



Amendment to the

Regional ITS Architecture

Grand Region

November 2014 | Version 2

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1 INTRODUCTION

The Michigan Department of Transportation (MDOT) has continued to strive to be a leader in the application of technology to improve transportation. Projects that are selected to implement these technological solutions are required to conform to a regional ITS architecture if they utilize federal funds. Prior to 2005, the focus of technology deployments was in the urban areas, but needs began to arise that warranted solutions for other areas of the state. In 2008, the Department completed an effort that supplemented existing documentation and completed regional intelligent transportation systems (ITS) architectures and deployment plans that comprehensively covered all seven regions and provide a statewide vision for MDOT's ITS program. In 2014, MDOT initiated an administrative update for all but two of the regional ITS architectures, the two omitted were completed more recently and cover the metropolitan planning organizations (MPOs) around Grand Rapids and Lansing.

The National ITS Architecture is the standard template that regions and statewide ITS architectures customize to bridge together stakeholders, needs, and solutions for ITS projects. The architecture represents a shared view between agencies on how to integrate information and resources in order to provide solutions that help move travelers through the region safely and efficiently. It is the long range vision for what could be implemented without being technology specific. The architecture is a foundation of that vision and allows stakeholders to derive strategies that can be implemented through more specific ITS projects that benefit the current regional transportation system.

1.1 Project Overview

MDOT initiated a project to perform an administrative update to all but two (2) regional ITS architectures within the state. It is recommended that a full architecture update occurs every 5-7 years however MDOT has decided an administrative update could address the changes and shift in focus for the region. The administrative update incorporates revisions in the National ITS Architecture, updates to portions of the architecture that have been completed, and recent changes in the focus of the region.

The Grand Region ITS Architecture previously was completed in 2008, using version 5.1 of the National Architecture and version 4.0 for the Turbo Architecture Database. The Amendment to the Grand Region ITS Architecture focuses on the following:

- Format changes – conforming the Grand Region ITS Architecture with the National ITS Architecture and Turbo Architecture Database versions 7
- Content update – adding or revising agency names and inventory statuses, revising current stakeholder relationships, and identifying new stakeholders and their relationships
- Project confirmation – confirming completed projects have been incorporated into the regional ITS architecture and identifying upcoming short term projects (5-6 years) conform to the regional ITS architecture

This update does not include an update to the Deployment Plan.

1.2 National Architecture

The National ITS Architecture and the Turbo Architecture database were updated to Version 7 in January 2012. Version 7 adds a planning view to provide additional details on the connection between the regional ITS architecture and how it can be used to support transportation planning through project development. Version 7 also continues to be consistent with the connected vehicle program. As the program changes, the National ITS Architecture is updated to be aligned with the current direction. Other new focuses of the

National ITS Architecture includes enhancements, additional service packages for active traffic management strategies, alignment with the Federal Motor Carrier Safety Administration (FMCSA) Commercial Vehicle Information Systems and Networks (CVISN), and the synchronization with the Canadian Architecture by updated verbiage and outputs.

To support integration with the planning process, the National ITS Architecture now encompasses a new planning view. This view is highlighting the connection between the services packages within the National ITS Architecture and characteristics of the planning process. The characteristics include performance measures, cost/benefit (<http://www.itsbenefits.its.dot.gov/>), and goal setting (as identified in 23 CFR 450).

The National ITS Architecture version 7 was updated with minor terminology changes to reflect the connected vehicle program. The connected vehicles topic has emerged with increasing focus on technology and test beds around the world. The updated version continues to accommodate and incorporate these changes to ensure upcoming ITS projects are in compliant. In part with the National ITS Architecture, a new research effort was released known as the Connected Vehicle Reference Implementation Architecture (CVRIA). The website is <http://www.iteris.com/cvria/>. This effort is to help produce a standardization plan for connected vehicles which in turn will align with the National ITS Architecture both in defining and implementing.

1.3 Document Overview

The Amendment to the Grand Region ITS Architecture is assembled into four main sections. These sections present the consolidation of information collected during administrative update. To a large extent the document is an abridged version of the current regional ITS architecture. Some supplemental information that was not revised during the administrative update can be accessed in the version that is available on the external MDOT ITS Planning website (www.MDOTITSPlanning.com). The sections within the Amendment include:

1 – Introduction

This section provides a project overview and geographic information within the Grand Region.

2 – Administrative Update Process

This section highlights the process taken to develop the Amendment to the Grand Region ITS Architecture. It also identifies the stakeholders who provided comments regarding the administrative updates as well as the updated inventory of the region.

3 – Application of the Regional ITS Architecture

This section reviews standards per the regional ITS architecture and updates to operational concepts identified by stakeholders.

4 – Use and Maintenance

This section highlights the importance of conforming to the regional ITS architecture as well as maintaining the current version. After a period of time, the architecture should be updated with either an administrative or a full update.

The Amendment to the Grand Region ITS Architecture also contains three appendices:

- Appendix A – National ITS Architecture Service Package Definitions

- Appendix B – Customized Service Packages
- Appendix C – Architecture Maintenance Documentation Form

1.4 Geographic Information

The Grand Region's geographic boundary includes the same boundary as MDOT Grand Region, except for Kent County and portions of Ottawa County. These are comprised within the Grand Valley Metropolitan Council area (GVMC). The GVMV Regional ITS Architecture was updated most recently and is not included within this administrative update. The boundary for the Grand Region ITS Architecture is shown in **Figure 1**.

NOTE: Additional details on the characteristics and existing infrastructure within these defined boundaries can be found in Section 1.4.1 of the Grand Region ITS Architecture (2008).

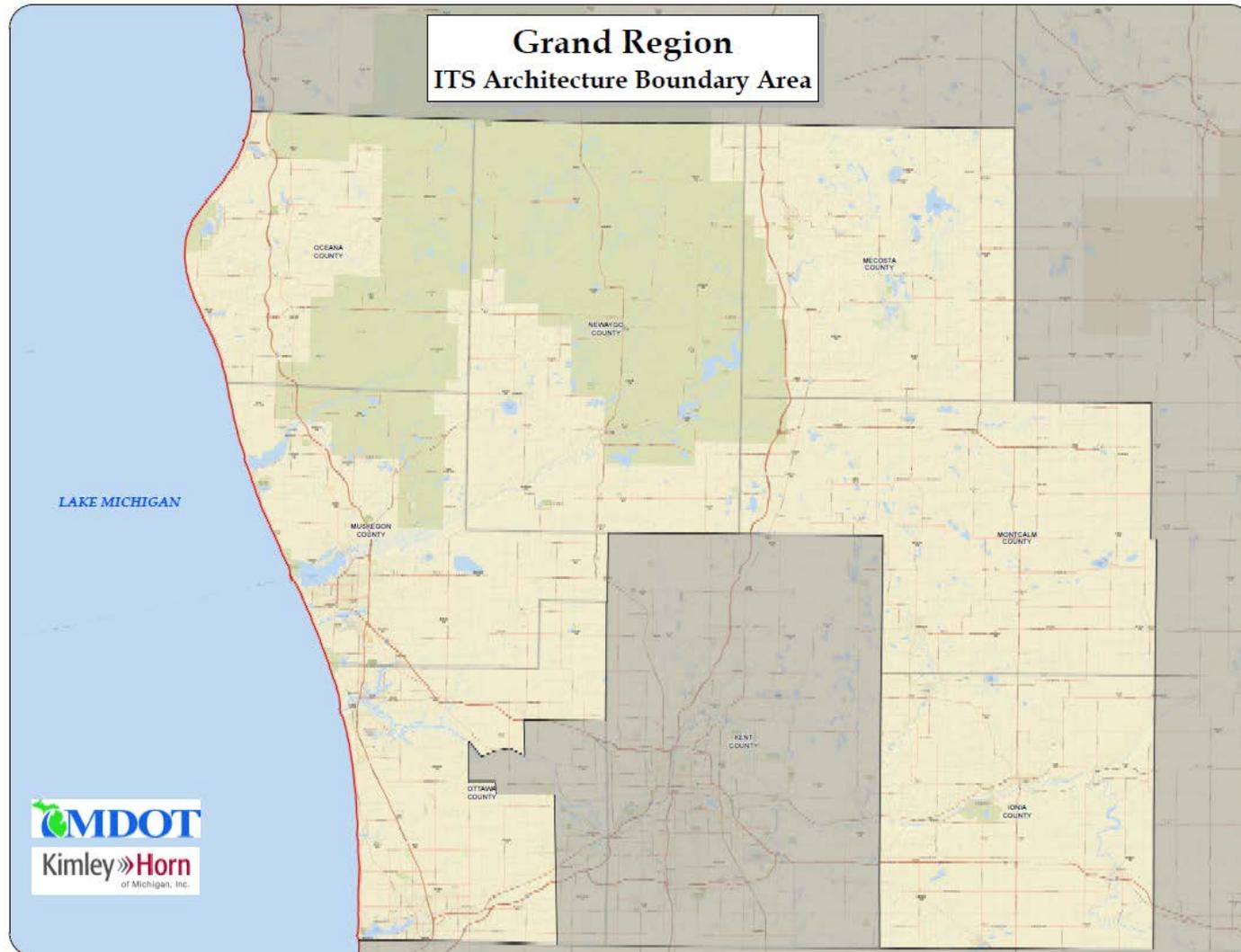


Figure 1. Grand Region ITS Architecture Boundary Area

2 ADMINISTRATIVE UPDATE PROCESS

The administrative update relied heavily on stakeholder input to reflect the changes within the region. The feedback includes input focused on recently completed projects, upcoming projects, and new or modified agency relationships. These relationships either were within MDOT or between MDOT and another stakeholder. Since this was not a full update, documentation efforts were focused on upcoming projects that are anticipated within the next five years. As newer technological applications are continuously being implemented around the world, stakeholders are often assessing these applications that may have once been disregarded. The administrative update integrates the addition of these newer strategies so projects will be in conformance with the regional ITS architecture when funding becomes available.

The administrative process is less intensive than a full update and focused within a considerably short duration of time. To accommodate the abbreviated process, a majority of the coordination and communication with the stakeholders was conducted either via email or made available on the the MDOT ITS Planning website.

The abbreviated process only included one (1) stakeholder workshop. As such, it was important to determine a method that gathers the most effective information and feedback with limited face-to-face coordination with the stakeholders. Including the stakeholder workshop, the complete approach involved:

- Project Level Kick-off Workshop – conference call with primary MDOT regional ITS coordinators to discuss the overall project scope of work, schedule, and the expectations of this effort. Also, preliminary discussions reviewed known projects that could influence the updates.
- Preliminary Revision List – the project list included within the current regional ITS architecture was revised. Revisions included the identification of completed and newly defined projects based on recent project programming documentation and the team’s experience of ITS projects in the area.
- Stakeholder Workshop– a Grand Region ITS architecture workshop was conducted with range of stakeholders from multiple agencies within the region. Stakeholders provided comments on the revised project list, agency name changes, identification of projects within the next five years, changes with interagency connections, newly implemented technology, and new technology applications the stakeholders have identified for near term implementations.
- Revised Inventory Table – information gathered during the workshop was used to update the current architecture inventory table.
 - o The table presents all of the stakeholders within the region, the elements belonging to that stakeholder, a description of the element, and a status (existing or future)
- Draft Final Amendment Architecture Document – comments received from the revised inventory table were used to update both the service package diagrams within the regional ITS architecture document and the Turbo Architecture Database. The document was provided to the stakeholders for their review.
 - o The document included updated tables exported from the Turbo Architecture Database.
- Final Deliverable – comments on the Draft Final Amendment Architecture Document were used to assemble the final deliverables, which included a final Amendment to the Grand Regional ITS Architecture Document and Grand Regional Turbo Architecture database.

Figure 2 below illustrates the process followed.

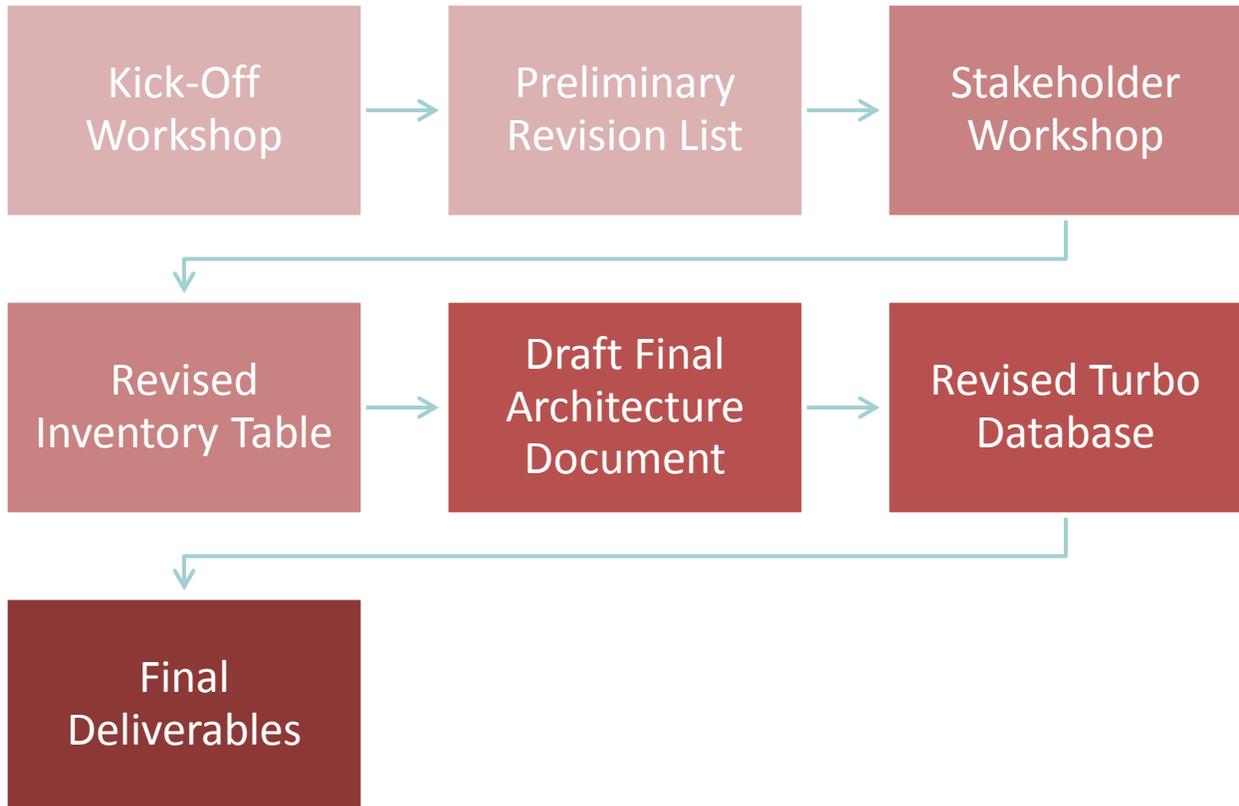


Figure 2. ITS Architecture Administrative Update Process

2.1 Customization

As with the previous architecture process, the administrative update includes an established inventory table of existing ITS elements and elements identified as part of future systems. Stakeholder input was key to an accurate update of this table.

The National ITS Architecture has eight groups of ITS service areas. They include:

- **Traffic Management** (ATMS) – includes transportation operations centers, detection systems, closed circuit television (CCTV) cameras, dynamic message signs (DMS), portable changeable message signs (PCMS), and other related technologies.
- **Emergency Management** (EM) – 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** (MC) – includes work zone management, roadway maintenance and construction information, winter maintenance, and road weather information systems (RWIS).
- **Public Transportation Management** (APTS) – includes transit and paratransit AVL, dispatch systems, transit travel information systems, electronic fare collection, and transit security.

- **Commercial Vehicle Operations (CVO)** – includes coordination with Commercial Vehicle Information Systems and Networks (CVISN) efforts, hazardous material (HAZMAT) management, weigh-in motion (WIM) technology, and security technology, including driver authentication.
- **Traveler Information (ATIS)** – includes broadcast traveler information such as web sites, traveler information kiosks, and highway advisory radio (HAR).
- **Archived Data Management (AD)** – includes electronic data management and archiving systems.
- **Vehicle Safety (AVSS)** – includes connected vehicle technology such as collision avoidance and vehicle automation, specifically speed and steering.

As mentioned above, customizing the elements was based on the previous inventory table and feedback captured during the Grand Regional ITS Architecture Workshop. The local agency elements were used to capture agencies with longer term planned implementations versus calling each out specifically at this time. If an agency has implemented a project, and their elements should be updated to existing, the agency then is documented separately. This strategy allows the regional ITS architecture to cover those agencies and remain eligible for federal funds for an ITS deployments.

NOTE: Additional details regarding subsystems and terminators can be found in Section 3.3.1 of the Grand Regional ITS Architecture.

2.1.1 ITS Inventory by Stakeholder

Each stakeholder is associated with one or more systems or elements that together comprise the transportation system in the Grand Region. Input from the stakeholders was critical to ensure the information within the architecture is accurate and easily reviewed to demonstrate project conformance. A listing of stakeholders, description of the agency, and contact information of those stakeholders who assisted with achieving this goal is found in **Table 1**.

Table 1. Grand Region Stakeholders

Organization	Name		Email
City of Grand Haven, Harbor Transit	Tom	Manderscheid	tmanderscheid@grandhaven.org
FHWA - Michigan	Morrie	Hoevel	Morris.Hoevel@dot.gov
Fox 17 West Michigan (Traffic Reporter)	Robb	Westaby	rwestaby@fox17online.com
Grand Haven Public Safety	Jeffery	Hawke	jhawke@grandhaven.org
Grand Haven Streets & Utilities	William	Hunter	bhunter@grandhaven.org
Macatawa Area Coordinating Council	Steve	Bulthuis	sbulthuis@the-macc.org
MDOT	Dennis	Kent	kentd@michigan.gov
MDOT	Leigh Ann	Mikesell	MikesellL@michigan.gov
MDOT - Grand Rapids TSC	Paul	Arends	ArendsP@michigan.gov
MDOT - Grand Rapids TSC	Bart	Franklin	franklinb@michigan.gov
MDOT - Grand Rapids TSC	Kara	Stein	steink@michigan.gov
MDOT - Grand Region	Suzette	Peplinski	peplinskis@michigan.gov
MDOT - Grand Region	Tom	Richer	RicherT@michigan.gov
MDOT - ITS Program Office	Luke	Biernbaum	BiernbaumL@michigan.gov

Organization	Name		Email
MDOT - ITS Program Office	Collin	Castle	CastleC@michigan.gov
MDOT - ITS Program Office	Elise	Kapphahn	KapphahnE@michigan.gov
MDOT - ITS Program Office	Matt	Smith	SmithM81@michigan.gov
MDOT - Muskegon TSC	David	Brinks	BrinksD@michigan.gov
MDOT - Muskegon TSC	Art	Green	green5@michigan.gov
MDOT - Muskegon TSC	Tim	Terry	terryt@michigan.gov
MSP - 6th District	Doug	Roesler	roeslerd@michigan.gov
MSP - 6th District Motor Carrier Division	Brad	Cushman	cushmanb@michigan.gov
Muskegon Area Transit System	James	Koens	koensj@co.muskegon.mi.us
Muskegon Area Transit System	Melissa	Olstrom	OlstromMe@co.muskegon.mi.us
National Oceanic and Atmospheric Administration	John	Kowaleski	John.Kowaleski@noaa.gov
Ottawa County Road Commission	Fred	Keena	fkeena@ottawacorc.com

Table 2 sorts the inventory by stakeholder so that each stakeholder can easily identify and review all of the architecture elements associated with their agency and its status. An added feature of the inventory table is an element’s association with the service areas. This feature helps to quickly identify the relationship between the elements and the service it is providing. However, if an element status is considered existing this does not necessarily equate to the flows within a service package as existing.

For example, the elements: MDOT Maintenance Decision Support Software and Local DPW are existing elements, but currently the flow of information between the elements are not automated, so this is considered a planned flow.

KEY for Table 2

ATMS	Traffic Management	CVO	Commercial Vehicle Operations
EM	Emergency Management	ATIS	Traveler Information
MC	Maintenance & Construction Management	AD	Archived Data Management
APTS	Public Transportation	AVSS	Vehicle Safety

Table 2. Grand Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Financial Institution	Financial Service Provider	Handles exchange of money for transit electronic payment collection.	Existing				X				
	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.	Existing								
Ionia Transit Authority	Ionia Transit Authority Data Archive	The transit data archive for the Ionia Transit Authority. Used by FTA and MDOT Office of Passenger Transportation	Planned							X	
	Ionia Transit Authority Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of demand response vehicles operated by Ionia Area Transit Authority.	Planned	X	X	X	X		X	X	
	Ionia Transit Authority Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned				X				
	Ionia Transit Authority Transit Center CCTV Surveillance	CCTV surveillance at the Ionia Transit Authority Transit Center.	Planned				X				
	Ionia Transit Authority Vehicles	Transit Vehicles owned by Ionia Area Transit Authority	Existing				X				
	Ionia Transit Authority Website	Website with information about fares and schedules.	Planned				X				

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Local Agency	County 911 Dispatch	Central Dispatch is responsible for the dispatch of all public safety vehicles (police and fire). After hours Central Dispatch will also dispatch the Street Department on-call emergency responder. Counties included are Muskegon, Newaygo, Montcalm, Ottawa and Ionia. Ottawa County Central Dispatch provides CAD feed via a workstation in the WMTOC and STOC.	Existing	X	X	X	X		X		
	County Road Commission	Contract agency managed by a county that oversees road maintenance and snow removal on local and MDOT facilities.	Existing	X	X	X	X	X			
	County Road Commission Maintenance Vehicles	County Road Commission vehicles used in maintenance operations. Includes the ITS equipment installes on the vehicles (automatic vehicle location (AVL) systems, onboard mobile data terminals (MDT), and automatic passenger counters (APC)).	Existing			X					
	Gerald R Ford International Airport	Airport located in Grand Rapids, Michigan. The Kent County Department of Aeronautics is responsible for the management and operation of the airfield and airport facilities.	Existing			X					
	Local Agency 911 Dispatch	Central dispatch responsible for the dispatch of local public safety vehicles (police and fire).	Existing	X	X	X	X	X	X		
	Local Agency Anti-Icing Field Equipment	Roadside equipment located along routes maintained by local agencies that collects weather data such as temperature and visibility.	Planned			X					

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Local Agency	Local Agency CCTV Cameras	Closed circuit television cameras operated by the Local Agency TOC for traffic condition monitoring and management of incidents.	Planned	X							
	Local Agency DPW	Contract agency managed by a local municipality that oversees road maintenance and snow removal on local and MDOT facilities.	Existing	X	X	X	X	X			
	Local Agency DPW Vehicles	Local agency vehicles used in maintenance operations.	Existing			X					
	Local Agency ESS	Environmental sensor stations operated by local agencies that collect information about the roadways such as temperature and moisture levels.	Planned	X							
	Local Agency Fog Detection	Roadside equipment operated by local agencies that collect information about fog visibility levels in fog prone areas.	Planned	X							
	Local Agency High Water Detection	Roadside equipment operated by local agencies that collect information about the water level on flood prone roadways.	Planned	X							
	Local Agency Parking Management System	System operated by a local agency that monitors available vehicle parking at key parking facilities.	Planned	X							
	Local Agency Public Safety Vehicles	Local law enforcement, fire and EMS vehicles. Includes the ITS equipment installed on the cruisers (AVL, MDTs, etc.).	Existing		X						

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Local Agency	Local Agency Ride Sharing Program	System used for matching riders with similar origins and destinations to promote carpooling.	Planned						X		
	Local Agency Roadway Barrier System	Roadside equipment operated by local agencies that close roadway segments automatically due to unsafe conditions such as flooding.	Planned	X							
	Local Agency TOC	Local Traffic Operations Center responsible for municipal signal system operations.	Planned	X	X	X	X				
	Local Agency Traffic Signals	Multiple traffic signals interconnected and operated by a Local Agency	Planned	X	X						
	Local Agency Vehicle Detectors	Roadway equipment on local routes used to detect vehicle volumes and/or speeds. This information is used in the operation of the traffic signal system and collected by the TOC.	Planned	X							
	Local Agency Website	Traveler information website operated by a local agency for dissemination of real-time road conditions, incidents, and special event information.	Existing	X							
	Local Emergency Operations Center	Central command and control facility responsible for carrying out the principles of emergency preparedness and emergency management, or disaster management functions at a strategic level in an emergency situation.	Planned		X						
	Local Regional Airports	Municipal and county owned airports.	Planned			X					

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Local Agency	School Transportation Agencies	Agencies responsible for operating school bus fleets.	Existing		X	X					
MAX	MAX Data Archive	The transit data archive for the MAX. Used by FTA and MDOT Office of Passenger Transportation	Planned							X	
	MAX Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by MAX.	Existing	X	X	X	X		X	X	
	MAX Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned				X				
	MAX Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned				X				
	MAX Transit Center CCTV Surveillance	CCTV surveillance at MAX transit center	Planned				X				
	MAX Vehicles	Transit Vehicles owned by Macatawa Area Express	Existing				X				
	MAX Website	Website with information about fares and schedules.	Existing				X				

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	MDOT Anti-Icing Field Equipment	This system uses a variety of atmospheric and pavement sensors to detect when anti-icing and de-icing fluids should be applied to a bridge. The application is performed automatically using spray equipment mounted on the bridge. The system reports to maintenance personnel when fluids have been applied. Maintenance personnel are able to call into the system using cell-phones to monitor system status or activate the fluid application remotely.	Planned			X					
	MDOT Asset Management Database	Statewide database that collects and tracks the assets throughout the state, including the connection between devices, when a device was installed, and maintenance information.	Existing			X					
	MDOT ATMS	Advanced Transportation Management Software - Statewide software that integrates the operations of ITS field devices via a single interface. The information collected and disseminated is for construction and maintenance activities, incidents, and special events.	Existing	X		X		X	X		
	MDOT CCTV Cameras	Roadside equipment located on local roadways used for traffic condition monitoring and management of incidents.	Existing	X							
	MDOT Commercial Vehicle Permitting System	MDOT system for tracking and monitoring oversize and overweight permits for commercial vehicles.	Existing					X			
	MDOT DMS	Roadside equipment on MDOT routes used to share traveler information with motorists through dynamic messaging.	Planned	X	X	X					

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	MDOT Drawbridge Control Equipment	Roadside equipment located on MDOT drawbridges that close approaching roadways or stop traffic prior to the drawbridge opening to waterway traffic.	Existing	X							
	MDOT Drawbridge Management Center	Management of the waterways used by boats and ferries and the roadways used by vehicles.	Existing	X							
	MDOT Drawbridge Notification Equipment	Roadside equipment located on MDOT drawbridges that send notifications when the drawbridge is open for waterway traffic.	Existing	X							
	MDOT ESS	Environmental sensor stations located on MDOT routes that collect information about the roadways such as temperature and moisture levels.	Existing			X					
	MDOT Freeway Courtesy Vehicles	Fully equipped vehicles that provide motorist assistance to vehicles in need on MDOT facilities.	Planned		X						
	MDOT Frost Tube Sensors	Roadside equipment located along MDOT routes that collect data from frost tube sensors	Planned			X					
	MDOT Grand Region Commercial Vehicle Parking Management System	System operated on MDOT routes that monitor available commercial vehicle parking at rest areas and other key locations.	Planned	X							
	MDOT Grand Region Office	The Grand Region Office serves as a data collection and dissemination point for traffic information in the Grand Region. This includes coordination with other agencies such as public safety, emergency management, and transit.	Existing	X		X					

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	MDOT Grand Region TSCs	MDOT field office that oversees road construction and maintenance on MDOT facilities. Most maintenance and snow removal in this region is achieved through contract agencies.	Existing	X	X	X	X	X	X		
	MDOT Maintenance Decision Support Software	System that collects RWIS data and distributes the information to maintenance garages to determine maintenance needs in real time.	Existing			X					
	MDOT Maintenance Vehicles	Michigan Department of Transportation vehicles used in maintenance operations.	Existing			X					
	MDOT MI Drive Website	MDOT website for dissemination of real-time traveler information for travel conditions for unplanned and planned events.	Existing	X					X		
	MDOT Office of Communications	Michigan Department of Transportation responsible for the dissemination of traffic information to the media and public.	Existing			X			X		
	MDOT Planning Division Data Warehouse	Archive that contains historical traffic data such as volume and speed information.	Existing							X	
	MDOT Roadside Equipment for Connected Vehicles	Equipment located along MDOT routes that allows communication between roadside devices and vehicles.	Planned								X
	MDOT Roadside Intersection Collision Avoidance Equipment	Equipment located along MDOT routes that communicate between multiple roadside devices and vehicles to alert of unsafe travel conditions or conditions conducive to crashes.	Planned								X

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	MDOT Roadside Signing Equipment	Equipment located along MDOT routes that provide data through in-vehicle messaging.	Planned						X		
	MDOT Security Monitoring Field Equipment	Roadside equipment located on MDOT routes that is used for monitoring key infrastructure elements from damage or attacks. These elements include structures such as bridges or dams.	Planned		X						
	MDOT SEMTOC	MDOT traffic operations center located in the Detroit. SEMTOC operates the freeway management system and ITS deployments within the Metro Region.	Existing	X							
	MDOT STOC	MDOT statewide traffic operations center located in Lansing. The STOC operates the freeway management system and statewide ITS deployments outside the areas of SEMTOC and WMTOC. The STOC does operate WMTOC system during off-hours and weekends. The STOC also dispatches freeway courtesy patrol vehicles for those areas covered by STOC operations.	Existing	X							
	MDOT Traffic Signals	Multiple traffic signals interconnected and operated by MDOT.	Existing	X	X						
	MDOT Traveler Information Kiosks	Interactive kiosks that provides users the ability to request and received transportation information.	Planned						X		

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	MDOT Vehicle Detectors	Roadway equipment located on MDOT roadways used to detect vehicle volumes and/or speeds. MDOT vehicle sensors include MVDS and any other vehicle detection.	Existing	X							
	MDOT Weigh-in-Motion	Michigan Department of Transportation device to capture and record truck axle weights and gross vehicle weights as the traveler drive over a sensor.	Existing					X			
	MDOT WMTOC	MDOT traffic operations center located in Grand Rapids. WMTOC is responsible for the operations along the freeway around the Grand Rapids area.	Existing	X	X	X	X		X		X
	MDOT Work Zone Safety Monitoring Equipment	Equipment used to detect vehicle intrusion within work zones and provide notifications of the identified hazard.	Planned			X					
	Other MDOT Region TSCs	Local MDOT offices outside of the Grand Region that oversee the operations and maintenance on MDOT facilities.	Existing			X					
Media	Local Print and Broadcast Media	Local media that provide traffic or incident information to the public.	Existing	X	X	X			X		
MSP	CJIC Database	Database for the archiving of crash data and crime reporting information that can be accessed by multiple agencies.	Existing							X	

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MSP	MIOC	The Michigan Intelligence Operations Center. Provides 24-hours a day statewide information sharing among local, state and federal public safety agencies and private sector organizations in order to facilitate the collection, analysis and dissemination of intelligence relevant to terrorism and public safety.	Existing		X	X					
	MSP Commercial Vehicle Enforcement Division (CVED)	Responsible for monitoring commercial vehicle regulations on MDOT routes.	Existing					X			
	MSP District 6 Dispatch	Michigan State Police dispatch for the Grand Region. Provides call-taking and dispatch for public safety agencies.	Existing	X	X	X	X		X		
	MSP Lansing Regional	Michigan State Police dispatch center providing additional support within District 5, 6, and 1.	Existing		X	X					
	MSP Office of Highway Safety Planning	Create programs to increase safety along Michigan's roadways and facilitate partnerships with public and private organizations..	Existing								X
	MSP Vehicles	Public Safety vehicles owned and operated by Michigan State Police. Includes the ITS equipment installed on the cruisers (AVL, MDTs, etc.).	Existing		X						
	MSP Winter Travel Advisory Website	Traveler Information website operated by Michigan State Police for dissemination of winter weather advisories	Existing			X					

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MSP	MSP Winter Travel Toll Free Number	Winter weather information operated from November through March to share winter weather conditions as received.	Existing			X					
Muskegon Area Transit System	Muskegon Area Transit System CCTV Surveillance	CCTV surveillance at the Muskegon Area Transit System Transit Center.	Existing				X				
	Muskegon Area Transit System Data Archive	The transit data archive for the Muskegon Area Transit System. Used by FTA and MDOT Office of Passenger Transportation	Planned							X	
	Muskegon Area Transit System Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Muskegon Area Transit System.	Existing	X	X	X	X		X	X	
	Muskegon Area Transit System Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned				X				
	Muskegon Area Transit System Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned				X				
	Muskegon Area Transit System Vehicles	Transit Vehicles owned by Muskegon Area Transit	Existing				X				
	Muskegon Area Transit System Website	Website with information about fares and schedules.	Existing				X				
Other Agencies	Department of Homeland Security	Responsible for coordinating with multiple agencies to secure the nation's borders and protect the infrastructure and citizens.	Existing		X						

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Other Agencies	National Weather Service	Provides official US weather, marine, fire and aviation forecasts, warnings, meteorological products, climate forecasts, and information about meteorology.	Existing		X	X			X		
Other Elements	ASOS Weather Stations	Automated Surface Observing System operated and maintained through a partnership of FAA, NWS, and DoD. Stations are located at airports able to detect significant changes in the weather pattern for aviation operations and weather forecasting.	Existing			X					
	AWOS Weather Stations	Automated Weather Observing System operated and maintained by FAA. Stations typically located at airports collecting weather data used for aviation operations as well as weather forecasting	Existing			X					
	DNR Weather Stations	Department of Natural Resources field equipment that collects weather data such as temperature and visibility	Existing			X					
	MAWN Stations	Michigan Automated Weather Network stations (Enviro-weather) are used to collect weather related data as part of the Michigan State University agricultural program. Data includes air temp, humidity, speed, and precipitation.	Existing			X					
	Potential Obstacles	Obstacles that could interfere with the safe operation of vehicles.	Existing								X
	RAWS Stations	Remote Automatic Weather Stations strategically placed to monitor the weather. The data collected is used for monitoring air quality, fire dangers, and research.	Planned			X					

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Other Elements	Roadway Environment	All objects and conditions in the vicinity of the traveler that can affect the operations of the traveler.	Existing								X
Private Information Service Provider	Private Sector ISP	Private entities that collect and disseminate traffic information.	Existing						X		
	Private Sector Traveler Information Services	Website sponsored by a private entity. Often this information is provided through a subscription.	Existing	X			X				
Private Operators	Contractor Smart Work Zone Equipment	Smart Work Zone Equipment owned by private contractor. 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.	Existing			X					
	Multimodal Transportation Service Provider	Agency that offers services across multiple transportation modes.	Planned						X		
	Private Concierge Provider	Private entities that provides customized services to the traveler. This service is usually subscription based.	Existing		X						
	Private Fleet Operators	Private companies that proactively manage and operate their fleet routing. Includes reactions to incidents and possible delays.	Existing					X			
	Private Parking Operator	Manages and disseminates parking information to the general public through DMS, the MDOT traveler information website, etc.	Existing	X							

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Private Transportation Providers	Private Transportation Providers	Private providers of transportation services in the Region such as taxis and intercity bus services.	Existing	X	X	X	X		X		
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.	Planned	X							
Regional Demand Response Transit Providers	Regional Demand Response Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned				X				
	Regional Demand Response Transit Provider Data Archive	The transit data archive for the Regional Demand Response Transit Providers. Used by FTA and MDOT Office of Passenger Transportation	Planned							X	
	Regional Demand Response Transit Provider Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Regional Demand Responsive Transit Authorities.	Planned	X	X	X	X		X	X	
	Regional Demand Response Transit Provider Transit Center CCTV Surveillance	CCTV surveillance at the Regional Demand Response Transit Providers Center	Planned				X				

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Regional Demand Response Transit Providers	Regional Demand Response Transit Provider Vehicles	Transit Vehicles owned by the regional demand responsive transit providers. (Harbor Transit will install security cameras in ten buses. They will also install MDT and AVL on each bus in 2014)	Existing				X				
	Regional Demand Response Transit Provider Website	Website with information about fares and schedules. At this time the website is static.	Planned				X				
System Users	Archived Data Users	Those who request information from the data archive systems	Existing							X	
	Commercial Vehicle	Privately owned commercial vehicles that travel throughout the Region. Included in the architecture to cover HAZMAT incident reporting.	Existing					X			
	Commercial Vehicle Driver	The operator of the commercial vehicle.	Existing					X			
	Maintenance and Construction Field Personnel	Individuals working at the maintenance or construction site.	Existing			X					
	Other Vehicle	Vehicles outside of the control of the traveler	Existing								X
	Private Travelers Personal Computing Devices	Computing devices that travelers use to access public information.	Existing		X		X		X		
	Private Vehicles	Vehicles operated by the public.	Existing	X	X	X			X		X
	Traveler	Individual using the transportation network.	Existing				X				

2.1.2 Top Level Regional System Interconnect Diagram

A system interconnect diagram, or “sausage diagram”, shows the systems and primary interconnects in the Region. The National ITS Architecture interconnect diagram has been customized for the Grand Region based on the system inventory and information gathered from the stakeholders. **Figure 3** summarizes the existing and planned ITS elements for the Grand 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. 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 correspond to physical elements such as: traffic operations centers, traffic signals, or vehicles. 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.

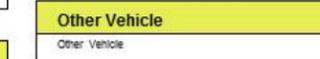
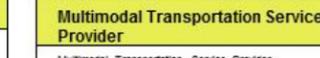
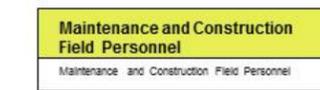
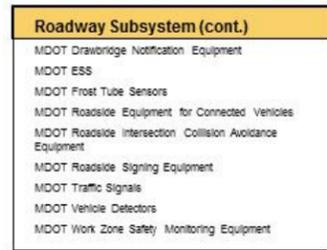
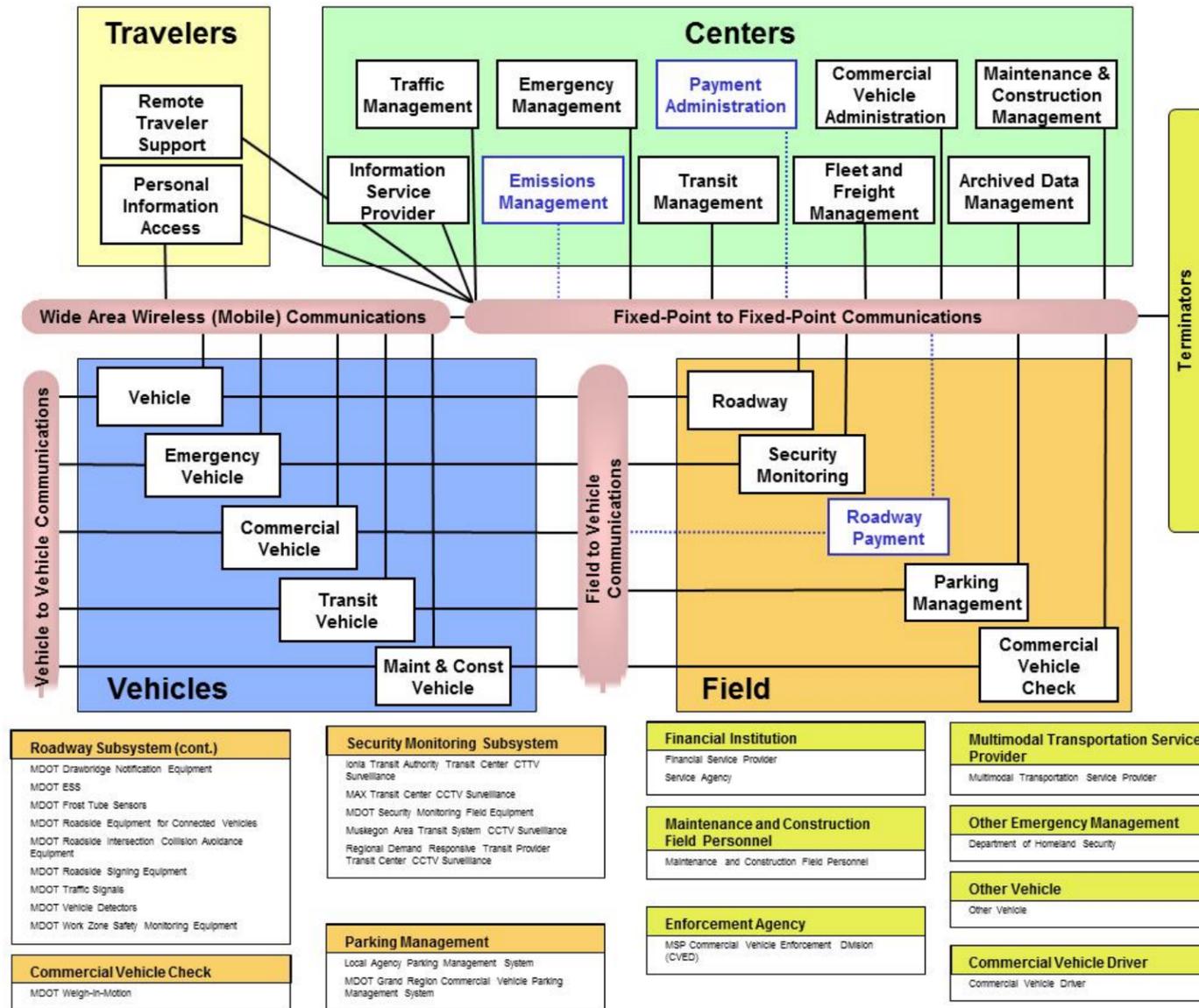
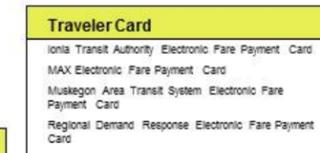
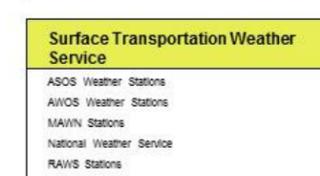
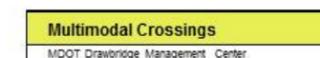
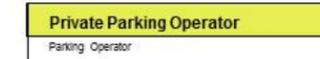
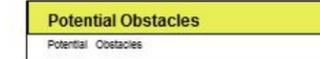
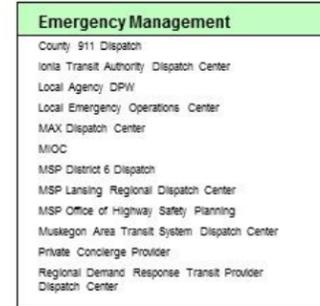
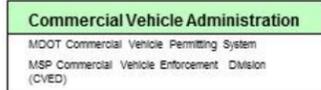
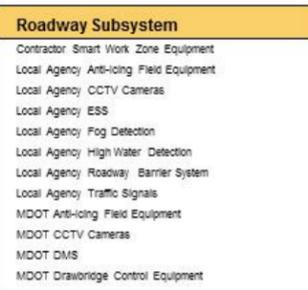
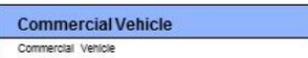
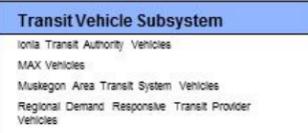
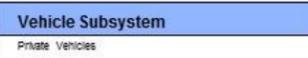
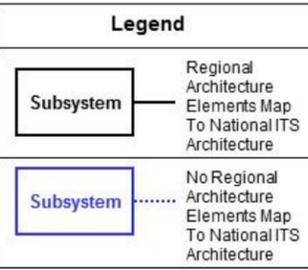


Figure 3. Grand Region System Interconnect Diagram

2.1.3 Service Packages

The National ITS Architecture Version 7.0 references services as service packages. This is a revision from the previous version where services were called market packages. The primary catalyst in this revision is to align the National ITS Architecture with the Canadian ITS Architecture. Service packages can include several stakeholders and elements that work together to provide a service in the Region. They are customized to reflect the unique systems, subsystems, and terminators in the Grand Region. Each service package is shown graphically with the service package name, agencies and elements involved, and desired data flows included.

For the administrative update, the focus included revisions to existing service packages and the inclusion of any additional services packages currently not included. The Grand Regional ITS Architecture provides a more extensive overview of service packages. The document discusses how service packages were identified and selected and then prioritized by functional area. It also presents examples on how the service packages were customized with element interfaces based on needs within the region (*reference Section 3.4 and Section 3.5*). **Appendix A** provides definitions for all of the service packages available in the National ITS Architecture Version 7.0. **Appendix B** includes the service packages that have been updated specific to the Grand region.

3 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 Grand Region. The National ITS Architecture provides recommendations for standards 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. Both sections have been updated to reflect changes within the architecture.

3.1 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Grand 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. **Table 3** identifies each of the ITS standards that could apply to the Grand Regional ITS Architecture.

Table 3. Grand Region Applicable ITS Standards

Document ID	Standard Title	SDO
APTA TCIP-S-001 3.0.4	Standard for Transit Communications Interface Profiles	APTA
ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems	ASTM
ATIS General Use	Advanced Traveler Information Systems (ATIS) General Use Standards Group	SAE
ATIS Low Bandwidth	Advanced Traveler Information Systems (ATIS) Bandwidth Limited Standards Group	SAE

Document ID	Standard Title	SDO
DSRC 5GHz	Dedicated Short Range Communication at 5.9 GHz Standards Group	ASTM/IEEE/SAE
DSRC 915MHz	Dedicated Short Range Communication at 915 MHz Standards Group	ASTM
IEEE 1455-1999	Standard for Message Sets for Vehicle/Roadside Communications	IEEE
IEEE 1570-2002	Standard for the Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection	IEEE
IEEE IM	Incident Management Standards Group	IEEE
IEEE P1609.11	Standard for Wireless Access in Vehicular Environments (WAVE) - Over- the-Air Data Exchange Protocol for Intelligent Transportation Systems (ITS)	IEEE
ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	AASHTO/ITE
Mayday	On-board Vehicle Mayday Standards Group	SAE
NTCIP 1201	Global Object Definitions	AASHTO/ITE/NEMA
NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller (ASC) Units	AASHTO/ITE/NEMA
NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)	AASHTO/ITE/NEMA
NTCIP 1204	Object Definitions for Environmental Sensor Stations (ESS)	AASHTO/ITE/NEMA
NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control	AASHTO/ITE/NEMA
NTCIP 1206	Object Definitions for Data Collection and Monitoring (DCM) Devices	AASHTO/ITE/NEMA
NTCIP 1208	Object Definitions for Closed Circuit Television (CCTV) Switching	AASHTO/ITE/NEMA
NTCIP 1209	Data Element Definitions for Transportation Sensor Systems (TSS)	AASHTO/ITE/NEMA
NTCIP 1210	Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters	AASHTO/ITE/NEMA
NTCIP 1211	Object Definitions for Signal Control and Prioritization (SCP)	AASHTO/ITE/NEMA
NTCIP 1214	Object Definitions for Conflict Monitor Units (CMU)	AASHTO/ITE/NEMA
NTCIP C2C	NTCIP Center-to-Center Standards Group	AASHTO/ITE/NEMA
NTCIP C2F	NTCIP Center-to-Field Standards Group	AASHTO/ITE/NEMA
SAE J2735	Dedicated Short Range Communications (DSRC) Message Set Dictionary	SAE

3.2 Operational Concepts

An operational concept documents each stakeholder’s current and future roles and responsibilities. It spans across a range of transportation services, as grouped in the Operational Concepts section of Turbo Architecture Database. 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).
- **Advanced Vehicle Safety** – The development of systems to support private sector vehicle safety initiatives (e.g., intersection collision avoidance)

Table 4 identifies the roles and responsibilities of key stakeholders for a range of transportation services.

Table 4. Grand 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 such as CCTV cameras and field sensors on MDOT routes not managed by local agencies.
		Provide traffic information reports to regional information service providers.
		Coordinate traffic information and control with Local Agency TOCs and other MDOT TOCs.
	Local Agency	Operate traffic signal systems on local routes.

Transportation Service	Stakeholder	Roles/Responsibilities
		<p>Operate network surveillance equipment such as CCTV cameras and field sensors on local routes to facilitate traffic signal operations.</p> <p>Provide traffic information reports to regional information service providers.</p> <p>Provide traffic information to regional agencies including transit, emergency management, maintenance and construction, and the media.</p> <p>Coordinate traffic information and control with MDOT WMTOC and MDOT STOC.</p> <p>Coordinate traffic information with other local agencies.</p> <p>Coordinate HRI signal adjustments with private rail operators.</p> <p>Provide traffic signal preemption for emergency vehicles.</p>
Highway Management	MDOT	<p>Operate network surveillance equipment including CCTV cameras as well as DMS to convey traffic information to travelers on MDOT highway routes.</p> <p>Provide traffic information to regional information service providers.</p> <p>Provide traffic information to regional transportation agencies and the general public through traffic information devices primarily DMS.</p> <p>Coordinate traffic information and control with other MDOT TOC's</p>
Incident Management (Traffic)	MDOT	<p>Perform network surveillance for detection and verification of incidents on MDOT routes.</p> <p>Provide incident information to travelers via traffic information devices on highways (e.g. DMS).</p> <p>Provide incident information to regional emergency responders, including the MSP and local agencies.</p>

Transportation Service	Stakeholder	Roles/Responsibilities
		Responsible for the coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.
		Coordinate maintenance resources for incident response with MDOT TSC Construction and Maintenance Operations.
Incident Management (Traffic) (continued)	Local Agency	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 Grand Region TSCs and Local Agencies.
		Responsible for the coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
Incident Management (Emergency)	MSP	Dispatch MSP vehicles for incidents on highways.
		Coordinate incident response with other public safety agencies (local police, fire, EMS, sheriff) as well as MDOT.
		Perform incident detection and verification for the highways within the region and provide this information to traffic and other public safety agencies.
	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 incident response with other public safety agencies (fire, EMS, ambulance, etc.).

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Emergency)	Local Agency	Coordinate public safety resources for incident response on local routes.
		Coordinate public safety resources for incident response on local routes.
		Perform incident detection and verification on local routes and provide this information to the local agency TOC.
Emergency Management	MSP	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 security monitoring of critical infrastructure for MDOT.
		Provide regional traffic, transit, emergency management, and maintenance operations with disaster information to disseminate to the traveling public.
	Local Agency	Participate in incident response, coordination, and reporting.
		Dispatch local agency fire/EMS/police vehicles.
		Perform incident detection and verification on local roadways.
		Receive AMBER Alert and other wide area alert information from MSP Headquarters.
Respond to transit emergencies/alerts 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.
		Support coordinated response to incidents.

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management	MDOT	Responsible for the tracking and dispatch MDOT maintenance vehicles.
		Receive vehicle location information from MDOT maintenance and construction vehicles.
		Receive vehicle maintenance conditions from MDOT maintenance and construction vehicle and coordinate fleet management 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 for all ITS field equipment owned by MDOT.	
	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.

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management	Private Operators	Provide maintenance of local routes and MDOT facilities (per contract), including pavement maintenance and construction activities.
Transit Management	Muskegon Area Transit System	Provide fixed route bus service for Muskegon Area Transit System.
		Provide paratransit bus service for the Muskegon Area Transit System.
		Track and evaluate schedule performance on all Muskegon Area Transit System fixed route and demand response vehicles.
		Provide transit schedule and fare information to the Muskegon Area Transit System website and private sector traveler information service providers.
		Provide a paratransit transit plan from the agency website.
		Provide transit passenger electronic fare payment on all Muskegon Area Transit System 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 Muskegon Area Transit System fixed route and demand response vehicles.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the local public safety agency 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 Muskegon Area Transit System transit operations.		

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	MAX	Provide fixed route bus service for MAX.
		Provide paratransit bus service for MAX.
		Provide transit schedule and fare information to the MAX website and private sector traveler information service providers.
		Track and evaluate schedule performance on all MAX fixed route and demand response vehicles.
		Provide a paratransit transit plan from the agency website.
		Provide transit passenger electronic fare payment on all MAX 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 MAX fixed route and demand response vehicles.
		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, local private sector traveler information services, and the local public safety agency 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 MAX transit operations.		
	Ionia Transit Authority	Provide demand response bus service for the Ionia Transit Authority.
		Provide transit schedule and fare information to the Ionia Transit Authority website and private sector traveler information service providers.

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Ionia Transit Authority	Track and evaluate schedule performance on all Ionia Transit Authority fixed route and demand response vehicles.
		Provide a demand response transit plan from the agency website.
		Provide transit passenger electronic fare payment on all Ionia Transit 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 Ionia Transit Authority fixed route and demand response vehicles.
		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, local private sector traveler information services, and the Local Public Safety Agency 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).
	Regional Demand Responsive Transit Providers	Collect and archive transit data from Ionia Transit Authority transit operations.
		Provide demand response bus service for the Regional Demand Responsive Transit Providers.
		Provide transit schedule and fare information to the Regional Demand Responsive Transit Providers website and private sector traveler information service providers.
		Track and evaluate schedule performance on all Regional Demand Responsive Transit Providers demand response vehicles.
		Provide a demand response transit plan from the agency website.

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Regional Demand Responsive Transit Providers	Provide transit passenger electronic fare payment on all Regional Demand Responsive Transit Providers 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 Regional Demand Responsive Transit Providers demand response vehicles.
		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 Responsive Transit Providers transit operations.
Commercial Vehicle Operations	MSP	Provide enforcement of regional permits for overheight/overweight or HAZMAT commercial vehicles.
		Provide first response to commercial vehicle incidents and coordinate for HAZMAT conditions/clean-up.
	MDOT	Provide automated weigh-in-motion inspections for private fleet operations (both commercial vehicles and rail).
		Provide regional permits (overheight/overweight and HAZMAT) to private fleet systems.
		Provide route restriction information to private fleet systems.
		Provide permit information to regional emergency management providers and regional enforcement agencies.

Transportation Service	Stakeholder	Roles/Responsibilities
Traveler Information	MDOT	Collection, processing, storage, and broadcast dissemination for traffic, transit, maintenance and construction, and weather information to travelers via the MDOT 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 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.
Advanced Vehicle Safety	MDOT	Collect and share traffic safety information that is distributed from vehicle to vehicle.
		Collect and share potential dangers with the driver of the vehicles.

4 USE AND MAINTENANCE

As the Region grows, needs change, and, as technology progresses, new ITS opportunities arise. Shifts in regional needs, changes in the regional focus, and revisions to the National ITS Architecture will necessitate that the Grand Regional ITS Architecture be updated to remain a useful resource. If the resources are not available, and the changes within a region do not warrant a full update, an administrative update or abbreviated update process can facilitate the integration of the minor updates. The administrative update for the Grand Region addresses the region's changes since 2008.

4.1 Conformity

To satisfy federal requirements and remain eligible to use federal funds, a project must be accurately documented and in conformity with the regional ITS architecture. MDOT ITS Program Office (IPO) oversees the regional ITS architecture maintenance conformance forms. These forms document any necessary changes to the architecture affected by a project. If there are no revisions, the project is in conformance; if there are changes required within the architecture, the form provides an opportunity to describe and illustrate the modifications. Once the form has been completed, it is submitted to the MDOT IPO for approval. Once approved, the form is sent to FHWA/FTA as a record of conformity. During updates to the architecture all existing maintenance forms are referenced so documented changes can be incorporated.

Figure 4 illustrates the process project managers take to determine architecture conformity. The Grand Regional ITS Architecture provides additional details regarding this process and each step (see *Section 5.1*).

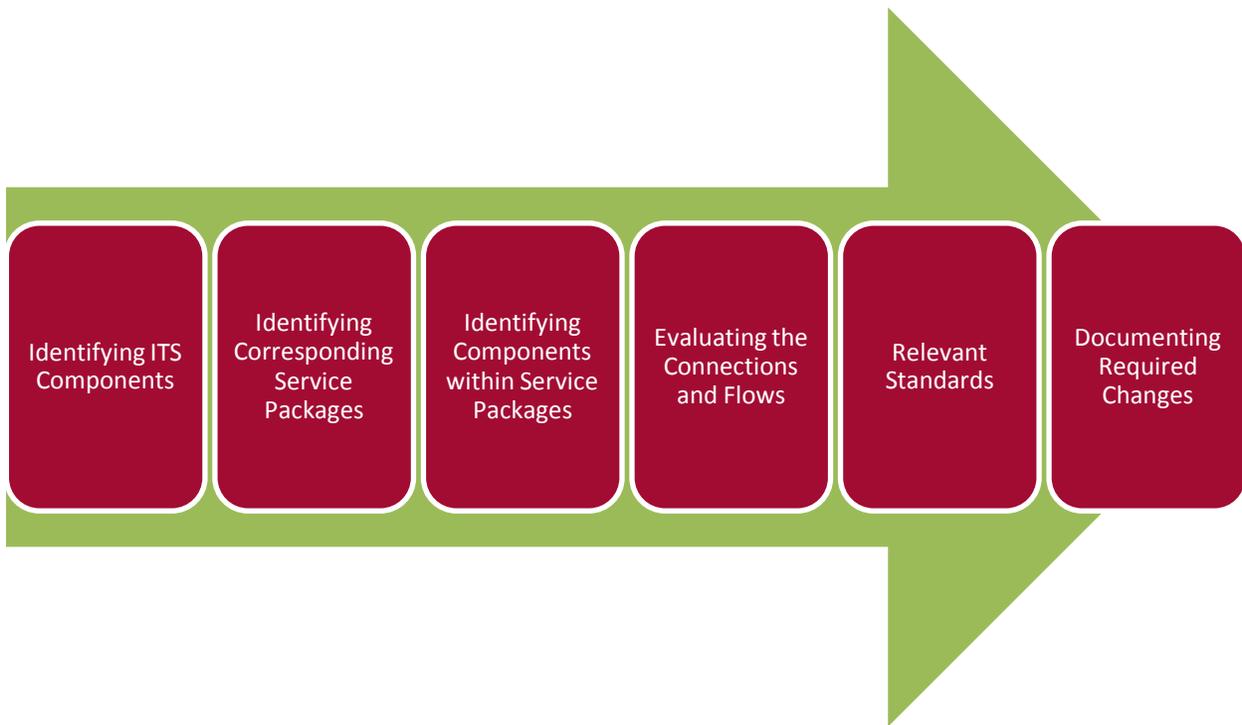


Figure 4. Steps to Determining Architecture Conformity

4.2 Maintenance

MDOT ITS Program Office will be responsible for leading the maintenance of the Grand Regional ITS Architecture in coordination with the regional contact. The Grand Regional ITS Architecture describes the maintenance plan put in place for a full update. However it does not describe the administrative update as part of this overall plan.

Regional ITS architectures are not static documents. The documents represent regional visions and should be amended as regional needs change, names change, new stakeholders are introduced, or if updates to one architecture affect an adjoining architecture. Updates are completed to incorporate those changes along with necessary format changes driven by newer versions of the National ITS Architecture. There are no set time limits on when to perform an update, but they should be considered if considerable changes have occurred within a region or state.

In between the scheduled updates, each region should continue to update using the [ITS Architecture Maintenance Documentation Form \(Appendix C\)](#) and submitting to the MDOT IPO. Additional details on this are included within Section 5.3 of the Grand Regional ITS Architecture.

If cost and resources are an issue, the easiest and quickest way to update the architecture is through an administrative update. An administrative update typically is less intensive, requiring fewer in-person interactions and less demanding on available resources, whether funding or time. Most of the updates are driven by project implementation with documented changes within maintenance forms or updates to the National ITS Architecture. The information updated is focused around agency name changes, element changes, and flow status. The changes must be documented within both the service packages and the Turbo architecture database. The accompanying document is more concise than one developed as part of a full architecture development, as it is intended to highlight the changes driving the update.

A full update focuses on updating all facets of a regional architecture. It requires more interactions with the stakeholders over several workshops. The workshops begin at a much higher planning level, looking at the long term vision; asking the stakeholder where they see transportation needs in 20 years. The needs are used to select and prioritize service packages that build the structure for the regional ITS architecture. A full update typically warrants twice the amount of time to complete due to the amount of data collection and stakeholder involvement necessary to accurately capture all components of the architecture.

Table 5 documents the version history of the Grand Regional ITS Architecture and Turbo architecture database. **Figure 5** illustrates a timeline capturing the last revision, the administrative update, and forecasting for the next full architecture update.

Table 5. Version History

Grand Region	Version History	Architecture Version	Turbo Version
Last Revision	January 2008	v5.1	v4.0
New Revision	August 2014	v7.0	v7.0

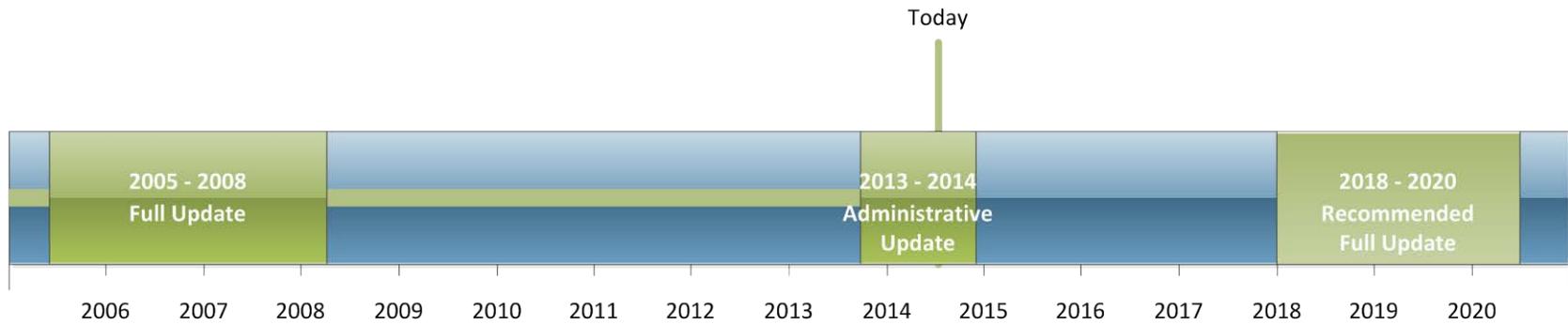


Figure 5. Time Lapse between Architecture Updates

APPENDIX A – SERVICE PACKAGE DEFINITIONS

Service Package	Service Package Name	Description
Traffic Management Service Area		
ATMS01	Network Surveillance	Collects and transmits data to a traffic management center from devices such as traffic detectors, CCTV cameras, and other surveillance equipment.
ATMS02	Traffic Probe Surveillance	Provides road network conditions such as average speed and congestion conditions using position and speed information from probe vehicles.
ATMS03	Traffic Signal Control	Provides the control and monitoring, communications, and signal control equipment to support local street and/or arterial traffic management. Consistent with urban traffic signal control systems.
ATMS04	Traffic Metering	Provides the control and monitoring, communications, and field equipment to support metering of traffic. Such strategies include ramp, interchange, and mainline metering. It also incorporates instrumentation from ATMS01 to support traffic monitoring so responsive and adaptive strategies can be implemented.
ATMS05	HOV Lane Management	Manages HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals.
ATMS06	Traffic Information Dissemination	Provides drivers with traffic information using roadway equipment; most frequently dynamic message signs or highway advisory radio. Information can include road conditions, closures, detour information, incident information, emergency alerts, and advisories.
ATMS07	Regional Traffic Management	Shares traffic information and control among traffic management centers. Examples include: coordinated signal operations across jurisdictional boundaries; coordination between freeway operations and arterial signal control; and sharing of congestion or incident information.
ATMS08	Traffic Incident Management System	Manages both unexpected incidents and planned events by coordinating with other agencies to support traffic operations personnel in developing an appropriate response to minimize the impact to the transportation network and traveler safety. Includes coordination with emergency management and roadway maintenance agencies to support a coordinated response.
ATMS09	Traffic Decision Support and Demand Management	Recommends courses of action based on an assessment of the current and forecast road network performance as well as information on special events, parking, or transit operations if applicable. Example responses include predefined incident response plans, transit strategies, and congestion management strategies.
ATMS10	Electronic Toll Collection	Provides the ability to collect tolls electronically and detect and process violations. Toll tags and roadside readers also can be used to collect road use statistics for highway authorities.
ATMS11	Emissions Monitoring and Management	Collects and monitors air quality data collected by wide area or point emissions monitoring sensors.
ATMS12	Roadside Lighting System Control	Monitors operational conditions along the roadway to vary the amount of light that is provided along the roadside.
ATMS13	Standard Railroad Grade Crossing	Manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (typically where rail operational speeds are less than 80 miles per hour).
ATMS14	Advanced Railroad Grade Crossing	Manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (typically where rail operational speeds are greater than 80 miles per hour).
ATMS15	Railroad Operations Coordination	Provides an additional level of strategic coordination between freight rail operations and traffic management centers. Could include train schedules, maintenance schedules or any other anticipated HRI closures.
ATMS16	Parking Facility Management	Provides enhanced monitoring and management of parking facilities. Market package assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees.
ATMS17	Regional Parking Management	Supports communication and coordination between parking facilities as well as coordination between parking facilities and traffic and transit management systems.

Service Package	Service Package Name	Description
Traffic Management Service Area (continued)		
ATMS18	Reversible Lane Management	Provides the management of reversible lane facilities. Includes the field equipment, lane access controls, and associated electronics.
ATMS19	Speed Warning and Enforcement	Monitors the speeds of vehicles traveling through a roadway system and warns the driver when their speed is excessive. This service can also support notifications to an enforcement agency to enforce the speed limit and roadside safe speed advisories based on current roadway conditions.
ATMS20	Drawbridge Management	Supports systems that manage drawbridges at rivers and canals and other multimodal crossings. Includes control devices as well as traveler information systems.
ATMS21	Roadway Closure Management	Closes roadways to vehicular traffic automatically or using remote activation when driving conditions are unsafe, maintenance must be performed, or in other situations where access must be prohibited. Includes gates or barriers to control access, control and monitoring systems, and field devices.
ATMS22	Variable Speed Limits	Sets variable speed limits along a roadway to create more uniformed speeds, promote safer driving during adverse conditions, and reduce air pollution. This service monitors traffic and environmental conditions along the roadway to then calculate and set suitable speed limits. Can be monitored and controlled by a management center or autonomous.
ATMS23	Dynamic Lane Management and Shoulder Use	Provides lane configuration changes on the roadway according to traffic demands and lane destination along a section. Can be used to allow temporary or interim use of shoulders as travel lanes. Lanes can be designated for use by special vehicles (buses), HOV, or special event, etc.
ATMS24	Dynamic Roadway Warning	Provides warning to the driver of approaching hazards on the roadway dynamically. Warnings can be warning signs, flashing lights, in-vehicle messages, etc. This service does not include speed warnings considered by roadway geometry limitations – see ATMS19.
ATMS25	VMT Road User Payment	Supports charging fees to vehicle owners traveling on a specific roadway with potentially different rates based on a number of considerations – time of day, roadway used, class of vehicles, etc. Owners register with a single payment entity and pay according to the policy set in place.
ATMS26	Mixed Use Warning Systems	Supports the sensing and warning systems used to interact with pedestrians, bicyclists, and other vehicles that operate on the main vehicle roadway or those that intersect with the main roadway. These systems are either automated warnings or active protection for the user.
Emergency Management Service Area		
EM01	Emergency Call - Taking and Dispatch	Provides basic emergency call-taking and dispatch services. Includes emergency vehicle equipment, dispatch centers, communications, and coordination between emergency management agencies.
EM02	Emergency Routing	Provides special priority and other specific emergency traffic control strategies to help improve the response of a vehicles en-route as well as coordination between emergency management agencies. Includes traffic information, road conditions, and signal preemption.
EM03	Mayday and Alarms Support	Supports user request for emergency assistance. The assistance includes gathering information about the location and incident, and then determining the appropriate response.
EM04	Roadway Service Patrols	Provides roadway services to vehicles for minor incidents, such as flat tires, out of gas, etc. Incident information is collected and shared with traveler information systems, traffic management, and maintenance and construction.
EM05	Transportation Infrastructure Protection	Supports monitoring of transportation infrastructure such as bridges, tunnels, and TMCs for potential threats and provides safeguards against them or strategies to minimize the impact if one should occur.
EM06	Wide-Area Alert	Provides information about alerts to the public in emergency situations such as child abductions, severe weather, or other life threatening situations.

Service Package	Service Package Name	Description
Emergency Management Service Area		
EM07	Early Warning System	Monitors and detects potential or actual natural or man-made disaster and notifies appropriate responding agencies.
EM08	Disaster Response and Recovery	Supports the coordination of emergency response plans to address natural or man-made disasters. It identifies key points of integration between agencies and their basic responses to address the transportation system and maintain awareness.
EM09	Evacuation and Reentry Management	Supports coordination of evacuation plans of the general public for all types of disasters. Information is shared amongst all agencies involved to implement specific strategies to effectively implement resources at the right time and right place.
EM10	Disaster Traveler Information	Provides disaster-related information to the public during a disaster. It is used to assist the public by providing evacuation route information, emergency instructions, roadway conditions and other traveler information.
Maintenance and Construction Management Service Area		
MC01	Maintenance and Construction Vehicle and Equipment Tracking	Tracks the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities.
MC02	Maintenance and Construction Vehicle Maintenance	Performs routine and corrective vehicle maintenance scheduling using on-board sensors that automatically perform diagnostics on the vehicles.
MC03	Road Weather Data Collection	Collects current road and weather conditions from sensors placed alongside the roadway. Data may also be requested or received from other meteorological systems (i.e. National Weather Service)
MC04	Weather Information Processing and Distribution	Uses the environmental data collected to help detect hazards, such as icy roads, high winds, or dense fog. The data can be used to help make decisions and keep operators updated on current condition information.
MC05	Roadway Automated Treatment	Automatically treats a section of road based on conditions detected by environmental sensors. Treatment options could include anti-icing chemical or, fog dispersion techniques, among others.
MC06	Winter Maintenance	Supports winter road maintenance. Monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities.
MC07	Roadway Maintenance and Construction	Supports management of scheduled and unscheduled maintenance and construction services on the roadway.
MC08	Work Zone Management	Manages work zones by monitoring traffic conditions, coordinating with other agencies, and providing speed and delay information to the public prior to the work zone.
MC09	Work Zone Safety Monitoring	Detects intrusions in the work zone and warns workers of the potential hazards. Crews are monitored to warn those who leave the designated safety zone. Supports both mobile and stationary work zones.
MC10	Maintenance and Construction Activity Coordination	Supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations. (i.e., traffic management, transit, emergency management)
MC11	Environmental Probe Surveillance	Collects real-time data from on-board vehicle systems about environmental conditions on the roadway.
MC12	Infrastructure Monitoring	Monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure using fixed and vehicle-based monitoring sensors.
Public Transportation Service Area		
APTS1	Transit Vehicle Tracking	Monitors current transit vehicle locations using an automated vehicle location (AVL) system. Location data may be used to determine real time schedule adherence.

Service Package	Service Package Name	Description
Public Transportation Service Area		
APTS2	Transit Fixed-Route Operations	Performs automated dispatch and system monitoring for fixed-route and flexible-route transit services. This service performs scheduling activities including the creation of schedules, as well as operator assignment.
APTS3	Demand Response Transit Operations	Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for demand response transit services.
APTS4	Transit Fare Collection Management	Manages transit fare collection on-board transit vehicles and at transit stops using electronic means.
APTS5	Transit Security	Provides for the physical security of transit passengers and transit vehicle operators. Includes on-board security cameras and panic buttons.
APTS6	Transit Fleet Management	Provides on-board monitoring of vehicle status. Information is processed and transmitted to schedule preventative and corrective maintenance.
APTS7	Multi-modal Coordination	Establishes two-way communications between multiple transit and traffic agencies to improve service coordination and operating efficiency.
APTS8	Transit Traveler Information	Provides transit information for those at transit stops and on-board transit vehicles. Also provides transit trip itineraries and other tailored information services that may occur pre-trip.
APTS9	Transit Signal Priority	Determines the need for transit priority on routes and at certain intersections and requests transit vehicle priority at these locations through coordination between traffic and transit management centers.
APTS10	Transit Passenger Counting	Counts the number of passengers entering and exiting a transit vehicle using sensors mounted on the vehicle and communicates the collected passenger data back to the management center.
APTS11	Multimodal Connection Protection	Supports the coordination of multimodal services to optimize the travel time of travelers as they move from one mode to another mode (or different routes within a single mode). Agencies coordinate routes so passengers have the opportunity to transfer with minimum wait time to either another route or mode of transportation.
Commercial Vehicle Operations Service Area		
CVO01	Carrier Operations and Fleet Management	Provides the capabilities to manage a fleet of commercial vehicles. Vehicle routing and tracking as well as notification of emergency management of any troublesome route deviations (such as a HAZMAT vehicle) are part of this market package.
CVO02	Freight Administration	Tracks the movement of cargo and monitors the cargo condition.
CVO03	Electronic Clearance	Provides for automatic clearance at roadside check facilities. Allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and dedicated short range communications to the roadside.
CVO04	CV Administrative Processes	Provides for electronic application, processing, fee collection, issuance and distribution of CVO credentials and tax filing.
CVO05	International Border Electronic Clearance	Provides for automated clearance at international border crossings. Works in coordination with the electronic clearance (CVO 03) services to gather data about the vehicle, cargo, and driver.
CVO06	Weigh-In-Motion	Provides for high speed weigh-in-motion with or without automated vehicle identification (AVI) capabilities. Works in conjunction with CVO03.
CVO07	Roadside CVO Safety	Provides for automated roadside safety monitoring and reporting by automating commercial vehicle safety inspections at the roadside check locations.
CVO08	On-board CVO Safety	Provides for on-board commercial vehicle safety monitoring and reporting as well as roadside support for reading on-board safety data via tags.
CVO09	CVO Fleet Maintenance	Supports maintenance of CVO fleet vehicles with on-board monitoring equipment and automated vehicle location capabilities by recording vehicle mileage, repairs, and safety violations.

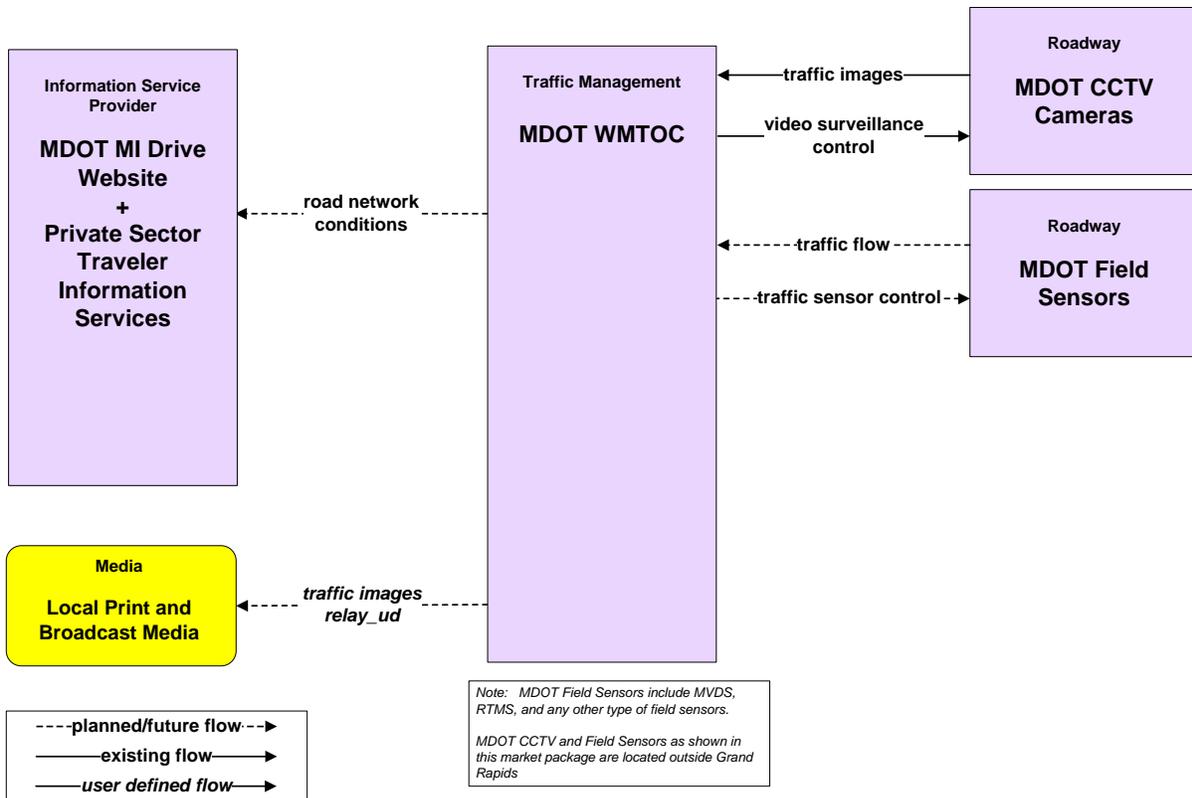
Service Package	Service Package Name	Description
Commercial Vehicle Operations Service Area		
CVO10	HAZMAT Management	Supports coordination between incident management response and commercial vehicle tracking to ensure HAZMAT materials are effectively treated during an incident.
CVO11	Roadside HAZMAT Security Detection and Mitigation	Provides the capability to detect and classify security sensitive HAZMAT on commercial vehicles using roadside sensing and imaging technology. Credentials information can be accessed to verify if the commercial driver, vehicle and carrier are permitted to transport the identified HAZMAT.
CVO12	CV Driver Security Authentication	Provides the ability to detect when an unauthorized driver attempts to drive a vehicle using stored identity information. If an unauthorized driver has been detected, the commercial vehicle can be disabled.
CVO13	Freight Assignment Tracking	Provides tracking, and monitoring of the commercial vehicle, freight equipment, and commercial vehicle driver during a shipment.
Traveler Information Service Area		
ATIS01	Broadcast Traveler Information	Collects traffic conditions, advisories, general public transportation information, toll and parking information, incident information, roadway maintenance and construction information, and air quality and weather information for dissemination through wide area digital broadcast services such as using radio or internet websites.
ATIS02	Interactive Traveler Information	Provides the traveler with current information regarding traffic conditions, roadway maintenance and construction, transit services, parking management, detours and pricing information based on the request made by the traveler. 511 services are included in this market package.
ATIS03	Autonomous Route Guidance	Enables route planning and detailed route guidance based on static, stored information.
ATIS04	Dynamic Route Guidance	Offers advanced route planning and guidance that is responsive to current conditions.
ATIS05	ISP Based Trip Planning and Route Guidance	Provides pre-trip route planning and route guidance based on traveler preference and constraints. May or may not utilize real-time network conditions.
ATIS06	Transportation Operations Data Sharing	Provides current traffic and travel conditions to transportation system operators to facilitate information exchange between agencies.
ATIS07	Travel Services Information and Reservation	Provides travel information and reservation services to the user through multiple ways for accessing information.
ATIS08	Dynamic Ridesharing	Provides near real time ridesharing/ride matching services to travelers.
ATIS09	In Vehicle Signing	Provides sign and signal information directly to the driver through in-vehicle devices. Information includes static sign information and dynamic information.
ATIS10	VII Traveler Info	Provides location-specific information including travel times, incident information, road conditions, and emergency traveler information to travelers in vehicles using Vehicle Infrastructure Integration (VII).
Archived Data Management Service Area		
AD01	ITS Data Mart	Houses archived data from a single agency/organization. Data is typically focused on a single transportation mode or one jurisdiction.
AD02	ITS Data Warehouse	Includes all data collection and management of ITS Data Mart, but includes data from multiple agencies/organizations across modal and jurisdictional boundaries.
AD03	ITS Virtual Data Warehouse	Includes all data collection and management of ITS Data Warehouse, but supports access between several archives in different physical locations.
Advanced Vehicle Safety		
AVSS01	Vehicle Safety Monitoring	Monitors the vehicle's condition, performance, on-board safety data, and display information using on-board sensors.

Service Package	Service Package Name	Description
Advanced Vehicle Safety		
AVSS02	Driver Safety Monitoring	Monitors the driver's condition, performance, on-board safety data, and display information using on-board sensors.
AVSS03	Longitudinal Safety Monitoring	Utilizes safety and collision sensors to monitor in front of and behind the vehicle to warn the driver of potential hazards.
AVSS04	Lateral Safety Warning	Utilizes safety and collision sensors to monitor the sides of the vehicle to warn the driver of potential hazards.
AVSS05	Intersection Safety Warning	Monitors potential conflicts between approaching vehicles to an intersection and provides a warning to those vehicles involved using short range communications and/or signs/signals in the intersection.
AVSS06	Pre-Crash Restraint Deployment	Monitors the vehicle's local environment using in-vehicle sensors and on-board communications to determine collision probability. If needed it will deploy a pre-crash safety system.
AVSS07	Driver Visibility Improvement	Enhances the driver's visibility using an enhanced vision system. On-board display hardware is needed
AVSS08	Advanced Vehicle Longitudinal Control	Utilizes safety and collision sensors to measure longitudinal gaps and a processor for controlling the vehicle speed and throttle.
AVSS09	Advanced Vehicle Lateral Control	Utilizes safety and collision sensors to measure the vehicle's lane position and lateral deviations and a processor for controlling the vehicle steering.
AVSS10	Intersection Collision Avoidance	Utilizes roadway sensors and communications equipment to assess vehicle locations and speeds near an intersection to determine the probability of a collision. Timely warnings are provided and avoidance actions are taken.
AVSS11	Automated Vehicle Operations	Enables communications between vehicles and between vehicles and supporting infrastructure for check-in and check-out from the automated highway system.
AVSS12	Cooperative Vehicle Safety Systems	Enhances stand-alone warning systems by exchanging messages with surrounding vehicles and roadside equipment. Special messages from approaching emergency vehicles also may be received and processed.

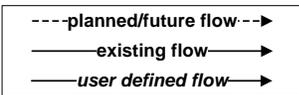
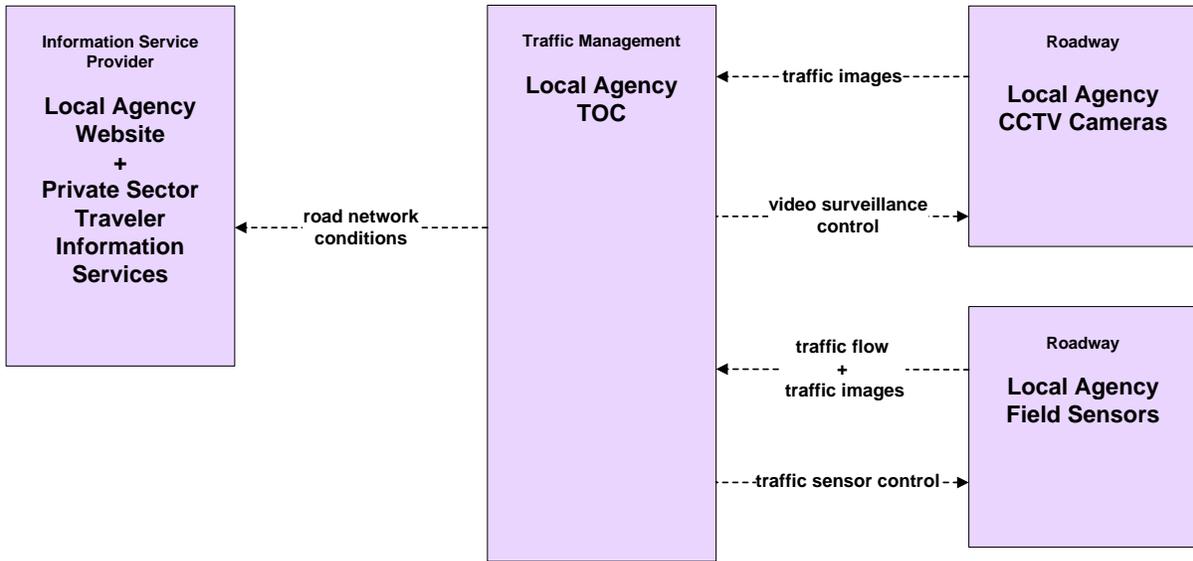
APPENDIX B – CUSTOMIZED SERVICE PACKAGES

Advanced Traffic Management System

ATMS01 – Network Surveillance MDOT



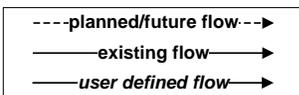
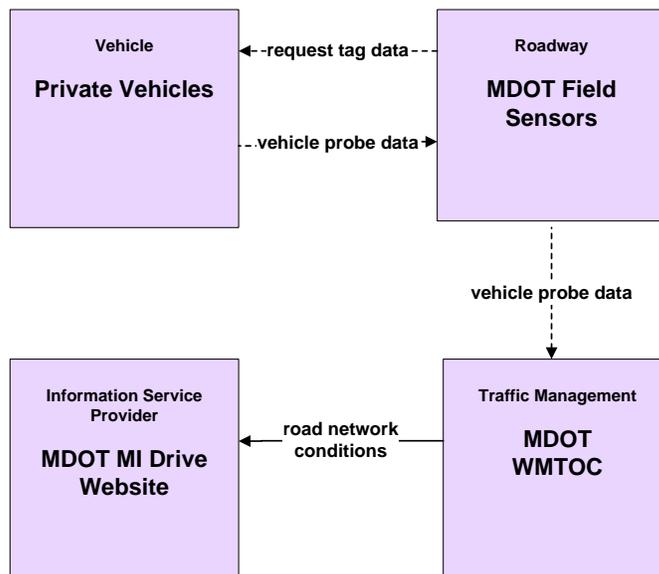
**ATMS01 – Network Surveillance
Local Agency**



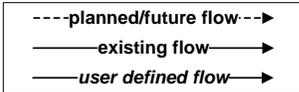
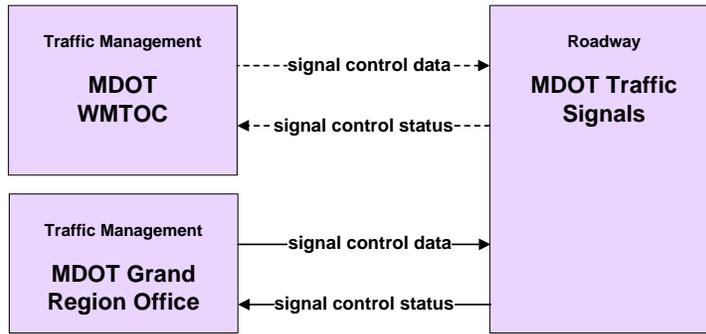
Note: Local Agency Field Sensors include MVDS and any other type of vehicle detection.

Local Agencies include: City of Holland, Ottawa CRC, City of Greenville, City of Ionia, City of Muskegon, Muskegon CRC, City of Norton Shores, City of Muskegon Heights, City of Zeeland, City of Portland, and Mecosta CRC

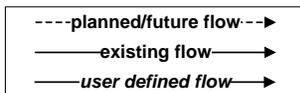
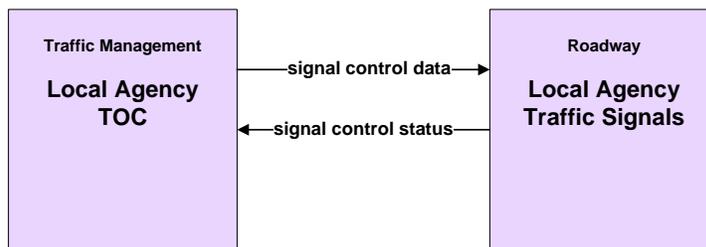
**ATMS02 – Probe Surveillance
MDOT**



**ATMS03 – Traffic Signal Control
MDOT**

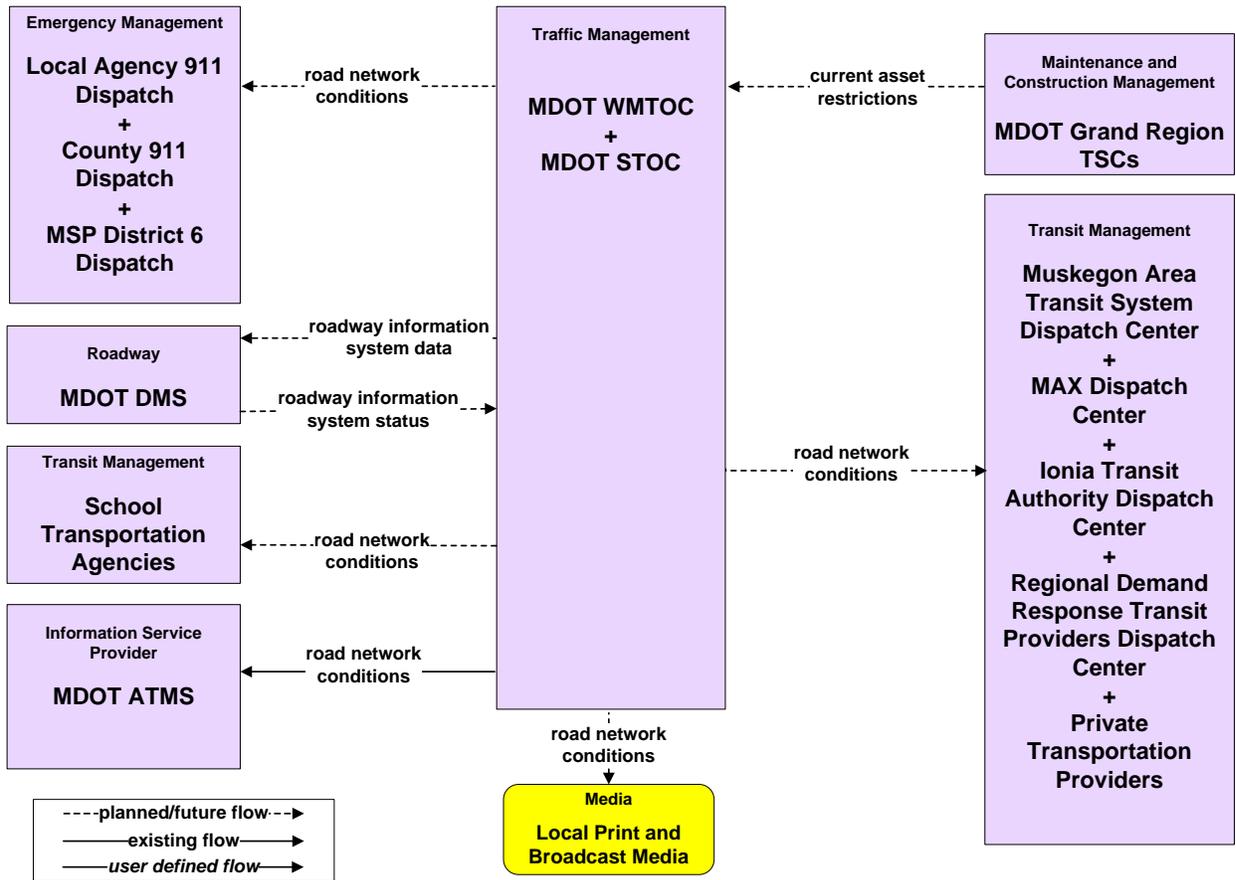


**ATMS03 – Traffic Signal Control
Local Agency**

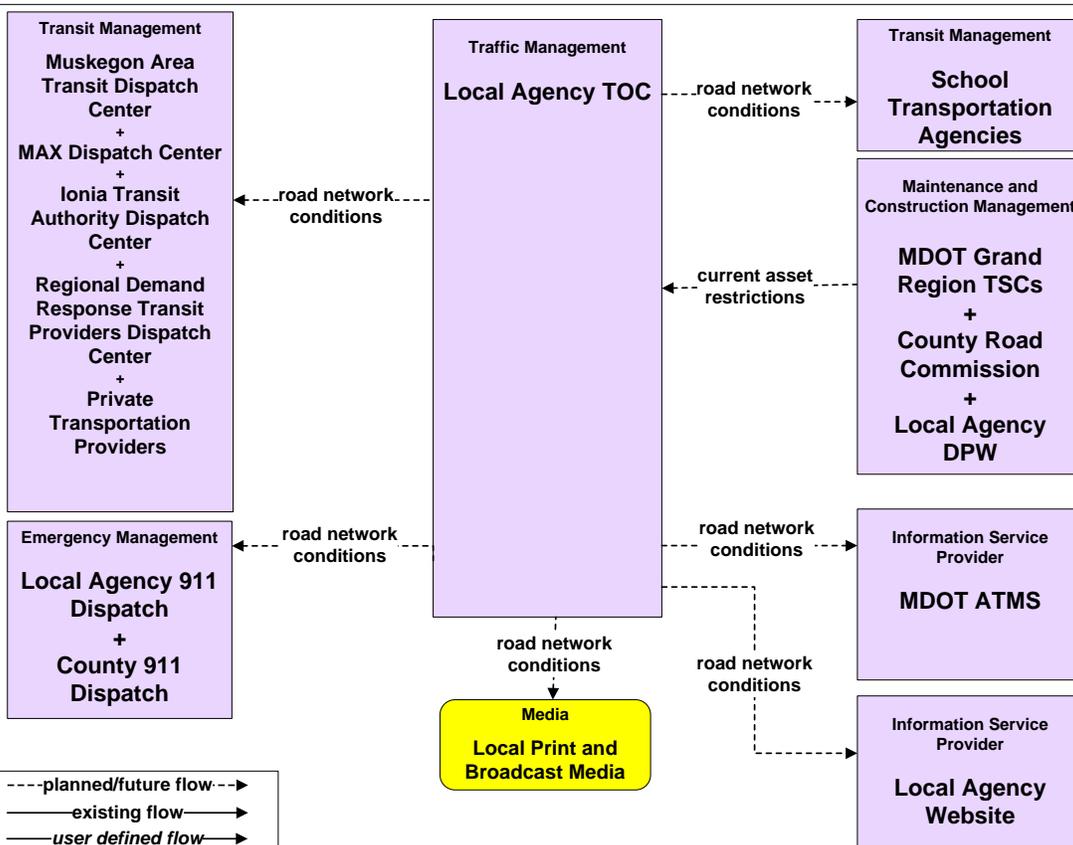


Note: Local Agencies include- City of Holland, Ottawa CRC, City of Greenville, City of Ionia, City of Muskegon, Muskegon CRC, City of Norton Shores, City of Muskegon Heights, City of Zeeland, City of Portland, Mecosta CRC

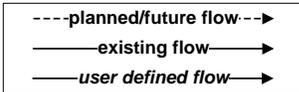
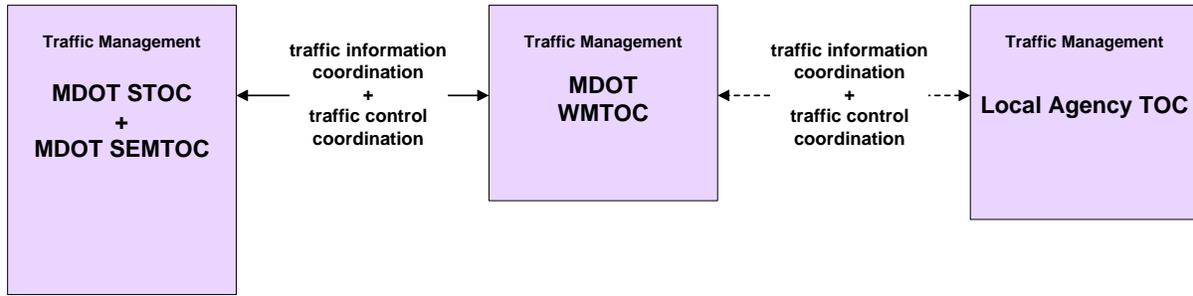
**ATMS06 – Traffic Information Dissemination
MDOT**



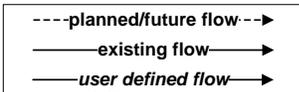
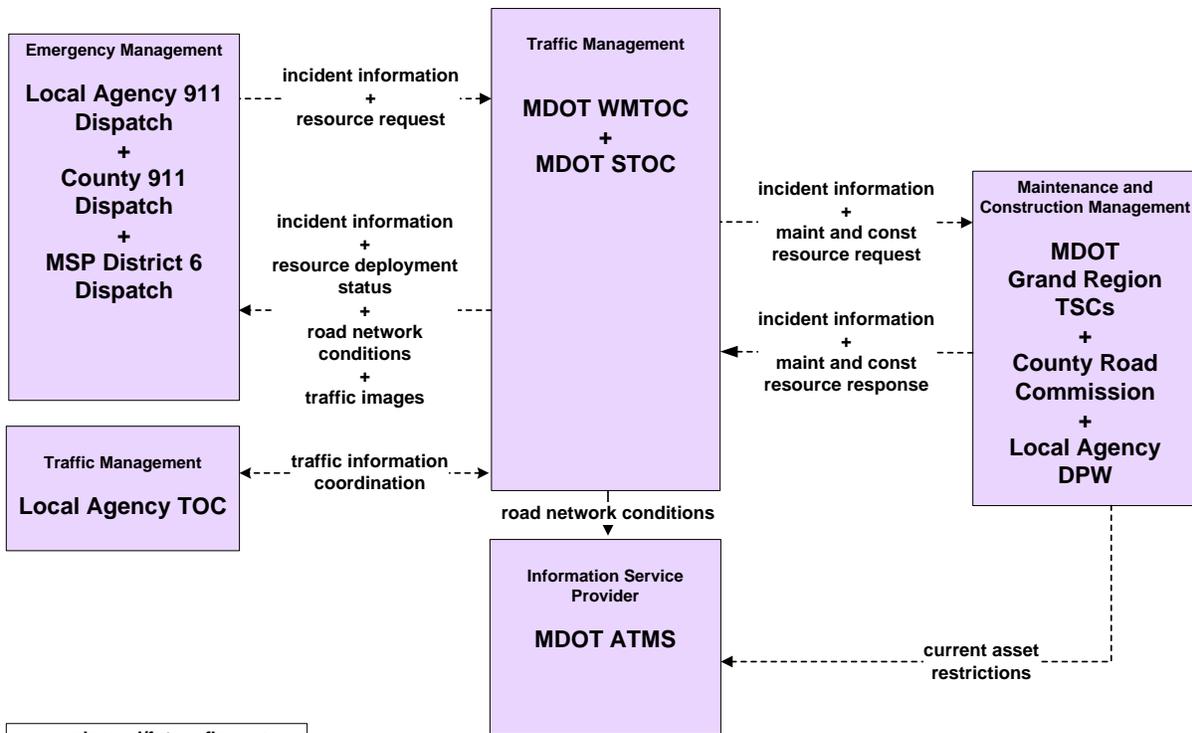
**ATMS06 – Traffic Information Dissemination
Local Agency**



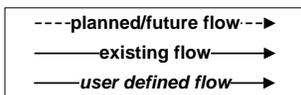
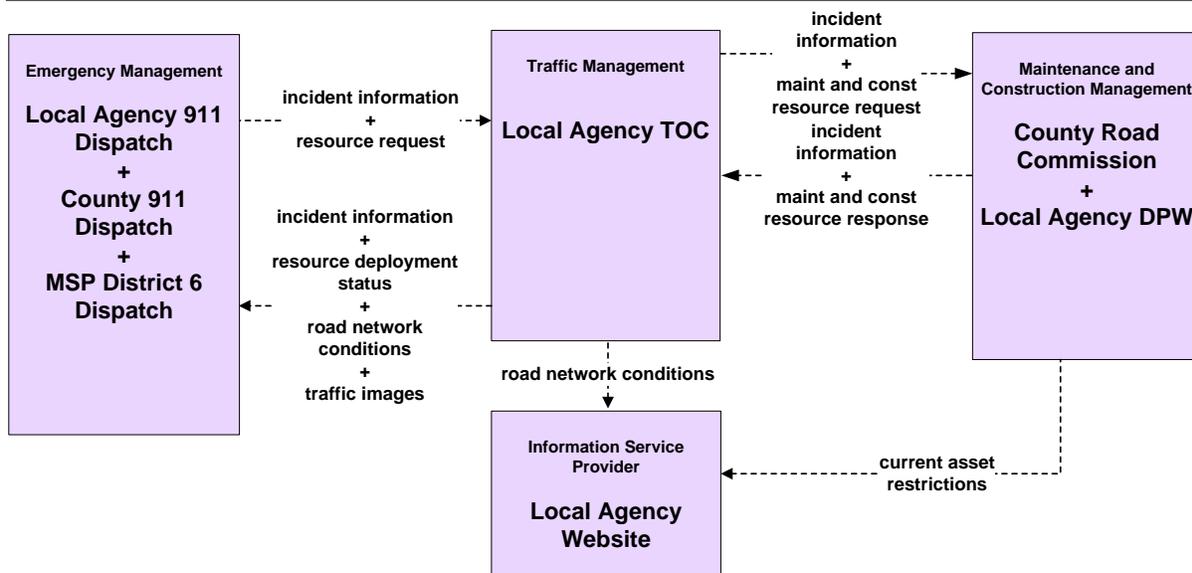
**ATMS07 – Regional Traffic Control
MDOT**



**ATMS08 – Incident Management
MDOT**

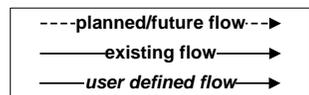
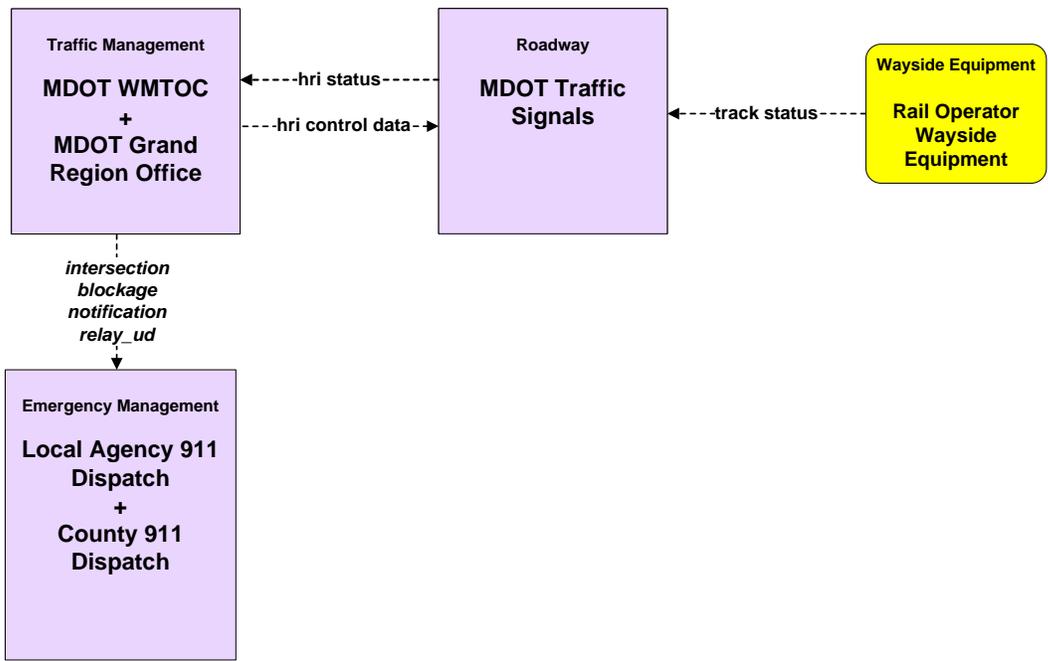


ATMS08 – Incident Management Local Agency

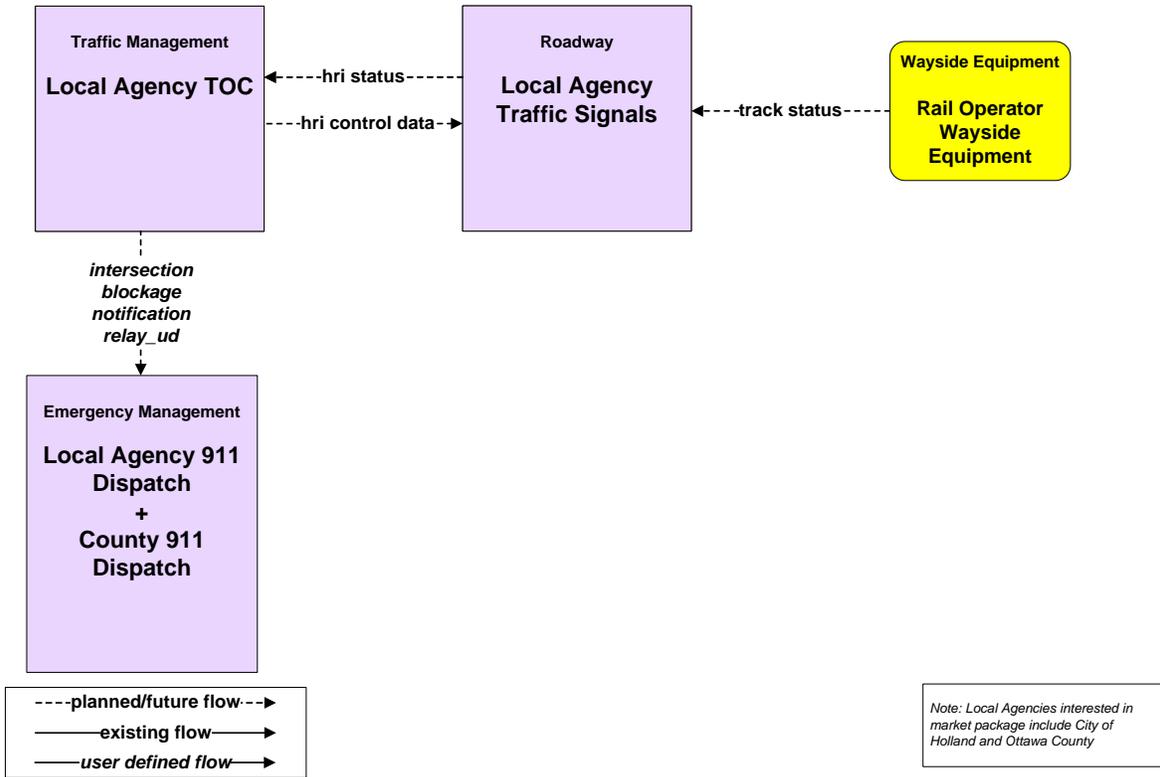


Note: Local Agencies include: City of Holland, Ottawa CRC, City of Greenville, City of Ionia, City of Muskegon, Muskegon CRC, City of Norton Shores, City of Muskegon Heights, City of Zeeland, City of Portland, and Mecosta CRC

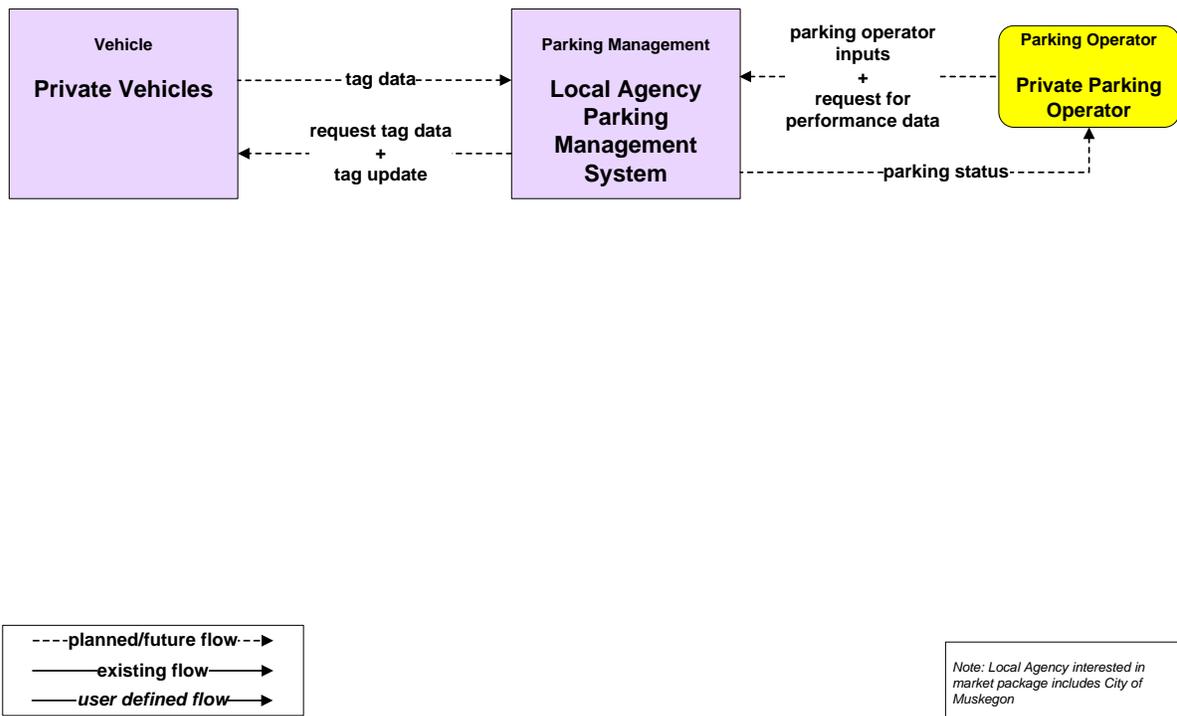
ATMS13 – Standard Railroad Grade Crossing MDOT Traffic Signal System



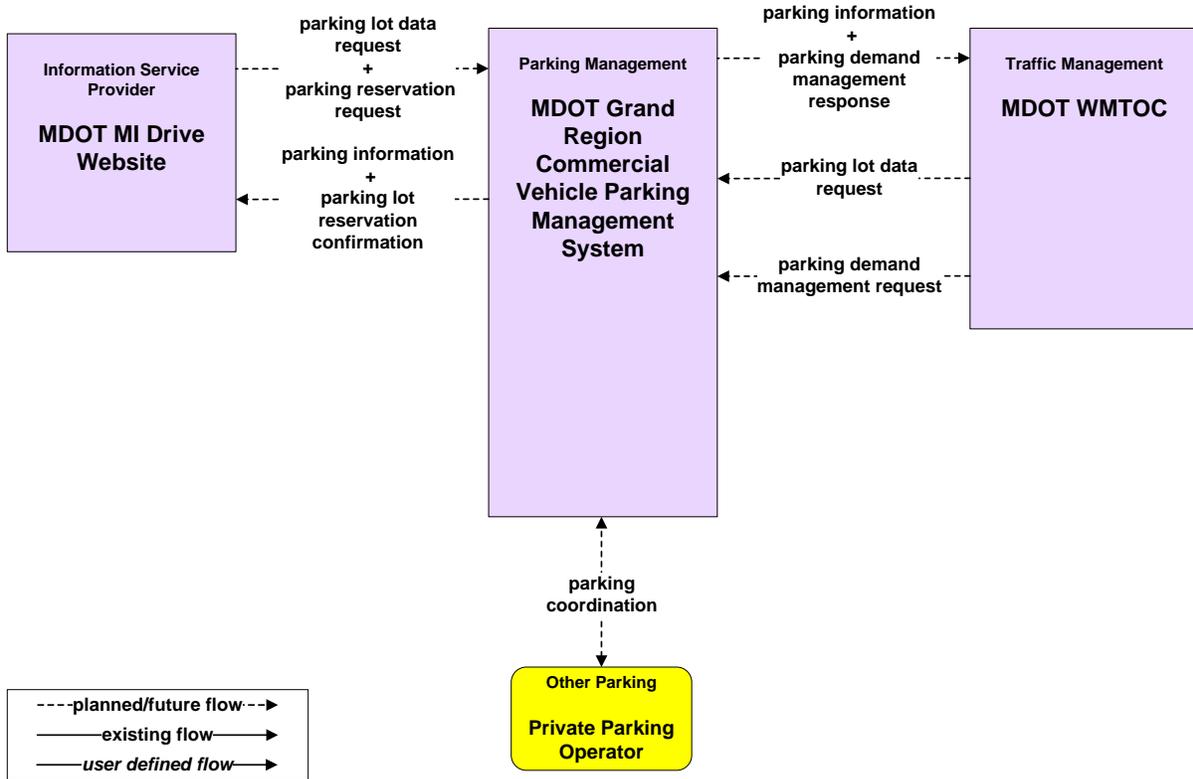
**ATMS13 – Standard Railroad Grade Crossing
Local Agency**



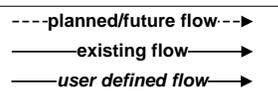
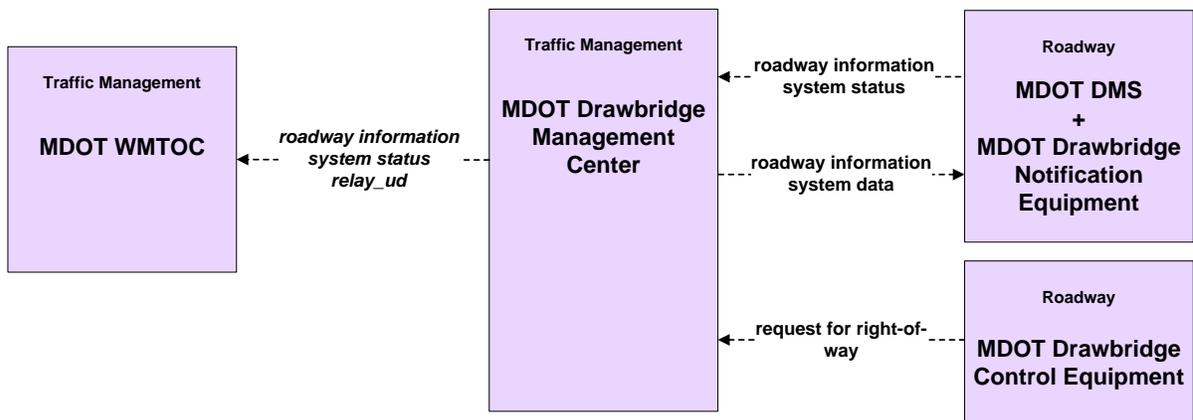
**ATMS16 – Parking Facility Management
Local Agency**



**ATMS17 – Regional Parking Management
MDOT**

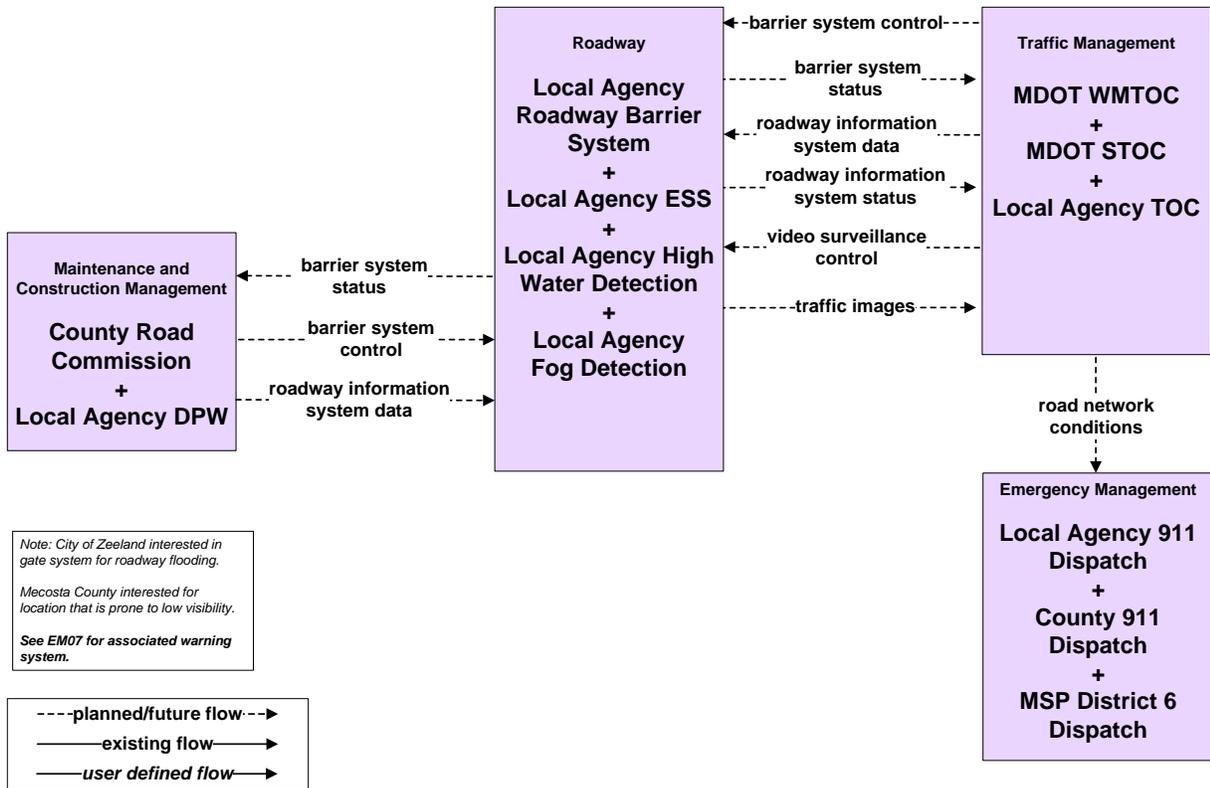


**ATMS20 – Drawbridge Management
MDOT**



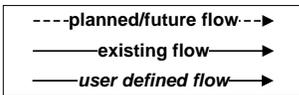
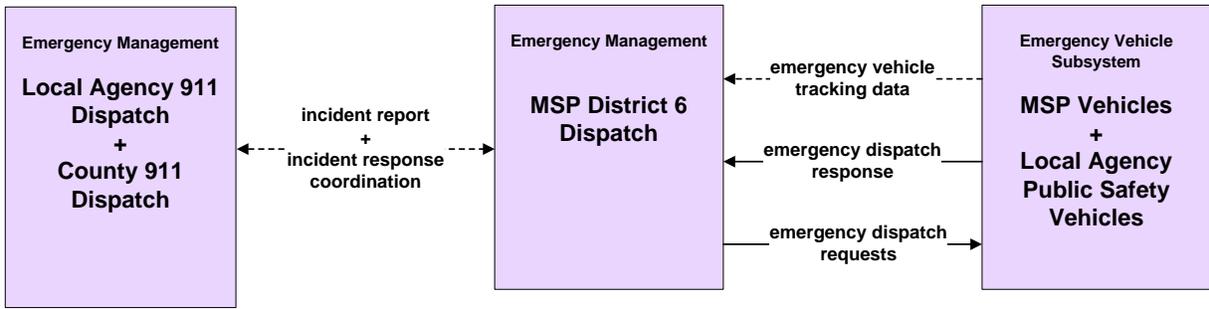
Note: Drawbridge Management existing for Grand Haven Bascule Bridge

**ATMS21 – Roadway Closure Management
Local Agency**

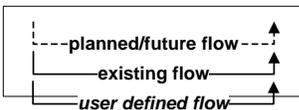
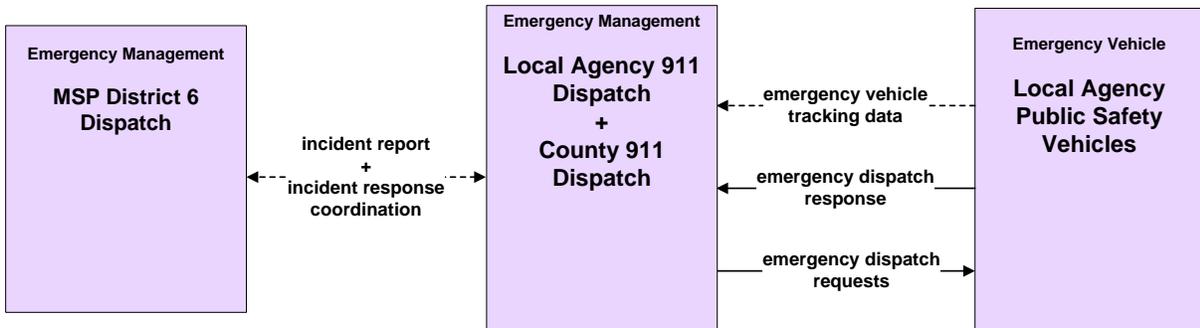


Emergency Management

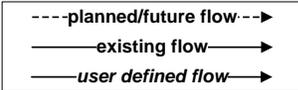
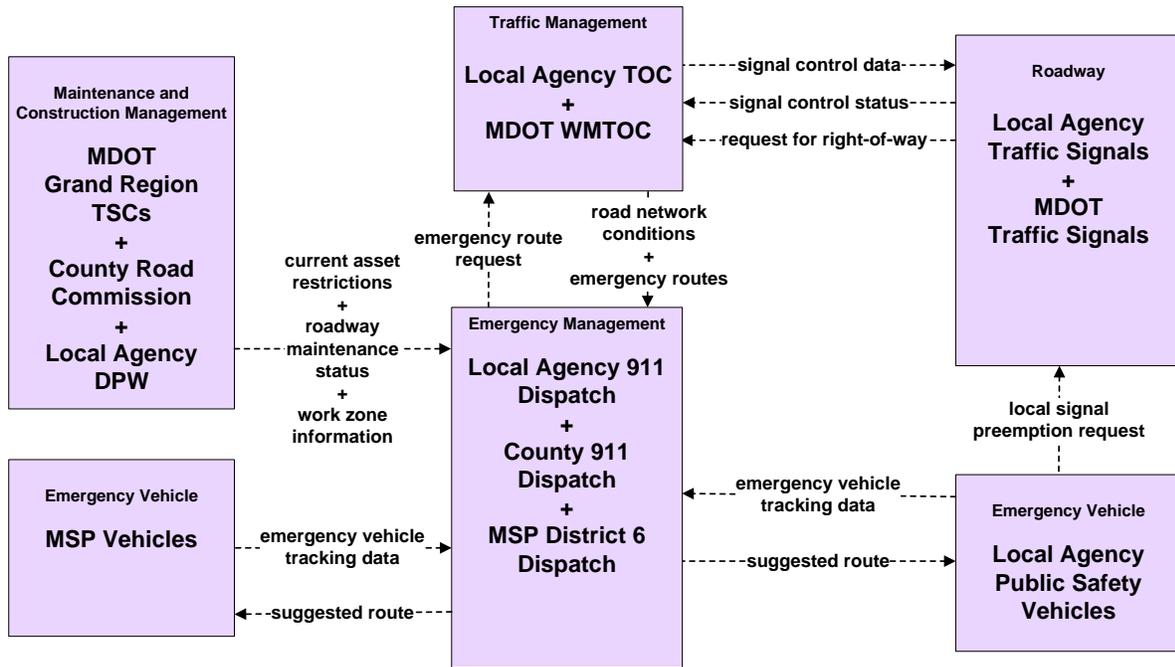
**EM01 – Emergency Call Taking and Dispatch
Michigan State Police**



**EM01 – Emergency Call Taking and Dispatch
Local Agency**

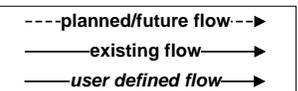
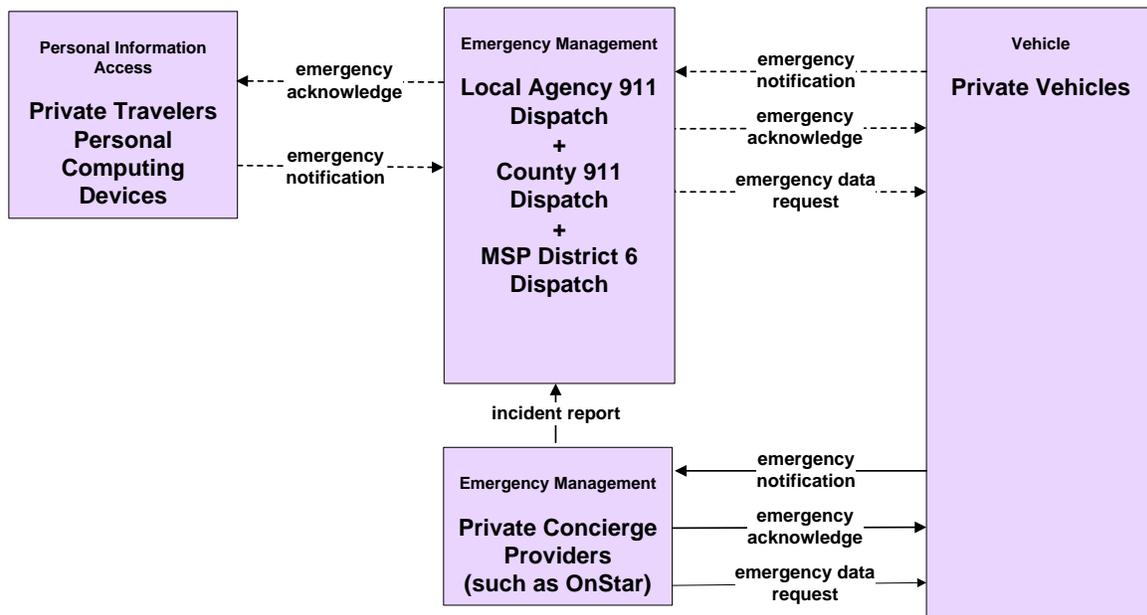


**EM02 – Emergency Routing
Local Agency**

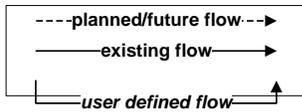
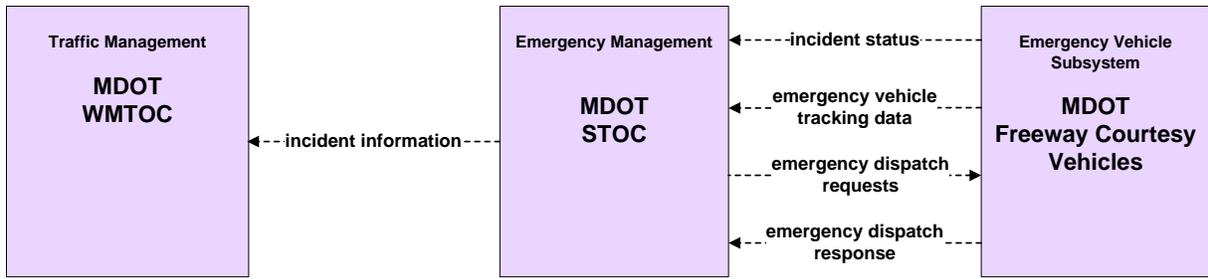


*Note:
 Emergency vehicle signal preemption is for Fire and EMS vehicles only.
 Signal control is as shown in ATMS03 and emergency dispatch relationships are as shown in EM01.*

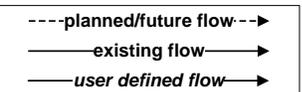
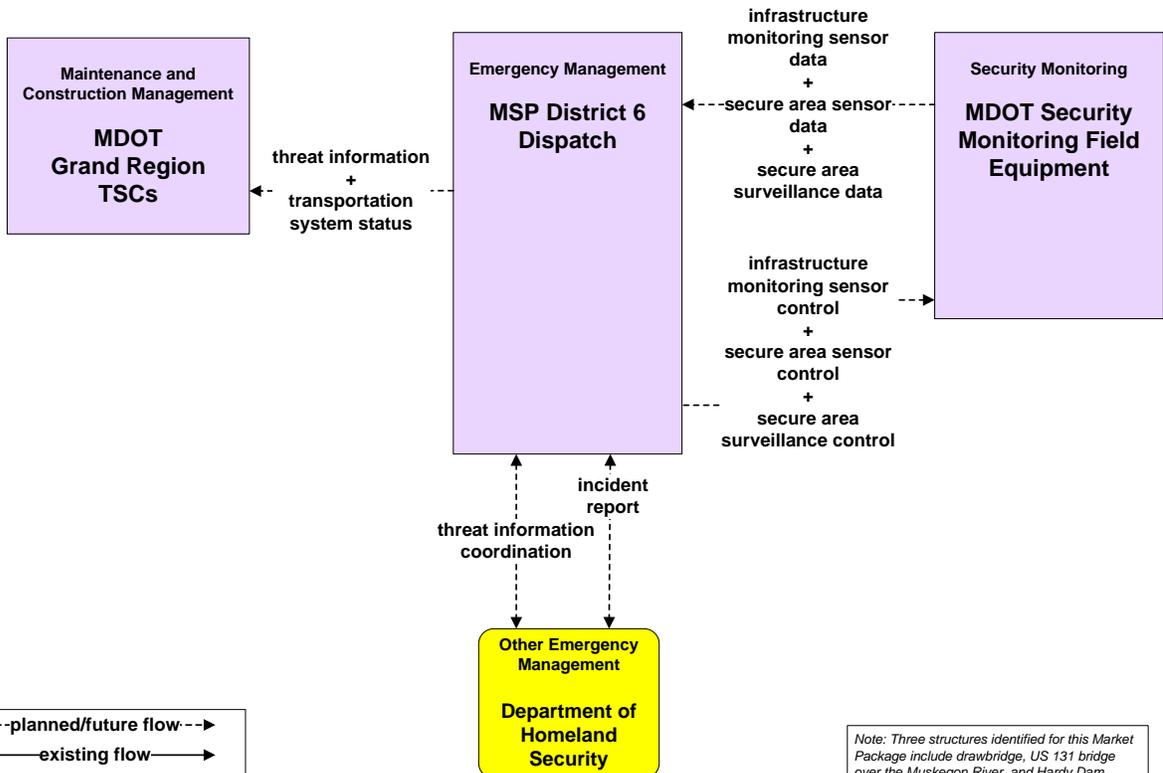
**EM03 – Mayday Support and Alarms Support
Local Agency**



**EM04 – Freeway Courtesy Patrols
MDOT**

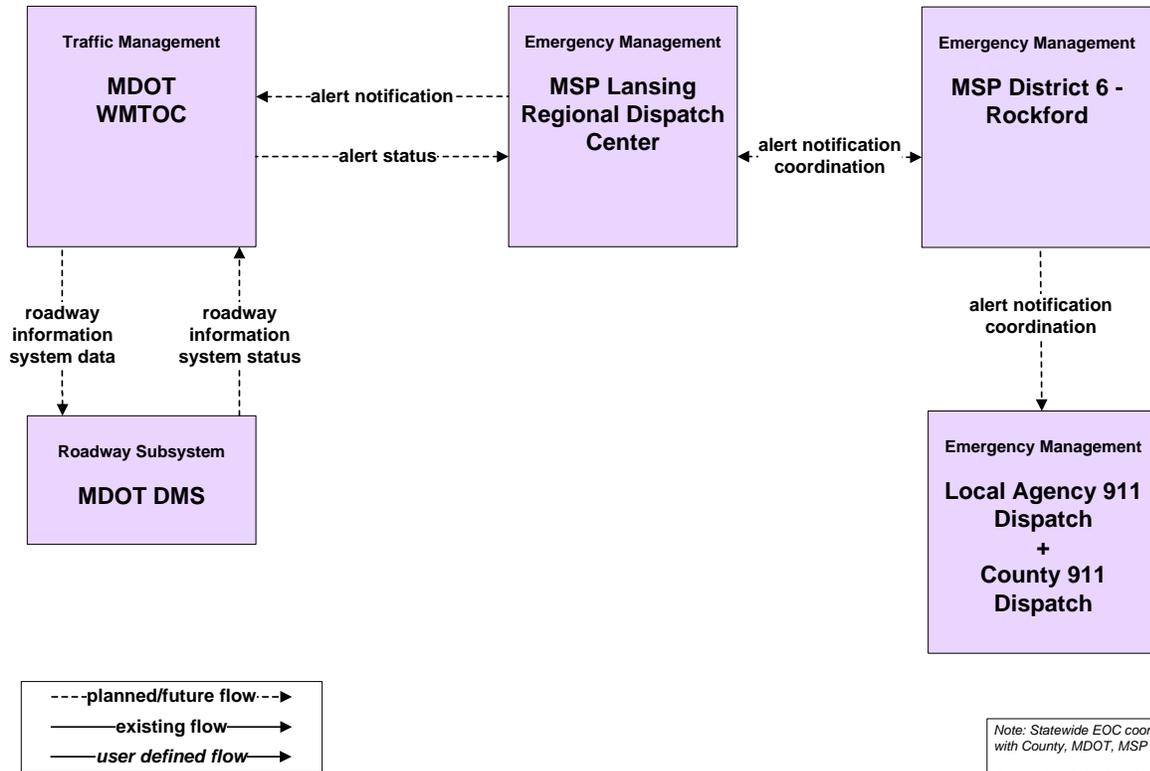


**EM05 – Transportation Infrastructure Protection
MDOT**

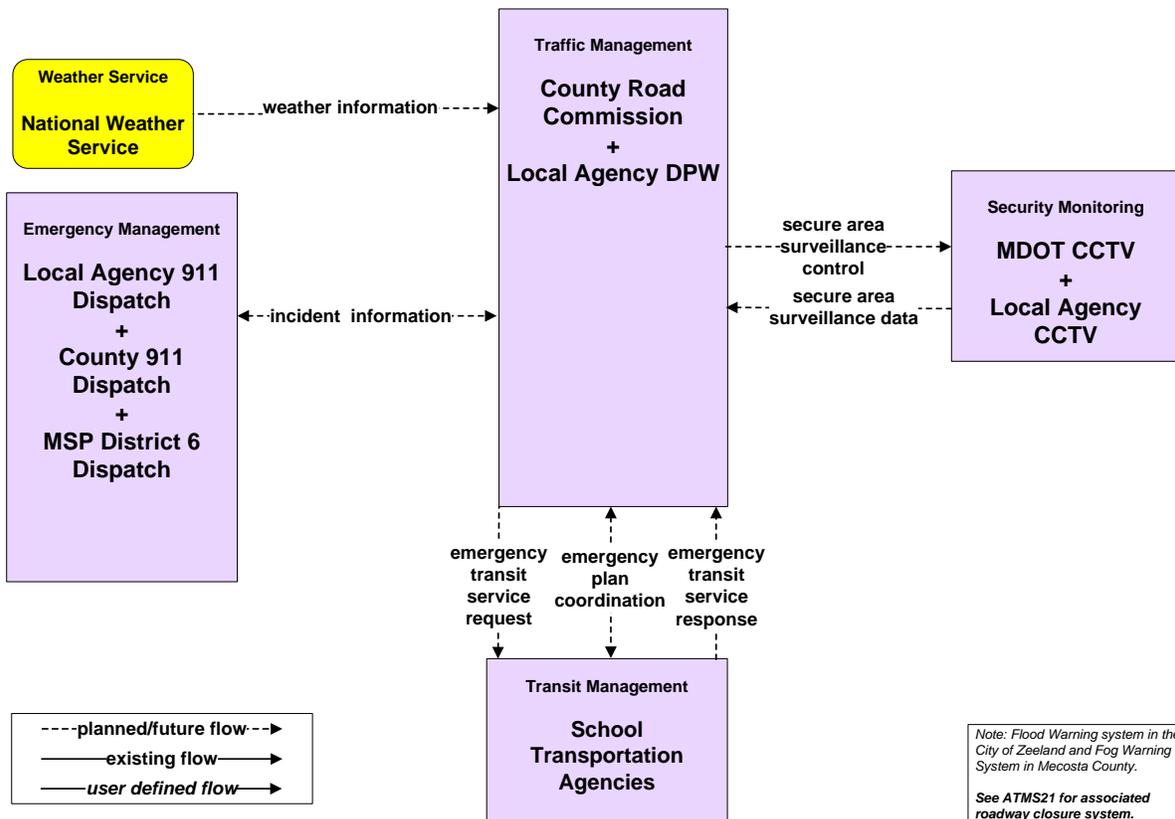


Note: Three structures identified for this Market Package include drawbridge, US 131 bridge over the Muskegon River, and Hardy Dam (consumer Energy).

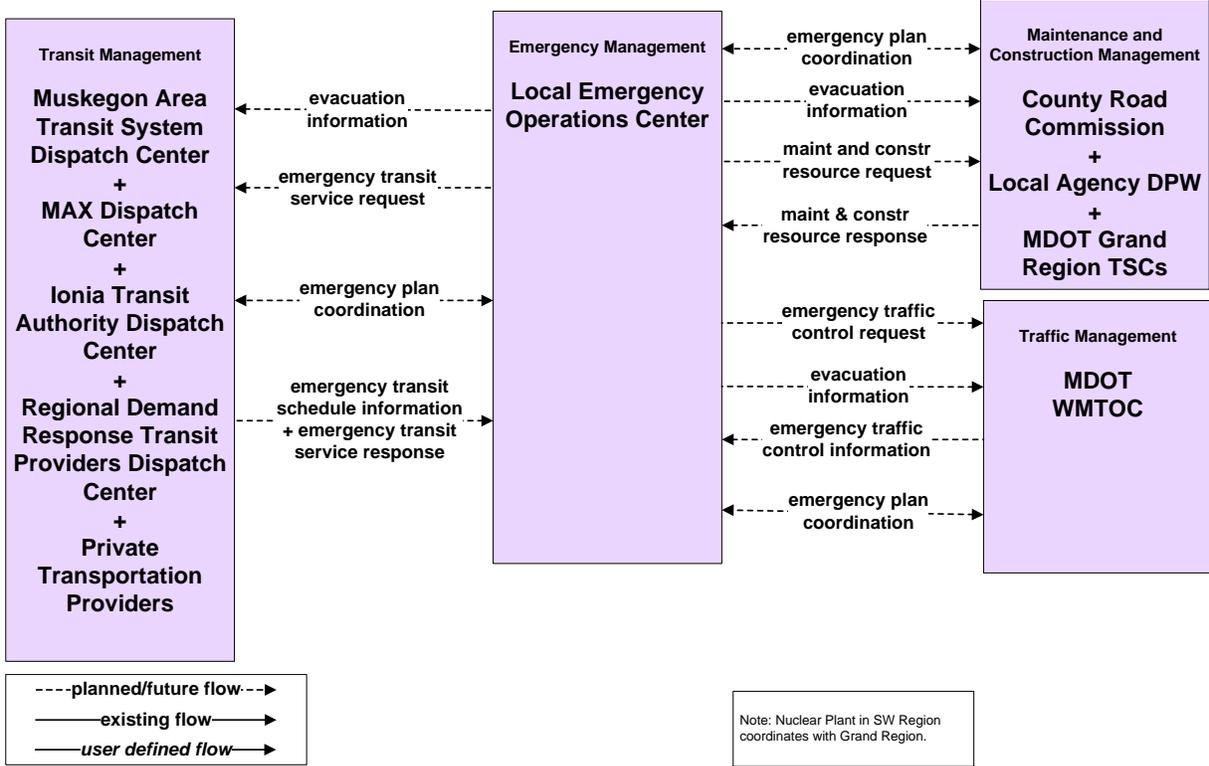
**EM06 – Wide-Area Alerts
AMBER Alert**



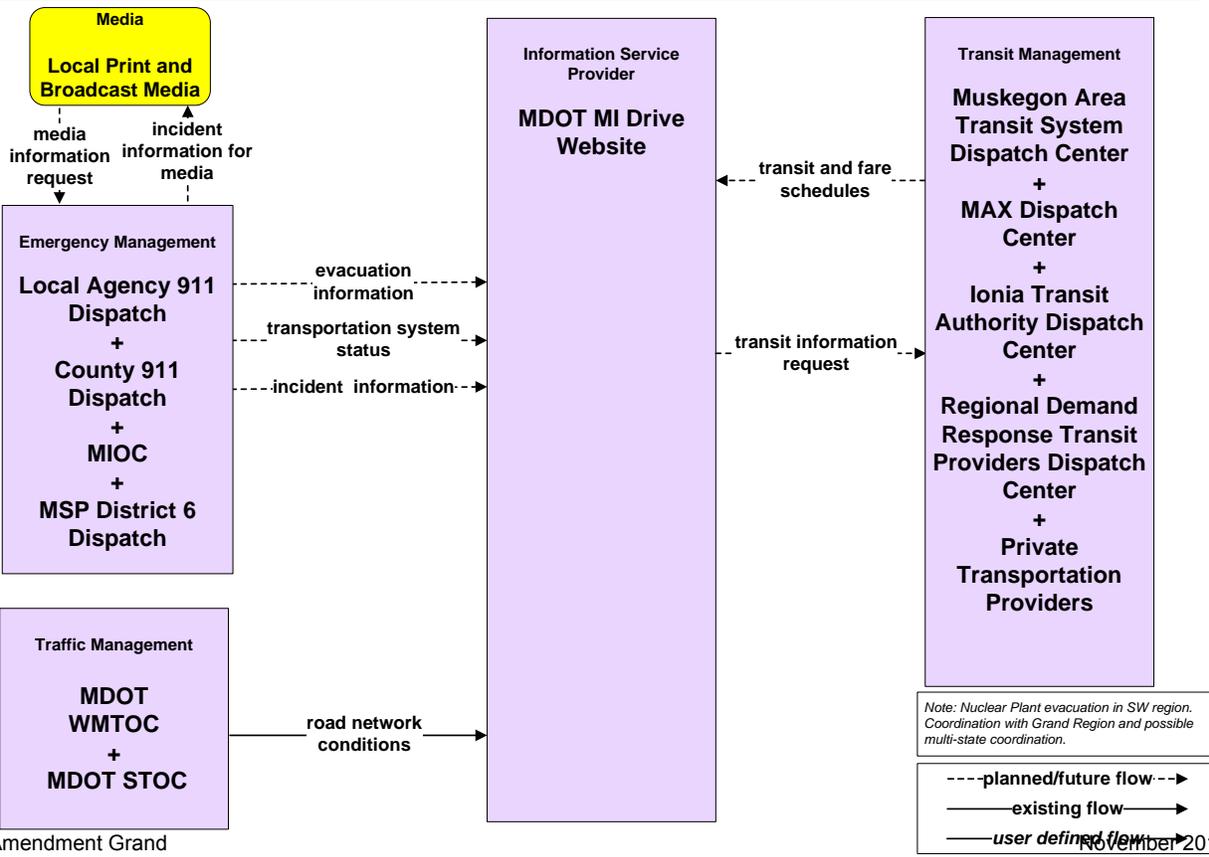
**EM07 – Early Warning System
Local Agency**



**EM09 – Evacuation and Reentry Management
Local Agency**

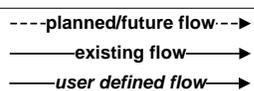
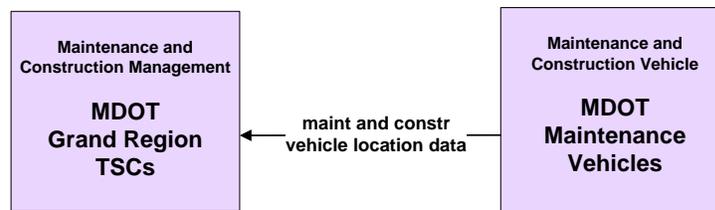


**EM10 – Disaster Traveler Information
MDOT**



Maintenance and Construction Management

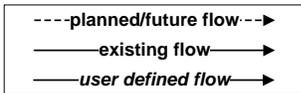
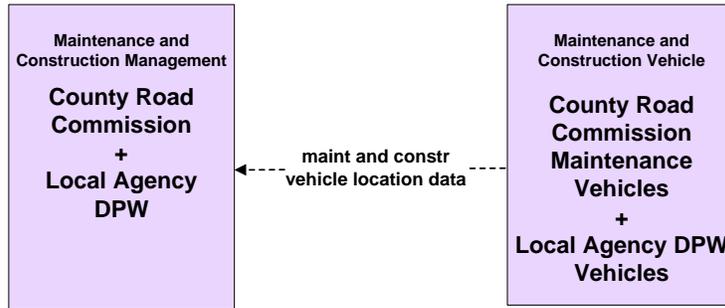
MC01 – Maintenance and Construction Vehicle Tracking MDOT



Note: Have same frequency for radios. I-96 corridor concept, from University Region through Muskegon. MDOT personnel will handle some snow removal in Ionia County.

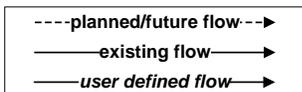
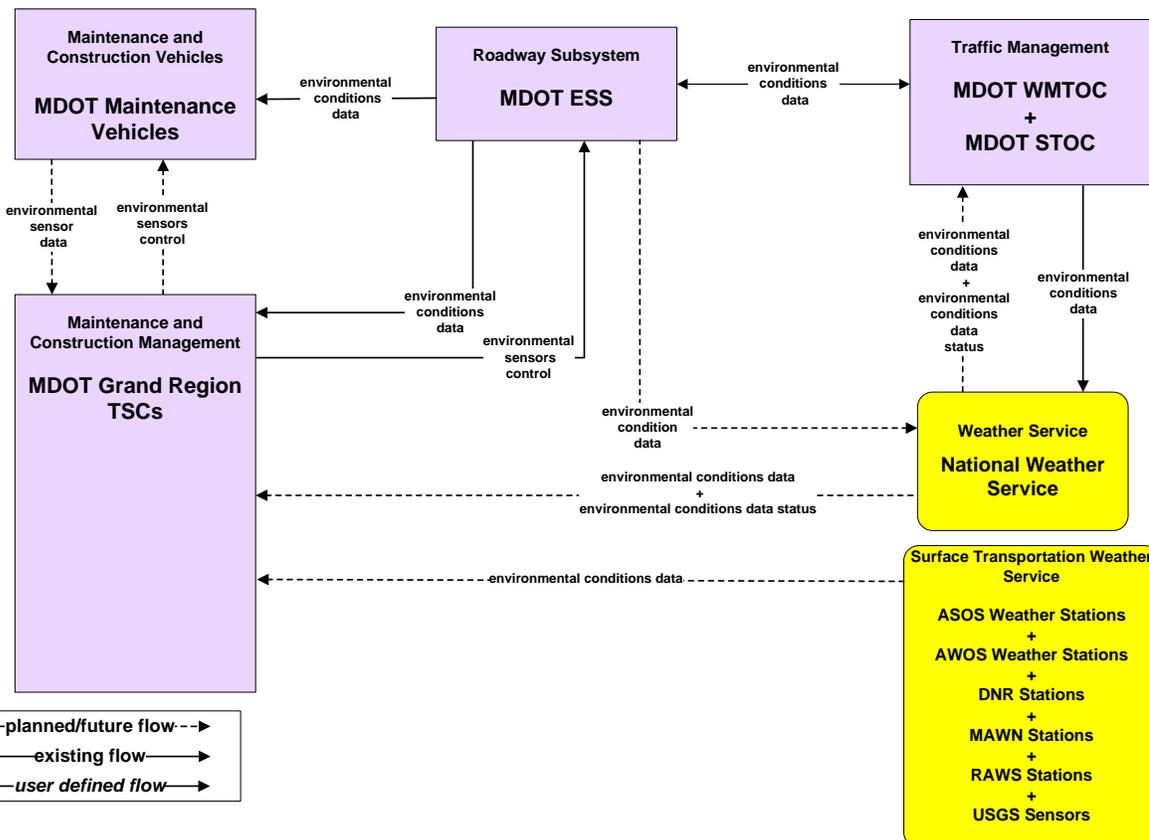
AVL is existing on the maintenance vehicles.

**MC01 – Maintenance and Construction Vehicle Tracking
Local Agency**

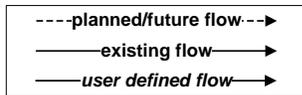
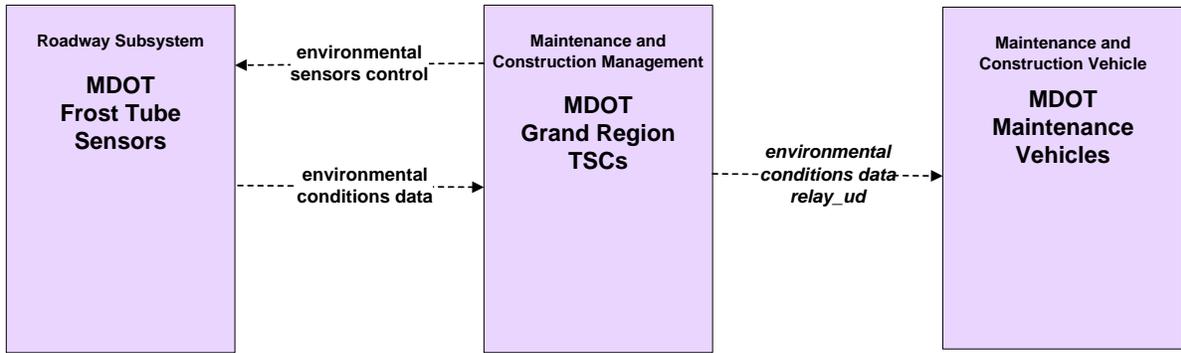


Note: Have same frequency for radios. I-96 corridor concept, from University Region through Muskegon. MDOT personnel will handle some snow removal in Ionia County.

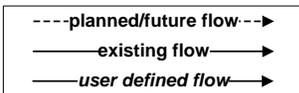
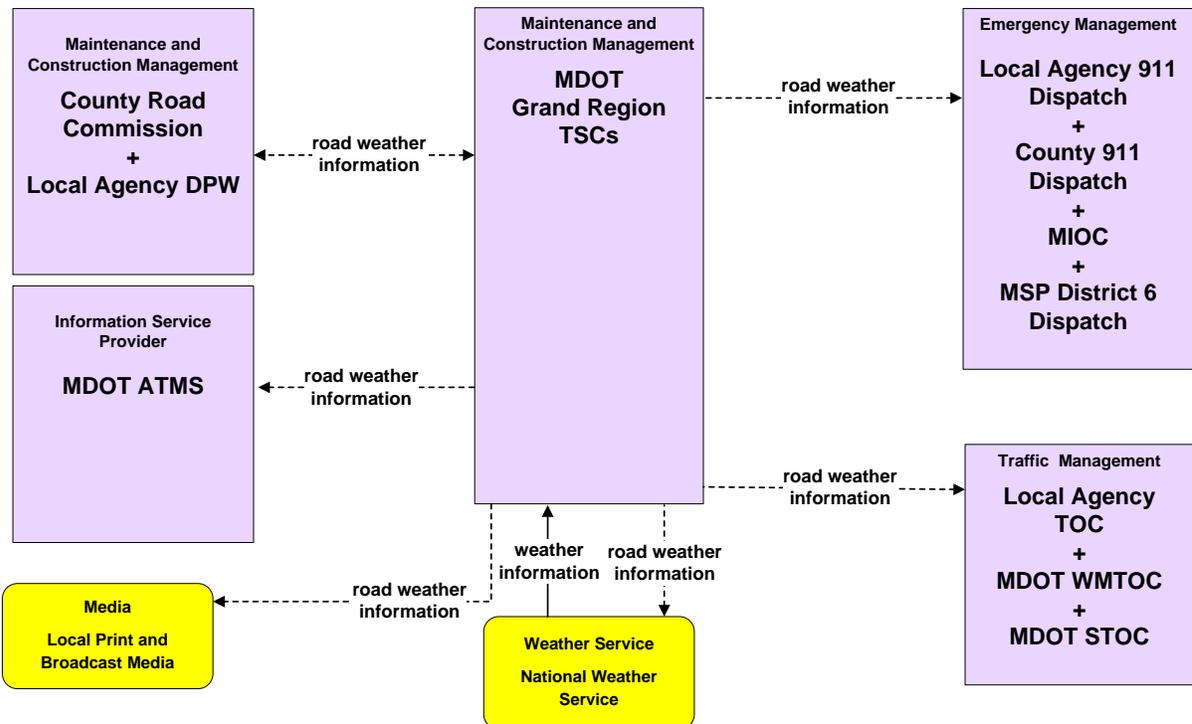
**MC03 – Road Weather Data Collection
MDOT**



**MC03 – Road Weather Data Collection
MDOT**

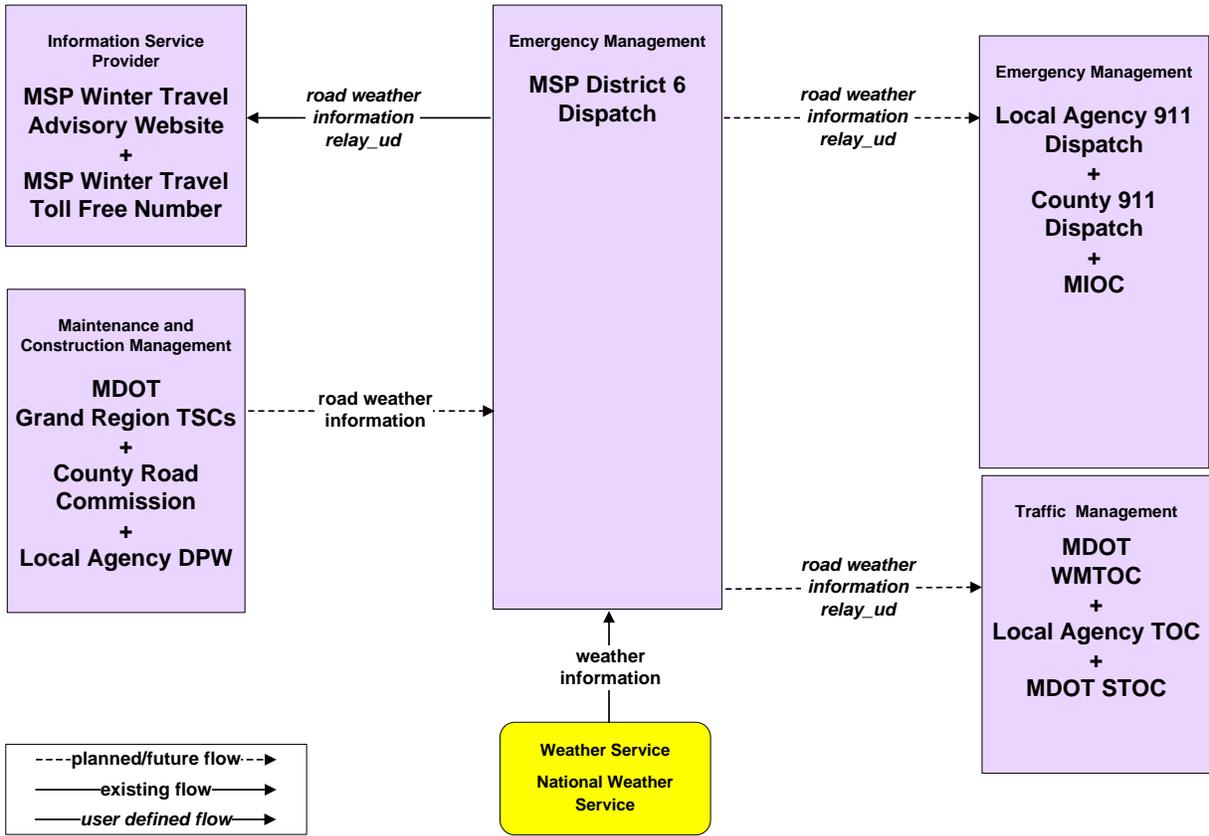


**MC04 – Weather Information Processing and Distribution
MDOT**

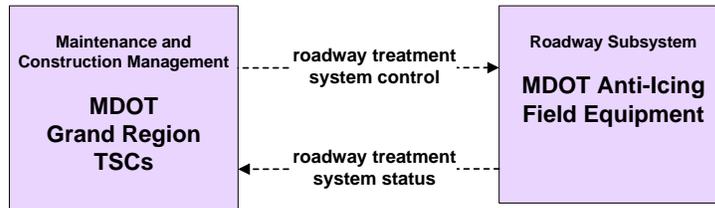


Note: Local Agencies include: City of Holland, Ottawa CRC, City of Greenville, City of Ionia, City of Muskegon, Muskegon CRC, City of Norton Shores, City of Muskegon Heights, City of Zeeland, City of Portland, and Mecosta CRC

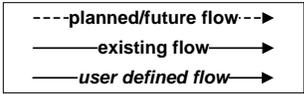
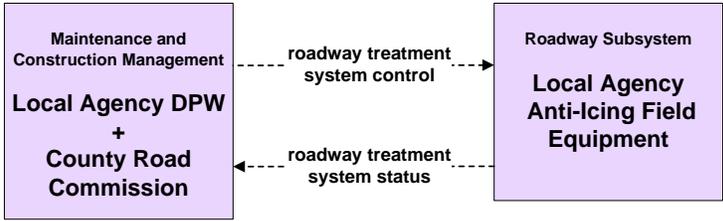
**MC04 – Weather Information Processing and Distribution
Michigan State Police**



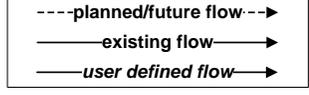
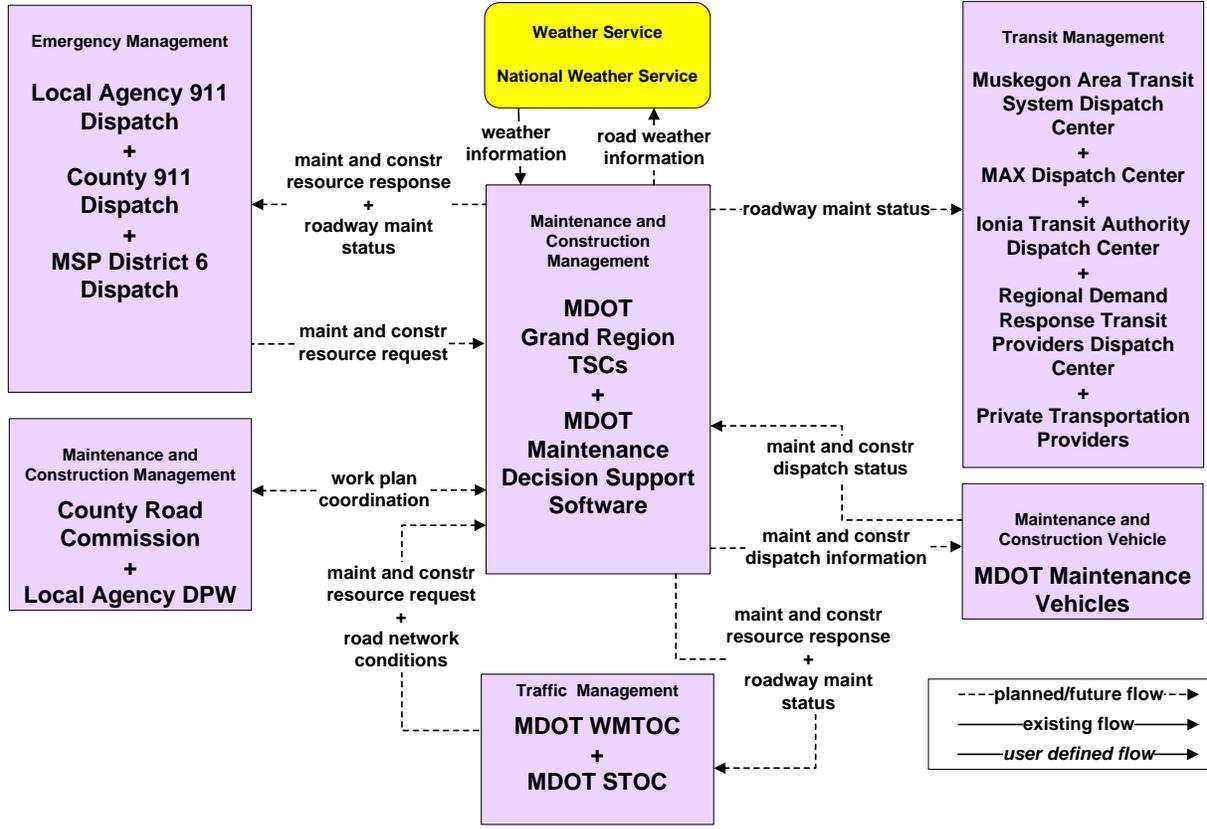
**MC05 – Roadway Automated Treatment
MDOT**



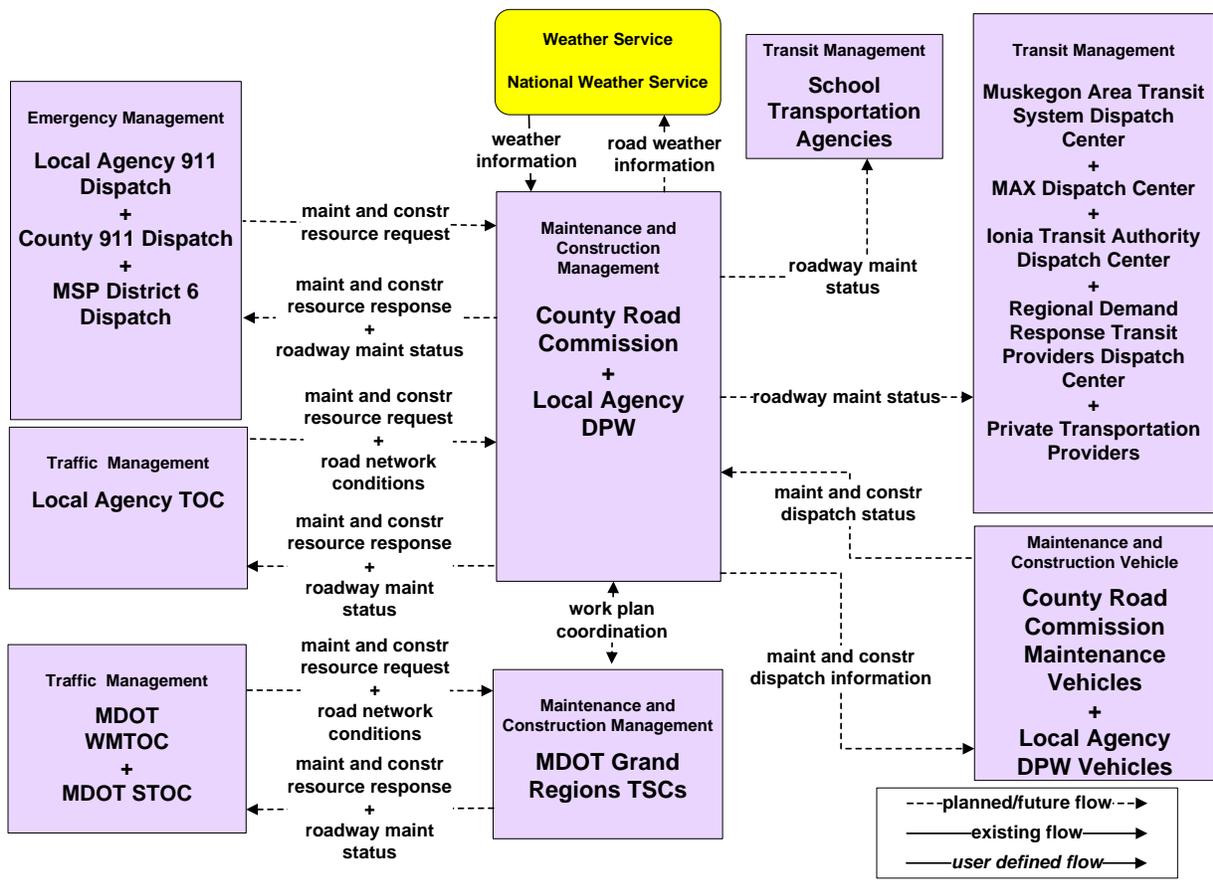
**MC05 – Roadway Automated Treatment
Local Agency**



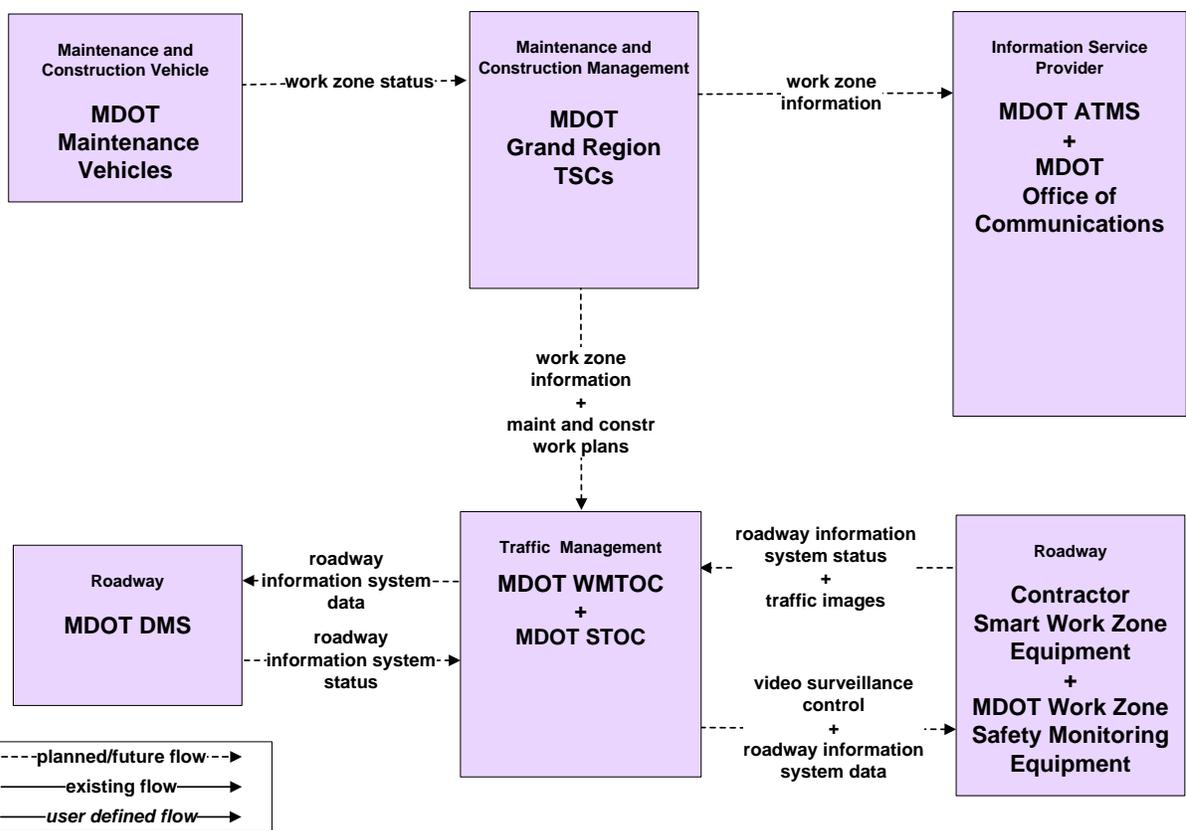
**MC06 – Winter Maintenance
MDOT**



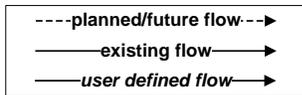
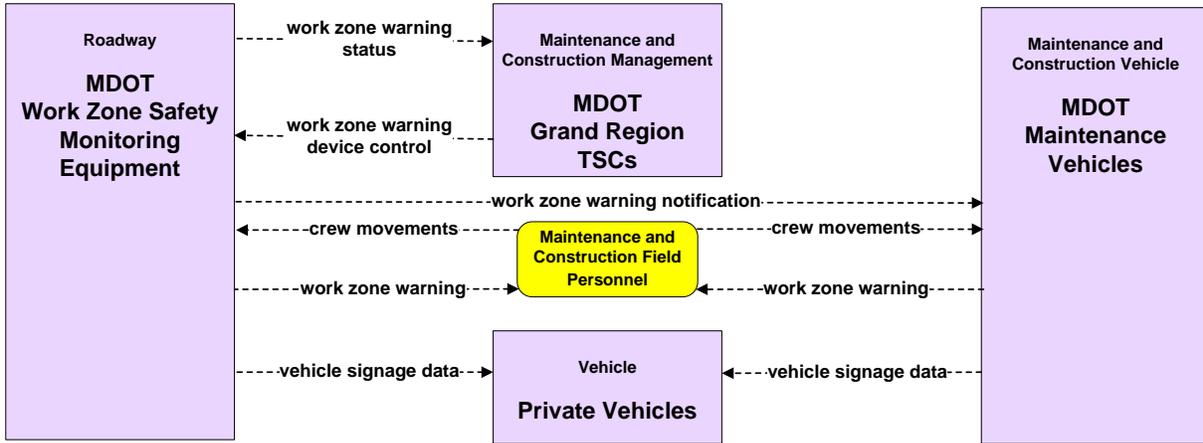
**MC06 – Winter Maintenance
Local Agency**



**MC08 – Work Zone Management
MDOT**

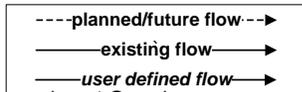
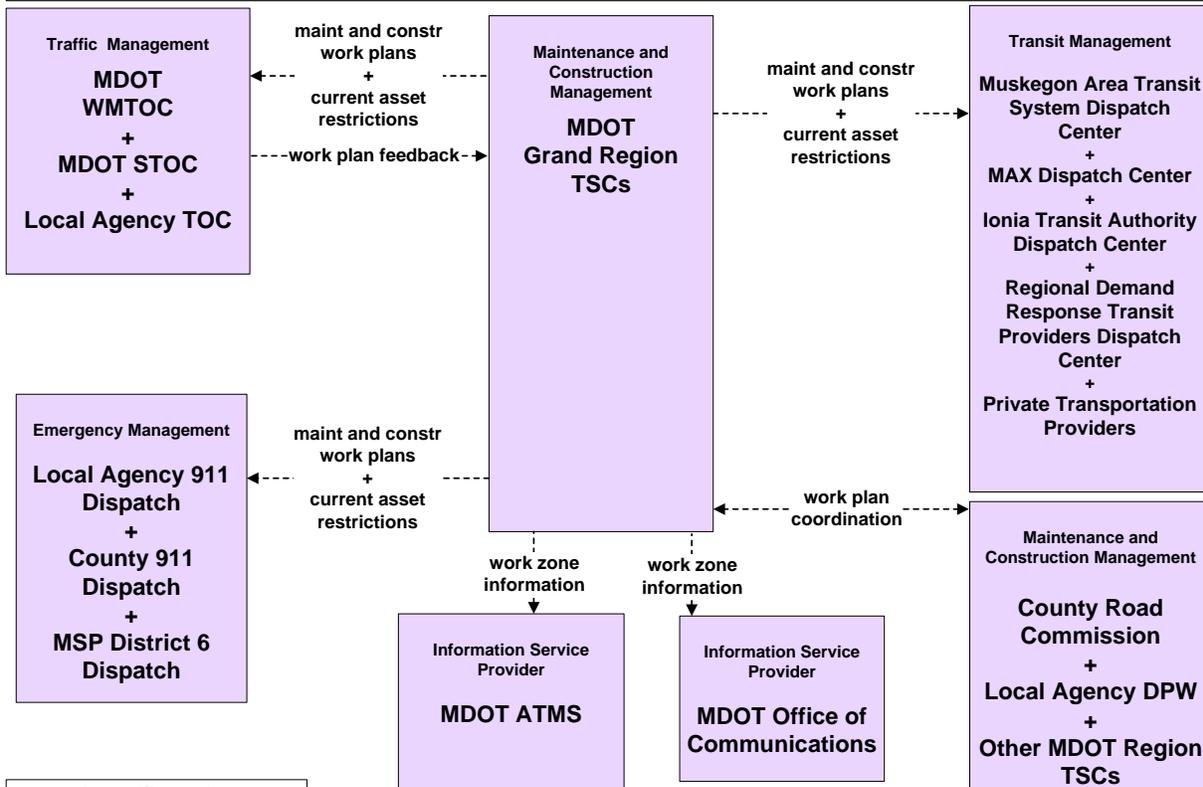


**MC09 – Work Zone Safety Monitoring
MDOT**



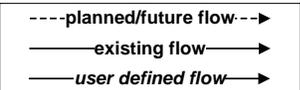
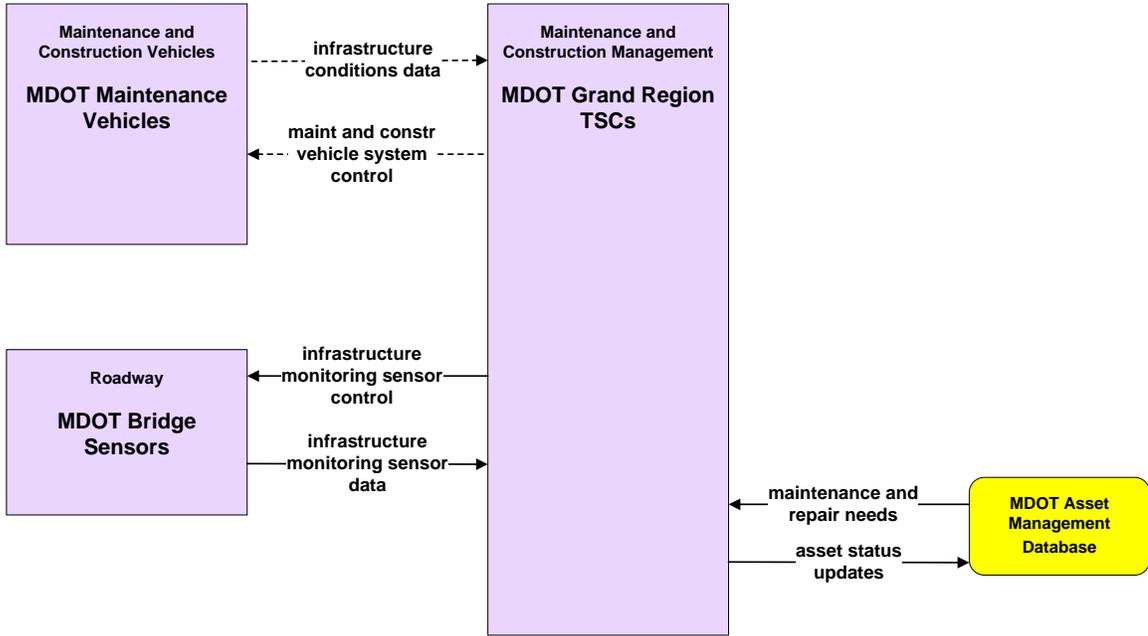
Note: Potential in Holland or Grand Haven with major construction project

**MC10 – Maintenance and Construction Activity Coordination
MDOT / Local Agency**



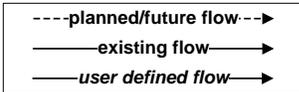
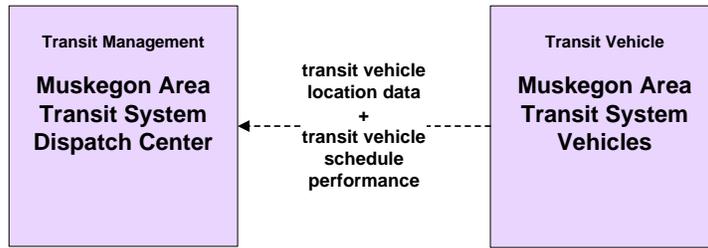
Note: Contracting agency performing work will handle traffic control for maintenance activities. Construction is handled by contractor. Maintenance Coordinator in each TSC disseminates a lane closure notification to certain list of contacts.

**MC12 – Infrastructure Monitoring
MDOT**

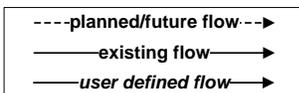
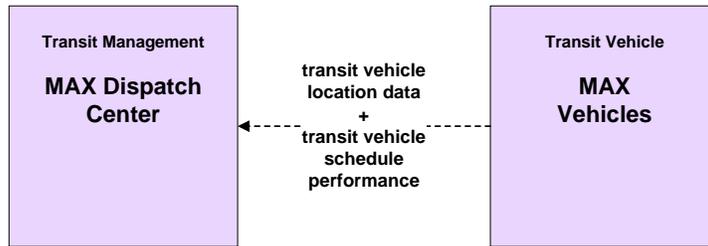


Advanced Public Transportation Systems

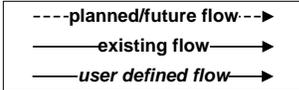
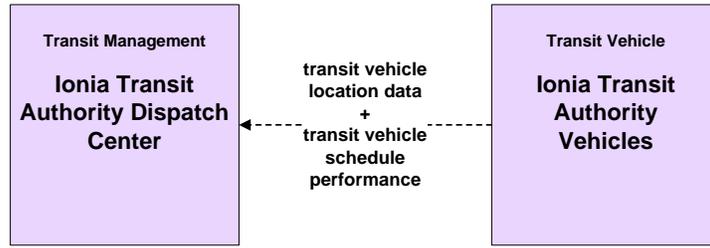
**APTS1 – Transit Vehicle Tracking
Muskegon Area Transit System**



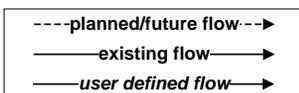
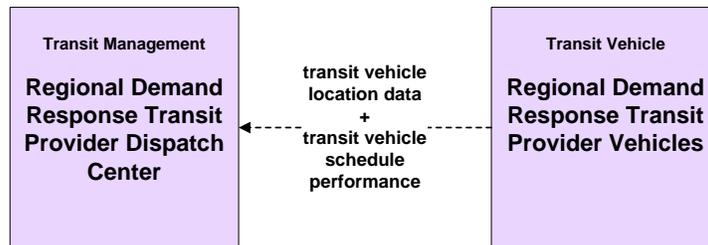
**APTS1 – Transit Vehicle Tracking
Macatawa Area Express (MAX)**



**APTS1 – Transit Vehicle Tracking
Ionia Transit Authority**

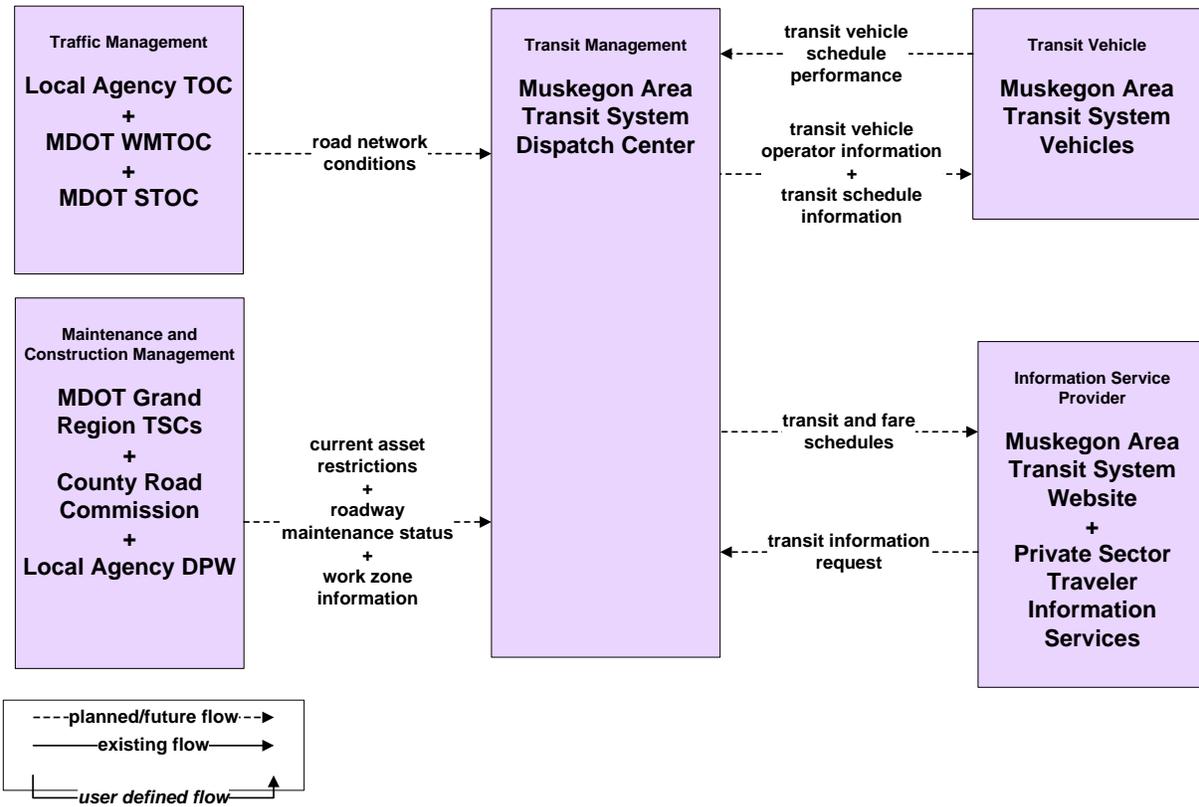


**APTS1 – Transit Vehicle Tracking
Regional Demand Response Transit Providers**

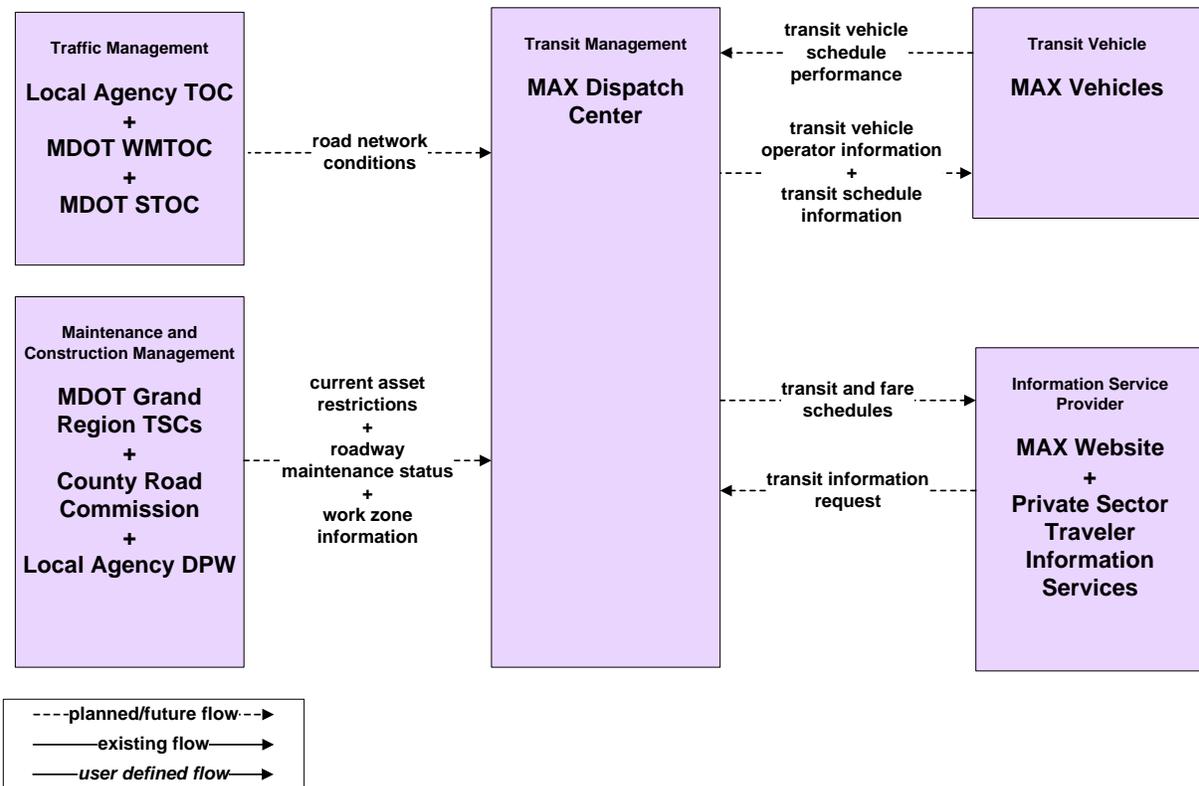


*Note:
Includes Demand Response Transit Agencies in
Big Rapids, Belding and Grand Haven (Harbor
Transit)*

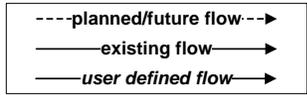
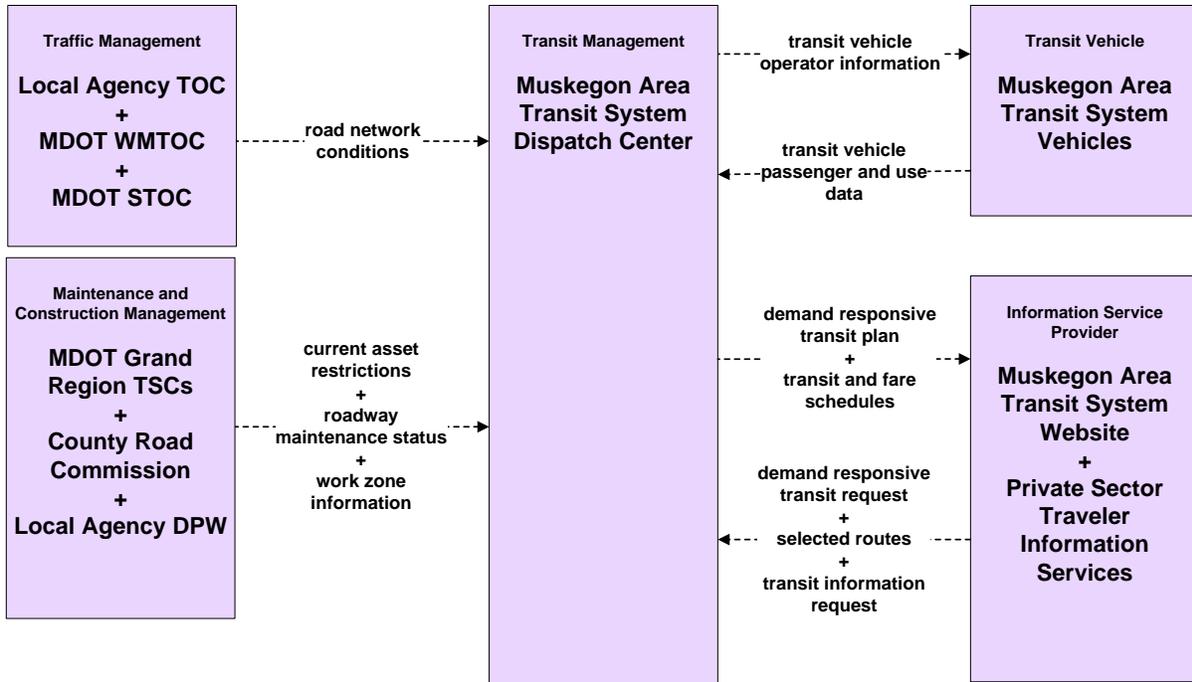
**APTS2 – Transit Fixed Route Operations
Muskegon Area Transit System**



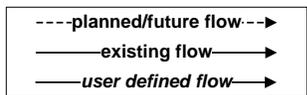
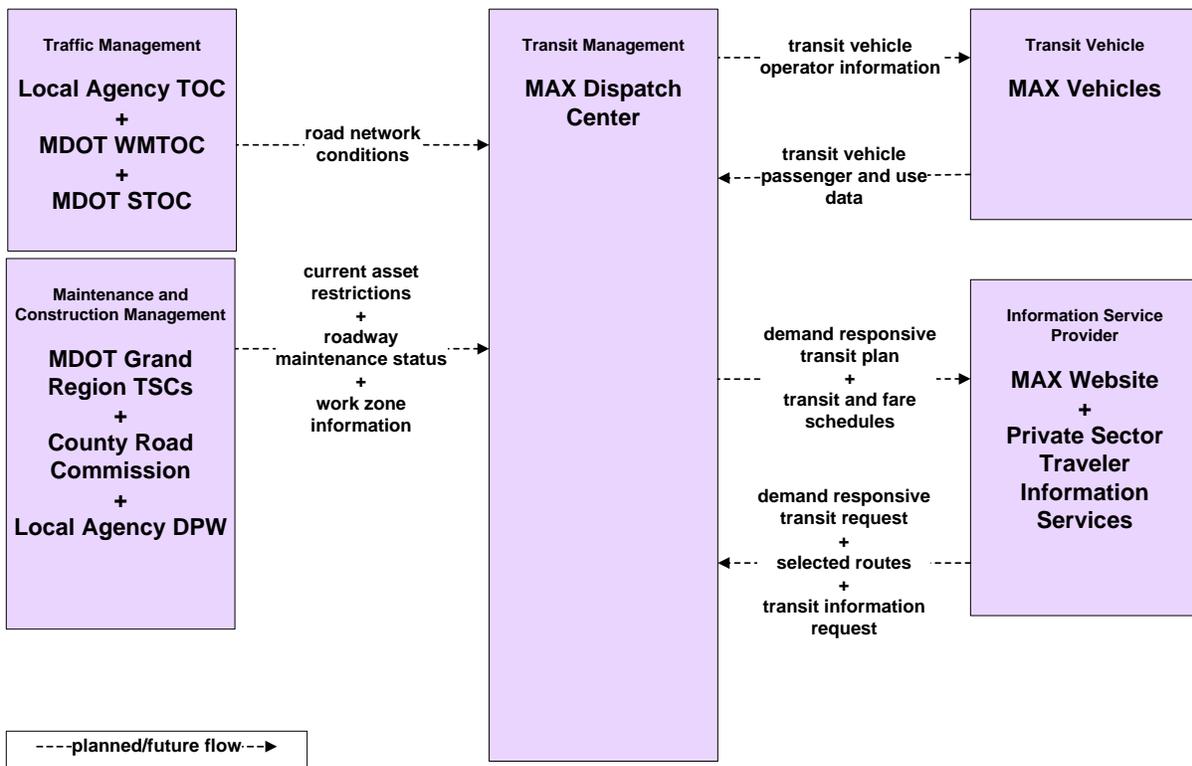
**APTS2 – Transit Fixed Route Operations
Macatawa Area Express (MAX)**



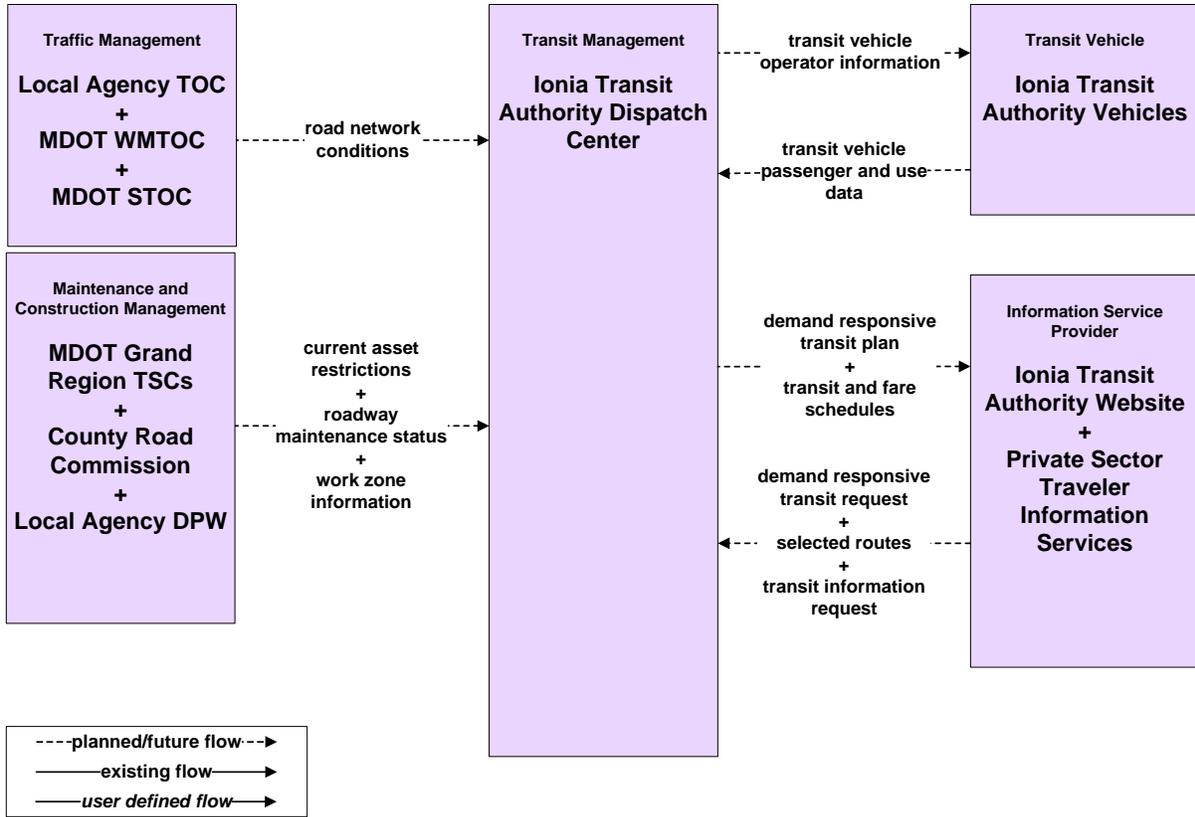
**APTS3 – Demand Response Transit Operations
Muskegon Area Transit System**



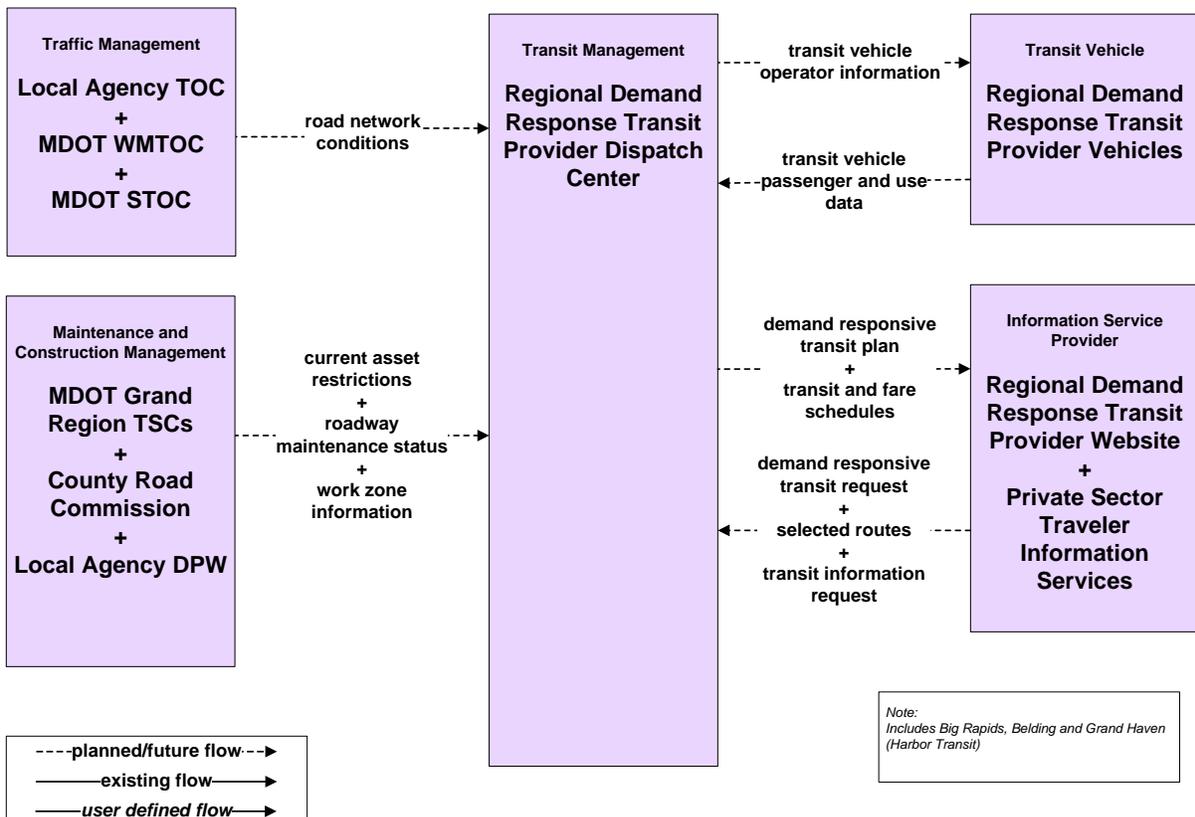
**APTS3 – Demand Response Transit Operations
Macatawa Area Express (MAX)**



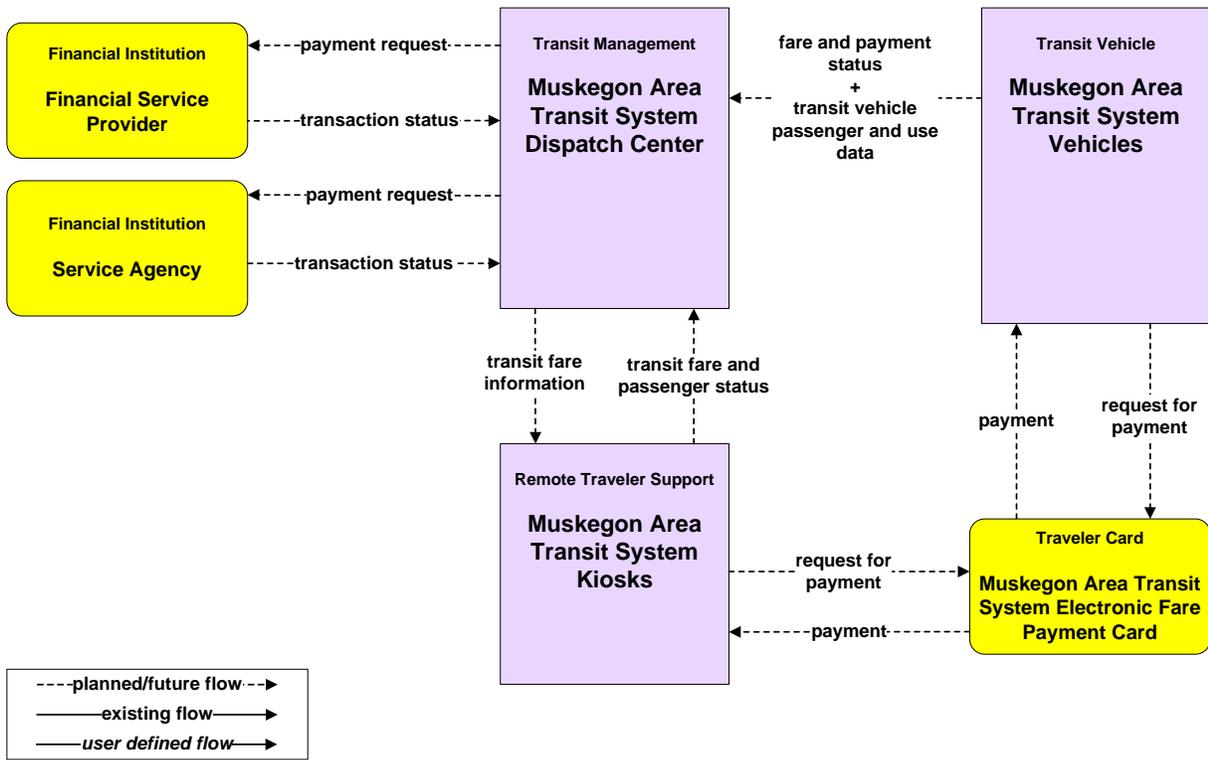
**APTS3 – Demand Response Transit Operations
Ionia Transit Authority**



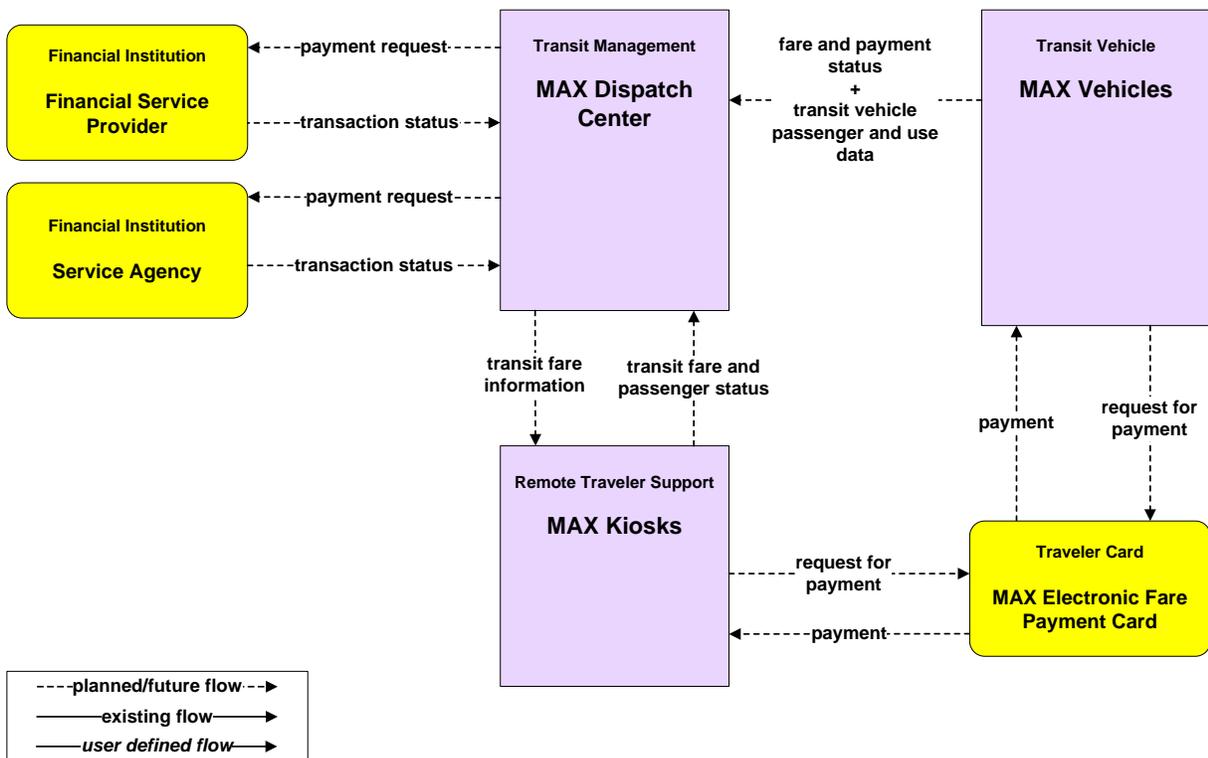
**APTS3 – Demand Response Transit Operations
Regional Demand Response Transit Provider**



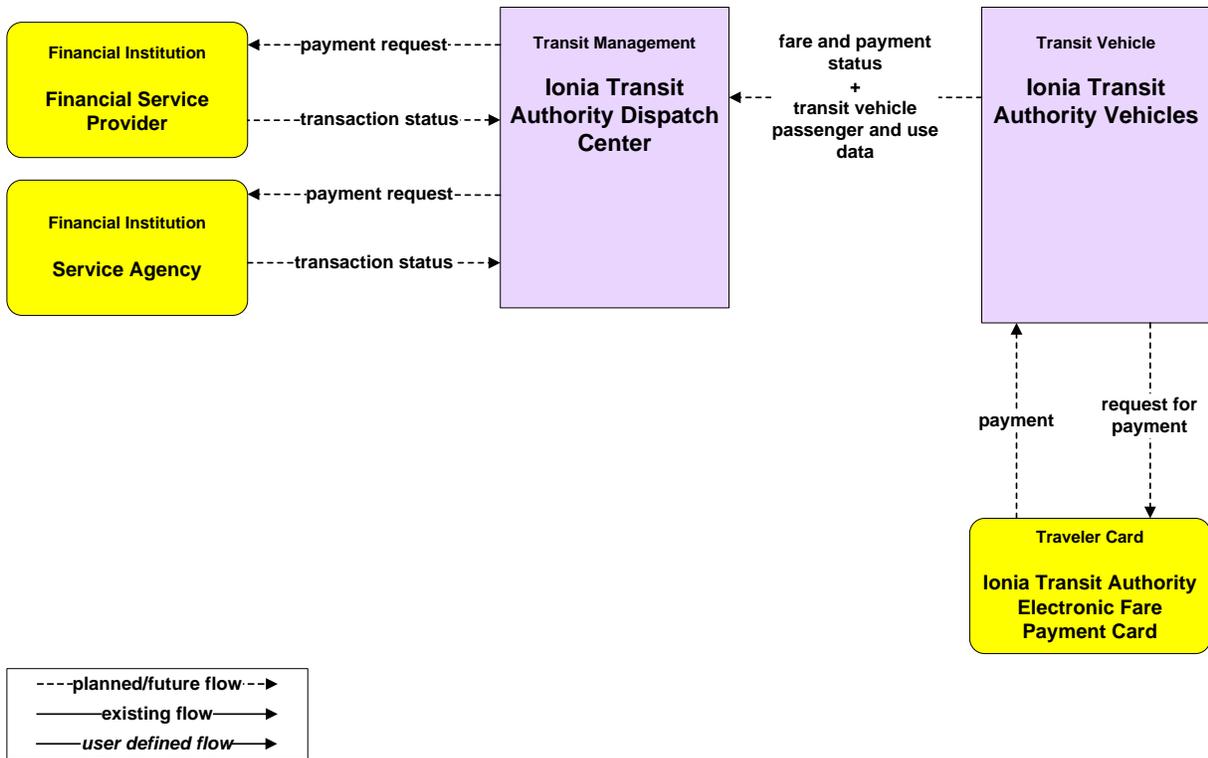
**APTS4 – Transit Passenger and Fare Management
Muskegon Area Transit System**



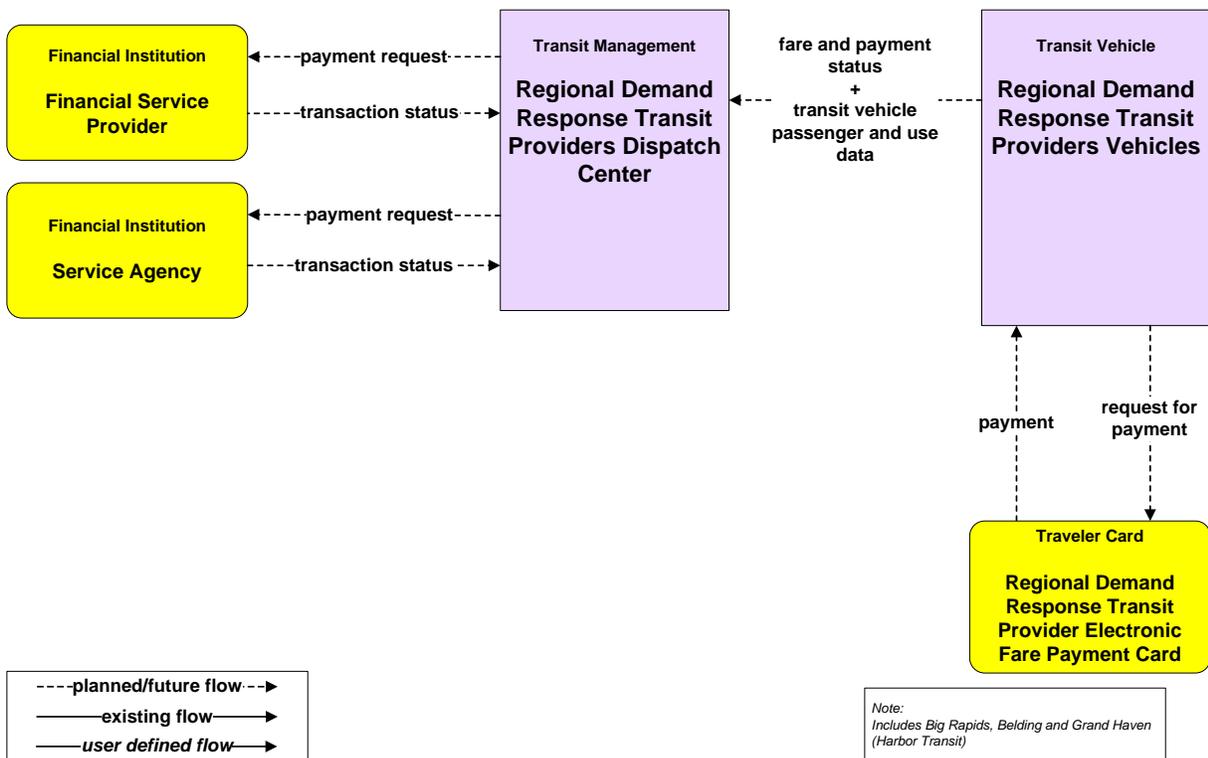
**APTS4 – Transit Passenger and Fare Management
Macatawa Area Express (MAX)**



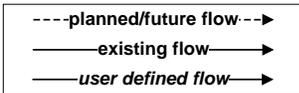
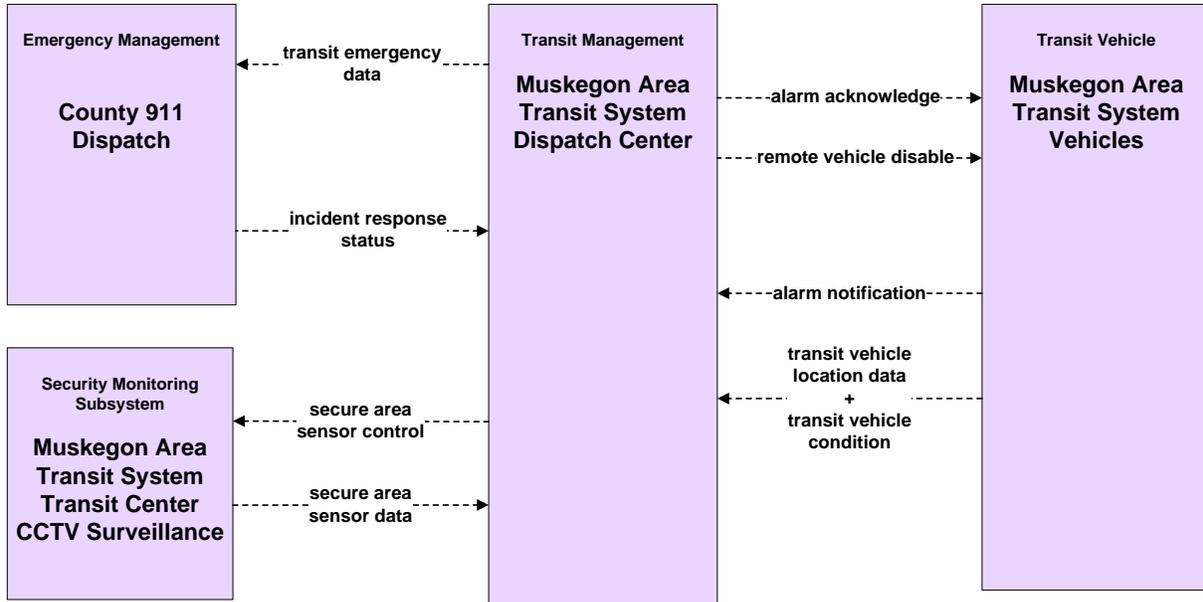
**APTS4 – Transit Passenger and Fare Management
Ionia Transit Authority**



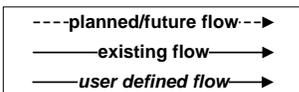
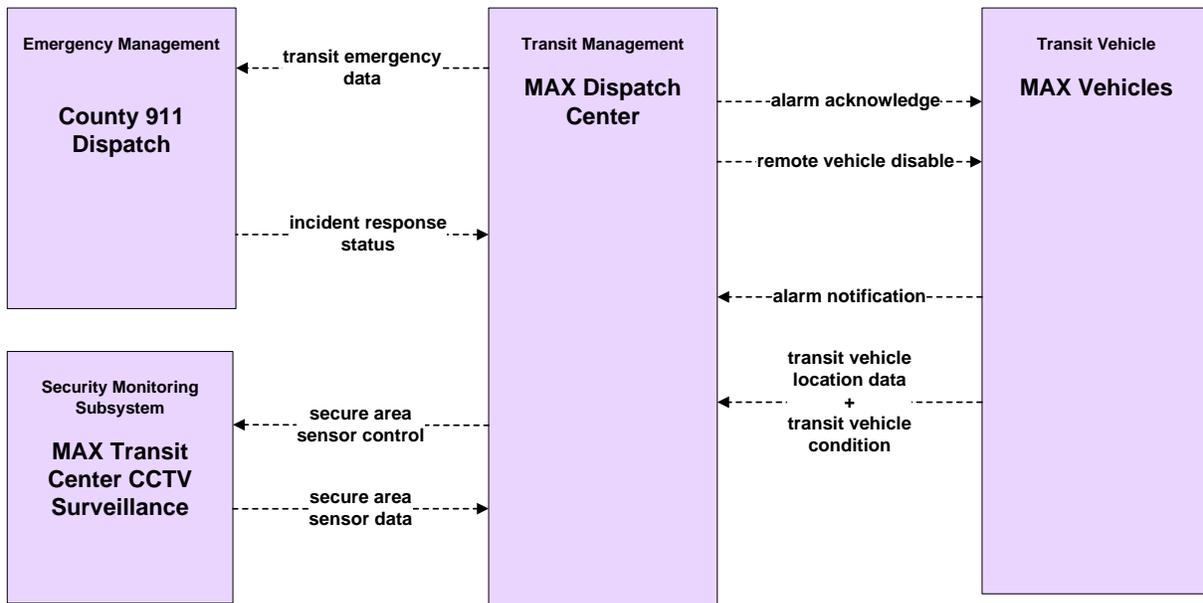
**APTS4 – Transit Passenger and Fare Management
Regional Demand Response Transit Providers**



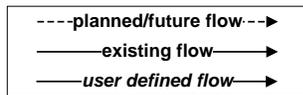
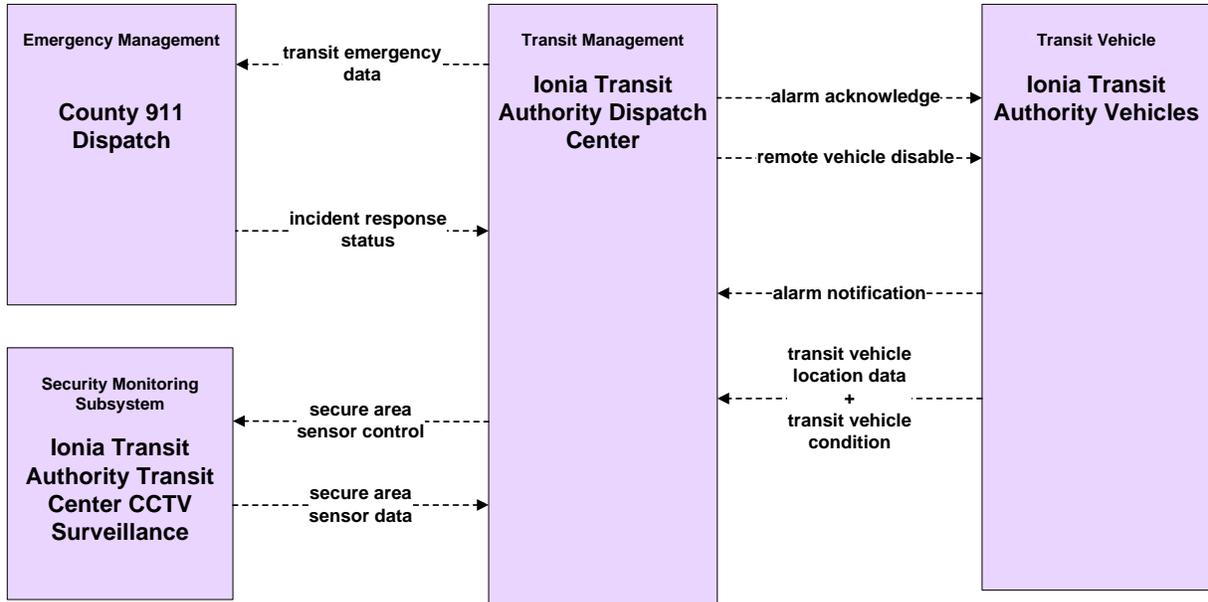
**APTS5 – Transit Security
Muskegon Area Transit System**



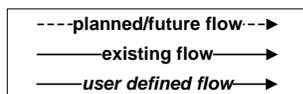
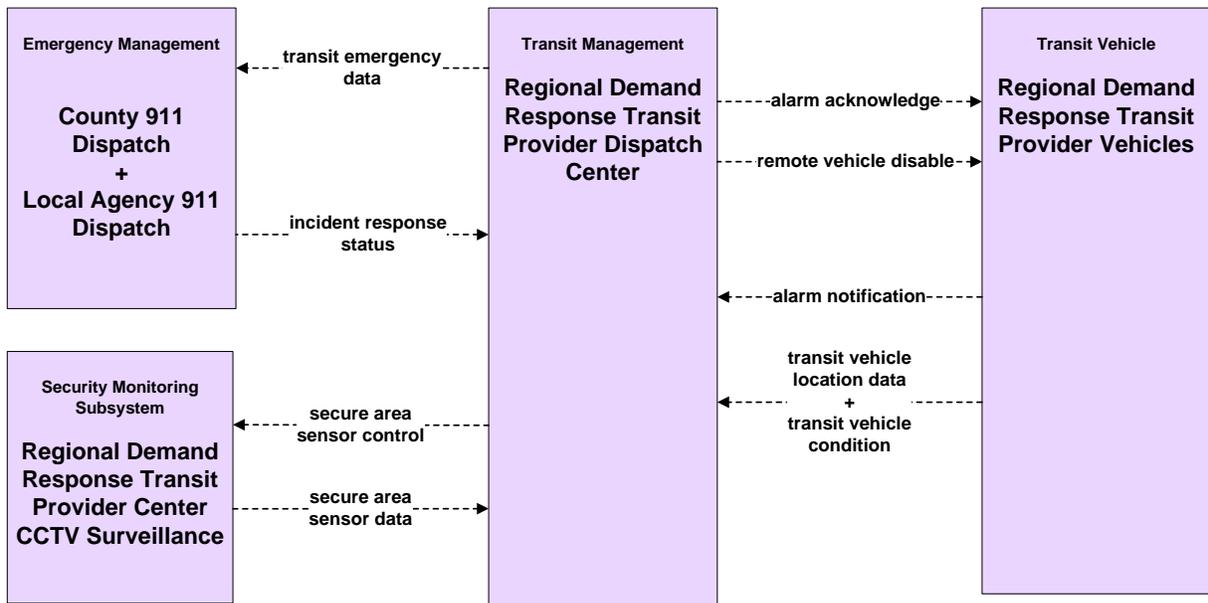
**APTS5 – Transit Security
Macatawa Area Express (MAX)**



**APTS5 – Transit Security
Ionia Transit Authority**

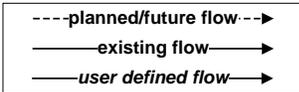
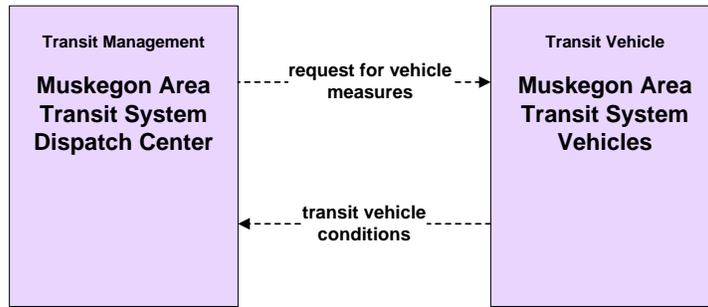


**APTS5 – Transit Security
Regional Demand Response Transit Providers**



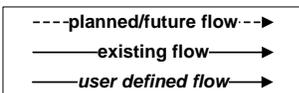
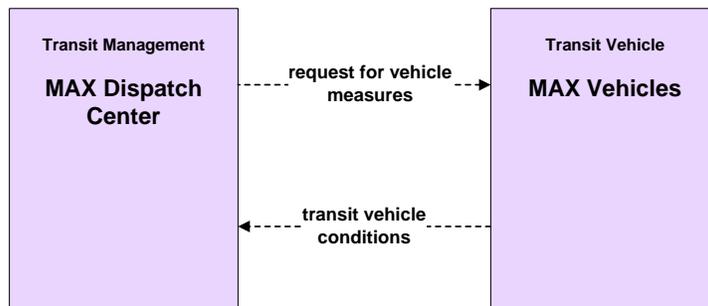
*Note:
Includes Big Rapids, Belding, and Grand Haven
(Harbor Transit)*

**APTS6 – Transit Maintenance
Muskegon Area Transit System**



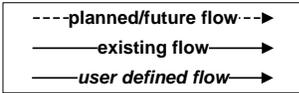
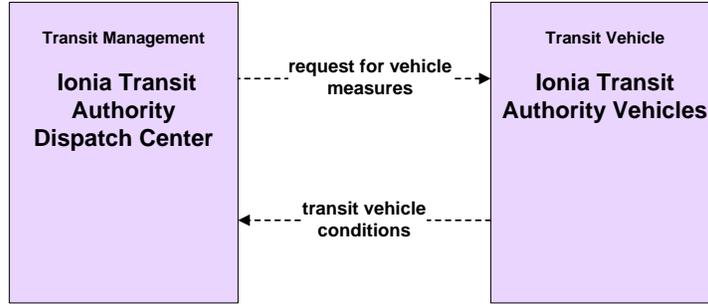
*Note:
Transit maintenance data will be collected at the maintenance garage at the end of the day rather than real-time.*

**APTS6 – Transit Maintenance
Macatawa Area Express (MAX)**



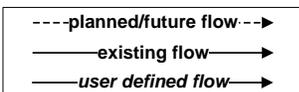
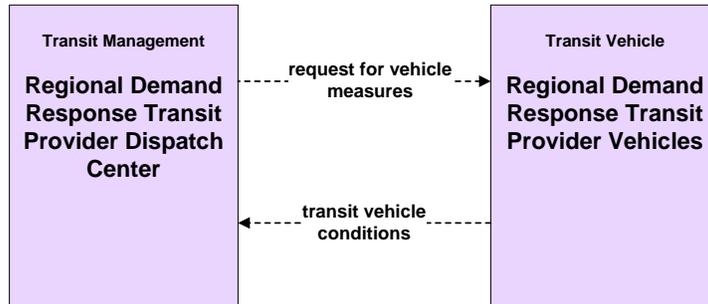
*Note:
Transit maintenance data will be collected at the maintenance garage at the end of the day rather than real-time.*

**APTS6 – Transit Maintenance
Ionia Transit Authority**



*Note:
Transit maintenance data will be collected at the maintenance garage at the end of the day rather than real-time.*

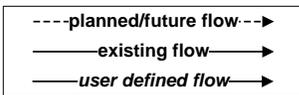
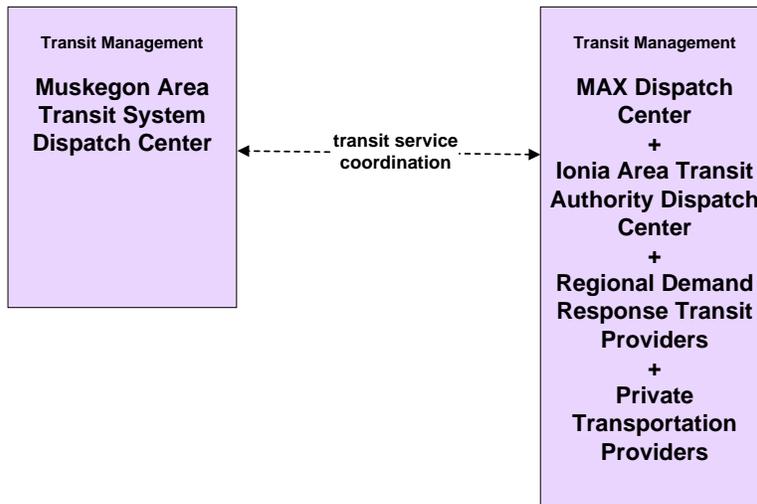
**APTS6 – Transit Maintenance
Regional Demand Response Transit Providers**



*Note:
Transit maintenance data will be collected at the maintenance garage at the end of the day rather than real-time.

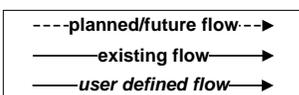
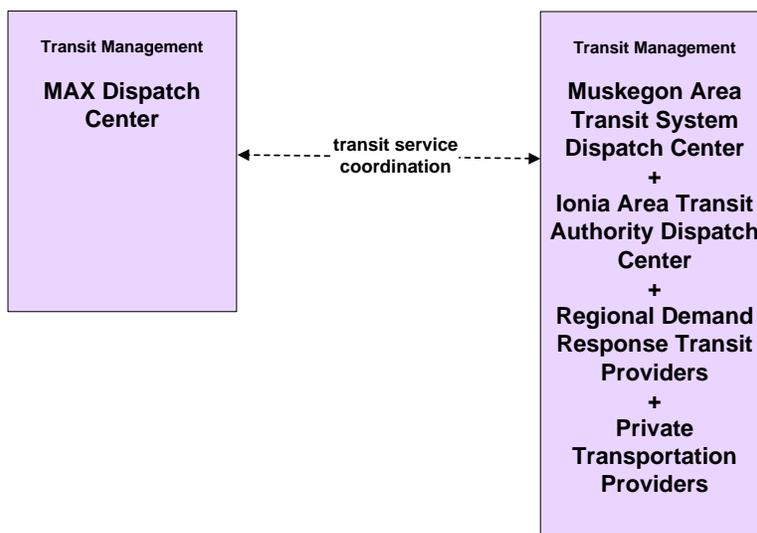
Includes Big Rapids, Belding and Grand Haven (Harbor Transit)*

**APTS7 – Multi-modal Coordination
Muskegon Area Transit System**



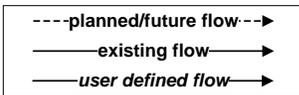
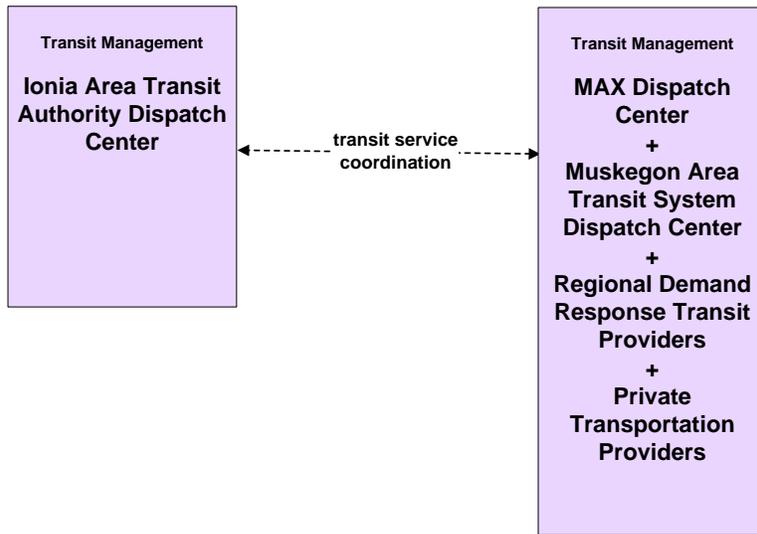
*Note:
Includes Demand Response Transit Agencies in
for Grand Haven (Harbor Transit).*

**APTS7 – Multi-modal Coordination
Macatawa Area Express (MAX)**

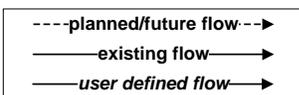
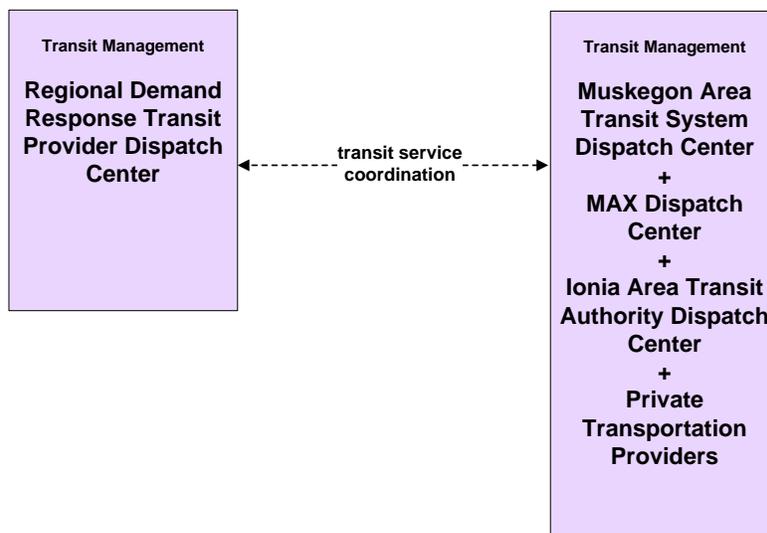


*Note:
Includes Demand Response Transit Agencies in
for Grand Haven (Harbor Transit).*

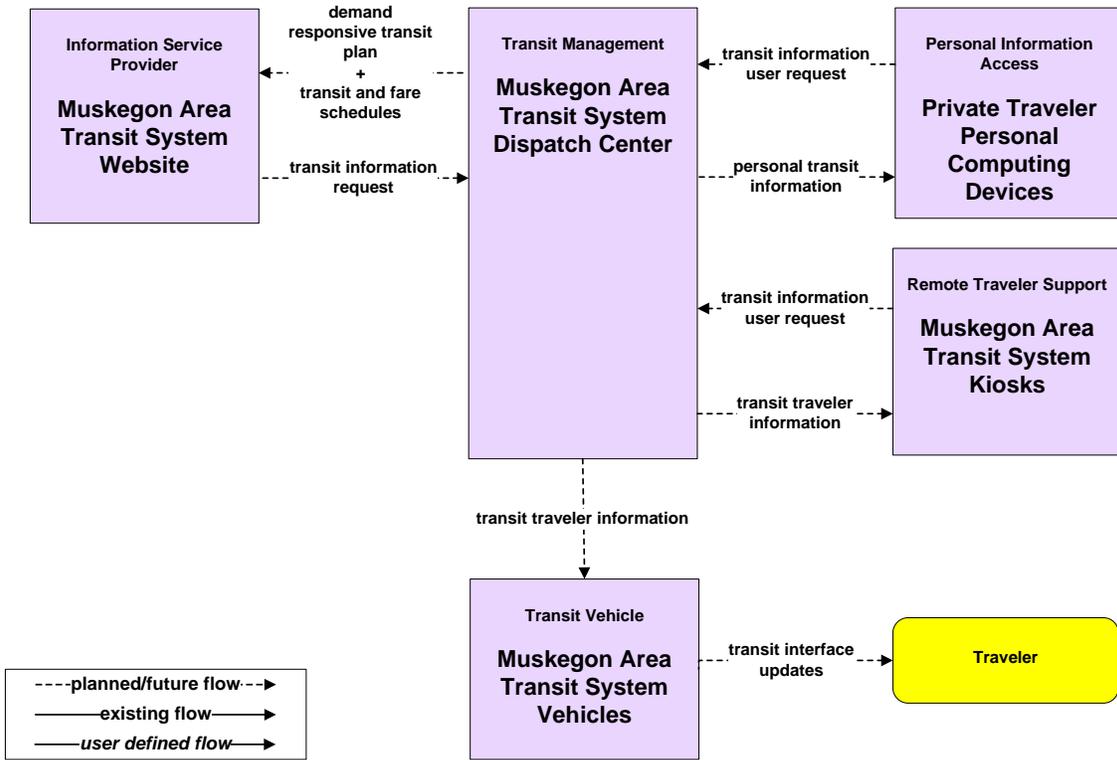
**APTS7 – Multi-modal Coordination
Ionia Area Transit Authority**



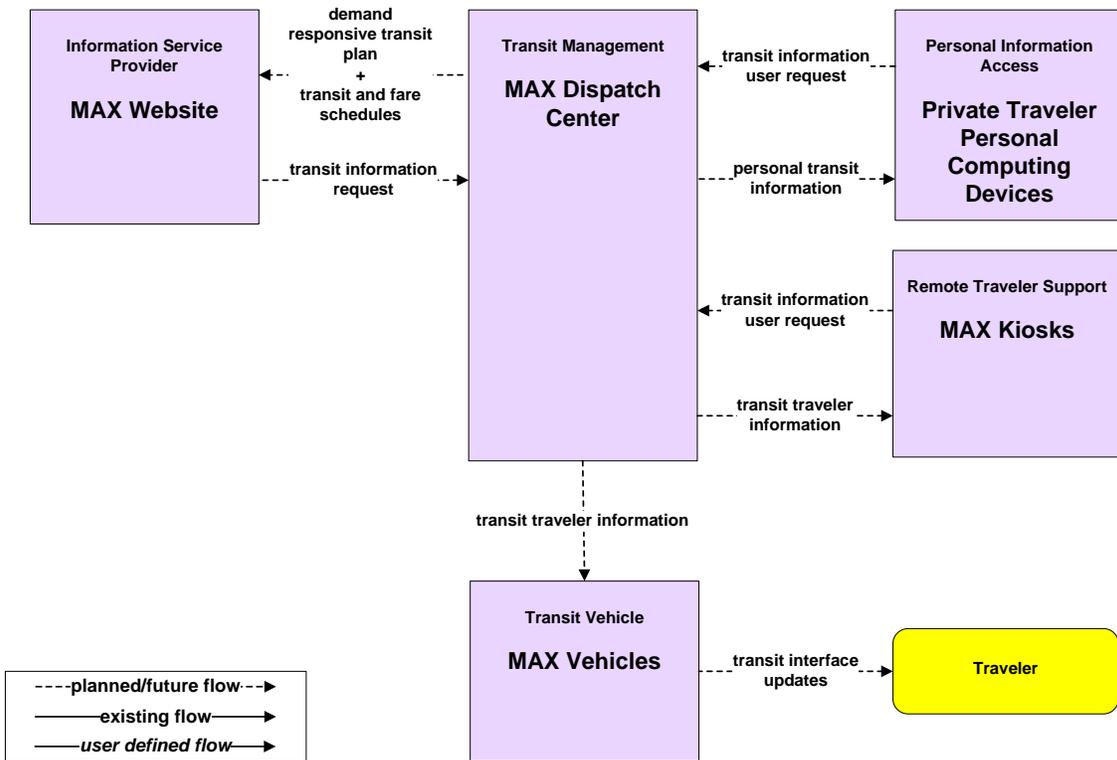
**APTS7 – Multi-modal Coordination
Regional Demand Response Transit Providers**



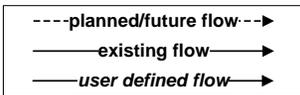
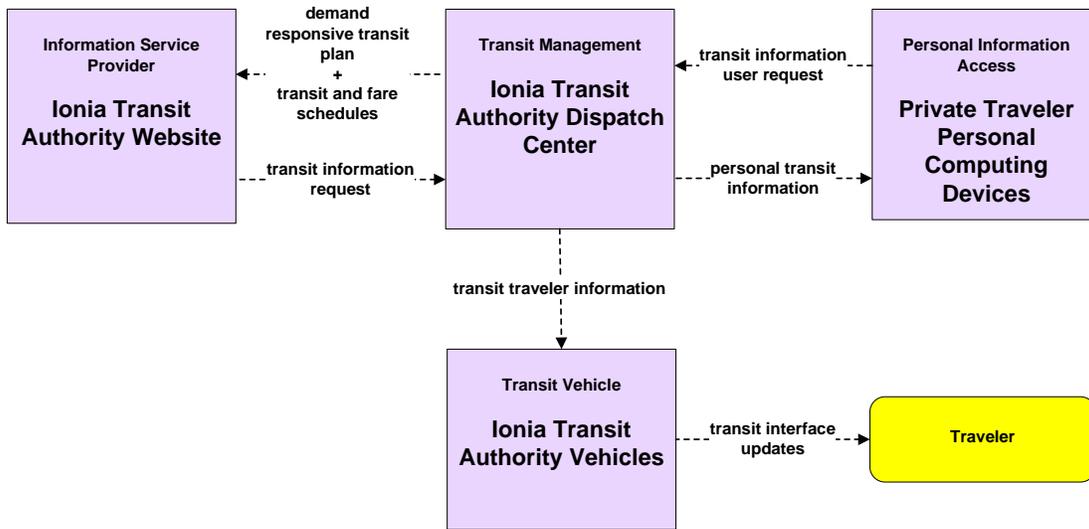
**APTS8 – Transit Traveler Information
Muskegon Area Transit System**



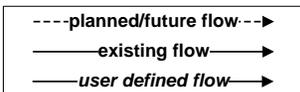
**APTS8 – Transit Traveler Information
Macatawa Area Express (MAX)**



**APTS8 – Transit Traveler Information
Ionia Transit Authority**

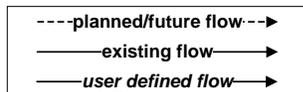
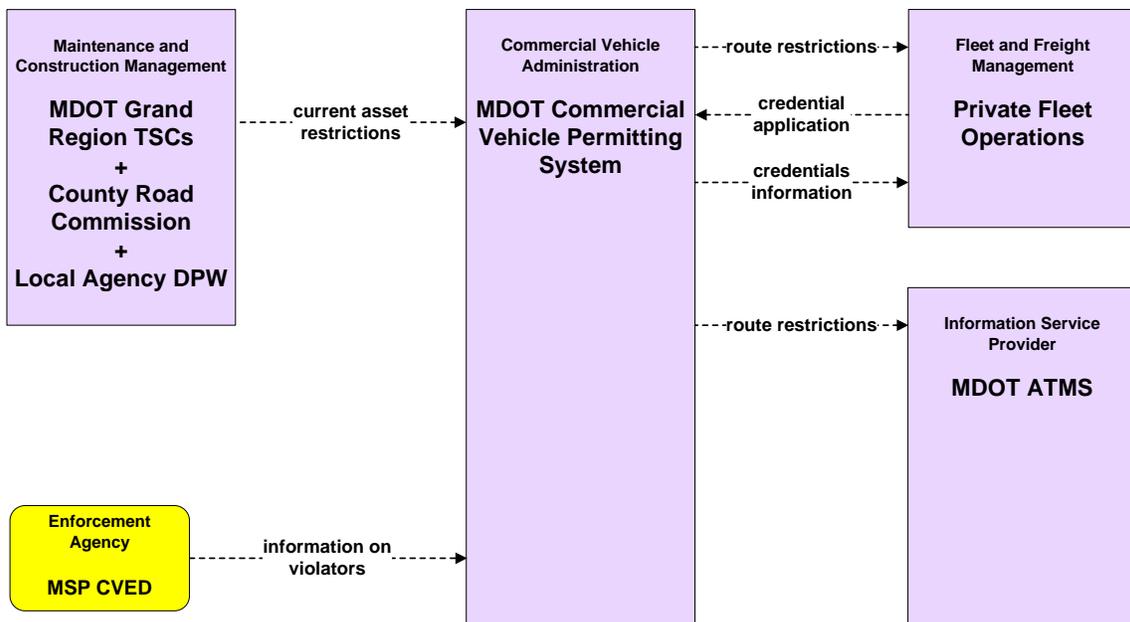


**APTS8 – Transit Traveler Information
Regional Demand Response Transit Providers**

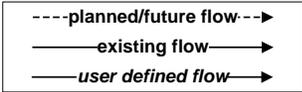
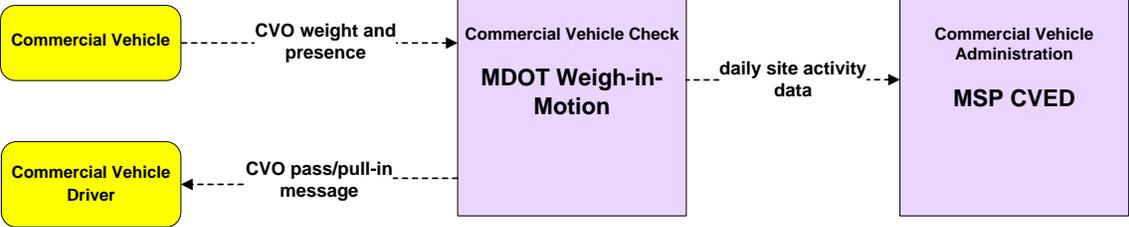


Commercial Vehicle Operations

CVO04 – CV Administration Process MDOT

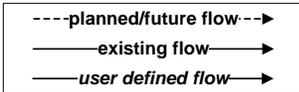
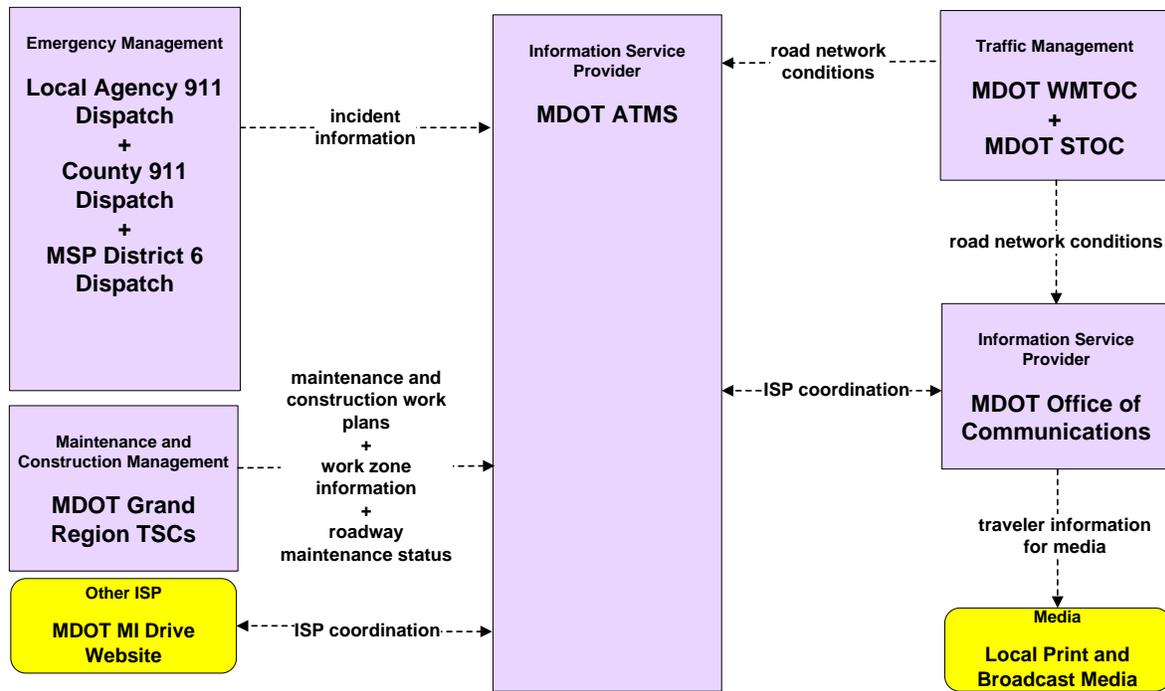


**CVO6 – Weigh-In-Motion
MDOT**

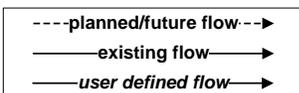
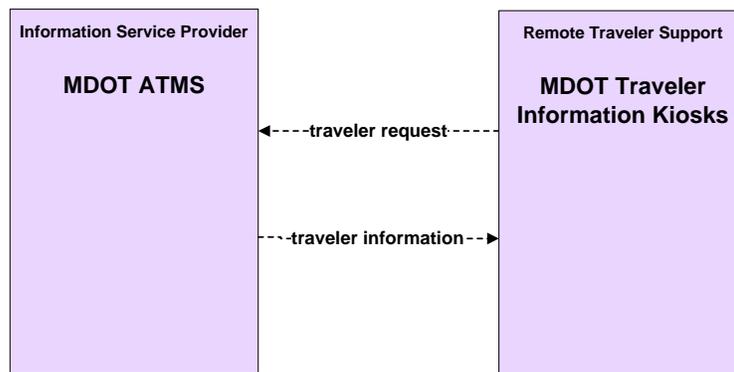


Advanced Traveler Information System

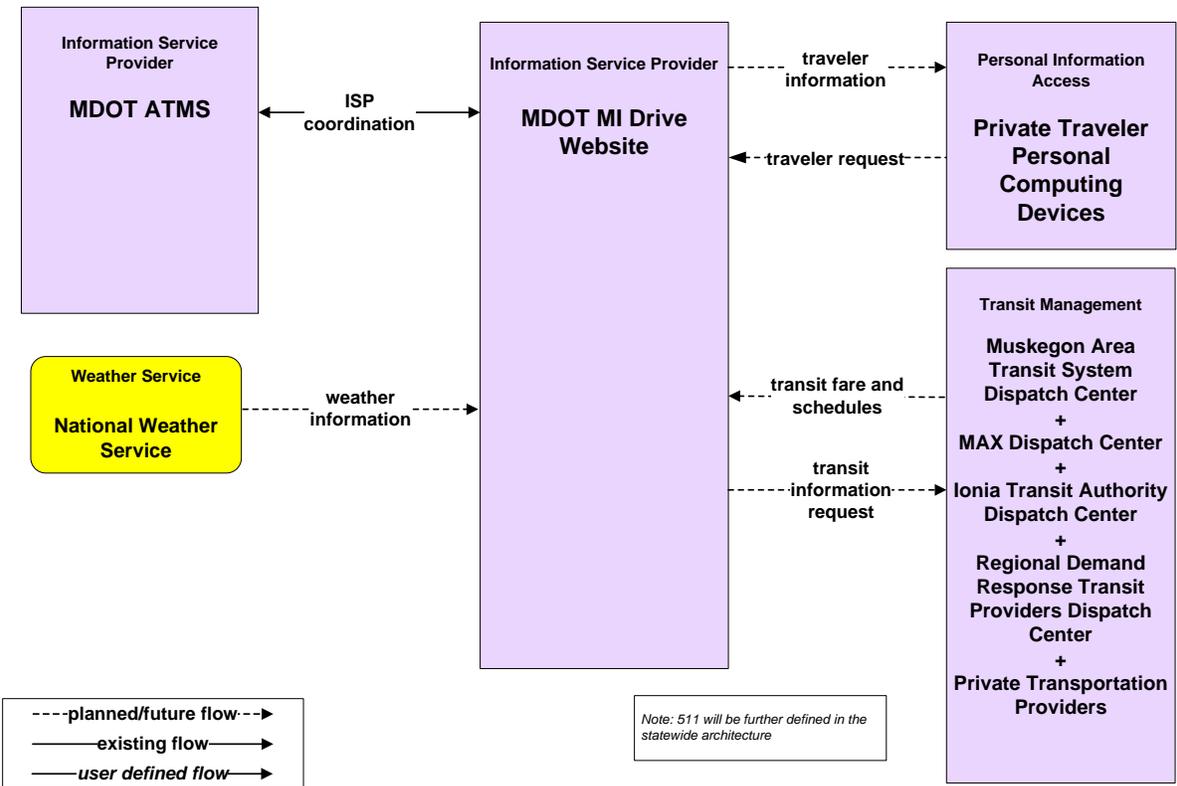
**ATIS1 – Broadcast Traveler Information
MDOT**



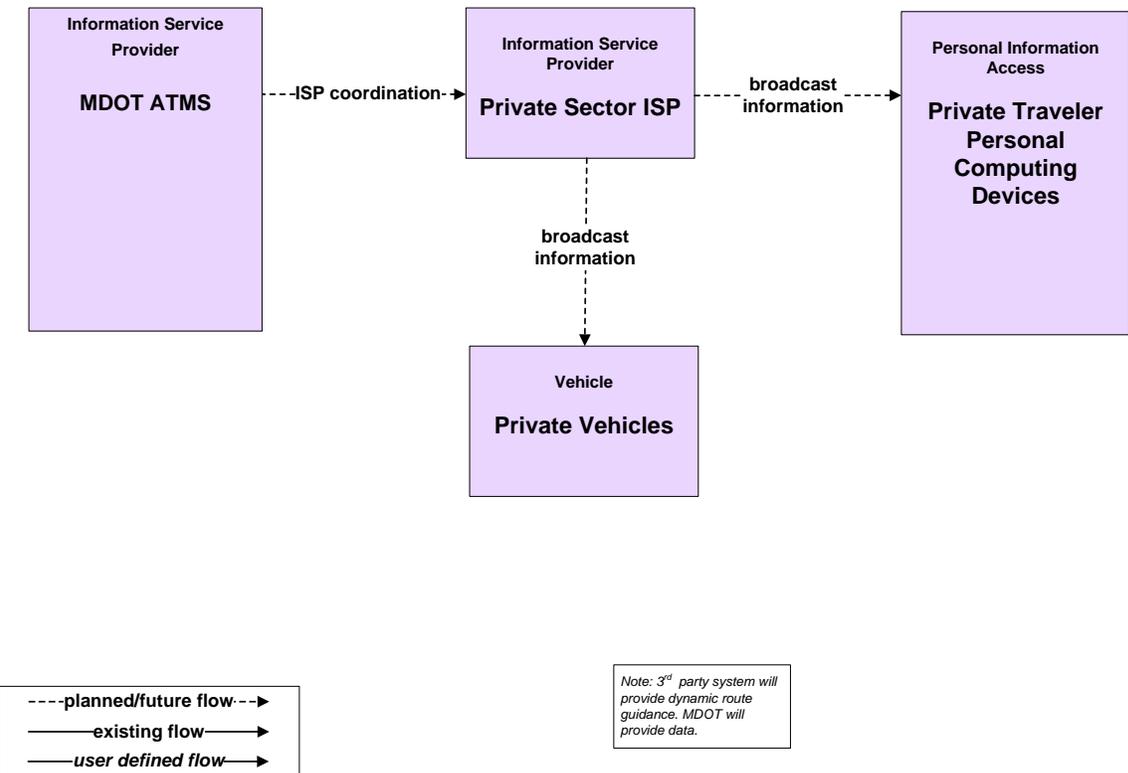
**ATIS2 – Interactive Traveler Information
MDOT**



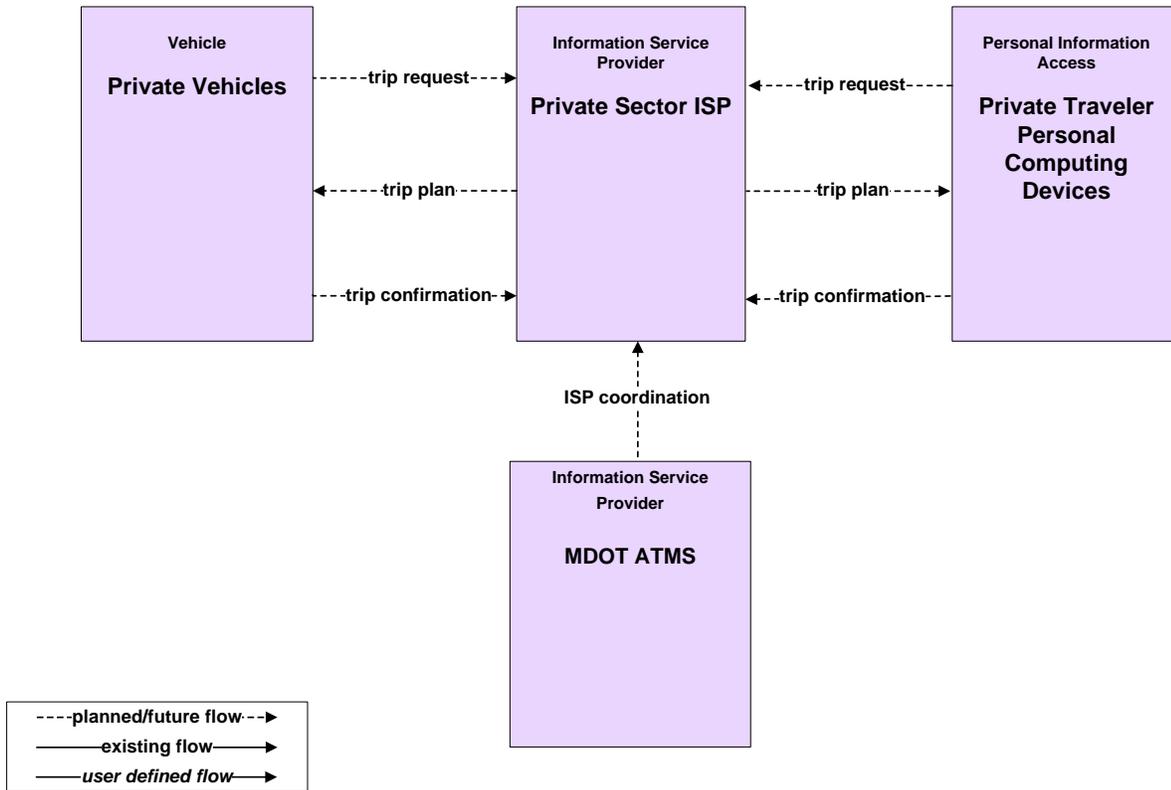
ATIS2 – Interactive Traveler Information MDOT



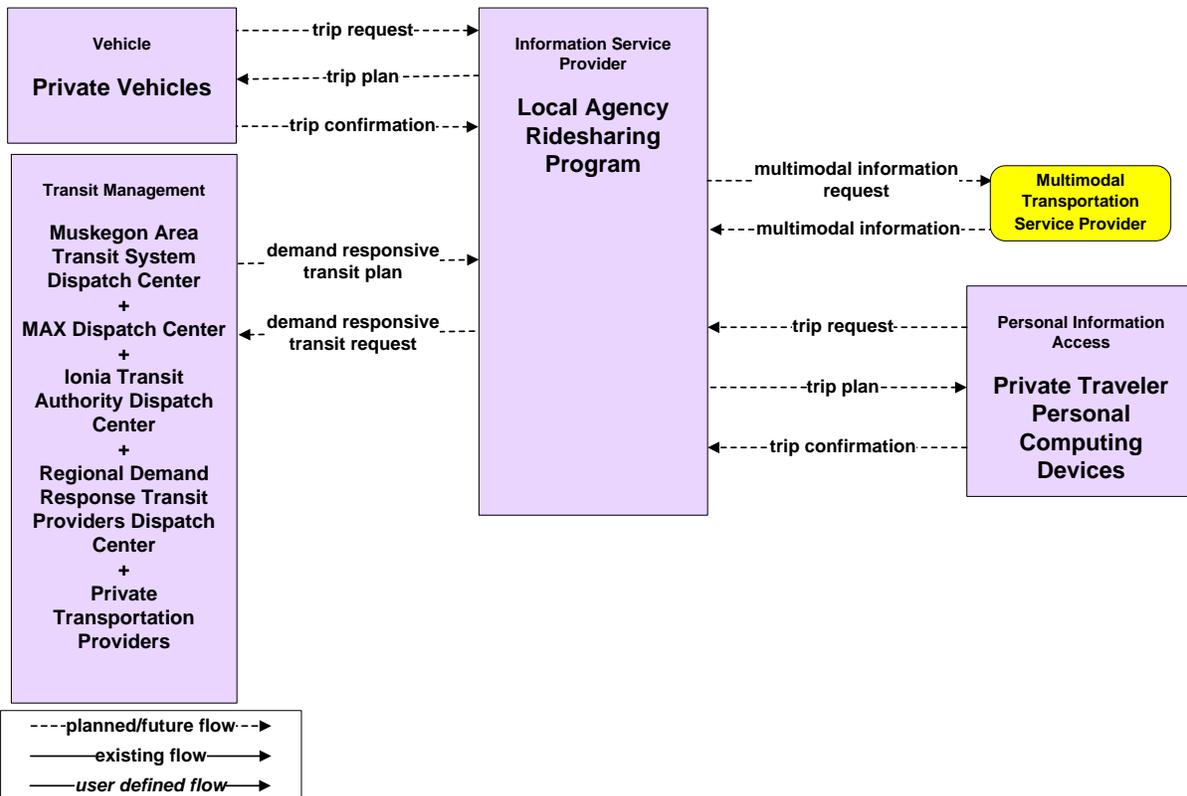
ATIS4 – Dynamic Route Guidance Private Sector ISP



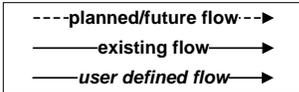
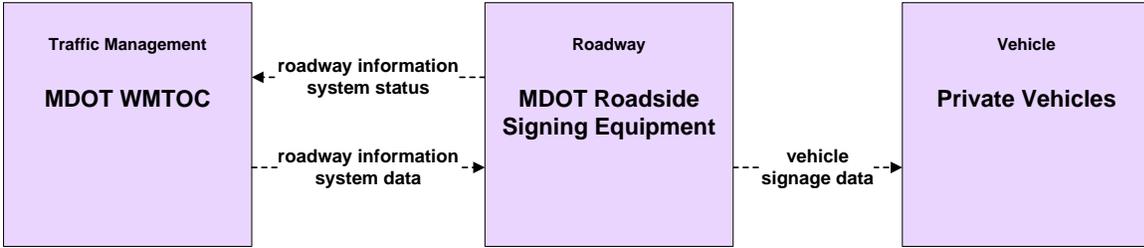
**ATIS5 – ISP Based Route Guidance
Private Sector ISP**



**ATIS8 – Dynamic Ridesharing
Local Agency**

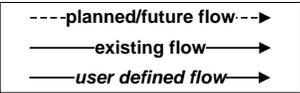
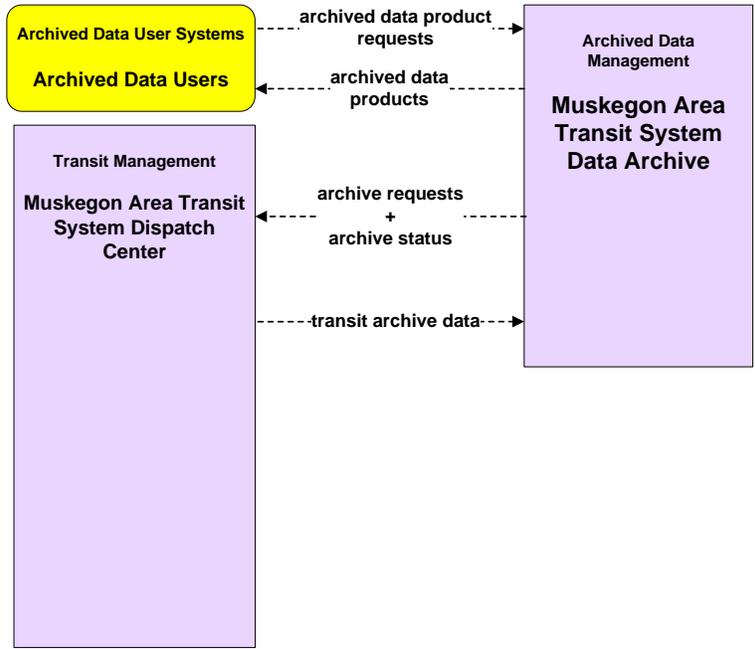


ATIS9 – In Vehicle Signing
MDOT

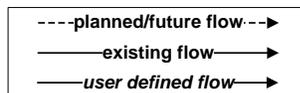
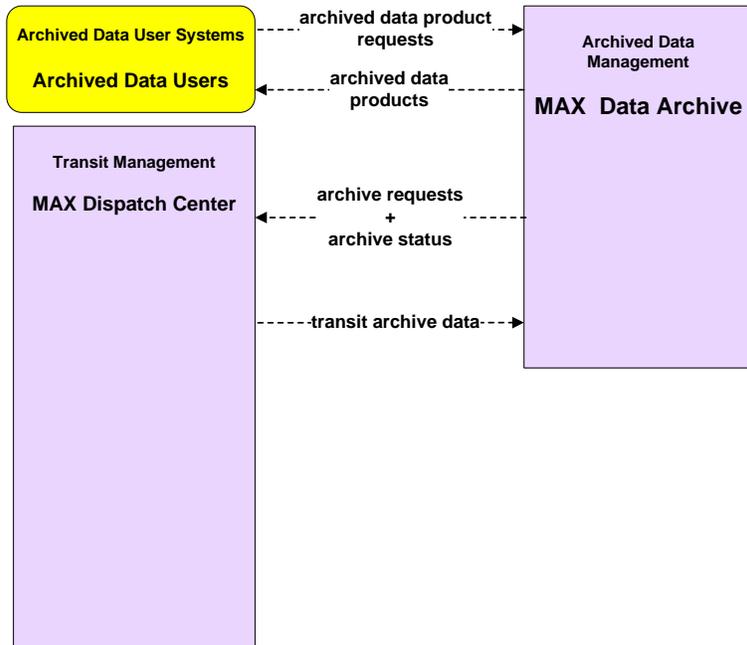


Archived Data

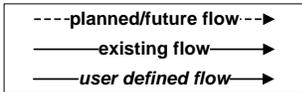
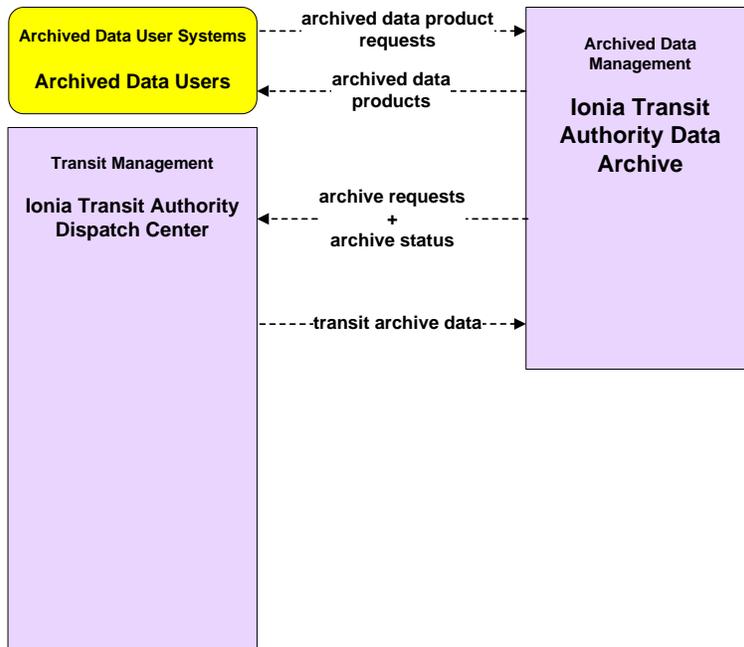
**AD1 – ITS Data Mart
Muskegon Area Transit System**



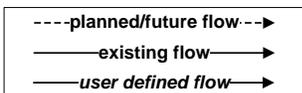
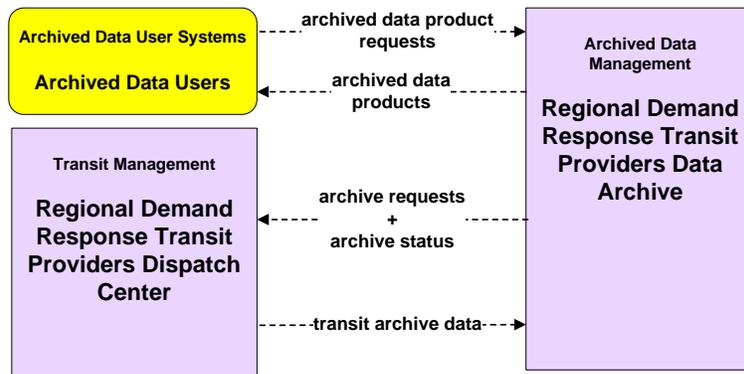
**AD1 – ITS Data Mart
Macatawa Area Express (MAX)**



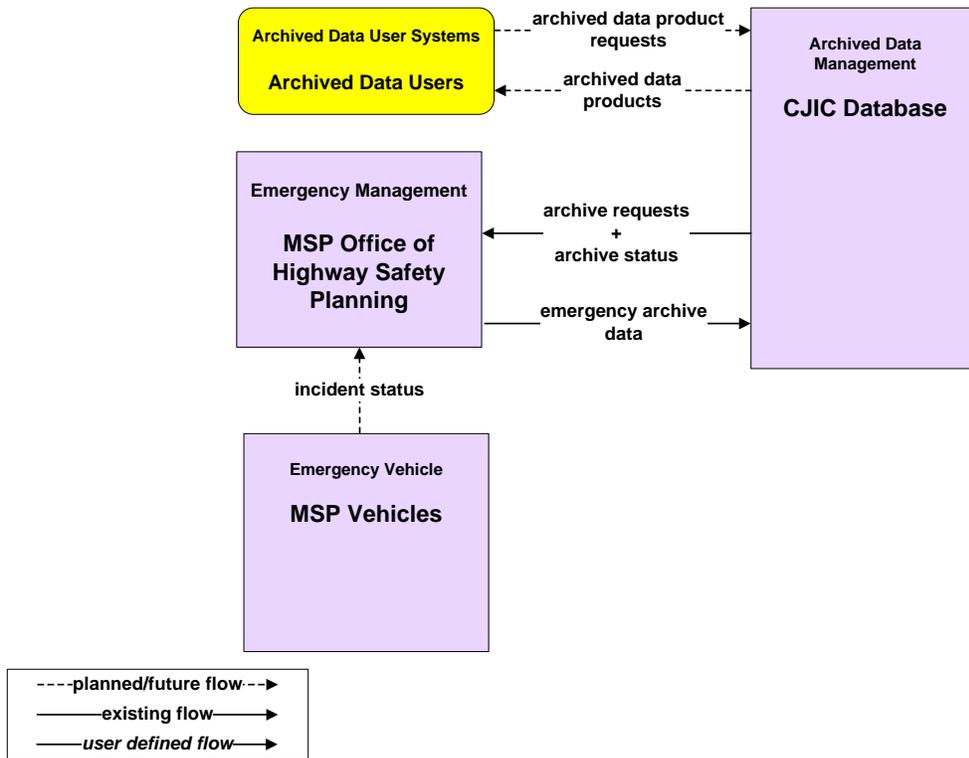
**AD1 – ITS Data Mart
Ionia Transit Authority**



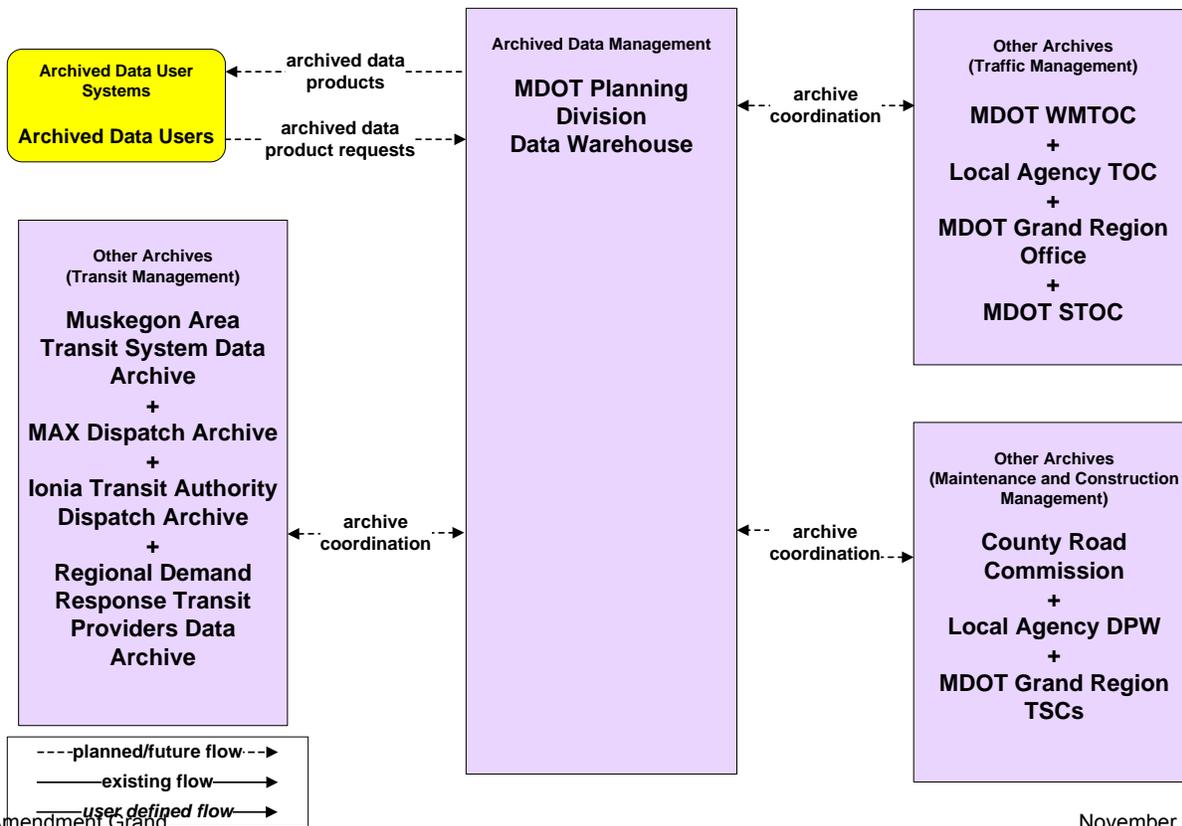
**AD1 – ITS Data Mart
Regional Demand Response Transit Providers**



**AD1 – ITS Data Mart
CJIC**

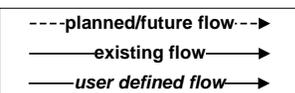
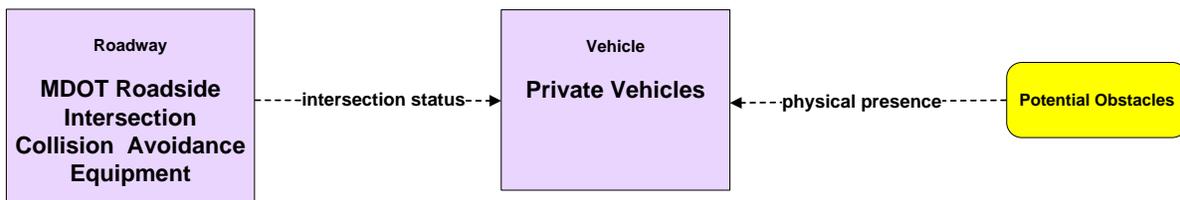


**AD3 – ITS Virtual Data Warehouse
MDOT**



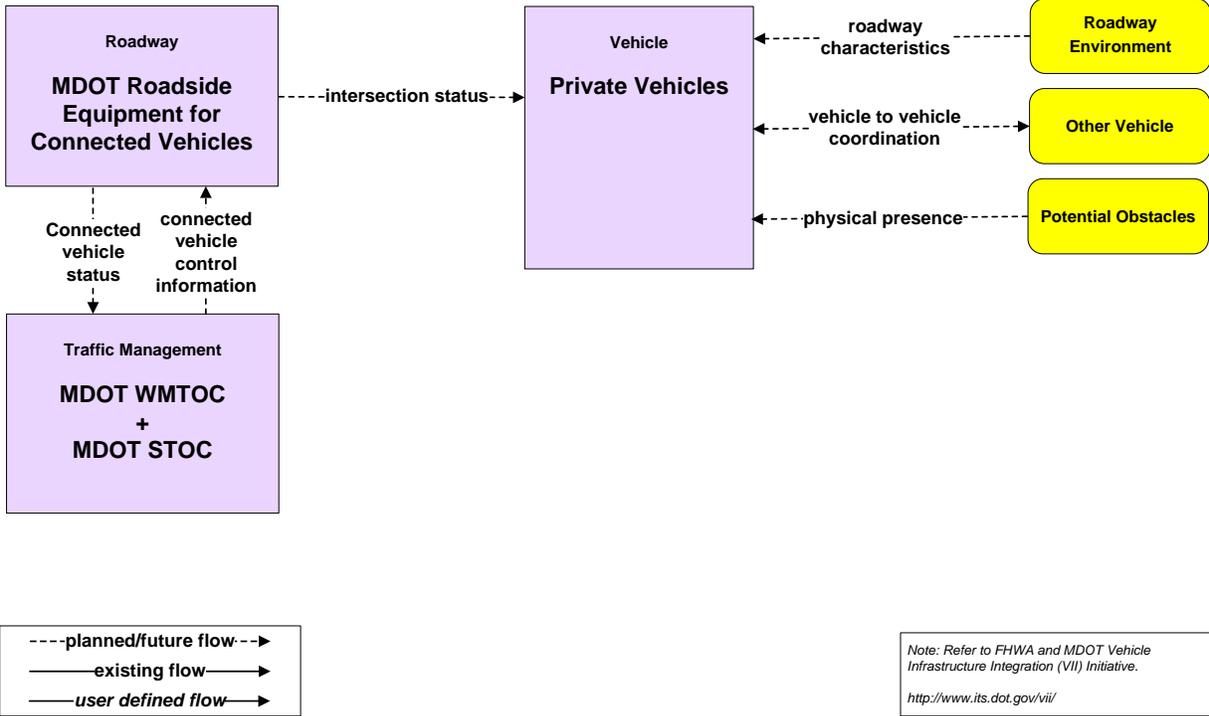
Advanced Vehicle Safety System

AVSS10 – Intersection Collision Avoidance MDOT



Note: Refer to FHWA Cooperative Intersection Collision Avoidance System (CICAS) initiative.
<http://www.its.dot.gov/cicas/index.htm>

**AVSS11 – Automated Highway System
MDOT**



**APPENDIX C – ARCHITECTURE CONFORMANCE AND MAINTENANCE
FORM**

REGIONAL ITS ARCHITECTURE CONFORMANCE AND MAINTENANCE DOCUMENTATION FORM

Please complete the following questionnaire to document conformance or changes for the Regional ITS Architecture. Modifications will be made during the next architecture update.

AGENCY

AGENCY CONTACT PERSON

STREET ADDRESS

CITY

STATE

ZIP CODE

TELEPHONE

FAX

E-MAIL

PROJECT INFORMATION

PROJECT NAME

PROJECT DESCRIPTION

PROJECT SPONSOR (Agency providing funds)

ESTIMATED COST

DEPLOYMENT PLAN PROJECT NUMBER (if applicable)

MDOT OR LOCAL AGENCY PROJECT NUMBER (if applicable)

MDOT JOB NUMBER (if applicable)

MDOT CONTROL SECTION (if applicable)

REGION

CONFORMANCE TO REGIONAL ITS ARCHITECTURE

- This project conforms to the existing Regional ITS Architecture. No changes are required.
- This project does not conform to the existing Regional ITS Architecture. Requested changes are noted in the next section.

CHANGE INFORMATION

Please indicate the type of change:

- Level 1: Basic changes that does not affect the structure of the architecture. Examples include: Changes to the 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 your 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, incorporation of a new stakeholder into the architecture.

DESCRIBE REQUESTED CHANGE

IF THE PROPOSED CHANGE IMPACTS ANY MARKET PACKAGES, LIST THOSE MARKET PACKAGES (NOTE: If the proposed change involves creating or modifying a market package please attach a sketch of the new or modified market package.)

IF THE PROPOSED CHANGE AFFECTS ANY STAKEHOLDERS, LIST THOSE STAKEHOLDERS

IF COORDINATION WITH IMPACTED STAKEHOLDERS HAS OCCURRED, DESCRIBE THE RESULTS

<input type="checkbox"/> Approved by regional contact	REGIONAL CONTACT NAME	DATE
<input type="checkbox"/> Approved by ITS Program Office	ITS PROGRAM OFFICE NAME	DATE
<input type="checkbox"/> Forwarded to FHWA		DATE

Please submit change forms to:
MDOT-ITS@mdot.gov

Transit-related projects should also be sent to:
MDOT – Bureau of Passenger Transportation and
Federal Transit Authority (FTA)

Process for Documenting Regional ITS Architecture Conformance and Maintenance

- The project manager evaluates the projects conformance to the Regional ITS Architecture.
- The project manager then completes the architecture conformance and maintenance documentation form and submits it to ITS Program Office.
- If the form is approved by the ITS Program Office, it is then submitted to the FHWA, the regional contact, the project manager and if applicable, the corresponding Metropolitan Planning Organization (MPO).
- If the form is rejected, the ITS Program Office coordinates with the project manager and the regional contact to then re-submit the new form for approval.
- To request a new form Contact your business area Forms Coordinator or Connie Bretes, MDOT FMO at (517) 335-2520.