Michigan Department of Transportation
Regional ITS Architectures and Deployment Plans

Superior Region

Final
Regional ITS Architecture

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January 17, 2008
012578004

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AASHTO	American Association of State Highway and Transportation Officials
AHS	Automated Highway System
AMBER	America's Missing: Broadcast Emergency Response
ANSI	American National Standards Institute
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
AWOS	Automated Weather Observing System
CCTV	Closed Circuit Television
CJIC	Criminal Justice Information Center
DCM	Data Collection and Monitoring
DMS	Dynamic Message Sign
DNR	Department of Natural Resources
DPW	Department of Public Works
DSRC	Dedicated Short Range Communication
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HRI	Highway Rail Intersection
IEEE	Institute of Electrical and Electronics Engineers
IMMS	Incident Management Message Sets
ISO	International Standards Organization
ITS	Intelligent Transportation System
MAC	Medium Access Control
MDT	Mobile Data Terminal
MITSC	Michigan Intelligent Transportation Systems Center
MOU	Memorandum of Understanding
MSP	Michigan State Police
NEMA	National Emergency Management Association

LIST OF ACRONYMS

NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol
NWS	National Weather Service
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users
SDO	Standards Development Organization
STMF	Simple Transportation Management Framework
TCP/IP	Transmission Control Protocol/Internet Protocol
TEA-21	Transportation Equity Act for the 21st Century
TIP	Transportation Improvement Program
TMC	Transportation Management Center
TOC	Traffic Operations Center
TSC	Transportation Service Centers
UDP/IP	User Datagram Protocol/Internet Protocol
USDOT	United States Department of Transportation
VIVDS	Vehicle Imaging Video Detection Systems
XML	Extensible Mark-up Language

1. INTRODUCTION

1.1 Project Overview

Development of a regional intelligent transportation system (ITS) architecture is one of the most important steps in planning for and implementing ITS in a region. ITS architectures provide a framework for implementing ITS projects, encourage interoperability and resource sharing among agencies, identify applicable standards to apply to projects, and allow for cohesive long-range planning among regional stakeholders. The ITS architecture allows stakeholders to plan for what they want their system to look like in the long-term, and then break out the system into smaller, more modular pieces that can be implemented over time as funding permits.

ITS architectures satisfy the conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) bill passed in 2005. In response to Section 5206(e) of TEA-21, the Federal Highway Administration (FHWA) issued a final rule and the Federal Transit Administration (FTA) issued a final policy that required regions implementing any ITS projects using federal funds to have an ITS architecture in place by April 2005. After this date, any ITS projects must show conformance with their regional ITS architecture in order to be eligible for funding from FHWA or FTA. Regions that had not yet deployed ITS were given four years to develop an ITS architecture after their first ITS project proceeded to final design.

In November 2006, the Michigan Department of Transportation (MDOT) began development of the Superior Regional ITS Architecture. The Regional ITS Architecture has the same geographic boundaries of the MDOT Superior Region and focuses on a 10-year vision of ITS for the Region. In addition, a separate ITS Deployment Plan was developed to identify and prioritize specific ITS projects recommended for the Region in order to implement the ITS architecture.

The ITS Architecture and the ITS Deployment Plan were both developed with significant input from local, state, and federal officials. A series of four workshops were held to solicit input from stakeholders and ensure that the plans reflected the unique needs of the Region. Copies of the draft reports were provided to all stakeholders. The Regional ITS Architecture and Deployment Plan developed reflects an accurate snapshot of existing ITS deployments and future ITS plans in the Region. Needs and priorities of the Region will change over time and in order to remain effective this plan should be periodically reviewed and updated.

1.2 Document Overview

The Superior Regional ITS Architecture report is organized into five key sections:

Section 1 – Introduction

This section provides an overview of the National ITS Architecture requirements, the Superior Regional ITS Architecture, and the key features and stakeholders in the Superior Region.

Section 2 – Regional ITS Architecture Development Process

An overview of the key steps involved in developing the ITS architecture for the Superior Region is provided in this section. It includes a discussion of stakeholder involvement, architecture workshops, and the architecture development process.

Section 3 – Customization of the National ITS Architecture for the Superior Region

This section contains a summary of regional needs and details the customization of the National ITS Architecture to meet the ITS vision for the Region. The market packages that were selected for the Region are included in this section and interconnects are presented, including the "sausage diagram" showing the relationships of the key subsystems and elements in the Region.

Section 4 – Application of the Regional ITS Architecture

Functional requirements and standards that apply to the Region, as indicated by the Regional ITS Architecture, are presented in Section 4. Operational concepts identifying stakeholder roles and responsibilities have been prepared and potential agreements to support the sharing of data and resources have been identified.

Section 5 – Maintaining the Regional ITS Architecture

A use and maintenance plan has been developed for the Superior Regional ITS Architecture and is included in this section. The plan outlines the procedure for updating the ITS architecture over time.

The Superior Regional ITS Architecture also contains five appendices:

- Appendix A – National ITS Architecture Market Package Definitions;
- Appendix B – Customized Market Packages;
- Appendix C – Element Functional Requirements;
- Appendix D – Stakeholder Database; and
- Appendix E – Architecture Conformance and Maintenance Documentation Form.

1.3 Assessment

The Superior Regional ITS Architecture and Deployment Plan has been assessed based on twelve items derived from both the April 8, 2001 USDOT ITS Architecture and Standards Conformity Rule/Policy and from the architecture development process described in the *Regional ITS Architecture Guidance Document*. A listing of these items is shown in **Table 1**.

Table 1 - Summary of Architecture Assessment Categories

Content Criteria	Architecture Implementation Criteria
1. Architecture Scope	8. Implementation Plan (use)
2. Stakeholder Identification	9. Maintenance Plan
3. System Inventory	10. Agreements
4. Needs and Services	11. Standards Identification
5. Operational Concept	12. Project Sequencing
6. Functional Requirements	
7. Interfaces/Flows	

1.4 The Superior Region

1.4.1 Geographic Overview

The Superior Region is defined by the boundaries of Lake Superior to the north, Lake Huron and Lake Michigan to the south, St. Mary's River on the east, and Wisconsin on the west, as shown in **Figure 1**. The Region encompasses the 15 counties of the MDOT Superior Region on the Upper Peninsula of Michigan.

The largest cities within the Superior Region include Escanaba, Marquette, and Sault Ste Marie, and there are several other smaller communities within the geographic boundaries of the Region. When developing the stakeholder group, the project team coordinated with MDOT to invite the appropriate cities, counties, state and federal agencies, and area transit providers. The Delta Area Transit, Eastern Upper Peninsula Transportation Authority, and Marq-Tran are the transit providers that operate within the regional boundaries. Marq-Tran provides fixed route and paratransit services within the City of Marquette. The Delta Area Transit and Eastern Upper Peninsula Transportation Authority operate demand response service in the rural areas of the Region. **Table 2** in Section 1.4.4 identifies the stakeholders that participated in the process.

When developing the architecture, a 10-year vision for ITS in the Region was documented. In the ITS Deployment Plan, the 10-year time frame was broken down into smaller time periods to prioritize and sequence the projects. The naming convention used for elements in the Superior Regional ITS Architecture is consistent with the naming convention that will be used in the North, Bay, Grand, and Southwest Regions and the Statewide ITS Architecture. This consistency provides seamless connections to those other architectures without requiring that they be specifically called out. Statewide initiatives, such as statewide commercial vehicle operations and 511 traveler information service, are referenced in the Regional ITS Architecture, but will be addressed in further detail in the Statewide ITS Architecture.

1.4.2 Transportation Infrastructure

As illustrated in Figure 1, the Region is served by several State and Federal highways. The primary roadway facilities include US 2, I-75, and M-28.

US 2 is one of the major east-west roadways that traverses the Upper Peninsula from Ironwood, Michigan, close to the Wisconsin border, to I-75. The highway generally follows the southern Lake Michigan coastline of the Upper Peninsula and provides the Region with access to Escanaba and the Mackinac Bridge. M-28 is the other major east-west highway that services the northern part of the Region and passes through the city of Marquette. M-28 begins in Wakefield, Michigan, in the western part of the Upper Peninsula and eventually intersects with I-75. I-75 runs north-south through the eastern part of the Region, running from the International Bridge in Sault Ste Marie, through the Upper Peninsula, and connecting the Upper Peninsula to main Michigan at the Mackinac Bridge.

Figure 1 - Superior Regional Boundaries

1.4.3 Superior Regional ITS Plans

The Superior Region began the development of a regional ITS architecture in 2006 when MDOT contracted with a consultant to develop several regional ITS architectures and deployment plans in the State of Michigan. Version 5.1 of the National ITS Architecture was used in the Architecture development.

It is important to recognize the initial deployment of ITS infrastructure in a region because as of April 2005, in order for a region to receive funding for ITS projects from the Highway Trust Fund, the United States Department of Transportation (USDOT) requires that the region have an ITS architecture developed. This requirement only applies to regions with existing ITS infrastructure deployed. For regions that do not have any ITS infrastructure deployed, the USDOT requires that they have an ITS architecture within four years of their first ITS project entering final design.

The Superior Region has several ITS components deployed in the field. Examples of implementations in the Region include closed loop signal systems with video image vehicle detection systems (VIVDS), portable dynamic message signs (DMS), and weather stations. As the Superior Region pursues funding opportunities for additional projects, it will be necessary to show that a project fits within the ITS architecture developed for the Region.

1.4.4 Stakeholders

Due to the fact that ITS often transcends traditional transportation infrastructure, it is important to involve non-traditional stakeholders in the architecture development and visioning process. Input from these stakeholders, both public and private, is a critical part of defining the interfaces, integration needs, and overall vision for ITS in a region.

Table 2 contains a listing of stakeholders in the Superior Region who have participated in the project workshops or provided input to the study team as to the needs and issues that should be considered as part of the Regional ITS Architecture. Other stakeholders that were invited to participate but were not able to attend were provided minutes of workshops and copies of reports to encourage their participation as much as possible. Appendix D contains a copy of the stakeholder database and workshop attendance records.

Table 2 - Superior Stakeholder Agencies and Contacts

Stakeholder Agency	Address	Contact
Delta Area Transit Authority	2901 27th Avenue North Escanaba, Michigan 49829	Ray Leach
Delta County 9-1-1 Dispatch	1900 Third Avenue North Escanaba, Michigan 49829	Robert Berbohm
Mackinac County 9-1-1	100 South Marley St. Ignace, Michigan 49781	Bryce Tracy
Marquette County CVB	337 West Washington Marquette, Michigan 49855	Pat Black
MDOT - Crystal Falls TSC	120 Tobin-Alpha Road Crystal Falls, Michigan 49920	Benjamin Feldhausen
MDOT - Escanaba Region	1818 3rd Avenue North Escanaba, Michigan 49829	Randy VanPortlfiet
MDOT - Escanaba Region	1818 3rd Avenue North Escanaba, Michigan 49829	Jack Bedard

Table 2 - Superior Stakeholder Agencies and Contacts

Stakeholder Agency	Address	Contact
MDOT - Escanaba TSC	1818 3rd Avenue North Escanaba, Michigan 49829	Douglas Noble
MDOT - Escanaba TSC	1818 3rd Avenue North Escanaba, Michigan 49829	Mark Maloney
MDOT - Escanaba TSC	1818 3rd Avenue North Escanaba, Michigan 49829	Steve Cadeau
MDOT - Ishpeming TSC	100 South Westwood Drive Ishpeming, Michigan 49849	John Dault
MDOT - Ishpeming TSC	100 South Westwood Drive Ishpeming, Michigan 49849	Jeffery Barsch
MDOT - IT	100 South Westwood Drive Ishpeming, Michigan 49849	Chuck Lindstrom
MDOT - Lansing Aeronautics	2700 East Airport Service Drive Lansing, Michigan 49806	Gary Ross
MDOT - Metro	18101 West Nine Mile Road Southfield, Michigan 48075	Greg Krueger
MDOT - Metro	18101 West Nine Mile Road Southfield, Michigan 48075	Collin Castle
MDOT - Newberry TSC	14113 M-28 Newberry, Michigan 49868	Mike Lusk
MDOT - Superior Region	1818 3rd Avenue North Escanaba, Michigan 49829	Dawn Gustafson
Michigan Center for Truck Safety	1401 North 26th Street, Suite 118 Escanaba, Michigan 49829	Jan Charles
Michigan Center for Truck Safety	1401 North 26th Street, Suite 118 Escanaba, Michigan 49829	Bob Ramels
Michigan Department of Natural Resources, Parks and Recreation	Wells State Park, N7670 M-35 Cedar River, Michigan 49887	Christine Cope
Michigan State Police	1504 West Washington Street, Suite A Marquette, Michigan 49855	John Bruno
Michigan State Police Emergency Dispatch	180 US 41 East Negaunee, Michigan 49866	Brian McEachern
Michigan State Police Emergency Dispatch	180 US 41 East Negaunee, Michigan 49866	Greg Sharp
National Weather Service	112 Airpark Drive South Negaunee, Michigan 49866	Jack Rice
National Weather Service - Marquette	112 Airpark Drive South Negaunee, Michigan 49866	Matt Zika
Office of Highway Safety Planning	1504 West Washington Street, Suite A Marquette, Michigan 49855	Jamie Dolan
WDMJ-AM/WJBD-FM/WIAN-AM (RADIO)	P.O. Box 700 Marquette, Michigan 49855	Tom Feldhusen

2. REGIONAL ITS ARCHITECTURE DEVELOPMENT PROCESS

Development of the Regional ITS Architecture and Deployment Plan for the Superior Region relied heavily on stakeholder input to ensure that the architecture reflected local needs. A series of four workshops was held with stakeholders to gather input, and draft documents were made available to stakeholders for review and comment.

The process followed for the Superior Region was designed to ensure that stakeholders could provide input and review for the development of the Region's ITS Architecture and Deployment Plan. **Figure 2** illustrates the process followed.

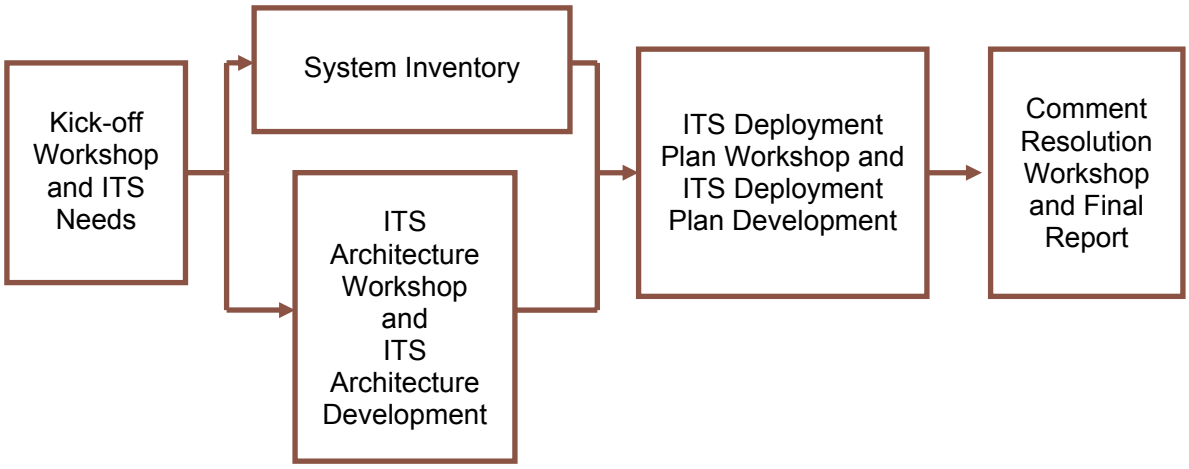

Figure 2 - Superior Regional ITS Architecture and Deployment Plan Development Process

A total of four workshops with stakeholders over a period of eleven months were used to develop the Superior Regional ITS Architecture and Deployment Plan. These workshops included:

- Kick-Off Workshop, December 14, 2006;
- Regional ITS Architecture Development Workshop, January 9, 2007;
- ITS Deployment Plan Workshop, July 19, 2007; and
- Comment Resolution Workshop, October 30, 2007.

Key components of the process are described below:

Task 1 – Kick-Off Workshop and ITS Needs: A stakeholder group was identified that included representatives from regional transportation, transit, and emergency management agencies. The group was invited to the project Kick-Off Workshop where ITS needs for the Region were identified.

Task 2 – System Inventory: Collecting information for the system inventory began at the Kick-Off Workshop through discussions with the stakeholders to determine existing and planned ITS elements in the Region. After the Kick-Off Workshop, follow-up calls were conducted with several local stakeholders to gather additional input.

Task 3 – ITS Architecture Workshop and ITS Architecture Development: The purpose of the Regional ITS Architecture Workshop was to review the system inventory with stakeholders and develop the Superior Regional ITS Architecture. Training on the National ITS Architecture was integrated into the workshop so that key elements of the architecture, such as market packages, could be explained prior to the selection and editing of these elements. The result of the Regional ITS Architecture

Workshop was an ITS Architecture for the Superior Region that included a system inventory, interconnect diagrams, customized market packages, functional requirements, and relevant ITS standards. Following the workshop, a Draft Regional ITS Architecture document was prepared and sent to stakeholders for review and comment.

Task 4 – ITS Deployment Plan Workshop and ITS Deployment Plan Development: A draft project listing for the Region was presented to stakeholders at the Regional ITS Deployment Plan Workshop. Stakeholders were asked to provide input on the recommended projects, responsible agencies, associated costs, and deployment timeframe. Following the workshop, a Draft Regional ITS Deployment Plan document was prepared and sent to stakeholders for review and comment.

Task 5 – Comment Resolution Workshop and Final Report: A Comment Resolution Workshop was held with stakeholders to review the Draft Regional ITS Architecture and the Draft Regional ITS Deployment Plan. Next steps for the Region were also discussed. Comments were incorporated and a final Regional ITS Architecture and Regional ITS Deployment Plan were developed.

3. CUSTOMIZATION OF THE NATIONAL ITS ARCHITECTURE FOR THE SUPERIOR REGION

3.1 Systems Inventory

An important initial step in the architecture development process is to establish an inventory of existing ITS elements. At the Kick-Off Workshop and through subsequent discussions with agency representatives, Superior Region stakeholders provided the team with information about existing and planned systems that would play a role in the Region's ITS Architecture.

The National ITS Architecture has eight groups of ITS service areas. Existing, planned, and future systems in the Region were identified in the following service areas:

- ***Traffic Management*** – includes the Michigan Intelligent Transportation Systems Center (MITSC) located in Detroit as well as other existing and future TMCs and traffic operations centers (TOCs), detection systems, closed circuit television (CCTV) cameras, fixed and portable dynamic message signs (DMS), and other related technologies.
- ***Emergency Management*** – includes emergency operations/management centers, improved information sharing among traffic and emergency services, automated vehicle location (AVL) on emergency vehicles, traffic signal preemption for emergency vehicles, and wide-area alerts.
- ***Maintenance and Construction Management*** – includes work zone management, roadway maintenance and construction information, and road weather detection systems.
- ***Public Transportation Management*** – includes transit and paratransit AVL, transit travel information systems, electronic fare collection, and transit security.
- ***Commercial Vehicle Operations*** – includes coordination with Commercial Vehicle Information Systems and Networks (CVISN) efforts, and hazardous material (HAZMAT) management
- ***Traveler Information*** – includes broadcast traveler information such as 511, traveler information kiosks, and highway advisory radio (HAR).
- ***Archived Data Management*** – includes electronic data management and archiving systems.
- ***Vehicle Safety*** – includes collision avoidance and automated highway systems.

3.2 Regional Needs

Needs from the Region were identified by Stakeholders at the Kick-Off Workshop held in December of 2006. The needs identified provided guidance for determining which market packages should be included in the architecture. Stakeholders identified ITS needs for the Superior Region in the following areas:

- Traffic management;
- Emergency management;
- Maintenance and construction management;
- Public transportation management;
- Commercial vehicle operations;
- Traveler information; and
- Archived data management.

Section 3.4.3 contains additional information about the specific needs identified and relates those needs to the market packages that document the corresponding ITS service.

3.3 Element Customization

The inventory and needs documented at the Kick-Off Workshop are the starting point for developing an ITS architecture for the Superior Region. These ITS systems and components are used to customize the National ITS Architecture and create the architecture for the Superior Region.

When developing customized elements, the stakeholder group agreed not to create individual traffic, maintenance, and emergency management elements for individual cities within the Superior Region. The smaller communities in the Region were documented as part of the local agency elements. This documentation allows the communities to be included in the Regional ITS Architecture, and therefore eligible to use federal monies on potential future ITS deployments.

3.3.1 Subsystems and Terminators

Each identified system or component in the Superior Regional ITS inventory was mapped to a subsystem or terminator in the National ITS Architecture. Subsystems and terminators are the entities that represent systems in ITS.

Subsystems are the highest level building blocks of the physical architecture, and the National ITS Architecture groups them into four major classes: Centers, Field, Vehicles, and Travelers. Each of these major classes includes various components that represent a set of transportation functions (or processes). Each set of functions is grouped under one agency, jurisdiction, or location, and corresponds to physical elements such as: traffic operations centers, traffic signals, or vehicles. **Figure 3** shows the National ITS Architecture subsystems. This figure, also known as the "sausage diagram," is a standard interconnect diagram, showing the relationships of the various subsystems within the architecture. A customized interconnect diagram for the Superior Region is shown in **Figure 4**. Communication functions between the subsystems are represented in the ovals. Fixed-point to fixed-point communications include not only twisted pair and fiber optic technologies, but also wireless technologies such as microwave and spread spectrum.

Terminators are the people, systems, other facilities, and environmental conditions outside of ITS that need to communicate or interface with ITS subsystems. Terminators help define the boundaries of the National ITS Architecture as well as a regional system. Examples of terminators include: drivers, weather information providers, and information service providers.

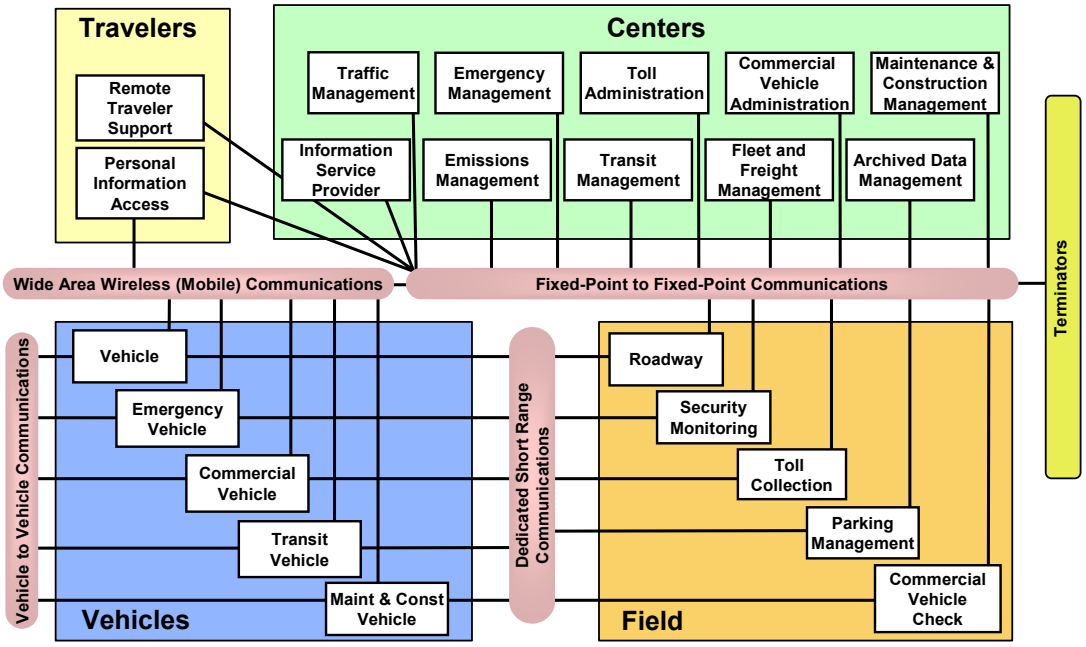

Figure 3 - National ITS Architecture Physical Subsystem Interconnect Diagram

3.3.2 ITS Inventory by Stakeholder

Each stakeholder is associated with one or more systems or elements (subsystems and terminators) that make up the transportation system in the Superior Region. A listing of stakeholders as identified in the architecture can be found in **Table 3** along with a description of the stakeholder. For example, rather than individually documenting each of the smaller local agencies in the Region, a single stakeholder was created for local agencies which represents the cities and towns not specifically called out in the architecture. **Table 4** sorts the inventory by stakeholder so that each stakeholder can easily identify and review all of the architecture elements associated with their agency. The table includes the status of the element. In many cases, an element classified as existing might still need to be enhanced to attain the service level desired by the Region.

Table 3 - Superior Region Stakeholder Descriptions

Stakeholder	Stakeholder Description
Delta Area Transit Authority	Transit provider that operates demand response service within the County of Delta.
Department of Homeland Security	Cabinet department of the Federal Government responsible for protecting the United States from terrorist attacks and responding to natural disasters.
DNR	Department of Natural Resources is responsible for Michigan's natural resources and for the provision of outdoor recreational opportunities.
Eastern Upper Peninsula Transportation Authority	Transit provider that operates both bus and ferry services the Counties of Lucie and Chippewa.
Financial Institution	Handles exchange of money for transit electronic fare collection.
International Bridge Authority	Oversees the movement of people, goods, and collecting tolls across the International Bridge. The International Bridge connects Sault Ste. Marie, Michigan to Sault Ste. Marie, Ontario.
Local Agency	Local government for all cities and municipalities within the Region that are not specifically called out. Covers all city departments including those that deal with traffic and public safety.
Mackinac Bridge Authority	Oversees the movement of people and goods across the Mackinac Bridge, the third largest suspension bridge in the world, which connects the Upper Peninsula with the Lower Peninsula.
Marq-Tran	Marquette County Transit Authority. Transit provider that operates both fixed route and paratransit service within the County of Marquette.
MDOT	The Michigan Department of Transportation is responsible for the planning, design, construction, maintenance and operation for all aspects of a comprehensive integrated transportation system in the State of Michigan. Some of these roles are achieved through contract services with local agencies and private entities.
Media	Local media outlets. This can include television stations, newspapers, radio stations and their associated websites.
MSP	Michigan State Police. State law enforcement agency that enforces traffic safety laws as well as commercial vehicle regulations.
NOAA	National Oceanic and Atmospheric Administration, agency that gathers weather information and issues severe weather warnings.
Other Agencies	This stakeholder represents a wide variety of agencies. The associated elements are groups of agencies or providers that do not have a primary stakeholder agency.
Other Elements	Includes: Potential Obstacles and Roadway Environment.
Other States or Countries	Emergency or traffic management agencies in other states or countries adjacent to Michigan. In the Superior Region this includes Wisconsin and Ontario, Canada.
Private Operators	Private Operators manage privately owned resources that interconnect with public sector elements and sub-systems of the regional architecture.
Private Service Provider	Private sector business responsible for the gathering and distribution of traveler information. This service is typically provided on a subscription basis.
Rail Operators	Companies that operate trains and/or are responsible for the maintenance and operations of railroad tracks.
Regional Demand Response Transit Providers	Transit providers within the Superior Region aside from Marq-Tran, Delta Area Transit Authority, and the Eastern Upper Peninsula Transportation Authority that provide demand response services.
System Users	All of the users of the transportation system.
US Army Corp of Engineers (USACE)	Full-spectrum engineer force delivering solutions for national security, environmental sustainability and economic vitality, water-resource management and emergency assistance throughout the Great Lakes Region.

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Delta Area Transit Authority	Delta Area Transit Center CCTV Surveillance	CCTV surveillance at the Delta Transit Authority Transit Center.	Planned
	Delta Area Transit Data Archive	The Transit Data Archive for Delta County. Used by NTD, FTA, and MDOT.	Planned
	Delta Area Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Delta Area Transit Authority.	Existing
	Delta Area Transit Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	Delta Area Transit Vehicles	Transit vehicles that operate within Delta County	Existing
	Delta Area Transit Website	Website with information about fares and schedules. Currently static information only.	Existing
Department of Homeland Security	Department of Homeland Security	Cabinet department of the Federal Government responsible for protecting the United States from terrorist attacks and responding to natural disasters.	Existing
DNR	DNR Weather Stations	Weather stations owned and operated by the Department of Natural Resources.	Existing
Eastern Upper Peninsula Transportation Authority	Eastern Upper Peninsula Transportation Authority Data Archive	The Transit Data Archive for the Eastern Upper Peninsula Transportation Authority. Used by NTD, FTA, and MDOT.	Planned
	Eastern Upper Peninsula Transportation Authority Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Eastern Upper Peninsula Transportation Authority within both Lucie and Chippewa Counties.	Existing
	Eastern Upper Peninsula Transportation Authority Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	Eastern Upper Peninsula Transportation Authority Transit Center CCTV Surveillance	CCTV surveillance at the Eastern Upper Peninsula Transportation Authority Transit Center.	Planned
	Eastern Upper Peninsula Transportation Authority Vehicles	Transit vehicles that operate within both Lucie and Chippewa Counties.	Existing
	Eastern Upper Peninsula Transportation Authority Website	Website with information about fares and schedules. Currently static information only.	Planned

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Financial Institution	Financial Service Provider	Handles exchange of money for transit electronic payment collection.	Planned
	Service Agency	Agency responsible for payment of transit fares for medical transportation as part of government subsidized medical care. This includes Medicare, and VA programs.	Planned
International Bridge Authority	International Bridge Authority ESS	Environmental sensor stations maintained by the International Bridge Authority that are installed in the field to gather information about the roadways such as temperature and moisture levels.	Planned
	International Bridge Authority TOC	Traffic Operations Center responsible for bridge system operations.	Existing
	International Bridge Authority Website	Bridge website providing information on customs and immigration, monthly traffic statistics, traffic trends, toll rates, and bus bridge schedule.	Existing
	International Bridge CCTV Cameras	Closed circuit television cameras operated by the Bridge Authority for traffic condition monitoring and management of incidents.	Existing
	International Bridge DMS	Dynamic message signs operated by the International Bridge Authority for the posting of messages.	Planned
	International Bridge Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS or traditional loops.	Planned
	International Bridge HAR	Highway advisory radio operated by the International Bridge Authority to get information to drivers.	Planned
	International Bridge Security Monitoring Field Equipment	Security equipment owned and operated by the International Bridge Authority.	Existing
Local Agency	Alger County 911 Dispatch	Answers all 911 calls made from within the county and then forwards the call to the appropriate dispatcher.	Existing
	CCE Combined Dispatch Center	Charlevoix-Cheboygan-Emmet (CCE) Central Dispatch Center provides emergency call receipt and dispatch service for Emmit, Charlevoix, and Cheboygan counties. Enhanced 911 telephone service, computer-aided dispatch and a multi-channel radio system are in place.	Existing

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Local Agency (continued)	Chippewa County E911	Answers all 911 calls made from within the county and then forwards the call to the appropriate dispatcher.	Existing
	County Road Commission	Duties include road and bridge construction and maintenance, snow removal and salting, surface treatments, street lane painting and markings, controlling roadside vegetation and mowing, gravel road grading, and roadside ditch and drain maintenance.	Existing
	Delta County Central 911 Dispatch	Answers all 911 calls made from within the county and then forwards the call to the appropriate dispatcher.	Existing
	Iron County 911 Dispatch	Answers all 911 calls made from within the county and then forwards the call to the appropriate dispatcher.	Existing
	Local Agency CCTV Cameras	Closed circuit television cameras operated by the Local Agency TOC for traffic condition monitoring and management of incidents.	Existing
	Local Agency DMS	Dynamic message signs operated by a local agency to provide information to drivers such as lane closures due to a crash or from the weather.	Planned
	Local Agency DPW	Department of Public Works runs by individual local agencies.	Existing
	Local Agency Drawbridge Control Equipment	The physical equipment used to control the actual lifting of the bridge.	Planned
	Local Agency Drawbridge Management Center	Management of the waterways used by boats and ferries and the roadways used by vehicles.	Existing
	Local Agency Drawbridge Notification Equipment	The physical equipment used to warn drivers of drawbridge and the actual lifting of the bridge.	Planned
	Local Agency ESS	Environmental sensor stations maintained by the Local Agency that are installed in the field to gather information about the roadways such as temperature and moisture levels.	Planned
	Local Agency Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS or traditional loops.	Planned
	Local Agency Police Department Speed Monitoring Equipment	Speed monitoring equipment owned and operated by Local Agency police departments. Includes radar, lidar, etc.	Existing

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Local Agency (continued)	Local Agency Public Safety Vehicles	Local law enforcement, fire and EMS vehicles. Includes the ITS equipment installed on the vehicles (AVL, MDTs, etc.).	Existing
	Local Agency Ridesharing Program	Local Agency coordinates people and drivers to help move people from one location to the next.	Planned
	Local Agency TOC	Local Traffic Operations Center responsible for municipal signal system operations.	Existing
	Local Agency Traffic Signals	Traffic signal system operated by the Local Agency.	Planned
	Local Agency Website	Transportation information website for each local agency. In the future will include real-time construction, work zone, special event, incident, and traffic information.	Planned
	Marquette County Central Dispatch	Answers all 911 calls made from within the county and then forwards the call to the appropriate dispatcher.	Existing
	Menominee County 911 Dispatch	Answers all 911 calls made from within the county and then forwards the call to the appropriate dispatcher.	Planned
	Sault Ste Marie Canada 911 Dispatch Center	Answers all 911 calls made from within the county and then forwards the call to the appropriate dispatcher.	Existing
Mackinac Bridge Authority	Mackinac Bridge Authority	Oversees the movement of people and goods across the Mackinac Bridge, the third largest suspension bridge in the world, which connects the Upper Peninsula with the Lower Peninsula.	Existing
	Mackinac Bridge Authority ESS	Environmental sensor stations maintained by the Mackinac Bridge Authority that are installed in the field to gather information about the roadways such as temperature and moisture levels.	Planned
	Mackinac Bridge Authority TOC	Traffic Operations Center responsible for bridge system operations at the Mackinac Bridge.	Existing
	Mackinac Bridge Authority Website	Provides information about the history of the bridge, the fare schedule, and provides an up-to-date bridge WebCam. The website also provides the current bridge conditions as well as monthly travel statistics.	Existing
	Mackinac Bridge CCTV Cameras	Closed circuit television cameras operated by the Bridge Authority for traffic condition monitoring and management of incidents.	Existing

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Mackinac Bridge Authority (continued)	Mackinac Bridge DMS	Dynamic message signs operated by the Mackinac Bridge Authority for the posting of messages.	Existing
	Mackinac Bridge Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS or traditional loops.	Planned
	Mackinac Bridge HAR	Highway advisory radio operated by the Mackinac Bridge Authority to get information to drivers.	Existing
	Mackinac Bridge Security Monitoring Field Equipment	Security equipment owned and operated by the Mackinac Bridge Authority.	Existing
	Mackinac Bridge Toll Plazas	Toll collection location for use of the Mackinac Bridge.	Existing
Marq-Tran	Marq-Tran Data Archive	The transit data archive for the Marquette County Transit Authority. Used by FTA and MDOT.	Planned
	Marq-Tran Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Marquette County Transit Authority.	Existing
	Marq-Tran Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	Marq-Tran Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
	Marq-Tran Transit Center CCTV Surveillance	CCTV surveillance at the Marq-Tran Center.	Planned
	Marq-Tran Vehicles	Transit vehicles that operate within County of Marquette.	Existing
	Marq-Tran Website	Website with information about fares and schedules.	Existing
MDOT	MDOT Anti-Icing Field Equipment	Equipment used for anti-icing that is owned by the Michigan Department of Transportation.	Planned
	MDOT Bay Region TMC	Transportation management center for Bay Region that will include the freeway management system in the Bay Region as well as rural ITS deployments.	Planned
	MDOT Beacon Warning Signs	Warning signs used in overheight vehicle detection and are owned and operated by the Michigan Department of Transportation.	Planned
	MDOT CCTV Cameras	Closed circuit television cameras operated by MDOT North TMC and, in the future, MDOT Superior TMC for traffic condition monitoring and management of incidents.	Planned

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
MDOT (continued)	MDOT Commercial Vehicle Parking Management System	Direct commercial vehicles to available parking at rest areas and truck stops. Goal is to prevent overcrowding at certain locations and keep trucks from parking along the highway.	Planned
	MDOT Commercial Vehicle Permitting System	System to direct the electronic application, processing, fee collection, issuance, and distribution of commercial vehicle operation credentials and tax filings.	Planned
	MDOT DMS	Dynamic message signs operated by MDOT to provide information to drivers such as lane closures due to a crash or from the weather.	Existing
	MDOT Drawbridge Control Equipment	The physical equipment used to control the actual lifting of the bridge.	Planned
	MDOT Drawbridge Management Center	Management of the waterways used by boats and ferries and the roadways used by vehicles.	Existing
	MDOT Drawbridge Notification Equipment	The physical equipment used to warn drivers of drawbridge and the actual lifting of the bridge.	Planned
	MDOT ESS	Environmental sensor stations maintained by the Michigan Department of Transportation that are installed in the field to gather information about the roadways such as temperature and moisture levels.	Planned
	MDOT Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS or traditional loops.	Planned
	MDOT HAR	Highway advisory radio allows roadway conditions, incidents, etc. to be broadcast to travelers.	Planned
	MDOT Maintenance Vehicles	Michigan Department of Transportation vehicles used in maintenance operations.	Existing
	MDOT MI Drive Website	Website for dissemination of traveler information.	Planned
	MDOT MITSC	Transportation management center that operates the freeway management system and ITS deployments for the Detroit/SE Michigan area.	Existing

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
MDOT (continued)	MDOT North Region TMC	Transportation management center for North Region and a back up center for the Superior Region TMC after hours. Responsible for the operation of the ITS equipment located in North Region including the freeway management system as well as rural ITS deployments.	Existing
	MDOT North Region TSCs	Transportation Service Centers are responsible for maintaining and implementing traffic and roadway projects. TSCs report to the regional transportation management center.	Existing
	MDOT Office of Communications	Michigan Department of Transportation responsible for the dissemination of traffic information to the media and public.	Planned
	MDOT Overheight Vehicle Detection	Detection equipment that turns on the beacon warn sings when an overheight vehicle is detected approaching an overhead structure with limited clearance.	Planned
	MDOT Planning Division Data Warehouse	The Planning Division data warehouse for the Michigan Department of Transportation throughout the Superior Region.	Planned
	MDOT Roadside Equipment for AHS	Refers to a set of designated lanes on a limited access roadway where specially equipped vehicles are operated under completely automatic control. Combines magnetic sensors, computers, digital radio, forward-looking sensors, video cameras, and display technologies.	Planned
	MDOT Roadside Intersection Collision Avoidance Equipment	Focuses on minimizing the risk involved when a vehicle nears and/or enters an intersection. Choice between two radar based systems: vehicle-based image processing and cooperative infrastructure-vehicle communications.	Planned
	MDOT Roadside Signing Equipment	The roadside signing equipment owned and operated by the Michigan Department of Transportation. The information gathered by the roadside signing equipment is then sent to drivers by way of in vehicle signing.	Planned
	MDOT SABRE Driver Feedback System	Speed, Aggressive (driving), Belts, Rural Enforcement (SABRE) campaign to increase awareness of the need for safe driving on US-2 in the Upper Peninsula.	Existing

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
MDOT (continued)	MDOT SABRE Speed Monitoring Equipment	Speed, Aggressive (driving), Belts, Rural Enforcement (SABRE) campaign to increase awareness of the need for safe driving on US-2 in the Upper Peninsula through the use of law enforcement, increased signage, and overall care.	Existing
	MDOT Security Monitoring Field Equipment	Security equipment owned and operated by MDOT.	Planned
	MDOT Service Patrol Dispatch	Service patrol operated by MDOT that provides motorist assistance along roadways.	Planned
	MDOT Service Patrol Vehicles	Vehicles used by the MDOT Service Patrol when providing motorist assistance along roadways.	Planned
	MDOT Smart Work Zone Equipment	Work zone monitoring and alerting equipment owned by MDOT.	Planned
	MDOT Speed Monitoring Equipment	Speed monitoring equipment owned and operated by the Michigan Department of Transportation. Includes radar, lidar, etc.	Planned
	MDOT Statewide TMC - Lansing	Transportation management center that is also a backup center for all other TMCs.	Planned
	MDOT Superior Region Equipment Repair	The location where construction and other kinds of equipment used within the Superior Region are repaired.	Planned
	MDOT Superior Region Maintenance Management System	Michigan Department of Transportation's system to manage maintenance operations.	Planned
	MDOT Superior Region TMC	Transportation management center for Superior Region that will include the freeway management system in the Superior Region as well as rural ITS deployments.	Planned
	MDOT Superior Region TSCs	Transportation Service Centers are responsible for maintaining and implementing traffic and roadway projects. TSCs report to the regional transportation management center.	Existing
	MDOT Traffic Signals	Traffic signal systems operated by MDOT.	Existing
	MDOT Traveler Information Database	A central location to input and disseminate traffic information regarding various transportation related information.	Planned
	MDOT Traveler Information Kiosks	Kiosks for dissemination of traveler information.	Planned

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
MDOT (continued)	MDOT Weigh-in-Motion	Michigan Department of Transportation's devices to capture and record truck axle weights and gross vehicle weights as the driver drives over a sensor.	Planned
	MDOT West Michigan TMC	Transportation management center for Grand Region. Responsible for the operation of the ITS equipment in the Region.	Existing
	MDOT Work Zone Safety Monitoring Equipment	Portable ITS equipment that can be used in work zones to more efficiently manage traffic and provide traveler information. Includes CCTV, vehicle detection, and/or DMS.	
	MDOT-Grand Traverse County TOC	Transportation management center located in the North Region for Grand Traverse County. It will be a joint facility with MDOT, Grand Traverse County, and Traverse City. Will include the freeway management system in the North Region as well as rural ITS deployments and municipal traffic operations.	Planned
	Michigan 511 System	511 Traveler information system central server.	Planned
	Michigan 511 Voice Response System	Future Michigan 511 Interactive Voice Response system. This is the customer interface component of the 511 system.	Planned
	Other MDOT Region TSCs	Transportation Service Centers are responsible for maintaining and implementing traffic and roadway project.	Existing
	Local Print and Broadcast Media	Local media that provide traffic or incident information to the public.	Planned
Media	CJIC Database	Database for the archiving of crash data and crime reporting information.	Planned
MSP	Michigan Intelligence Operations Center (MIOC)	Provides 24-hours a day statewide information sharing among local, state and federal public safety agencies.	Existing
	MSP Headquarters - East Lansing	Michigan State Police headquarters located in East Lansing.	Planned
	MSP Motor Carrier Division	Michigan State Police Motor Carrier Division's role is to protect the structure of Michigan's highway system through enforcement, investigations and audits of commercial vehicle traffic.	Existing

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
MSP (continued)	MSP Motor Carrier Division Enforcement	Carried out through the detection of illegal activity with commercial vehicles. Investigator work with trucking industry to detect commercial frauds. Audits performed to determine compliance with driver qualifications, safety inspections and repairs.	Existing
	MSP Negaunee 911 Regional Dispatch Center	Answers all 911 calls made from within the county and then forwards the call to the appropriate dispatcher.	Existing
	MSP Office of Highway Safety Planning	Create programs to increase safety along Michigan's roadways and facilitate partnerships with public and private organizations.	Existing
	MSP St. Ignace Post	Michigan State Police office located in St. Ignace.	Planned
	MSP Vehicles	Police vehicles owned and operated by Michigan State Police. Includes the ITS equipment installed on the cruisers (AVL, MDTs, etc.).	Existing
	MSP Winter Travel Advisory Website	Website operated by the Michigan State Police that provides travel information to the public.	Existing
	MSP Winter Travel Toll Free Number	Toll-free number operated by the Michigan State Police that provides travel information to the public.	Existing
NOAA	National Weather Service	Provides official US weather, marine, fire and aviation forecasts, warnings, meteorological products, climate forecasts, and information about meteorology.	Existing
	NWS Weather Stations	Facilities with instruments and equipment to make weather observations owned and operated by the National Weather Service.	Existing
Other Agencies	Coast Guard	Military unit responsible for maritime and coastal patrol.	Existing
	Contractor Smart Work Zone Equipment	Work zone monitoring and alerting equipment owned by a contractor.	Planned
	Multimodal Transportation Service Provider	An entity that provides a variety of transportation modes to the public.	Planned
Other Elements	AWOS Weather Stations	Automated Weather Observation Stations located at airports.	Existing
	Potential Obstacles	Any number of physical obstacles that could hinder a driver.	Planned

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Other Elements (continued)	Roadway Environment	The roadway characteristics a driver needs to be aware of to proceed along the roadway in a safe manner.	Planned
Other States or Countries	Providence of Ontario Ministry of Transportation	Agency in charge of transportation concerns, issues, and development in Ontario, Canada.	Existing
	Transport Canada	Provides Acts and Regulations, Safety and Security and other information related to transportation in Canada.	Existing
	Minnesota DOT	The Minnesota Department of Transportation is responsible for the construction, maintenance, and operation of roadways in the State of Minnesota.	Existing
	Wisconsin DOT	The Wisconsin Department of Transportation is responsible for the construction, maintenance, and operation of roadways in the State of Wisconsin.	Existing
Contract Operators	Contract Winter Maintenance Agencies	Michigan Department of Transportation contracts winter maintenance work out to these entities.	Existing
	Contract Winter Maintenance Vehicles	Contractor vehicles used in winter maintenance operations.	Existing
Private Service Provider	Private Concierge Providers	Private entities that provide customized services to travelers. This service is usually subscription based.	Existing
	Private Fleet Operations	Private companies that proactively manage and operate their fleet routing. Includes reactions to incidents and possible delays.	Planned
	Private Sector Traveler Information Services	Website sponsored by a private entity. Often this information is provided through a subscription.	Existing
	Private Transportation Providers	Private providers of transportation services in the Region such as taxis.	Existing
	Private Travelers Personal Commuting Devices	Computing devices that travelers use to access public information.	Existing

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Rail Operators	Rail Operator Wayside Equipment	Equipment located along the tracks including railroad crossing gates, bells, and lights as well as the interface to the traffic signal controller indicating the presence of a train.	Existing
Regional Demand Response Transit Providers	Regional Demand Response Transit Providers Data Archive	The transit data archive for Regional Demand Response Providers. Used by FTA and MDOT.	Planned
	Regional Demand Response Transit Providers Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of demand response vehicles.	Existing
	Regional Demand Response Transit Providers Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	Regional Demand Response Transit Providers Transit Center CCTV Surveillance	CCTV surveillance at the Regional Demand Response Transit Center.	Planned
	Regional Demand Response Transit Providers Vehicles	Demand Response transit vehicles that operate within different areas in the Superior Region.	Existing
	Regional Demand Response Transit Providers Website	Website with information about fares and schedules.	Planned
System Users	Archived Data Users	Those who request information from the data archive systems.	Planned
	Commercial Vehicle	Privately owned commercial vehicles that travel throughout the Region.	Planned
	Commercial Vehicle Driver	The operator of the commercial vehicle.	Planned
	Driver	Individual operating a vehicle on roadways within the Region.	Existing
	Maintenance and Construction Field Personnel	The individuals working at the maintenance or construction site.	Planned
	Other Vehicle	Vehicle outside the control of the driver.	Existing

Table 4 - Superior Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
System Users (continued)	Private Parking Operator	Manages and disseminates parking information to the general public through DMS, the MDOT Traveler Information Website, etc.	Planned
	Private Vehicles	Vehicles operated in the Region by a private sector individual.	Existing
	Traveler	Caller seeking information from 511 system.	Planned
US Army Corp of Engineers (USACE)	USACE Sault Ste Marie Area Office	The office is also responsible for compiling statistics on commerce passing through the locks. This office maintains and operates a hydroelectric power plant that supplies power to the Soo complex. The Soo Locks has also had a role in our nation's defense; supplying waterborne raw materials.	Existing
	USACE Security Monitoring Field Equipment	Security equipment owned and operated by USACE.	Planned

3.3.3 Top Level Regional System Interconnect Diagram

A system interconnect diagram, or "sausage diagram" (shown previously in **Figure 3**), shows the systems and primary interconnects in the Region. The National ITS Architecture interconnect diagram has been customized for the Superior Region based on the system inventory and information gathered from the stakeholders. **Figure 4** summarizes the existing and planned ITS elements for the Superior Region in the context of a physical interconnect. Subsystems and elements specific to the Region are called out in the boxes surrounding the main interconnect diagram, and these are color-coded to the subsystem with which they are associated.

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MDOT

Legend

- **Subsystem** — Regional Architecture Elements Map To National ITS Architecture
- **Subsystem** ····· No Regional Architecture Elements Map To National ITS Architecture

Traffic Management
- International Bridge Authority TOC
- Local Agency Drawbridge Management Center
- Local Agency TOC
- Mackinac Bridge Authority TOC
- MDOT Bay Region TMC
- MDOT Drawbridge Management Center
- MDOT-Grand Traverse County TOC
- MDOT MITSC
- MDOT North Region TMC
- MDOT Statewide TMC – Lansing
- MDOT Superior Region TMC
- MDOT West Michigan TMC
- Providence of Ontario Ministry of Transportation

Toll Administration
- Mackinac Bridge Authority

Fleet and Freight Management
- Private Fleet Operations

Information Service Provider
- Delta Area Transit Website
- Eastern Upper Peninsula Transportation Authority Website
- International Bridge Authority Website
- Local Agency Ride Sharing Program
- Local Agency Website
- Mackinac Bridge Authority Website
- Marq-Tran Website
- MDOT MI Drive Website
- MDOT Office of Communications
- MDOT Traveler Information Database
- Michigan 511 System
- MSP Winter Travel Advisory Website
- MSP Winter Travel Toll Free Number
- Private Concierge Providers
- Private Sector Traveler Information Services
- Regional Demand Responsive Transit Provider Website

Emergency Management
- Alger County 911 Dispatch
- CCE Combined Dispatch Center
- Chippewa County E911
- Coast Guard
- Delta County Central 911 Dispatch
- International Bridge Authority TOC
- Iron County 911 Dispatch
- Mackinac Bridge Authority TOC
- Marquette County Central Dispatch
- MDOT Service Patrol Dispatch
- Menominee County 911 Dispatch
- MIOC
- MSP Headquarters - East Lansing
- MSP Negaunee 911 Regional Dispatch Center
- MSP Office of Highway Safety Planning
- MSP St. Ignace Post
- Private Concierge Providers
- Sault Ste Marie Canada 911 Dispatch Center
- USACE Sault Ste Marie Area Office

Transit Management
- Delta Area Transit Dispatch Center
- Eastern Upper Peninsula Transportation Authority Dispatch Center
- Marq-Tran Dispatch Center
- Private Transportation Providers
- Regional Demand Response Transit Providers Dispatch Center

Archived Data Management
- CJIC Database
- Delta Area Transit Authority Data Archive
- Eastern Upper Peninsula Transportation Authority Data Archive
- Marq-Tran Data Archive
- MDOT Planning Division Data Warehouse
- Regional Demand Response Transit Providers Data Archive

Commercial Vehicle Administration
- MDOT Commercial Vehicle Permitting System
- MSP Motor Carrier Division

Maintenance & Construction Mgmt
- Contract Winter Maintenance Agencies
- County Road Commission
- Local Agency DPW
- MDOT North Region TSCs
- MDOT Superior Region TSCs
- Other MDOT Region TSCs

Maintenance and Construction Administrative Systems
- MDOT Superior Region TMC

Maintenance and Construction Field Personnel
- MDOT Maintenance and Construction Field Personnel

Media
- Local Print and Broadcast Media

Multimodal Transportation Service Provider
- Multimodal Transportation Service Provider

Other Emergency Management
- Department of Homeland Security

Other Maintenance & Construction Mgmt
- Transport Canada
- Wisconsin DOT

Other Parking
- Private Parking Operator

Other Roadway
- MDOT SABRE Driver Feedback System

Other Traffic Management
- Minnesota DOT
- Wisconsin DOT

Other Vehicle
- Other Vehicle

Potential Obstacles
- Potential Obstacles

Roadway Environment
- Roadway Environment

Telecommunications System for Traveler Information
- Michigan 511 Voice Response System

Traveler
- Traveler

Traveler Card
- Delta Area Transit Electronic Fare Payment Card
- Eastern Upper Peninsula Transportation Authority Electronic Fare Payment Card
- Marq-Tran Electronic Fare Payment Card
- Regional Demand Response Electronic Fare Payment Card

Wayside Equipment
- Rail Operator Wayside Equipment

Weather Service
- National Weather Service

Remote Traveler Support
- Delta Area Transit Kiosks
- Marq-Tran Kiosks
- MDOT Traveler Information Kiosks

Personal Information Access
- Private Travelers Personal Computing Devices

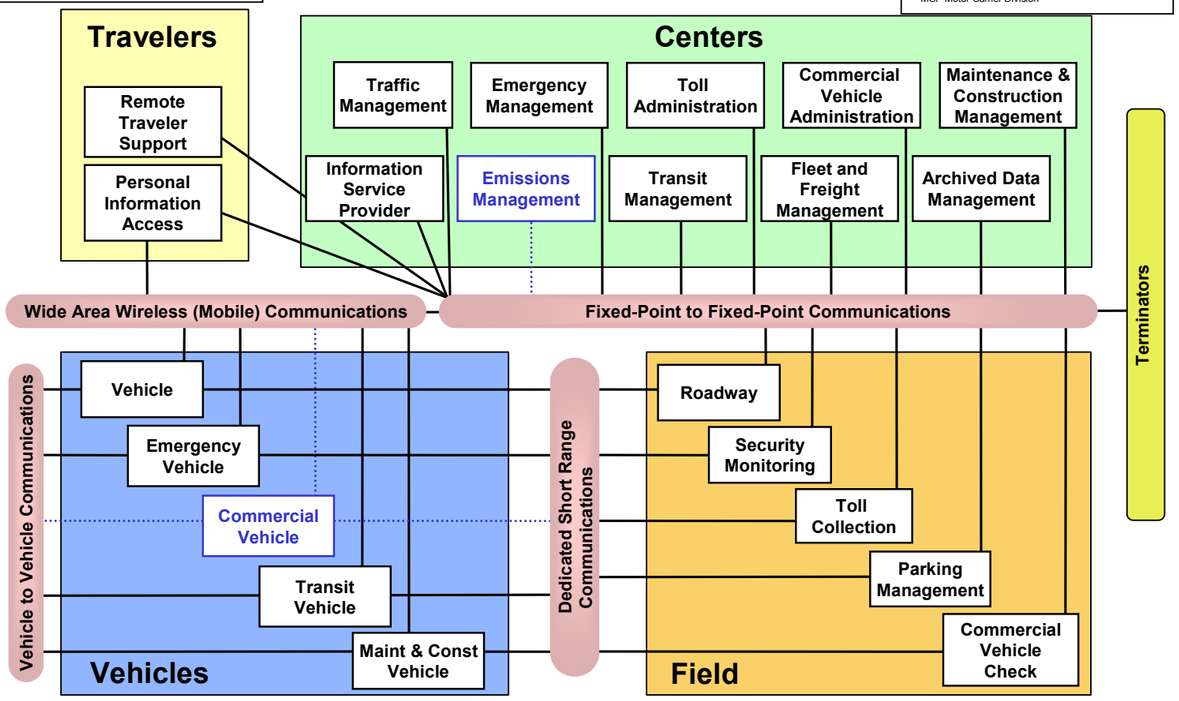
Vehicle Subsystem
- Private Vehicles

Emergency Vehicle Subsystem
- Local Agency Public Safety Vehicles
- MDOT Service Patrol Vehicles
- MSP Vehicles

Transit Vehicle Subsystem
- Delta Area Transit Vehicles
- Eastern Upper Peninsula Transportation Authority Vehicles
- Marq-Tran Vehicles
- Regional Demand Response Transit Provider Vehicles

Maint. and Construction Vehicle
- Contract Winter Maintenance Vehicles
- MDOT Maintenance Vehicles

Roadway Subsystem
- AWOS Weather Stations
- Contractor Smart Work Zone Equipment
- DNR Weather Stations
- International Bridge Authority ESS
- International Bridge CCTV Cameras
- International Bridge DMS
- International Bridge Field Sensors
- International Bridge HAR
- Local Agency CCTV Cameras
- Local Agency DMS
- Local Agency Drawbridge Control Equipment
- Local Agency Drawbridge Notification Equipment
- Local Agency Field Sensors
- Local Agency Police Department Speed Monitoring Equipment
- Local Agency ESS
- Local Agency Traffic Signals
- Mackinac Bridge Authority ESS
- Mackinac Bridge CCTV Cameras
- Mackinac Bridge DMS
- Mackinac Bridge Field Sensors
- Mackinac Bridge HAR
- MDOT Anti-Icing Field Equipment
- MDOT Beacon Warning Signs
- MDOT CCTV Cameras
- MDOT DMS
- MDOT Drawbridge Control Equipment
- MDOT Drawbridge Notification Equipment



Roadway Subsystem (cont.)
- MDOT Field Sensors
- MDOT HAR
- MDOT Overheight Vehicle Detection
- MDOT Roadside Equipment for AHS
- MDOT Roadside Intersection Collision Avoidance Equipment
- MDOT Roadside Signing Equipment
- MDOT ESS
- MDOT SABRE Speed Monitoring Equipment
- MDOT Smart Work Zone Equipment
- MDOT Speed Monitoring Equipment
- MDOT Traffic Signals
- MDOT Work Zone Safety Monitoring Equipment
- NWS Weather Stations

Security Monitoring Subsystem
- Delta Area Transit Center CCTV Surveillance
- Eastern Upper Peninsula Transportation Authority CCTV Surveillance
- International Bridge Security Monitoring Field Equipment
- Mackinac Bridge Security Monitoring Field Equipment
- Marq-Tran Transit Center CCTV Surveillance
- MDOT Security Monitoring Field Equipment
- Regional Demand Responsive Transit Providers CCTV Surveillance
- USACE Security Monitoring Field Equipment

Parking Management
- MDOT Commercial Vehicle Parking Management System

Commercial Vehicle Check
- MDOT Weigh-in-Motion

Toll Collection
- Mackinac Bridge Toll Plazas

Archived Data User Systems
- Archived Data Users

Asset Management
- MDOT Superior Region Maintenance Management System

Basic Commercial Vehicle
- Commercial Vehicle

Commercial Vehicle Driver
- Commercial Vehicle Driver

CVO Inspector
- MSP Motor Carrier Division Enforcement

Driver
- Driver

Equipment Repair Facility
- MDOT Superior Region Equipment Repair

Financial Institution
- Financial Service Provider
- Service Agency

Figure 4 - Superior Regional System Interconnect Diagram

3.4 Market Packages

Upon completion of the system inventory, the next step in the development of the architecture was to identify the transportation services that are important to the Superior Region. In the National ITS Architecture, services are referred to as market packages. Market packages can include several stakeholders and elements that work together to provide a service in the Region. Examples of market packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are currently a total of 85 market packages identified in the National ITS Architecture Version 5.1. **Appendix A** provides definitions for each of the National ITS Architecture market packages.

The market packages are grouped together into eight ITS service areas: Traffic Management, Emergency Management, Maintenance and Construction Management, Public Transportation Management, Commercial Vehicle Operations, Traveler Information, Archived Data Management, and Vehicle Safety.

3.4.1 Selection and Prioritization of Regional Market Packages

In the Superior Region, the National ITS Architecture market packages were reviewed by the stakeholders and selected based on the relevance of the service that the market package could provide to the Region. Forty-four market packages were selected for implementation in the Region. They are identified in **Table 5**. The market packages were then prioritized, and the table organizes the market packages into service areas and priority groupings. These priorities are based on need within the Region and do not necessarily represent the timeframe for funding of the deployments. These priorities can also be affected by several other factors such as existing infrastructure, dependency on other systems, and the maturity of the technology associated with the market package.

After selecting the market packages that were applicable for the Region, stakeholders reviewed each market package and the elements that could be included to customize it for the Region. This customization is discussed further in the following section.

Table 5 - Superior Region Market Package Prioritization by Functional Area

High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
Travel and Traffic Management		
ATMS01 Network Surveillance ATMS03 Surface Street Control ATMS06 Traffic Information Dissemination ATMS10 Electronic Toll Collection ATMS19 Speed Monitoring	ATMS07 Regional Traffic Control ATMS08 Traffic Incident Management System ATMS13 Standard Railroad Grade Crossing ATMS20 Drawbridge Management	ATMS02 Probe Surveillance ATMS17 Regional Parking Management
Emergency Management		
EM01 Emergency Call-Taking and Dispatch EM02 Emergency Routing EM06 Wide-Area Alert	EM03 Mayday and Alarm Support EM04 Roadway Service Patrols EM05 Transportation Infrastructure Protection	
Maintenance and Construction Management		
MC01 Maintenance and Construction Vehicle and Equipment Tracking MC03 Road Weather Data Collection MC04 Weather Information Processing and Distribution MC06 Winter Maintenance MC08 Work Zone Management MC09 Work Zone Safety Monitoring MC10 Maintenance and Construction Activity Coordination	MC02 Maintenance and Construction Vehicle Maintenance MC05 Roadway Automated Treatment MC07 Roadway Maintenance and Construction	
Public Transportation Management		
APTS1 Transit Vehicle Tracking APTS2 Transit Fixed-Route Operations APTS3 Demand Response Transit Operations APTS5 Transit Security	APTS4 Transit Passenger and Fare Management APTS8 Transit Traveler Information	APTS6 Transit Maintenance APTS7 Multi-modal Coordination
Commercial Vehicle Operations		
CVO06 Weigh-in-Motion		
Traveler Information		
ATIS1 Broadcast Traveler Information	ATIS2 Interactive Traveler Information	ATIS8 Dynamic Ridesharing ATIS9 In Vehicle Signing
Archived Data Management		
	AD1 ITS Data Mart AD3 ITS Virtual Data Warehouse	
Advanced Vehicle Safety System		
	AVSS10 Intersection Collision Avoidance	AVSS11 Automated Highway System

3.4.2 Customized Market Packages

The market packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the Superior Region. Each market package is shown graphically with the market package name, local agencies involved and desired data flows included. Market packages represent a service that will be deployed as an integrated capability.

Figure 5 is an example of an ATMS market package for Surface Street Control that has been customized for the Region. This market package shows the two subsystems, Traffic Management and Roadway, and the associated entities (MDOT Superior Region TMC, MDOT North Region TMC, and MDOT Traffic Signals) for surface street control in the Region. Data flows between the subsystems indicate what information is being shared. The remainder of the market packages that were customized for the Superior Region is shown in **Appendix B**.

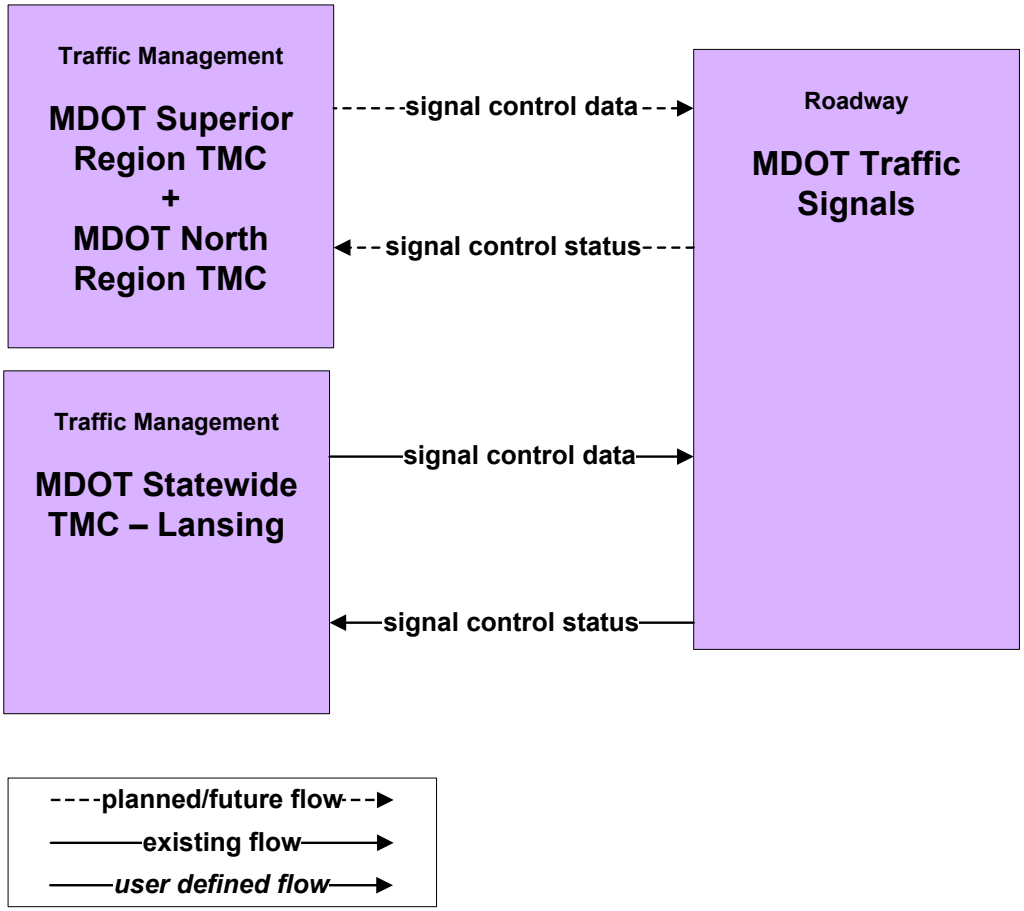


Figure 5 - Example Market Package Diagram: ATMS03 - Surface Street Control

3.4.3 Regional ITS Needs and Customized Market Packages

Input received from stakeholders at the Architecture Workshop provided valuable input for the market package customization process. The specific needs identified are included in **Table 6**. The table also identifies which market package documents the particular ITS need.

Table 6 - Regional ITS Needs and Corresponding Market Packages

ITS Need	Market Package
Traffic Management and Traveler Information	
Need improved access to traveler information on local access TV, highway advisory radio (HAR) and the Internet	ATMS07
Need weather information and road closure information more available to all agencies and the public	ATMS06 ATMS08 MC04
Need access to closed circuit television (CCTV) cameras at resorts, colleges, and tourist areas	ATMS01 ATMS06
Need construction delays and alternate route data more available	ATMS01 MC07 MS08 MC10
Need weather forecasts to be confirmed and shared with the trucking industry through single information point	MC04
Need a consistent method for posting road condition information	ATMS06
Public Transportation Management	
Need 800 Mhz radio technology for voice and data	APTS1 APTS2 APTS3 APTS8
Need GPS technology for transit authorities within the Superior Region	APTS1 APTS2 APTS3 APTS8
Need electronic information kiosk for Delta Area Transit Authority	APTS4
Need security cameras in intermodal terminals	APTS5
Emergency Management	
Need Law enforcement, EMS, Fire, MDOT, and Road Commissions on same 800 MHz radio for communication	ATMS08 EM01
Need a plan for an Emergency Alert System	EM06
Need CCTV camera video feeds shared with the public safety agencies	ATMS08
Maintenance and Construction Management	
Need GPS on snowplows or MDOT vehicles	MC01
Need GPS data on snowplow locations available to law enforcement agencies	MC01 MC06
Need real time traffic count data	ATMS01
Need to explore utilizing weather alert information system for road closure information	MC03 MC04 MC06
Need access to outside temperature and road temperature sensors data from snow plows	MC03 MC04 MC06
Archived Data Management	
Need the ability to archive speed data and weather data	AD3
Need historic data for use by MSP in choosing locations for targeted speed enforcement	AD3

3.5 Architecture Interfaces

While it is important to identify the various systems and stakeholders that are part of a regional ITS, a primary purpose of the architecture is to identify the connectivity between transportation systems in the Superior Region. The system interconnect diagram shown previously in **Figure 4** showed the high-level relationships of the subsystems and terminators in the Superior Region and the associated local projects and systems. The customized market packages represent services that can be deployed as an integrated capability and the market package diagrams show the information flows between the subsystems and terminators that are most important to the operation of the market packages. How these systems interface with each other is an integral part of the overall ITS architecture.

3.5.1 Element Connections

There are a variety of different elements identified that are part of the Superior Regional ITS Architecture. These elements include traffic management centers, transit vehicles, dispatch systems, emergency management agencies, media outlets, and others—essentially, all of the existing and planned physical components that contribute to the regional ITS. Interfaces have been identified for each element in the Superior Regional ITS Architecture and each element has been mapped to those other elements with which it must interface. The Turbo Architecture software can generate interconnect diagrams for each element in the Region that show which elements are connected to one another. **Figure 6** is an example of a context style interconnect diagram from the Turbo Architecture database output. This particular interconnect diagram is for MDOT Traffic Signals and is called a context diagram because it shows every element in the architecture that the signals connect to.

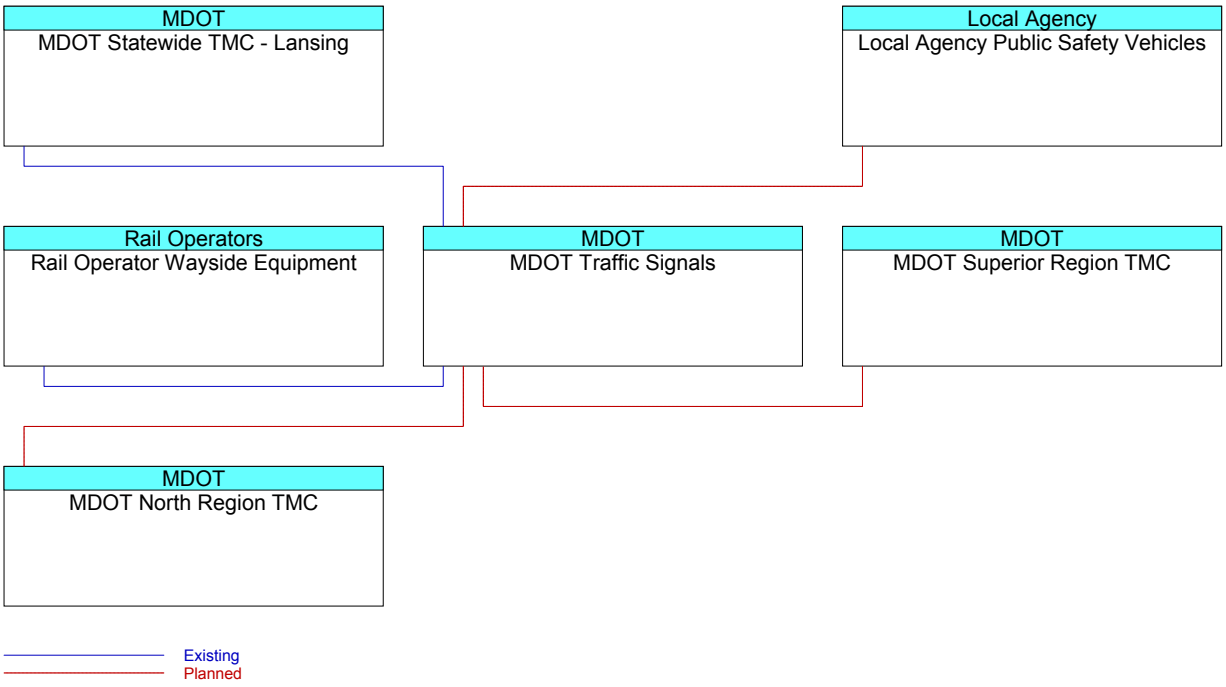


Figure 6 - Example Interconnect Diagram: MDOT Traffic Signals

3.5.2 Data Flows Between Elements

In the market package diagrams, flows between the subsystems and terminators define the specific information (data) that is exchanged between the elements and the direction of the exchange. The data flows could be requests for information, alerts and messages, status requests, broadcast advisories, event messages, confirmations, electronic credentials, and other key information requirements. Turbo Architecture can be used to output flow diagrams and can be filtered by market package for ease of interpretation; however, it is important to remember that custom data flows will not show up in diagrams that are filtered by market package. An example of a flow diagram for the MDOT SABRE System that has been filtered for ATMS19 – MDOT SABRE System is shown in **Figure 7**.

The flow diagrams can vary greatly in complexity, an in turn legibility. **Figure 8** shows a more complex flow diagram for ATMS06 – Traffic Information Dissemination – MDOT Superior Region TMC.

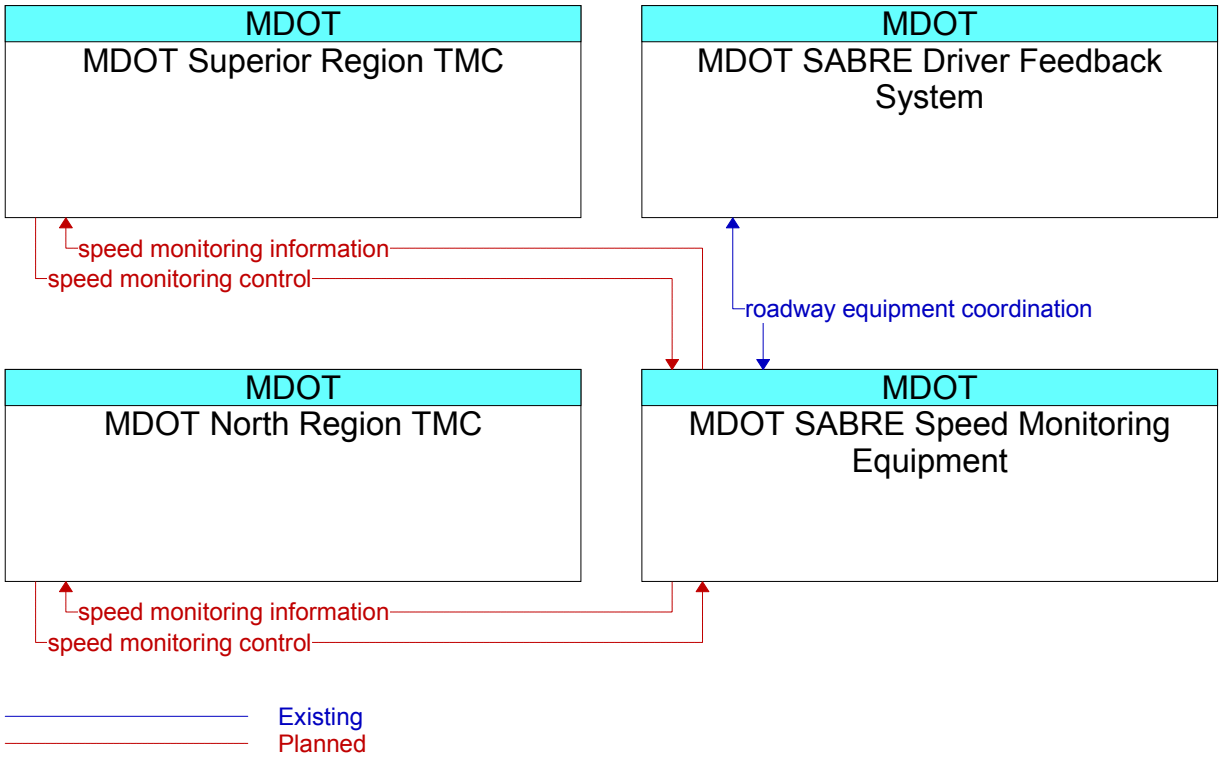


Figure 7 - Example Flow Diagram: ATMS19-1 - MDOT SABRE System

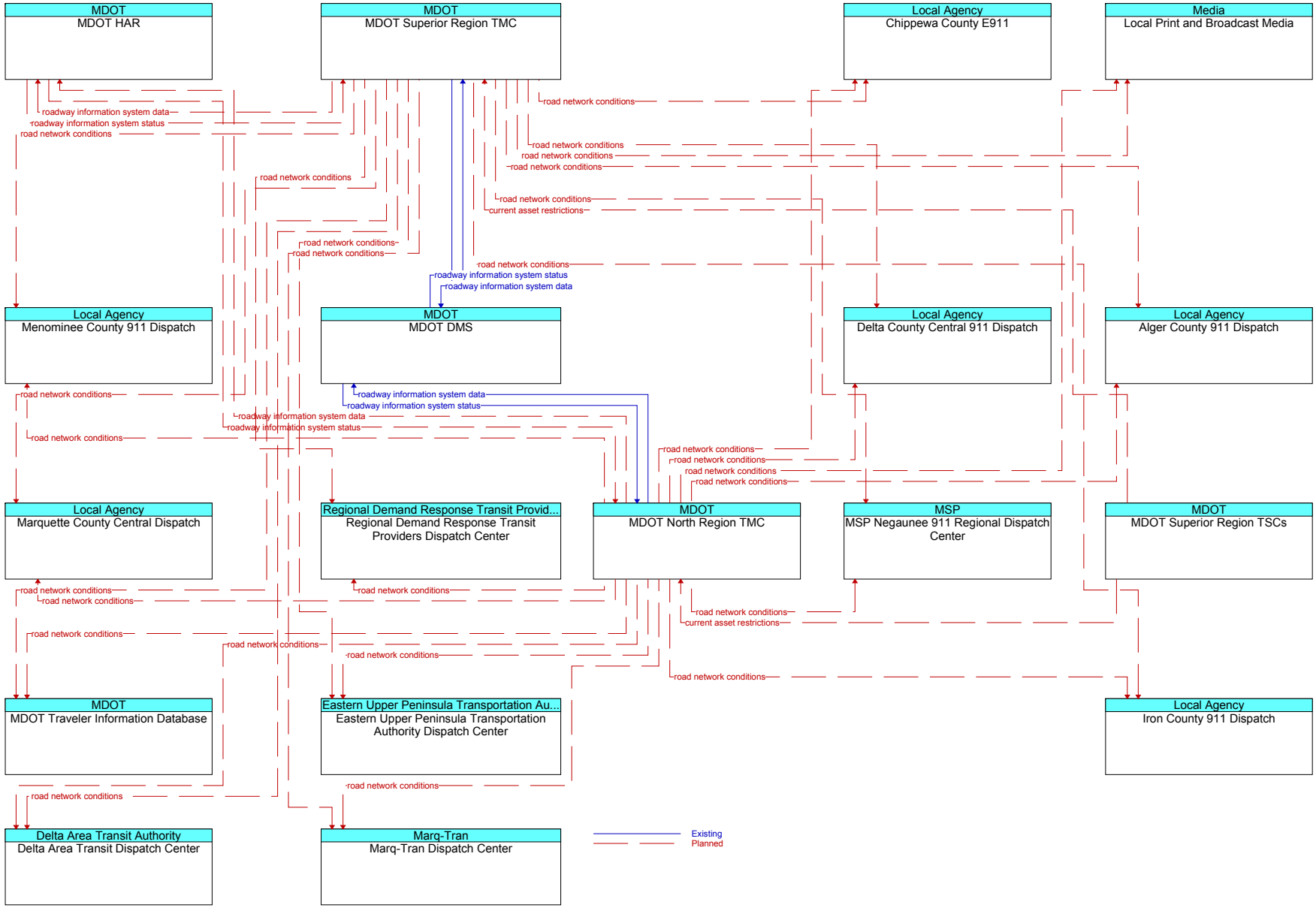


Figure 8 - Example Flow Diagram: ATMS06 - Traffic Information Dissemination

In addition to market package style flow diagrams Turbo Architecture has the ability to create flow diagrams that show only the connections between two or three specific elements or context diagrams that sow all of the flows that involve an element. Filtering the diagrams to generate specific scenarios can be very useful during the project implementation process. For example, **Figure 9** shows the flows between the Mackinac Bridge Authority TOC and Mackinac Bridge DMS. While this is a portion of the existing interactions, it could also be useful to use a context diagram for the element, as shown in **Figure 10** to view all of the other interactions so that the project can be designed with the future in mind. Context style flow diagrams can get very large and complicated for elements with lots of connections such as a TMC.

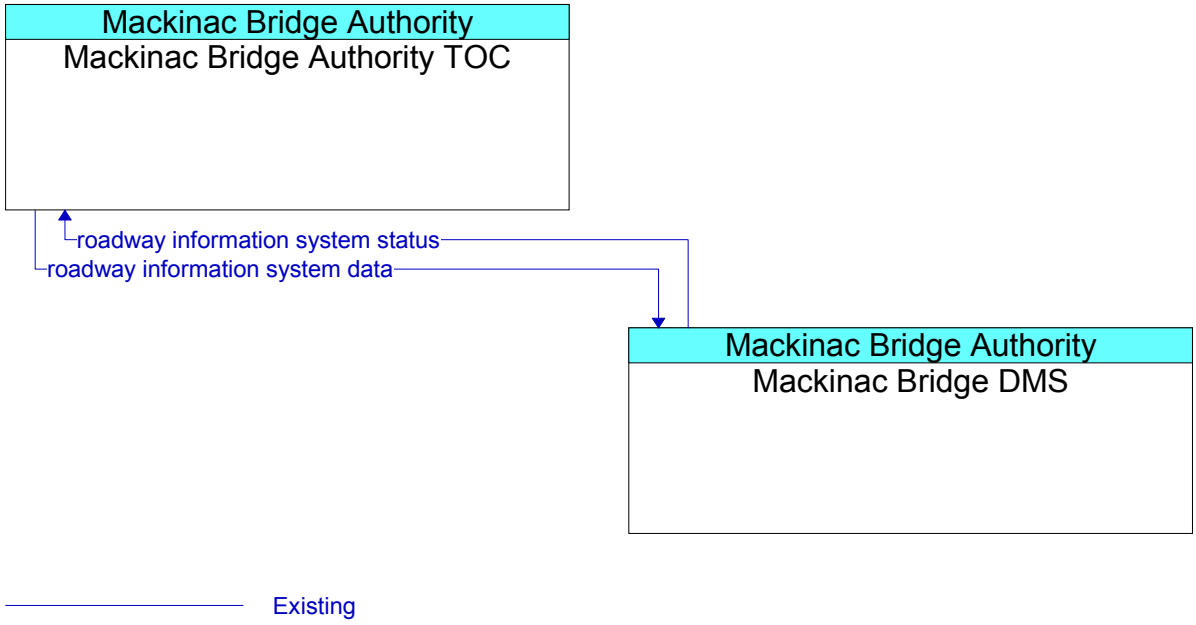


Figure 9 - Example Two Element Flow Diagram

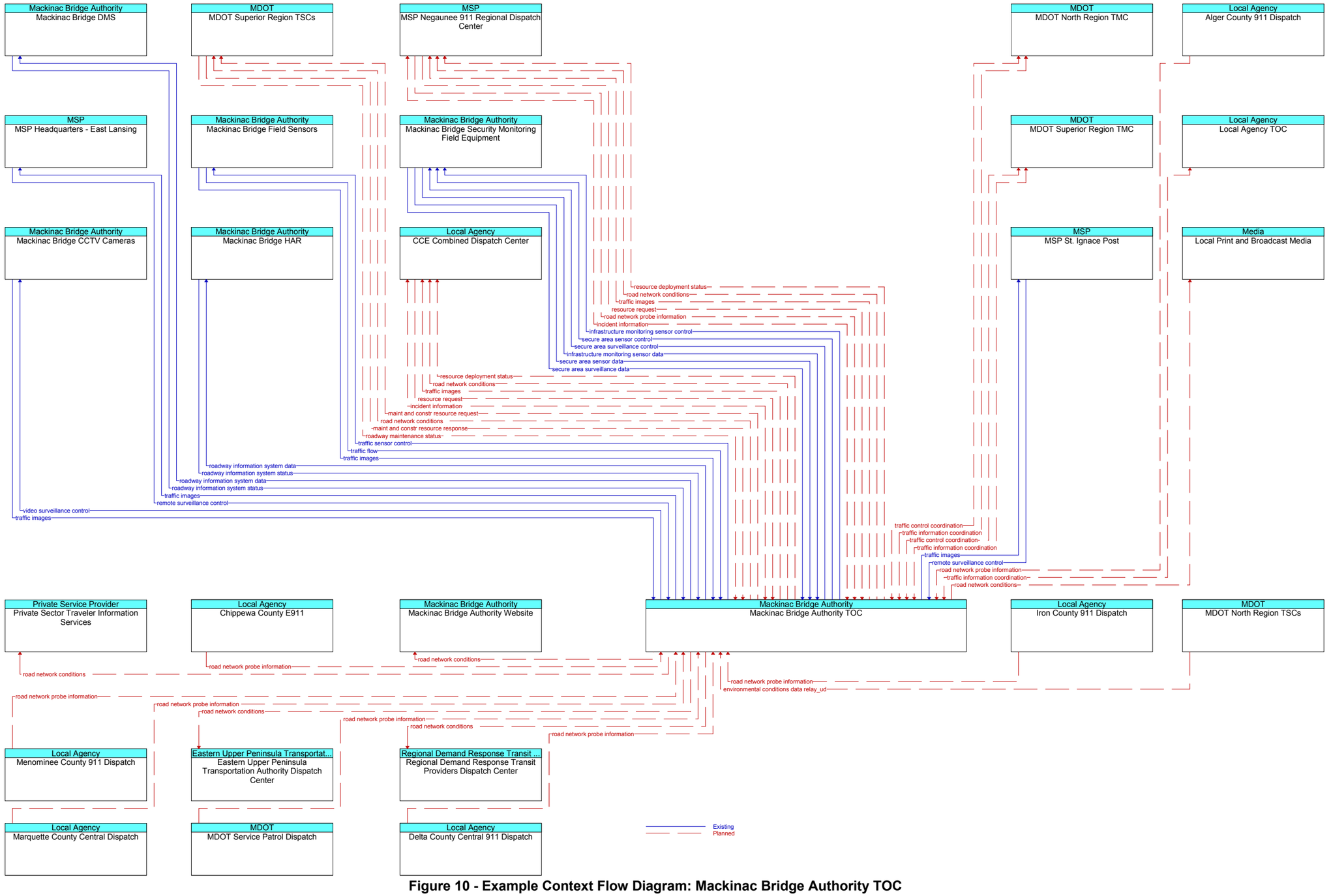


Figure 10 - Example Context Flow Diagram: Mackinac Bridge Authority TOC

4. APPLICATION OF THE REGIONAL ITS ARCHITECTURE

Once a region has identified the desired components of ITS for their area and established which agencies and systems need to be connected, the structure of the National ITS Architecture assists with the region's planning and implementation. This section addresses the application of the Regional ITS Architecture in the Superior Region. The National ITS Architecture provides recommendations for standards and functional requirements that should be considered when implementing ITS elements. In addition, an operational concept has been developed for the Region and documents the roles and responsibilities of stakeholders in the operation of the regional ITS. The implementation of ITS in the Superior Region will likely require interagency agreements. Potential agreements have been identified based on the desired data flows identified in the Superior Region. The ITS Architecture and ITS Deployment Plan developed as part of this process will be incorporated into the existing planning process for the Region to ensure that the maximum benefit is realized from the development effort.

4.1 Functional Requirements

Functions are a description of what the system has to do. In the National ITS Architecture, functions are defined at several different levels, ranging from general subsystem descriptions through somewhat more specific equipment package descriptions to process specifications that include substantial detail. Guidance from the USDOT on developing a Regional ITS Architecture recommends that each Region determine the level of detail of the functional requirements for their Region. In the Superior Region, it is recommended that the development of detailed functional requirements such as the "shall" statements included in process specifications for a system be developed at the project level. These detailed "shall" statements identify all functions that a project or system needs to perform.

For the Superior Regional ITS Architecture, functional requirements have been identified at two levels. The customized market packages, discussed previously in Section 3.4.2, describe the services that ITS needs to provide in the Region and the architecture flows between the elements. These market packages and data flows describe what the systems in the Superior Region have to do and the data that needs to be shared among elements.

At a more detailed level, functional requirements for the Superior Region are described in terms of functions that each element in the architecture performs or will perform in the future. **Appendix C** contains a table that summarizes the functions by element.

4.2 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Superior Regional ITS Architecture over time. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve. The USDOT's ITS Joint Program Office is supporting Standards Development Organizations (SDOs) with an extensive, multi-year program of accelerated, consensus-based standards development to facilitate successful ITS deployment in the United States. **Table 7** identifies each of the ITS standards that could apply to the Superior Regional ITS Architecture. These standards are based on the physical subsystem architecture flows previously identified in Section 3.5.2.

Table 7 - Superior Region Applicable ITS Standards

SDO	Document ID	Title
ANSI	ANSI TS286	Commercial Vehicle Credentials
AASHTO/ITE/NEMA	NTCIP 1101	Simple Transportation Management Framework (STMF)
	NTCIP 1102	Octet Encoding Rules Base Protocol
	NTCIP 1103	Transportation Management Protocols
	NTCIP 1104	Center-to-Center Naming Convention Specification
	NTCIP 1105	CORBA Security Service Specification
	NTCIP 1106	CORBA Near-Real Time Data Service Specification
	NTCIP 1201	Global Object Definitions
	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller Units
	NTCIP 1203	Object Definitions for DMS
	NTCIP 1204	Environmental Sensor Station Interface Standard
	NTCIP 1205	Object Definitions for CCTV Camera Control
	NTCIP 1206	Object Definitions for Data Collection and Monitoring (DCM) Devices
	NTCIP 1208	Object Definitions for CCTV Switching
	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems
	NTCIP 1210	Field Management Stations – Part 1: Object Definitions for Signal System Masters
	NTCIP 1211	Object Definitions for Signal Control and Prioritization
	NTCIP 1401	TCIP Common Public Transportation Objects
	NTCIP 1402	TCIP Incident Management Objects
	NTCIP 1403	TCIP Passenger Information Objects
	NTCIP 1404	TCIP Scheduling/Runcutting Objects
	NTCIP 1405	TCIP Spatial Representation Objects
	NTCIP 1406	TCIP On-Board Objects
	NTCIP 1407	TCIP Control Center Objects
	NTCIP 1408	TCIP Fare Collection Business Area Objects
	NTCIP 2101	Point to Multi-Point Protocol Using RS-232 Subnetwork Profile
	NTCIP 2102	Point to Multi-Point Protocol Using Frequency Shift Keying Modem Subnetwork Profile
	NTCIP 2103	Point-to-Point Protocol Over RS-232 Subnetwork Profile
	NTCIP 2104	Ethernet Subnetwork Profile
	NTCIP 2201	Transportation Transport Profile
	NTCIP 2202	Internet (TCP/IP and UDP/IP) Transport Profile
	NTCIP 2301	STMF Application Profile
	NTCIP 2302	Trivial File Transfer Protocol Application Profile
	NTCIP 2303	File Transfer Protocol Application Profile
	NTCIP 2304	Application Profile for DATEX-ASN (AP-DATEX)
	NTCIP 2305	Application Profile for CORBA (AP-CORBA)
	NTCIP 2306	Application Profile for XML Message Encoding and Transport in ITS Center-to-Center Communications
	NTCIP 2501	Information Profile for DATEX
	NTCIP 2502	Information Profile for CORBA

Table 7 - Superior Region Applicable ITS Standards

SDO	Document ID	Title
ASTM	ASTM E2158-01	Standard Specification for Dedicated Short Range Communication (DSRC) Physical Layer using Microwave in the 902-928 MHz Band
	ASTM E2259-xx	Standard Specification for Metadata to Support Archived Data Management Systems
	ASTM E2259-yy	Standard Specification for Archiving ITS Generated Travel Monitoring Data
	ASTM PS 105-99	Standard Provisional Specification for DSRC Data Link Layer
IEEE	IEEE 1455-1999	Standards for Message Sets for Vehicle/Roadside Communications
	IEEE 1512.1-2003	Standard for Traffic Incident Management Message Sets for Use by EOCs
	IEEE 1512.2-2004	Standard for Public Safety Incident Management Message Sets (IMMS) for use by EOCs
	IEEE 1512.3-2002	Standard for Hazardous Material IMMS
	IEEE 1512-2000	Standard for Common IMMS for use by EOCs
	IEEE 1570-2002	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection
	IEEE 1609.1	Resource Manager for DSRC 5.9 GHz
	IEEE 1609.2	Application Services (Layers 6,7) for DSRC 5.9 GHz
	IEEE 1609.3	Communications Services (Layers 4,5) for DSRC 5.9 GHz (Future Standard)
	IEEE 1609.4	Medium Access Control (MAC) Extension and the MAC Extension Management Entity for DSRC 5.9 GHz
	IEEE 802.11	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems – 5 GHz Band DSRC MAC and Physical Layer Specifications
	IEEE 802.2	Logical Link (Layer 2) for DSRC 5.9 GHz
	IEEE P1512.4	Standard for Common Traffic Incident Management Message Sets for Use in Entities External to Centers
ISO	ISO 21210	Networking Services (Layer 3) for DSRC 5.9 GHz
SAE	ITE TM 1.03	Standard for Functional Level Traffic Management Data Dictionary
	ITE TM 2.01	Message Sets for External TMC Communication
	SAE J2266	Location Referencing Message Specification
	SAE J2313	On-Board Lance Vehicle Mayday Reporting Interface
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards
	SAE J2540-1	Radio Data System Phrase Lists
	SAE J2540-2	International Traveler Information Systems Phrase Lists
	SAE J2540-3	National Names Phrase List

4.3 Operational Concepts

An operational concept documents each stakeholder's current and future roles and responsibilities across a range of transportation services, as grouped in the Operational Concepts section of Turbo Architecture, in the operation of the regional ITS. The services covered are:

- ***Arterial Management*** – The development of signal systems that react to changing traffic conditions and provide coordinated intersection timing over a corridor, an area, or multiple jurisdictions.
- ***Highway Management*** – The development of systems to monitor freeway (or tollway) traffic flow and roadway conditions, and provide strategies such as ramp metering or lane access control to improve the flow of traffic on the freeway. Includes systems to provide information to travelers on the roadway.
- ***Incident Management*** – The development of systems to provide rapid and effective response to incidents. Includes systems to detect and verify incidents, along with coordinated agency response to the incidents.
- ***Emergency Management*** – The development of systems to provide emergency call taking, public safety dispatch, and emergency operations center operations.
- ***Maintenance and Construction Management*** – The development of systems to manage the maintenance of roadways in the Region, including winter snow and ice clearance. Includes the managing of construction operations.
- ***Transit Management*** – The development of systems to more efficiently manage fleets of transit vehicles or transit rail. Includes systems to provide transit traveler information both pre-trip and during the trip.
- ***Electronic Payment*** – The development of electronic fare payment systems for use by transit and other agencies (e.g., parking).
- ***Commercial Vehicle Operations*** – The development of systems to facilitate the management of commercial vehicles (e.g., electronic clearance).
- ***Traveler Information*** – The development of systems to provide static and real time transportation information to travelers.
- ***Archived Data Management*** – The development of systems to collect transportation data for use in non-operational purposes (e.g., planning and research).
- ***Vehicle Safety*** – The development of systems to support private sector vehicle safety initiatives (e.g., intersection collision avoidance).

Table 8 identifies the roles and responsibilities of key stakeholders for a range of transportation services.

Table 8 - Superior Region Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Arterial Management	MDOT	Operate and maintain traffic signal systems on MDOT routes not managed by local agencies.
		Operate network surveillance equipment including CCTV cameras and field sensors on MDOT routes not managed by local agencies to facilitate traffic signal operations.
		Provide traffic information to regional agencies including transit, emergency management, maintenance and construction, and the media.
		Coordinate traffic information and control with local agency TOCs and other MDOT TMCs.
		Provide traffic signal preemption for emergency vehicles.
		Coordinate HRI signal adjustments with private rail operators.
	Local Agency	Operate traffic signal systems on local routes.
		Operate network surveillance equipment including CCTV cameras and field sensors on local routes to facilitate traffic signal operations.
		Provide traffic information reports to regional information service providers.
		Provide traffic information to regional agencies including transit, emergency management, maintenance and construction, and the media.
		Coordinate traffic information and control with MDOT Superior and North TMCs.
		Coordinate traffic information with other local agencies.
		Coordinate HRI signal adjustments with private rail operators.
Highway Management	MDOT	Operate network surveillance equipment including CCTV cameras and field sensors, as well as DMS, to convey traffic information, on MDOT highway routes.
		Provide traffic information to regional information service providers.
		Provide traffic information to regional transportation agencies and the general public through traffic information devices (DMS).
		Coordinate traffic information and traffic control with other MDOT TMCs.
Incident Management (Traffic)	MDOT	Perform network surveillance for detection and verification of incidents on MDOT routes.
		Provide incident information to travelers via traffic information devices on highways (e.g. MDOT DMS).
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response with MDOT Superior Region TSC Construction and Maintenance Operations.
	Local Agency	Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.

Table 8 - Superior Region Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Traffic) (continued)	Local Agency (continued)	Perform network surveillance for detection and verification of incidents on local routes.
		Provide incident information to regional emergency responders, including the MSP and MDOT.
		Coordinate maintenance resources for incident response with MDOT Superior Region TSCs and local agencies.
Incident Management (Emergency)	MSP	Receive emergency calls for incidents on local routes.
		Dispatch the local agency emergency vehicles to incidents, including the local agency police, fire, and EMS/rescue.
		Dispatch MSP vehicles for incidents on highways.
		Perform incident detection and verification for the highways within the region and provide this information to traffic and other public safety agencies.
		Coordinate incident response with other public safety agencies (local police, fire, EMS, sheriff) as well as MDOT.
		Coordinate public safety resources for incident response on local routes.
	Local Agency	Receive emergency calls for incidents on local routes.
		Dispatch the local agency emergency vehicles to incidents, including the local agency police, fire, and EMS/rescue.
		Coordinate public safety resources for incident response on local routes.
		Coordinate incident response with other public safety agencies (fire, EMS, ambulance, etc.).
		Perform incident detection and verification on local routes and provide this information to the Local Agency TOC.
Emergency Management	MSP	Dispatch local agency emergency vehicles to incidents in areas where MSP has primary 911 call-taking responsibilities.
		Dispatch MSP vehicles to incidents within their jurisdiction.
		Receive AMBER Alert and other wide area alert information from MSP Headquarters.
		Receive early warning information and threat information from the NWS and local agencies.
		Coordinate with regional emergency management providers, maintenance and construction providers, and regional traffic management providers for emergency plans and evacuation and reentry plans.
		Provide regional traffic, transit, emergency management, and maintenance operations with disaster information to disseminate to the traveling public.
		Provide security monitoring of critical infrastructure for MDOT.
	MIOC	Participate in the incident response, coordination, and reporting.

Table 8 - Superior Region Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Local Agency	Dispatch local agency fire/EMS/police vehicles.
		Participate in the incident response, coordination, and reporting.
		Perform incident detection and verification for arterials on local routes.
		Receive AMBER Alert and other Wide Area Alert information from MSP.
		Respond to transit emergencies/alarms on-board transit vehicles or at the transit facilities of local transit agencies.
Maintenance and Construction Management	MDOT	Receive requests for maintenance resources for incident response from regional emergency management agencies.
		Supports coordinated response to incidents.
		Responsible for the tracking and dispatch of MDOT maintenance vehicles.
		Receive vehicle maintenance conditions from MDOT maintenance and construction vehicle and coordinate fleet management the with MDOT equipment repair facility.
		Collect road weather information with MDOT equipment and distribute it to regional traffic, maintenance, and transit agencies.
		Provide maintenance of state highways within the region, including pavement maintenance, winter maintenance, and construction activities.
		Manage work zones on all MDOT maintenance and construction activities, as well as monitor work zone safety with MDOT field devices and vehicles.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, transit operations, emergency operations, rail operations, and the media.
		Perform maintenance of ITS field equipment owned by MDOT.
		Coordinate snow removal resources with other regional maintenance providers.
	Local Agency	Receive a request for maintenance resources for incident response from regional emergency management agencies.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive vehicle location information from local agency DPW vehicles.
		Dispatch Local Agency maintenance vehicles.
		Provide maintenance of local routes and MDOT facilities (per contract), including pavement maintenance, construction activities, and snow removal.

Table 8 - Superior Region Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	Private Operators	Provide maintenance of local routes and MDOT facilities (per contract), including pavement maintenance, construction activities, and snow removal.
Transit Management	Delta Area Transit Authority	Track and evaluate schedule performance on all Delta Area Transit Authority's demand response vehicles.
		Provide transit schedule and fare information to the Delta Area Transit Authority website and private sector traveler information service providers.
		Provide demand response transit service for the Delta Area Transit Authority.
		Provide transit passenger electronic fare payment on Delta Area Transit Authority demand response transit vehicles.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Delta Area Transit Authority demand response vehicles.
		Provide schedule and fare information on Delta Area Transit Authority.
		Coordinate emergency plans with the local public safety agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry)
		Collect and archive transit data from Delta Area Transit Authority transit operations.
	Eastern Upper Peninsula Transportation Authority	Track and evaluate schedule performance on all Eastern Upper Peninsula Transportation Authority fixed route and demand response vehicles.
		Provide transit schedule and fare information to the Eastern Upper Peninsula Transportation Authority website and private sector traveler information service providers.
		Provide fixed route bus service for the Eastern Upper Peninsula Transportation Authority.
		Provide demand response transit service for the Eastern Upper Peninsula Transportation Authority.
		Provide a demand response transit plan from the agency website.
		Provide transit passenger electronic fare payment on all Eastern Upper Peninsula Transportation Authority fixed route and demand response transit vehicles.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Eastern Upper Peninsula Transportation Authority fixed route and demand response vehicles.
		Provide schedule and fare information on Eastern Upper Peninsula Transportation Authority.

Table 8 - Superior Region Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Eastern Upper Peninsula Transportation Authority (continued)	Coordinate transit service with other regional transit providers as well as regional intermodal terminals and the regional airport.
		Provide transit traveler information to the agency website and local private sector traveler information services in addition to making it available on transit information kiosks.
		Coordinate emergency plans with the local public safety agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry)
		Collect and archive transit data from Eastern Upper Peninsula Transportation Authority transit operations.
	Marq-Tran	Track and evaluate schedule performance on all Marq-Tran fixed route and demand response vehicles.
		Provide transit schedule and fare information to the Marq-Tran website and private sector traveler information service providers.
		Provide fixed route bus service for Marq-Tran.
		Provide demand response transit service for Marq-Tran.
		Provide a demand response transit plan from the agency website.
		Provide transit passenger electronic fare payment on all Marq-Tran fixed route and demand response transit vehicles.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Marq-Tran fixed route and demand response vehicles.
		Provide schedule and fare information on Marq-Tran.
		Coordinate transit service with other regional transit providers as well as regional intermodal terminals and the regional airport.
		Provide transit traveler information to the agency website and local private sector traveler information services in addition to making it available on transit information kiosks.
		Coordinate emergency plans with the local public safety agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry)
		Collect and archive transit data from Marq-Tran transit operations.
	Regional Demand Response Transit Providers	Track and evaluate schedule performance on all Regional Demand Response Transit Providers' transit vehicles.
		Provide transit schedule and fare information to the Regional Demand Response Transit Providers website and private sector traveler information service providers.
		Provide demand response transit service for the Regional Demand Response Transit Providers.
		Provide a demand response transit plan for the agency website.

Table 8 - Superior Region Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Regional Demand Response Transit Providers (continued)	Provide transit passenger electronic fare payment on all Regional Demand Response Transit Providers' transit vehicles.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Regional Demand Response Transit Providers' demand response vehicles.
		Provide schedule and fare information on Regional Demand Response Transit Providers.
		Coordinate transit service with other regional transit providers as well as regional intermodal terminals and the regional airport.
		Coordinate emergency plans with the local public safety agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry)
		Collect and archive transit data from Regional Demand Response Transit Providers transit operations.
Commercial Vehicle Operations	MSP	Provide automated weigh-in-motion inspections for private fleet operations.
		Provide enforcement of regional permits for overheight/overweight or HAZMAT.
		Provide first response to commercial vehicle incidents and coordinate for HAZMAT conditions/clean-up.
	MDOT	Provide route restriction information to private fleet systems.
		Provide permit information to regional emergency management providers and regional enforcement agencies.
Traveler Information	MDOT	Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, and weather information to travelers via the 511 Traveler Information System and MI Drive website.
		Provide traveler information to private travelers through in vehicle, personal computing devices or kiosks upon request.
		Provide traveler information to the media.
	MSP	Collect traffic information (road network conditions), work zone information, travel times, and weather information.
	Local Agency	Collect traffic information (road network conditions), work zone information, travel times, and weather information.
		Coordinate and share traveler information with all other traveler information providers within the region.
Archived Data Management	MDOT	Collect and archive asset status information from all MDOT maintenance offices and MDOT asset management systems.
		Collect and archive traffic information from regional traffic management providers and centers, emergency information from MSP and Local Agency Police, and transit information from regional transit agencies for planning purposes.
		Coordinate with MDOT Transportation Planning Division.
	MSP	Collect and archive emergency and incident information from MSP and the region's emergency responders.

4.4 Potential Agreements

The Regional ITS Architecture for the Superior Region has identified many agency interfaces, information exchanges, and integration strategies that would be needed to provide the ITS services and systems identified by the stakeholders in the Region. Interfaces and data flows among public and private entities in the Region will require agreements among agencies that establish parameters for sharing agency information to support traffic management, incident management, provide traveler information, and perform other functions identified in the Regional ITS Architecture.

With the implementation of ITS technologies, integrating systems from one or more agencies, and the anticipated level of information exchange identified in the architecture, it is likely that formal agreements between agencies will be needed in the future. These agreements, while perhaps not requiring a financial commitment from agencies in the Region, should outline specific roles, responsibilities, data exchanges, levels of authority, and other facets of regional operations. Some agreements will also outline specific funding responsibilities, where appropriate and applicable.

Agreements should avoid being specific with regards to technology when possible. Technology is likely to change rapidly and changes to technology could require an update of the agreement if the agreement was not technology neutral. Focus of the agreement should be on the responsibilities of the agencies and the high level information that needs to be exchanged. Depending on the type of agreement being used, agencies should be prepared for the process to complete an agreement to take several months to years. Agencies must first reach consensus on what should be in an agreement and then proceed through the approval process. The approval process for formal agreements varies by agency and can often be quite lengthy, so it is recommended that agencies plan ahead to ensure that the agreement does not delay the project.

When implementing an agreement for ITS, it is recommended that as a first step any existing agreements are reviewed to determine whether they can be amended or modified to include the additional requirements that will come with deploying a system. If there are no existing agreements that can be modified or used for ITS implementation, then a new agreement will need to be developed. The formality and type of agreement used is a key consideration. If the arrangement will be in affect for an extended duration or involve any sort of long term maintenance, then written agreements should be used. Often during long term operations, staff may change and a verbal agreement between agency representatives may be forgotten by new staff.

Common agreement types and potential applications include:

- **Handshake Agreement:** Handshake agreements are often used in the early stage of a project. This type of informal agreement depends very much on relationships between agencies and may not be appropriate for long term operations where staff is likely to change.
- **Memorandum of Understanding (MOU):** A MOU demonstrates general consensus or willingness to participate as part of a particular project but is not typically very detailed.
- **Interagency and Intergovernmental Agreements:** These agreements between public agencies can be used for operation, maintenance, or funding of its projects and systems. They can include documentation on the responsibility of each agency, functions they will provide, and liability.
- **Funding Agreements:** Funding agreements document the funding arrangements for ITS projects. At a minimum, funding agreements include a detailed scope, services to be performed, and a detailed project budget.

- **Master Agreements:** Master agreements include standard contract language for an agency and serve as the main agreement between two entities which guides all business transactions. Use of a master agreement can allow an agency to do business with another agency or private entity without having to go through the often lengthy development of a formal agreement each time.

Table 9 provides a list of existing and potential agreements for the Superior Region based on the interfaces identified in the Regional ITS Architecture. It is important to note that as ITS services and systems are implemented in the Region, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations.

Table 9 - Superior Region Potential Agreements

Status	Agreement and Agencies	Agreement Description
Future	**Joint Operations/Shared Control Agreements (Public-Public or Public-Private)** – MDOT, Local Agencies, MSP	These agreements would allow joint operations or control of certain systems and equipment. The agreement should define such items as hours of operation and time of day/day of week when shared control would take effect, circumstances, or incidents when shared control would take effect, notification procedures between the agencies agreeing to shared control arrangements, overriding capabilities of owning agency, etc. Private agencies, such as information service providers that provide traffic reports, could also be part of this agreement.
Future	**Data Sharing and Usage (Public-Public)** – MDOT, Local Agencies, MSP	These agreements would define the parameters, guidelines, and policies for inter- and intra-agency ITS data sharing. This data sharing would support regional activities related to traffic management, incident management, traveler information, and other functions. The terms of this agreement should generally address such items as types of data and information to be shared, how the information will be used (traffic incident information to be shared, displayed on web site for travel information, distributed to private media, etc.), and parameters for data format, quality, security.
Future	**Data Sharing and Usage (Public-Private)** – MDOT, Local Agencies, media	These agreements would define the parameters, guidelines, and policies for private sector (such as the media or other information service providers) use of ITS data. This type of agreement is recommended to define terms of use for broadcasting public-agency information regarding traffic conditions, closures, restrictions, as well as video images. Agreements can also include requirements for the media to 'source' the information (i.e., using the providing agency's logo on all video images broadcast.

4.5 Phases of Implementation

The Regional ITS Architecture will be implemented over time through a series of projects led by both public sector and private sector agencies. Key foundation systems will need to be implemented in order to support other systems that have been identified in the Regional ITS Architecture. The deployment of all of the systems required to achieve the final Regional ITS Architecture build out will occur over many years.

A sequence of projects and their respective time frames have been identified in the Superior Regional ITS Deployment Plan. These projects have been sequenced over a 10-year period, with projects identified for deployment in 5- and 10-year timeframes.

Some of the key market packages that will provide the functions for the foundation systems in the Superior Region are listed below. Projects associated with these and other market packages identified for the Region have been included in the Superior Regional ITS Deployment Plan.

- Network Surveillance;
- Maintenance and Construction Vehicle Tracking;
- Weather Information Processing and Distribution;
- Surface Street Control;
- Traffic Information Dissemination; and
- Transit Vehicle Tracking.

5. USE AND MAINTENANCE PLAN FOR THE REGIONAL ITS ARCHITECTURE

The ITS Architecture developed for the Superior Region addresses the Region's vision for ITS implementation at the time the plan was developed. Stakeholders invested a considerable amount of effort in the development of the Regional ITS Architecture and Regional ITS Deployment Plan. As the Region grows, needs will change, and, as technology progresses, new ITS opportunities will arise. Shifts in regional needs and focus as well as changes in the National ITS Architecture will necessitate that the Superior Region ITS Architecture be updated to remain a useful resource for the Region.

The following section outlines how the Region and its stakeholders can work with the MDOT ITS Program Office to ensure projects are in conformity and also provide updates as ITS evolves in the region.

5.1 Process for Determining Architecture Conformity

The Superior Regional ITS Architecture and Deployment Plan documents the customized market packages that were developed as part of the ITS architecture process. To satisfy federal requirements and remain eligibility to use federal funds, a project must be accurately documented. To document the conformity of an ITS project with the regional architecture, MDOT's ITS Program Office will oversee the development of a regional architecture conformance form to guide project managers through the process. The project managers will be able to coordinate with the ITS Program Office and regional contact for additional assistance and guidance. The steps of the process are as follows:

- Identify the ITS components in the project;
- Identify the corresponding market packages(s) from the Regional ITS Architecture;
- Locate the component within the market package;
- Compare the connections to other agencies or elements documented in the ITS architecture as well as the information flows between them to the connections that will be part of the project;
- Assess the use of relevant standards; and
- Document any changes necessary to the ITS Architecture or the project to ensure there is conformance.

Identifying the ITS Components

ITS components can be fairly apparent in an ITS focused project such as CCTV or DMS deployments, but could also be included in other types of projects. For example, an arterial widening project could include the installation of signal system interconnect, signal upgrades, and the incorporation of the signals in the project limits into the MDOT's signal system. These are all ITS deployments and should be part of the ITS architecture.

Identifying the Corresponding Market Packages

If a project was included in Table 10 of the Deployment Plan, then the applicable market package(s) for that project are identified in a column. ITS projects are not required to be included in the ITS Deployment Plan in order to be eligible for federal funding; therefore, market packages might need to be identified without the assistance of an ITS Deployment Plan. In that case, the market packages selected and customized for the Superior Region are identified in **Table 5** of this document, detailed market package definitions are located in **Appendix A**, and customized market packages for the Superior Region are included in **Appendix B**.

Identifying the Component within the Market Package

The customized market packages for the Superior Region are located in **Appendix B**. Once the element is located on the market package, the evaluator may determine that the element name should be modified. For example, an element called the Superior Region TMC in Escanaba was included in the architecture, but at the time of deployment, MDOT may decide to call the center by a new name once the location is finalized. This name change should be documented using the process outlined in Section 1.3.

Evaluating the Connections and Flows

The connections and architecture flows documented in the market package diagrams were selected based on the information available at the time the plan was developed. As the projects are designed, decisions will be made on the system layout that might differ from what is shown in the market package. These changes in the project should be documented in the ITS market packages using the process outlined in Section 1.3.

Relevant Standards

ITS Standards are documented guidelines or rules specifying the interconnections among elements and the characteristics of technologies and products to be used in ITS installations. Standards describe in detail what types of interfaces should exist between ITS components and how the components will exchange information and work together to deliver certain user services. The Superior Regional ITS Architecture highlights the relevant standards based on the region's needs. These standards should be reviewed as part of this conformity exercise. Where standards can be utilized, they should be noted. Where standards are not or could not be utilized, an explanation of why, also should be noted.

Documenting Required Changes

If any changes are needed to accommodate the project under review, Section 1.3 describes how those changes should be documented. Any changes will be incorporated during the next architecture update. Conformance will be accomplished by documenting how the market package(s) should be modified so that the connections and data flows are consistent with the project.

5.2 Maintenance Process

MDOT's ITS Program Office will be responsible for leading the maintenance of the Superior Regional ITS Architecture and Deployment Plan in coordination with the regional contact. Maintenance includes modifications to the plan as well as complete updates. **Table 10** summarizes the maintenance process agreed upon by stakeholders in the Region.

Table 10 - Regional ITS Architecture and Deployment Plan Maintenance Summary

Maintenance Details	Regional ITS Architecture		Regional ITS Deployment Plan	
	Modification	**Complete Update**	**Modification**	**Complete Update**
Timeframe for Updates	As needed	Every 5-7 years	As needed	Every 5-7 years
Scope of Update	Update market packages to satisfy architecture conformance requirements of projects or to document other changes that impact the ITS Architecture	Entire ITS Architecture	Update project status and add or remove projects as needed	Entire ITS Deployment Plan
Lead Agency	MDOT ITS Program Office*		MDOT ITS Program Office*	
Participants	Stakeholders impacted by market package modifications	Entire stakeholder group	Entire stakeholder group	
Results	Market package or other change(s) documented for next complete update	Updated Superior Regional ITS Architecture document, Appendices, and Turbo Architecture database	Updated project tables	Updated Superior Regional ITS Deployment Plan document

** Transit related projects will be supported by MDOT's Bureau of Passenger Transportation*

Modifications to the Regional ITS Architecture and Deployment Plan will often be necessitated by ITS projects that are receiving federal funding but do not conform to the Regional ITS Architecture. MDOT's ITS Program Office will take the lead in working with agencies that receive federal funding for ITS projects and will keep a record of any changes that are needed to the Regional ITS Architecture. Complete updates to the Regional ITS Architecture will occur approximately every five to seven years and will be led by the MDOT's ITS Program Office with support from the MDOT Superior Region and other key stakeholders. The entire stakeholder group that was engaged to develop this first Regional ITS Architecture will be reconvened for the complete updates.

5.3 Procedure for Submitting ITS Architecture Changes Between Scheduled Updates

Updates to the Superior Regional ITS Architecture will occur on a regular basis as described in Section 1.2 to maintain the architecture as a useful planning tool. Between complete plan updates, smaller modifications will likely be required to accommodate ITS projects in the Region. Section 1.1 contains step by step guidance for determining whether or not a project requires architecture modifications.

For situations where a change is required, an ITS Architecture Maintenance Documentation Form was developed and is included in **Appendix E**. This form should be completed and submitted to the MDOT ITS Program Office whenever a change to the Regional ITS Architecture or Deployment Plan is proposed. Please note that MDOT's Bureau of Passenger Transportation also should be copied if the project has a transit related component.

The Maintenance Documentation form identifies three levels of modifications. They include:

- Level 1 – Basic changes that do not affect the structure of the architecture.
  Examples include: Changes to stakeholder or element name, element status, or data flow status.
- Level 2 – Structural changes that impact only one agency.
  Examples include: Addition of a new market package or modifications to an existing market package that affects only one agency.
- Level 3 – Structural changes that have the potential to impact multiple agencies.
  Examples include: Addition of a new market package or modifications to an existing market package that involves multiple agencies or incorporation of a new stakeholder into the architecture.

While documenting the proposed change, the project manager completing the change form should coordinate with any of the other agencies that may be impacted by the modification. This communication between agencies will simplify the process of performing a complete plan update. MDOT's ITS Program Office will review and accept the proposed changes. When a complete update is performed by MDOT's ITS Program Office, all of the documented changes will be incorporated into the regional ITS architecture. **Figure 11** graphically illustrates this process.

Figure 11 - Process for Documenting Architecture Performance