



Amendment to the

Regional ITS Architecture

Bay Region

July 2014 | Version 1

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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 Bay 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 Bay Region ITS Architecture focuses on the following:

- Format changes – conforming the Bay 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 Bay 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 Bay Region.

2 – Administrative Update Process

This section highlights the process taken to develop the Amendment to the Bay 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 Bay 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 Bay Region's geographic boundary includes the same boundary as MDOT Bay Region with the addition of Shiawassee County from the University Region. The geographical location of Shiawassee County and the similarity in needs to the Bay Region supported the decision to include it within this administrative update. The previous iteration of regional ITS architectures included Shiawassee County within the Southwest Regional ITS Architecture and Deployment Plan. The updated boundary for the Bay 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 1.4.2 of the Bay Region ITS Architecture (2008).

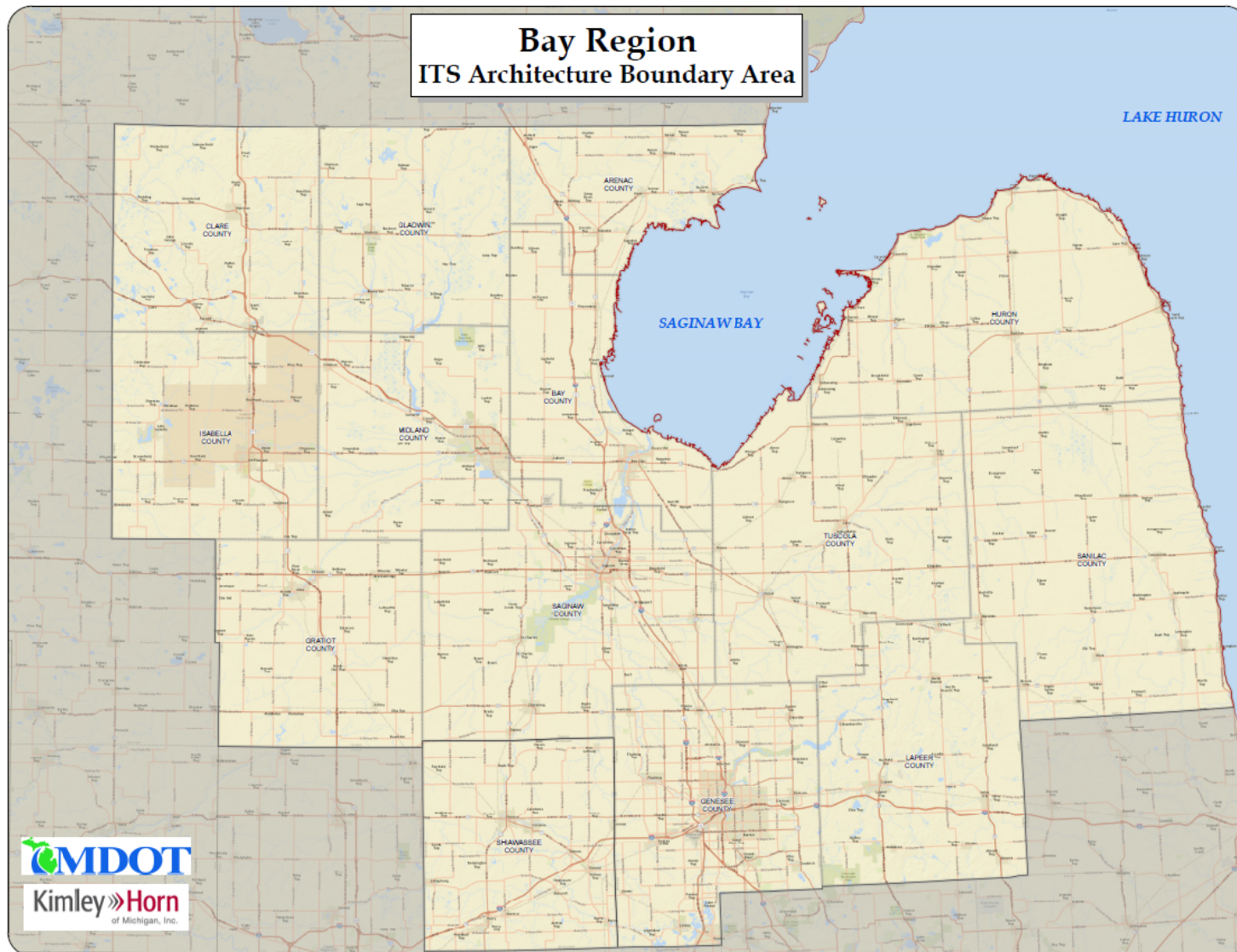


Figure 1. Bay Region ITS Architecture Boundary Area

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 Bay 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 Bay Regional ITS Architecture Document and Bay Regional Turbo Architecture database.

Figure 2 below illustrates the process followed.

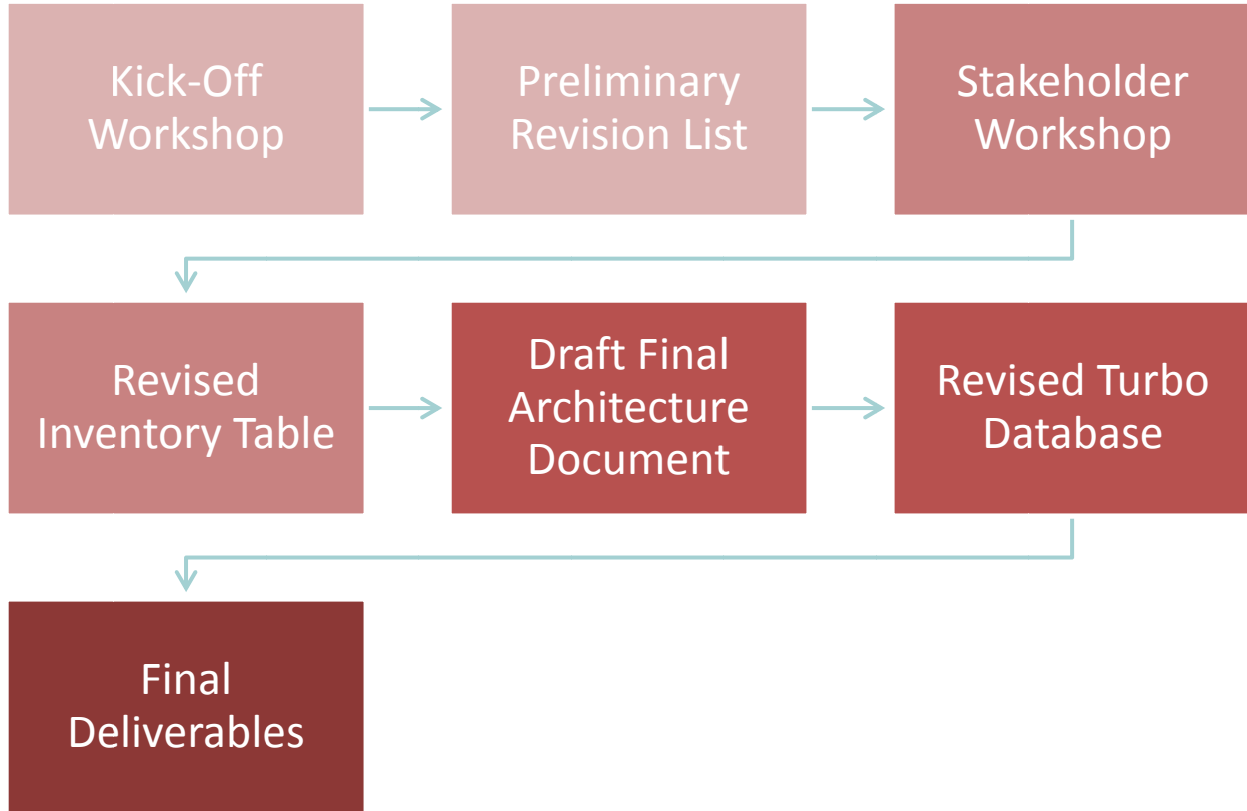


Figure 2. ITS Architecture Administrative Update Process

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 Bay 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 Bay 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 Bay Region, including Shiawassee County. 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. Bay Region Stakeholders

Organization	Name		Email
Arenac County Road Commission	Blair	Dyer	BDyerACRC@Centurytel.net
Bay City Area Transportation Study (BCATS) - Bay County	Dave	Engelhardt	engelhardtd@baycounty.net
Bay County Road Commission	James	Lillo	jlillo@baycoroad.org
Bay Metro Transit	Eric	Sprague	esprague@baymetro.com
Clare County Road Commission	Ronald	Bushong	rbushong@clarecrc.com
ECMPDR (Regional Planning Commission)	Anamika	Laad	alaad@emcog.org
FHWA - Michigan	Morrie	Hoevel	Morris.Hoevel@dot.gov
Genesee Co MPC	Jacob	Maurer	Jmaurer@co.genesee.mi.us
Genesee County Metropolitan Planning Commission	Damon	Fortney	dfortney@co.genesee.mi.us
Genesee County Metropolitan Planning Commission	Sharon	Gregory	sgregory@co.genesee.mi.us
Genesee County Metropolitan Planning Commission	Jason	Nordberg	jnordberg@co.genesee.mi.us
Genesee County Road Commission	Felicia	Ivey	fivey@gcrc.org
Genesee County Road Commission	Kenneth	Johnson	kjohnson@gcrc.org
Genesee County Road Commission	Ron	Latimer	rlatimer@gcrc.org

Organization	Name		Email
Genesee County Road Commission	Bonnie	Wood	bwood@gcrc.org
Gratiot County Road Commission	Ray	Welke	ray@gratiotroads.org
Isabella County Road Commission	Tony	Casali	tcasali@isabellaroads.com
Lapeer Intermediate School District	Chuck	Madden	cmadden@lcisd.k12.mi.us
Mass Transit Authority	Edward	Benning	ebenning@mtaflint.org
MDOT	Travis	Phillips	PhillipsT3@michigan.gov
MDOT	Kimberly	Zimmer	ZimmerK@michigan.gov
MDOT - Bay Region Construction	Gregg	Brunner	brunnerg@michigan.gov
MDOT - Bay Region Construction	Selena	Friend	friends@michigan.gov
MDOT - Bay Region Construction	Duane	Maas	maasd@michigan.gov
MDOT - Bay Region Planning	Jay	Reithel	reithelj@michigan.gov
MDOT - Central Maintenance	Tim	Croze	CrozeT@michigan.gov
MDOT - Davison TSC	Keith	Brown	Brownk4@michigan.gov
MDOT - Davison TSC	Linda	Burchell	burchelll@michigan.gov
MDOT - Davison TSC	Jackie	Pethers	PethersJ@michigan.gov
MDOT - Davison TSC	Annette	Shelton	Sheltona1@michigan.gov
MDOT - ITS Program Office	Luke	Biernbaum	biernbaum@michigan.gov
MDOT - ITS Program Office	Collin	Castle	CastleC@michigan.gov
MDOT - ITS Program Office	Elise	Kapphahn	kapphahnE@michigan.gov
MDOT - Lansing TSC	Josh	Carey	CareyJ2@michigan.gov
MDOT - Lansing TSC	John	Engle	EngleJ1@michigan.gov
MDOT - Lansing TSC	Tom	Fisher	FisherT1@michigan.gov
MDOT - University Region	Stephanie	Palmer	palmers3@michigan.gov
Midland Area Transportation Study	Maja	Bolanowska	info@midlandmpo.com
Midland County Road Commission	Deepak	Gupta	gupta@midlandroads.com
Saginaw County MPO	Doug	Bell	dbell@saginawcounty.com
Saginaw County Road Commission	Joe	Wisniewski	wisniewskij@scrc-mi.org
Saginaw Metropolitan Area Transportation Study (SMATS) and SCMPC	Phil	Grimaldi	pgrimaldi@saginawcounty.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 MBA TOC are existing elements, but currently the flow of information between the elements are not automated, so this is considered a planned flow.

Table 2. Bay Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Bay Metro Transit Authority	Bay Metro Transit Authority CCTV Surveillance	CCTV surveillance at the Bay Metro Transit Authority Center.	Planned				X				
	Bay Metro Transit Authority Data Archive	The transit data archive for the Bay Metro Transit Authority. Used by FTA and MDOT Office of Passenger Transportation	Planned							X	
	Bay Metro Transit Authority Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Bay Metro Transit Authority.	Existing	X	X	X	X		X	X	
	Bay Metro Transit Authority Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned				X				
	Bay Metro Transit Authority 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				
	Bay Metro Transit Authority Vehicles	Transit Vehicles owned by Bay Metro Transit Authority	Existing				X				
	Bay Metro Transit Authority Website	Website with information about fares and schedules.	Existing				X				
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				X				
Flint-Mass Transportation Authority	Flint-Mass Transportation Authority CCTV Surveillance	CCTV surveillance at the Flint-Mass Transportation Authority Center.	Planned				X				

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Flint-Mass Transportation Authority	Flint-Mass Transportation Authority Control Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Flint-Mass Transportation Authority.	Existing	X	X	X	X		X	X	
	Flint-Mass Transportation Authority Data Archive	The transit data archive for the Flint Mass Transportation Authority. Used by FTA and MDOT Office of Passenger Transportation	Planned							X	
	Flint-Mass Transportation Authority Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned				X				
	Flint-Mass Transportation Authority 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				
	Flint-Mass Transportation Authority Vehicles	Transit Vehicles owned by Flint Mass Transportation Authority. Includes the ITS equipment installed on the vehicles (automatic vehicle location (AVL) systems, on-board mobile data terminals (MDT), and automatic passenger counters (APC).	Existing				X				
	Flint-Mass Transportation Authority Website	Website with information about fares and schedules.	Planned				X				
Genesee County Road Commission (GCRC)	GCRC TOC	CRC Traffic Operations Center responsible for municipal signal system operations.	Existing	X							
	GCRC Traffic Signals	Multiple traffic signals interconnected and operated by a CRC.	Existing	X							
	GCRC 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.	Existing	X							
Local Agency	Bay City Drawbridge Control Equipment	Roadside equipment located on Bay City drawbridges that close approaching roadways or stop traffic prior to the drawbridge opening to waterway traffic.	Planned	X							

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Local Agency	Bay City Drawbridge Management Center	Central facility that monitors vehicle and waterway traffic and controls drawbridge traffic in Bay City.	Planned	X							
	Bay City Drawbridge Notification Equipment	Roadside equipment located on Bay City drawbridges that send notifications when the drawbridge is open for waterway traffic.	Planned	X							
	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 Clare, Gladwin, Arenac, Isabella, Midland, Bay, Gratiot, Saginaw, Huron, Tuscola, Sanilac, Genesee and Lapper.	Existing	X	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 Equipment Repair	Facility responsible for maintenance of County Road Commission vehicles.	Planned			X					
	County Road Commission Maintenance Vehicles	County Road Commission vehicles used in maintenance operations. Includes the ITS equipment installes on the vehciels (automatic vehicle location (AVL) systems, onboard mobile data terminals (MDT), and automatic passenger counters (APC)).	Existing			X					
	Genesee County Office of Emergency Management and Homeland Security	Agency responsible for the management of large scale emergencies within Genesee County.	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 CCTV Cameras	Closed circuit television cameras operated by the Local Agency TOC for traffic condition monitoring and management of incidents.	Planned	X							

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Local Agency	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 Government vehicles used in maintenance operations.	Existing			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						
	Local Agency Ridesharing Program	System used for matching riders with similar origins and destinations to promote carpooling.	Planned						X		
	Local Agency Speed Monitoring Equipment	Speed monitoring equipment owned and operated by a local agency. Includes radar, lidar, etc.	Planned	X							
	Local Agency TOC	Local Traffic Operations Center responsible for municipal signal system operations.	Planned	X	X	X	X				X
	Local Agency Traffic Signals	Multiple traffic signals interconnected and operated by a Local Agency	Existing	X	X						
	Local Agency Vehicle Detectors	Roadway equipment on local routes used to detect vehicle volumes and/or speeds. Includes equipment such as MVDS, RTMS or traditional loops.	Planned	X							
	Local Agency Website	Transportation information website for each local agency. In the future will include real-time construction, work zone, special event, incident, and traffic information.	Existing	X							

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Local Agency	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.	Existing			X					
	MBS International Airport	Midland Bay City Saginaw International Airport is a municipal airport. Tri-owned by 3 municipalities.	Planned			X					
	School Transportation Agencies	Agencies responsible for operating school bus fleets.	Existing	X	X	X					
	SMART Dispatch Center	Suburban Mobility Authority for Regional Transportation transit vehicle dispatch center.	Existing				X				
MDOT	MDOT Animal Crossing Detection	Roadside equipment that monitors roadway for animal activity that could impact traffic.	Planned	X							
	MDOT Animal Crossing Warning System	In-vehicle and roadside equipment that can notify traveler about possible animal activity.	Planned	X							
	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					

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	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	X	
	MDOT Bay 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 Bay Region Maintenance Management System	Central system used to track and plan maintenance on MDOT Bay Region vehicles.	Planned			X					
	MDOT Bay Region Office TOC	Transportation operations center for Bay Region that will include the operations of ITS devices within the area. This TOC is considered to be small in nation, limited to a workstation with ATMS connection	Planned			X					
	MDOT Bay Region TSCs	MDOT Transportation Service Centers are field offices that oversee road construction and maintenance on MDOT facilities. Most maintenance and snow removal in this region is achieved through contract agencies.	Planned	X	X	X	X	X	X	X	
	MDOT Bridge Sensors	Roadway equipment located on MDOT bridges use to determine the amount of load a bridge can withhold. Located on the Zilwaukee Bridge.	Existing			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			

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	MDOT DMS	Roadside equipment on MDOT routes used to share traveler information with motorists through dynamic messaging.	Existing	X	X	X					
	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.	Planned	X							
	MDOT Drawbridge Management Center	Management of the waterways used by boats and ferries and the roadways used by vehicles.	Planned	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.	Planned			X					
	MDOT Freeway Courtesy Vehicles	Fully equipped vehicles that provide motorist assistance to vehicles in need on MDOT facilities.	Existing		X						
	MDOT Frost Tube Sensors	Roadside equipment located along MDOT routes that collect data from frost tube sensors	Planned			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	

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	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
	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	X	X					
	MDOT Speed Monitoring Equipment	Speed monitoring equipment owned and operated by the Michigan Department of Transportation. Includes radar, lidar, etc.	Planned	X							

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MDOT	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		
	MDOT Vehicle Detectos	Roadway equipment located on MDOT roadways used to detect vehicle volumes and/or speeds. MDOT vehicle detectors include MVDS and any other vehicle detection.	Existing	X							
	MDOT Weigh-in-Motion	Michigan Department of Transportation's device to capture and record truck axle weights and gross vehicle weights as the traveler drives 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							
	MDOT Work Zone Safety Monitoring Equipment	Equipment used to detect vehicle intrusion within work zones and provide notifications of the identified hazard.	Existing			X					
	Other MDOT Region TSCs	Local MDOT Transportation Service Centers outside of the Bay Region that oversee the operations and maintenance on MDOT facilities.	Existing			X					

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
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	
	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		X			
	MSP Commercial Vehicle Enforcement (CVED)	Responsible for monitoring commercial vehicle regulations on MDOT routes.	Existing					X			
	MSP District 3 - Flint	Michigan State Police dispatch for the Bay Region. Provides call-taking and dispatch for public safety agencies.	Existing	X	X	X	X	X	X		
	MSP Gaylord Regional	Dispatch center providing additional service support within District 3 and 7 and small portion of Oakland County; also answers 911 calls within Otsego county.	Existing		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						

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
MSP	MSP Winter Travel Advisory Website	Traveler Information website operated by Michigan State Police for dissemination of winter weather advisories	Existing			X					
	MSP Winter Travel Toll Free Number	Winter weather information operated from November through March to share winter weather conditions as received.	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						
	National Weather Service	Provides official US weather, marine, fire and aviation forecasts, warnings, meteorological products, climate forecasts, and information about meteorology.	Existing			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

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
Other Elements	RAWS Station	Remote Automatic Weather Stations strategically placed to monitor the weather. The data collected is used for monitoring air quality, fire dangers, and research.	Existing			X					
	Roadway Environment	All objects and conditions in the vicinity of the traveler that can affect the operations of the traveler.	Existing								X
	USGS Sensors	United States Geological Society field equipment that collects flood information to distribute to other agencies. Alerts are provided to 911 dispatch.	Planned			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 Management Systems	A way to track and manage the contents private commercial vehicle fleets carry.	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	System operated on private property that monitors available commercial vehicle parking.	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.	Planned	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 Transit Providers CCTV Surveillance	CCTV surveillance at the Regional Demand Response Transit Providers Center.	Planned				X				
	Regional Demand Response Transit Providers 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 Providers Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of demand response vehicles operated by Regional Demand Response Transit Providers. This includes County Connection of Midland and Dial-a-Ride Transportation System-Midland, Caro Transit Authority.	Existing	X	X	X	X		X	X	
	Regional Demand Response Transit Providers Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned				X				
	Regional Demand Response Transit Providers Vehicles	Transit Vehicles owned by Regional Demand Response Transit Authority	Existing				X				
	Regional Demand Response Transit Providers 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
Saginaw Transit Authority Regional Services (STARS)	STARS CCTV Surveillance	CCTV surveillance at the Saginaw Transit Authority Regional Services.	Planned				X				
	STARS Data Archive	The transit data archive for the Saginaw Transit Authority Regional Services. Used by FTA and MDOT Office of Passenger Transportation	Planned							X	
	STARS Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Saginaw Transit Authority Regional Services.	Existing	X	X	X	X		X	X	
	STARS Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned				X				
	STARS 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				
	STARS Vehicles	Transit Vehicles owned by STARS	Existing				X				
	STARS Website	Website with information about fares and schedules.	Existing				X				
System Users	Archived Data Users	Those who request information from the data archive systems	Planned							X	
	Commercial Vehicle Driver	Operator of a commercial vehicle	Existing					X			
	Commercial Vehicles	Privately owned commercial vehicles that travel throughout the Region. Included in the architecture to cover HAZMAT incident reporting.	Existing					X			
	Maintenance and Construction Field Personnel	Individuals working at the maintenance or construction site.	Existing			X					
	Other Vehicles	Vehicles outside of the control of the traveler.	Existing								X

Stakeholder	Element Name	Element Description	Element Status	ATMS	EM	MC	APTS	CVO	ATIS	AD	AVSS
System Users	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 Bay Region based on the system inventory and information gathered from the stakeholders. **Figure 3** summarizes the existing and planned ITS elements for the Bay 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.

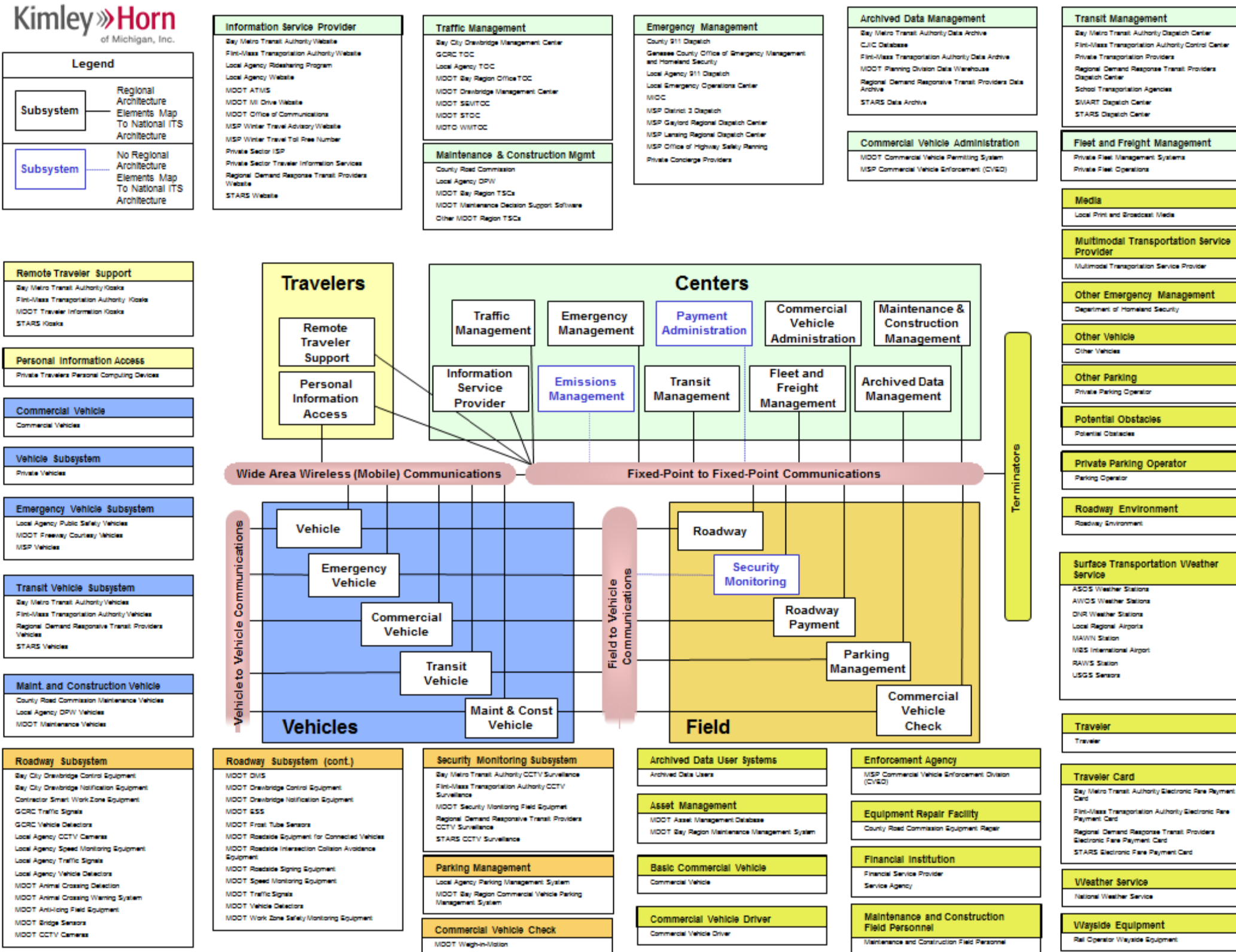


Figure 3. Bay Region System Interconnect Diagram

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 Bay Region, including Shiawassee County. 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 Bay 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 Bay 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 Bay 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 Bay 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 Bay Regional ITS Architecture.

Table 3. Bay 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
DSRC 5GHz	Dedicated Short Range Communication at 5.9 GHz	ASTM/IEEE/SAE

Document ID	Standard Title	SDO
	Standards Group	
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 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. Bay 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 TMCs.
	Local Agency	Operate traffic signal systems on local routes.
		Operate network surveillance equipment such as CCTV cameras and field sensors on local routes to facilitate traffic signal operations.
Provide traffic information reports to regional information service providers.		

Transportation Service	Stakeholder	Roles/Responsibilities
		<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 STOC and MDOT Bay Region Office.</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>
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> <p>Responsible for the coordination with other traffic operations centers and emergency management agencies for coordinated incident management.</p> <p>Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.</p> <p>Coordinate maintenance resources for incident response with MDOT TSC Construction and Maintenance Operations.</p>

Transportation Service	Stakeholder	Roles/Responsibilities
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 Bay 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.).
		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.

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management	MSP	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/alarms on-board transit vehicles or at the transit facilities of local transit agencies.
Maintenance and Construction Management	MDOT	Receive requests for maintenance resources for incident response from regional emergency management agencies.
		Support coordinated response to incidents.
		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.

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management	MDOT	Collect road weather information with MDOT equipment and distribute it to regional traffic, maintenance, and transit agencies.
		Provide maintenance of state highways within the region, including pavement maintenance, winter maintenance, and construction activities.
		Manage work zones on all MDOT maintenance and construction activities, as well as monitor work zone safety with MDOT field devices and vehicles.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, transit operations, emergency operations, rail operations, and the media.
		Perform maintenance of 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.
Private Operators	Provide maintenance of local routes and MDOT facilities (per contract), including pavement maintenance and construction activities.	
Transit Management	Bay Metro Transit Authority	Provide fixed route bus service for Bay Metro Transit System.
		Provide paratransit bus service for the Bay Metro Transit System.

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Bay Metro Transit Authority (continued)	Track and evaluate schedule performance on all Bay Metro Transit Authority fixed route and paratransit vehicles.
		Provide transit schedule and fare information to the Bay Metro Transit Authority website and private sector traveler information service providers.
		Provide a demand response transit plan from the agency website.
		Provide transit passenger electronic fare payment on all Bay Metro 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 Bay Metro Transit Authority 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 Bay Metro Transit System transit operations.
Provide paratransit bus service for the Flint-Mass Transportation Authority.		
Track and evaluate schedule performance on all Flint-Mass Transportation Authority fixed route and paratransit vehicles.		

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Flint-Mass Transportation Authority	Provide transit schedule and fare information to the Flint-Mass Transportation Authority website and private sector traveler information service providers.
		Provide a demand response transit plan from the agency website.
		Provide transit passenger electronic fare payment on all Flint-Mass Transportation Authority fixed route and demand response transit vehicles.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Flint-Mass Transportation 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).
		Collect and archive transit data from Flint-Mass Transportation Authority transit operations.
	Saginaw Transit Authority Regional Services	Provide fixed route bus service for Saginaw Transit Authority Regional Services.
		Provide paratransit bus service for the Saginaw Transit Authority Regional Services.
		Track and evaluate schedule performance on all Saginaw Transit Authority Regional Services fixed route and paratransit vehicles.

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Saginaw Transit Authority Regional Services	Provide transit schedule and fare information to the Saginaw Transit Authority Regional Services website and private sector traveler information service providers.
		Provide a demand response transit plan from the agency website.
		Provide transit passenger electronic fare payment on all Saginaw Transit Authority Regional Services 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 Saginaw Transit Authority Regional Services 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 Saginaw Transit Authority Regional Services transit operations.
	Provide transit schedule and fare information to the Regional Demand Responsive Transit Providers website and private sector traveler information service providers.	

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Regional Demand Responsive Transit Providers	Provide demand response bus service for the Regional Demand Responsive Transit Providers.
		Provide a demand response transit plan from the agency website.
		Provide transit passenger electronic fare payment on all Regional Demand Responsive Transit Providers' transit vehicles.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Regional Demand 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.

Transportation Service	Stakeholder	Roles/Responsibilities
Commercial Vehicle Operations	MDOT	Provide permit information to regional emergency management providers and regional enforcement agencies.
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 Bay 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 Bay 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 Bay Regional ITS Architecture provides additional details regarding this process and each step (see Section 5.1).

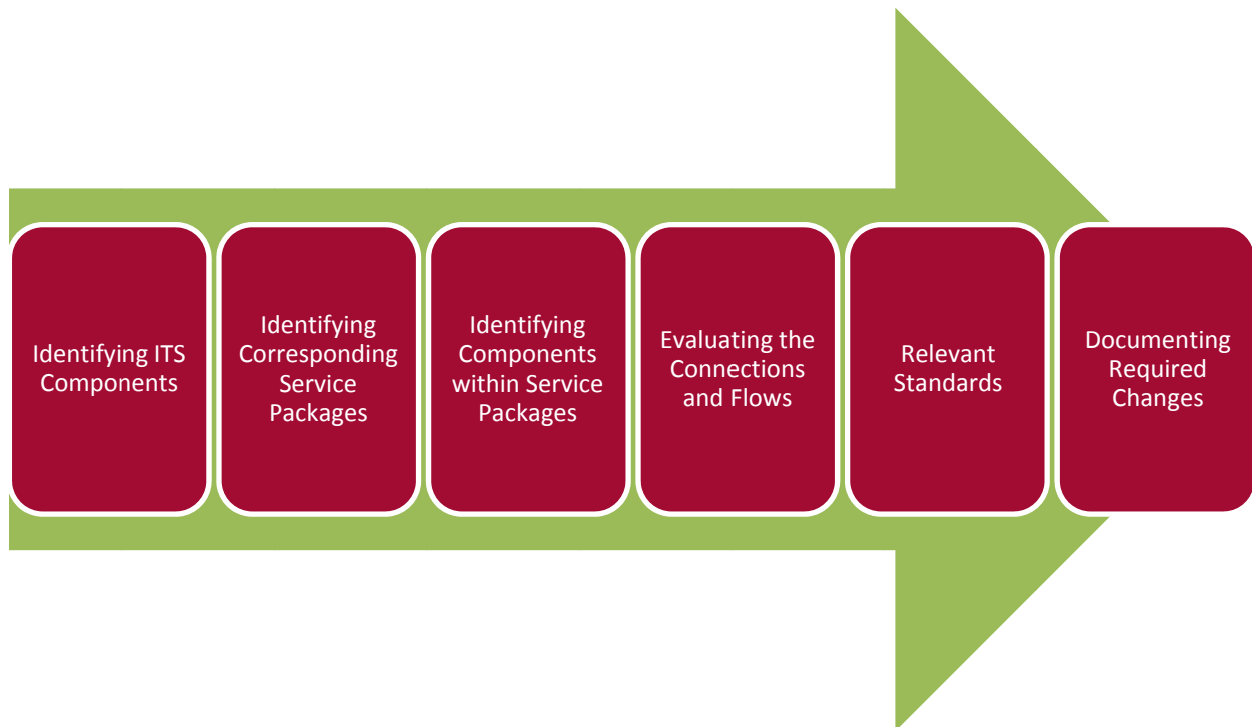


Figure 4. Steps to Determining Architecture Conformity

4.2 Maintenance

MDOT ITS Program Office will be responsible for leading the maintenance of the Bay Regional ITS Architecture in coordination with the regional contact. The Bay 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 Bay 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 Bay 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

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

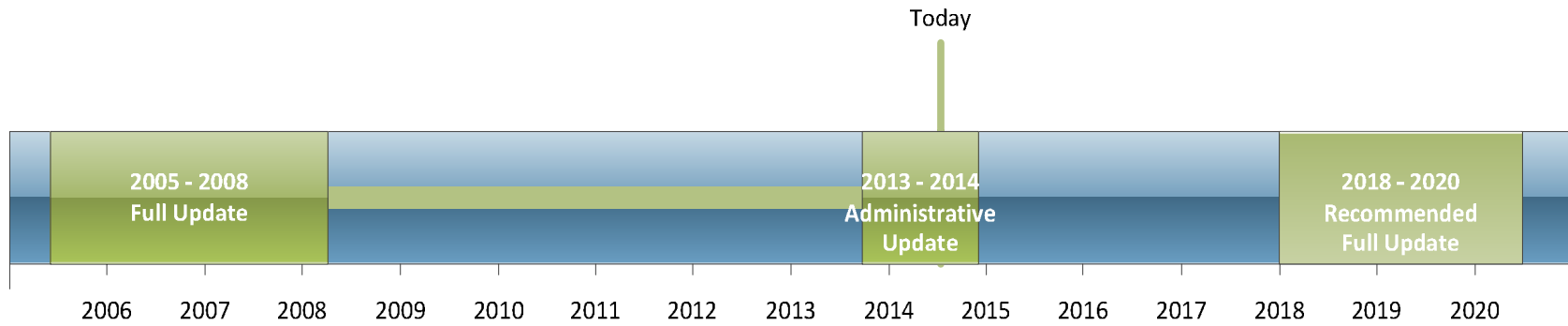


Figure 5. Time Lapse between Architecture Updates