Memphis Urban Area

Regional ITS Architecture

Regional ITS Architecture Report

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AD	Archived Data
AHTD	Arkansas State Highway and Transportation Department
AMBER	America's Missing: Broadcast Emergency Response
APTA	American Public Transportation Association
APTS	Advanced Public Transportation System
ASTM	American Society for Testing and Materials
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
CCTV	Closed Circuit Television
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
DARTS	Delta Area Rural Transit System
DMS	Dynamic Message Sign
DSRC	Dedicated Short Range Communication
EM	Emergency Management
EMA	Emergency Management Agency
EMS	Emergency Medical Services
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
HRA	Human Resource Agency
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
IVR	Interactive Voice Response

LIST OF ACRONYMS

LRTP	Long-Range Transportation Plan
MATA	Memphis Area Transit Authority
MC	Maintenance and Construction
MDOT	Mississippi Department of Transportation
MEMA	Mississippi Emergency Management Agency
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
NEMA	National Electrical Manufacturers Association
NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol
PSAP	Public Safety Answering Point
RPO	Regional Planning Organization
RTMS	Remote Traffic Microwave Sensor
RWIS	Road Weather Information System
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users
SDO	Standards Development Organization
TDOT	Tennessee Department of Transportation
TEA-21	Transportation Equity Act for the 21st Century
TEMA	Tennessee Emergency Management Agency
TIP	Transportation Improvement Program
THP	Tennessee Highway Patrol
TITAN	Tennessee Integrated Traffic Analysis Network
TMC	Transportation Management Center
TOC	Traffic Operations Center
TraCS	Traffic and Criminal Software
TSIS	TDOT SmartWay Information System
USDOT	United States Department of Transportation
VIVDS	Video Image Vehicle Detection Systems
WAVE	Wireless Access in Vehicular Environments

1. INTRODUCTION

1.1 Project Overview

The Memphis Urban Area Regional Intelligent Transportation System (ITS) Architecture was developed in 2002 by the Tennessee Department of Transportation (TDOT). Since that time the Memphis Urban Area has seen the implementation of a number of significant ITS programs and projects including most recently the TDOT Region 4 SmartWay ITS, which provides freeway management capabilities for a majority of the urban freeway system in the Memphis Urban Area and also includes deployments on I-40 and I-55 in Arkansas. Regional ITS architectures are living documents and need to be continuously updated in order for them to accurately reflect the ITS needs, plans, and visions within a region. In October 2009 the Memphis Urban Area Metropolitan Planning Organization (MPO), in coordination with TDOT, began the process of updating the Memphis Urban Area Regional ITS Architecture with the goal of completing the update by June 2010.

A regional ITS architecture provides a framework for implementing ITS projects, encourages interoperability and resource sharing among agencies, identifies applicable standards to apply to projects, and allows for cohesive long-range planning among regional stakeholders. ITS architectures allow stakeholders to plan for what they want their system to look like long-term and then break out the system into smaller pieces that can be implemented as funding permits. A regional ITS architecture is also necessary to satisfy the ITS conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) bill passed in 2005. In response to Section 5206(e) of TEA-21, the Federal Highway Administration (FHWA) issued a final rule and the Federal Transit Administration (FTA) issued a final policy that required regions implementing any ITS project to have an ITS architecture in place by April 2005. After this date, any ITS projects must show conformance with their regional ITS architecture in order to be eligible for funding from FHWA or FTA. In order to show this conformance, it is important that any region deploying ITS have an updated regional ITS architecture in place.

The Memphis Urban Area Regional ITS Architecture update included the same geographic area and agencies that are included as part of the Memphis Urban Area MPO. In addition, stakeholders recommended that the TDOT SmartWay ITS deployments on I-40 and I-55 in Arkansas also be considered part of the Memphis Urban Area Regional ITS Architecture. These deployments, which include closed circuit television (CCTV) cameras, dynamic message signs (DMS), and highway advisory radio (HAR), were deployed and are operated by TDOT to monitor freeways and provide traveler information to travelers approaching the Mississippi River bridges. Stakeholders developed the Regional ITS Architecture based on a 20-year vision of how they wanted to implement and operate ITS in the Memphis Urban Area. In addition to the Regional ITS Architecture, a separate ITS Deployment Plan was developed to identify and prioritize specific ITS projects recommended for the Region in order to implement the ITS Architecture.

The Memphis Urban Area Regional ITS Architecture and the ITS Deployment Plan were both developed with significant input from local, state, and federal officials. A series of four workshops were held to solicit input from stakeholders and ensure that the plans reflected the unique needs of the Region. Copies of the draft reports were provided to all stakeholders. The Regional ITS Architecture and Deployment Plan developed reflects an accurate snapshot of existing ITS deployments and future ITS plans in the Region. Needs and priorities of the Region

will change over time and in order to remain effective this plan should be periodically reviewed and updated.

1.2 Document Overview

The Memphis Urban Area Regional ITS Architecture report is organized into five key sections:

Section 1 – Introduction

This section provides an overview of the National ITS Architecture requirements, the Memphis Urban Area Regional ITS Architecture, and the key features and stakeholders in the Memphis Urban Area.

Section 2 – Regional ITS Architecture Development Process

This section provides an overview of the key steps involved in developing the ITS architecture for the Memphis Urban Area as well as an overview of the Turbo Architecture database and reports.

Section 3 – Regional Needs and Inventory

This section contains a summary of regional needs that are related to ITS for the Memphis Urban Area as well as a description of the stakeholders and ITS elements in the Region. Elements are grouped based on the owner, such as the City of Memphis or the Memphis Area Transit Authority (MATA), and their current status is listed as either existing or planned in the Region.

Section 4 – Regional ITS Architecture

This section describes how the National ITS Architecture was customized to meet the ITS needs, plans, and visions for the Memphis Urban Area. The ITS market packages that were selected for the Region are included in this section and interconnects are presented, including the "sausage diagram" showing the relationships of the key subsystems and elements in the Region. Functional requirements and standards that apply to the Region, as indicated by the Regional ITS Architecture, are presented. Operational concepts identifying stakeholder roles and responsibilities have been prepared and potential agreements to support the sharing of data and resources have been identified.

Section 5 – Use and Maintenance of the Regional ITS Architecture

This section describes how the Regional ITS Architecture can be use to show architectural conformance of ITS projects in the planning or design phase. A process for maintaining the Regional ITS Architecture and submitting requested changes to the Regional ITS Architecture is also presented.

The Memphis Urban Area Regional ITS Architecture also contains five appendices:

- Appendix A – Market Package Definitions;
- Appendix B – Customized Market Packages;
- Appendix C – Element Functions;
- Appendix D – Stakeholder Database; and
- Appendix E – Architecture Maintenance Documentation Form.

1.3 Memphis Urban Area

1.3.1 Geographic Boundaries

The geographic boundaries were defined for the Memphis Urban Area Regional ITS Architecture using the boundaries of the Memphis Urban Area MPO. The MPO includes all of Shelby County and the western portion of Fayette County in Tennessee, and the northern portion of De Soto County in Mississippi. In addition, the TDOT SmartWay ITS deployments on I-40 and I-55 in Arkansas are also considered part of the Memphis Urban Area Regional ITS Architecture boundaries. These deployments were implemented and are currently operated by the TDOT Region 4 SmartWay TMC in Memphis.

When developing the stakeholder group, the project team coordinated with the Memphis Urban Area MPO to invite the appropriate city, county, regional, state and federal agencies. Stakeholders included both local representatives as well as representatives from the TDOT Long Range Planning Division in Nashville, Arkansas State Highway and Transportation Department (AHTD) in Little Rock, Mississippi Department of Transportation (MDOT) in Jackson, and FHWA from the Tennessee Division Office in Nashville.

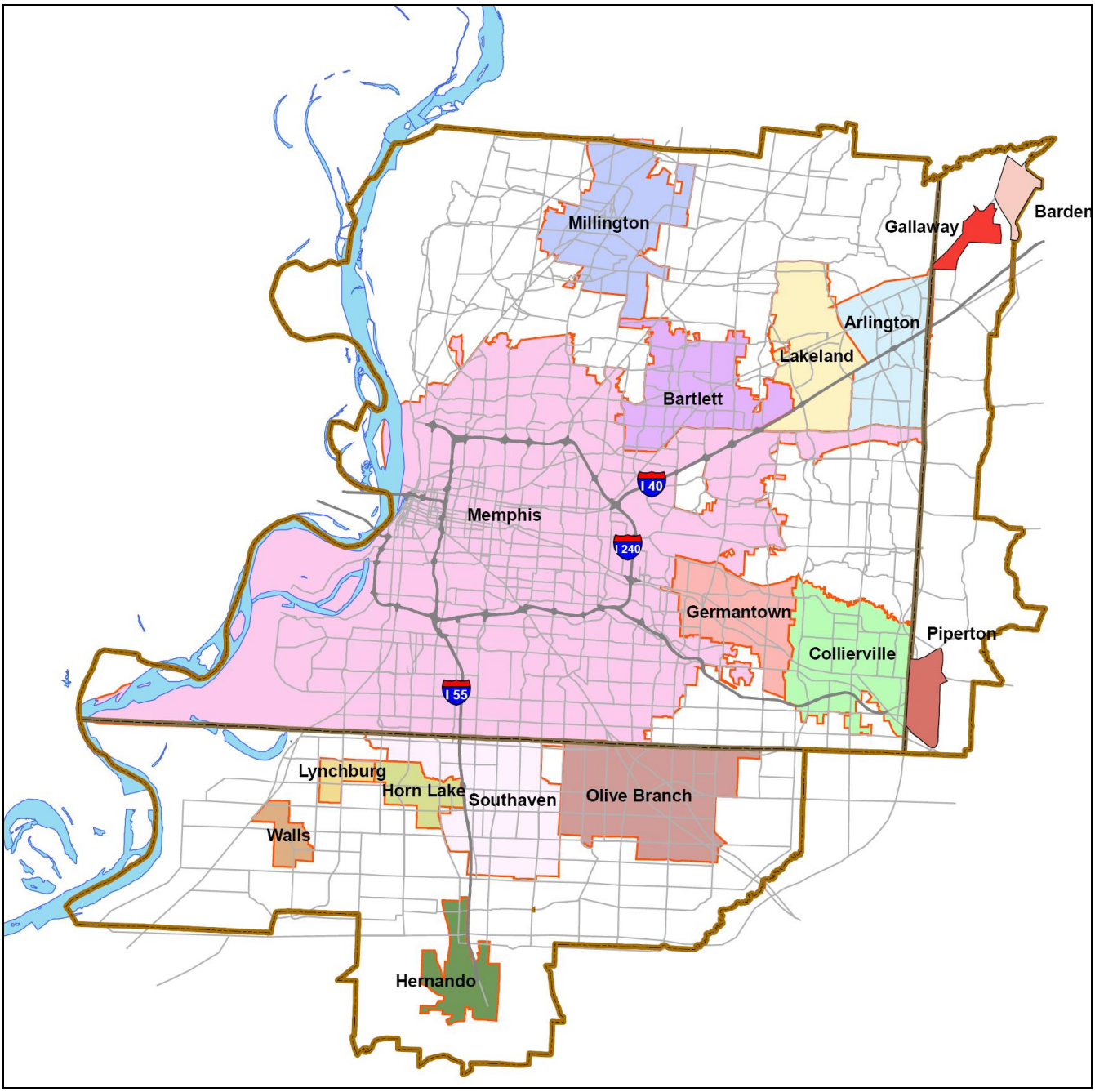

Figure 1 – Memphis Urban Area MPO Boundaries

1.3.2 Transportation Infrastructure

The transportation infrastructure in the Memphis Urban Area is diverse and robust, consisting of all forms of transportation. The Memphis Urban Area is fortunate to be served by two existing interstate highways, with two more planned in the near future, and several federal highways. The interstate facilities presently consist of I-40, which runs from North Carolina to California, and I-55 which runs from New Orleans to Chicago. In addition, portions of the I-69 international trade corridor and I-22 from Birmingham are presently under construction. The other federal highways that serve the Memphis Urban Area include US 51, US 61, US 64, US 70, US 72, and US 78.

The Memphis Urban Area is also one of the few cities to be served by five Class 1 railroads. Burlington Northern Santa Fe, Union Pacific, Norfolk Southern Railroad and CNIC all have major intermodal facilities in the Memphis Urban Area. Only the CSX does not have an intermodal facility in Memphis. In addition, Memphis is being considered for the extension of a high speed passenger rail facility from Little Rock, Arkansas. The security of the existing railroad bridges across the Mississippi River is a major issue since any disruption of the rail service through Memphis would have impacts over most of the continental United States.

Being on the banks of the Mississippi River, Memphis also has a robust water port. The port facility serves numerous businesses and industries and is home to the Memphis District U.S. Corps of Engineers. The Memphis port handles the fourth largest amount of cargo of all of the inland water ports in the United States.

One of the key elements for transportation and the economics of the Memphis Urban Area is the Memphis International Airport. Being the home to Federal Express, the Memphis International Airport is the largest cargo handling airport in the world, and has held that distinction for more than 20 years.

With all of these freight elements being part of the Memphis infrastructure, it follows that truck traffic is a significant element of the road system. Truck volumes on I-40 and I-55 are near 40 percent, with some sections of road having truck volumes well in excess of 50 percent. Many of the truck origins and destinations are in the southern part of Memphis or northern DeSoto County, MS. This puts most of the pressure for moving freight on the southern portion of I-240 and on I-55.

Fixed route, paratransit, and demand responsive transit services are provided in the Memphis Urban Area by the MATA. Commuter rail or light rail services are not provided at this time. However, MATA has a fixed guideway corridor currently in the Environmental Impact Study phase and follows the 1997 Memphis Regional Transit Plan developed by MATA that outlines three corridors for fixed guideway transit.

1.3.3 Memphis Urban Area ITS Initiatives and Activities

The deployment of ITS initiatives in the Memphis Urban Area has been underway for over ten years. The deployments have been undertaken primarily by TDOT and the local government agencies. Many of these deployments have involved multiple agencies and have crossed jurisdictional lines. The agencies involved continue to work in a cooperative manner to deploy ITS technologies to benefit the traveling public. Some of the ITS initiatives existing or underway in the Memphis Urban Area are listed below.

- **TDOT SmartWay Program** – This freeway management program is continuing to evolve and grow in the Memphis Urban Area. The program was initiated with the early deployment of CCTV cameras, DMS, and HAR to assist with incident management and provide information to motorists during the major seismic retrofit of the I-40 bridge over the Mississippi River. The early deployment system extended five miles into Arkansas along I-40. Since that time, the system has continued to grow and now includes CCTV cameras, DMS, speed and incident detection devices, and HAR covering approximately 70 miles in Arkansas and Tennessee. The communications for the system are handled through a fiber optic backbone. The system is managed from the TDOT Region 4 SmartWay TMC located in Memphis with a microwave communications link to the Region 4 office in Jackson.
- **TDOT HELP** – The TDOT HELP program has been in operation in the Memphis Urban Area since July 1999. The HELP program trucks patrol I-40, I-55, I-240, SR-385, and Sam Cooper Boulevard, helping motorists with flat tire changes, fuel, and minor vehicle repairs. The HELP program also provides assistance to the local police and State Highway Patrol with the management of incidents by providing traffic control and advance warning to motorists. Since the inception of this program, over 200,000 motorists have been assisted in the Memphis Urban Area. The incident management effort is now assisted by the TDOT SmartWay Program.
- **511 Traveler Information Number** – TDOT currently operates a statewide traveler information number that provides real-time traveler information throughout the state. Information is put into 511 through the TDOT SmartWay Information System (TSIS), which is updated by the TDOT SmartWay TMC operators and the Tennessee Highway Patrol (THP) dispatchers. 511 information can also be accessed through a 511 website and several social media sites such as Twitter and Facebook.
- **City of Memphis Traffic Operations Center** – The City of Memphis has an existing signal system that supports real time monitoring and control of traffic signals for approximately 150 intersections in downtown Memphis and the Medical Center. From the TOC and the Signal Maintenance facility, they have the capability to implement traffic signal timing plans, monitor traffic conditions and the operations of the signals, and to monitor the status of equipment. The City is expecting to receive bids for several additions to this existing system in Spring 2010 that will provide an Ethernet communications system over the existing fiber optic backbone, expand the system by more than 200 additional signals, and extend the communications backbone. The backbone will be extended in the east to the City boundary, in the south to I-240, and in the northeast to Bartlett. With the enhanced communications, Memphis plans to begin installation of CCTV cameras in the future as funding becomes available.
- **Bartlett Signal System** – The City of Bartlett presently has a signal system that provides the ability to monitor traffic operations and change signal timing plans for ten signals within the City. Future plans include providing real time monitoring capabilities, CCTV cameras, and expanding the system which will allow it to be connected with the City of Memphis system.
- **Germantown Signal System** – The City of Germantown TOC is connected to twenty intersections across the city. The TOC will allow the traffic operations to be monitored and signal timing plans to be added or changed. Memphis and Germantown are cooperatively working on a project to be bid in Spring 2010 to connect the Memphis communications backbone to the Germantown system, upgrade the Germantown system to Ethernet communications, and allow Germantown the ability to monitor signal operations real time, to install CCTV cameras, and to make other upgrades to

their system. The Germantown TOC will also be able to communicate directly with the Memphis TOC and the Memphis Signal Maintenance facility.

- **Town of Collierville Signal System** – The Town of Collierville TOC is directly connected to 13 signals across the Town limits, providing signal coordination along the major thoroughfare through the Town, the ability to monitor the operations of these signals, and the ability to adjust signal timing plans as needed. The Town of Collierville TMC also has the ability to remotely access the signal system and allow remote monitoring or adjustments when needed. The Town has plans to extend the communications system to incorporate approximately 15 more signals, convert to Ethernet communications, and install CCTV in the future.

1.3.4 Project Participants

Due to the fact that ITS often transcends traditional transportation infrastructure, it is important to involve a wide range of local, state, and federal stakeholders in the ITS architecture development and visioning process. Input from these stakeholders is a critical part of defining the interfaces, integration needs, and overall vision for ITS in a region. In addition to stakeholders that represented agencies included in the Memphis Urban Area Regional ITS Architecture boundaries, representatives from the Arkansas State Highway and Transportation Department, Arkansas Highway Patrol, and the West Memphis MPO also participated.

Table 1 contains a listing of stakeholders in the Memphis Urban Area who have participated in the project workshops or provided input to the study team as to the needs and issues that should be considered as part of the Regional ITS Architecture. Other stakeholders that were invited to participate but were not able to attend were provided minutes of workshops and notified when copies of reports were available for review on the project website to encourage their participation as much as possible. A complete listing of stakeholders invited to participate in the project and workshop attendance records is included in the stakeholder database in **Appendix D**.

Table 1 – Memphis Urban Area Stakeholder Agencies and Contacts

Stakeholder Agency	Address	Contact
Arkansas Highway Patrol	3205 North Washington Forrest City, AR 72335	Nathaniel Jackson
Arkansas State Highway & Transportation Department	P.O. Box 2261 Little Rock, AR 72203	Gary Bennett
Arkansas State Highway & Transportation Department	10324 Interstate 30 Little Rock, AR 72209	Dorothy Rhodes
City of Bartlett	2939 Altruria Road Bartlett, TN 38134	Terry Wiggins
City of Bartlett	6382 Stage Rd. Bartlett, TN 38134	Becky Bailey
City of Bartlett Police	3730 Appling Rd. Bartlett, TN 38133	Gary Rikard
City of Germantown	1920 Germantown Road South Germantown, TN 38138	Jerry Cook
City of Horn Lake Police	3101 Gresham Rd. Horn Lake, MS	Tray Rowell
City of Horn Lake Police	3101 Gresham Rd. Horn Lake, MS	Michael Norris
City of Memphis	125 North Main St. Suite 644 Memphis, TN 38103	Wain Gaskins
City of Memphis	125 North Main St. Suite 668 Memphis, TN 38103	Richard Merrill
City of Memphis Police	125 North Main St. Suite 668 Memphis, TN 38103	Kenneth Shackleford
City of Millington	4836 Navy Road Suite 2 Millington, TN 38083	Darek Baskin
City of Millington	4836 Navy Road Suite 2 Millington, TN 38083	Mike Lantrip
FHWA – Arkansas Division	Federal Office Building 700 West Capitol Avenue, Room 3130 Little Rock, AR 72201-3298	Gary Dalporto
FHWA – Tennessee Division	404 BNA Drive Building 200, Suite 508 Nashville, TN 37217	Don Gedge
Gresham, Smith and Partners	6750 Poplar Avenue, Suite 625 Memphis, TN 38138	Gregory Dotson
Gresham, Smith and Partners	4780 I-55 North, Suite 175 Jackson, MS 39211	Steve Mosher
Memphis Area RPO	1075 Mullins Station Road - Rm 118 Memphis, TN 38134	Dan Frazier
Memphis Area Transit Authority	1370 Levee Road Memphis, TN 38108	John Lancaster

Table 1 – Memphis Urban Area Stakeholder Agencies and Contacts (continued)

Stakeholder Agency	Address	Contact
Memphis Urban Area MPO	1075 Mullins Station Road - Rm 118 Memphis, TN 38134	Sajid Hossain
Memphis Urban Area MPO	1075 Mullins Station Road - Rm 118 Memphis, TN 38134	Pragati Srivastava
Memphis Urban Area MPO	1075 Mullins Station Road - Rm 118 Memphis, TN 38134	Martha Lott
Memphis Urban Area MPO	1075 Mullins Station Road - Rm 118 Memphis, TN 38134	Carlos McCloud
Memphis Urban Area MPO	1075 Mullins Station Road - Rm 118 Memphis, TN 38134	Tim Moreland
Memphis Urban Area MPO	1075 Mullins Station Road - Rm 118 Memphis, TN 38134	Paul Morris
Memphis Urban Area MPO	1075 Mullins Station Road - Rm 118 Memphis, TN 38134	Brett Roler
Mississippi DOT	P.O. Box 1850 Jackson, MS 39215-1850	Acey Roberts
Mississippi DOT	2567 N. West St. Jackson, MS 39157	John Gilligan
Mississippi DOT	2567 N. West St. Jackson, MS 39157	Mike Stokes
Shelby County Office of Preparedness	2668 Avery Memphis, TN 38111	Cheryl Yarbro
Shelby County Office of Preparedness	1075 Mullins Station Memphis, TN 38134	Johanna Harrell
Shelby County Office of Preparedness	1075 Mullins Station Memphis, TN 38134	Mike Brazzell
TDOT Long Range Planning Division	505 Deaderick Street Suite 900, James K Polk Bldg Nashville, TN 37243	Mike Presley
TDOT Long Range Planning Division	505 Deaderick Street Suite 900, James K Polk Bldg Nashville, TN 37243	Terry Gladden
TDOT Region 4	5334 Boswell Avenue Memphis, TN 38120	Joe Warren
TDOT Region 4	5344 Boswell Avenue Memphis, TN 38120	Ed Johnson
TDOT Region 4	300 Benchmark Place Jackson, TN 38301	John Thomas
TDOT Region 4	5334 Boswell Ave. Memphis, TN	Michael Rebick
Tennessee Highway Patrol	6348 Summer Avenue Memphis, TN	Vance Pitts
Town of Collierville	500 Poplar View Pkwy Collierville, TN 38017	Frank McPhail
Town of Collierville	500 Poplar View Pkwy Collierville, TN 38017	Mark King
West Memphis MPO	796 W. Broadway West Memphis, AR 72301	Eddie Brawley

2. REGIONAL ITS ARCHITECTURE UPDATE PROCESS

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

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

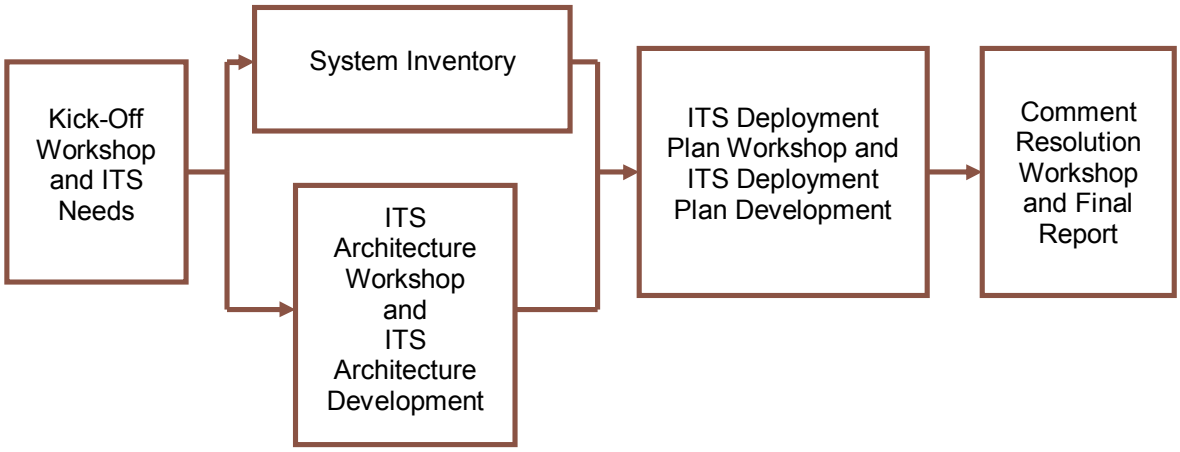

Figure 2 – Memphis Urban Area Regional ITS Architecture and Deployment Plan Development Process

2.1 Stakeholder Workshops

A total of four workshops with stakeholders over a period of eight months were held to update the Memphis Urban Area Regional ITS Architecture and Deployment Plan. These workshops included:

- Kick-Off Workshop;
- Regional ITS Architecture Development Workshop;
- ITS Deployment Plan Workshop;
- Comment Resolution Workshop;

Key components of the process are described below:

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

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

Task 3 – ITS Architecture Workshop and ITS Architecture Development: The purpose of the Regional ITS Architecture Workshop was to review the system inventory with stakeholders and update the Memphis Urban Area Regional ITS Architecture. Training on the National ITS Architecture was integrated into the workshop so that key elements of the architecture, such as market packages, could be explained prior to the selection and editing of these elements. Stakeholders reviewed the market packages that are currently available in the National ITS Architecture as well as those that were included in the 2002 Memphis Area Regional ITS Architecture. A consensus was reached on which market packages to include in the 2010 update and then the selected market packages were customized for the Region.

The result of the Regional ITS Architecture Workshop was an ITS architecture for the Memphis Urban Area that included a system inventory, interconnect diagram, customized market packages, functional requirements, and relevant ITS standards. Following the workshop, a Draft Regional ITS Architecture document was prepared and sent to stakeholders for review and comment.

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

Task 5 – Comment Resolution Workshop and Final Report: A Comment Resolution Workshop was held with stakeholders to review comments on the Draft Regional ITS Architecture and Draft Regional ITS Deployment Plan, and discuss how the Regional ITS Architecture should be used and maintained. Comments were addressed and a Final Draft Regional ITS Architecture and Final Draft Regional ITS Deployment Plan were developed and sent to stakeholders for a second round of comments before the final reports were developed. In addition, an Executive Summary was also developed as well as a Turbo Architecture database. Project documents were made available to all stakeholders on the project website. Hard copies of the final documents as well as an electronic copy of the Turbo Architecture database for the Memphis Urban Area were also sent to representatives from the Memphis Urban Area MPO, TDOT Long Range Planning Division, and the FHWA Tennessee Division Office.

2.2 Turbo Architecture

Turbo Architecture Version 4.1 was used to develop the Memphis Urban Area Regional ITS Architecture. Turbo Architecture is a software application that was developed by the United States Department of Transportation (USDOT) to be used as a tool for documenting and maintaining ITS architectures. Version 4.1 of Turbo Architecture was released in March 2009 and was developed to support Version 6.1 of the National ITS Architecture. Use of the Turbo Architecture software in development of the regional ITS architectures is recommended by both the FHWA and the FTA.

In the Memphis Urban Area, the Turbo Architecture database that was developed was based on the ITS market packages which are provided in **Appendix B** of this report. The ITS market packages provide a graphical representation of the services stakeholders in the Region would like ITS to provide. In each market package the elements, such as a TMC or a CCTV camera, and the data that is shared between them are shown. Turbo Architecture allows the Region to document all of the elements and data flows that exist or are planned in the Region. Turbo Architecture also allows the user to quickly access any standards that are associated with the data flows as well as generate reports and diagrams to assist in reviewing the data. Some examples of the useful

reports and diagrams that may be generated using the Turbo Architecture software are included in **Table 2**.

Table 2 – Turbo Architecture Report and Diagrams

Report or Diagram Name	Functions
Stakeholder Report	Provides a description of the stakeholder and the associated elements for each stakeholder in the Regional ITS Architecture.
Inventory Report	Provides a description and status for each element in the Regional ITS Architecture.
Market Packages Report	Identifies each of the market packages selected for the Region and the elements associated with each market package.
Functional Requirements Report	Identifies the functions that each element provides.
Interconnect Report	Identifies for each element all of the other elements that are connected and the status of each connection.
Standards Activities Report	Identifies relevant standards associated with each of the data flows used in the Regional ITS Architecture.
Subsystem Diagram	Identifies the subsystems from the National ITS Architecture that are included in the Regional ITS Architecture.
Interconnect Diagrams	Identifies for each element all of the other elements that are connected and the status of each connection. The Interconnect Diagrams can be customized to show all elements in the Regional ITS Architecture or a single element can be selected so that only the connections it has with other elements are shown. Interconnect Diagrams can also be viewed by individual market packages to view all of the elements and connections in each market package.
Flow Diagrams	Flow Diagrams are similar to Interconnect Diagrams; however, the actual data flows that are part of each connection between elements are also shown.

Turbo Architecture saves data in Microsoft Access compatible data files. Turbo Architecture files can be accessed using Microsoft Access, although use of Access will not provide nearly the same amount of capabilities as accessing the files using the Turbo Architecture software. With the release of Version 4.1 of Turbo Architecture, the USDOT began offering the Turbo Architecture software free of charge and provides a link for downloading the software on the National ITS Architecture website. At the time this report was written that site was located at www.iteris.com/itsarch/ and Version 4.1 was the most recent version available.

3. REGIONAL NEEDS AND INVENTORY

3.1 Regional Needs

Regional needs that could be addressed by ITS were identified by stakeholders in the Memphis Urban Area Regional ITS Architecture workshops held in October and December of 2009 and March of 2010. In addition, the Memphis Urban Area 2030 Long-Range Transportation Plan (LRTP) was reviewed to determine other regional needs that could possibly be addressed in some way through ITS.

Within the 2030 LRTP there were nine goals that were defined for the plan, each with a corresponding set of objectives. Two of the goals had objectives that could be met in part through the use of ITS. These goals are summarized below.

2030 Long-Range Transportation Plan Goal 8 – Increase the safety and security of the transportation system for motorized and non-motorized users: ITS systems offer a number of ways to improve the overall safety of the transportation system. ITS can improve the ability of an agency to detect an incident, improve coordination with public safety agencies for response, and be used to provide advanced warning of incidents to motorists. Through the HELP service patrol program TDOT is able to assist disabled motorists and move them out of travel lanes or off of shoulders quicker, which increases the safety of both the disabled motorists and reduces a potential roadside hazard for other drivers. Use of ITS to detect severe weather and provide advanced warning of railroad crossings are other examples of how ITS can increase safety. ITS can also be used in transit to provide alarms on buses and surveillance capabilities both on buses and at transit stops.

2030 Long-Range Transportation Plan Goal 9 – Continue to develop a multi-modal transportation network that utilizes strategies for addressing congestion management and air quality issue in the Memphis MPO region: Incidents are one of the primary causes of congestion. Through ITS transportation agencies are better able to manage incidents which can result in quicker clearance time and less people caught in congestion due to advanced notification. Improved traffic signal coordination, both within cities and at jurisdictional boundaries, can also reduce congestion and lead to improvements in air quality.

The needs identified through the Regional ITS Architecture development process as well as the 2030 LRTP provided guidance for determining which market packages should be included in the architecture. Stakeholders identified ITS needs for the Memphis Urban Area in the following areas:

- Traffic Management;
- Traveler Information;
- Emergency Management; and
- Maintenance and Construction Management; and
- Public Transportation Management.

In addition to the above areas, during discussions of specific ITS market packages for the Region stakeholders also identified market packages in the areas of Archived Data Management and Commercial Vehicles Operations.

In Section 4.1.4 a complete list of regional needs is presented along with the ITS market packages that have been recommended for the Region to consider implementing or expanding (if the

market package currently exists.) Some of the key needs that were specific to ITS that were identified through the development of the Regional ITS Architecture included:

- Improve incident management across jurisdictional boundaries, especially as it relates to traffic management;
- Develop and implement advanced plans for traffic management response to roadway closures including detour routing and arterial management;
- Establish an arterial version of the HELP service patrol program;
- Provide roadside traveler information, including travel times, through dynamic message signs;
- Establish a Traffic Incident Management group that plans for incidents and reviews response after large scale incidents;
- Improve traffic signal coordination between cities at jurisdictional boundaries;
- Improve signal coordination and active signal system management, especially for special events; and
- Improve coordination between MATA and the Arkansas State Highway and Transportation Department.

3.2 Regional Inventory

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

When developing customized elements, the stakeholder group agreed to create individual traffic, maintenance, and emergency management elements for the larger cities. Elements were also called out for the three counties in the Memphis Urban Area, which included Shelby and Fayette Counties in Tennessee and De Soto County in Mississippi. Smaller cities were generally covered under elements named as Municipal elements. These elements acted as placeholders in the Regional ITS Architecture for small municipalities that do not have ITS deployed at this time but may add ITS elements in the future. This documentation allows those communities to be included in the Regional ITS Architecture, and therefore eligible to use federal funding on potential future ITS deployments provided those deployments conform to the Regional ITS Architecture, even if there are no specific plans for ITS implementation at this time.

3.2.1 Stakeholders

Each element included in the Memphis Urban Area Regional ITS Architecture is associated with a stakeholder agency. A listing of stakeholders as identified in the Memphis Urban Area Regional ITS Architecture can be found in **Table 3** along with a description of the stakeholder.

Table 3 – Memphis Urban Area Stakeholder Descriptions

Stakeholder	Stakeholder Description
AHTD	Arkansas State Highway and Transportation Department. Responsible for the construction, maintenance, and operation of state roadways in Arkansas.
Arkansas State Police	Statewide law enforcement agency responsible for enforcing all criminal and traffic laws of the State of Arkansas.
City of Bartlett	Municipal government for the City of Bartlett. Covers all city departments including those that deal with traffic and public safety.
City of Collierville	Municipal government for the City of Collierville. Covers all city departments including those that deal with traffic and public safety.
City of Germantown	Municipal government for the City of Germantown. Covers all city departments including those that deal with traffic and public safety.
City of Horn Lake	Municipal government for the City of Horn Lake. Covers all city departments including those that deal with traffic and public safety.
City of Memphis	Municipal government for the City of Memphis. Covers all city departments including those that deal with traffic and public safety.
City of Millington	Municipal government for the City of Millington. Covers all city departments including those that deal with traffic and public safety.
City of Olive Branch	Municipal government for the City of Olive Branch. Covers all city departments including those that deal with traffic and public safety.
City of Southaven	Municipal government for the City of Southaven. Covers all city departments including those that deal with traffic and public safety.
City of West Memphis	Municipal government for the City of West Memphis. Covers all city departments including those that deal with traffic and public safety.
Commercial Vehicle Operators	Operators of commercial vehicles.
DARTS	Delta Area Rural Transit System. Provides demand response rural transit service in northwestern Mississippi including DeSoto County.
Delta HRA	Delta Human Resource Agency. Responsible for demand response transportation services in the Region.
DeSoto County	Government for DeSoto County. Includes all county departments including the Sheriff's Office and Highway Department as well as the DeSoto County Emergency Management Agency.
Fayette County	Government for Fayette County. Includes all county departments including the Sheriff's Office and Highway Department as well as the Fayette County Emergency Management Agency.
Financial Institution	Institution that handles exchange of money for transit electronic fare collection.
Greater Memphis Regional Express Bus	Regional express bus envisioned to travel between Tennessee and Mississippi. MDOT is currently studying the feasibility of developing a regional express bus system.
MATA	Memphis Area Transit Authority. Provides transit service in the City of Memphis and portions of Shelby County. MATA operates fixed route buses, paratransit service, a downtown trolley system, and various special event shuttles.
MDOT	Mississippi Department of Transportation. Responsible for the construction, maintenance, and operation of state roadways in Mississippi.
Media	Local media that provide traffic or incident information to the public.

Table 3 – Memphis Urban Area Stakeholder Descriptions (continued)

Stakeholder	Stakeholder Description
MEMA	Mississippi Emergency Management Agency. Responsible for emergency operations during a disaster or large scale incident.
Memphis and Shelby County Health Department	Health Department for Memphis and Shelby County. Responsible for providing a variety of environmental and personal health services.
Memphis MPO	Metropolitan Planning Organization for Memphis and Shelby County.
Mississippi Highway Patrol	Agency responsible for the enforcement of traffic safety laws on state and federal highways.
MS Municipal and County Emergency Management Stakeholder Group	Stakeholder group made up of Emergency Management Agencies in Mississippi including the following: City of Horn Lake, City of Olive Branch, City of Southaven, DeSoto County and Municipal/County Government.
MS Municipal and County Traffic Management Stakeholder Group	Stakeholder group made up of Traffic Management Agencies in Mississippi including the following: City of Horn Lake, City of Olive Branch, City of Southaven, and Municipal/County Government.
Municipal/County Government	Government for various municipalities and counties within the Region that are not specifically called out. Covers all departments including those that deal with traffic and public safety.
NOAA	National Oceanic and Atmospheric Administration. Responsible for gathering weather information and issuing severe weather warnings.
Other Agencies	Stakeholder group made up of a wide variety of agencies. The associated elements are groups of agencies or providers that do not have a primary stakeholder agency.
Private Information Provider	Private sector business responsible for the gathering and distribution of traveler information. This service is typically provided on a subscription basis.
Private Service Provider	Private business providing transportation related services.
Rail Operators	Companies that operate rail systems including the dispatch and control of trains and the maintenance and operations of railroad tracks.
Shelby County	Government for Shelby County. Includes all county departments including the Sheriff's Office and Highway Department as well as the Shelby County Emergency Management Agency.
Shelby County Emergency Management Stakeholder Group	Stakeholder group made up of Emergency Management Agencies in Shelby County including the following: City of Memphis, City of Bartlett, City of Collierville, City of Germantown, Shelby County, and Municipal/County Government.
Shelby County Traffic Management Stakeholder Group	Stakeholder group made up of Traffic Management Agencies in Shelby County including the following: City of Memphis, City of Bartlett, City of Collierville, City of Germantown, City of Millington, Shelby County, and Municipal/County Government.
Southwest HRA	Southwest Human Resource Agency. Responsible for demand response transportation services in several counties adjacent to the Memphis Region.
System Users	All of the users of the transportation system.
TDOT	Tennessee Department of Transportation. Responsible for the construction, maintenance, and operation of state roadways in Tennessee.

Table 3 – Memphis Urban Area Stakeholder Descriptions (continued)

Stakeholder	Stakeholder Description
TEMA	Tennessee Emergency Management Agency. Responsible for emergency operations during a disaster or large scale incident.
Tennessee Bureau of Investigation	Statewide law enforcement agency responsible for issuing statewide AMBER Alerts in Tennessee.
THP	Tennessee Highway Patrol. Responsible for the statewide enforcement of traffic safety laws as well as commercial vehicle regulations.
TN Municipal and County Emergency Management Stakeholder Group	Stakeholder group made up of Emergency Management Agencies in Tennessee including the following: City of Memphis, City of Bartlett, City of Collierville, City of Germantown, Shelby County, Fayette County and Municipal/County Government.
TN Municipal and County Traffic Management Stakeholder Group	Stakeholder group made up of Traffic Management Agencies in Tennessee including the following: City of Memphis, City of Bartlett, City of Collierville, City of Germantown, City of Millington, Shelby County and Municipal/County Government.
US Coast Guard	United States Coast Guard. Responsible for all navigable waterways including the Mississippi River.

3.2.2 ITS Elements

The ITS inventory is documented in the Regional ITS Architecture as elements. **Table 4** sorts the inventory by stakeholder so that each stakeholder can easily identify and review all of the architecture elements associated with their agency. The table includes the status of the element. In many cases an element classified as existing might still need to be enhanced to attain the service level desired by the Region.

The naming convention used for elements in the Memphis Urban Area Regional ITS Architecture is consistent with the naming convention used in the Statewide ITS Architecture. This consistency provides seamless connections between the Regional and Statewide ITS Architecture.

Table 4 – Memphis Urban Area Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
ADEM	Arkansas DEM	The Arkansas Department of Emergency Management is responsible for emergency operations during a disaster or large scale incident.	Existing
AHTD	AHTD Crittenden County Local TOC	Traffic operations center in Crittenden County with shared access to TDOT CCTV cameras located in Arkansas.	Existing
	AHTD District 1 TMC	Transportation management center for AHTD District 1. Responsible for the operation of the ITS equipment located in District 1.	Planned
	AHTD District Maintenance	AHTD entity responsible for the oversight of maintenance activities in AHTD District 1.	Existing
	AHTD Statewide TMC	Arkansas Statewide Traffic Management Center located in Little Rock.	Planned
	Arkansas 511 System	Statewide 511 traveler information system central server.	Planned
	Arkansas TSIS	Statewide roadway conditions database for Arkansas.	Existing
Arkansas State Police	Arkansas State Police	Statewide law enforcement agency with powers to enforce all criminal and traffic laws of the State of Arkansas.	Existing
City of Bartlett	City of Bartlett CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Bartlett DMS	Dynamic message signs for traffic information dissemination.	Planned
	City of Bartlett Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems (VIVDS), remote traffic microwave sensors (RTMS), or traditional loops. Also includes sensors to detect train lengths and speeds to estimate the anticipated duration of closures.	Planned
	City of Bartlett Fire/EMS Vehicles	City of Bartlett Fire Department and Emergency Medical Services vehicles.	Existing
	City of Bartlett Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Bartlett Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Bartlett Police Vehicles	City of Bartlett Police Department vehicles.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
City of Bartlett (continued)	City of Bartlett Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Bartlett Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Bartlett TOC	Traffic operations center for the City of Bartlett. Responsible for the operation of the traffic signal system, closed circuit television (CCTV) cameras, dynamic message signs (DMS), and any other ITS infrastructure deployed by the City.	Existing
	City of Bartlett Traffic Signals	Traffic signal system operated by the City of Bartlett.	Existing
	City of Bartlett Website	Website for the City of Bartlett. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
City of Collierville	City of Collierville CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Collierville DMS	Dynamic message signs for traffic information dissemination.	Planned
	City of Collierville Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems (VIVDS), remote traffic microwave sensors (RTMS), or traditional loops. Also includes sensors to detect train lengths and speeds to estimate the anticipated duration of closures.	Planned
	City of Collierville Fire Vehicles	City of Collierville Fire Department vehicles.	Existing
	City of Collierville Police Department	911 Public Safety Answering Point responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Collierville Police Vehicles	City of Collierville Police Department vehicles.	Existing
	City of Collierville Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Collierville Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Collierville TOC	Traffic operations center for the City of Collierville. Responsible for the operation of the traffic signal system, closed circuit television cameras, dynamic message signs, and any other ITS infrastructure deployed by the City.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
City of Collierville (continued)	City of Collierville Traffic Signals	Traffic signal system operated by the City of Collierville.	Existing
	City of Collierville Website	Website for the City of Collierville. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
City of Germantown	City of Germantown CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Germantown DMS	Dynamic message signs for traffic information dissemination.	Planned
	City of Germantown Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops. Also includes sensors to detect train lengths and speeds to estimate the anticipated duration of closures.	Planned
	City of Germantown Fire Vehicles	City of Germantown Fire Department vehicles.	Existing
	City of Germantown Police Department	911 Public Safety Answering Point responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Germantown Police Vehicles	City of Germantown Police Department vehicles.	Existing
	City of Germantown Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Germantown Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Germantown TOC	Traffic operations center for the City of Germantown. Responsible for the operation of the traffic signal system, closed circuit television cameras, dynamic message signs, and any other ITS infrastructure deployed by the City.	Existing
	City of Germantown Traffic Signals	Traffic signal system operated by the City of Germantown.	Existing
	City of Germantown Website	Website for the City of Germantown. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
City of Horn Lake	City of Horn Lake 911 Dispatch	Responsible for emergency call-taking and dispatch for the City of Horn Lake.	Existing
	City of Horn Lake Fire/EMS Vehicles	City of Horn Lake Fire Department and Emergency Medical Services vehicles.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
City of Horn Lake (continued)	City of Horn Lake Police Vehicles	City of Horn Lake Police Department vehicles.	Existing
	City of Horn Lake Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Horn Lake TOC	Traffic operations center for the City of Horn Lake. Responsible for the operation of the traffic signal system.	Planned
	City of Horn Lake Traffic Signals	Traffic signal system operated by the City of Horn Lake.	Existing
City of Memphis	City of Memphis Arterial Emergency Response Dispatch	Dispatch for roadway service patrol vehicles operating on arterials in the City of Memphis.	Planned
	City of Memphis Arterial Emergency Response Vehicles	Roadway service patrol vehicles that operate off the interstate system in the City of Memphis to aid in incident clearance and incident scene traffic management.	Planned
	City of Memphis CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Memphis Engineer's Office	Office responsible for administration of maintenance and construction projects within the City as well as communicating work zone information to the public and other affected agencies.	Existing
	City of Memphis DMS	Dynamic message signs for traffic information dissemination.	Planned
	City of Memphis Engineering Division	Division responsible for design, survey, and inspection during construction of streets, bridges, storm drains, sanitary sewers, traffic control devices and City facilities. The division also provides installation and maintenance of signs and markings along streets and maintenance of traffic lights for the City and County municipalities.	Existing
	City of Memphis Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops. Also includes sensors to detect train lengths and speeds to estimate the anticipated duration of closures.	Planned
	City of Memphis Fire/EMS Vehicles	City of Memphis Fire Department and Emergency Medical Services vehicles.	Existing
	City of Memphis Parking Management System	Parking management system to provide real-time parking availability information to drivers in coordination with private parking facilities and transit and traffic management.	Planned
	City of Memphis Police Department	911 Public Safety Answering Point responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
City of Memphis (continued)	City of Memphis Police Portable DMS	Portable dynamic message signs owned and operated by the City of Memphis Police for the distribution of work zone information. In the future the Public Works and Engineering Divisions would like to be able to place messages on the signs as well.	Existing
	City of Memphis Police Vehicles	City of Memphis Police Department vehicles.	Existing
	City of Memphis Public Works Division	Division responsible for the operation and maintenance of the City's infrastructure which includes streets, sanitary sewers, storm drains, bridges and flood control.	Existing
	City of Memphis Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Memphis Service Vehicles	City of Memphis vehicles used by the Public Works Division and Engineering Division to support maintenance, construction, and operation of the City's transportation infrastructure.	Existing
	City of Memphis Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Memphis TOC	Traffic operations center for the City of Memphis. Responsible for the operation of the traffic signal system, closed circuit television cameras, dynamic message signs, and any other ITS infrastructure deployed by the City.	Existing
	City of Memphis Traffic Signals	Traffic signal system operated by the City of Memphis.	Existing
	City of Memphis Website	Website for the City of Memphis. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
City of Millington	City of Millington CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Millington DMS	Dynamic message signs for traffic information dissemination.	Planned
	City of Millington Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops. Also includes sensors to detect train lengths and speeds to estimate the anticipated duration of closures.	Planned
	City of Millington Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Millington Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
City of Millington (continued)	City of Millington TOC	Traffic operations center for the City of Millington. Responsible for the operation of the traffic signal system, closed circuit television cameras, dynamic message signs, and any other ITS infrastructure deployed by the City.	Existing
	City of Millington Traffic Signals	Traffic signal system operated by the City of Millington.	Existing
	City of Millington Website	Website for the City of Millington. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
City of Olive Branch	City of Olive Branch CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Olive Branch DMS	Dynamic message signs for traffic information dissemination.	Planned
	City of Olive Branch Emergency Communications Center	911 Public Safety Answering Point responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Olive Branch Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Planned
	City of Olive Branch Fire/EMS	City of Olive Branch Fire Department and Emergency Medical Services vehicles.	Existing
	City of Olive Branch Police Vehicles	City of Olive Branch Police Department vehicles.	Existing
	City of Olive Branch Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Olive Branch TOC	Traffic operations center for the City of Olive Branch. Responsible for the operation of the traffic signal system, closed circuit television cameras, dynamic message signs, and any other ITS infrastructure deployed by the City.	Existing
	City of Olive Branch Traffic Signals	Traffic signal system operated by the City of Olive Branch.	Existing
	City of Olive Branch Website	Website for the City of Olive Branch. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
City of Southaven	City of Southaven Fire/EMS	City of Southaven Fire Department and Emergency Medical Services vehicles.	Existing
	City of Southaven Police Department	Police Department for the City of Southaven. Responsible for emergency call-taking and dispatch for the City of Southaven.	Existing
	City of Southaven Police Vehicles	City of Southaven Police Department Vehicles.	Existing
	City of Southaven Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Southaven Traffic Signals	Traffic signal system operated by the City of Southaven.	Existing
City of West Memphis	City of West Memphis Police Department	Police Department for the City of West Memphis.	Existing
	City of West Memphis TOC	Traffic operations center for the City of West Memphis. Responsible for the operation of the traffic signal system and any other ITS infrastructure deployed by the City.	Planned
	West Memphis MPO Data Archive	Archive of regional transportation data used in planning.	Planned
Commercial Vehicle Operators	Commercial Vehicles	Privately owned commercial vehicles traveling within the Region.	Existing
	Private Fleet Management Systems	Fleet and freight management for private carriers.	Existing
	Rail Freight	Rail cars traveling within the Region.	Existing
DARTS	DARTS Data Archive	Delta Area Rural Transit System transit ridership statistics used by the National Transit Database, FTA, and MDOT.	Planned
	DARTS Demand Response Vehicles	Delta Area Rural Transit System demand response vehicle fleet.	Existing
	DARTS Dispatch Center	Delta Area Rural Transit System dispatch center responsible for the tracking, scheduling, and dispatching of DARTS demand response services.	Existing
	DARTS Transit Facility CCTV Camera Surveillance	Delta Area Rural Transit System closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Planned
	DARTS Website	Delta Area Rural Transit System website. Includes information on services and in the future it is envisioned that the website will have real-time information about regional transit services and the ability to make trip requests online.	Existing
Delta HRA	Delta HRA Data Archive	Delta Human Resource Agency transit ridership statistics used by the National Transit Database, FTA, and TDOT Office of Public Transportation.	Planned
	Delta HRA Demand Response Vehicles	Delta Human Resource Agency demand response vehicle fleet.	Existing
	Delta HRA Transit Facility CCTV Camera Surveillance	Delta Human Resource Agency closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Planned

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
Delta HRA (continued)	Delta HRA Transportation Dispatch Center	Delta Human Resource Agency dispatch center responsible for the tracking, scheduling and dispatching of Delta HRA demand response services.	Existing
	Delta HRA Website	Delta Human Resource Agency transit website. Includes information on services and in the future it is envisioned that the website will have real-time information about regional transit services and the ability to make trip requests online.	Existing
DeSoto County	DeSoto County E-911	Primary 911 Public Safety Answering Point responsible for answering most 911 calls made within the County and dispatching emergency responders.	Existing
	DeSoto County EMA	Emergency Management Agency for DeSoto County. Responsible for disaster planning for the County and operating the emergency operations center.	Existing
	DeSoto County EMS Dispatch	Emergency Medical Services dispatch for DeSoto County.	Existing
	DeSoto County EMS Vehicles	DeSoto County Emergency Medical Services vehicles.	Existing
	DeSoto County Sheriff Vehicles	DeSoto County Sheriff's Office vehicles.	Existing
Fayette County	Fayette County EMA	Emergency Management Agency for Fayette County. Responsible for disaster planning for the County and operating the emergency operations center.	Existing
	Fayette County EMS Dispatch	Emergency Medical Services dispatch for Fayette County.	Existing
	Fayette County EMS Vehicles	Fayette County Emergency Medical Services vehicles.	Existing
	Fayette County Sheriff	Primary 911 Public Safety Answering Point responsible for answering most 911 calls made within the County and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	Fayette County Sheriff Vehicles	Fayette County Sheriff's Office vehicles.	Existing
Financial Institution	Financial Service Provider	Service provider that handles exchange of money for transit electronic payment collection.	Existing
Greater Memphis Regional Express Bus	Greater Memphis Regional Express Bus Dispatch Center	Dispatch center for a future express bus system between Mississippi and Tennessee that is currently being evaluated by MDOT.	Planned
	Greater Memphis Regional Express Bus System Website	Website for potential regional express bus service between Mississippi and Tennessee.	Planned
	Regional Express Bus Vehicles	Express bus vehicles that may be part of a future express bus system between Mississippi and Tennessee that is currently being evaluated by MDOT.	Planned

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
MATA	MATA Bus Arrival Status Boards	Memphis Area Transit Authority real-time next bus arrival information boards at transit transfer centers and select bus stops.	Existing
	MATA Data Archive	Memphis Area Transit Authority transit ridership statistics used by the National Transit Database, FTA, and TDOT Office of Public Transportation.	Existing
	MATA Dispatch Center	Memphis Area Transit Authority central dispatch for fixed route and paratransit operations.	Existing
	MATA Fare Collection Kiosks	Memphis Area Transit Authority kiosks used for the purchase and recharging of electronic fare payment cards.	Existing
	MATA Fixed Route Vehicles	Memphis Area Transit Authority fixed route vehicles. Includes neighborhood routes, downtown trolleys, and any other fixed route service.	Existing
	MATA Paratransit Vehicles	Memphis Area Transit Authority paratransit vehicles.	Existing
	MATA Transit Facility CCTV Surveillance	Memphis Area Transit Authority closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Existing
	MATA Trolleys	Memphis Area Transit Authority trolley.	Existing
	MATA Website	Memphis Area Transit Authority website. Includes information on MATA services and in the future it is envisioned that the website will have real-time information about regional transit services.	Existing
MDOT	MDOT CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Existing
	MDOT Data Archive	Archive of transportation data used in planning.	Existing
	MDOT District 2 Engineer's Office	District 2 Engineer's Office is responsible for administration of maintenance and construction projects within the District as well as communicating work zone information to the public through the Public Information Office.	Existing
	MDOT District 2 Maintenance	Office that handles most of the routine roadway maintenance and responds to incidents when services are requested by local emergency management.	Existing
	MDOT DMS	Dynamic message signs for traffic information dissemination.	Existing
	MDOT Emergency Services Coordinator	Coordinator responsible for managing the MDOT response in a large scale incident or disaster in which the Mississippi Emergency Management Agency activates the state emergency operations center.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
MDOT (continued)	MDOT Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Existing
	MDOT HAR	Highway advisory radio for traffic information dissemination.	Planned
	MDOT Maintenance Vehicles	MDOT vehicles used in maintenance operations.	Existing
	MDOT Northwest Regional TMC	MDOT traffic management center for Northwest Mississippi, located in Southaven. Responsible for the operation of traffic signals and other ITS devices in the area. The City of Southaven is co-located with MDOT at the TMC.	Existing
	MDOT Portable DMS	Portable dynamic message signs for the distribution of traffic and roadway condition information.	Existing
	MDOT Public Information Office	Office responsible for the dissemination of traffic information to the media and the public.	Existing
	MDOT RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	MDOT Smart Work Zone Equipment	Portable ITS equipment that can be used in work zones to more efficiently manage traffic and provide traveler information. Includes portable closed circuit television cameras, vehicle detection, and dynamic message signs.	Planned
	MDOT Traffic Signals	Traffic signal system operated by the Mississippi DOT.	Existing
Media	Local Print and Broadcast Media	Local media outlets including television stations, newspapers, radio stations and their associated websites.	Existing
MEMA	Mississippi EMA	The Mississippi Emergency Management Agency manages emergency operations during a disaster or large scale incident.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
Memphis and Shelby County Health Department	Memphis and Shelby County Health Department Emissions Sensors	Air quality sensors that monitor ozone and particulate matter levels.	Existing
	Memphis and Shelby County Health Department Pollution Control	Responsible for administering local air pollution control laws and monitoring air quality in Shelby County.	Existing
Memphis MPO	Memphis MPO Data Archive	Archive of regional transportation data used in planning.	Planned
	Memphis MPO Website	Website for the Memphis Urban Area MPO.	Existing
Mississippi Highway Patrol	MHP Dispatch	Mississippi Highway Patrol dispatch center. There are several MHP dispatch centers around the state of Mississippi.	Existing
	MHP Vehicles	Mississippi Highway Patrol vehicles.	Existing
MS Municipal and County Emergency Management Stakeholder Group	All MS Municipal and County Emergency Dispatch Agencies	Group of emergency management agencies in Mississippi that includes the following: the City of Horn Lake 911 Dispatch, City of Olive Branch Emergency Communications Center, City of Southaven Police Department, DeSoto County E-911, and Municipal Emergency Dispatch.	Existing
MS Municipal and County Traffic Management Stakeholder Group	All MS Municipal and County TOCs	Group of traffic management agencies in Mississippi that includes the following: City of Horn Lake TOC, City of Olive Branch TOC, City of Southaven (MDOT Northwest Regional TMC) and Municipal TOC.	Existing
Municipal/County Government	Municipal Arterial Emergency Response Dispatch	Dispatch for roadway service patrol vehicles operating on arterials in the municipality.	Planned
	Municipal Arterial Emergency Response Vehicles	Roadway service patrol vehicles that operate off the interstate system within the municipality to aid in incident clearance and incident scene traffic management.	Planned
	Municipal CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	Municipal Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Planned
	Municipal Public Safety Dispatch	Responsible for the dispatch of municipal public safety vehicles.	Existing
	Municipal Public Safety Vehicles	Vehicles used by municipal public safety agencies.	Existing
	Municipal Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
Municipal/County Government (continued)	Municipal TOC	Municipal traffic operations center. Responsible for the operation of the traffic signal system, closed circuit television cameras, dynamic message signs, and any other ITS infrastructure deployed by the municipality.	Planned
	Municipal Traffic Signals	Municipal traffic signal systems within the Memphis Region.	Existing
	Municipal/County Engineers Office	Municipal/County Engineer's office is responsible for administration of maintenance and construction projects within the municipality as well as communicating work zone information to the public through the Public Information Office.	Existing
	Municipal/County Maintenance	Department that oversees the maintenance of streets, sidewalks, and roadway right-of-way.	Existing
	Municipal/County Maintenance Vehicles	Municipal/County vehicles used in maintenance operations.	Existing
	Municipal/County Portable DMS	Portable dynamic message signs used for traffic information dissemination during maintenance and construction activities, special events, or incidents.	Planned
	Municipal/County RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	Municipal/County Website	Municipal or county website that includes information on agency departments. In the future it is envisioned that the website would have real-time information about roadway conditions.	Planned
	Other Municipal/County Maintenance	Maintenance groups in adjacent municipalities or counties for coordination of maintenance activities.	Existing
NOAA	National Weather Service	Provides official US weather, marine, fire, and aviation forecasts, warnings, meteorological products, climate forecasts, and information about meteorology.	Existing
Other Agencies	Other Maintenance and Construction Management	Additional maintenance and construction operations agencies with which information is shared for coordination in an emergency situation.	Existing
	Other Traffic Management	Additional traffic management agencies with which information is shared for coordination in an emergency situation.	Existing
Private Information Provider	Private Probe Data Provider	Private provider of aggregated vehicle probe data for monitoring of road network conditions.	Planned
	Private Sector Traveler Information Services	Traveler information service operated by a private entity.	Existing
	Private Transit Information Provider	Private company that repackages transit information for subscribers.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
Private Service Provider	Private Contract EMS Vehicles	Emergency Medical Services vehicles operating within Shelby County under contract with the Shelby County Fire Department.	Existing
	Private Parking Facilities	Privately owned public parking facilities that typically charge a fee for parking.	Existing
	Private Transportation Providers	Private providers of transportation services in the Region. This includes taxis, Greyhound or other inter-city bus providers, Amtrak and the New Freedoms Program.	Existing
Rail Operators	Rail Operator Wayside Equipment	Equipment located along the tracks including railroad crossing gates, bells, and lights as well as the interface to the traffic signal controller indicating the presence of a train.	Existing
Shelby County	Memphis-Shelby County EMA	Emergency Management Agency for the City of Memphis and Shelby County. Responsible for disaster planning for the County and operating the emergency operations center.	Existing
	Shelby County Fire Department	Responsible for dispatch of private contract EMS vehicles operating on behalf of the Fire Department within Shelby County.	Existing
	Shelby County Fire Vehicles	Shelby County Fire Department vehicles.	Existing
	Shelby County Sheriff	911 Public Safety Answering Point responsible for answering all 911 calls made within the County outside the Cities of Memphis, Bartlett, Collierville and Germantown and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	Shelby County Sheriff Vehicles	Shelby County Sheriff's Office vehicles.	Existing
	Shelby County TOC	Traffic operations center for Shelby County. Responsible for the operation of the traffic signal system.	Planned
	Shelby County Traffic Signals	Traffic signal system operated by Shelby County.	Existing
Shelby County Emergency Management Stakeholder Group	All Shelby County Emergency Dispatch Agencies	Group of emergency management agencies in Shelby County that includes the following: the City of Memphis Police Department, City of Bartlett Police Department, City of Collierville Police Department, City of Germantown Police Department, Shelby County Sheriff, and Municipal Emergency Dispatch.	Existing
Shelby County Traffic Management Stakeholder Group	All Shelby County TOCs	Group of traffic management agencies in Shelby County that includes the following: the City of Bartlett TOC, City of Collierville TOC, City of Germantown TOC, City of Millington TOC, Shelby County TOC, and Municipal TOC.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
System Users	Archive Data user	Those who request information from the data archive systems.	Existing
	Private Travelers Personal Computing Devices	Computing devices that travelers use to access public information.	Existing
	Private Vehicles	Private Vehicle	Existing
	Traveler	User of the transportation system.	Existing
TDOT	Other TDOT Region Construction and Maintenance Offices	Other TDOT regional construction and maintenance offices besides those in Region 4.	Existing
	TDOT Automated Roadway Treatment Equipment	Equipment used for the automated application on anti-icing chemicals at locations prone to freezing.	Planned
	TDOT CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Existing
	TDOT District Maintenance	Office that handles most of the routine roadway maintenance and responds to incidents when services are requested by local emergency management.	Existing
	TDOT DMS	Dynamic message signs for traffic information dissemination.	Existing
	TDOT Emergency Services Coordinator	Coordinator responsible for managing the Tennessee Department of Transportation response in a large scale incident or disaster in which the Tennessee Emergency Management Agency activates the state emergency operations center.	Existing
	TDOT Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Existing
	TDOT HAR	Highway advisory radio for traffic information dissemination.	Existing
	TDOT HELP Vehicles	Roadway service patrol vehicles. Currently operate in the Memphis area only and are dispatched elsewhere in the Region for large incidents.	Existing
	TDOT Infrastructure Monitoring Equipment	Surveillance equipment deployed on and near the Mississippi River bridges to monitor the security of the bridges.	Existing
	TDOT Infrastructure Monitoring Sensors	Sensors on bridge structures that are monitoring seismic activity. The data is transmitted to the University of Memphis Center for Earthquake Research and Information from the TDOT Region 4 TMC.	Existing
	TDOT Maintenance Headquarters	TDOT maintenance headquarters.	Existing
	TDOT Maintenance Vehicles	TDOT vehicles used in maintenance operations.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
TDOT (continued)	TDOT Project Planning Division Archive	Data archive for the Project Planning Division. The Division is responsible for traffic data collection and analysis and includes the Short Range Planning Office.	Existing
	TDOT Public Information Office	Office responsible for the dissemination of traffic information to the media and the public.	Existing
	TDOT Ramp Metering Equipment	Roadway equipment used in the operation of a ramp metering system. Includes the signals and any other ITS equipment.	Planned
	TDOT Region 1 TMC - Knoxville	Transportation management center for Region 1, located in Knoxville. Responsible for the operation of the ITS equipment located in Region 1. This includes the freeway management system in Knoxville as well as rural ITS deployments.	Existing
	TDOT Region 2 TMC - Chattanooga	Transportation management center for Region 2, located in Chattanooga. Responsible for the operation of the ITS equipment located in Region 2. This includes the freeway management system in Chattanooga as well as rural ITS deployments.	Existing
	TDOT Region 3 TMC - Nashville	Transportation management center for Region 3, located in Nashville. Responsible for the operation of the ITS equipment located in Region 3. This includes the freeway management system in Nashville as well as rural ITS deployments.	Existing
	TDOT Region 4	TDOT Region 4 is responsible for the administration and operation of the state highway system in 21 counties in west Tennessee.	Existing
	TDOT Region 4 Backup TMC - Jackson	Backup TMC for TDOT Region 4 located in Jackson at the Region 4 offices. The TMC is connected to the TMC in Memphis via a wireless link.	Existing
	TDOT Region 4 Construction Office	Office responsible for oversight of construction projects in Region 4.	Existing
	TDOT Region 4 Engineer's Office	Office responsible for administration of maintenance and construction projects within the Region as well as communicating work zone information to the public through the Public Information Office.	Existing
	TDOT Region 4 HELP Dispatch	Roadway service patrol dispatch. Currently service is limited to the Memphis area except in the case of a large scale incident.	Existing
	TDOT Region 4 Maintenance	Region 4 maintenance headquarters. Responsible for maintenance operations in the Region; however, most routine maintenance is handled by the District Maintenance Offices. There are several District Maintenance Offices within the Region.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
TDOT (continued)	TDOT Region 4 Smart Work Zone Equipment	Portable ITS equipment that can be used in work zones to more efficiently manage traffic and provide traveler information. Includes portable closed circuit television (CCTV) cameras, vehicle detection, and dynamic message signs (DMS).	Planned
	TDOT Region 4 TMC - Memphis	Transportation management center for Region 4, located in Memphis. Responsible for the operation of the ITS equipment located in Region 4. This includes the freeway management system in Memphis as well as rural ITS deployments.	Existing
	TDOT RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	TDOT SmartWay Information System (TSIS)	TSIS is a statewide roadway conditions database. Currently information can be entered by District and Regional maintenance personnel as well as staff at any of the traffic management centers and the Tennessee Highway Patrol. TSIS feeds the Statewide 511 system and SmartWay website.	Existing
	TDOT SmartWay Website	Website providing road network conditions including incident and construction information and camera views. Much of the data for the website comes from TSIS.	Existing
	TDOT Toll Plazas	Toll plazas used for electronic toll collection on potential future toll roads.	Planned
	Tennessee 511 IVR	Tennessee 511 Interactive Voice Response. TDOT contracts the IVR operation to a vendor. The IVR accepts callers' requests and provides responses to specific traveler information needs. This is the customer interface component of the 511 phone system.	Existing
	Tennessee 511 System	511 traveler information system central server.	Existing
TEMA	Tennessee EMA	Tennessee Emergency Management Agency responsible for managing emergency operations during a disaster or large scale incident.	Existing
Tennessee Bureau of Investigation	Tennessee Bureau of Investigation	Responsible for issuing statewide America's Missing: Broadcast Emergency Response (AMBER) Alerts in Tennessee.	Existing
THP	THP Dispatch	Tennessee Highway Patrol dispatch center. There are several THP dispatch centers around the state of Tennessee.	Existing
	THP Vehicles	Tennessee Highway Patrol vehicles.	Existing

Table 4 – Memphis Urban Area Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
THP (continued)	TITAN Database	The Tennessee Integrated Traffic Analysis Network is the Tennessee Department of Safety crash record database maintained by THP for the collection of crash record information. TITAN interfaces with the TraCS (Traffic and Criminal Software) system.	Existing
TN Municipal and County Emergency Management Stakeholder Group	All TN Municipal and County Emergency Dispatch Agencies	Group of emergency management agencies that includes the following: the City of Memphis Police Department, City of Bartlett Police Department, City of Collierville Police Department, City of Germantown Police Department, Fayette County Sheriff, Shelby County Sheriff, and Municipal Emergency Dispatch.	Existing
	All TN Municipal and County Public Safety Vehicles	Public safety vehicles operated by municipal and county emergency management agencies.	Existing
TN Municipal and County Traffic Management Stakeholder Group	All TN Municipal and County TOCs	Group of traffic management agencies that includes the following: the City of Bartlett TOC, City of Collierville TOC, City of Germantown TOC, City of Millington TOC, Shelby County TOC, and Municipal TOC.	Existing
US Coast Guard	US Coast Guard	United States Coast Guard has jurisdiction on navigable waterways, such as the Mississippi River.	Existing

4. REGIONAL ITS ARCHITECTURE

Upon completion of the system inventory, the next step in the development of the Regional ITS Architecture was to identify the ITS services that are important to the Memphis Urban Area. The National ITS Architecture has the following eight groups of ITS service areas:

- ***Traffic Management*** – includes incident management, network surveillance, freeway control, roadside traveler information, and electronic tolling. Traffic signal operations on arterials and at rail crossings are also included in this service area.
- ***Emergency Management*** – includes emergency operations and emergency management centers, improved information sharing among traffic and emergency services, emergency vehicle tracking and dispatch, traffic signal preemption for emergency vehicles, and wide-area alerts.
- ***Maintenance and Construction Management*** – includes work zone management, roadway maintenance and construction information, and road weather detection systems.
- ***Public Transportation Management*** – includes transit and paratransit tracking and dispatch, transit travel information systems, electronic fare collection, transit security, and transit traffic signal priority.
- ***Commercial Vehicle Operations*** – includes coordination with CVISN efforts.
- ***Traveler Information*** – includes broadcast traveler information, traveler information kiosks, and highway advisory radio.
- ***Archived Data Management*** – includes electronic data management and archiving systems.
- ***Vehicle Safety*** – these systems were discussed, but at this time this service group is primarily a private sector initiative to incorporate technologies such as intersection collision avoidance and automated vehicle operation systems into vehicles.

Existing, planned, and future systems in the Memphis Urban Area were considered in each of the service areas. Vehicle Safety was not included in the Memphis Urban Area Regional ITS Architecture because implementation of those market packages would primarily be by private sector automobile manufacturers and information service providers.

4.1 Market Packages

In the National ITS Architecture, services are referred to as market packages. Market packages can include several stakeholders and elements that work together to provide a service in the Region. Examples of market packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are currently a total of 91 market packages identified in the National ITS Architecture Version 6.1.

4.1.1 Overview of Market Package Structure

A market package is made up of elements and data flows. Each identified system or component in the Memphis Urban Area regional ITS inventory, which is documented in the previous section, was mapped to a subsystem or terminator in the National ITS Architecture. Subsystems and terminators represent the various functional categories that define the role of an element in ITS and the regional architecture. The elements are connected together by architecture flows that document the existing and planned flow of information. **Figure 3** depicts a sample market package with each of the components identified. Additional explanation of the terminology used can be found after the figure.

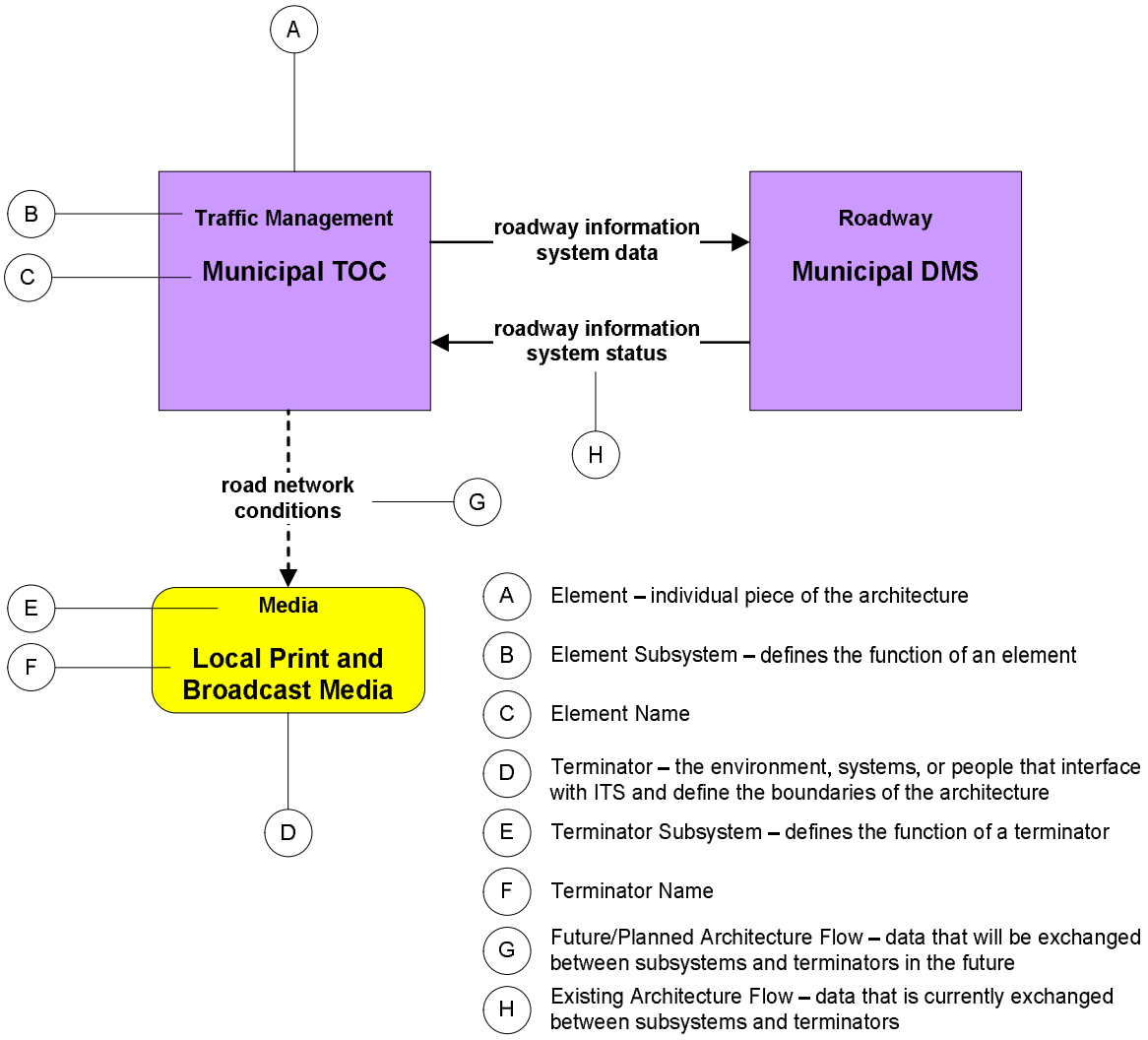

Figure 3 – Overview of Market Package Structure

Elements represent the ITS inventory for the Region. Both existing and planned elements have been included in the inventory and incorporated into the architecture through the development of the market package diagrams.

Subsystems are the highest level building blocks of the physical architecture, and the National ITS Architecture groups them into four major classes: Centers, Fields, Vehicles, and Travelers. Each of these major classes includes various subsystems 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. Each element is assigned to one or more subsystems.

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 services, and information service providers.

Architecture Flows provide a standardized method for documenting the types of information that flow between elements. A flow can be shown as either existing or future/planned. Existing flows indicate a connection that has already been established to share at least a portion of the desired information but showing a flow as existing is not meant to imply that the function is complete. For example, the traffic information coordination flow between traffic management agencies includes the sharing of video images, incident information and other relevant data. The flow could be shown as existing to capture the sharing of video images while incident information is still a future desired expansion of functionality. Many of the architecture flows have associated technical specifications, known as standards, which define the format of the data being shared.

4.1.2 Selection and Prioritization of Regional Market Packages

In the Memphis Urban Area, the National ITS Architecture market packages were reviewed by the stakeholders and selected based on the relevance of the service that the market package could provide to the Region. Stakeholders selected 44 market packages for implementation in the Region. The selected market packages are identified in **Table 5**. Stakeholders prioritized the selected market packages during the workshops, and the table organizes the market packages into service areas and priority groupings.

TDOT is leading a separate effort to develop and implement the CVISN program. CVISN addresses commercial vehicle operations, including ITS, on a statewide level and includes such applications as electronic clearance, safety enforcement, and registration. Unless a specific need was identified in the Memphis Urban Area that could be addressed locally, the commercial vehicle operations market packages were not selected and instead will be covered in the CVISN effort to ensure consistency.

After selecting the market packages that were applicable for the Region, stakeholders reviewed each market package and the elements that could be included to customize it for the Region. This customization is discussed further in the Section 4.1.3.

Table 5 – Memphis Urban Area ITS Market Package Prioritization by Functional Area

High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
Traffic Management		
ATMS01 Network Surveillance ATMS03 Surface Street Control ATMS06 Traffic Information Dissemination ATMS07 Regional Traffic Management ATMS08 Traffic Incident Management System	ATMS04 Freeway Control ATMS13 Standard Railroad Grade Crossing ATMS17 Regional Parking Management	ATMS02 Traffic Probe Surveillance ATMS10 Electronic Toll Collection ATMS11 Emissions Monitoring and Management ATMS19 Speed Monitoring
Emergency Management		
EM01 Emergency Call-Taking and Dispatch EM02 Emergency Routing EM04 Roadway Service Patrols EM05 Transportation Infrastructure Protection	EM06 Wide-Area Alert EM08 Disaster Response and Recovery EM09 Evacuation and Reentry Management EM10 Disaster Traveler Information	
Maintenance and Construction Management		
MC08 Work Zone Management MC10 Maintenance and Construction Activity Coordination MC12 Infrastructure Monitoring	MC01 Maintenance and Construction Vehicle and Equipment Tracking MC03 Road Weather Data Collection MC04 Weather Information Processing and Distribution	MC05 Roadway Automated Treatment MC06 Winter Maintenance
Public Transportation Management		
APTS01 Transit Vehicle Tracking APTS02 Transit Fixed Route Operations APTS03 Demand Response Transit Operations APTS08 Transit Traveler Information APTS09 Transit Signal Priority	APTS04 Transit Fare Collection Management APTS05 Transit Security APTS07 Multi-Modal Coordination APTS10 Transit Passenger Counting	APTS06 Transit Fleet Management
Traveler Information		
ATIS01 Broadcast Traveler Information ATIS02 Interactive Traveler Information		
Commercial Vehicle Operations		
	CVO10 HAZMAT Management	
Archived Data Management		
	AD1 ITS Data Mart	AD2 ITS Data Warehouse AD3 ITS Virtual Data Warehouse

4.1.3 Customization of Regional Market Packages

The market packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the Memphis Urban Area. Market packages represent a service that will be deployed as an integrated capability. Each market package is shown graphically with the market package name, local agencies involved, and desired data flows. The data flows are shown as either existing or planned/future. Data flows shown as existing indicate that in at least one location within the jurisdiction the connection exists. Data flows shown as existing should not be interpreted to mean that deployment of that service is complete as there are many cases where a data flow exists in a service but a need has been identified to expand the service to additional locations.

Figure 4 is an example of an Advanced Traffic Management System (ATMS) market package for traffic information dissemination that has been customized for the Region. This instance focuses on the activities of TDOT. The market package shows the distribution of traffic information from the TDOT Region 4 TMC to emergency dispatch agencies and the media as well as in the future to transit management agencies. Messages are also placed on DMS and HAR and entered into TSIS for inclusion on the SmartWay website and 511. Data flows between the subsystems indicate what information is being shared. The remainder of the market packages that were customized for the Memphis Urban Area Regional ITS Architecture are shown in **Appendix B**.

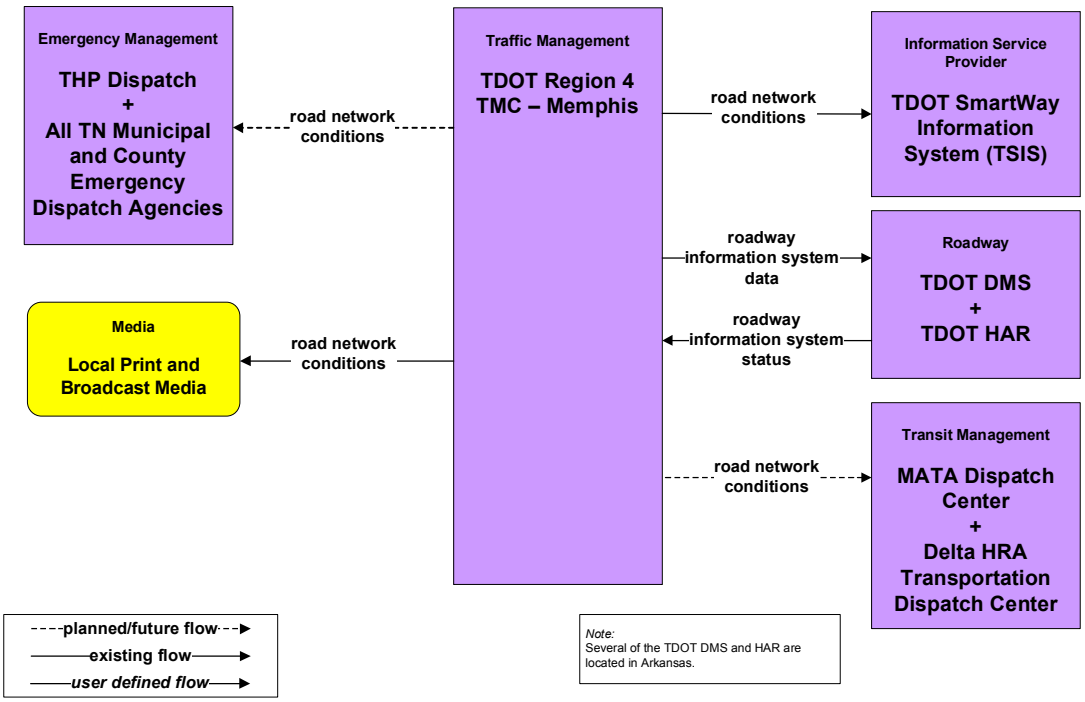

Figure 4 – Example Market Package Diagram: ATMS06 – Traffic Information Dissemination (TDOT Region 4 TMC)

4.1.4 Regional Needs and Corresponding Market Packages

Input received from stakeholders at the Memphis Urban Area Regional ITS Architecture workshops provided valuable input for the market package customization process. The needs identified in the ITS Architecture workshops, as well as needs from the Memphis Urban Area 2030 Long-Range Transportation Plan are identified in **Table 6**. The table also identifies which market package documents the particular ITS need.

Table 6 – Memphis Urban Area Regional ITS Needs and Corresponding Market Packages

ITS Need	Market Package
Traffic Management and Traveler Information	
Continue to develop a multi-modal transportation network that utilizes strategies for addressing congestion management and air quality issues in the Memphis MPO region	ATMS03 – Surface Street Control ATMS06 – Traffic Information Dissemination ATMS07 – Regional Traffic Management EM04 – Roadway Service Patrols
Improve traffic signal coordination between cities at jurisdictional boundaries	ATMS03 – Surface Street Control ATMS06 – Traffic Information Dissemination ATMS07 – Regional Traffic Management
Provide roadside traveler information through dynamic message signs	ATMS06 – Traffic Information Dissemination
Improve signal coordination and active signal system management, especially for special events	ATMS03 – Surface Street Control ATMS07 – Regional Traffic Management ATMS08 – Traffic Incident Management System
Emergency Management	
Increase the safety and security of the transportation system for motorized and non-motorized users	ATMS08 – Traffic Incident Management System EM01 – Emergency Call-Taking and Dispatch EM02 – Emergency Routing EM05 – Transportation Infrastructure Protection
Improve incident management across jurisdictional boundaries, especially as it relates to traffic management	ATMS08 – Traffic Incident Management System EM01 – Emergency Call-Taking and Dispatch EM02 – Emergency Routing EM04 – Roadway Service Patrols
Develop and implement advanced plans for traffic management response to roadway closures including detour routing and arterial management	ATMS03 – Surface Street Control ATMS07 – Regional Traffic Management ATMS08 – Traffic Incident Management System EM04 – Roadway Service Patrols MC08 – Work Zone Management MC10 – Maintenance and Construction Activity Coordination
Establish an arterial version of the HELP service patrol program	EM04 – Roadway Service Patrols
Establish a Traffic Incident Management group that plans for incidents and reviews response after large scale incidents	ATMS08 – Traffic Incident Management System EM04 – Roadway Service Patrols EM08 - Disaster Response and Recovery EM09 – Evacuation and Reentry Management EM10 – Disaster Traveler Information
Public Transportation Management	
Increase the safety and security of the transportation system for motorized and non-motorized users	APTS05 – Transit Security
Improve coordination between MATA and the Arkansas State Highway and Transportation Department	ATMS06 – Traffic Information Dissemination ATMS08 – Traffic Incident Management System

4.2 Architecture Interfaces

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

4.2.1 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 Memphis Urban Area based on the system inventory and information gathered from the stakeholders. **Figure 4** summarizes the existing and planned ITS elements for the Memphis Urban Area 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.

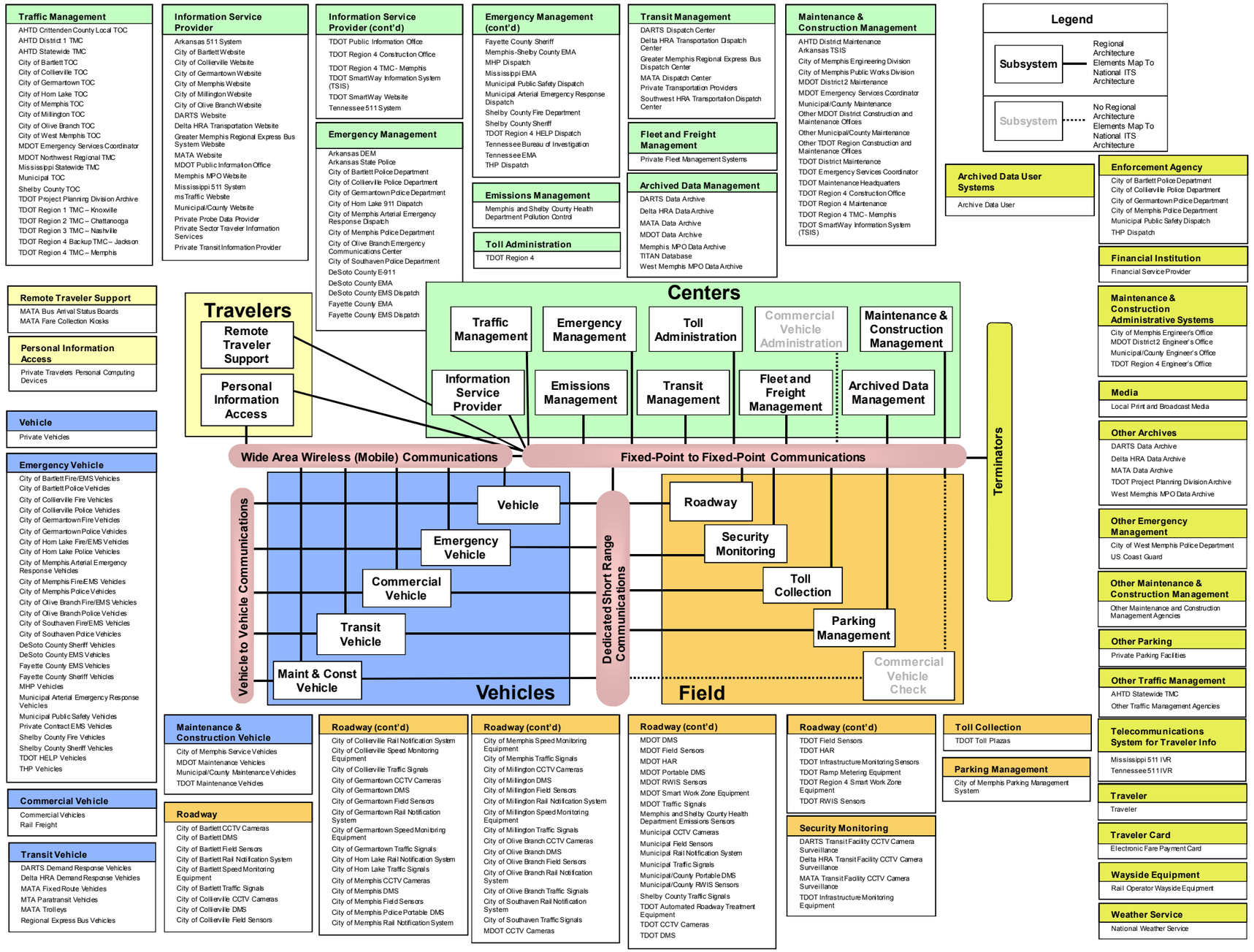

Figure 5 – Memphis Urban Area Regional System Interconnect Diagram

4.2.2 Element Connections

A number of different elements are identified as part of the Memphis Urban Area Regional ITS Architecture. These elements include transportation management centers, transit vehicles, dispatch systems, emergency management agencies, media outlets, and others—essentially, all of the existing and planned physical components that contribute to the regional ITS. Interfaces have been identified for each element in the Memphis Urban Area Regional ITS Architecture and each element has been mapped to those other elements with which it must interface. The Turbo Architecture software can generate interconnect diagrams for each element in the Region that show which elements are connected to one another. **Figure 6** is an example of an interconnect diagram from the Turbo database output. This particular interconnect diagram is for the City of Memphis Traffic Signals.

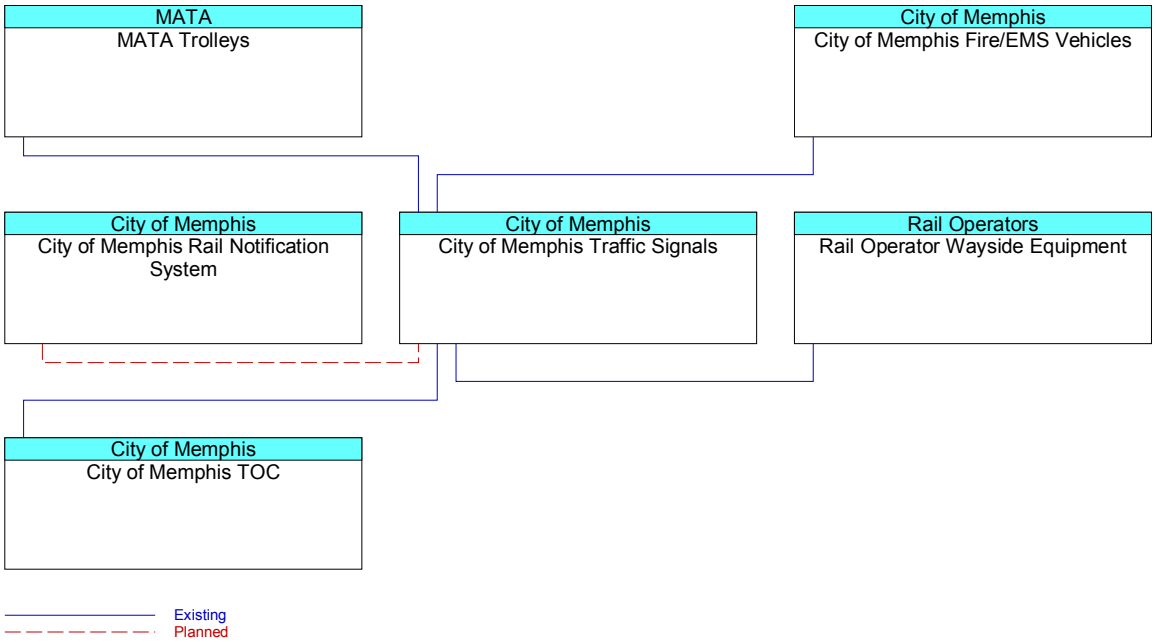

Figure 6 – Example Interconnect Diagram: City of Memphis Traffic Signals

4.2.3 Data Flows Between Elements

In the market package diagrams, flows between the subsystems and terminators define the specific information (data) that is exchanged between the elements and the direction of the exchange. The data flows could be requests for information, alerts and messages, status requests, broadcast advisories, event messages, confirmations, electronic credentials, and other key information requirements. Turbo Architecture can be used to output flow diagrams and can be filtered by market package for ease of interpretation; however, it is important to remember that custom data flows will not show up in diagrams that are filtered by market package. An example of a flow diagram that has been filtered for the ATMS01 – Network Surveillance market package is shown in **Figure 7**.

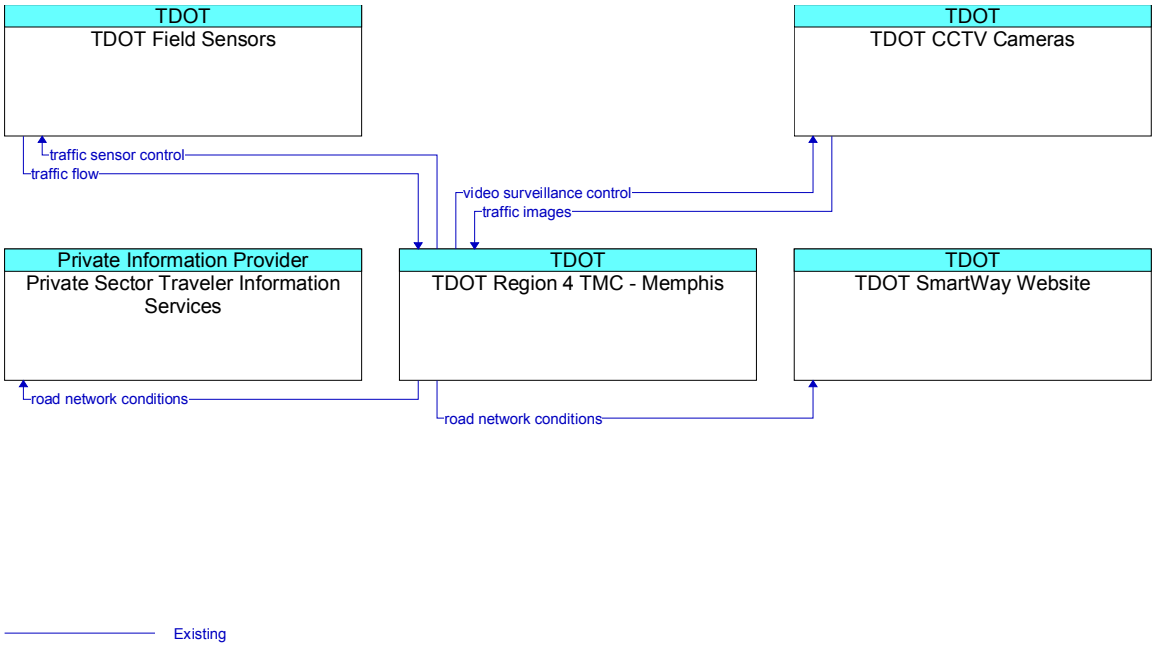

Figure 7 – Example Flow Diagram: ATMS01 – Network Surveillance

4.3 Functional Requirements

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

For the Memphis Urban Area Regional ITS Architecture, functional requirements have been identified at two levels. The customized market packages, discussed previously in Section 4.1.3, describe the services that ITS needs to provide in the Region and the architecture flows between the elements. These market packages and data flows describe what ITS in the Memphis Urban Area has to do and the data that needs to be shared among elements.

At a more detailed level, functional requirements for the Memphis Urban Area are described in terms of functions that each element in the architecture performs or will perform in the future. In the final documents **Appendix C** will contain a table that summarizes the functions by element.

4.4 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Memphis Urban Area Regional ITS Architecture over time. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve. The USDOT's ITS Joint

Program Office is supporting Standards Development Organizations (SDOs) with an extensive, multi-year program of accelerated, consensus-based standards development to facilitate successful ITS deployment in the United States. **Table 7** identifies each of the ITS standards that could apply to the Memphis Urban Area Regional ITS Architecture. These standards are based on the physical subsystem architecture flows previously identified in Section 4.2.3 and shown in the market package diagrams in **Appendix B**.

While **Table 7** does not match the standards to specific architecture flows, that information is available through the National ITS Architecture website and Turbo Architecture. Since the website is updated more frequently than the software and links directly to additional information about the applicable standard, the website is the preferred method for determining which standards apply to a particular architecture flow. To locate this information do the following:

- Go to the main page of the National Architecture website at *http://www.iteris.com/itsarch/*;
- In the menu bar on the left hand side select the tab for Physical Architecture;
- Select the Architecture Flows link embedded in the descriptive paragraph about the Physical Architecture;
- From the alphabetical list of flows that appears locate and select the desired flow;
- Architecture flows are often used between multiple subsystems so scrolling may be required to find the appropriate information associated with the particular use of the flow, in the descriptive information any applicable standards will be identified; and
- For additional information on the applicable standards the standard name is a link that when selected leads to a more detailed description of the standard.

Table 7 – Memphis Urban Area Applicable ITS Standards

SDO	Document ID	Title
AASHTO/ITE/NEMA	NTCIP 1102	Octet Encoding Rules Base Protocol
	NTCIP 1103	Transportation Management Protocols
	NTCIP 1104	Center-to-Center Naming Convention Specification
	NTCIP 1201	Global Object Definitions
	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller Units
	NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)
	NTCIP 1204	Object Definitions for Environmental Sensor Stations
	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control
	NTCIP 1207	Object Definitions for Ramp Meter Control (RMC) Units
	NTCIP 1208	Object Definition for CCTV Camera Switching
	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems
	NTCIP 1210	Field Management Stations – Part 1: Object Definitions for Signal System Masters
	NTCIP 1211	Object Definitions for Signal Control and Prioritization
	NTCIP 2101	Point to Multi-Point Protocol Using RS-232 Subnetwork Profile
	NTCIP 2102	Point to Multi-Point Protocol Using Frequency Shift Keying Modem Subnetwork Profile
	NTCIP 2103	Point-to-Point Protocol Over RS-232 Subnetwork Profile
	NTCIP 2104	Ethernet Subnetwork Profile
	NTCIP 2201	Transportation Transport Profile
	NTCIP 2202	Internet Transmission Control Protocol/Internet Protocol and Universal Datagram Protocol/Internet Protocol Transport Profile
	NTCIP 2301	Simple Transportation Management Framework Application Profile
	NTCIP 2302	Trivial File Transfer Protocol Application Profile
	NTCIP 2303	File Transfer Protocol Application Profile
	NTCIP 2304	Application Profile for DATEX-ASN (AP-DATEX)
	NTCIP 2306	Application Profile for Extensible Markup Language (XML) Message Encoding and Transport in ITS Center-to-Center Communications
AASHTO/ITE	ITE TMDD	Traffic Management Data Dictionary and Message Sets for External TMC Communications (TMDD and MS/ETMCC)
APTA	APTA TCIP-S-001 3.0.0	Standard for Transit Communications Interface Profiles
ASTM	ASTM E2213-03	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems – 5 GHz Band DSRC Medium Access Control and Physical Layer Specifications
	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems
	ASTM WK7604	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data

Table 7 – Memphis Urban Area Applicable ITS Standards (continued)

SDO	Document ID	Title
IEEE	IEEE 1455-1999	Standard for Message Sets for Vehicle/Roadside Communications
	IEEE 1512-2006	Standard for Common Incident Management Message Sets for use by Emergency Management Centers
	IEEE 1512.1-2006	Standard for Traffic Incident Management Message Sets for Use by Emergency Management Centers
	IEEE 1512.2-2004	Standard for Public Safety Traffic Management Message Sets for use by Emergency Management Centers
	IEEE 1512.3-2006	Standard for Hazardous Material Incident Management Sets for Use by Emergency Management Centers
	IEEE 1570-2002	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection
	IEEE 1609.1 – 2006	Standard for Wireless Access in Vehicular Environments (WAVE) – Resource Manager
	IEEE 1609.2 – 2006	Standard for WAVE – Security Services for Applications and Management Messages
	IEEE 1609.3	Standard for Wireless Access in Vehicular Environments (WAVE) –Networking Services
	IEEE 1609.4 – 2006	Standard for WAVE – Multi-Channel Operation
	IEEE 802.11p	Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part II: Wireless LAN Medium Access Control and Physical Layer Specifications
	IEEE P1512.4	Standard for Common Traffic Incident Management Message Sets for Use in Entities External to Centers
	IEEE P1609.0	Standard for WAVE - Architecture
SAE	SAE J2266	Location Referencing Message Specification
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards
	SAE J2540/1	Radio Data System Phrase Lists
	SAE J2540/2	International Traveler Information Systems Phrase Lists
	SAE J2540/3	National Names Phrase List

4.5 Operational Concepts

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

- ***Surface Street 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.
- ***Freeway Management*** – The development of systems to monitor freeway 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. Also includes road service patrols.
- ***Maintenance and Construction Management*** – The development of systems to manage the maintenance of roadways in the Region. Includes the management of construction operations, coordination of construction activities with other agencies, and roadside weather monitoring.
- ***Transit Management*** – The development of systems to more efficiently manage fleets of transit vehicles. Includes systems to provide transit traveler information both pre-trip and during the trip.
- ***Traveler Information*** – The development of systems to provide static and real time transportation information to travelers.
- ***Commercial Vehicle Operations*** – The development of systems to facilitate the management of commercial vehicles (e.g., HAZMAT management).
- ***Archived Data Management*** – The development of systems to collect transportation data for use in non-operational purposes (e.g., planning and research).

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

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Surface Street Management	City of Memphis	Operate and maintain traffic signal systems within the City.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
		Provide traffic signal priority for transit vehicles.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
	City of Bartlett	Operate and maintain traffic signal systems within the City.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
	City of Collierville	Operate and maintain traffic signal systems within the City.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
	City of Germantown	Operate and maintain traffic signal systems within the City.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Surface Street Management (continued)	City of Horn Lake	Operate and maintain traffic signal systems within the City.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
	City of Millington	Operate and maintain traffic signal systems within the City.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
	City of Olive Branch	Operate and maintain traffic signal systems within the City.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
	City of Southaven	Operate and maintain traffic signal systems within the City.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
	Municipal	Operate and maintain traffic signal systems within the City.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the City to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Surface Street Management (continued)	Shelby County	Operate and maintain traffic signal systems within the County.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Provide traffic signal preemption for emergency vehicles.
	MDOT	Operate and maintain traffic signal systems on state routes within the Region.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemption requests.
		Provide traffic signal preemption for emergency vehicles.
Freeway Management	TDOT	Operate DMS and HAR to distribute traffic information and roadway conditions to travelers on the roadway.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on state roadways.
	MDOT	Operate DMS and HAR to distribute traffic information and roadway conditions to travelers on the roadway.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on state roadways.
Incident Management (Traffic)	City of Memphis	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	City of Bartlett	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	City of Collierville	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Traffic) (continued)	City of Collierville (continued)	Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	City of Germantown	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	City of Millington	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	City of Olive Branch	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	TDOT	Remotely control traffic and video sensors from the SmartWay TMC to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Operate DMS and HAR to distribute incident information to travelers on the roadway.
		Responsible for coordination with other TOCs and emergency management agencies for coordinated incident management.
		Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.
	MDOT	Remotely control traffic and video sensors from the TMC to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Operate DMS and HAR to distribute incident information to travelers on the roadway.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Traffic) (continued)	MDOT (continued)	Responsible for coordination with other TOCs and emergency management agencies for coordinated incident management.
		Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.
Incident Management (Emergency)	City of Memphis Police Department	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the TDOT SmartWay Center for incidents on state facilities.
	City of Bartlett Police Department	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the TDOT SmartWay Center for incidents on state facilities.
	City of Collierville Police Department	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the TDOT SmartWay Center for incidents on state facilities.
	City of Germantown Police Department	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the TDOT SmartWay Center for incidents on state facilities.
	City of Horn Lake 911 Dispatch	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the MDOT Northwest Regional TMC for incidents on state facilities.
	City of Olive Branch Emergency Communications Center	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the MDOT Northwest Regional TMC for incidents on state facilities.
	City of Southaven Police Department	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the MDOT Northwest Regional TMC for incidents on state facilities.
	Fayette County Sheriff	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the TDOT SmartWay Center for incidents on state facilities.
	Shelby County Sheriff	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the TDOT SmartWay Center for incidents on state facilities.
	DeSoto Count E-911	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other emergency dispatch agencies and the MDOT Northwest Regional TMC for incidents on state facilities.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Emergency) (continued)	THP Dispatch	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other public safety and traffic management agencies as well as the TDOT SmartWay Center for incidents on state facilities.
Emergency Management	City of Memphis Police Department	Responsible for emergency call-taking as the 911 PSAP for the City of Memphis.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	City of Bartlett Police Department	Responsible for emergency call-taking for the City of Bartlett as the 911 PSAP.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	City of Germantown Police Department	Responsible for emergency call-taking for the City of Germantown as the 911 PSAP.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	City of Horn Lake 911 Dispatch	Responsible for emergency call-taking for the City of Horn Lake as the 911 PSAP.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	City of Horn Lake 911 Dispatch (continued)	Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	City of Olive Branch Emergency Communications Center	Responsible for emergency call-taking for the City of Olive Branch as the 911 PSAP.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	City of Southaven Police Department	Responsible for emergency call-taking for the City of Southaven as the 911 PSAP.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	DeSoto County E-911	Responsible for emergency call-taking for DeSoto County as the 911 PSAP outside of the boundaries of the municipalities that operate their own 911 PSAPs.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	DeSoto County EMA	Operates the EOC for DeSoto County in the event of a disaster or other large-scale emergency situation.
		Responsible for tactical decision support, resource coordination, and communications integration among emergency management agencies in the County.
		Lead regional efforts for emergency planning to support large-scale incidents and disasters.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	DeSoto County EMA (continued)	Lead evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	DeSoto County EMS Dispatch	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Fayette County EMA	Operates the EOC for Fayette County in the event of a disaster or other large-scale emergency situation.
		Responsible for tactical decision support, resource coordination, and communications integration among emergency management agencies in the County.
		Lead regional efforts for emergency planning to support large-scale incidents and disasters.
		Lead evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Fayette County EMS Dispatch	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Fayette County Sheriff	Responsible for emergency call-taking for Fayette County as the 911 PSAP.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Memphis-Shelby County EMA	Operates the EOC for the City of Memphis and Shelby County in the event of a disaster or other large-scale emergency situation.
		Responsible for tactical decision support, resource coordination, and communications integration among emergency management agencies in the County.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Memphis-Shelby County EMA (continued)	Lead regional efforts for emergency planning to support large-scale incidents and disasters.
		Lead evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Municipal Public Safety Dispatch	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Shelby County Fire Department	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Shelby County Sheriff	Responsible for emergency call-taking for Shelby County as the 911 PSAP outside of the boundaries of the municipalities that operate their own 911 PSAPs.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	MEMA	Operates the EOC for the State of Mississippi in the event of a disaster or other large-scale emergency situation.
		Responsible for tactical decision support, resource coordination, and communications integration among emergency management agencies in the State.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	MEMA (continued)	Responsible for coordination with adjacent states, including the State of Tennessee, as needed to support emergency management.
		Lead statewide efforts for emergency planning to support large-scale incidents and disasters.
		Lead evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	MHP	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	TEMA	Operates the EOC for the State of Tennessee in the event of a disaster or other large-scale emergency situation.
		Responsible for tactical decision support, resource coordination, and communications integration among emergency management agencies in the State.
		Responsible for coordination with adjacent states, including Arkansas and Mississippi, as needed to support emergency management.
		Lead statewide efforts for emergency planning to support large-scale incidents and disasters.
		Lead evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	THP	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Tennessee Bureau of Investigation	Responsible for the initiation of AMBER Alerts.
Maintenance and Construction Management	City of Memphis	Responsible for the tracking and dispatch of maintenance vehicles.
		Supports coordinated response to incidents.
		Supports work zone activities including the dissemination of work zone information through portable DMS and sharing of information with other groups.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	City of Memphis (continued)	Disseminates work zone activity schedules and current asset restrictions to other agencies.
	Municipal/County Government	Responsible for the tracking and dispatch of maintenance vehicles.
		Supports coordinated response to incidents.
		Monitors environmental sensors and distributes information about road weather conditions.
		Supports work zone activities including the dissemination of work zone information through portable DMS and sharing of information with other groups.
		Disseminates work zone activity schedules and current asset restrictions to other agencies.
	MDOT	Monitors environmental sensors and distributes information about road weather conditions.
		Responsible for the tracking and dispatch of maintenance vehicles.
		Supports coordinated response to incidents.
		Supports work zone activities including the dissemination of work zone information through portable DMS, HAR, and sharing of information with other groups.
		Responsible for entering and updating work zone information on the msTraffic Website.
		Disseminates work activity schedules and current asset restrictions to other agencies.
		Operates work zone traffic control equipment including portable surveillance equipment, DMS, and HAR transmitters.
	TDOT	Monitors environmental sensors and distributes information about road weather conditions.
		Responsible for the tracking and dispatch of maintenance vehicles.
		Supports coordinated response to incidents.
		Supports work zone activities including the dissemination of work zone information through portable DMS, HAR, and sharing of information with other groups.
		Responsible for entering and updating work zone information in TSIS.
		Disseminates work activity schedules and current asset restrictions to other agencies.
		Operates work zone traffic control equipment including portable surveillance equipment, DMS, and HAR transmitters.
Transit Management	DARTS	Operates demand response transit services from a central dispatch facility responsible for tracking vehicle location and status.
		Provide transit security on transit vehicles and at transit terminals through silent alarms and surveillance systems.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	DARTS (continued)	Provide transit traveler information to the agency website, local private sector traveler information services, and the Mississippi 511 Traveler Information System.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Delta Human Resource Agency	Operates demand response transit services from a central dispatch facility responsible for tracking vehicle location and status.
		Provide transit security on transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Mississippi 511 Traveler Information System.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	MATA	Operates fixed route and paratransit services from a central dispatch facility responsible for tracking their location and status.
		Provide transit passenger electronic fare payment on fixed route transit vehicles.
		Provide transit security on transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Coordinate with the City of Memphis Engineering Division on transit signal priority.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Tennessee 511 system.
		Provide real-time arrival information on kiosks at transfer stations.
		Operate on-board systems to provide next stop annunciation.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
Traveler Information	City of Memphis	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
	City of Bartlett	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.

Table 8 – Memphis Urban Area Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Traveler Information (continued)	City of Collierville	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
	City of Germantown	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
	City of Millington	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
	City of Olive Branch	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
	TDOT	Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event and weather information to travelers via the SmartWay Website and the Tennessee 511 system.
		Provide transportation information to travelers via traveler information kiosks.
		Provide transportation network condition data to private sector information service providers.
Commercial Vehicle Operations	THP	Operate weigh-in-motion commercial vehicle inspection station.
		Enforce commercial vehicle regulations in the State of Tennessee.
Archived Data Management	DARTS	Collect and maintain transit archive data.
	Delta Human Resource Agency	Collect and maintain transit archive data.
	MATA	Collect and maintain transit archive data.
	Memphis MPO	Collect and maintain data from regional traffic, transit, and emergency management agencies.
	TDOT	Collect and maintain traffic archive data.
	THP	Collect and maintain crash record information from regional emergency management agencies.

4.6 Potential Agreements

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

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

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

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

Common agreement types and potential applications include:

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

performed, and a detailed project budget. Agency funding expectations or funding sources are also typically identified.

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

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

Table 9 – Memphis Urban Area Existing and Potential ITS Agreements

Status	Agreement and Agencies	Agreement Description
Existing	**Data Sharing and Usage (Public-Private)**	Agreement would allow private sector media and information service providers to access and broadcast public sector transportation agency CCTV camera video feeds, real time traffic speed and volume data, and incident data. Agreements should specify the control priority to allow traffic agencies first priority to control cameras during incidents or other events. The ability of the traffic agency to deny access to video and data feeds if a situation warrants such action should also be part of the agreement.
Existing	**Data Sharing and Usage (Public-Public)**	Agreement would define the parameters, guidelines, and policies for inter-agency ITS data sharing between public sector agencies including CCTV camera feeds. Similar to data sharing and usage agreements for public-private agencies, the agency that owns the equipment should have first priority of the equipment and the ability to discontinue data sharing if a situation warrants such action.
Future	**Traffic Signal Timing Data Sharing and Usage**	Agreement would define the parameters, guidelines, and policies for inter-agency traffic signal timing, including sharing of timing plans and joint operations of signals, between cities and counties.
Future	**Incident Data Sharing and Usage**	Agreement would define the parameters, guidelines, and policies for inter-agency sharing of incident data between transportation and emergency management agencies in the Region. Incident information could be sent directly to computer-aided dispatch systems and include information on lane closures, travel delays, and weather.

4.7 Phases of Implementation

The Memphis Urban Area Regional ITS Architecture will be implemented over time through a series of projects. Though TDOT and many of the larger municipalities have already made significant ITS deployments in the Region, for other agencies key foundation systems will need to be implemented in order to support other systems that have been identified in the Regional ITS Architecture. The deployment of all of the systems required to achieve the final Regional ITS Architecture build out will occur over many years.

A sequence of projects and their respective time frames have been identified in the Memphis Urban Area Regional ITS Deployment Plan. These projects have been sequenced over a 20-year period, with projects identified for deployment in 5-, 10- and 20-year timeframes.

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

- ATMS01 – Network Surveillance;
- ATMS03 – Surface Street Control;
- ATMS06 – Traffic Information Dissemination;
- ATMS07 – Regional Traffic Management;
- ATMS08 – Traffic Incident Management System;
- EM02 – Emergency Routing;
- EM04 – Roadway Service Patrols;
- EM05 – Transportation Infrastructure Protection;
- APTS01 – Transit Vehicle Tracking;
- APTS02 – Transit Fixed Route Operations;
- APTS03 – Demand Response Transit Operations; and
- APTS08 – Transit Traveler Information.

5. USE AND MAINTENANCE OF THE REGIONAL ITS ARCHITECTURE

The Regional ITS Architecture developed for the Memphis Urban Area addresses the Region's vision for ITS implementation at the time the plan was developed. With the growth of the Region, needs will change and as technology progresses new ITS opportunities will arise. Shifts in regional needs and focus as well as changes in the National ITS Architecture will necessitate that the Memphis Urban Area Regional ITS Architecture be updated periodically to remain a useful resource for the Region. As projects are developed and deployed it will be important that those projects either conform to the Regional ITS Architecture so that they are consistent with both the Region's vision for ITS as well as the National standards described in the Regional ITS Architecture. In some cases if projects do not conform it may be necessary to modify the Regional ITS Architecture to reflect changes in the Region's vision for ITS rather than modify the project. In this Section, a process for determining architecture conformity of projects is presented and a plan for how to maintain and update the Regional ITS Architecture is described.

5.1 Incorporation into the Regional Planning Process

Stakeholders invested a considerable amount of effort in the development of the Regional ITS Architecture and Regional ITS Deployment Plan for the Memphis Urban Area. The plans need to be incorporated into the regional planning process so that the ITS vision for the Region is considered when implementing ITS projects in the future, and to ensure that the Region remains eligible for federal funding. The FHWA and FTA require that any project that is implemented with federal funds conform to the Regional ITS Architecture. Many metropolitan or transportation planning organizations around the country now require that an agency certify that a project with ITS elements conforms to the Regional ITS Architecture before allowing the project to be included in the Transportation Improvement Program (TIP).

Stakeholders in the Memphis Urban Area agreed that as projects are submitted for inclusion in the TIP each project should be evaluated by the submitting agency to determine if the project includes any ITS elements. If the project contains any ITS elements, then the project needs to be reviewed to determine if the ITS elements in the project are in conformance with the Regional ITS Architecture. The submitting agency will perform this examination as part of the planning process using the procedure outlined in Section 5.2 and the Memphis Urban Area MPO will review each project to confirm it does conform to the Regional ITS Architecture.

5.2 Process for Determining Architecture Conformity

The Memphis Urban Area Regional ITS Architecture documents the customized market packages that were developed as part of the ITS architecture process. To satisfy FHWA and FTA requirements and remain eligible to use Federal funds, a project must be accurately documented. The steps of the process are as follows:

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

The steps for determining ITS architecture conformity of a project are described in more detail below.

Step 1 – Identify the ITS Components

ITS components can be fairly apparent in an ITS focused project such as CCTV or DMS deployments, but could also be included in other types of projects where they are not as apparent. For example, an arterial widening project could include the installation of signal system interconnect, signal upgrades, and the incorporation of the signals in the project limits into a city's closed loop signal system. These are all ITS functions and should be included in the ITS Architecture.

Step 2 – Identify the Corresponding Market Packages

If a project was included in the projects identified in the Memphis Urban Area Regional ITS Deployment Plan, then the applicable market package(s) for that project are identified in a column of the tables. However, ITS projects are not required to be included in the ITS Deployment Plan in order to be eligible for federal funding; therefore, market packages might need to be identified for projects that have not been covered in the ITS Deployment Plan. In that case, the market packages selected and customized for the Memphis Urban Area should be reviewed to determine if they adequately cover the project. Market packages selected for the Memphis Urban Area Regional ITS Architecture are identified in **Table 5** of this document and detailed market package definitions are located in **Appendix A**.

Step 3 – Identify the Component within the Market Package

The customized market packages for the Memphis Urban Area are located in **Appendix B**. Once the element is located within the appropriate market package the evaluator should determine if the element name used in the market package is accurate or if a change to the name is needed. For example, a future element called the City of Memphis Arterial Emergency Response Vehicles was included in the Memphis Urban Area Regional ITS Architecture for a future roadway service patrol to be operated by the City of Memphis. Detailed planning for this system has not begun and it would not be unusual for City of Memphis to select a different name for the system once planning and implementation is underway. Such a name change should be documented using the process outlined in Section 5.4.

Step 4 – Evaluate the Connections and Flows

The connections and architecture flows documented in the market package diagrams were selected based on the information available at the time the Regional ITS Architecture was developed. As the projects are designed, decisions will be made on the system layout that might differ from what is shown in the market package. These changes in the project should be documented in the ITS market packages using the process outlined in Section 5.4.

Step 5 – Document Required Changes

If any changes are needed to accommodate the project under review, Section 5.4 describes how those changes should be documented. Any changes will be incorporated during the next Regional ITS Architecture update. Conformance will be accomplished by documenting how the market package(s) should be modified so that the connections and data flows are consistent with the project.

5.3 Maintenance Process

The Memphis Urban Area MPO will be responsible for leading the process to update the Memphis Urban Area Regional ITS Architecture and Deployment Plan in coordination with the TDOT Long Range Planning Division. **Table 10** summarizes the maintenance process agreed upon by stakeholders in the Region.

Table 10 – Memphis Urban Area Regional ITS Architecture and Deployment Plan Maintenance Summary

Maintenance Details	Regional ITS Architecture		Regional ITS Deployment Plan	
	Minor Update	**Major Update**	**Minor Update**	**Major Update**
Timeframe for Updates	As needed	Approximately every 4 years	Annually	Approximately every 4 years
Scope of Update	Review and update market packages to satisfy architecture compliance requirements of projects or to document other changes that impact the Regional ITS Architecture	Entire Regional ITS Architecture	Review and update project status and add or remove projects as needed	Entire Regional ITS Deployment Plan
Lead Agency	Memphis Urban Area MPO		Memphis Urban Area MPO	
Participants	Stakeholders impacted by market package modifications	Entire stakeholder group	Entire stakeholder group	
Results	Market package or other change(s) documented for next complete update	Updated Regional ITS Architecture document, Appendices, and Turbo Architecture database	Updated project tables	Updated Regional ITS Deployment Plan document

Stakeholders agreed that a full update of the Regional ITS Architecture and Deployment Plan should occur approximately every four years in the year preceding the Long-Range Transportation Plan (LRTP) update. By completing a full update in the year prior to the LRTP update, stakeholders will be able to determine the ITS needs and projects that are most important to the Region and document those needs and projects for consideration when developing the LRTP. The Memphis Urban Area MPO, in coordination with the TDOT Long Range Planning Division, will be responsible for completing the full updates. During the update process all of the stakeholder agencies that participated in the original development of the Regional ITS Architecture and Deployment Plan should be included as well as any other agencies in the Region that are deploying or may be impacted by ITS projects.

Minor changes to the Regional ITS Architecture should occur as needed between full updates of the plan. In Section 5.4 of this document the procedure for submitting a change to the Regional ITS Architecture is documented. Documentation of changes to the Regional ITS Architecture is

particularly important if a project is being deployed and requires a change to the Regional ITS Architecture in order to establish conformity.

Stakeholders recommended that the Memphis Urban Area MPO lead an annual meeting to review projects in the Regional ITS Deployment Plan to update project status, remove projects that were completed, add project detail when available, and add new projects. Minor changes to the Regional ITS Deployment Plan should be noted by the Memphis Urban Area MPO. Any corresponding changes to the Regional ITS Architecture will be documented and retained by the MPO for inclusion during the next complete update.

5.4 Procedure for Submitting ITS Architecture Changes Between Major Updates

Updates to the Memphis Urban Area Regional ITS Architecture will occur on a regular basis as described in Section 5.3 to maintain the architecture as a useful planning tool. Between major plan updates, smaller modifications will likely be required to accommodate ITS projects in the Region. Section 5.2 contains step by step guidance for determining whether or not a project requires architecture modifications to the Regional ITS Architecture.

For situations where a change is required, an Architecture Maintenance Documentation Form was developed and is included in **Appendix E**. This form should be completed and submitted to the architecture maintenance contact person identified on the form whenever a change to the Regional ITS Architecture is proposed. There are several key questions that need to be answered when completing the Architecture Maintenance Documentation Form including those described below.

Change Information: The type of change that is being requested can include an Administrative Change, Functional Change – Single Agency, Functional Change – Multiple Agency, or a Project Change. A description of each type of change is summarized below.

- Administrative Change: Basic changes that do not affect the structure of the ITS market packages in the Regional ITS Architecture. Examples include changes to stakeholder or element names, element status, or data flow status.
- Functional Change – Single Agency: Structural changes to the ITS market packages that impact only one agency in the Regional ITS Architecture. Examples include the addition of a new ITS market package or changes to data flow connections of an existing market package. The addition or change would only impact a single agency.
- Functional Change – Multiple Agencies: Structural changes to the ITS market packages that have the potential to impact multiple agencies in the Regional ITS Architecture. Examples include the addition of a new ITS market package or changes to data flow connections of an existing ITS market package. The addition or changes would impact multiple agencies and require coordination between the agencies.
- Project Change: Addition, modification, or removal of a project in the Regional ITS Deployment Plan.

Description of the requested change: A brief description of the type of change being requested should be included.

Market packages being impacted by the change: Each of the ITS market packages that are impacted by the proposed change should be listed on the ITS Architecture Maintenance Documentation Form. If the proposed change involves creating or modifying an ITS market package then the agency completing the ITS Architecture Maintenance Documentation Form is asked to include a sketch of the new or modified market package.

Impact of proposed change on other stakeholders: If the proposed change is expected to have any impact on other stakeholders in the Region, then those stakeholders should be listed on the ITS Architecture Maintenance Documentation Form. A description of any coordination that has occurred with other stakeholders that may be impacted by the change should be also included. Ideally all stakeholders that may be impacted by the change should be contacted and consensus should be reached on any new or modified ITS market packages that will be included as part of the Regional ITS Architecture.

The Memphis Urban Area MPO will review and accept the proposed changes and forward the form to the TDOT Long Range Planning Division for their records. When a major update is performed, all of the documented changes should be incorporated into the Regional ITS Architecture.

APPENDIX A – MARKET PACKAGE DEFINITIONS

Market Package	Market Package Name	Description
Traffic Management Service Area		
ATMS01	Network Surveillance	Includes traffic detectors, CCTV cameras, other surveillance equipment, supporting field equipment and fixed point to point communications to transmit the collected data back to a traffic management center.
ATMS02	Traffic Probe Surveillance	Provides an alternative approach for surveillance of the roadway network. Probe vehicles are tracked, and the vehicle's position and speed information are utilized to determine road network conditions such as average speed and congestion conditions.
ATMS03	Surface Street Control	Provides the central control and monitoring equipment, communication links and signal control equipment that support local street and/or arterial traffic management. This market package is consistent with typical urban traffic signal control systems.
ATMS04	Freeway Control	Provides the communications and roadside equipment to support ramp control, lane controls and interchange control for freeways. This market package is consistent with typical urban traffic freeway control systems. Also includes the capability to utilize surveillance information for detection of incidents.
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 driver information using roadway equipment such as dynamic message signs or highway advisory radio. Information can include traffic and road conditions, closure and detour information, incident information, emergency alerts and driver advisories.
ATMS07	Regional Traffic Management	Sharing of traffic information and control among traffic management centers to support a regional management strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions.
ATMS08	Traffic Incident Management System	Manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. This market package includes incident detection capabilities and coordination with other agencies. It supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel.
ATMS09	Traffic Forecast 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, variable toll rates, transit strategies, and congestion management strategies.
ATMS10	Electronic Toll Collection	Provides toll operators with the ability to collect tolls electronically and detect and process violations.
ATMS11	Emissions Monitoring and Management	Monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data.
ATMS12	Roadside Lighting System Control	Manages electrical lighting systems by monitoring operational conditions and using the lighting controls to vary the amount of light provided along the roadside.
ATMS13	Standard Railroad Grade Crossing	Manages highway traffic at highway-rail intersections (HRIs) where rail operational speeds are less than 80 mph.
ATMS14	Advanced Railroad Grade Crossing	Manages highway traffic at highway-rail intersections (HRIs) where operational speeds are greater than 80 mph. Augments Standard Railroad Grade Crossing market package with additional safety features to mitigate the risks associated with higher rail speeds.
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.

Market Package	Market Package Name	Description
Traffic Management Service Area (continued)		
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.
ATMS18	Reversible Lane Management	Provides for the management of reversible lane facilities and includes the field equipment, physical lane access controls, and associated control electronics.
ATMS19	Speed Monitoring	Monitors the speeds of vehicles traveling through a roadway system. 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 when driving conditions are unsafe, maintenance must be performed, or other situations. Market package covers general road closures applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other market packages.
Emergency Management Service Area		
EM01	Emergency Call-Taking and Dispatch	Provides basic public safety call-taking and dispatch services. Includes emergency vehicle equipment, equipment used to receive and route emergency calls, wireless communications and coordination between emergency management agencies.
EM02	Emergency Routing	Supports automated vehicle location and dynamic routing of emergency vehicles. Traffic information, road conditions and suggested routing information are provided to enhance emergency vehicle routing. Includes signal preemption and priority applications.
EM03	Mayday and Alarms Support	Allows the user to initiate a request for emergency assistance and enables the emergency management subsystem to locate the user, gather information about the incident and determine the appropriate response.
EM04	Roadway Service Patrols	Supports the roadway service patrol vehicles that aid motorists, offering rapid response to minor incidents (flat tire, crashes, out of gas) to minimize disruption to the traffic stream. This market package monitors service patrol vehicle locations and supports vehicle dispatch.
EM05	Transportation Infrastructure Protection	Includes the monitoring of transportation infrastructure (e.g. bridges, tunnels and management centers) for potential threats using sensors, surveillance equipment, barriers and safeguard systems to preclude an incident, control access during and after an incident or mitigate the impact of an incident. Threats can be acts of nature, terrorist attacks or other incidents causing damage to the infrastructure.
EM06	Wide-Area Alert	Uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather, civil emergencies or other situations that pose a threat to life and property.
EM07	Early Warning System	Monitors and detects potential, looming and actual disasters including natural, technological and man-made disasters.
EM08	Disaster Response and Recovery	Enhances the ability of the surface transportation system to respond to and recover from disasters. Supports coordination of emergency response plans, provides enhanced access to the scene and better information about the transportation system in the vicinity of the disaster, and maintains situation awareness.

Market Package	Market Package Name	Description
Emergency Management Service Area (continued)		
EM09	Evacuation and Reentry Management	Supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. This market package supports both anticipated, well-planned and orderly evacuations such as for a hurricane, as well as sudden evacuations with little or no time for preparation or public warning such as a terrorist act. Employs a number of strategies to maximize capacity along an evacuation route including coordination with transit.
EM10	Disaster Traveler Information	Use of ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster.
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 vehicle maintenance scheduling and manages both routine and corrective maintenance activities. Includes on-board sensors capable of automatically performing diagnostics.
MC03	Road Weather Data Collection	Collects current road weather conditions using data collected from environmental sensors deployed on and about the roadway.
MC04	Weather Information Processing and Distribution	Processes and distributes the environmental information collected from the Road Weather Data Collection market package. This market package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so system operators can make decisions on corrective actions to take.
MC05	Roadway Automated Treatment	Automatically treats a roadway section based on environmental or atmospheric conditions. Includes the sensors that detect adverse conditions, automated treatment (such as anti-icing chemicals), and driver information systems.
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 numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.
MC08	Work Zone Management	Directs activity in work zones, controlling traffic through portable dynamic message signs and informing other groups of activity for better coordination management. Also provides speed and delay information to motorists prior to the work zone.
MC09	Work Zone Safety Monitoring	Includes systems that improve work crew safety and reduce collisions between the motoring public and maintenance and construction vehicles. Detects vehicle intrusions in work zones and warns workers and drivers of safety hazards when encroachment occurs.
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 data from vehicles in the road network that can be used to directly measure on infer current environmental conditions.
MC12	Infrastructure Monitoring	Monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure using both fixed and vehicle-based infrastructure monitoring sensors. Monitors vehicle probes used to determine current pavement conditions.

Market Package	Market Package Name	Description
Public Transportation Service Area		
APTS01	Transit Vehicle Tracking	Monitors current transit vehicle location using an automated vehicle location system. Location data may be used to determine real time schedule adherence and update the transit system's schedule in real time.
APTS02	Transit Fixed-Route Operations	Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for fixed-route and flexible-route transit services.
APTS03	Demand Response Transit Operations	Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for demand responsive transit services.
APTS04	Transit Fare Collection Management	Manages transit fare collection on-board transit vehicles and at transit stops using electronic means. Allows the use of a traveler card or other electronic payment device.
APTS05	Transit Security	Provides for the physical security of transit passengers and transit vehicle operators. Includes on-board security cameras and panic buttons.
APTS06	Transit Fleet Management	Supports automatic transit maintenance scheduling and monitoring for both routine and corrective maintenance.
APTS07	Multi-modal Coordination	Establishes two way communications between multiple transit and traffic agencies to improve service coordination.
APTS08	Transit Traveler Information	Provides transit users at transit stops and on board transit vehicles with ready access to transit information. Services include stop annunciation, imminent arrival signs and real-time transit schedule displays. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.
APTS09	Transit Signal Priority	Determines the need for transit priority on routs and at certain intersections and requests transit vehicle priority at these locations to improve on-time performance of the transit system.
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.
Commercial Vehicle Operations Service Area		
CVO01	Fleet Administration	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.
CVO06	Weigh-In-Motion	Provides for high speed weigh-in-motion with or without automated vehicle identification capabilities.
CVO07	Roadside CVO Safety	Provides for automated roadside safety monitoring and reporting. Automates commercial vehicle safety inspections at the roadside check facilities.
CVO08	On-board CVO and Freight Safety and Security	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.
CVO10	HAZMAT Management	Integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents.

Market Package	Market Package Name	Description
Commercial Vehicle Operations Service Area (continued)		
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 for fleet and freight management to detect when an unauthorized commercial vehicle driver attempts to drive a vehicle based on stored identity information. If an unauthorized driver has been detected the commercial vehicle can be disabled.
CVO13	Freight Assignment Tracking	Provides for the planning and tracking of the commercial vehicle, freight equipment and the commercial vehicle driver.
Traveler Information Service Area		
ATIS01	Broadcast Traveler Information	Collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadly disseminates this information through existing infrastructures (radio, cell phones, etc.).
ATIS02	Interactive Traveler Information	Provides tailored information in response to a traveler request. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information.
ATIS03	Autonomous Route Guidance	Using vehicle location and other information, this market package 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	Offers the user pre-trip route planning and en-route guidance services. Routes may be based on static or real time network conditions.
ATIS06	Transportation Operations Data Sharing	Collects, processes, and stores current information on traffic and travel conditions and other information about the current state of the transportation network and makes the information available to transportation system operators.
ATIS07	Yellow Pages and Reservation	Provides yellow pages and reservations services to the user.
ATIS08	Dynamic Ridesharing	Provides dynamic ridesharing/ride matching services to travelers.
ATIS09	In Vehicle Signing	Supports the distribution of traffic and travel advisory information to drivers through in-vehicle devices.
ATIS10	VII Traveler Information	Provides location specific information to travelers in vehicles using Vehicle Infrastructure Integration (VII).
Archived Data Management Service Area		
AD1	ITS Data Mart	Provides a focused archive that houses data collected and owned by a single agency or other organization. Focused archive typically covers a single transportation mode and one jurisdiction.
AD2	ITS Data Warehouse	Includes all the data collection and management capabilities of the ITS Data Mart. Adds the functionality to allow collection of data from multiple agencies and data sources across modal and jurisdictional boundaries.
AD3	ITS Virtual Data Warehouse	Provides the same broad access to multimodal, multidimensional data from varied sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed.

Market Package	Market Package Name	Description
Vehicle Safety Service Area		
AVSS01	Vehicle Safety Monitoring	Diagnoses critical components of the vehicle and warns the driver of potential dangers. On-board sensors will determine the vehicle's condition, performance, and on-board safety data and display that information to the driver.
AVSS02	Driver Safety Monitoring	Determines the driver's condition and warns the driver of potential dangers. On-board sensors will determine the driver's condition, performance, and on-board safety data and display that information to the driver.
AVSS03	Longitudinal Safety Monitoring	Uses on-board safety sensors and collision sensors to monitor the areas in front of and behind the vehicle and present warnings to the driver about potential hazards.
AVSS04	Lateral Safety Warning	Uses on-board safety sensors and collision sensors to monitor the areas to the sides of the vehicle and present warnings to the driver about potential hazards.
AVSS05	Intersection Safety Warning	Determines the probability of a collision in an equipped intersection (either highway-highway or highway-rail) and provides timely warnings to drivers in response to hazardous conditions. Monitors in the roadway infrastructure assess vehicle locations and speeds near an intersection. Using this information, a warning is determined and communicated to the approaching vehicle using a short range communications system. Information can be provided to the driver through the ATIS09 – In-Vehicle Signing market package.
AVSS06	Pre-Crash Restraint Deployment	Provides in-vehicle sensors to monitor the vehicle's local environment (lateral and longitudinal gaps, weather, and roadway conditions), determine collision probability, and deploy a pre-crash safety system.
AVSS07	Driver Visibility Improvement	Enhances the driver visibility using an enhanced vision system. On-board display hardware is needed.
AVSS08	Advanced Vehicle Longitudinal Control	Automates the speed and headway control functions on board the vehicle utilizing safety sensors and collision sensors combined with vehicle dynamics processing to control the throttle and brakes. Requires on-board sensors to measure longitudinal gaps and a processor for controlling the vehicle speed.
AVSS09	Advanced Vehicle Lateral Control	Automates the steering control on board the vehicle utilizing safety sensors and collision sensors combined with vehicle dynamics processing to control the steering. Requires on-board sensors to measure lane position and lateral deviations and a processor for controlling the vehicle steering.
AVSS10	Intersection Collision Avoidance	Determines the probability of an intersection collision and provides timely warnings to approaching vehicles so that avoidance actions can be taken. This market package builds on the intersection collision warning infrastructure and in-vehicle equipment and adds equipment in the vehicle that can take control of the vehicle in emergency situations.
AVSS11	Automated Highway System	Enables "hands-off" operation of the vehicle on the automated portion of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control, and automated highway system check-in and check-out.
AVSS12	Cooperative Vehicle Safety Systems	Enhances the on-board longitudinal and lateral warning stand-alone systems by exchanging messages wirelessly with other surrounding vehicles. Vehicles send out information concerning their location, speed, and direction to any surrounding vehicles. Special messages from approaching emergency vehicles may also be received and processed.

APPENDIX B – CUSTOMIZED MARKET PACKAGES

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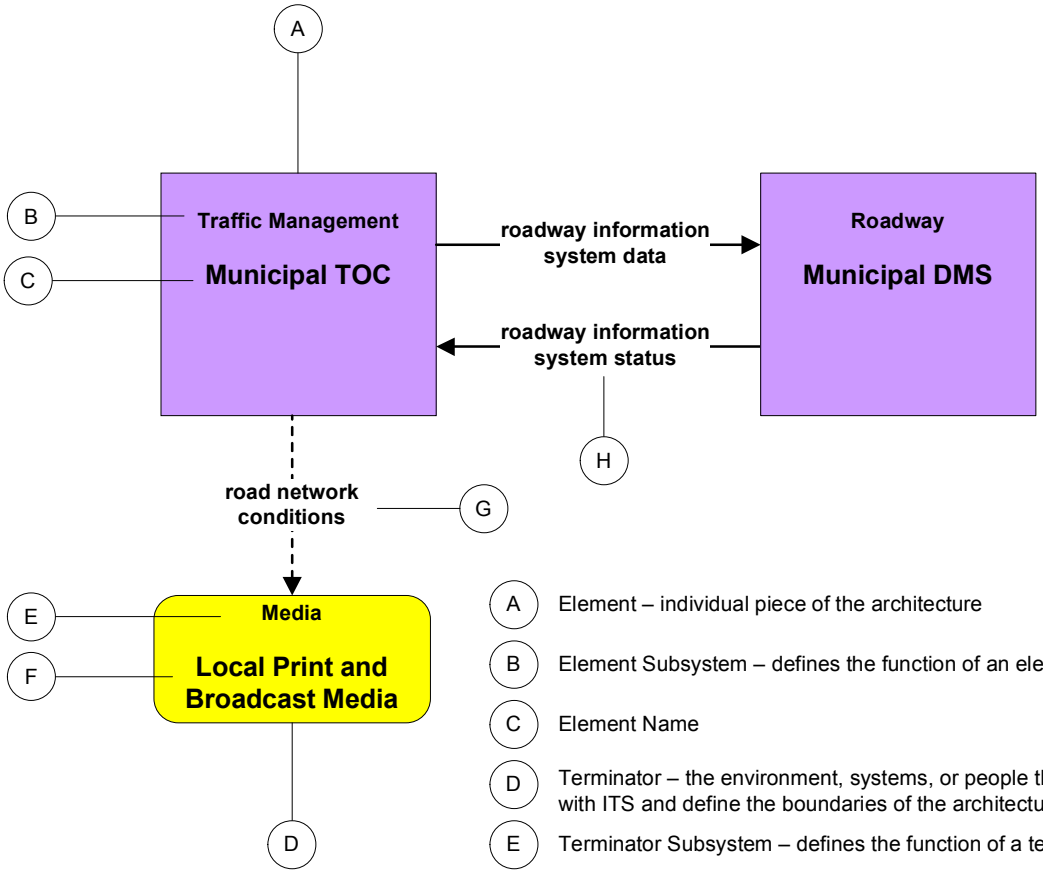
APPENDIX B

MARKET PACKAGE DIAGRAM COMPONENT AND TERMINOLOGY KEY



A – Element – individual piece of the architecture

B – Element Subsystem – defines the function of an element

C – Element Name

D – Terminator – the environment, systems, or people that interface with ITS and define the boundaries of the architecture

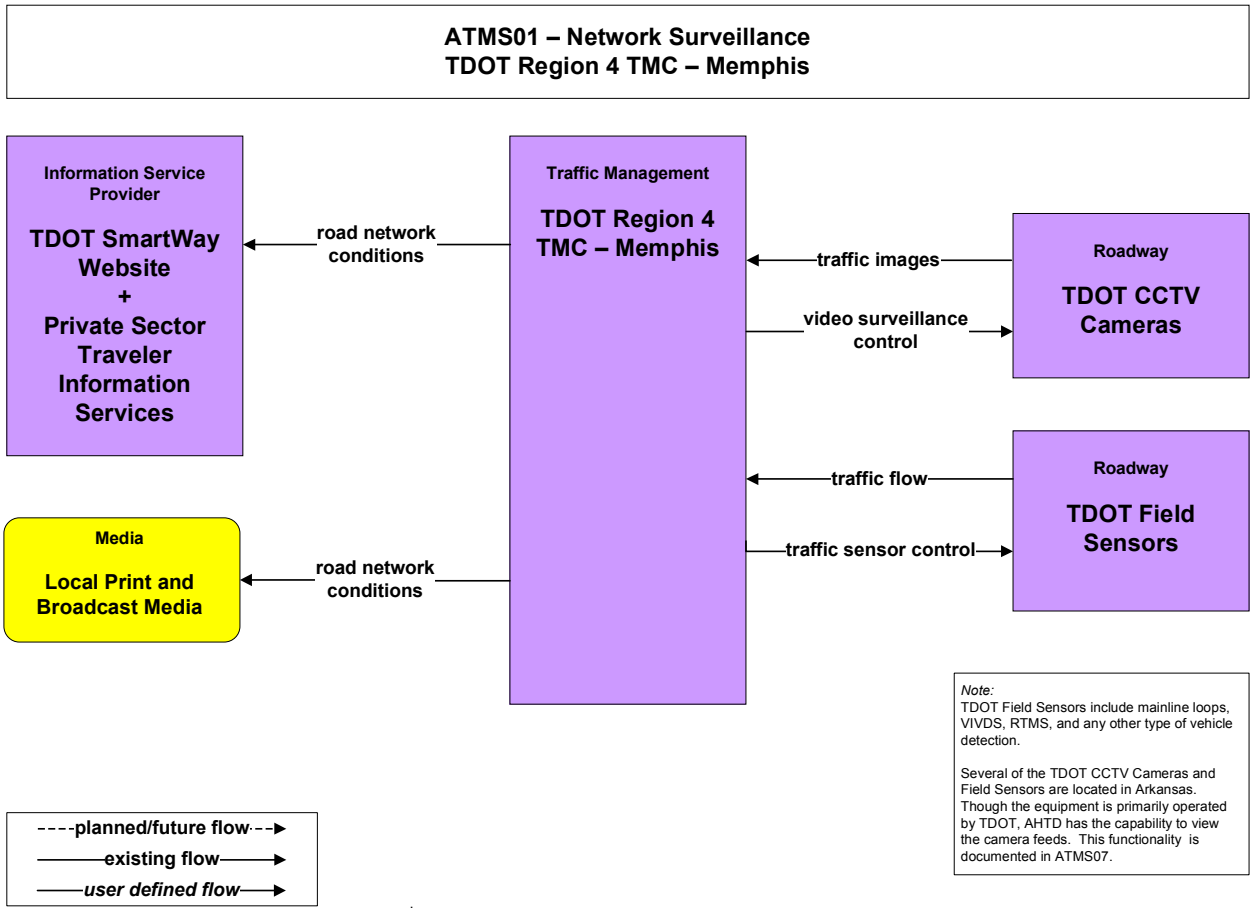
E – Terminator Subsystem – defines the function of a terminator

F – Terminator Name

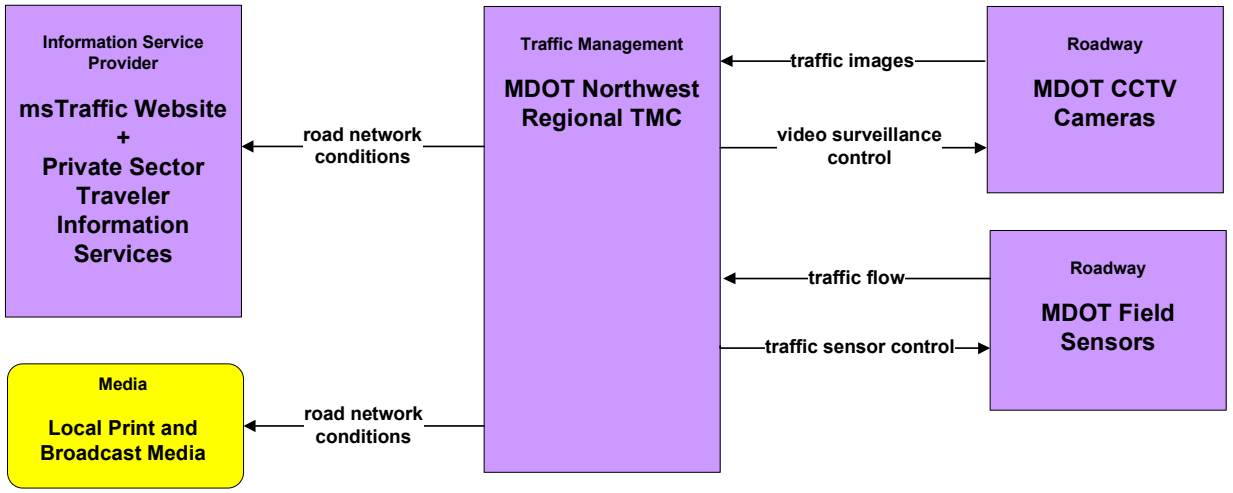
G – Future/Planned Architecture Flow – data that will be exchanged between subsystems and terminators in the future

H – Existing Architecture Flow – data that is currently exchanged between subsystems and terminators

Advanced Traffic Management System



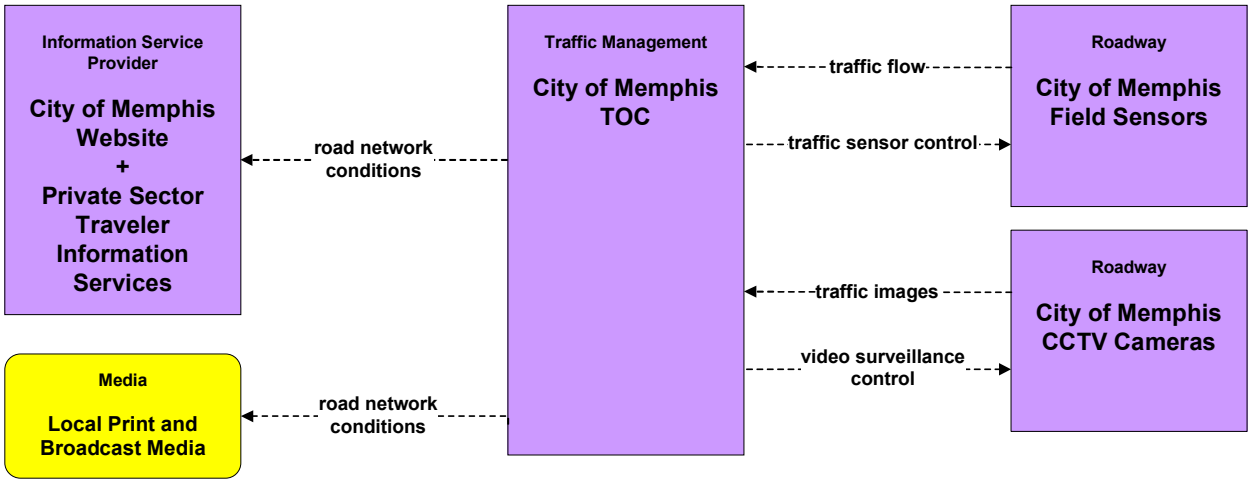
ATMS01 – Network Surveillance
MDOT Northwest Regional TMC



Note:
The City of Southaven is co-located with MDOT in the Northwest Regional TMC and therefore shares MDOT ITS devices. The City has no plans to deploy and cameras or sensors of their own.

planned/future flow
existing flow
user defined flow

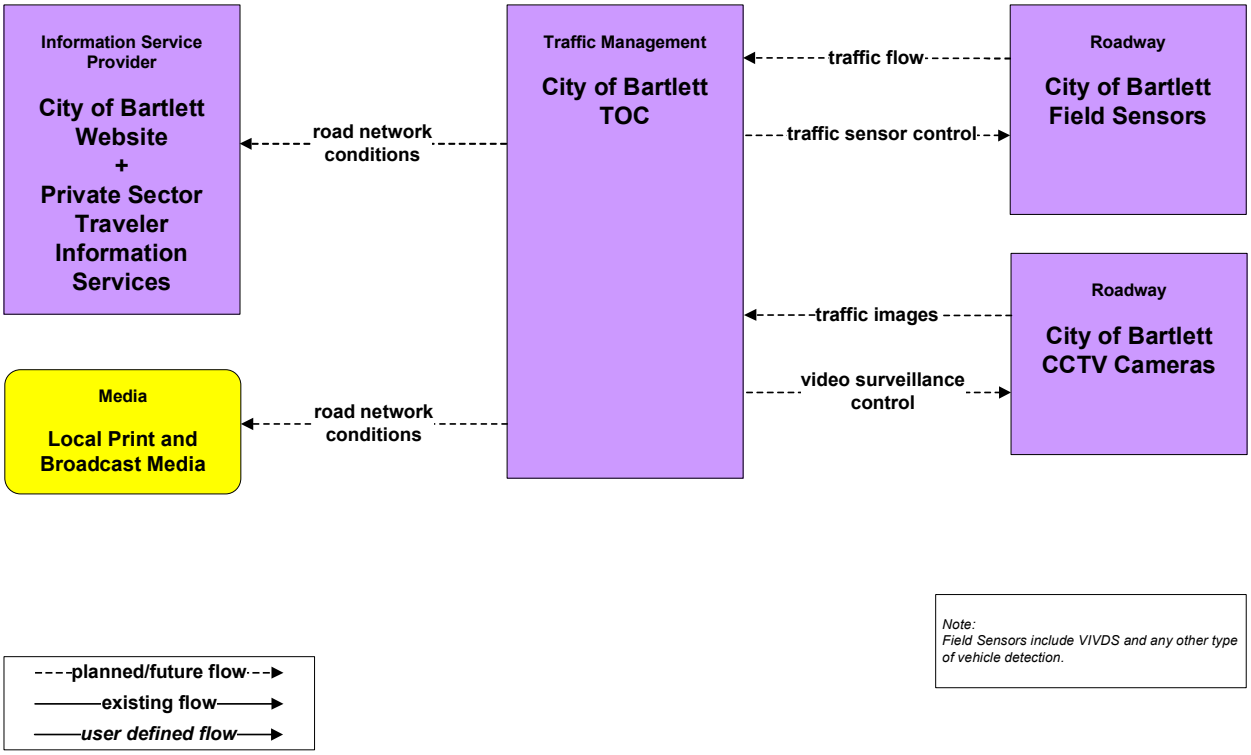
ATMS01 – Network Surveillance
City of Memphis



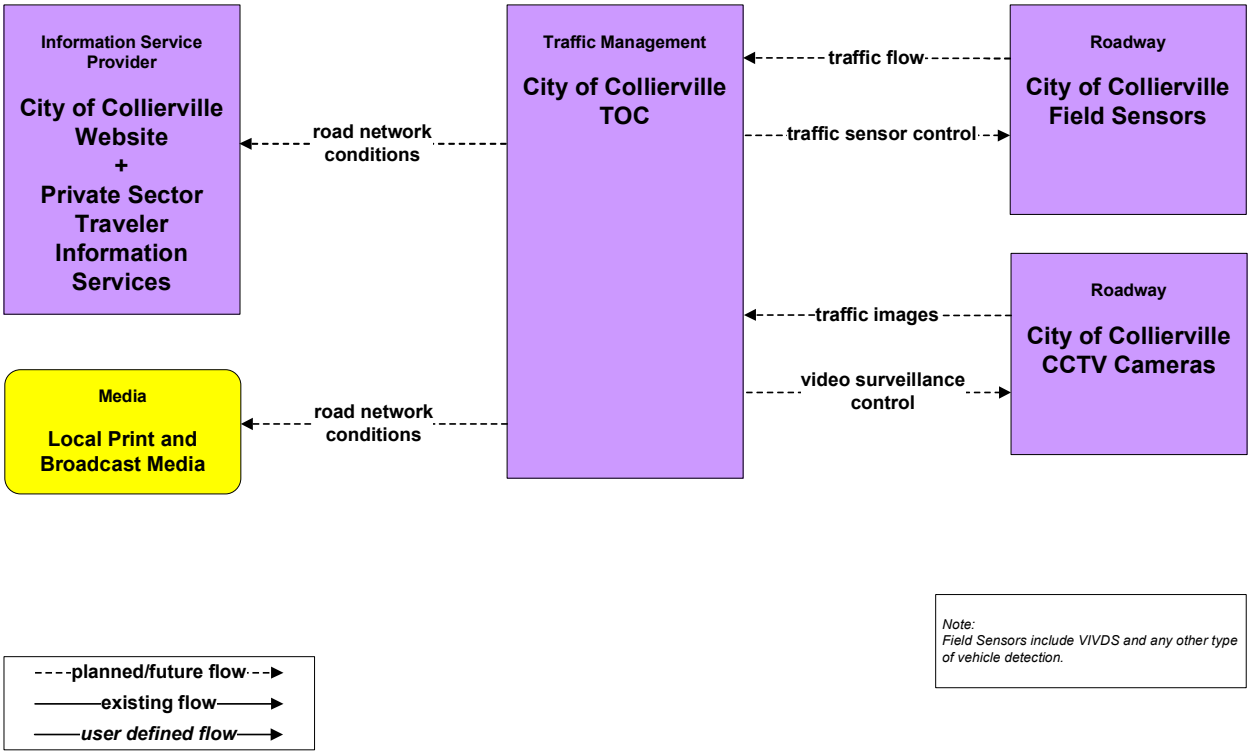
Note:
City of Memphis Field Sensors include VIVDS and any other type of vehicle detection.

planned/future flow
existing flow
user defined flow

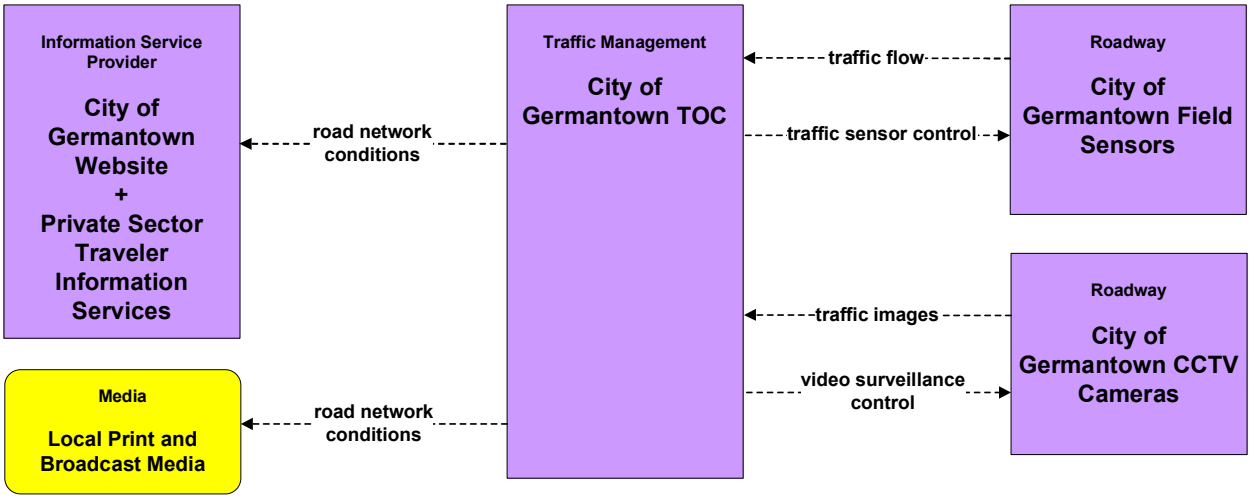
ATMS01 – Network Surveillance
City of Bartlett



ATMS01 – Network Surveillance
City of Collierville



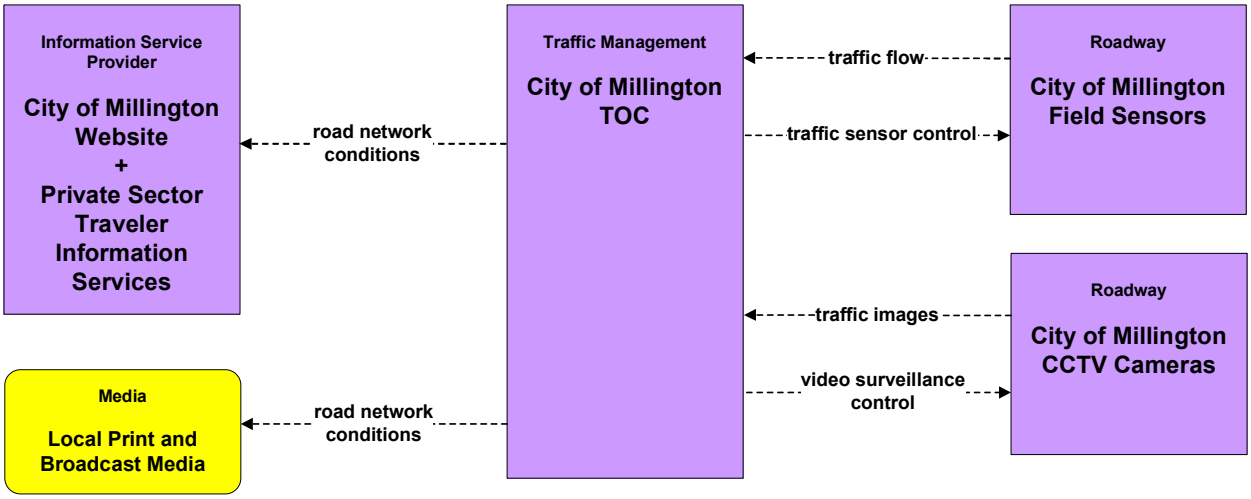
ATMS01 – Network Surveillance
City of Germantown



Note:
Field Sensors include VIVDS and any other type of vehicle detection.

planned/future flow
existing flow
user defined flow

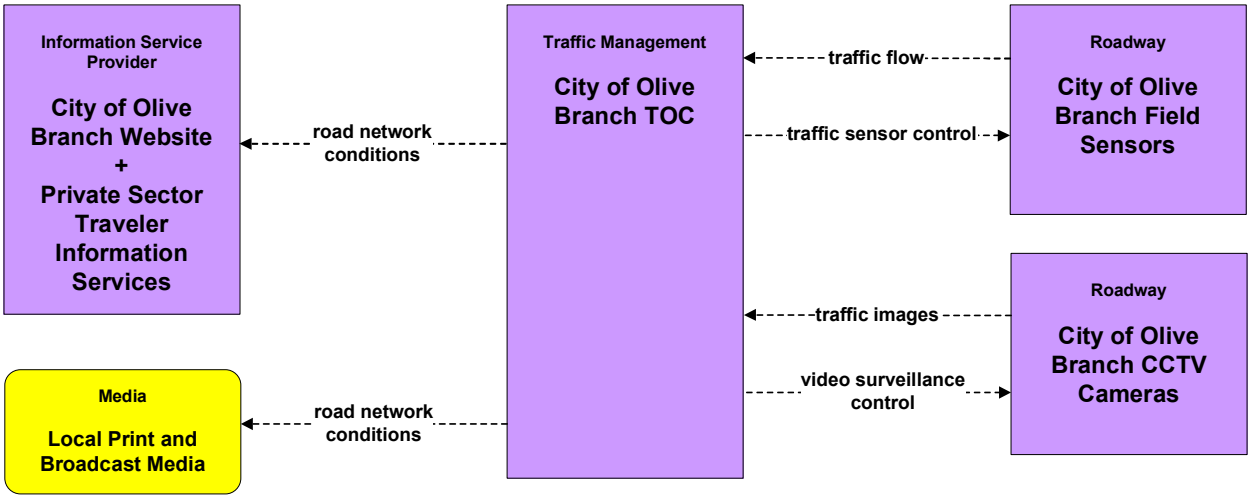
ATMS01 – Network Surveillance
City of Millington



Note:
Field Sensors include VIVDS and any other type of vehicle detection.

planned/future flow
existing flow
user defined flow

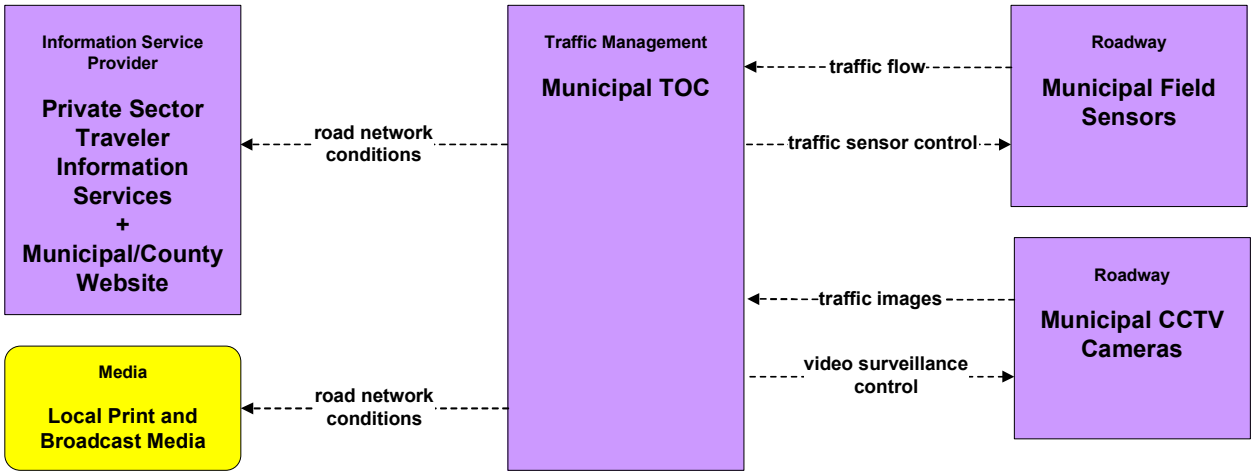
ATMS01 – Network Surveillance
City of Olive Branch



Note:
Field Sensors include VIVDS and any other type of vehicle detection.

----planned/future flow-->
————existing flow————>
——*user defined flow*——>

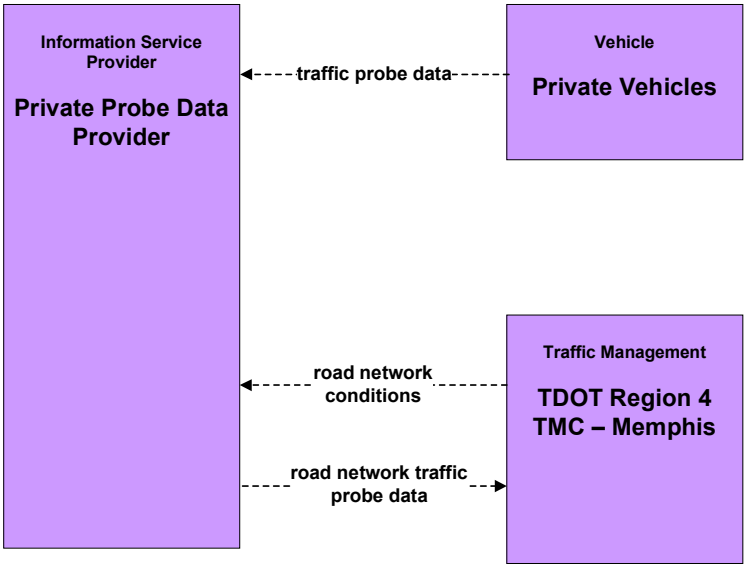
ATMS01 – Network Surveillance
Municipal

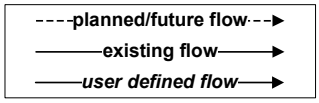


Note:
Municipal Field Sensors include VIVDS and any other type of vehicle detection.

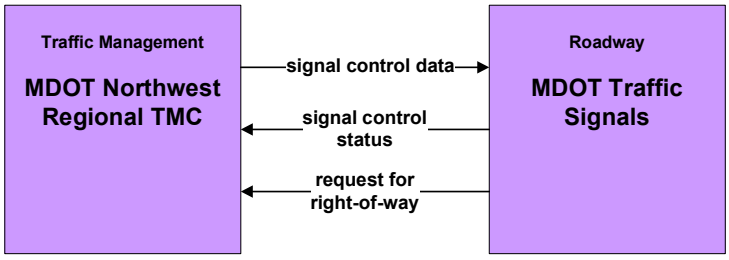
----planned/future flow-->
————existing flow————>
——*user defined flow*——>

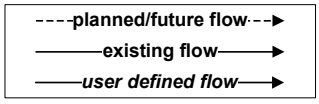
ATMS02 – Traffic Probe Surveillance
TDOT



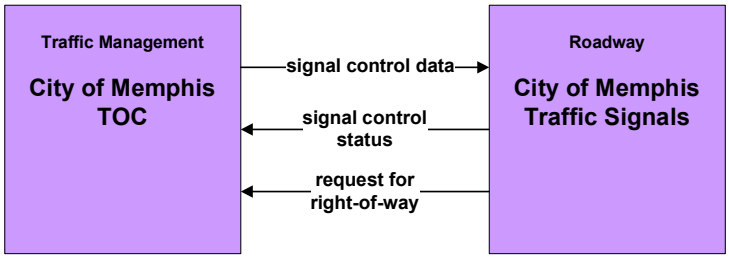


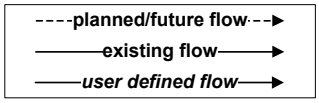
ATMS03 – Surface Street Control
MDOT



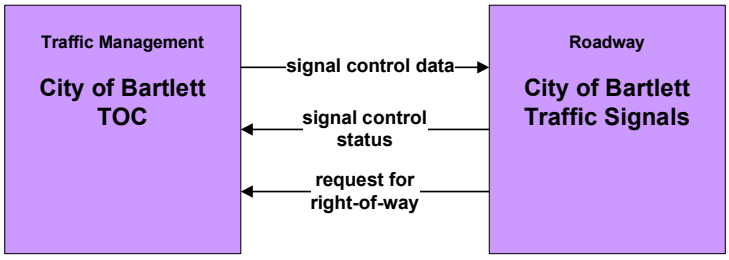


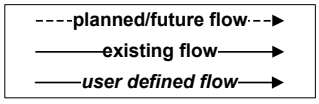
ATMS03 – Surface Street Control
City of Memphis



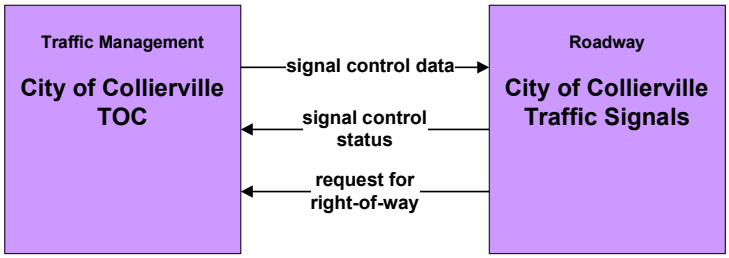


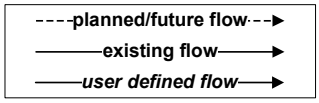
ATMS03 – Surface Street Control
City of Bartlett



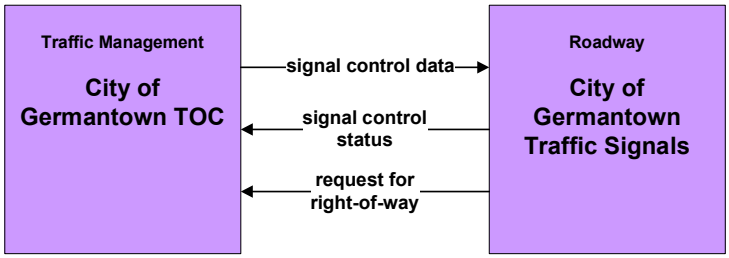


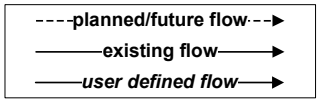
ATMS03 – Surface Street Control
City of Collierville



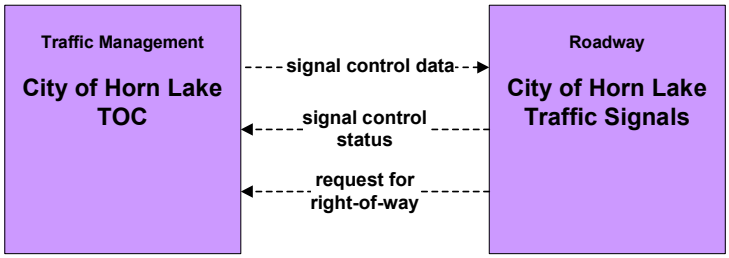


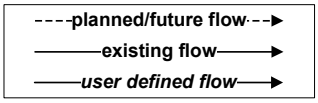
ATMS03 – Surface Street Control
City of Germantown



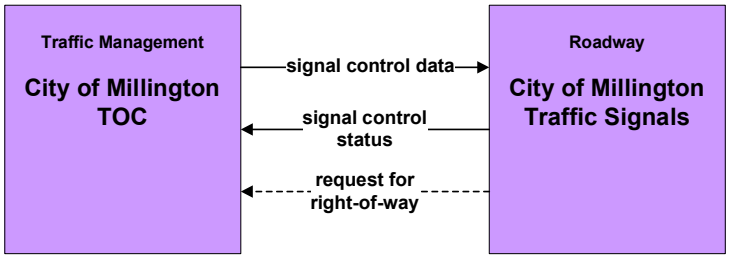


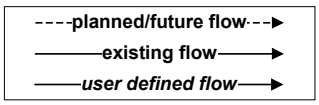
ATMS03 – Surface Street Control
City of Horn Lake



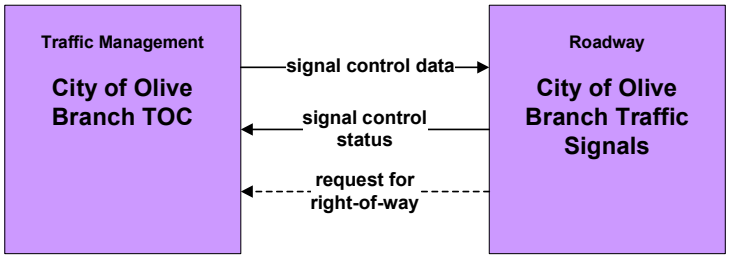


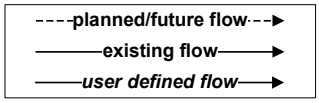
ATMS03 – Surface Street Control
City of Millington



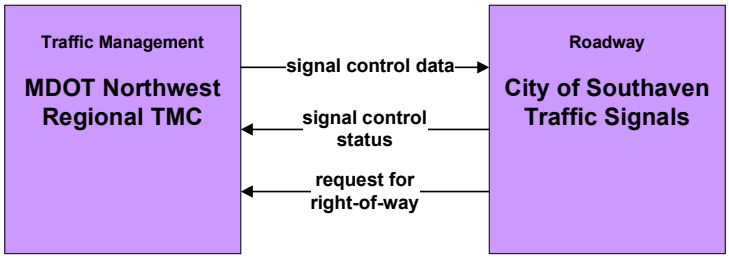


ATMS03 – Surface Street Control
City of Olive Branch

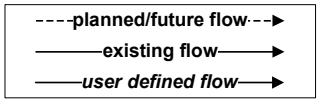




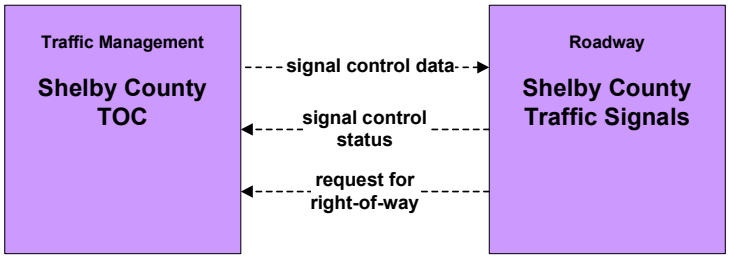
ATMS03 – Surface Street Control
City of Southaven

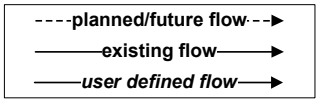


Note:
The City of Southaven is co-located with and controls their traffic signals from the MDOT Northwest Regional TMC.

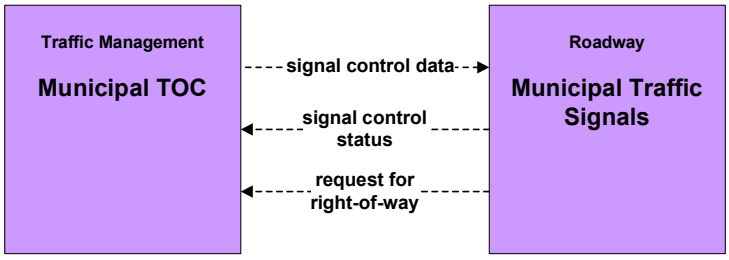


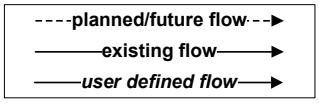
ATMS03 – Surface Street Control
Shelby County



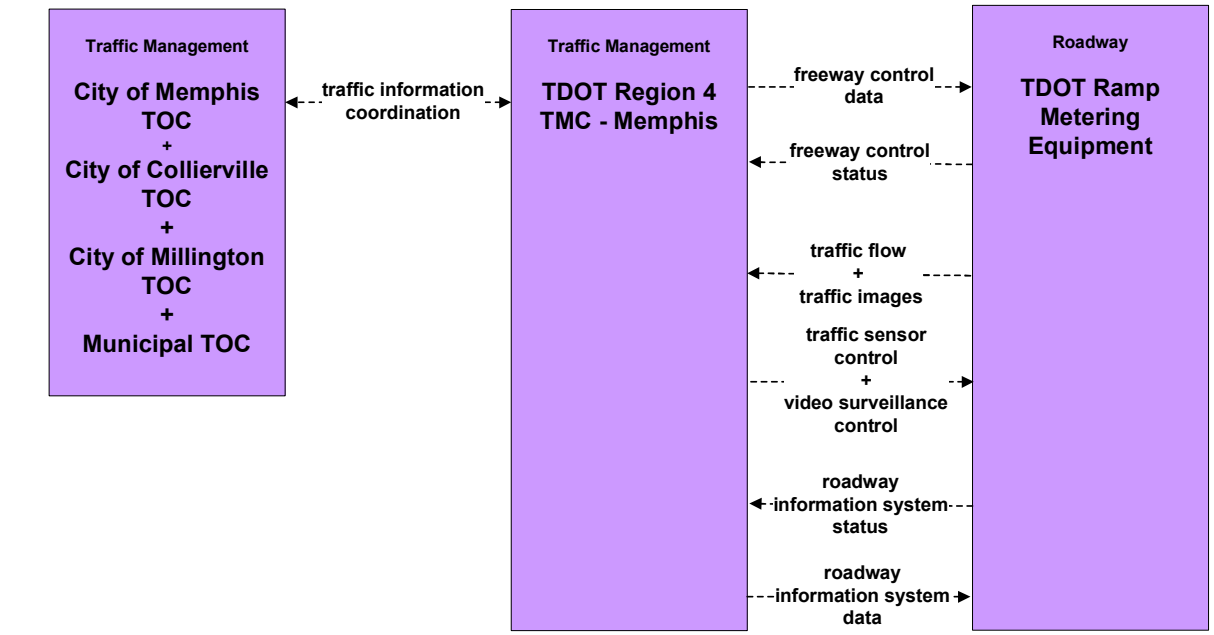


ATMS03 – Surface Street Control
Municipal



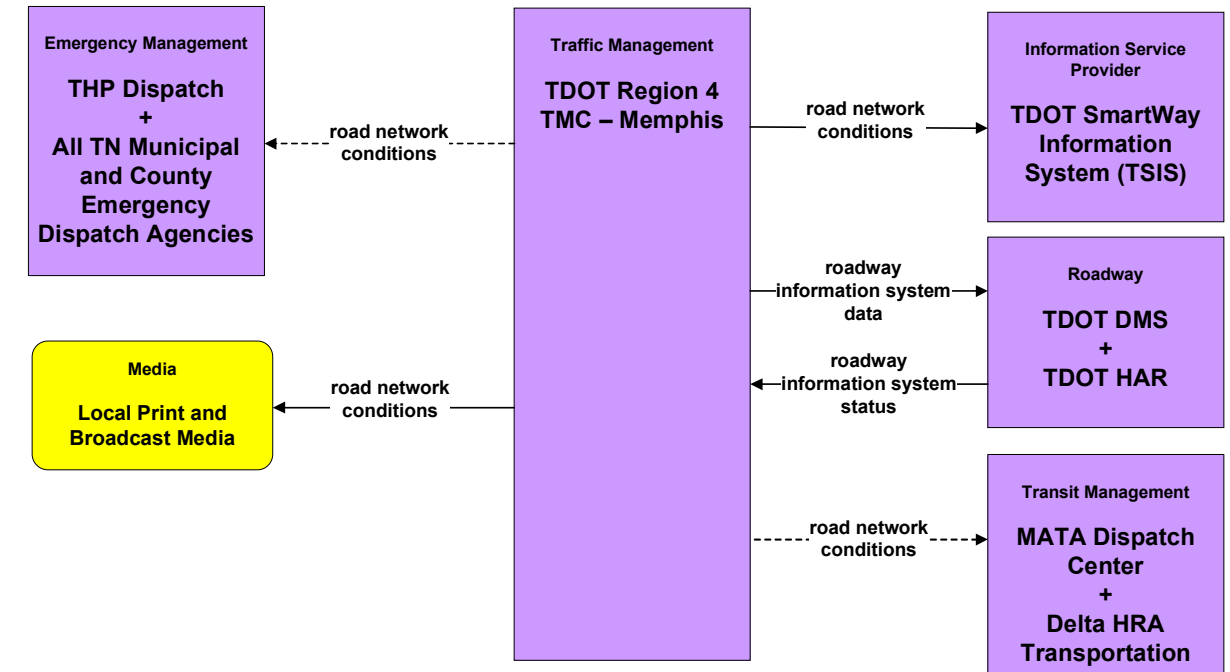


ATMS04 – Freeway Control
TDOT Region 4 TMC – Memphis



planned/future flow
existing flow
user defined flow

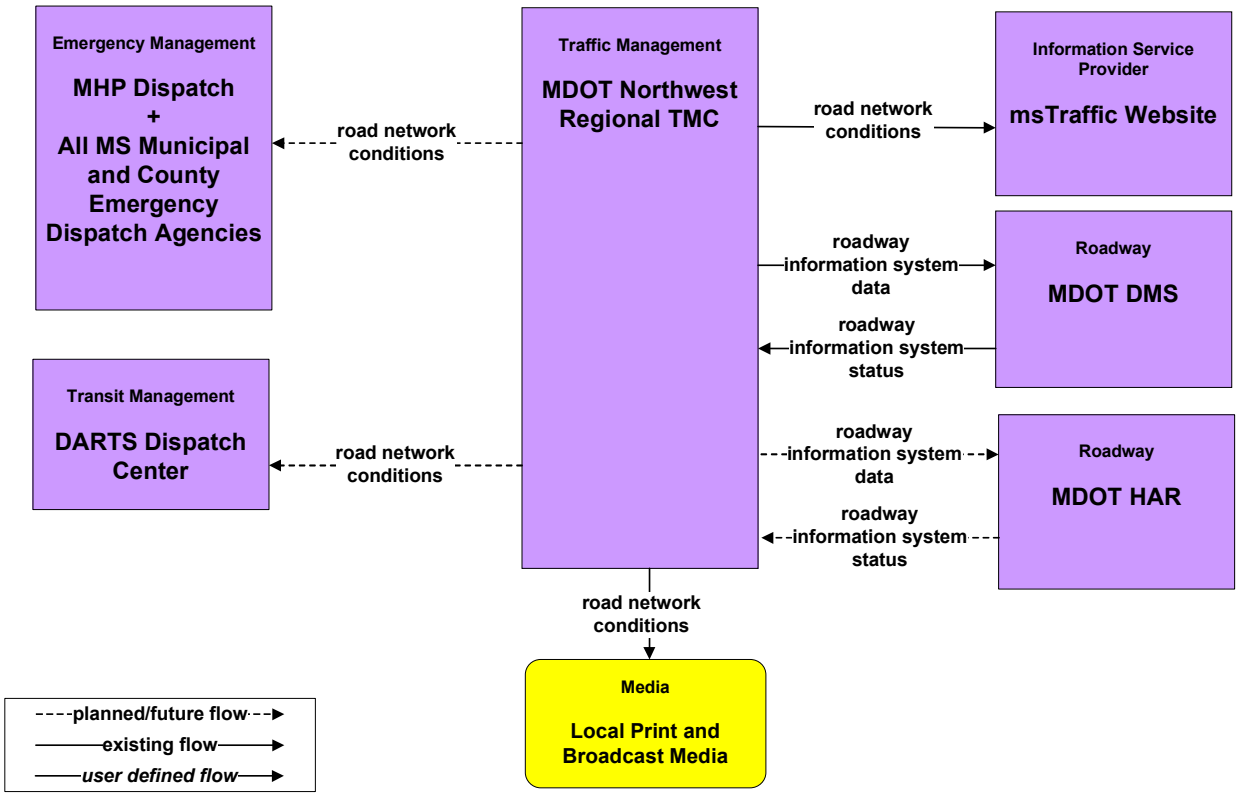
ATMS06 – Traffic Information Dissemination
TDOT Region 4 TMC – Memphis



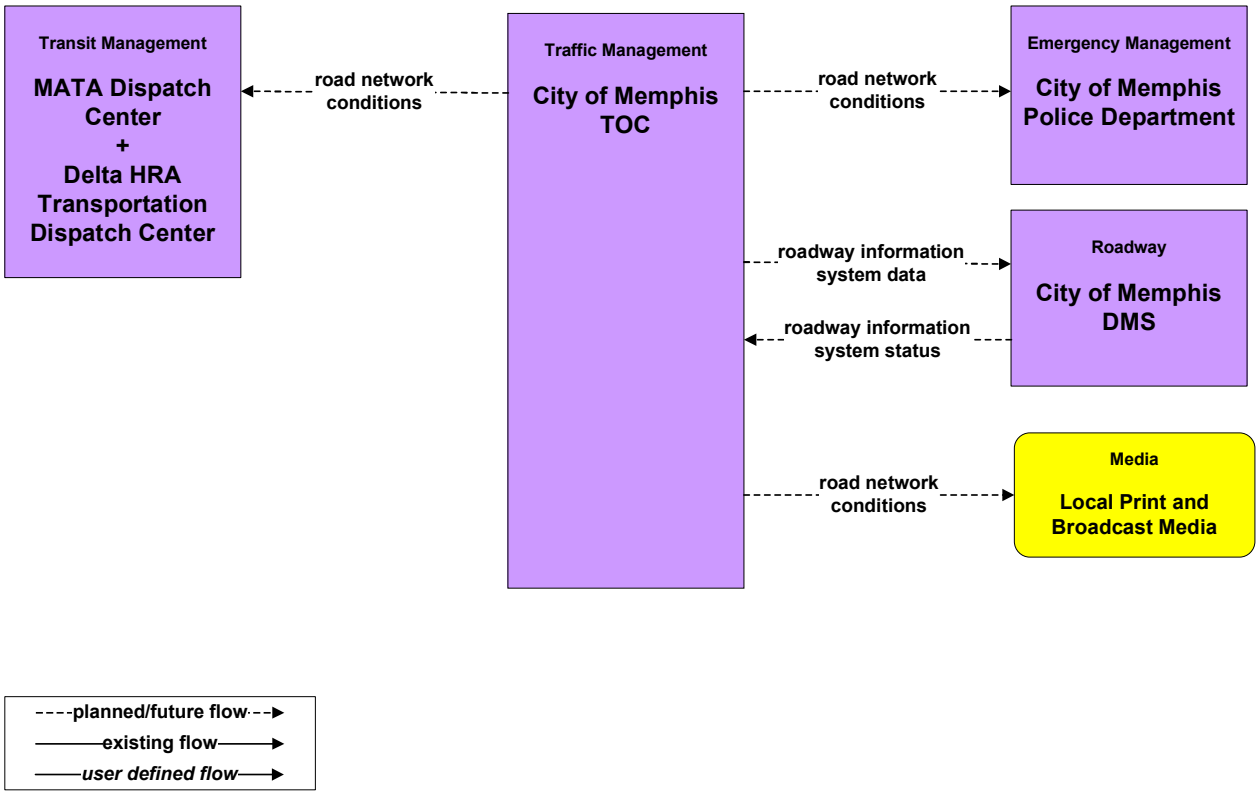
planned/future flow
existing flow
user defined flow

Note:
Several of the TDOT DMS and HAR are located in Arkansas.

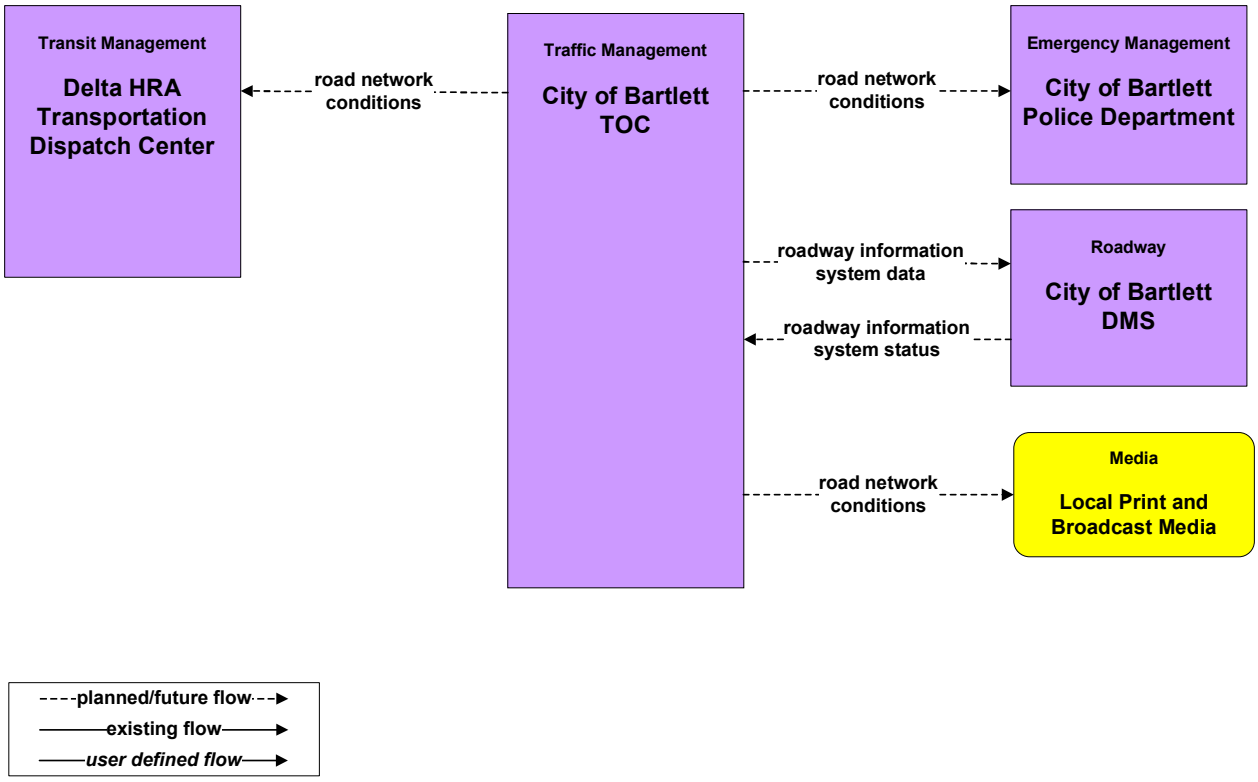
ATMS06 – Traffic Information Dissemination
MDOT Northwest Regional TMC



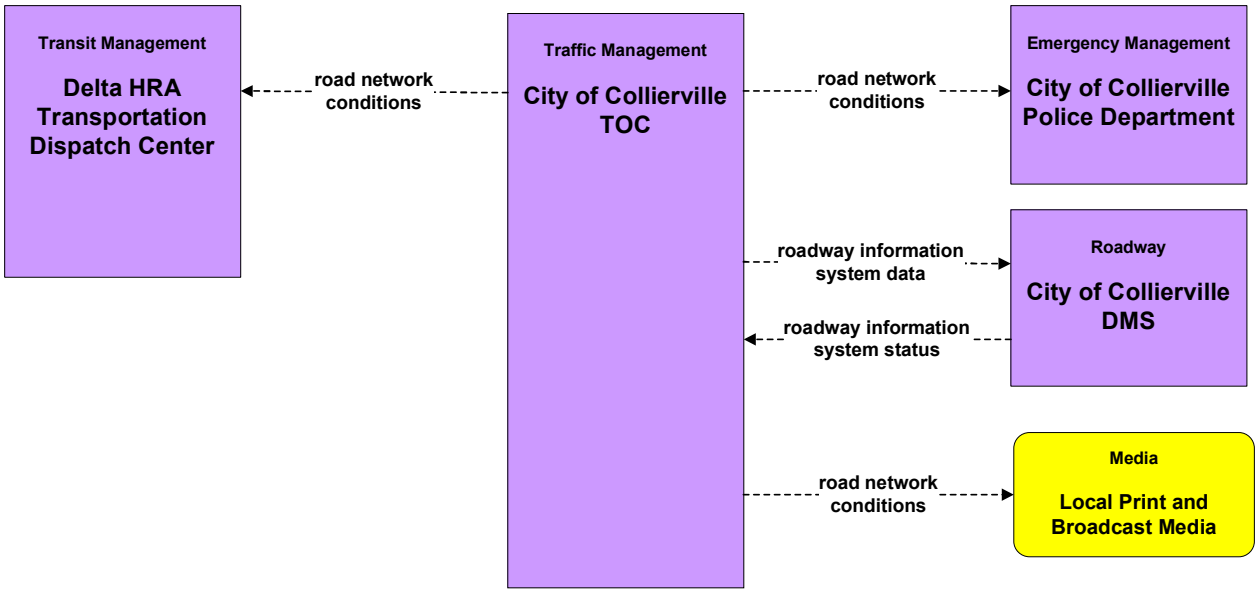
ATMS06 – Traffic Information Dissemination
City of Memphis

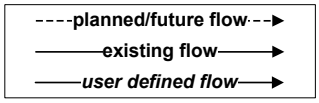


ATMS06 – Traffic Information Dissemination
City of Bartlett

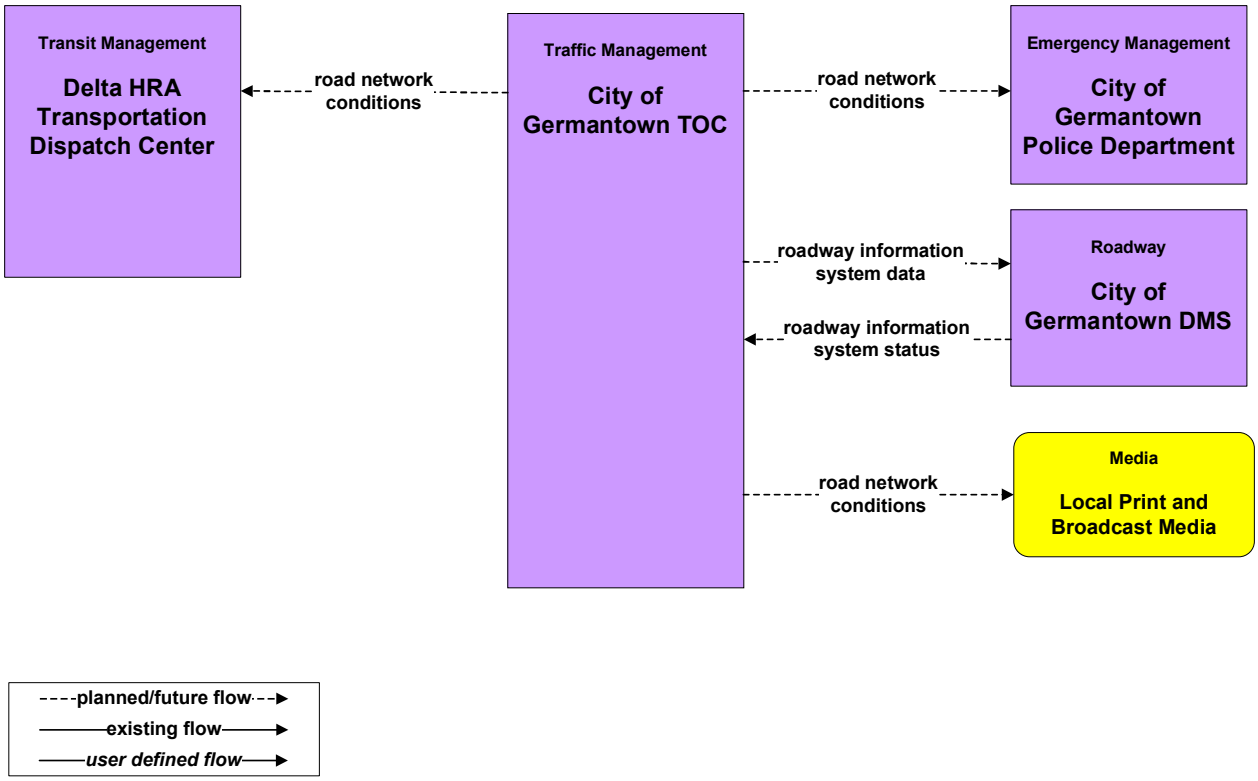


ATMS06 – Traffic Information Dissemination
City of Collierville

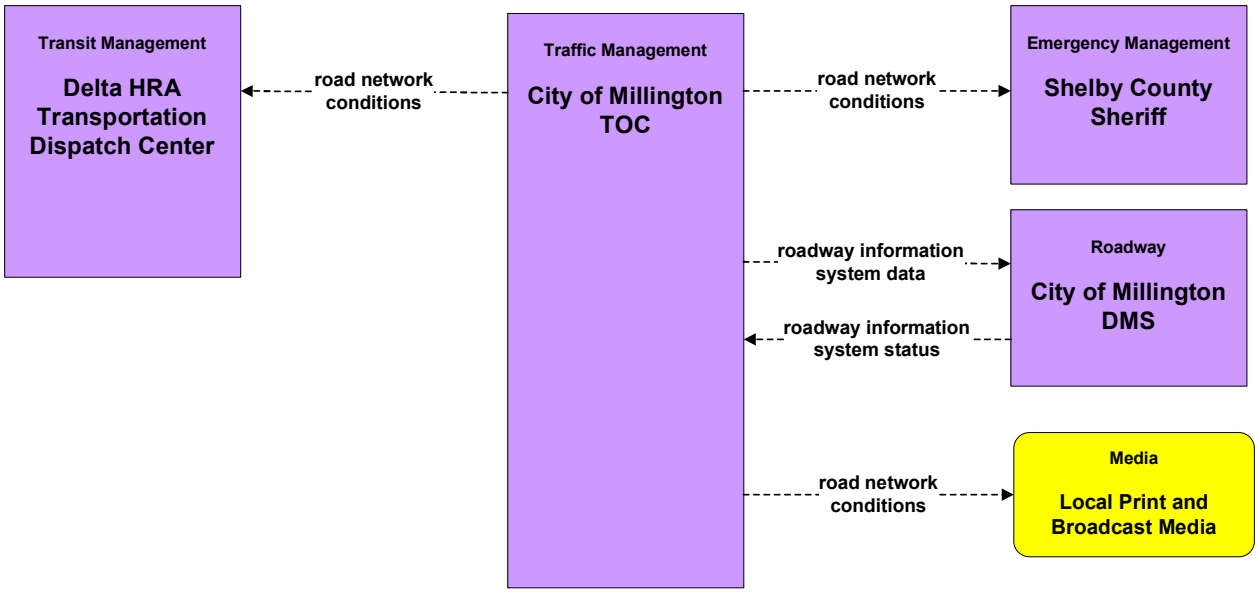


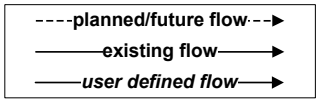


ATMS06 – Traffic Information Dissemination
City of Germantown

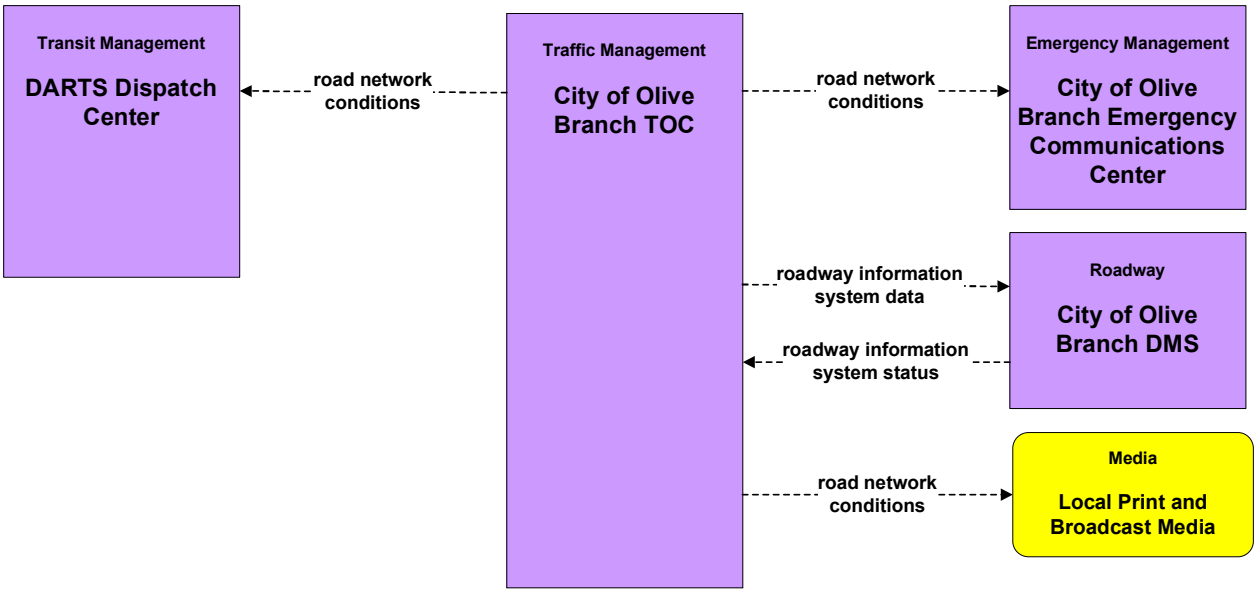


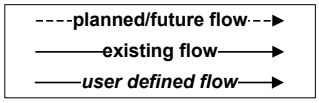
ATMS06 – Traffic Information Dissemination
City of Millington



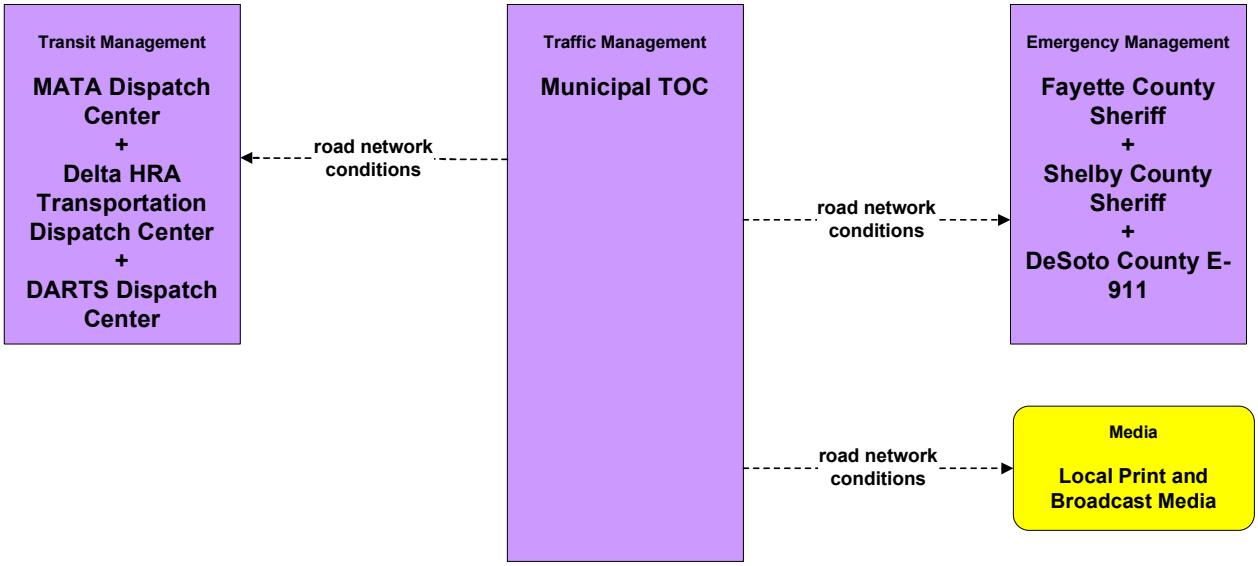


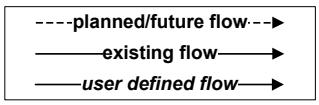
ATMS06 – Traffic Information Dissemination
City of Olive Branch

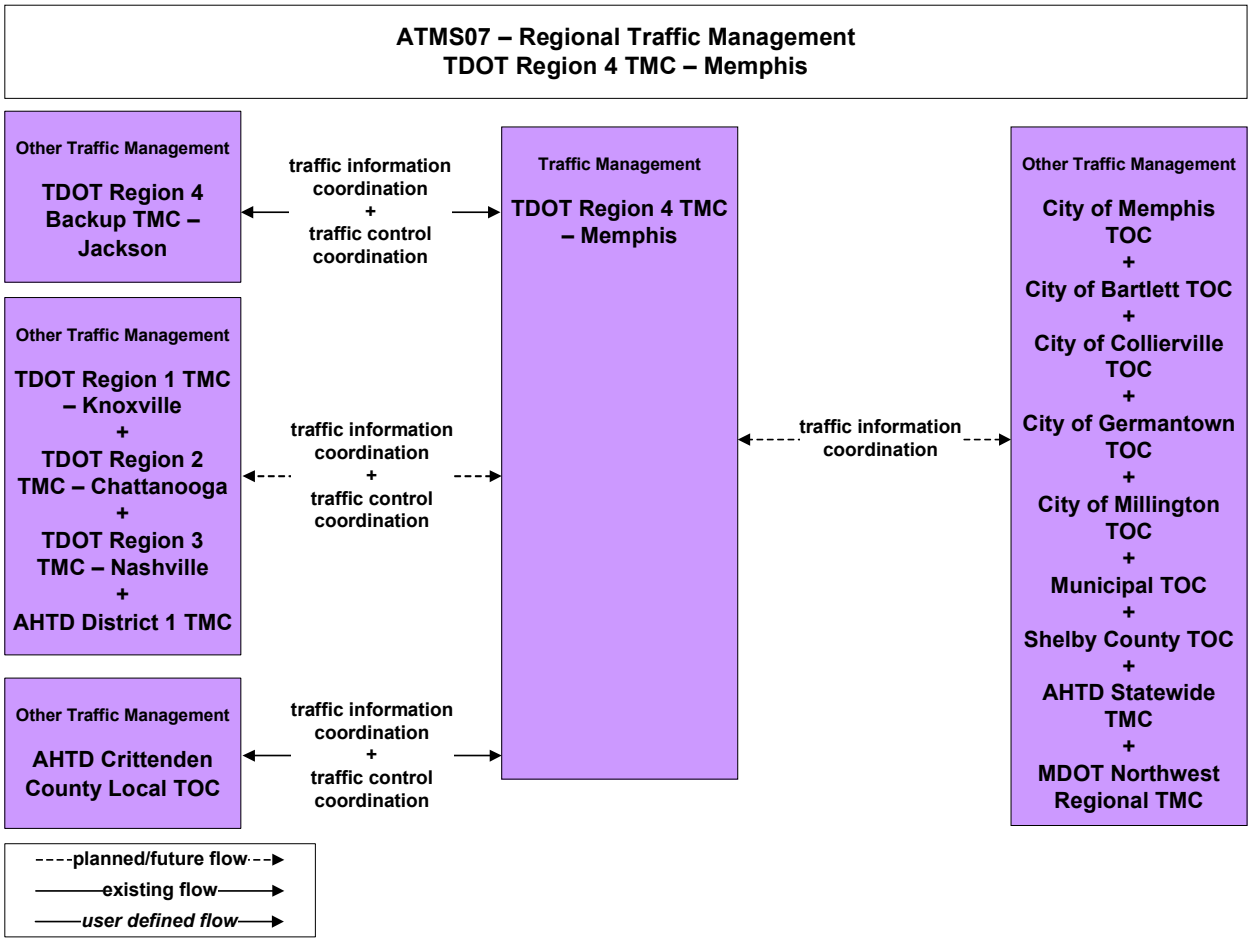


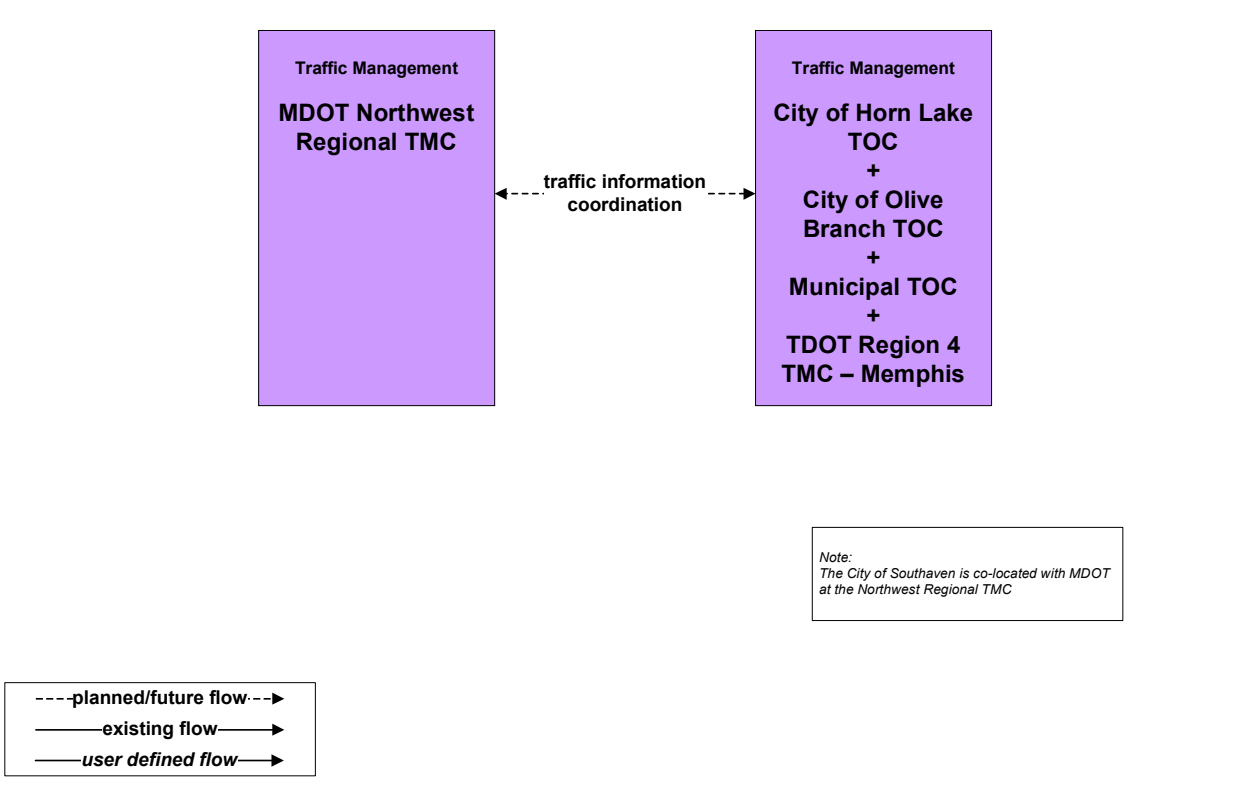


ATMS06 – Traffic Information Dissemination
Municipal

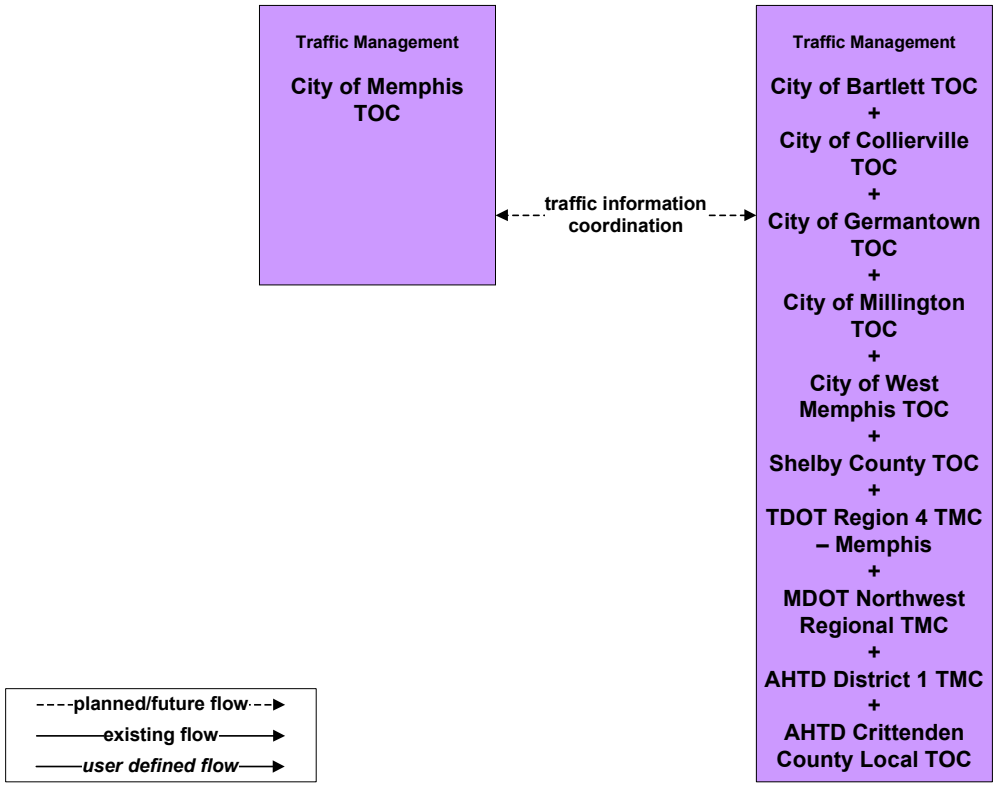




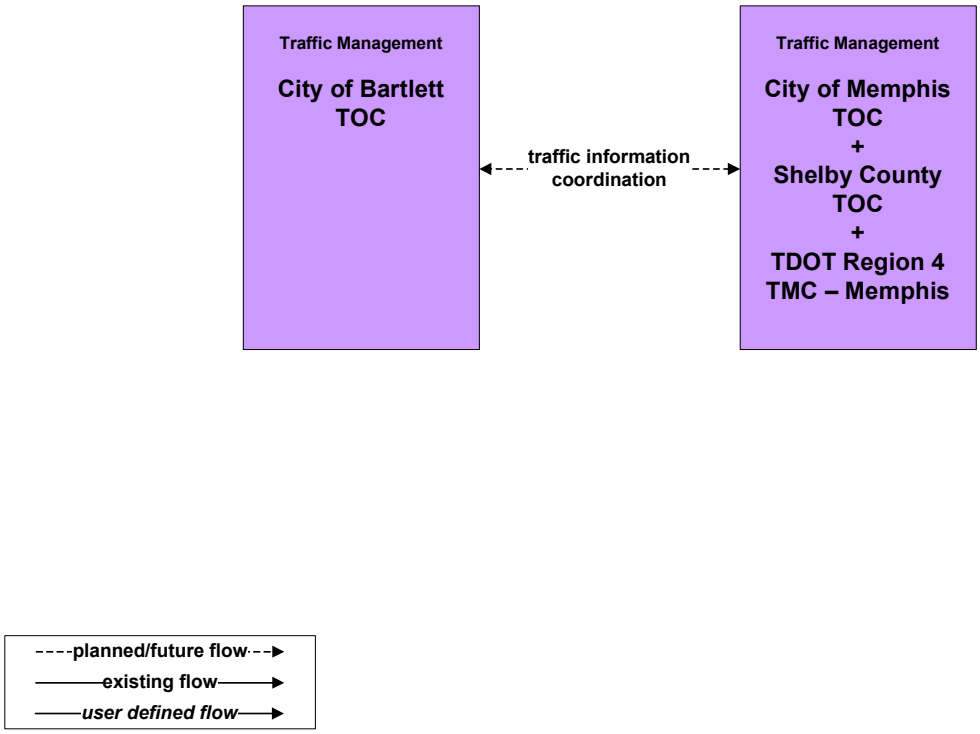

ATMS07 – Regional Traffic Management
TDOT Region 4 TMC – Memphis
Other Traffic Management
TDOT Region 4 Backup TMC – Jackson
traffic information coordination + traffic control coordination
Traffic Management
TDOT Region 4 TMC – Memphis
Other Traffic Management
City of Memphis TOC + City of Bartlett TOC + City of Collierville TOC + City of Germantown TOC + City of Millington TOC + Municipal TOC + Shelby County TOC + AHTD Statewide TMC + MDOT Northwest Regional TMC
traffic information coordination
Other Traffic Management
TDOT Region 1 TMC – Knoxville + TDOT Region 2 TMC – Chattanooga + TDOT Region 3 TMC – Nashville + AHTD District 1 TMC
traffic information coordination + traffic control coordination
Other Traffic Management
AHTD Crittenden County Local TOC
traffic information coordination + traffic control coordination
planned/future flow
existing flow
user defined flow


ATMS07 – Regional Traffic Management
MDOT Northwest Regional TMC
Traffic Management
MDOT Northwest Regional TMC
traffic information coordination
Traffic Management
City of Horn Lake TOC + City of Olive Branch TOC + Municipal TOC + TDOT Region 4 TMC – Memphis
Note:
The City of Southaven is co-located with MDOT at the Northwest Regional TMC
planned/future flow
existing flow
user defined flow

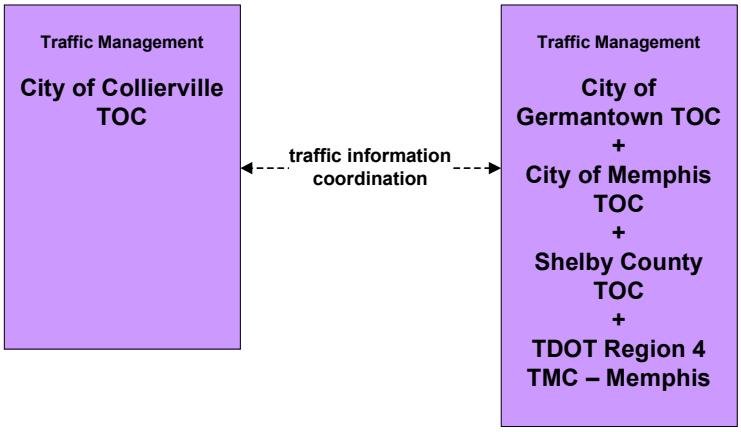
ATMS07 – Regional Traffic Management
City of Memphis

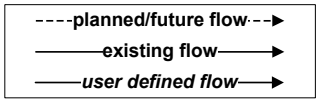


ATMS07 – Regional Traffic Management
City of Bartlett

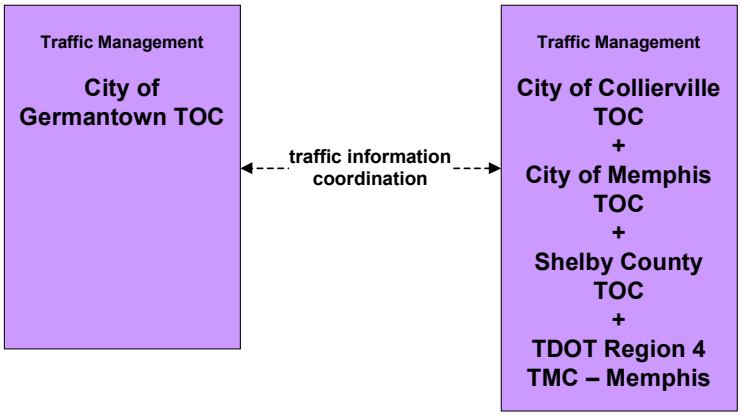


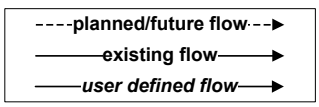
ATMS07 – Regional Traffic Management
City of Collierville



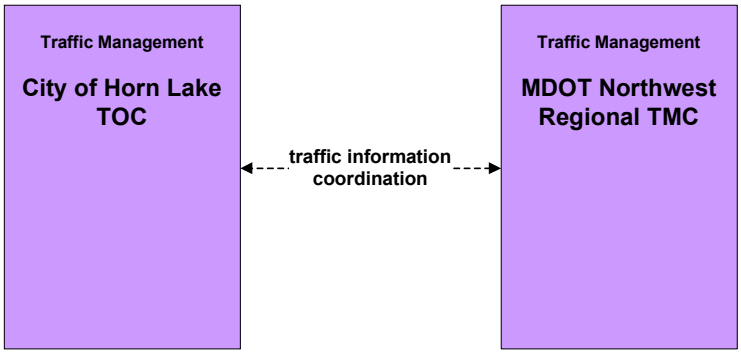


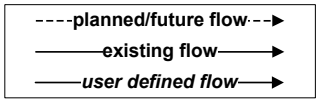
ATMS07 – Regional Traffic Management
City of Germantown



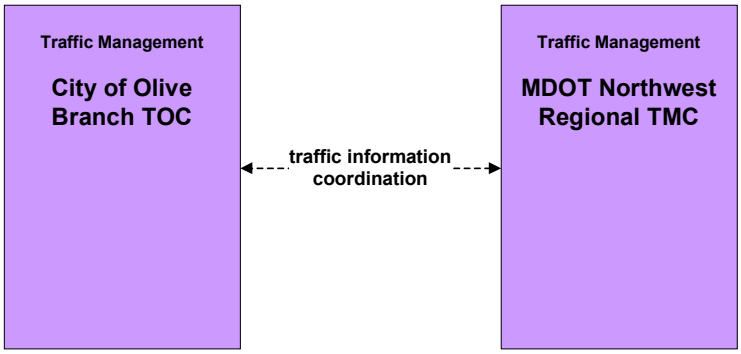


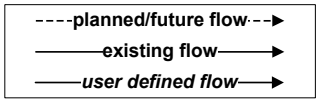
ATMS07 – Regional Traffic Management
City of Horn Lake



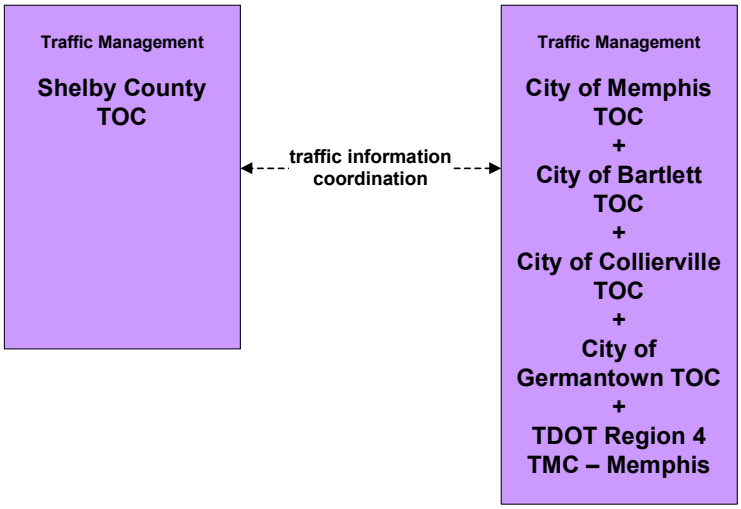


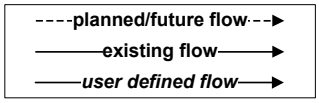
ATMS07 – Regional Traffic Management
City of Olive Branch



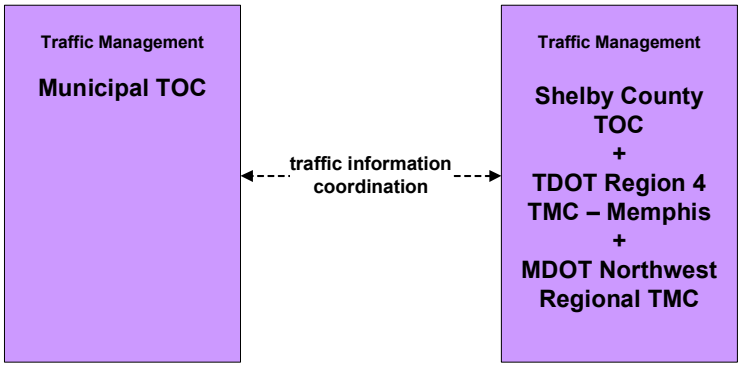


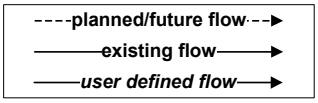
ATMS07 – Regional Traffic Management
Shelby County



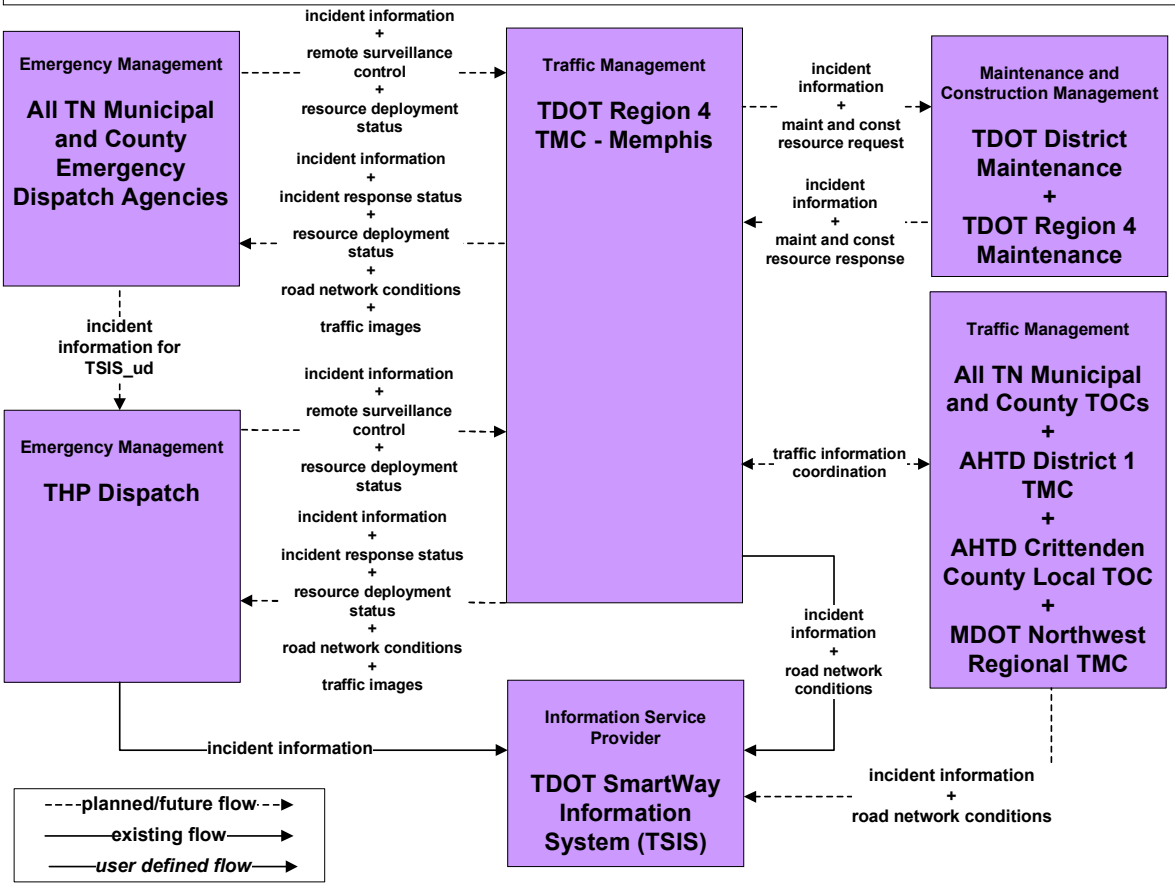


ATMS07 – Regional Traffic Management
Municipal

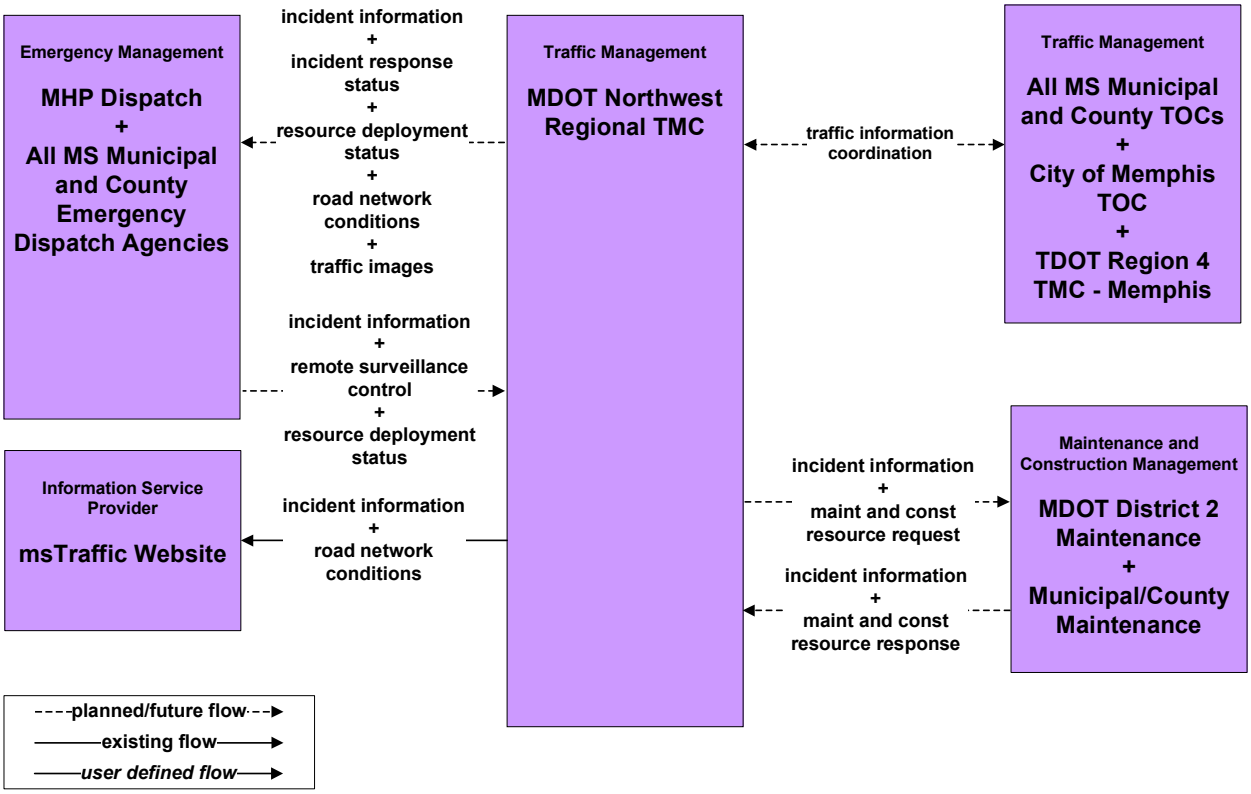




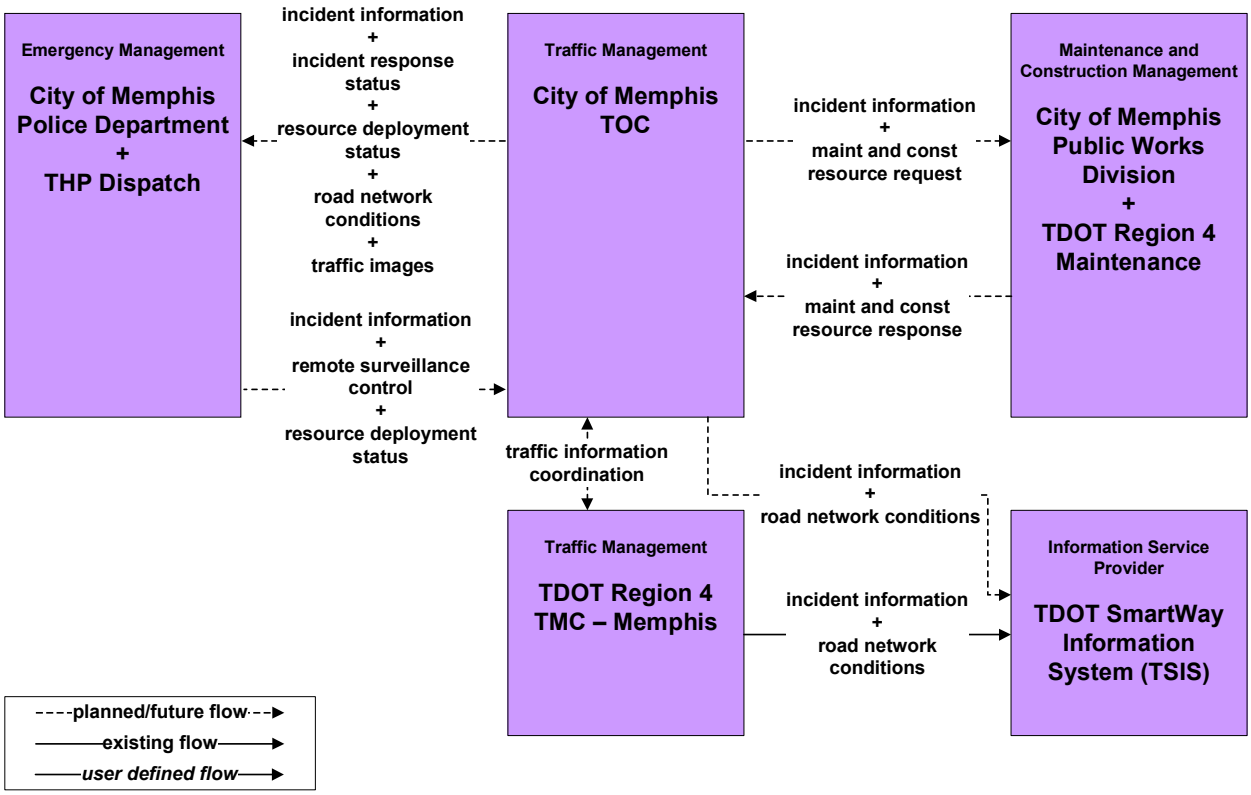
ATMS08 - Traffic Incident Management System
TDOT Region 4 TMC - Memphis



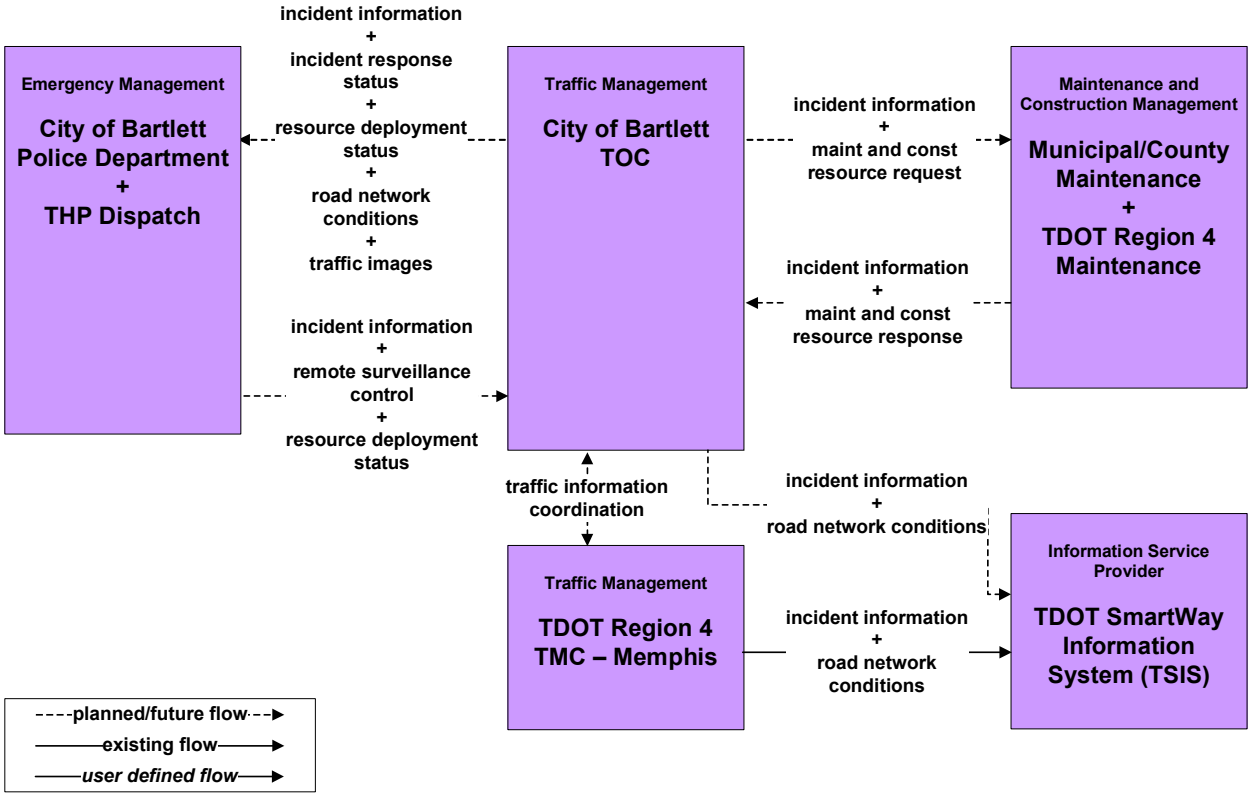
ATMS08 – Traffic Incident Management System
MDOT Northwest Regional TMC



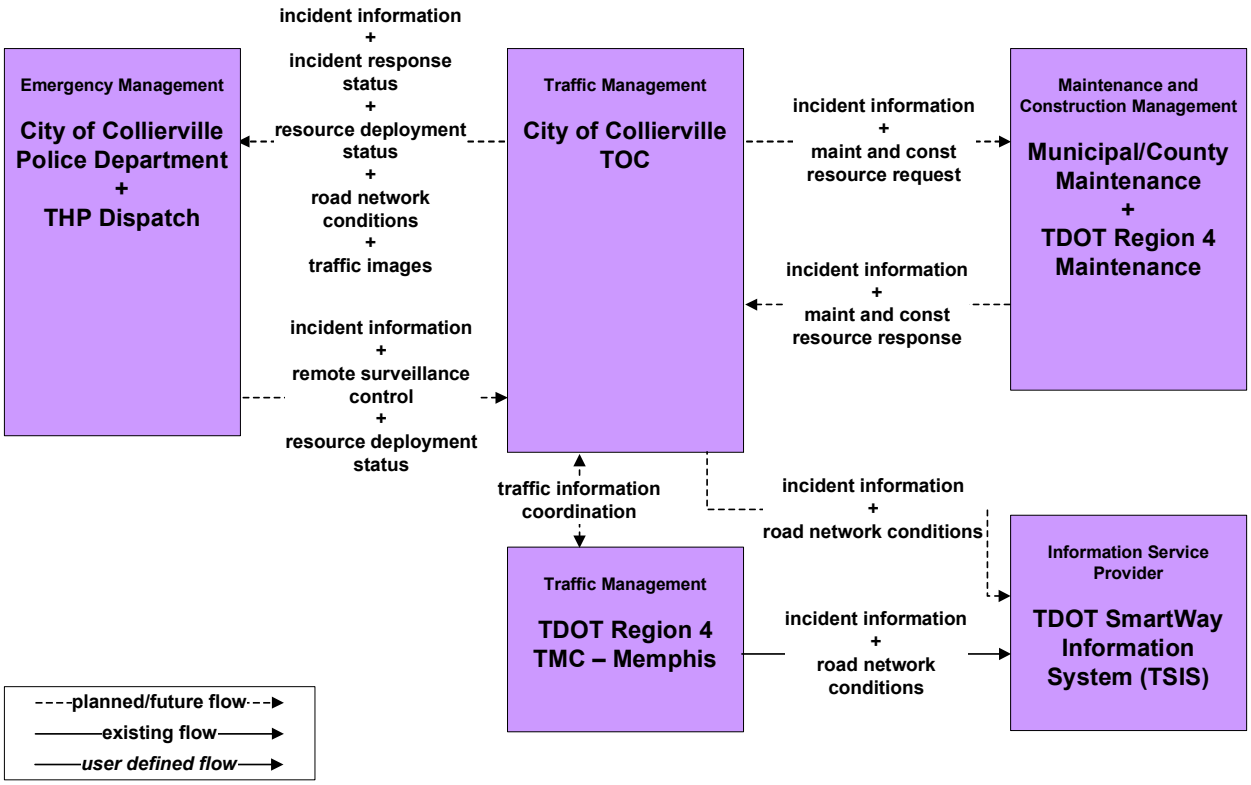
ATMS08 – Traffic Incident Management System
City of Memphis



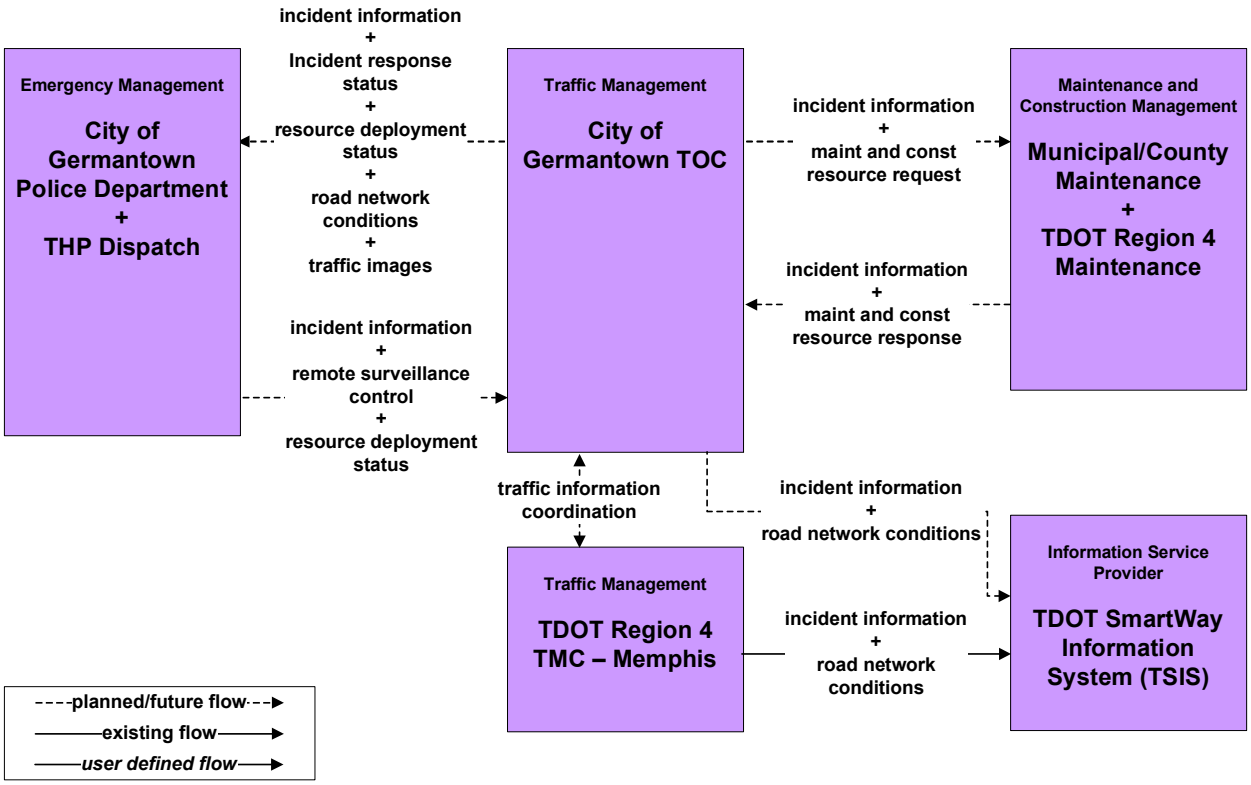
ATMS08 – Traffic Incident Management System
City of Bartlett



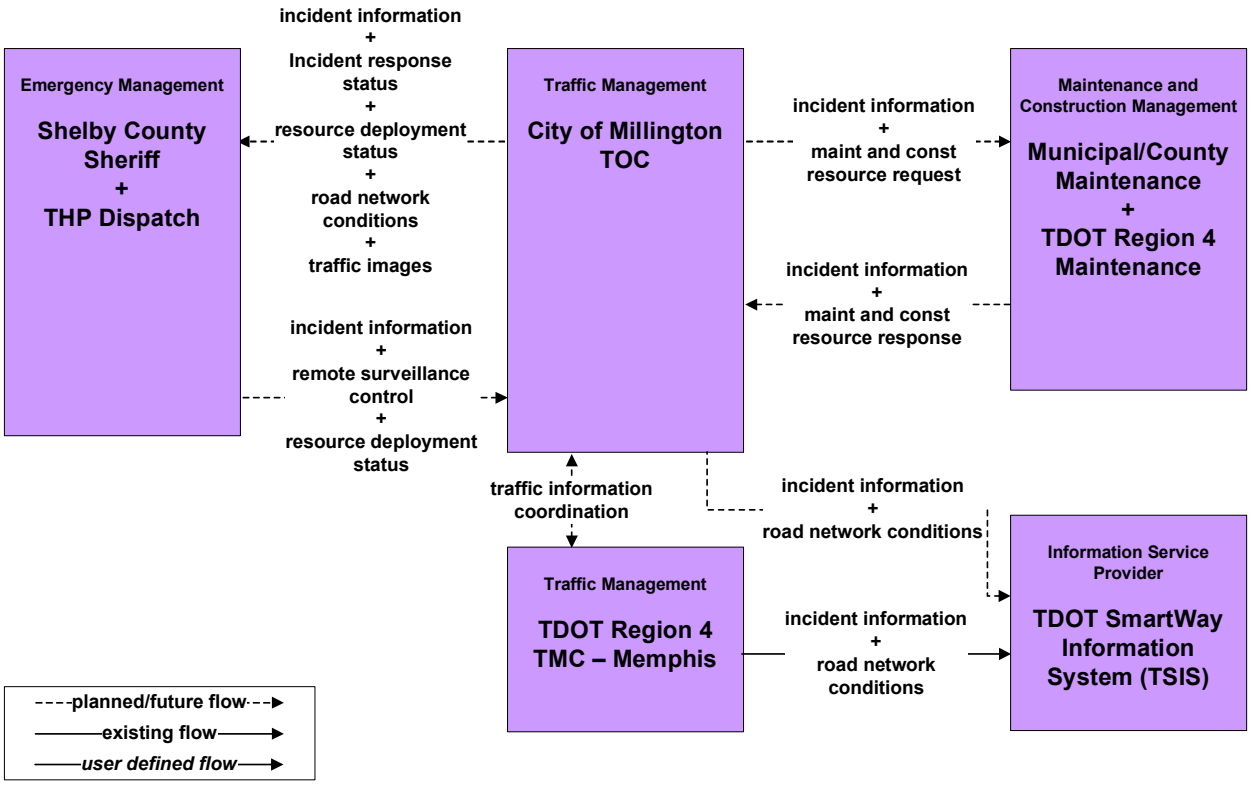
ATMS08 – Traffic Incident Management System
City of Collierville



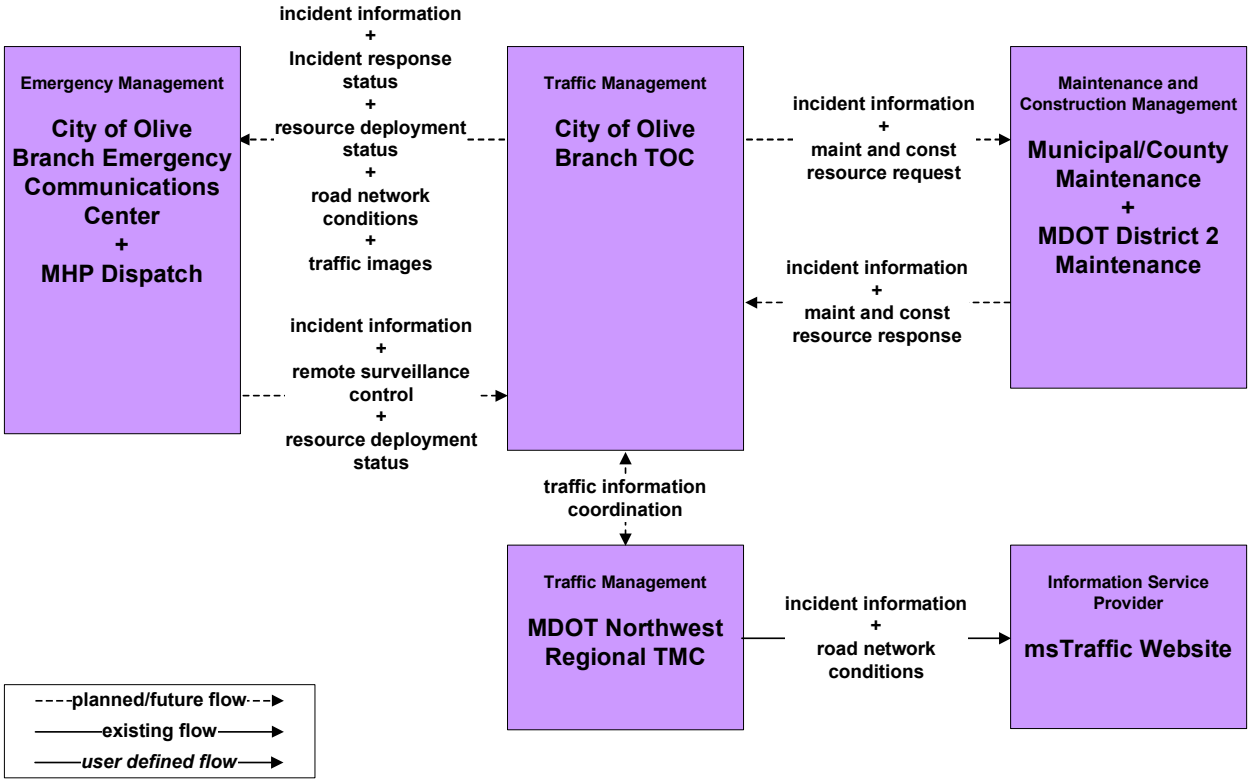
ATMS08 – Traffic Incident Management System
City of Germantown



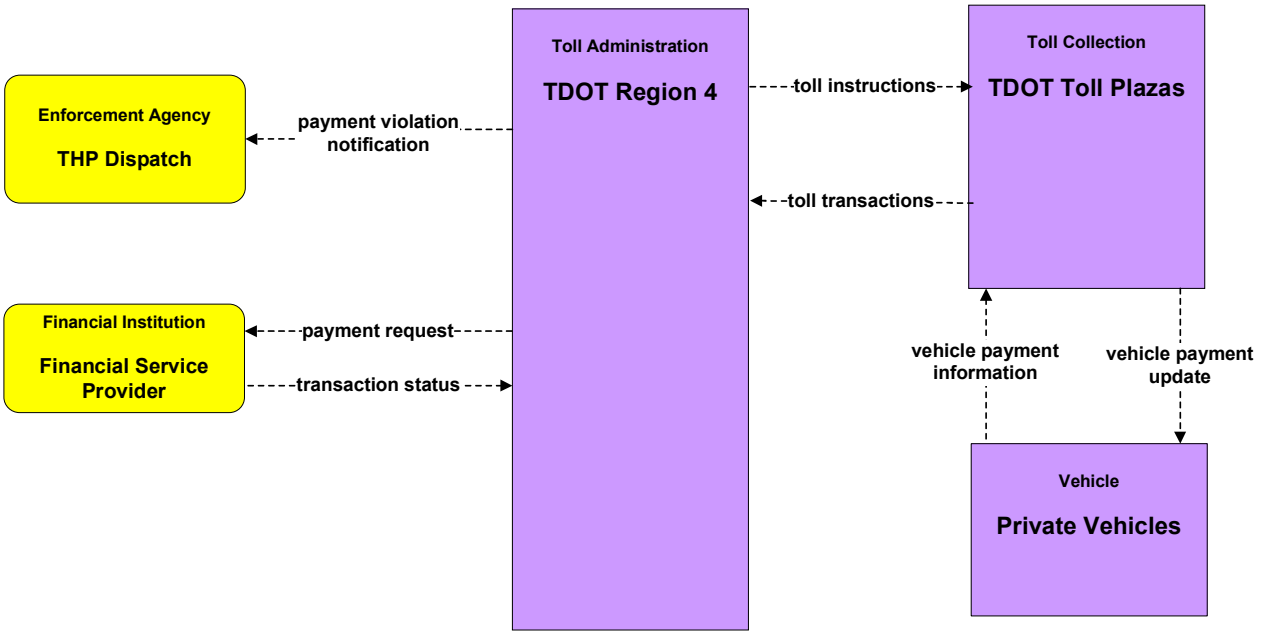
ATMS08 – Traffic Incident Management System
City of Millington



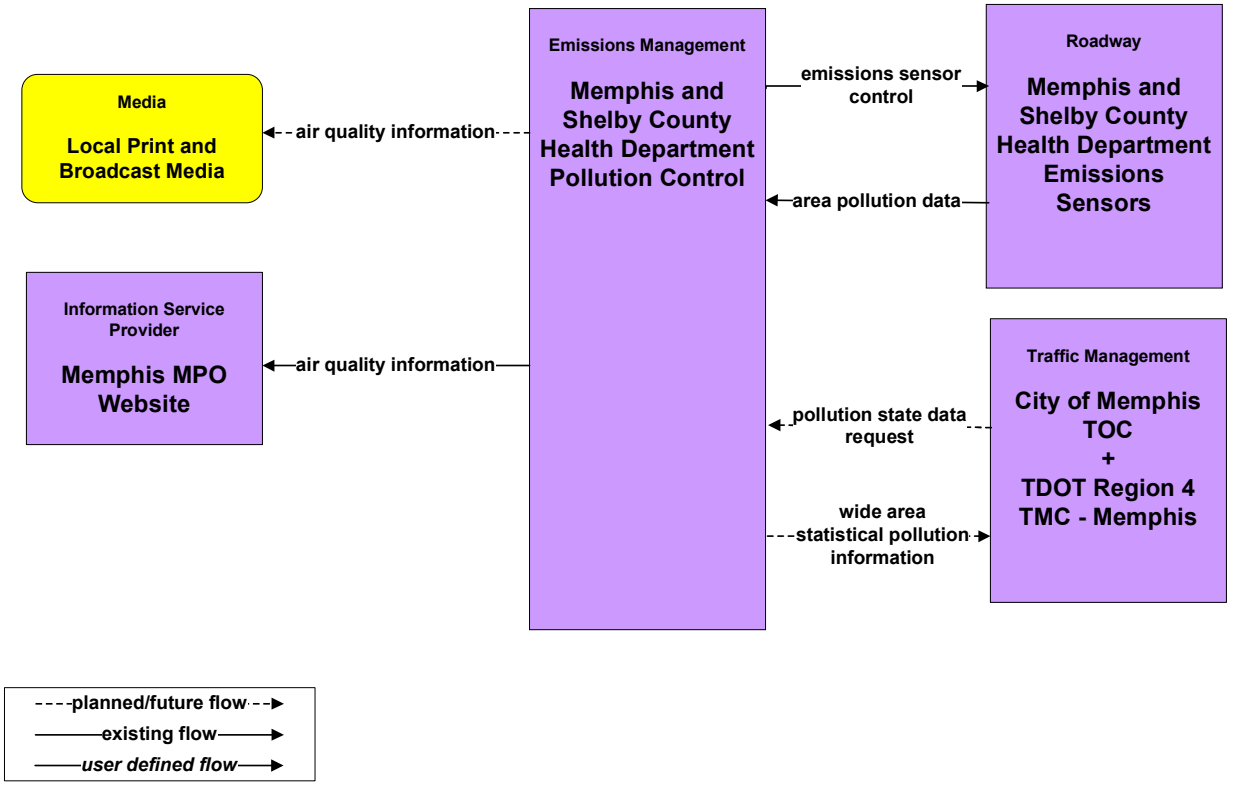
ATMS08 – Traffic Incident Management System
City of Olive Branch



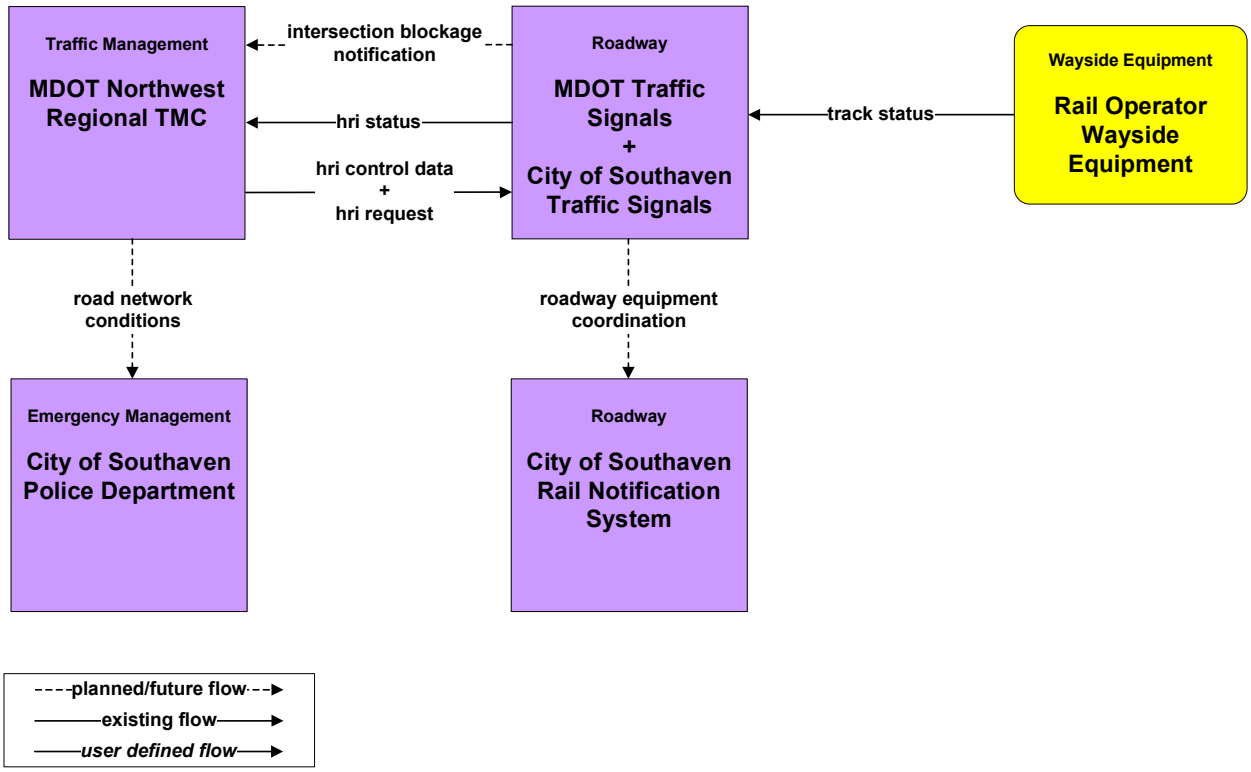
ATMS10 – Electronic Toll Collection
TDOT Region 4



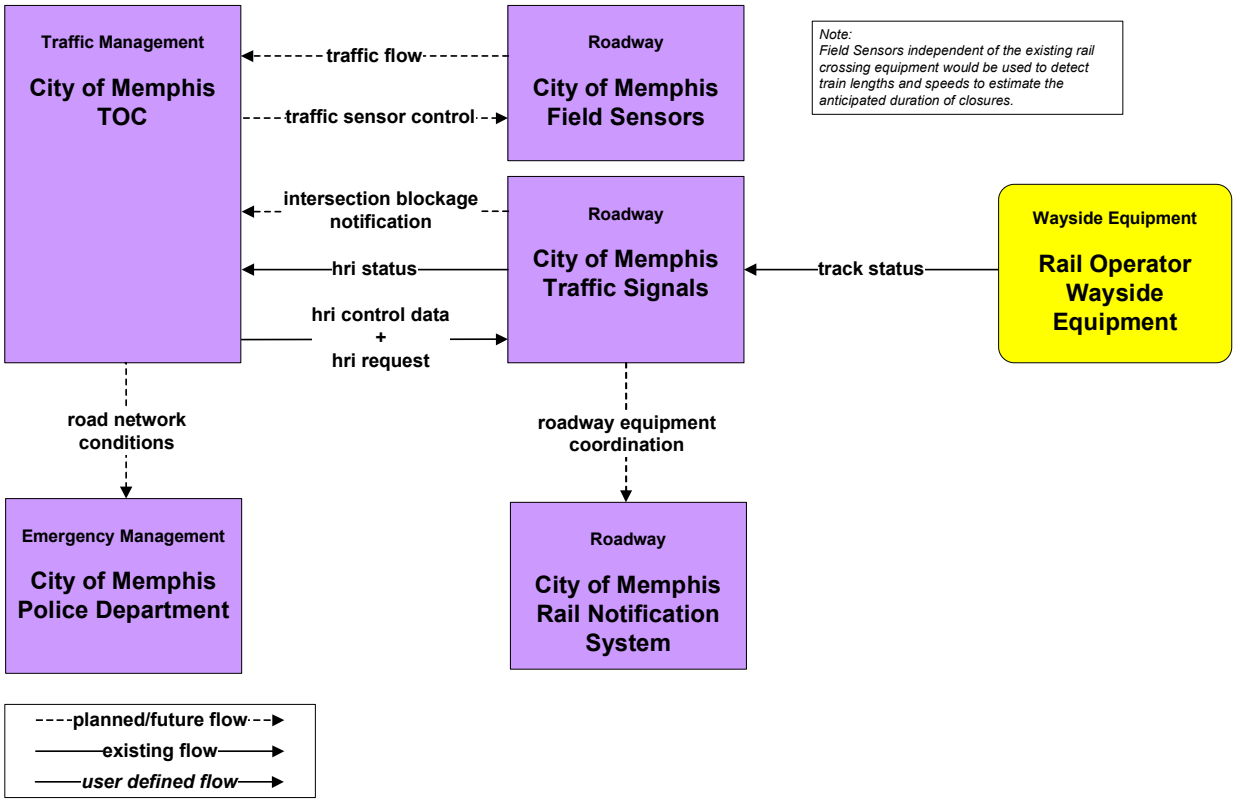
ATMS11 – Emissions Monitoring and Management
Memphis and Shelby County Health Department



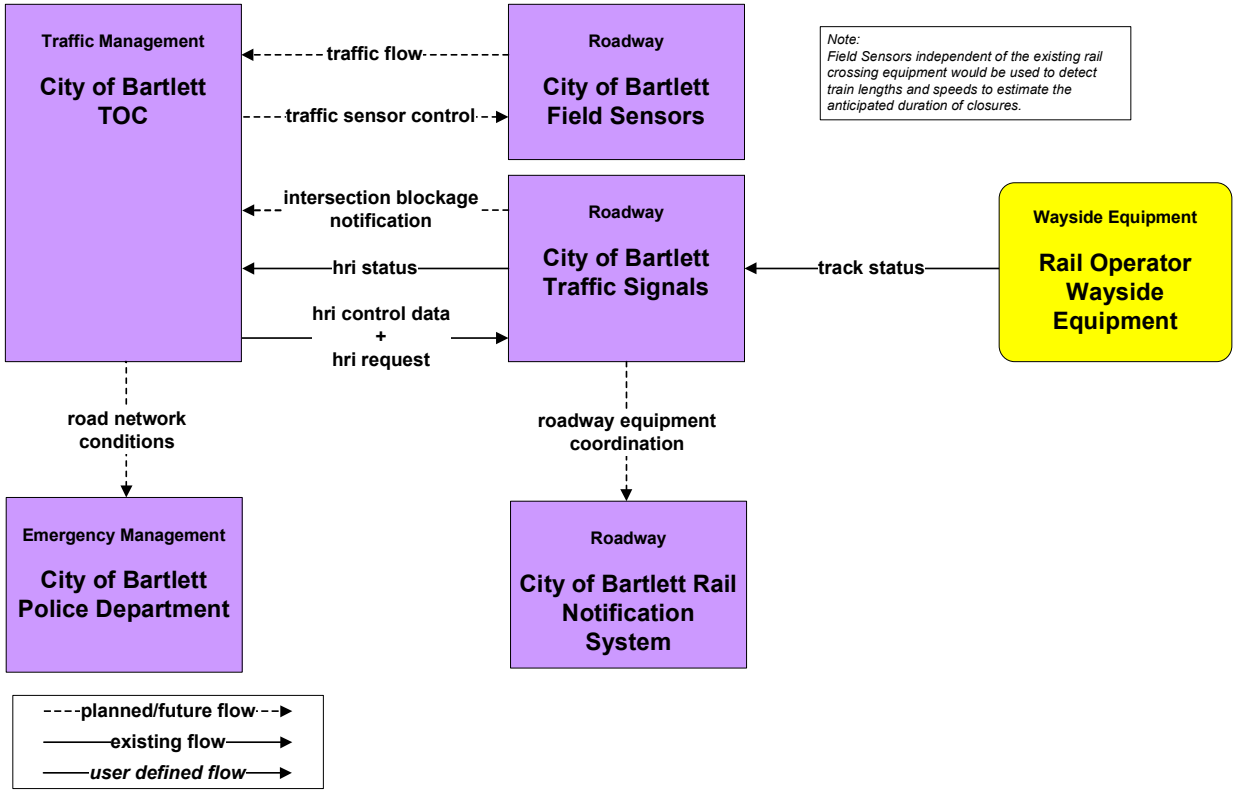
ATMS13 – Standard Railroad Grade Crossing
MDOT and City of Southaven



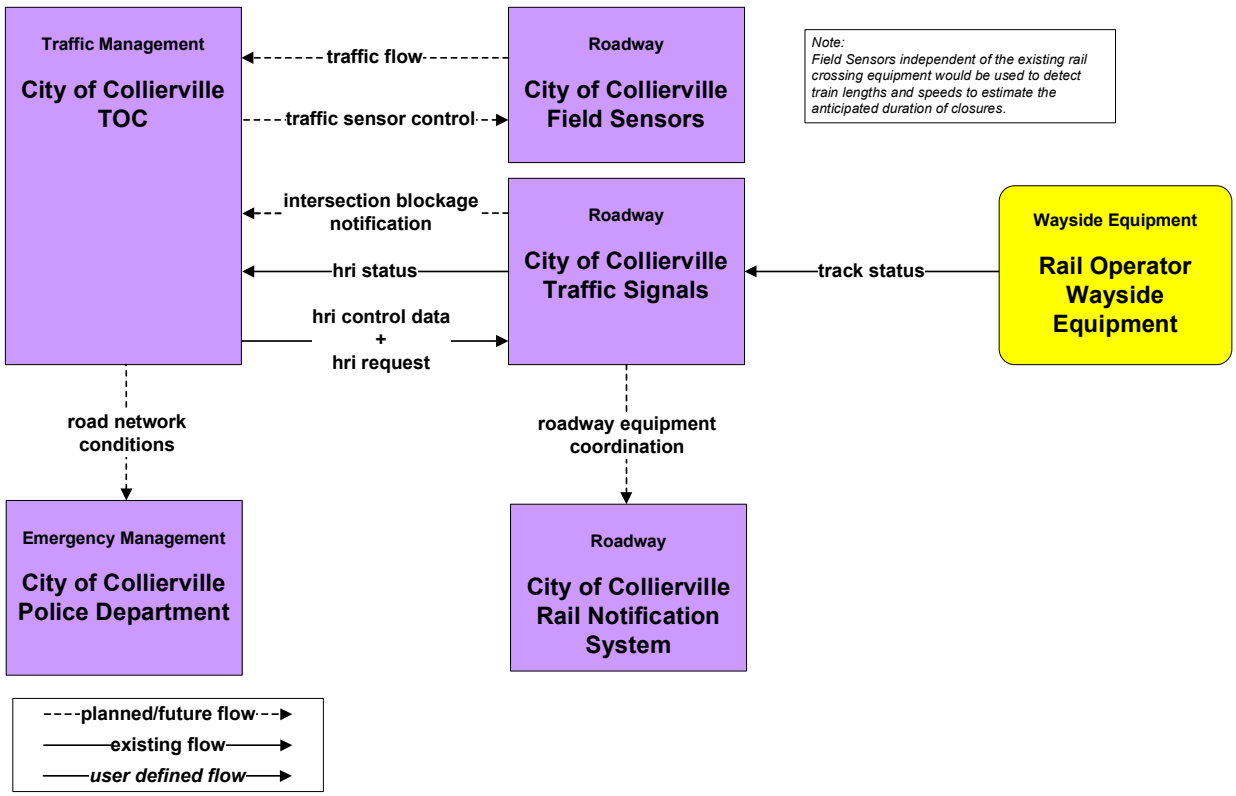
ATMS13 – Standard Railroad Grade Crossing
City of Memphis



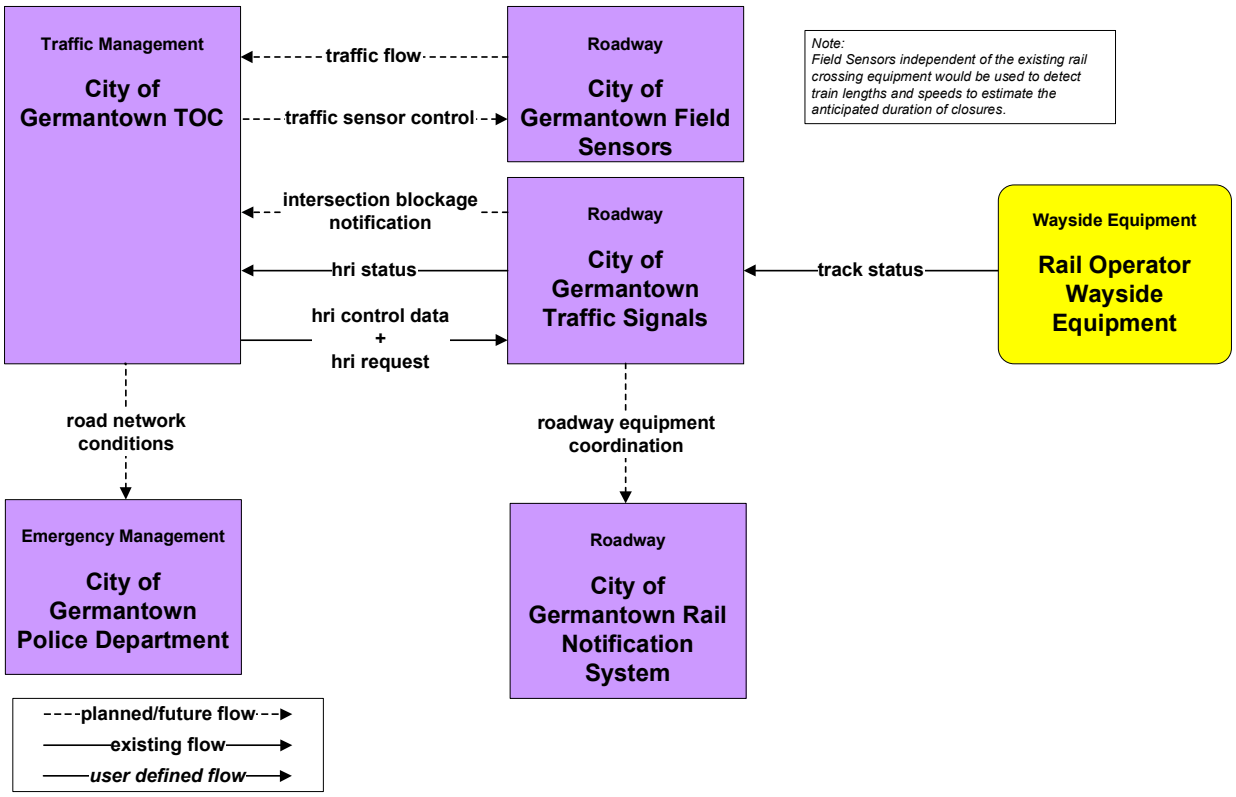
ATMS13 – Standard Railroad Grade Crossing
City of Bartlett



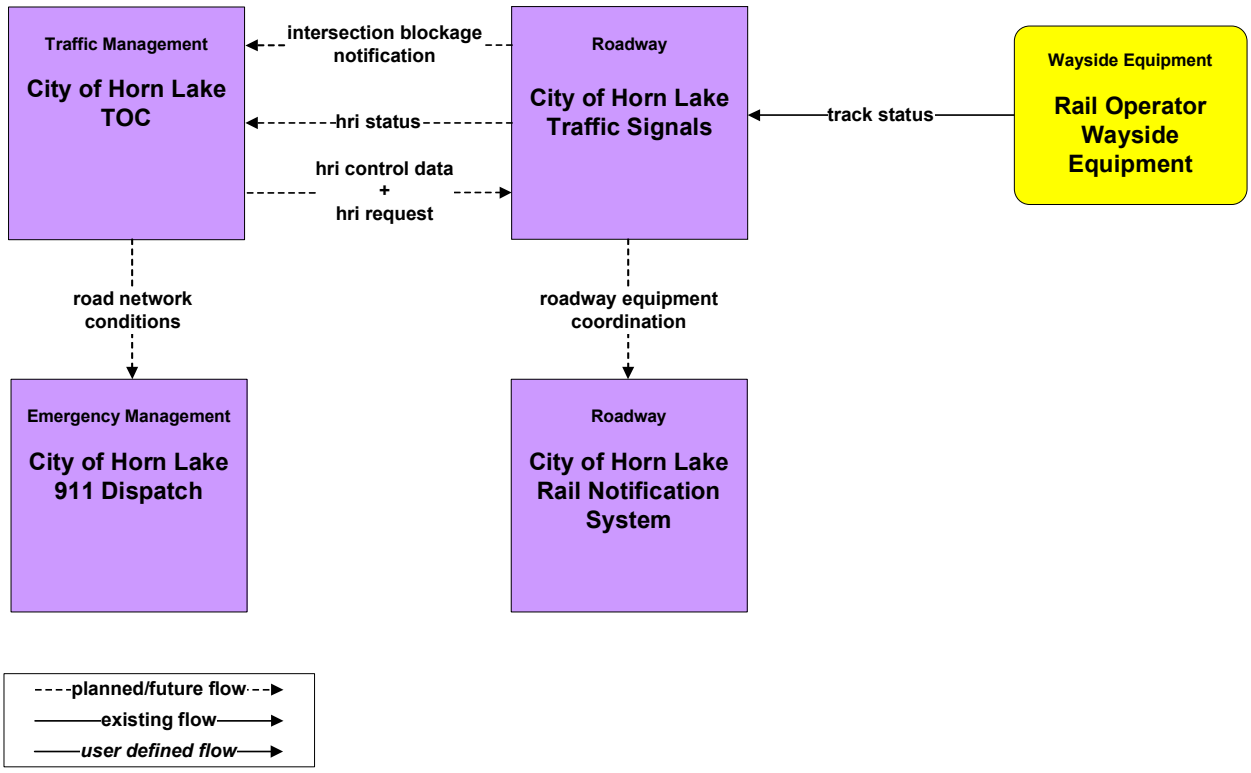
ATMS13 – Standard Railroad Grade Crossing
City of Collierville



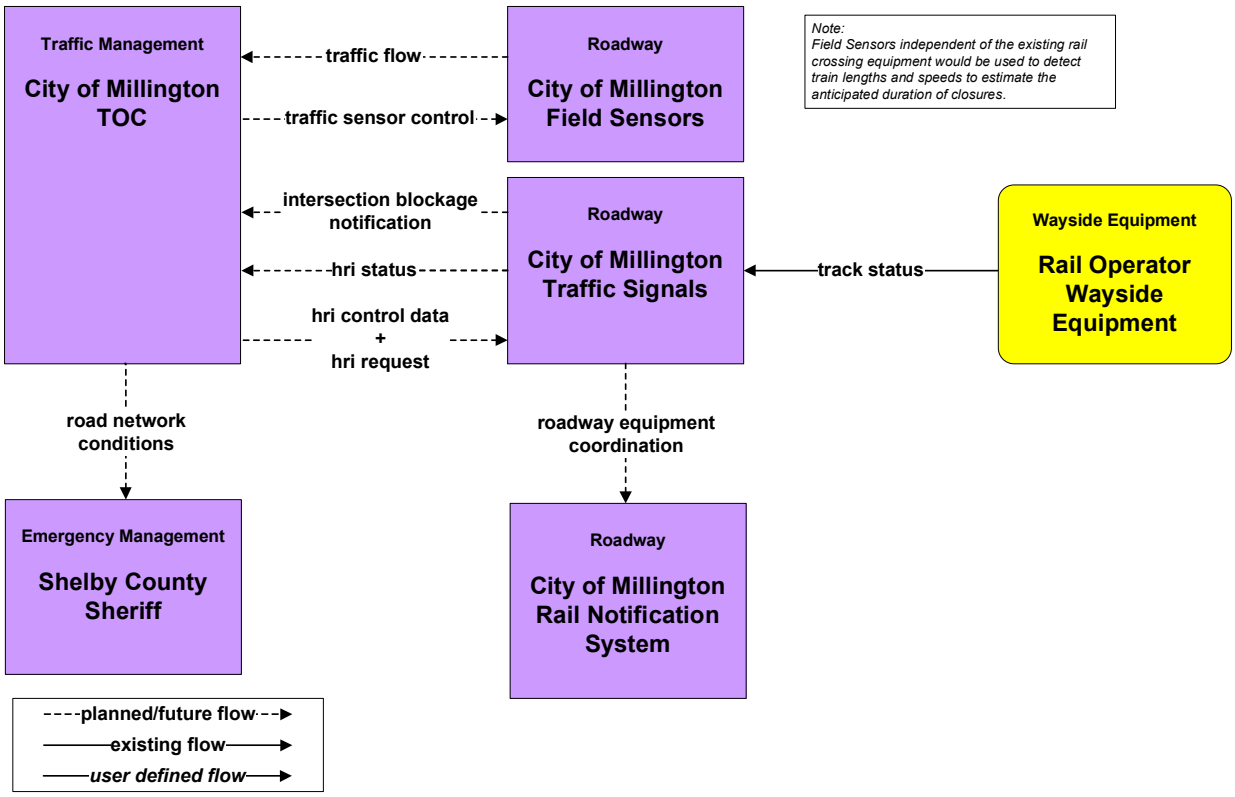
ATMS13 – Standard Railroad Grade Crossing
City of Germantown



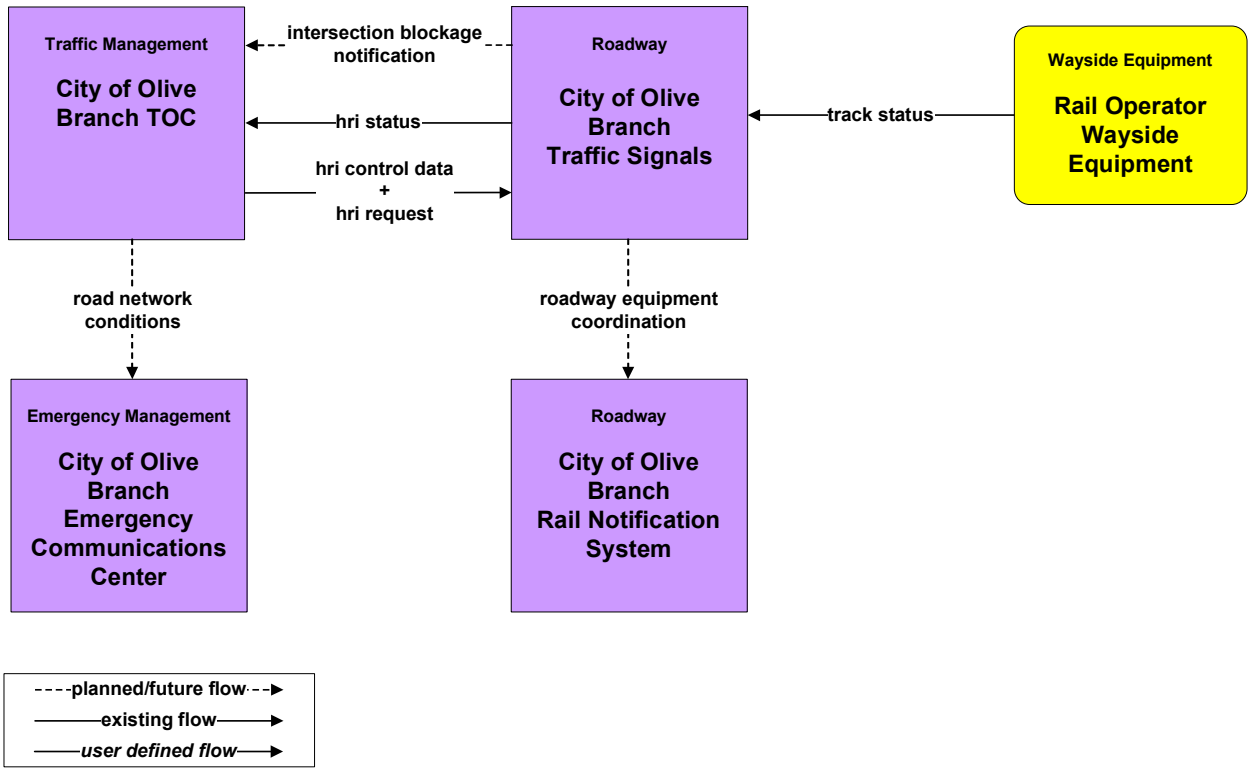
ATMS13 – Standard Railroad Grade Crossing
City of Horn Lake



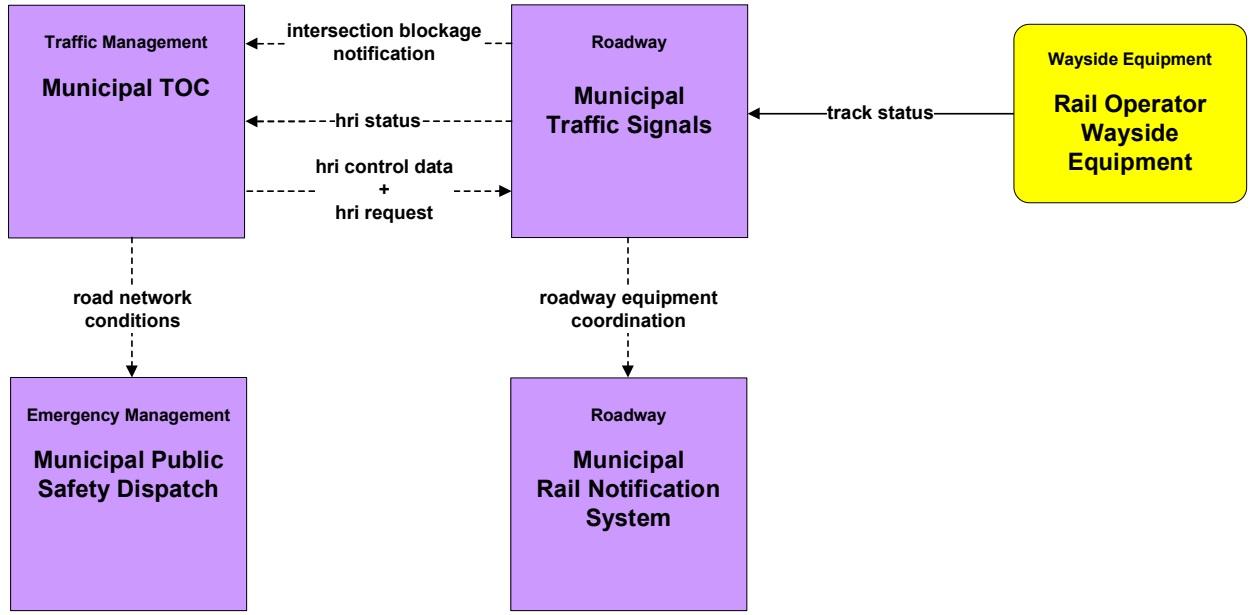
ATMS13 – Standard Railroad Grade Crossing
City of Millington



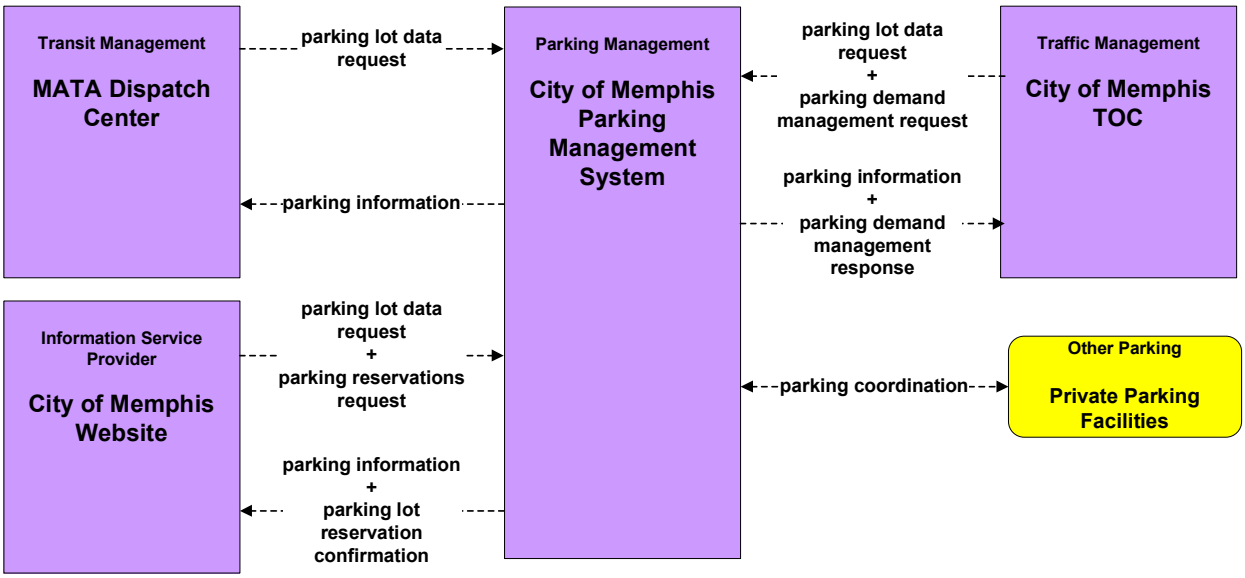
ATMS13 – Standard Railroad Grade Crossing
City of Olive Branch



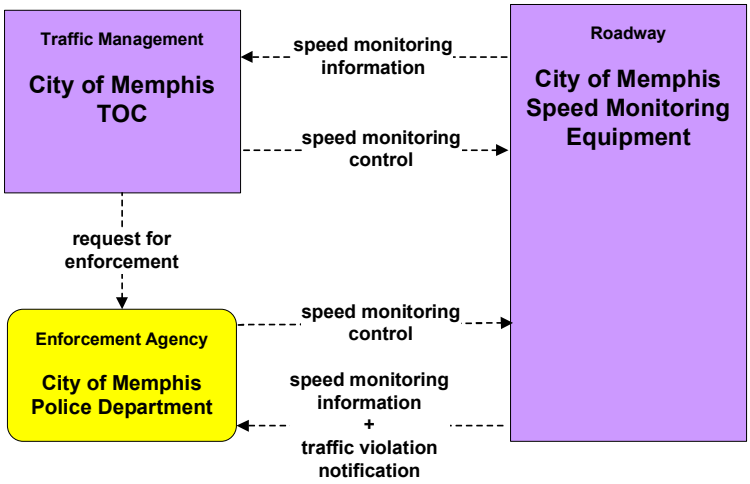
ATMS13 – Standard Railroad Grade Crossing
Municipal

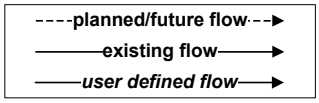


ATMS17 – Regional Parking Management
City of Memphis

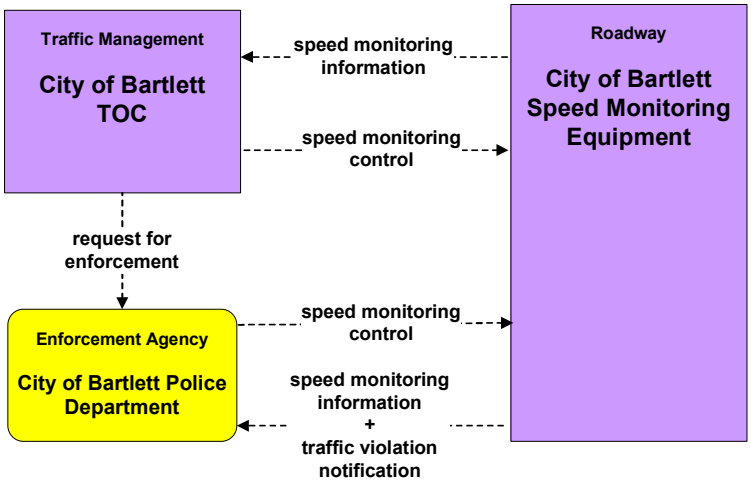


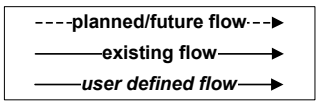
ATMS19 – Speed Monitoring
City of Memphis



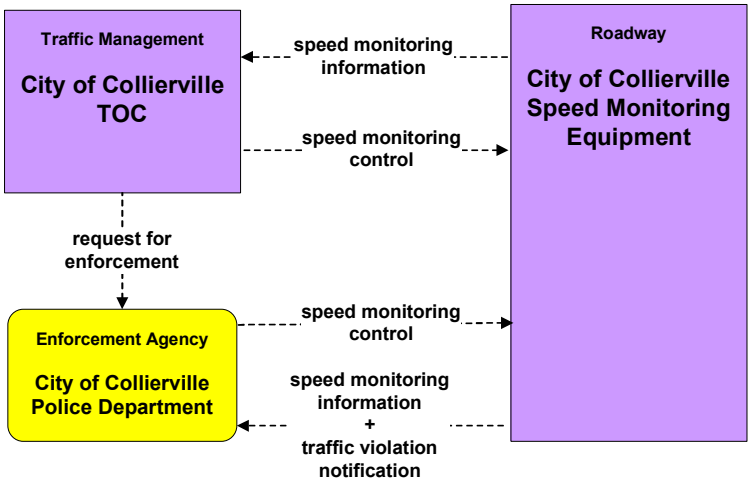


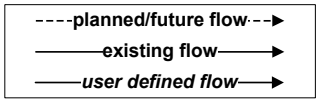
ATMS19 – Speed Monitoring
City of Bartlett



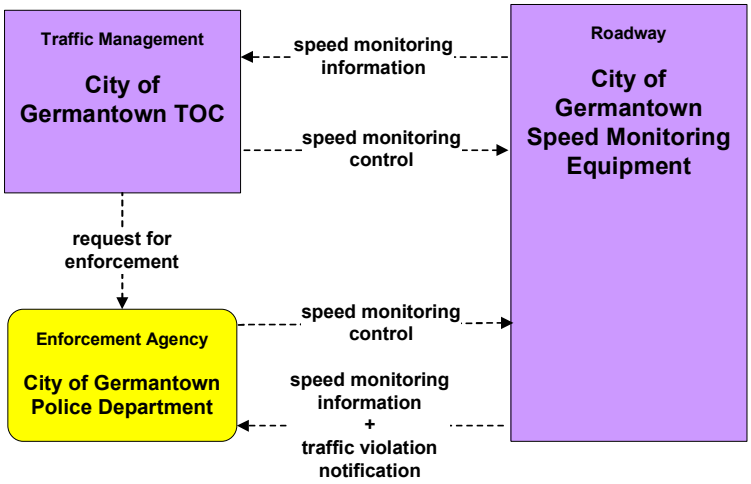


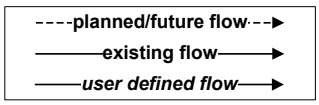
ATMS19 – Speed Monitoring
City of Collierville



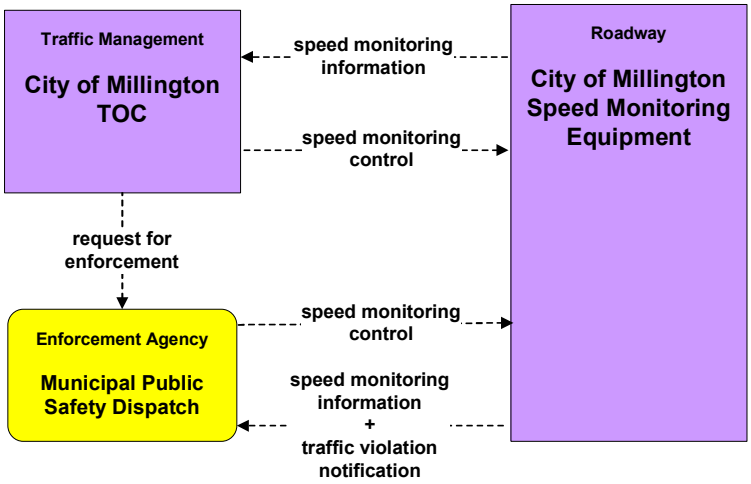


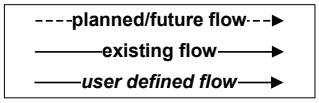
ATMS19 – Speed Monitoring
City of Germantown



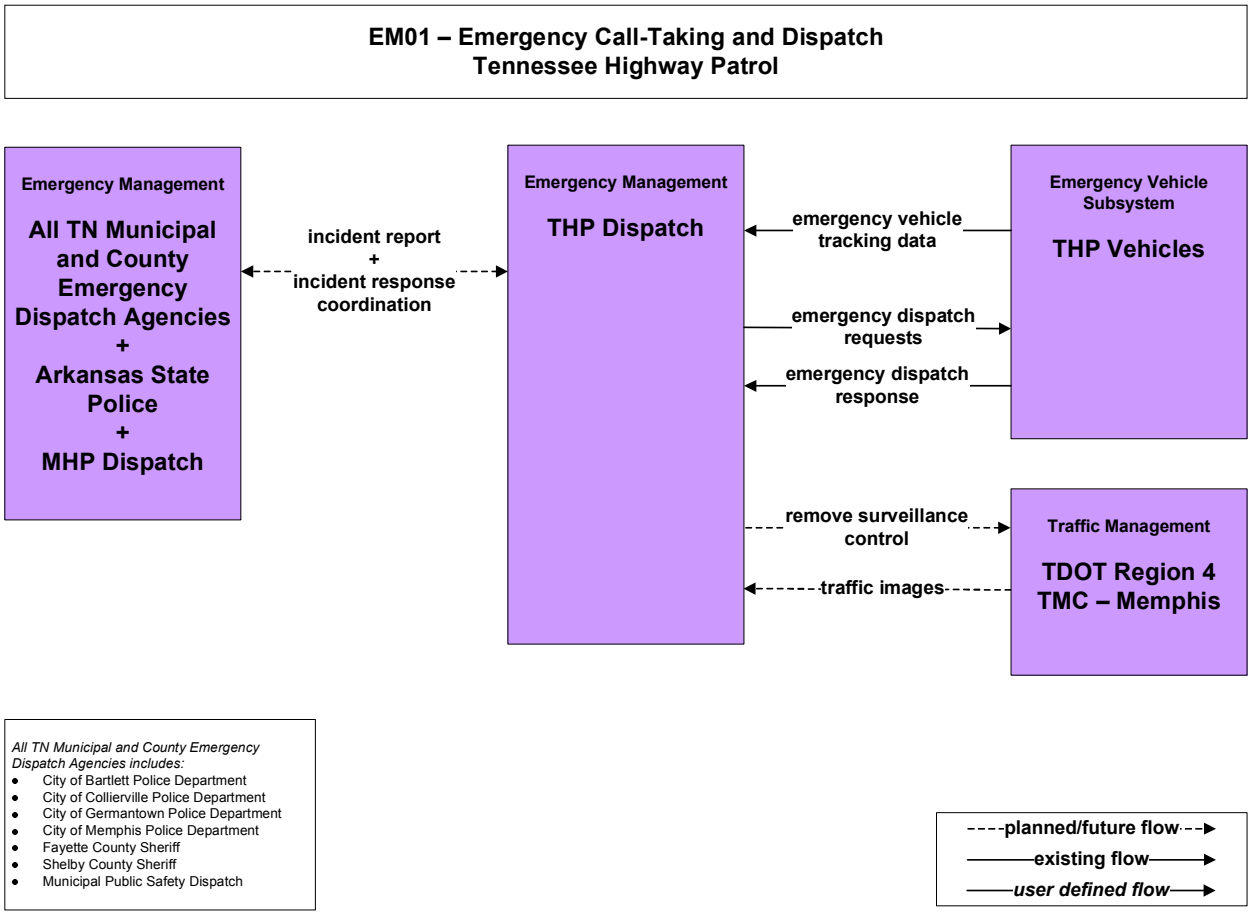


ATMS19 – Speed Monitoring
City of Millington

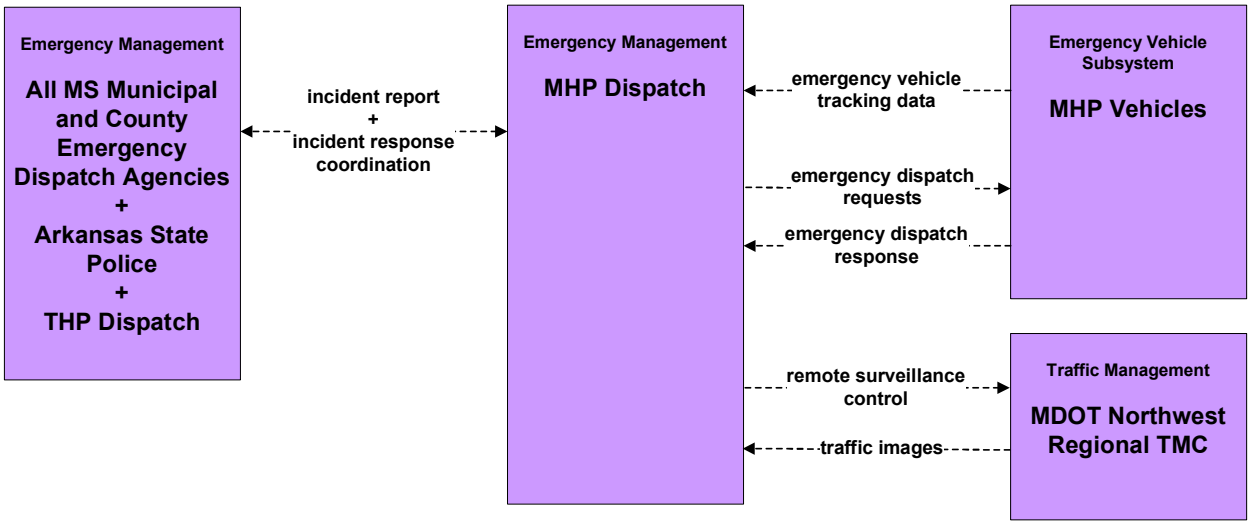




Emergency Management

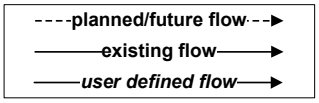


EM01 – Emergency Call-Taking and Dispatch
Mississippi Highway Patrol

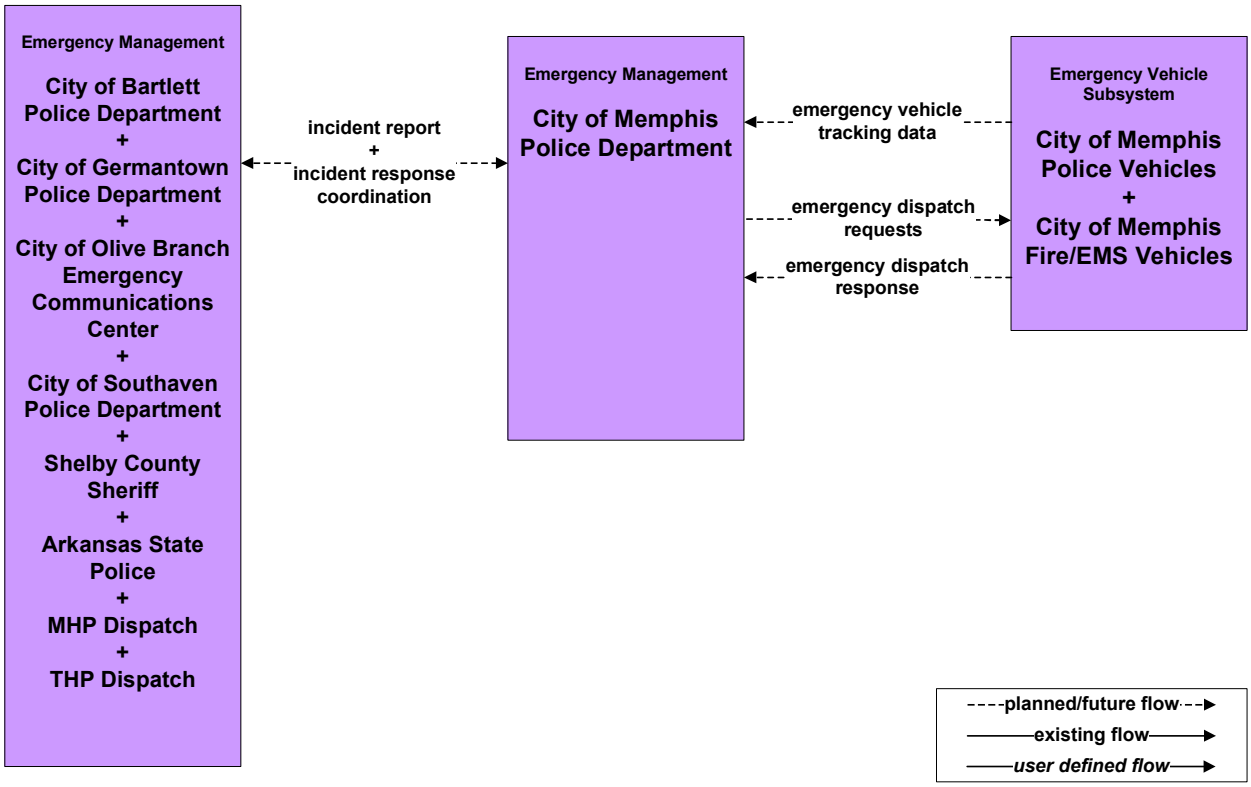


All MS Municipal and County Emergency Dispatch Agencies includes:

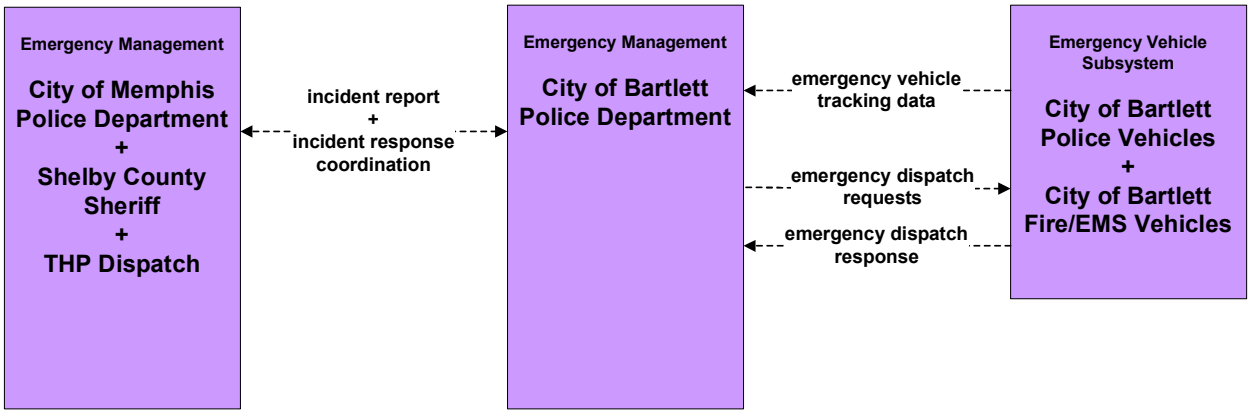
- City of Horn Lake 911 Dispatch
- City of Olive Branch Emergency Communications Center
- City of Southaven Police Department
- DeSoto County E-911
- Municipal Public Safety Dispatch

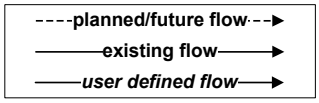


EM01 – Emergency Call-Taking and Dispatch
City of Memphis Police Department

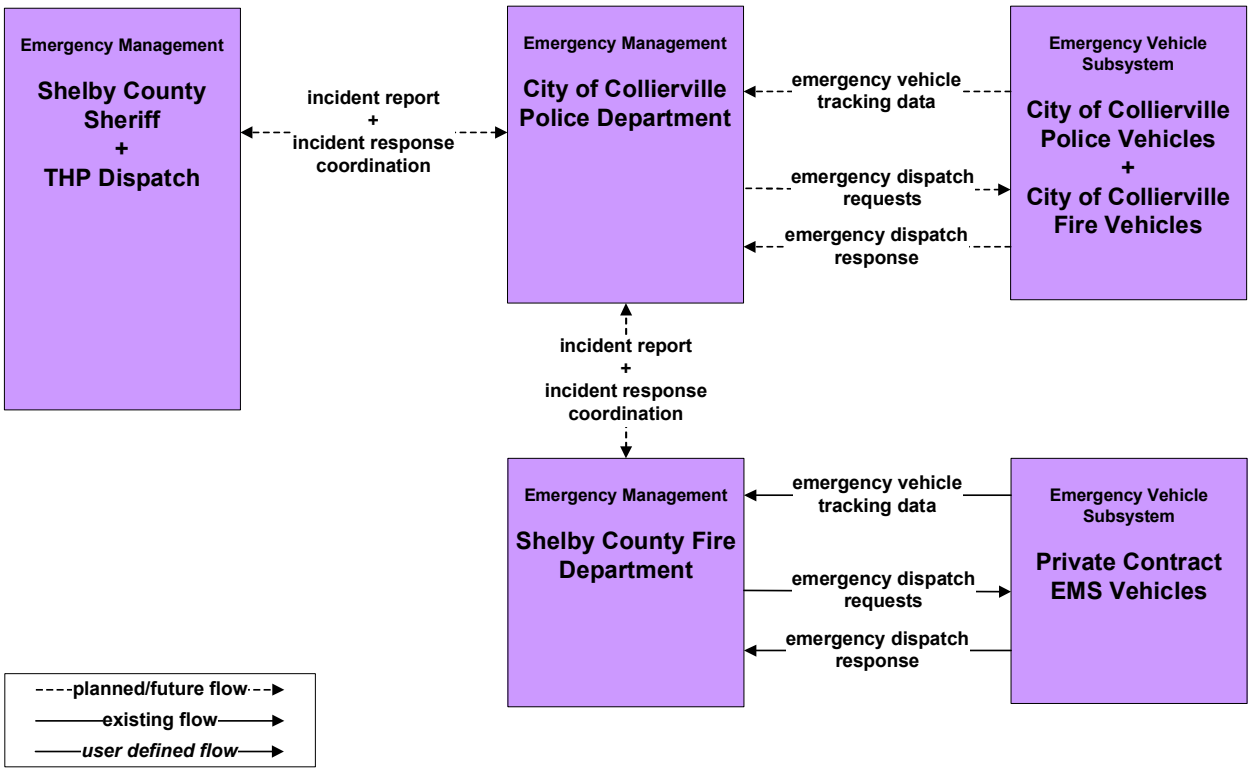


EM01 – Emergency Call-Taking and Dispatch
City of Bartlett Police Department

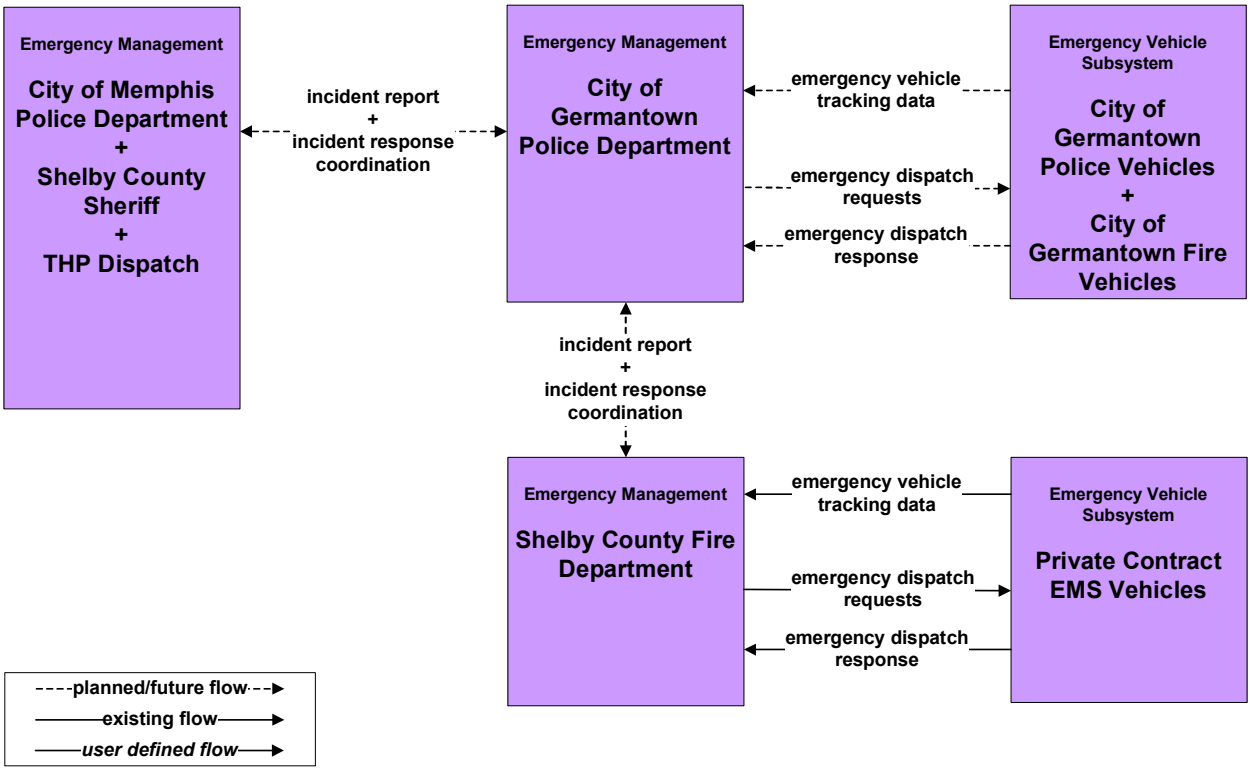




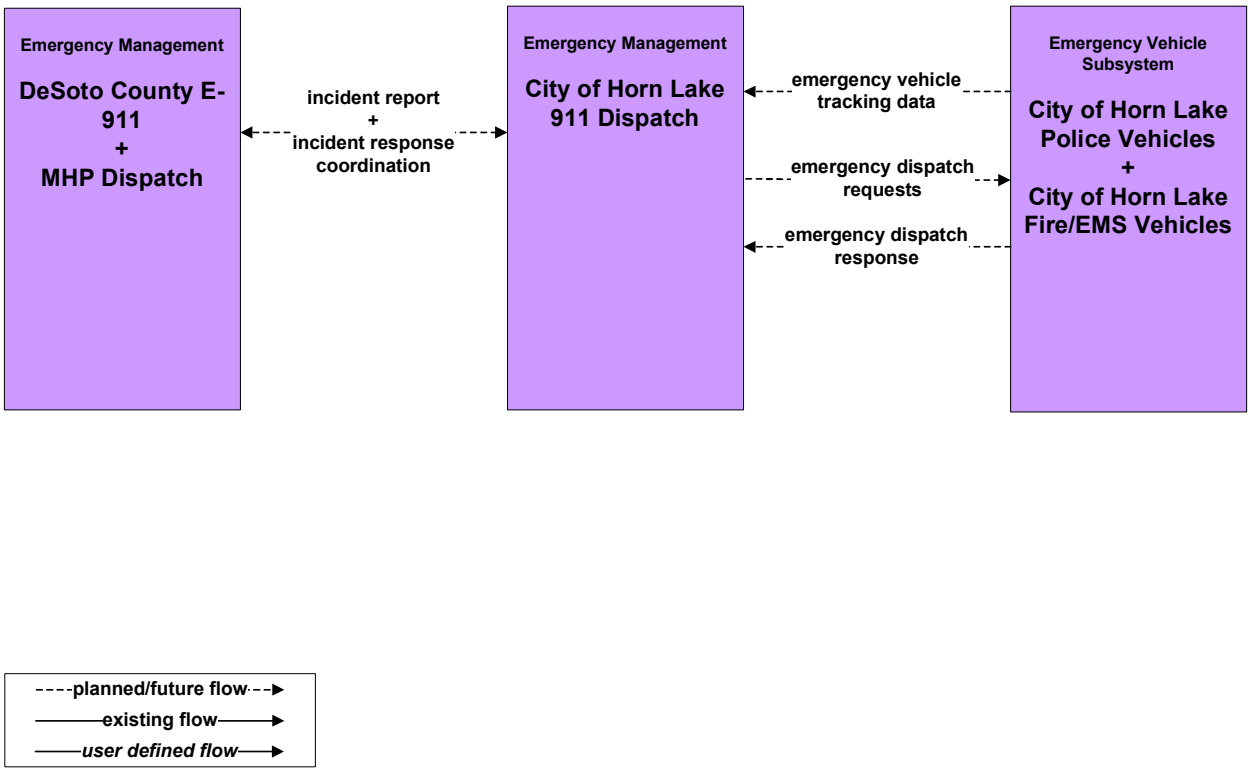
EM01 – Emergency Call-Taking and Dispatch
City of Collierville Police Department



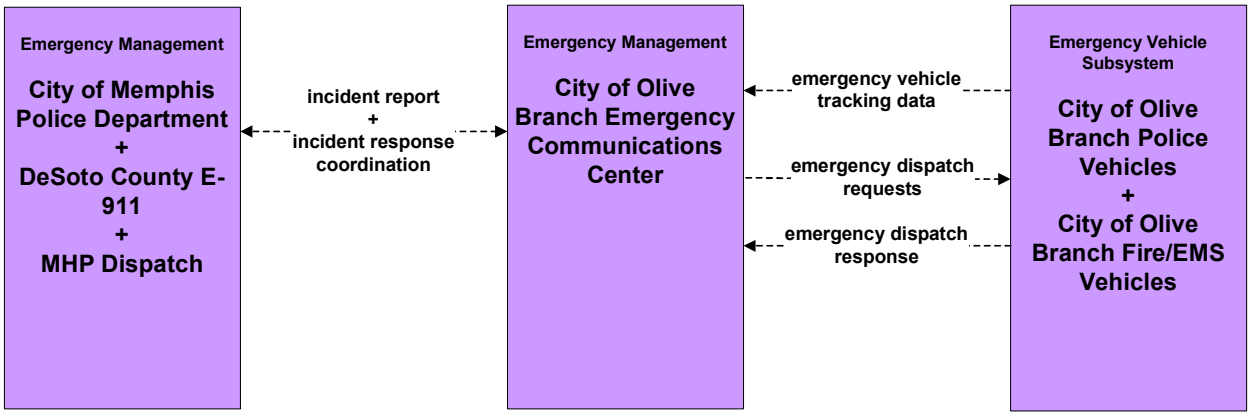
EM01 – Emergency Call-Taking and Dispatch
City of Germantown Police Department

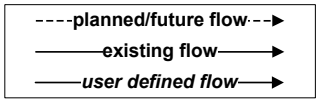


EM01 – Emergency Call-Taking and Dispatch
City of Horn Lake 911 Dispatch

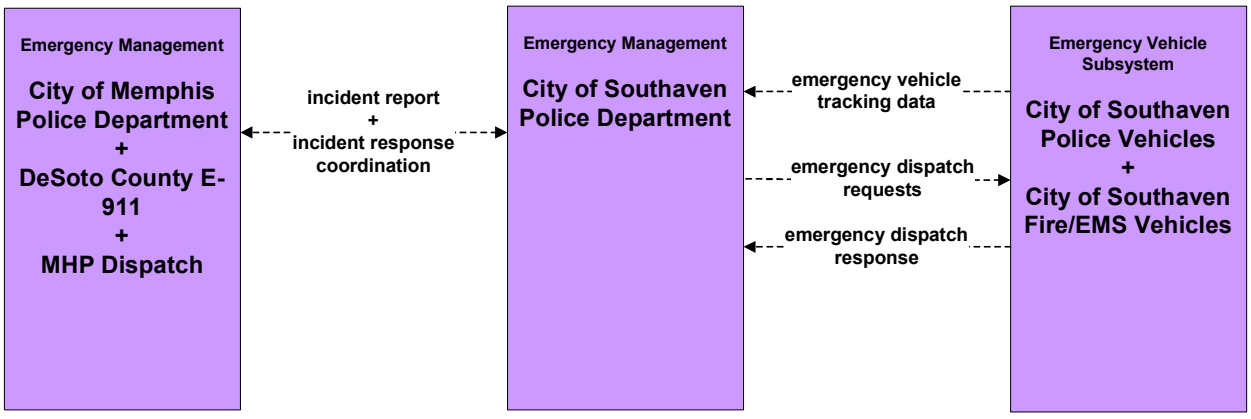


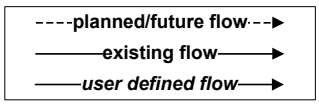
EM01 – Emergency Call-Taking and Dispatch
City of Olive Branch Emergency Communications Center

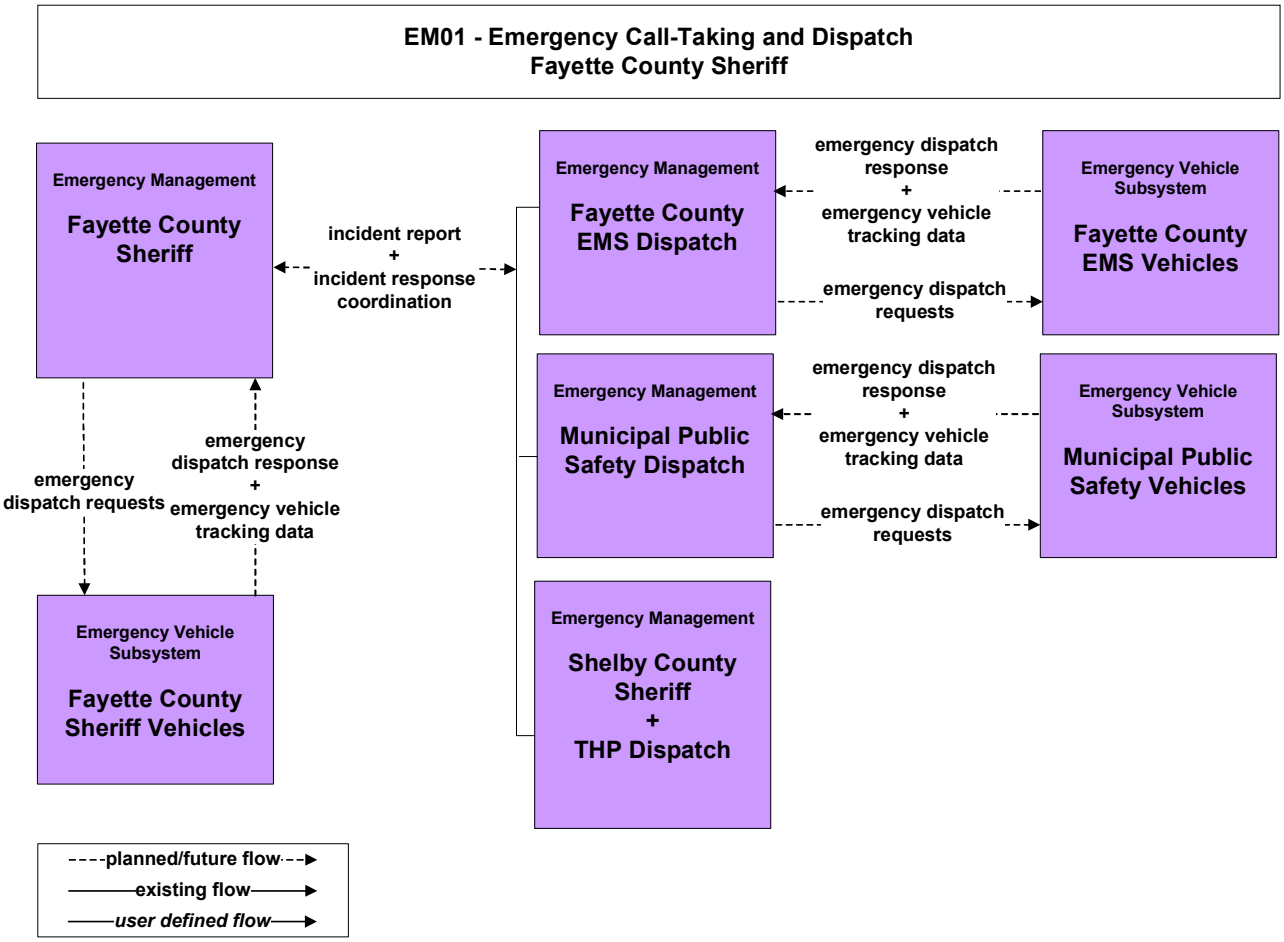


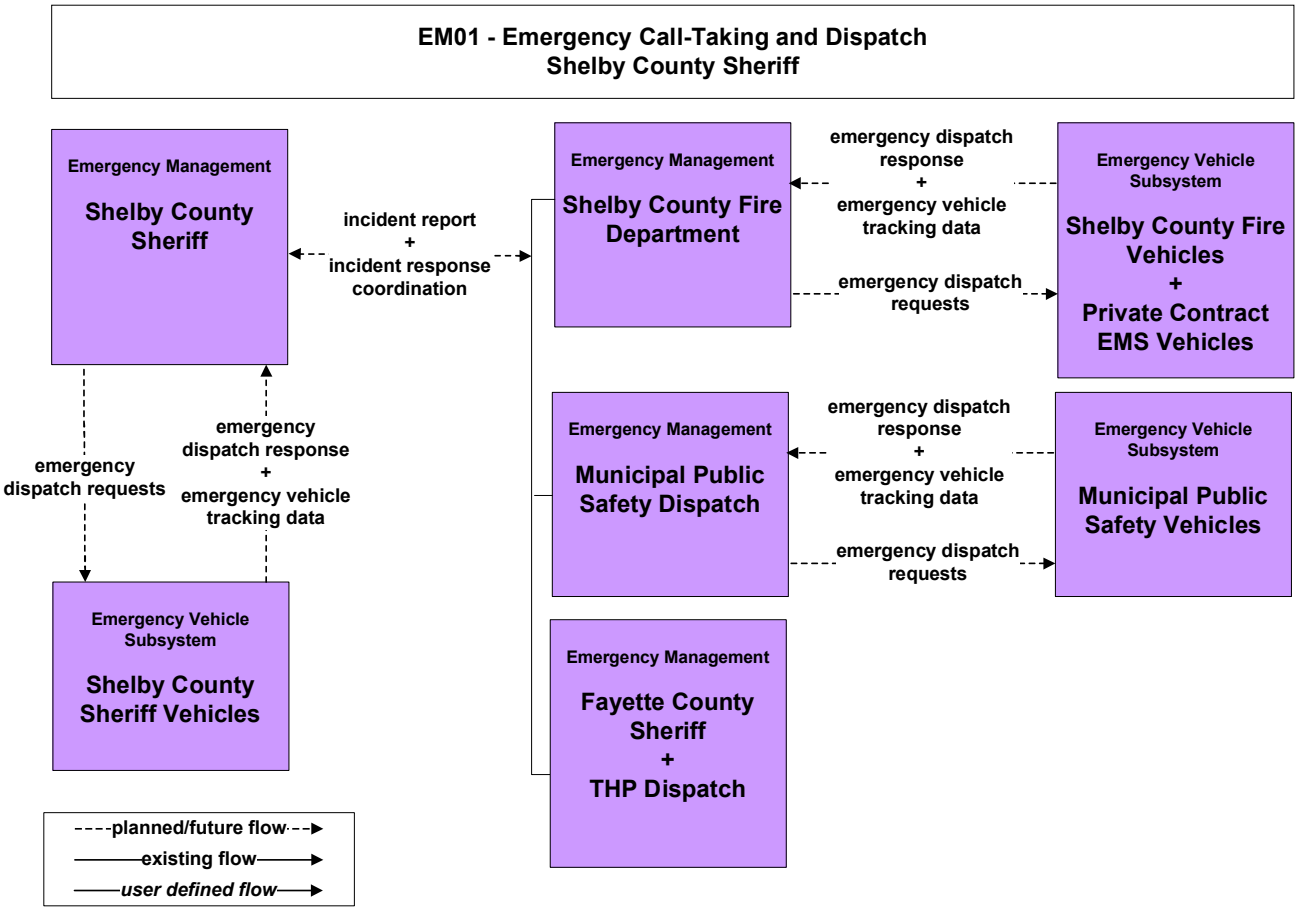


EM01 – Emergency Call-Taking and Dispatch
City of Southaven Police Department

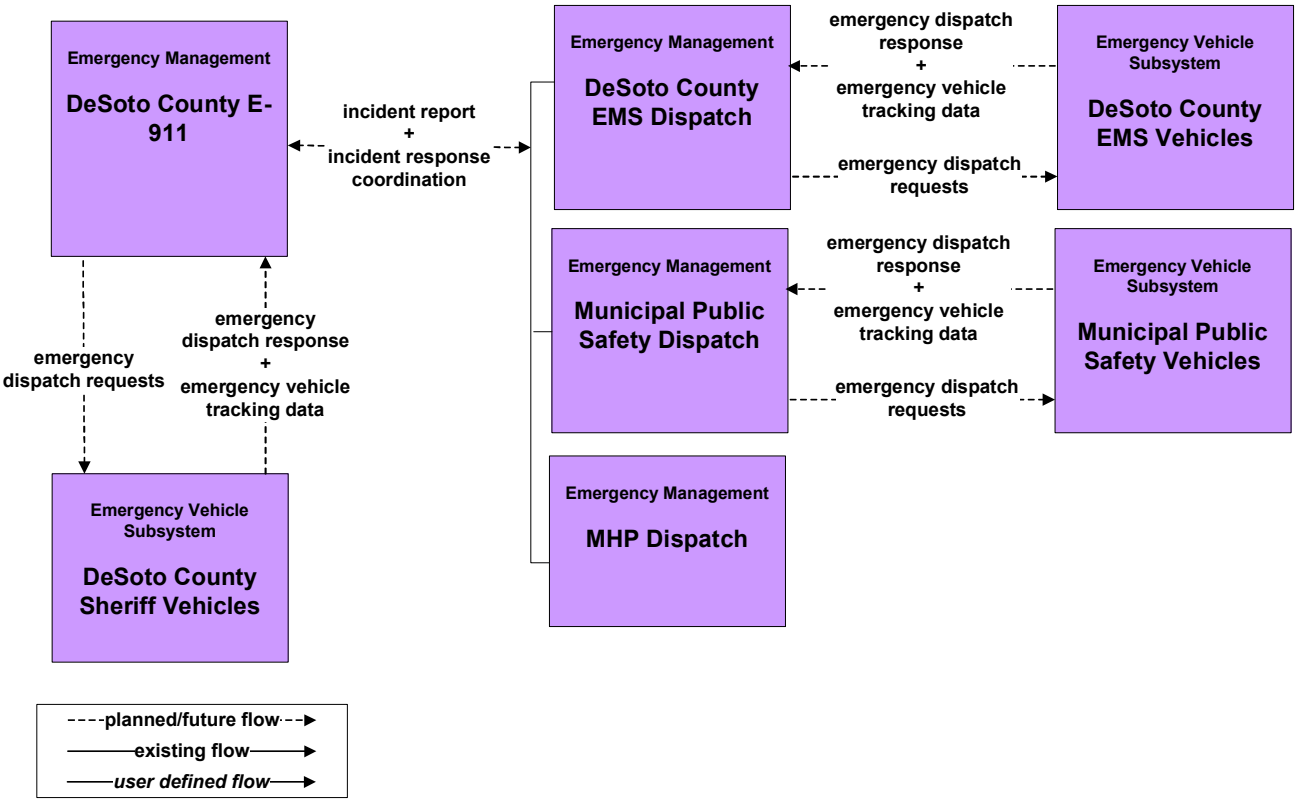




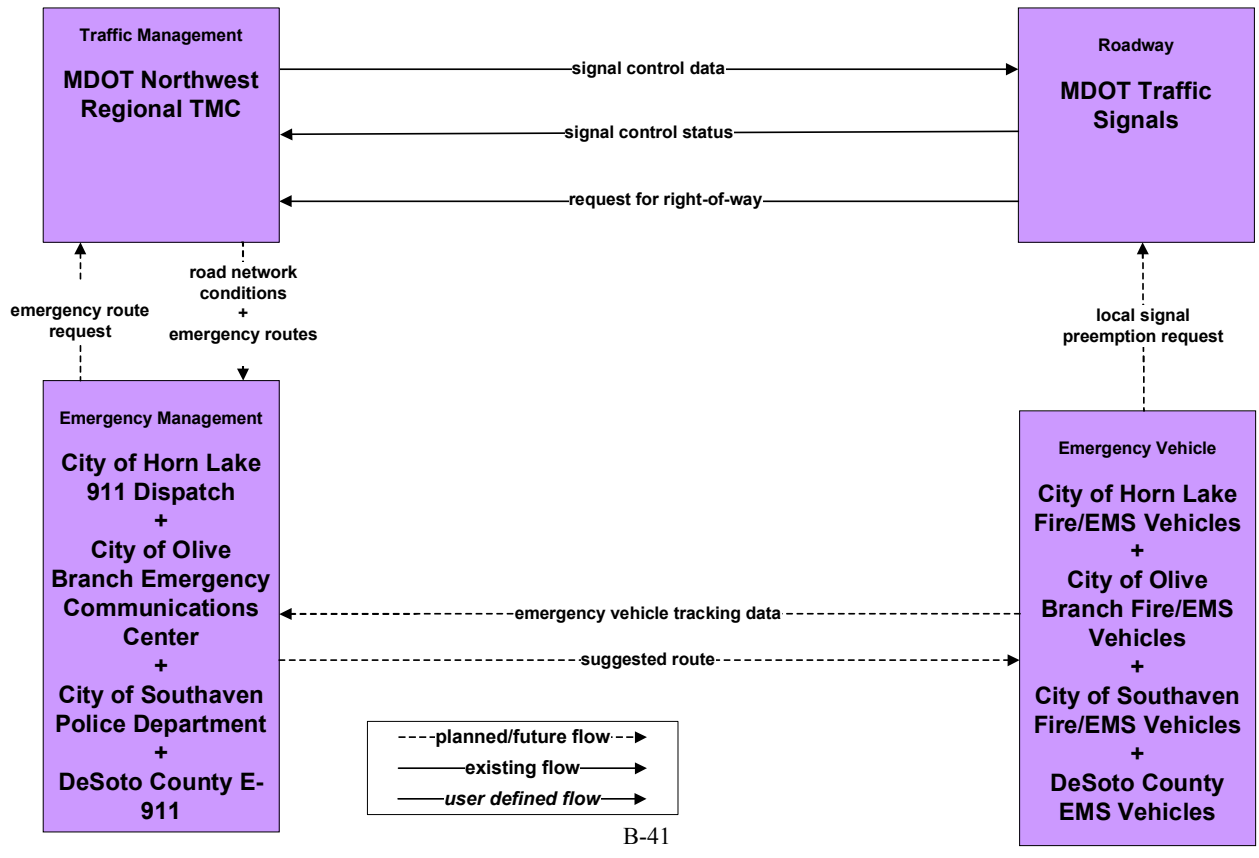

EM01 - Emergency Call-Taking and Dispatch
Fayette County Sheriff
Emergency Management
Fayette County Sheriff
incident report
+
incident response coordination
Emergency Management
Fayette County EMS Dispatch
emergency dispatch response
+
emergency vehicle tracking data
Emergency Vehicle Subsystem
Fayette County EMS Vehicles
emergency dispatch requests
Emergency Management
Municipal Public Safety Dispatch
emergency dispatch response
+
emergency vehicle tracking data
Emergency Vehicle Subsystem
Municipal Public Safety Vehicles
emergency dispatch requests
emergency dispatch response
+
emergency vehicle tracking data
Emergency Management
Shelby County Sheriff
+
THP Dispatch
Emergency Vehicle Subsystem
Fayette County Sheriff Vehicles
planned/future flow
existing flow
user defined flow


EM01 - Emergency Call-Taking and Dispatch
Shelby County Sheriff
Emergency Management
Shelby County Sheriff
incident report
+
incident response coordination
Emergency Management
Shelby County Fire Department
emergency dispatch response
+
emergency vehicle tracking data
Emergency Vehicle Subsystem
Shelby County Fire Vehicles
+
Private Contract EMS Vehicles
emergency dispatch requests
Emergency Management
Municipal Public Safety Dispatch
emergency dispatch response
+
emergency vehicle tracking data
Emergency Vehicle Subsystem
Municipal Public Safety Vehicles
emergency dispatch requests
emergency dispatch response
+
emergency vehicle tracking data
Emergency Management
Fayette County Sheriff
+
THP Dispatch
Emergency Vehicle Subsystem
Shelby County Sheriff Vehicles
planned/future flow
existing flow
user defined flow

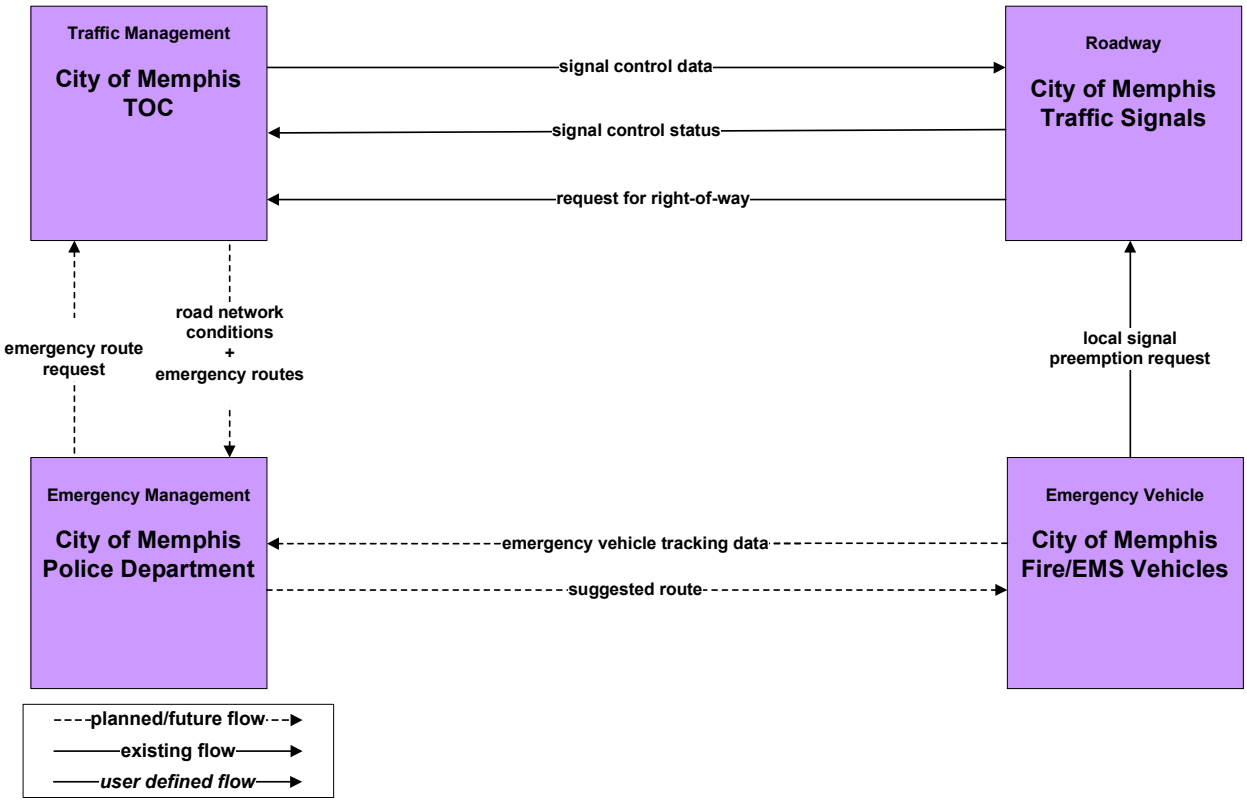
EM01 - Emergency Call-Taking and Dispatch
DeSoto County E-911



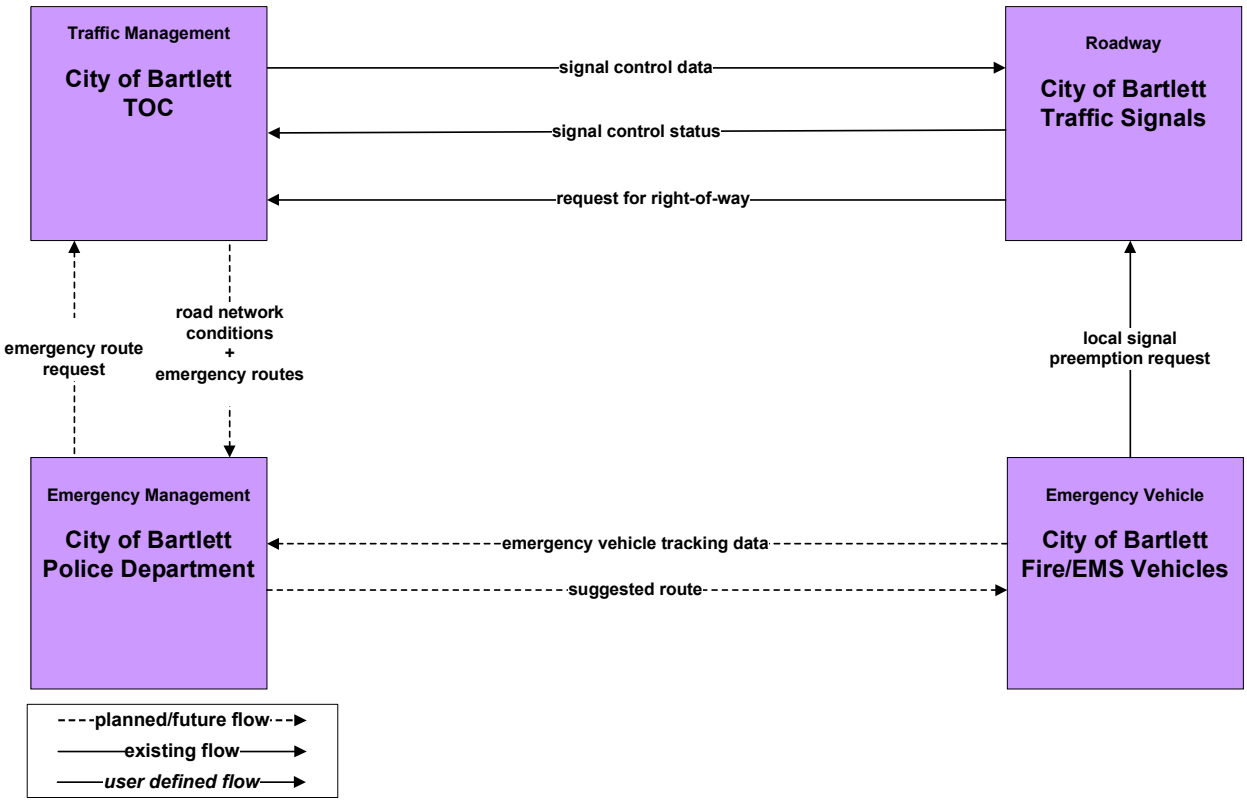
EM02 – Emergency Routing
MDOT



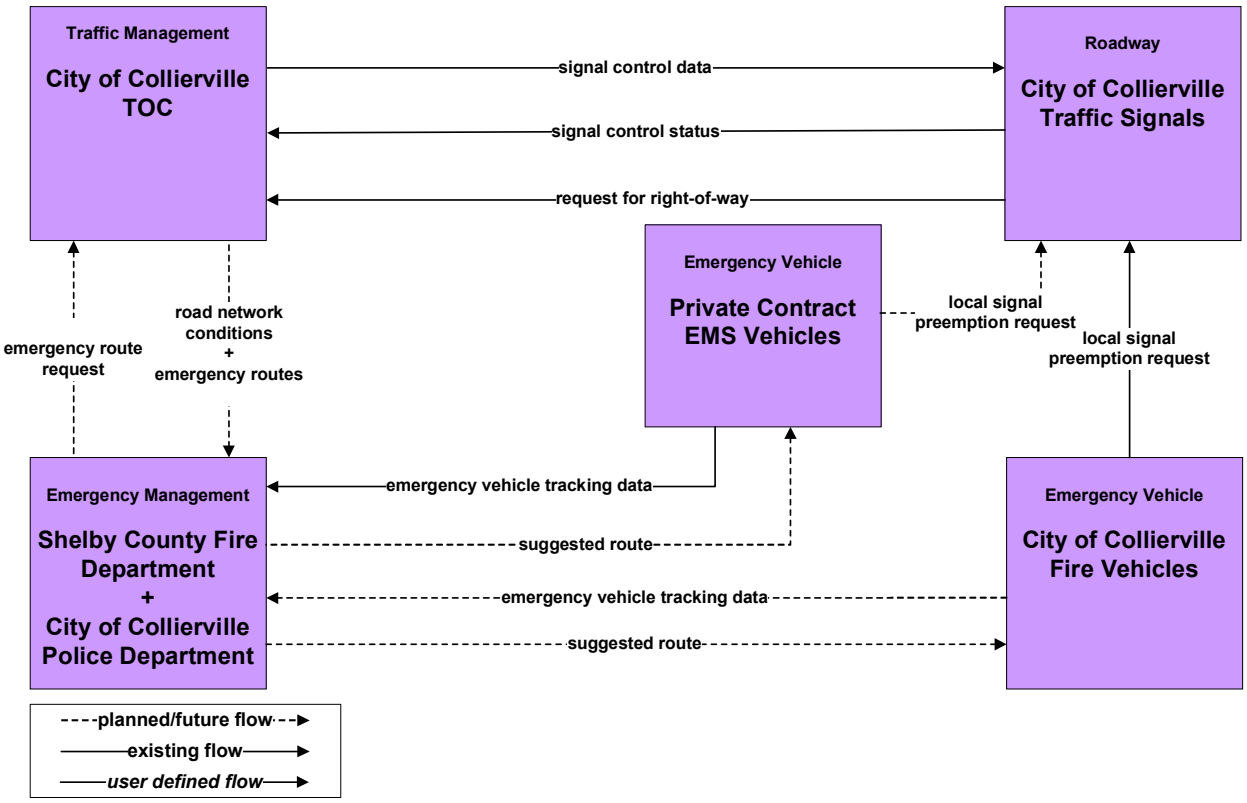
EM02 – Emergency Routing
City of Memphis



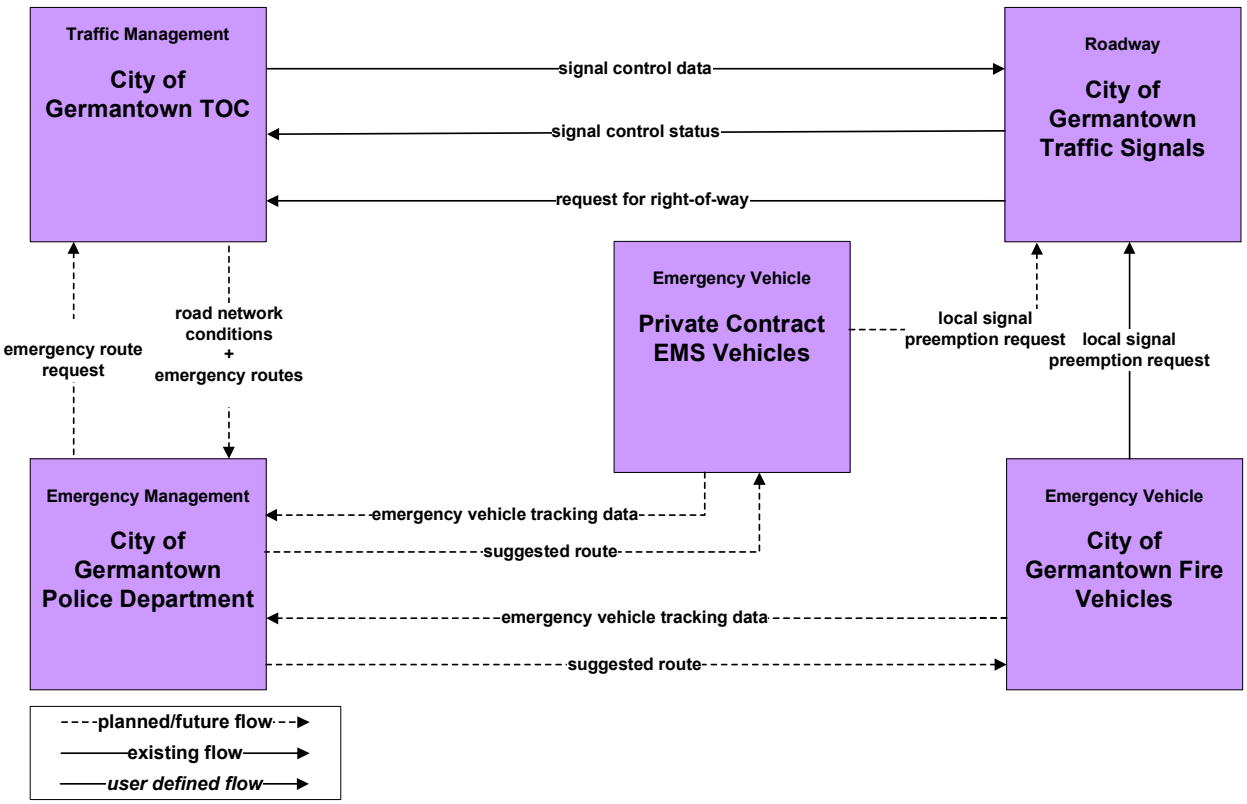
EM02 – Emergency Routing
City of Bartlett



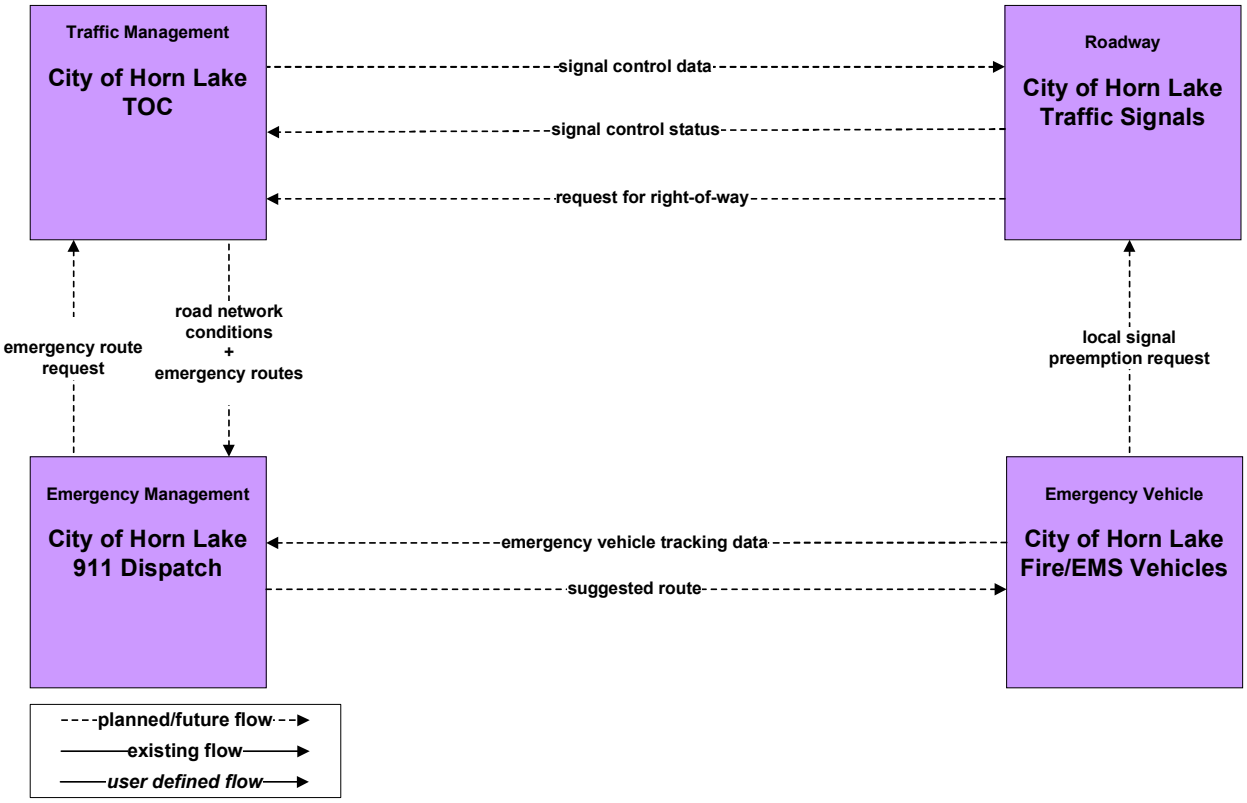
EM02 – Emergency Routing
City of Collierville



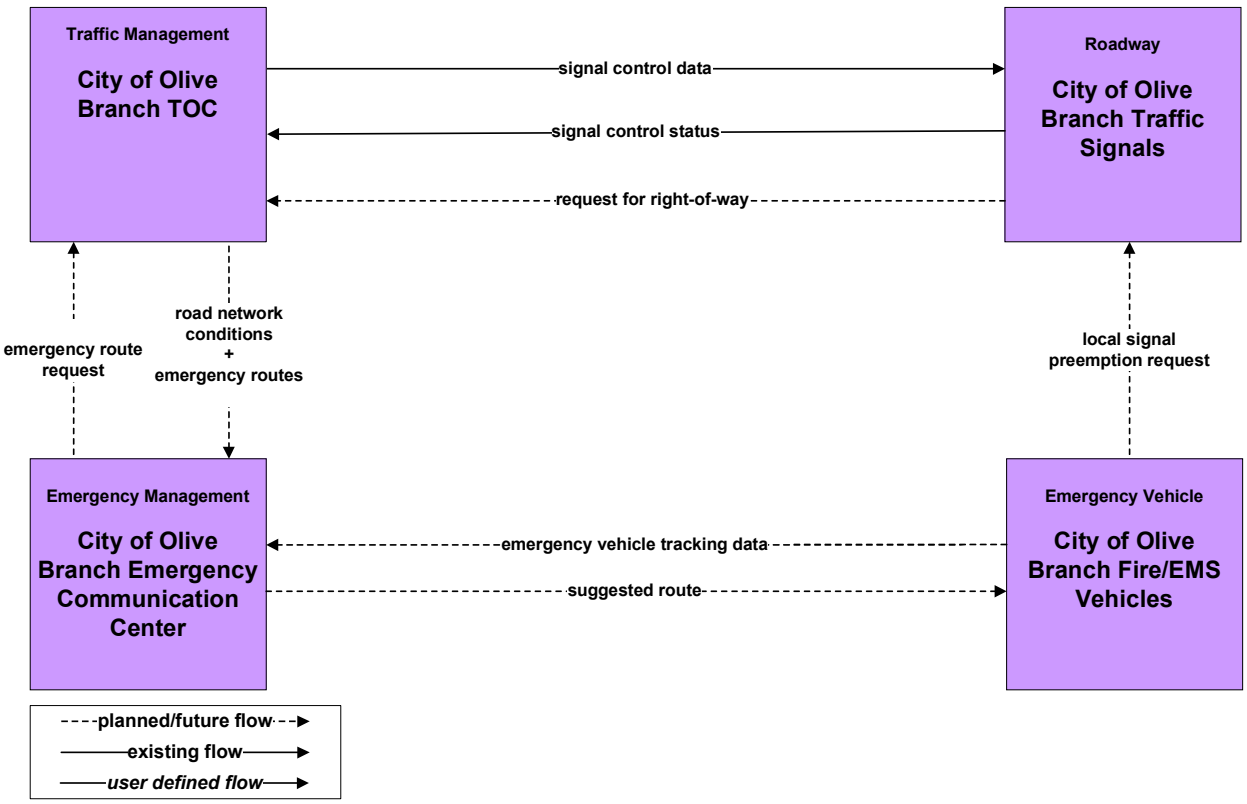
EM02 – Emergency Routing
City of Germantown



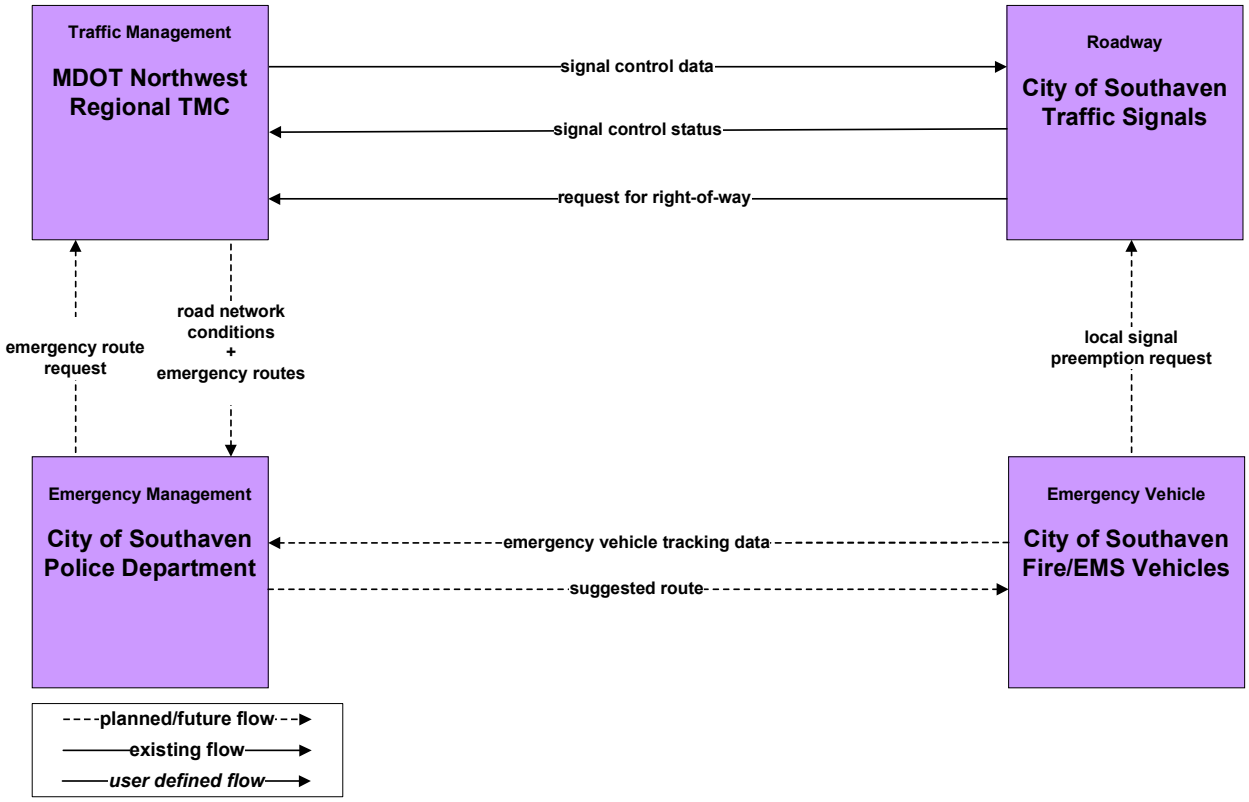
EM02 – Emergency Routing
City of Horn Lake



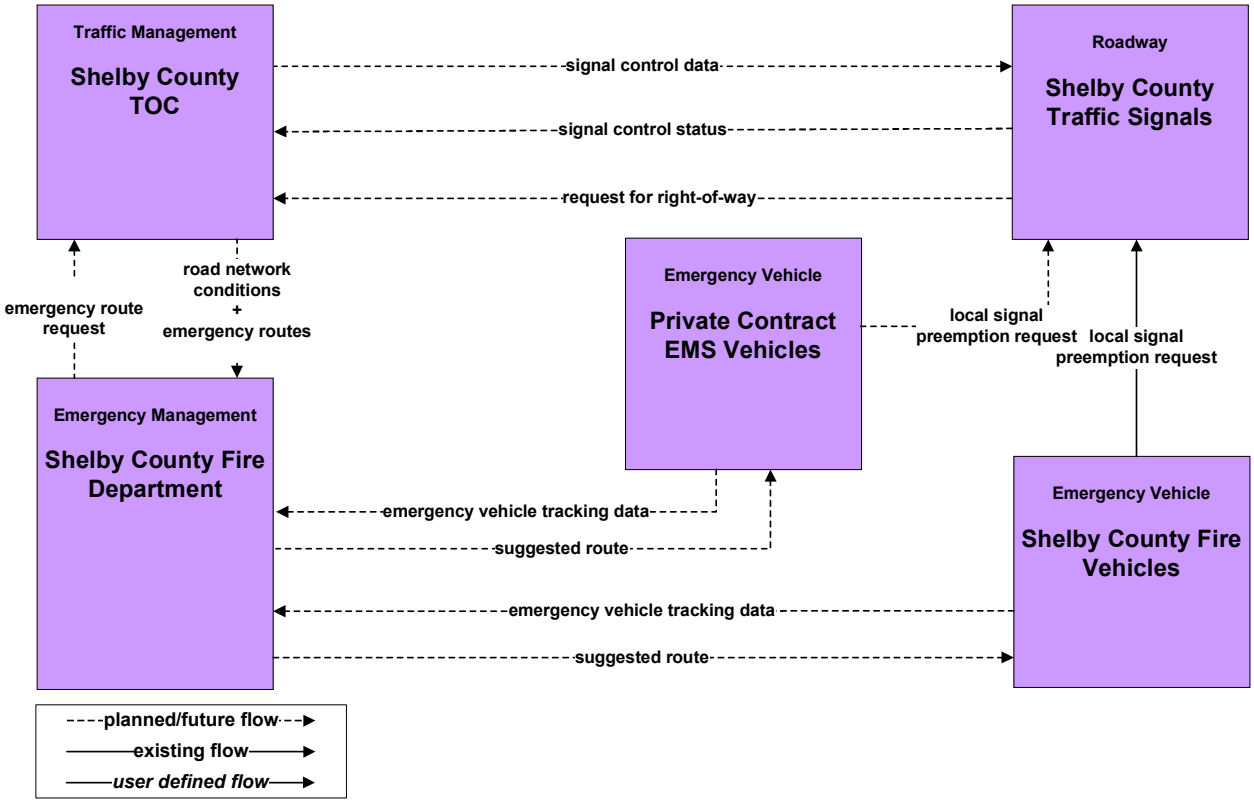
EM02 – Emergency Routing
City of Olive Branch Emergency Communication Center



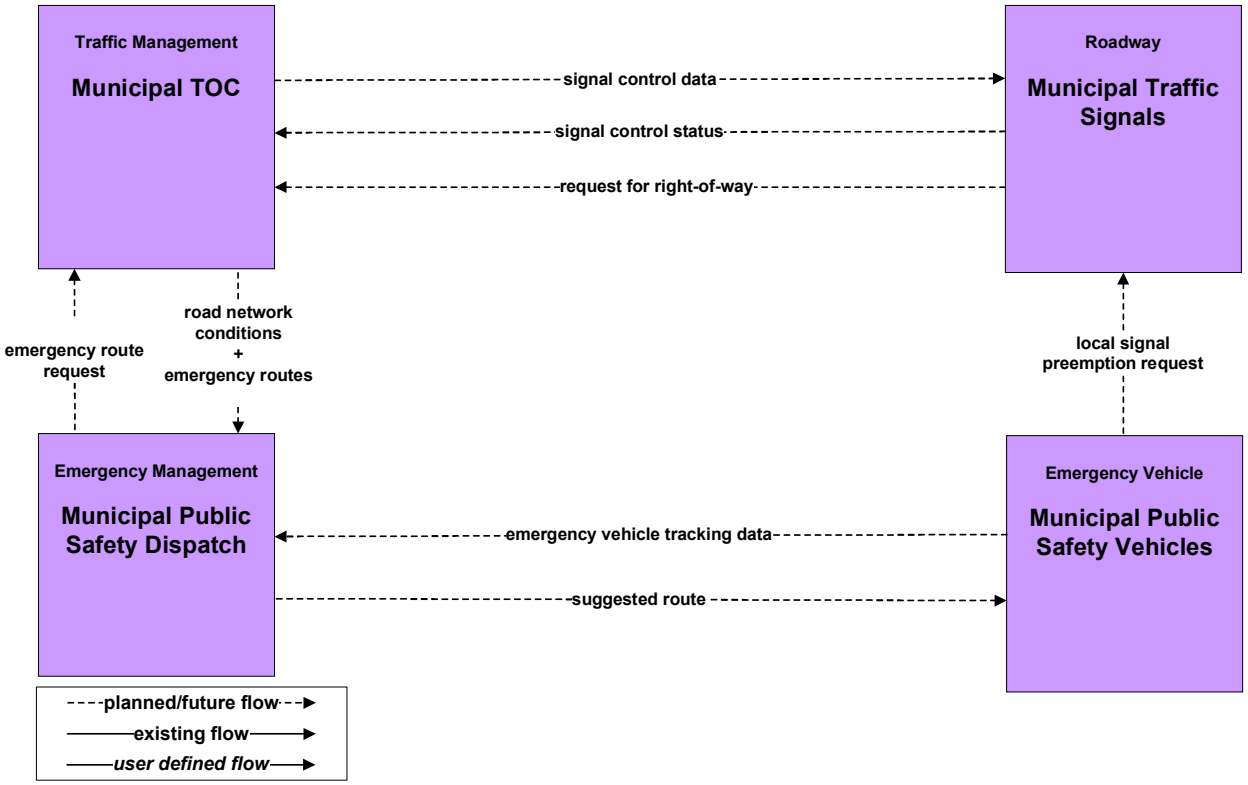
EM02 – Emergency Routing
City of Southaven



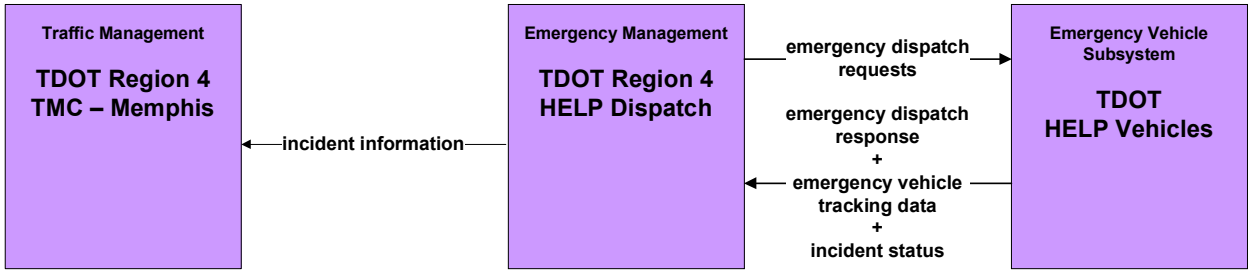
EM02 – Emergency Routing
Shelby County

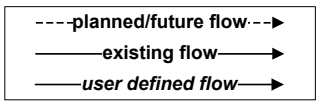


EM02 – Emergency Routing
Municipal

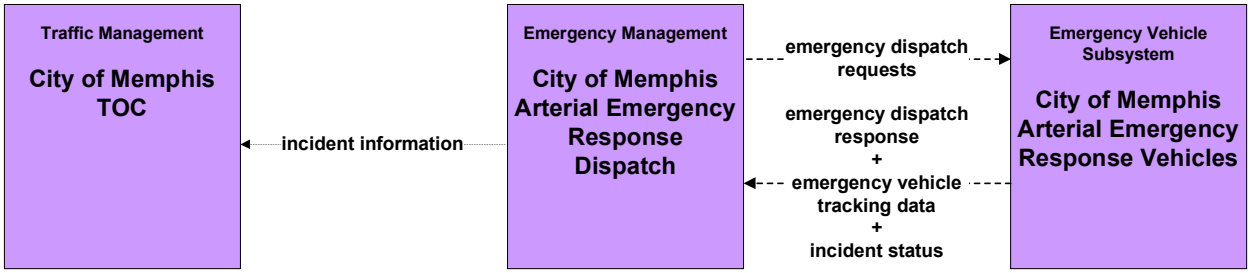


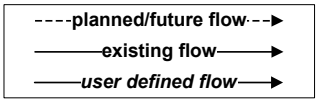
EM04 – Roadway Service Patrols
HELP



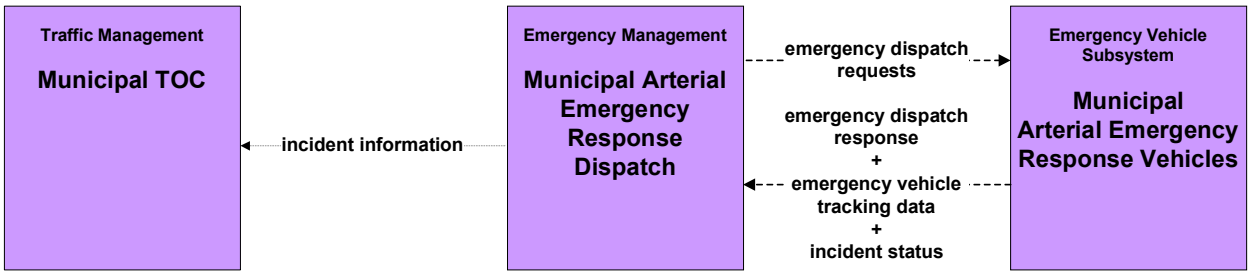


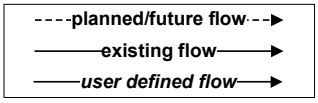
EM04 – Roadway Service Patrols
City of Memphis Arterial Emergency Response Team



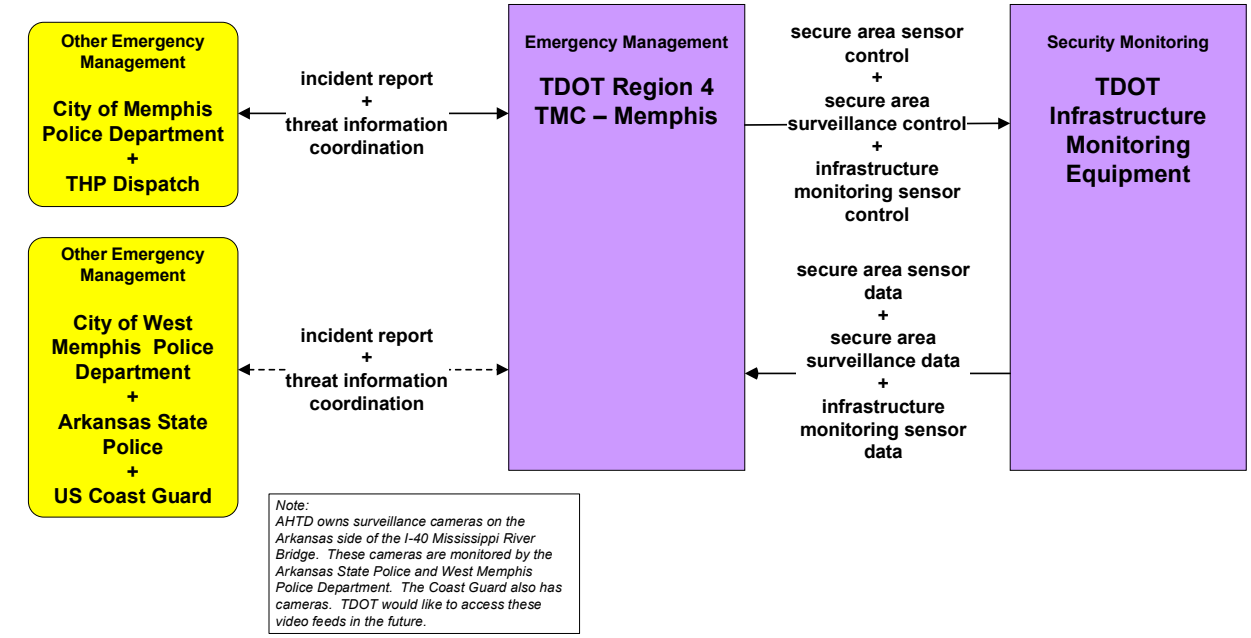


EM04 – Roadway Service Patrols
Municipal Arterial Emergency Response Team

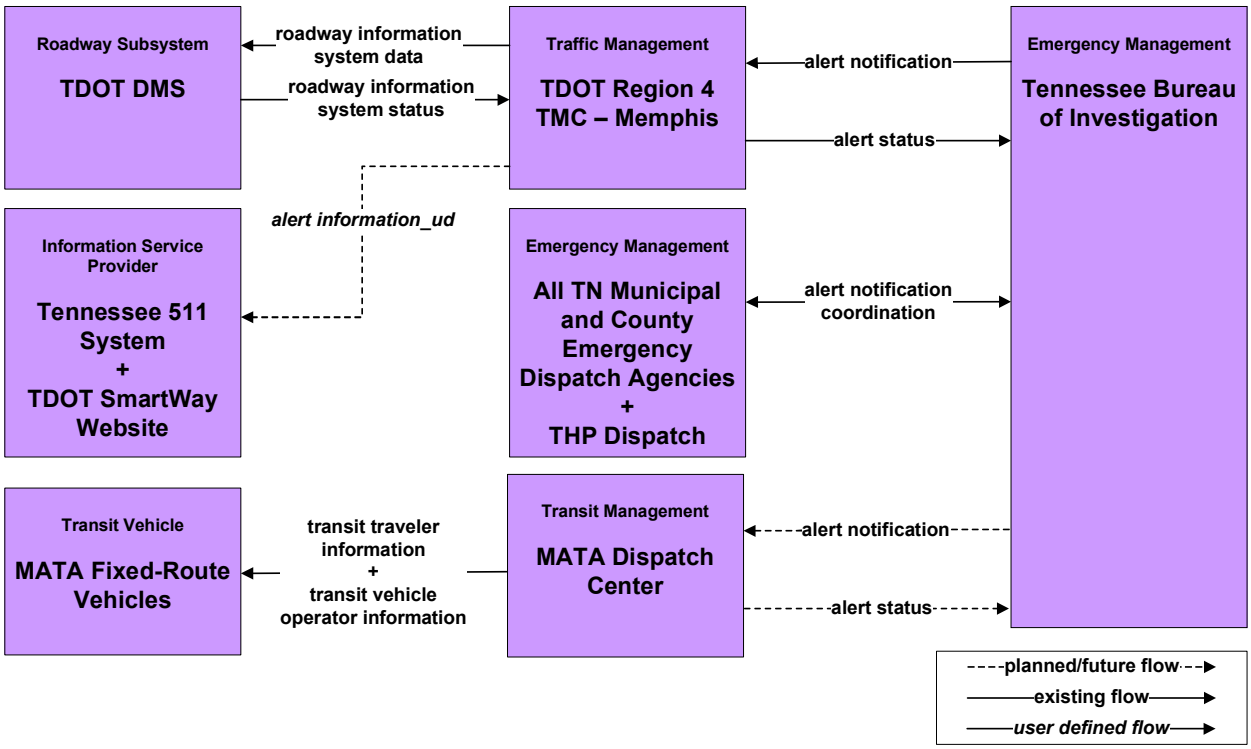




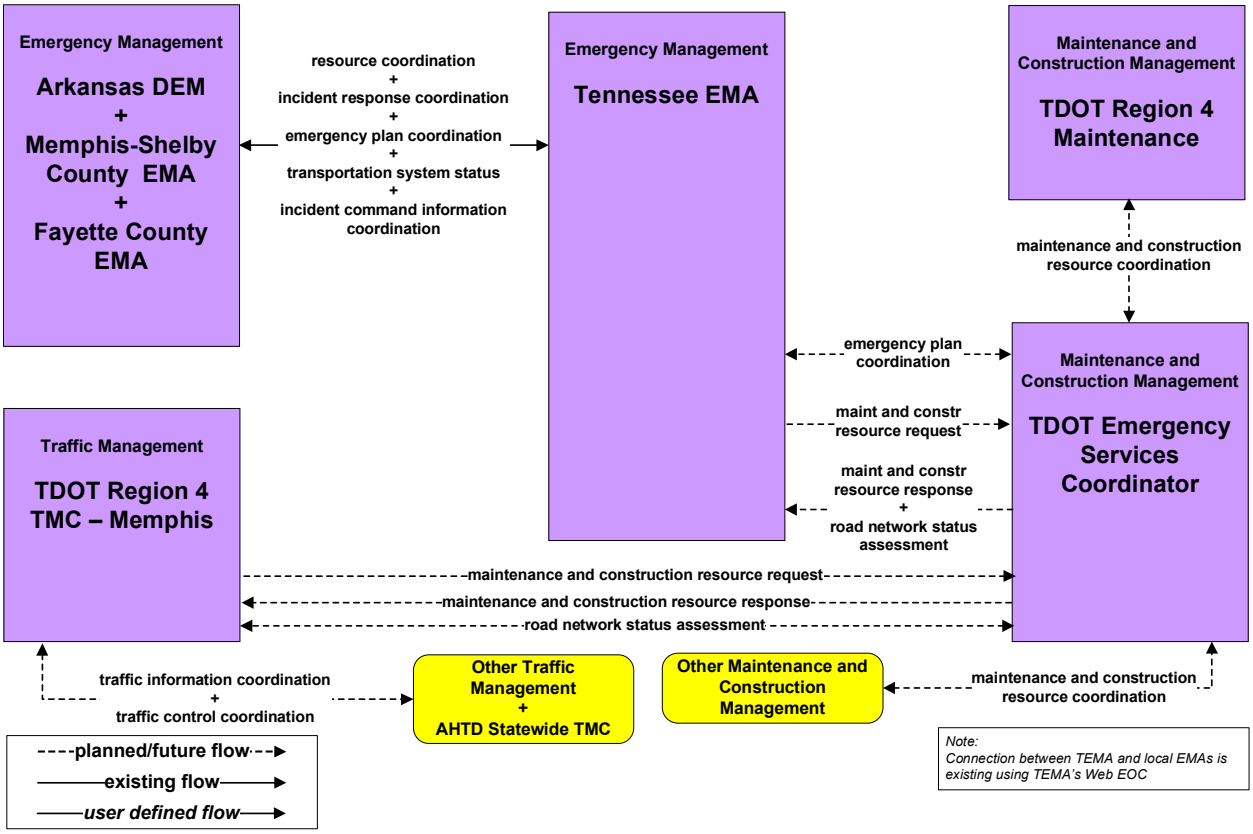
EM05 – Transportation Infrastructure Protection
TDOT



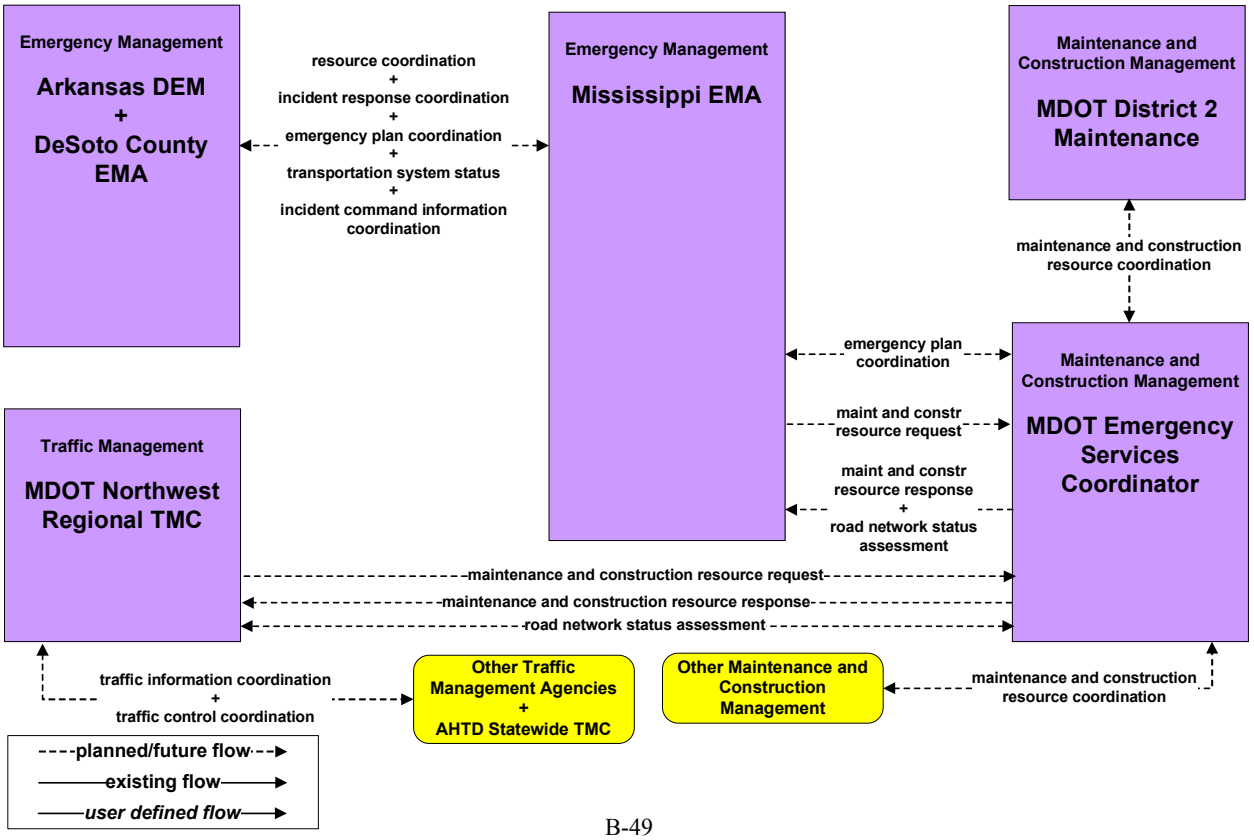
EM06 – Wide-Area Alert
Tennessee AMBER Alert



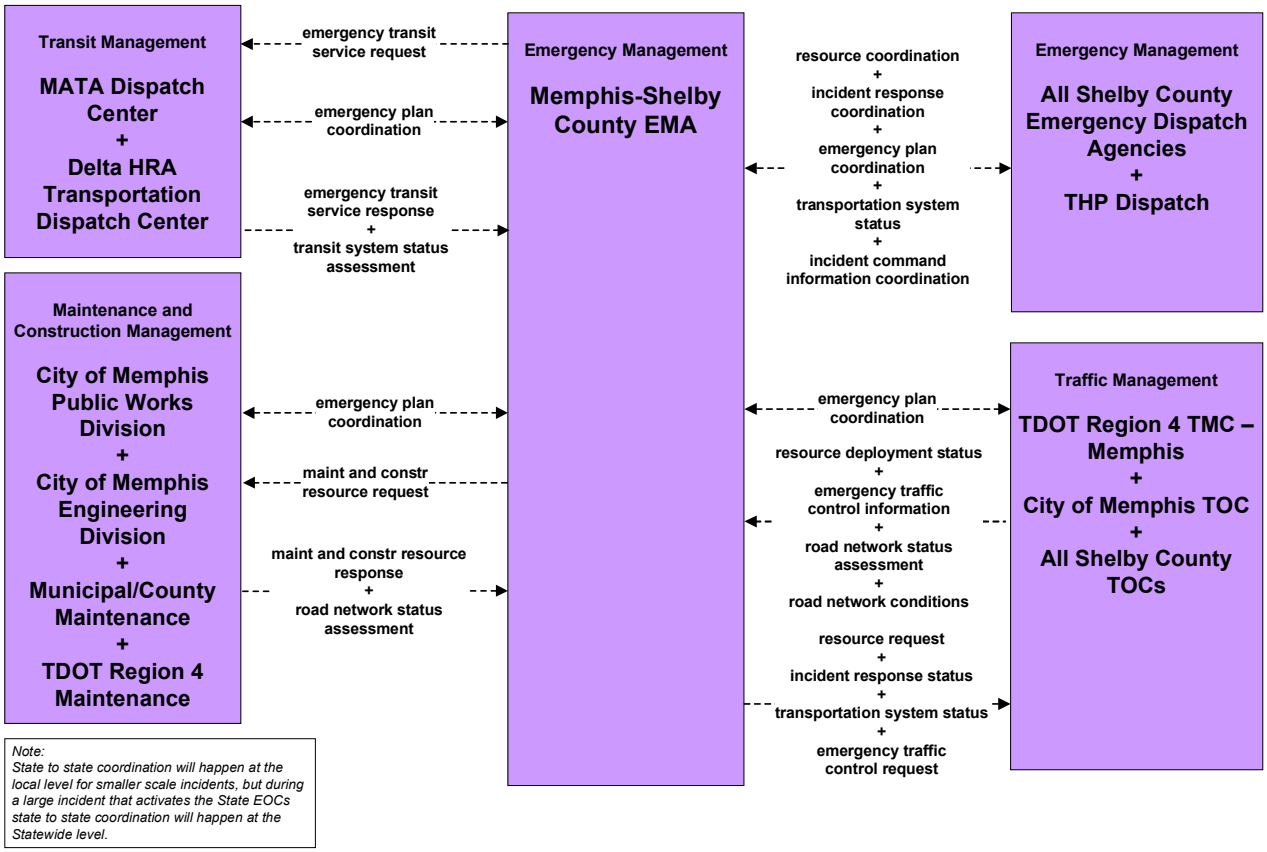
EM08 – Disaster Response and Recovery
Tennessee EMA



EM08 – Disaster Response and Recovery
Mississippi EMA

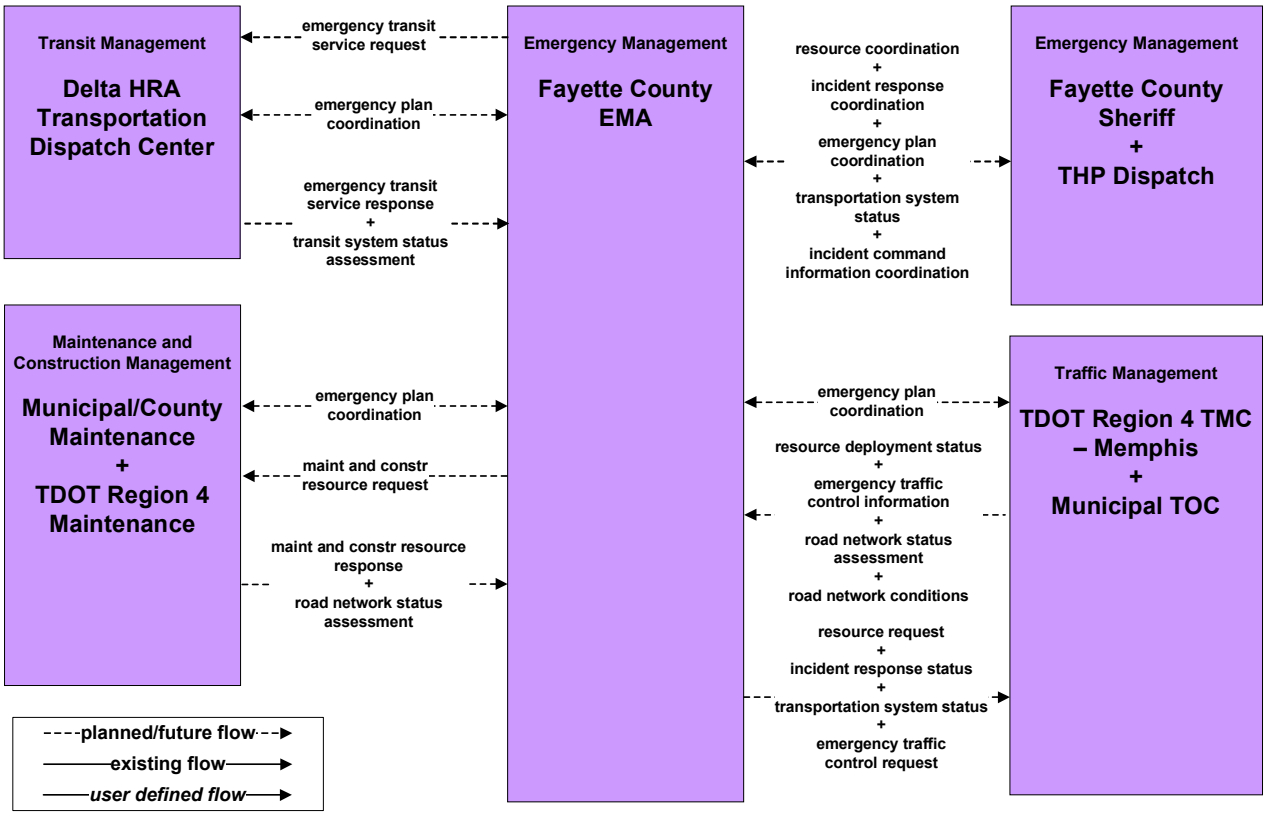


EM08 – Disaster Response and Recovery
Memphis-Shelby County EMA

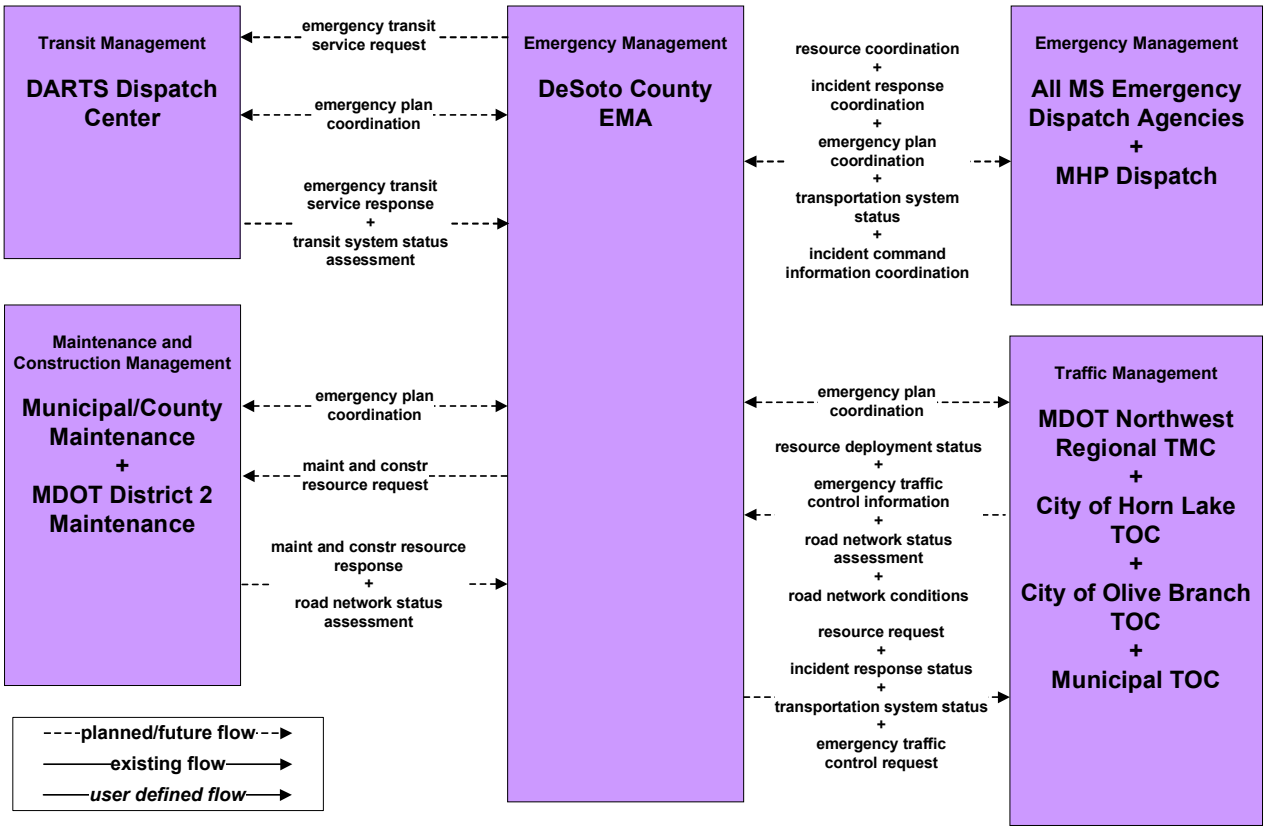


Note:
State to state coordination will happen at the local level for smaller scale incidents, but during a large incident that activates the State EOCs state to state coordination will happen at the Statewide level.

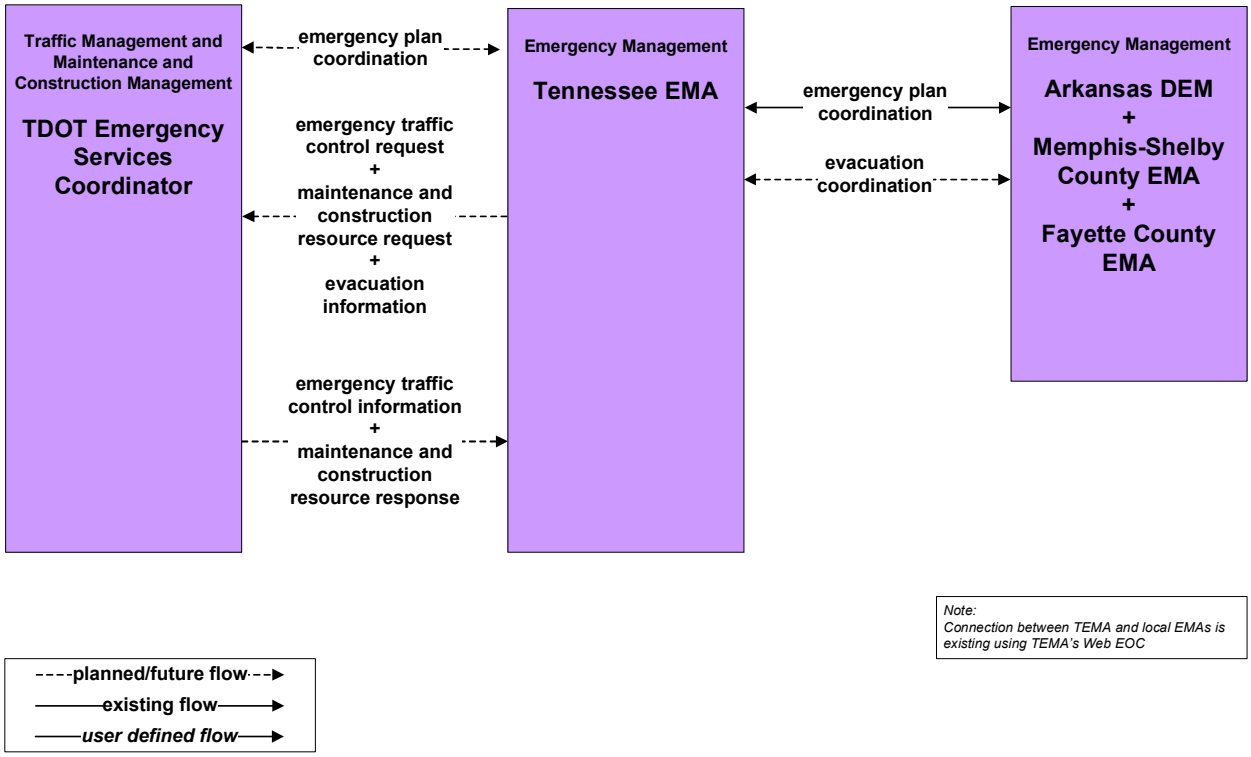
EM08 – Disaster Response and Recovery
Fayette County EMA



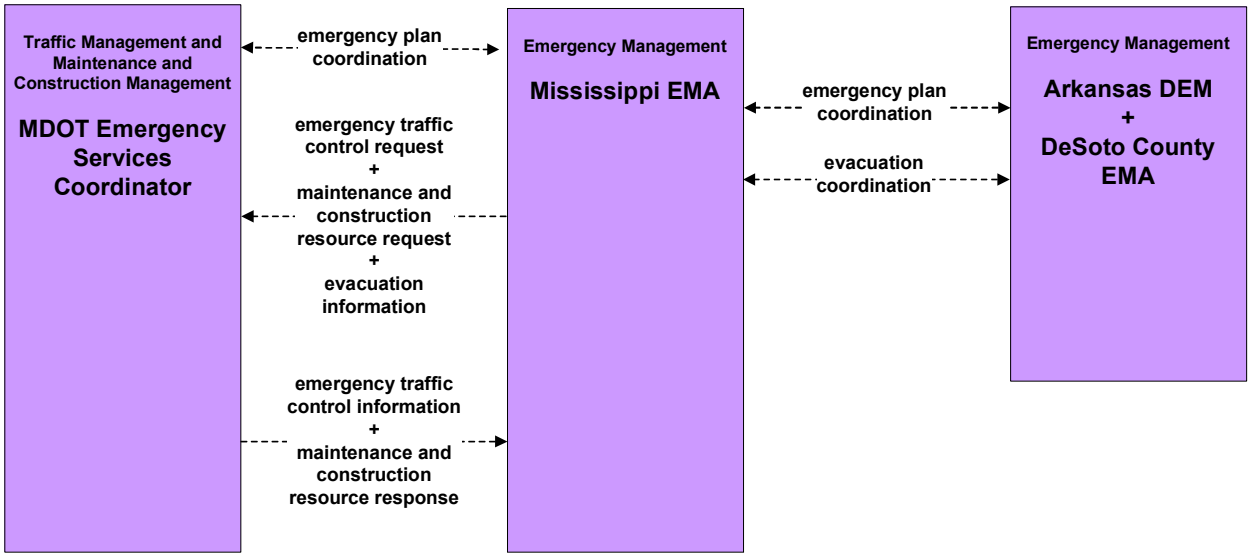
EM08 – Disaster Response and Recovery
DeSoto County EMA

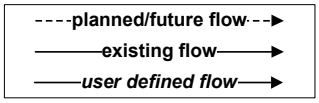


EM09 – Evacuation and Reentry Management
Tennessee EMA

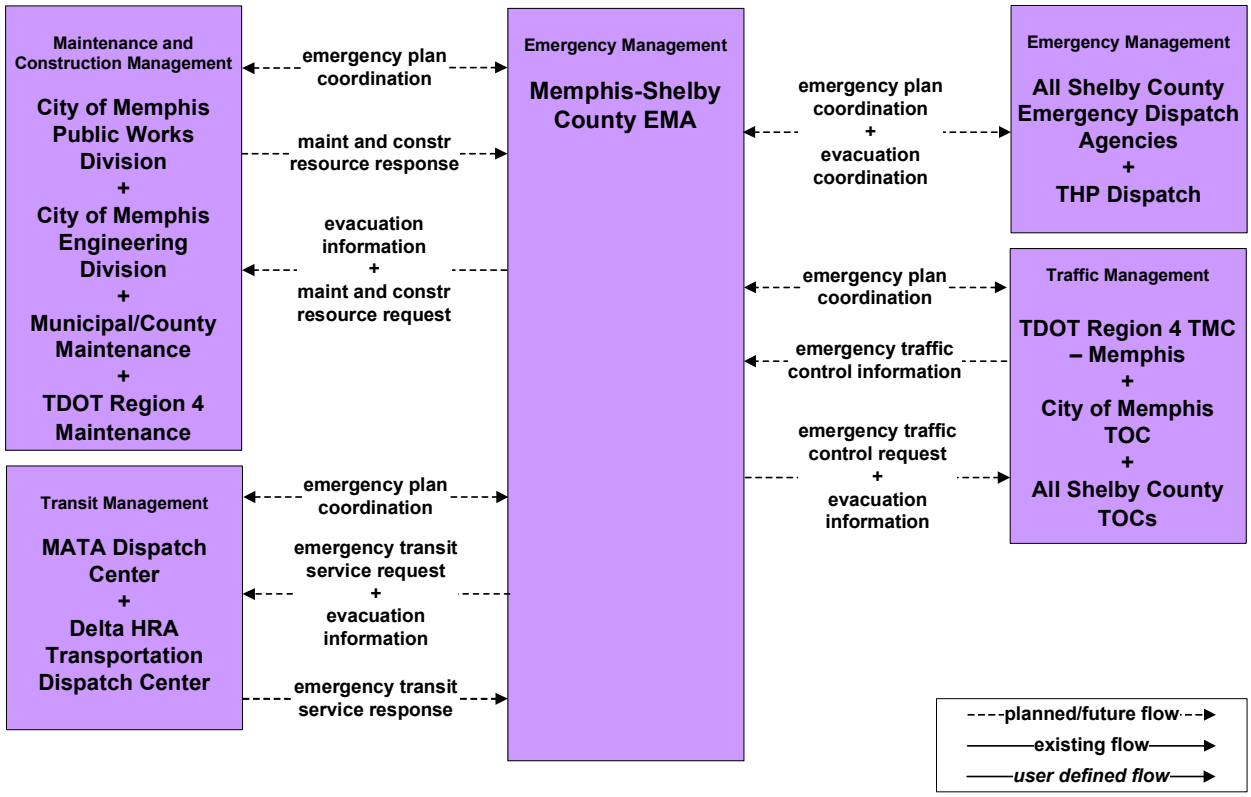


EM09 – Evacuation and Reentry Management
Mississippi EMA

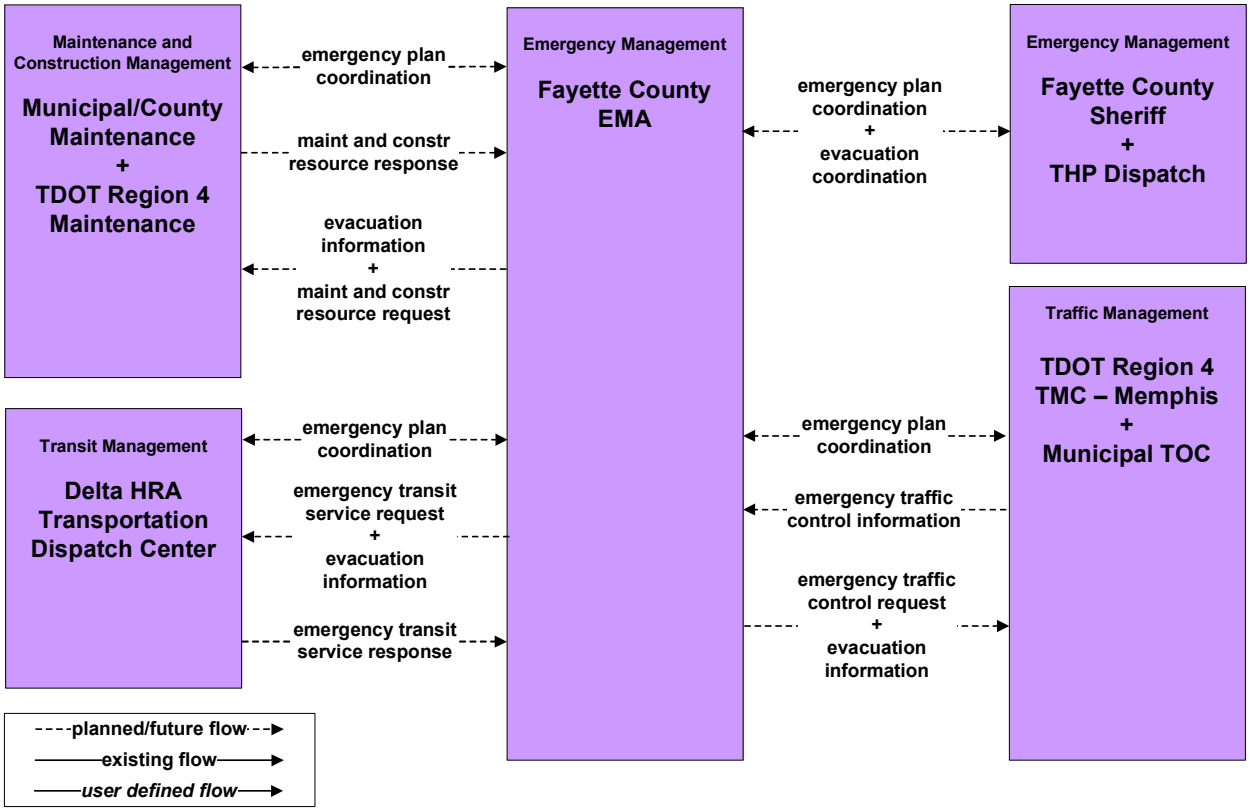




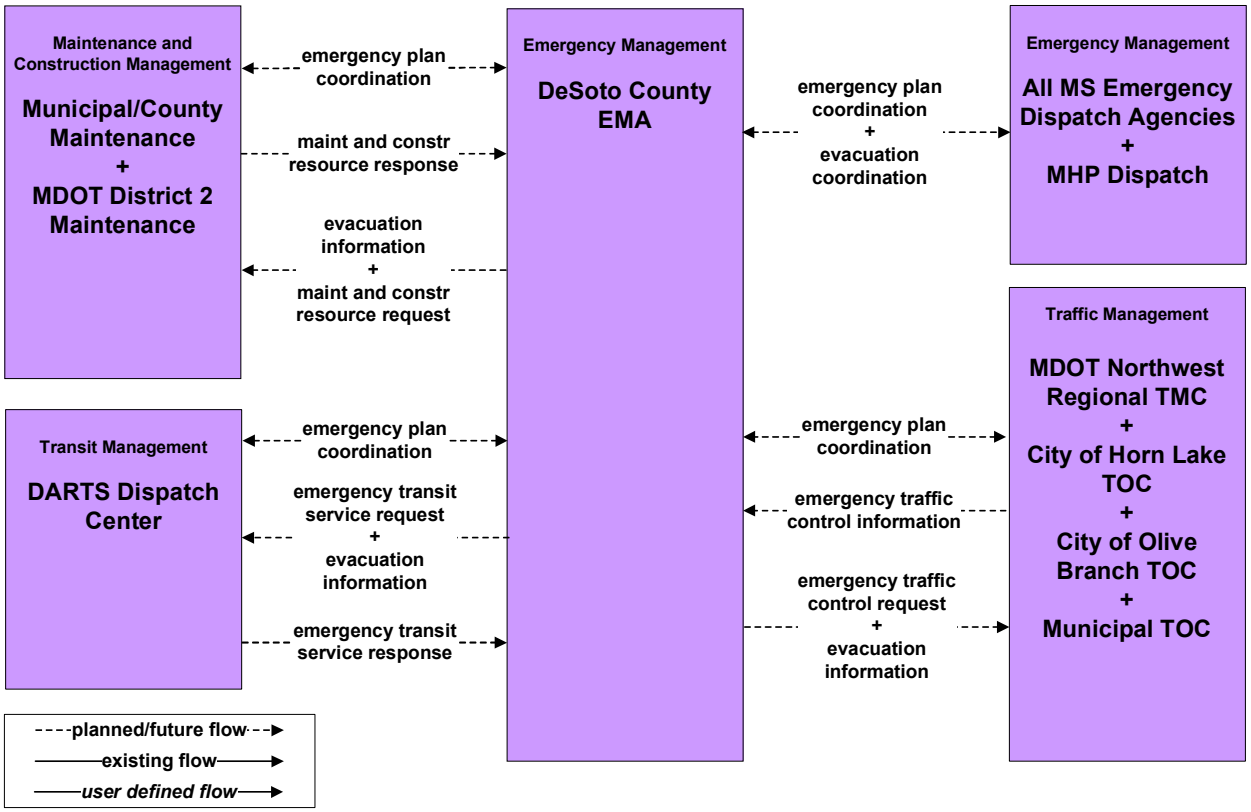
EM09 – Evacuation and Reentry Management
Memphis-Shelby County Emergency Management Agency



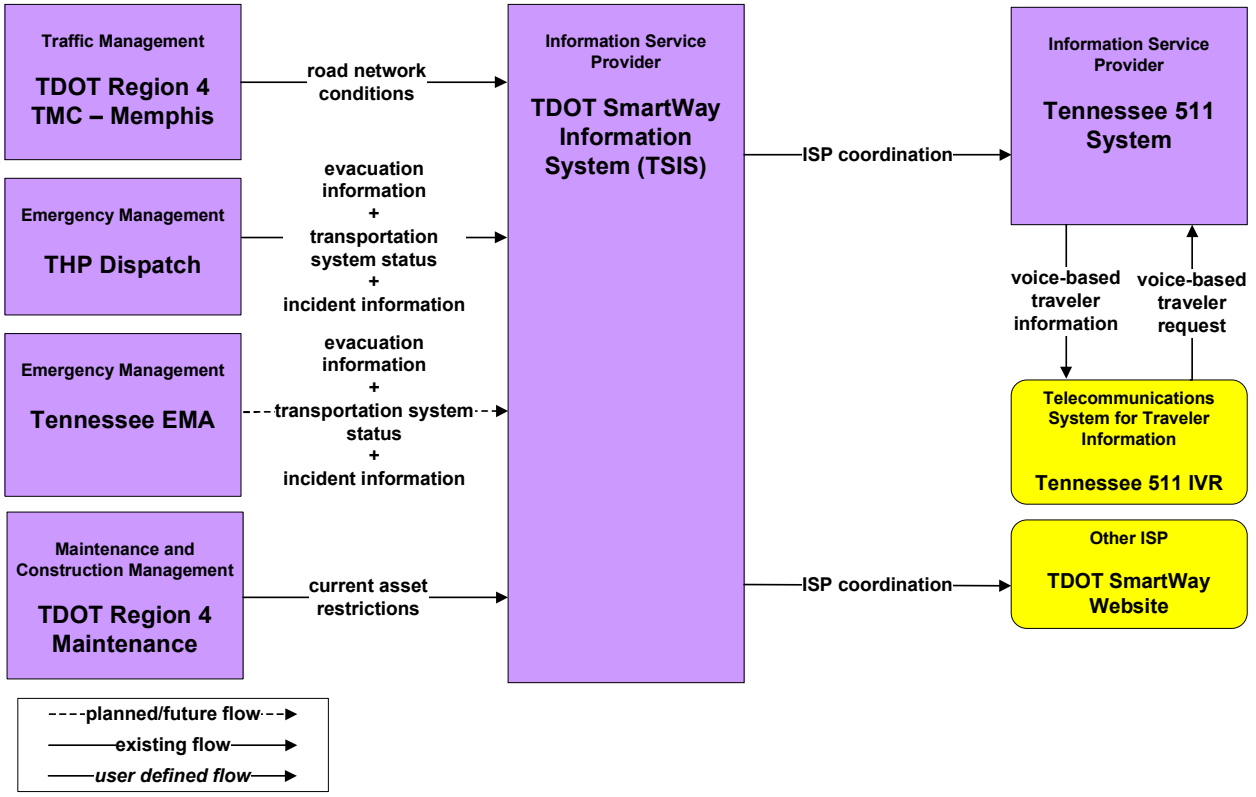
EM09 – Evacuation and Reentry Management
Fayette County EMA



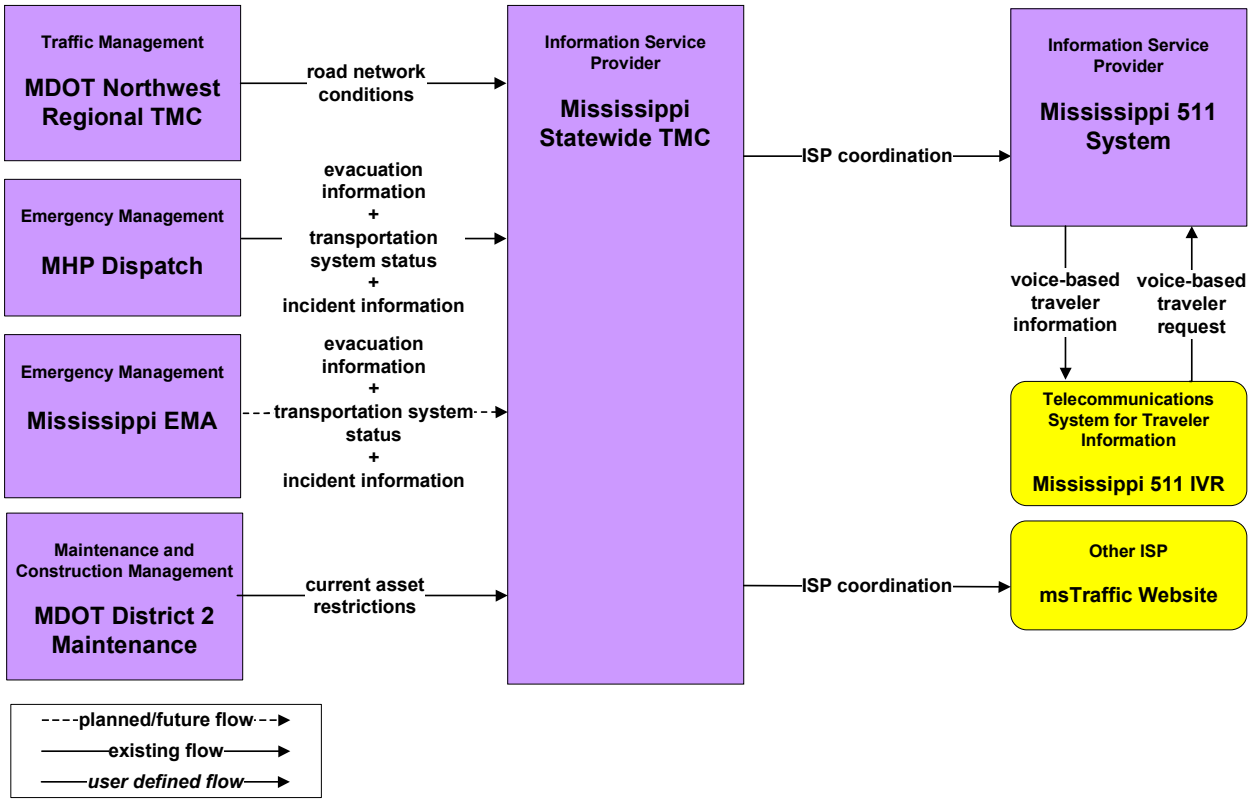
EM09 – Evacuation and Reentry Management
DeSoto County EMA



EM10 – Disaster Traveler Information
Tennessee 511 and TSIS

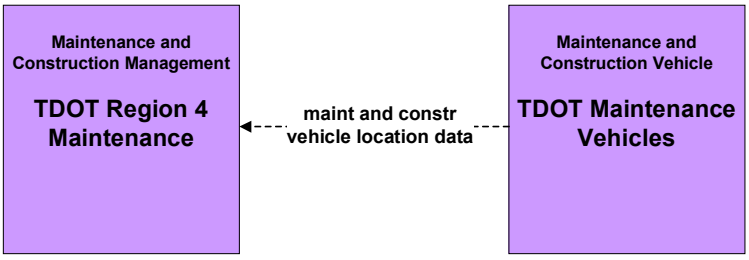


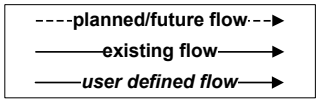
EM10 – Disaster Traveler Information
MDOT



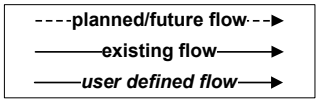
Maintenance and Construction Management

MC01 – Maintenance and Construction Vehicle and Equipment Tracking
TDOT Region 4 Maintenance

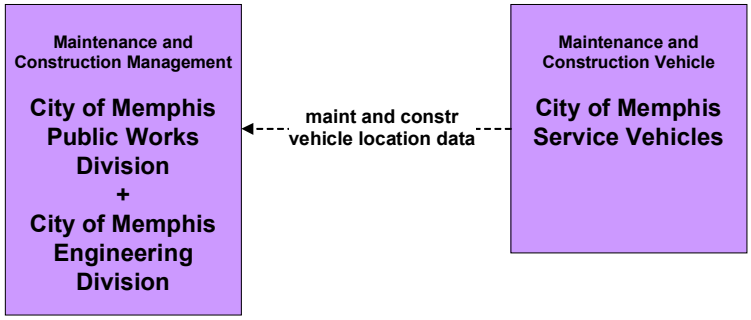


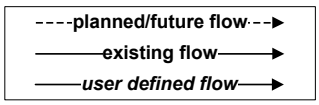


MC01 – Maintenance and Construction Vehicle and Equipment Tracking
MDOT District 2 Maintenance

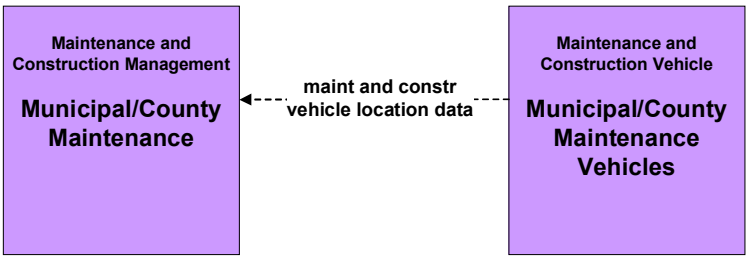


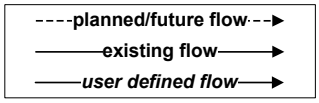
MC01 – Maintenance and Construction Vehicle and Equipment Tracking
City of Memphis



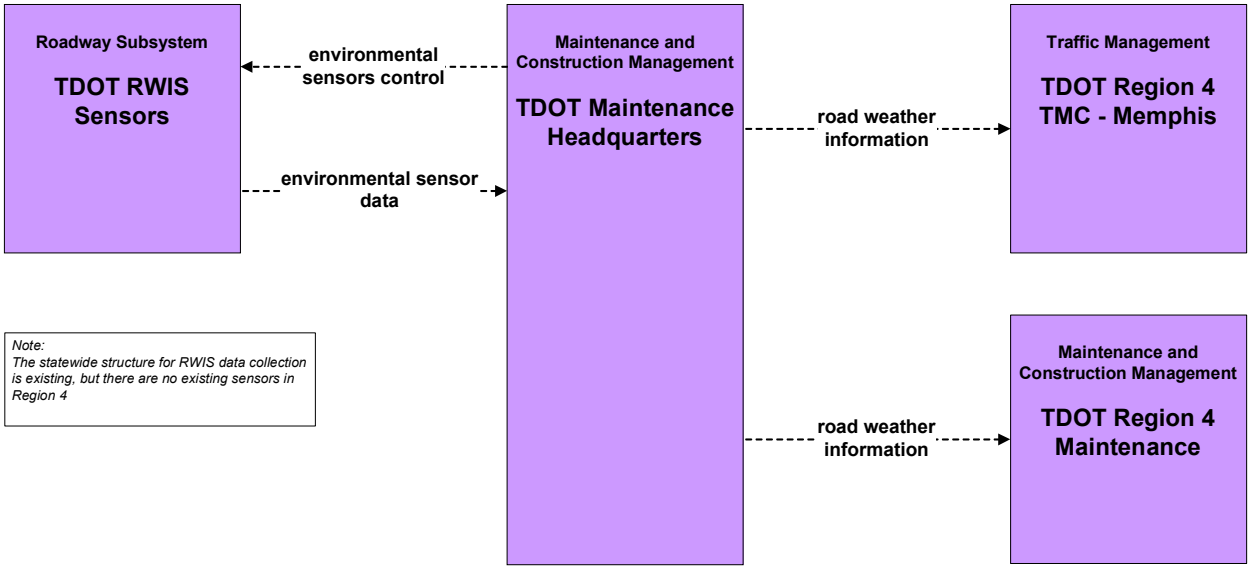


MC01 – Maintenance and Construction Vehicle and Equipment Tracking
Municipal/County

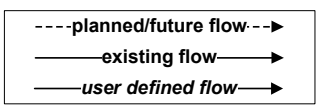




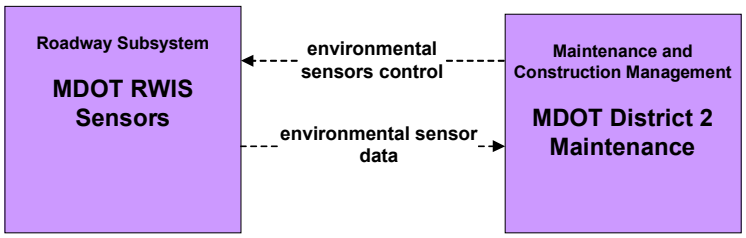
MC03 – Road Weather Data Collection
TDOT RWIS

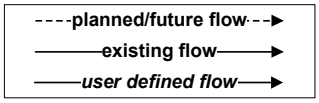


Note:
The statewide structure for RWIS data collection is existing, but there are no existing sensors in Region 4

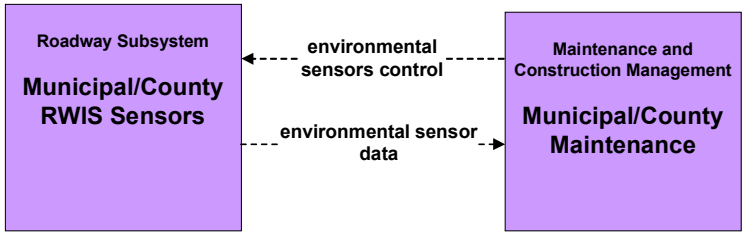


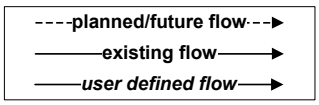
MC03 – Road Weather Data Collection
MDOT

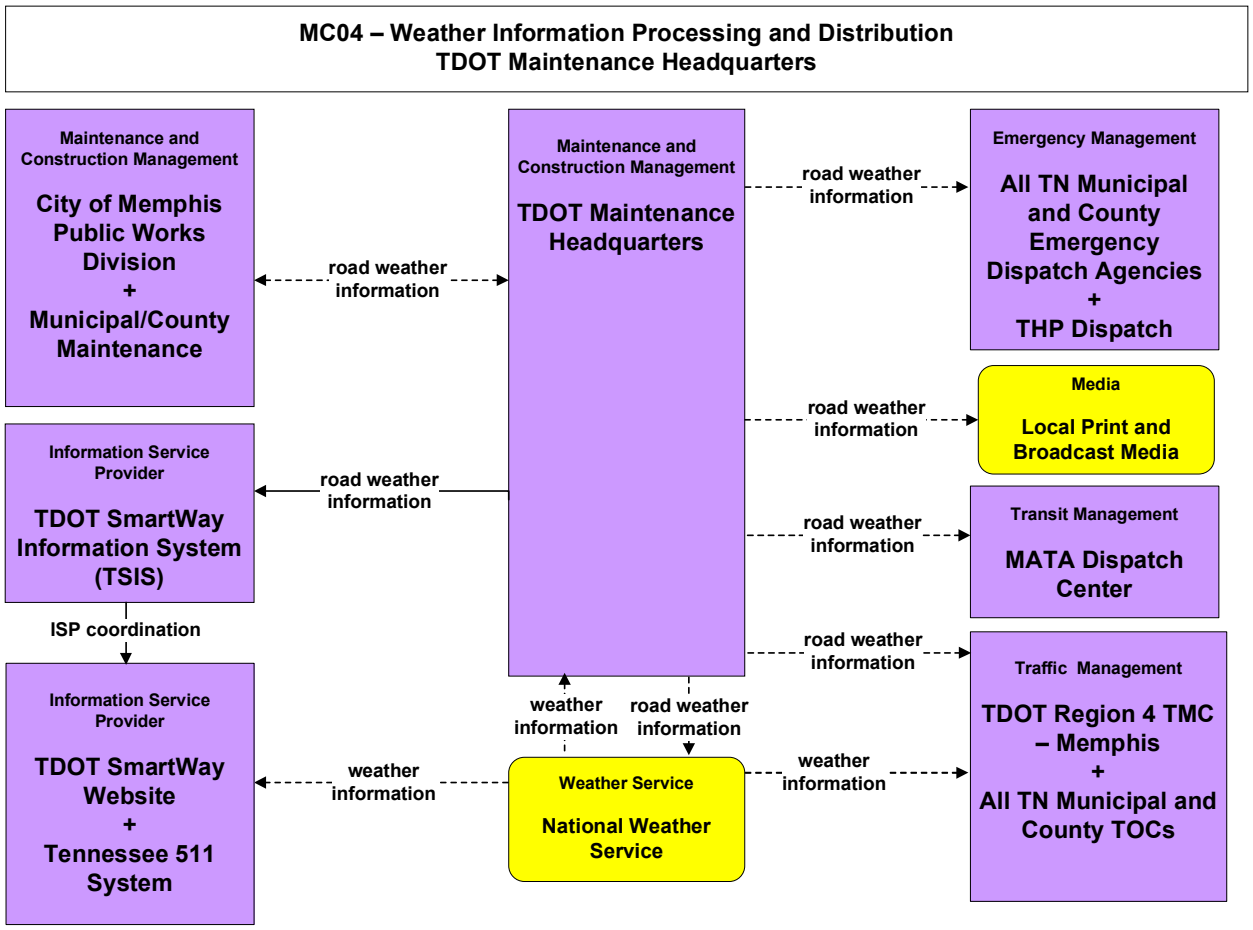


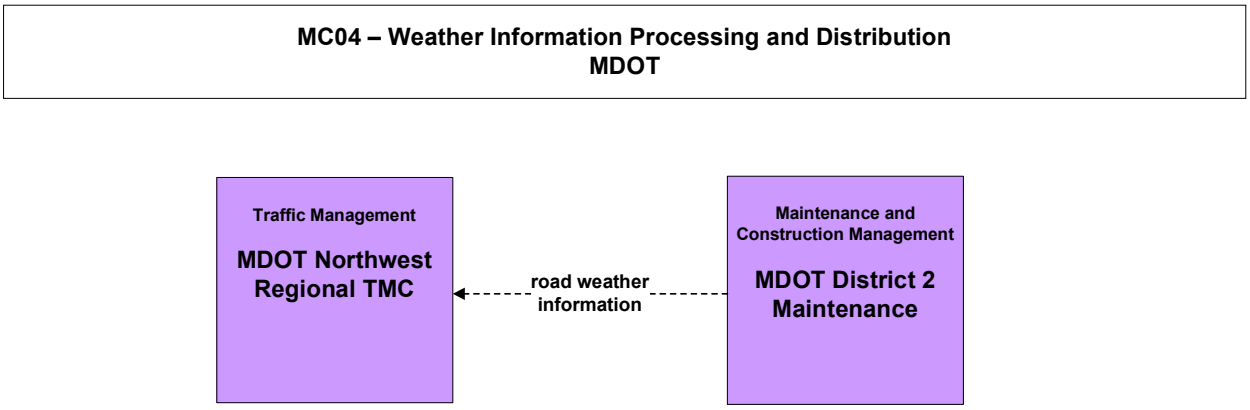


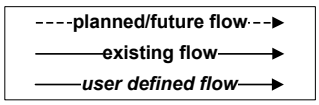
MC03 – Road Weather Data Collection
Municipal/County



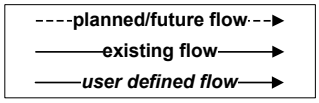



MC04 – Weather Information Processing and Distribution
TDOT Maintenance Headquarters
Maintenance and Construction Management
City of Memphis Public Works Division
+
Municipal/County Maintenance
road weather information
Maintenance and Construction Management
TDOT Maintenance Headquarters
road weather information
Emergency Management
All TN Municipal and County Emergency Dispatch Agencies
+
THP Dispatch
road weather information
Media
Local Print and Broadcast Media
Information Service Provider
TDOT SmartWay Information System (TSIS)
road weather information
road weather information
Transit Management
MATA Dispatch Center
ISP coordination
road weather information
Traffic Management
TDOT Region 4 TMC – Memphis
+
All TN Municipal and County TOCs
Information Service Provider
TDOT SmartWay Website
+
Tennessee 511 System
weather information
road weather information
weather information
Weather Service
National Weather Service
weather information

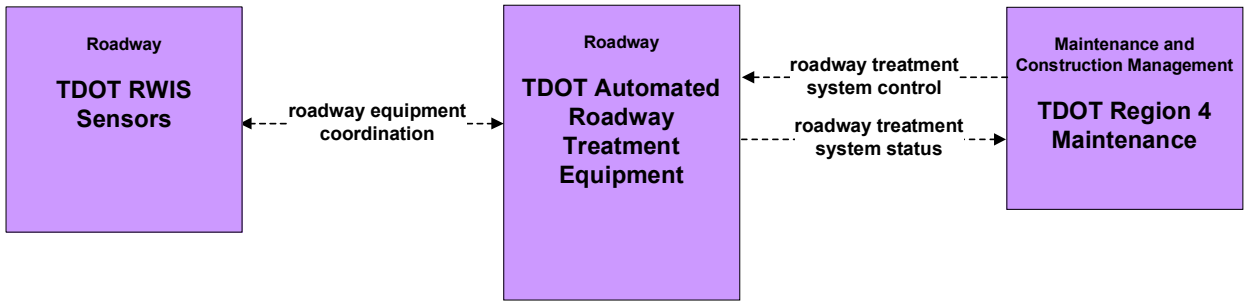

MC04 – Weather Information Processing and Distribution
MDOT
Traffic Management
MDOT Northwest Regional TMC
road weather information
Maintenance and Construction Management
MDOT District 2 Maintenance

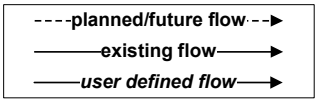

planned/future flow
existing flow
user defined flow

MC04 – Weather Information Processing and Distribution
Municipal

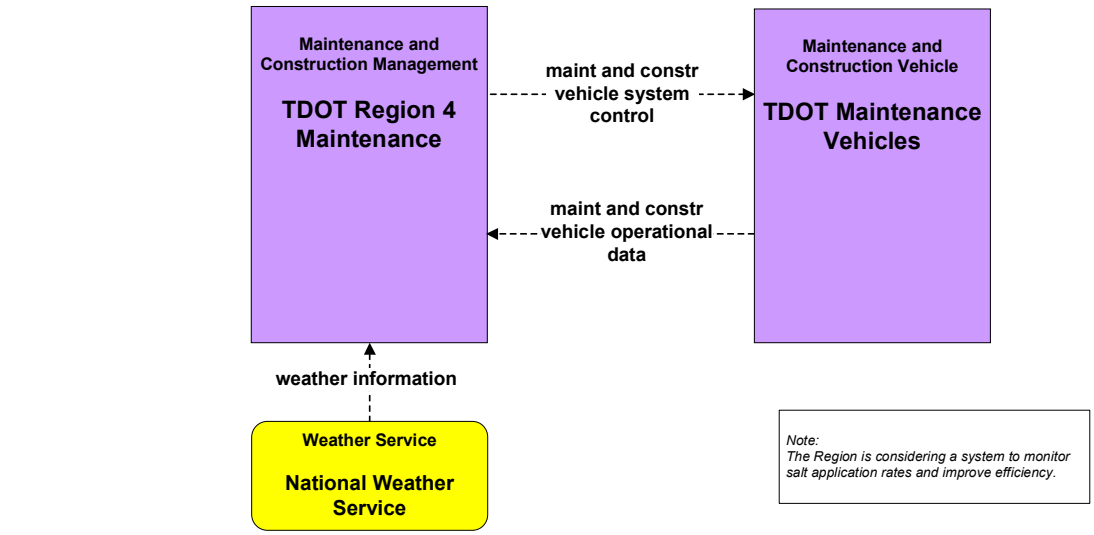


MC05 – Roadway Automated Treatment
TDOT Region 4 Maintenance

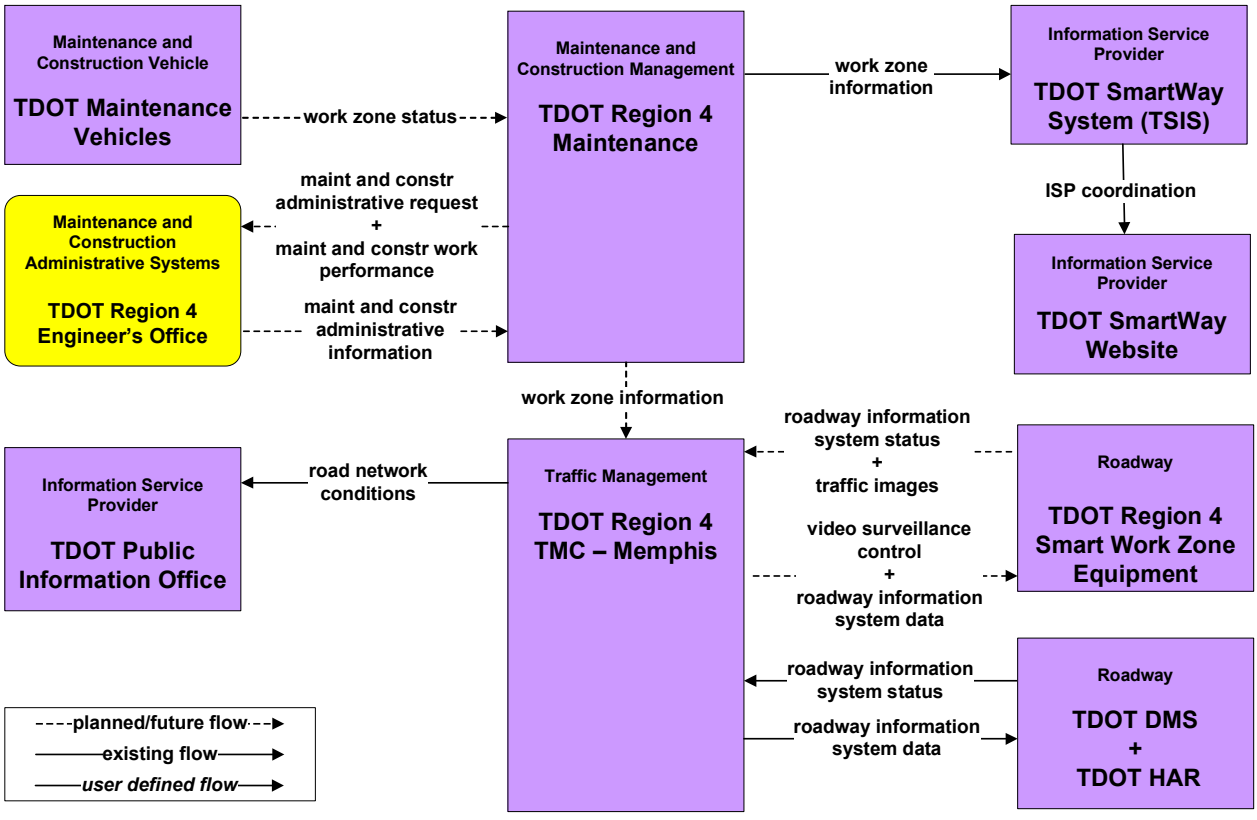


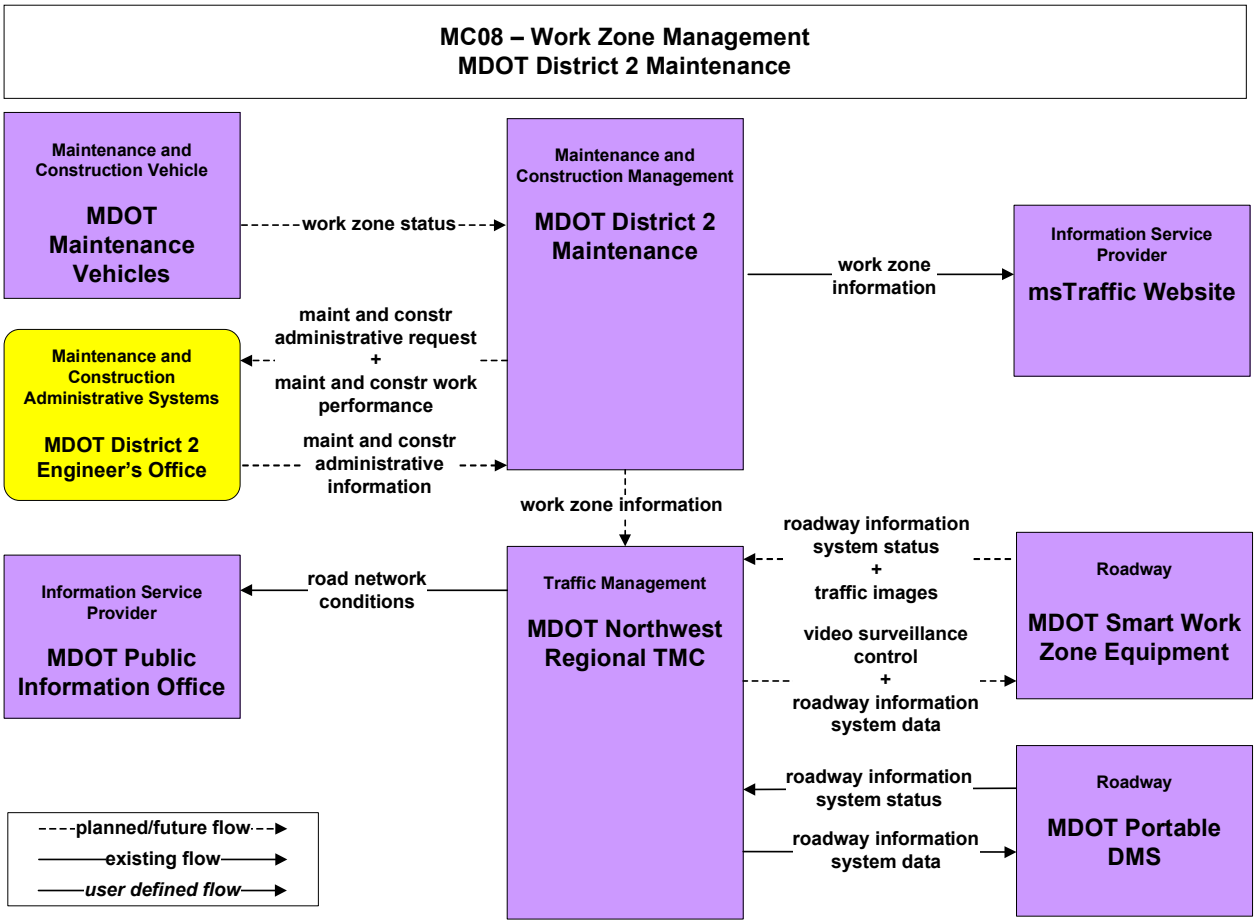


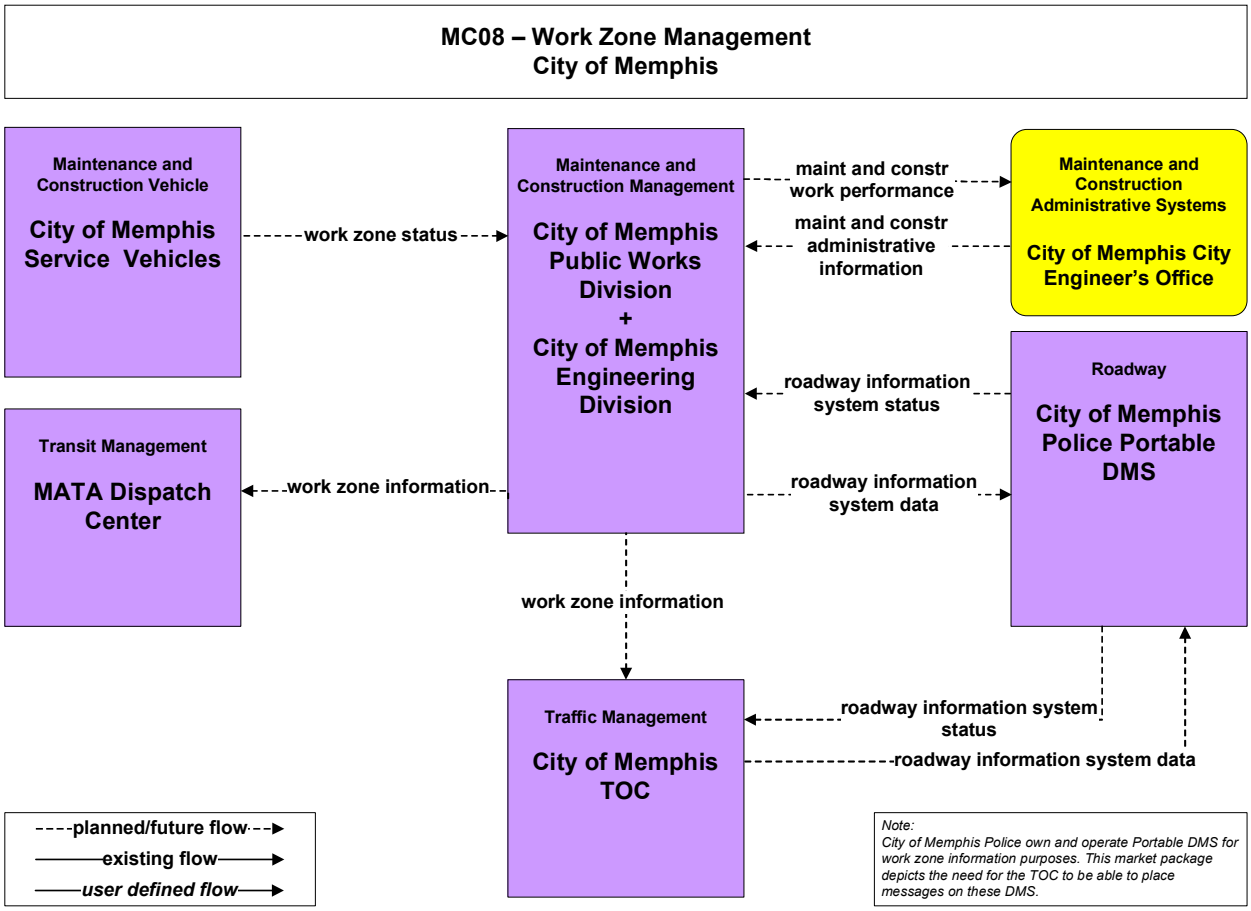
MC06 – Winter Maintenance
TDOT Region 4 Maintenance



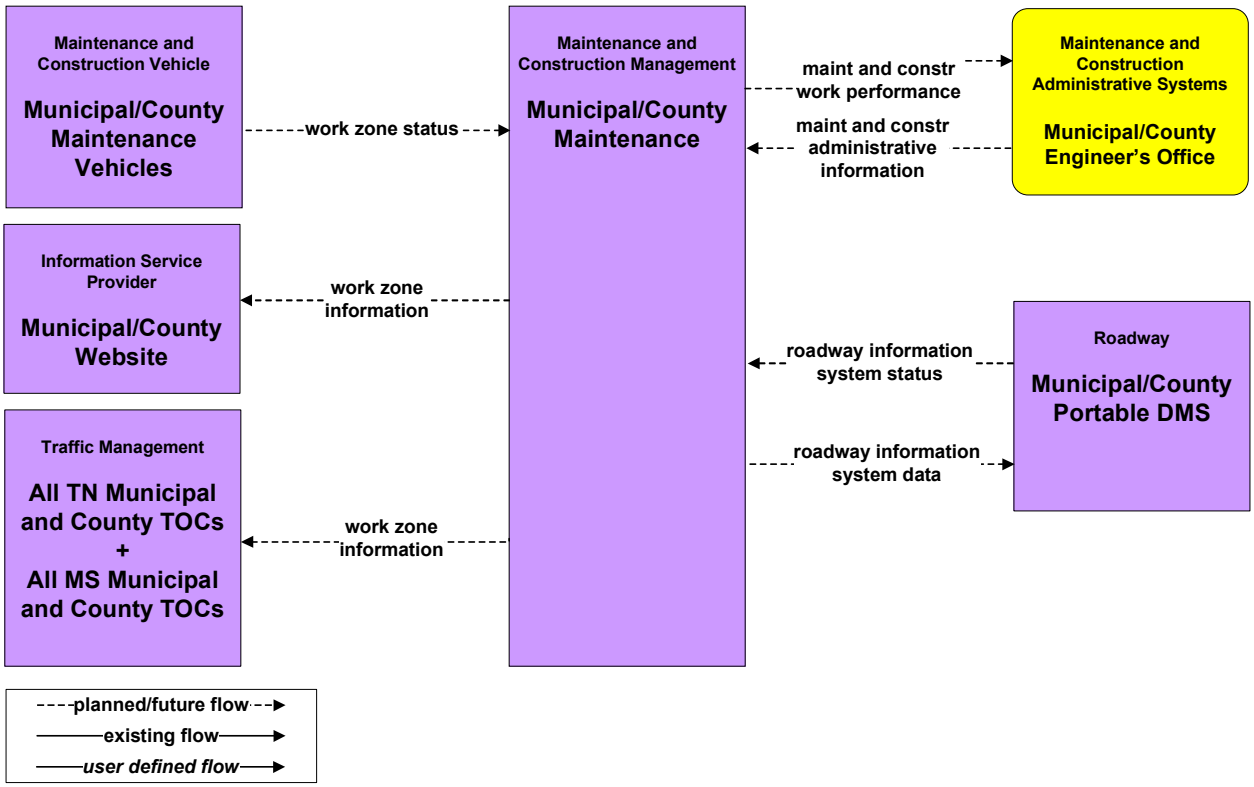
MC08 – Work Zone Management
TDOT Region 4 Maintenance



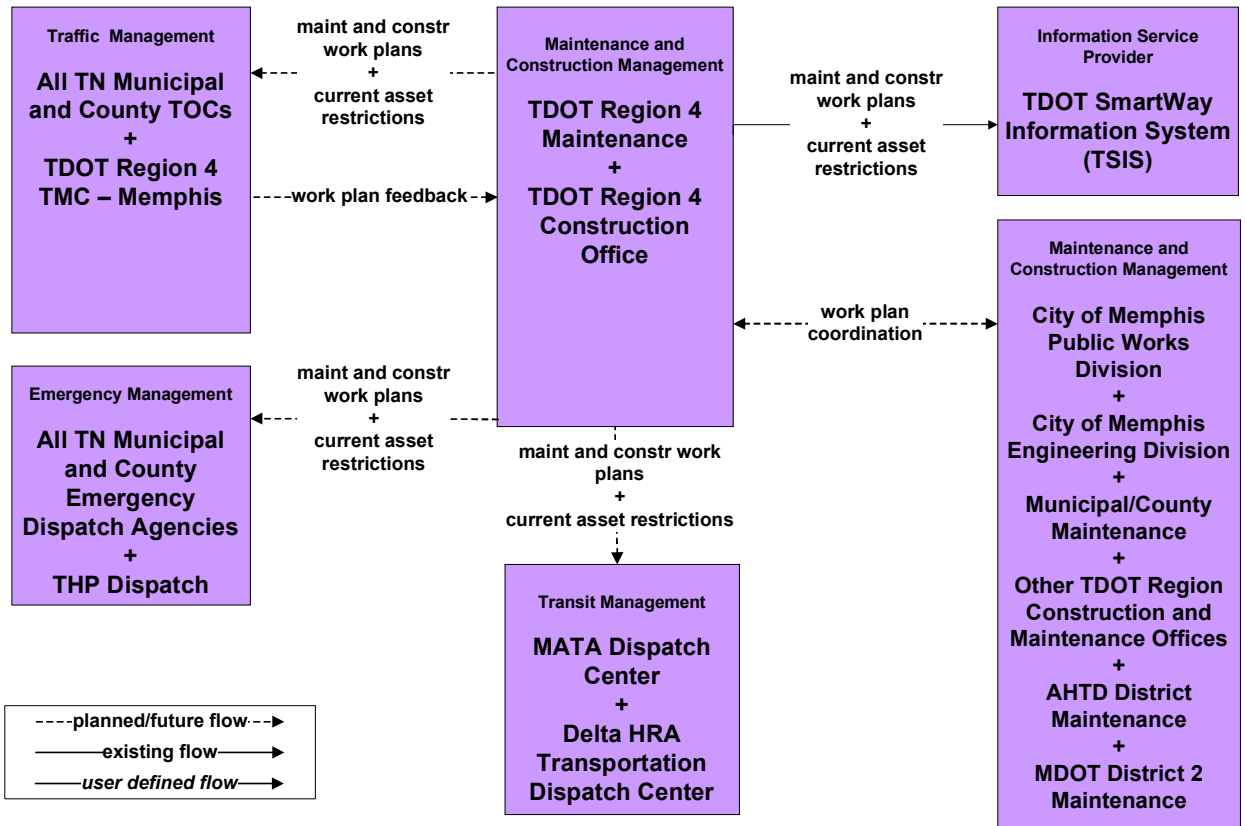

MC08 – Work Zone Management
MDOT District 2 Maintenance
Maintenance and Construction Vehicle
MDOT Maintenance Vehicles
work zone status
Maintenance and Construction Management
MDOT District 2 Maintenance
work zone information
Information Service Provider
msTraffic Website
Maintenance and Construction Administrative Systems
MDOT District 2 Engineer's Office
maint and constr administrative request
+
maint and constr work performance
maint and constr administrative information
work zone information
Information Service Provider
MDOT Public Information Office
road network conditions
Traffic Management
MDOT Northwest Regional TMC
roadway information system status
+
traffic images
Roadway
MDOT Smart Work Zone Equipment
video surveillance control
+
roadway information system data
roadway information system status
roadway information system data
Roadway
MDOT Portable DMS
planned/future flow
existing flow
user defined flow

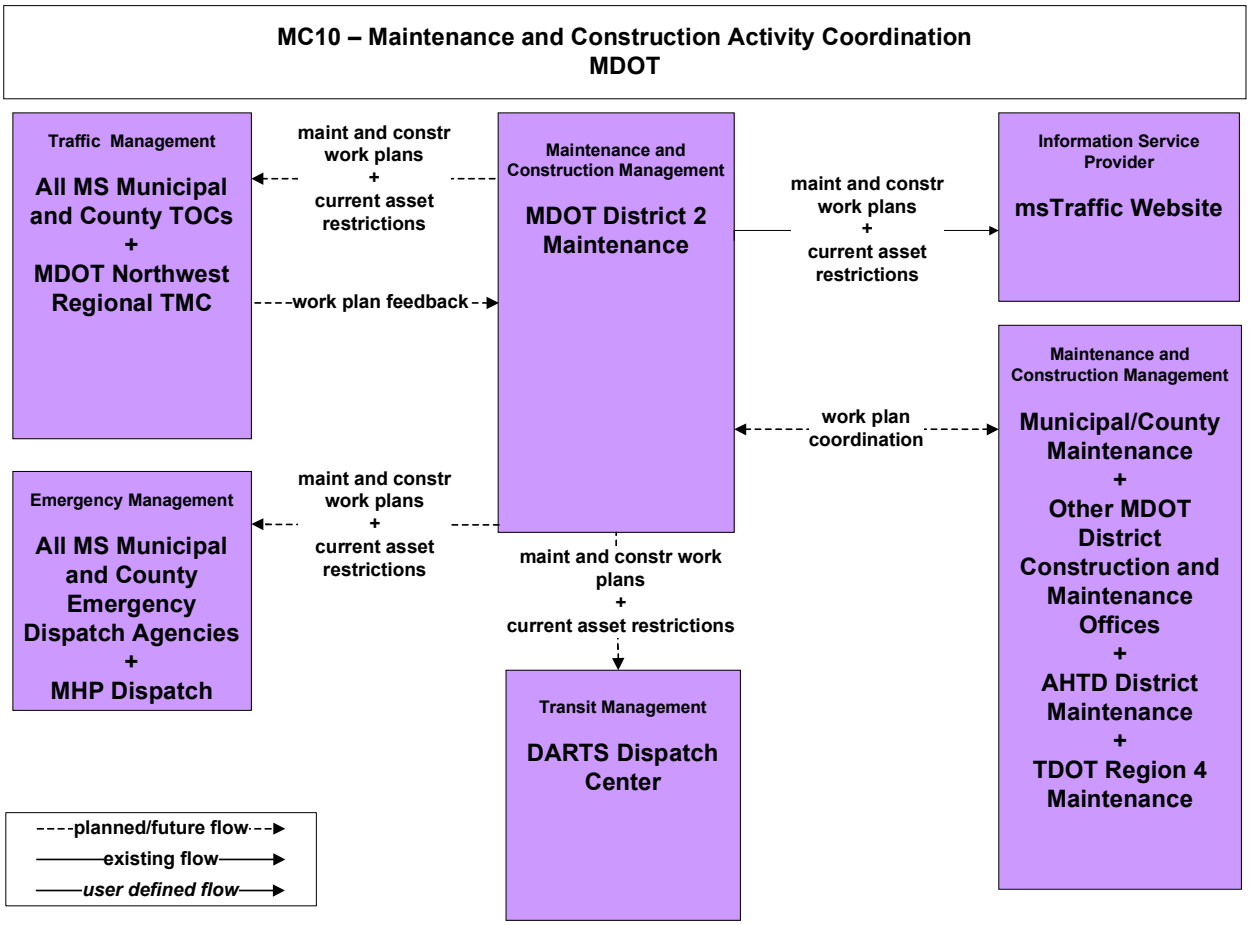

MC08 – Work Zone Management
City of Memphis
Maintenance and Construction Vehicle
City of Memphis Service Vehicles
work zone status
Maintenance and Construction Management
City of Memphis Public Works Division
+
City of Memphis Engineering Division
maint and constr work performance
maint and constr administrative information
Maintenance and Construction Administrative Systems
City of Memphis City Engineer's Office
Transit Management
MATA Dispatch Center
work zone information
roadway information system status
roadway information system data
Roadway
City of Memphis Police Portable DMS
work zone information
Traffic Management
City of Memphis TOC
roadway information system status
roadway information system data
planned/future flow
existing flow
user defined flow
Note:
City of Memphis Police own and operate Portable DMS for work zone information purposes. This market package depicts the need for the TOC to be able to place messages on these DMS.

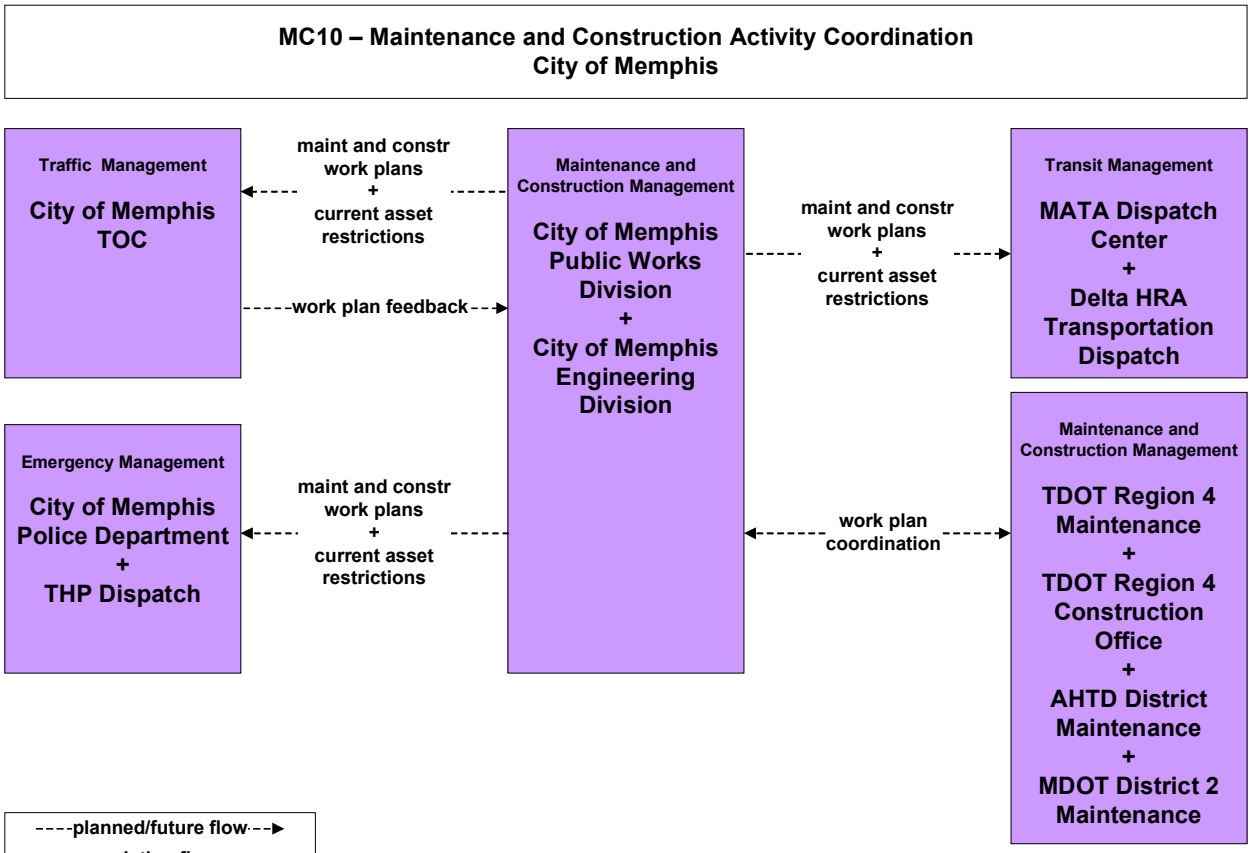
MC08 – Work Zone Management
Municipal/County



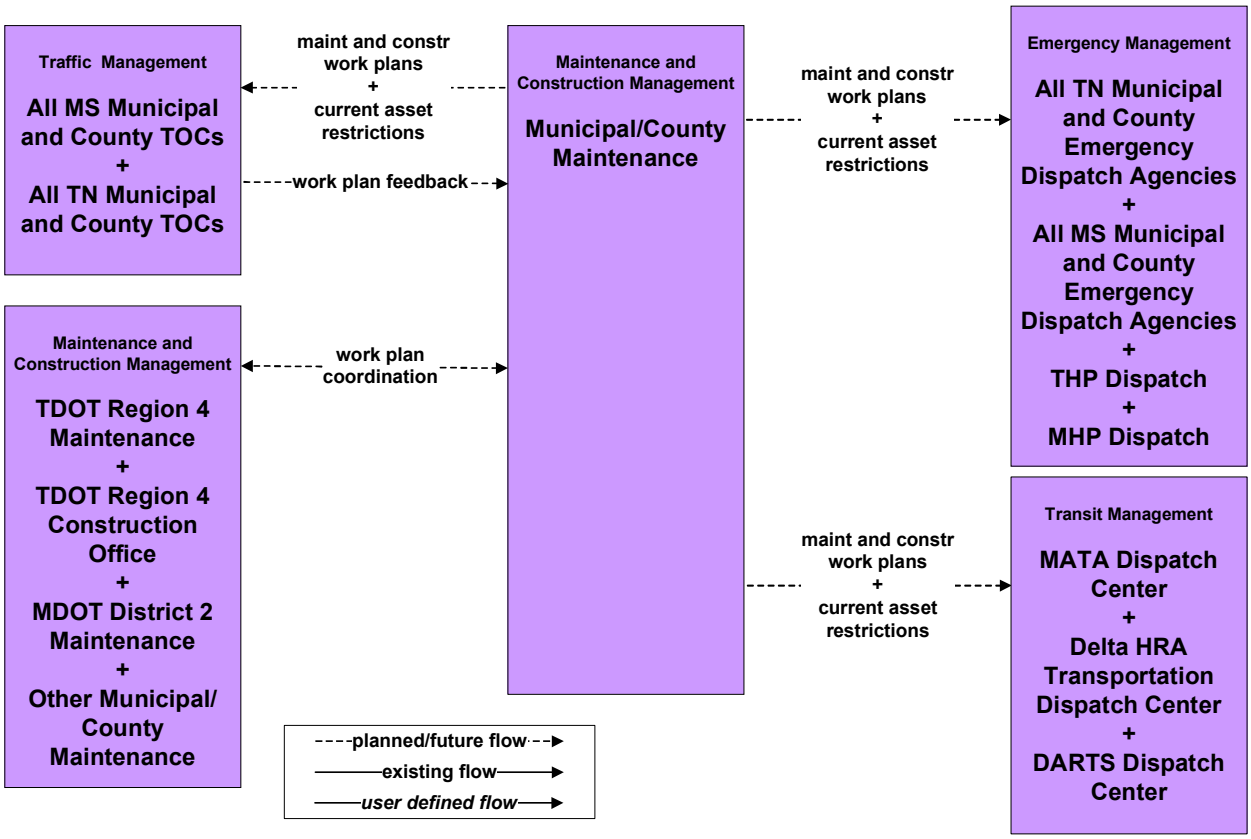
MC10 – Maintenance and Construction Activity Coordination
TDOT



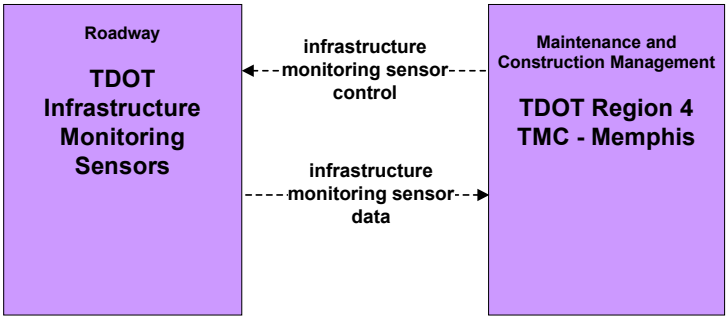

MC10 – Maintenance and Construction Activity Coordination
MDOT
Traffic Management
All MS Municipal and County TOCs
+
MDOT Northwest Regional TMC
maint and constr work plans
+
current asset restrictions
work plan feedback
Maintenance and Construction Management
MDOT District 2 Maintenance
maint and constr work plans
+
current asset restrictions
Information Service Provider
msTraffic Website
work plan coordination
Maintenance and Construction Management
Municipal/County Maintenance
+
Other MDOT District Construction and Maintenance Offices
+
AHTD District Maintenance
+
TDOT Region 4 Maintenance
Emergency Management
All MS Municipal and County Emergency Dispatch Agencies
+
MHP Dispatch
maint and constr work plans
+
current asset restrictions
maint and constr work plans
+
current asset restrictions
Transit Management
DARTS Dispatch Center
planned/future flow
existing flow
user defined flow


MC10 – Maintenance and Construction Activity Coordination
City of Memphis
Traffic Management
City of Memphis TOC
maint and constr work plans
+
current asset restrictions
work plan feedback
Maintenance and Construction Management
City of Memphis Public Works Division
+
City of Memphis Engineering Division
maint and constr work plans
+
current asset restrictions
Transit Management
MATA Dispatch Center
+
Delta HRA Transportation Dispatch
Emergency Management
City of Memphis Police Department
+
THP Dispatch
maint and constr work plans
+
current asset restrictions
work plan coordination
Maintenance and Construction Management
TDOT Region 4 Maintenance
+
TDOT Region 4 Construction Office
+
AHTD District Maintenance
+
MDOT District 2 Maintenance
planned/future flow
existing flow
user defined flow

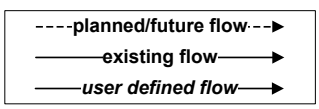
MC10 – Maintenance and Construction Activity Coordination
Municipal/County



MC12 – Infrastructure Monitoring
TDOT

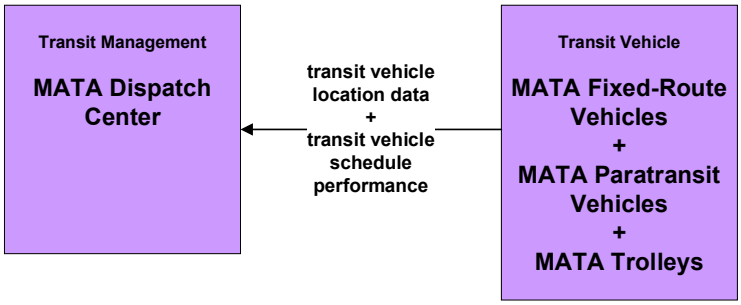


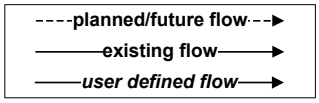
Note:
Infrastructure monitoring data is transmitted from the TMC to the University of Memphis Center for Earthquake Research and Information.



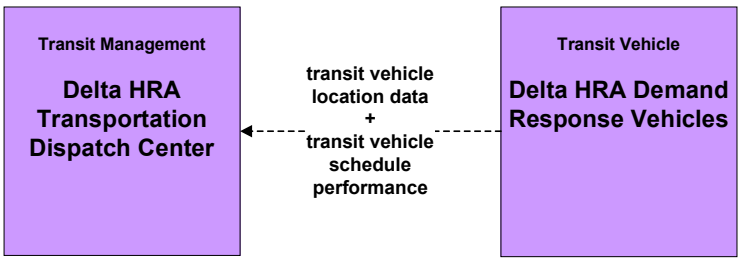
Advanced Public Transportation Systems

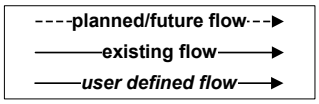
APTS01 – Transit Vehicle Tracking
Memphis Area Transit Authority



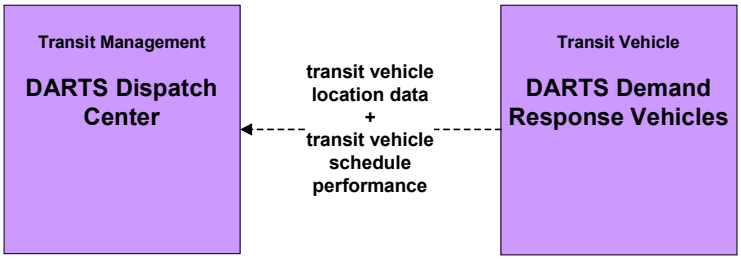


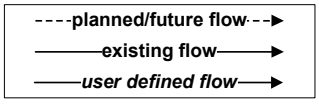
APTS01 – Transit Vehicle Tracking
Delta HRA Transportation



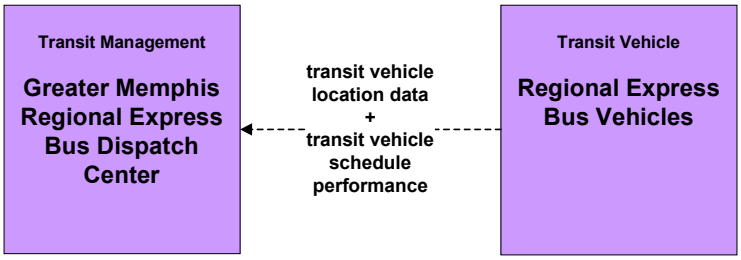


APTS01 – Transit Vehicle Tracking
DARTS





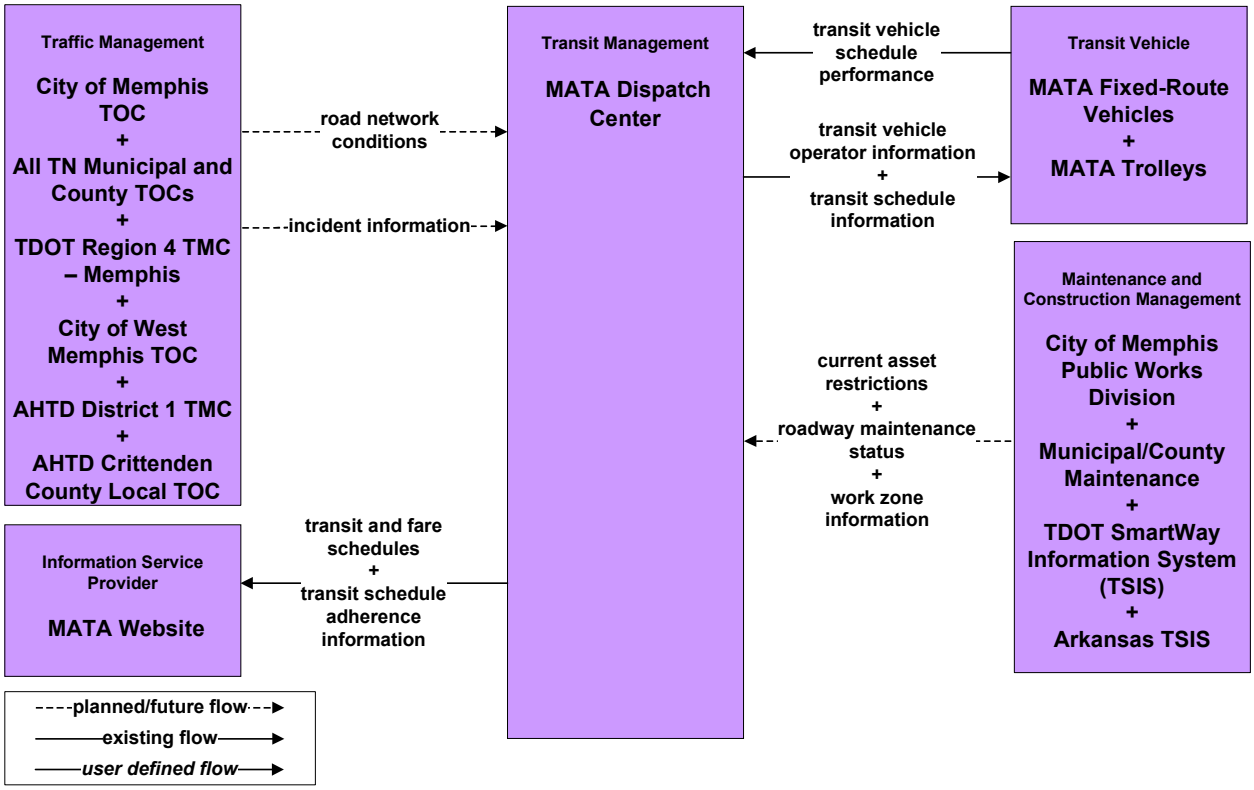
APTS01 – Transit Vehicle Tracking
Greater Memphis Regional Express Bus System



Note:
The Greater Memphis Regional Express Bus System is a future element. MDOT is currently studying the feasibility of an express bus system that would travel between TN and MS.

----planned/future flow-->
————existing flow————>
——*user defined flow*——>

APTS02 – Transit Fixed-Route Operations
Memphis Area Transit Authority



----planned/future flow-->
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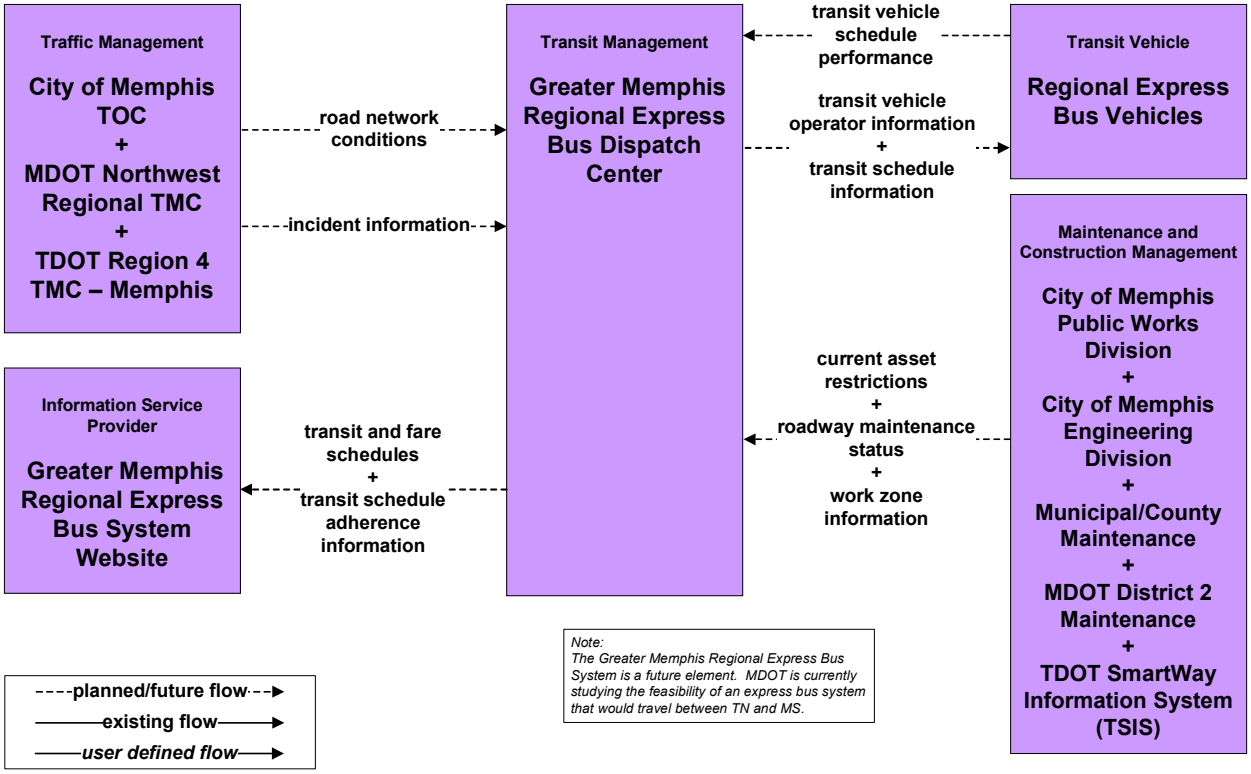
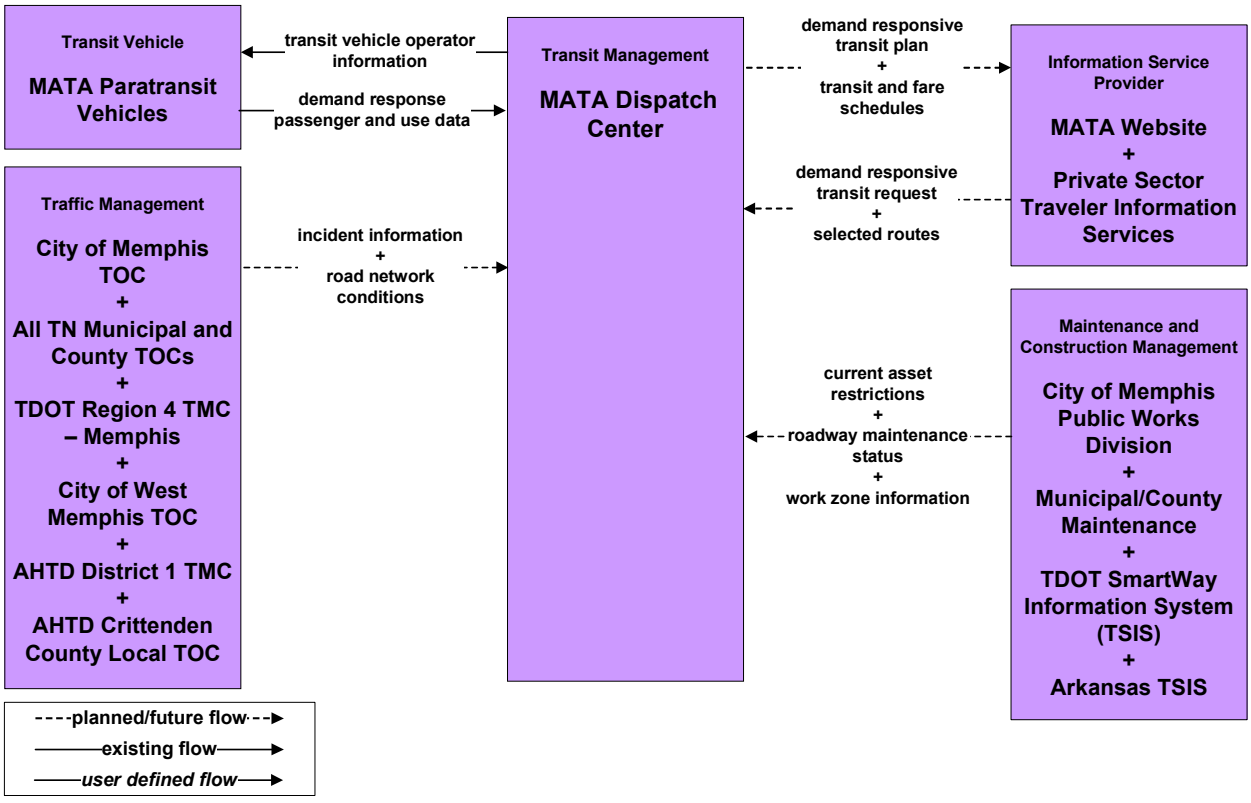
——*user defined flow*——>

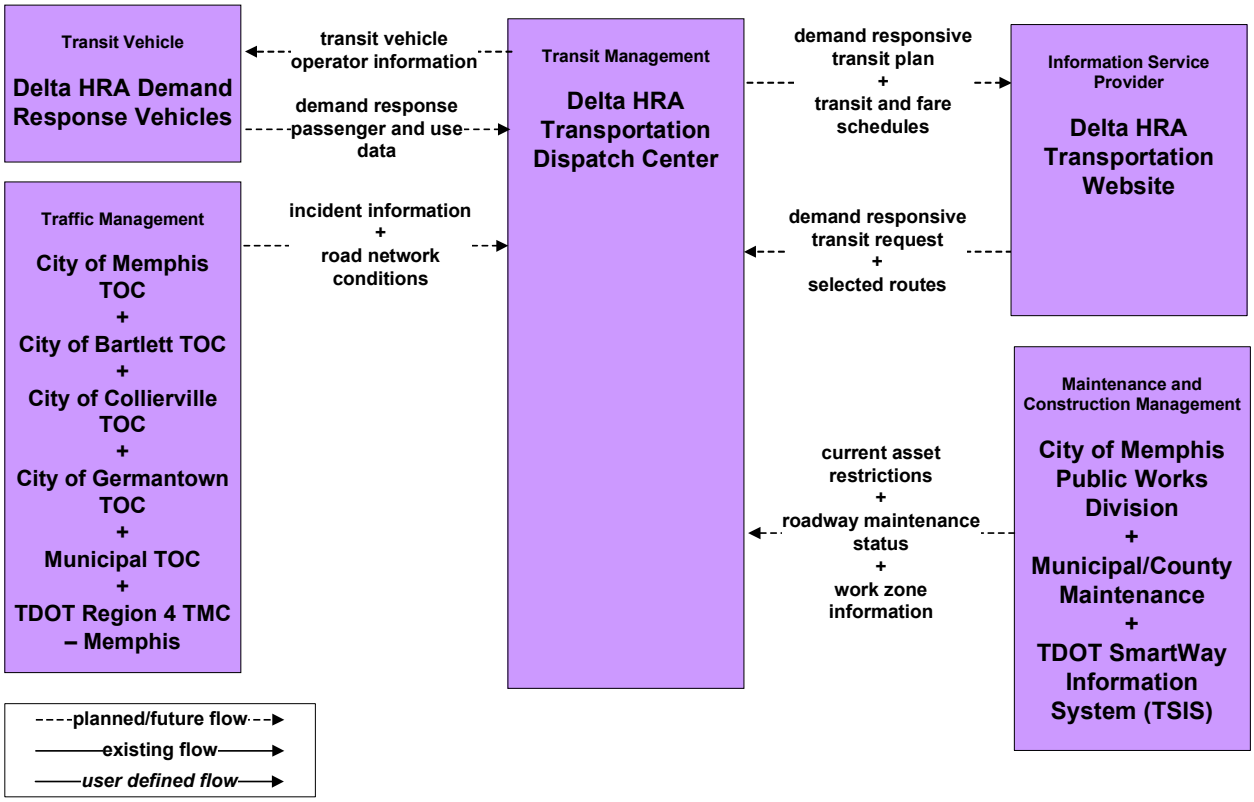
APTS02 – Transit Fixed-Route Operations
Greater Memphis Regional Express Bus System



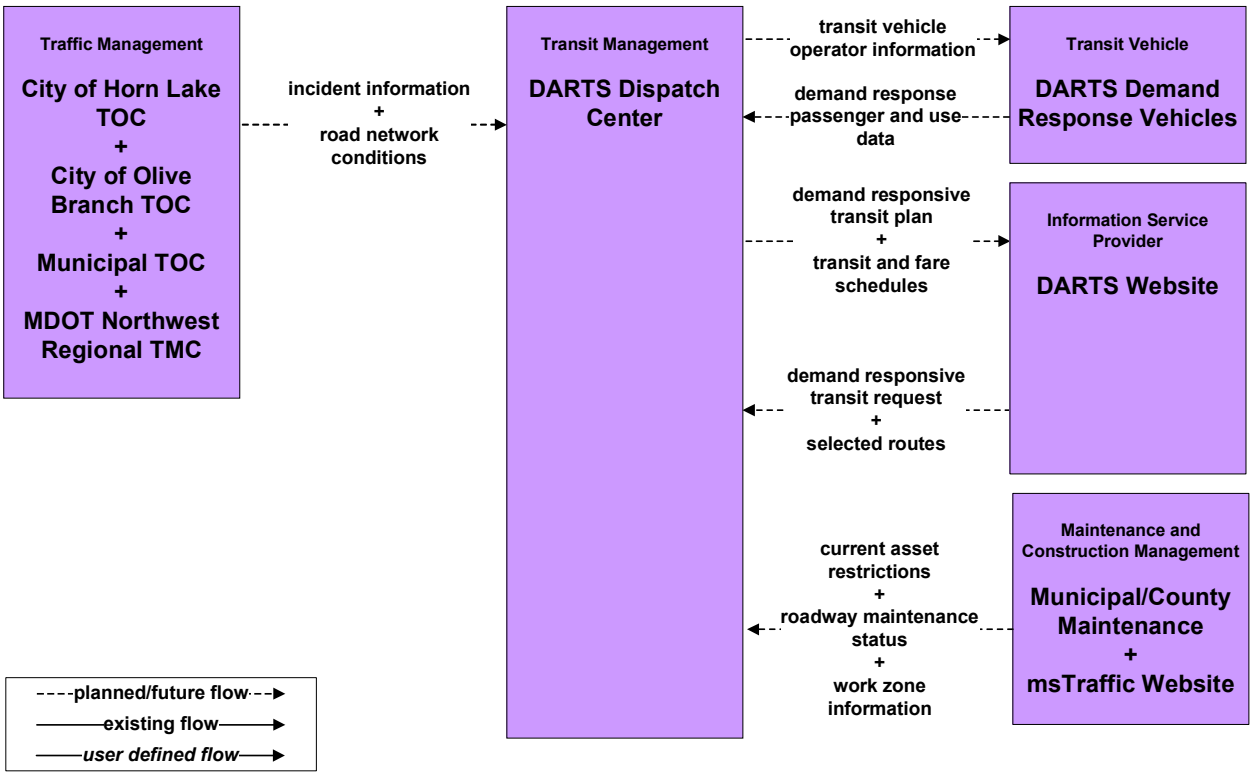
APTS03 – Demand Response Transit Operations
Memphis Area Transit Authority



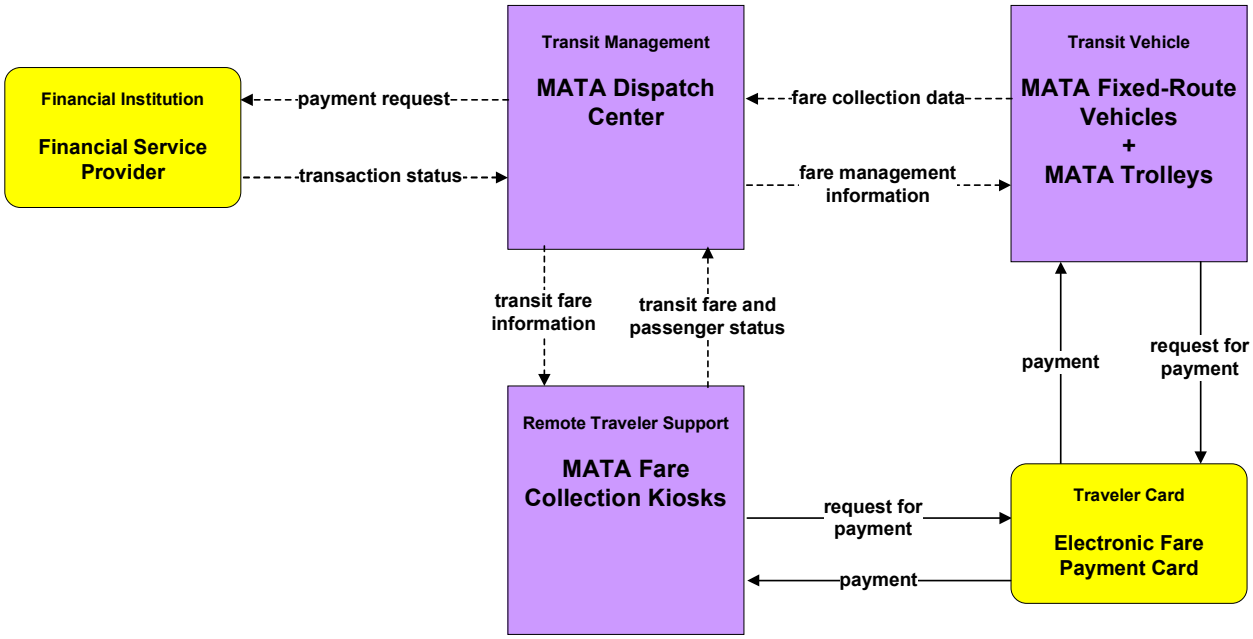
APTS03 – Demand Response Transit Operations
Delta HRA Transportation

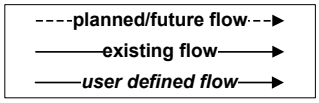


APTS03 – Demand Response Transit Operations
DARTS

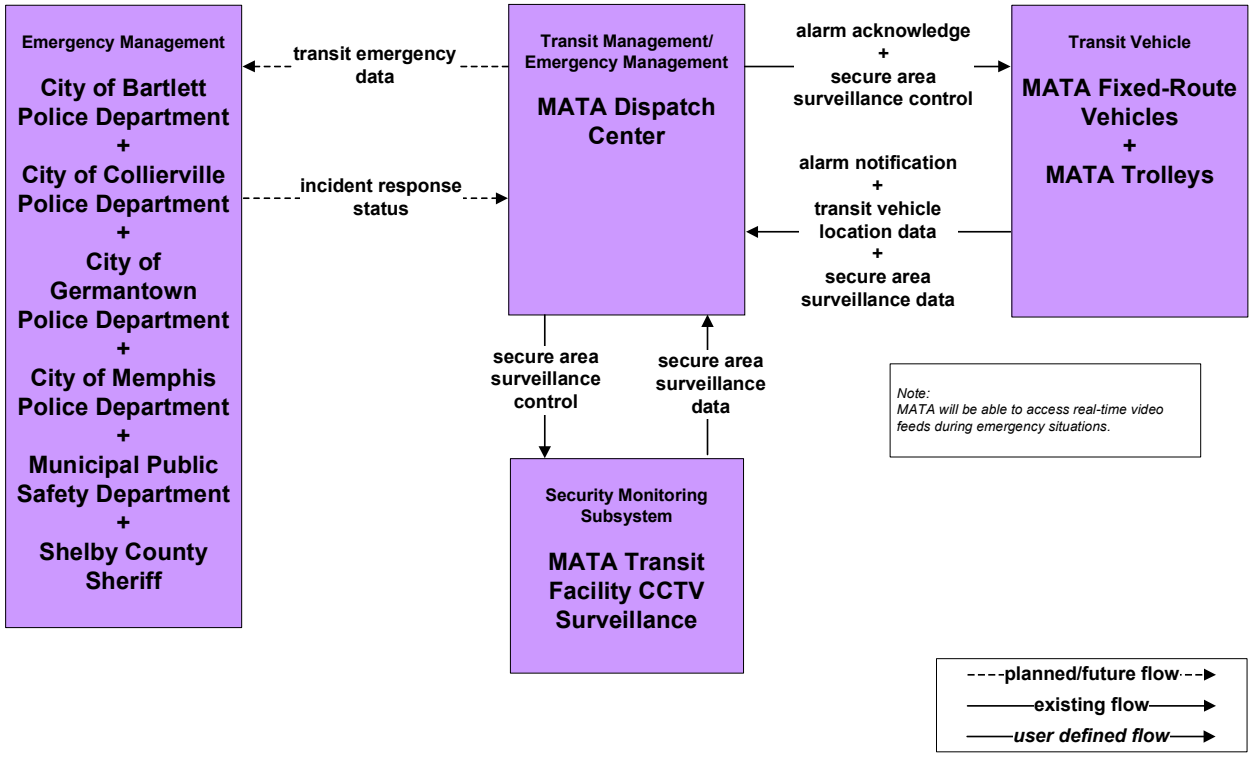


APTS04 – Transit Fare Collection Management
Memphis Area Transit Authority

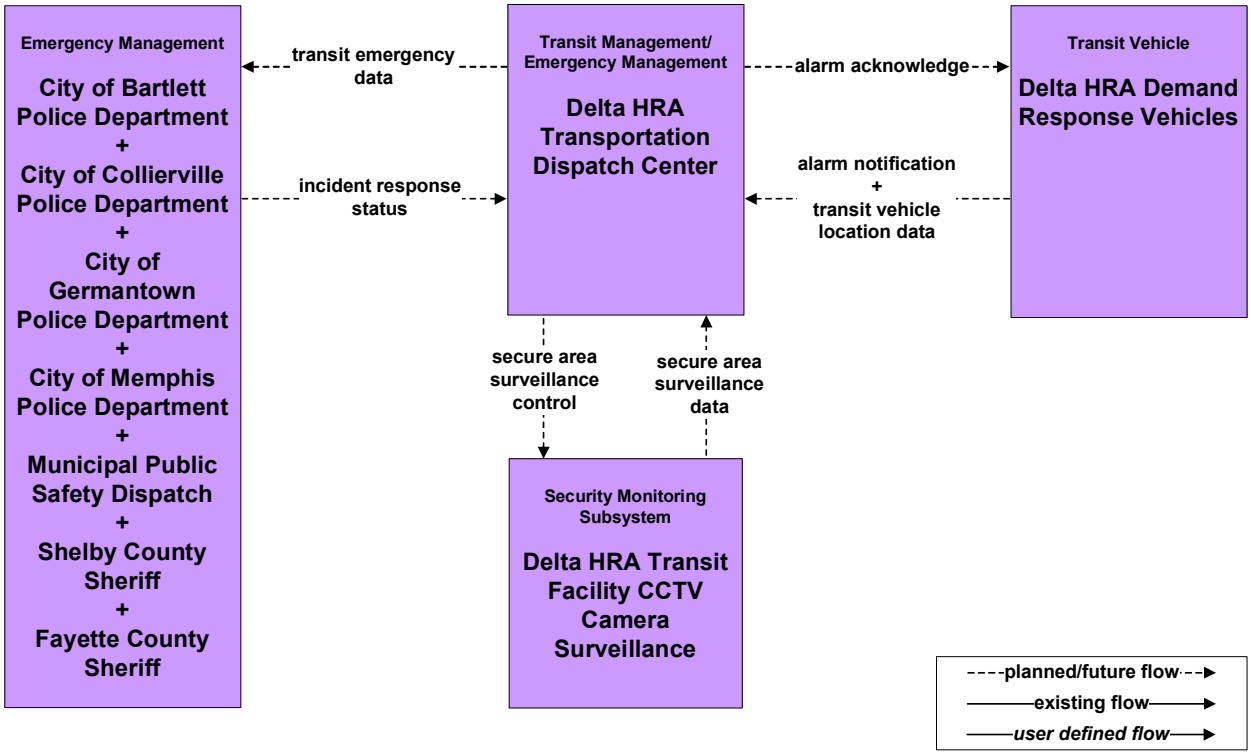




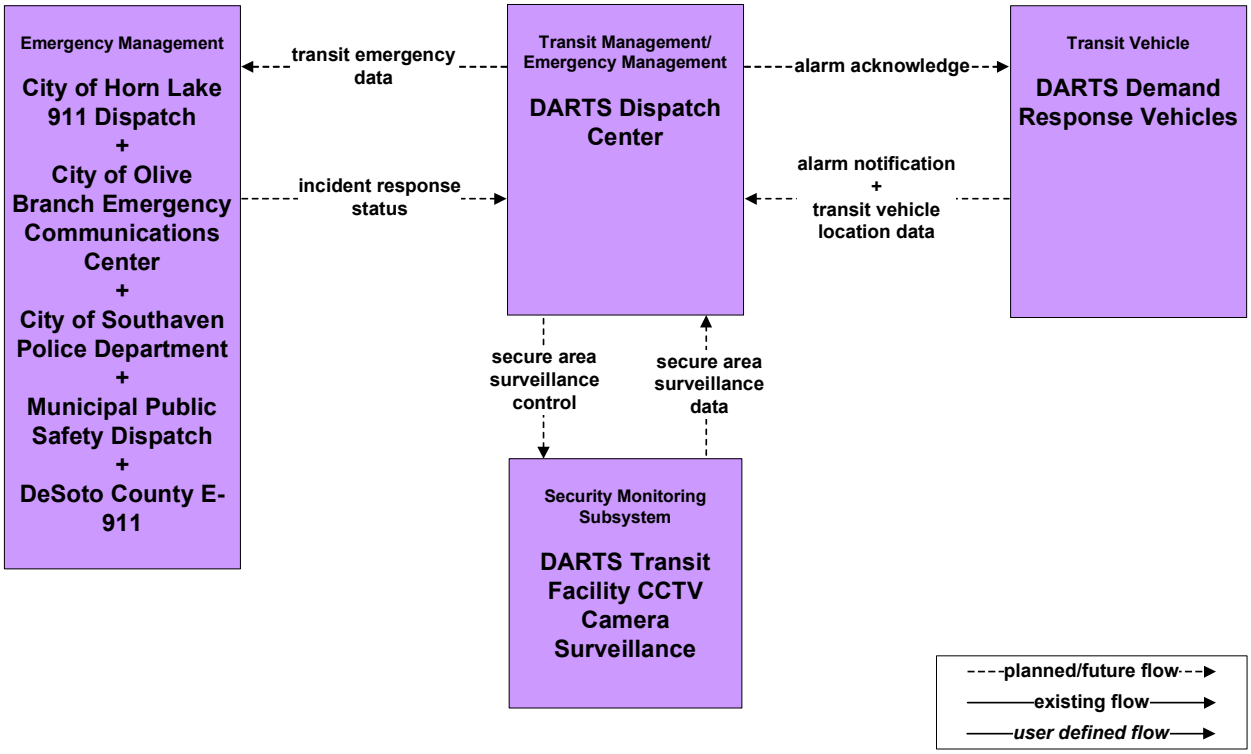
APTS05 – Transit Security
Memphis Area Transit Authority



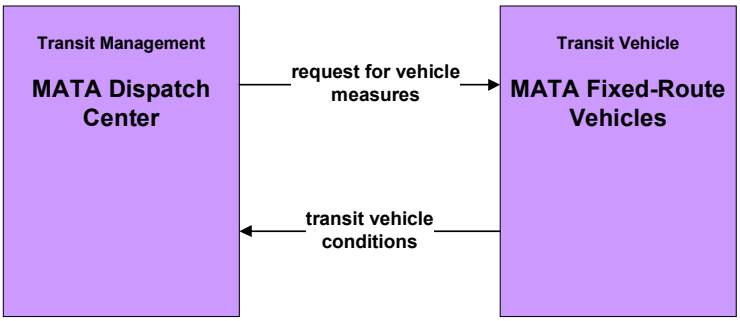
APTS05 – Transit Security
Delta HRA Transportation

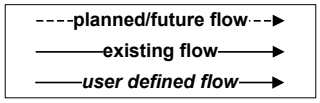


APTS05 – Transit Security
DARTS

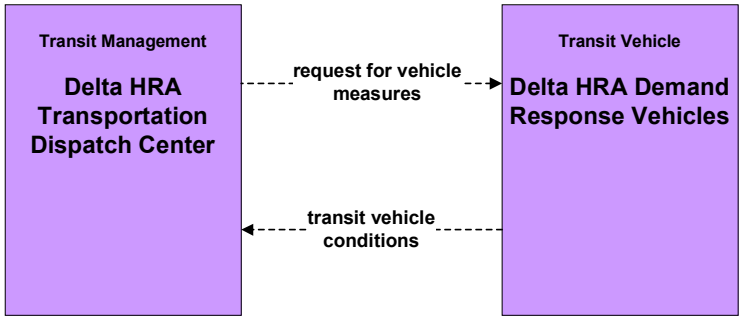


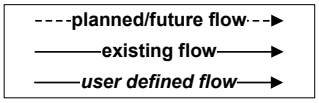
APTS06 – Transit Fleet Management
Memphis Area Transit Authority



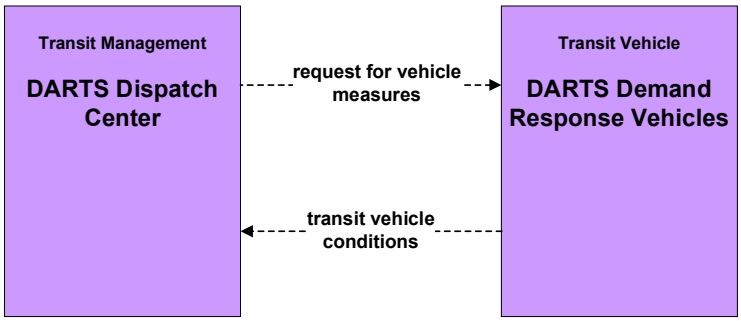


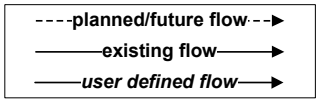
APTS06 – Transit Fleet Management
Delta HRA Transportation



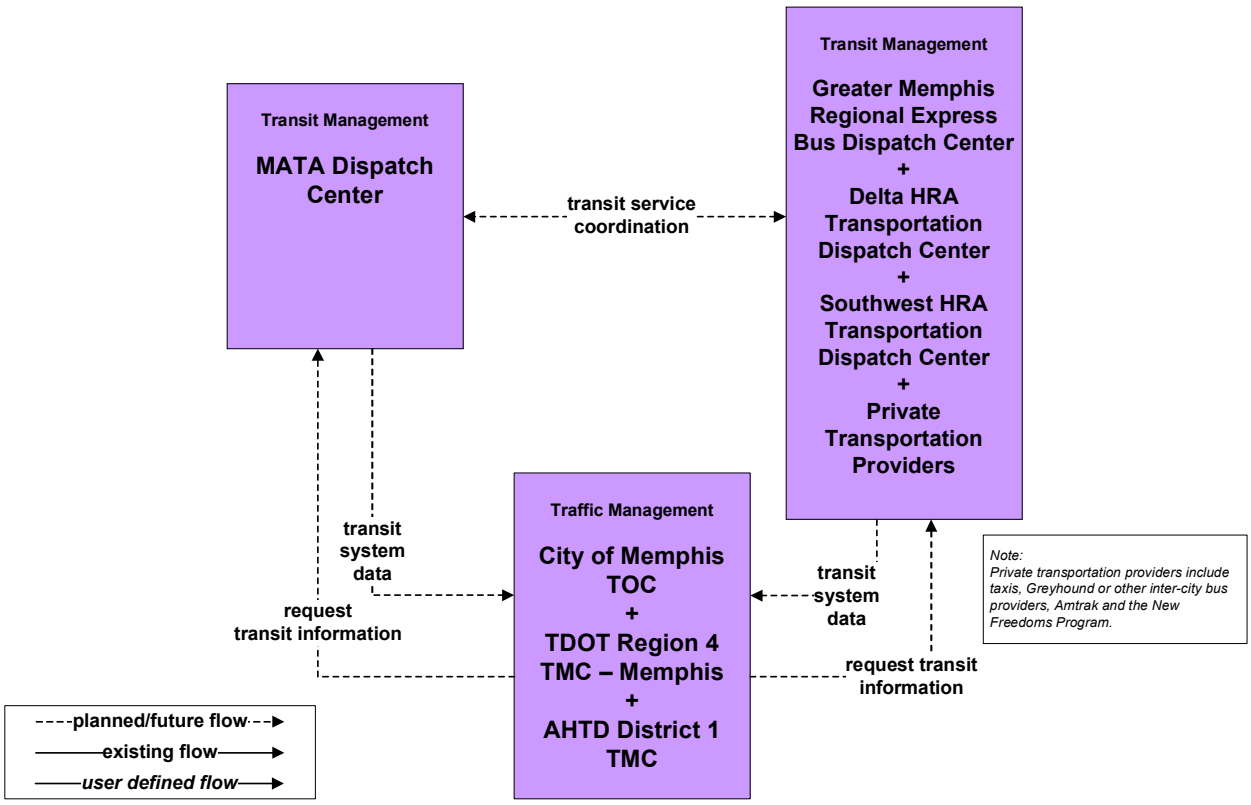


APTS06 – Transit Fleet Management
DARTS

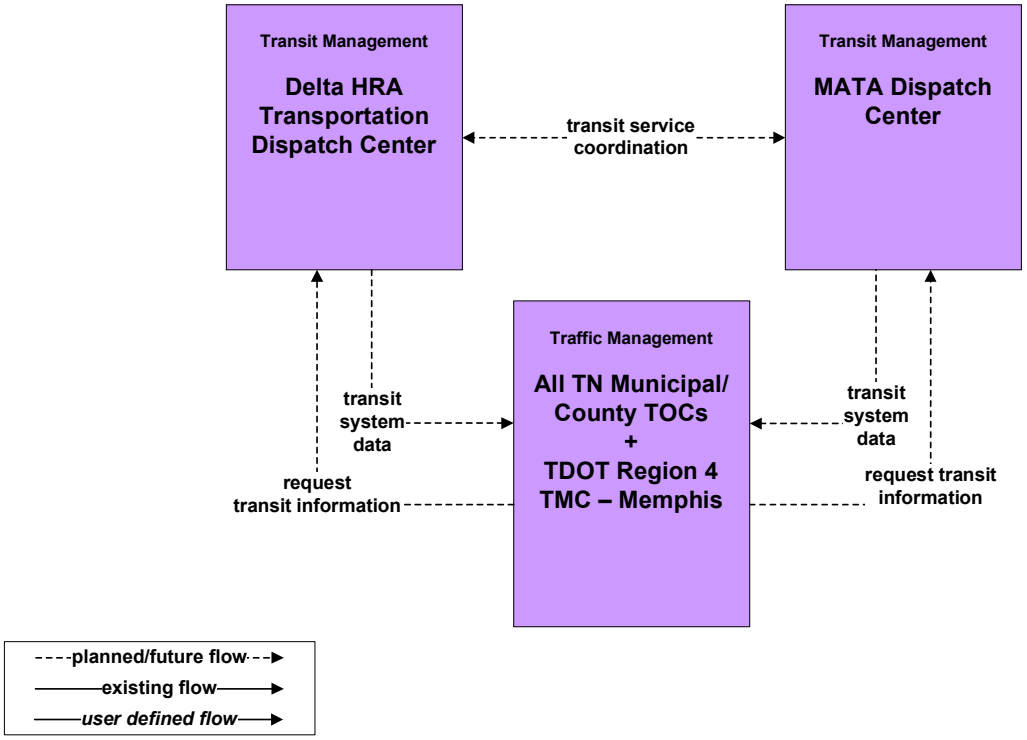




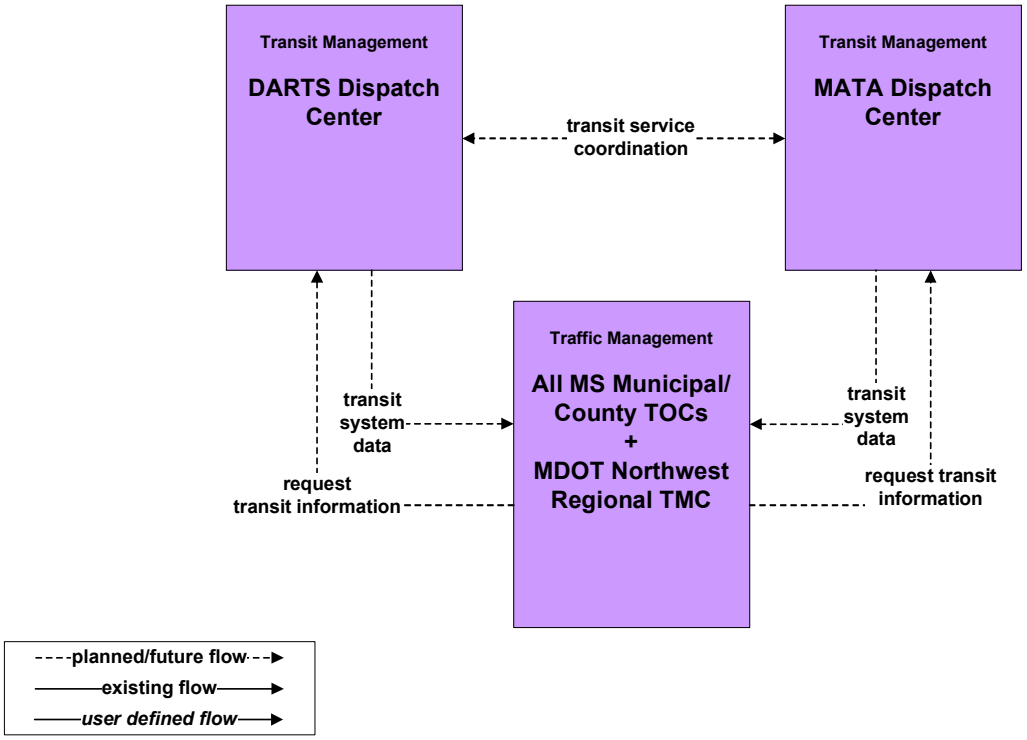
APTS07 – Multi-Modal Coordination
Memphis Area Transit Authority



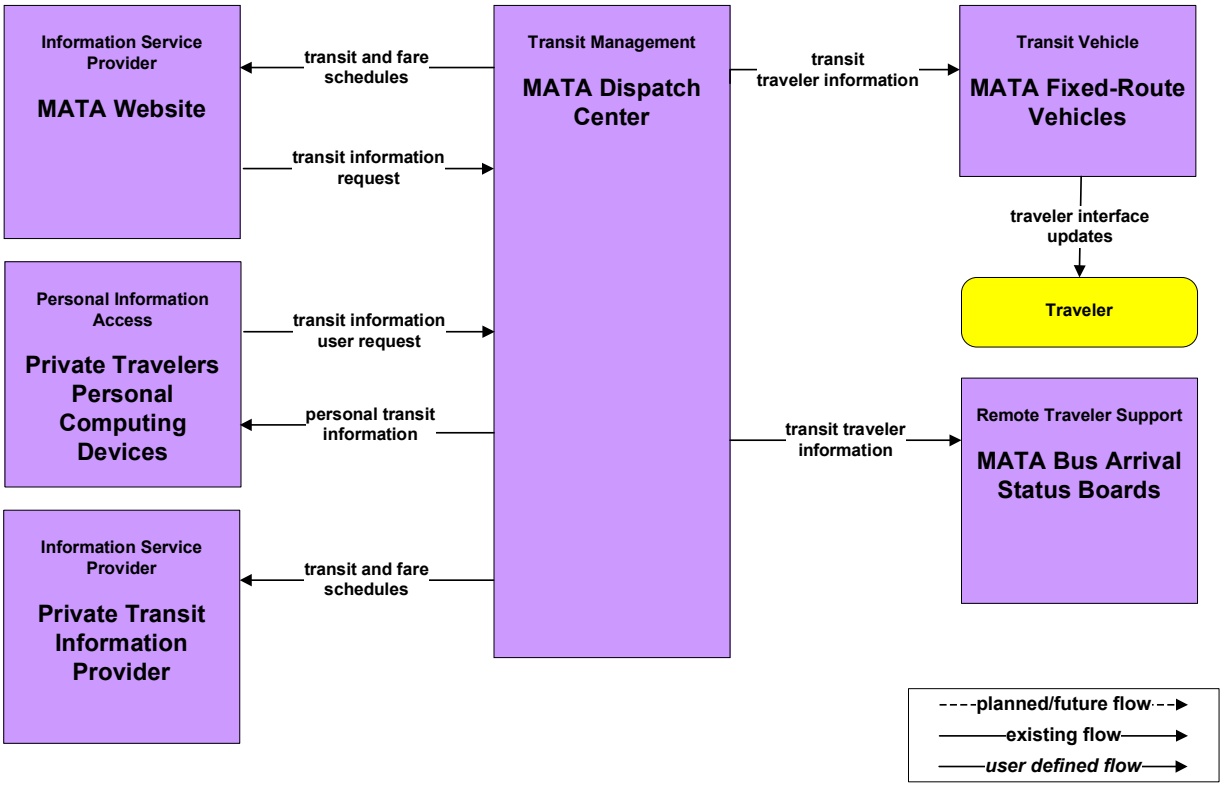
APTS07 – Multi-Modal Coordination
Delta HRA Transportation



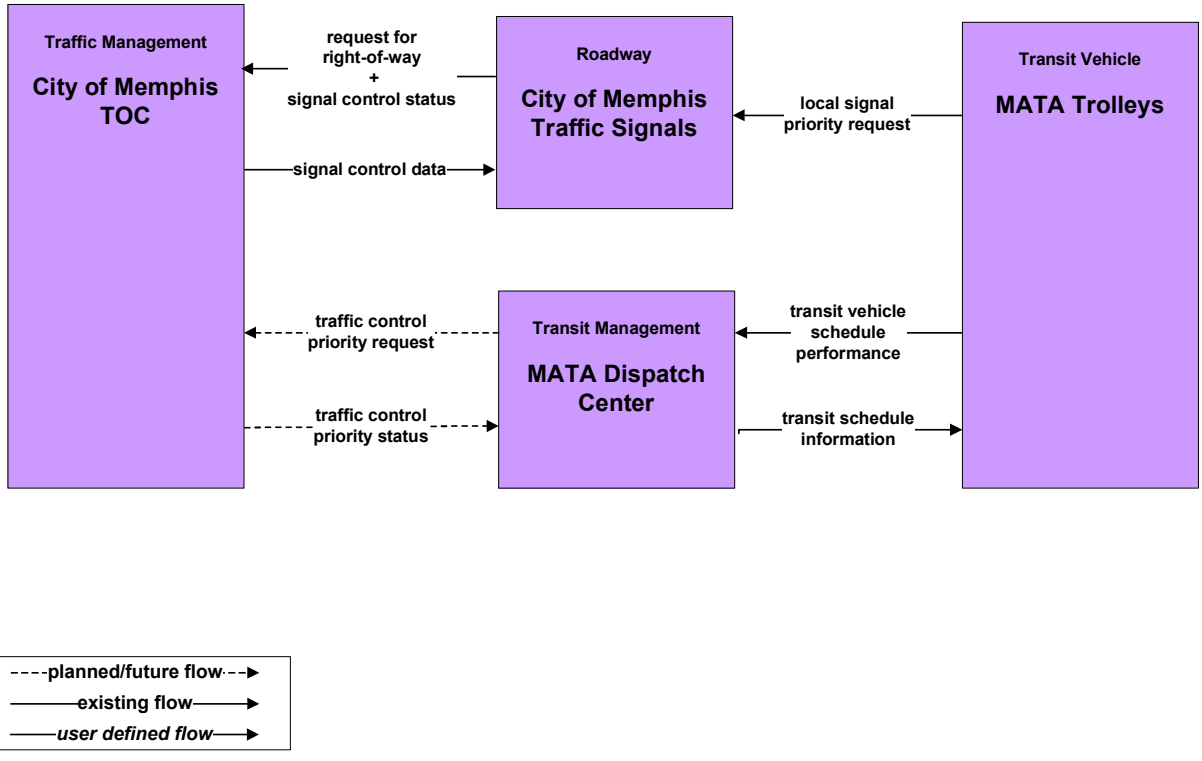
APTS07 – Multi-Modal Coordination
DARTS



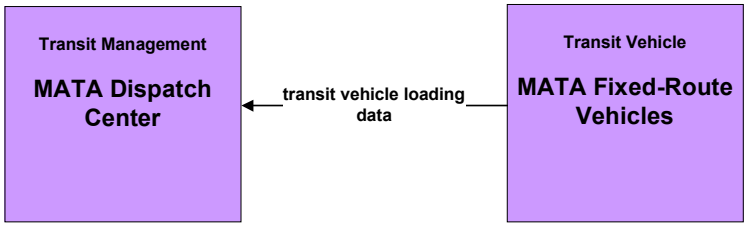
APTS08 – Transit Traveler Information
Memphis Area Transit Authority

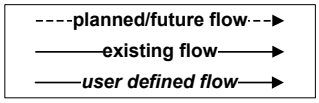


APTS09 – Transit Signal Priority
Memphis Area Transit Authority

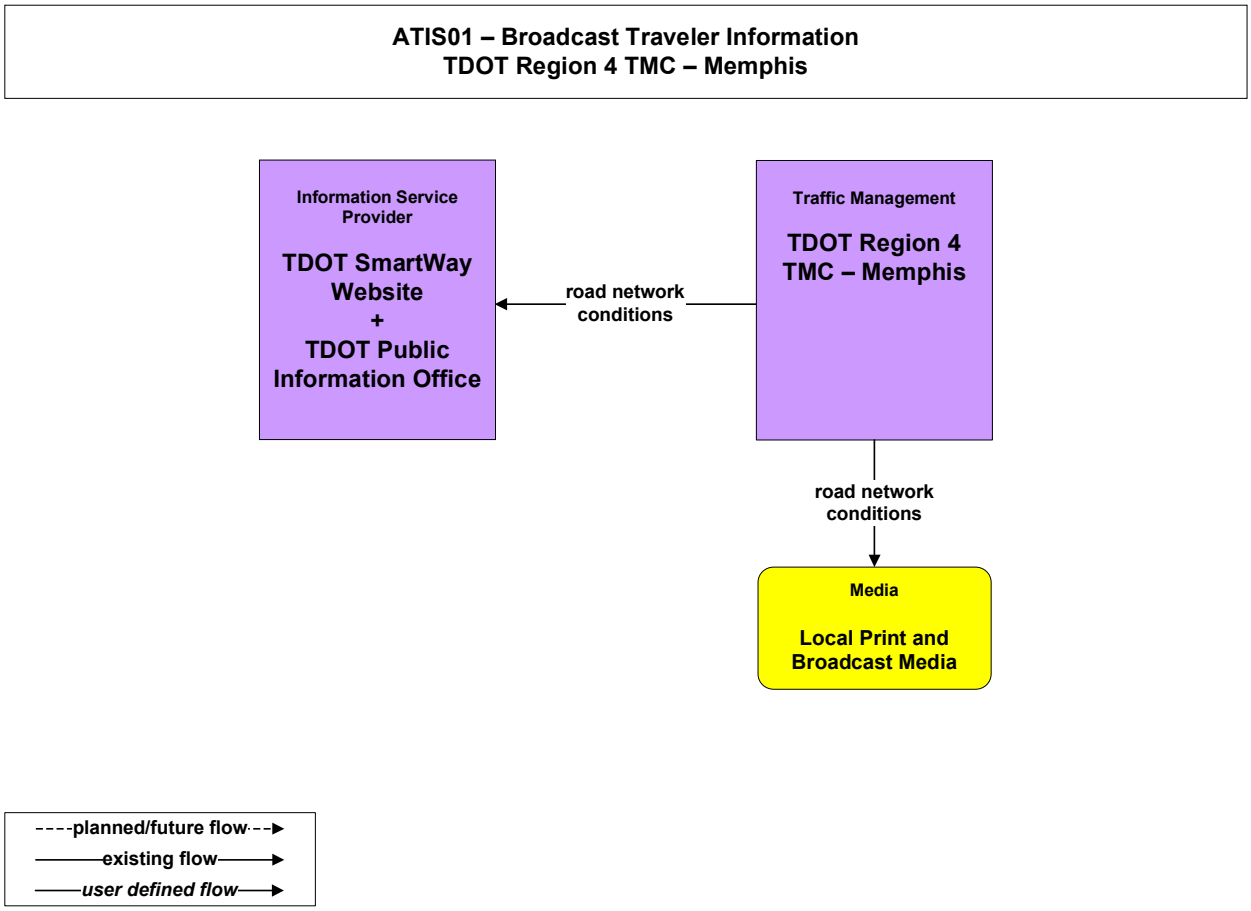


APTS10 – Transit Passenger Counting
Memphis Area Transit Authority

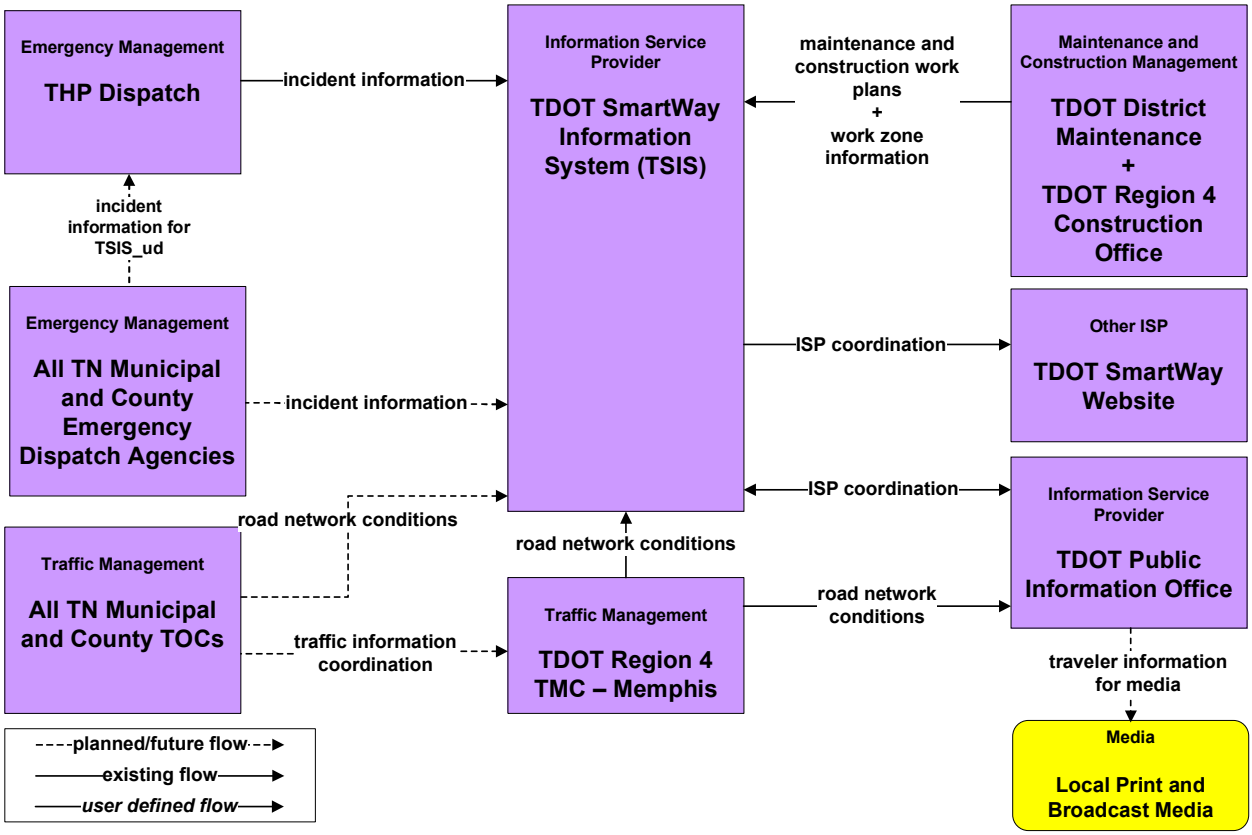




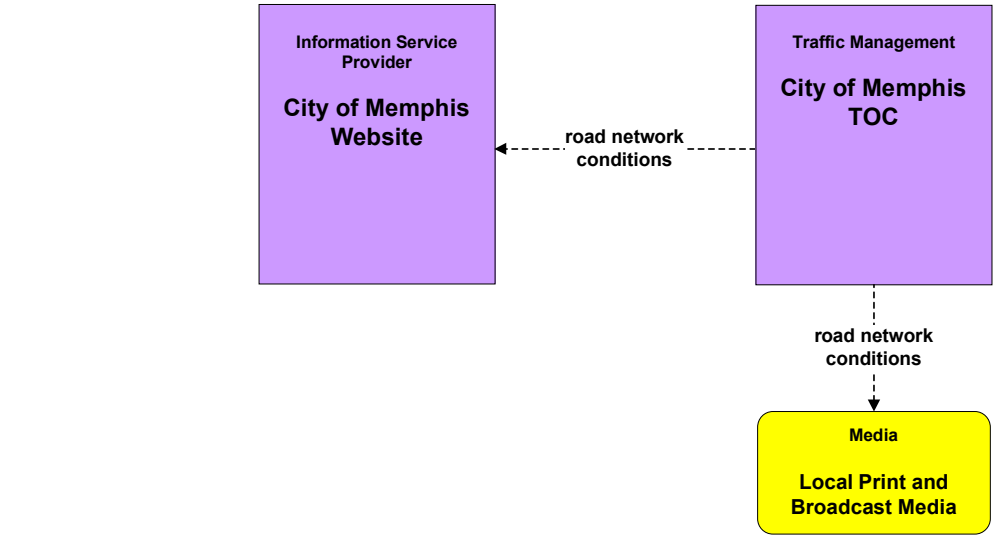
Advanced Traveler Information System



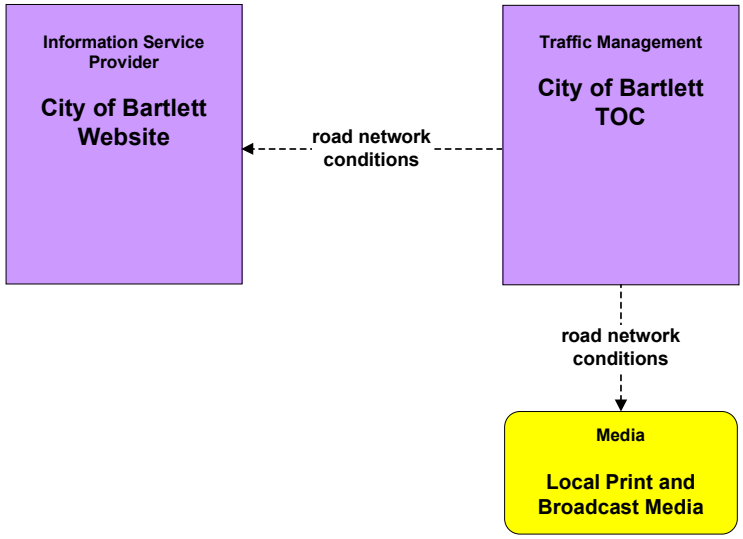
ATIS01 – Broadcast Traveler Information
TSIS

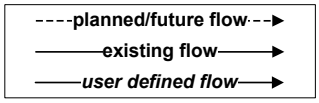


ATIS01 – Broadcast Traveler Information
City of Memphis

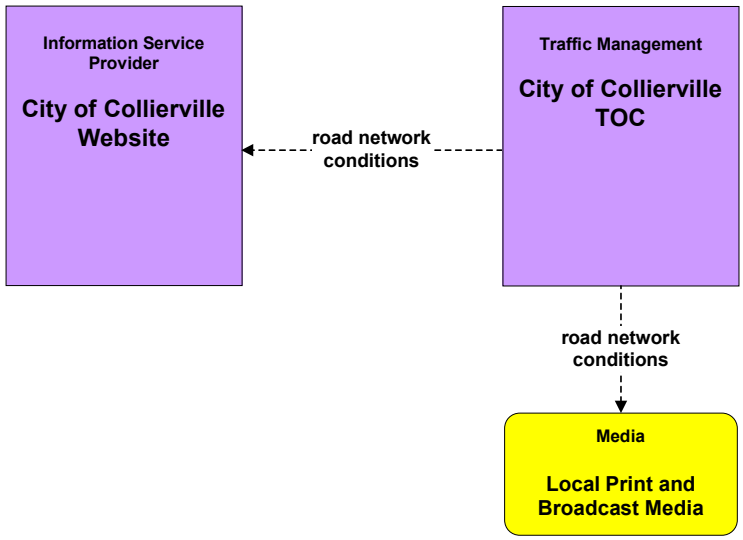


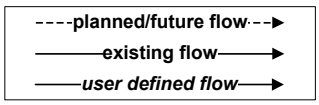
ATIS01 – Broadcast Traveler Information
City of Bartlett



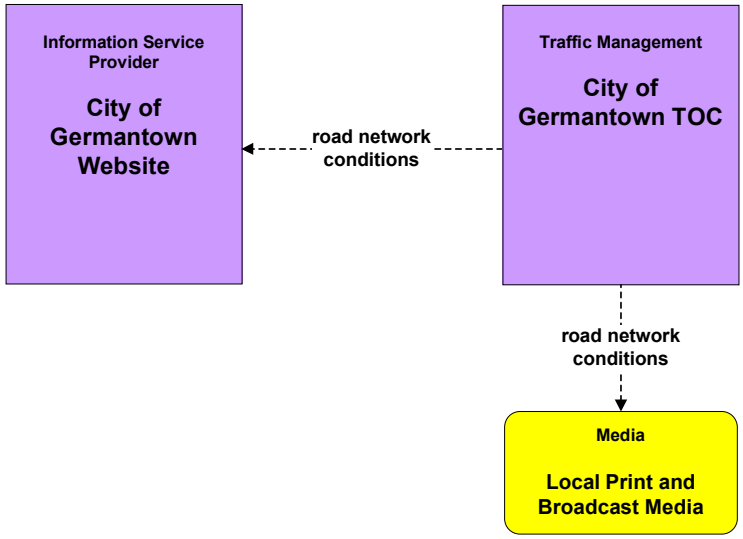


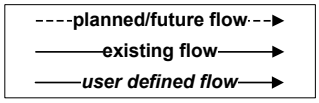
ATIS01 – Broadcast Traveler Information
City of Collierville



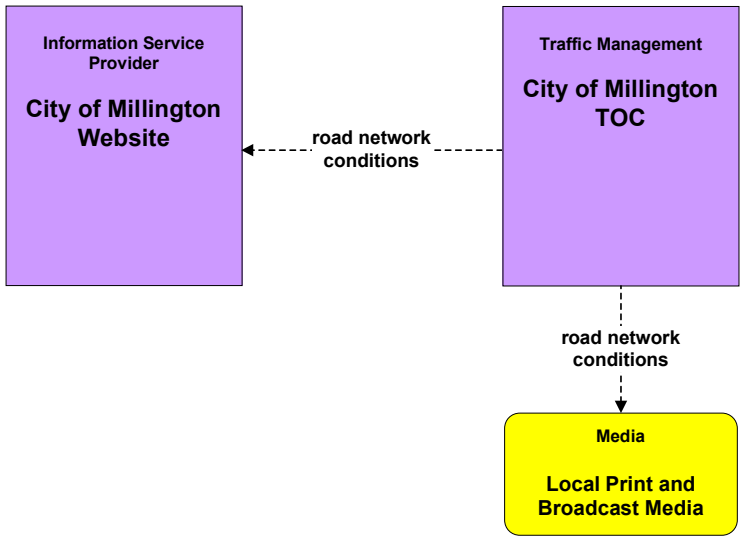


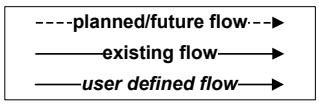
ATIS01 – Broadcast Traveler Information
City of Germantown



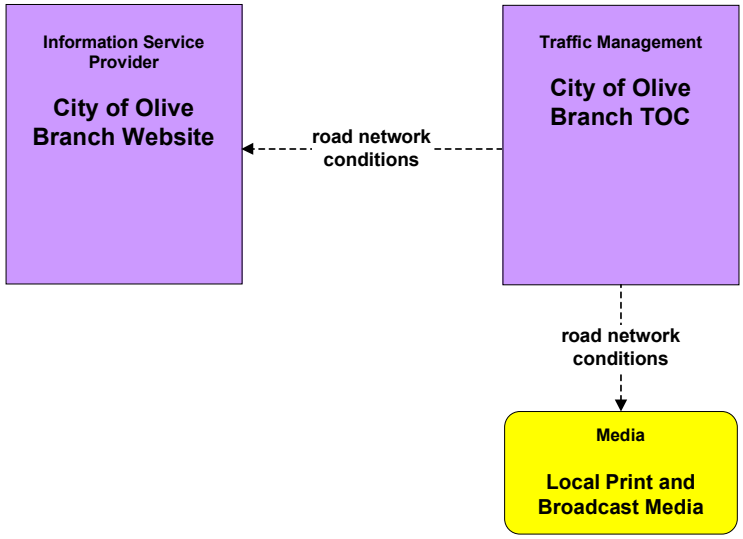


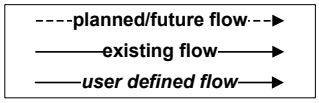
ATIS01 – Broadcast Traveler Information
City of Millington



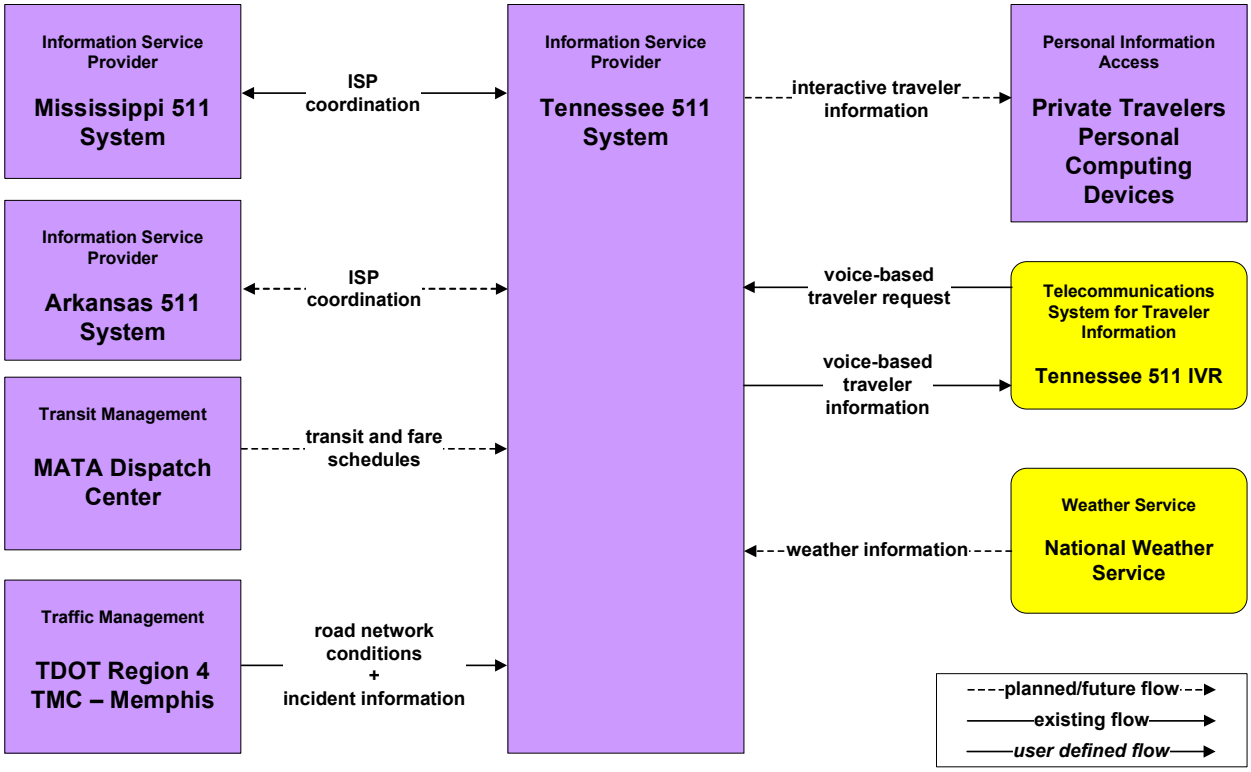


ATIS01 – Broadcast Traveler Information
City of Olive Branch

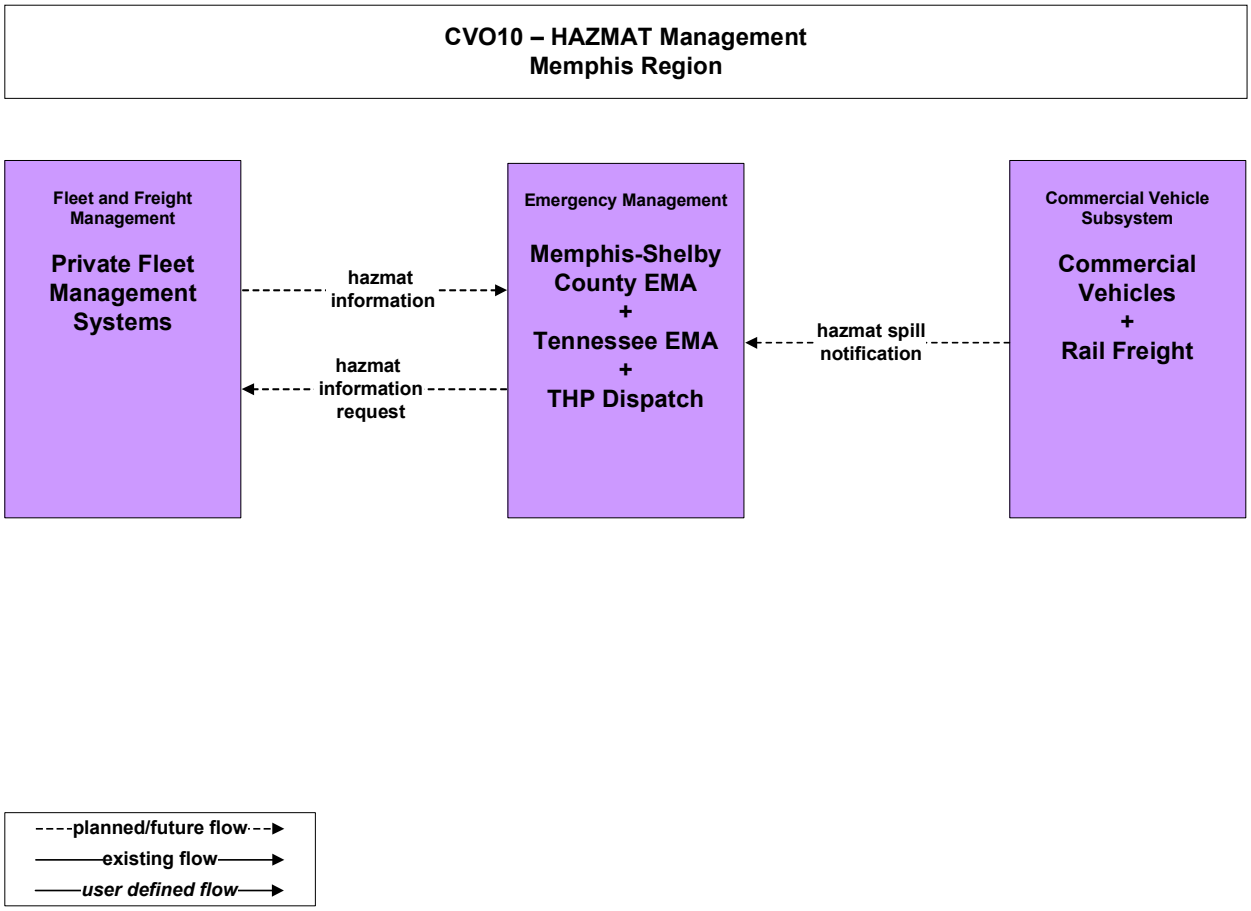




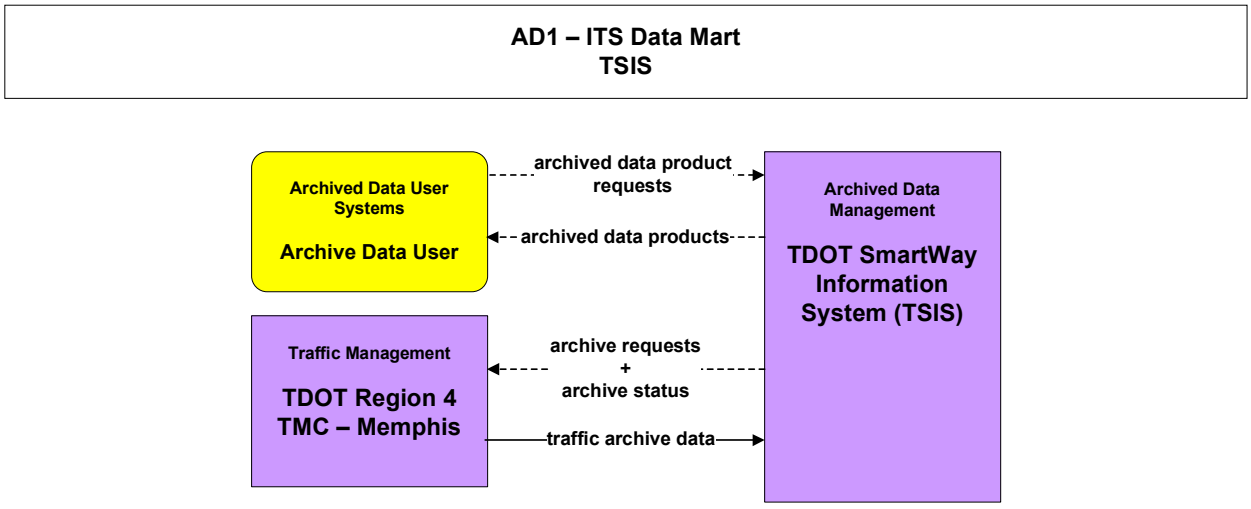
ATIS02 – Interactive Traveler Information
Tennessee 511

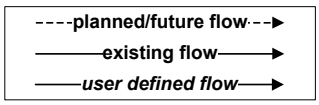


Commercial Vehicle Operations

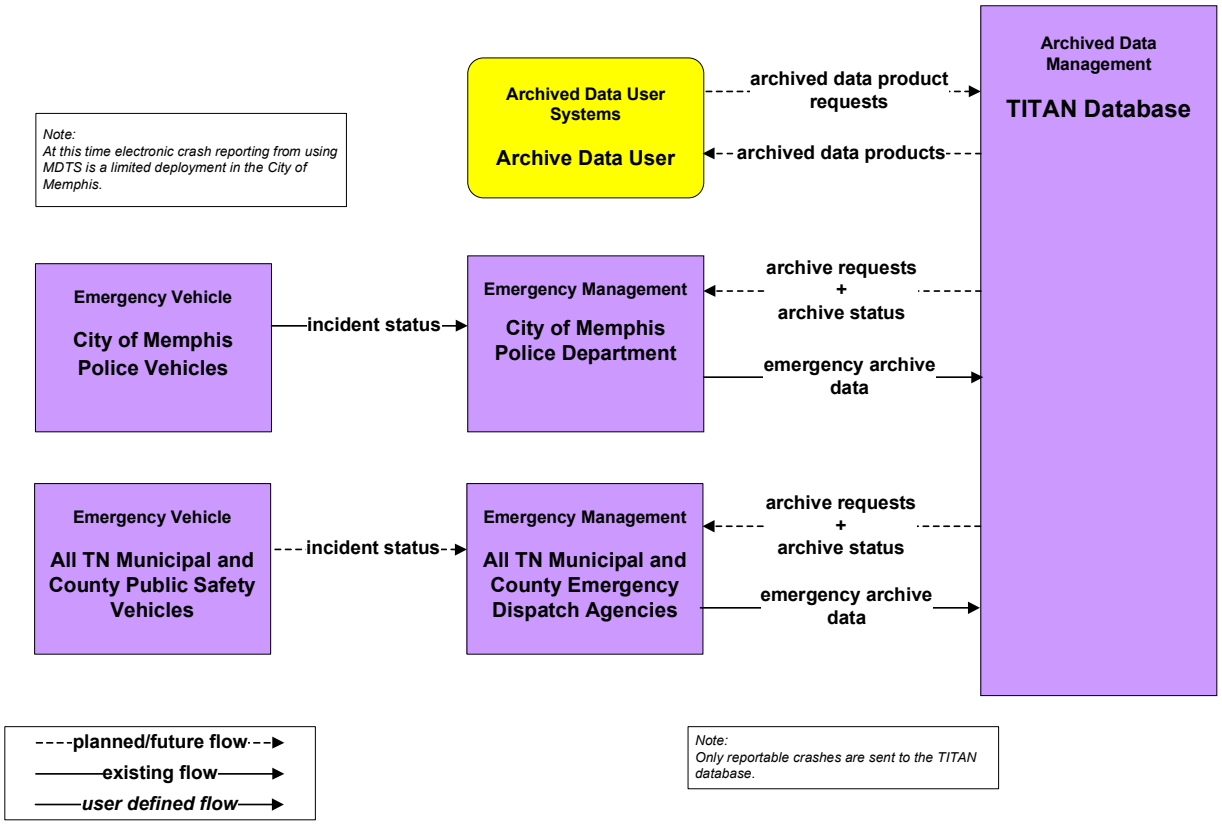


Archived Data

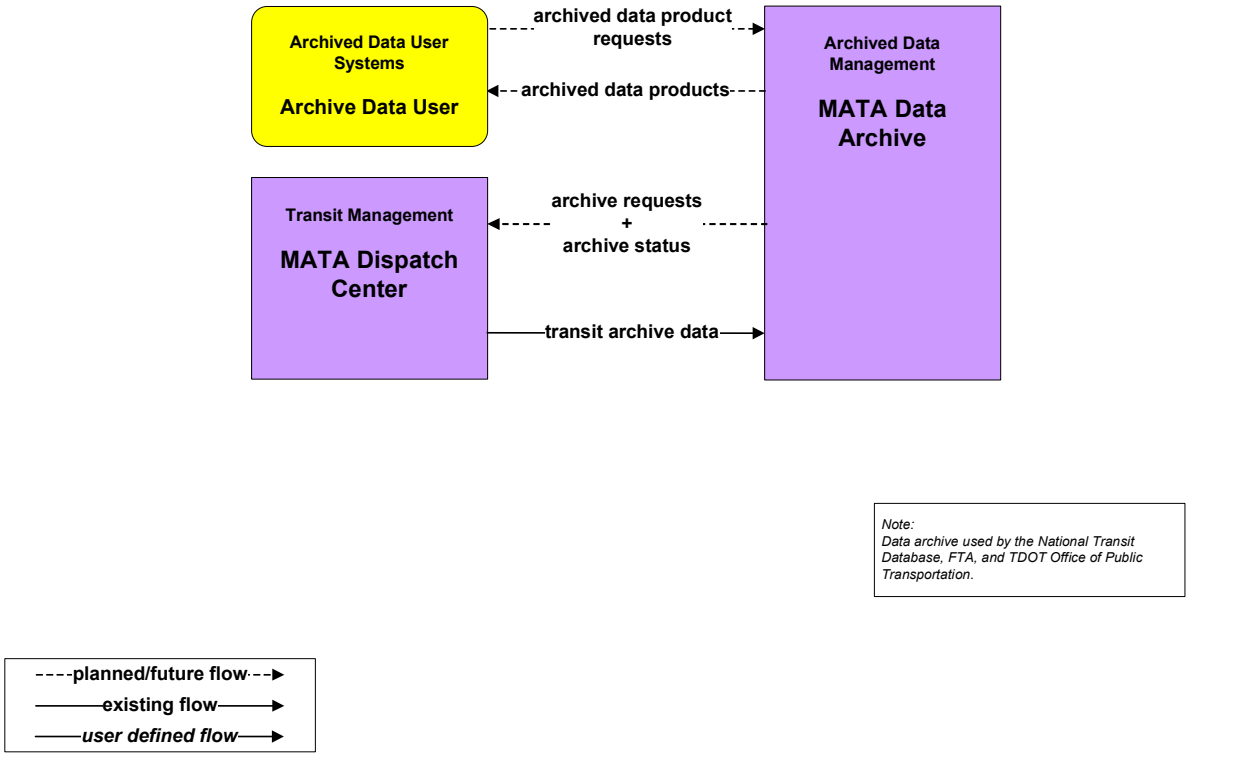




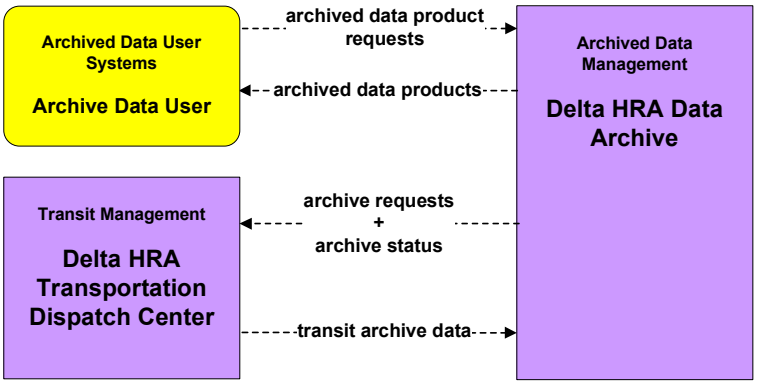
AD1 – ITS Data Mart
TITAN



AD1 – ITS Data Mart
Memphis Area Transit Authority



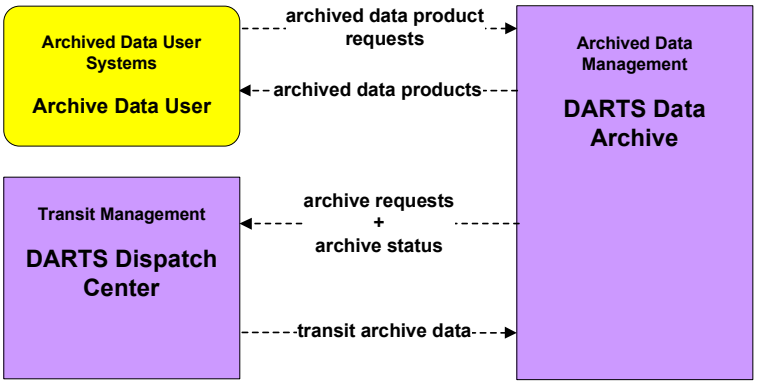
AD1 – ITS Data Mart
Delta HRA Transportation



Note:
Data archive used by the National Transit Database, FTA, and TDOT Office of Public Transportation.

planned/future flow
existing flow
user defined flow

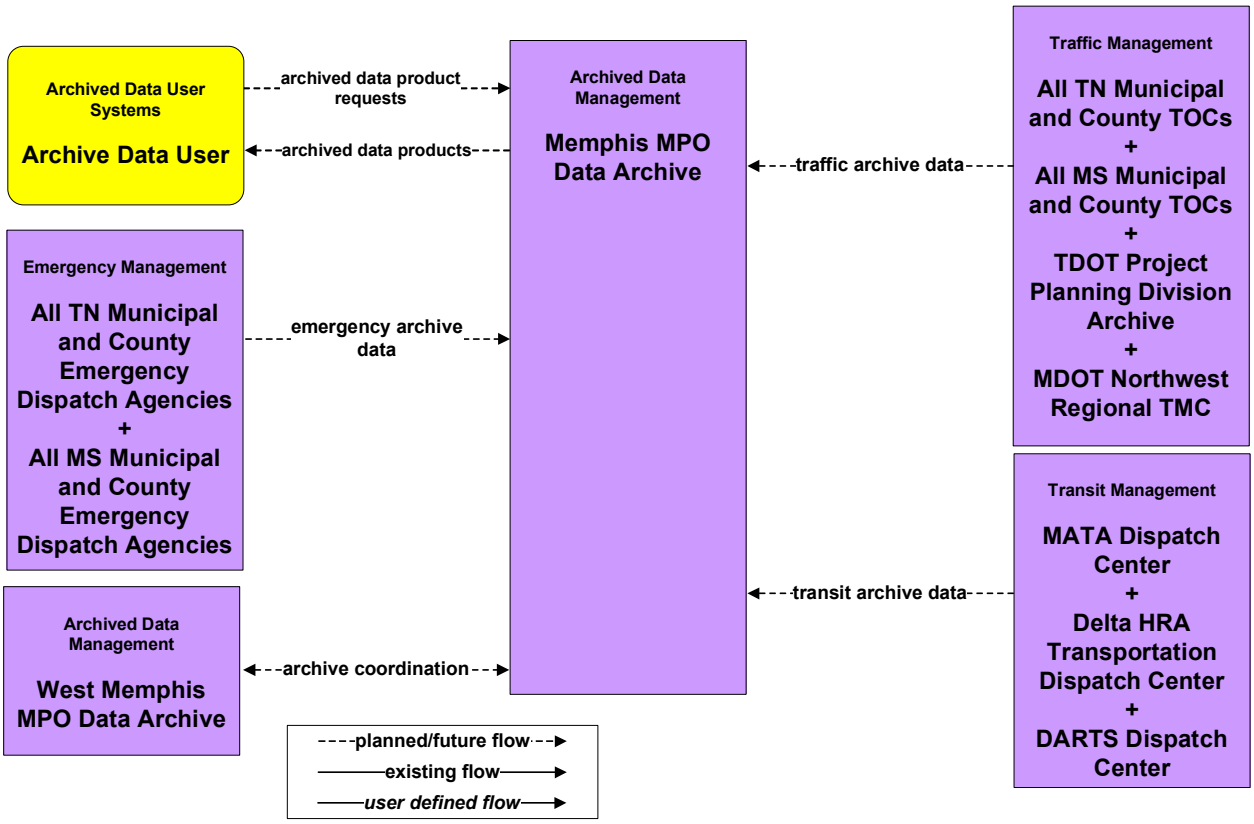
AD1 – ITS Data Mart
DARTS



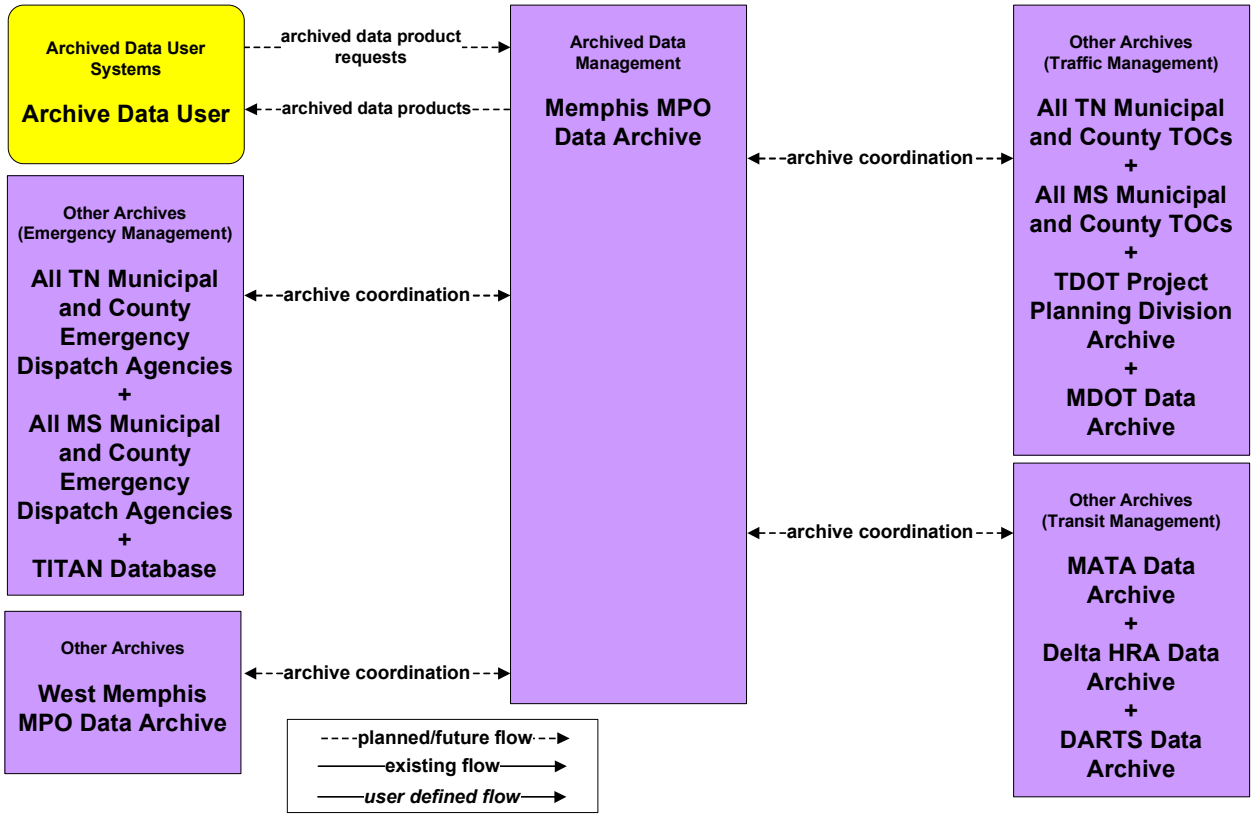
Note:
Data archive used by the National Transit Database, FTA, and MDOT

planned/future flow
existing flow
user defined flow

AD2 – ITS Data Warehouse
Memphis MPO



AD3 – ITS Virtual Data Warehouse
Memphis MPO



APPENDIX C – ELEMENT FUNCTIONS

Element Name	Equipment Package (Function)
AHTD Crittenden County Local TOC	TMC Regional Traffic Management
AHTD District 1 TMC	TMC Regional Traffic Management
AHTD District Maintenance	MCM Work Activity Coordination
AHTD Statewide TMC	TMC Regional Traffic Management
Arkansas 511 System	ISP Traveler Data Collection
	ISP Traveler Information Alerts
	Interactive Infrastructure Information
	Traveler Telephone Information
Arkansas DEM	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
Arkansas State Police	Emergency Call-Taking
	Emergency Dispatch
	Incident Command
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
City of Bartlett CCTV Cameras	Roadway Basic Surveillance
City of Bartlett DMS	Roadway Traffic Information Dissemination
City of Bartlett Field Sensors	Roadway Basic Surveillance
	Standard Rail Crossing
	Roadway Equipment Coordination
City of Bartlett Fire/EMS Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Bartlett Police Department	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
City of Bartlett Police Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Bartlett Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
City of Bartlett Speed Monitoring Equipment	Roadway Speed Monitoring
City of Bartlett TOC	Collect Traffic Surveillance

Element Name	Equipment Package (Function)
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	HRI Traffic Management
	TMC Speed Monitoring
	Traffic Maintenance
City of Bartlett Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
City of Bartlett Website	ISP Traveler Data Collection
	Basic Information Broadcast
City of Collierville CCTV Cameras	Roadway Basic Surveillance
City of Collierville DMS	Roadway Traffic Information Dissemination
City of Collierville Field Sensors	Roadway Basic Surveillance
	Standard Rail Crossing
	Roadway Equipment Coordination
City of Collierville Fire Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Collierville Police Department	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
City of Collierville Police Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Collierville Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
City of Collierville Speed Monitoring Equipment	Roadway Speed Monitoring
City of Collierville TOC	Collect Traffic Surveillance
	TMC Signal Control

Element Name	Equipment Package (Function)
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	HRI Traffic Management
	TMC Speed Monitoring
	Traffic Maintenance
City of Collierville Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
City of Collierville Website	ISP Traveler Data Collection
	Basic Information Broadcast
City of Germantown CCTV Cameras	Roadway Basic Surveillance
City of Germantown DMS	Roadway Traffic Information Dissemination
City of Germantown Field Sensors	Roadway Basic Surveillance
	Standard Rail Crossing
	Roadway Equipment Coordination
City of Germantown Fire Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Germantown Police Department	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
City of Germantown Police Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Germantown Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
City of Germantown Speed Monitoring Equipment	Roadway Speed Monitoring
City of Germantown TOC	Collect Traffic Surveillance
	TMC Signal Control

Element Name	Equipment Package (Function)
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	HRI Traffic Management
	TMC Speed Monitoring
	Traffic Maintenance
City of Germantown Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
City of Germantown Website	ISP Traveler Data Collection
	Basic Information Broadcast
City of Horn Lake 911 Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Emergency Response Management
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
City of Horn Lake Fire/EMS Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Horn Lake Police Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Horn Lake Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
City of Horn Lake TOC	Collect Traffic Surveillance
	TMC Signal Control
	TMC Regional Traffic Management
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	HRI Traffic Management
	Traffic Maintenance
City of Horn Lake Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Signal Priority

Element Name	Equipment Package (Function)
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
City of Memphis Arterial Emergency Response Dispatch	Service Patrol Management
City of Memphis Arterial Emergency Response Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Memphis CCTV Cameras	Roadway Basic Surveillance
City of Memphis DMS	Roadway Traffic Information Dissemination
City of Memphis Engineering Division	MCM Vehicle Tracking
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Work Zone Management
	MCM Work Activity Coordination
City of Memphis Field Sensors	Roadway Basic Surveillance
	Standard Rail Crossing
	Roadway Equipment Coordination
City of Memphis Fire/EMS Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Memphis Parking Management System	Parking Coordination
City of Memphis Police Department	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
	Emergency Data Collection
City of Memphis Police Portable DMS	Roadway Work Zone Traffic Control
City of Memphis Police Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Memphis Public Works Division	MCM Vehicle Tracking
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Work Zone Management
	MCM Work Activity Coordination

Element Name	Equipment Package (Function)
City of Memphis Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
City of Memphis Service Vehicles	MCV Vehicle Location Tracking
	MCV Work Zone Support
City of Memphis Speed Monitoring Equipment	Roadway Speed Monitoring
City of Memphis TOC	Collect Traffic Surveillance
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	HRI Traffic Management
	TMC Speed Monitoring
	Traffic Maintenance
	TMC Work Zone Traffic Management
	TMC Multimodal Coordination
City of Memphis Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
City of Memphis Website	ISP Traveler Data Collection
	Basic Information Broadcast
City of Millington CCTV Cameras	Roadway Basic Surveillance
City of Millington DMS	Roadway Traffic Information Dissemination
City of Millington Field Sensors	Roadway Basic Surveillance
	Standard Rail Crossing
	Roadway Equipment Coordination
City of Millington Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
City of Millington Speed Monitoring Equipment	Roadway Speed Monitoring
City of Millington TOC	Collect Traffic Surveillance
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support

Element Name	Equipment Package (Function)
	HRI Traffic Management
	TMC Speed Monitoring
	Traffic Maintenance
City of Millington Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
City of Millington Website	ISP Traveler Data Collection
	Basic Information Broadcast
City of Olive Branch CCTV Cameras	Roadway Basic Surveillance
City of Olive Branch DMS	Roadway Traffic Information Dissemination
City of Olive Branch Emergency Communications Center	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
City of Olive Branch Field Sensors	Roadway Basic Surveillance
	Roadway Equipment Coordination
City of Olive Branch Fire/EMS Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Olive Branch Police Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Olive Branch Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
City of Olive Branch TOC	Collect Traffic Surveillance
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	HRI Traffic Management
	Traffic Maintenance
City of Olive Branch Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls

Element Name	Equipment Package (Function)
	Roadway Signal Priority
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
City of Olive Branch Website	ISP Traveler Data Collection
	Basic Information Broadcast
City of Southaven Fire/EMS Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Southaven Police Department	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Emergency Response Management
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
City of Southaven Police Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
City of Southaven Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
City of Southaven Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
City of West Memphis TOC	TMC Regional Traffic Management
Commercial Vehicles	On-board Cargo Monitoring
DARTS Data Archive	ITS Data Repository
	Traffic and Roadside Data Archival
	Government Reporting Systems Support
	Virtual Data Warehouse Services
DARTS Demand Response Vehicles	On-board Transit Trip Monitoring
	On-board Schedule Management
	On-board Paratransit Operations
	On-board Transit Security
	On-board Maintenance
DARTS Dispatch Center	Transit Center Vehicle Tracking
	Transit Center Paratransit Operations
	Transit Center Security
	Transit Vehicle Operator Assignment

Element Name	Equipment Package (Function)
	Transit Garage Maintenance
	Transit Vehicle Assignment
	Transit Center Multi-Modal Coordination
	Transit Evacuation Support
	Transit Data Collection
DARTS Transit Facility CCTV Camera Surveillance	Field Secure Area Sensor Monitoring
	Field Secure Area Surveillance
Delta HRA Data Archive	ITS Data Repository
	Traffic and Roadside Data Archival
	Government Reporting Systems Support
	Virtual Data Warehouse Services
Delta HRA Demand Response Vehicles	On-board Transit Trip Monitoring
	On-board Schedule Management
	On-board Paratransit Operations
	On-board Transit Security
	On-board Maintenance
Delta HRA Transit Facility CCTV Camera Surveillance	Field Secure Area Sensor Monitoring
	Field Secure Area Surveillance
Delta HRA Transportation Dispatch Center	Transit Center Vehicle Tracking
	Transit Center Paratransit Operations
	Transit Center Security
	Transit Vehicle Operator Assignment
	Transit Garage Maintenance
	Transit Vehicle Assignment
	Transit Center Multi-Modal Coordination
	Transit Evacuation Support
	Transit Data Collection
DeSoto County E-911	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Emergency Response Management
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
DeSoto County EMA	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
DeSoto County EMS Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing

Element Name	Equipment Package (Function)
DeSoto County EMS Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
DeSoto County Sheriff Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
Fayette County EMA	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
Fayette County EMS Dispatch	Emergency Call-Taking
	Emergency Dispatch
Fayette County EMS Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
Fayette County Sheriff	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
Fayette County Sheriff Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
Greater Memphis Regional Express Bus Dispatch Center	Transit Center Vehicle Tracking
	Transit Center Fixed-Route Operations
	Transit Center Multi-Modal Coordination
MATA Bus Arrival Status Boards	Remote Transit Information Services
MATA Data Archive	ITS Data Repository
	Traffic and Roadside Data Archival
	Government Reporting Systems Support
	Virtual Data Warehouse Services
MATA Dispatch Center	Transit Center Vehicle Tracking
	Transit Center Fixed-Route Operations
	Transit Center Paratransit Operations
	Transit Center Fare Management
	Transit Center Passenger Counting
	Transit Center Signal Priority
	Transit Center Security
	Transit Vehicle Operator Assignment
	Transit Garage Maintenance
	Transit Vehicle Assignment

Element Name	Equipment Package (Function)
	Transit Center Information Services
	Transit Environmental Monitoring
	Transit Center Multi-Modal Coordination
	Transit Evacuation Support
	Transit Data Collection
	Transit Transportation Operations Data Collection
MATA Fare Collection Kiosks	Remote Transit Fare Management
MATA Fixed-Route Vehicles	On-board Transit Trip Monitoring
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Passenger Counting
	On-board Transit Security
	On-board Maintenance
	On-board Transit Information Services
MATA Paratransit Vehicles	On-board Transit Trip Monitoring
	On-board Paratransit Operations
MATA Transit Facility CCTV Surveillance	Field Secure Area Sensor Monitoring
	Field Secure Area Surveillance
MATA Trolleys	On-board Transit Trip Monitoring
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Signal Priority
MATA Website	ISP Traveler Data Collection
	Infrastructure Provided Trip Planning
MDOT CCTV Cameras	Roadway Basic Surveillance
MDOT Data Archive	ITS Data Repository
	Virtual Data Warehouse Services
MDOT District 2 Maintenance	MCM Vehicle Tracking
	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Work Zone Management
	MCM Work Activity Coordination
MDOT DMS	Roadway Traffic Information Dissemination
MDOT Emergency Services Coordinator	MCM Incident Management
	MCM Roadway Maintenance and Construction
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support

Element Name	Equipment Package (Function)
MDOT Field Sensors	Roadway Basic Surveillance
	Roadway Equipment Coordination
MDOT HAR	Roadway Traffic Information Dissemination
MDOT Maintenance Vehicles	MCV Vehicle Location Tracking
	MCV Work Zone Support
MDOT Northwest Regional TMC	Collect Traffic Surveillance
	TMC Signal Control
	TMC Freeway Management
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	HRI Traffic Management
	Traffic Maintenance
	TMC Work Zone Traffic Management
	Traffic Data Collection
MDOT Portable DMS	Roadway Work Zone Traffic Control
MDOT RWIS Sensors	Roadway Environmental Monitoring
MDOT Smart Work Zone Equipment	Roadway Work Zone Traffic Control
MDOT Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
Memphis and Shelby County Health Department Emissions Sensors	Roadway Emissions Monitoring
Memphis and Shelby County Health Department Pollution Control	Emissions Data Management
Memphis MPO Data Archive	ITS Data Repository
	Government Reporting Systems Support
	On-Line Analysis and Mining
	Virtual Data Warehouse Services
Memphis-Shelby County EMA	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
	Mayday Support
	Emergency Commercial Vehicle Response
MHP Dispatch	Emergency Call-Taking
	Emergency Dispatch

Element Name	Equipment Package (Function)
	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
MHP Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
Mississippi 511 System	ISP Traveler Data Collection
	ISP Traveler Information Alerts
	Interactive Infrastructure Information
	Traveler Telephone Information
	ISP Emergency Traveler Information
Mississippi EMA	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
msTraffic Website	ISP Traveler Data Collection
	Basic Information Broadcast
	ISP Emergency Traveler Information
Municipal Arterial Emergency Response Dispatch	Service Patrol Management
Municipal Arterial Emergency Response Vehicles	On-board EV En Route Support
Municipal CCTV Cameras	Roadway Basic Surveillance
Municipal Field Sensors	Roadway Basic Surveillance
	Roadway Equipment Coordination
Municipal Public Safety Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Emergency Response Management
	Emergency Evacuation Support
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
Municipal Public Safety Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
Municipal Rail Notification System	Standard Rail Crossing
Municipal TOC	Collect Traffic Surveillance
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	HRI Traffic Management

Element Name	Equipment Package (Function)
	Traffic Maintenance
Municipal Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
	Advanced Rail Crossing
	Roadway Equipment Coordination
Municipal/County Maintenance	MCM Vehicle Tracking
	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Work Zone Management
	MCM Work Activity Coordination
Municipal/County Maintenance Vehicles	MCV Vehicle Location Tracking
	MCV Work Zone Support
Municipal/County Portable DMS	Roadway Work Zone Traffic Control
Municipal/County RWIS Sensors	Roadway Environmental Monitoring
Other MDOT District Construction and Maintenance Offices	MCM Work Activity Coordination
Other Municipal/County Maintenance	MCM Work Activity Coordination
Other TDOT Region Construction and Maintenance Offices	MCM Work Activity Coordination
Private Contract EMS Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
Private Fleet Management Systems	Commercial Vehicle and Freight Security
	Fleet HAZMAT Management
Private Probe Data Provider	ISP Traveler Data Collection
	ISP Probe Information Collection
Private Transit Information Provider	ISP Traveler Data Collection
	Infrastructure Provided Trip Planning
Private Transportation Providers	Transit Center Multi-Modal Coordination
Private Travelers Personal Computing Devices	Personal Interactive Information Reception
Private Vehicles	Vehicle Location Determination
	Vehicle Toll/Parking Interface
	Vehicle Traffic Probe Support
Rail Freight	On-board Cargo Monitoring
Regional Express Bus Vehicles	On-board Transit Trip Monitoring
	On-board Schedule Management
Shelby County Fire Department	Emergency Call-Taking
	Emergency Dispatch

Element Name	Equipment Package (Function)
	Emergency Routing
Shelby County Fire Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
Shelby County Sheriff	Emergency Call-Taking
	Emergency Dispatch
	Incident Command
	Emergency Response Management
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Center Secure Area Alarm Support
Shelby County Sheriff Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
Shelby County TOC	Collect Traffic Surveillance
	TMC Signal Control
	TMC Freeway Management
	TMC Regional Traffic Management
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	Traffic Maintenance
Shelby County Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Controls
	Roadway Equipment Coordination
Southwest HRA Transportation Dispatch Center	Transit Center Multi-Modal Coordination
TDOT Automated Roadway Treatment Equipment	Roadway Traffic Information Dissemination
	Roadway Automated Treatment
TDOT CCTV Cameras	Roadway Basic Surveillance
TDOT District Maintenance	MCM Incident Management
TDOT DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
TDOT Emergency Services Coordinator	MCM Incident Management
	MCM Roadway Maintenance and Construction
TDOT Field Sensors	Roadway Basic Surveillance
TDOT HAR	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
TDOT HELP Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
TDOT Infrastructure Monitoring Sensors	Roadway Infrastructure Monitoring
TDOT Maintenance Headquarters	MCM Environmental Information Collection
	MCM Environmental Information Processing

Element Name	Equipment Package (Function)
TDOT Maintenance Vehicles	MCV Vehicle Location Tracking
	MCV Winter Maintenance
	MCV Work Zone Support
TDOT Project Planning Division Archive	Traffic Data Collection
TDOT Public Information Office	ISP Traveler Data Collection
	Basic Information Broadcast
TDOT Ramp Metering Equipment	Roadway Basic Surveillance
	Roadway Freeway Control
	Roadway Traffic Information Dissemination
	Roadway Equipment Coordination
TDOT Region 1 TMC - Knoxville	TMC Regional Traffic Management
TDOT Region 2 TMC - Chattanooga	TMC Regional Traffic Management
TDOT Region 3 TMC - Nashville	TMC Regional Traffic Management
TDOT Region 4	Toll Administration
TDOT Region 4 Backup TMC - Jackson	TMC Freeway Management
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Evacuation Support
	TMC Work Zone Traffic Management
TDOT Region 4 Construction Office	MCM Work Activity Coordination
TDOT Region 4 HELP Dispatch	Service Patrol Management
TDOT Region 4 Maintenance	MCM Vehicle Tracking
	MCM Automated Treatment System Control
	MCM Incident Management
	MCM Winter Maintenance Management
	MCM Roadway Maintenance and Construction
	MCM Work Zone Management
	MCM Work Activity Coordination
TDOT Region 4 Smart Work Zone Equipment	Roadway Work Zone Traffic Control
TDOT Region 4 TMC - Memphis	MCM Environmental Information Processing
	MCM Data Collection
	Collect Traffic Surveillance
	TMC Probe Information Collection
	TMC Freeway Management
	TMC Traffic Information Dissemination
	TMC Regional Traffic Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication

Element Name	Equipment Package (Function)
	TMC Evacuation Support
	Traffic Maintenance
	TMC Work Zone Traffic Management
	Traffic Data Collection
TDOT RWIS Sensors	Roadway Environmental Monitoring
TDOT SmartWay Information System (TSIS)	ISP Traveler Data Collection
	Basic Information Broadcast
	ISP Emergency Traveler Information
	ISP Data Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Work Zone Management
	MCM Work Activity Coordination
	MCM Data Collection
TDOT SmartWay Website	ISP Traveler Data Collection
	Basic Information Broadcast
	ISP Emergency Traveler Information
TDOT Toll Plazas	Toll Plaza Toll Collection
Tennessee 511 System	ISP Traveler Data Collection
	ISP Traveler Information Alerts
	Interactive Infrastructure Information
	Traveler Telephone Information
	ISP Emergency Traveler Information
Tennessee Bureau of Investigation	Incident Command
Tennessee EMA	Incident Command
	Emergency Response Management
	Emergency Evacuation Support
	Mayday Support
	Emergency Commercial Vehicle Response
THP Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Routing
	Incident Command
	Emergency Early Warning System
	Emergency Response Management
	Emergency Evacuation Support
	Emergency Environmental Monitoring
	Center Secure Area Surveillance
	Center Secure Area Sensor Management
	Mayday Support

Element Name	Equipment Package (Function)
	Emergency Commercial Vehicle Response
THP Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
TITAN Database	ITS Data Repository
	Government Reporting Systems Support
	Virtual Data Warehouse Services
West Memphis MPO Data Archive	ITS Data Repository
	Government Reporting Systems Support
	On-Line Analysis and Mining
	Virtual Data Warehouse Services

APPENDIX D – STAKEHOLDER DATABASE

Memphis Urban Area Regional ITS Architecture Stakeholder Attendance Record

	Invitees		Workshop Attendance			
Organization	**First Name**	**Last Name**	**Kick-Off**	**ITS Architecture**	**ITS Deployment Plan**	**Comment Res**
Arkansas Highway Patrol	Nathaniel	Jackson	☐	☐	☐	☐
Arkansas State Highway & Transportation Department	Ray	Woodruff	☐	☐	☐	☐
Arkansas State Highway & Transportation Department	Gary	Bennett	☑	☐	☐	☐
Arkansas State Highway and Transportation Department	Dorothy	Rhodes	☑	☑	☑	☑
Arrow Transportation	Fred	Dorse	☐	☐	☐	☐
City of Bartlett	Terry	Wiggins	☑	☐	☐	☐
City of Bartlett	Gary	Rikard	☑	☐	☐	☐
City of Bartlett	Rick	McClanahan	☐	☐	☐	☐
City of Bartlett	Becky	Bailey	☑	☑	☑	☑
City of Bartlett	Bill	Yearwod	☐	☐	☐	☐
City of Germantown	Jerry	Cook	☑	☐	☐	☐
City of Germantown	Richard	Hall	☐	☐	☐	☐
City of Germantown	Dennis	Wolf	☐	☐	☐	☐
City of Germantown	Bo	Mills	☐	☐	☐	☐
City of Hernando	Mike	Riley	☐	☐	☐	☐

Organization	First Name	Last Name	Kick-Off	ITS Architecture	ITS Deployment Plan	Comment Res
City of Hernando	Bob	Barber	☐	☐	☐	☐
City of Hernando	Hubert	Jones	☐	☐	☐	☐
City of Horn Lake	David	Linville	☐	☐	☐	☐
City of Horn Lake	Rich	Kimmel	☐	☐	☐	☐
City of Horn Lake	Darryl	Whaley	☐	☐	☐	☐
City of Horn Lake	Spencer	Shields	☐	☐	☐	☐
City of Horn Lake Police Department	Tray	Rowell	☑	☐	☐	☐
City of Horn Lake Police Department	Michael	Norris	☑	☐	☐	☐
City of Lakeland	Philip	Stuckert	☐	☐	☐	☐
City of Lakeland	Claude	Talford	☐	☐	☐	☐
City of Memphis	Richard	Merrill	☐	☑	☑	☑
City of Memphis	Wain	Gaskins	☐	☐	☐	☑
City of Memphis Emergency Management Agency	Bob	Nations	☐	☐	☐	☐
City of Memphis Fire Services	Alvin	Benson	☐	☐	☐	☐
City of Memphis Police Department	John	Harvey	☐	☐	☐	☐
City of Memphis Police Department	Kenneth	Shackleford	☐	☑	☐	☐
City of Millington	Gary	Graves	☐	☐	☐	☐
City of Millington	Darek	Baskin	☑	☑	☐	☑
City of Millington	Mike	Lantrip	☑	☐	☐	☐

Organization	First Name	Last Name	Kick-Off	ITS Architecture	ITS Deployment Plan	Comment Res
City of Millington	Ray	Douglas	☐	☐	☐	☐
City of Millington	Jack	Huffman	☐	☐	☐	☐
City of Olive Branch	Steve	Bigelow	☐	☐	☐	☐
City of Olive Branch	Tim	LaFleur	☐	☐	☐	☐
City of Olive Branch	Art	Huen	☐	☐	☐	☐
City of Olive Branch	John	Eason	☐	☐	☐	☐
City of Olive Branch	BJ	Page	☐	☐	☐	☐
City of Southaven	Michael	Brackin	☐	☐	☐	☐
City of Southaven	Ray	Tarrance	☐	☐	☐	☐
City of Southaven	Ronald	Smith	☐	☐	☐	☐
City of Southaven	Tom	Long	☐	☐	☐	☐
Delta Area Rural Transit System (DARTS)	Antoinette	Gray-Brown	☐	☐	☐	☐
Delta HRA Transportation	Wesley	Fowler	☐	☐	☐	☐
DeSoto County	Bill	Rasco	☐	☐	☐	☐
DeSoto County	Andy	Swims	☐	☐	☐	☐
DeSoto County	Jim	McDougal	☐	☐	☐	☐
DeSoto County Emergency Management Agency	T.H.	Walker	☐	☐	☐	☐
Fayette County	John	Pitner	☐	☐	☐	☐
Fayette County	Bobby	Riles	☐	☐	☐	☐

Organization	First Name	Last Name	Kick-Off	ITS Architecture	ITS Deployment Plan	Comment Res
Fayette County	Esther	Sykes-Wood	☐	☐	☐	☐
Fayette County Emergency Management Agency	Ed	Gaugh	☐	☐	☐	☐
Federal Transit Authority - Region IV	Brandy	Smith	☐	☐	☐	☐
Federal Transit Authority - Region IV	Abigail	Rivera	☐	☐	☐	☐
Federal Transit Authority - Region IV	David	Schilling	☐	☐	☐	☐
FHWA - Arkansas Division	Joe	Heflin	☐	☐	☐	☐
FHWA - Arkansas Division	Gary	Dalporto	☐	☐	☑	☐
FHWA - Mississippi Division	Randal	Jansen	☐	☐	☐	☐
FHWA - Tennessee Division	Don	Gedge	☐	☑	☑	☐
Gresham, Smith and Partners	Steve	Mosher	☑	☑	☐	☐
Gresham, Smith and Partners	Gregory	Dotson	☑	☐	☐	☐
Gresham, Smith and Partners	Laura	Evans	☐	☐	☑	☐
Memphis Area RPO	Dan	Frazier	☑	☐	☑	☑
Memphis Area Transit Authority	John	Lancaster	☑	☑	☑	☑
Memphis Area Transit Authority	Tom	Fox	☐	☐	☐	☐
Memphis Inter-Faith Association (MIFA)	Ron	Jackson	☐	☐	☐	☐
Memphis Urban Area MPO	Carlos	McCloud	☑	☑	☑	☑
Memphis Urban Area MPO	Tim	Moreland	☑	☑	☑	☑
Memphis Urban Area MPO	Martha	Lott	☐	☑	☑	☑

Organization	First Name	Last Name	Kick-Off	ITS Architecture	ITS Deployment Plan	Comment Res
Memphis Urban Area MPO	Brett	Roler	☐	☑	☑	☑
Memphis Urban Area MPO	Pragati	Srivastava	☑	☑	☑	☑
Memphis Urban Area MPO	Paul	Morris	☑	☑	☑	☑
Memphis Urban Area MPO	Sajid	Hossain	☑	☑	☑	☑
Mississippi DOT	Dreher	Harris	☐	☐	☐	☐
Mississippi DOT	John	Gilligan	☐	☑	☑	☐
Mississippi DOT	Mike	Stokes	☐	☑	☐	☐
Mississippi DOT	Acey	Roberts	☐	☑	☐	☑
Mississippi Highway Patrol - District 3	Roosevelt	Howard	☐	☐	☐	☐
North Delta Planning and Development District	Fadlalla	Zein, PhD.	☐	☐	☐	☐
Premier Transportation Services	Ham	Smythe	☐	☐	☐	☐
RNR Consulting w/ MATA ITS Project Mgmt	Heshani	Jayadeva	☐	☐	☐	☑
RNR Consulting w/ MATA ITS Project Mgmt	Simeon	Ivanov	☐	☐	☐	☑
RNR Consulting w/ MATA ITS Project Mgmt	Tarak	Shah	☐	☐	☐	☑
Shelby County	Mark	Luttrell	☐	☐	☐	☐
Shelby County	Michael	Oakes	☐	☐	☐	☐
Shelby County	Clarence	Cash, Jr.	☐	☐	☐	☐
Shelby County Office of Preparedness	Cheryl	Yarbro	☐	☑	☑	☐
Shelby County Office of Preparedness	Bob	Nations, Jr.	☐	☐	☐	☐

Organization	First Name	Last Name	Kick-Off	ITS Architecture	ITS Deployment Plan	Comment Res
Shelby County Office of Preparedness	Johanna	Harrell	☐	☑	☑	☐
Shelby County Office of Preparedness	Mike	Brazzell	☑	☐	☐	☑
Southaven Taxi Company	Everett	Edlin	☐	☐	☐	☐
TDOT Long Range Planning Division	Angela	Midgett	☐	☐	☐	☐
TDOT Long Range Planning Division	Terry	Gladden	☑	☐	☑	☐
TDOT Long Range Planning Division	Mike	Presley	☑	☐	☑	☑
TDOT Region 4	Joe	Warren	☑	☑	☐	☑
TDOT Region 4	Ed	Johnson	☑	☑	☑	☑
TDOT Region 4	John	Thomas	☐	☑	☐	☐
TDOT Region 4	Michael	Rebick	☐	☑	☑	☑
TDOT Region 4	Carl	Berry	☐	☐	☐	☐
Tennessee Highway Patrol District 4	Cheryl	McNeary	☐	☐	☐	☐
Tennessee Highway Patrol District 4	Joel	Deal	☐	☐	☐	☐
Tennessee Highway Patrol District 4	Vance	Pitts	☑	☐	☐	☐
Town of Arlington	Dennis	Rutledge	☐	☐	☐	☐
Town of Arlington	Dickie	Wiseman	☐	☐	☐	☐
Town of Arlington	Steve	Hill	☐	☐	☐	☐
Town of Collierville	Wilbur	Betty	☐	☐	☐	☐
Town of Collierville	Jerry	Crawford	☐	☐	☐	☐

Organization	First Name	Last Name	Kick-Off	ITS Architecture	ITS Deployment Plan	Comment Res
Town of Collierville	Chief	Goodwin	☐	☐	☐	☐
Town of Collierville	Mark	King	☑	☐	☑	☑
Town of Collierville	Frank	McPhail	☐	☑	☐	☐
U.S. Coast Guard	James	Dixon	☐	☐	☐	☐
West Memphis MPO	Eddie	Brawley	☑	☐	☑	☑

APPENDIX E – ARCHITECTURE MAINTENANCE DOCUMENTATION FORM

Memphis Urban Area Regional ITS Architecture

ITS Architecture Maintenance Documentation Form

Please complete the following form to document changes to the 2010 Memphis Urban Area Regional ITS Architecture. Forms should be submitted to the Memphis Urban Area Metropolitan Planning Organization (MPO) for review and acceptance. All accepted changes will be kept on file by the MPO and shared with the TDOT Long Range Planning Division. Changes will be incorporated into the 2010 Memphis Urban Area Regional ITS Architecture during the next scheduled update.

Contact Information

Agency	
Agency Contact Person	
Street Address	
City	
State, Zip Code	
Telephone	
Fax	
E-Mail	

Change Information

Please indicate the type of change to the Regional ITS Architecture or Deployment Plan:

- ☐ Administrative Change: Basic changes that do not affect the structure of the ITS market packages in the Regional ITS Architecture.
  Examples include: Changes to stakeholder or element name, element status, or data flow status.
- ☐ Functional Change – Single Agency: Structural changes to the ITS market packages that impact only one agency in the Regional ITS Architecture.
  Examples include: Addition of a new ITS market package or changes to data flow connections of an existing ITS market package. The addition or changes would only impact a single agency.
- ☐ Functional Change – Multiple Agencies: Structural changes to the ITS market packages that have the potential to impact multiple agencies in the Regional ITS Architecture.
  Examples include: Addition of a new ITS market package or changes to data flow connections of an existing ITS market package. The addition or changes would impact multiple agencies and require coordination between the agencies.
- ☐ Project Change: Addition, modification, or removal of a project in the Regional ITS Deployment Plan.
- ☐ Other: _____
  _____

Submittal

Please submit ITS Architecture Maintenance Documentation form to:

Memphis Urban Area Metropolitan Planning Organization
1075 Mullins Station Road
Memphis, TN 38134
Phone: 901-379-7840
Fax: 901-379-7865

Form Submittal Date: _____

Memphis Urban Area Regional ITS Architecture

ITS Architecture Maintenance Documentation Form

Question 1 Describe the requested change to the Regional ITS Architecture or Deployment Plan.	*Example: City A is planning to deploy CCTV cameras for network surveillance on arterial streets. In the Regional ITS Architecture, the City A Traffic Operations Center (TOC) is shown as the only center controlling the CCTV cameras. The City A TOC is now planning to provide images and control of the CCTV cameras to the City A Police Department for use during incidents.*
Question 2 Are any of the Regional ITS Architecture market packages impacted by the proposed change?	☐ Yes: Please complete Questions 2A and 2B ☐ No: Please proceed to Question 3 ☐ Unknown: Please coordinate with the Memphis Urban Area MPO to determine impacts of the change to the Regional ITS Architecture
Question 2A List all of the ITS market packages impacted by the proposed change.	*Example: ATMS08 – Traffic Incident Management System* *ATMS01 – Network Surveillance*
Question 2B Include a copy of the ITS market packages impacted by the proposed change and mark any proposed modifications to the ITS market packages. Add any additional notes on proposed changes in this section.	*Example: A sketch of the ATMS08 – Traffic Incident Management System market package diagram for City A is attached. Changes have been marked by hand to indicate the new data connections that will be established to allow the City A TOC to send traffic images to the City A Police Department and for the City A Police Department to control the CCTV cameras. The deployment of the CCTV cameras will also result in several of the data flows in ATMS01 – Network Surveillance being changed from planned to existing. These have also been marked on the market package diagram. (Note: The ITS market package diagrams can be found in Appendix B of the Regional ITS Architecture.)*
Question 3 Does the proposed change impact any stakeholder agencies other than the agency completing this form?	☐ Yes: Please complete Questions 3A and 3B ☐ No: Form is complete ☐ Unknown: Please coordinate with the Memphis Urban Area MPO to determine impacts of change to other agencies in the Regional ITS Architecture
Question 3A Identify the stakeholder agencies impacted by the change and a contact person for each agency.	*Example: The City A TOC and City A Police Department are the two agencies impacted by this change. (Note: Assuming the City A TOC representative is completing this form, the contact person from the City A Police Department working on this project should be listed.)*
Question 3B Describe the coordination that has occurred with the stakeholder agencies and the results of the coordination?	*Example: The City A TOC and City A Police Department have had several meetings in the last year to discuss the operations of the arterial CCTV cameras. An operational agreement for the joint operations of the CCTV cameras is currently being developed.*