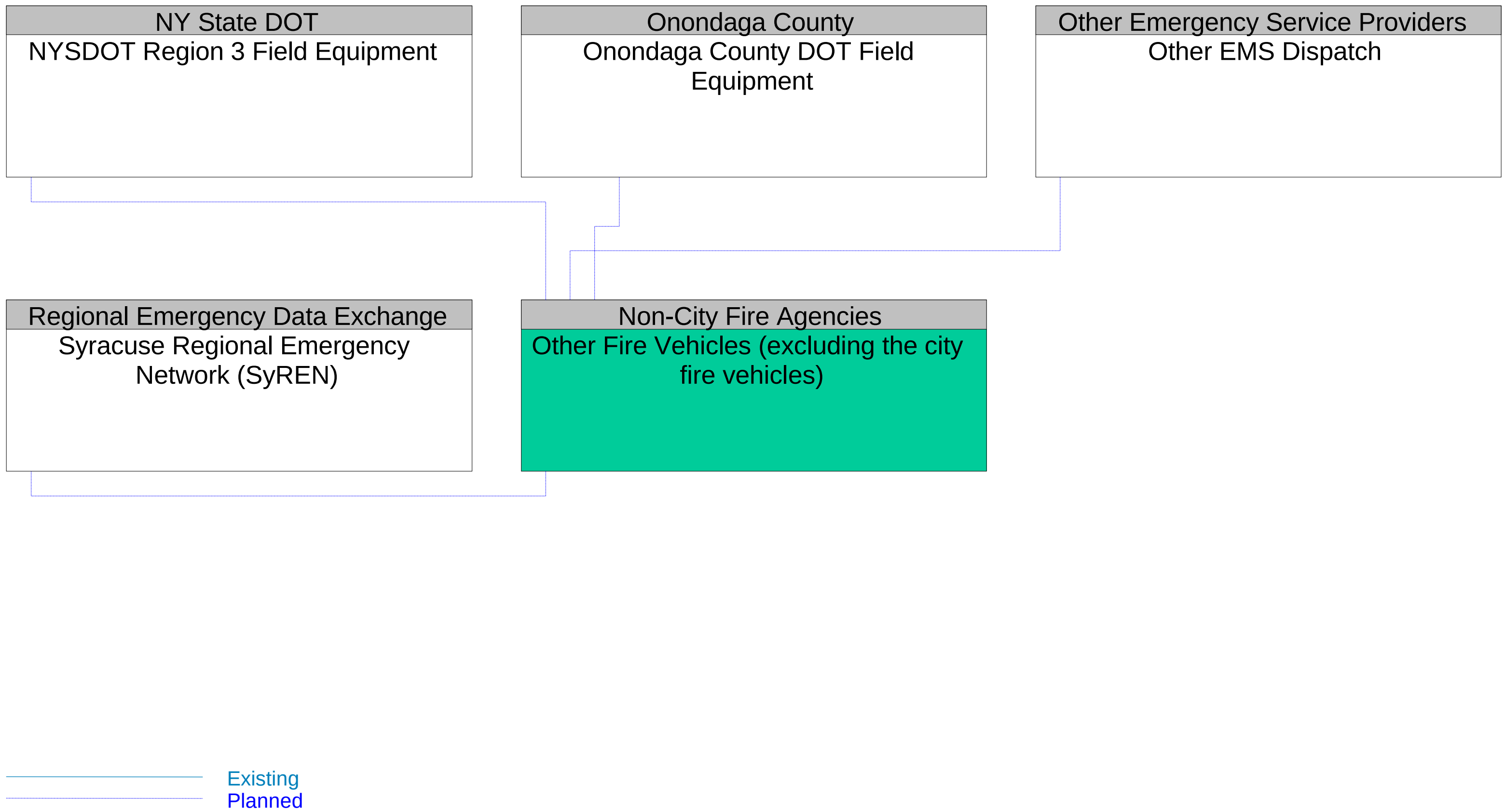
Onondaga County
Onondaga County Sheriff
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
Onondaga County
Onondaga County Sheriff (Police) Vehicles
Existing
Planned

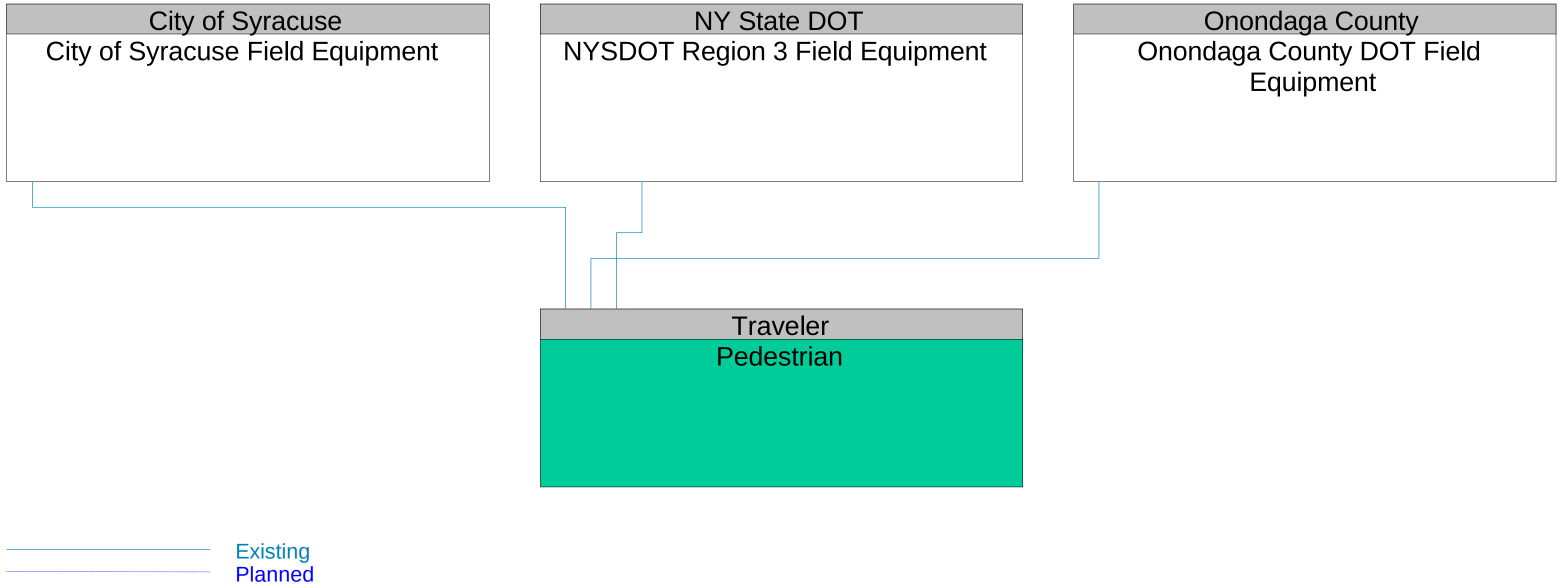


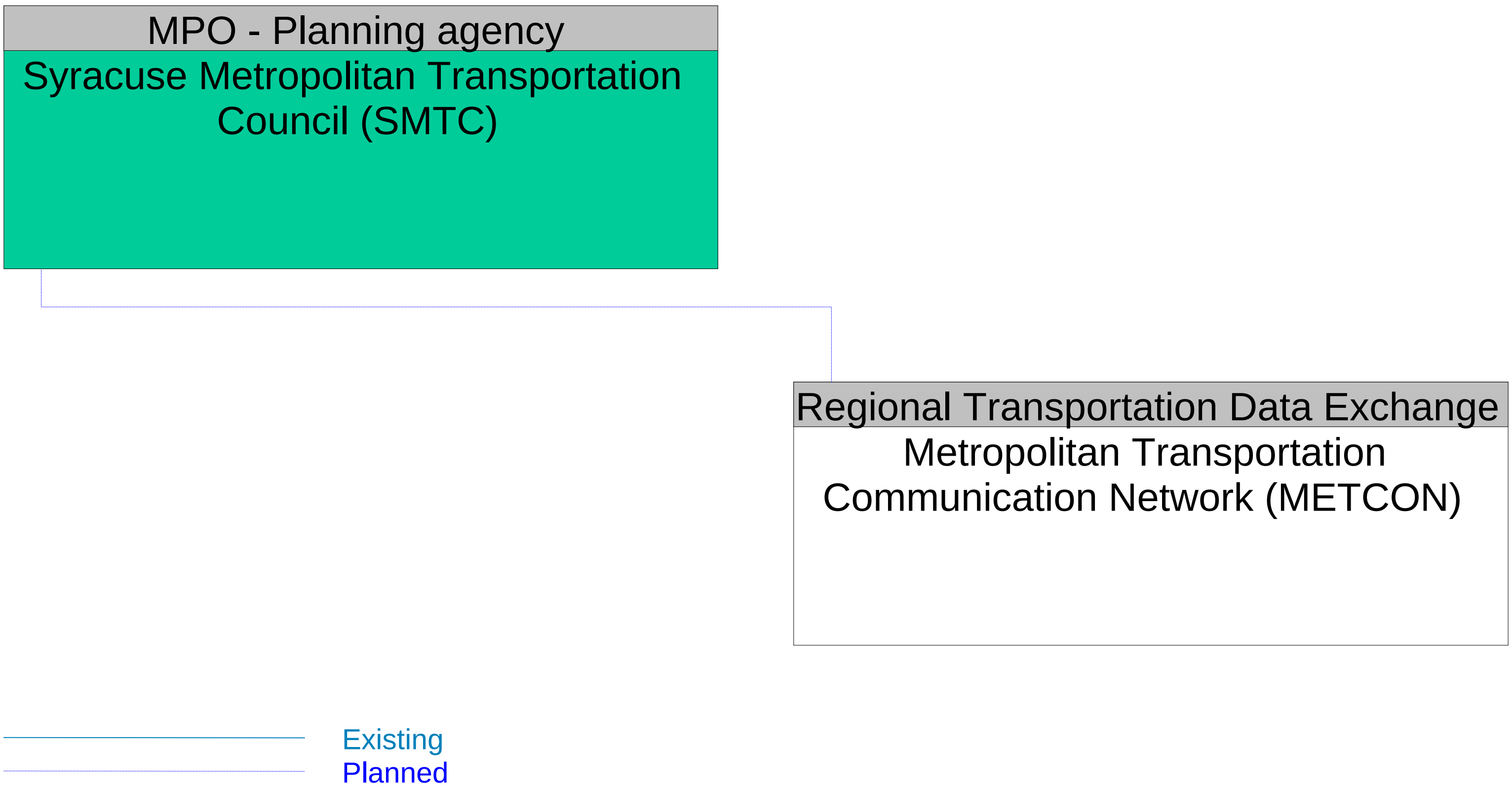
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Other Emergency Service Providers
Other EMS Vehicles
Non-City Fire Agencies
Other Fire Vehicles (excluding the city fire vehicles)
Regional Emergency Data Exchange ...
Syracuse Regional Emergency Network (SyREN)
Other Emergency Service Providers
Other EMS Dispatch
Existing
Planned

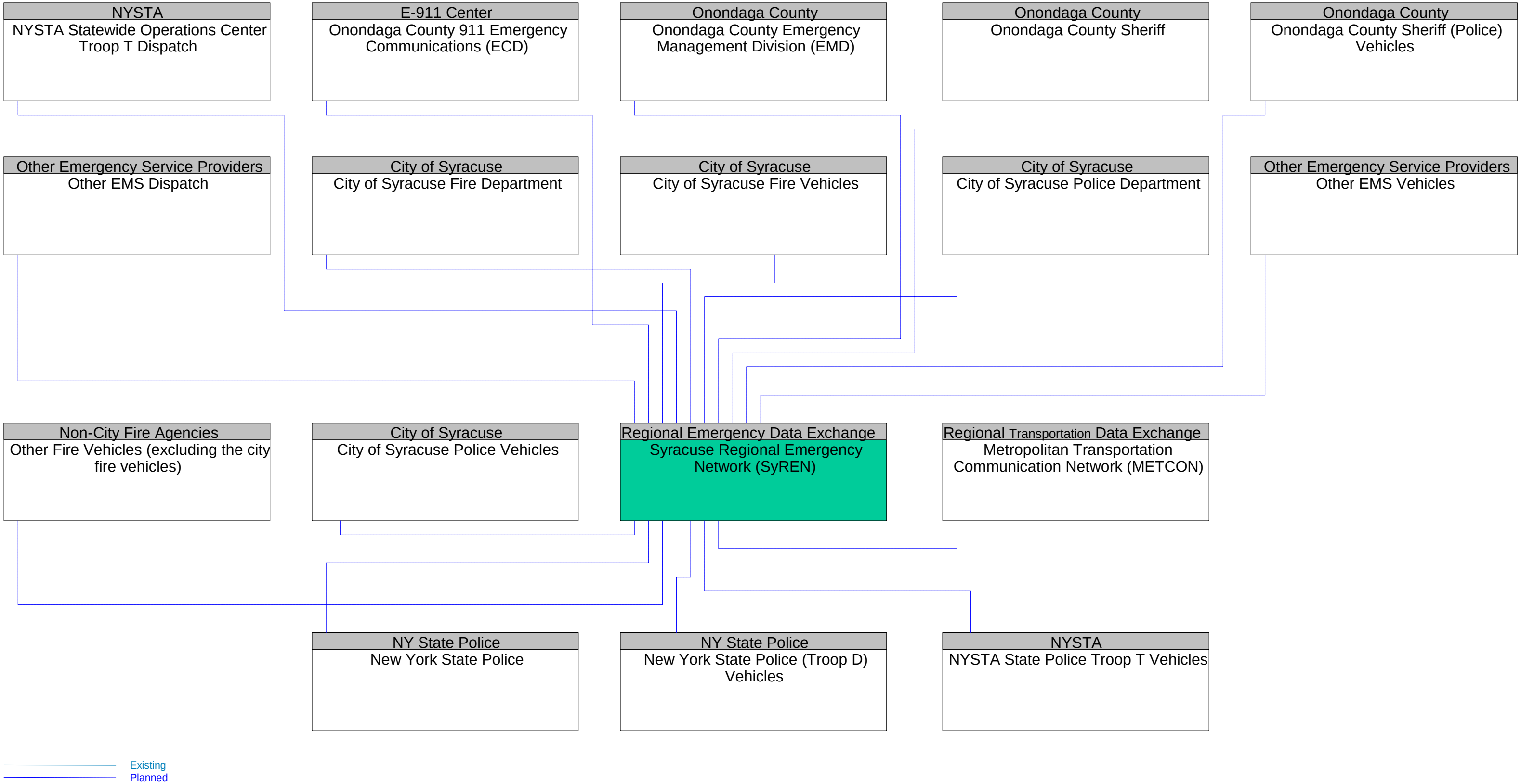


NY State DOT
NYSDOT Region 3 Field Equipment
Onondaga County
Onondaga County DOT Field Equipment
Other Emergency Service Providers
Other EMS Dispatch
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
Other Emergency Service Providers
Other EMS Vehicles
Existing
Planned

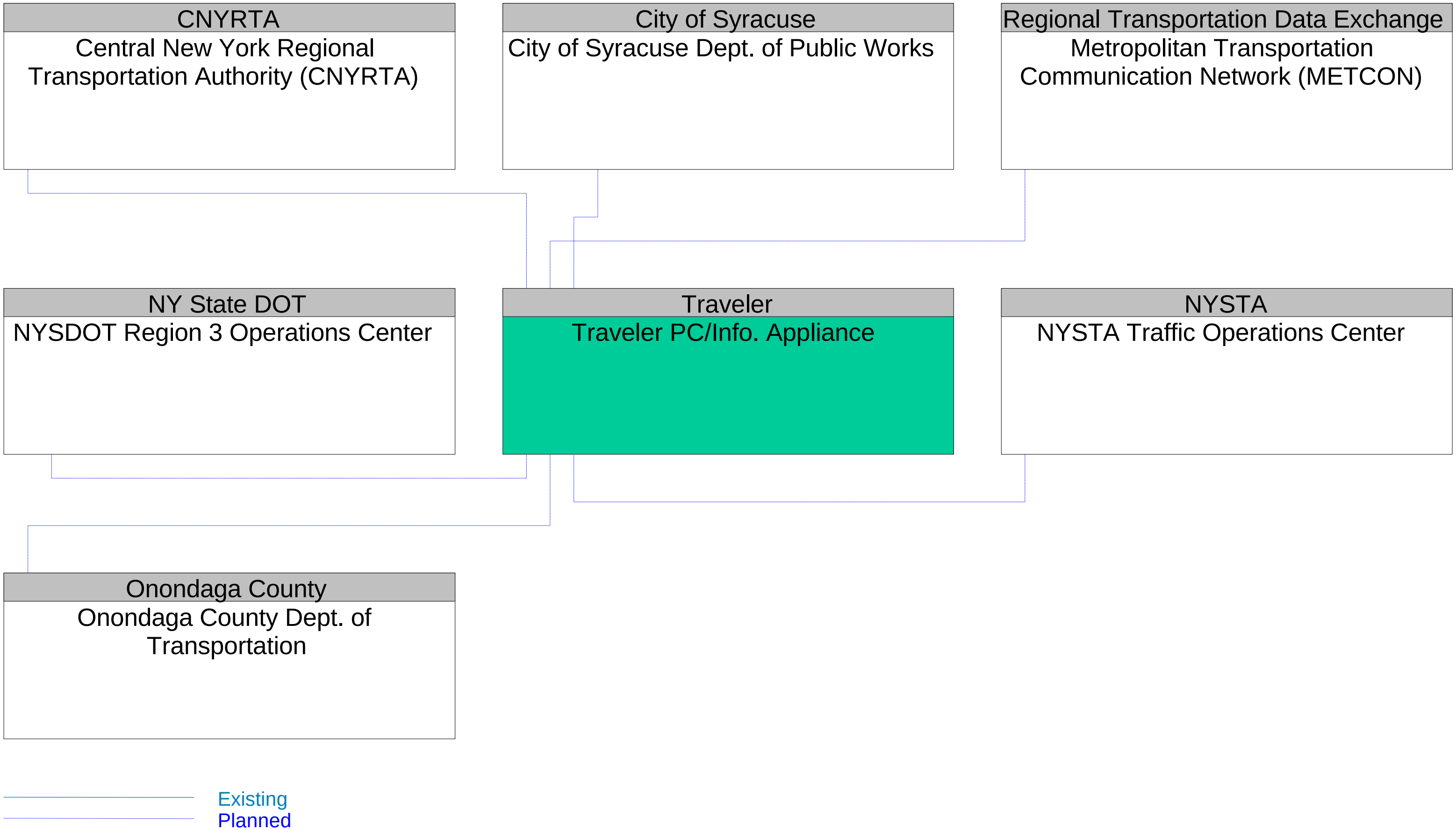

NY State DOT
NYSDOT Region 3 Field Equipment
Onondaga County
Onondaga County DOT Field Equipment
Other Emergency Service Providers
Other EMS Dispatch
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
Non-City Fire Agencies
Other Fire Vehicles (excluding the city fire vehicles)
Existing
Planned


City of Syracuse
City of Syracuse Field Equipment
NY State DOT
NYSDOT Region 3 Field Equipment
Onondaga County
Onondaga County DOT Field Equipment
Traveler
Pedestrian
Existing
Planned


MPO - Planning agency
Syracuse Metropolitan Transportation Council (SMTC)
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Existing
Planned



NYSTA
NYSTA Statewide Operations Center Troop T Dispatch
E-911 Center
Onondaga County 911 Emergency Communications (ECD)
Onondaga County
Onondaga County Emergency Management Division (EMD)
Onondaga County
Onondaga County Sheriff
Onondaga County
Onondaga County Sheriff (Police) Vehicles
Other Emergency Service Providers
Other EMS Dispatch
City of Syracuse
City of Syracuse Fire Department
City of Syracuse
City of Syracuse Fire Vehicles
City of Syracuse
City of Syracuse Police Department
Other Emergency Service Providers
Other EMS Vehicles
Non-City Fire Agencies
Other Fire Vehicles (excluding the city fire vehicles)
City of Syracuse
City of Syracuse Police Vehicles
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
NY State Police
New York State Police
NY State Police
New York State Police (Troop D) Vehicles
NYSTA
NYSTA State Police Troop T Vehicles
Existing
Planned


CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
City of Syracuse
City of Syracuse Dept. of Public Works
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
NY State DOT
NYSDOT Region 3 Operations Center
Traveler
Traveler PC/Info. Appliance
NYSTA
NYSTA Traffic Operations Center
Onondaga County
Onondaga County Dept. of Transportation
Existing
Planned

Appendix D Definition of Architecture Flow Definitions

archive analysis requests

A user request that initiates data mining, analytical processing, aggregation or summarization, report formulation, or other advanced processing and analysis of archived data. The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.

archive analysis results

Processed information products, supporting meta data, and any associated transaction information resulting from data mining, analytical processing, aggregation or summarization, report formulation, or other on-line processing and analysis of archived data.

archive coordination

Catalog data, meta data, published data, and other information exchanged between archives to support data synchronization and satisfy user data requests.

archive management data

Information used to support the management of an ITS archive including database reports on the condition and quality of the archived data, status of the import and collection process, reports that monitor archive usage, and any special requests that require direct action by the administrator (e.g., requests for access to new data sources).

archive management requests

Commands, requests, and queries that support the administration and management of an ITS data archive.

archive request confirmation

Confirmation that an archive request has been received and processed with information on the disposition of the request

archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

archived data product requests

A user-specified request for archived data products (i.e. data, meta data, or data catalogs). The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.

archived data products
Raw or processed data, meta data, data catalogs and other data products provided to a user system upon request. The response may also include any associated transaction information.

bad tag list
List of invalid transit user tags which may have previously failed a fare payment transaction.

broadcast information
General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.

construction and maintenance archive data
Information describing road construction and maintenance activities identifying the type of activity, the location of the activity, and the activity status. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

crossing call
Request for pedestrian crossing.

crossing permission
Signal to pedestrians indicating permission to cross roadway.

current asset restrictions
Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

current network conditions
Current traffic information, road conditions, and camera images that can be used to locate and verify reported incidents, and plan and implement an appropriate response.

demand responsive transit plan
Plan regarding overall demand responsive transit schedules and deployment.

demand responsive transit request
Request for paratransit support.

dispatch information
Dispatch information and command to emergency personnel.

emergency acknowledge
Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

emergency archive data
Logged incident information that characterizes the identified incidents and provides a record of the corresponding incident response. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

emergency dispatch requests
Emergency vehicle dispatch instructions including incident location and available information concerning the incident.

emergency dispatch response
Request for additional emergency dispatch information (e.g., a suggested route) and provision of en-route status.

emergency notification
An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device. Sufficient information is provided so that the recipient can determine the location of the emergency as a minimum. Additional information identifying the requestor and requesting device and the nature and severity of the emergency may also be provided (and required) by some systems.

emergency operations request
Emergency operator inputs supporting call taking, dispatch, and other operations and communications center operator functions.

emergency operations status
Emergency operations data supporting a range of emergency operating positions including call taker, dispatch, and various other operations and communications center operator positions.

emergency personnel inputs
Current incident status information and requests from emergency personnel in the field for information and/or resources.

emergency traffic control request
Special request to preempt the current traffic control strategy in effect at one or more signalized intersections or highway segments. For example, this flow can request all signals to red-flash, request a progression of traffic control preemptions along an emergency vehicle route, or request another special traffic control plan.

emergency traffic control response
Status of the special traffic signal control strategy implemented in response to the emergency traffic control request.

emergency vehicle tracking data
The current location and operating status of the emergency vehicle.

equipment maintenance status
Current status of field equipment maintenance actions.

external reports
Traffic and incident information that is collected by the media through a variety of mechanisms (e.g., radio station call-in programs, air surveillance).

fare and payment status
Current fare collection information including the operational status of the fare collection equipment and financial payment transaction data.

fare and price information
Current transit, parking, and toll fee schedule information.

fare management information
Transit fare information and transaction data used to manage transit fare processing on the transit vehicle.

fault reports
Reports from field equipment (sensors, signals, signs, controllers, etc.) which indicate current operational status.

field equipment status
Identification of field equipment requiring repair and known information about the associated faults.

freeway control data
Control commands and operating parameters for ramp meters, dynamic message signs, mainline metering/lane controls and other systems associated with freeway operations.

freeway control status
Current operational status and operating parameters for ramp meters, dynamic message signs, mainline metering/lane controls and other control equipment associated with freeway operations.

incident command information
Information that supports local management of an incident. It includes resource deployment status, hazardous material information, traffic, road, and weather conditions, evacuation advice, and other information that enables emergency personnel in the field to implement an effective, safe incident response.

incident command information presentation
Presentation of information to emergency personnel in the field that supports local tactical decision-making within an incident command system structure.

incident command request
Request for resources, commands for relay to other allied response agencies, and other requests that reflect local command of an evolving incident response.

incident data
Data and imagery from the roadside supporting incident detection and verification.

incident information
Notification of existence of incident and expected severity, location, time and nature of incident.

incident information for media
Report of current desensitized incident information prepared for public dissemination through the media.

incident information request
Request for incident information, clearing time, severity. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

incident notification
The notification of an incident including its nature, severity, and location.

incident notification response
Interactive acknowledgement and verification of the incident information received, requests for additional information, and general information on incident response status.

incident report
Report of an identified incident including incident location, type, severity and other information

necessary to initiate an appropriate incident response.

incident response coordination
Incident response procedures, resource coordination, and current incident response status that are shared between allied response agencies to support a coordinated response to incidents. This flow also coordinates a positive hand off of responsibility for all or part of an incident response between agencies.

incident response status
Status of the current incident response including traffic management strategies implemented at the site (e.g., closures, diversions, traffic signal control overrides).

incident status
Information gathered at the incident site that more completely characterizes the incident and provides current incident response status.

infrastructure conditions data
Current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.

intersection blockage notification
Notification that a highway-rail intersection is obstructed and supporting information.

intersection status
Status of intersection congestion, approaching vehicles, etc.

ISP coordination
Coordination and exchange of transportation information between centers. This flow allows a broad range of transportation information collected by one ISP to be redistributed to many other ISPs and their clients.

local signal preemption request
Direct control signal or message to a signalized intersection that results in preemption of the current control plan and grants right-of-way to the requesting vehicle.

local signal priority request
Request from a vehicle to a signalized intersection for priority at that intersection.

logged special vehicle route
Anticipated route information for special vehicles (e.g., oversize vehicles) or groups of vehicles (e.g., governer's motorcade) that may require changes in traffic control strategy.

maint and constr archive data
Information describing road construction and maintenance activities identifying the type of activity, the work performed, and work zone information including work zone configuration and safety (e.g., a record of intrusions and vehicle speeds) information.. For construction activities, this information also includes a description of the completed infrastructure, including as-built plans as applicable. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

maint and constr dispatch information
Information used to dispatch maintenance and construction vehicles, equipment, and crews.

This information includes routing information, traffic information, road restrictions, incident information, environmental information, decision support information, maintenance schedule data, dispatch instructions, personnel assignments, and corrective actions.

maint and constr dispatch status

Current maintenance and construction status including work data, operator status, crew status, and equipment status.

maint and constr resource request

Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.

maint and constr resource response

Current status of maintenance and construction resources including availability and deployment status.

maint and constr vehicle conditions

Vehicle diagnostics information that is collected, filtered, and selectively reported by a maintenance and construction vehicle. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.

maint and constr vehicle location data

- The current location and related status (e.g., direction and speed) of the maintenance/construction vehicle.

maint and constr vehicle operational data

Data that describes the maintenance and construction activity performed by the vehicle. Operational data includes materials usage (amount stored and current application rate), operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), vehicle safety status, and other measures associated with the operation of a maintenance, construction, or other special purpose vehicle. Operational data may include basic operational status of the vehicle equipment or a more precise record of the work performed (e.g., application of crack sealant with precise locations and application

maint and constr vehicle system control

Configure and control data that supports remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle. For example, the data can be used to adjust material application rates and spread patterns.

maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

map update request

Request for a map update which could include a new underlying map or map layer updates.

map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

media information request

Request from the media for current transportation information.

other data source archive data
Data extracted from other data sources. A wide range of ITS and non-ITS data and associated meta data may be provided.

parking archive data
Data used to analyze and monitor trends in parking demand, pricing, and operational actions. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

parking availability
Current parking lot occupancy, parking availability, and cost information.

parking demand management request
Request to change the demand for parking facility use through pricing or other mechanisms.

parking demand management response
Response to parking demand management change requests indicating level of compliance with request.

parking information
General parking information and current parking availability.

parking instructions
Information that allows local parking facilities to be managed to support regional traffic management objectives.

parking lot data request
Request for parking lot occupancy, fares, and availability.   The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

parking lot reservation confirmation
Confirmation for parking lot reservation.

parking reservations request
Reservation request for parking lot.

payment
Payment of some kind (e.g., toll, parking, fare) by traveler which in most cases can be related to a credit account.

payment request
Request for payment from financial institution.

personal transit information
General and personalized transit information for a particular fixed route, flexible route, or paratransit system.

remote surveillance control
The control commands used to remotely operate another center's sensors or surveillance equipment so that roadside surveillance assets can be shared by more than one agency.

request fare and price information
Requests for current fare and price information from a service provider that can be used to

augment the traffic manager's overall view of current transportation network status.

request for bad tag list
Request for list of bad vehicle tag IDs.

request for information on violators
Request for law enforcement information on vehicles and drivers suspected of violations.

request for payment
Request to deduct cost of service from user's payment account.

request for right-of-way
Forwarded request from signal prioritization, signal preemption, pedestrian call, multi-modal crossing activation, or other source for right-of-way.

request for traffic information
Request for traffic information that specifies the region/route of interest, the desired effective time period, and other parameters that allow preparation of a tailored response. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

request for vehicle measures
Request for vehicle performance and maintenance data collected by onboard sensors.

request tag data
Request for tag information including credit identity, stored value card cash, etc.

request transit information
Request for transit service information and current transit status.

resource deployment status
Status of traffic management center resource deployment identifying the resources available and their current deployment status.

resource request
A request for traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc.

reversible lane status
Current reversible lane status including traffic sensor and surveillance data and the operational status and mode of the reversible lane control equipment.

road network conditions
Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

road network probe information
Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

road network use
Aggregated route usage and associated travel data from clients for planning and analysis.

road weather information
Road conditions and weather information that are made available by road maintenance

operations to other transportation system operators.

roadside archive data
A broad set of data derived from roadside sensors that includes current traffic conditions, environmental conditions, and any other data that can be directly collected by roadside sensors. This data also indicates the status of the sensors and reports of any identified sensor faults.

roadway information system data
Information used to initialize, configure, and control roadside systems that provide driver information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.

roadway information system status
Current operating status of dynamic message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.

roadway maintenance status
Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

selected routes
Routes selected based on route request criteria.

sensor and surveillance control
Information used to configure and control sensor and surveillance systems at the roadside.

signal control data
Information used to configure and control traffic signal systems.

signal control status
Status of surface street signal controls.

suggested route
Suggested route for a dispatched emergency vehicle that may reflect current network conditions and the additional routing options available to en-route emergency vehicles that are not available to the general public.

tag data
Unique tag ID and related vehicle information for the purposes of payment for services.

tag update
Update data held in tag which can be read at another screening.

traffic archive data
Information describing the use and vehicle composition on transportation facilities and the traffic control strategies employed. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

traffic control coordination
Information transfers that enable remote monitoring and control of traffic management devices.

This flow is intended to allow cooperative access to, and control of, field equipment during incidents and special events and during day-to-day operations. This flow also allows 24-hour centers to monitor and control assets of other centers during off-hours, allows system redundancies and fail-over capabilities to be established, and otherwise enables integrated traffic control strategies in a region.

traffic control priority request
Request for signal priority at one or more intersections along a particular route.

traffic control priority status
Status of signal priority request functions at the roadside (e.g. enabled or disabled).

traffic flow
Raw and/or processed traffic detector information which allows derivation of traffic flow variables (e.g., speed, volume and density measures).

traffic images
High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications.

traffic information
Current and forecasted traffic information, road and weather conditions, incident information, and pricing data. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

traffic information coordination
Traffic information exchanged between TMC's. Normally would include incidents, congestion data, traffic data, signal timing plans, and real-time signal control information.

traffic information for media
Report of current traffic conditions, incidents, maintenance activities and other traffic-related information prepared for public dissemination through the media.

traffic information for transit
Current and forecasted traffic information and incident information.

transaction status
Response to transaction request. Normally dealing with a request for payment.

transit and fare schedules
Specific transit and fare schedule information including schedule adherence.

transit demand management request
Request to change the demand for transit facility use through pricing or other mechanisms.

transit demand management response
Response to transit demand management change requests indicating level of compliance with request.

transit incident information
Information on transit incidents that impact transit services for public dissemination.

transit incidents for media
Report of an incident impacting transit operations for public dissemination through the media.

transit information for media
Report of transit schedule deviations for public dissemination through the media.

transit information request
Request for transit operations information including schedule and fare information. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

transit information user request
Request for special transit routing, real-time schedule information, and availability information.

transit request confirmation
Confirmation of a request for transit information or service.

transit schedule information
Current and projected transit schedule adherence.

transit system data
Current transit system operations information indicating current transit routes, the level of service on each route, and the progress of individual vehicles along their routes for use in forecasting demand and estimating current transportation network performance.

transit traveler information
Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, and general transit service information.

transit traveler request
Request by a Transit traveler to summon assistance, request transit information, or request any other transit services.

transit user fare status
Status of fare transaction for transit user.

transit user inputs
Requests from transit user through either an on-board or fixed location traveler information station.

transit user outputs
Information for traveler from either an on-board or fixed location traveler information station.

transit vehicle conditions
Operating conditions of transit vehicle (e.g., mileage).

transit vehicle location data
Current transit vehicle location and related operational conditions data provided by a transit vehicle.

transit vehicle passenger and use data
Data collected on board the transit vehicle pertaining to availability and/or passenger count.

transit vehicle schedule performance
Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.

traveler archive data
Data associated with traveler information services including service requests, facility usage, rideshare, routing, and traveler payment transaction data. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

traveler information
Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.

traveler information for media
General traveler information regarding incidents, unusual traffic conditions, transit issues, or other advisory information that has been desensitized and provided to the media.

traveler inputs
Request by a traveler to summon assistance, request travel information, make a reservation, or request any other traveler service.

traveler interface updates
Visual or audio information (e.g., routes, messages, guidance) to the traveler.

traveler profile
Information about a traveler including equipment capabilities, personal preferences and recurring trip characteristics.

traveler request
Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.

trip confirmation
Acknowledgement by the driver/traveler of acceptance of a route.

trip plan
A sequence of links and special instructions comrising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

trip request
Request by a driver/traveler for special routing.

vehicle probe data
Vehicle probe data indicating identity, route segment identity, link time and location.

vehicle signage data
In-vehicle signage data generated by the roadway infrastructure indicating either road conditions, street names, or special information which will be useful for a vehicle passing a specific point on the roadway.

violation notification
Notification to enforcement agency of violation or regulations.

weather information
Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).

work zone warning status
Status of a work zone safety monitoring and warning devices. This flow documents system activations and includes additional supporting information (e.g., an image) that allows verification of the alarm.

work plan feedback
Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

work zone information
Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Appendix E Architecture Flows

Source	Destination	Flow Name	Status
Central New York Regional Transportation Authority (CNYRTA)			
	Financial Institutions		
		payment request	Planned
	Local Media		
		transit incidents for media	Planned
		transit information for media	Planned
	Local Transit Vehicles		
		bad tag list	Planned
		emergency acknowledge	Planned
		fare management information	Planned
		request for vehicle measures	Planned
		transit schedule information	Planned
		transit traveler information	Planned
	Metropolitan Transportation Communication Network (METCON)		
		archive requests	Planned
		archive status	Planned
		demand responsive transit plan	Planned
		traffic control priority request	Planned
		transit and fare schedules	Planned
		transit demand management response	Planned

		transit incident information	Planned
		transit request confirmation	Planned
		transit system data	Planned
	Traveler PC/Info. Appliance		
		personal transit information	Planned
City of Syracuse Dept. of Public Works			
	City of Syracuse Field Equipment		
		freeway control data	Existing
		roadway information system data	Existing
		sensor and surveillance control	Existing
		signal control data	Existing
	City of Syracuse Maintenance Vehicles		
		maint and constr dispatch information	Planned
		maint and constr vehicle system control	Planned
	City of Syracuse Police Department		
		archive coordination	Planned
		archive requests	Planned
		archive status	Planned
		current network conditions	Planned
		emergency archive data	Planned
		emergency traffic control response	Planned
		incident information request	Planned

	incident report	Planned
	incident response coordination	Planned
	maint and constr resource response	Planned
	request for information on violators	Planned
	resource deployment status	Planned
	violation notification	Planned
Financial Institutions		
	payment request	Existing
Local Media		
	incident information for media	Planned
	traffic information for media	Planned
	traveler information for media	Planned
Metropolitan Transportation Communication Network (METCON)		
	archive coordination	Planned
	archive requests	Planned
	archive status	Planned
	current asset restrictions	Planned
	current network conditions	Planned
	fare and price information	Planned
	field equipment status	Planned
	incident information	Planned
	incident information request	Planned
	incident report	Planned
	incident response status	Planned

intersection blockage notification	Planned
ISP coordination	Planned
logged special vehicle route	Planned
maint and constr archive data	Planned
maint and constr resource request	Planned
maint and constr resource response	Planned
maint and constr work plans	Planned
parking archive data	Planned
parking availability	Planned
parking demand management response	Planned
parking information	Planned
parking lot reservation confirmation	Planned
request fare and price information	Planned
request for traffic information	Planned
resource request	Planned
road network conditions	Planned
road network probe information	Planned
road network use	Planned
road weather information	Planned
roadway maintenance status	Planned
traffic information	Planned
traffic information coordination	Planned
work plan feedback	Planned

		work zone information	Planned
	Traveler PC/Info. Appliance		
		broadcast information	Planned
		emergency acknowledge	Planned
		traveler information	Planned
		trip plan	Planned
City of Syracuse Field Equipment			
	City of Syracuse Dept. of Public Works		
		fault reports	Existing
		freeway control status	Existing
		incident data	Existing
		request for right-of-way	Existing
		roadside archive data	Planned
		roadway information system status	Existing
		signal control status	Existing
		traffic flow	Existing
		traffic images	Existing
		vehicle probe data	Planned
	EZPASS TAG		
		intersection status	Planned
		request tag data	Planned
		vehicle signage data	Planned
	Pedestrian		
		crossing permission	Existing
City of Syracuse Fire Department			

	City of Syracuse Fire Vehicles		
		emergency dispatch requests	Planned
		incident command information	Planned
		incident report	Planned
		incident response coordination	Planned
		suggested route	Planned
	Metropolitan Transportation Communication Network (METCON)		
		emergency traffic control request	Planned
		incident information	Planned
		incident response status	Planned
		remote surveillance control	Planned
		resource request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		incident notification response	Planned
		incident report	Planned
City of Syracuse Fire Vehicles			
	City of Syracuse Field Equipment		
		local signal preemption request	Existing
	City of Syracuse Fire Department		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned

		incident report	Planned
		incident response coordination	Planned
		incident status	Planned
		local signal preemption request	Planned
	NYSDOT Region 3 Field Equipment		
		local signal preemption request	Planned
	Onondaga County DOT Field Equipment		
		local signal preemption request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
City of Syracuse Maintenance Vehicles			
	City of Syracuse Dept. of Public Works		
		infrastructure conditions data	Planned
		maint and constr dispatch status	Planned

		maint and constr vehicle conditions	Planned
		maint and constr vehicle location data	Planned
		maint and constr vehicle operational data	Planned
		work zone warning status	Planned
City of Syracuse Police Department			
	City of Syracuse Dept. of Public Works		
		archive coordination	Planned
		archive requests	Planned
		emergency archive data	Planned
		emergency traffic control request	Planned
		incident information	Planned
		incident report	Planned
		incident response coordination	Planned
		incident response status	Planned
		incident status	Planned
		local signal preemption request	Planned
		maint and constr resource request	Planned
		resource request	Planned
	City of Syracuse Police Vehicles		
		archive requests	Planned
		archive status	Planned
		emergency dispatch requests	Planned

		emergency personnel inputs	Planned
		incident command information	Planned
		incident notification	Planned
		incident report	Planned
		incident response coordination	Planned
		suggested route	Planned
	Metropolitan Transportation Communication Network (METCON)		
		archive requests	Planned
		archive status	Planned
		incident information	Planned
		incident response status	Planned
		resource request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		archive requests	Planned
		archive status	Planned
		incident notification	Planned
		incident notification response	Planned
		incident response coordination	Planned
City of Syracuse Police Vehicles			
	City of Syracuse Police Department		
		dispatch information	Planned
		emergency archive data	Planned
		emergency dispatch response	Planned

		emergency vehicle tracking data	Planned
		incident command information presentation	Planned
		incident command request	Planned
		incident notification response	Planned
		incident report	Planned
		incident response coordination	Planned
		incident status	Planned
		local signal preemption request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
EZPASS TAG			
	City of Syracuse Field Equipment		
		vehicle probe data	Planned
	NYSTA Field Equipment		
		request for payment	Existing
		tag data	Existing
Financial Institutions			

	Central New York Regional Transportation Authority (CNYRTA)		
		transaction status	Planned
	City of Syracuse Dept. of Public Works		
		transaction status	Existing
	NYSDOT Region 3 Operations Center		
		transaction status	Existing
	NYSTA Traffic Operations Center		
		transaction status	Existing
	Onondaga County Dept. of Transportation		
		transaction status	Existing
Local Media			
	Central New York Regional Transportation Authority (CNYRTA)		
		media information request	Planned
	City of Syracuse Dept. of Public Works		
		external reports	Planned
		media information request	Planned
	Metropolitan Transportation Communication Network (METCON)		
		external reports	Planned
		media information request	Planned

	NYSDOT Region 3 Operations Center		
		external reports	Planned
		media information request	Planned
	NYSTA Traffic Operations Center		
		external reports	Planned
		media information request	Planned
	Onondaga County Dept. of Transportation		
		external reports	Planned
		media information request	Planned
Local Transit Vehicles			
	Central New York Regional Transportation Authority (CNYRTA)		
		emergency notification	Planned
		fare and payment status	Planned
		request for bad tag list	Planned
		transit traveler request	Planned
		transit vehicle conditions	Planned
		transit vehicle location data	Planned
		transit vehicle passenger and use data	Planned
		transit vehicle schedule performance	Planned
	NYSDOT Region 3 Field Equipment		
		local signal priority request	Planned
	Onondaga County DOT Field Equipment		

		local signal priority request	Planned
Metropolitan Transportation Communication Network (METCON)			
	Central New York Regional Transportation Authority (CNYRTA)		
		current asset restrictions	Planned
		demand responsive transit request	Planned
		maint and constr archive data	Planned
		maint and constr work plans	Planned
		request transit information	Planned
		road weather information	Planned
		roadway maintenance status	Planned
		selected routes	Planned
		traffic archive data	Planned
		traffic control priority status	Planned
		traffic information for transit	Planned
		transit demand management request	Planned
		transit information request	Planned
		traveler archive data	Planned
		work zone information	Planned
	City of Syracuse Dept. of Public Works		
		archive coordination	Planned
		archive requests	Planned
		current asset restrictions	Planned

current network conditions	Planned
fare and price information	Planned
field equipment status	Planned
incident information	Planned
incident information request	Planned
incident report	Planned
logged special vehicle route	Planned
maint and constr archive data	Planned
maint and constr resource request	Planned
maint and constr resource response	Planned
maint and constr work plans	Planned
parking demand management request	Planned
parking instructions	Planned
parking lot data request	Planned
parking reservations request	Planned
request fare and price information	Planned
request for traffic information	Planned
resource deployment status	Planned
road network conditions	Planned
road network probe information	Planned
road network use	Planned
road weather information	Planned
roadway maintenance status	Planned
traffic archive data	Planned
traffic information	Planned

	traffic information coordination	Planned
	traveler archive data	Planned
	work plan feedback	Planned
	work zone information	Planned
City of Syracuse Fire Department		
	current asset restrictions	Planned
	current network conditions	Planned
	emergency traffic control response	Planned
	incident information	Planned
	incident information request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	resource deployment status	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	violation notification	Planned
	work zone information	Planned
City of Syracuse Maintenance Vehicles		
	maint and constr dispatch information	Planned
City of Syracuse Police Department		
	current asset restrictions	Planned
	current network conditions	Planned
	incident information	Planned
	incident information request	Planned

	maint and constr archive data	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	resource deployment status	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	traffic archive data	Planned
	traveler archive data	Planned
	violation notification	Planned
	work zone information	Planned
Local Media		
	traffic information for media	Planned
	traveler information for media	Planned
New York State Police		
	current asset restrictions	Planned
	current network conditions	Planned
	emergency traffic control response	Planned
	incident information	Planned
	incident information request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	resource deployment status	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	violation notification	Planned
	work zone information	Planned

NYSDOT Region 3		
	maint and constr archive data	Planned
	traffic archive data	Planned
	traffic information coordination	Planned
	traveler archive data	Planned
NYSDOT Region 3 Maintenance and Supervisory Vehicles		
	maint and constr dispatch information	Planned
NYSDOT Region 3 Operations Center		
	archive coordination	Planned
	archive requests	Planned
	current asset restrictions	Planned
	current network conditions	Planned
	fare and price information	Planned
	field equipment status	Planned
	incident information	Planned
	incident information request	Planned
	incident report	Planned
	logged special vehicle route	Planned
	maint and constr archive data	Planned
	maint and constr resource request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	parking demand management request	Planned

		parking instructions	Planned
		parking lot data request	Planned
		parking reservations request	Planned
		request fare and price information	Planned
		request for traffic information	Planned
		resource deployment status	Planned
		road network conditions	Planned
		road network probe information	Planned
		road network use	Planned
		road weather information	Planned
		roadway maintenance status	Planned
		traffic archive data	Planned
		traffic information	Planned
		traffic information coordination	Planned
		traveler archive data	Planned
		work plan feedback	Planned
		work zone information	Planned
	NYSTA Maintenance and Supervisory Vehicles		
		maint and constr dispatch information	Planned
	NYSTA Statewide Operations Center Troop T Dispatch		
		current asset restrictions	Planned
		current network conditions	Planned
		emergency traffic control response	Planned
		incident information	Planned

	incident information request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	resource deployment status	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	violation notification	Planned
	work zone information	Planned
NYSTA Traffic Operations Center		
	current asset restrictions	Planned
	field equipment status	Planned
	logged special vehicle route	Planned
	maint and constr archive data	Planned
	maint and constr resource request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	request for traffic information	Planned
	road network conditions	Planned
	road network probe information	Planned
	road network use	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	traffic information coordination	Planned
	work plan feedback	Planned
	work zone information	Planned

Onondaga County 911 Emergency Communications (ECD)		
	current asset restrictions	Planned
	current network conditions	Planned
	emergency traffic control response	Planned
	incident information	Planned
	incident information request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	resource deployment status	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	work zone information	Planned
Onondaga County Dept. of Transportation		
	archive coordination	Planned
	archive requests	Planned
	current asset restrictions	Planned
	current network conditions	Planned
	fare and price information	Planned
	field equipment status	Planned
	incident information	Planned
	incident information request	Planned
	incident report	Planned
	logged special vehicle route	Planned
	maint and constr archive data	Planned

		maint and constr resource request	Planned
		maint and constr resource response	Planned
		maint and constr work plans	Planned
		parking demand management request	Planned
		parking instructions	Planned
		parking lot data request	Planned
		parking reservations request	Planned
		request fare and price information	Planned
		request for traffic information	Planned
		resource deployment status	Planned
		road network conditions	Planned
		road network probe information	Planned
		road network use	Planned
		road weather information	Planned
		roadway maintenance status	Planned
		traffic archive data	Planned
		traffic information	Planned
		traffic information coordination	Planned
		traveler archive data	Planned
		work plan feedback	Planned
		work zone information	Planned
	Onondaga County Emergency Management Division (EMD)		
		current asset restrictions	Planned
		current network conditions	Planned

	emergency traffic control response	Planned
	incident information	Planned
	incident information request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	resource deployment status	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	traffic archive data	Planned
	traveler archive data	Planned
	work zone information	Planned
Onondaga County Maintenance Vehicles		
	maint and constr dispatch information	Planned
Onondaga County Sheriff		
	current asset restrictions	Planned
	current network conditions	Planned
	emergency traffic control response	Planned
	incident information	Planned
	incident information request	Planned
	maint and constr archive data	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	resource deployment status	Planned

	road weather information	Planned
	roadway maintenance status	Planned
	traffic archive data	Planned
	traveler archive data	Planned
	violation notification	Planned
	work zone information	Planned
Other EMS Dispatch		
	current asset restrictions	Planned
	current network conditions	Planned
	emergency traffic control response	Planned
	incident information	Planned
	incident information request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	resource deployment status	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	work zone information	Planned
Syracuse Metropolitan Transportation Council (SMTC)		
	current asset restrictions	Planned
	ISP coordination	Planned
	maint and constr archive data	Planned
	maint and constr work plans	Planned
	map update request	Planned
	request fare and price information	Planned

		road weather information	Planned
		roadway maintenance status	Planned
		traffic archive data	Planned
		traffic information	Planned
		traveler archive data	Planned
		work zone information	Planned
	Syracuse Regional Emergency Network (SyREN)		
		current asset restrictions	Planned
		current network conditions	Planned
		emergency traffic control response	Planned
		incident information	Planned
		incident information request	Planned
		maint and constr resource response	Planned
		maint and constr work plans	Planned
		resource deployment status	Planned
		road weather information	Planned
		roadway maintenance status	Planned
		work zone information	Planned
	Traveler PC/Info. Appliance		
		broadcast information	Planned
		traveler information	Planned
		trip plan	Planned
New York State Police			
	Metropolitan Transportation Communication Network (METCON)		

	emergency traffic control request	Planned
	incident information	Planned
	incident response status	Planned
	resource request	Planned
New York State Police (Troop D) Vehicles		
	emergency dispatch requests	Planned
	emergency personnel inputs	Planned
	incident command information	Planned
	suggested route	Planned
NYSDOT Region 3 Operations Center		
	archive coordination	Planned
	archive requests	Planned
	emergency archive data	Planned
	emergency traffic control request	Planned
	incident information	Planned
	incident report	Planned
	incident response coordination	Planned
	incident response status	Planned
	incident status	Planned
	local signal preemption request	Planned
	maint and constr resource request	Planned
	resource request	Planned
Syracuse Regional Emergency Network (SyREN)		

		emergency dispatch response	Planned
		emergency operations request	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident notification response	Planned
		incident report	Planned
		incident status	Planned
New York State Police (Troop D) Vehicles			
	New York State Police		
		dispatch information	Planned
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command information presentation	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned

NYSDOT Region 3			
	Metropolitan Transportation Communication Network (METCON)		
		archive requests	Planned
		archive status	Planned
		traffic information coordination	Planned
	NYSDOT Region 3 Operations Center		
		archive analysis requests	Planned
		archive coordination	Planned
		archive management requests	Planned
		archive requests	Planned
		archive status	Planned
		archived data product requests	Planned
		other data source archive data	Planned
		sensor and surveillance control	Planned
		traffic control coordination	Planned
		traffic information coordination	Planned
NYSDOT Region 3 Field Equipment			
	City of Syracuse Fire Vehicles		
		emergency notification	Planned
	EZPASS TAG		
		intersection status	Planned
		request tag data	Planned
		vehicle signage data	Planned

	NYSDOT Region 3 Operations Center		
		fault reports	Existing
		freeway control status	Existing
		incident data	Existing
		request for right-of-way	Existing
		roadside archive data	Planned
		roadway information system status	Existing
		signal control status	Existing
		traffic flow	Existing
		traffic images	Existing
		vehicle probe data	Planned
	Pedestrian		
		crossing permission	Existing
		transit user fare status	Planned
		transit user outputs	Planned
		traveler interface updates	Planned
NYSDOT Region 3 Maintenance and Supervisory Vehicles			
	NYSDOT Region 3 Operations Center		
		infrastructure conditions data	Planned
		maint and constr dispatch status	Planned
		maint and constr vehicle conditions	Planned
		maint and constr vehicle location data	Planned

		maint and constr vehicle operational data	Planned
		work zone warning status	Planned
NYSDOT Region 3 Operations Center			
	Financial Institutions		
		payment request	Existing
	Local Media		
		incident information for media	Planned
		traffic information for media	Planned
		traveler information for media	Planned
	Metropolitan Transportation Communication Network (METCON)		
		archive coordination	Planned
		archive requests	Planned
		archive status	Planned
		current asset restrictions	Planned
		current network conditions	Planned
		fare and price information	Planned
		field equipment status	Planned
		incident information	Planned
		incident information request	Planned
		incident report	Planned
		incident response status	Planned
		intersection blockage notification	Planned
		ISP coordination	Planned
		logged special vehicle route	Planned

	maint and constr archive data	Planned
	maint and constr resource request	Planned
	maint and constr resource response	Planned
	maint and constr work plans	Planned
	parking archive data	Planned
	parking availability	Planned
	parking demand management response	Planned
	parking information	Planned
	parking lot reservation confirmation	Planned
	request fare and price information	Planned
	request for traffic information	Planned
	resource request	Planned
	road network conditions	Planned
	road network probe information	Planned
	road network use	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	traffic information	Planned
	traffic information coordination	Planned
	work plan feedback	Planned
	work zone information	Planned
New York State Police		
	archive coordination	Planned
	archive requests	Planned

	archive status	Planned
	current network conditions	Planned
	emergency archive data	Planned
	emergency traffic control response	Planned
	incident information request	Planned
	incident report	Planned
	incident response coordination	Planned
	maint and constr resource response	Planned
	request for information on violators	Planned
	resource deployment status	Planned
	violation notification	Planned
NYSDOT Region 3		
	archive analysis results	Planned
	archive coordination	Planned
	archive management data	Planned
	archive request confirmation	Planned
	archive requests	Planned
	archive status	Planned
	archived data products	Planned
	construction and maintenance archive data	Planned
	emergency archive data	Planned
	other data source archive data	Planned
	roadside archive data	Planned
	traffic archive data	Planned
	traffic information coordination	Planned

		traveler archive data	Planned
	NYSDOT Region 3 Field Equipment		
		freeway control data	Existing
		roadway information system data	Existing
		sensor and surveillance control	Existing
		signal control data	Existing
	NYSDOT Region 3 Maintenance and Supervisory Vehicles		
		maint and constr dispatch information	Planned
		maint and constr vehicle system control	Planned
	Traveler PC/Info. Appliance		
		broadcast information	Planned
		emergency acknowledge	Planned
		traveler information	Planned
		trip plan	Planned
NYSTA Field Equipment			
	EZPASS TAG		
		intersection status	Planned
		payment	Existing
		request tag data	Planned
		tag update	Existing
		vehicle signage data	Planned
	NYSTA Traffic Operations Center		
		fault reports	Existing
		freeway control status	Existing

		incident data	Existing
		roadside archive data	Planned
		traffic flow	Existing
		traffic images	Existing
		vehicle probe data	Planned
NYSTA Maintenance and Supervisory Vehicles			
	NYSTA Traffic Operations Center		
		infrastructure conditions data	Planned
		maint and constr dispatch status	Planned
		maint and constr vehicle conditions	Planned
		maint and constr vehicle location data	Planned
		maint and constr vehicle operational data	Planned
		work zone warning status	Planned
NYSTA State Police Troop T Vehicles			
	NYSTA Statewide Operations Center Troop T Dispatch		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned

	Syracuse Regional Emergency Network (SyREN)		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
NYSTA Statewide Operations Center Troop T Dispatch			
	Metropolitan Transportation Communication Network (METCON)		
		emergency traffic control request	Planned
		incident information	Planned
		incident response status	Planned
		resource request	Planned
	NYSTA State Police Troop T Vehicles		
		emergency dispatch requests	Planned
		incident command information	Planned
		suggested route	Planned
	NYSTA Traffic Operations Center		
		emergency archive data	Planned
		emergency traffic control request	Planned
		incident information	Planned

		incident report	Planned
		incident response coordination	Planned
		incident response status	Planned
		remote surveillance control	Planned
		resource request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		incident notification response	Planned
		incident report	Planned
		incident response coordination	Planned
NYSTA Traffic Operations Center			
	Financial Institutions		
		payment request	Existing
	Local Media		
		incident information for media	Planned
		traffic information for media	Planned
		traveler information for media	Planned
	Metropolitan Transportation Communication Network (METCON)		
		current asset restrictions	Planned
		field equipment status	Planned
		maint and constr archive data	Planned
		maint and constr resource request	Planned
		maint and constr resource response	Planned
		maint and constr work plans	Planned

	road network conditions	Planned
	road network probe information	Planned
	road weather information	Planned
	roadway maintenance status	Planned
	traffic control coordination	Planned
	traffic information	Planned
	traffic information coordination	Planned
	work plan feedback	Planned
	work zone information	Planned
NYSDOT Region 3 Maintenance and Supervisory Vehicles		
	maint and constr vehicle system control	Planned
NYSTA Field Equipment		
	equipment maintenance status	Planned
	freeway control data	Existing
	incident information	Existing
	roadway information system data	Existing
	roadway information system status	Existing
	sensor and surveillance control	Existing
	signal control data	Existing
	signal control status	Existing
NYSTA Maintenance and Supervisory Vehicles		
	maint and constr dispatch information	Existing
	maint and constr vehicle system control	Planned

	NYSTA Statewide Operations Center Troop T Dispatch		
		archive requests	Planned
		archive status	Planned
		current network conditions	Planned
		emergency traffic control response	Planned
		incident information	Planned
		incident information request	Planned
		incident report	Planned
		incident response coordination	Planned
		resource deployment status	Planned
		violation notification	Planned
		weather information	Planned
	Traveler PC/Info. Appliance		
		broadcast information	Planned
		traveler information	Planned
		trip plan	Planned
Onondaga County 911 Emergency Communications (ECD)			
	Metropolitan Transportation Communication Network (METCON)		
		emergency traffic control request	Planned
		incident information	Planned
		incident response status	Planned
		resource request	Planned

	Syracuse Regional Emergency Network (SyREN)		
		incident notification	Planned
		incident notification response	Planned
		incident report	Planned
		incident response coordination	Planned
Onondaga County Dept. of Transportation			
	Financial Institutions		
		payment request	Existing
	Local Media		
		incident information for media	Planned
		traffic information for media	Planned
		traveler information for media	Planned
	Metropolitan Transportation Communication Network (METCON)		
		archive coordination	Planned
		archive requests	Planned
		archive status	Planned
		current asset restrictions	Planned
		current network conditions	Planned
		fare and price information	Planned
		field equipment status	Planned
		incident information	Planned
		incident information request	Planned
		incident report	Planned
		incident response status	Planned

intersection blockage notification	Planned
ISP coordination	Planned
logged special vehicle route	Planned
maint and constr archive data	Planned
maint and constr resource request	Planned
maint and constr resource response	Planned
maint and constr work plans	Planned
parking archive data	Planned
parking availability	Planned
parking demand management response	Planned
parking information	Planned
parking lot reservation confirmation	Planned
request fare and price information	Planned
request for traffic information	Planned
resource request	Planned
road network conditions	Planned
road network probe information	Planned
road network use	Planned
road weather information	Planned
roadway maintenance status	Planned
traffic information	Planned
traffic information coordination	Planned
work plan feedback	Planned

	work zone information	Planned
Onondaga County DOT Field Equipment		
	freeway control data	Existing
	roadway information system data	Existing
	sensor and surveillance control	Existing
	signal control data	Existing
Onondaga County Maintenance Vehicles		
	maint and constr dispatch information	Planned
	maint and constr vehicle system control	Planned
Onondaga County Sheriff		
	archive coordination	Planned
	archive requests	Planned
	archive status	Planned
	current network conditions	Planned
	emergency archive data	Planned
	emergency traffic control response	Planned
	incident information request	Planned
	incident report	Planned
	incident response coordination	Planned
	maint and constr resource response	Planned
	request for information on violators	Planned
	resource deployment status	Planned

		violation notification	Planned
	Traveler PC/Info. Appliance		
		broadcast information	Planned
		emergency acknowledge	Planned
		traveler information	Planned
		trip plan	Planned
Onondaga County DOT Field Equipment			
	Onondaga County Dept. of Transportation		
		fault reports	Existing
		freeway control status	Existing
		incident data	Existing
		request for right-of-way	Existing
		roadside archive data	Planned
		roadway information system status	Existing
		signal control status	Existing
		traffic flow	Existing
		traffic images	Existing
		vehicle probe data	Planned
	Pedestrian		
		crossing permission	Existing
Onondaga County Emergency Management Division (EMD)			
	Metropolitan Transportation Communication Network (METCON)		
		archive requests	Planned

		archive status	Planned
		emergency traffic control request	Planned
		incident information	Planned
		incident response status	Planned
		remote surveillance control	Planned
		resource request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		incident report	Planned
		incident response coordination	Planned
Onondaga County Maintenance Vehicles			
	Onondaga County Dept. of Transportation		
		infrastructure conditions data	Planned
		maint and constr dispatch status	Planned
		maint and constr vehicle conditions	Planned
		maint and constr vehicle location data	Planned
		maint and constr vehicle operational data	Planned
		work zone warning status	Planned
Onondaga County Sheriff			
	Metropolitan Transportation Communication Network (METCON)		
		archive requests	Planned

	archive status	Planned
	emergency traffic control request	Planned
	incident information	Planned
	incident response status	Planned
	remote surveillance control	Planned
	resource request	Planned
Onondaga County Dept. of Transportation		
	archive coordination	Planned
	archive requests	Planned
	emergency archive data	Planned
	emergency traffic control request	Planned
	incident information	Planned
	incident report	Planned
	incident response coordination	Planned
	incident response status	Planned
	incident status	Planned
	local signal preemption request	Planned
	maint and constr resource request	Planned
	resource request	Planned
Onondaga County Sheriff (Police) Vehicles		
	emergency dispatch requests	Planned
	emergency personnel inputs	Planned
	incident command information	Planned

		suggested route	Planned
	Syracuse Regional Emergency Network (SyREN)		
		archive requests	Planned
		archive status	Planned
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident notification response	Planned
		incident report	Planned
		incident response coordination	Planned
		incident status	Planned
		local signal preemption request	Planned
Onondaga County Sheriff (Police) Vehicles			
	Onondaga County Sheriff		
		dispatch information	Planned
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command information presentation	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
	Syracuse Regional Emergency Network (SyREN)		

		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
Other EMS Dispatch			
	Metropolitan Transportation Communication Network (METCON)		
		emergency traffic control request	Planned
		incident information	Planned
		incident response status	Planned
		remote surveillance control	Planned
		resource request	Planned
	Other EMS Vehicles		
		emergency dispatch requests	Planned
		incident command information	Planned
		suggested route	Planned
	Other Fire Vehicles (excluding the city fire vehicles)		
		emergency dispatch requests	Planned
		incident command information	Planned
		suggested route	Planned
	Syracuse Regional Emergency Network (SyREN)		
		incident notification response	Planned
		incident report	Planned

		incident response coordination	Planned
Other EMS Vehicles			
	NYSDOT Region 3 Field Equipment		
		local signal preemption request	Planned
	Onondaga County DOT Field Equipment		
		local signal preemption request	Planned
	Other EMS Dispatch		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
Other Fire Vehicles (excluding the city fire vehicles)			

	NYSDOT Region 3 Field Equipment		
		local signal preemption request	Planned
	Onondaga County DOT Field Equipment		
		local signal preemption request	Planned
	Other EMS Dispatch		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
	Syracuse Regional Emergency Network (SyREN)		
		emergency dispatch response	Planned
		emergency vehicle tracking data	Planned
		incident command request	Planned
		incident status	Planned
		local signal preemption request	Planned
Pedestrian			
	City of Syracuse Field Equipment		
		crossing call	Existing

	NYSDOT Region 3 Field Equipment		
		crossing call	Existing
		transit user inputs	Planned
		traveler inputs	Planned
	Onondaga County DOT Field Equipment		
		crossing call	Existing
Syracuse Metropolitan Transportation Council (SMTC)			
	Metropolitan Transportation Communication Network (METCON)		
		archive requests	Planned
		archive status	Planned
		fare and price information	Planned
		fault reports	Planned
		freeway control status	Planned
		incident data	Planned
		intersection blockage notification	Planned
		ISP coordination	Planned
		logged special vehicle route	Planned
		map updates	Planned
		request for right-of-way	Planned
		request for traffic information	Planned
		reversible lane status	Planned
		road network use	Planned

		roadway information system status	Planned
		signal control status	Planned
		traffic flow	Planned
		traffic images	Planned
		vehicle probe data	Planned
Syracuse Regional Emergency Network (SyREN)			
	City of Syracuse Fire Department		
		incident notification	Planned
		incident report	Planned
		incident response coordination	Planned
	City of Syracuse Fire Vehicles		
		emergency dispatch requests	Planned
		incident command information	Planned
		suggested route	Planned
	City of Syracuse Police Department		
		emergency archive data	Planned
		incident notification	Planned
		incident notification response	Planned
		incident report	Planned
		incident response coordination	Planned
	City of Syracuse Police Vehicles		
		emergency dispatch requests	Planned
		incident command information	Planned
		suggested route	Planned

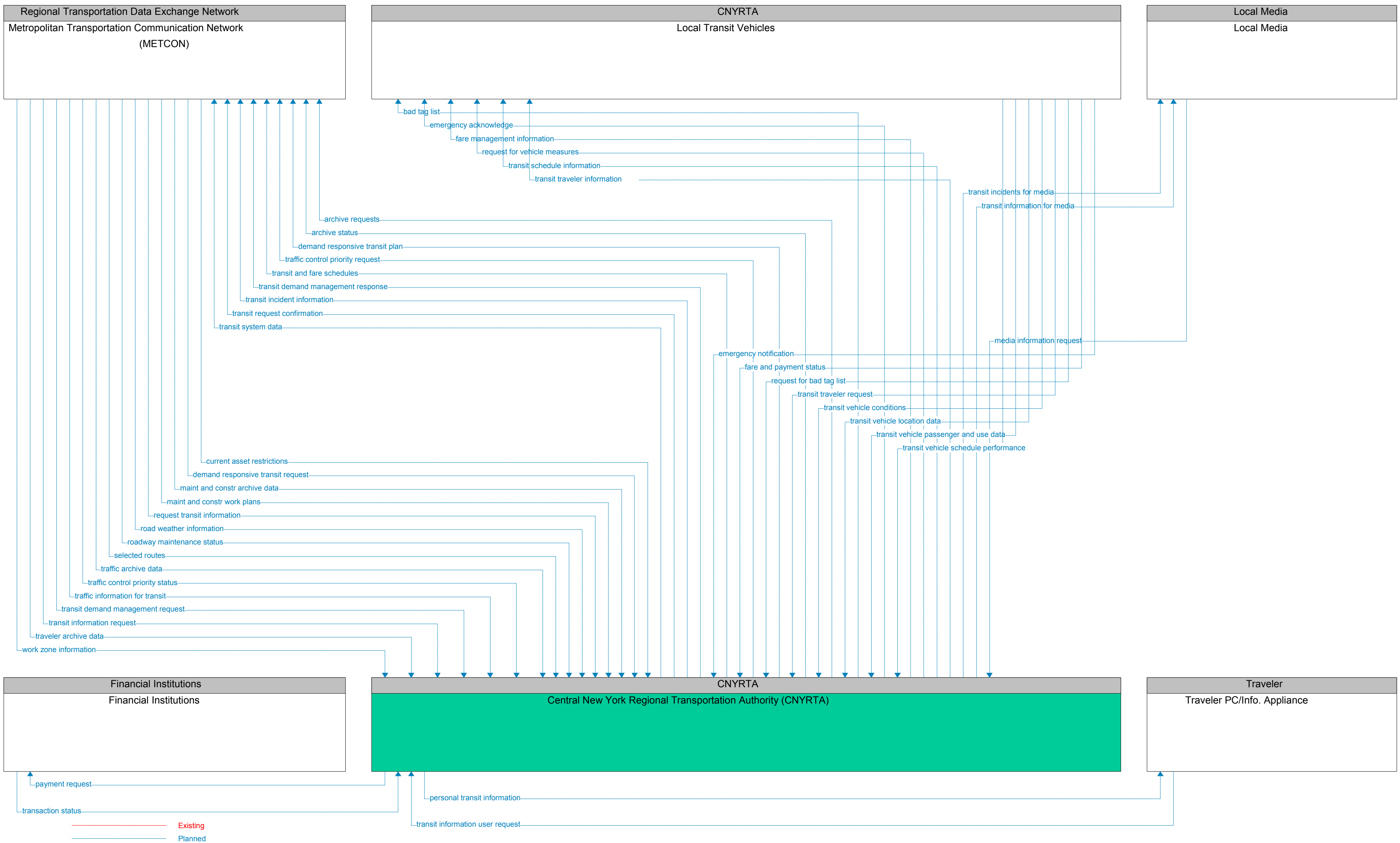
Metropolitan Transportation Communication Network (METCON)		
	emergency traffic control request	Planned
	incident information	Planned
	incident response status	Planned
	remote surveillance control	Planned
	resource request	Planned
New York State Police		
	emergency dispatch requests	Planned
	emergency operations status	Planned
	incident command information	Planned
	incident notification	Planned
	incident report	Planned
	incident response coordination	Planned
	suggested route	Planned
New York State Police (Troop D) Vehicles		
	emergency dispatch requests	Planned
	incident command information	Planned
	suggested route	Planned
NYSTA State Police Troop T Vehicles		
	emergency dispatch requests	Planned
	incident command information	Planned
	suggested route	Planned
NYSTA Statewide Operations Center Troop T Dispatch		

	incident notification	Planned
	incident report	Planned
	incident response coordination	Planned
Onondaga County 911 Emergency Communications (ECD)		
	emergency operations status	Planned
	incident notification	Planned
	incident notification response	Planned
	incident report	Planned
	incident response coordination	Planned
Onondaga County Emergency Management Division (EMD)		
	incident report	Planned
	incident response coordination	Planned
Onondaga County Sheriff		
	emergency archive data	Planned
	emergency dispatch requests	Planned
	incident command information	Planned
	incident notification	Planned
	incident report	Planned
	incident response coordination	Planned
	suggested route	Planned
Onondaga County Sheriff (Police) Vehicles		
	emergency dispatch requests	Planned
	incident command information	Planned
	suggested route	Planned
Other EMS Dispatch		

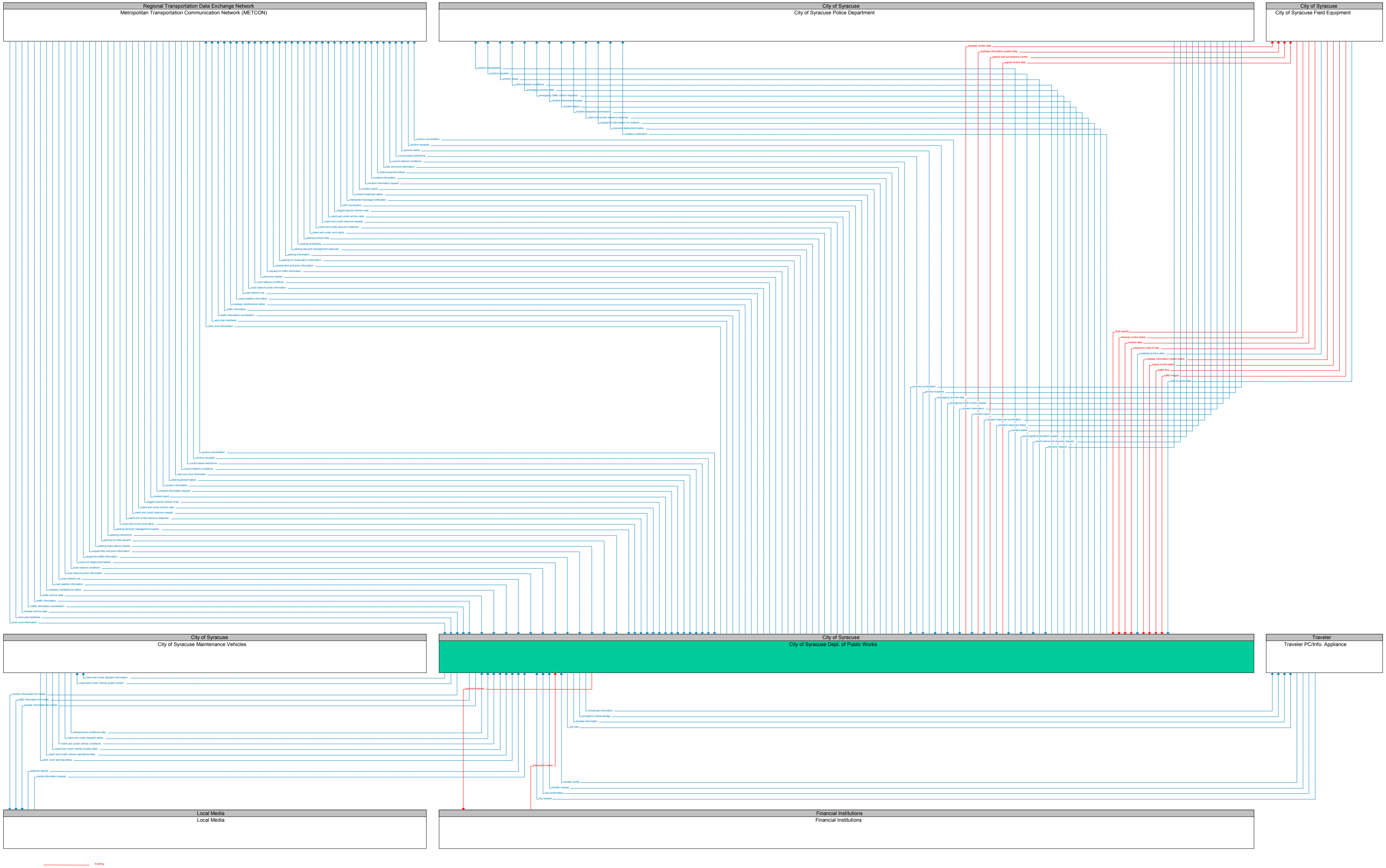
		incident notification	Planned
		incident report	Planned
		incident response coordination	Planned
	Other EMS Vehicles		
		emergency dispatch requests	Planned
		incident command information	Planned
		suggested route	Planned
	Other Fire Vehicles (excluding the city fire vehicles)		
		emergency dispatch requests	Planned
		incident command information	Planned
		suggested route	Planned
Traveler PC/Info. Appliance			
	Central New York Regional Transportation Authority (CNYRTA)		
		transit information user request	Planned
	City of Syracuse Dept. of Public Works		
		traveler profile	Planned
		traveler request	Planned
		trip confirmation	Planned
		trip request	Planned
	Metropolitan Transportation Communication Network (METCON)		
		traveler profile	Planned
		traveler request	Planned
		trip confirmation	Planned

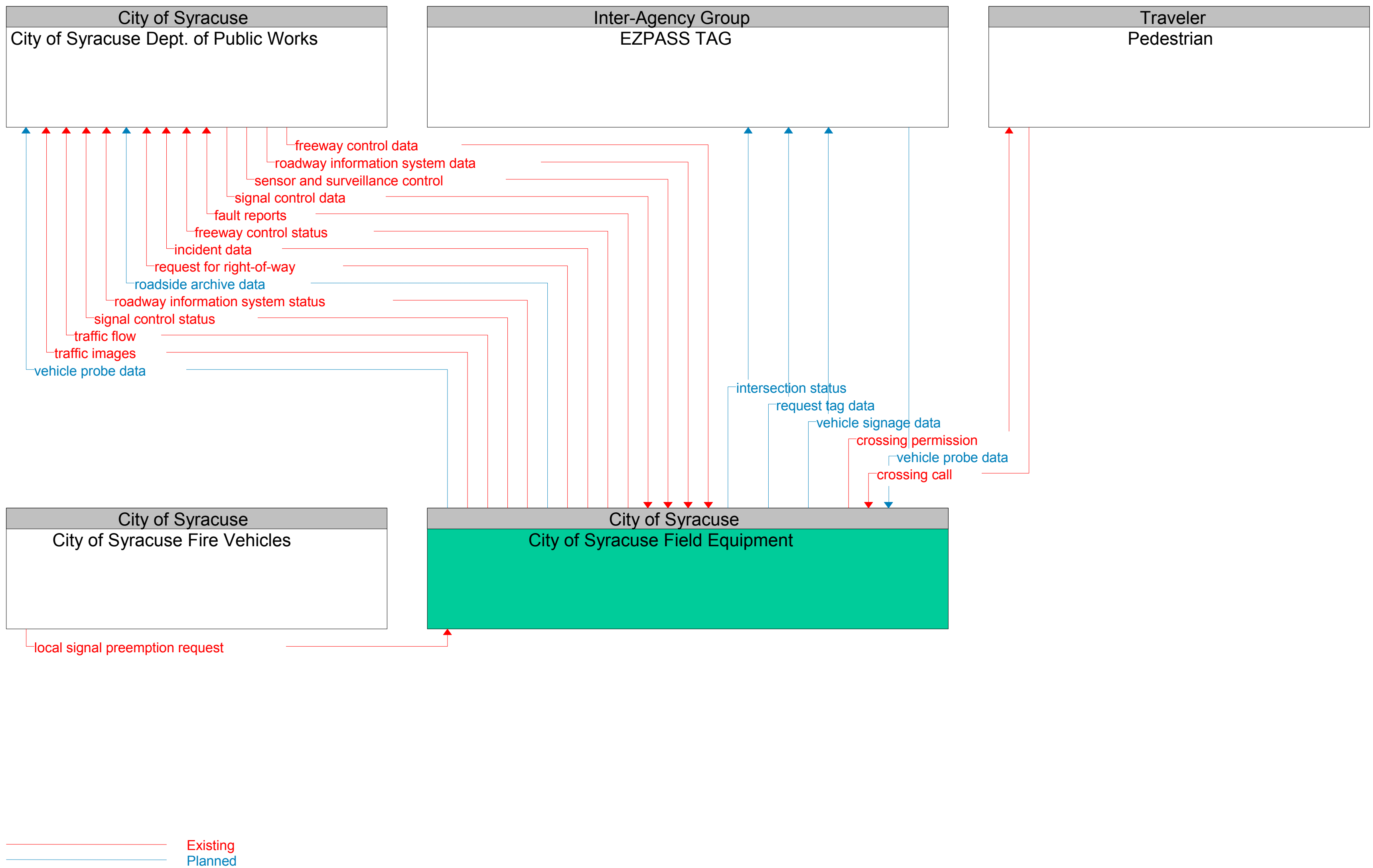
	trip request	Planned
NYSDOT Region 3 Operations Center		
	traveler profile	Planned
	traveler request	Planned
	trip confirmation	Planned
	trip request	Planned
NYSTA Traffic Operations Center		
	traveler profile	Planned
	traveler request	Planned
	trip confirmation	Planned
	trip request	Planned
Onondaga County Dept. of Transportation		
	traveler profile	Planned
	traveler request	Planned
	trip confirmation	Planned
	trip request	Planned

APPENDIX F Architecture Flow Diagrams

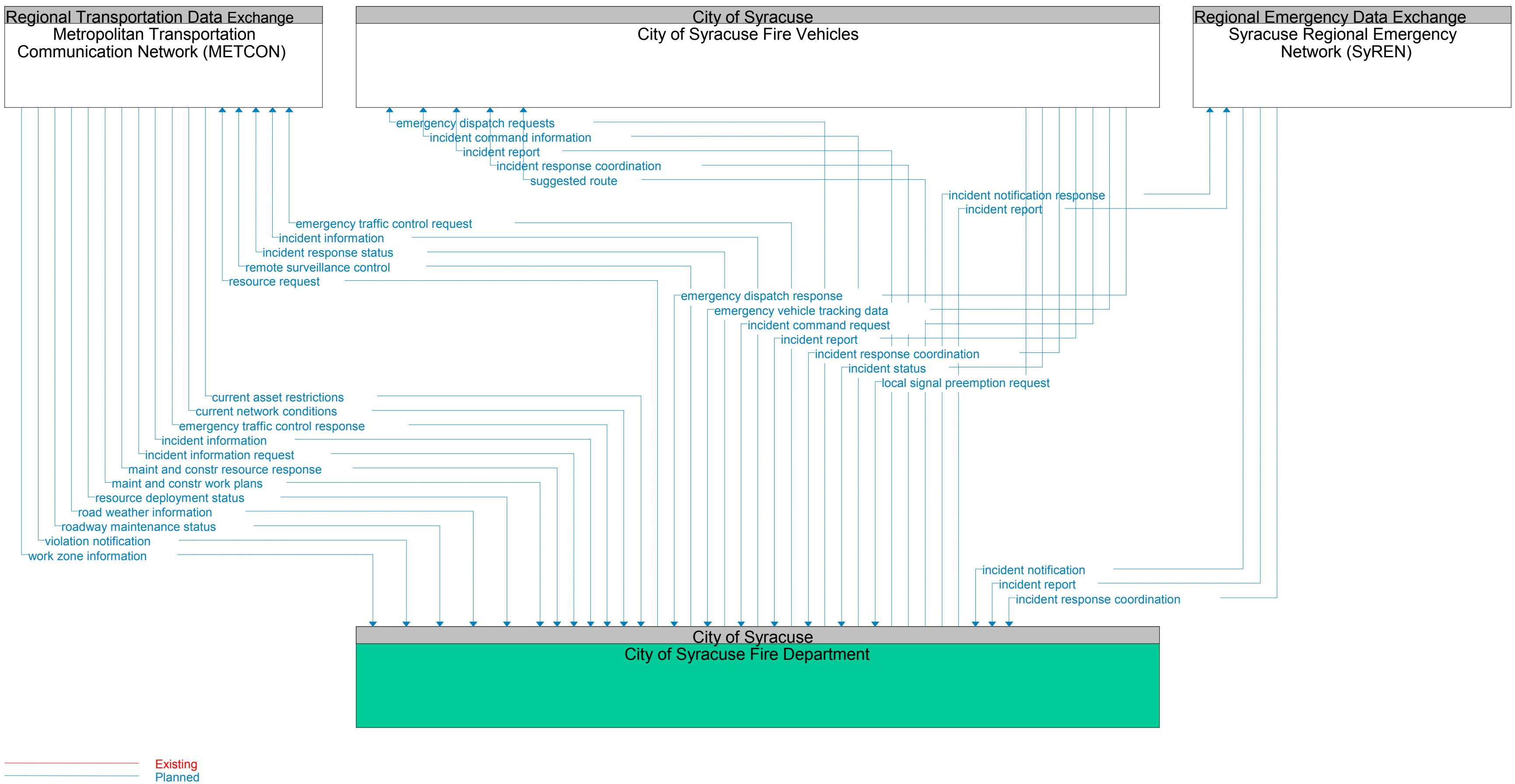


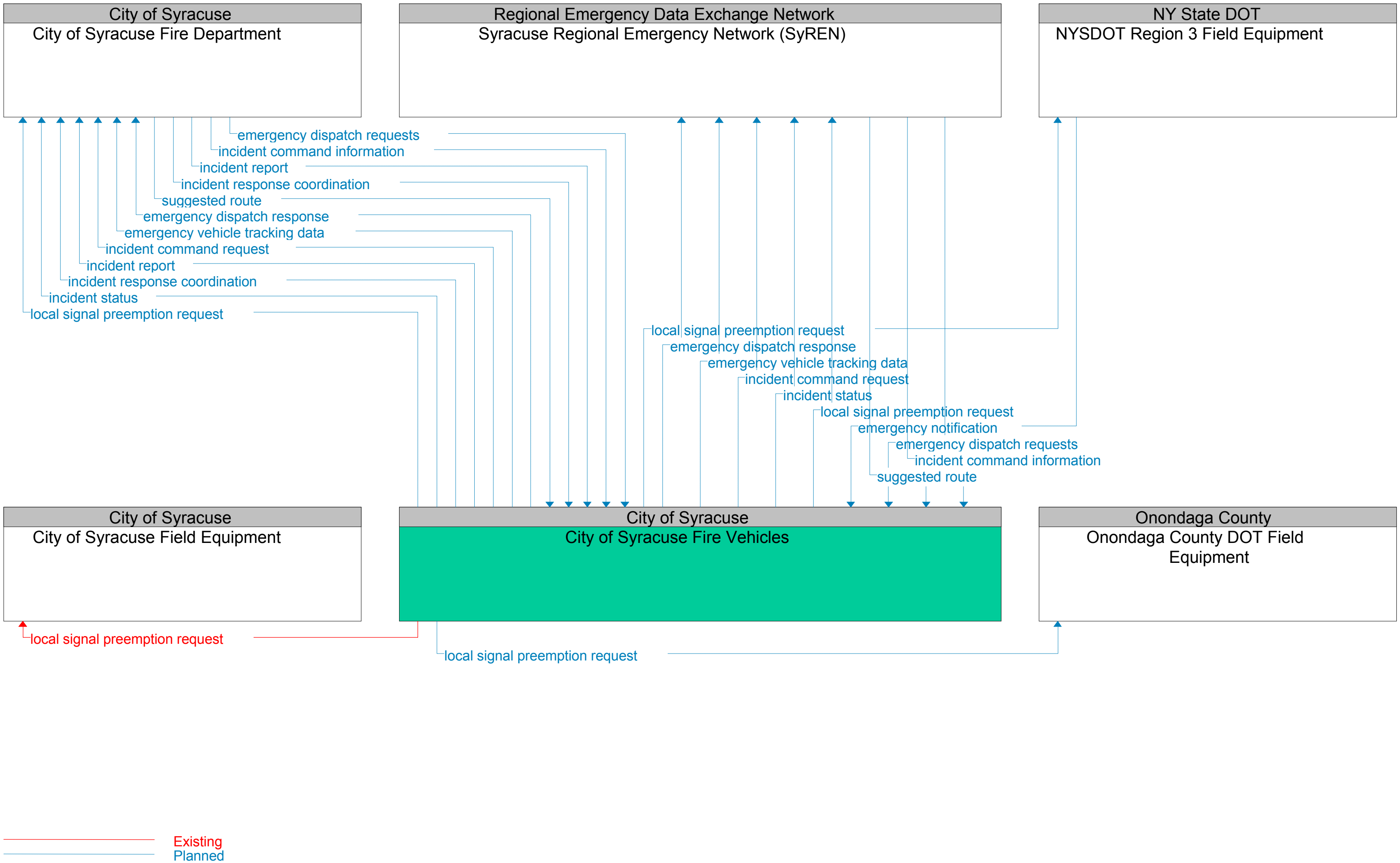
Regional Transportation Data Exchange Network
Metropolitan Transportation Communication Network (METCON)
CNYRTA
Local Transit Vehicles
Local Media
Local Media
bad tag list
emergency acknowledge
fare management information
request for vehicle measures
transit schedule information
transit traveler information
transit incidents for media
transit information for media
archive requests
archive status
demand responsive transit plan
traffic control priority request
transit and fare schedules
transit demand management response
transit incident information
transit request confirmation
transit system data
media information request
emergency notification
fare and payment status
request for bad tag list
transit traveler request
transit vehicle conditions
transit vehicle location data
transit vehicle passenger and use data
transit vehicle schedule performance
current asset restrictions
demand responsive transit request
maint and constr archive data
maint and constr work plans
request transit information
road weather information
roadway maintenance status
selected routes
traffic archive data
traffic control priority status
traffic information for transit
transit demand management request
transit information request
traveler archive data
work zone information
Financial Institutions
Financial Institutions
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
Traveler
Traveler PC/Info. Appliance
payment request
transaction status
personal transit information
transit information user request
Existing
Planned

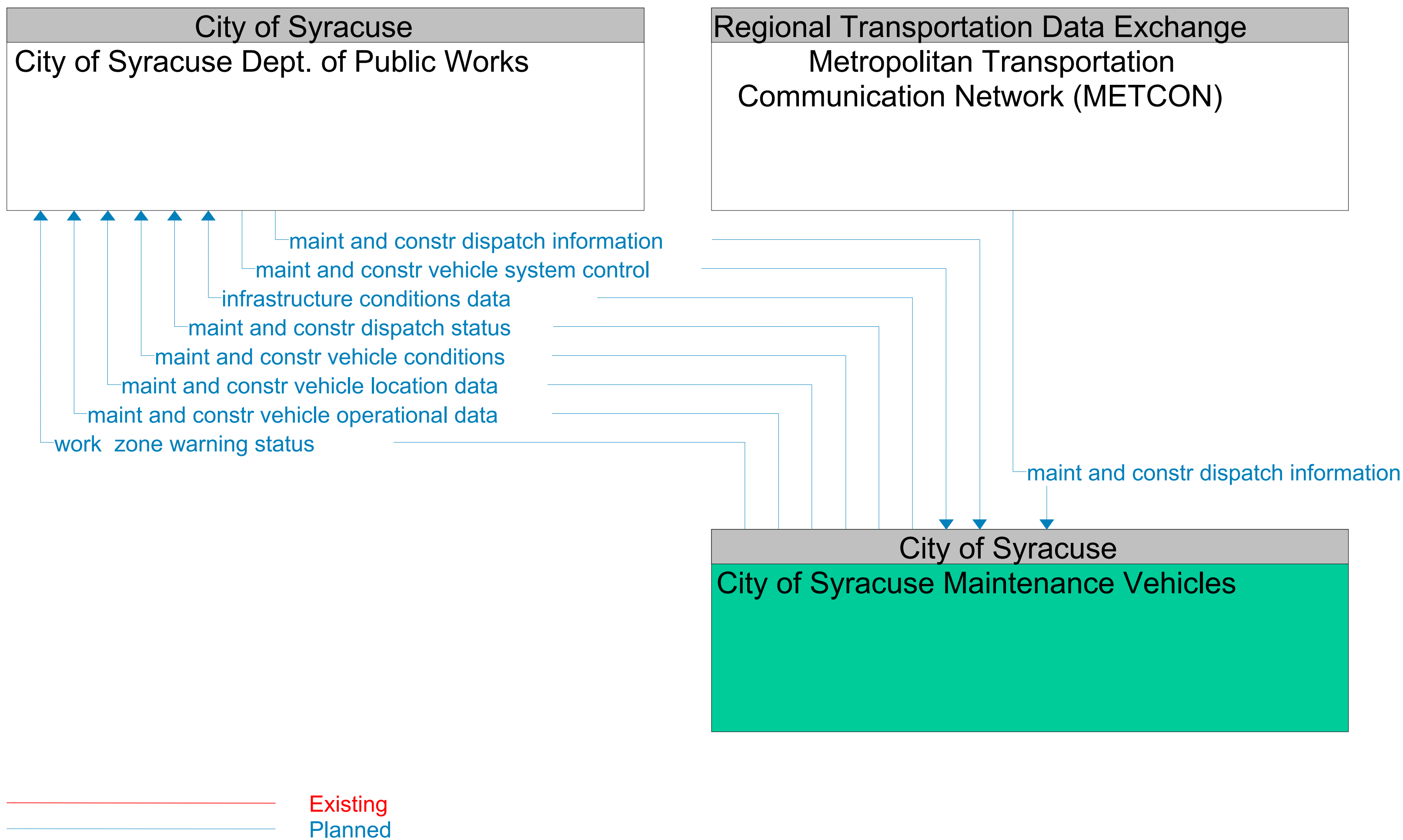

Regional Transportation Data Exchange Network
Metropolitan Transportation Communication Network (METCON)
City of Syracuse
City of Syracuse Police Department
City of Syracuse
City of Syracuse Field Equipment
City of Syracuse
City of Syracuse Maintenance Vehicles
City of Syracuse
City of Syracuse Dept. of Public Works
Traveler
Traveler PC/Info. Appliance
Local Media
Local Media
Financial Institutions
Financial Institutions
Existing
Planned

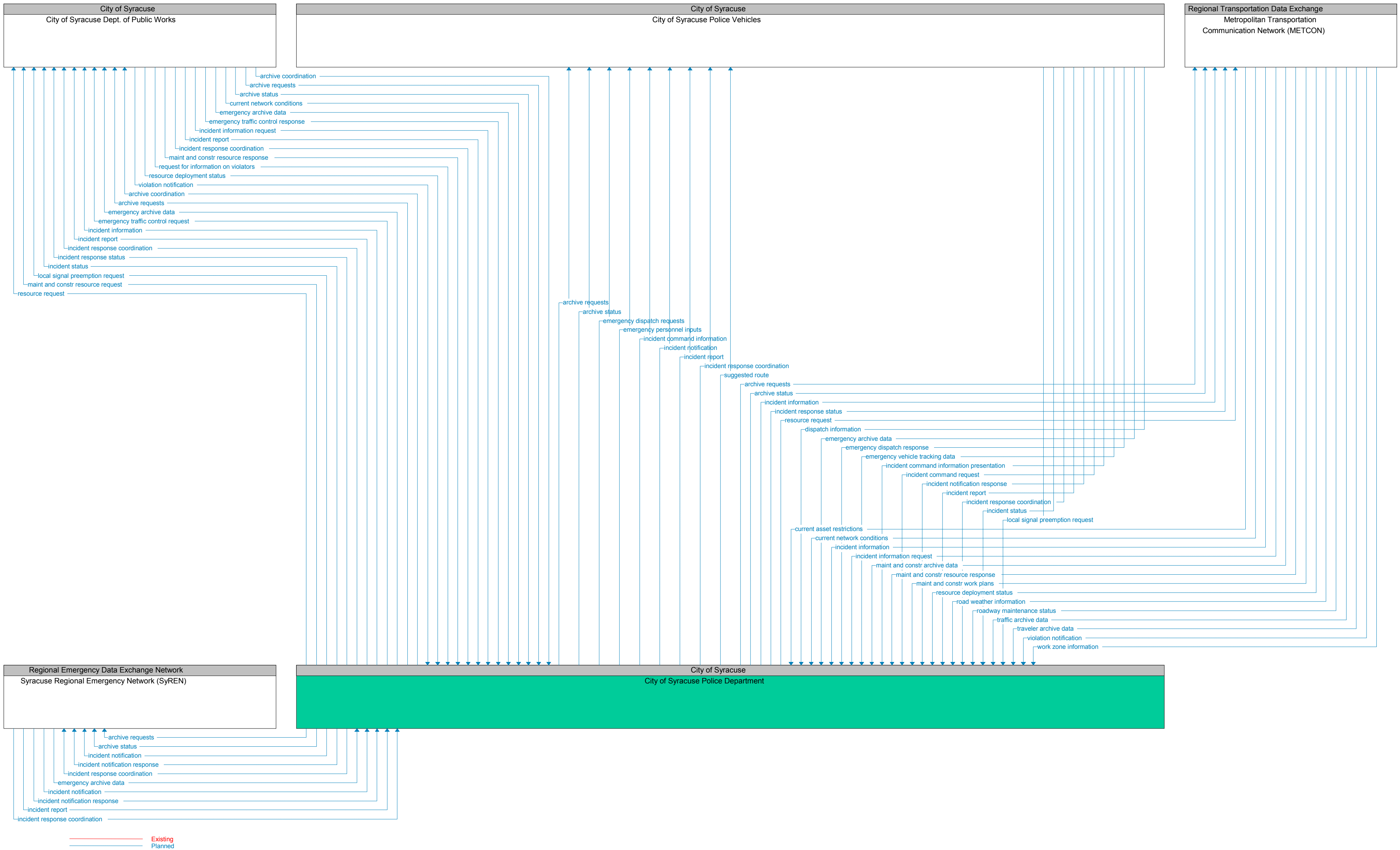


City of Syracuse
City of Syracuse Dept. of Public Works
Inter-Agency Group
EZPASS TAG
Traveler
Pedestrian
freeway control data
roadway information system data
sensor and surveillance control
signal control data
fault reports
freeway control status
incident data
request for right-of-way
roadside archive data
roadway information system status
signal control status
traffic flow
traffic images
vehicle probe data
intersection status
request tag data
vehicle signage data
crossing permission
vehicle probe data
crossing call
City of Syracuse
City of Syracuse Fire Vehicles
City of Syracuse
City of Syracuse Field Equipment
local signal preemption request
Existing
Planned

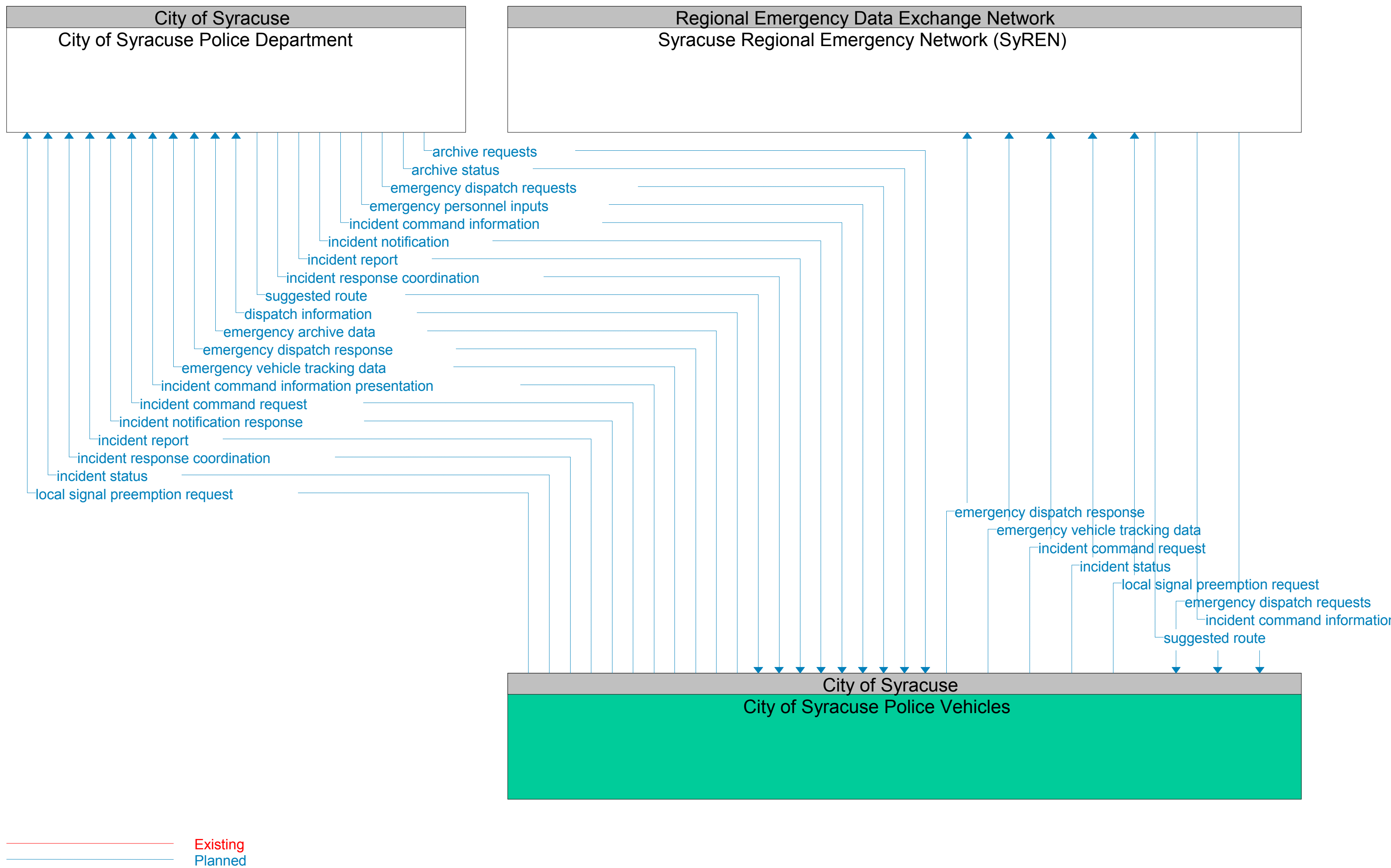

Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
City of Syracuse
City of Syracuse Fire Vehicles
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
emergency dispatch requests
incident command information
incident report
incident response coordination
suggested route
incident notification response
incident report
emergency traffic control request
incident information
incident response status
remote surveillance control
resource request
emergency dispatch response
emergency vehicle tracking data
incident command request
incident report
incident response coordination
incident status
local signal preemption request
current asset restrictions
current network conditions
emergency traffic control response
incident information
incident information request
maint and constr resource response
maint and constr work plans
resource deployment status
road weather information
roadway maintenance status
violation notification
work zone information
incident notification
incident report
incident response coordination
City of Syracuse
City of Syracuse Fire Department
Existing
Planned

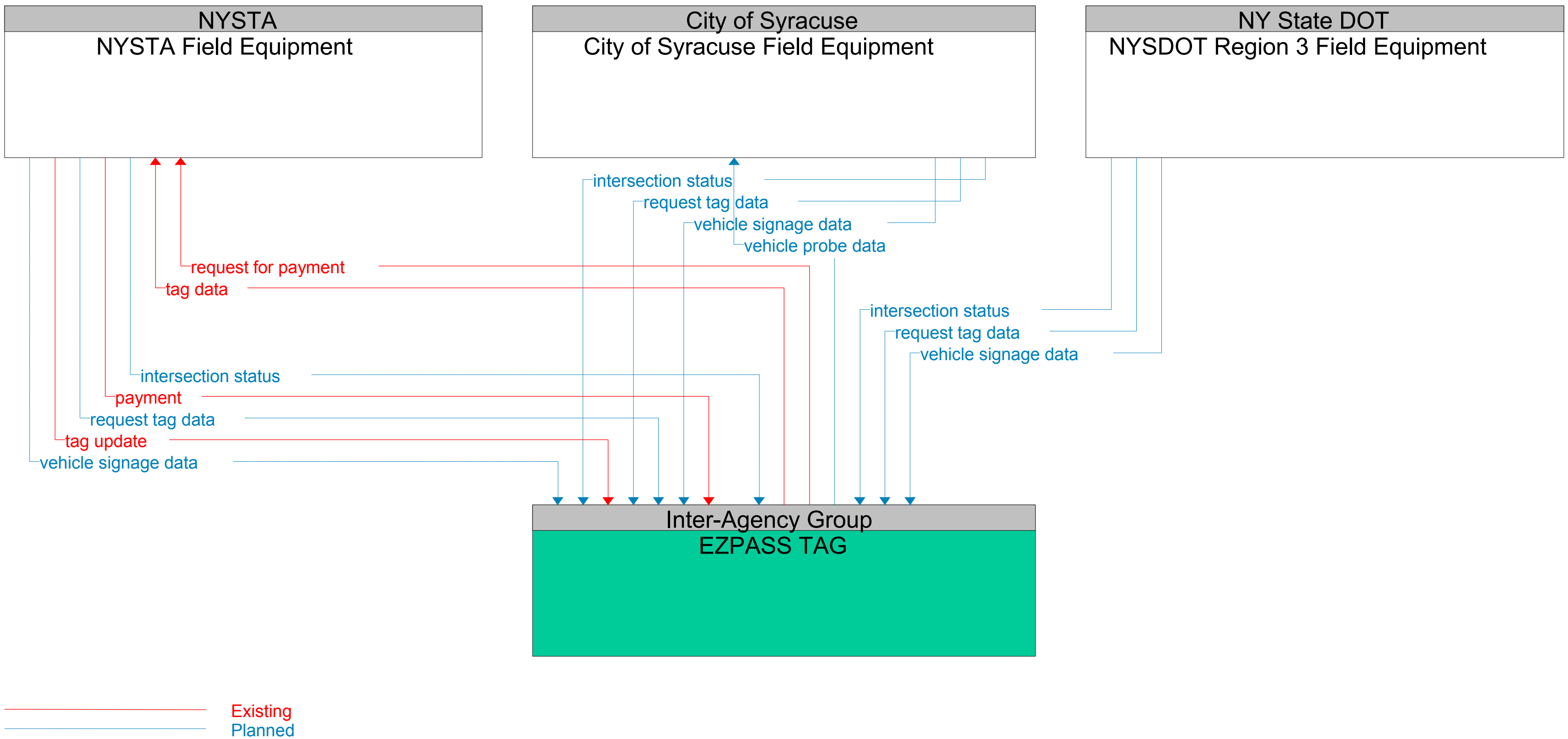

City of Syracuse
City of Syracuse Fire Department
Regional Emergency Data Exchange Network
Syracuse Regional Emergency Network (SyREN)
NY State DOT
NYSDOT Region 3 Field Equipment
emergency dispatch requests
incident command information
incident report
incident response coordination
suggested route
emergency dispatch response
emergency vehicle tracking data
incident command request
incident report
incident response coordination
incident status
local signal preemption request
local signal preemption request
emergency dispatch response
emergency vehicle tracking data
incident command request
incident status
local signal preemption request
emergency notification
emergency dispatch requests
incident command information
suggested route
City of Syracuse
City of Syracuse Field Equipment
City of Syracuse
City of Syracuse Fire Vehicles
Onondaga County
Onondaga County DOT Field Equipment
local signal preemption request
local signal preemption request
Existing
Planned


City of Syracuse
City of Syracuse Dept. of Public Works
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
maint and constr dispatch information
maint and constr vehicle system control
infrastructure conditions data
maint and constr dispatch status
maint and constr vehicle conditions
maint and constr vehicle location data
maint and constr vehicle operational data
work zone warning status
maint and constr dispatch information
City of Syracuse
City of Syracuse Maintenance Vehicles
Existing
Planned

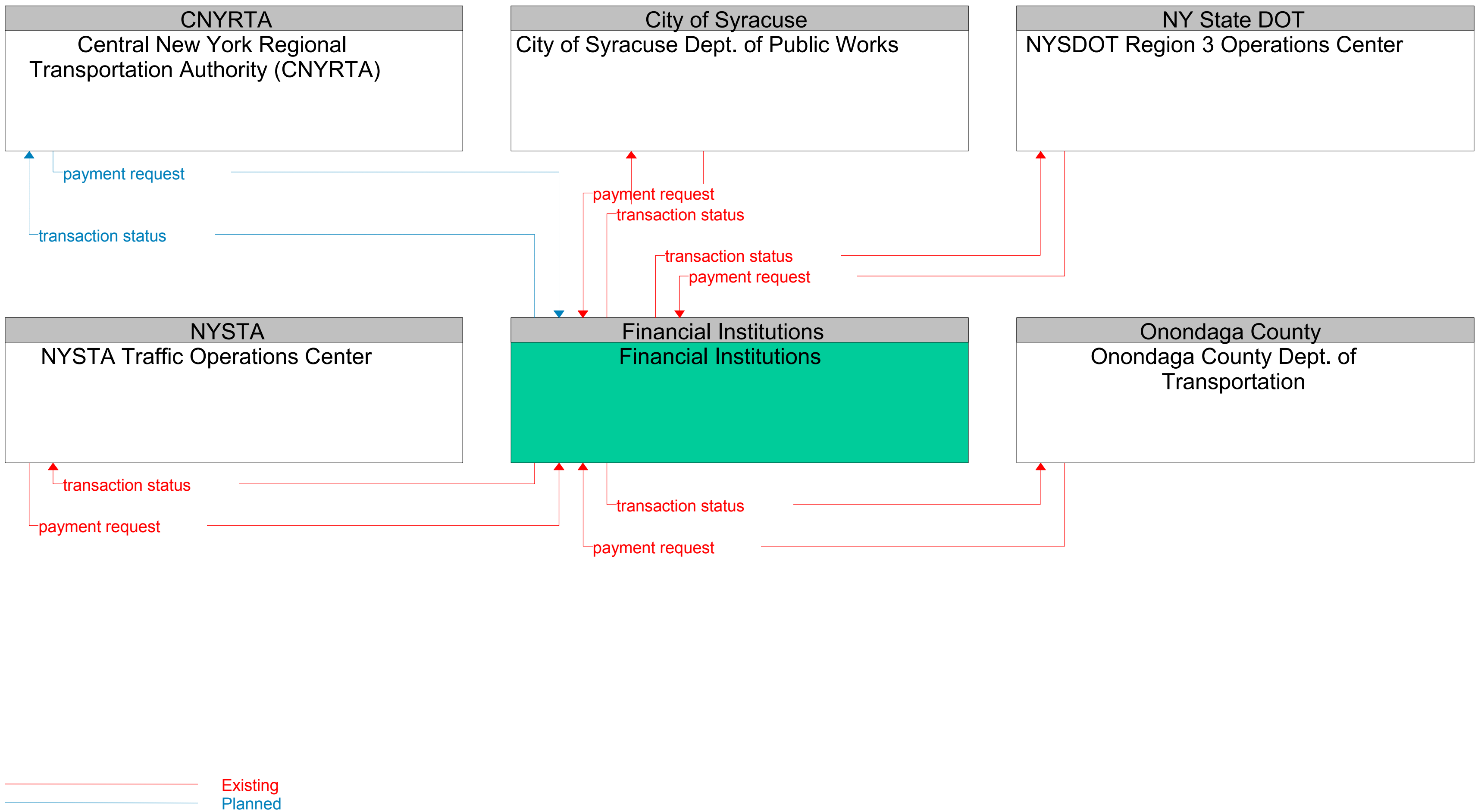


City of Syracuse
City of Syracuse Dept. of Public Works
City of Syracuse
City of Syracuse Police Vehicles
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
archive coordination
archive requests
archive status
current network conditions
emergency archive data
emergency traffic control response
incident information request
incident report
incident response coordination
maint and constr resource response
request for information on violators
resource deployment status
violation notification
archive coordination
archive requests
emergency archive data
emergency traffic control request
incident information
incident report
incident response coordination
incident response status
incident status
local signal preemption request
maint and constr resource request
resource request
archive requests
archive status
emergency dispatch requests
emergency personnel inputs
incident command information
incident notification
incident report
incident response coordination
suggested route
archive requests
archive status
incident information
incident response status
resource request
dispatch information
emergency archive data
emergency dispatch response
emergency vehicle tracking data
incident command information presentation
incident command request
incident notification response
incident report
incident response coordination
incident status
local signal preemption request
current asset restrictions
current network conditions
incident information
incident information request
maint and constr archive data
maint and constr resource response
maint and constr work plans
resource deployment status
road weather information
roadway maintenance status
traffic archive data
traveler archive data
violation notification
work zone information
Regional Emergency Data Exchange Network
Syracuse Regional Emergency Network (SyREN)
City of Syracuse
City of Syracuse Police Department
archive requests
archive status
incident notification
incident notification response
incident response coordination
emergency archive data
incident notification
incident notification response
incident report
incident response coordination
Existing
Planned

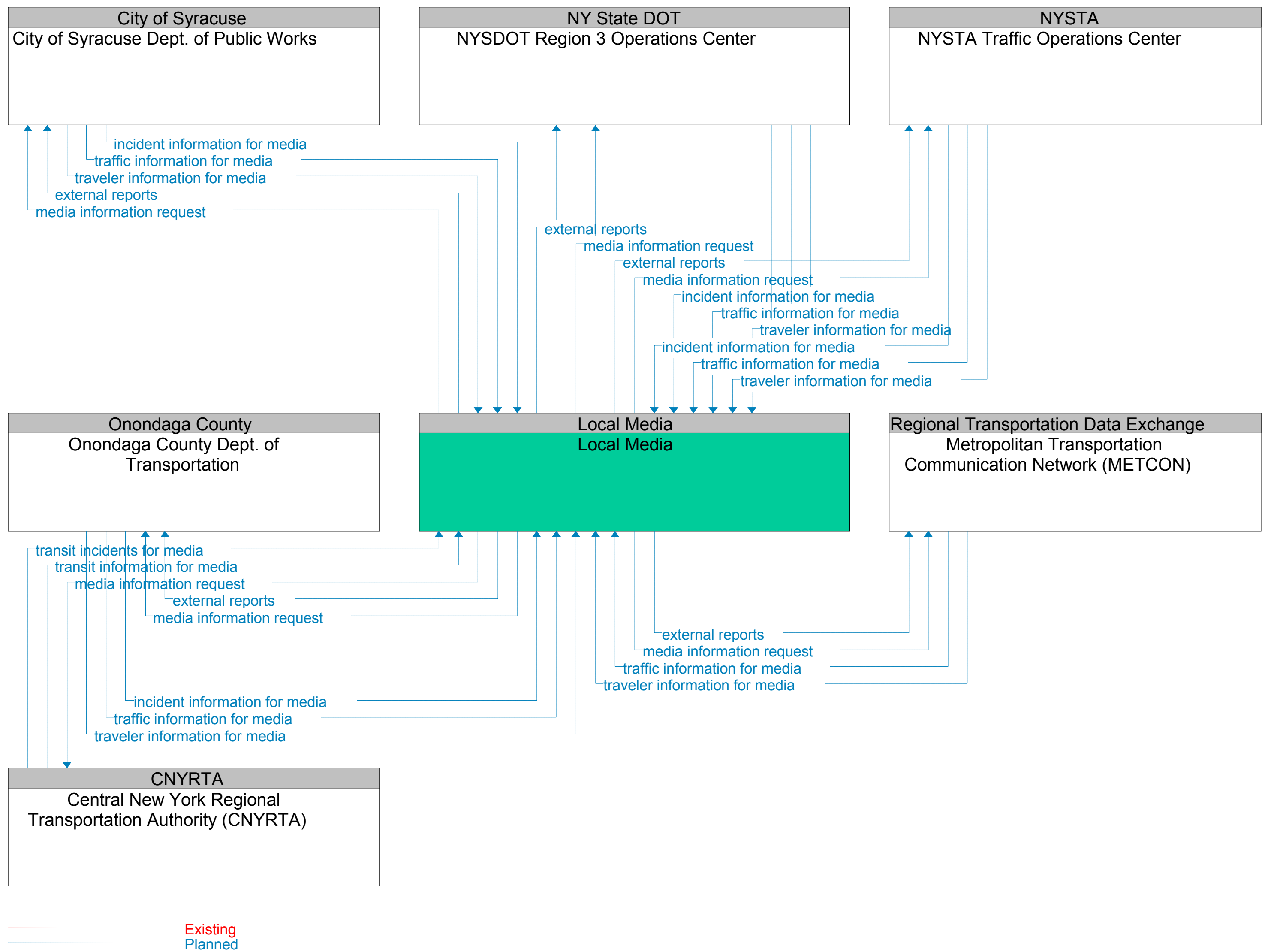

City of Syracuse
City of Syracuse Police Department
Regional Emergency Data Exchange Network
Syracuse Regional Emergency Network (SyREN)
archive requests
archive status
emergency dispatch requests
emergency personnel inputs
incident command information
incident notification
incident report
incident response coordination
suggested route
dispatch information
emergency archive data
emergency dispatch response
emergency vehicle tracking data
incident command information presentation
incident command request
incident notification response
incident report
incident response coordination
incident status
local signal preemption request
emergency dispatch response
emergency vehicle tracking data
incident command request
incident status
local signal preemption request
emergency dispatch requests
incident command information
suggested route
City of Syracuse
City of Syracuse Police Vehicles
Existing
Planned

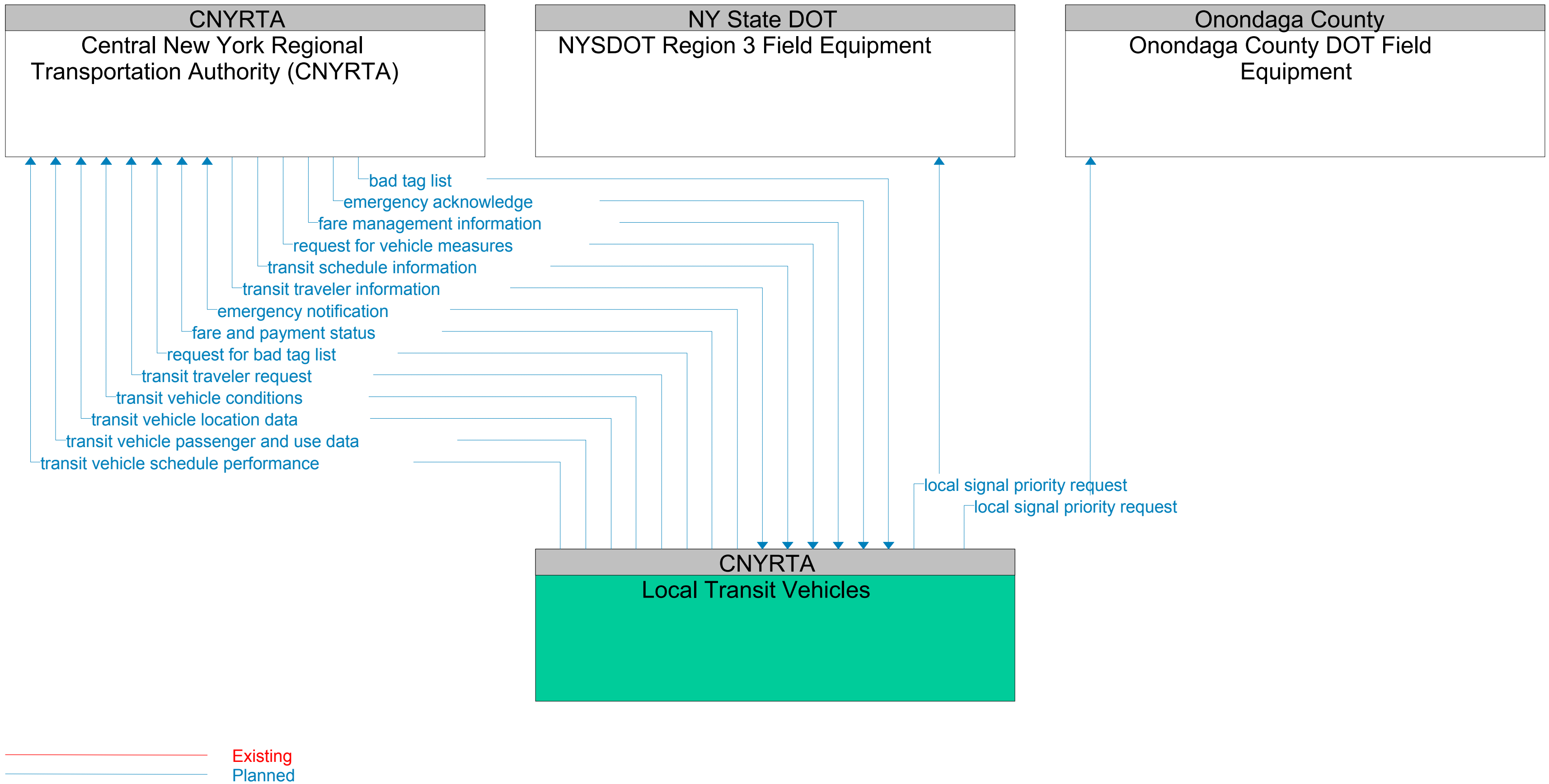


NYSTA
NYSTA Field Equipment
City of Syracuse
City of Syracuse Field Equipment
NY State DOT
NYSDOT Region 3 Field Equipment
intersection status
request tag data
vehicle signage data
vehicle probe data
request for payment
tag data
intersection status
request tag data
vehicle signage data
intersection status
payment
request tag data
tag update
vehicle signage data
Inter-Agency Group
EZPASS TAG
Existing
Planned

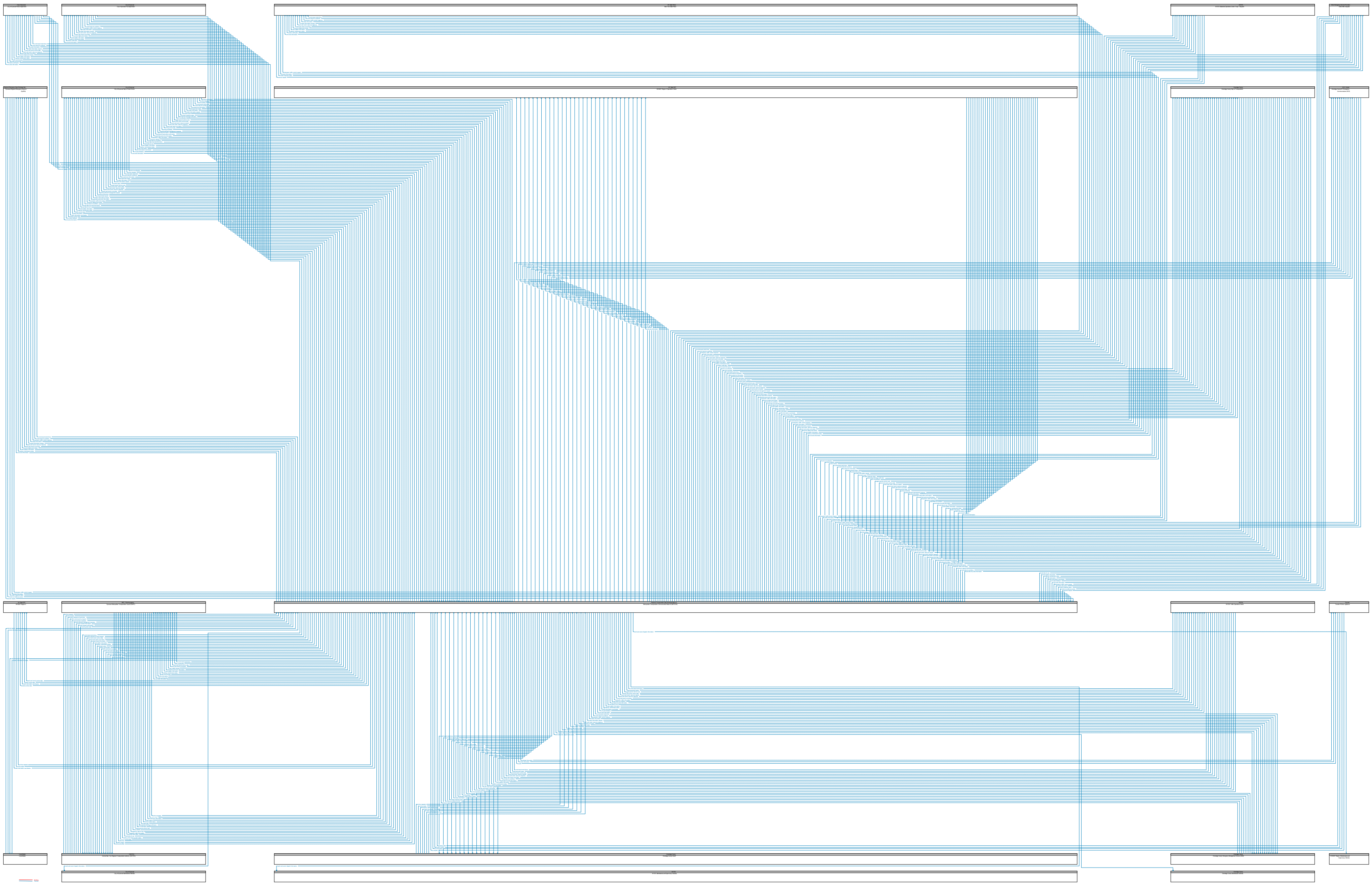


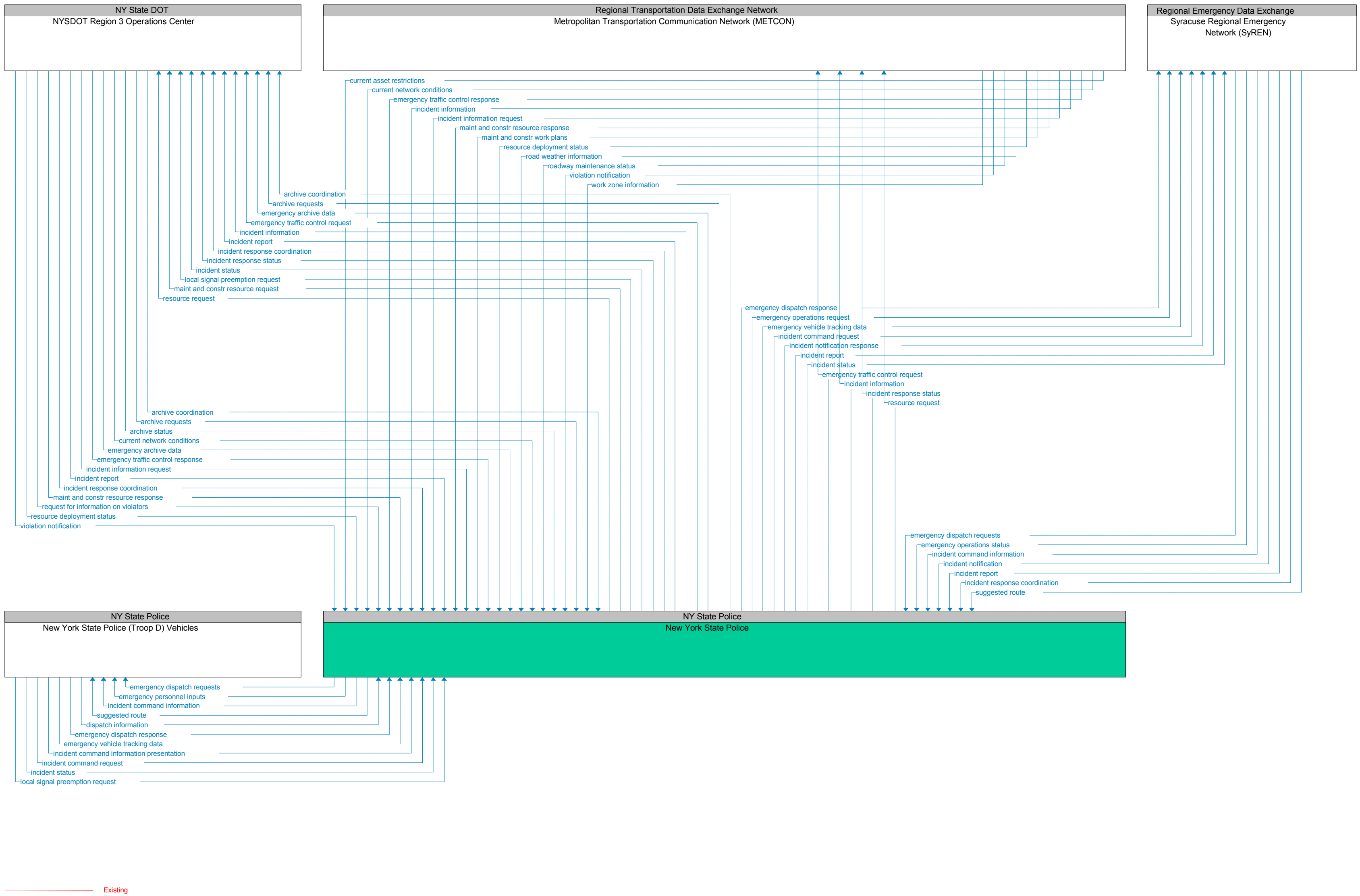
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
City of Syracuse
City of Syracuse Dept. of Public Works
NY State DOT
NYSDOT Region 3 Operations Center
payment request
transaction status
payment request
transaction status
transaction status
payment request
NYSTA
NYSTA Traffic Operations Center
Financial Institutions
Financial Institutions
Onondaga County
Onondaga County Dept. of Transportation
transaction status
payment request
transaction status
payment request
Existing
Planned

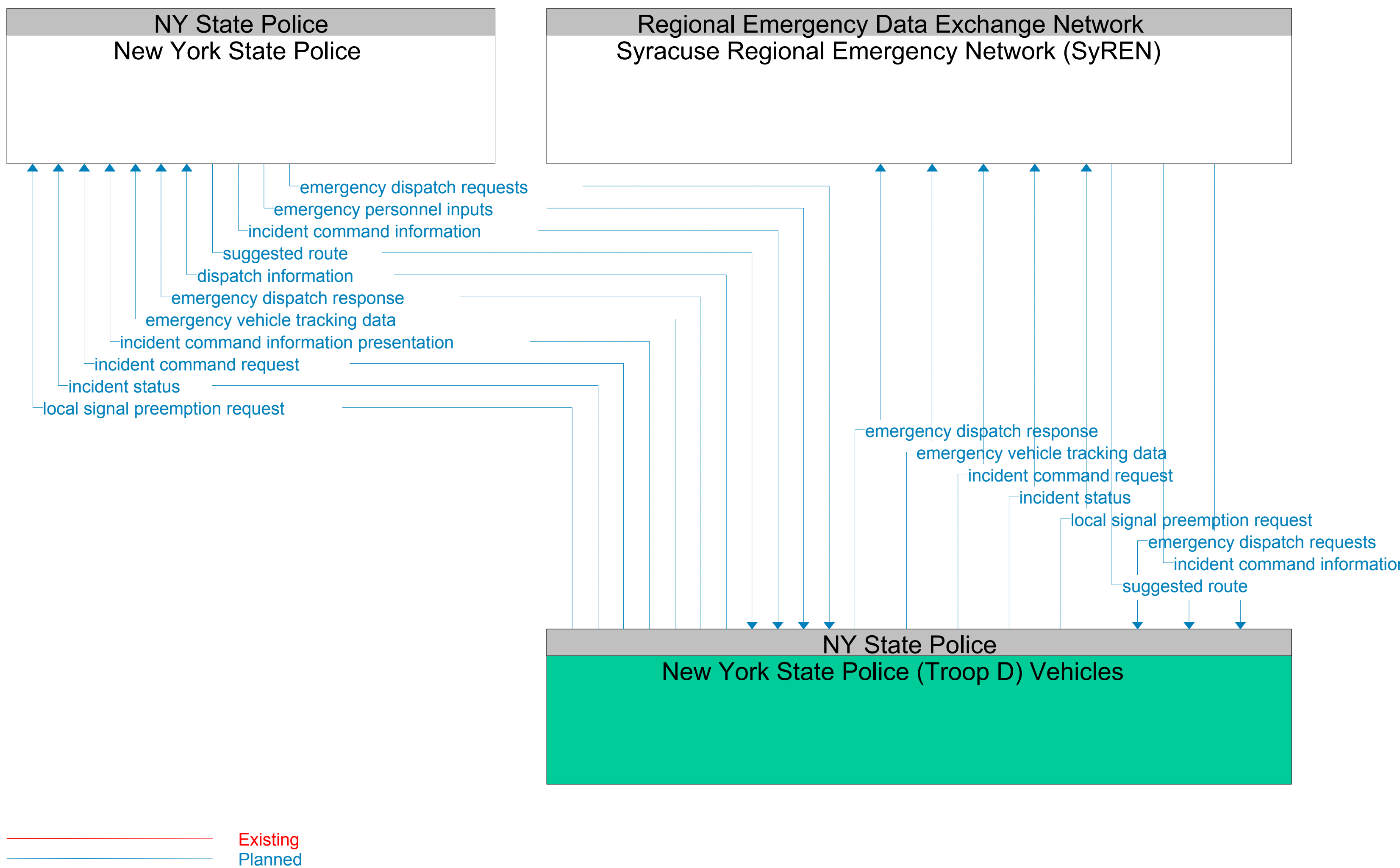

City of Syracuse
City of Syracuse Dept. of Public Works
NY State DOT
NYSDOT Region 3 Operations Center
NYSTA
NYSTA Traffic Operations Center
incident information for media
traffic information for media
traveler information for media
external reports
media information request
external reports
media information request
external reports
media information request
incident information for media
traffic information for media
traveler information for media
incident information for media
traffic information for media
traveler information for media
Onondaga County
Onondaga County Dept. of Transportation
Local Media
Local Media
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
transit incidents for media
transit information for media
media information request
external reports
media information request
external reports
media information request
traffic information for media
traveler information for media
incident information for media
traffic information for media
traveler information for media
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
Existing
Planned

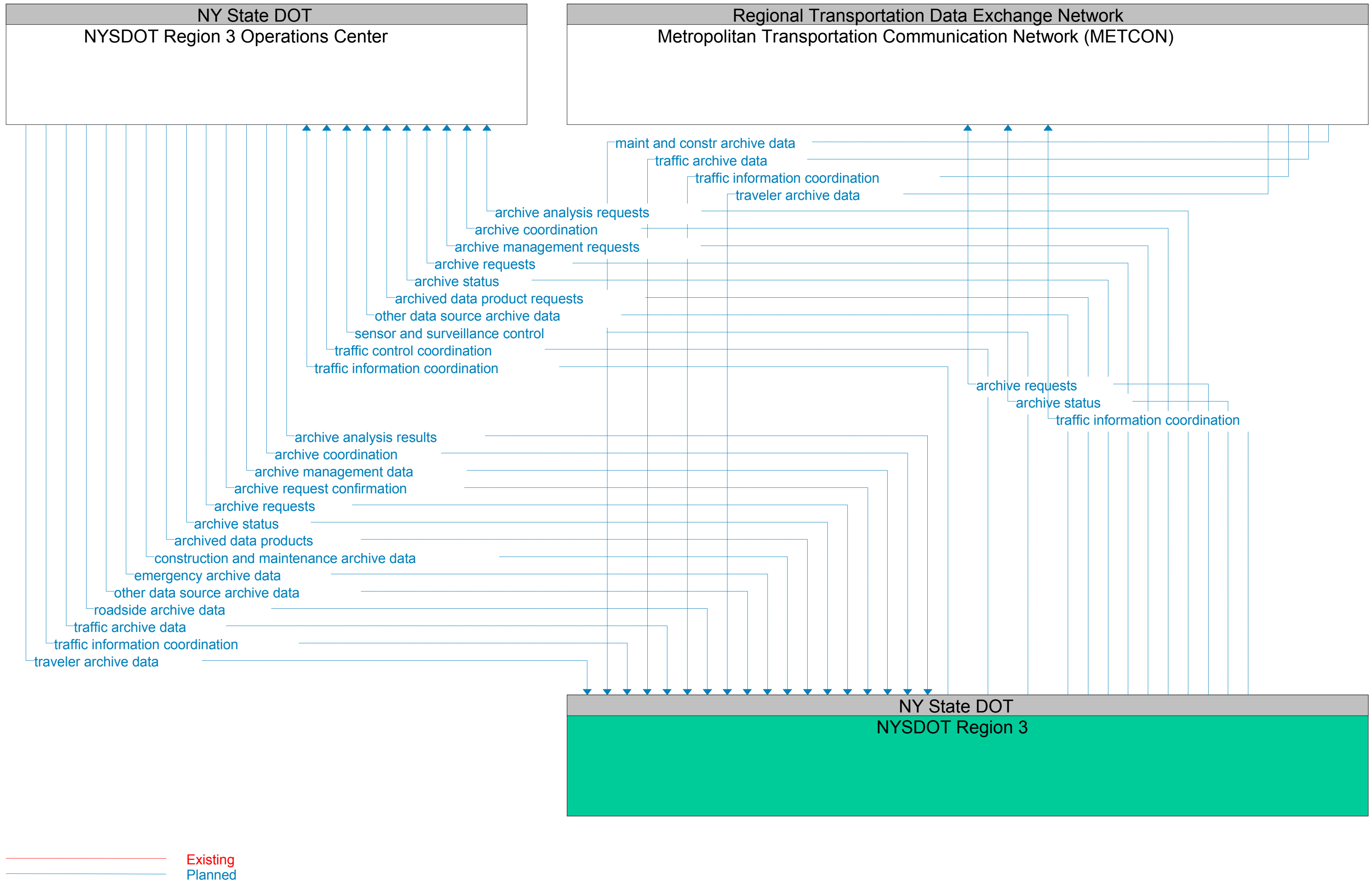


CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
NY State DOT
NYSDOT Region 3 Field Equipment
Onondaga County
Onondaga County DOT Field Equipment
bad tag list
emergency acknowledge
fare management information
request for vehicle measures
transit schedule information
transit traveler information
emergency notification
fare and payment status
request for bad tag list
transit traveler request
transit vehicle conditions
transit vehicle location data
transit vehicle passenger and use data
transit vehicle schedule performance
local signal priority request
local signal priority request
CNYRTA
Local Transit Vehicles
Existing
Planned

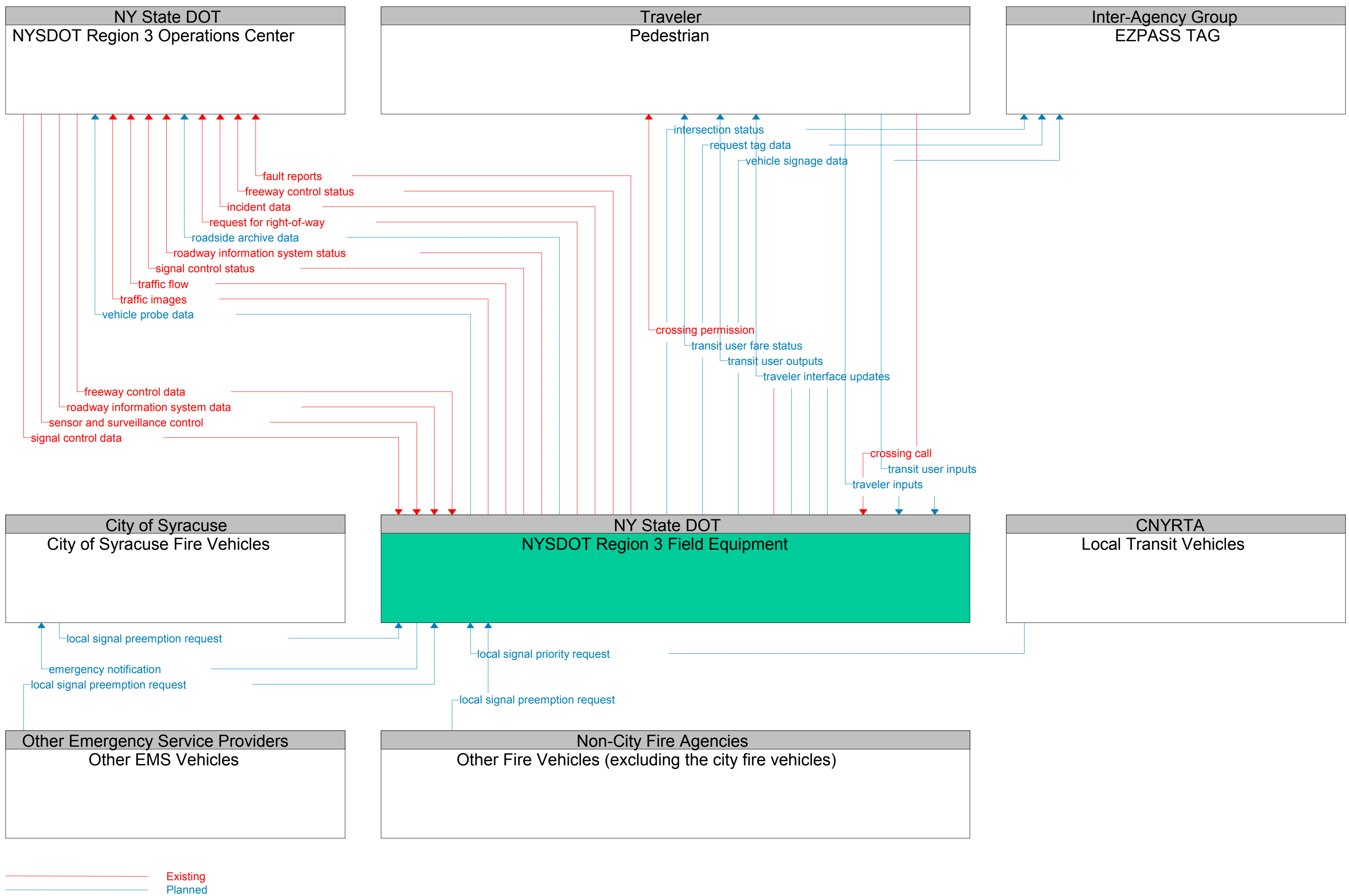



NY State DOT
NYSDOT Region 3 Operations Center
Regional Transportation Data Exchange Network
Metropolitan Transportation Communication Network (METCON)
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
current asset restrictions
current network conditions
emergency traffic control response
incident information
incident information request
maint and constr resource response
maint and constr work plans
resource deployment status
road weather information
roadway maintenance status
violation notification
work zone information
archive coordination
archive requests
emergency archive data
emergency traffic control request
incident information
incident report
incident response coordination
incident response status
incident status
local signal preemption request
maint and constr resource request
resource request
emergency dispatch response
emergency operations request
emergency vehicle tracking data
incident command request
incident notification response
incident report
incident status
emergency traffic control request
incident information
incident response status
resource request
archive coordination
archive requests
archive status
current network conditions
emergency archive data
emergency traffic control response
incident information request
incident report
incident response coordination
maint and constr resource response
request for information on violators
resource deployment status
violation notification
emergency dispatch requests
emergency operations status
incident command information
incident notification
incident report
incident response coordination
suggested route
NY State Police
New York State Police (Troop D) Vehicles
NY State Police
New York State Police
emergency dispatch requests
emergency personnel inputs
incident command information
suggested route
dispatch information
emergency dispatch response
emergency vehicle tracking data
incident command information presentation
incident command request
incident status
local signal preemption request
Existing
Planned

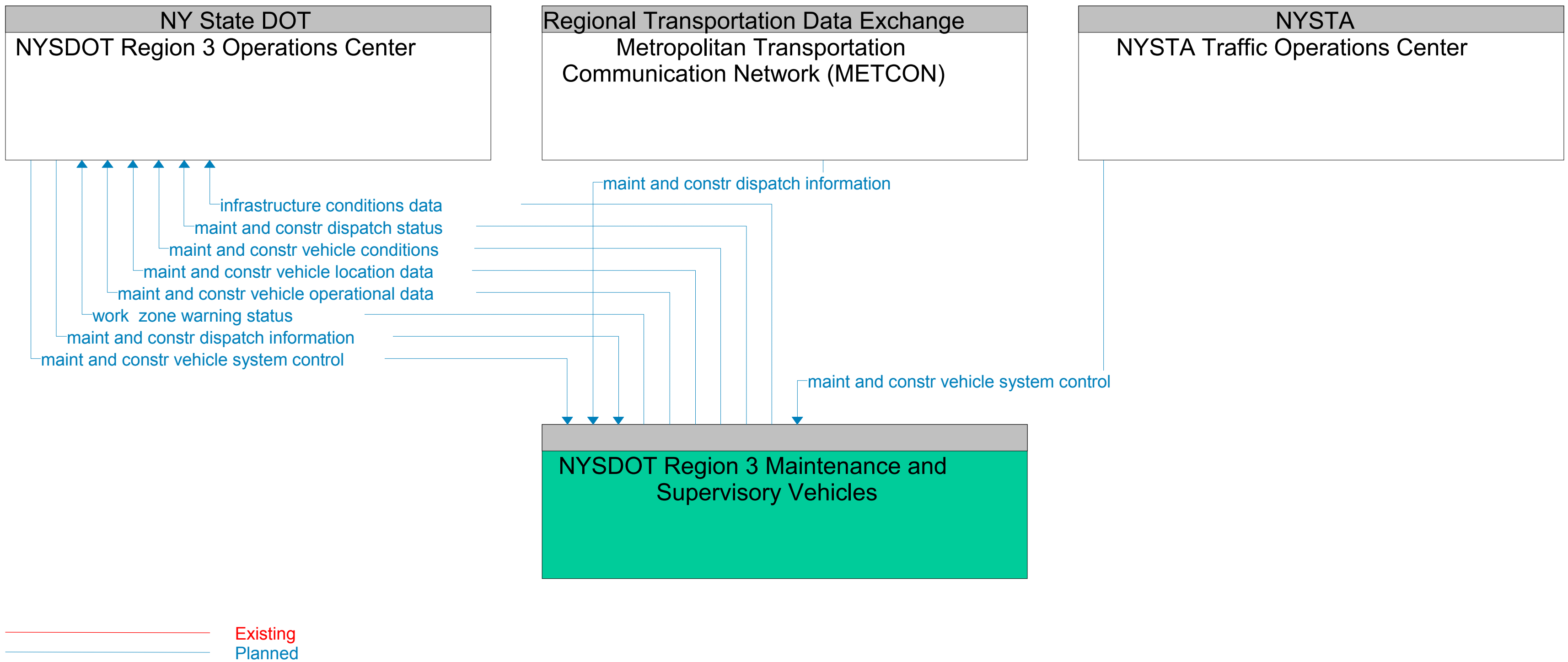

NY State Police
New York State Police
Regional Emergency Data Exchange Network
Syracuse Regional Emergency Network (SyREN)
emergency dispatch requests
emergency personnel inputs
incident command information
suggested route
dispatch information
emergency dispatch response
emergency vehicle tracking data
incident command information presentation
incident command request
incident status
local signal preemption request
emergency dispatch response
emergency vehicle tracking data
incident command request
incident status
local signal preemption request
emergency dispatch requests
incident command information
suggested route
NY State Police
New York State Police (Troop D) Vehicles
Existing
Planned

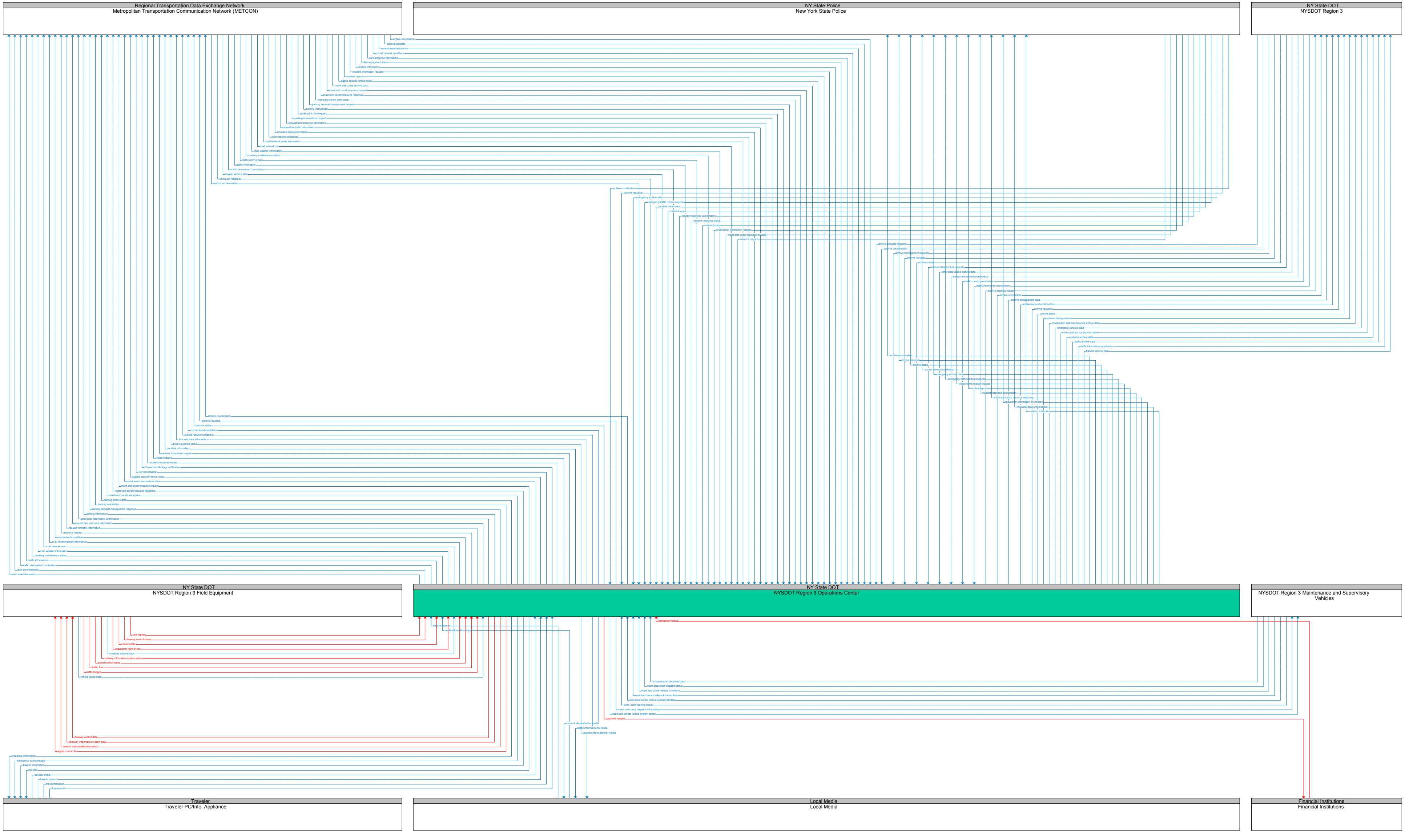


NY State DOT
NYSDOT Region 3 Operations Center
Regional Transportation Data Exchange Network
Metropolitan Transportation Communication Network (METCON)
maint and constr archive data
traffic archive data
traffic information coordination
traveler archive data
archive analysis requests
archive coordination
archive management requests
archive requests
archive status
archived data product requests
other data source archive data
sensor and surveillance control
traffic control coordination
traffic information coordination
archive requests
archive status
traffic information coordination
archive analysis results
archive coordination
archive management data
archive request confirmation
archive requests
archive status
archived data products
construction and maintenance archive data
emergency archive data
other data source archive data
roadside archive data
traffic archive data
traffic information coordination
traveler archive data
NY State DOT
NYSDOT Region 3
Existing
Planned

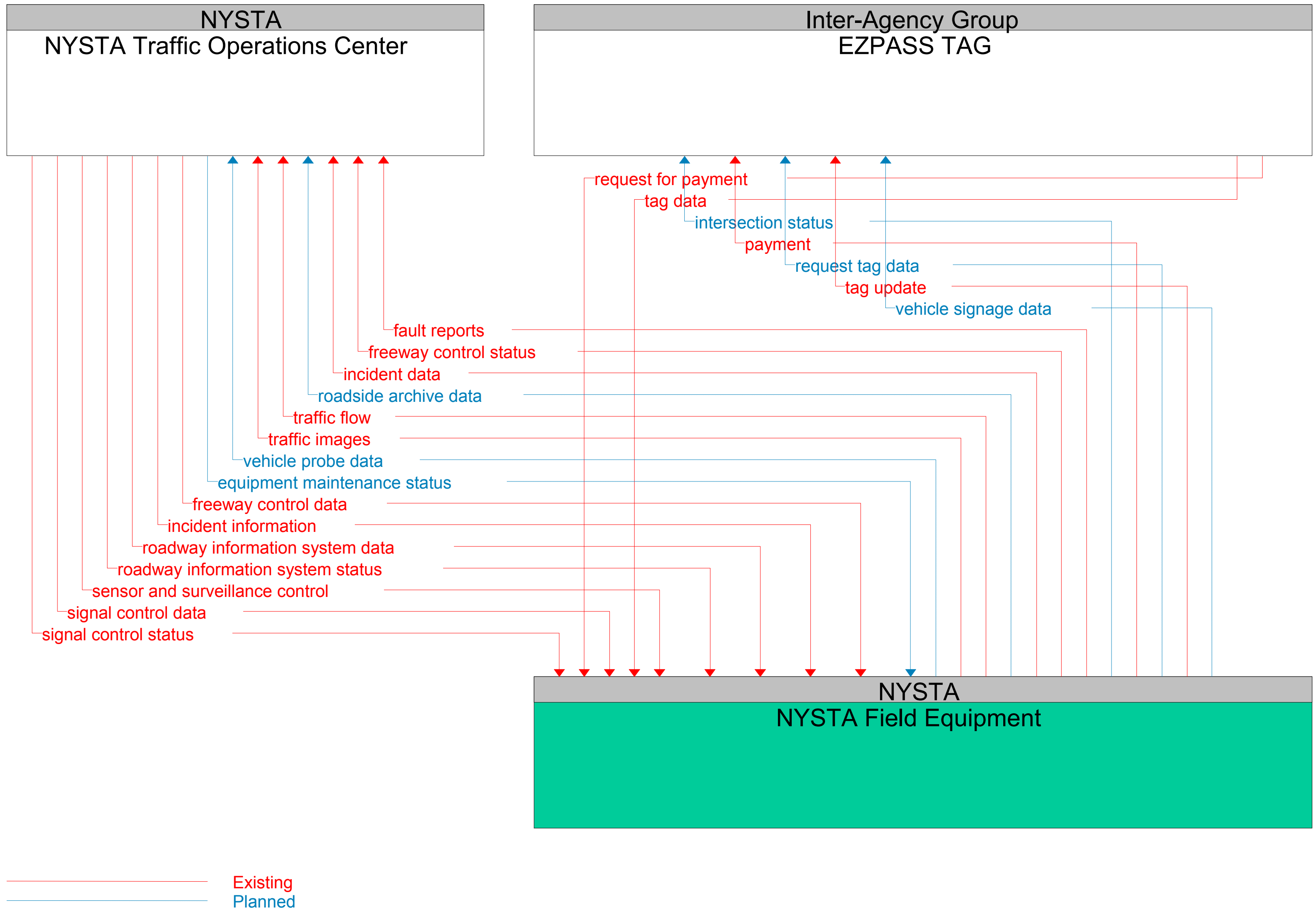


NY State DOT
NYSDOT Region 3 Operations Center
Traveler
Pedestrian
Inter-Agency Group
EZPASS TAG
intersection status
request tag data
vehicle signage data
fault reports
freeway control status
incident data
request for right-of-way
roadside archive data
roadway information system status
signal control status
traffic flow
traffic images
vehicle probe data
crossing permission
transit user fare status
transit user outputs
traveler interface updates
freeway control data
roadway information system data
sensor and surveillance control
signal control data
crossing call
transit user inputs
traveler inputs
City of Syracuse
City of Syracuse Fire Vehicles
NY State DOT
NYSDOT Region 3 Field Equipment
CNYRTA
Local Transit Vehicles
local signal preemption request
local signal priority request
emergency notification
local signal preemption request
local signal preemption request
Other Emergency Service Providers
Other EMS Vehicles
Non-City Fire Agencies
Other Fire Vehicles (excluding the city fire vehicles)
Existing
Planned

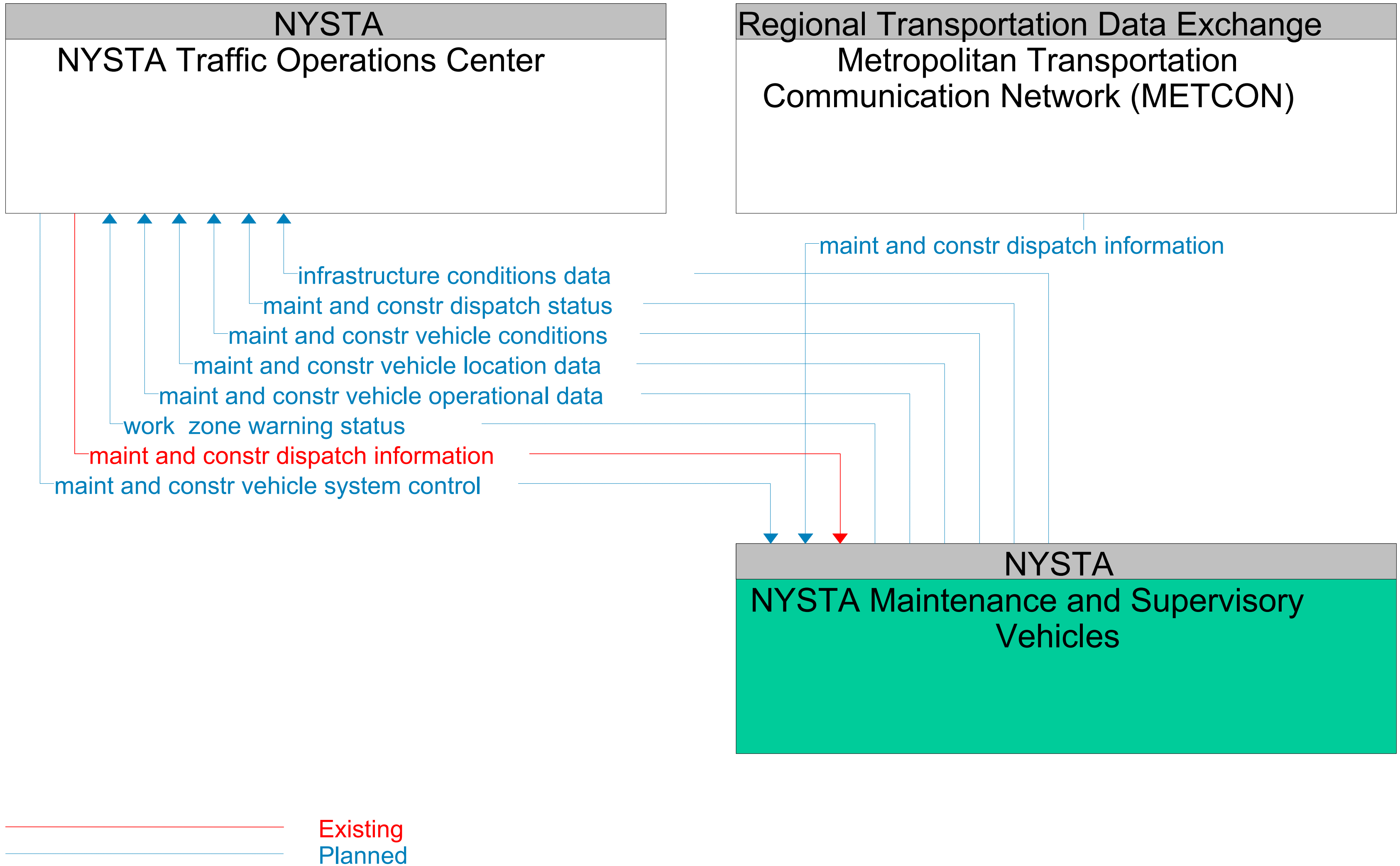

NY State DOT
NYSDOT Region 3 Operations Center
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
NYSTA
NYSTA Traffic Operations Center
maint and constr dispatch information
infrastructure conditions data
maint and constr dispatch status
maint and constr vehicle conditions
maint and constr vehicle location data
maint and constr vehicle operational data
work zone warning status
maint and constr dispatch information
maint and constr vehicle system control
maint and constr vehicle system control
NYSDOT Region 3 Maintenance and Supervisory Vehicles
Existing
Planned

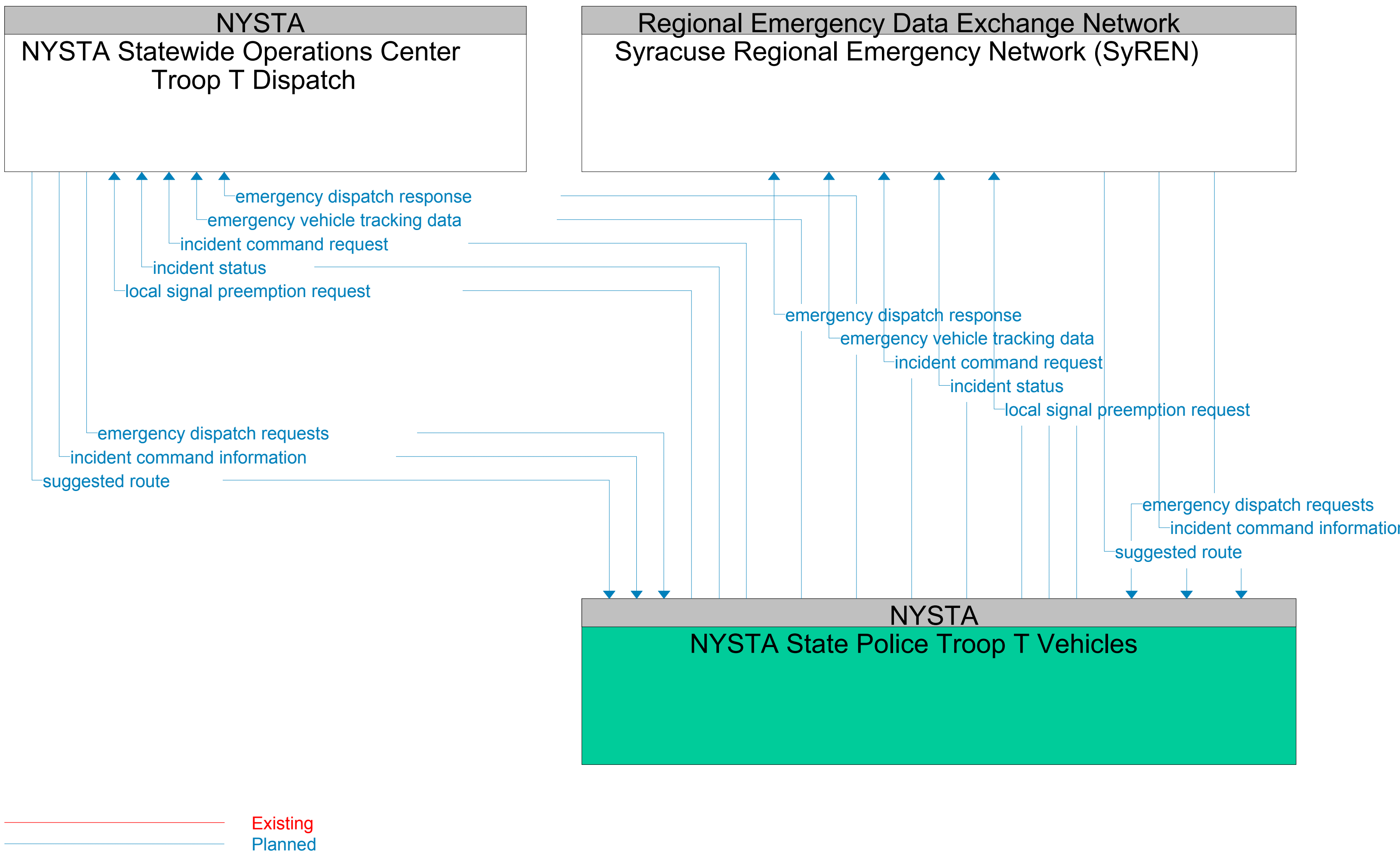


Regional Transportation Data Exchange Network
Metropolitan Transportation Communication Network (METCON)
NY State Police
New York State Police
NY State DOT
NYSDOT Region 3
NY State DOT
NYSDOT Region 3 Field Equipment
NY State DOT
NYSDOT Region 3 Operations Center
NYSDOT Region 3 Maintenance and Supervisory Vehicles
Traveler
Traveler PC/Info. Appliance
Local Media
Local Media
Financial Institutions
Financial Institutions
Existing
Planned



NYSTA
NYSTA Traffic Operations Center
Inter-Agency Group
EZPASS TAG
request for payment
tag data
intersection status
payment
request tag data
tag update
vehicle signage data
fault reports
freeway control status
incident data
roadside archive data
traffic flow
traffic images
vehicle probe data
equipment maintenance status
freeway control data
incident information
roadway information system data
roadway information system status
sensor and surveillance control
signal control data
signal control status
NYSTA
NYSTA Field Equipment
Existing
Planned


NYSTA
NYSTA Traffic Operations Center
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
maint and constr dispatch information
infrastructure conditions data
maint and constr dispatch status
maint and constr vehicle conditions
maint and constr vehicle location data
maint and constr vehicle operational data
work zone warning status
maint and constr dispatch information
maint and constr vehicle system control
NYSTA
NYSTA Maintenance and Supervisory Vehicles
Existing
Planned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Syracuse Regional Emergency Network (SyREN)
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local signal preemption request
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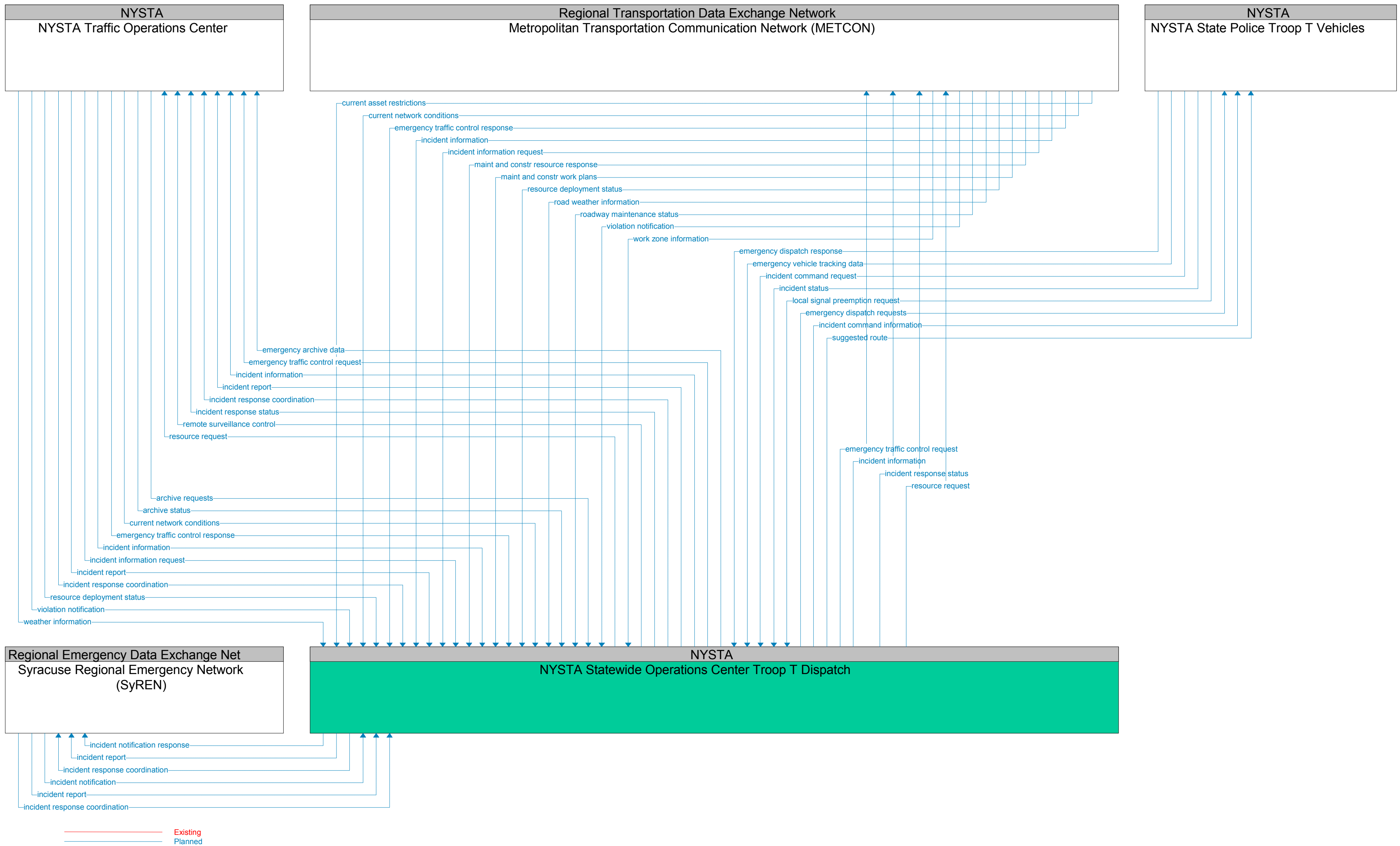
NYSTA
NYSTA State Police Troop T Vehicles
Existing
Planned



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NYSTA State Police Troop T Vehicles
current asset restrictions
current network conditions
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incident information
incident information request
maint and constr resource response
maint and constr work plans
resource deployment status
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roadway maintenance status
violation notification
work zone information
emergency dispatch response
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incident command request
incident status
local signal preemption request
emergency dispatch requests
incident command information
suggested route
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emergency traffic control request
incident information
incident report
incident response coordination
incident response status
remote surveillance control
resource request
emergency traffic control request
incident information
incident response status
resource request
archive requests
archive status
current network conditions
emergency traffic control response
incident information
incident information request
incident report
incident response coordination
resource deployment status
violation notification
weather information
Regional Emergency Data Exchange Net
Syracuse Regional Emergency Network (SyREN)
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incident report
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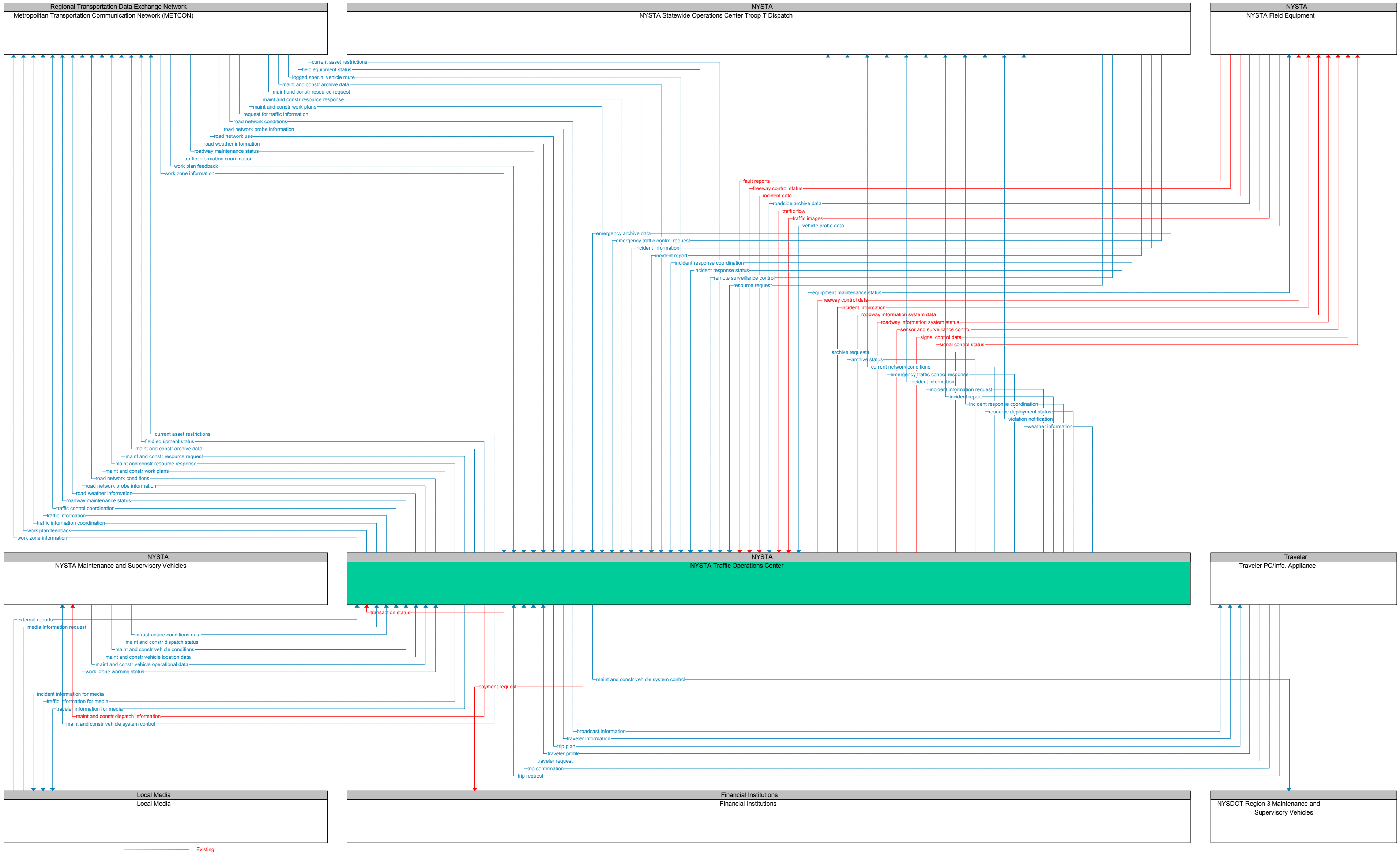
incident response coordination
Existing
Planned



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road network use
road weather information
roadway maintenance status
traffic information coordination
work plan feedback
work zone information
fault reports
freeway control status
incident data
roadside archive data
traffic flow
traffic images
vehicle probe data
emergency archive data
emergency traffic control request
incident information
incident report
incident response coordination
incident response status
remote surveillance control
resource request
equipment maintenance status
freeway control data
incident information
roadway information system data
roadway information system status
sensor and surveillance control
signal control data
signal control status
archive requests
archive status
current network conditions
emergency traffic control response
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incident information request
incident report
incident response coordination
resource deployment status
violation notification
weather information
current asset restrictions
field equipment status
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maint and constr resource response
maint and constr work plans
road network conditions
road network probe information
road weather information
roadway maintenance status
traffic control coordination
traffic information
traffic information coordination
work plan feedback
work zone information
NYSTA
NYSTA Maintenance and Supervisory Vehicles
NYSTA
NYSTA Traffic Operations Center
Traveler
Traveler PC/Info. Appliance
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transaction status
infrastructure conditions data
maint and constr dispatch status
maint and constr vehicle conditions
maint and constr vehicle location data
maint and constr vehicle operational data
work zone warning status
maint and constr vehicle system control
incident information for media
payment request
traffic information for media
traveler information for media
maint and constr dispatch information
maint and constr vehicle system control
broadcast information
traveler information
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traveler profile
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trip confirmation
trip request
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Local Media
Financial Institutions
Financial Institutions
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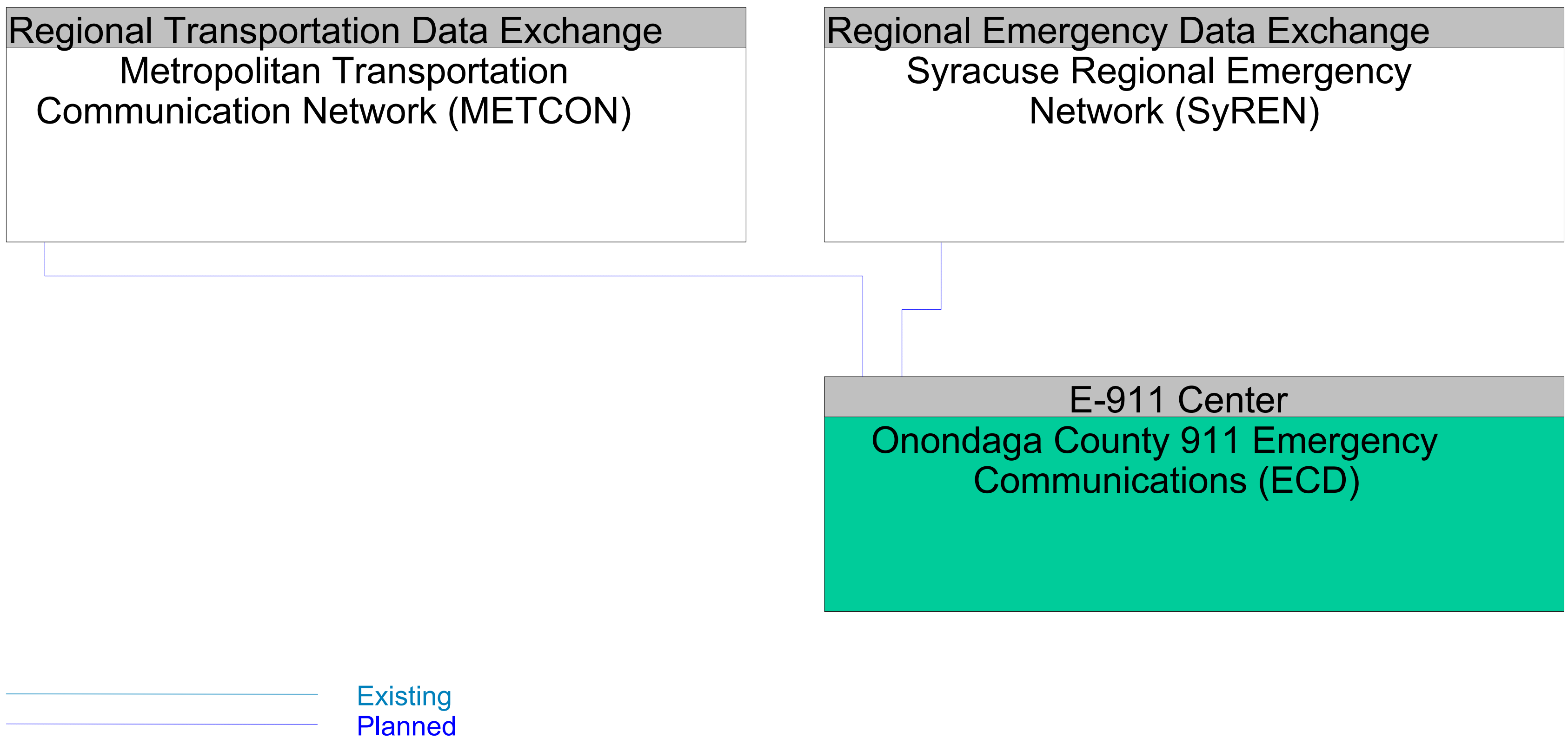
Planned



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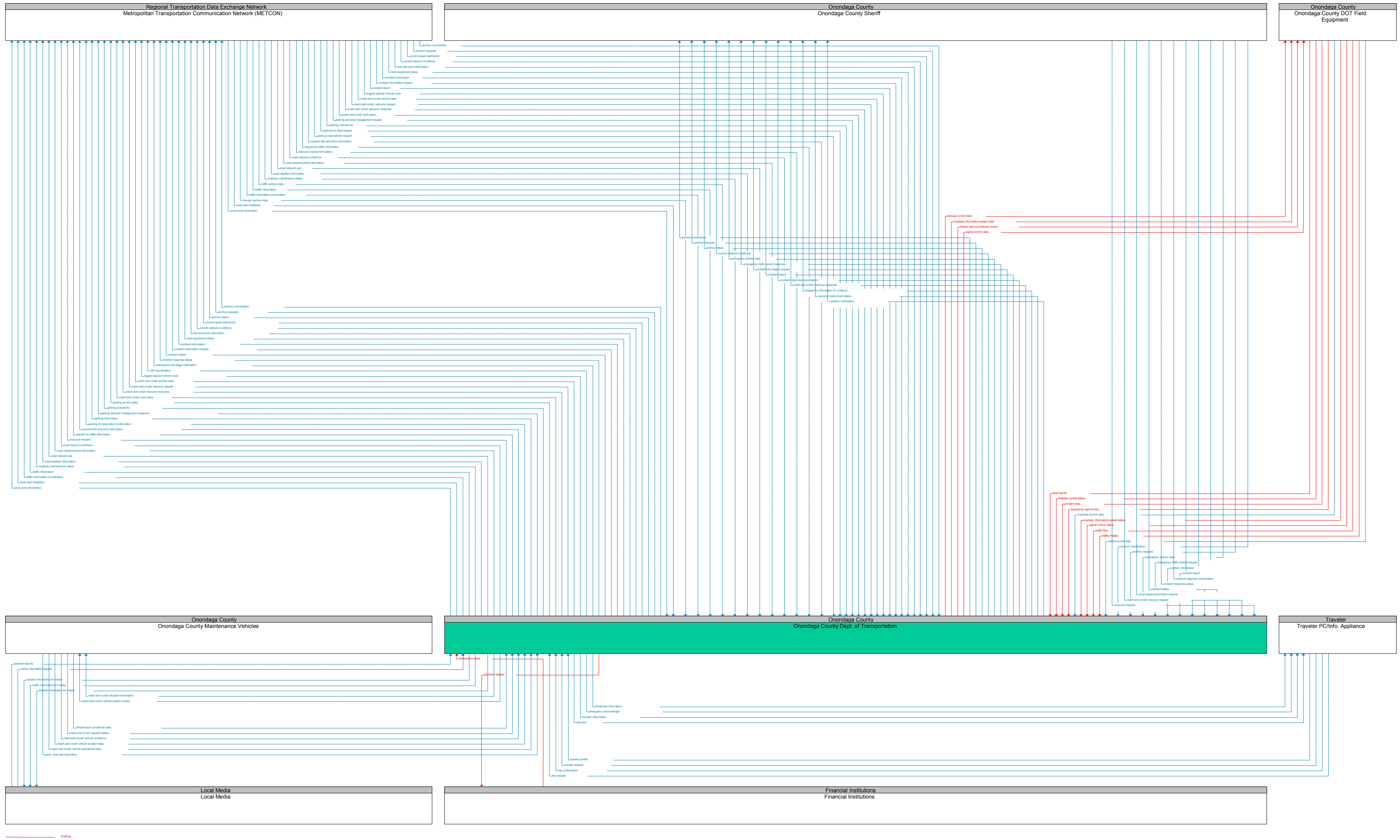

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Onondaga County
Onondaga County Maintenance Vehicles
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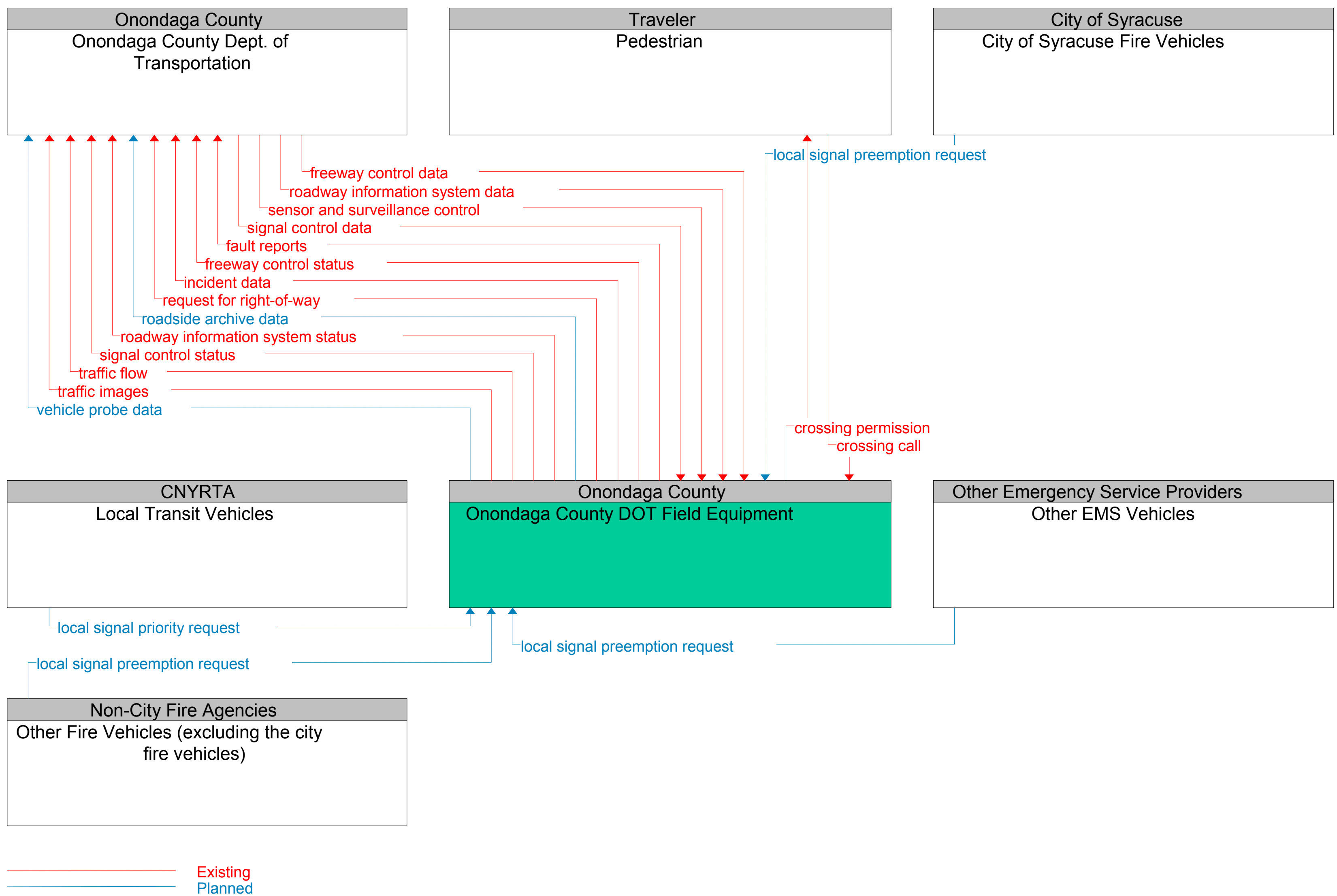
Traveler PC/Info. Appliance
Local Media
Local Media
Financial Institutions
Financial Institutions
Existing
Planned



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Pedestrian
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signal control data
fault reports
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incident data
request for right-of-way
roadside archive data
roadway information system status
signal control status
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vehicle probe data
crossing permission
crossing call
CNYRTA
Local Transit Vehicles
Onondaga County
Onondaga County DOT Field Equipment
Other Emergency Service Providers
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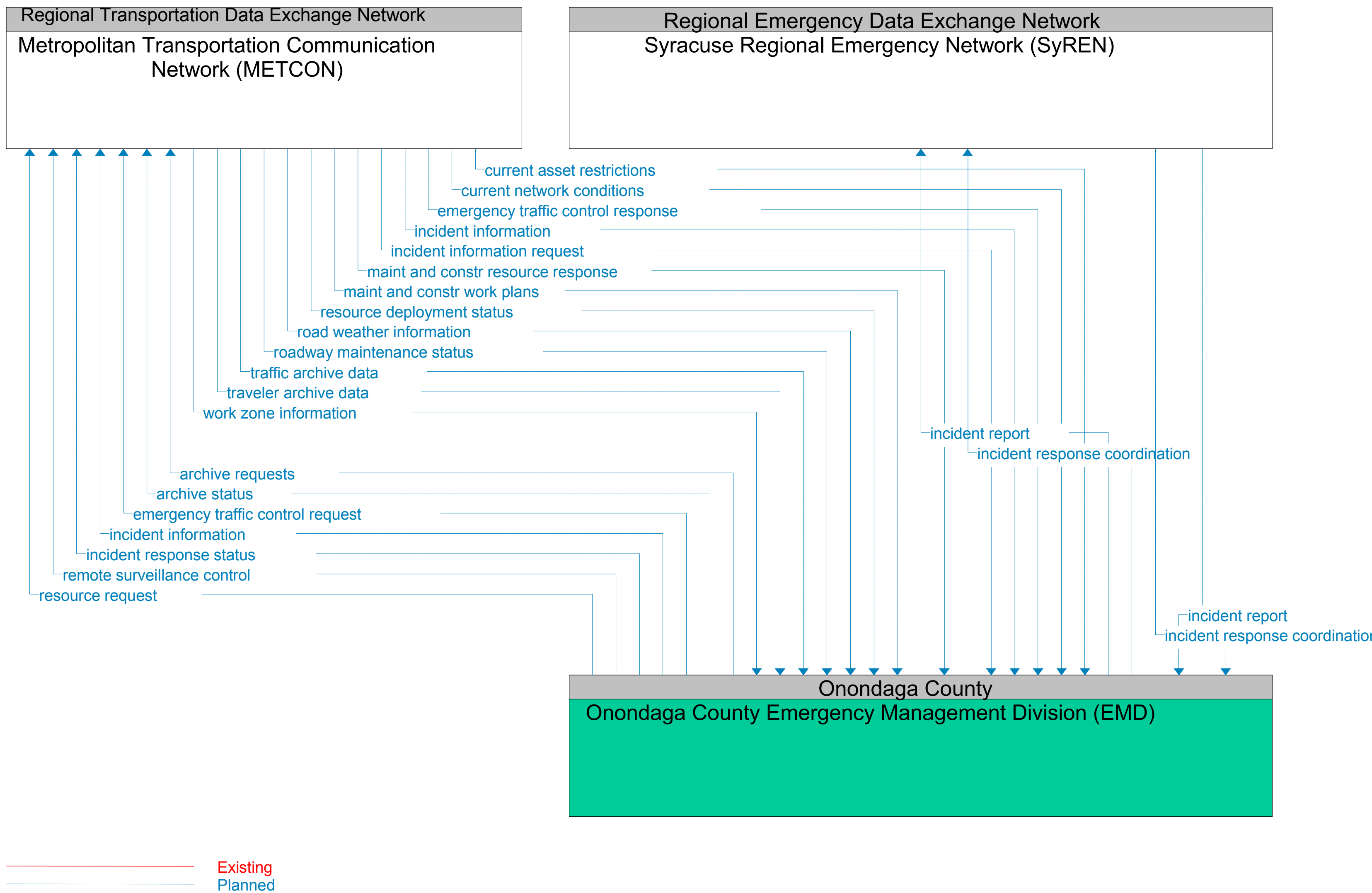
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Existing
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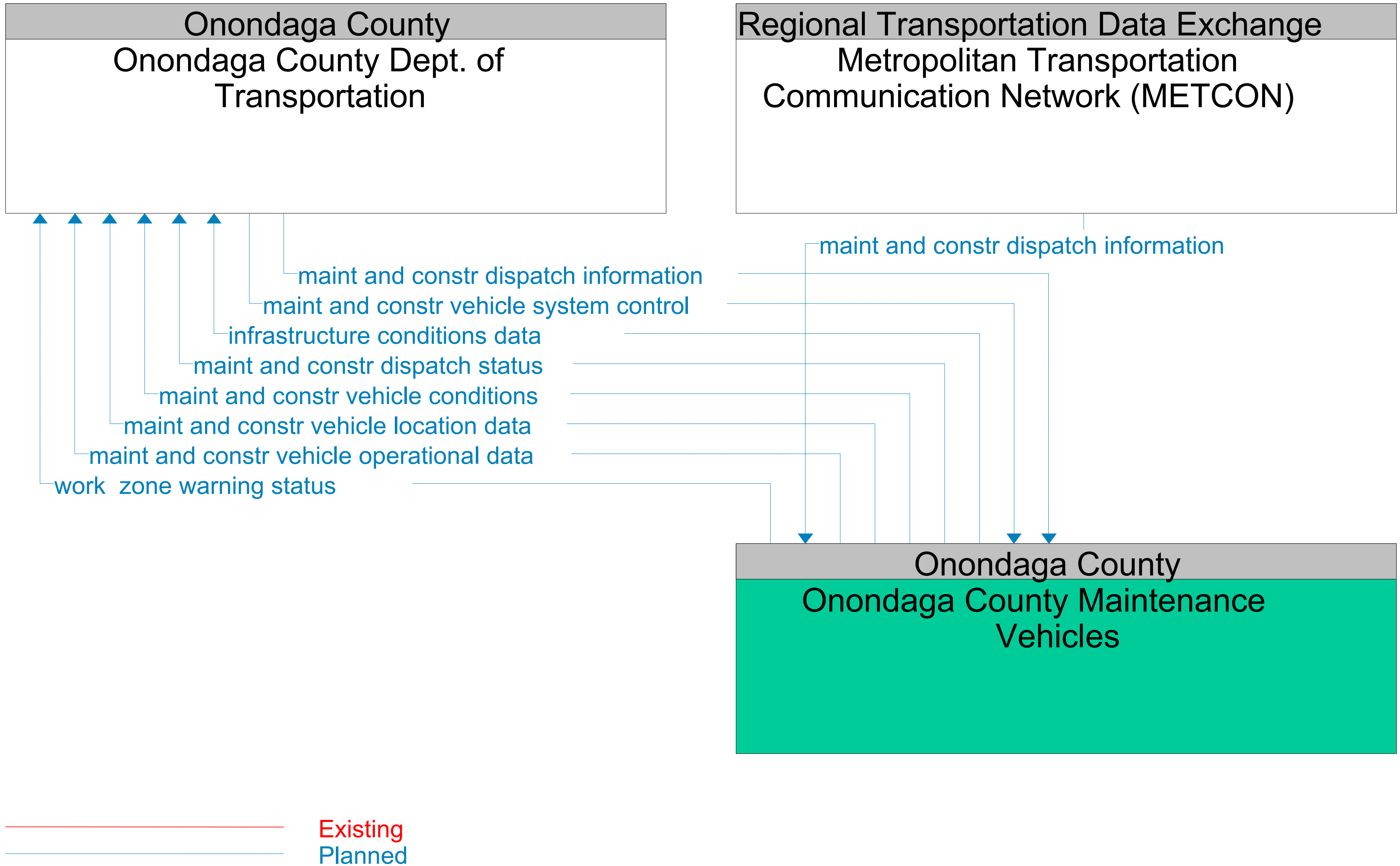

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Onondaga County Maintenance Vehicles
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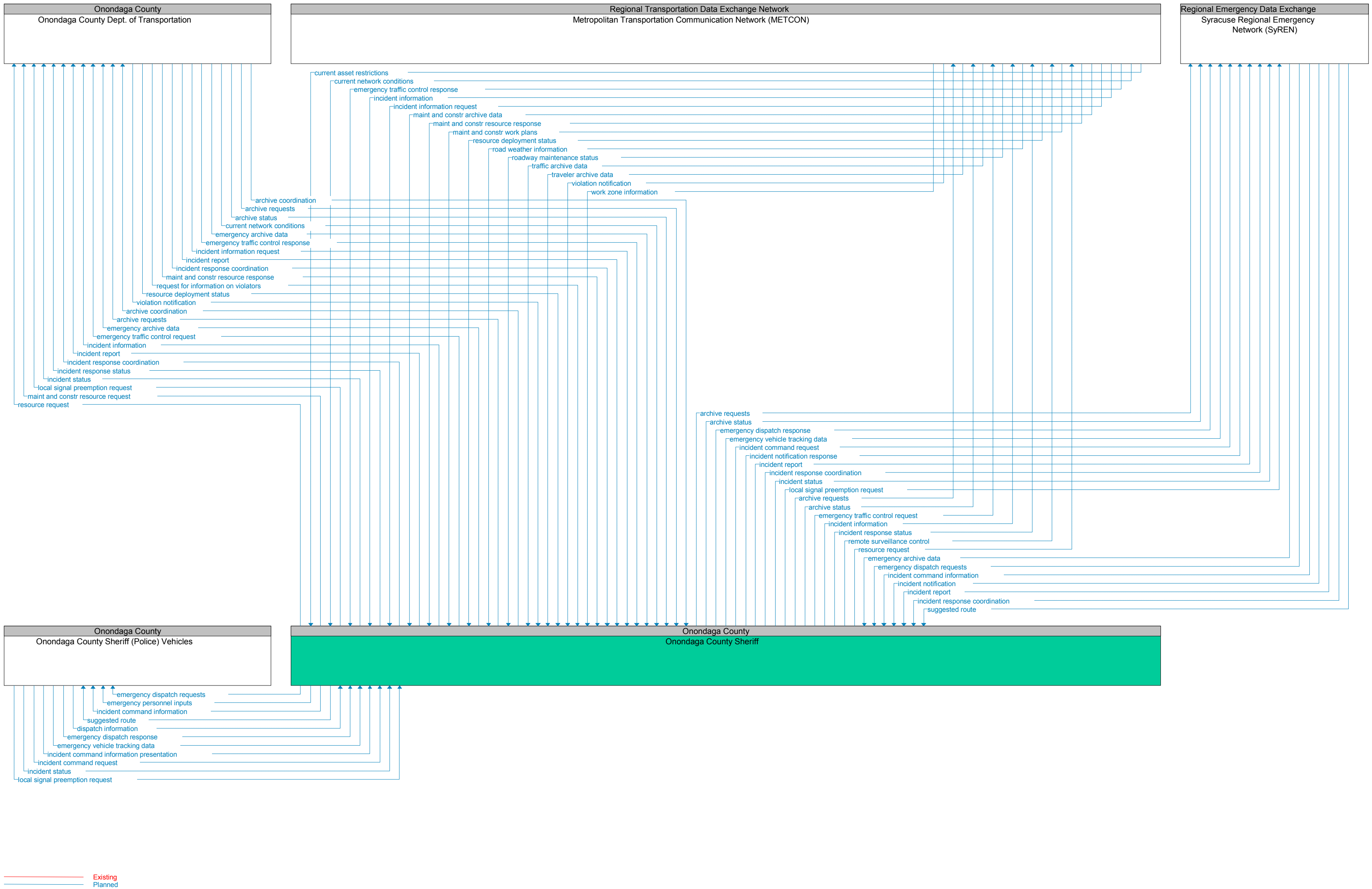
Planned



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incident response coordination
suggested route
Onondaga County
Onondaga County Sheriff (Police) Vehicles
Onondaga County
Onondaga County Sheriff
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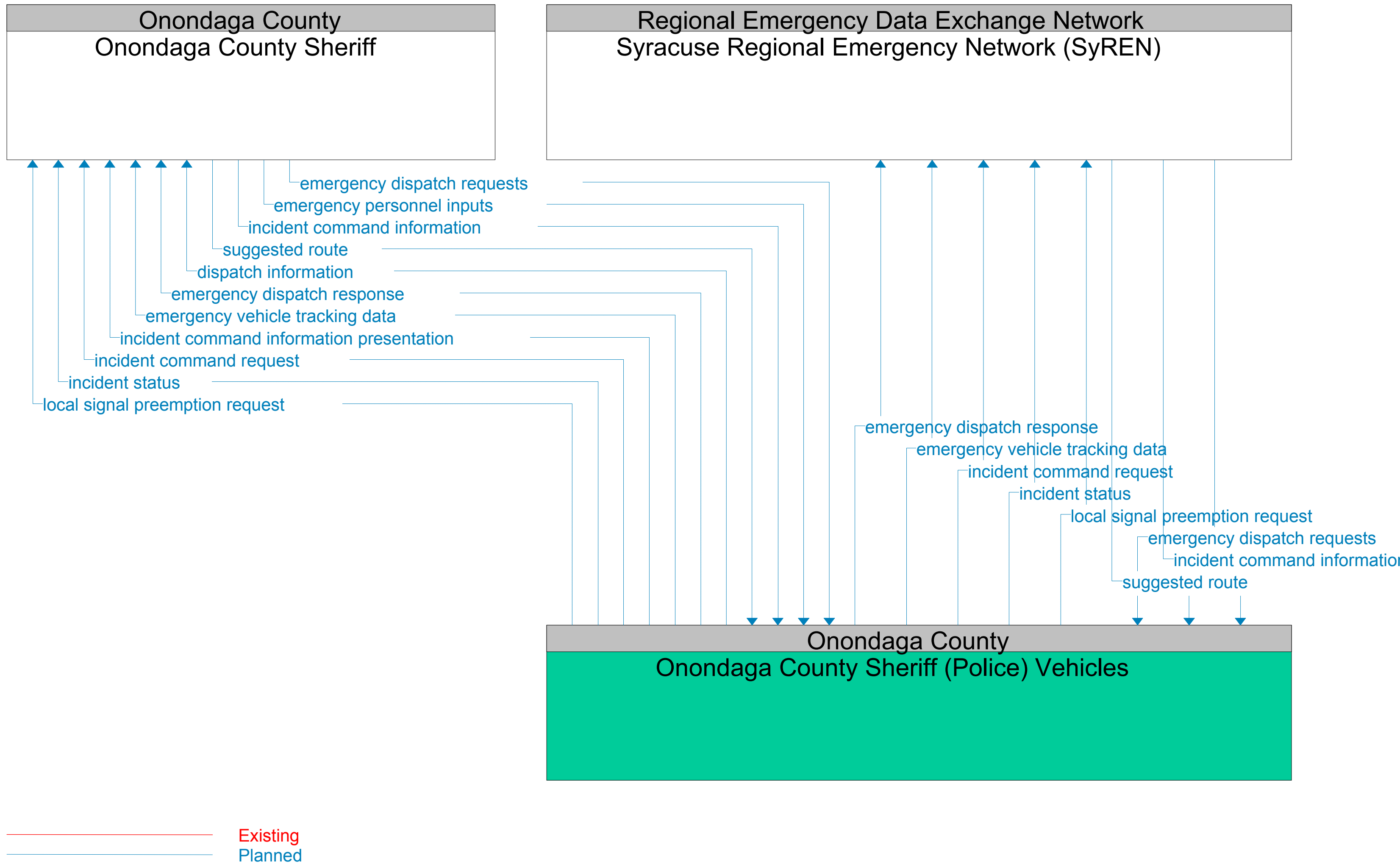
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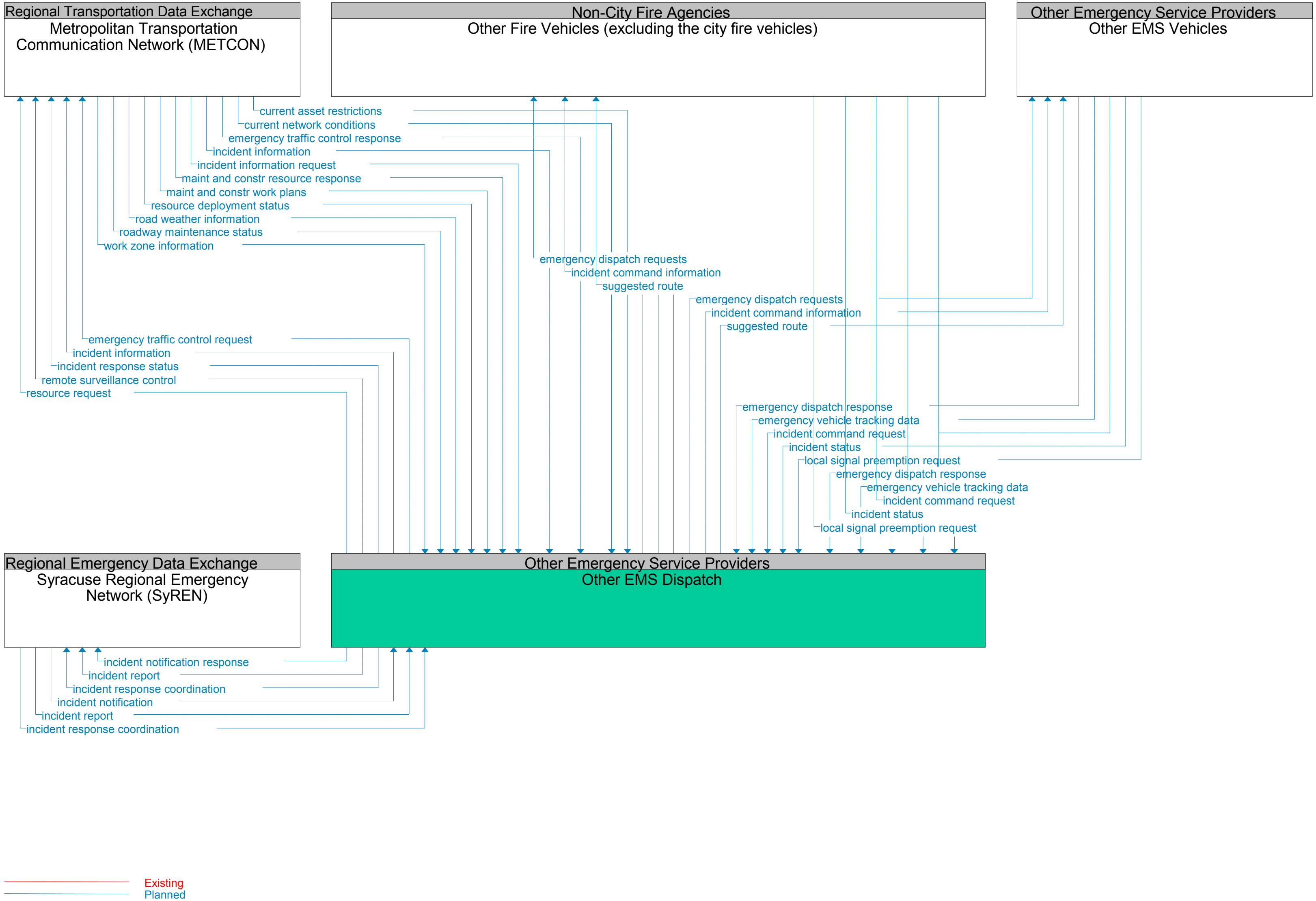
Existing
Planned



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incident information request
maint and constr resource response
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resource deployment status
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incident response status
remote surveillance control
resource request
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local signal preemption request
Regional Emergency Data Exchange
Syracuse Regional Emergency Network (SyREN)
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incident response coordination
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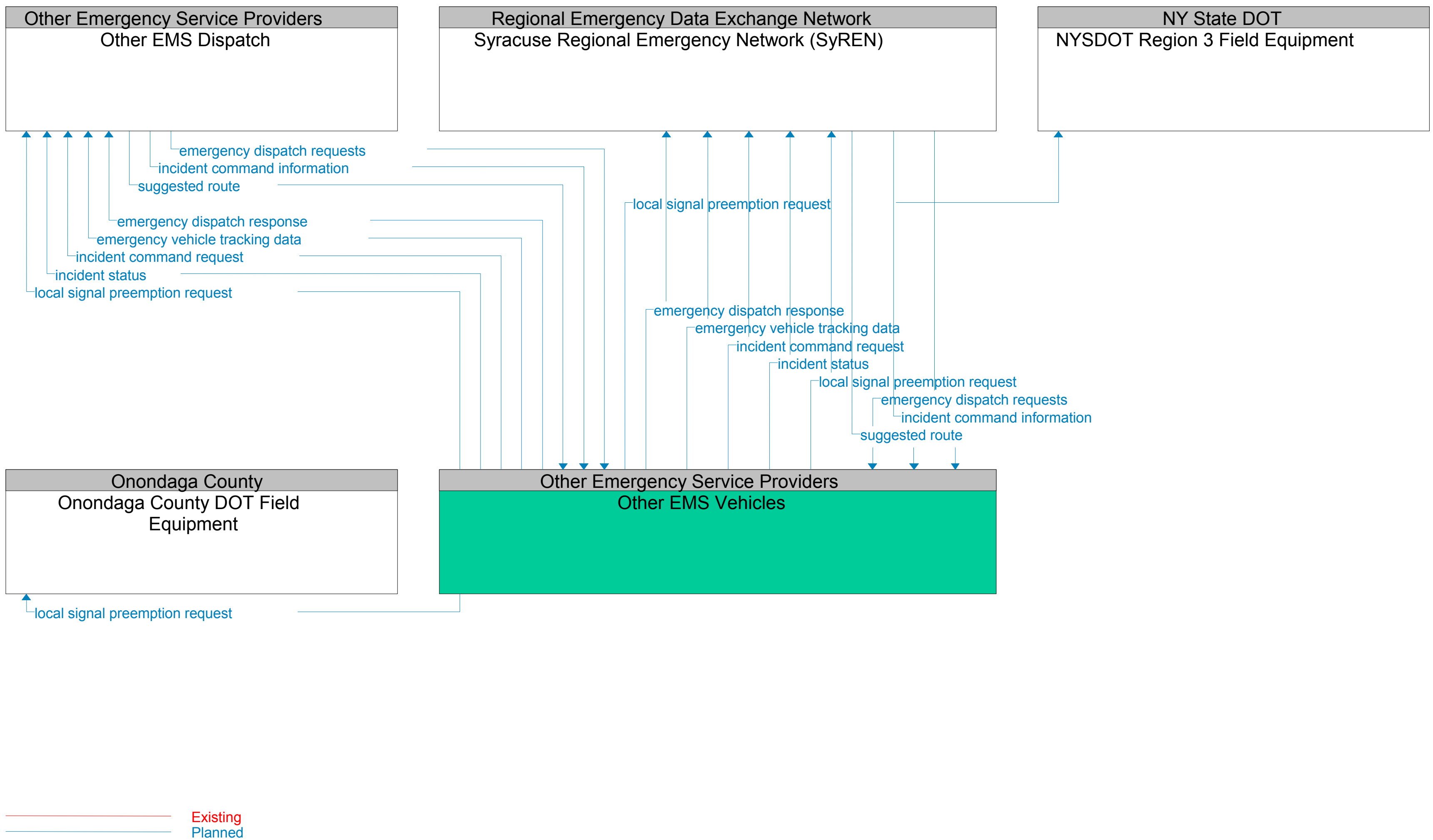
Planned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NY State DOT
NYSDOT Region 3 Field Equipment
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incident status
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incident status
local signal preemption request
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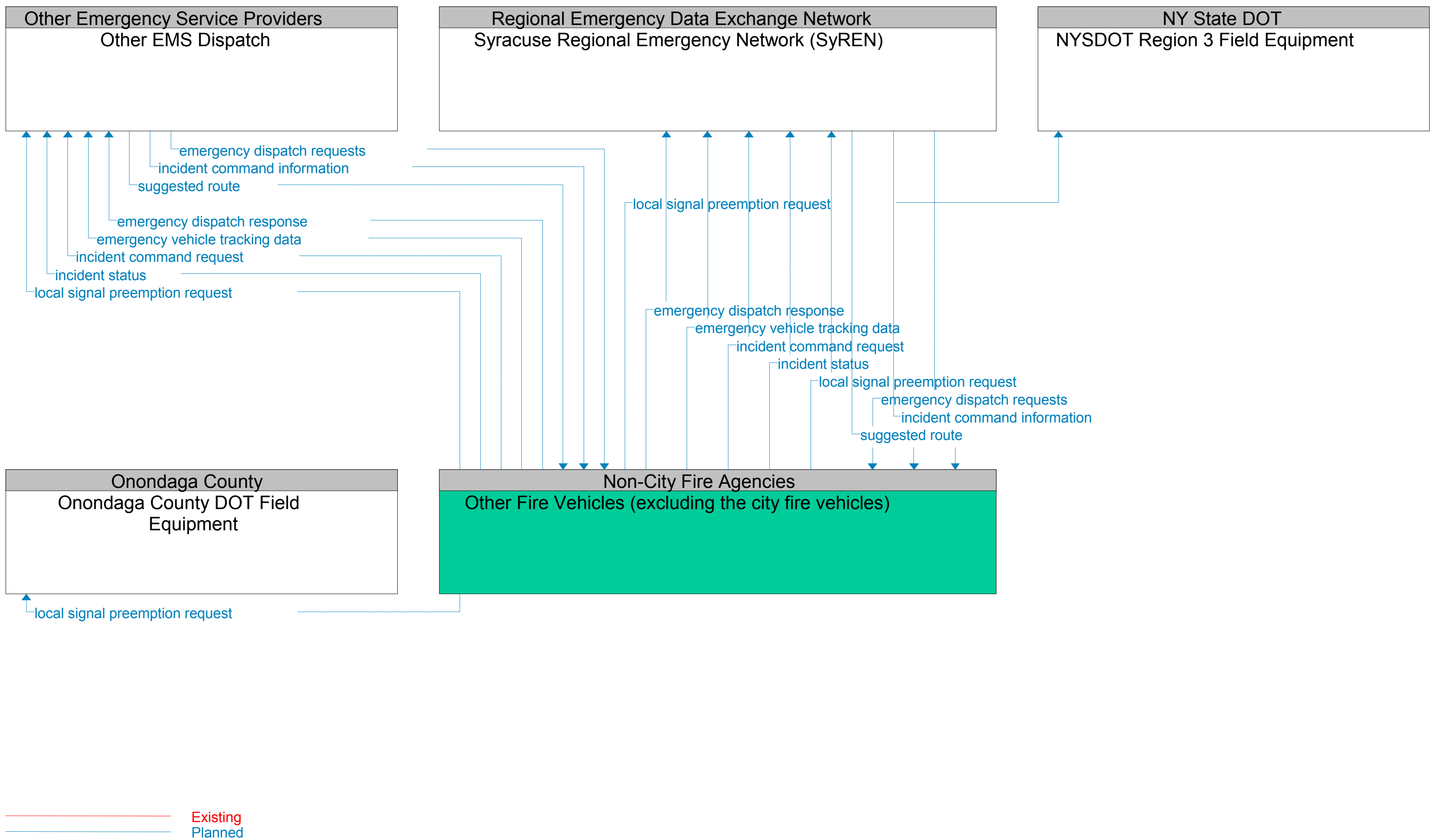
Onondaga County DOT Field Equipment
Other Emergency Service Providers
Other EMS Vehicles
local signal preemption request
Existing
Planned



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NYSDOT Region 3 Field Equipment
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incident command information
suggested route
emergency dispatch response
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incident status
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incident status
local signal preemption request
emergency dispatch requests
incident command information
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Onondaga County DOT Field Equipment
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Other Fire Vehicles (excluding the city fire vehicles)
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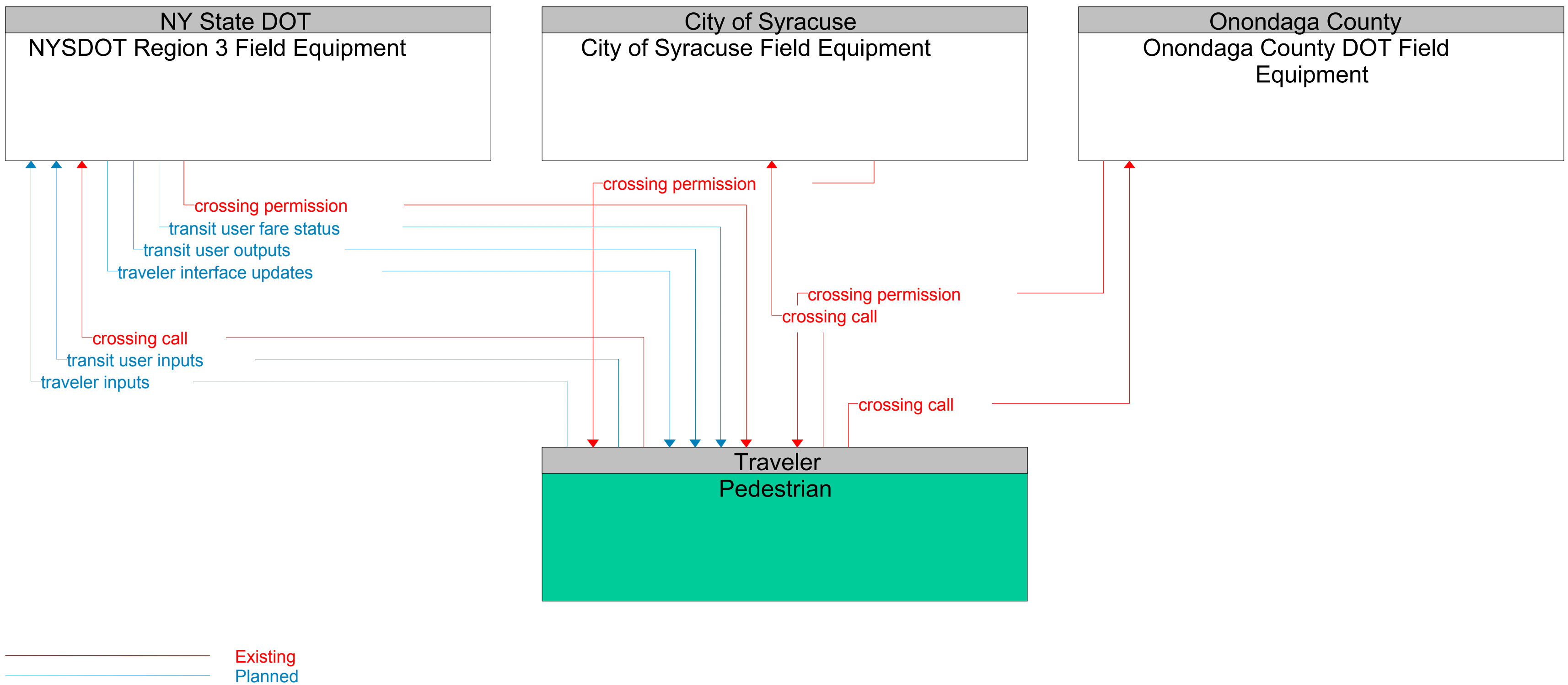
Planned



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City of Syracuse
City of Syracuse Field Equipment
Onondaga County
Onondaga County DOT Field Equipment
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crossing permission
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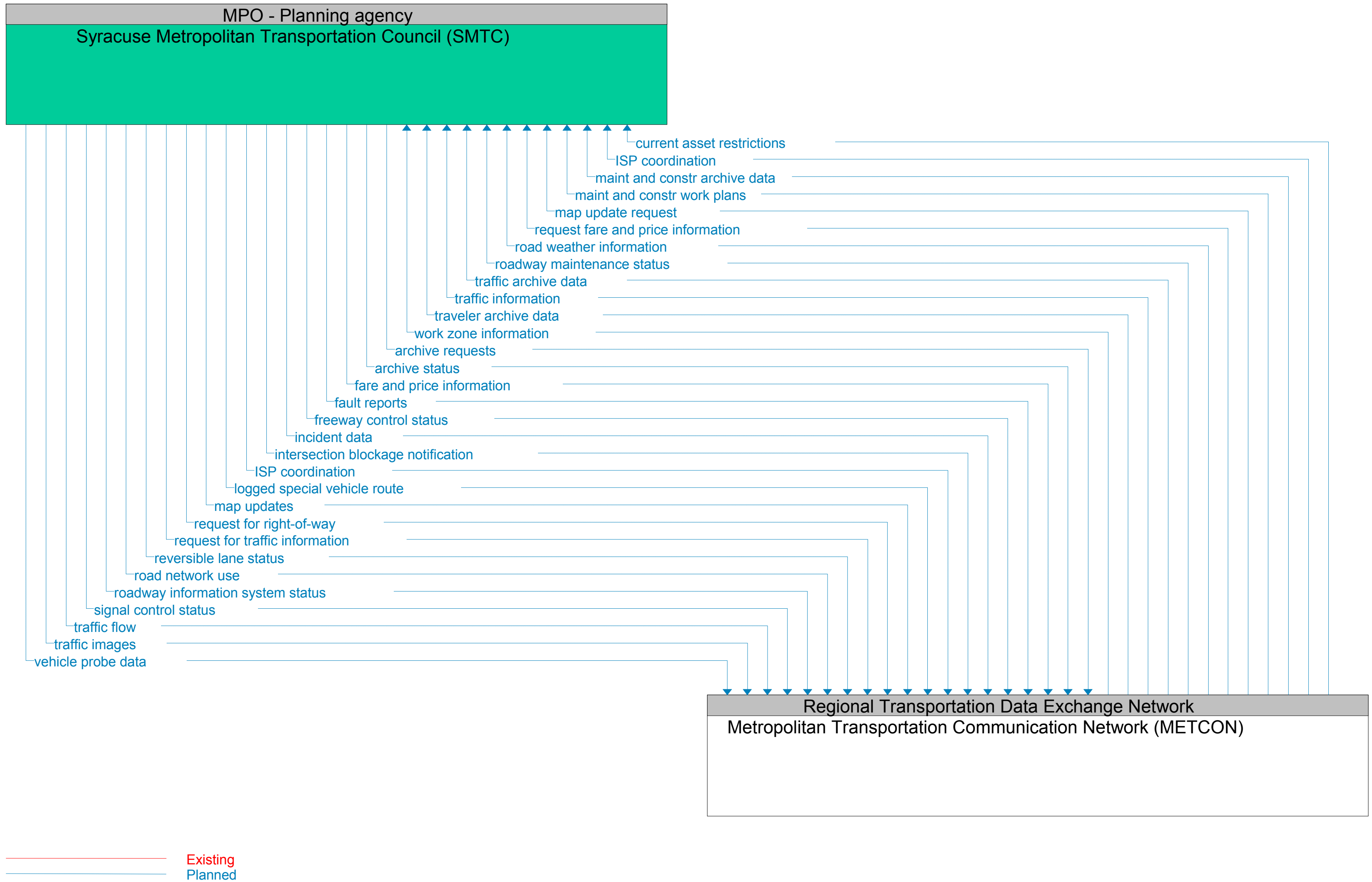
transit user outputs
traveler interface updates
crossing permission
crossing call
crossing call
transit user inputs
traveler inputs
crossing call
Traveler
Pedestrian
Existing
Planned



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ISP coordination
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maint and constr work plans
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road weather information
roadway maintenance status
traffic archive data
traffic information
traveler archive data
work zone information
archive requests
archive status
fare and price information
fault reports
freeway control status
incident data
intersection blockage notification
ISP coordination
logged special vehicle route
map updates
request for right-of-way
request for traffic information
reversible lane status
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traffic images
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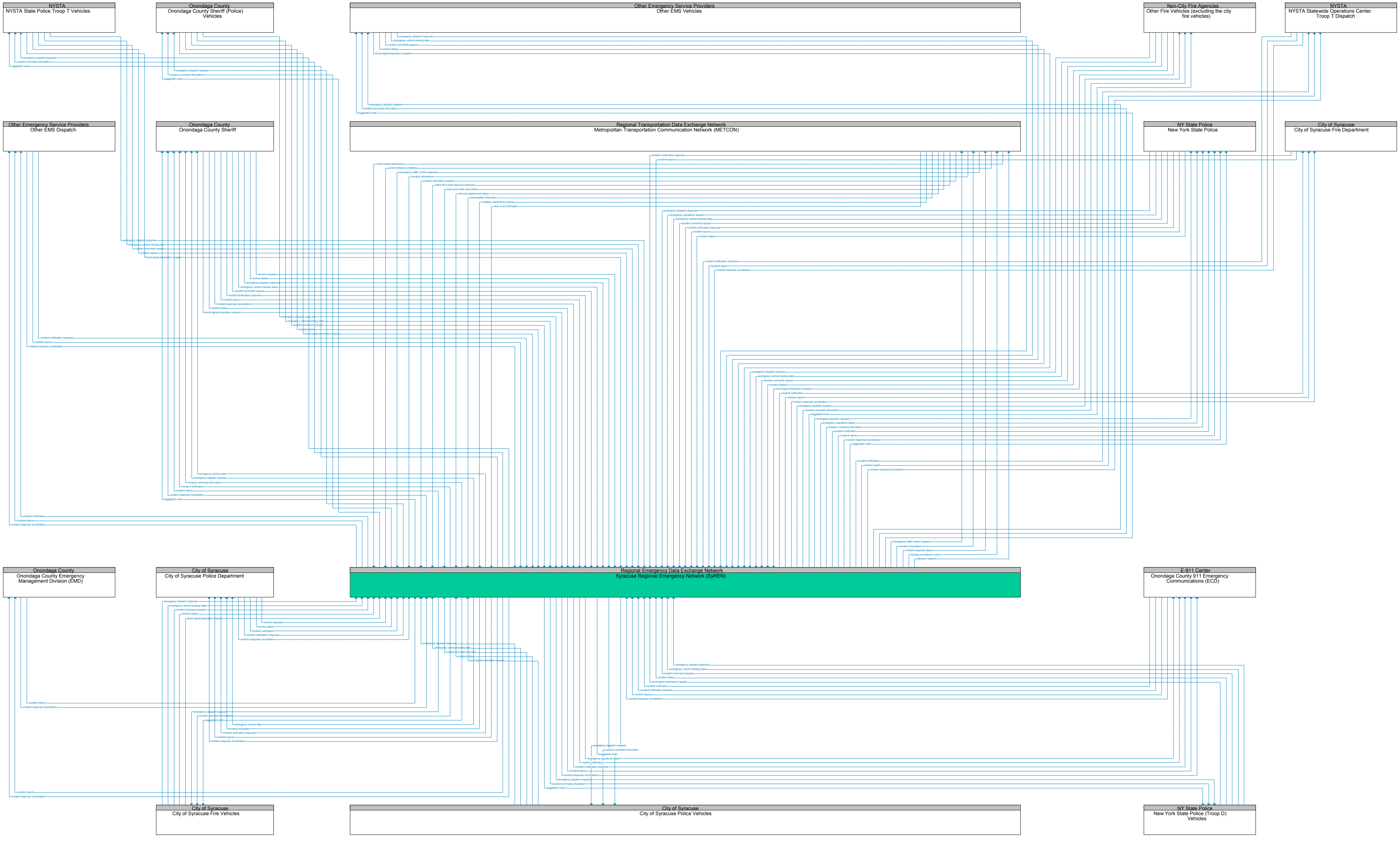
Metropolitan Transportation Communication Network (METCON)
Existing
Planned


NYSTA
NYSTA State Police Troop T Vehicles
Onondaga County
Onondaga County Sheriff (Police) Vehicles
Other Emergency Service Providers
Other EMS Vehicles
Non-City Fire Agencies
Other Fire Vehicles (excluding the city fire vehicles)
NYSTA
NYSTA Statewide Operations Center Troop T Dispatch
Other Emergency Service Providers
Other EMS Dispatch
Onondaga County
Onondaga County Sheriff
Regional Transportation Data Exchange Network
Metropolitan Transportation Communication Network (METCON)
NY State Police
New York State Police
City of Syracuse
City of Syracuse Fire Department
Onondaga County
Onondaga County Emergency Management Division (EMD)
City of Syracuse
City of Syracuse Police Department
Regional Emergency Data Exchange Network
Syracuse Regional Emergency Network (SyREN)
E-911 Center
Onondaga County 911 Emergency Communications (ECD)
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City of Syracuse Fire Vehicles
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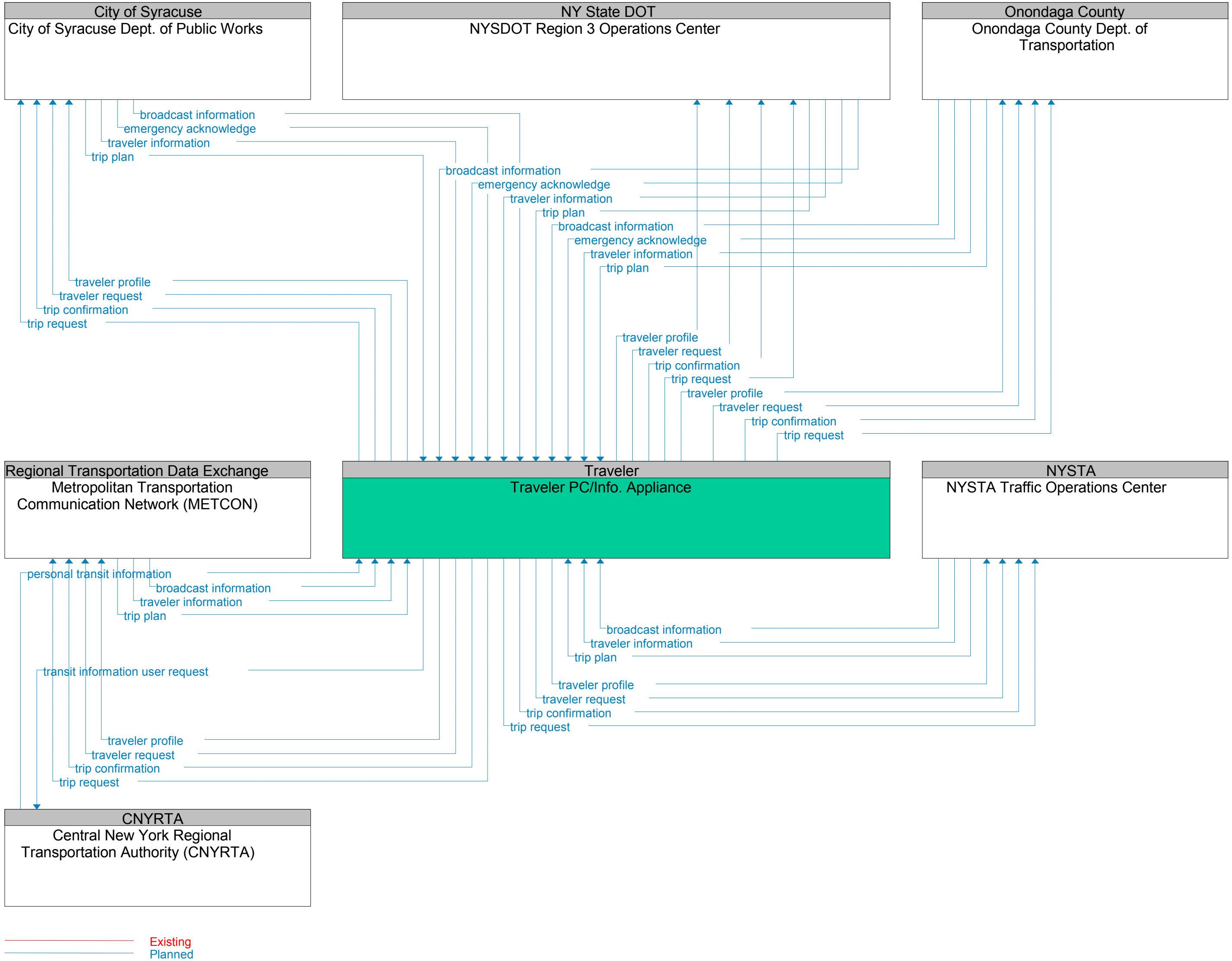
New York State Police (Troop D) Vehicles
Existing
Planned


City of Syracuse
City of Syracuse Dept. of Public Works
NY State DOT
NYSDOT Region 3 Operations Center
Onondaga County
Onondaga County Dept. of Transportation
Regional Transportation Data Exchange
Metropolitan Transportation Communication Network (METCON)
Traveler
Traveler PC/Info. Appliance
NYSTA
NYSTA Traffic Operations Center
CNYRTA
Central New York Regional Transportation Authority (CNYRTA)
broadcast information
emergency acknowledge
traveler information
trip plan
traveler profile
traveler request
trip confirmation
trip request
personal transit information
transit information user request
Existing
Planned

Technical Memorandum #3

ITS Implementation Plan

Submitted to:
New York State
Department of Transportation
March 2003

Submitted by:
PB Farradyne
New York, New York

TABLE OF CONTENTS

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1. INTRODUCTION

The New York State Department of Transportation has retained PB Farradyne (PB) to develop a Strategic Plan for the Deployment of Intelligent Transportation Systems (ITS) in the Syracuse, N.Y. Metropolitan Area. This Technical Memorandum is the third and final Technical Memorandum (one of a series of reports) produced by the PB Team. These three Technical Memoranda, prefaced by an Executive Report, will constitute the Final Strategic Plan. This memorandum presents an overall ITS implementation plan, including individual projects to be deployed over a period of time.

The first technical memorandum documented the established goals, assessed operational deficiencies, analyzed the existing conditions of transportations facilities, prioritized facilities for potential ITS deployment and prioritized the ITS Market Packages needs of each involved agency and the region.

Projects were identified based on information gathered throughout the course of this study. The critical information came from interactions with agencies during many interviews and meetings. An Existing Conditions report highlighted the major critical locations (congestion, safety, etc.) for the deployment of ITS. An Inventory of Existing ITS Elements established the baselines for deployment and integration. The rating and priority settings for all ITS Market Packages were used to identify ITS needs, as well as the deployment time frames.

The second technical memorandum documented the processes and examined regional ITS application interface alternatives and provided specific actions that could facilitate electronic exchange of National ITS Architecture data elements among Syracuse Metropolitan Area members. To that end, an ITS architecture that is in conformance with the United States Department of Transportation's National ITS Architecture has been developed to advance the status of electronic exchange of regional ITS information in this area.

The defined regional architecture as well as available technologies dictated the need for a regional information communication network as well as a regional centralized database. The locations of operations centers, and their ability to host co-located activities, also determined the magnitude of communications infrastructure and the need for remote functionalities. Ultimately, all recommendations were made with a view to achieve the region's established transportation goals and objectives.

The ITS projects are recommended for specific agencies in Onondaga County. There are four categories of recommended projects, based on the urgency with which they are needed:

- "**Early Action**" projects are critical to the operations of the region's transportation infrastructure, and they are recommended for immediate deployment.

- "**Short-Term**" projects are intended to serve immediate transportation needs, and they are recommended for deployment in the next five years.

- "**Mid-Term**" projects will build on the short-term projects and provide enhanced functionality and coverage. They are recommended for deployment in a six to ten year horizon.

- Finally, the "**Long-Term**" projects are intended to expand on the short- and mid-terms projects to complete the comprehensive ITS deployment in the region, and they are recommended for deployment in an eleven to twenty year horizon.

Each project identified in this document is defined with the required components/ technologies to be deployed, approximate locations and cost of deployments and the cost of operations and maintenance.

The primary focus of this document is to provide recommendations to the New York State Department of Transportation, City of Syracuse Department of Public Works, Onondaga County Department of Transportation, Central New York Regional Transportation Authority, New York State Thruway Authority and ultimately to the Syracuse Metropolitan Transportation Council (SMTC). However, ITS deployments will normally require cooperation among other agencies that are involved (most notably, emergency responders), directly or indirectly, in the operations and maintenance of the overall transportation system. Therefore, all ITS projects are identified with the goal of maximizing the emergency service providers' performance and functionalities.

The primary emergency service providers involved in this project are: City of Syracuse Police and Fire Departments, New York State Police, Onondaga County Sheriff, and Onondaga County Department of Emergency Communication 911 (DEC). The emergency service providers' responsibilities extend beyond and above the transportation management function. Any recommended future technology enhancements must be evaluated and procured with the overall needs of such agencies in mind. In such cases as the NYSP Troop D, any and all recommendations must be in compliance with the State Police Statewide Architecture and policies. In addition, seamless integration with neighboring jurisdictions should be developed and maintained. Accordingly, this project will focus on providing a general description, and recommending the general direction of projects, rather than, on details.

Some projects will require deployment efforts by more than one agency. As an example, the implementation of the NYSDOT Regional Operations Center will require the combined deployment efforts of both NYSDOT Region 3 and New York State Police. Where applicable, interagency projects are identified with the names of the involved agencies noted so that the primary agency can initiate a dialogue with the other involved agency to facilitate an appropriate course of action to implement the project.

For instance, some major arterials and/or intersections in the City's area are under the jurisdiction of the Onondaga County Department of Transportation and New York State Department of Transportation. ITS projects for these intersections are identified as interagency deployments to be undertaken in close cooperation between the agencies. Similarly, ITS projects for the roadways owned by the New York State Thruway Authority or New York State Department of Transportation in the vicinity of interchanges will require cooperation among these agencies.

The remaining sections of this report are as follows. Chapter 2 explains the methodology used in the preparation of this ITS implementation plan. Chapter 3 presents the ITS projects recommended for deployment by the agencies. In Chapter 4, the operations and maintenance (O&M) aspects of ITS are discussed. The recommendations are summarized based on the premise that "operations and maintenance" covers the activities required for a system to function properly. The discussion on operations and maintenance of ITS provided in this document is intended to be guidance on how the O&M will evolve as the agencies expand their ITS deployments.

Overall, this document is intended to serve as a road map for the ITS deployment program for the Onondaga County area and in particular the Syracuse Metropolitan Area.

2. METHODOLOGY

Intelligent Transportation Systems (ITS) technologies are recommended for deployment in the Onondaga County Area through a series of individual projects. Each recommended project is identified with the project location, technology components or options, quantities, costs, implementation time frame and generalized benefits.

2.1 PROJECT DEFINITION

Projects have been defined by grouping ITS subsystems and communications to deliver one or more Market Packages on a portion of the transportation network. The metropolitan area is considered to be comprised of several transportation networks each related to an agency or geographic location.

While this Technical Memorandum defines these projects as stand-alone efforts, in many cases it will be more cost effective to implement ITS as a component of a larger construction project (e.g., installation of conduit under a roadway as part of a resurfacing job). Therefore, it is recommended that as part of any new construction or rehabilitation of an existing facility, project planners examine this Implementation Plan to ascertain which ITS components could be implemented.

During project planning, design and deployment, it is likely that the agencies will modify the central and/or field elements, the geographic areas of coverage, the phasing, or other aspects of the projects defined in this document. These modifications will result from the implementers' more detailed focus, coordination with the rest of an agency's construction program as well as those of other agencies, the need to address local conditions not considered in this study and availability of funding sources.

2.2 IMPLEMENTATION TIME FRAME

Four implementation time frames are used for the recommended projects:

- Early Action projects are recommended for immediate deployments.
- Short-Term projects are recommended for implementation in one through five years. These projects are intended to serve the agencies' highest priorities and immediate needs.

- Mid-Term projects are recommended for implementation between six and ten years in the future. These projects will build on the short-term projects to provide enhanced functionality and expanded geographic coverage.

- Long-Term projects are recommended for implementation between 11 and 20 years in the future. These projects are intended to complete the comprehensive ITS deployments in the region.

2.3 COST

Several sources were utilized to estimate unit costs for the recommended deployments. The sources included, but were not limited to, the ITS Planning Handbook, the National ITS Architecture Cost Analysis document, contacts with consultants and vendors, review of documentation on ITS planning projects, and discussions with various experts in various technology domains. Local conditions (e.g., availability of electrical and communications services at an intersection) were not considered. To account for such uncertainties, a range of costs (+/- 25%) is presented at the end of each table in Chapter 3.

With regard to project costs, for each project there are three categories of costs:

- Hardware, field equipment and construction/installation cost
- Engineering and inspection (E&I) cost - Engineering and inspection costs are estimated to be twenty-two percent (22%) of the component costs, based on assumptions of ten percent (10%) for design, ten percent (10%) for construction inspection, and two percent (2%) for construction engineering.
- Annual operations and maintenance (O&M) costs – This cost is estimated to be approximately ten percent (10%) of the deployed component cost.

The former two categories together comprise the total capital cost. The cost summaries are prepared providing a range (+/- 25%) of costs to account for uncertainties within the estimates for factors including rapid changes and innovations in technologies. The text refers to the midpoint of this range, unless otherwise noted.

2.4 SYNERGY AMONG PROJECTS

The overall vision of this study is a "seamless" ITS for the region, in which the various deployments will work together to meet ITS goals and objectives. Achieving this vision requires an understanding of the relationships among existing, planned and recommended ITS projects.

Several types of relationships between projects are identified. One dependency involves a project being a prerequisite for others (e.g., roadway traveler information projects are dependent on the deployment of surveillance systems capable of supplying real-time traffic status information.) These relationships are identified in the "Prerequisite Projects" column in the Chapter 3 tables. A second type of synergy is found when multiple agencies deploy ITS projects that utilize similar technologies. As an example, NYSDOT, City of Syracuse DPW and Onondaga County DOT have projects recommended for deploying the Automatic Vehicle Location system. These types of projects are identified in the "Related Projects of Other Agencies" column in the tables in Chapter 3. Such projects may benefit from economies of scale associated with a joint procurement or adoption of a standard accepted by multiple agencies.

2.5 BENEFIT

High costs and other constraints limit the traditional means of increasing capacity, such as construction of new facilities on the transportation network. More efficient use of the existing network, enabled through ITS deployment, provides an attractive alternative. The ITS projects that are defined in this document will benefit the local economy by helping to alleviate congestion and its financial drain, and by improving mobility. The measures employed by these projects include improved traveler information to inform travelers about current conditions and alternative routes and modes, as well as improved incident management to minimize non-recurring delay.

In addition to congestion relief, ITS projects recommended in this Implementation Plan are expected to produce benefits in several areas related to safety, productivity, efficiency, and environmental impact. Unfortunately, it is often difficult to quantify the degree to which individual ITS projects will produce these benefits. Agencies within the geographic scope of the Syracuse Metropolitan Area are in fact grappling with a classic capital budgeting scenario called "capital rationing". That is – how do we select and prioritize investment opportunities, in an environment of limited resources, such that "return" is maximized? An organization's definition of “return” itself will help determine which methodologies are used to select and prioritize investments.

Since quantitative benefits assessment results are therefore limited the approach taken is to list the types of benefits that can be expected from a recommended project based on the results of similar projects around the nation.

Most ITS projects can be grouped into the USDOT-defined ITS “building blocks” of:

- Traffic Signal Control Systems
- Freeway Management Systems
- Transit Management Systems
- Incident Management Systems
- Electronic Fare Payment Systems
- Electronic Toll Collection
- Multi-modal Traveler Information Systems

A summary of the benefits experienced for each of these groups is presented in Table 1. The letters (A through G) in the “item” column in this table is referenced in the Chapter 3 tables to designate the types of benefits expected from a specific recommended project.

TABLE 1 BENEFITS SUMMARY

Item	Type of System	Benefits Summary
A	Freeway Management Systems (e.g., network surveillance, ramp metering)	• Decrease travel time 20% to 48% • Increase travel speed 16% to 62% • Increase freeway capacity 17% to 25% • Decrease accident rate 15% to 50% • Decrease fuel used in congestion 41% • Decrease CO emissions 122,000 tons annually (Detroit) • Decrease HC emissions 1,400 tons annually (Detroit) • Decrease NOx emissions 1,200 tons annually (Detroit)
B	Traffic Signal Systems	• Decrease travel time 8% to 15% • Increase travel speed 14% to 22% • Decrease vehicle stops 0% to 35% • Decrease delay 17% to 37% • Decrease fuel consumption 6% to 12% • Decrease CO emissions 5% to 13% • Decrease HC emissions 4% to 10%
C	Incident Management Programs (e.g., service patrols)	• Incident Clearance Time Decrease 8 min for stalls, decrease wrecker response time 5 - 7 minutes • Decrease travel time 10% to 42% • Decrease fatalities 10% in urban areas
D	Multi-modal traveler Information Systems (e.g., roadway VMS, kiosks, telephone information systems)	• Decrease travel time 8% to 20% for equipped vehicles • Decrease delay up to 1,900 vehicle hours per incident • Decrease fuel consumption 6% to 12% • Decrease VOC emissions 25% from affected vehicles • Decrease HC emissions 33% from affected vehicles • Decrease NOx emissions 1.5% from affected vehicles
E	Transit Management Systems – Automatic Vehicle Location System	• Decrease travel time 15% to 18% • Increase service reliability 12% to 23% in on-time performance • Decrease incident response time to as little as one minute • 45% annual return on investment
	Other Transit ITS	• ITS increases safety, comfort and convenience for passengers, and thus increases attractiveness of transit to customers • ITS improves transit efficiency and thus helps to reduce operating costs • ITS assists transit operations managers and vehicle operators by automating many labor-intensive duties • ITS promotes an intermodal transportation system that helps motorists transition between vehicles and transit

F	Electronic Toll Collection Systems	• Decrease operating expenses up to 90% • Increase capacity 250% • Decrease fuel consumption 6% to 12% • Decrease CO emissions 72% per affected mile • Decrease HC emissions 83% per affected mile • Decrease NOx emissions 45% per affected mile
G	Electronic Fare Payment	• High patron popularity: up to 90% usage where available • Increase fare collection 3% to 30% • Decrease data collection costs $1.5 million to $5 million

Sources: Intelligent Transportation Infrastructure Benefits: Expected and Experienced, USDOT, Jan. 1996
ITS Deployment Guidelines for Transit Systems – Executive Edition, USDOT, April 1997

3. RECOMMENDED ITS PROJECTS

3.1 ITS IMPLEMENTATION BY AGENCY

In the context of this Implementation Plan, specific ITS projects are viewed as building blocks of the proposed regional architecture with full integration needs in mind. An integrated system deployed incrementally is the goal of ITS planning, and is consistent with FHWA's vision, as promulgated in the National ITS Architecture effort.

The projects in this chapter are identified by agency and assigned a unique project number. The agencies for which specific ITS projects are recommended include:

- New York State Department Of Transportation Region 3 (NYSDOT)
- New York State Thruway Authority (NYSTA)
- Central New York Regional Transportation Authority (CNYRTA)
- City of Syracuse Department of Public Work. (City DPW)
- Onondaga County Department of Transportation (Onondaga DOT)

This study did not evaluate the specific ITS implementation needs for emergency service providers in the Syracuse Metropolitan Region, but their association, where appropriate, is noted with regard to the ITS projects recommended for the metropolitan area. As an example, NYSP directly benefits from the recommended NYSDOT Freeway Management System projects and as such the concept of co-locations will assure such benefits to both agencies. Instead, a general section is presented at the end of this chapter where overall technology needs are highlighted and general recommendations are made.

The following format is followed to discuss each agency's recommended projects.

- The general descriptions of projects for each agency are categorized based on functionalities. Under each functional group, various related projects are listed along with the assigned project numbers as well as the appropriate deployment time frames.

- A detailed table of all recommended projects broken down by: recommended time frame for deployment, National Architecture relationship, associated components and/or technologies, pre-requisite projects, locations, estimated capital and O&M costs and associated benefits is presented for each agency.

- A detailed cost breakdown table is provided for each agency that includes the cost of: network/communication, central software and hardware, field equipment, interface, capital and operations and maintenance.

- Each agency is also provided with an operations and maintenance cost table broken down for the various deployment terms (Short-Term, mid-term and Long-Term).

- Finally, various figures are provided for each agency representing projects with the approximate ITS equipment locations.

The ITS planning cost estimates and the realistic programmed funds cannot be easily compared. While the exact components of the ITS projects are defined as part of this study, the details of the programmed projects were not reviewed as part of this study. Thus, the programmed costs may include items - such as right of way - that are not “ITS” and therefore are not part of the ITS planning cost estimate.

With regard to the projects related to traveler information, it is emphasized that the modes of providing traveler information have been changing and expanding rapidly. The factors that are likely to have a profound impact in providing traveler information include:

- Advancements in wireless telephone technology,

- Commercial Information Service Provider (ISP) initiatives to provide customized traveler information,

- The approved Federal initiative to reserve a range of frequencies to be used for transportation related Digital Short Range Communications (DSRC).

- USDOT initiative to dedicate a three-digit number (511), similar to 911 being used for police emergencies, that the travelers can dial to receive up-to-date traveler information,

- Initiatives being undertaken by the vehicle manufacturers to equip the vehicles with tracking technologies such as Global Positioning System (GPS) and to provide the drivers with up-to-date traffic information on demand (for example, GM's OnStar System), and

- In a few years from now, when the infrastructure in the area is equipped with ITS, the role of a localized traveler information center is likely to be more focused on developing advanced interfaces with operations centers. The interface will also allow the Traveler Information Service Providers to provide appropriate regional traffic/transportation information via ITS devices (e.g. VMS signs) controlled by the agencies.

After implementation of the Regional Information Sharing network in the metropolitan area, the interagency TMC-to-TMC communications between agencies systems and operations centers would most likely occur through this network in the near future. If any direct electronic link between two agencies is needed, the involved agencies would establish such a link through a mutual agreement.

3.2 NEW YORK STATE DEPARTMENT OF TRANSPORTATION (NYSDOT)

The proposed NYSDOT deployment has been broken out into individual projects, which, seen in their entirety, form a broadly functional and integrated regional ITS. Our proposed approach is to develop this overall ITS infrastructure incrementally, through these individual projects. The general descriptions of projects defined for NYSDOT Region 3 are listed below and categorized by various functions.

Syracuse Metropolitan Communications Network (METCON) – During the course of this project and as a result of agency interviews, meetings and discussions, the lack of transportation information sharing among agencies became obvious. The following benefits of sharing transportation information were identified by all agencies:

- Since construction, lane closures or any other kinds of incidents will end up diverting some traffic to others' facilities, prior knowledge of such events is essential in preparation to accommodate additional traffic.
- The knowledge of weather conditions will assist agencies in better management of their facilities.
- Once roadways become equipped with ITS elements, real time status of transportation facilities will be beneficial to all agencies.
- Most agencies would like to access video images of cameras that will directly effect their operation.
- The automated process of archiving transportation data can benefit all agencies. The regional database can help all, in particular, the operations of SMTC.
- Ultimately, the end users (travelers) need to be informed of the transportation conditions in the region. Implementation of an information sharing network amongst agencies can provide the foundation for development of regional ATIS, perhaps in the form of a regional 511 system supported by internet access, and with pager and text messaging capability. Ultimately, such a system could integrate with, provide information to and draw information from, a New York statewide 511 system.

- The study recommends the development of a Syracuse Metropolitan Regional Information Sharing Communication Network, in essence, an information exchange network. This network will be built in four phases.

Phase 1 – *NYSDOT-01* -This phase is recommended as an early action project. The system will cover the entire Region 3 area. It will be a web-browser based system. The servers will be hosted at NYSDOT Main Office. There will be a map and user interfaces. Information such as construction, incidents, etc., will be inserted manually and shared by all agencies that have access to the web site. The server would use a Commercial off-the-shelf Software (COTS) database to share information; this avoids the costs for new software development. This database could be accessed by all operators with the appropriate rights. This software would provide real-time status of incidents to assist operators with decision making. The efficiency of such system could be extended by encouraging all drivers to report incidents, disablements, weather and all events to which the police might not necessarily respond. By keeping all the Syracuse regional data on one web accessible database the operational hours of individual TMCs can be reduced, assuming any TMC that closes at night could transfer control over devices in their area to another location.

Phase 2 – *NYSDOT-16* – In this phase, Short-Term, the system becomes more automated by creating real time data interfaces to some external systems (in particular the I-84, I-690, I-481 system). This will enable the METCON system to receive real time information such as volume, speed, travel time, and incidents directly from other systems. Also, in this phase, the system will be ready to provide real time information to other systems (e.g., NYSDOT statewide system).

Phase 3 – *NYSDOT-19* - This phase is recommended as a mid-term project and will follow up the second phase. In this phase of deployment, in addition to integrating with additional systems (e.g., NYSTA FMS, NYSDOT Weather information, City of Syracuse System, etc.) and collecting more real time information, agencies will be able to share video images of each others' cameras.

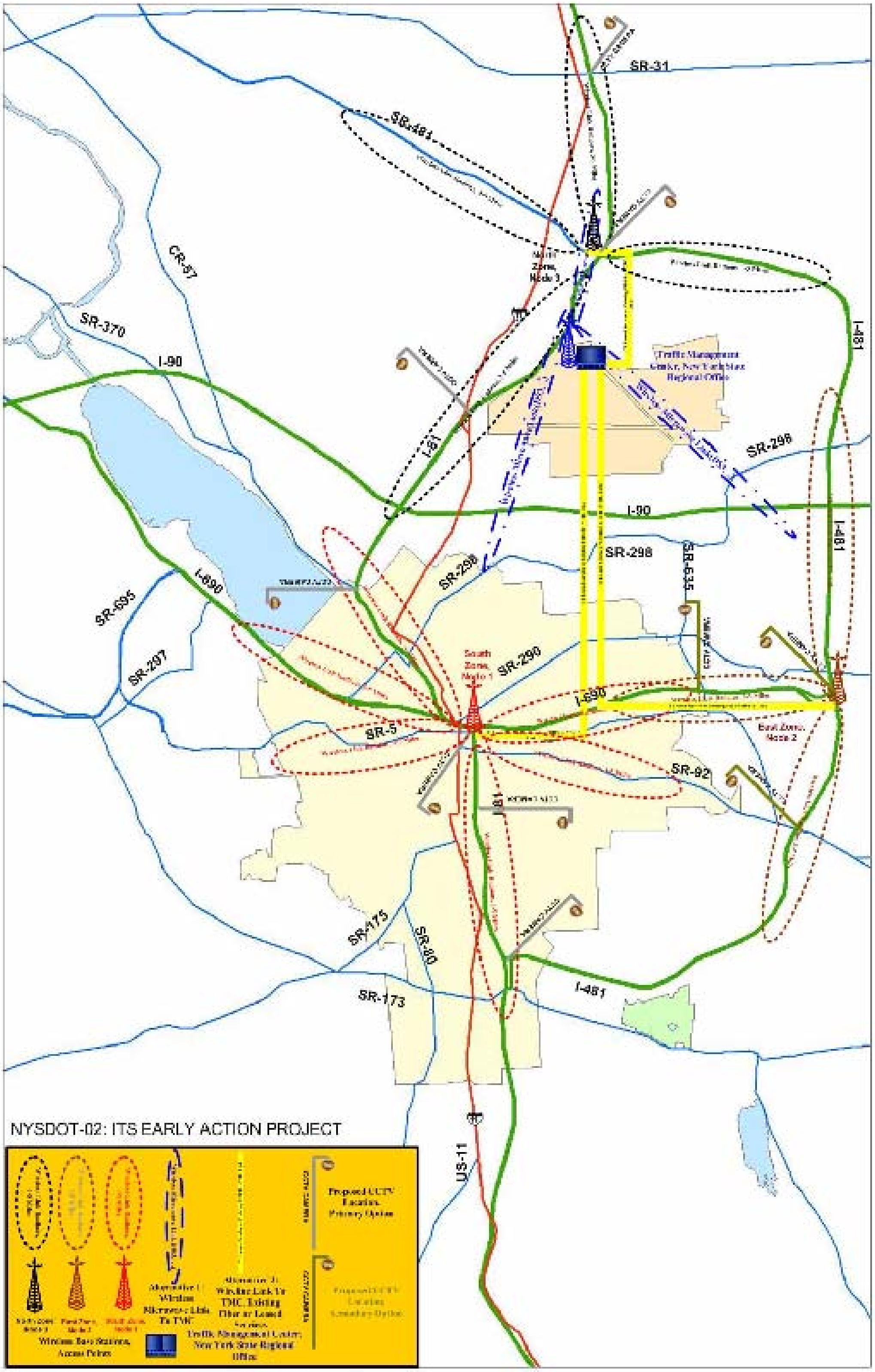
Traveler Information System – 511 Calls - Implementation of the information sharing network amongst agencies (METCON) is a prerequisite for the recommended NYSDOT-08 project to provide the foundation for development of the regional ATIS in the form of a regional 511 system supported by internet access, and with pager and text messaging capability. Ultimately, such a system will integrate with, provide information to and draw information from, a New York statewide 511 system.

Communication Network – a robust communication network is a vital part of any ITS project, as it in large part defines the speed and volume of data that can be transmitted. The full deployment of a communication network is time consuming and very expensive. The immediate needs must be implemented within the context of overall needs. There are various alternatives to procure the communication infrastructure, such as:

- Leased lines
- Build Wireless network and lease T1 lines from the towers
- Build full wireless network
- Build conduits and pull fiber along the State ROW
- Build a combination of wireless and wireline network
- Use the existing available conduit infrastructure in the region and build more conduits to extend the coverage area and pull fibers.

The study recommends building a wireless communication network as an early action/Short-Term project (*NYSDOT-02*) for placement of ITS on I-81, and to expand its coverage by adding wireless hubs as additional ITS elements are deployed under the *NYSDOT-10* project.

Figure 1 shows the approximate locations of proposed field equipment for the recommended early action project *NYSDOT-02* that includes wireless base stations as well as CCTV locations.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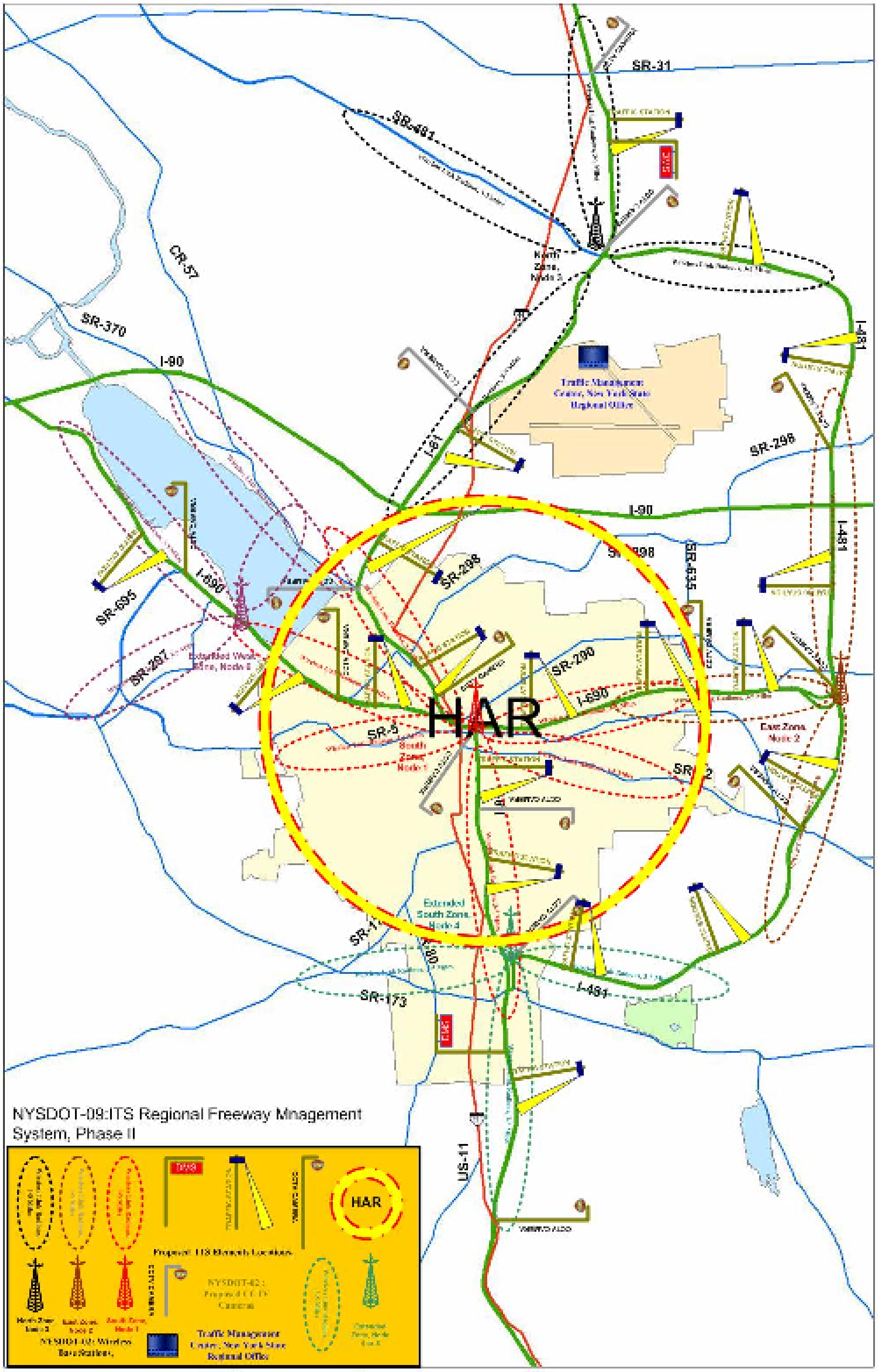
US-11
South Zone, Node 1
East Zone, Node 2
Traffic Management Center, New York State Regional Office
NYSDOT-02: ITS EARLY ACTION PROJECT
Proposed CCTV Location, Primary Option
Wireless Base Stations, Access Points
Traffic Management Center, New York State Regional Office

FIGURE 1

The approximate field equipment locations for the recommended *NYSDOT-10* project are shown in Figure 2. This project will include placement of two additional wireless base stations as well as inclusion of additional cameras, DMS and HAR.



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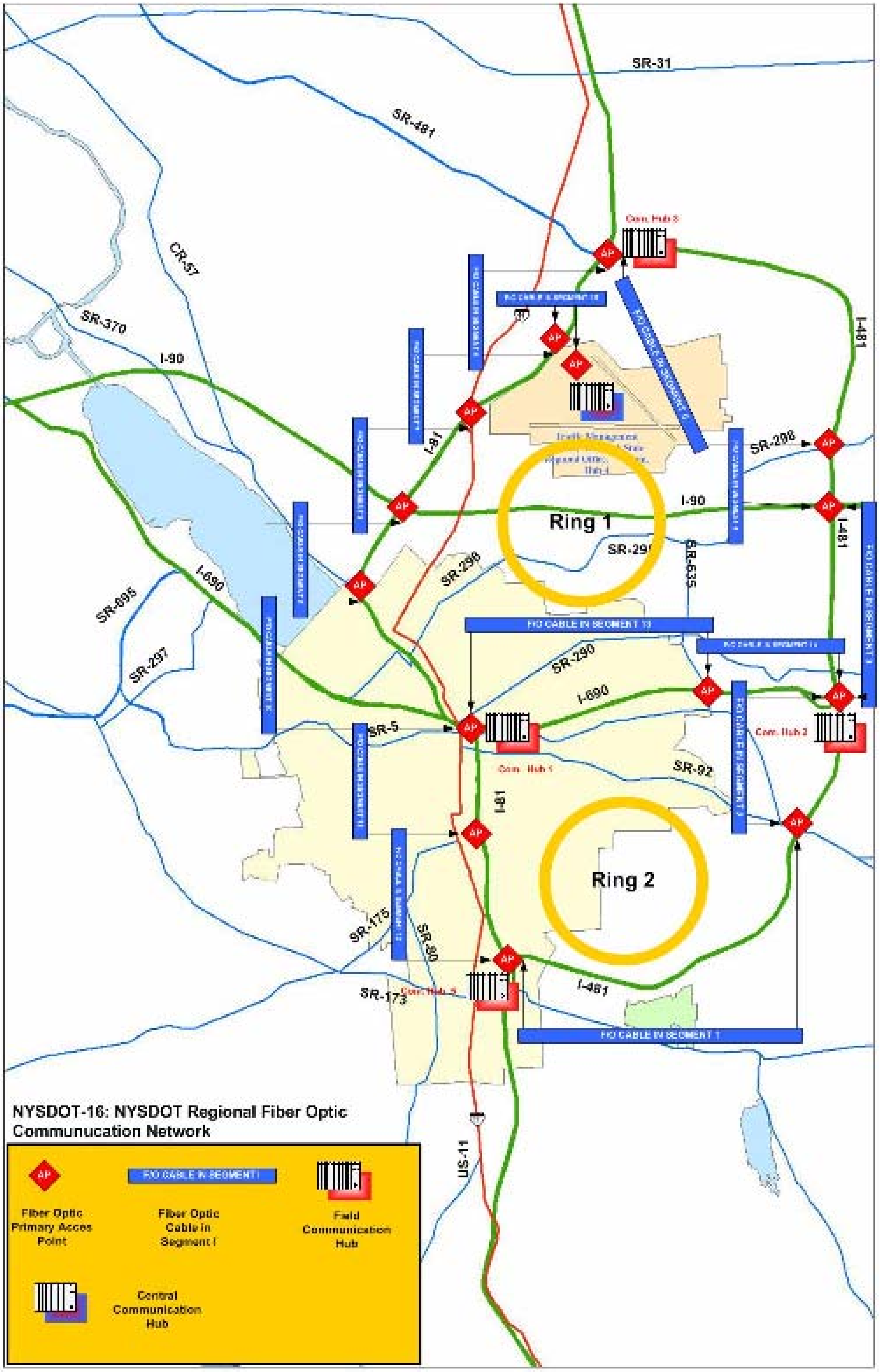
East Zone, Node 2
South Zone, Node 1
Extended South Zone, Node 4
SR-173
I-481
US-11
NYSDOT-09:ITS Regional Freeway Mnagement System, Phase II
HAR
Proposed ITS Elements Locations
NYSDOT-02: Proposed CCTV Cameras
Traffic Management Center, New York State Regional Office

FIGURE 2

In mid and Long-Term periods, the study recommends building a fiber optic network (*NYSDOT-18 and NYSDOT-32 projects*) and use the wireless network as the backup.

Figure 3 shows the first phase of the recommended Regional Fiber Optic Network deployment project where the emphasis will be on placing conduits and fibers along the I-81, I-481 and I-690 loop.



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Com. Hub 2
Com. Hub 1
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Ring 2
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F/O CABLE IN SEGMENT 1
US-11
NYSDOT-16: NYSDOT Regional Fiber Optic Communucation Network
Fiber Optic Primary Acces Point
Fiber Optic Cable in Segment I
Field Communication Hub
Central Communication Hub

FIGURE 3

This fiber network will further be expanded in Long-Term under the *NYSDOT-32* project as shown in Figure 4.

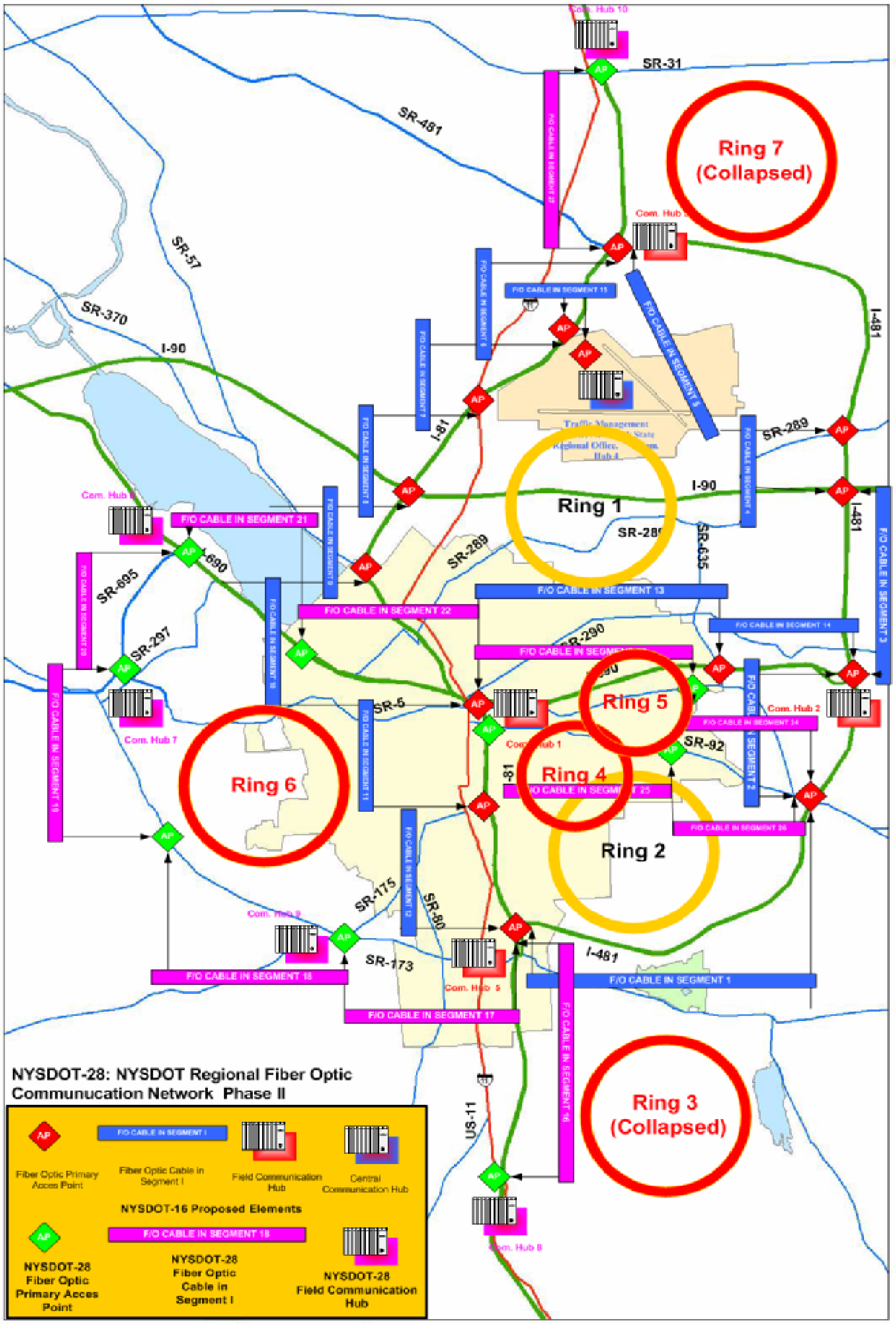
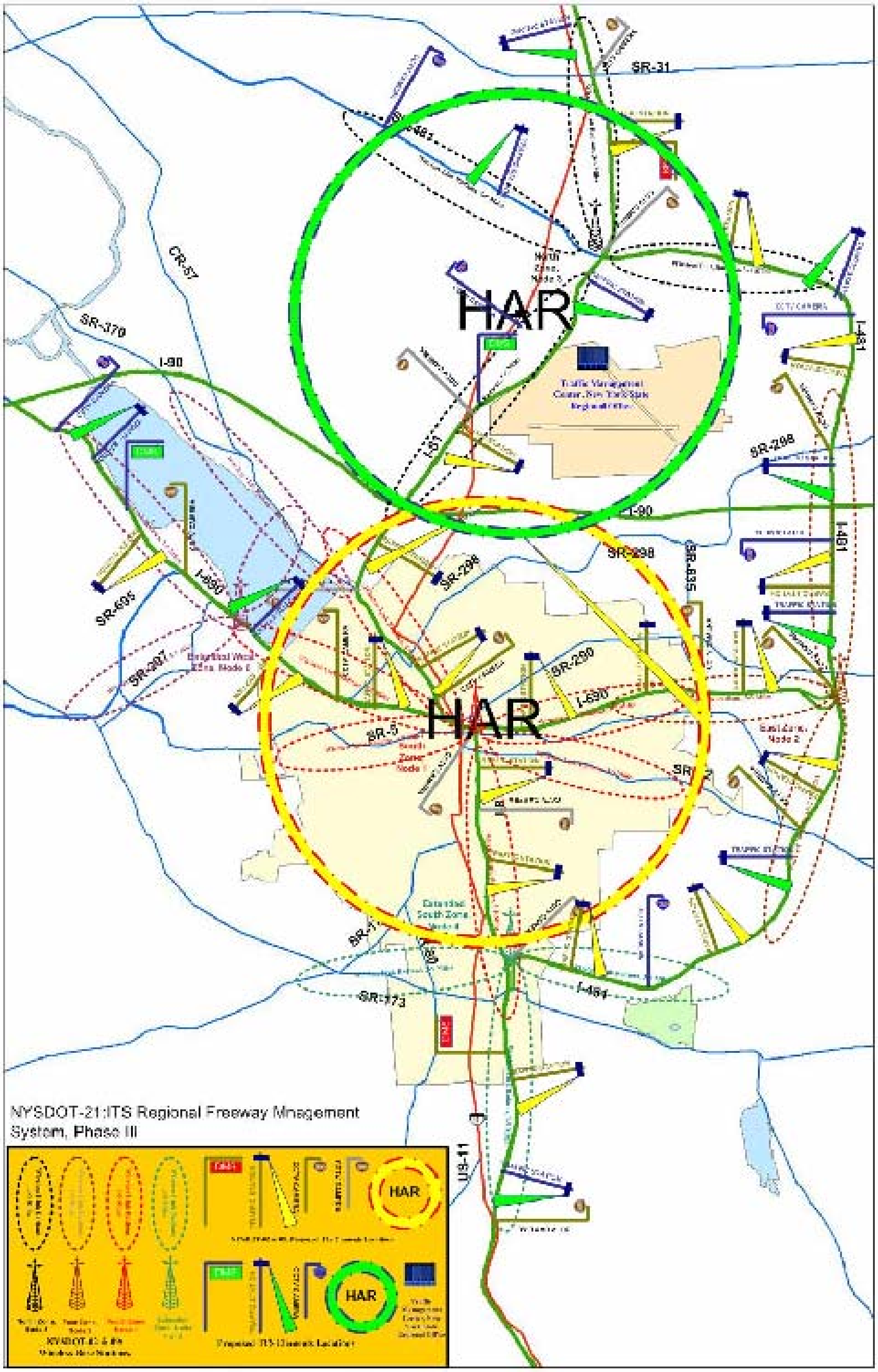


FIGURE 4

Transportation Management Center (TMC) – various alternatives for the location of a NYSDOT TMC were discussed and evaluated. The co-location of NYSDOT and NYSP Troop D is recommended at the State Police facility in the City of Syracuse Airport area. The study recommends, as an early action project (NYSDOT-03), expanding the existing State Police facility to accommodate the needs. As part of this project, TMC design is recommended to evaluate functional needs and design accordingly.

ITS Field Equipment – based on the metropolitan area needs, the study recommends focusing primarily on placement of ITS on the loop of I-81, I-481 and I-690 with consideration to serve the State Fair Grounds and future developments in the Lakefront Area. NYSTA will complement this with the placement of ITS on I-90 within the Metropolitan area. This coverage area will provide multiple alternative routes in the event of incidents. The recommendation will focus on the early action placement of Cameras mainly on I-81 as part of the NYSDOT-02 project shown in Figure 1. NYSDOT-10 recommended Short-Term project will complement the early action project by placing additional ITS devices along the I-81, I-690 and I-481at critical locations as shown in Figure 2. Finally, NYSDOT-24 recommended mid-term project that includes deployment of ITS devices at the remaining locations along the I-81, I-690 and I-480 for a comprehensive freeway management system as shown in Figure 5.



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NYSDOT-21:ITS Regional Freeway Management System, Phase III
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HAR

FIGURE 5

Four ITS field equipment installation projects are recommended for Long-Term deployment. Figure 6 shows the recommended field equipment locations along the SR 92 (NYSDOT-27).

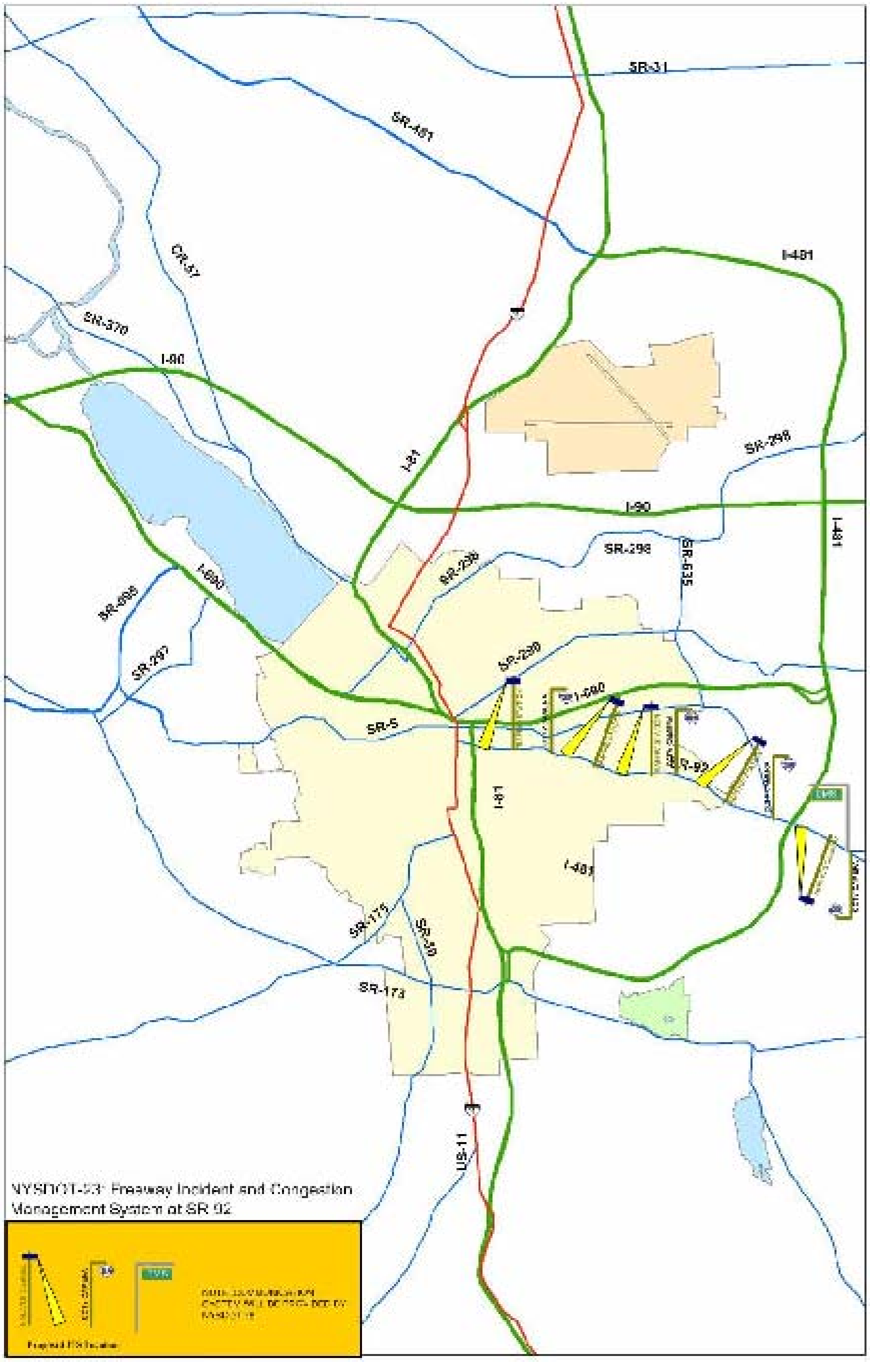
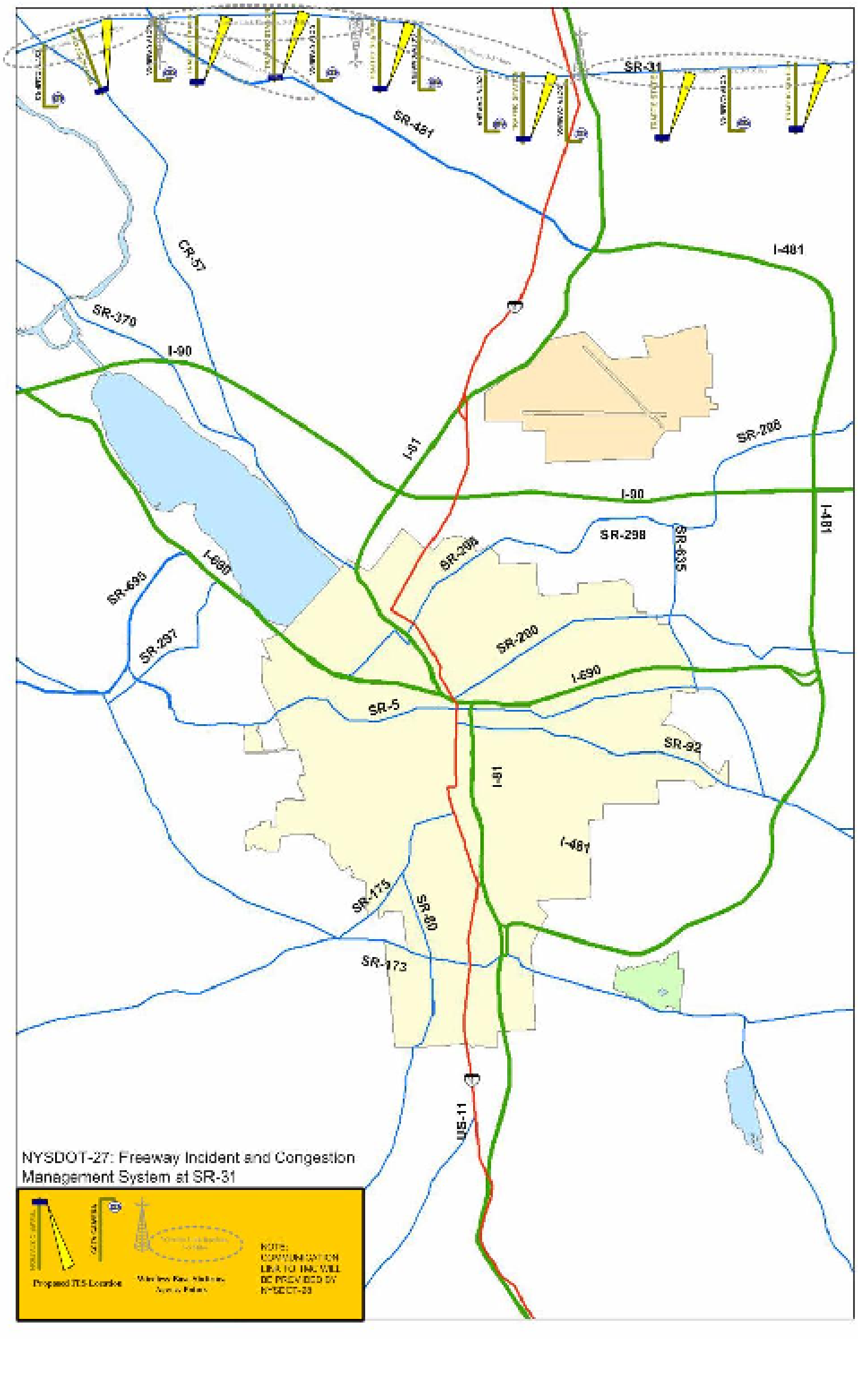


FIGURE 6

The recommended ITS field equipment locations along the SR 31 are shown in Figure 7 as part of the NYSDOT-28 project.



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SR-92
I-81
I-481
SR-175
SR-80
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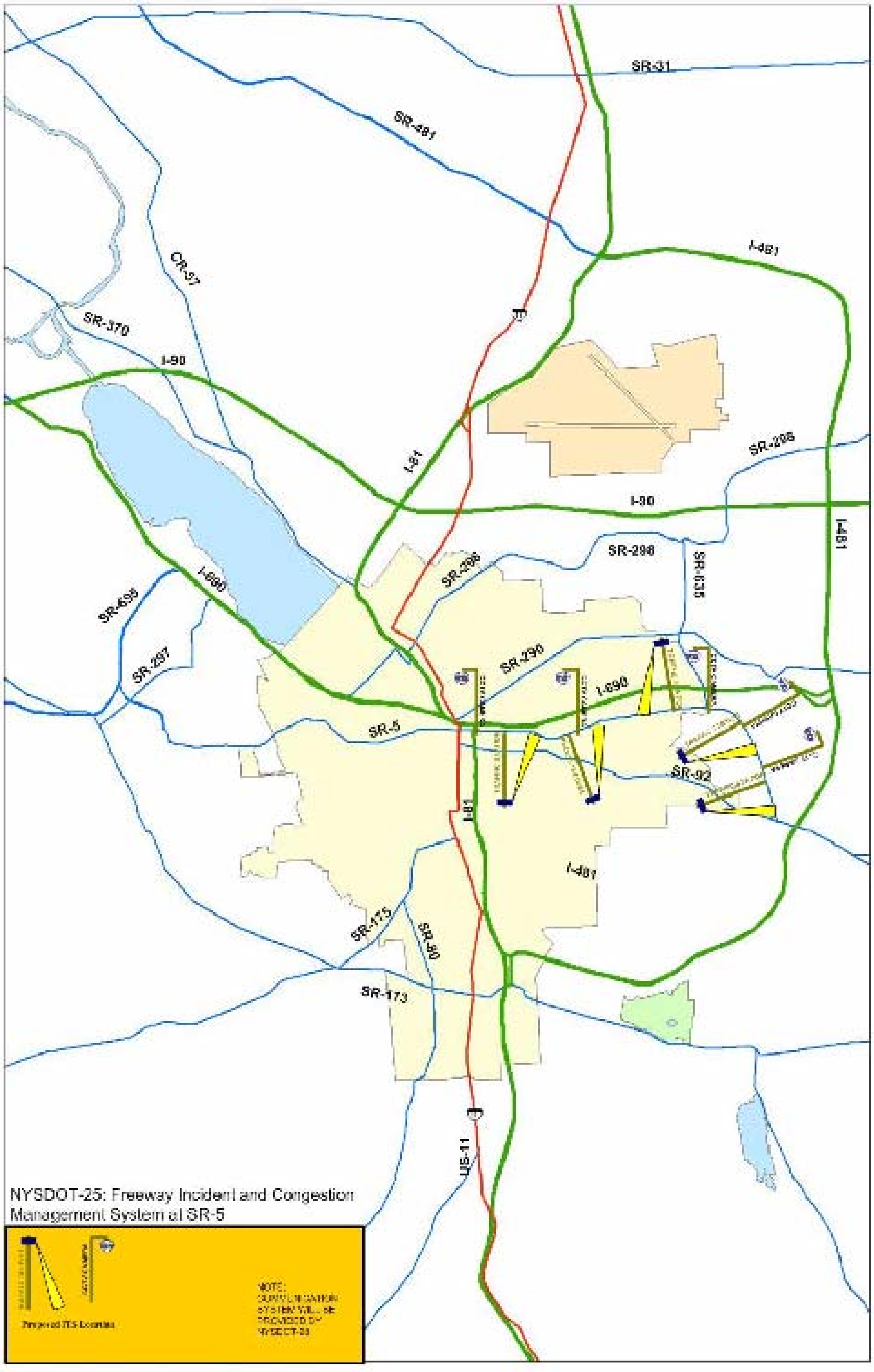
US-11
NYSDOT-27: Freeway Incident and Congestion Management System at SR-31

FIGURE 7

The recommended NYSDOT-29 project will place ITS field equipment along the SR 5. Figure 8 shows the approximate locations of the field equipment.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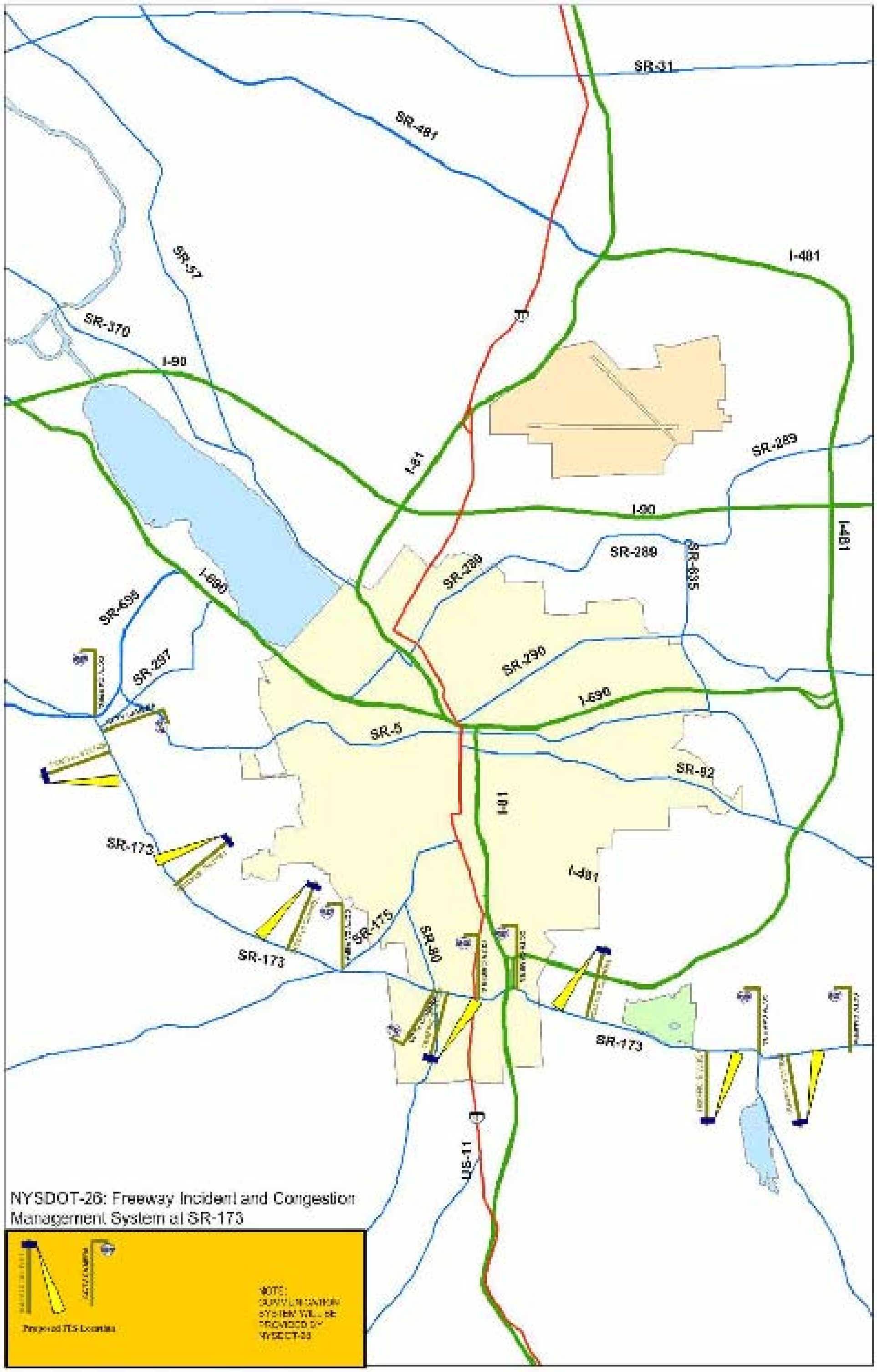
NYSDOT-25: Freeway Incident and Congestion Management System at SR-5
Proposed ITS Location

FIGURE 8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SR-290
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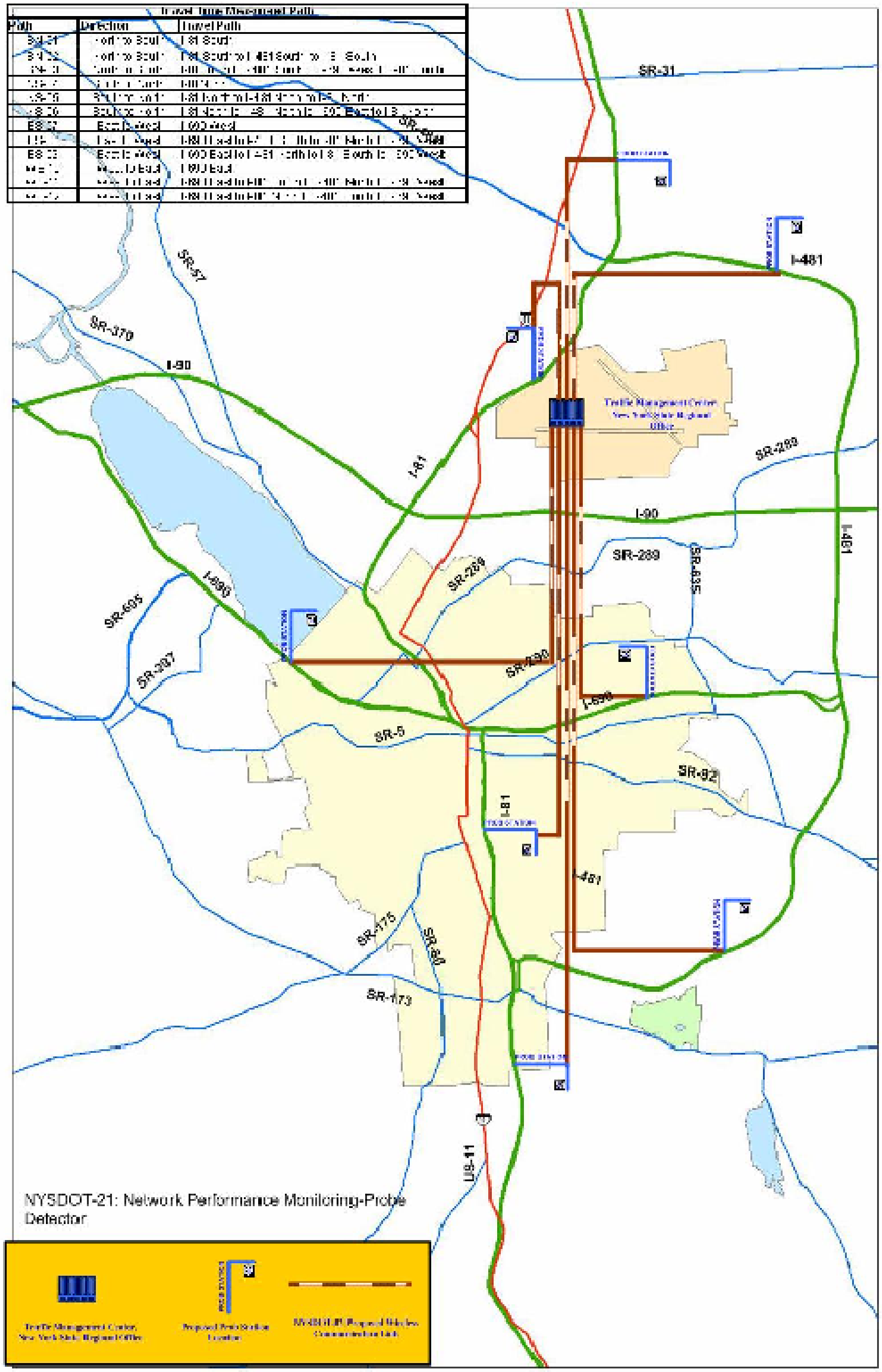
SR-5
SR-92
I-81
SR-173
I-481
SR-175
SR-80
SR-173
SR-173
US-11
NYSDOT-26: Freeway Incident and Congestion Management System at SR-173
Proposed ITS Location

FIGURE 9

NYSDOT-30 project recommends ITS deployment on SR 173 as shown in Figure 9.

Finally, NYSDOT-21 project recommends placement of probe surveillance technology at six locations along I-81, I-481 and, I-690 as shown in Figure 10 to provide travel time along various links. NYSTA will implement the same probe surveillance technology along the I-90. Both agencies will be able to monitor flow of traffic and travel time from and to each other facilities to assist them in better managing the operations.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Travel Path
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Traffic Management Center
New York State Regional Office
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I-690
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SR-297
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SR-92
I-81
I-481
SR-175
SR-173
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NYSDOT-21: Network Performance Monitoring-Probe Detector
Traffic Management Center, New York State Regional Office
Proposed Probe Station Location

FIGURE 10

In terms of ITS devices at each selected location a cluster of devices could be installed. For example, these could include: a pole mounted camera, one or two speed detectors, a wireless modem (or telephone if available). The intent here is to detect the slowdown of traffic. Then, use the camera to view the local situation and the modem to transmit still frame images over the wireless or phone connection back to the traffic management center. As the system grows, and perhaps additional budget and fiber optic communication is available in later years, then higher quality video can be used. If applicable, the weather station may also be included.

ITS Freeway Management System (Central Software) – An open architecture freeway management software is recommended to integrate operations and maintenance of various ITS technologies. The importance of an open architecture cannot be overstated. Use of interoperability standards like the National Transportation Communications for ITS Protocol (NTCIP) and Traffic Management Data Dictionary (TMDD) make possible use of hardware and equipment from multiple vendors, and data exchange with other systems. This is desirable not only for the increased flexibility and functionality, but also because architecting a system in this fashion is essential in order to garner Federal funds for deployment and operations. It is also recommended to design the system for integration with the Regional Information Sharing network.

In the past, NYSDOT has acquired the statewide license for the MIST Freeway Management System and has adopted its use within both the Region 1 and Region 4. It will be beneficial to migrate the same system for use in Region 3.

NYSDOT-02 project will implement both the hardware and software at the TMC for most components of the freeway management system. The remaining component will be installed as part of the NYSDOT-10 project.

Expansion and Integration of Weather Monitoring System - Under the existing statewide plan, NYSDOT will fund an additional 36 Road Weather Information System (RWIS) within Onondaga County (NYSDOT-5). NYSDOT-6 project is recommended to upgrade the system software and NYSDOT-7 recommends integration of the weather information with the NYSDOT Freeway Management System. All three projects are recommended for deployment in the next five years (Short-Term).

Incident Management Plan – Currently, there is no incident management plan in the region. The study recommends as a Short-Term NYSDOT-12 project, the creation of an incident management group that includes all emergency service providers and transportation facility operators that will be responsible for the development of a regional incident management plan. The plan will be comprehensive, multi-agency and multi-modal.

ITS Systematic Performance Monitoring – In compliance with the FHWA requirements, the study recommends planning for various ITS systematic performance monitoring projects (NYSDOT-11) in order to magnify the quantitative and qualitative benefits of ITS deployments.

Signalized Intersection Upgrade – The majority of the traffic controllers at existing signalized intersections are in need of replacement. The existing state policy will require replacement of the existing controllers with the 2070 controllers. The study recommends a two-phase upgrade of all controllers. NYSDOT-17 project recommends Short-Term controller upgrades for 110 intersections. The same amount of controller upgrades are also recommended under the NYSDOT-23 project during the mid-term deployment.

In addition, various critical corridors are recommended for system upgrade. The study recommends as part of the NYSDOT-15 and NYSDOT-20 expansion of the signal systems where two new closed-loop systems will be deployed per year for the next ten years.

The study also recommends the NYSDOT-09 Short-Term project to replace the current closed-loop systems with a centralized system to be located at the new Region 3/NYSP TMC. Figure 11 shows the schematic diagram of the proposed centralized signal system architecture.

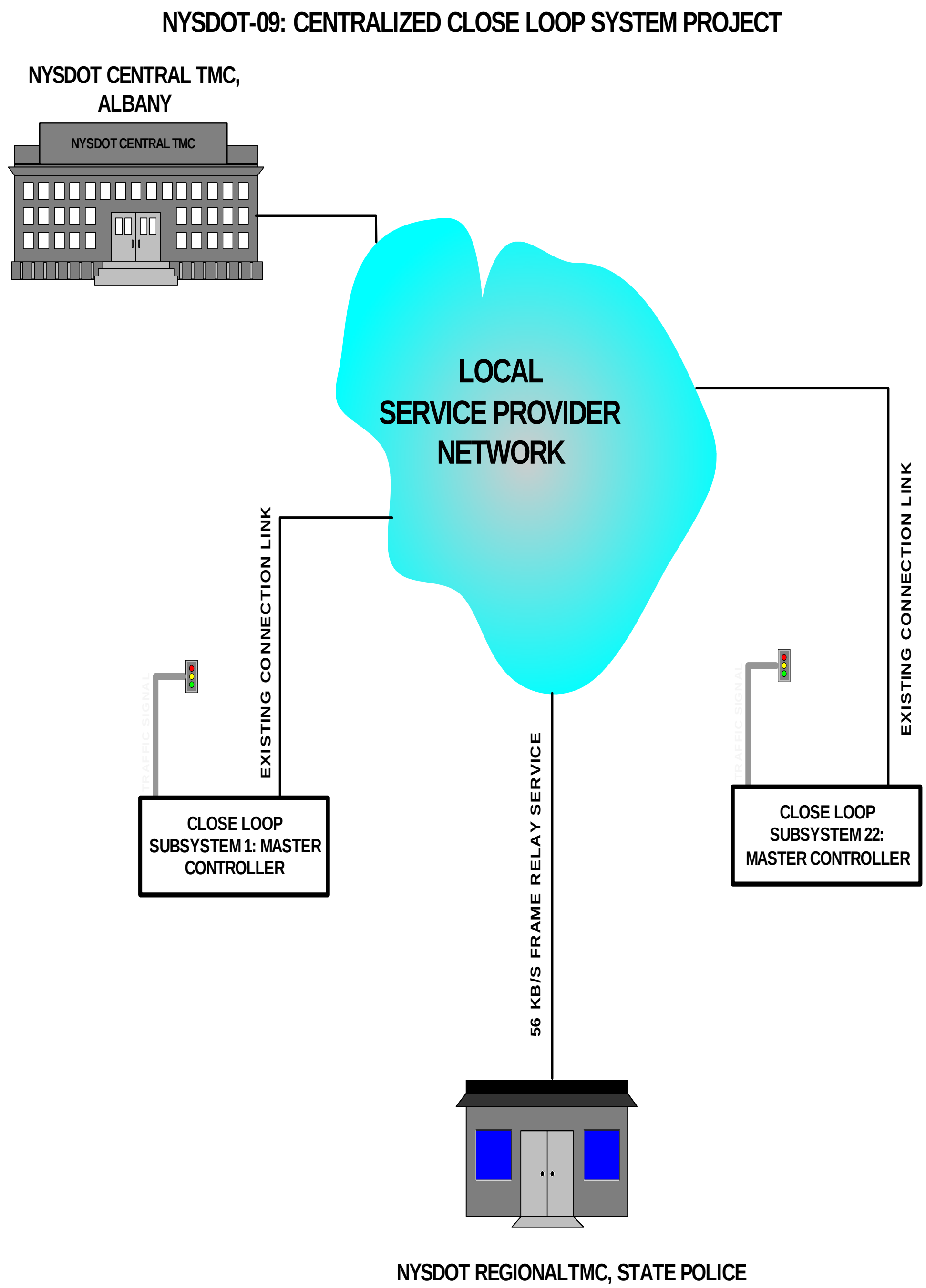


FIGURE 11

Automatic Vehicle Locations – CNYRTA is the only agency in process of deploying the AVL system. CNYRTA's system has expansion capabilities to include other agencies. It is recommended to expand the CNYRTA's system to provide AVL functions to the NYSDOT, County DOT and City DPW maintenance fleet. The study recommends two-phase deployment of AVL technology. NYSDOT-26 will include deployment of AVL technology on 30 state maintenance fleets. The NYSDOT-34 project recommends Long-Term expansion of the AVL coverage to an additional 30 state maintenance fleets.

POST ITS Strategic Plan – It is recommended to budget for the continuation of ITS coordination activities as well as for revisions of the ITS Strategic Plan on a regular basis (every three to five years). This could take the form of a "Syracuse Regional ITS Policy Committee" or another formal (or informal) body that meets periodically to discuss issues and problems, and to plan for maintenance and continued upgrade of the region's ITS. Such bodies are in existence in both metropolitan areas and along interstate corridors all around the nation, and once established are eligible for both state and Federal funding support. NYSDOT-13 and NYSDOT-22 projects are defined to keep the ITS Strategic Plan updated for the next ten years.

Operations and Maintenance Cost – In order to operate and maintain any ITS equipment, it is vital to allocate budget for such cost. The cost is comprised of software and hardware upgrades and maintenance cost, TMC staffing cost, utility and other direct cost and the maintenance cost of field equipment and communication network. Experience tells us that annual O&M costs for a system are approximately 10% of the deployed cost of the system. The O&M cost are budgeted as three separate projects; NYSDOT-14 (Short-Term cost, first five years), NYSDOT-25 (Mid-Term cost, years six through ten) and, NYSDOT-33 (Long-Term cost).

Deployment Time Frame

Early Action Projects – The focus of early action projects is to define projects that best serve the immediate needs of NYSDOT Region 3 in the Onondaga County Area. NYSDOT has taken the ITS champion role in the region by initiating three early action projects at a capital cost of approximately $2.2M. The operations and maintenance cost for these projects are included in the Short-Term projects cost.

Short-Term Projects - Recommended Short-Term projects will focus on deployments within the next five years. A total of fourteen projects are recommended for deployment with a total capital cost of $11M. In addition, at the end of all Short-Term deployments, the annual O&M cost for these systems will be about $1.1M.

Mid-Term Projects - A total of nine projects were defined for deployment within the six to ten years time frame. The capital cost of these projects will total about $16.2M with the average annual O&M cost of $1.8M.

Long-Term Projects - The Long-Term projects are to be deployed between year eleven and year twenty. A total of eight projects have been identified at a capital cost of $9.3M. The annual Long-Term O&M cost for the all systems will be about $2.2M.

The total cost of the thirty-four recommended projects for the State-DOT is estimated to be $39M in capital costs.

Table 2 lists all NYSDOT recommended projects broken down by; recommended time frame for deployment, National Architecture relationship, associated components and/or technologies, pre-requisite projects, locations, estimated capital and O&M costs and associated benefits.

Table 3 shows the detailed cost breakdown table that includes the cost of; network/communication, central software and hardware, field equipment, interface, capital and operations and maintenance.

Finally, the O&M cost broken down for the various deployment terms (Short-Term, mid-term and Long-Term) are listed in Table 4.

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital Components	Engineering & Inspection (E&I)	Total	Annual Service &I Operation	Annual Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
1	NYSDOT-01	METCON - Phase 1	Early Action	**TMS**	**Not Applicable**	Communication networking	NA		?	$ 500,000		$ 500,000	$ 27,600	$ 10,000	?			
2	NYSDOT-02	**ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 1:** Wireless Communication Network	Early Action	EMS, TMS	Incident Management System (ATMS08), Traffic Surveillance (ATMS)	- Wireless Technology - Central hardware/software - Center-to-field communications	NA	35 to 50 miles roadway at I-81, I-690, and I-481	0	$ 980,000	$ 215,600	$ 1,195,600	$ 78,000	$ 19,600	BC			
		ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 2: Freeway Incident and Congestion Management Central System				- DI to Regional Network - Central hardware / software - CCTV Driver		NYSDOT Regional TMC										
		ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 3: Field ITS Element at I-690				CCTV Interfaces hardware / software		1 location in I-690: Junction of I-81 with I-690										
		ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 4: Field ITS Element at I-81						5 locations in I-81 junction with R-11, I-91, I-370, SR-31 and Adams St.										
		ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 5: Field ITS Element at I-481						2 locations in I-481 junction with I-81(South) and I-81 (North)										
3	NYSDOT-03	NYSDOT Regional TMC	Early Action	TMS	En-Route Roadway Traveler Information Dissemination (ATMS06), Network Data Collection (ATMS01), Incident Management System (ATMS08)	- Central hardware - Software support -State Police Building Renovation	NA	TMC and associated subsystems	Not Available	$ 410,000	$ 90,200	$ 500,200	$ 30,000	$ 8,200	B,C			Joint TMC at State Police Airport Facility.
4	NYSDOT-04	A Portable HAR (NYSDOT)	Short Term	TMS	En-Route Roadway Traveler Information Dissemination (ATMS06)	- HAR	NA	NA	0	$ 49,000	$ -	$ 49,000	$ 2,400	$ 980	B,C	Mobile Unit Ordering/ No design work required		
5	NYSDOT-05	RWIS Location Expansion	Short Term	TMS	Surface Street Control (ATMS03)	RWIS	NYSDOT-02	36 RWIS station in the Onondaga County	Cost will supported by NYSDOT Central Office	$ -	$ -	$ -	$ 58,800	$ 26,850	B,C			Operation and Maintenance Cost will be supported by the Regional Office
6	NYSDOT-06	RWIS Software Upgrade	Short Term	TMS	Surface Street Control (ATMS03)	RWIS Central System Forecasting Package?	NYSDOT-01	NYSDOT Regional IT Office	90	$ -	$ -	$ -	$ -	$ 1,800	B,C			

Table 2 - Recommended ITS Projects for New York State Department of Transportation

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Engineering & Inspection (E&I)	Total	Annual: Service &I Operation	Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
7	NYSDOT-07	Integrate RWIS Central system to NYSDOT Regional TMC	Short Term	TMS	Surface Street Control (ATMS03)	- - Central hardware / software - Center-to-Center communications	NYSDOT-02	NYSDOT Regional TMC	0	$ 85,000		$ 85,000	$ 1,200	$ 1,700	B,C	Upgrade by the manufacture, No design required		The focus here is to import a flat file for RWIS to the MIST system at TMC
8	NYSDOT-08	511 Travel Information System	Short Term	TMS	En-Route Roadway Traveler Information Dissemination (ATMS06)	Central Hardware and Software, a T1 line for multi phone channels	NYSDOT-01, 02, 03	NYSDOT Regional TMC	0	$ 370,000		$ 370,000	$ 10,800	$ 2,400	B,C			
9	NYSDOT-09	Central monitoring of the state closed loop systems	Short Term	TMS	Not Applicable	- Central hardware/software - Center-to-field communications	NYSDOT-02	14 closed loop systems	0	$ 144,000	$ -	$ 144,000	$ 24,000	$ 2,880	B,C			There are 20 closed loop. They need to be redirected to Region 3 TMC along with servers and communication plus software.
10	NYSDOT-10	**ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 1:** Wireless Communication Network Expansion	Short Term	EMS, TMS	Incident Management System (ATMS08), Traffic Surveillance (ATMS)	- Wireless Technology - - Center-to-field communications	NYSDOT-02	10 to 15 miles roadway under 1 new wireless zone	0	$ 1,855,100	$ 408,122	$ 2,263,222	$ 15,600	$ 37,102	BC			One new wireless zone is consider for this project.
		ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 2: Freeway Incident and Congestion Management Central System Expansion				- DI to Regional Network - Central hardware / software expansion - Detector Station Driver - VMS Driver - HAR Interface		NYSDOT Regional TMC										This should be complementary part of NYSDOT-07. e early action. The software and hardware should be integrated with the I-81, I690 and I481 plus the communication cost and this might be the wireless with two towers.
		ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 3: Field ITS Element at I-690				- CCTV - Detector Station - VMS HAR Interfaces hardware / software		I-690 FROM I-481 to I-695 (I 90)										
		ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 4: Field ITS Element at I-81						I-81 FROM I-481(South) to I-481 (North)										
		ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 5: Field ITS Element at I-481						I-481 FROM I-81(South) to I-81 (North)										
11	NYSDOT-11	ITS Systematic Performance Monitoring Project	Short Term	Not Applicable	Network Data Collection (ATMS01)		NA	ITS operated Projects in the Region	0	$ 130,000	$ -	$ 130,000	$ -	$ -	B,C			

Table 2 - Recommended ITS Projects for New York State Department of Transportation

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital Components	Engineering & Inspection (E&I)	Total	Annual Service &I Operation	Annual Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
12	NYSDOT-12	Incident Management Plan	Short Term	TMS, EM	Incident Management System (ATMS08), Traffic Surveillance (ATMS)	Plan development and system programming	NA			$ 100,000		$ 100,000	$ -	$ -	B,C			
13	NYSDOT-13	Post ITS Strategic Coordination	Short Term	Not Applicable	Network Data Collection (ATMS01)	coordination meeting	NA			$ 150,000		$ 150,000	$ -	$ -	B,C			
14	NYSDOT-14	TMC O&M -- Short Term	Short Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff	NYSDOT-02 NYSDOT-09	Regional TMC and associated subsystems	0	$ -	$ -	$ -	$ 379,500	$ 189,500				
15	NYSDOT-15	Expansion of Close Loop systems. Phase I	Short Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	NYSDOT-08	Implementation or Expansion of Close Loop System,2 System per year	1	$ 3,605,000	$ 793,100	$ 4,398,100	$ 21,600	$ 72,100	B,C			mid term, I-81 and 690. Long term add the 481.
16	NYSDOT-16	METCON Expansion Phase 2	Short term	**TMS**	**Not Applicable**	Communication networking	NYSDOT-01, 02, 03		?	$ 250,000		$ 250,000	$ 3,000	$ 5,000	?			
17	NYSDOT-17	Conversion of Traffic Controller to 2070 controller Phase I	Short Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software		Conversion of 110 Intersections	0	$ 2,539,000	$ 558,580	$ 3,097,580	$ -	$ 50,780	B,C			
18	NYSDOT-18	NYSDOT Regional Fiber Optic Communucation Network	Mid Term	TMS	Preperation for ITS	- Fiber optic cable - Communications equipment	NA	Selected Roadways, 30 Miles network	0	$ 4,565,000	$ 1,004,300	$ 5,569,300	$ 1,920	$ 91,300	B,C			
19	NYSDOT-19	METCON Expansion Phase 3 (Video Sharing and Metro Agency Data Interfaces)	Mid Term	TMS	**Not Applicable**	Communication networking	NYSDOT-16		0	$ 400,000	$ -	$ 400,000	$ 13,800	$ 8,000	B,C			
20	NYSDOT-20	Expansion of Close Loop systems. Phase II	Mid Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	NYSDOT-08, 14	Implementation or Expansion of Close Loop System,2 System per year	0	$ 3,611,000	$ 794,420	$ 4,405,420	$ 21,600	$ 72,220				
21	NYSDOT-21	Network Performance Monitoring-Probe Detector	Mid Term	TMS, EM	Surface Street Control (ATMS03)	Probe Detectors	NYSDOT-02	6 locations	0	$ 508,000	$ 111,760	$ 619,760	$ 8,880	$ 10,160				
22	NYSDOT-22	ITS Strategic Plan Review and update	Mid Term	Not Applicable	Network Data Collection (ATMS01)	Plan Updating and adjustment	NA			$ 150,000	$ -	$ 150,000	$ -	$ -	B,C			
23	NYSDOT-23	Conversion of Traffic Controller to 2070 controller Phase II	Mid Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software		Conversion of 110 Intersections	0	$ 2,464,000	$ 542,080	$ 3,006,080	$ -	$ 49,280	B,C			

Table 2 - Recommended ITS Projects for New York State Department of Transportation

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Engineering & Inspection (E&I)	Total	Annual: Service & Operation	Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
24	NYSDOT-24	ITS Regional Freeway Mnagement System, Phase III: ITS Improvement in Ring Belts (I-81. I-481, and I-690)	Mid Term	TMS, EM	Incident Management System (ATMS08), Traffic Surveillance (ATMS)	- CCTV - Detector Station - VMS HAR Central hardware / software	NYSDOT-09	Syracuse Ring Belts (I-81. I-481, and I-690)	0	$ 1,180,500	$ 259,710	$ 1,440,210	$ 13,440	$ 23,320	B,C			
25	NYSDOT-25	TMC O&M -- Mid Term	Mid Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff	NYSDOT-09	Regional TMC and associated subsystems	0	$ -	$ -	$ -	$ 580,500	$ 346,500				
26	NYSDOT-26	Vehicle Fleet Administration (AVL Project) Phase I	Mid Term	TMS	Fleet Administration (CVO1)	- GPS AVL - Central hardware / software - Wide area mobile communications		30 State Vehicles	0	$ 560,000	$ 123,200	$ 683,200	$ 2,700	$ 11,200				
27	NYSDOT-27	Freeway Incident and Congestion Management System at SR-92	Long Term ?	TMS, EM	Incident Management System (ATMS08), Traffic Surveillance (ATMS)	- CCTV - Detector Station - VMS HAR Central hardware / software	NYSDOT-09	SR-92	0	$ 634,000	$ 139,480	$ 773,480	$ 4,800	$ 12,740	B,C			NYSDOT to determine whether it should be midterm or long term.
28	NYSDOT-28	Freeway Incident and Congestion Management System at SR-31	Long Term ?	TMS, EM	Incident Management System (ATMS08), Traffic Surveillance (ATMS)	- GIS map - Central hardware / software	NYSDOT-09	SR-370, SR-31		$ 716,400	$ 157,608	$ 874,008	$ 4,800	$ 14,328	B,C			
29	NYSDOT-29	Freeway Incident and Congestion Management System at SR-5	Long Term ?	TMS, EM	Incident Management System (ATMS08), Traffic Surveillance (ATMS)	- GIS map - Central hardware / software	NYSDOT-09	SR-5	0	$ 422,000	$ 92,840	$ 514,840	$ 4,800	$ 8,440				
30	NYSDOT-30	Freeway Incident and Congestion Management System at SR-173	Long Term	TMS, EM	Incident Management System (ATMS08), Traffic Surveillance (ATMS)	- CCTV - Detector Station - VMS HAR Central hardware / software	NYSDOT-09	SR-173	0	$ 560,800	$ 123,376	$ 684,176	$ 4,800	$ 11,216	B,C			
31	NYSDOT-31	Interactive Kiosks (coordinate with Regional Architecture Center Design Project)	Long Term	ISP	Interactive Traveler Information (ATIS02)	- Kiosks (processor and monitor / user interface)		10 locations		$ 322,000	$ 70,840	$ 392,840	$ 10,800	$ 6,440				Long Term
32	NYSDOT-32	NYSDOT Regional Fiber Optic Communucation Network Phase 2	Long Term	Not Applicable	Not Applicable	ITS componets - none. (see Project 2 for the ITS Portion)	NYSDOT-15	The State Regional Roadway	0	$ 4,610,000	$ 1,014,200	$ 5,624,200	$ 1,920	$ 92,200				
33	NYSDOT-33	TMC O&M -- Long Term	Long Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff	NYSDOT-09	Regional TMC and associated subsystems	0	$ -	$ -	$ -	$ 768,000	$ 436,000				
34	NYSDOT-34	Vehicle Fleet Administration (AVL Project) Phase II	Long Term	TMS	Fleet Administration (CVO1)	- GPS AVL - Central hardware / software - Wide area mobile communications		30 State Vehicles	1	$ 360,000	$ 79,200	$ 439,200	$ -	$ 7,200				
		NYS Department of Transportation		Subtotal for Early Action Projects			3	Projects	Mid Range	1,890,000	305,800	2,195,800	135,600	37,800	1 Component costs include hardware, firmware, software, integration, and			

Table 2 - Recommended ITS Projects for New York State Department of Transportation

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Engineering & Inspection (E&I)	Total	Annual: Service &I Operation	Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
									High-end	2,362,500	$ 382,250	$ 2,744,750	$ 169,500	$ 47,250	firmware, software, integration, and communications costs as specified in the New York State Cost Estimate Sheet.			
									Low-end	1,417,500	$ 229,350	$ 1,646,850	$ 101,700	$ 28,350				
		NYS Department of Transportation		Subtotal for all Short Term Projects			14	Projects	Mid Range	**9,277,100**	**1,759,802**	**11,036,902**	**652,500**	**428,892**	[1] E&I costs include preliminary through final engineering, inspection, and other (e.g., construction engineering) costs; estimated at 22 percent of component costs			
									High-end	11,596,375	$ 2,199,753	$ 13,796,128	$ 815,625	$ 536,115				
									Low-end	6,957,825	$ 1,319,852	$ 8,277,677	$ 489,375	$ 321,669				
		NYS Department of Transportation		Subtotal for all Mid Term Projects			9	Projects	Mid Range	**13,438,500**	**2,835,470**	**16,273,970**	**915,840**	**851,372**				
									High-end	16,798,125	$ 3,544,338	$ 20,342,463	$ 1,144,800	$ 1,064,215				
									Low-end	10,078,875	$ 2,126,603	$ 12,205,478	$ 686,880	$ 638,529				
		NYS Department of Transportation		Subtotal for all Long Term Projects			8	Projects	Mid Range	**7,625,200**	**1,677,544**	**9,302,744**	**1,135,260**	**1,093,436**				
									High-end	9,531,500	$ 2,096,930	$ 11,628,430	$ 1,419,075	$ 1,366,795				
									Low-end	5,718,900	$ 1,258,158	$ 6,977,058	$ 851,445	$ 820,077				
		Summary		Grand Total			34	Projects	Mid Range	**$ 32,230,800**	**$ 6,578,616**	**$ 38,809,416**						
									High-end	40,288,500	$ 8,223,270	$ 48,511,770						
									Low-end	24,173,100	$ 4,933,962	$ 29,107,062						

Table 3 NYSDOT Traffic Operation Center Operation and Maintenance Cost Estimate

Item No.	Project No.	Project Name	Time Frame	Operation					Maintenance					Operation Cost (Yearly)	Operation Cost (5 Years)	Maintenance Cost	Maintenance Cost (5 Years)
				TMC Supervisor	System Engineer	Operator	Technician	Utilities	Supervisor	Technician	Transportation	Equipment	Miscellaneous				
115	NYSDOT-24	Central TMC Operation & Maintenance, Phase I	Short Term	1	1	**2**	1	1000	1	1	$ 1,000	$ 10,000	$ 10,000	$ 379,500	$ 1,897,500	$ 189,500	$ 947,500
116	NYSDOT-25	Central TMC Operation & Maintenance, Phase II	Mid Term	1	2	**4**	1	1500	1	3	$ 2,000	$ 20,000	$ 10,000	$ 580,500	$ 2,902,500	$ 346,500	$ 1,732,500
117	NYSDOT-26	Central TMC Operation & Maintenance, Phase III	Long Term	1	2	**6**	2	1500	1	4	$ 3,000	$ 30,000	$ 10,000	$ 768,000	$ 3,840,000	$ 436,000	$ 2,180,000

Table 4 New York State Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and Study: Component	Network Construction and Study: Unit Cost (k)	Network Construction and Study: Quantity	Central Software/Hardware: Component	Central Software/Hardware: Unit Cost (k)	Central Software/Hardware: Quantity	Interface: Component	Interface: Unit Cost (k)	Interface: Quantity	ITS Field Construction: Component	ITS Field Construction: Unit Cost (k)	ITS Field Construction: Quantity	Operation Maintenabnce Services Repair Estimate: Com. Service Low Speed (DS0)	Operation Maintenabnce Services Repair Estimate: Com. Service High Speed (T1)	Operation Maintenabnce Services Repair Estimate: Power Service	Operation Maintenabnce Services Repair Estimate: Repaire Support	Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES
State of New York Department of Transportation																						
1	NYSDOT-01	METCON - Phase 1				Lamp Sum Price for Central Hardware and Software	500	1							0	2	500	$ 833	$ 500,000	$ 27,600	$ 10,000	
2	NYSDOT-02	ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 1: Wireless Communication Network	Wireless Network	60	3	LAN upgrade and expand with video and data servers	50	1	Wireless network interfaces and construction cost.	20	4		0	0	0	6	400	$ 517	$ 310,000	$ 69,600	$ 6,200	$ 980,000 | $ 78,000 | $ 19,600
		ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 2: Freeway Incident and Congestion Management Central System				Central Hardware and Software	250	1	Physical Hardware for Data Interfaces	50	1	ITS Drivers	50	0	0	0	100	$ 500	$ 300,000	$ 1,200	$ 6,000	
		ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 3: Field ITS Element at I-690				Video Switching	50	1	Data Interface	5 2	1 0	Traffic Detector CCTV VMS HAR	32.4 35 253.4 34.5	0 1 0 0	0	0	200	$ 150	$ 90,000	$ 2,400	$ 1,800	
		ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 4: Field ITS Element at I-81							Data Interface	5 2	5 0	Traffic Detector CCTV VMS HAR	32.4 35 253.4 34.5	0 5 0 1	0	0	240	$ 333	$ 200,000	$ 2,880	$ 4,000	
		ITS Regional Freeway Mnagement System, Phase I: Early Action Project, Subsystem 5: Field ITS Element at I-481							Data Interface	5 2	2 0	Traffic Detector CCTV VMS HAR	32.4 35 253.4 34.5	0 2 0 0	0	0	160	$ 133	$ 80,000	$ 1,920	$ 1,600	
3	NYSDOT-03	NYSDOT Regional TMC	Building Expansion, Operation Room	250	1	Central Hardware (LAN & Radio Interface) and Furniture	150	1	network interfaces	5	2				2	2	500	$ 683	$ 410,000	$ 30,000	$ 8,200	Building should include furniture, HVAC, lighting, raised floor, building a garage to TMC, etc. Hardware should include three computers, LAN, wiring, etc to prepare for accepting a FMS or Signal system, etc. The building should also include State Police needs for Radio and a remote CAD from 911 Center. Also, a remote NYSDOT radio needs to be accommodated.
4	NYSDOT-04	A Portable HAR (NYSDOT)							Wireless Interface	2	2	HAR	45	1	1		100	$ 82	$ 49,000	$ 2,400	$ 980	Low speed data will be Cellular Phone Service.
5	NYSDOT-05	RWIS Location Expansion				Hardware (computer and com. Interfaces)	30	1		2	35	RWIS	35.5	35	35	0	1400	$ 2,238	$ -	$ 58,800	$ 26,850	Note: (1) the cost for implementation of this project will supported by NYSDOT Central Office. (2) The unit price of RWIS was $20,00, which is increase to $30,000 in this estimate. (3) Com. Links are leased service connections in this estimate. It is anticipate some stations can connect to wireless network, project NDSDOT-02, 09 .(4) 35 RWIS are pre-specified for Onondaga County, therefore total Number of RWIS in the study area may will be less than 35.
6	NYSDOT-06	RWIS Software Upgrade				Upgrade Computer Servers and Software Modules.	80	1	Modified the Com. Interface with new update equipment	10	1		0	0	0	0	0	$ 150	$ -	$ -	$ 1,800	Note: Cost of power and com. Services will be same as existing system.
7	NYSDOT-07	Integrate RWIS Central system to NYSDOT Regional TMC				Central Hardware	75	1	Data Interface	5	2				1	0	0	$ 142	$ 85,000	$ 1,200	$ 1,700	Note: Cost of Optional Forecasting Module is not considered in the estimates

Table 4 New York State Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and Study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenabnce Services Repair Estimate				Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support				
8	NYSDOT-08	511 Travel Information System	TMC LAN Expansion	50	1	Central Automated System (Hardware, Software) Lump Sum	300	1	Voice/Data Interface	20	1					1		$ 200	$ 370,000	$ 10,800	$ 2,400	
9	NYSDOT-09	Central monitoring of the state closed loop systems				Central Monitoring System (software and hardware)	100	1		2	22		0	0	20		0	$ 240	$ 144,000	$ 24,000	$ 2,880	Note: (1) The operation and Maintenance cost of Close loop system is not include in this estimate. (2) Com. Links are leased service connections in this estimate. It is anticipate some close loop systems can connect to wireless network, project NDSDOT-02, 09
10	NYSDOT-10	ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 1: Wireless Communication Network Expansion	Wireless Network expansion zone	60	**2**				Wireless network interfaces and construction cost.	20	**6**		0	0	0	**0**	600	$ 400	$ 240,000	$ 7,200	$ 4,800	
		ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 2: Freeway Incident and Congestion Management Central System Expansion				Central Hardware and Software expansion	75	1	Physical Hardware for Data Interfaces expansion	20	1	ITS Drivers	50	0	0	0	100	$ 158	$ 95,000	$ 1,200	$ 1,900	
		ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 3: Field ITS Element at I-690							Data Interface	5 2	4 6	Traffic Detector CCTV VMS HAR	32.4 35 253.4 34.5	**6** 4 0 0	0	0	200	$ 611	$ 366,400	$ 2,400	$ 7,328	$ 1,855,100 $ 15,600 $ 37,102
		ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 4: Field ITS Element at I-81							Data Interface	5 2	2 10	Traffic Detector CCTV VMS HAR	32.4 35 253.4 34.5	7 2 2 1	0	0	240	$ 1,446	$ 867,300	$ 2,880	$ 17,346	
		ITS Regional Freeway Mnagement System, Phase II: ITS Improvement in Ring Belts (I-81. I-481, and I-690), Subsystem 5: Field ITS Element at I-481							Data Interface	5 2	2 6	Traffic Detector CCTV VMS HAR	32.4 35 253.4 34.5	6 2 0 0	0	0	160	$ 477	$ 286,400	$ 1,920	$ 5,728	
11	NYSDOT-11	ITS Systematic Performance Monitoring Project	Performance study	60	1	recording	20	1				Data Collection	50	1			0	$ -	$ 130,000	$ -	$ -	
12	NYSDOT-12	Incident Management Plan	Planning Study	100	1												0	$ -	$ 100,000	$ -	$ -	
13	NYSDOT-13	Post ITS Strategic Coordination	Coordination efforts	150	1												0	$ -	$ 150,000	$ -	$ -	
14	NYSDOT-14	TMC O&M -- Short Term																	$ -	$ 379,500	$ 189,500	Note: Cost Estimate for Operation and Maintenance are presented to O&M Cost Estimate Table

Table 4 New York State Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and Study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenabnce Services Repair Estimate				Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support				
15	NYSDOT-15	Expansion of Close Loop systems. Phase I	Interconnection: Assumed 5 intersections will be in an 2 mile arterial. Duct Cable	212	10	Central Monitoring System (software and hardware required upgrading and system integration)	50	1	Data Interface and construction	2	50	Traffic Signal Upgrading	26.7	50	6	0	1200	$ 6,008	$ 3,605,000	$ 21,600	$ 72,100	Note: (1)The interconnection system will assumed to be an average of 1 mile with F/O cable for each close loop system. (2) Com. Links to Center are leased service connections in this estimate. It is anticipate some close loop systems can connect to wireless network, project NDSDOT-2, 9 (3) 2 close loop system with average 10 intersection at each year will be added to the network, total of 50 intersection on 5 years.
16	NYSDOT-16	METCON Expansion Phase 2				Lamp Sum Price for System Expansion	250	1							0	0	250	$ 417	$ 250,000	$ 3,000	$ 5,000	
17	NYSDOT-17	Conversion of Traffic Controller to 2070 controller Phase I	Interconnection: Assumed 110 intersections controller will be converted to 2070 controller.			Central Monitoring System (software and hardware required upgrading and system integration)	75	1				Traffic controller Upgrading	22.4	110	0	0	0	$ 4,232	$ 2,539,000	$ -	$ 50,780	Note: (1) In this phase almost half of the existing 179 controller, 110, will converted to 2070 controller. (2) The central software of close loop system will be modified in this phase. The close loop systems will use the same communication links for connection to center as the existing systembut it is anticipate some close loop systems can connect to wireless network, project NDSDOT-2, 9 (3) The conversion project include changing the controller to 2070, repairing the detector loops and system programming and setting. Changing the traffic signal and other traffic furniture are not considered in this project estimate.
18	NYSDOT-18	NYSDOT Regional Fiber Optic Communucation Network	F/ O Duct F/O Cable	212	20	Network Management and Switch/Mux	40	5	Optical Interface for connection of 15 Element to the network	3	15	Com. Hub Cabinet and power service	20	4	0	0	160	$ 7,608	$ 4,565,000	$ 1,920	$ 91,300	Note: (1) The fiber Optic Network will be furnished in the network in total length of 20 miles with 4 Com. Hubs. (2) Portion of duct system may be available as part of other project such as NUSDOT-13 or other non ITS project. (3) This project will be permanent communication system for NYSDOT-02, 9.
19	NYSDOT-19	METCON Expansion Phase 3 (Video Sharing and Metro Agency Data Interfaces)				Lamp Sum Price for System Expansion	200	1	Agencies Interface Hardware and Communication Interfaces	50	4					1	250	$ 667	$ 400,000	$ 13,800	$ 8,000	
20	NYSDOT-20	Expansion of Close Loop systems. Phase II	Interconnection: Assumed 5 intersections will be in an 1 mile arterial. Duct Cable	212	10	Central Monitoring System (software and hardware required upgrading and system integration)	50	1	Data Interface and construction	11	10	Traffic Signal Upgrading	26.7	50	6	0	1200	$ 6,018	$ 3,611,000	$ 21,600	$ 72,220	Note: (1)The interconnection system will assumed to be an average of 1 mile with Fiber Optic cable for each close loop system. (2) Com. Links are leased service connections in this estimate. It is anticipate some close loop systems can connect to wireless network, NYSDOT 02, 9 or Fiber Optic Network NYSDOT-16
21	NYSDOT-21	Network Performance Monitoring-Probe Detector				central Hardware and Software	100	1		2	9	Probe station on the existing infrastructure	65	6	5		240	$ 847	$ 508,000	$ 8,880	$ 10,160	Note: 6 Prob stations are assumed in this cost estimate
22	NYSDOT-22	ITS Strategic Plan Review and update	Planning Study	150	1		0	0		0	0		0	0	0	0	0	$ -	$ 150,000	$ -	$ -	
23	NYSDOT-23	Conversion of Traffic Controller to 2070 controller Phase II	Interconnection: Assumed 110 intersections controller will be converted to 2070 controller.									Traffic controller Upgrading	22.4	110	0	0	0	$ 4,107	$ 2,464,000	$ -	$ 49,280	Note: (1) In this phase rest of the existing 179 controller, 110, will converted to 2070 controller. (2) The close loop systems will use the same communication links for connection to center as the existing systembut it is anticipate some close loop systems can connect to wireless network, project NYSDOT-2, 9 or fiber optic network NYSDOT-16. (3) The conversion project include changing the controller to 2070, repairing the detector loops and system programming and setting. Changing the traffic signal and other traffic furniture are not considered in this project estimate.
24	NYSDOT-24	ITS Regional Freeway Mnagement System, Phase III: ITS Improvement in Ring Belts (I-81. I-481, and I-690)				Central Hardware and Software Integration	50	1	Data Interface	5 2	6 13	Traffic Detector CCTV VMS HAR ITS Device Driver	32.4 35 253.4 34.5	10 6 2 1 0	0	0	1120	$ 1,943	$ 1,180,500	$ 13,440	$ 23,320	

Table 4 New York State Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and Study: Component	Unit Cost (k)	Quantity	Central Software/Hardware: Component	Unit Cost (k)	Quantity	Interface: Component	Unit Cost (k)	Quantity	ITS Field Construction: Component	Unit Cost (k)	Quantity	Operation Maintenabnce Services Repair Estimate: Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support	Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES
25	NYSDOT-25	TMC O&M -- Mid Term																		$ 580,500	$ 346,500	Note: Cost Estimate for Operation and Maintenance are presented to O&M Cost Estimate Table
26	NYSDOT-26	Vehicle Fleet Administration (AVL Project) Phase I	One Radio Expanded Twoer	60	1	Dispatching System AVL Application Software/ Hardware	150	1	Interface to CYNTRO	50	1	Vehicle Equipment	10	30	0	0.25	0	933.3333	$ 560,000	$ 2,700	$ 11,200	Note: A quarter of T1 or Frame relay link will be considered between the State Regional TMC and Centro Operation Center for Sharing the Data.
27	NYSDOT-27	Freeway Incident and Congestion Management System at SR-92				Central Hardware and Software Integration	50	1	Data Interface	5 2	4 6	Traffic Detector CCTV VMS HAR ITS Device Driver	32.4 35 253.4 34.5	5 4 1 0			400	$ 1,062	$ 634,000	$ 4,800	$ 12,740	
28	NYSDOT-28	Freeway Incident and Congestion Management System at SR-31	Wireless Network	60	3	Central Hardware and Software Integration	50	1	Data Interface	5 2	7 6	Traffic Detector CCTV VMS HAR ITS Device Driver	32.4 35 253.4 34.5	6 7 0 0			400	$ 1,194	$ 716,400	$ 4,800	$ 14,328	
29	NYSDOT-29	Freeway Incident and Congestion Management System at SR-5				Central Hardware and Software	50	1	Data Interface	5 2	5 5	Traffic Detector CCTV VMS HAR	32.4 35 253.4 34.5	5 5 0 0			400	$ 703	$ 422,000	$ 4,800	$ 8,440	
30	NYSDOT-30	Freeway Incident and Congestion Management System at SR-173				Central Hardware and Software			Data Interface	5 2	8 7	Traffic Detector CCTV VMS HAR	32.4 35 253.4 34.5	7 8 0 0			400	$ 935	$ 560,800	$ 4,800	$ 11,216	
31	NYSDOT-31	Interactive Kiosks (coordinate with Regional Architecture Center Design Project)				Central Hardware and Software	100	1	Data Interface	2	11	Kiosks	20	10	5		400	$ 537	$ 322,000	$ 10,800	$ 6,440	
32	NYSDOT-32	NYSDOT Regional Fiber Optic Communucation Network Phase 2	F/ O Duct F/O Cable	212	20	Network Management and Switch/Mux	40	5	Optical Interface for connection of 30 Element to the network	3	30	Com. Hub Cabinet and power service	20	4	0	0	160	$ 7,683	$ 4,610,000	$ 1,920	$ 92,200	Note: (1) The fiber Optic Network will be furnished in the network in total length of 20 miles with 4 Com. Hubs. (2) Portion of duct system may be available as part of other project such as NUSDOT-12 , 14 or other non ITS projects.
33	NYSDOT-33	TMC O&M -- Long Term																	$ -	$ 768,000	$ 436,000	Note: Cost Estimate for Operation and Maintenance are presented to O&M Cost Estimate Table
34	NYSDOT-34	Vehicle Fleet Administration (AVL Project) Phase II	Centro AVL System Enhancement	50	1	AVL or other Applications Modules with Access Modules	100	0	Data Interface Expansion/ modification	5	2	Vehicle Equipment	10	30	0	0	0	600	$ 360,000	$ -	$ 7,200	

3.3 CITY OF SYRACUSE DEPARTMENT OF PUBLIC WORKS

The general description of projects defined for the City of Syracuse Department of Public Works are listed below and categorized by various functions.

Communication Upgrade - The existing traffic signal interconnect project is in need of an upgrade. The existing communications architecture should properly be redesigned to increase the available capacity, enhance performance and efficiency, as well as accommodate future expandability. The existing interconnect system has all multi-mode point-to-point fiber with T1 technology.

City DPW-01 project is recommended to perform a communication study in the near future (Short-Term) and to evaluate various alternatives and design the communication network for the entire City Information Technology needs. As the result, more advanced communication technologies such as SONET or Giga-bite Optical Ethernet will be recommended for deployment. Figure 12 shows one recommended communication network architecture alternative for deployment.

FIGURE 12

City DPW-03 Short-Term project is recommended to build the approved communication design and to upgrade the network to the recommended communication technology and replace some fiber to single-mode.

Signal Management System - The existing Traffic Signal System (MIST®) is currently operating under the OS2 operating system which is no longer being supported by Microsoft. City DPW-05 project is recommended to upgrade the software to the latest available operating system environment.

TMC Co-Location - As the communication system will be upgraded and the interconnect project will be expanded as well as more cameras and other ITS projects are added to the system, the existing TMC needs to be upgraded or relocated. In addition, the City of Syracuse Police Department can benefit from ITS information for provision of more efficient management of transportation and incidents. City DPW-12 recommends a mid-term co-location of the TMC for both the City DPW and City Police at the City Police facility. The cost of relocation is minimal since both facilities are located on the path of interconnect fiber. This recommendation will minimize cost and maximize efficiency by reducing any duplication cost of two separate centers as well as the cost of staffing both locations. Also, due to the nature of City Police business, the operations center will be operating 24/7 at no additional staffing cost to the City DPW.

CCTV – City DPW-04 project is recommended to install fifteen cameras at critical locations along the existing Interconnect fiber path. Figure 13 shows the proposed fifteen camera locations.

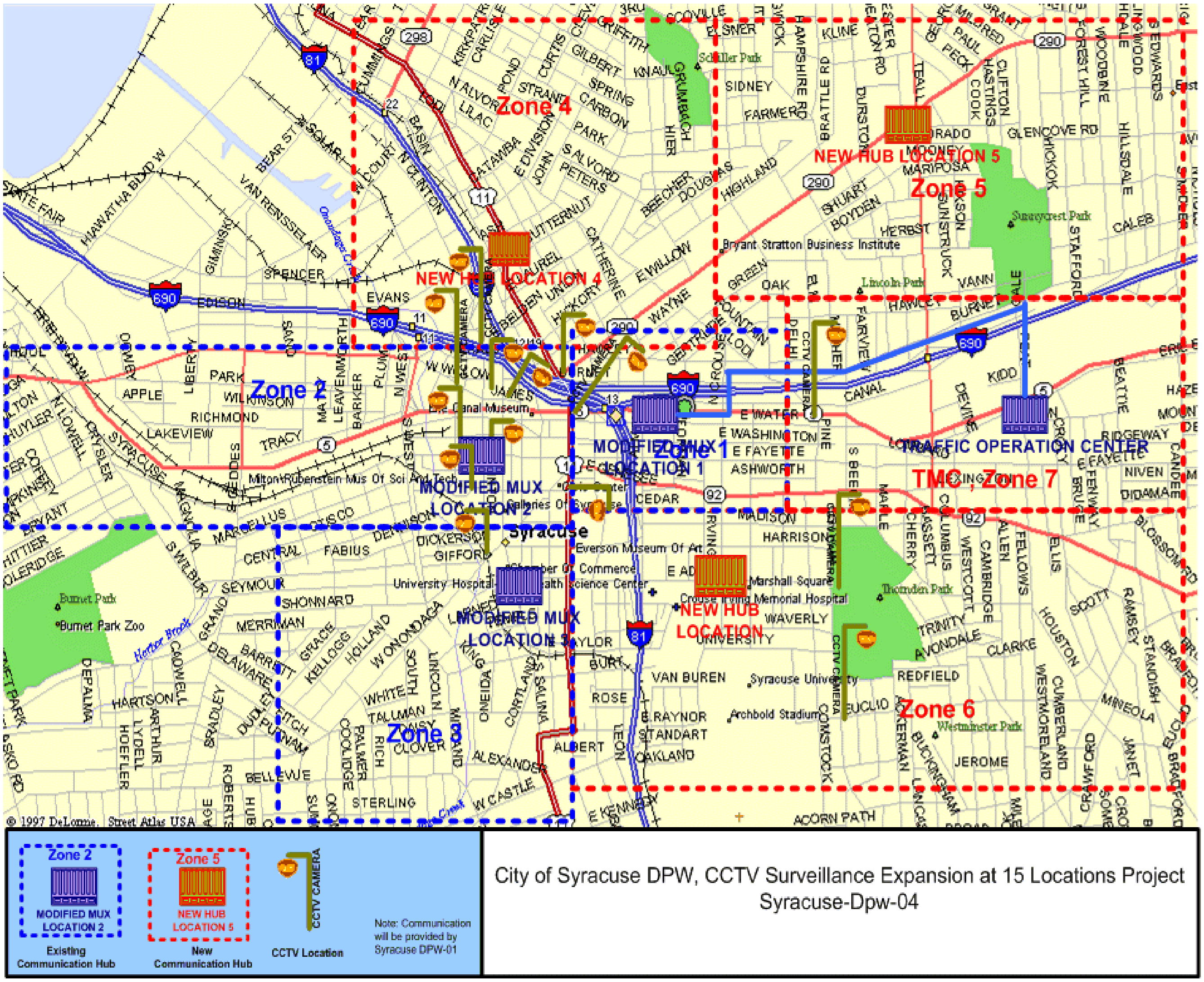


FIGURE 13

Expansion of Signal System Coverage - The recommended signal system expansion project considers the following two separate categories of intersections.

- The first category of intersections are those that are in the vicinity of the interconnect system and they are part of a corridor that traffic flow is in need of improvement and integration. These corridors are grouped under various projects that include upgrading of controllers at all intersections as well as integrating/extending the fiber communication to the Interconnect system and placement of cameras at critical locations. A total of five corridor-based projects are recommended that include the addition of forty intersections to the

Interconnect system in the Short-Term and thirty-eight more intersections in the mid-term period.

City DPW-02 project will upgrade twenty-four intersections along Geddes and Genesee streets as shown in Figure 14 in Short-Term period.

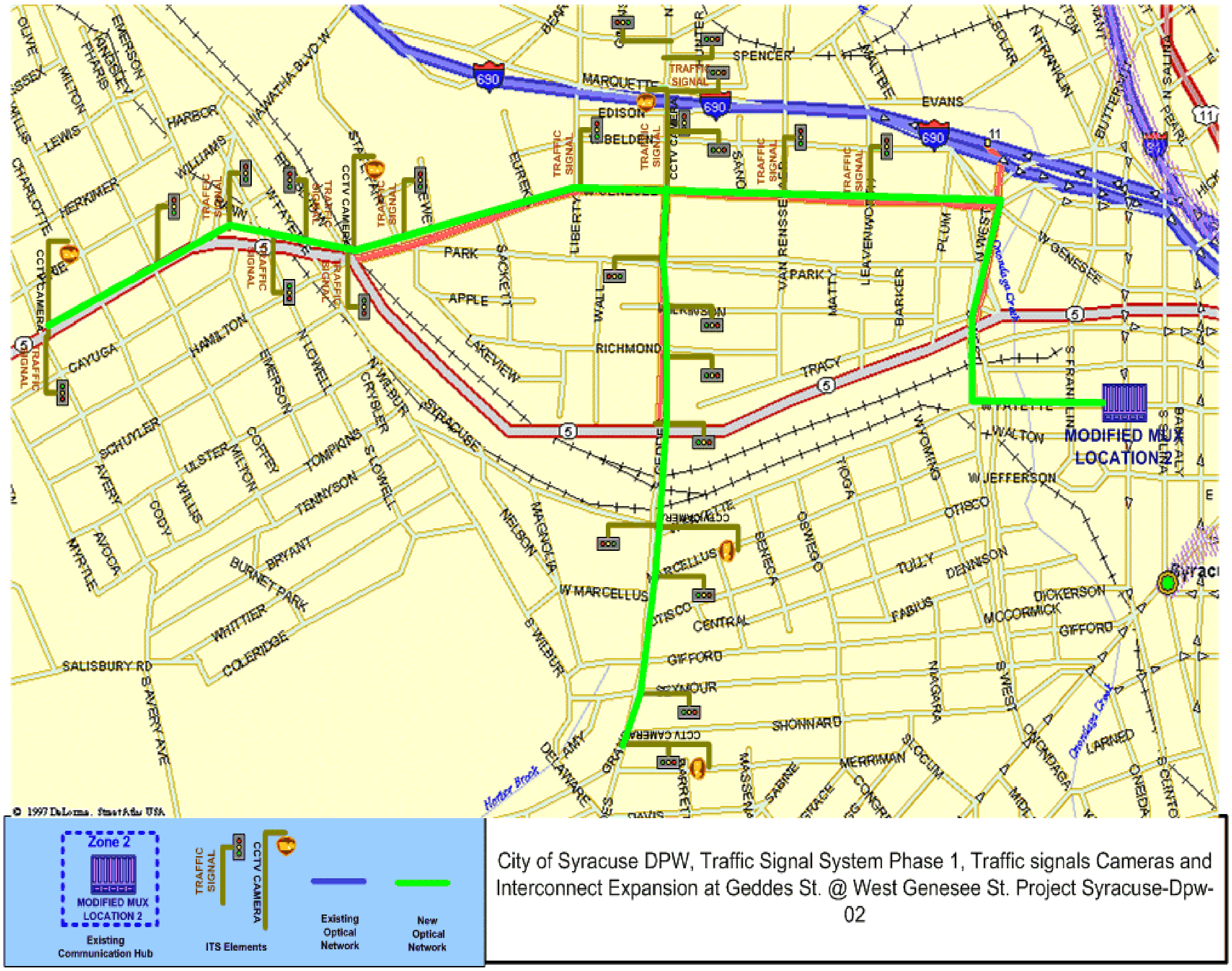
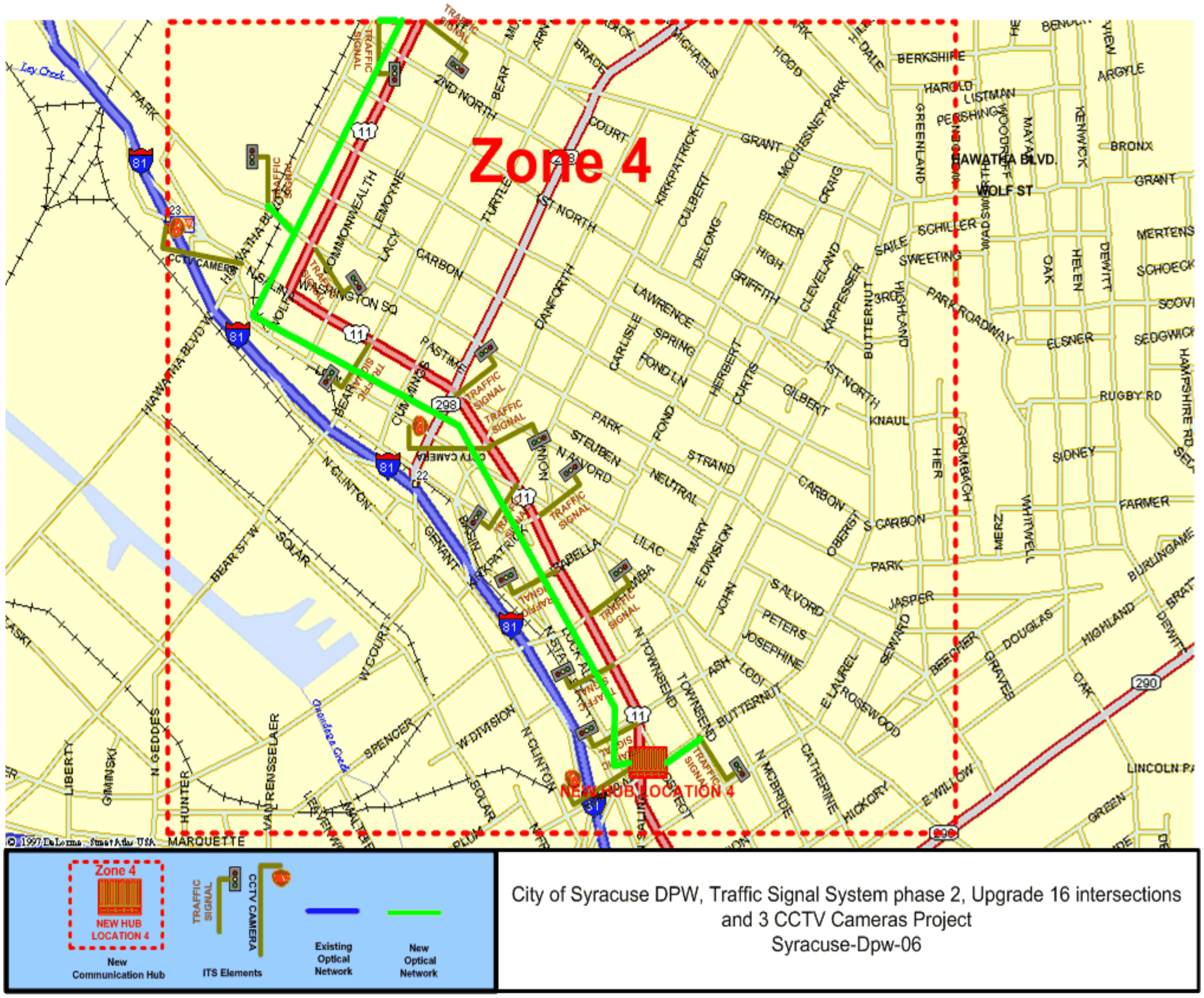


FIGURE 14

Also, for the Short-Term deployment time frame, the City DPW-06 project recommends deployment of sixteen additional intersections as shown in Figure 15.



City of Syracuse DPW, Traffic Signal System phase 2, Upgrade 16 intersections and 3 CCTV Cameras Project
Syracuse-Dpw-06

FIGURE 15

City DPW-13 project is recommended for mid-term deployment at nine congested intersections as shown in Figure 16.

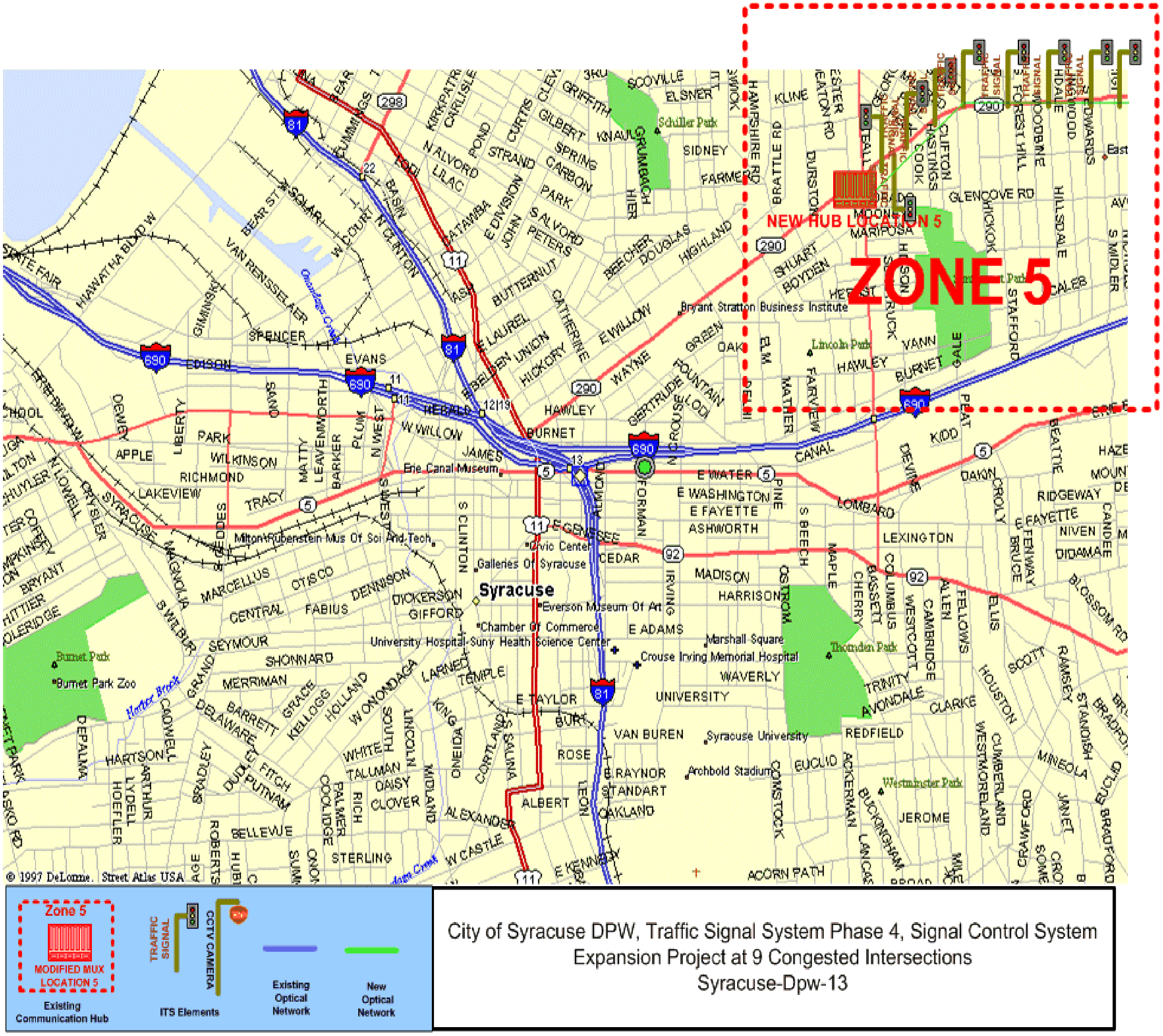


FIGURE 16

Figure 17 shows the location of eighteen additional intersections recommended for mid-term deployment as part of the City DPW-14 project.

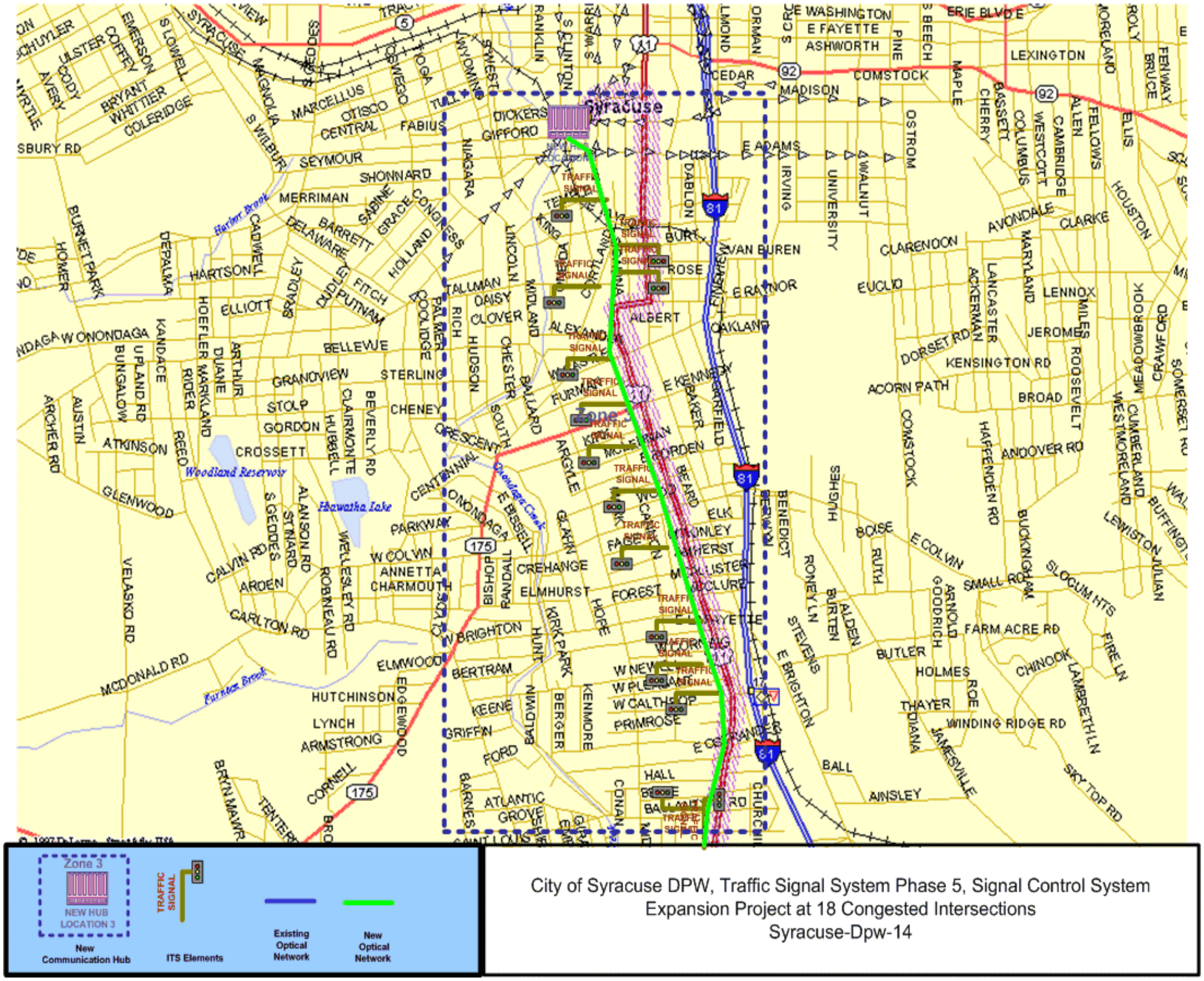


FIGURE 17

The City DPW-19 project recommends Mid-Term deployment at eleven intersections as shown in Figure 18. Additionally, 66 intersections will be upgraded and integrated into the system as part of the recommended City DPW-20 project for mid-term deployment. Finally, the remaining seventy-three intersections will be scheduled for Long-Term deployment as part of the recommended City DPW-21 project.

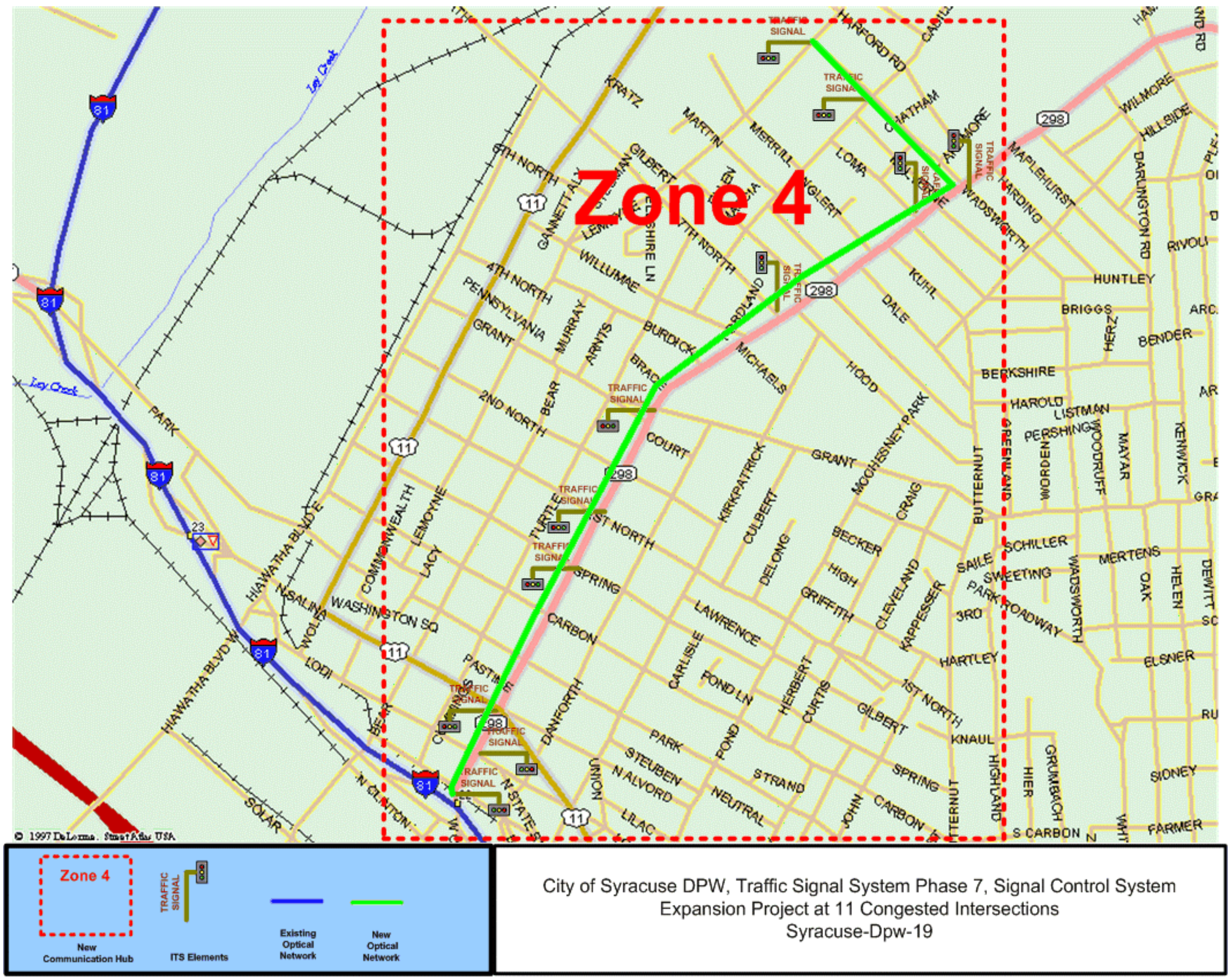
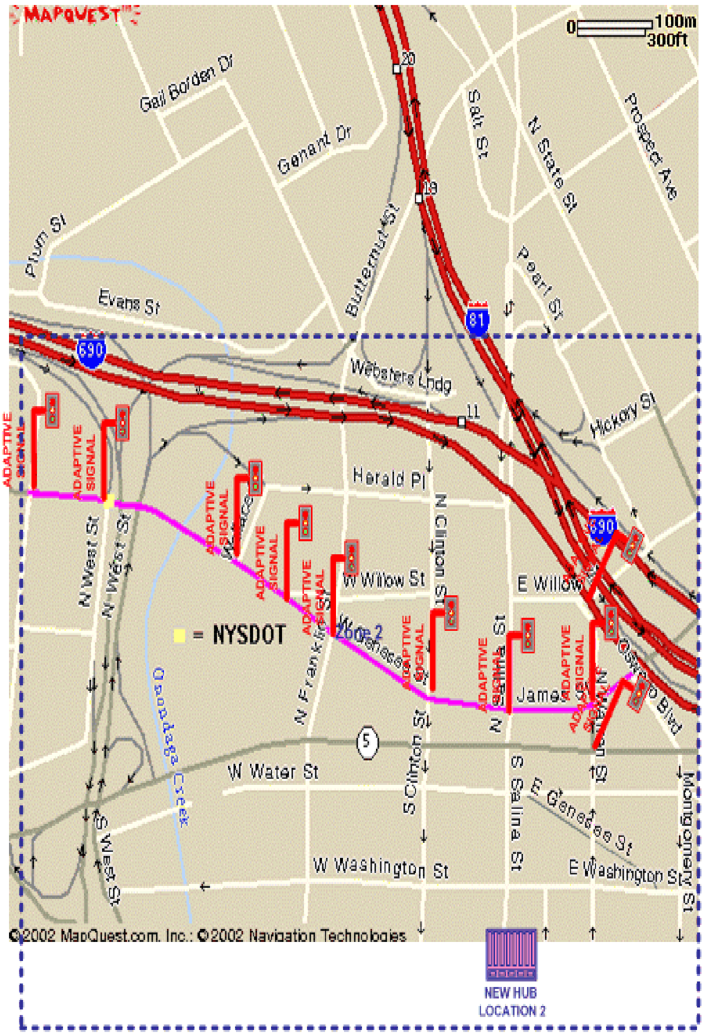
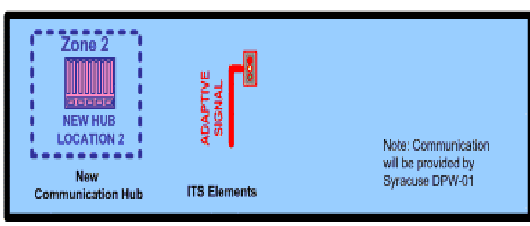


FIGURE 18

- The second category of projects includes intersections that are part of one or more critical corridors where traffic flow is unpredictable and fluctuates. For such corridors, an adaptive signal system is recommended where detectors on the roadway determine the magnitude of traffic fluctuations and signal timing and patterns are calculated accordingly on each cycle basis. The study recommends two adaptive signal system projects. The City DPW-10 project recommends Short-Term deployment of adaptive signal system at ten intersections as shown in Figure 19.





City of Syracuse DPW, Traffic Signal System Phase 3, Adaptive Signal Control System Pilot Project
Syracuse-Dpw-10

FIGURE 19

The second recommended adaptive signal system project, City DPW-17, is recommended for mid-term deployment at twenty intersections as shown in Figure 20.

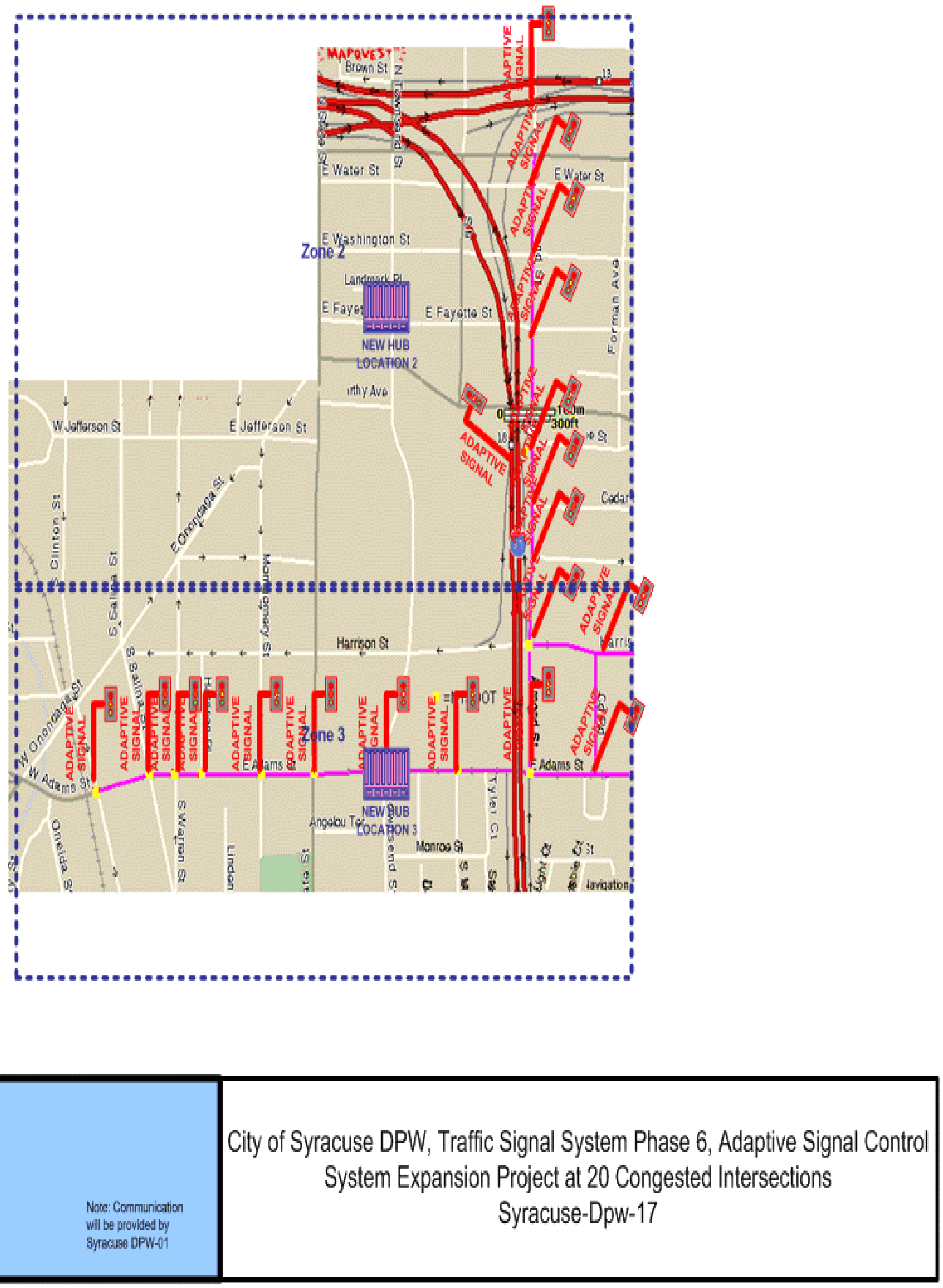


FIGURE 20

Variable Message Signs – The study recommends the Short-Term procurement of four portable Dynamic Message Signs, City DPW-08 project, for use in various locations during construction activities, incidents and special events.

Pedestrian Safety – The pilot project City DPW-11 is recommended for Short-Term deployment at nine high-accident intersections and school locations to test the feasibility of installing pedestrian safety technologies.

Automatic Vehicle Location – CNYRTA is the only agency in the process of deploying the AVL system. CNYRTA's system has expansion capabilities to include other agencies. It is recommended to expand the CNYRTA's system to provide AVL functions to the City DPW maintenance fleet. The study recommends the City DPW-07 pilot project to deploy AVL on ten maintenance fleets in the Short-Term and City DPW-15 to expand the coverage to fifteen additional fleets in the mid-term period.

Parking Management - The study recommends two Long-Term pilot projects to evaluate the application of technologies to better manage parking facilities and operations. The first project, City DPW-22, builds a Geo-based parking lot and garage locations and capacity database and the second project, City DPW-23, provides off-street parking management and information system.

Internal & External Information Sharing Network – The study recommends using the Regional Information Sharing network (NYSDOT sponsored project) to share construction, accidents and special events information with other internal as well as external agencies.

Operations and Maintenance Cost – In order to maintain and operate any ITS equipment, it is vital to allocate budget for such cost. The cost is comprised of: software and hardware upgrade and maintenance cost; TMC staffing cost; utility and other direct cost; and the maintenance cost of field equipment.

Experience tells us that annual O&M costs for a system are approximately 10% of the deployed cost of the system. The O&M cost are budgeted as three separate projects; City DPW-09 (Short-Term cost, first five years), City DPW-18 (Mid-Term cost, years six through ten) and, City DPW-24 (Long-Term cost).

Deployment Time Frame

Short-Term Projects - Recommended Short-Term projects will focus on deployments within the next five years. A total of eleven projects are recommended for deployment with a total capital cost of about $8.7M. In addition, at the end of all deployments, the annual O&M cost of will be about $658k.

Mid-Term Projects - A total of nine projects were defined for deployment within the six to ten years time frame. The capital cost of these projects will total at about $6.9M with the annual cost of $1.1M to operate and maintain all systems.

Long-Term Projects - The Long-Term projects are to be deployed between year eleven and year twenty. A total of four projects have been identified at a capital cost of $10.2M with the annual cost of $1.5M to operate and maintain all systems.

Overall Projects - The total cost of the twenty-four recommended projects for the City of Syracuse DPW is estimated to be $ 26M.

Table 5 lists all City DPW recommended projects broken down by; recommended time frame for deployment, National Architecture relationship, associated components and/or technologies, pre-requisite projects, locations, estimated capital and O&M costs and associated benefits.

Table 6 shows the detailed cost breakdown table that includes the cost of; network/communication, central software and hardware, field equipment, interface, capital and operations and maintenance.

Finally, the O&M cost broken down for the various deployment terms (Short-Term, mid-term and Long-Term) are listed in Table 7.

Table 5 - Recommended ITS Projects for City of Syracuse Department of Public Work

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship		Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost (X $1,000)					Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
										Capital				Ann.				
				NITSA Subsystem	NITSA Market Packages					Components	Engineering & Inspection (E&I)	Total	Service &I Operation	Maintenance Repaired				
1	Syracuse DPW-01	The Citywide Traffic Signal Communication Network Design	Short Term	TMC	Not Applicable	Evaluate and design of the city communication infrastructures including Fiber Optic Network, Digital communication Systems	Syracuse DPW 3	Expansion of Communication system to coverage the new ITS locations (CCTV and Intersections).	0	$ 200,000	0	0	$ -	$ -	B,C	Expansion of the traffic signal communication network to cover the remained city with 4 new communication zones.		
2	Syracuse DPW-02	Traffic Signal System Phase 1, Traffic signals Cameras and Interconnect Expansion at Geddes St. @ West Genesee St.	Short Term	TMS	Surface Street Control (ATMS03), Network Surveillance (ATMS01), Incident Management System (ATMS08)	Traffic Signs , , Communication Links, CCTV	none	24 Intersection: **Genesee** @ Levonworth, Van Renselaer, Geddes, Liberty, Statefair, Erie, Fayette, Emerson, Milton, Willis, Avery **Geddes** @ Kirpatrik / spencer, I690 WB off ramp, Belden, Park, Richmond, Erie, Fayette, Otisco, Gifford, Seymour, Shonnard/Grand, Delaware **Grand** @ Delaware and 5 CCTV Locations are Genesy junctions with (1) Avery, (2) Erie, (3) Geddes and Geddes junctions with (4) Fayete and (5) Shonnard.	2,860,000	$ 2,860,000	0	2,860,000	$ 11,520	$ 57,200	B,C			25 Intersections, 5 CCTV and F/O Interconnections are recommend to be added to Traffic Signal System. This project is on the TIP project for the year 2004/2005
3	Syracuse DPW-03	Modification of Traffic Signal Communication Network	Short Term	TMC	Not Applicable	communication Backbone, Fiber Optic Devices	none	City Existing Traffic Signal, Interconnect	0	$ 546,200	120,164	666,364	$ 240	$ 910	B,C	**Modification of existing fiber optic network to reach more capacity and distribution. The existing fiber optic component will be modified and network backbone will be implied. Three new communication hubs and three new fiber optic single mode cable are considered for this project.**		

Table 5 - Recommended ITS Projects for City of Syracuse Department of Public Work

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship		Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost (X $1,000)					Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
										Capital				Ann.				
				NITSA Subsystem	NITSA Market Packages					Components	Engineering & Inspection (E&I)	Total	Service &I Operation	Maintenance Repaired				
4	Syracuse DPW-04	CCTV Surveillance Expansion at 15 Locations	Short Term	TMS	Network Surveillance (ATMS01)	CCTV, Central Hardware/Software, Center-to-Field Communications	Syracuse DPW 01 and 05	15 locations: 1- Clinton & W Genesee, 2- James & N Salina, 3- E Fayette & Warren, 4- Franklin & W Fayette, 5- State & Erie, 6- James & State, 7- Euclid & Comstock, 8- Franklin & Genesee, 9- State & Jefferson, 10- State & Butternut, 11- Adams & Comstock, 12- Harrison & Salina, 13- Butternut & Franklin, 14- Erie & Walnut and 15- Jefferson & Clinton	0	$ 1,235,000	271,700	1,506,700	$ 7,200	$ 14,380	B,C	Estimated capital cost of $ 35,000 for each site.		
5	Syracuse DPW-05	Existing Traffic Signal System Upgrade	short term	TMS	Surface Street Control (ATMS03)	- Central hardware / software - Center-to-field communications	none	TMC	0	$ 155,000	0	155,000	$ -	$ 3,100	B,C	Upgrade MIST Central System.	Early Action	
6	Syracuse DPW-06	Traffic Signal System phase 2, Upgrade 16 intersections and 3 CCTV Cameras	Short Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	Syracuse DPW 01 and 05	16 intersections: Salina @ 1- Ash, 2- Division, 3- Catawba, 4- Isabella, 5- Danforth, 6- Court, 7- Bear, 8- Wolf, 9- Hiawatha / I81 Park @ 10- Wolf, 11- Hiawatha, Hiawatha @ 12- Tex Simone, 13- Grant, Butternut @ 14-lodi, Wolf @ 15- Tex Simone, 16- Grant. AND Three CCTV locations, which are, Salina junctions with Butternut, Kirpatrick and Wolf	0	$ 1,728,300	380,226	2,108,526	$ 7,680	$ 34,566	B,C	Upgrade 16 controlled intersections to the central control system.(see St., North Salina and Lodi St.		
7	Syracuse DPW-07	Vehicle Fleet Administration Pilot Project (with Sanitation Dept.)	Short Term	TMS	Fleet Administration (CVO1)	- GPS AVL - Central hardware / software - Wide area mobile communications	Syracuse DPW 01 and 05	snow removal vehicles	0	$ 220,000	48,400	268,400	$ -	$ 4,400				
8	Syracuse DPW-08	Primary Arterial VMS Deployment	Short Term	TMS	En-Route Roadway Traveler Information Dissemination (ATMS06)	- VMS - Central hardware/software - Center-to-field communications		4 Portable VMS	0	$ 320,000	70,400	390,400	$ 1,920	$ 14,504	B,C			

Table 5 - Recommended ITS Projects for City of Syracuse Department of Public Work

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost (X $1,000) Capital: Components	Estimated Cost (X $1,000) Capital: Engineering & Inspection (E&I)	Estimated Cost (X $1,000) Capital: Total	Estimated Cost (X $1,000) Capital: Service &I Operation	Estimated Cost (X $1,000) Ann.: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
9	Syracuse DPW-09	TMC Operation and Maintenance Phase I, Short Term	Short Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff		TMC and associated subsystems	?	$ -	0	0	$ 274,500	$ 189,500	B,C	Estimated annual TMC cost to operate and maintain short, mid, and long term projects. It is assumed that the Syracuse TMC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		
10	Syracuse DPW-10	Traffic Signal System Phase 3, Adaptive Signal Control System Pilot Project	Short Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software		10 intersections at: 1- James & Oswego 2- James & Warren 3- Warren & Water 4- Warren & Erie 5- James & Genesee & Salina 6- Genesee & Clinton 7- Genesee & Franklin 8- Genesee & Wallace 9- Genesee & West (NYSDOT) 10- Genesee & Plum	0	$ 387,000	85,140	472,140	$ 4,800	$ 7,740		A Pilot project on adaptive signal control		
11	Syracuse DPW-11	Pedestrian Safety Systems Project	Short Term	TMS	Intersection / Grade Crossing / Pedestrian / Bicyclist Safety Warning (AVSS05)	- Pedestrian sensors - Warning signals - Misc.	Syracuse DPW-03, 05	9 high accident intersections and school locations. Pedestrian Safety project locations · Almond & Adams NYSDOT · Almond & Harrison NYSDOT · Adams & CD(Sara Lougan) · Adams & Eliz Blackwell · Harrison & Harrison pl · Butternut & State · Butternut & Salina · State & Salina · Salina & Laurel	0	$ 205,000	45,100	250,100	$ 16,800	$ 7,000				

Table 5 - Recommended ITS Projects for City of Syracuse Department of Public Work

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship		Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost (X $1,000)					Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
										Capital			Ann.					
				NITSA Subsystem	NITSA Market Packages					Components	Engineering & Inspection (E&I)	Total	Service &I Operation	Maintenance Repaired				
12	Syracuse DPW-12	City Traffic Management Center Relocation to PSB.	Mid Term	TMS	Regional Transportation Control (ATMS07), Multi-modal Coordination (APTS7), Integrated Transportation Management (ATIS 6), Probe Surveillance (ATMS 02),	- Central hardware / software - Reruting the head-end communication cables,	none	TMC	0	$ 210,000	46,200	256,200	$ 2,400	$ 4,200	B,C			
13	Syracuse DPW-13	Traffic Signal System Phase 4, Signal Control System Expansion Project at 9 Congested Intersections	Mid Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	Syracuse DPW-01, 03	1)'GRANT & JAMES & SHOTWELL, James and 2) 'HICKOK 3) MARLBOROUGH, 4) NORTH, LILLIAN 5) COLLINGWOOD 6) MIDLER 7) HOMECROFT, 8)LAMSON, 9)PLYMOUTH	0	$ 972,300	213,906	1,186,206	$ 4,320	$ 19,446			map not correct	
14	Syracuse DPW-14	Traffic Signal System Phase 5, Signal Control System Expansion Project at 18 Congested Intersections	Mid- Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors CCTV system - Central hardware / software - Center-to-field communications - F/O Network	Syracuse DPW-01, 03	1) SALINA & TAYLOR, 2) BURT & CORTLAND & SALINA, 3) RAYNOR & SALINA, 4) CASTLE & SALINA, 5) KENNEDY & SALINA, 6) COLVIN & SALINA, 7) BRIGHTON & SALINA, 8) NEWELL & SALINA, 9) CALTHROP & SALINA, 10) MATSON & SALINA, 11) BALLANTYNE & SALINA & WALWRATH, 12) DAWES & SALINA, 13) CASTLE & STATE, 14) KENNEDY & STATE, 15) COLVIN & STATE, 16) CASTLE & CORTLAND, 17) ASTLE & OAKWOOD, 18)CORTLAND & TALLMAN	0	$ 1,450,600	319,132	1,769,732	$ 9,600	$ 29,012	B,C	Upgrade an additional 40 intersections to the central control system.		
15	Syracuse DPW-15	Snow Removal Vehicle Location System (interagency with Sanitation Dept.)	Mid Term	TMS	Fleet Administration (CVO1)	- GPS AVL - Central hardware / software - Wide area mobile communications	Syracuse DPW-07	snow removal vehicles	0	$ 230,000	50,600	280,600	$ 7,200	$ 4,600	B,C	Deploy GPS AVL on 10 snow removal vehicles.		AVL on how many ? What type of vehicle? Short term vs. midterm? Stand alone or use Centro?

Table 5 - Recommended ITS Projects for City of Syracuse Department of Public Work

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost (X $1,000) Capital: Components	Engineering & Inspection (E&I)	Total	Service &I Operation	Ann.: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
16	Syracuse DPW-16	Enhance Syracuse WWW Site	Mid Term	ISP	Interactive Traveler Information (ATIS02)	- Central hardware / software - ISP-to-TMS communications	none	TMC	0	$ 100,000	22,000	122,000	$ -	$ 2,000		Provide real-time transportation information and video footage on the WWW site.		
17	Syracuse DPW-17	Traffic Signal System Phase 6, Adaptive Signal Control System Expansion Project at 20 Congested Intersections	Mid Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	Syracuse DPW-01, 03, 10	20 intersections at: 1- Erie & Almond 2- Water & Almond 3- Washington & Almond 4- Fayette & Almond 5- Genessee & Almond 6- I 81 off ramp @ Harrison & Almond (NYSDOT) 7- Harrison & Almond (NYSDOT) 8- Adams & almond (NYSDOT) 9- Harrison & Irving 10- Harrison & CD(Sara Lougan) 11- Adams & CD(Sara Lougan) 12- Adams & Irving 13- Adams & McBride (NYSDOT) 14- Adams & Townsend (NYSDOT) 15- Adams & State (NYSDOT) 16- Adams & Montgomery (NYSDOT) 17- Adams & Harrison pl (NYSDOT) 18- Adams & Warren (NYSDOT) 19- Adams & Salina (NYSDOT) 20- Adams & Clinton (NYSDOT)	0	$ 624,000	137,280	761,280	$ 9,600	$ 12,480				
18	Syracuse DPW-18	TMC Operation and Maintenance Phase II, Mid Term	Mid Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff	none	TMC and associated subsystems	0	$ -	0	0	$ 445,500	$ 279,000	B,C	Estimated annual TMC cost to operate and maintain mid term projects. It is assumed that the Syracuse TMC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		Maintenance cost allocated in each construction project

Table 5 - Recommended ITS Projects for City of Syracuse Department of Public Work

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost (X $1,000) Capital: Components	Engineering & Inspection (E&I)	Total	Service &I Operation	Ann.: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
19	Syracuse DPW-19	Traffic Signal System Phase 7, Signal Control System Expansion Project at 11 Congested Intersections	Mid Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	Syracuse DPW-01, 03	11 intersections at: Court St Corridor: Court @ Lodi, Park, North Spring Lillian 1st North Collingwood Grant Midler 7th North / Hood Homecroft Loma Plymouth Wadsworth Also Caddilac @ Wadsworth & Lemoyne @ Wadsworth	0	$ -	0	0	$ 5,280	$ 22,874				
20	Syracuse DPW-20	Traffic Signal System Phase 8, Signal Control System Expansion Project at 66 intersections	Mid Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	Syracuse DPW-01, 03	List is attached	0	$ 2,026,200	445,764	2,471,964	$ 31,680	$ 40,524				
21	Syracuse DPW-21	Traffic Signal System Phase 9, Signal Control System Expansion Project at 73 Intersections with Communication Interconnect	Long Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	Syracuse DPW-13,14	73 intersections as specified by DPW	0	$ 6,174,100	1,358,302	7,532,402	$ 35,040	$ 123,482	B,C	Upgrade an additional 73 intersections to the central control system.		
22	Syracuse DPW-22	Geo-based Parking Lot/Garage Location and Capacity Database	Long Term	TMS, Parking	Parking Management (ATMS13)	- GIS map - Central hardware / software		TMC (In coordination with the city Parking Authority)	0	$ 150,000	33,000	183,000	$ -	$ 3,000	B,C	Pilot Project to provide parking information on public and private facilities via the Internet. Project also involves a feasibility study for parking guidance. Cost is reduced if combined with project Syracuse DPW-14.		
23	Syracuse DPW-23	Off-street Parking Management and Information System	long Term	TMS, Parking	En-route Roadway Traveler Information Dissemination (ATMS06), Parking Management (ATMS13)	- Debit / credit card readers - Vehicle detectors - VMS - Central hardware / software - Center-to-field communications	Syracuse DPW-21	Major off-street parking lots/garages, Major Intersections	0	$ 1,994,000	438,680	2,432,680	$ 2,400	$ 39,880		Will utilize communications network being installed as part of ATMS projects. An advanced parkometer, 40 parking dynamic sign and central hardware and software are the project items.		

Table 5 - Recommended ITS Projects for City of Syracuse Department of Public Work

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost (X $1,000) Capital: Components	Estimated Cost (X $1,000) Capital: Engineering & Inspection (E&I)	Estimated Cost (X $1,000) Capital: Total	Estimated Cost (X $1,000) Capital: Service & Operation	Estimated Cost (X $1,000) Ann.: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
24	Syracuse DPW-24	TMC Operation and Maintenance Phase III, Long Term	Long Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff	none	TMC and associated subsystems	0	$ -	0	0	$ 505,500	$ 368,500	B,C	Estimated annual TMC cost to operate and maintain short, mid, and long term projects. It is assumed that the Syracuse TMC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		Maintenance cost allocated in each construction project
		Syracuse Department of Public Work		Subtotal for all Short Term Projects			11	projects	Mid Range	**7,856,500**	**1,021,130**	**8,677,630**	**324,660**	**333,300**				
									High-end	9,820,625	1,276,413	10,847,038	405,825	416,625				
									Low-end	5,892,375	765,848	6,508,223	243,495	249,975				
		Syracuse Department of Public Work		Subtotal for all Mid Term Projects			9	projects	Mid Range	**5,613,100**	**1,234,882**	**6,847,982**	**565,740**	**557,936**				
									High-end	7,016,375	1,543,603	8,559,978	707,175	697,420				
									Low-end	4,209,825	926,162	5,135,987	424,305	418,452				
		Syracuse Department of Public Work		Subtotal for all Long Term Projects			4	projects	Mid Range	**8,318,100**	**1,829,982**	**10,148,082**	**663,180**	**813,798**				
									High-end	10,397,625	2,287,478	12,685,103	828,975	1,017,248				
									Low-end	6,238,575	1,372,487	7,611,062	497,385	610,349				
		Summary		Grand Total			24	projects	Mid Range	**21,787,700**	**4,085,994**	**25,673,694**						
									High-end	27,234,625	5,107,493	32,092,118						
									Low-end	16,340,775	3,064,496	19,255,271						

[2] E&I costs include preliminary through final engineering, inspection, and other (e.g., construction engineering) costs; estimated at 22 percent of component costs

Table 6 City of Syracuse Traffic Operation Center Operation and Maintenance Cost Estimate

Item No.	Project No.	Project Name	Time Frame	Operation					Maintenance					Operation Cost (Yearly)	Operation Cost (5 Years)	Maintenance Cost	Maintenance Cost (5 Years)
				TMC Manager	System Traffic, Engineer	Operator	Technician	Utilitites	Supervisor	Technician	Transportation	Equipment	Miscellaneous				
10	Syracuse DPW-10	TMC Operation and Maintenance Phase I, Short Term	Short Term	0	1	2	1	1000	1	1	$ 1,000	$ 10,000	$ 10,000	$ 274,500	$ 1,372,500	$ 189,500	$ 947,500
18	Syracuse DPW-18	TMC Operation and Maintenance Phase II, Mid Term	Mid Term	1	1	3	1	1500	1	2	$ 2,000	$ 20,000	$ 10,000	$ 445,500	$ 2,227,500	$ 279,000	$ 1,395,000
24	Syracuse DPW-24	TMC Operation and Maintenance Phase III, Long Term	Long Term	1	1	4	1	1500	1	3	$ 3,000	$ 30,000	$ 10,000	$ 505,500	$ 2,527,500	$ 368,500	$ 1,842,500

Table 7 City of Syracuse Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenabnce Services Repair Estimate				Project Construction Cost Estimate	Yearly Operation Service Cost	Yearly Maintenance Repair Cost	NOTES
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support				
City of Syracuse Department of Public Work																						
1	Syracuse DPW-01	The Citywide Traffic Signal Communication Network Design	Communication network Study for developing the city traffic signal communication master plan. The plan will include the fiber optic network expansion phasing, communicattion backbone and infrastructures expansion.	200	1														$ 200,000	$ -	$ -	Note: (1) Expansion of fiber optic/infrastructures network to city area as part of different raffic signal expansion phasing. Hub locations are considered in this estimate.(2) develop the communication system expansion plan.
2	Syracuse DPW-02	Traffic Signal System Phase 1, Traffic signals Cameras and Interconnect Expansion at Geddes St. @ West Genesee St.												24	0	0	960	4766.67	$ 2,860,000	$ 11,520	$ 57,200	Tip project schedule for 2003-2004
3	Syracuse DPW-03	Modification of Traffic Signal Communication Network	Install new SM fiber on the existing duct for the new Hubs	42	**3**	Operation Room Modification	75	1	Backbone Equipment and central communication equipments	30 100	**6** **1**	CCTV Display Modules Upgrade and expand	64	1	0	0	240	910.333	$ 546,200	$ 2,880	$ 10,924	
4	Syracuse DPW-04	CCTV Surveillance Expansion at 15 Locations	fiber optic interconnection (20 miles)	42	3	Switching Expansion	50	1	Video Interface	3	15	CCTV Field Equipment	33.6	15	0	0	600	1198.33	$ 1,235,000	$ 7,200	$ 14,380	
5	Syracuse DPW-05	Existing Traffic Signal System Upgrade	Modified Hardware	10	3	MIST Upgrad modification of the database	110	1	Upgrading the Communication Interfaces	15	1		0	0	0	0	0	258.333	$ 155,000	$ -	$ 3,100	
6	Syracuse DPW-06	Traffic Signal System phase 2, Upgrade 16 intersections and 3 CCTV Cameras	fiber optic interconnection (5 miles)	212	5	Central Integration	60	1	Data Interface	3	16	Traffic Signal Upgrading	28.7 33.7	16 3	0	0	640	2880.5	$ 1,728,300	$ 7,680	$ 34,566	
7	Syracuse DPW-07	Vehicle Fleet Administration Pilot Project (with Sanitation Dept.)				AVL or other Applications Modules with Access Modules	100	1	Data Interface	2	10	Vehicle Equipment	10	10	0	0	0	366.667	$ 220,000	$ -	$ 4,400	
8	Syracuse DPW-08	Primary Arterial VMS Deployment				Central application system	60	1	Data Interface	2	5	VMS Driver	50 50	4 1	0	0	160	1208.67	$ 320,000	$ 1,920	$ 14,504	Noe: (1) 4 VMS, 2 lines Matrix , are assumed in this cost estimate. (2) The proposed VMS will be connect to the traffic signal communication network. (3) 1 new device driver for the sign are considered in this estimate.
9	Syracuse DPW-09	TMC Operation and Maintenance Phase I, Short Term																	0	$ 274,500	$ 189,500	Note: See Operation and Maintenance sheet for details of these Estimates.

Table 7 City of Syracuse Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenabnce Services Repair Estimate				Project Construction Cost Estimate	Yearly Operation Service Cost	Yearly Maintenance Repair Cost	NOTES
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support				
10	Syracuse DPW-10	Traffic Signal System Phase 3, Adaptive Signal Control System Pilot Project				Central application system	100	1				Traffic Signal Modification	28.7	10	0	0	400	645	$ 387,000	$ 4,800	$ 7,740	Note: (1) total of 10 Intersections are considered in this estimate. (2) The proposed intersection will be modified with new controller, processing module, system loop detectors and System Seting. (3) It is assumed that intersection traffic signals and cabling will not be changeed. (4) The intersections are using the existing Communication network for connection to the network.
11	Syracuse DPW-11	Pedestrian Safety Systems Project										Ped. Detector Warning Sign	25 20	5 4	10	0	400	583.333	$ 205,000	$ 16,800	$ 7,000	Note: 20 intersection , equiped with Ped Sensors and 10 School crossing equipped with the Warning Signal, are assumed in this cost estimate.
12	Syracuse DPW-12	City Traffic Management Center Relocation to PSB.	Colocation Operation Room Furnishing	100	1	Communication rerutiing to new operation center.	100	1	network interfaces	5	2				0	0	200	350	$ 210,000	$ 2,400	$ 4,200	
13	Syracuse DPW-13	Traffic Signal System Phase 4, Signal Control System Expansion Project at 9 Congested Intersections	Install new SM fiber on the existing duct for the new Hubs	212	**3**	Central Integration	60	1	Traffic Signal or Video Optical Interfaces	2	9	Hub Nodes	28.7	9	0	0	360	1620.5	$ 972,300	$ 4,320	$ 19,446	
14	Syracuse DPW-14	Traffic Signal System Phase 5, Signal Control System Expansion Project at 18 Congested Intersections	fiber optic interconnection (4 miles)	212	4	Central Integration	60	1	Data Interface	2	13	Traffic Signal Upgrading	28.7	18	0	0	800	2417.67	$ 1,450,600	$ 9,600	$ 29,012	Note: the proposed signal systems will connecte to the existing communication networlk.
15	Syracuse DPW-15	Snow Removal Vehicle Location System (interagency with Sanitation Dept.)				AVL or other Applications Modules with Access Modules	50	1	Data Interface	2	15	Vehicle Equipment	10	15	0	0	600	383.333	$ 230,000	$ 7,200	$ 4,600	
16	Syracuse DPW-16	Enhance Syracuse WWW Site				Web System Modification	100	1									0	166.667	$ 100,000	$ -	$ 2,000	
17	Syracuse DPW-17	Traffic Signal System Phase 6, Adaptive Signal Control System Expansion Project at 20 Congested Intersections				Upgrade the Central Module	50	1				Traffic Signal Modification	28.7	20	0	0	800	1040	$ 624,000	$ 9,600	$ 12,480	Note: (1) total of 10 Intersections are considered in this estimate. (2) The proposed intersection will be modified with new controller, processing module, system loop detectors and System Seting. (3) It is assumed that intersection traffic signals and cabling will not be changeed. (4) The intersections are using the existing Communication network for connection to the network.
18	Syracuse DPW-18	TMC Operation and Maintenance Phase II, Mid Term																	$ -	$ 445,500	$ 279,000	Note: See Operation and Maintenance sheet for details of these Estimates.

Table 7 City of Syracuse Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenabnce Services Repair Estimate				Project Construction Cost Estimate	Yearly Operation Service Cost	Yearly Maintenance Repair Cost	NOTES
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repair Support				
19	Syracuse DPW-19	Traffic Signal System Phase 7, Signal Control System Expansion Project at 11 Congested Intersections	Install new SM fiber on the existing duct for the new Hubs	212	**3**	upgrade the communication equipment	20	8	Traffic Signal or Video Optical Interfaces	2	16	Hub Nodes	28.7	11	0	0	440	1906.17	$ 1,143,700	$ 5,280	$ 22,874	
20	Syracuse DPW-20	Traffic Signal System Phase 8, Signal Control System Expansion Project at 66 intersections							Traffic Signal or Video Optical Interfaces	2	66	Hub Nodes	28.7	66	0	0	2640	3377	$ 2,026,200	$ 31,680	$ 40,524	Note: the proposed signal systems will connected to the existing communication network.
21	Syracuse DPW-21	Traffic Signal System Phase 9, Signal Control System Expansion Project at 73 Intersections with Communication Interconnect	fiber optic interconnection (73/4 miles)	212	18	Central Integration	60	1	Data Interface	2	75	Traffic Signal Upgrading	28.7	73	0	0	2920	10290.2	$ 6,174,100	$ 35,040	$ 123,482	
22	Syracuse DPW-22	Geo-based Parking Lot/Garage Location and Capacity Database				Upgrading equipment	150	1					0	0	0	0	0	250	$ 150,000	$ -	$ 3,000	
23	Syracuse DPW-23	Off-street Parking Management and Information System				Central application system	150	1	Data Interface	2	60	Traffic Detector Ticket Machine VMS	28.7 25 40	20 30 10	0	0	200	3323.33	$ 1,994,000	$ 2,400	$ 39,880	Note: total of 60 Field devices are considered in this estimate. The field devices are using the existing Communication network for connection to the network.
24	Syracuse DPW-24	TMC Operation and Maintenance Phase III, Long Term													0	0	0	0	$ -	$ 505,500	$ 368,500	Note: See Operation and Maintenance sheet for details of these Estimates.

3.4 ONONDAGA COUNTY DEPARTMENT OF TRANSPORTATION

The general description of projects defined for the Onondaga County Department of Transportation are listed below and categorized by various functions.

Traffic Management Center – The County DOT-01 project is recommended to establish a TMC at the existing maintenance facility in the next five years and provide remote functionalities at the Civic Center and 911 Center to operate and maintain the ITS field equipment and system hardware and software.

Communications Network – Currently, there is a six-mile fiber network along Route 57. As additional closed loop signal systems are brought on board, it becomes essential to provide a communications network among intersections and with the TMC at the maintenance facility. Also, as more cameras will be deployed, the need for a County-owned communication media becomes more evident. Due to large spacing of intersections and coverage area, it becomes very expensive to build a County owned fiber optic network. The study recommends staged deployment of a wireless network. As additional closed loop signal systems are deployed, the study recommends installation of two or more wireless hubs for transmission of data and video among intersections and to the TMC. The recommended signal system expansion projects will also include deployment of a wireless hub network (County DOT-05, through County DOT-08). Finally, the County DOT-16 mid-term project is recommended to integrate and the deployed wireless communications network with the missing fiber optic cables or wireless links/zones and integrate all systems into the TMC at the maintenance facility.

Signal System Expansions - The Route 57 closed loop signal system project (County DOT-05) is the only ongoing ITS construction project in the county. This project will upgrade fourteen intersections field equipment including controllers and will connect them using fiber optic cables. The County DOT-03 project is recommended to install a centralized signal system software, as shown in Figure 21, at the maintenance facility to remotely manage the operations of all signals under this project, with the expansion capability to extend to other recommended closed loop systems. In addition, three additional closed loop signal systems as indicated below are recommended for the short-term deployment.

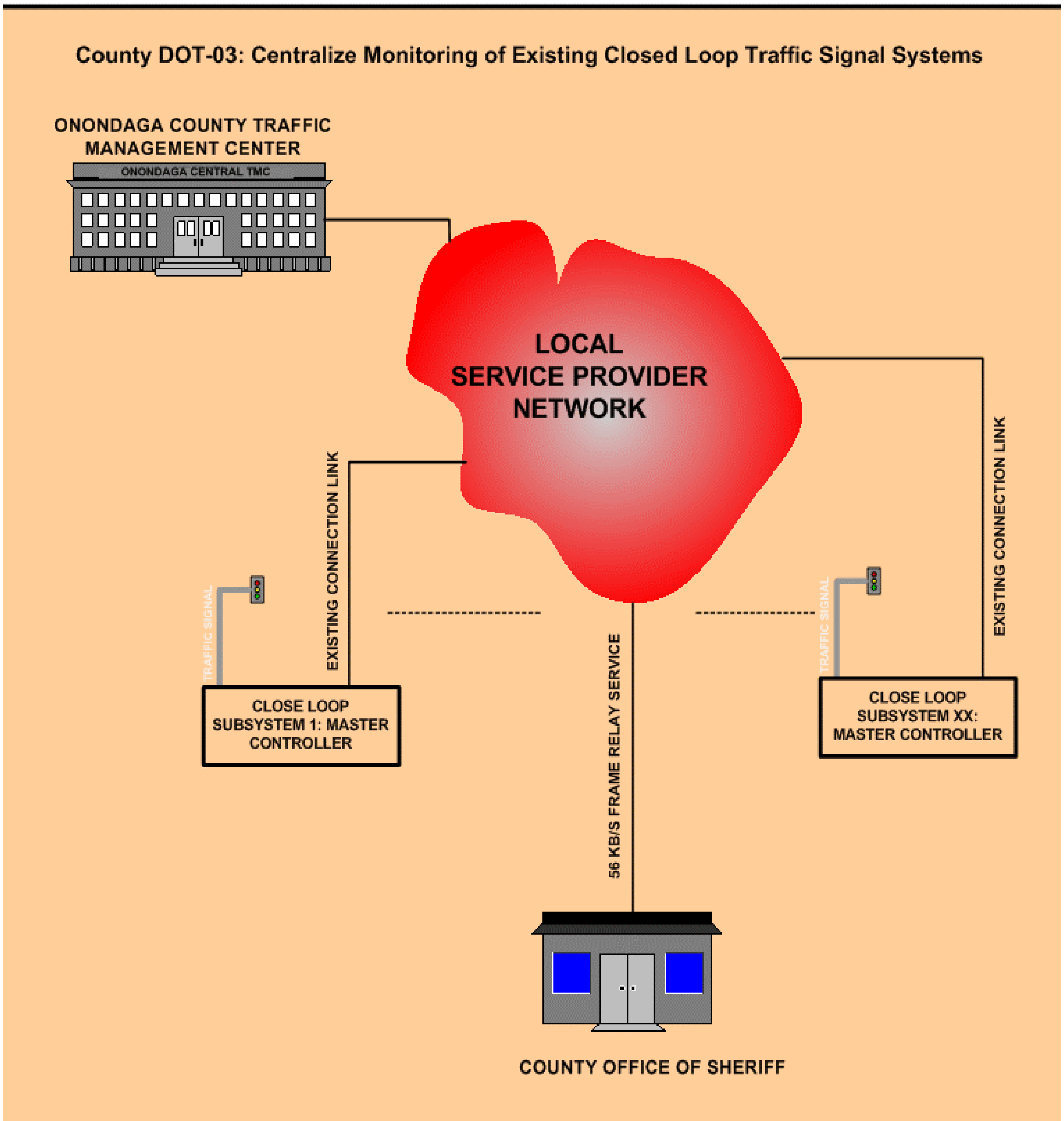
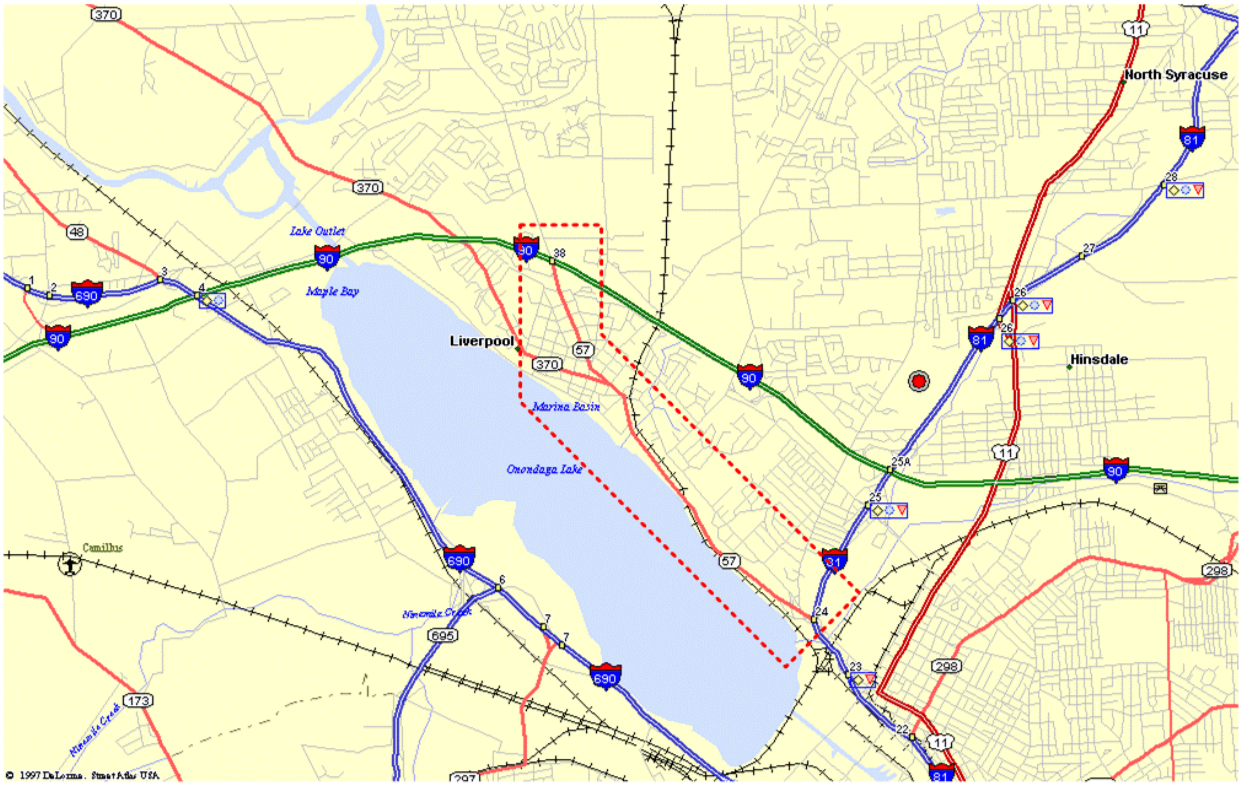

County DOT-03: Centralize Monitoring of Existing Closed Loop Traffic Signal Systems
ONONDAGA COUNTY TRAFFIC MANAGEMENT CENTER
ONONDAGA CENTRAL TMC
LOCAL SERVICE PROVIDER NETWORK
EXISTING CONNECTION LINK
TRAFFIC SIGNAL
CLOSE LOOP SUBSYSTEM 1: MASTER CONTROLLER
56 KB/S FRAME RELAY SERVICE
TRAFFIC SIGNAL
EXISTING CONNECTION LINK
CLOSE LOOP SUBSYSTEM XX: MASTER CONTROLLER
COUNTY OFFICE OF SHERIFF

FIGURE 21

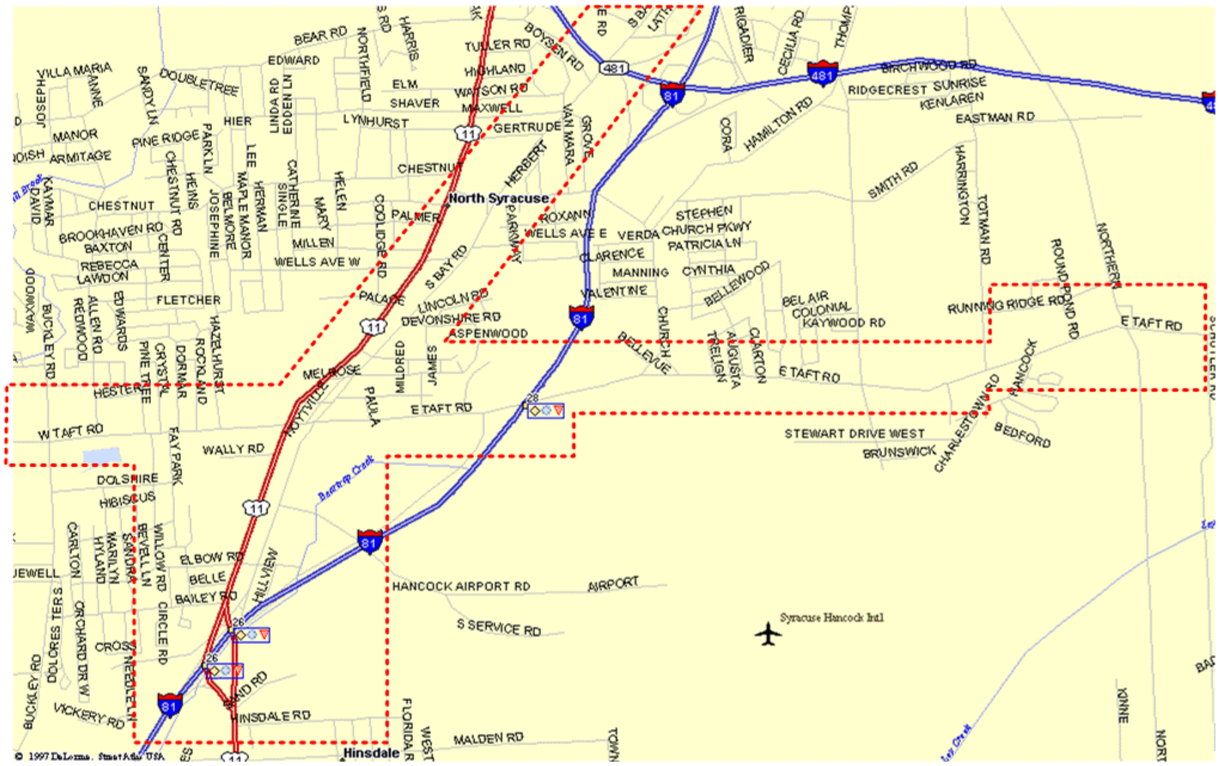
County DOT-06, Taft and South Bay Roads – this recommended Short-Term project will upgrade the equipment at seventeen intersections on both Taft Rd. and South Bay Rd. The approximate location of the project is shown in Figure 22. This project will include the deployment of three cameras and a connection through the County owned wireless network.



County DOT-05 - Signal System Phase 1 (Route 57)

FIGURE 22

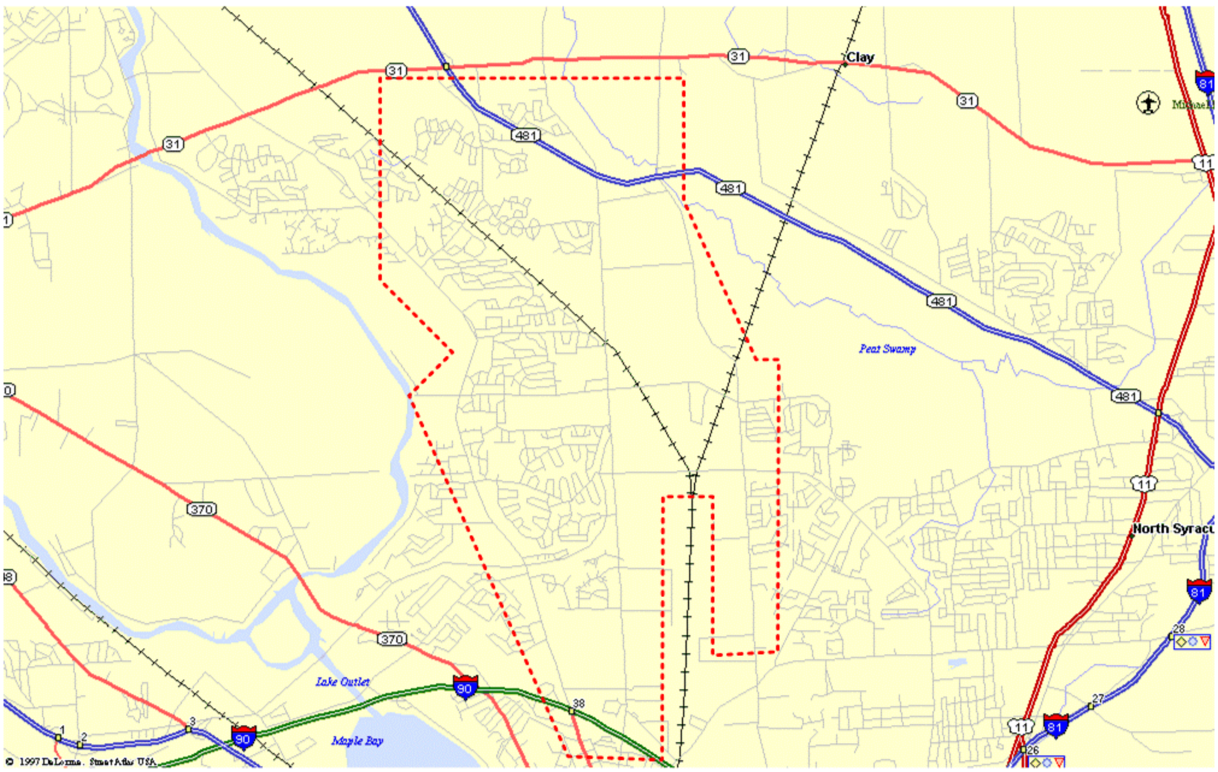
County DOT-07, Morgan and Glay Roads - The second recommended closed loop signal system project will include eleven intersections on Morgan and Glay roads. The approximate location of the project area is shown in Figure 3-23. This project will include installation of three cameras and deployment of two additional wireless hubs.



County DOT-06 - Signal System Phase 2 (South Bay Rd.and West and East Taft Rd)

FIGURE 23

County DOT-08, Electronics Pkway, Henry Clay Blvd., Hopkins Rd., Buckley Rd., Seventh North St. – The third recommended closed loop signal system project will include the installation of the system along twenty intersections. The approximate location of the project area is shown in Figure 24. This project will include the installation of two cameras and expansion of the wireless network hubs to accommodate communications needs.



County DOT-07 - Signal System Phase 3 (Buckley, Morgan, Henry Clay, Wetzeland Soule)

FIGURE 24

The existing signal controllers at most intersections are becoming obsolete. Two additional projects are recommended to upgrade the intersection controllers at a total of 60 intersections. The County DOT-09 will upgrade 30 controllers in Short-Term period and the remaining thirty intersections will be upgraded in mid-term period under the recommended County DOT-13 project.

Finally, a project is recommended to upgrade, integrate and coordinate inter-jurisdictional systems. At the current time, agencies believe, due to the large spacing of the intersections, such a project will not be needed. This project will be reevaluated later as agencies deploy more ITS equipment.

Portable Dynamic Message Signs (DMS) - The recommended County DOT-04 project will procure two portable dynamic signs for procurement in Short-Term period to disseminate proper construction, incidents and special events information to travelers.

Automatic Vehicle Location – The AVL technology is highly recommended for deployment on the County DOT fleet and snow vehicles. It is also recommended to enter into an agreement with the CNYRTA to expand their system to provide AVL functions to the County DOT. The recommended Short-Term County DOT-10 project will include the installation of AVL in 50 County-owned fleet vehicles. Two other projects are defined for mid-term deployment. County DOT-17 project will expand the AVL coverage on ten snow removal fleet vehicles and the County DOT-18 project will add another thirty County owned fleet vehicles to the AVL system.

Operations and Maintenance Cost – In order to maintain and operate any ITS equipment, it is vital to allocate budget for such cost. The cost is comprised of: software and hardware upgrades and maintenance cost; TMC staffing cost; utility and other direct cost; and the maintenance cost of field equipment.

Experience tells us that annual O&M costs for a system are approximately 10% of the deployed cost of the system. The O&M cost are budgeted as three separate projects; County DOT-02 (Short-Term cost, first five years), County DOT-12 (Mid-Term cost, years six through ten) and, County DOT-21 (Long-Term cost).

Bridge and Pavement Monitoring systems – in the Long-Term, two pilot projects are defined to install bridge structure remote monitoring systems at five critical bridges (County DOT-19) and deploy five pavement monitoring systems at critical locations (County DOT-20).

Deployment Time Frame

Short-Term Projects - Recommended Short-Term projects will focus on deployments within the next five years. A total of ten projects are recommended for deployment with a total capital cost of about $5.6M. In addition, at the end of all deployments, the annual O&M cost is estimated at $533K.

Mid-Term Projects - A total of eight projects were defined for deployment within the six to ten year time frame. The capital cost of these projects will total at about $3.5M. At the end of all deployments, it will cost $850K annually to operate and maintain all systems.

Long-Term Projects - The Long-Term projects are to be deployed between years eleven and twenty. A total of three projects have been identified at a capital cost of $972K. The Long-Term O&M annual cost is estimated at $1.1M.

Overall Projects - The total cost of the 21 recommended projects for Onondaga County Department of Transportation is estimated to be $10M in capital costs.

Table 8 lists all County DOT recommended projects broken down by: recommended time frame for deployment, National Architecture relationship, associated components and/or technologies, pre-requisite projects, locations, estimated capital and O&M costs and associated benefits.

Table 9 shows the detailed cost breakdown table that includes the cost of; network/communication, central software and hardware, field equipment, interface, capital and operations and maintenance.

Finally, the O&M cost broken down for the various deployment terms (Short-Term, mid-term and Long-Term) are listed in Table 10.

Table 8 - Recommended ITS Projects for County of Onondaga Department of Transportation

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Estimated Cost: Capital: Engineering & Inspection (E&I)	Estimated Cost: Capital: Total	Estimated Cost: Annual: Service Operation	Estimated Cost: Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
1	Onondaga DOT-01	County Traffic Management Center, Onondaga TMC	Short Term	TMS	En-Route Roadway Traveler Information Dissemination (ATMS06), Network Data Collection (ATMS01), Incident Management System (ATMS08)	- Central hardware maintenance - Software support - Operations & maintenance staff	none	TMC at the maintenance facility with remote at the Civic Center and 911 Center.	Not Available	$ 173,000	38,060	211,060	$ 15,602	$ 3,460	B,C			
2	Onondaga DOT-02	TMC Operation and Maintenance Phase I Short Term	Short Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff	Onondaga DOT-01	County TMC and associated subsystems	0	$ -	0	0	$ 147,000	$ 189,500	B,C			
3	Onondaga DOT-03	Centralize monitoring of Existing Closed Loop Traffic Signal Systems	Short Term	TMS	Surface Street Control (ATMS03)	- Central hardware / software - Center-to-field communications	Onondaga DOT-01	TMC	$ -	$ 202,000	44,440	246,440	$ 20,402	$ 4,040	B,C			
4	Onondaga DOT-04	Portable VMS	Short Term	TMS	Surface Street Control (ATMS03)	- Central hardware / software - Center-to-field communications - VMS Sign	Onondaga DOT-02	2 portable VMS										
5	Onondaga DOT-05	Signal System Expansion Phase 1	Short Term	TMS	Surface Street Control (ATMS03), Network Surveillance (ATMS01), Incident Management System (ATMS08)	Closed loop, 14 intersection, interconeect, conduit and fiber, about 6 miles, Peek 3000 and system included		Route 57	$ 2,500,000					???				Maintenance Cost
6	Onondaga DOT-06	Signal System Expansion Phase 2	Short Term	TMS	Surface Street Control (ATMS03), Network Surveillance (ATMS01), Incident Management System (ATMS08)	17 Traffic Signals , 3 CCTV and wireless network,	none	(South Bay Rd.and West and East Taft Rd)	Not Available	$ 947,300	208,406	1,155,706	$ 24,360	$ 17,146	B,C			

Table 8 - Recommended ITS Projects for County of Onondaga Department of Transportation

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Engineering & Inspection (E&I)	Total	Annual: Service Operation	Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
7	Onondaga DOT-07	Signal System Expansion Phase 3	Short Term	TMS	Surface Street Control (ATMS03), Network Surveillance (ATMS01), Incident Management System (ATMS08)	11traffic signals, 3 CCTV and wireless network	none	Buckley, Morgan, Henry Clay, Wetzel and Soule	Not Available	$ 740,300	162,866	903,166	$ 21,000	$ 13,006	B,C			
8	Onondaga DOT-08	Signal System Expansion Phase 4	Short Term	TMS	Surface Street Control (ATMS03), Network Surveillance (ATMS01), Incident Management System (ATMS08)	20 traffic signals, 2 CCTVs and wireless network	none	Electronics Pkway, Henry Clay Blvd., Hopkins Rd., Buckley Rd., Seventh North St.	Not Available	$ 1,007,200	221,584	1,228,784	$ 25,800	$ 18,344	B,C			
9	Onondaga DOT-09	Conversion of Old Traffic Controller Phase I	Short Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software		Conversion of 30 Intersections	0	$ 759,000	166,980	925,980	$ -	$ 15,180	B,C			
10	Onondaga DOT-10	Vehicle Fleet Administration (AVL Project) Phase I	Short Term	TMS	Fleet Administration (CVO1)	- GPS AVL - Central hardware / software - Wide area mobile communications	Onondaga DOT-01	50 County Vehicles	0	$ 760,000	167,200	927,200	$ 2,700	$ 15,200	B,C			
11	Onondaga DOT-11	Integration Traffic Signal System Upgrade - the State Signals Coordination control (Interagency Common mode Control)	Mid Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software - Center-to-field communications	Onondaga DOT-01, Onondaga DOT-10	Automated Coordination Control for other agencies Signals in the County	$ -	$ 210,000	46,200	256,200	$ 10,800	$ 4,200	B,C			
12	Onondaga DOT-12	TMC Operation and Maintenance Phase II Mid Term	Mid term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff	Onondaga DOT-01	County TMC and associated subsystems	0	$ -	0	0	$ 318,000	$ 279,000	B,C	check the overhead in the cost table		

Table 8 - Recommended ITS Projects for County of Onondaga Department of Transportation

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship		Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost					Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
										Capital			Annual	Annual				
				NITSA Subsystem	NITSA Market Packages					Components	Engineering & Inspection (E&I)	Total	Service Operation	Maintenance Repaired				
13	Onondaga DOT-13	Conversion of Old Traffic Controller Phase II	Mid Term	TMS	Surface Street Control (ATMS03)	- Traffic signal controllers - Loop detectors - Central hardware / software		Conversion of 30 Intersections	0	$ 759,000	166,980	925,980	$ -	$ -	B,C			
14	Onondaga DOT-14	Onondaga County WWW Site Enhancement (Traveler Information expansion module)	Mid Term	ISP	Interactive Traveler Information (ATIS02)	- Central hardware / software	none	TMC	$ -	$ 95,000	20,900	115,900	$ -	$ -	B,C			
15	Onondaga DOT-15	Onondaga County Travel Advisory - Create an Interface with the region ISP networks	Mid Term	ISP	Broadcast Traveler Information (ATIS01)	- Central hardware / software - ISP-to-ISP communications	none	TMC	$ -	$ 80,000	17,600	97,600	$ -	$ -				
16	Onondaga DOT-16	County Traffic Signal Communication Network enhancement	Mid- Term	Not Applicable	Not Applicable	Duct System Expansion, Fiber optic cable Distribution, Communications equipment	Onondaga DOT-01, 04, 05, 06, 07, 08, 09, 10, 20, 21, 22, 23	Countywide Area	0	$ 1,116,000	245,520	1,361,520	$ 3,360	$ 22,320	B,C	Pending the fiber option, this might be removed if signal projects go with radio in place of fiber		
17	Onondaga DOT-17	Snow Removal Vehicle Fleet Administration Pilot Project Phase 2	Mid Term	TMS	Fleet Administration (CVO1)	- GPS AVL - Central hardware / software - Wide area mobile communications	Onondaga DOT-01, 12	snow removal vehicles	$ -	$ 220,000	48,400	268,400	$ 4,800	$ 4,400	B,C	Deploy GPS AVL on 10 snow removal vehicles.		
18	Onondaga DOT-18	Vehicle Fleet Administration (AVL Project) Phase 3	Mid Term	TMS	Fleet Administration (CVO1)	- GPS AVL - Central hardware / software - Wide area mobile communications	Onondaga DOT-01	30 County Vehicles	0	$ 360,000	79,200	439,200	$ -	$ 7,200	B,C			
19	Onondaga DOT-19	Bridge Structure Remote Monitoring & Maintenance System	Long Term	TMS	Weather Sensing (ATMS11A)	- Weather sensors - Strain gauges - Central hardware / software - Center-to-field communications		5 locations	$ -	$ 414,100	91,102	505,202	$ 8,400	$ 8,282				

Table 8 - Recommended ITS Projects for County of Onondaga Department of Transportation

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship		Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost					Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
										Capital			Annual	Annual				
				NITSA Subsystem	NITSA Market Packages					Components	Engineering & Inspection (E&I)	Total	Service Operation	Maintenance Repaired				
20	Onondaga DOT-20	Pavement Monitoring at Critical Locations	Long Term	TMS	Weather Sensing (ATMS11A)	- Weather sensors - Strain gauges - Central hardware / software - Center-to-field communications	Onondaga DOT-01	5 locations	$ -	$ 382,500	84,150	466,650	$ 8,400	$ 4,882	B,C	Feasibility analysis and pilot demonstration project to support preventative maintenance of the infrastructure.		
21	Onondaga DOT-21	TMC Operation and Maintenance Phase III Long Term	Long Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff	Onondaga DOT-01	County TMC and associated subsystems	0	$ -	0	0	$ 445,500	$ 368,500	B,C	Estimated annual TMC cost to operate and maintain short, mid, and long term projects. It is assumed that the County TMC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		
		Onondaga County Department of Transportation	Subtotal for all Short Term Projects				10	projects	Mid Range	**4,588,800**	**1,009,536**	**5,598,336**	**256,865**	**275,876**				
									High-end	5,736,000	1,261,920	6,997,920	321,081	344,845	Component costs include hardware, firmware, software, integration, and communications costs			
									Low-end	3,441,600	757,152	4,198,752	192,649	206,907				
		Onondaga County Department of Transportation	Subtotal for all Mid Term Projects				8	projects	Mid Range	**2,840,000**	**624,800**	**3,464,800**	**446,825**	**403,496**				
									High-end	3,550,000	781,000	4,331,000	558,531	504,370				
									Low-end	2,130,000	468,600	2,598,600	335,119	302,622	E&I costs include preliminary through final engineering, inspection, and other (e.g., construction engineering) costs; estimated at 22 percent of component costs			
		Onondaga County Department of Transportation	Subtotal for all Long Term Projects				3	projects	Mid Range	**796,600**	**175,252**	**971,852**	**591,125**	**506,160**				
									High-end	995,750	219,065	1,214,815	738,906	632,700				
									Low-end	597,450	131,439	728,889	443,344	379,620				
		Summary	Grand Total				21	projects	Mid Range	**8,225,400**	**1,809,588**	**10,034,988**	**1,294,814**	**1,185,532**	Annual O&M costs of field equipment; estimated at 10 percent of component costs			
									High-end	10,281,750	2,261,985	12,543,735	1,618,518	1,481,915				
									Low-end	6,169,050	1,357,191	7,526,241	971,111	889,149				

Table 9 Onondaga County Traffic Management Center Operation and Maintenance Cost Estimate

Item No.	Project No.	Project Name	Time Frame	Operation					Maintenance					Operation Cost (Yearly)	Operation Cost (5 Years)	Maintenance Cost (Yearly)	Maintenance Cost (5 Years)
				TMC Supervisor	System Engineer	Operator	Technician	Utilities	Supervisor	Technician	Transportation	Equipment	Miscellaneous				
2	Onondaga DOT-02	TMC Operation and Maintenance Phase I Short Term	Short Term	0	1	1	0	$ 1,000	1	1	$ 1,000	$ 10,000	$ 10,000	**$ 147,000**	**$ 735,000**	**$ 189,500**	**$ 947,500**
12	Onondaga DOT-12	TMC Operation and Maintenance Phase II Mid Term	Mid Term	1	1	2	0	$ 1,500	1	2	$ 2,000	$ 20,000	$ 10,000	**$ 318,000**	**$ 1,590,000**	**$ 279,000**	**$ 1,395,000**
21	Onondaga DOT-21	TMC Operation and Maintenance Phase III Long Term	Long Term	1	1	3	1	$ 1,500	1	3	$ 3,000	$ 30,000	$ 10,000	**$ 445,500**	**$ 2,227,500**	**$ 368,500**	**$ 1,842,500**

Table 10 County of Onondaga Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and study: Component	Unit Cost (k)	Quantity	Central Software/Hardware: Component	Unit Cost (k)	Quantity	Interface: Component	Unit Cost (k)	Quantity	ITS Field Construction: Component	Unit Cost (k)	Quantity	Operation Maintenabnce Services Repair Estimate: Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support	Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES
Onondaga County Department of Transportation																						
1	Onondaga DOT-01	County Traffic Management Center, Onondaga TMC	Operation Room	60	1	Central Hardware and Software	75	1	network interfaces	2	4	Remote Access for the Civic Center and 911 Center.	15	2	4	1	$ 0	288.333	$ 173,000	$ 15,602	$ 3,460	Note: Two Half T1 line is considered in this estimate for Remotesites. These link will be able for data and viodeo sharing.
2	Onondaga DOT-02	TMC Operation and Maintenance Phase I Short Term																0	$ -	$ 147,000	$ 189,500	Note: Cost Estimate for Operation and Maintenance are presented to O&M Cost Estimate Table
3	Onondaga DOT-03	Centralize monitoring of Existing Closed Loop Traffic Signal Systems	leased service connection	5	17	Central Monitoring System	100	1	Mastercontroller Data Interfaces	1	17				17		$ 0	336.667	$ 202,000	$ 20,402	$ 4,040	
4	Onondaga DOT-04	Portable VMS				VMS sign control hardware and Software	50	1	Data Interface	1	2	Portable VMS	50	2	2		$ 80	253.333	$ 152,000	$ 3,360	$ 3,040	
5	Onondaga DOT-05	Signal System Expansion Phase 1																0	$ -	$ -	$ -	Existing $ 2.5M FOUND.
6	Onondaga DOT-06	Signal System Expansion Phase 2	Construct the wireless Communication Interconnect (TAFT and South Bay) of the roadway (2 wireless zone)	60	2	Central Hardware and Software for CCTV and Close loop system	50 30	1 2	Data Interface	4	20	Traffic Signal CCTV System	30.5 39.6	17 3	0	1.5	$ 680	$1,429	$ 947,300	$ 24,360	$ 17,146	Fiber or no? should we keep the cost at $50k or $15k? We can use the radio for comm.
7	Onondaga DOT-07	Signal System Expansion Phase 3	Construct wireless Communication Interconnect (Morgan and Glay Rd.)of the roadway	60	2	Central Hardware and Software for CCTV and Close loop system	50 30	0 2	Data Interface	4	14	Traffic Signal CCTV System	30.5 39.6	11 3	0	1.5	$ 400	$1,084	$ 740,300	$ 21,000	$ 13,006	
8	Onondaga DOT-08	Signal System Expansion Phase 4	Construct the wireless Communication Interconnect (7th St., Buckley and Electronics) of the roadway	60	2	Central Hardware and Software for CCTV and Close loop system	50 30	0 2	Data Interface	4	22	Traffic Signal CCTV System	30.5 39.6	20 2	0	1.5	$ 800	$1,529	$ 1,007,200	$ 25,800	$ 18,344	

Table 10 County of Onondaga Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenabnce Services Repair Estimate				Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES		
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support						
9	Onondaga DOT-09	Conversion of Old Traffic Controller Phase I	Interconnection: Assumed 30 intersections controller will be converted to NEW controller.			Central Monitoring System (software and hardware required upgrading and system integration)	75	1				Traffic controller Upgrading	22.8	30	0	0	0	1265	$ 759,000	$ -	$ 15,180	Note: (1) In this phase 30 of the existing old controller will converted to new controller. (2) The central software of close loop system will be modified in this phase. The close loop systems will use the same communication links for connection to center as the existing system. (3) The conversion project include changing the controller to new controller , repairing the detector loops and system programming and setting. Changing the traffic signal and other traffic furniture are not considered in this project estimate.		
10	Onondaga DOT-10	Vehicle Fleet Administration (AVL Project) Phase I	One Radio Expanded Twoer	60	1	Dispatching System AVL Application Software/ Hardware	150	1	Interface to CYNTRO	50	1	Vehicle Equipment	10	50	0	0.25	0	1266.67	$ 760,000	$ 2,700	$ 15,200	Note: A quarter of T1 or Frame relay link will be considered between the County TMC and Centro Operation Center for Sharing the Data.		
11	Onondaga DOT-11	Integration Traffic Signal System Upgrade - the State Signals Coordination control (Interagency Common mode Control)				Central Interface	200	1	Data Interface	2	5				0	1	$ -	$ 350	$ 210,000	$ 10,800	$ 4,200			
12	Onondaga DOT-12	TMC Operation and Maintenance Phase II Mid Term													0	1	$ -	$ -	$ -	$ 318,000	$ 279,000	Note: Cost Estimate for Operation and Maintenance are presented to O&M Cost Estimate Table		

Table 10 County of Onondaga Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and study: Component	Unit Cost (k)	Quantity	Central Software/Hardware: Component	Unit Cost (k)	Quantity	Interface: Component	Unit Cost (k)	Quantity	ITS Field Construction: Component	Unit Cost (k)	Quantity	Operation Maintenabnce Services Repair Estimate: Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support	Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES
13	Onondaga DOT-13	Conversion of Old Traffic Controller Phase II	Interconnection: Assumed 30 intersections controller will be converted to NEW controller.			Central Monitoring System (software and hardware required upgrading and system integration)	75	1				Traffic controller Upgrading	22.8	30	0	0	0	$1,265	$ 759,000	$ -	$ -	Note: (1) In this phase 30 of the existing old controller will converted to new controller. (2) The central software of close loop system will be modified in this phase. The close loop systems will use the same communication links for connection to center as the existing system. (3) The conversion project include changing the controller to new controller , repairing the detector loops and system programming and setting. Changing the traffic signal and other traffic furniture are not considered in this project estimate.
14	Onondaga DOT-14	Onondaga County WWW Site Enhancement (Traveler Information expansion module)				Web System	90	1	Data Interface	5	1					1	40	$ 158	$ 95,000	$ -	$ -	
15	Onondaga DOT-15	Onondaga County Travel Advisory - Create an Interface with the region ISP networks				Central application system	75	1	Data Interface	5	1				0	1	40	$ 133	$ 80,000	$ -	$ -	
16	Onondaga DOT-16	County Traffic Signal Communication Network enhancement	Modified the Communication network with Missing fiber optic (3 miles) or wireless link 4 zones	212 60	3 4	Com. Network Management System	100	1	Backbone Equipment	20	7						280	$1,860	$ 1,116,000	$ 3,360	$ 22,320	Rrplace the leased service with fiber links to TMS. The fiber links will be interconnection fiber between the traffic subsystem to TMC.
17	Onondaga DOT-17	Snow Removal Vehicle Fleet Administration Pilot Project Phase 2				AVL or other Applications Modules with Access Modules	100	1	Data Interface	2	10	Vehicle Equipment	10	10			400	$ 367	$ 220,000	$ 4,800	$ 4,400	
18	Onondaga DOT-18	Vehicle Fleet Administration (AVL Project) Phase 3	Centro AVL System Enhancement	50	1	AVL or other Applications Modules with Access Modules	100	0	Data Interface	5	2	Vehicle Equipment	10	30	0	0	0	600	$ 360,000	$ -	$ 7,200	
19	Onondaga DOT-19	Bridge Structure Remote Monitoring & Maintenance System				Central Interface	50	1	Data Interface	2	10	Traffic Detector RWIS Pavment Sensor	32.4 34.6 29.5	1x5 1x1 1x5	5	0	$ 200	$ 690	$ 414,100	$ 8,400	$ 8,282	

Table 10 County of Onondaga Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenabnce Services Repair Estimate				Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES		
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support						
20	Onondaga DOT-20	Pavement Monitoring at Critical Locations				Central Interface	50	1	Data Interface	2	6	RWIS Pavment Sensor	34.6 29.6	1 5	5	0	$ 200	$ 407	$ 382,500	$ 8,400	$ 4,882			
21	Onondaga DOT-21	TMC Operation and Maintenance Phase III Long Term																		$ 445,500	$ 368,500			

3.5 NEW YORK STATE THRUWAY AUTHORITY (NYSTA)

The Thruway Authority is currently in the process of deploying additional ITS field equipment devices as well as procuring a statewide freeway management system to manage all ITS devices from the Statewide Operations Center in Albany with remote command and control functionalities from regional offices, including the Syracuse office. These projects will have overlap points with the Syracuse metropolitan roadway network, but they are statewide projects and as such they are not listed here.

Regional TMC - NYSTA-01, Regional TMC – This is a statewide initiative and will not be included in this study. This project will provide the software and hardware to command and control ITS field equipment from a centralized TMC as well as remote offices. This project will furnish all the needed software and hardware at the Syracuse Regional Office TMC.

ITS Field Equipment - Majority of the recommended projects for the Authority are related to the deployment of ITS field equipment. The recommended ITS field equipment deployment projects are listed below based on the recommended deployment time frame.

NYSTA-02, Phase 1 ITS Deployment – This early action project recommends the deployment of two cameras at Exit 34A and three cameras at Exit 36. In addition the installation of two Dynamic Message Signs is recommended at MP 292.10 and MP 274.43. The recommended ITS field equipment locations are shown in Figure 25. Since the cost of CCTV deployments are funded by the statewide ITS implementation, this cost is not included in the cost calculation.

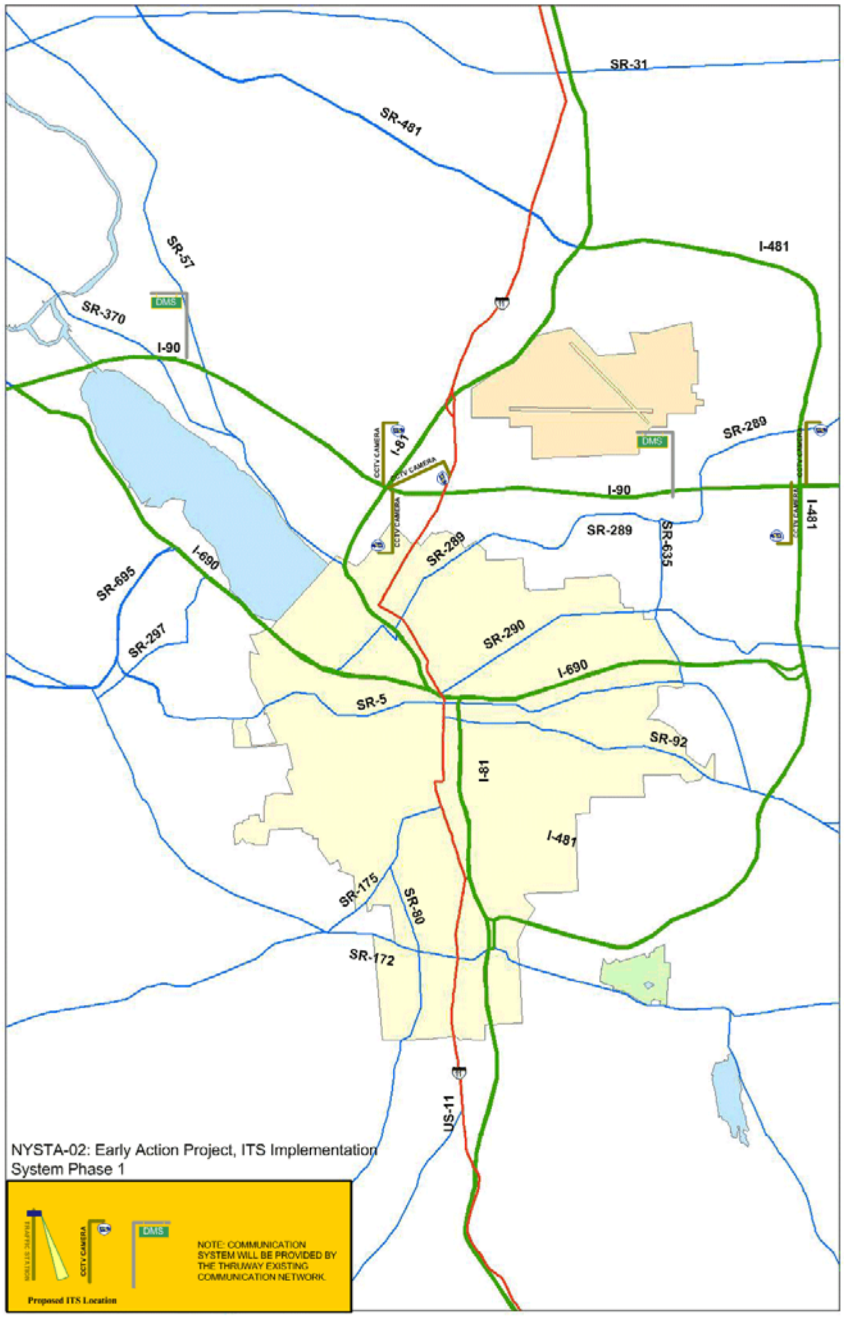


FIGURE 25

NYSTA-03, Conversion of Off Line Traffic Stations to On Line Stations – This project is also recommended for early action deployment and it will include equipment upgrade at 35 detector stations, central monitoring system and connections to the fiber network.

NYSTA-04, Phase 2 ITS Deployment – This project recommends Short-Term deployment of four cameras at Exits 35, 37, 38 and 39. In addition, two Dynamic Message Signs are recommended at mile points 281.7 and 285.2. One Highway Advisory Radio is also recommended for deployment. Figure 26 shows the approximate location of the recommended ITS field devices.

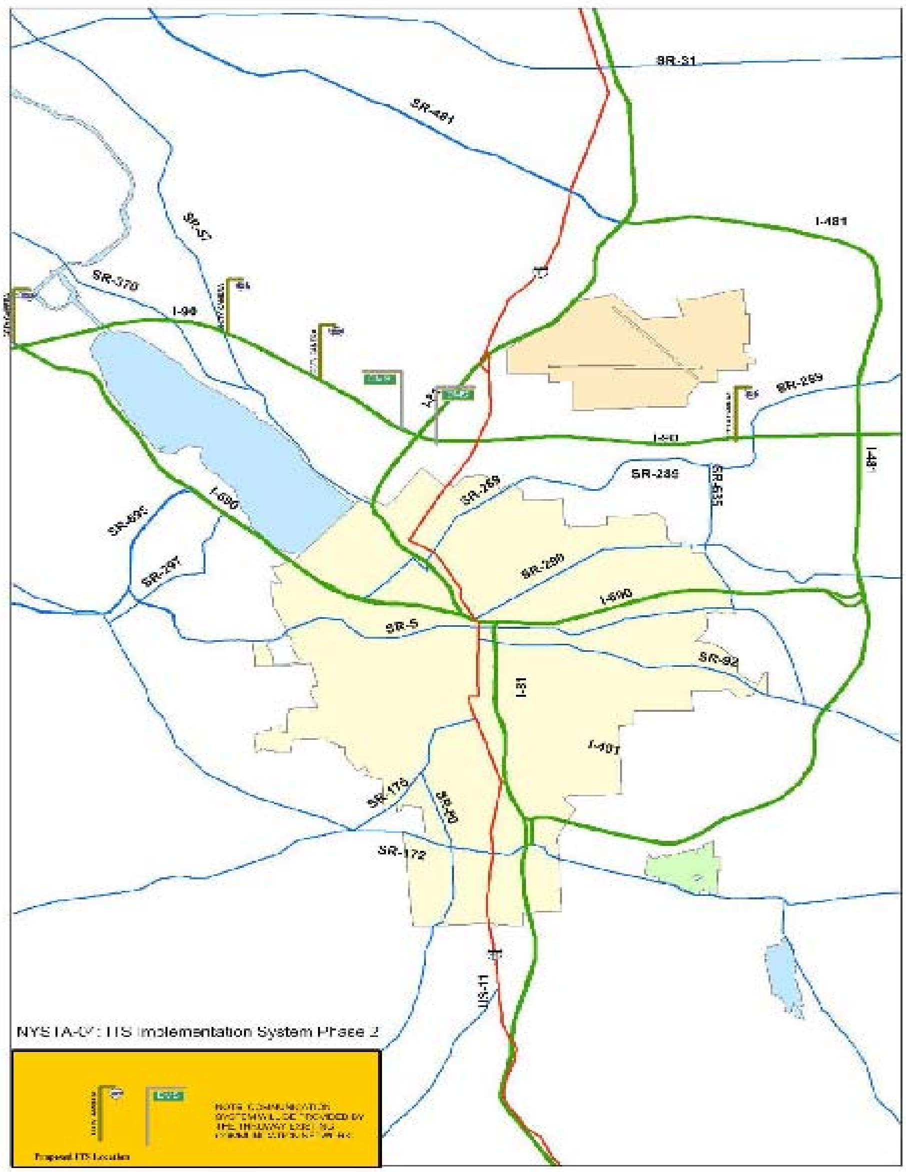


FIGURE 26

NYSTA-05, Phase 3 ITS Deployment – A pavement sensor implementation project is recommended for Short-Term deployment. This project is composed of one RWIS station and ten pavement sensors stations. Figure 27 shows the approximate location of field devices.

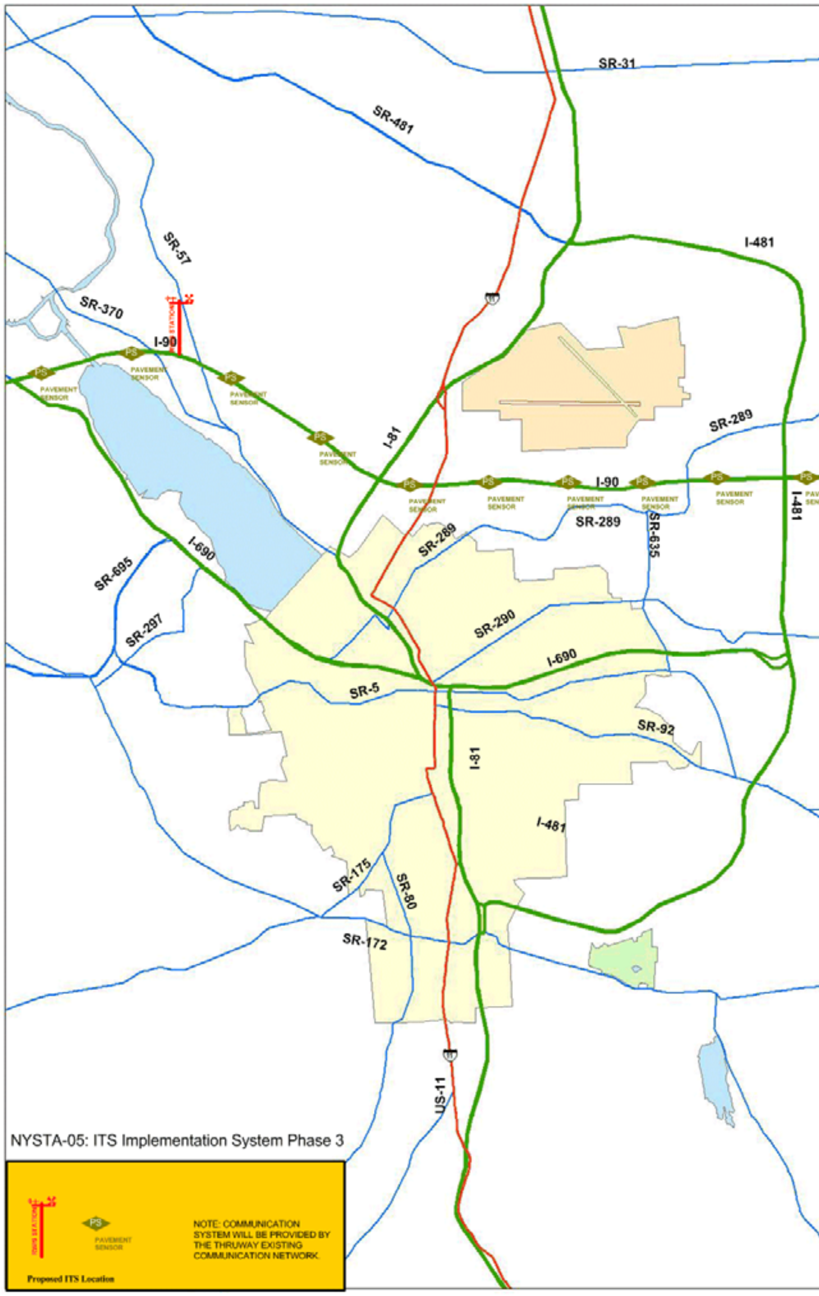


FIGURE 27

NYSTA-07, Phase 4, Dynamic Network Monitoring System Deployment – this mid-term project is recommended to deploy probe surveillance technology (TRANSMIT) at seven locations to provide travel time and incident management functionalities. The approximate deployment locations are shown in Figure 28.

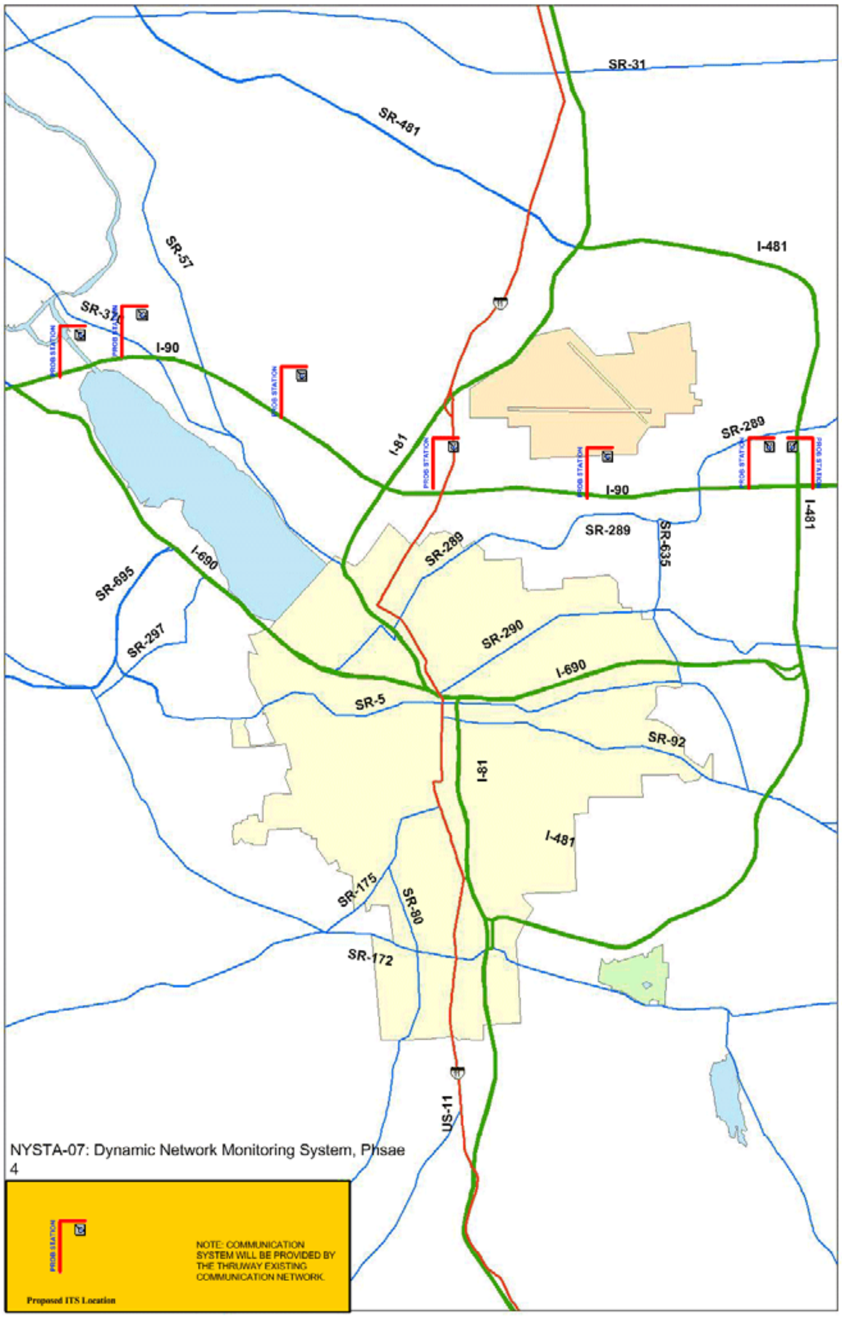


FIGURE 28

NYSTA-08, Phase 5 ITS Deployment – In mid-term deployment phase, three additional cameras and two more DMS's will be installed to provide full coverage for the entire length of Thruway within the metropolitan area. The approximate locations of field equipment are shown in Figure 29.

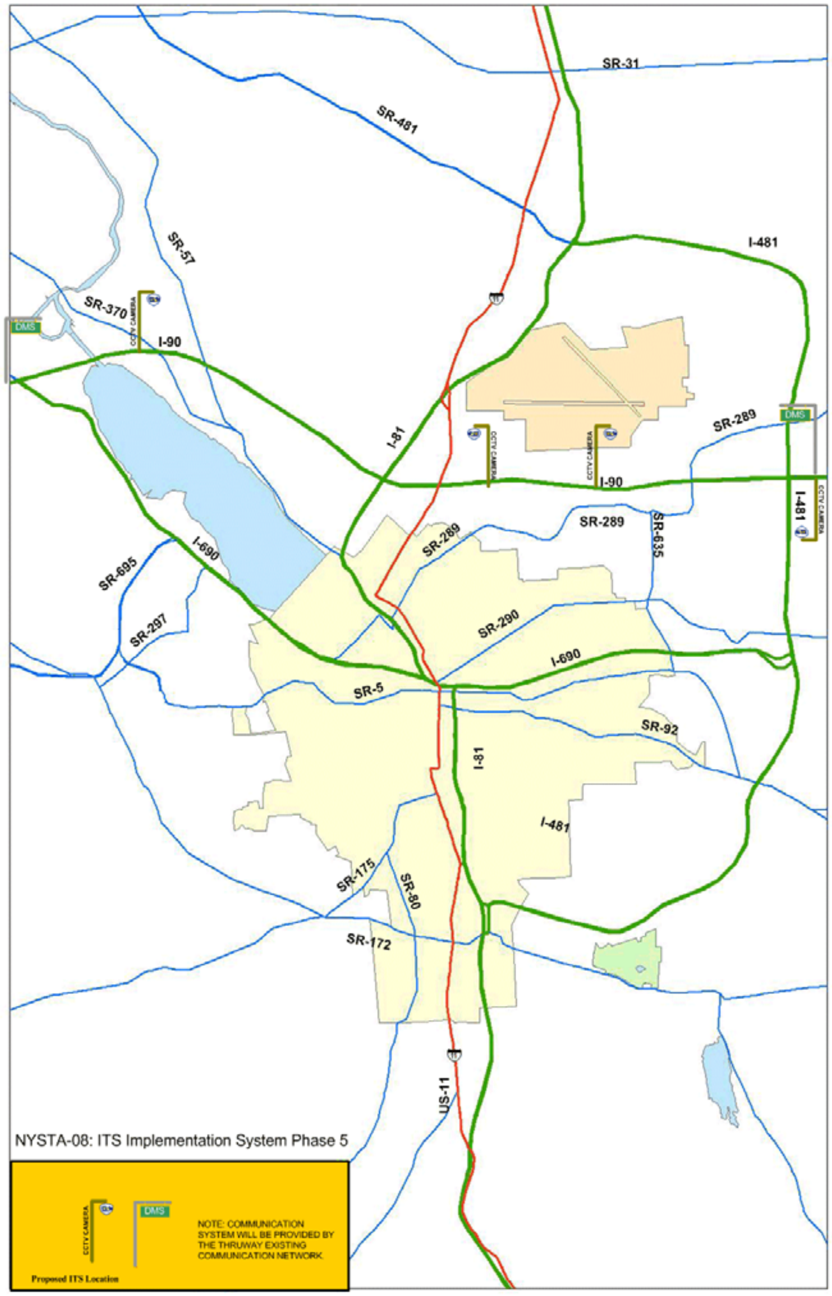


FIGURE 29

<u>NYSTA-10, Phase 6 ITS Deployment</u> – This project is recommended for Long-Term deployment. It includes installation of detector stations at fifteen additional locations.

Operations and Maintenance Cost – In order to maintain and operate any ITS equipment, it is vital to allocate budget for such cost. The cost is comprised of: software and hardware upgrade and maintenance cost, TMC staffing cost, utility and other direct cost, and the maintenance cost of field equipment.

Experience tells us that annual O&M costs for a system are approximately 10% of the deployed cost of the system. The O&M cost are budgeted as three separate projects; NYSTA-06 (Short-Term cost, first five years), NYSTA-09 (Mid-Term cost, years six through ten) and, NYSTA-11 (Long-Term cost).

Deployment Time Frame

Early Action Projects – The focus of early action projects is to define projects that best serve the immediate needs of NYSTA in the Onondaga County Area. Three projects are recommended for immediate deployment for an approximate capital cost of $1.6M. The operations and maintenance cost for these projects are included in the Short-Term projects cost.

Short-Term Projects - Recommended Short-Term projects will focus on deployments within the next five years. A total of three projects are recommended for deployment with a total capital cost of $1.35M. In addition, at the end of all Short-Term deployments, the annual cost of operations and maintenance for these systems will be about $308K.

Mid-Term Projects - A total of three projects were defined for deployment within the six to ten years time frame. The capital cost of these projects will total at about $1.9annual O&M cost of $630K.

Long-Term Projects - The Long-Term projects are to be deployed between year eleven and year twenty. A total of two projects have been identified at a capital cost of $790K and an annual O&M cost of $663K.

Table 11 lists all NYSTA recommended projects broken down by; recommended time frame for deployment, National Architecture relationship, associated components and/or technologies, pre-requisite projects, locations, estimated capital and O&M costs and associated benefits.

Table 12 shows the detailed cost breakdown table that includes the cost of; network/communication, central software and hardware, field equipment, interface, capital and operations and maintenance.

Finally, the O&M cost broken down for the various deployment terms (Short-Term, mid-term and Long-Term) are listed in Table 13.

Table 11 Recommended ITS Projects for New York State Thruway

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship		Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost					Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
				NITSA Subsystem	NITSA Market Packages					Capital: Components	Capital: Engineering & Inspection (E&I)	Capital: Total	Annual: Service & Operation	Annual: Maintenance Repaired				
1	NYSTA-01	Early Action Project, Regional TMC, Enhance Remote Access/Control Capability	Early Action	TMS	En-Route Roadway Traveler Information Dissemination (ATMS06), Network Data Collection (ATMS01), Incident Management System (ATMS08)	- Center (Albany TMC) to Center (Regional Office) Communication system Central hardware Upgrading - Software support - VMS System - Redundant Regional TMC	none	Ney York Thruway Regional Office	Available fromCentral Office	$ -	0	0	$ -	$ -	B,C			The existing remot capability for the regional office will be upgrade to provide more capability for monitoring and control of video and data in the regional office. Also the network architechture will be modified that regional office can be a redundant TOC for the regional Thruway Sections.
2	NYSTA-02	Early Action Project, ITS Implementation System Phase 1	Early Action	TMS	En-Route Roadway Traveler Information Dissemination (ATMS06), Network Data Collection (ATMS01), Incident Management System (ATMS08)	- CCTV System - VMS System -Central hardware Upgrading - Software support -Communication Access (Center-to-Field)	none	5 CCTV Cameras at Exit 34A (2 units) and Exit 36 (3 units) and 2 VMS at: MP 292.10 and MP 274.43	Cost of the CCTV will founded by the state wide ITS Implementation, which is not in this cost estimate	$ 576,000	126,720	702,720	$ 1,920	$ 11,520	B,C			5 Cameras will be added to the existing Thruway Surveillance system. These camera will monitor in the Albany Thruway Traffic Operation Center. Remote capability will be added for regional office.
3	NYSTA-03	Early Action Project, Conversion of Off Line Traffic Station to On Line Station	Early Action	TMS	Surface Street Control (ATMS03)	- Central hardware / software - Communication Access (Center-to-Field)	none	TMC	?	$ 730,000	160,600	890,600	$ 16,800	$ 14,600	B,C			1) The number of statation in the regional section is less than 35. Therefore the cost estimate should be verified based on the new quantity. 2) This project may found by central office
4	NYSTA-04	ITS Implementation System Phase 2	Short Term	TMS	En-Route Roadway Traveler Information Dissemination (ATMS06), Network Data Collection (ATMS01), Incident Management System (ATMS08)	- CCTV System - VMS System -Central hardware Upgrading - Software support -Communication Access (Center-to-Field)	none	4 cctv Cameras at: Exit 35, 37, 38 and 39 DMS at: MP 281.7, 285.2, Also one HAR.	Not Available	$ 804,000	176,880	980,880	$ 2,880	$ 16,080	B,C			
5	NYSTA-05	ITS Implementation System Phase 3, Pavement Sensore Implementation	Short Term	TMS	Surface Street Control (ATMS03), Network Surveillance (ATMS01), Incident Management System (ATMS08)	- Communication Access (Center-to-Field) - RWIS system	none	One RWIS station and 10 Pavement station collocated at existing Detector Station Cabinets	Not Available	$ 303,000	66,660	369,660	$ 480	$ 6,060	B,C			Weather condition is not necessary to monitor in a short distance (less than 20 miles) in a general road network. But the pavement temperature condition may varied in a shorter range. In addition the cost of the pavement sensor will be less than a full RWIS station.

Table 11 Recommended ITS Projects for New York State Thruway

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Estimated Cost: Capital: Engineering & Inspection (E&I)	Estimated Cost: Capital: Total	Estimated Cost: Annual: Service & Operation	Estimated Cost: Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
6	NYSTA-06	Regional TMC Operation and Maintenance Phase I, Short Term	Short Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff		TMC and associated subsystems	?	$ -	0	0	$ 138,600	$ 99,500	B,C	Estimated annual TMC cost to operate and maintain short, mid, and long term projects. It is assumed that the Regional TMC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		
7	NYSTA-07	Dynamic Network Monitoring System, Phase 4	Mid Term	TMS	Surface Street Control (ATMS03), Network Surveillance (ATMS01), Incident Management System (ATMS08)	Probe Station	none	Local Regional Network	Not Available	$ 755,000	166,100	921,100	$ 2,400	$ 15,100	B,C	Two-way electronic data and information exchange interface		
8	NYSTA-08	ITS Implementation System Phase 5,	Mid Term	TMS	Surface Street Control (ATMS03), Incident Management System (ATMS08)	- CCTV System - VMS System -Central hardware Upgrading - Software support -Communication Access (Center-to-Field)	none	Full Coverage of CCTV surveillance, 3 Cameras and 2 more VMS	Not Available	$ 776,000	170,720	946,720	$ 2,880	$ 15,520	B,C			
9	NYSTA-09	Regional TMC Operation and Maintenance Phase 2, Mid Term	Mid Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff		TMC and associated subsystems	?	$ -	0	0	$ 313,500	$ 211,500	B,C	Estimated annual TMC cost to operate and maintain short, mid, and long term projects. It is assumed that the Regional TMC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		
10	NYSTA-10	ITS Implementation System Phase 6,	Long Term	TMS	Surface Street Control (ATMS03), Incident Management System (ATMS08)	-Central hardware Upgrading - Software support -Modified Detector Station	none	Modiffied Detector Station System at 15 locations	Not Available	$ 645,000	141,900	786,900	$ 7,200	$ 12,900	B,C			The existing Detector station will be modified with new traffic sensor and Data logger equipment. The construction cost will be focus to new equipment.

Table 11 Recommended ITS Projects for New York State Thruway

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Estimated Cost: Capital: Engineering & Inspection (E&I)	Estimated Cost: Capital: Total	Estimated Cost: Annual: Service & Operation	Estimated Cost: Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
11	NYSTA-11	Regional TMC Operation and Maintenance Phase 3, Long Term	Long Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff		TMC and associated subsystems	?	$ -	0	0	$ 313,500	$ 223,500	B,C	Estimated annual TMC cost to operate and maintain short, mid, and long term projects. It is assumed that the Regional TMC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		
		New York State Thruway Authority		Subtotal for all Early Action Projects			3	projects	Mid Range	**1,306,000**	**287,320**	**1,593,320**	**18,720**	**26,120**				
									High-end	1,632,500	359,150	1,991,650	23,400	32,650				
									Low-end	979,500	215,490	1,194,990	14,040	19,590				
		New York State Thruway Authority		Subtotal for all Short Term Projects			3	projects	Mid Range	**1,107,000**	**243,540**	**1,350,540**	**160,680**	**147,760**				
									High-end	1,383,750	304,425	1,688,175	200,850	184,700	Component costs include hardware, firmware, software, integration, and communications costs			
									Low-end	830,250	182,655	1,012,905	120,510	110,820				
		New York State Thruway Authority		Subtotal for all Mid Term Projects			3	projects	Mid Range	**1,531,000**	**336,820**	**1,867,820**	**340,860**	**290,380**				
									High-end	1,913,750	421,025	2,334,775	426,075	362,975				
									Low-end	1,148,250	252,615	1,400,865	255,645	217,785	E&I costs include preliminary through final engineering, inspection, and other (e.g., construction engineering) costs; estimated at 22 percent of component costs			
		New York State Thruway Authority		Subtotal for all Long Term Projects			2	projects	Mid Range	**645,000**	**141,900**	**786,900**	**348,060**	**315,280**				
									High-end	806,250	177,375	983,625	435,075	394,100				
									Low-end	483,750	106,425	590,175	261,045	236,460				
		Summary		Grand Total			11	projects	Mid Range	**3,283,000**	**722,260**	**4,005,260**						
									High-end	4,103,750	902,825	5,006,575						
									Low-end	2,462,250	541,695	3,003,945						

Table 12 Traffic Management Center Operation and Maintenance Cost Estimate

Item No.	Project No.	Project Name	Time Frame	Operation					Maintenance					Operation Cost (Yearly)	Operation Cost (5 Years)	Maintenance Cost (Yearly)	Maintenance Cost (5 Years)
				TMC Supervisor	System Engineer	Operator	Technician	Utilities	Supervisor	Technician	Transportation	Equipment	Miscellaneous				
6	NYSTA-06	Regional TMC Operation and Maintenance Phase I, Short Term	Short Term	0	1	1	0	$ 300	0	1	$ 1,000	$ 10,000	$ 10,000	$ 138,600	$ 693,000	$ 99,500	$ 497,500
9	NYSTA-09	Regional TMC Operation and Maintenance Phase 2, Mid Term	Mid Term	1	1	1	1	$ 500	1	1	$ 2,000	$ 20,000	$ 10,000	$ 313,500	$ 1,567,500	$ 211,500	$ 1,057,500
11	NYSTA-11	Regional TMC Operation and Maintenance Phase 3, Long Term	Long Term	1	1	1	1	$ 500	1	1	$ 3,000	$ 20,000	$ 10,000	$ 313,500	$ 1,567,500	$ 223,500	$ 1,117,500

Table 13 NYSTA Project Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenance Services Repair Estimate				Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support				
New York State Thruway																						
1	NYSTA-01	Early Action Project, Regional TMC, Enhance Remote Access/Control Capability	Apgrade Network Access between Regional office to Albany TOC	75	1	Central Hardware and Software (Redundanty Support)	100	1	Remote Network Interfaces	8	1				0	0	0	305	$ 183,000	$ -	$ 3,660	1) It is assumed the Regional Office at 290 Elwood Davis Road Liverpool, NY 13088-0308, is connected to the Thruway Communication Network via dedicated (Fiber optic) link. 2) the Redundancy function will be addressed in the design of new ITS elements. This function may not accessable for existing ITS elements in the regional sections.
2	NYSTA-02	Early Action Project, ITS Implementation System Phase 1	Access to Fiber Optic Network	10	2	Regional Hardware and Software	50	1	CCTV Data/Audio	5 3	0 2	CCTV VMS RWIS HAR	35 250 35 25	0 2 0 0	0	0	160	960	$ 576,000	$ 1,920	$ 11,520	
3	NYSTA-03	Early Action Project, Conversion of Off Line Traffic Station to On Line Station	Access to Fiber Optic Network	10	35	Central Monitoring System	100	1	Data	3	35	Upgrading the Detector Station	5	35	0	0	1400	1216.67	$ 730,000	$ 16,800	$ 14,600	
4	NYSTA-04	ITS Implementation System Phase 2	Access to Fiber Optic Network	10	6	Regional Hardware and Software	50	1	CCTV Data	5 3	4 3	CCTV VMS RWIS HAR	35 250 35 25	4 2 0 1	0	0	240	1340	$ 804,000	$ 2,880	$ 16,080	
5	NYSTA-05	ITS Implementation System Phase 3, Pavement Sensore Implementation	Access to Fiber Optic Network	10	1	Central Hardware and Software	75	1	network interfaces	3	11	RWIS Pavement Sensors	35 15	1 10	0	0	40	505	$ 303,000	$ 480	$ 6,060	
6	NYSTA-06	Regional TMC Operation and Maintenance Phase I, Short Term																	$ -	$ 138,600	$ 99,500	
7	NYSTA-07	Dynamic Network Monitoring System, Phase 4	Access to Fiber Optic Network	10	7	Central Hardware and Software	250	1	Data	3	5	Transmit Prob Station(on existing infrastructures)	60	7	0		200	1258.33	$ 755,000	$ 2,400	$ 15,100	
8	NYSTA-08	ITS Implementation System Phase 5,	Access to Fiber Optic Network	10	6	Regional Hardware and Software	50	1	CCTV Data/Audio	5 3	4 2	CCTV VMS RWIS HAR	35 250 35 25	4 2 0 0	0	0	240	1293.33	$ 776,000	$ 2,880	$ 15,520	

Table 13 NYSTA Project Cost Calculations

New York State Thruway																						
9	NYSTA-09	Regional TMC Operation and Maintenance Phase 2, Mid Term																	$ -	$ 313,500	$ 211,500	
10	NYSTA-10	ITS Implementation System Phase 6,				Central Hardware and Software	150	1	network interfaces	3	15	Advanced Detector Station Equipment	15	30	0	0	600	1075	$ 645,000	$ 7,200	$ 12,900	
11	NYSTA-11	Regional TMC Operation and Maintenance Phase 3, Long Term																	$ -	$ 313,500	$ 223,500	

3.6 CENTRAL NEW YORK REGIONAL TRANSPORTATION AUTHORITY (CNYRTA)

The Authority is currently in the final stages of deploying an automatic vehicle location and control system on their entire fleet as part of the CNYRTA-03 project. This includes the radio system needed for communications.

Transit Itinerary System – The study recommends Short-Term procurement of two transit itinerary systems. The recommended CNYRTA-01 project will provide automated transit itinerary information to the Authority and its operators. The second project, CNYRTA-02, will be a web-based transit itinerary planning system for the public use.

Radio System Upgrade – The existing radio system is not capable of transmitting video. As the recommended ITS projects are deployed, the need for additional bandwidth, additional base stations and more advanced technologies is obvious. The study recommends a Short-Term radio system upgrade project (CNYRTA-04).

Automatic Passenger counter – The existing ongoing project will equip 29 buses with the automatic passenger counters. The study recommends installation of additional passenger counters on buses in three phases. The CNYRTA-06 will install the automatic passenger counters on thirty buses in the next five years. The recommended mid –term CNYRTA-16 project will install the counters on seventy-seven more buses. Finally, the CNYRTA-25 Long-Term recommended project will equip the remaining seventy buses with the counters.

Station bus request – The Short-Term CNYRTA-07 is recommended to allow passengers in the bus station to send a bus request signal to the dispatching center. The dispatcher can then inform the appropriate bus driver to stop at the requested station.

Automated Fare Collection Machine – The Transit Development Study recommended twelve transit transfer stations. Currently there are six transfer locations in place. The other six locations will be built in the next six to ten years (Mid-Term). Currently there are two fare collection machines in place. The study recommends the CNYRTA-08 project to deploy four more automated fare collection machines in the next five years. The CNYRTA-20 project will install the remaining six machines in the Mid-Term as the stations are built.

Passenger Information Display at the Stations – Currently there are two transfer stations that are in an enclosed area. The four remaining existing stations and additional six transfer stations will be placed in future in enclosed spaces. The study recommends Short-Term deployment of two passenger information displays in the existing two enclosed stations (CNYRTA-09). The recommended CNYRTA-18 project will install Information Displays at four additional stations. The remaining six stations will be equipped with Information Display as part of the Long-Term CENRO-26 project.

On-Board Traveler Information System - The study recommends deployment of LED variable message signs and enunciators onboard buses to provide passengers with more information. The study recommends upgrading fifty buses in the Short-Term (CNYRTA-10), 100 buses in the Mid-Term (CNYRTA-17) and the remaining fifty-six buses in Long-Term periods (CNYRTA-24).

Interactive Kiosks - Currently there is money in the TIP allocated for the deployment of two kiosks in the next five years, CNYRTA-11. The study recommends deployment of four additional kiosks in the Mid-Term, CNYRTA-22 and six more in the Long-Term periods at major public attractions and venues, CNYRTA-31.

Transit Vehicle Surveillance System – The study recommends deployment of cameras on board buses, with low-frame transmission capabilities to the operations center as well as onboard recording ability. The study recommends deployment of this technology on fifty buses in the next five years, CNYRTA-12. CNYRTA-14 will upgrade additional 100 buses to this technology and the remaining fifty-six buses will be upgraded in Long-Term period as part of the CNYRTA-32 project.

TMC Expansion and Upgrade – The deployment of recommended projects and technologies will require expansion and upgrade of the existing TMC in the Mid-Term period. The recommended CNYRTA-13 project will expand the existing space to accommodate ongoing and planned ITS projects.

Automatic Vehicle Location and Control (AVLC) System, Expansion Phase – The study recommends deploying the same AVL technology currently being installed on the Authority's fleet, and on any and all new fleet vehicles as they are purchased. The CNYRTA-15 assumes purchase of an additional 100 buses and installation of AVLC on all buses.

Bus Driver Navigator System – The study recommends mid-term deployment of a static on-board navigator system with route guidance on ten buses, as a pilot project, (CNYRTA-21). The CNYRTA-29 project is recommended for Long-Term deployment of the navigator system on fifty additional buses.

Automated Vehicle Collision Avoidance System - The CNYRTA-23 pilot project is recommended for Mid-Term deployment of the automated collision avoidance system on ten buses (on-board detectors and processors to notify the driver of potential collision hazards and to take preemptive actions as needed). The CNYRTA-30 project will deploy the technology on additional fifty buses in the Long-Term.

Expansion and Upgrading of Existing CAD System – The CNYRTA-27 is recommended for Long-Term deployment to expand and upgrade the existing Computer Aided Dispatching system with the latest available technology.

Operations and Maintenance Cost – In order to maintain and operate any ITS equipment, it is vital to allocated budget for such cost. The cost is comprised of: software and hardware upgrade and maintenance cost; TMC staffing cost; utility and other direct cost; and the maintenance cost of field equipment.

Experience tells us that annual O&M costs for a system are approximately 10% of the deployed cost of the system. The O&M cost are budgeted as three separate projects; CNYRTA-05 (Short-Term cost, first five years), CETNR-19 (Mid-Term cost, years six through ten) and, CNYRTA-28 (Long-Term cost).

Deployment Time Frame

Short-Term Projects - Recommended Short-Term projects will focus on deployments within the next five years. A total of twelve projects are recommended for deployment with a total capital cost of $5.4M. In addition, the annual O&M cost of operating the systems is estimated at $700K.

Mid-Term Projects - A total of eleven projects were defined for deployment within the six to ten years time frame. The capital cost of these projects will total at about $7.7M. The annual O&M cost once all systems are deployed at this period is estimated at 1.2M.

Long-Term Projects - The Long-Term projects are to be deployed between year eleven and year twenty. A total of nine projects have been identified at a capital cost of $5M. The annual O&M cost once all systems are deployed and operational is estimated at $1.4M.

Table 14 lists all CNYRTA recommended projects broken down by; recommended time frame for deployment, National Architecture relationship, associated components and/or technologies, pre-requisite projects, locations, estimated capital and O&M costs and associated benefits.

Table 15 shows the detailed cost breakdown table that includes the cost of; network/communication, central software and hardware, field equipment, interface, capital and operations and maintenance.

Finally, the O&M cost broken down for the various deployment terms (Short-Term, mid-term and Long-Term) are listed in Table 16.

Table 14 Recommended ITS Projects for CENTRO

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Estimated Cost: Capital: Engineering & Inspection (E&I)	Estimated Cost: Capital: Total	Estimated Cost: Annual: Service &I Operation	Estimated Cost: Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
1	CENTRO-01	Automated Transit Itineary Agency based	Short Term			CSR-TRIP Planing				$ 200,000	44,000	244,000	$ -	$ 4,000				
2	CENTRO-02	Web based itinerary planning	Short Term			Web Based				$ 200,000	44,000	244,000	$ -	$ 4,000				
3	CENTRO-03	Automatic Vehicle Location and Control (AVLC) System	Short Term		Transit Vehicle Tracking (APTS01)		available		$4,800,000	$ -	0	0	$ 21,600	$ 96,000	B,C	This is the cost estimate of repaire support, which is estimated %2 of construction cost.		
4	CENTRO-04	Radio System Upgrade	Short Term							$ 1,068,000	234,960	1,302,960	$ -	$ 21,360				
5	CENTRO-05	Network Operation Center Operation & Maintenance, Phase I, Short Term	Short Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff		NOC and associated subsystems	?	$ -	0	0	$ 318,600	$ 167,000	B,C	Estimated annual NOC cost to operate and maintain short, mid, and long term projects. It is assumed that the Regional NOC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		
6	CENTRO-06	Automatic Passenger Counters, Phase I, Short Term	Short Term		Transit Passenger and Fare Management (APTS04)	- Automatic Passenger Counter Unit using infrared beam	none	TMC	?	$ 500,000	110,000	610,000	$ -	$ 10,000	B,C	30 buses will be equipped in the short term		29 now, 30 more for short term and the rest mid and long term.
7	CENTRO-07	Station Bus Request	Short Term		Interactive Traveler Information (ATIS02),	Bus Request System - Server - Center-to-field(station) Communications -Center to Bus			Not Available	$ 450,000	99,000	549,000	$ -	$ 9,000	B,C	Passenger in the Bus station can send the the bus request signal to the dispatching center. The driver from the center will inform to stop at the requested station.		

Table 14 Recommended ITS Projects for CENTRO

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship		Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost					Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
										Capital			Annual	Annual				
				NITSA Subsystem	NITSA Market Packages					Components	Engineering & Inspection (E&I)	Total	Service &I Operation	Maintenance Repaired				
8	CENTRO-08	Automated Fare Collection Machine, Phase I, Short Term	Short Term		Transit Passenger and Fare Management				?	$ 262,000	57,640	319,640	$ 4,800	$ 5,240	B,C	4 TICKET MEDIA MACHINES ASSUMED TO BE ADDED IN SHORT TERM.		cash, debit cards (10 trips ticket and monthly passes).Transit development study recommended 12 transit transfer stations. Currently there are 6 transfer locations in place. The other 6 location will be built in mid term. Curently we have 2 transit media machine and we need to add 4 more short term and 6 more mid term.
9	CENTRO-09	Display Monitor System Phase I, Short Term	Short Term		En-route Customer Information Dissemination (APTS08)	- Monitors - Server - Center-to-field Communications	none		Not Available	$ 206,000	45,320	251,320	$ 2,400	$ 4,120	B,C	2 stations will equippewd with passanger information display in short term.		12 transfer stations would like to be secured in a closed wall spaces. right now, there are two of them that are in enclosed area.
10	CENTRO-10	On-Board Traveler Information System Phase I, Short Term	Short Term		En-route Customer Information Dissemination (APTS08)	- LED VMS - External Speakers - Annunciator/On-board Computer - Recording Station - Center-to-field Communications	none		Not Available	$ 800,000	176,000	976,000	$ -	$ 16,000	B,C			50 short term, 100 mid term and the rest long term.
11	CENTRO-11	Interactive Kiosks Phase I	Short Term		Interactive Traveler Information (ATIS02)	- Kiosks - Server - Center-to-field Communications			available	$ -	0	0	$ 2,400	$ -	B,C	2 LOCATIONS		Currently there is money in the TIP for 2. Mid term Kiosk in every transfer location. 2 short term, 4 midterm, 6 long term. Add 6 long term at major attraction places.
12	CENTRO-12	Transit Vehicle Surveillance System Phase I, Short Term	Short Term		Transit Security (APTS05)	- Video Cameras - Video Cassette Player - Television	none			$ 700,000	154,000	854,000	$ -	$ 14,000		50 buses will be equipped with nsmision ym.stescamera, recorder and low fram transmission.		50 buses for short term and 100 buses for mid term rest will be long term.
13	CENTRO-13	Expansion/ Enhance TMC	Mid Term		TMS	Upgrade Hardware, Software, Increase workstations,	none		?	$ 420,000	92,400	512,400	$ 21,600	$ 8,400	B,C			
14	CENTRO-14	Transit Vehicle Surveillance System Phase II, Mid Term	Mid Term		Transit Security (APTS05)	- Video Cameras - Video Cassette Player - Television	none			$ 750,000	165,000	915,000	$ -	$ 15,000		100 buses will be equipped with nsmision ym.stescamera, recorder and low fram transmission.		50 buses for short term and 100 buses for mid term rest will be long term.

Table 14 Recommended ITS Projects for CENTRO

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Estimated Cost: Capital: Engineering & Inspection (E&I)	Estimated Cost: Capital: Total	Estimated Cost: Annual: Service &I Operation	Estimated Cost: Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
15	CENTRO-15	Automatic Vehicle Location and Control (AVLC) System, Expansion Phase	Mid Term		Transit Vehicle Tracking (APTS01)		none			$ 750,000	165,000	915,000	$ -	$ 15,000	B,C			DESTINY study recommends for 100 additional buses. Another optionn is BRT (bus rapid transit) Buses on exclusive right of way.
16	CENTRO-16	Automatic Passenger Counters Phase II, Mid Term	Mid Term		Transit Passenger and Fare Management (APTS04)	- Automatic Passenger Counter Unit using infrared beam			?	$ 1,205,000	265,100	1,470,100	$ -	$ 24,100	B,C			77 buses will be equipped
17	CENTRO-17	On-Board Traveler Information System Phase II, Mid Term	Mid Term		En-route Customer Information Dissemination (APTS08)	- LED VMS and Speakers - Server - Center-to-field Communications (CDPD)			?	$ 1,550,000	341,000	1,891,000	$ -	$ 31,000	B,C	equipped 100 buses to on board VMS.		
18	CENTRO-18	Display Monitor System Phase II, Mid Term	Mid Term		En-route Customer Information Dissemination (APTS08)	- Monitors - Server - Center-to-field Communications			?	$ 262,000	57,640	319,640	$ 4,800	$ 5,240	B,C	4 stations will equippewd with passanger information display.		
19	CENTRO-19	Network Operation Center Operation & Maintenance, Phase II, Mid Term	Mid Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff		NOC and associated subsystems	?	$ -	0	0	$ 493,500	$ 279,000	B,C	Estimated annual NOC cost to operate and maintain short, mid, and long term projects. It is assumed that the Regional NOC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		
20	CENTRO-20	Automated Fare Collection Machine, Phase II, Mid Term	Mid Term		Transit Passenger and Fare Management (APTS04)				?	$ 368,000	80,960	448,960	$ 7,200	$ 7,360	B,C	6 TICKET MEDIA MACHINES ASSUMED TO BE ADDED IN SHORT TERM.		cash, debit cards (10 trips ticket and monthly passes).Transit development study recommended 12 transit transfer stations. Currently there are 6 transfer locations in place. The other 6 location will be built in mid term. Curently we have 2 transit media machine and we need to add 4 more short term and 6 more mid term.

Table 14 Recommended ITS Projects for CENTRO

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship		Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost					Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
										Capital			Annual	Annual				
				NITSA Subsystem	NITSA Market Packages					Components	Engineering & Inspection (E&I)	Total	Service &I Operation	Maintenance Repaired				
21	CENTRO-21	Bus Driver Navigator System Phase I, Pilot Project	Mid Term		Autonomous Route Guidance	On board navigator system, Autonomous Route Guidance			?	$ 200,000	44,000	244,000	$ -	$ 4,000	B,C	This pilot phase will develop a static navigator system for 10 Buses		
22	CENTRO-22	Interactive Kiosks Phase II	Mid Term		Interactive Traveler Information (ATIS02)	- Kiosks - Server - Center-to-field Communications				$ 400,000	88,000	488,000	$ -	$ 8,000	B,C	4 LOCATIONS		Currently there is money in the TIP for 2. Mid term Kiosk in every transfer location. 2 short term, 4 midterm, 6 long term. Add 6 long term at major attraction places.
23	CENTRO-23	Automated Vehicle Collision Avoidance System Phase I, Pilot Project	Mid Term		AVCA	On Vehicle Detector system, On Vehicle Processor Unit			?	$ 400,000	88,000	488,000	$ -	$ 8,000	B,C	This pilot phase will develop an AVCAS for 10 Buses		
24	CENTRO-24	On-Board Traveler Information System Phase III, Long Term	Long Term		En-route Customer Information Dissemination (APTS08)	- LED VMS and Speakers - Server - Center-to-field Communications (CDPD)			?	$ 890,000	195,800	1,085,800	$ -	$ 17,800	B,C	equipped 56 Buses to on board VMS.		
25	CENTRO-25	Automatic Passenger Counters Phase III, Long Term	Long Term		Transit Passenger and Fare Management (APTS04)	- Automatic Passenger Counter Unit using infrared beam		TMC and associated subsystems	?	$ 540,000	118,800	658,800	$ -	$ 10,800	B,C	70 BUSES WILL BE EQUIPPED		
26	CENTRO-26	Display Monitor System Phase III, Long Term	Long Term		En-route Customer Information Dissemination (APTS08)	- Monitors - Server - Center-to-field Communications			?	$ 418,000	91,960	509,960	$ 7,200	$ 8,360	B,C	6 stations will equipped with passanger information display.		
27	CENTRO-27	Expansion and Upgrading of Existing CAD System	Long Term		Transit Fixed-Route Operations					$ 150,000	33,000	183,000	$ -	$ 3,000				

Table 14 Recommended ITS Projects for CENTRO

Item No.	Project No.	Project Name	Time Frame	National ITS Architecture (NITSA) Relationship: NITSA Subsystem	National ITS Architecture (NITSA) Relationship: NITSA Market Packages	Components / Technologies	Prerequisite Projects	Location	Currently Programmed Funds, if any (X $1,000)	Estimated Cost: Capital: Components	Estimated Cost: Capital: Engineering & Inspection (E&I)	Estimated Cost: Capital: Total	Estimated Cost: Annual: Service &I Operation	Estimated Cost: Annual: Maintenance Repaired	Benefits (refer to Table 1)	Comments	Related Projects of other agencies (if any)	NOTES
28	CENTRO-28	Network Operation Center Operation & Maintenance, Phase III, Long Term	Long Term	TMS	Not Applicable	- Central hardware maintenance - Software support - Operations & maintenance staff		NOC and associated subsystems	?	$ -	0	0	$ 613,500	$ 358,500	B,C	Estimated annual NOC cost to operate and maintain short, mid, and long term projects. It is assumed that the Regional NOC will be small sized when completed (when short, mid, and long term projects are implemented). Estimated O&M costs for other projects are in addition to these funds.		
29	CENTRO-29	Bus Driver Navigator System Phase II, Expansion Project	Long Term		Navigator System	On board navigator system			?	$ 700,000	154,000	854,000	$ -	$ 14,000	B,C	This phase will develop a static navigator system for 50 buses		
30	CENTRO-30	Automated Vehicle Collision Avoidance System Phase II, Expansion	Long Term		AVCS	On Vehicle Detector system, On Vehicle Processor Unit			?	$ 1,100,000	242,000	1,342,000	$ -	$ 22,000	B,C	This pilot phase will develop an AVCAS for 50 buses		
31	CENTRO-31	Interactive Kiosks Phase III	Long Term		Interactive Traveler Information (ATIS02)	- Kiosks - Server - Center-to-field Communications				$ -	0	0	$ -	$ -	B,C	12 LOCATIONS		Currently there is money in the TIP for 2. Mid term Kiosk in every transfer location. 2 short term, 4 midterm, 6 long term. Add 6 long term at major attraction places.
32	CENTRO-32	Transit Vehicle Surveillance System Phase III, Long Term	Long Term		Transit Security (APTS05)	- Video Cameras - Video Cassette Player - Television	none			$ 330,000	72,600	402,600	$ -	$ 6,600		56 buses will be equipped with nsmision ym.stescamera, recorder and low frame transmission.		50 buses for short term and 100 buses for mid term rest will be long term.
		CENTRO		**Subtotal for all Short Term Projects**			**12**	**projects**	**Mid Range**	**4,386,000**	**964,920**	**5,350,920**	**349,800**	**350,720**				
									High-end	5,482,500	1,206,150	6,688,650	437,250	438,400				
									Low-end	3,289,500	723,690	4,013,190	262,350	263,040				
		CENTRO		**Subtotal for all Mid Term Projects**			**11**	**projects**	**Mid Range**	**6,305,000**	**1,387,100**	**7,692,100**	**558,300**	**588,820**				
									High-end	7,881,250	1,733,875	9,615,125	697,875	736,025				
									Low-end	4,728,750	1,040,325	5,769,075	418,725	441,615				
		CENTRO		**Subtotal for all Long Term Projects**			**9**	**projects**	**Mid Range**	**4,128,000**	**908,160**	**5,036,160**	**685,500**	**750,880**				
									High-end	5,160,000	1,135,200	6,295,200	856,875	938,600				
									Low-end	3,096,000	681,120	3,777,120	514,125	563,160				
		Summary		**Grand Total**			**32**	**projects**	**Mid Range**	**14,819,000**	**3,260,180**	**18,079,180**						
									High-end	18,523,750	4,075,225	22,598,975						
									Low-end	11,114,250	2,445,135	13,559,385						

[1] Component costs include hardware, firmware, software, integration, and communications costs

[2] E&I costs include preliminary through final engineering, inspection, and other (e.g., construction engineering) costs; estimated at 22 percent of component costs

Table 15 CENTRO Traffic Management Center Operation and Maintenance Cost Estimate

Item No.	Project No.	Project Name	Time Frame	Operation					Maintenance					Operation Cost (Yearly)	Operation Cost (5 Years)	Maintenance Cost (Yearly)	Maintenance Cost (5 Years)
				TMC Supervisor	System Engineer	Operator	Technician	Utilities	Supervisor	Technician	Transportation	Equipment	Miscellaneous				
9	CENTRO-05	Network Operation Center Operation & Maintenance, Phase I, Short Term	Short Term	0	1	4	0	$ 300	0	2	$ 1,000	$ 10,000	$ 10,000	$ 318,600	$ 1,593,000	$ 167,000	$ 835,000
12	CENTRO-19	Network Operation Center Operation & Maintenance, Phase II, Mid Term	Mid Term	1	1	4	1	$ 500	1	2	$ 2,000	$ 20,000	$ 10,000	$ 493,500	$ 2,467,500	$ 279,000	$ 1,395,000
32	CENTRO-28	Network Operation Center Operation & Maintenance, Phase III, Long Term	Long Term	1	1	6	1	$ 500	1	3	$ 3,000	$ 20,000	$ 10,000	$ 613,500	$ 3,067,500	$ 358,500	$ 1,792,500

Table 16 CENTRO Projects Cost Calculations

Project Serial No.	Project No.	Project Name	Network Construction and Study			Central Software/Hardware			Interface			ITS Field Construction			Operation Maintenabnce Services Repair Estimate				Project Construction Cost Estimate	Annual Operation Service Cost	Annual Maintenance Repair Cost	NOTES
			Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Component	Unit Cost (k)	Quantity	Com. Service Low Speed (DS0)	Com. Service High Speed (T1)	Power Service	Repaire Support				
CENTRO																						
1	CENTRO-01	Automated Transit Itineary Agency based				Central Software Modules/ Hardware	200	1										$ 333	$ 200,000	$ -	$ 4,000	
2	CENTRO-02	Web based itinerary planning				Central Software Modules/ Hardware	200	1										$ 333	$ 200,000	$ -	$ 4,000	
3	CENTRO-03	Automatic Vehicle Location and Control (AVLC) System														2		$ 8,000	$ -	$ 21,600	$ 96,000	
4	CENTRO-04	Radio System Upgrade	Adding Two new Base stations (use existing or new Towers)	75	2	Upgrade Equipment	150	1	Upgrade Equipment	50	3	Mobile Data Unit Upgrade for 50 Buses	3	206				$ 1,780	$ 1,068,000	$ -	$ 21,360	
5	CENTRO-05	Network Operation Center Operation & Maintenance, Phase I, Short Term																	$ -	$ 318,600	$ 167,000	
6	CENTRO-06	Automatic Passenger Counters, Phase I, Short Term				Database and Software preparation	50	1				Bus conter Equipment	15	30				$ 833	$ 500,000	$ -	$ 10,000	
7	CENTRO-07	Station Bus Request				System Hardware and Software	150	1	Data Radio Interface for 50 Bus Stop Stations	3	50	Bus Request Unit	3	50				$ 750	$ 450,000	$ -	$ 9,000	
8	CENTRO-08	Automated Fare Collection Machine, Phase I, Short Term				Database and Software preparation	50	1	Data Interface	3	4	Ticket Media Machines	50	4	4			$ 437	$ 262,000	$ 4,800	$ 5,240	
9	CENTRO-09	Display Monitor System Phase I, Short Term				System Hardware and Software	100	1	Data Interface	3	2	Station Monitoring Package	50	2	2			$ 343	$ 206,000	$ 2,400	$ 4,120	
10	CENTRO-10	On-Board Traveler Information System Phase I, Short Term				System Hardware and Software	50	1				Bus Display Equipment	15	50				$ 1,333	$ 800,000	$ -	$ 16,000	

Table 16 CENTRO Projects Cost Calculations

CENTRO																						
11	CENTRO-11	Interactive Kiosks Phase I				System Hardware and Software	150	0	Data Interface	3	0	KISKS Stations	20	0	2			$ -	$ -	$ 2,400	$ -	Currently there is money in the TIP for 2 short term.
12	CENTRO-12	Transit Vehicle Surveillance System Phase I, Short Term				System Hardware and Software	200	1				Bus Camera Equipment	10	50				$ 1,167	$ 700,000	$ -	$ 14,000	
13	CENTRO-13	Expansion/ Enhance TMC	Upgrade Operation Room	150	1	Upgrade System Hardware and Software	150	1	Upgrade Communicat ion Interfases to the Base Stations	20	6					2		$ 700	$ 420,000	$ 21,600	$ 8,400	
14	CENTRO-14	Transit Vehicle Surveillance System Phase II, Mid Term				System Hardware and Software Expansion	50	1				Bus Camera Equipment (equipment unit cost will be %30 lower than shoert term period)	7	100				$ 1,250	$ 750,000	$ -	$ 15,000	
15	CENTRO-15	Automatic Vehicle Location and Control (AVLC) System, Expansion Phase				System Hardware and Software Expansion/U pgrading	150	1				Rmote Terminal Unit	6	100				1250	$ 750,000	$ -	$ 15,000	
16	CENTRO-16	Automatic Passenger Counters Phase II, Mid Term				Database and Software preparation	50	1				Bus conter Equipment	15	77				$ 2,008	$ 1,205,000	$ -	$ 24,100	
17	CENTRO-17	On-Board Traveler Information System Phase II, Mid Term				System Hardware and Software Expansion	50	1				Bus Display Equipment	15	100				$ 2,583	$ 1,550,000	$ -	$ 31,000	
18	CENTRO-18	Display Monitor System Phase II, Mid Term				System Hardware and Software	50	1	Data Interface	3	4	Station Monitoring Package	50	4	4			$ 437	$ 262,000	$ 4,800	$ 5,240	If the CENTRO-08 will be implemented the communication leased service can be served for this project and the operation cost should be adjusted.
19	CENTRO-19	Network Operation Center Operation & Maintenance, Phase II, Mid Term																	$ -	$ 493,500	$ 279,000	

Table 16 CENTRO Projects Cost Calculations

CENTRO																						
20	CENTRO-20	Automated Fare Collection Machine, Phase II, Mid Term				Database and Software preparation	50	1	Data Interface	3	6	Ticket Media Machines	50	6	6			$ 613	$ 368,000	$ 7,200	$ 7,360	
21	CENTRO-21	Bus Driver Navigator System Phase I, Pilot Project	CENTRO Static Guidance System Deployment	100	1							Bus Navigator Unit	10	10				$ 333	$ 200,000	$ -	$ 4,000	
22	CENTRO-22	Interactive Kiosks Phase II				System Hardware and Software	50	1	Data Interface	3	4	KIOSK Stations	20	4	4			$ 237	$ 142,000	$ 4,800	$ 2,840	
23	CENTRO-23	Automated Vehicle Collision Avoidance System Phase I, Pilot Project	CENTRO Automated Vehicle Collision Avoidance System Deployment	200	1							Bus, On vehicle Equipment (Sensors, Control devices)	20	10				$ 667	$ 400,000	$ -	$ 8,000	
24	CENTRO-24	On-Board Traveler Information System Phase III, Long Term				System Hardware and Software Expansion	50	1				Bus Display Equipment	15	56				$ 1,483	$ 890,000	$ -	$ 17,800	
25	CENTRO-25	Automatic Passenger Counters Phase III, Long Term				Database and Software preparation	50	1				Bus conter Equipment	7	70				$ 900	$ 540,000	$ -	$ 10,800	
26	CENTRO-26	Display Monitor System Phase III, Long Term				System Hardware and Software Upgrading	100	1	Data Interface	3	6	Station Monitoring Package	50	6	6			$ 697	$ 418,000	$ 7,200	$ 8,360	If the CENTRO-20 will be implemented the communication leased service can be served for this project and the operation cost should be adjusted.

Table 16 CENTRO Projects Cost Calculations

CENTRO																						
27	CENTRO-27	Expansion and Upgrading of Existing CAD System				Central Hardware and Software Upgrading	150	1										$ 250	$ 150,000	$ -	$ 3,000	
28	CENTRO-28	Network Operation Center Operation & Maintenance, Phase III, Long Term																	$ -	$ 613,500	$ 358,500	
29	CENTRO-29	Bus Driver Navigator System Phase II, Expansion Project	CENTRO Dynamic Guidance System Deployment	100	1	Central Hardware and Software	100	1				Bus Navigator Unit	10	50				$ 1,167	$ 700,000	$ -	$ 14,000	
30	CENTRO-30	Automated Vehicle Collision Avoidance System Phase II, Expansion Project	CENTRO Automated Vehicle Collision Avoidance System Expansion	100	1							Bus, On vehicle Equipment (Sensors, Control devices)	20	50				$ 1,833	$ 1,100,000	$ -	$ 22,000	
31	CENTRO-31	Interactive Kiosks Phase III				System Hardware and Software	50	1	Data Interface	3	12	KIOSK Stations	20	12	12			$ 543	$ 326,000	$ 14,400	$ 6,520	
32	CENTRO-32	Transit Vehicle Surveillance System Phase III, Long Term				System Hardware and Software Expansion	50	1				Bus Camera Equipment (equipment unit cost will be %30 lower than shoert term period)	5	56				$ 550	$ 330,000	$ -	$ 6,600	

3.7 EMERGENCY SERVICE PROVIDERS

Emergency service providers play a vital role in responding to transportation incidents. As such, any technology related equipment that can improve their performance is strongly recommended.

Currently, the 911 Center will receive all 911 calls and will dispatch all emergency service providers in the area. The 911 Center Computer Aided Dispatch system along with the radio communications network and in vehicle display unit has proven to efficiently work and benefit the region. The 911 Center is in process of deploying the E911 technology and will soon upgrade their CAD system as well as install an automatic vehicle location system.

Since the functions that emergency service providers perform are beyond and above the transportation management services, any recommended technology deployment or upgrade has to consider the overall impact and needs.

The detailed analysis of emergency service providers overall needs are not part of this study and any recommended project has to be comprehensive. Therefore, this section of the report will recommend general ITS improvement needs in the region without being specific.

Operations Center – As technology is implemented, the need for an operations center become more obvious. Whether dealing with the existing radio system and communication network, or upgrading these technologies and procuring Computer Aided Dispatch system (CAD) along with Automatic Vehicle Locations (AVL) technologies and having remote capabilities to monitor cameras on the roadways and managing ITS equipment, an operations center is needed.

This study recommends prior to any design of an operations center a study of Short-Term and Mid-Term functional needs.

This study also recommends, to the extent possible, co-location of emergency service providers along with their counterpart transportation agencies. In particular, a co-location of NYSDOT and NYSP as well as City of Syracuse DPW and City Police are strongly recommended.

Communications Network – As various agencies undertake wireless or wireline communications initiatives, others communication needs, overall share of resources and integration must be considered.

311 Non-Emergency Call Center – Since many of the 911 calls are not emergency calls, the FCC has allocated the 311 number for the purpose of reporting non-emergency calls. As the region will determine whether a centralized 311 Center is needed or more integrated agency based centers are better, the integration of such centers with the 911 Center must be considered.

Accident Reporting System – It is recommended to upgrade the current state of accident reporting system and procure additional technologies to automate the process.

ITS Information/ Video Sharing – ITS is most commonly used to assist in detection and management of incidents. Such information is beneficial to emergency service providers. The concept of Regional Information sharing will assure such coordination and communication of information. As the system evolves and is updated, ITS information will be shared among agencies, and ultimately, videos will be available on the web for others usage.

There are some cases where agencies need to share data and/or multiple videos and share command and control of field equipment (e.g., Syracuse Police and City DPW). In such cases, if co-location is not possible, direct communication links with agreed remote functionalities are recommended.

Signal Preemption – The study recommends extension of the existing signal preemption arrangements to ambulances, in addition to the Fire department. This concept needs to be re-evaluated with facility owners.

Portable VMS Speed Enforcement Trailers – It is recommended to procure additional Speed Enforcement Trailers to assist emergency service providers in calming traffic in particular in residential area and construction zones.

Automatic Vehicle Location – Since the 911 Center is dispatching all emergency service providers in the Onondaga County area, knowing the approximate locations of all emergency vehicles is essential to support the “closest car” concept. The 911 Center is planning to procure a county wide AVL system and equip all emergency fleet vehicles with the AVL technology and to integrate with their existing E911 and CAD initiatives. Due to security issues as well the volume of emergency fleet vehicles in the county, this concept of integration is highly desirable. Therefore, it is initially recommended to deploy a centralized AVL system at the 911 Center and provide agencies with a remote functionality to monitor the location of their fleet.

The 911 Center coverage area is within Onondaga County. The NYSDOT Troop D coverage area extends to four other counties. This recommendation will be further enhanced once the NYSP statewide plans and policies are better known. In the future, if any agencies will require installing an agency-based AVL system, integration with the 911 Center must be considered.

Computer Aided Dispatch – The 911 Center is in the process of upgrading their existing CAD system. It is recommended to provide emergency service providers with real-time remote functionalities of the status of 911 calls as well as the locations and status of their fleet vehicles. Also, the ability for agencies to communicate to their fleets via the CAD remote terminal for non-emergency needs is recommended. The 911 Center coverage is within Onondaga County. The NYSDOT Troop D coverage area extends to four other counties. This recommendation will be further enhanced once the NYSP statewide plans and policies are better known. In the future, if any agencies will require installing agency based CAD system, the integration with 911 Center must be considered.

Syracuse Regional Emergency Network (SYREN) - The existing emergency communication network is composed of the 911 Center CAD and radio systems. The 911 Center future upgrade plans include; an upgrade of the existing CAD system, inclusion of a GIS-based map for the county, geo-based location of all 911 cellular calls and, AVL system for all emergency fleets. As recommended in the Regional Architecture Report, the integration of all information along with provisions for additional remote functionalities to all emergency service providers is strongly recommended.

Operations and Maintenance - In order to maintain and operate any ITS equipment, it is vital to allocate a budget for such cost. The cost is comprised of: software and hardware upgrade and maintenance cost, Operations Center staffing cost, utility and other direct cost, and the maintenance cost of field equipment.

3.8 INTER-AGENCY PROJECTS

The ITS National Architecture attempts to promote the integration and sharing of resources among agencies. This goal forms the basis for the recommendations made, and ITS projects defined, in this study.

The first and most important step in achieving integration and sharing of information is to build an electronic communications network among the involved agencies, through which regional construction activities, incidents and special events can be shared across agency and geographic boundaries. The Regional Information Sharing Network, known to some as the METCON (METropolitan Communications Network), has been defined as the first early action project, upon which to build all future integration and information sharing needs. We recommend using ITS standards such as NTCIP for future ease of integration and to ensure compliance with the National Architecture. By using the approved ITS standards, all current and future local systems can translate their data into the same format via various data interfaces for integration using the METCON system. Even though this is considered an interagency project, NYSDOT has assumed the Champion role, has acquired the needed funds and will lead this effort on behalf of the region.

The architecture of the METCON system should provide for future integration with ITS, as well as dissemination of real-time information among agencies. As such, the next phase of the METCON project will provide integration with the I-81 Freeway Management System, to collect real time traffic conditions along the I-81 corridor. This integration will take place via a Data Interface (DI) and will provide real-time traffic conditions on the State facilities to other agencies. Upon further expansion of the NYSDOT Region 3 freeway coverage (e.g., I-690, I-480, etc.) the DI will automatically share additional traffic conditions with all agencies.

We also recommend that NYSTA, City of Syracuse and Onondaga County provide similar DIs from their existing and future systems to the METCON, for the benefit of all other agencies.

The expansion of the NYSDOT Weather Monitoring System will provide the region with a wealth of weather information. The study recommends integration and sharing of this information via the METCON system.

METCON will be a multi-modal, multi-agency system. Information from the CNYRTA will be integrated into this system. We also recommend integrating METCON and a future transit trips itinerary system to provide travelers with a single point of access to the regional information.

The study also recommends deployment of the Syracuse Regional Emergency Network (SYREN) under the 911 Center authority. This network will upgrade the existing network and will provide additional functionalities, such as the E911 system, upgraded GIS, AVL, etc. A direct data interface is recommended between SYREN and METCON to assure timely and real-time sharing of information.

The National Architecture emphasizes, to the extent possible, sharing of agencies resources, as well as data and information. NYSDOT is about to deploy ITS along the I-81 Freeway within the Syracuse Metropolitan area. There will be a minimum of eight cameras at the major interchanges within the City of Syracuse. The City of Syracuse can benefit from video feeds from these cameras to enhance its operations. Both, the NYSP and City of Syracuse Police can use this real-time video feed to better manage traffic conditions and incidents along the roadways. The 911 Center can take advantage of real time information to more efficiently dispatch needed resources to an incident. The study recommends future expansion of the METCON system to provide interagency video sharing ability across all facilities.

The development of a regional 511 system is another recommended interagency project that will take advantage of the METCON system to provide travelers with unified seamless transportation information.

We also recommend sharing the CENTRO's AVL infrastructure with the City of Syracuse, Onondaga County and NYSDOT agencies to provide AVL capabilities to each agency's' fleet.

CNYRTA has on its Transportation Improvement Plan funds to deploy two kiosks. We recommend using this opportunity to integrate the kiosks with METCON and provide multi-agency, multi-modal information to users.

Each agency can either develop or enhance their website to provide transportation information. We recommend using the METCON database for a regional transportation website to provide comprehensive information to the travelers.

The study recommends co-location of Transportation Management Centers to the extent possible to assure proper and needed integration of information and resources as well as minimize the cost of remote connections/integrations within agencies.

NYSDOT, the City of Syracuse DPW and the Onondaga County DOT do not believe there is a need for coordination of signal systems among the agencies. The study recommends further discussion on this issue. In particular, there are NYSDOT signals at the bottom of off-ramps from major interchanges that need to be integrated with the existing City signal system.

The study recommends, as a short-term project, the creation of an incident management group that includes all emergency service providers and transportation facility operators, to be responsible for the development of a regional incident management plan. The plan will be comprehensive, multi-agency focused, and multi-modal.

The study recommends continuing ITS coordination activities, as well as revising the ITS Strategic Plan on a regularly basis (every three to five years). This could take the form of a “Syracuse Regional ITS Policy Committee” or other formal (or informal) body that meets periodically to discuss issues and problems, and to plan for maintenance and continued upgrade of the region’s ITS.

4. OPERATIONS AND MAINTENANCE

The projects described in Chapter 3 include individual agency initiatives as well as coordinated activities between two or more of the agencies. Effectively operating and maintaining systems that share information may require institutional arrangements be put in place to enable the agencies to coordinate their initiatives over the plan period.

Further, it is essential that agencies view O&M as an integral part of the entire project lifecycle. Accordingly, agencies must include O&M in initial project planning, budgeting, staffing and resource allocation.

This Chapter presents general operations and maintenance issues that impact the Metropolitan Agencies and the regional ITS O&M including devices and services. The recommendations are summarized in Table 17.

Approaches to O&M

There are three approaches that can be followed to provide O&M support for ITS systems -- in-house, outsourcing, and facilities management. Each has its own distinct benefits and risks associated with them.

In-House Support

From an operations perspective, using all agency staff is ideal because managers and team leaders have a single personnel management system to deal with and team cohesiveness is easier to establish and maintain. But given today's trends of downsizing and doing more with less, many agencies around the country have a difficult time in finding, training, and keeping the required talented staff to operate and maintain their ITS.

In-House Benefits	Risks
Establish a high-tech career track within the State government. Share staff with other departments with similar needs. Sense of ownership and understanding of the system.	Recruiting, retention, and staffing technology positions is difficult in this region, with private firms offering high salaries to personnel with similar qualifications Traditionally difficult to control costs and maintain quality standards, for the reasons cited above Competing priorities within the State government make it difficult over the Long-Term to maintain the commitment

Outsourcing

Staffing from within an agency has many advantages; however, in an era of downsizing government, state and local agencies are, for the most part, facing diminishing budgets year after year. This leads to pressures to cut staffs and freeze existing vacancies even in those cases where outside non-general fund budget sources are available. Unfilled vacancies in an ITS supporting role will usually result in significantly reduced system effectiveness.

Outsourcing can often by-pass these problems. Staffing through outsourcing does not result in a "higher body count". The budgetary item for outsourcing is often treated by the agency administration like a line item for the electricity to run the TMC and field equipment, with none of the negative perceptions involved in the financing of new staff positions. It is also easier for a private firm to fill vacancies with appropriately skilled personnel as well as fire poorly performing employees.

Outsourcing Benefits	Risks
Clear separation between agency and contractor responsibilities Agency can decide what tasks it wishes for the contractor to perform, and which it wishes to perform with its own forces	Little flexibility to get services outside the specific scope without extensive administration and additional cost Little incentive for the contractor to exceed performance standards or accomplishment criteria

Facilities Management

The third option is for agencies to engage a facilities management contractor in a public-private venture for the purposes of providing ITS O&M. While facilities management shares some characteristics with contracting out, it also provides a level of flexibility and incentives for both parties that a service contract does not. Facilities management, or facilities outsourcing, involves use of private-sector staff to perform traditional government services, working on a broad mission basis, and targeting the standard of mission accomplishment. Although facilities management is a new concept in traffic management, it is a tried and true method for providing service in other high-technology environments, including computer facilities, law enforcement dispatching systems and telecommunications systems.

Facilities Management Benefits	Risks
Keep up with technical realities Keep up with business realities Provides common goals and the same incentive to succeed for all parties involved	All public/private ventures are risks if incentives are not carefully crafted. Control and liability concerns.

It is important to realize that there exists no one O&M model that fits all agencies. Regardless of the option chosen there is one consideration that is important to maintain, a commitment to the long-term sustenance of the system. No matter which method of O&M is utilized, the primary goal is to protect the value of the initial systems investment.

Importance of Preventive Maintenance

While most, if not all, public agencies provide response maintenance, few provide preventative maintenance on a regular, routine scheduled basis. Preventative maintenance, or routine maintenance, is defined as a set of checks and procedures to be performed at regularly scheduled intervals for the upkeep of equipment. Preventative maintenance is intended to ensure reliable mechanical and electrical functioning and operation of equipment, thereby reducing equipment failures, response maintenance, road user costs, and liability exposure. The emphasis on preventative maintenance is taking proactive steps to repair or replace defective equipment, thus ensuring that problems are not left until failure occurs.

Lack of staffing and funds are often cited as the primary reasons why preventative maintenance is not carried out. Furthermore, most ITS field devices are comprised of solid-state components that have become much more reliable in quality in over the past five years. As such, most agencies simply replace these components when they fail. Nonetheless, we strongly recommend that agencies within purview of the Syracuse ITS Strategic Plan making a preventive maintenance program an element of their overall O&M program.

TABLE 17 OPERATIONS AND MAINTENANCE ISSUES & RECOMMENDATIONS

ISSUES	RECOMMENDATION(S)
Geographic coverage	The priority impact/reporting area for the ITS is bounded by Onondaga County area and in particular, the Syracuse Metropolitan area. All agencies with operations in this geographic area are expected to cooperate and coordinate with the project stockholders with regard to sharing of information on incidents, management of incidents, and scheduled construction.
Equipment compatibility	ITS equipment specifications should be NTCIP or TCIP compliant. Compatibility does not require that agencies install identical equipment. Major devices recommended for compatibility: VMS, CCTV, Detectors,

	Field monitors, AVL/CAD/GPS, GIS, Kiosks, probe surveillance, signal controllers.
VMS Messaging	Common message formats are recommended but message standardization is out of scope of the project. Standardization is difficult because of different sign manufacturers and specifications for each agency. Message uniformity among intersecting/connecting agencies is important to avoid giving drivers conflicting messages. Guidelines should be developed regarding placement of future devices at strategic locations.
Hardware compatibility	Central office equipment should allow for remote system operations, and center-to-center connection sharing as defined in NTCIP Center To Center protocol.
Software compatibility	There should be an open architecture for each agency; an agency ITS systems should be able to communicate with each other and/or interact. GIS compatibility for information transfer is recommended.
Traffic mgt. resources	Signs, markings, etc. should be MUTCD compliant.
Contract or in-house management and maintenance of ITS	Maintenance begins with “maintenance friendly” design. System specifications should be in a “state of common usage”. Efforts should be made to deploy equipment that can be maintained, only. Preventive maintenance is essential. Agencies should not anticipate high tech maintenance expertise to be found in-house. The agencies should develop in-house expertise for basic maintenance. System-wide, sole source maintenance contracts are not advisable; Contractors should have fixed geographic and well-defined equipment assignments. Response time should be defined based on importance of equipment. Specifications (quality control, maintenance standards, response time, etc.) must be the same whether using in-house or contract maintenance. Operations and planning must be coordinated.
Lifecycle Costing	Lifecycle costing must be included for all projects. Maintenance of technology is different than mechanical or even highway maintenance. The term “operations” covers all activities required for a system to function properly. O&M costs range from 6-10% of the system’s present worth. Systems procurement must be based on functionality and maintainability. Systems may become obsolete before major maintenance is required. However, systems should be procured with the intent to upgrade wherever possible. When equipment is ultimately determined to be obsolete for its intended purpose, other uses should be identified.
Information Dissemination Policies	There should be free and open exchange between/among agencies. Further, dissemination of details to the public should be based on the originator’s request. Knowledge of other agency’s facilities/services is essential.

ISSUES	RECOMMENDATION(S)

Definition of Clearance	An incident is cleared when no incident related impacts remain.
Joint Control Center staffing	Joint control center operations requires a definitive agreement on supervisory roles. A mechanism for conflict resolution must exist. In joint operations, job sharing, training (orientation) and cross training are essential. Minimum skill requirements and qualifications must be established. Consideration should be given to a college training program (preferably with Transportation students).
Shared databases	An infrastructure that supports inter-agency information sharing without burdening other agencies should be developed. Syracuse Regional Information Sharing Network is anticipated to satisfy this need. All agencies should share all information. Information should be available upon request. Access to databases should be based on prior agreements. An agency has the right to know how its information will be used. The originating (supplying) agency has control. While not part of the scope of this project, liability issues must be addressed.
Traffic control devices	Agencies should share devices with/or provide access to other agencies. Like shared databases, the agency owning the devices has controlling and priority use. MOUs should be developed to define roles and expectations. Where possible, devices should be located where other agencies can take advantage of the device. A coordinating mechanism needs to be established for agencies to take advantage of this.
MOUs for shared use of traffic control devices	MOUs should be developed. Where devices are shared with public agencies, the MOUs should include: - definition and/or reason for use - duration of usage - specific circumstances - compensation for additional costs (maintenance, staffing, etc.) Reciprocity between transportation and non-transportation agencies should be encouraged. Device sharing with private organizations typically is limited to information sharing (i.e., not control.)
Integration of systems	Traffic knows no jurisdictional bounds; systems should be integrated. The regional architecture concept will address this, in most part. Control, responsibility and standards need to be addressed before any systems are fully integrated.
Funding	Systems should not be built without operations and maintenance funds identified. The process for acquiring funding needs to be streamlined and there should be greater flexibility in use of funds. Funds for O&M should be identified in the Regional Transportation Plan.

While these issues are fairly broad, virtually every inter-agency information or data-sharing situation is addressed. Furthermore, these recommendations establish challenges to the agencies not only for external arrangements but also for internal ones such as between the City Public Work, Police, Fire, and other departments within the City of Syracuse.