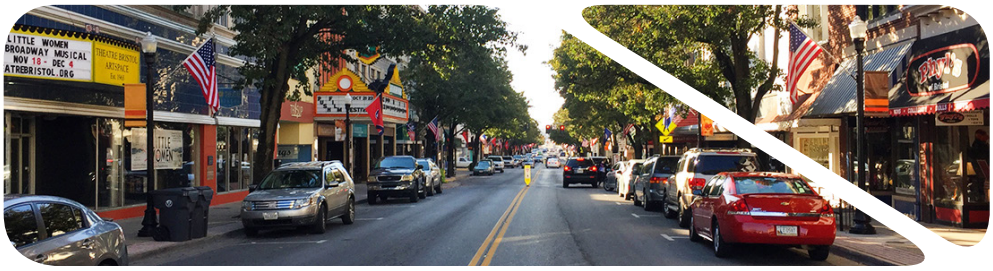
B R I S T O L

Regional Intelligent Transportation System Architecture and Deployment Plan



Prepared by:
Kimley»Horn

May 2017
118000043

Bristol

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Revised Draft

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AD	Archived Data
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
BTT	Bristol Tennessee Transit
BMS	Bristol Motor Speedway
BVT	Bristol Virginia Transit
CCTV	Closed Circuit Television
DMS	Dynamic Message Sign
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
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
IVR	Interactive Voice Response
LRTP	Long Range Transportation Plan
MC	Maintenance and Construction
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
NEMA	National Electrical Manufacturers Association

LIST OF ACRONYMS

NET Trans	Northeast Tennessee Transportation
NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol
PSAP	Public Safety Answering Point
RPO	Rural 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
SSP	Safety Service Patrol
TDOT	Tennessee Department of Transportation
TEA-21	Transportation Equity Act for the 21st Century
TEMA	Tennessee Management Emergency Agency
THP	Tennessee Highway Patrol
TIP	Transportation Improvement Program
TMC	Transportation Management Center or Traffic Management Center
TOC	Traffic Operations Center
TraCS	Traffic and Criminal Software
TSIS	TDOT SmartWay Information System
USDOT	United States Department of Transportation
VDOT	Virginia Department of Transportation
VIVDS	Video Image Vehicle Detection Systems
VSP	Virginia State Police
WAVE	Wireless Access in Vehicular Environments

1. INTRODUCTION

1.1 Project Overview

The Regional Intelligent Transportation System (ITS) Architecture provides a long-range plan for the deployment, integration, and operation of ITS in the Bristol Region. The Regional ITS Architecture allows stakeholders to plan how they would like their system to operate in the future and then break the system into smaller projects that can be implemented over time as funding permits. Development of a Regional ITS Architecture encourages interoperability and resource sharing among agencies and allows for cohesive long-range planning among regional stakeholders. Completion and update of the plan is also required by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) in order to use federal transportation funds from the highway trust fund for ITS projects within the Region.

Regional ITS Architectures are living documents and should be updated as necessary to reflect a region's needs and current guidelines. The Bristol Regional ITS Architecture was first developed in 2008 by the Tennessee Department of Transportation (TDOT), in coordination with the Bristol Metropolitan Planning Organization (MPO) and Virginia Department of Transportation (VDOT). Since that time, a number of ITS programs and projects have been implemented in the Bristol Region including VDOT's ramp queue warning system and roadway service patrols, the installation of additional closed-circuit television (CCTV) cameras, and the continued update and coordination of the City of Bristol Virginia's signal system. Additionally, the National ITS Architecture, which served as the basis for the Bristol Regional ITS Architecture, has been updated several times, with the most substantial update occurring in 2012. In order to incorporate these changes, TDOT, in close coordination with the Bristol MPO, completed an update of the Regional ITS Architecture in 2017.

The Regional ITS Architecture consists of several key components:

- ITS Needs – The needs describe the transportation related needs in the Region that could possibly be addressed by ITS.
- ITS Inventory – The inventory describes all of the ITS related elements that either exist or are planned for the Region.
- ITS Service Packages – The ITS service packages describe the services that stakeholders in the Region want ITS to provide. ITS service package diagrams have been developed to illustrate how each service will be deployed and operated by each agency in the Region that expressed interest in a particular service. In the previous version of the Bristol Regional ITS Architecture, ITS service packages were referred to as ITS market packages. The name change has been made to be consistent with the terminology that is now used in Version 7.1 of the National ITS Architecture.
- Use and Maintenance Plan – The use and maintenance plan describes how to use the Regional ITS Architecture for ITS planning and design efforts, such as the development of a Systems Engineering Analysis or to ensure that projects in the TPO's Transportation Improvement Program (TIP) conform to the architecture. It also describes how the Regional ITS Architecture should be maintained in the future.

A regional ITS architecture is 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; the Moving Ahead for Progress in the 21st Century (MAP-21) bill passed in 2012; and the Fixing America's Surface Transportation (FAST) Act bill passed in 2015. In response to Section 5206(e) of TEA-21, FHWA issued a final rule and 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 or statewide 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 Bristol Regional ITS architecture update includes the same geographic jurisdictions as the Bristol MPO Metropolitan Planning Area. The stakeholders developed the Regional ITS Architecture based on a vision of how they wanted to implement and operate ITS through the year 2040 in the Bristol Region. Additionally, the Regional ITS Architecture includes an ITS Deployment Plan. The ITS Deployment Plan identifies projects that have been recommended by the stakeholders as priority projects for their agency that will help achieve the vision of the Regional ITS Architecture.

The Bristol Regional ITS Architecture was developed with significant input from local, state, and federal officials. Two stakeholder workshops were held and individual interviews were conducted with many of the stakeholders outside of the workshops to gather input and help ensure that the plans reflected the unique needs of the Region. Copies of the draft reports were provided to all stakeholders for review during the update process. The Regional ITS Architecture and Deployment Plan developed reflects an accurate snapshot of existing ITS deployment 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 Bristol Region

1.2.1 Geographic Boundaries

The Bristol Region is comprised of eastern Sullivan County, Tennessee; central Washington County, VA; and the City of Bristol, Virginia. Additionally, the City of Bristol, Tennessee and the Town of Abingdon, Virginia are located within these boundaries. The boundaries correspond with the boundaries defined the Bristol MPO, which are shown in **Figure 1**. Bristol, Tennessee and Bristol Virginia (which share a central business district across State Street) are principal cities in a larger region known as the Tri-Cities. The other principal cities include Johnson City, TN and Kingsport, TN. Although the Tri-Cities are often referred to collectively, each city lies within a separate metropolitan or transportation planning organization.

When developing the stakeholder group, the project team coordinated with the Bristol MPO to include the appropriate city, county, regional, state and federal agencies. Stakeholders included both local representatives as well as representatives from TDOT headquarters and Region 1 in Knoxville, VDOT Bristol District, and FHWA from the Tennessee Division Office in Nashville and the Virginia Division Office in Richmond.

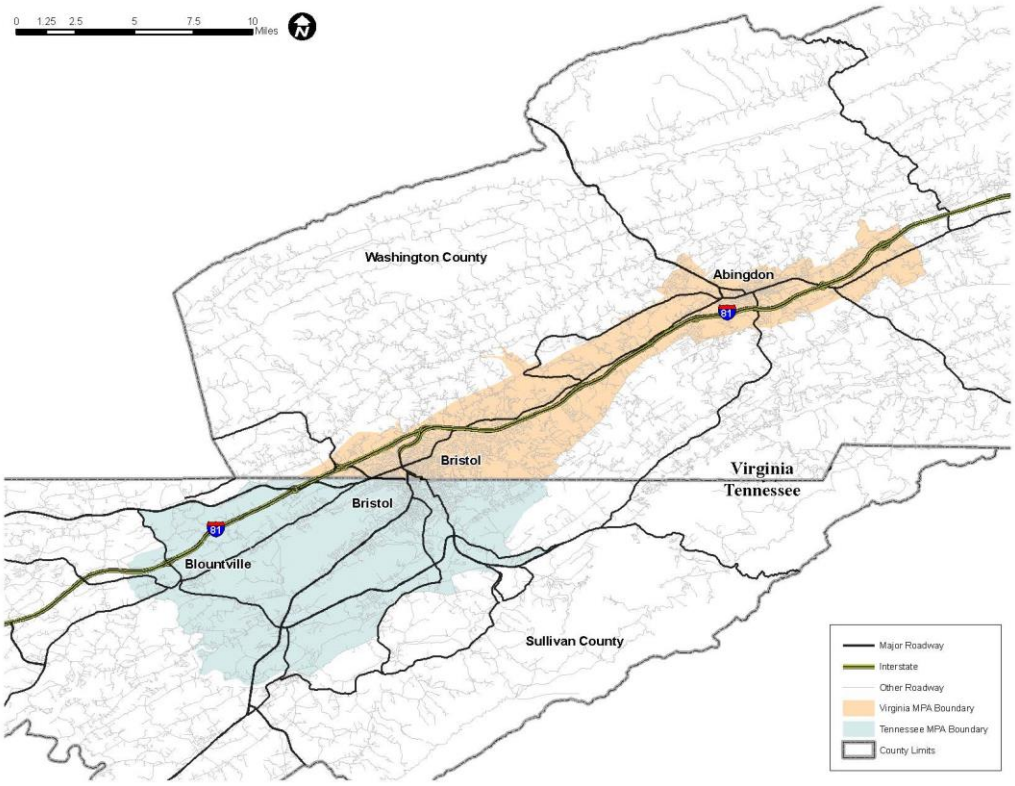


Figure 1 – Bristol Regional Boundaries

1.2.2 Transportation Infrastructure

The Bristol Region is served by multiple significant State and Federal Highways. The primary access controlled facilities are I-81 and I-381. I-81 is a north-south roadway which connects the Region with I-26 as well as Knoxville to the south and Roanoke, Virginia to the north. The I-24/I-81 interchange provides the connection between the principal cities of the Tri-Cities Region. I-381 is a short highway that connects I-81 to downtown Bristol, Virginia.

Major arterials in the Region include US 11E / US 19 (Volunteer Parkway/ Commonwealth Avenue) which is a north-south route that connects downtown Bristol, Tennessee and Virginia with Johnson City and western North Carolina to the south; US 11W which connects the Region with Kingsport to the west; US 11 which runs parallel with I-81 through much of Washington County, Virginia, toward Roanoke Virginia; and SR 394, which is an east-west route that connects I-81 to the Bristol Motor Speedway.

Bristol Motor Speedway is located within the boundaries of the Bristol MPO; located between Bluff City and Bristol, TN along US 11E / US 19. Bristol Motor Speedway seats over 160,000 people and hosts multiple National Association for Stock Car Auto Racing (NASCAR) races each year in addition to other events. These events at the speedway impact the local transportation network significantly as there are action plans to in place by multiple agency to mitigate their impact.

Fixed-Route and paratransit services are provided in the City of Bristol by the Bristol Tennessee Transit (BTT) and the Bristol Virginia Transit (BVT). Northeast Tennessee Transit (NET Trans), which is a part the First Tennessee Human Resource Agency (FTHRA), operates a demand response service in the Bristol Region. Demand response service in the

Virginia portion of the Bristol Region is operated by District Three Governmental Cooperative.

The Bristol Region is also served by one Class I railroad, operated by Norfolk Southern. Norfolk Southern's rail line traverses the western portion of the Region to connect to Knoxville in the west and central Virginia and eastern West Virginia to the north.

The Bristol Region has undertaken several deployments of ITS programs throughout the Region. These programs are from multiple agencies and cover multiple transportation modes, and multi-agency participation has been present with the implementation of some of the ITS initiatives. The following are some of the larger ITS initiatives underway or existing within the Bristol Region:

- **TDOT SmartWay Program** – TDOT's SmartWay platform is predominately a freeway traffic management platform comprised of closed-circuit television (CCTV) cameras, dynamic message signs (DMS), radar detection systems (RDS), and highway advisory radio (HAR). HAR devices are currently located along I-81 in the Bristol Region. Additionally, TDOT's SmartWay website provides congestion, incident, and construction information, in addition to live video from CCTV cameras, which could be expanded to the Bristol Region in the future. TDOT has also created the SmartView software program that allows municipalities to view live video feeds with expanded capabilities compared to the SmartWay website. SmartView will also allow municipalities to share their CCTV camera feeds with TDOT and other municipalities. Active ITS, an Advanced Traffic Management System (ATMS) platform, is also being implemented at TDOT to upgrade their current SmartWay ATMS platform and improve TDOT's ability to share information with other partners.
- **Virginia DOT –** VDOT installed CCTV cameras along I-81 which can be viewed on the Virginia 511 website along with messages on the DMS. VDOT has also deployed an over-height vehicle detection system that monitors the height of vehicles and warns drivers with flashing beacons and DMS if they are likely hit the bridge located at exit 10. Additionally, there are exits along I-81 that monitor the queues on ramps. If the queues reach a certain distance, the traffic signal that controls the ramp will clear the ramp. VDOT has also launched the VirginiaRoads website that provides the public with a vast array of transportation information including crash data, traffic volumes, roadway projects, pavement conditions, roadway projects, real-time snow plow location and more. VDOT typically owns, maintains, and operates signals along state routes and interstate ramps.

1.2.3 Project Participation

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.

Table 1 contains a listing of stakeholders in the Bristol Region who participated in the project workshops or provided input through in-person or telephone interviews to the study team as to the needs and issues to be considered as part of the Regional ITS Architecture. Other stakeholders that were invited to participate but were not able to attend were provided the minutes from the workshops and notified when copies of the 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 – Bristol Stakeholder Agencies and Contacts

Stakeholder Agency	Email	Contact
Bristol MPO	rmontgomery@bristoltn.org	Rex Montgomery Transportation Planner
City of Bristol TN	tbeavers@bristoltn.org	Time Beavers, Director of Public Works
City of Bristol VA	jdetrick@bristolva.org	Jay Detrick Transportation Planner
First Tennessee Rural Planning Organization	cosborne@ftdd.org	Corey Osborne, Planner
Federal Highway Administration – Tennessee Division	nicholas.renna@dot.gov	Nicholas Renna, Operations Program Manager
NET Trans (First Tennessee Human Resource Agency)	cgump@fthra.org	Candace Gump, NET Trans Deputy Director
Tennessee Department of Transportation Region 1	mark.best@tn.gov	Mark Best, TMC Manager
Tennessee Department of Transportation Long Range Planning Division	michelle.a.christian@tn.gov	Michelle Christian, Planning Specialist
Tennessee Department of Transportation Region 1	andrew.padgett@tn.gov	Andrew Padgett
Tennessee Department of Transportation Region 1	nathan.vatter.@tn.gov	Nathan Vatter, Civil Engineer Manager 1
Tennessee Department of Transportation Long Range Planning Division	rashad.pinckney@tn.gov	Rashad Pinkney, Planning Specialist
Tennessee Department of Transportation Long Range Planning Division	joseph.roach@tn.gov	Joseph Roach, Planning Specialist
Tennessee Department of Transportation Traffic Operations Division	eric.flora@tn.gov	Eric Flora
Tennessee Department of Transportation Traffic Operations Division	khuzaima.mahdi@tn.gov	Khuzaima Mahdi ITS Specialist
Town of Abingdon	tvencill@abingdonva.us	Tyler Vencill Civil Engineer
Virginia Department of Transportation	timl.martin@vdot.virginia.gov	Tim Martin, Regional Operations Systems Manager
Virginia Department of Transportation	donald.necessary@vdot.virgina.gov	Donny Necessary Transportation Planner
Virginia Department of Transportation	brett.randolph@vdot.virginia.gov	Brett Randolph, Acting Area Traffic Engineer

Table 1 – Bristol Stakeholder Agencies and Contacts (continued)

Stakeholder Agency	Email	Contact
Virginia Department of Transportation	brian.holt@vdot.virginia.gov	Brian Holt, Bristol Traffic Engineer
Virginia Department of Transportation	cmcdonald@vdot.virginia.gov	Chris McDonald, Regional Operations Director

1.3 Document Overview

The Bristol Regional ITS Architecture report is organized into seven key sections:

Section 1 – Introduction

This section provides an overview of the Bristol Regional ITS Architecture, including a description of the Region and list of participating stakeholders.

Section 2 – Regional ITS Architecture Development Process

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

Section 3 – Regional ITS Needs

This section contains a summary of regional needs for the Bristol Region that are related to ITS.

Section 4 – Regional ITS Inventory

This section provides a description of the stakeholders and ITS elements in the Region. Elements are grouped based on the stakeholder, such as the City of Bristol TN or Bristol VA Transit, and their current status is listed as either existing or planned.

Section 5 – Regional ITS Architecture

This section describes how the National ITS Architecture was customized to meet the ITS needs, plans, and visions for the Bristol Region. The ITS service 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 also 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 6 – Regional ITS Deployment Plan

This section describes the ITS projects that regional stakeholders expressed a need to deploy in order to deliver the ITS services identified in the regional ITS architecture. Project descriptions include a target deployment timeframe, responsible agency, an opinion of probable cost, funding status, and applicable ITS service packages.

Section 7 – Use and Maintenance of the Regional ITS Architecture

This section describes how the Regional ITS Architecture can be used 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 Bristol Regional ITS Architecture also contains six appendices:

- Appendix A – Service Package Definitions
- Appendix B – Customized Service Packages
- Appendix C – Element Functions
- Appendix D – Stakeholder Database
- Appendix E – Agreements
- Appendix F – Architecture Maintenance Documentation Form.

A corresponding website was also developed for the Bristol Regional ITS Architecture which contains electronic versions of all documents and an interactive version of the Turbo Architecture database. The website is located at the following address:

http://www.kimley-horn.com/projects/tennesseeITSarchitecture/bristol.html

2. REGIONAL ITS ARCHITECTURE DEVELOPMENT PROCESS

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

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

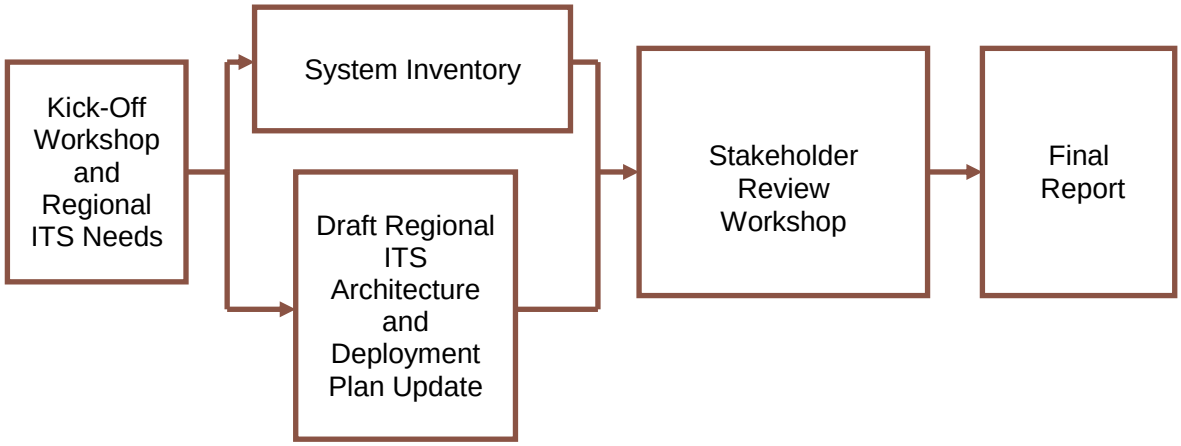


Figure 2 – Bristol Regional ITS Architecture and Deployment Plan Development Process

Two workshops with stakeholders were held to update the Bristol Regional ITS Architecture and Deployment Plan. These workshops included:

- Kick-Off Workshop
- Stakeholder Review Workshop

In addition, interviews were conducted with many of the key stakeholder agencies outside of the workshops to gather additional information for developing the Regional ITS Architecture. Key components of the process are described below:

Kick-Off Workshop: 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 an overview of the project was provided, the regional boundaries were defined, existing and planned ITS deployments in the Region were discussed, and ITS needs for the Region were identified.

Stakeholder Interviews: Stakeholder input was gathered through the two stakeholder workshops as well as a series of interviews that were conducted with stakeholder agencies. The interviews were used to complete the system inventory for the Region, define how ITS services are currently being operated, define how ITS services could be operated in the future, and identify potential ITS projects for the Region.

Develop Draft Regional ITS Architecture and Deployment Plan Update: Following the stakeholder input, a draft report was developed which identifies the roles and responsibilities of

participating agencies and stakeholders in the operation and implementation of the ITS system, identifies projects for deployment, and establishes a maintenance plan. Additionally, a website was created to allow stakeholders access to an interactive version of the ITS architecture and documents such as reports, meeting minutes, presentations, and the Turbo Architecture database.

Stakeholder Review Workshop: A second stakeholder workshop was conducted to review the Draft Regional ITS Architecture document as well as identify priorities for ITS service packages and confirm the list of potential ITS projects for the Bristol Region. Use and maintenance of the Regional ITS Architecture was also discussed.

Final Report: The final Regional ITS Architecture and Deployment Plan was developed, which included an executive summary, project report, Turbo Architecture database, and project website with an interactive version of the Regional ITS Architecture.

Turbo Architecture

Turbo Architecture Version 7.1 was used to develop the Bristol 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 7.1 of Turbo Architecture was released in April 2015 and was developed to support Version 7.1 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 FTA.

In the Bristol Region, the Turbo Architecture database that was developed was based on the ITS service packages, which are provided in **Appendix B** of this report. The ITS service packages provide a graphical representation of the services stakeholders in the Region would like ITS to provide. In each service 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 information 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 information 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**.

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 http://local.iteris.com/itsarch/index.htm and Version 7.1 was the most recent version available.

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.
Service Packages Report	Identifies each of the service packages selected for the Region and the elements associated with each service 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 information 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 service packages to view all of the elements and connections in each service package.
Flow Diagrams	Flow Diagrams are similar to Interconnect Diagrams; however, the actual information flows that are part of each connection between elements are also shown.

3. REGIONAL ITS NEEDS

Regional needs that could be addressed by ITS were identified by stakeholders in the Bristol Regional ITS Architecture Kick-off Workshop and interviews held in October and November 2016. In addition, the *Bristol Tennessee/Virginia Urban Area Long-Range Transportation Plan Year 2040* was reviewed to determine other regional needs that could possibly be addressed in some way through ITS.

Within the 2040 long-range transportation plan (LRTP), there are five regional goals, with associated objectives, that were identified to help direct future decisions regarding transportation for the Bristol Region as those five goals correspond to ten planning factors outlined in Fixing America's Surface Transportation (FAST) Act. Below are the goals and objectives outlined in the LRTP along with some ITS strategies that can directly support each goal and objective.

Goal – System Efficiency and Asset Management: Develop and maintain a transportation system to move people and goods at the most effective level of public and private cost.
Objectives:

- Maintain the efficiency and state of good repair of the existing transportation system.
- Maximize the cost-effectiveness of transportation investments.
- Select and program projects based on identified need and effectiveness.

ITS can address this goal by providing improved operations without adding additional capacity with measures such as improved traffic signal coordination through connected and coordinated signals, real-time travel information for travelers, transit signal priority, traffic metering, and dynamic land management.

Goal – Economic Development: Provide transportation resources to support economic growth and strengthen the regional economy.
Objectives:

- Enhance the transportation access to commercial and industrial areas.
- Increase the accessibility options for freight movement.
- Proactively plan and accommodate for growth in the regional economy.

Measures such as coordinating commercial vehicle carrier operations and fleet management can provide route information based on a vehicle's height, weight, or type of cargo. Additionally, providing parking information for truck drivers and remotely monitoring the operating condition of the commercial vehicles through on-board monitoring and diagnostic equipment will help improve the safety of all roadway users.

Goal – Healthy and Sustainable Communities: Develop a transportation system to preserve and enhance the natural environment and improve quality of life.
Objectives:

- Maintain the efficiency and state of good repair of the existing transportation system.
- Maximize the cost-effectiveness of transportation investments.
- Coordinate the provision of transportation facilities with land use activities to promote active transportation and healthy multimodal lifestyles that minimize single-occupancy vehicle travel.

ITS can be used to monitor the condition of the roadway infrastructure including pavement, bridges, and tunnels to improve maintenance of the roadway network. Additionally, ITS can help reduce the use of single occupancy vehicle usage through the management of HOV lanes

Goal – Mobility Options: Develop a transportation system that provides an opportunity for a choice of mode for the movement of people and goods.

Objectives:

- Encourage the development of bicycle facilities, sidewalks, and greenways.
- Enhance the connectivity of the transportation system between modes.
- Maintain an efficient and cost effective public transportation system.

Various modes of transportation can be supported though ITS including mixed use warning systems that notify drivers that cyclist or pedestrians may be in the road or crossing the road. ITS can provide information to transit riders including fare and schedule information in addition to real-time bus location information

Goal – User Safety and Security: Develop a transportation system for the movement of people and goods, which is safe for all modes and provides security for users and transportation infrastructure.

Objectives:

- Reduce motorized crashes, injuries, and fatalities.
- Reduce non-motorized crashes, injuries, and fatalities.
- Coordinate with state and local agencies to improve transportation security for critical infrastructure.

ITS can be used to implement measures to help improve safety such as early warning systems that notifies officials of potential hazards, dynamic roadway warning systems that warn drivers, and roadway service patrols that help clear stalled vehicles or crashes.

The investment needs identified through the Regional ITS Architecture development process as well as the 2040 LRTP regional goals provided guidance for determining which service packages should be included in the architecture. Stakeholders identified ITS needs for the Bristol Region in the following areas:

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

In Section 5.1.4, a complete list of regional needs is presented along with the ITS service packages that have been recommended for the Region to consider implementing or expanding (if the service package currently exists) in order to address the needs.

4. REGIONAL ITS INVENTORY

The inventory and needs documented during the individual interviews were the starting point for updating the Regional ITS Architecture. These ITS systems and components are used to customize the National ITS Architecture and create the updated Regional ITS Architecture for the Bristol Region.

The Bristol stakeholder group agreed to create individual traffic, maintenance, and emergency management elements for the City of Bristol, TN; the City of Bristol, VA; Town of Abingdon, VA; Sullivan County, TN; and Washington County, VA. Other small cities, towns, and census-designated places as well as counties in the Region were documented as part of the municipal/county elements. This documentation allows the smaller cities, towns and census-designated places and counties to be included in the Regional ITS Architecture, and therefore eligible to use federal funds from the highway trust fund for future ITS deployments, even if there are no specific plans for ITS implementation at this time.

4.1 Stakeholders

Each element included in the Bristol Regional ITS Architecture is associated with a stakeholder agency. A listing of stakeholder agencies identified in the Bristol Regional ITS Architecture can be found in **Table 3** along with a description of each stakeholder. Most stakeholder agencies are called out by name with exception of smaller municipalities or counties. In the Regional ITS Architecture, the City of Bristol, TN; the City of Bristol, VA; and the Town of Abingdon, VA along with Sullivan County, Tennessee and Washington County, Virginia are called out by name, but all other municipalities, census-designated places, and counties within the Region are covered under the general stakeholder name municipal/county government.

Table 3 – Bristol Region Stakeholder Descriptions

Stakeholder	Stakeholder Description
Bristol MPO	Agency that coordinates with local officials in multi-modal transportation planning to determine need and funding sources.
Bristol Tennessee Transit	Transit provider that operates fixed route and demand response transit service in the City of Bristol TN. Bristol Tennessee Transit (BTT) operates in close coordination with Bristol Virginia Transit (BVT) and several routes travel into Virginia. The transit agency is a department of the City of Bristol TN.
Bristol Virginia Transit	Transit provider that operates fixed route and demand response transit service in the City of Bristol VA. Bristol Virginia Transit (BVT) operates in close coordination with Bristol Tennessee Transit and several routes travel into Tennessee. The transit agency is a department of the City of Bristol VA.
City of Bristol TN	Municipal government for the City of Bristol TN. Covers all city departments including those that deal with traffic and public safety.
City of Bristol VA	Municipal government for the City of Bristol VA. Covers all city departments including those that deal with traffic and public safety.
City of Johnson City TN	Municipal government for the City of Johnson City TN. Covers all city departments including those that deal with traffic and public safety.
City of Kingsport TN	Municipal government for the City of Kingsport TN. Covers all city departments including those that deal with traffic and public safety.
District Three Governmental Cooperative	Agency that operates Washington County VA Public Transit and Abingdon VA Public Transit.
Financial Institution	Handles exchange of money for transit electronic fare collection.
First Tennessee Human Resource Agency	Agency that operates Northeast Tennessee Transportation. NET Trans provides demand response transit service outside of the urban areas in the TN portion of the Region.
Media	Local media outlets. This can include television stations, newspapers, radio stations and their associated websites.
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	The National Oceanic and Atmospheric Administration gathers weather information and issues severe weather warnings.
Other Agencies	This stakeholder represents a wide variety of agencies. The associated elements are groups of agencies or providers that do not have a primary stakeholder agency.
Private Information Provider	Private sector business responsible for the gathering and distribution of traveler information. This service is typically provided on a subscription basis.
Rail Operators	Companies that operate trains and/or are responsible for the maintenance and operations of railroad tracks.
Sullivan County, TN	County government for Sullivan County, TN. Includes all county departments including EMS and Fire, Sheriff, Emergency Management, and Highway Departments.
System Users	All of the users of the transportation system.
TDOT	The Tennessee Department of Transportation is responsible for the construction, maintenance, and operation of State roadways in Tennessee.
TEMA	The Tennessee Emergency Management Agency is 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 TN.
Tennessee Department of Health and Human Services	State department that manages funding for medical transportation services.

Table 3 – Bristol Region Stakeholder Descriptions (continued)

Stakeholder	Stakeholder Description
THP	Tennessee Highway Patrol. State law enforcement agency that enforces traffic safety laws as well as commercial vehicle regulations.
Town of Abingdon, VA	Municipal government for the Town of Abingdon VA. Covers all city departments including those that deal with traffic and public safety.
VDEM	Virginia Department of Emergency Management. Agency responsible for emergency operations during a disaster or large scale incident.
VDOT	The Virginia Department of Transportation is responsible for the construction, maintenance, and operation of roadways in the Commonwealth of Virginia.
VSP	Virginia State Police. State law enforcement agency that enforces traffic safety laws as well as commercial vehicle regulations.
Washington County, VA	County government for Washington County VA. Includes all county departments including EMS and Fire, the Sheriff's Office and the Washington County VA Department of Emergency Services.

4.2 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 Bristol 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 – Bristol Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Bristol MPO	Bristol MPO Data Archive	Archive for transportation information such as traffic counts or transit ridership data for use in regional transportation planning.	Planned
Bristol Tennessee Transit	BTT CCTV Camera Surveillance	Closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Planned
	BTT Data Archive	Transit data archive for Bristol Tennessee Transit. Used by the National Transit Database, Federal Transit Administration, and TDOT.	Planned
	BTT Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Bristol Tennessee Transit.	Existing
	BTT Fixed Route Vehicles	Transit vehicles that operate on fixed routes within the City of Bristol TN and limited locations in Bristol VA.	Existing
	BTT Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
	BTT Paratransit Vehicles	Bristol Tennessee Transit vehicles that provide transit means for disabled passengers.	Existing
	BTT Website	Website with information about fares and schedules. In the future real-time information could be incorporated.	Existing
Bristol Virginia Transit	BVT CCTV Camera Surveillance	Closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Planned
	BVT Data Archive	Transit data archive for Bristol Virginia Transit. Used by the National Transit Database, Federal Transit Administration, and VDOT.	Planned
	BVT Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Bristol Virginia Transit.	Existing
	BVT Fixed Route Vehicles	Transit vehicles that operate on fixed routes within the City of Bristol VA and limited locations in Bristol TN.	Existing
	BVT Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
Bristol Virginia Transit (continued)	BVT Paratransit Vehicles	Bristol Virginia Transit vehicles that provide transit means for disabled passengers.	Existing
	BVT Website	Website with information about fares and schedules. In the future real-time information could be incorporated.	Existing
City of Bristol TN	BMS Multi-Agency Command Center	Multi-agency command center led by the City of Bristol TN that is activated for use during Bristol Motor Speedway (BMS) events.	Existing
	BTN-TV Government Information Channel	A government cable television channel operated by the City of Bristol TN that provides residents in the Region with important information.	Existing
	City of Bristol TN 911 Dispatch	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City of Bristol TN and dispatching emergency responders.	Existing
	City of Bristol TN CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Bristol TN DMS	Dynamic message signs for traffic information dissemination operated by the City of Bristol TN.	Planned
	City of Bristol TN 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. Detection used specifically for the operation of signals is included under the element for traffic signals. Detection used specifically for the operation of signals is included under the element for traffic signals.	Planned
	City of Bristol TN Fire/EMS Vehicles	City of Bristol TN fire and emergency medical services vehicles.	Existing
	City of Bristol TN Police Department	Police department for the City of Bristol TN. The emergency dispatch functions for the Police Department are included in the Bristol TN 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing
	City of Bristol TN Police Vehicles	City of Bristol TN Police Department vehicles.	Existing
	City of Bristol TN Public Works Department	Department that oversees the maintenance of streets, sidewalks, and roadway right-of-way.	Existing
	City of Bristol TN Public Works Department Vehicles	Vehicles used by the City of Bristol TN Public Works Department in maintenance and construction activities.	Existing

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
City of Bristol TN (continued)	City of Bristol TN Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Bristol TN RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway for the City of Bristol TN.	Planned
	City of Bristol TN TOC	Traffic operations center for the City of Bristol TN. Responsible for operations of the traffic signal system, CCTV cameras and DMS.	Planned
	City of Bristol TN Traffic Signals	Traffic signal system operated by the City of Bristol TN.	Existing
	City of Bristol TN Website	Website for the City of Bristol, TN. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions.	Existing
City of Bristol VA	City of Bristol VA 911 Dispatch	911 PSAP responsible for answering all 911 calls made within the City of Bristol VA and dispatching emergency responders.	Existing
	City of Bristol VA CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Bristol VA DMS	Dynamic message signs for traffic information dissemination operated by the City of Bristol VA.	Planned
	City of Bristol VA Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS or traditional loops.	Planned
	City of Bristol VA Fire Vehicles	Vehicles from the City of Bristol VA Fire Department.	Existing
	City of Bristol VA Lifesaving Crew	Emergency medical services vehicles serving the City of Bristol VA.	Existing
	City of Bristol VA Police Department	Police department for the City of Bristol VA. The emergency dispatch functions for the Police Department are included in the Bristol VA 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing
	City of Bristol VA Police Vehicles	Police vehicles include City of Bristol VA Police Department patrol cars and helicopters.	Existing
	City of Bristol VA Public Works Department	Department that oversees the maintenance of streets, sidewalks, and roadway right-of-way.	Existing

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
City of Bristol VA (continued)	City of Bristol VA Public Works Department Vehicles	Vehicles used by the City of Bristol VA Public Works Department in maintenance and construction activities.	Existing
	City of Bristol VA Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Bristol VA RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway for the City of Bristol VA.	Planned
	City of Bristol VA TOC	Traffic operations center for the City of Bristol VA. Responsible for operations of the traffic signal system, CCTV cameras and DMS.	Planned
	City of Bristol VA Traffic Signals	Traffic signal system operated by the City of Bristol VA.	Existing
	City of Bristol VA Website	Website for the City of Bristol, VA. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions.	Existing
City of Johnson City	City of Johnson City TN TOC	Traffic operations center for the City of Johnson City TN. Responsible for operations of the traffic signal system, CCTV cameras and DMS.	Existing
City of Kingsport	City of Kingsport TN TOC	Traffic operations center for the City of Kingsport TN. Responsible for operations of the traffic signal system, CCTV cameras and DMS.	Existing
District Three Governmental Cooperative	Abingdon VA Public Transit CCTV Camera Surveillance	Closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Planned
	Abingdon VA Public Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by the District Three Governmental Cooperative for Abingdon Transit.	Existing
	Abingdon VA Public Transit Fixed Route Vehicles	Transit vehicles that operate on fixed routes within the Town of Abingdon.	Existing
	Abingdon VA Public Transit Paratransit Vehicles	Abingdon VA Public Transit vehicles that provide transit means for disabled passengers.	Existing
	Abingdon VA Public Transit Website	Website with information about fares and schedules.	Existing

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
District Three Governmental Cooperative (continued)	District Three Governmental Cooperative Transit Data Archive	Transit data archive for Abingdon VA Public Transit and Washington County VA Public Transit. Used by the National Transit Database, Federal Transit Administration, and VDOT.	Planned
	Washington County VA Public Transit CCTV Camera Surveillance	Closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Planned
	Washington County VA Public Transit Demand Response Vehicles	Washington County Public Transit vehicles.	Existing
	Washington County VA Public Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of demand response transit vehicles operated by the District Three Governmental Cooperative for Washington County Public Transit.	Existing
	Washington County VA Public Transit Website	Website with information about fares and schedules.	Planned
Financial Institution	Financial Service Provider	Service provider that handles exchange of money for transit electronic payment collection.	Existing
First Tennessee Human Resource Agency	FTHRA Data Archive	First Tennessee Human Resource Agency data archive for transit data.	Planned
	NET Tran CCTV Camera Surveillance	Closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Existing
	NET Trans Demand Response Vehicles	Transit vehicles for demand response transit operations.	Existing
	NET Trans Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of demand response vehicles operated by NET Trans.	Existing
	NET Trans Website	Website with information on fares and schedules.	Existing
Media	Local Print and Broadcast Media	Local media that provide traffic or incident information to the public.	Existing
Municipal/County Government	Municipal Police Department	Municipal Police Department. The emergency dispatch functions for the Police Department are included in the County 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing
	Municipal/County Engineer's Office	Municipal/County Engineer's office is 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

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
Municipal/County Government (continued)	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 and construction operations.	Existing
	Municipal/County Public Safety Vehicles	Municipal/County law enforcement, fire, and emergency medical services (EMS) vehicles.	Existing
	Municipal/County TOC	Traffic Operations Center responsible for the operation of municipal or county signal systems and other ITS infrastructure.	Planned
	Municipal/County Traffic Signals	Municipal or county traffic signal systems within the Bristol Region. Includes Sullivan County TN and Washington County VA.	Existing
	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.	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	Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	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 Transportation Providers	Private providers of transportation services in the Region such as taxis and intercity bus service.	Existing
Private Information Provider	Private Sector Traveler Information Services	Traveler information service operated by a private entity.	Existing
	Skyline OneView	Private provider of traffic information. Currently under contract with VDOT to provide CCTV camera images to the public and other media outlets.	Existing
	Social Networking Services	Subscription based services operated by private providers that provide an option for real-time traveler information dissemination. Examples of such services include Facebook or Twitter.	Existing

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
Rail Operators	Rail Operations	Centers responsible for the operation and tracking of trains.	Existing
	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
Sullivan County TN	Sullivan County TN 911 Dispatch	911 PSAP responsible for answering all 911 calls made within the county and dispatching emergency responders.	Existing
	Sullivan County TN EMA	Emergency management agency for Sullivan County TN. Responsible for disaster planning for the County and operating the emergency operations center.	Existing
	Sullivan County TN Public Safety Vehicles	Vehicles used by public safety in Sullivan County, including the Sullivan County Sheriff's Office.	Existing
	Sullivan County TN Sheriff's Office	Law enforcement agency for Sullivan County TN. The emergency dispatch functions for the Sheriff's Office are included in the Sullivan County TN 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing
System Users	Archive Data User	Users that request information from the data archive systems.	Existing
	Private Traveler Personal Computing Devices	Computing devices that travelers use to access public information.	Existing
	Traveler	User of the transportation system.	Existing
TDOT	Other TDOT Region District Operations	Other Tennessee Department of Transportation's regional district operations offices.	Existing
	TDOT CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	TDOT Changeable Speed Limit Signs	TDOT roadway equipment used to raise or lower speed limits on the roadway as conditions warrant.	Planned
	TDOT Community Relations Division	The office responsible for the dissemination of traffic information to the media and the public.	Existing
	TDOT DMS	Dynamic message signs for traffic information dissemination.	Planned
	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 (TEMA) activates the state emergency operations center (EOC).	Existing

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
TDOT (continued)	TDOT Field Sensors	TDOT 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. Detection used specifically for the operation of signals is included under the element for traffic signals.	Planned
	TDOT HAR	Highway advisory radio for traffic information dissemination.	Existing
	TDOT HELP Vehicles	Roadway service patrol vehicles that operate in the Region for large incidents and events.	Planned
	TDOT Long Range Planning Division Archive	Data archive for the Long Range Planning Division. The Division is responsible for traffic data collection and analysis.	Existing
	TDOT Maintenance Headquarters	The Tennessee Department of Transportation maintenance in headquarters in Nashville.	Existing
	TDOT Maintenance Vehicles	The Tennessee Department of Transportation vehicles used in maintenance operations.	Existing
	TDOT Overheight Vehicle Detection	Sensors that detect overheight vehicles on the approach to a height restricted underpass. The sensors trigger beacon warning signs and DMS to notify the driver.	Planned
	TDOT Ramp Queue Detection System	Vehicle detection system that monitors queues at exit ramps and can either warn drivers approaching the queue through DMS or warning beacons or the system can interact with the traffic signal system to clear the queue.	Planned
	TDOT Ramp Metering Equipment	TDOT roadway equipment used in the operation of a ramp metering system. Includes the signals and any other ITS equipment.	Planned
	TDOT Region 1 District Operations	TDOT Office responsible for roadway construction and routine roadway maintenance as well as responding to incidents when their services are requested by local emergency management agencies.	Existing
	TDOT Region 1 Engineer's Office	Region 1 Engineer's office is 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

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
TDOT (continued)	TDOT Region 1 HELP Dispatch	Roadway service patrol dispatch center located in Knoxville. Currently service is limited to the Knoxville area except in the case of a large scale incident or special events such as those at the Bristol Motor Speedway.	Existing
	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 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 Reversible Lane Equipment	Lane control signals, dynamic lane control signs, or other devices used in the operation of reversible lanes.	Planned
	TDOT RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	TDOT 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).	Existing
	TDOT SmartWay Website	Website providing road network conditions information. Much of the information for the website comes from SWIFT. In areas that have an operational TDOT Region TMC, additional information may be available such as camera views.	Existing

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
TDOT (continued)	TDOT Statewide Information for Travelers (SWIFT)	SWIFT 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 (TMCs) and the Tennessee Highway Patrol (THP). SWIFT feeds the Statewide 511 system and SmartWay website.	Existing
	TDOT Wrong-Way Detection and Warning Equipment	Electronic warning signs, field sensors, or other devices used in the operation of wrong-way vehicle detection and warning.	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	TEMA	The Tennessee Emergency Management Agency manages 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
Tennessee Department of Health and Human Services	Health and Human Services	Provides health related services including the subsidization of transportation to obtain medical services.	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
	TITAN Database	Tennessee Integrated Traffic Analysis Network database. 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
Town of Abingdon VA	Town of Abingdon VA CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	Town of Abingdon VA Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS or traditional loops. Detection used specifically for the operation of signals is included under the element for traffic signals.	Planned

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
Town of Abingdon VA (continued)	Town of Abingdon VA Police Department	Police department for the Town of Abingdon VA. The emergency dispatch functions for the Police Department are included in the Washington County VA 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing
	Town of Abingdon VA Police Vehicles	Police vehicles include Town of Abingdon VA Police Department patrol cars and helicopters.	Existing
	Town of Abingdon VA Public Works Department	Department that oversees the maintenance of streets, sidewalks, and roadway right-of-way.	Existing
	Town of Abingdon VA Public Works Department Vehicles	Vehicles used in maintenance and construction operations.	Existing
	Town of Abingdon VA Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Existing
	Town of Abingdon VA RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	Town of Abingdon VA TOC	Traffic operations center for the Town of Abingdon. Responsible for operations of the traffic signal system and CCTV cameras.	Planned
	Town of Abingdon VA Traffic Signals	Traffic signal system for the Town of Abingdon.	Existing
	Town of Abingdon VA Website	Website for the Town of Abingdon VA. Includes information on City departments and in the future it is envisioned that the website will have real-time information about roadway conditions.	Existing
VDEM	Virginia Statewide EOC	Emergency Operations Center for the Commonwealth of Virginia.	Existing
VDOT	VDOT Archive	Data archive for the transportation related data in Virginia.	Planned
	VDOT Bristol District	Responsible for the operation of the traffic signal system, CCTV Cameras, and DMS in the Bristol District.	Existing
	VDOT Bristol District Administrator’s Office	The Bristol District administrator's office is responsible for administration of maintenance and construction projects within the Bristol District as well as communicating work zone information to the public through the Public Information Office.	Existing
	VDOT Bristol District Maintenance	The Virginia Department of Transportation's maintenance for the Bristol District.	Existing

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
VDOT (continued)	VDOT CB Wizard Broadcast Device	Portable CB broadcasting equipment used to disseminate traveler information to those with CB radios, primarily commercial vehicles. The equipment is used for Bristol Motor Speedway events and other large scale events and incidents.	Existing
	VDOT CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management. Cameras can be in fixed locations or attached to drones.	Existing
	VDOT Commercial Truck Parking Management	System used to inform commercial vehicle drivers of available parking locations in the Region.	Planned
	VDOT District Communications	The office responsible for the dissemination of traffic information to the media and the public.	Existing
	VDOT DMS	Dynamic message signs for traffic information dissemination.	Existing
	VDOT Emergency Services Coordinator	The Virginia Department of Transportation emergency services coordinator is responsible for managing the VDOT response in a large scale incident or disaster in which the Virginia Statewide EOC is activated.	Existing
	VDOT Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS or traditional loops. Detection used specifically for the operation of signals is included under the element for traffic signals.	Existing
	VDOT HAR	Highway advisory radio for traffic information dissemination.	Existing
	VDOT Maintenance Vehicles	Virginia Department of Transportation vehicles used in maintenance operations.	Existing
	VDOT Overheight Vehicle Detection	Sensors that detect overheight vehicles on the approach to a height restricted underpass. The sensors trigger beacon warning signs and DMS to notify the driver.	Existing
	VDOT Portable RWIS Sensors	Portable road weather information system sensors to monitor road conditions for the Virginia Department of Transportation.	Existing
	VDOT Ramp Queue Detection System	Vehicle detection system that monitors queues at exit ramps and communicates with the traffic signal system to clear the queue.	Existing
	VDOT RWIS Sensors	Road weather information system sensors to monitor road conditions for the Virginia Department of Transportation.	Planned

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
VDOT (continued)	VDOT 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 CCTV cameras, vehicle detection, and DMS.	Existing
	VDOT Special Event Command Center	The special event command center combines traffic management and emergency management operations during special events in the Region, primarily for races at the Bristol Motor Speedway.	Existing
	VDOT SSP Dispatch	Safety Service Patrol vehicle dispatch center.	Existing
	VDOT SSP Vehicles	Vehicles operated by the VDOT Safety Service Patrol.	Existing
	VDOT TMC – Hampton Roads	VDOT traffic management center located in Hampton Roads and responsible for the operation of ITS equipment in the Hampton Roads region.	Existing
	VDOT TMC – Northern Virginia	VDOT traffic management center located in Northern Virginia and responsible for the operation of ITS equipment in the Northern Virginia region.	Existing
	VDOT TMC – Richmond	VDOT traffic management center located in Richmond and responsible for the operation of ITS equipment in the Richmond region.	Existing
	VDOT TMC – Staunton	VDOT traffic management center located in Staunton and responsible for the operation of ITS equipment in the Staunton region. The TMC in Staunton also has backup capability for the TOC in Salem.	Existing
	VDOT TOC – Salem	Traffic operations center located in Salem. Responsible for the operation of the ITS equipment located in the Salem region, including the Bristol District.	Existing
	VDOT Traffic Signals	Traffic signal system operated by the Virginia Department of Transportation.	Existing
	Virginia 511	511 traveler information system central server which feeds the Statewide 511 system.	Existing
	Virginia 511 IVR	Virginia 511 Interactive Voice Response. 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
	Virginia 511 Website	Website for the Commonwealth of Virginia's 511 traveler information system.	Existing

Table 4 – Bristol Region Inventory of ITS Elements (continued)

Stakeholder	Element Name	Element Description	Status
VSP	VSP Crash Record Database	Database for the archiving of information on recordable crashes in Virginia. The database is maintained by the Virginia State Police.	Existing
	VSP Dispatch	Virginia State Police Dispatch.	Existing
	VSP Missing Children Clearinghouse	Division of the Virginia State Police that is responsible for AMBER Alerts.	Existing
	VSP Vehicles	Vehicles for the Virginia State Police.	Existing
Washington County VA	Washington County VA 911 Dispatch	911 PSAP responsible for answering all 911 calls made within the county and dispatching emergency responders.	Existing
	Washington County VA Department of Emergency Services	Emergency management agency for Washington County VA. Responsible for communications with the Virginia Statewide EOC and coordination of local resources during a disaster or large scale incident.	Existing
	Washington County VA Public Safety Vehicles	Vehicles used by public safety in Washington County, including the Washington County Sheriff's Office.	Existing
	Washington County VA Sheriff's Department	Law enforcement agency for Washington County VA. The emergency dispatch functions for the Sheriff's Department are included in the Washington County VA 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing

5. 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 Bristol Region. The National ITS Architecture has the following eight groups of ITS service areas:

- ***Traffic Management*** – includes the TDOT SmartWay Transportation Management Center (TMC) in Knoxville as well as other existing and future TMCs and traffic operations centers (TOCs), detection systems, CCTV cameras, fixed and portable dynamic message signs (DMS), and other related technologies.
- ***Emergency Management*** – includes emergency operations/management centers, improved information sharing among traffic and emergency services, automated vehicle location (AVL) on emergency vehicles, traffic signal preemption for emergency vehicles, and wide-area alerts.
- ***Maintenance and Construction Management*** – includes work zone management, roadway maintenance and construction information, and road weather detection systems.
- ***Public Transportation Management*** – includes transit and paratransit AVL, transit travel information systems, electronic fare collection, and transit security.
- ***Commercial Vehicle Operations*** – includes freight administration, weigh-in-motion, HAZMAT management, and commercial vehicle operations fleet maintenance.
- ***Traveler Information*** – includes broadcast traveler information, social networking services and highway advisory radio (HAR).
- ***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 Region were considered in each of the service areas. Vehicle Safety was not included in the Bristol Regional ITS Architecture because implementation of those service packages would primarily be by private sector automobile manufacturers and information service providers. Additionally, Commercial Vehicle Operations was not included as it is viewed as more of a statewide effort and there was no expressed need by stakeholders to include this service on a regional level at this time.

5.1 ITS Service Packages

In the National ITS Architecture, services that are provided by ITS are referred to as ITS service packages. ITS service packages can include several stakeholders and elements that work together to provide a service in the Region. Examples of ITS service packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are currently a total of 97 ITS service packages identified in the National ITS Architecture Version 7.1, which was the most recent version available of the National ITS Architecture at the time of the 2017 Bristol Regional ITS Architecture update. As noted in Section 1.1, in the previous version of the Bristol Regional ITS Architecture, ITS service packages were referred to as ITS market packages. The name change has been made to be consistent with the terminology that is now used in Version 7.1 of the National ITS Architecture.

5.1.1 Overview of ITS Service Package Structure

An ITS service package is made up of elements and information flows. Each identified system or component in the Bristol 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 information flows that document the existing and planned flow of information. **Figure 3** depicts a sample service package with each of the components identified. Additional explanation of the terminology used can be found in the text that follows and in **Table 5**.

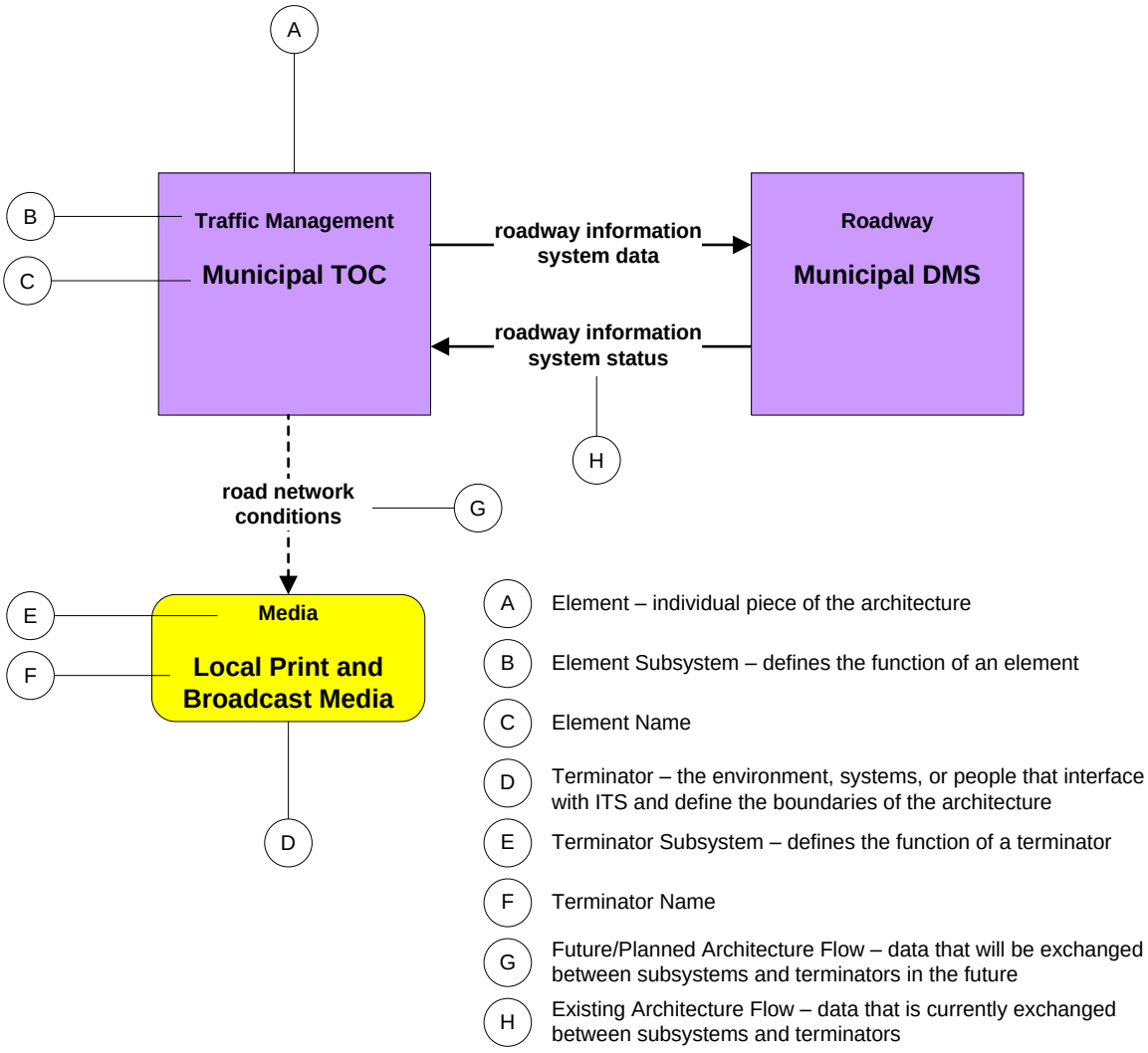


Figure 3 – Overview of ITS Service Package Structure

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 service 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, Field, 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.

Information Flows provide a standardized method for documenting the types of information that transfer 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 desired expansion of functionality. Many of the information flows have associated technical specifications, known as standards, which define the format of the data being shared.

Table 5 – Summary of ITS Architecture Terminology

Term	Definition	Notes	Examples
Element	Component of the ITS inventory for the Region	Assigned to a subsystem (see below)	Municipal TOC, Municipal DMS, RWIS Sensor
Subsystem	Building blocks of the physical ITS architecture that represent a set of transportation functions	Grouped into four major classes: Centers, Field, Vehicles, and Travelers	Traffic Management, Roadway, Information Service Provider
Terminator	Other people, systems, facilities, or conditions outside of the ITS system that need to interface with ITS architecture	Define the boundaries of an ITS architecture	Broadcast Media, National Weather Service, Traffic Operations Personnel
Information flow	The transfer of information between elements	Connect elements to one another and to terminators	Road network conditions, Incident response status, Work zone information

5.1.2 Selection and Prioritization of Regional ITS Service Packages

In the Bristol Region, the National ITS Architecture service packages were reviewed by the stakeholders and selected based on the relevance of the functionality that the ITS service package could provide to the Region. Stakeholders selected 39 ITS service packages for implementation in the Region, and they are identified in **Table 6**. Stakeholders prioritized the selected service packages during the workshop, and the table organizes the service packages into service areas and priority groupings.

It should be noted that ITS related commercial vehicle operations including applications such as electronic clearance, safety enforcement, and registration should be conducted on a statewide level and outlined in the Tennessee Statewide ITS Architecture. Unless a specific need was identified in the Bristol Region that could be addressed locally, the commercial vehicle operations service packages were not selected.

After selecting the ITS service packages that were applicable for the Region, stakeholders reviewed each ITS service package and the elements that could be included to customize it for the Region. This customization is discussed further in the next section (Section 5.1.3).

Table 6 – Bristol Regional ITS Service Package Prioritization by Functional Area

High Priority Service Packages	Medium Priority Service Packages	Low Priority Service Packages
Travel and Traffic Management		
ATMS01 Network Surveillance ATMS03 Traffic Signal Control ATMS06 Traffic Information Dissemination ATMS07 Regional Traffic Management ATMS08 Traffic Incident Management System	ATMS13 Standard Railroad Grade Crossing ATMS15 Railroad Operation Coordination ATMS22 Variable Speed Limits ATMS24 Dynamic Roadway Warning	ATMS04 Traffic Metering ATMS19 Speed Warning and Enforcement
Emergency Management		
EM01 Emergency Call-Taking and Dispatch EM02 Emergency Routing EM04 Roadway Service Patrols EM06 Wide-Area Alert EM10 Disaster Traveler Information	EM08 Disaster Response and Recovery EM09 Evacuation and Reentry Management	
Maintenance and Construction Management		
MC03 Road Weather Data Collection MC04 Weather Information Processing and Distribution MC08 Work Zone Management MC10 Maintenance and Construction Activity Coordination	MC01 Maintenance and Construction Vehicle and Equipment Tracking MC06 Winter Maintenance MC09 Work Zone Safety Monitoring	
Public Transportation Management		
APTS01 Transit Vehicle Tracking APTS02 Transit Fixed-Route Operations APTS03 Demand Response Transit Operations APTS05 Transit Security APTS08 Transit Traveler Information	APTS04 Transit Passenger and Fare Management APTS07 Multi-modal Coordination APTS11 Multimodal Connection Protection	APTS06 Transit Fleet Management APTS10 Transit Passenger Counting
Traveler Information		
ATIS01 Broadcast Traveler Information ATIS02 Interactive Traveler Information		
Archived Data Management		
	AD1 ITS Data Mart	AD3 ITS Virtual Data Warehouse

5.1.3 Customization of Regional ITS Service Packages

The ITS service packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the Bristol Region. ITS service packages represent a service that will be deployed as an integrated capability. Each service package is shown graphically with the service package name, local agencies involved, and desired information flows. The information flows are shown as either existing or planned/future. Information flows shown as existing indicate that in at least one location within the jurisdiction, the connection exists. Information flows shown as existing should not be interpreted to mean that deployment of that service is complete as there are many cases where an information 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) service package for traffic information dissemination that has been customized for the Region. This instance focuses on the activities of VDOT. The ITS service package shows the distribution of traffic information from both the Bristol District and the VDOT TOC – Salem to VSP dispatch and the media as well as in the future to local emergency dispatch and transit management agencies. Messages are also placed on DMS and HAR and entered into the Virginia 511 system for inclusion on the Virginia 511 website as well as Virginia 511's interactive voice response telephone number. Flows between the subsystems indicate what information is being shared. The remainder of the ITS service packages that were customized for the Bristol Region are shown in **Appendix B**.

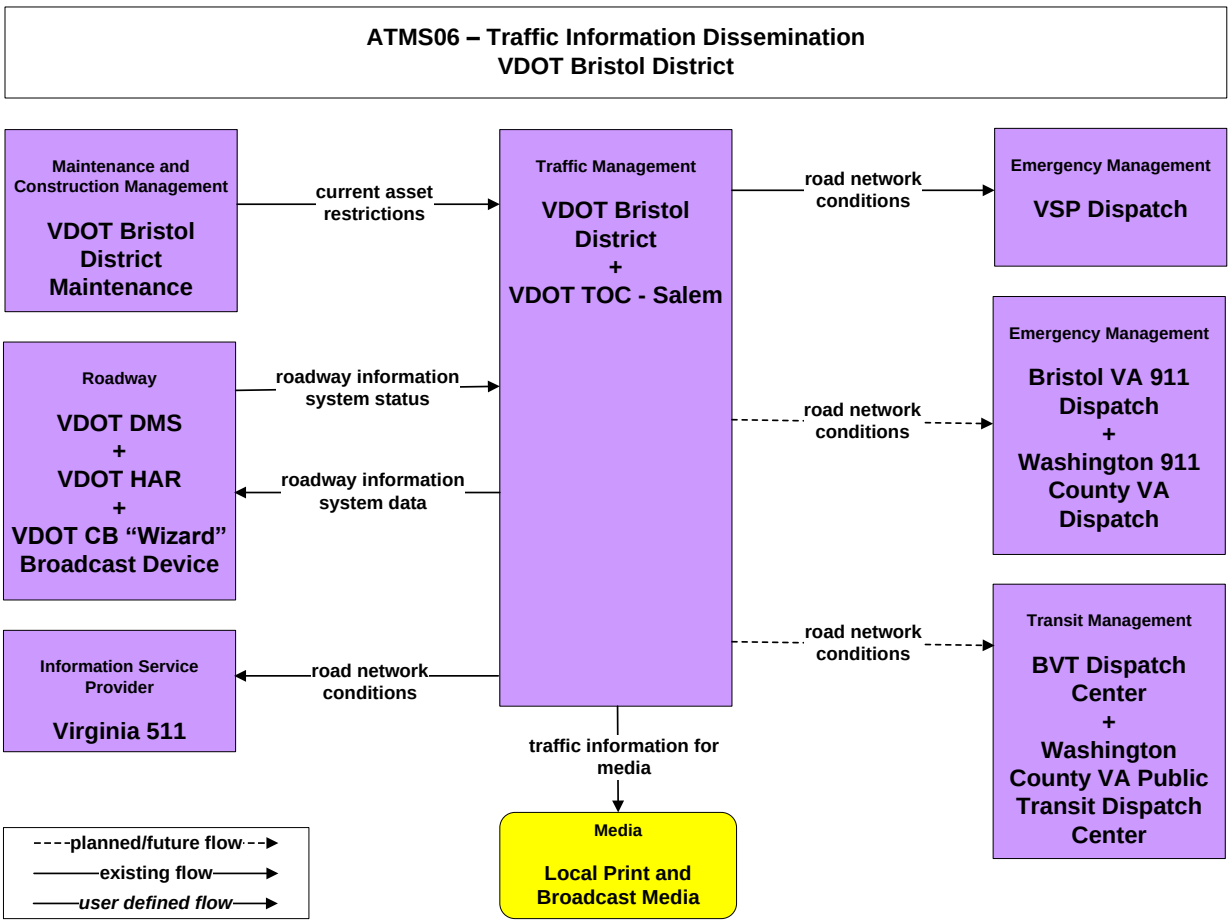


Figure 4 – Example ITS Service Package Diagram: ATMS06 – Traffic Information Dissemination (VDOT Bristol Distrcit)

5.1.4 Regional Needs and Corresponding ITS Service Packages

Input received from stakeholders at the Bristol Region ITS Architecture workshops provided valuable input for the ITS service package customization process. The needs identified in the ITS Architecture workshops, as well as needs from the Bristol MPO's *2040 Long Range Transportation Plan (LRTP)* are identified in **Table 7**. The table also identifies which ITS service packages could be implemented to address the particular need.

Table 7 – Bristol Regional ITS Needs and Corresponding ITS Service Packages

ITS Need	Corresponding ITS Service Packages
Traffic Management and Traveler Information	
Need to establish a joint TDOT and VDOT regional traffic management center for the entire Tri-Cities region.	ATMS07 – Regional Traffic Management ATMS08 – Traffic Incident Management System
Need to maintain a transportation system to move people and goods at the most effective level of public and private cost.	ATMS01 – Network Surveillance ATMS03 – Traffic Signal Control ATMS06 – Traffic Information Dissemination ATMS07 – Regional Traffic Management ATMS08 – Traffic Incident Management System ATMS24 – Dynamic Roadway Warning EM04 – Roadway Service Patrols MC08 – Work Zone Management MC10 – Maintenance and Construction Coordination
Need to enhance the connectivity of the transportation system among modes	ATMS01 – Network Surveillance ATMS03 – Traffic Signal Control ATMS06 – Traffic Information Dissemination ATMS07 – Regional Traffic Management APTS01 – Transit Vehicle Tracking APTS02 – Transit Fixed-Route Operations APTS03 – Demand Response Transit Operations
Need to establish or expand the interconnected traffic signal system network	ATMS03 – Traffic Signal Control
Need for traffic signal coordination among VDOT; Bristol, VA; and Bristol, TN	ATMS03 – Traffic Signal Control ATMS07 – Regional Traffic Management
Need to expand CCTV camera coverage areas throughout the Region	ATMS01 – Network Surveillance
Need to improve dissemination of information to drivers through dynamic message signs, highway advisory radio, social media, television, or other methods	ATMS06 – Traffic Information Dissemination ATMS24 – Dynamic Roadway Warning ATIS01 – Broadcast Traveler Information ATIS02 – Interactive Traveler Information
Need to monitor rail crossing and convey blockages to drivers	ATMS13 – Standard Railroad Grade Crossing
Need to encourage the development of bicycle facilities, sidewalks, and greenways, and reduce non-motorized crashes, injuries, and fatalities.	ATMS03 – Traffic Signal Control

Table 7 – Bristol Regional ITS Needs and Corresponding ITS Service Packages (continued)

ITS Need	Corresponding ITS Service Packages
Emergency Management	
Need to assist emergency vehicle movement with traffic signal preemption and monitoring	ATMS03 – Traffic Signal Control EM01 – Emergency Call-Taking and Dispatch EM02 – Emergency Routing

Need to expand roadway service patrols for motorist assistance and incident management	ATMS08 – Traffic Incident Management System EM04 – Roadway Service Patrols
Maintenance and Construction Management	
Need to monitor roadway weather conditions and provide accurate dissemination to agencies and travelers	ATMS06 – Traffic Information Dissemination ATMS24 – Dynamic Roadway Warning MC01 – Maintenance and Construction Vehicle and Equipment Tracking MC03 – Road Weather Data Collection MC04 – Weather Information Processing and Distribution MC06 – Winter Maintenance
Need for safe work zones	MC08 – Work Zone Management MC09 – Work Zone Safety Monitoring MC10 – Maintenance and Construction Coordination
Need to maintain the efficiency and state of good repair of the existing transportation system	MC07 – Roadway Maintenance and Construction MC10 – Maintenance and Construction Coordination
Public Transportation Management	
Need to maintain and efficient and cost-effective public transportation system	APTS01 – Transit Vehicle Tracking APTS02 – Transit Fixed-Route Operations APTS03 – Demand Response Transit Operations APTS07 – Multi-modal Coordination APTS08 – Transit Traveler Information APTS11 – Multimodal Connection Protection ATMS06 – Traffic Information Dissemination ATMS07 – Regional Traffic Management
Need to improve coordination among transit agencies	APTS02 – Transit Fixed-Route Operations APTS03 – Demand Response Transit Operations APTS07 – Multi-modal Coordination APTS11 – Multimodal Connection Protection
Archived Data Management	
Need to archive data gathered through ITS to make it more accessible to regional stakeholders	AD1 – ITS Data Warehouse AD2 – ITS Virtual Data Warehouse

5.2 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 Bristol Region. The system interconnect diagram shows the high-level relationships of the subsystems and terminators in the Bristol Region and the associated local projects and systems. The customized service packages represent services that can be deployed as an integrated capability, and the service package diagrams show the information flows between the subsystems and terminators that are most important to the operation of the service packages. How these systems interface with each other is an integral part of the overall ITS architecture.

5.2.1 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 Bristol Region based on the system inventory and information gathered from the stakeholders. **Figure 5** summarizes the existing and planned ITS elements for the Bristol Region in the context of a physical interconnect. Subsystems and elements specific to the Region are called out in the boxes surrounding the main interconnect diagram, and these are color-coded to the subsystem with which they are associated.

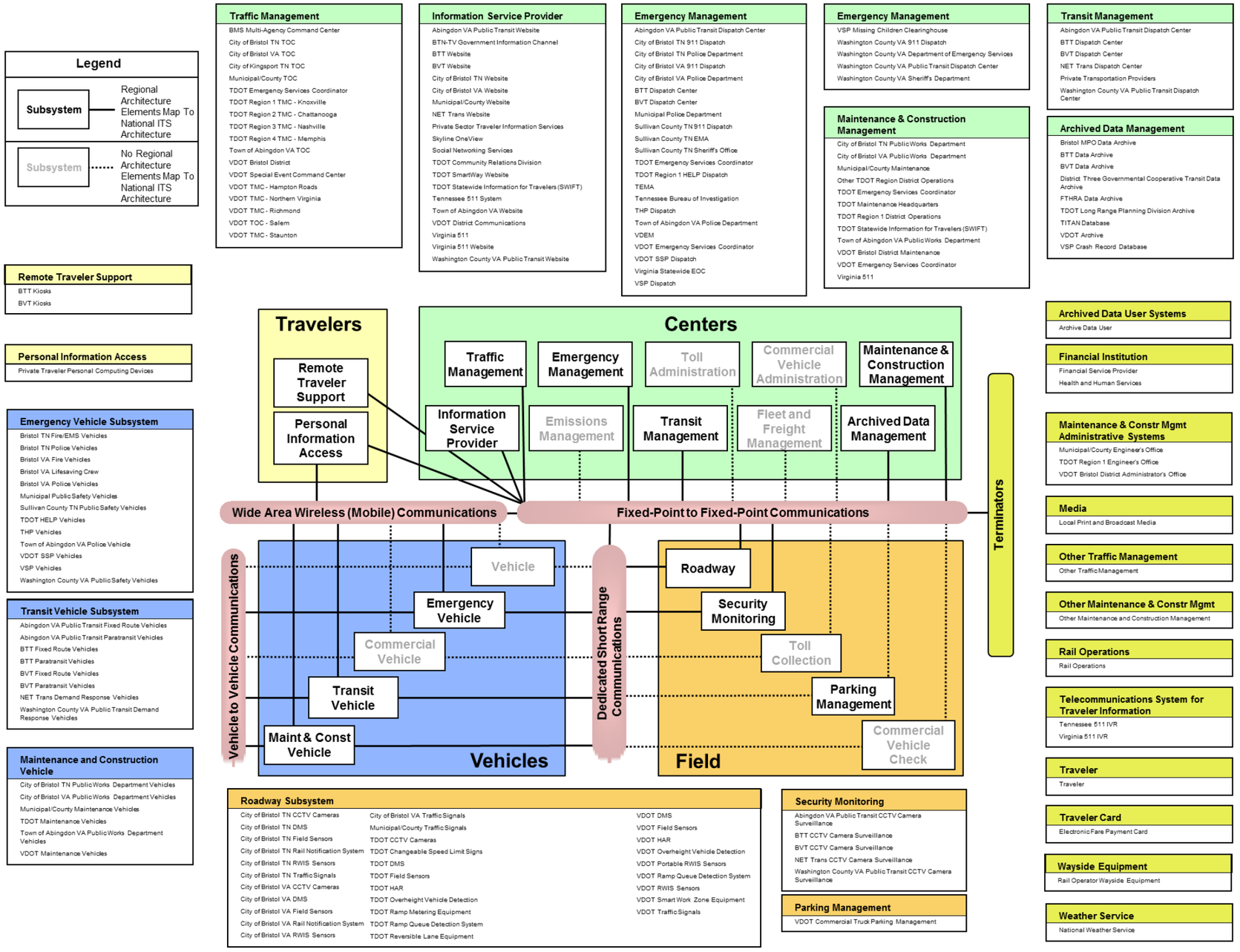


Figure 5 – Bristol Regional System Interconnect Diagram

5.2.2 Element Connections

A number of different elements are identified as part of the Bristol 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 Bristol 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 Bristol, VA Traffic Signals, which shows existing connections in addition to connections that could be made in the future.

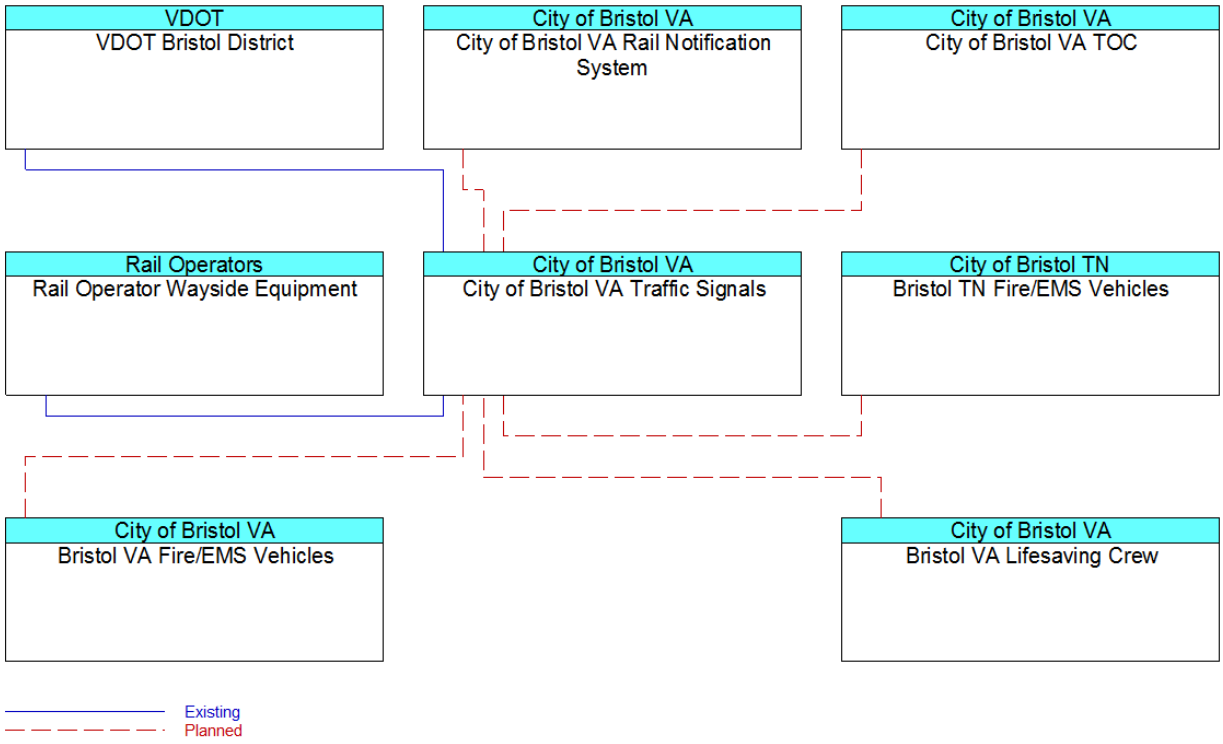


Figure 6 – Example Interconnect Diagram: City of Bristol VA Traffic Signals

5.2.3 Information Flows Between Elements

In the service 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 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 service package for ease of interpretation; however, it is important to remember that custom information flows will not show up in diagrams that are filtered by service package. An example of a flow diagram that has been filtered for the APTS02 – Transit Fixed-Route Operations service package is shown in **Figure 7**. The diagram shows existing and planned information flows between elements that support fixed-route transit operations.

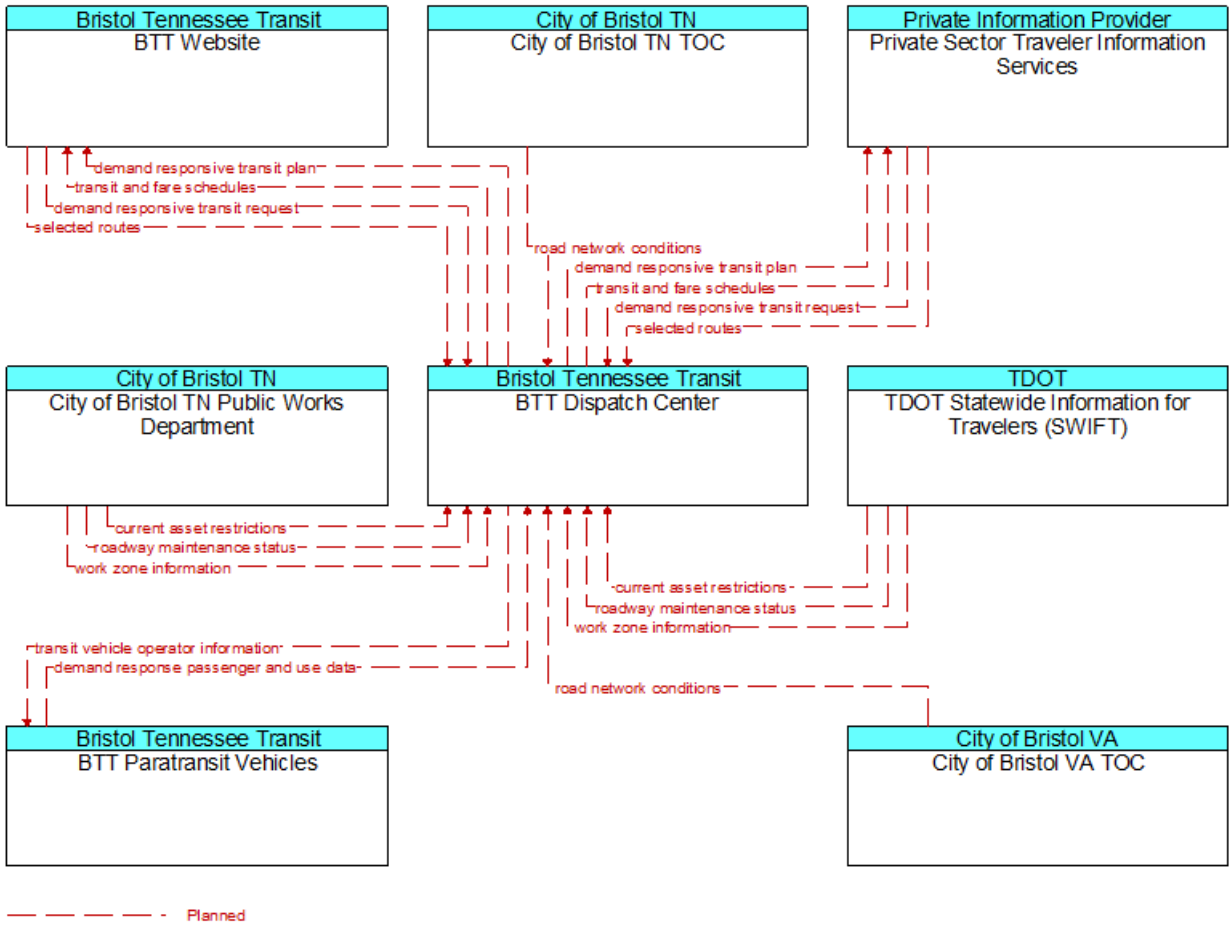


Figure 7 – Example Flow Diagram: APTS02 – Transit Fixed-Route Operations

5.3 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 Bristol Region, it is recommended that the development of detailed functional requirements such as the "shall" statements included in process specifications for a system be developed at the project level. These detailed "shall" statements identify all functions that a project or system needs to perform.

For the Bristol Regional ITS Architecture, functional requirements have been identified at two levels. The customized service packages, discussed previously in Section 5.1.3, describe the services that ITS needs to provide in the Region and the information flows between the elements. These service packages and information flows describe what ITS in the Bristol Region has to do and the data that needs to be shared among elements.

At a more detailed level, functional requirements for the Bristol Region are described in terms of functions that each element in the architecture performs or will perform in the future. **Appendix C** contains a table that summarizes the functions by element excluding terminators. In addition to Appendix C, the requirements tab within the Turbo Architecture database also includes the functional requirements that have been identified for each of the elements in the Bristol Region.

These functional requirements include the "shall" statements that describe what the system does. The "shall" statements should be reviewed during future project level planning and design phases, and stakeholders should determine which of the "shall" statements are existing, which need to be implemented, and which are not needed based on their specific project needs. Section 7.2 contains additional information on the use of functional requirements when performing a systems engineering analysis on a project.

5.4 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Bristol 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 8** identifies each of the ITS standards that could apply to the Bristol Regional ITS Architecture. These standards are based on the physical subsystem information flows previously identified in Section 5.2.3 and shown in the service package diagrams in **Appendix B**. As projects are being implemented in the Region, each agency is encouraged to require manufacturers and vendors to adhere to ITS standards. The information flows being implemented by a particular project will help the agency, vendors, and manufacturers determine which standards to follow.

While **Table 8** does not match the standards to specific information 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 information flow. To locate this information, take the following steps:

- Go to the main page (http://local.iteris.com/itsarch/index.htm) of the National Architecture website;
- In the menu bar on the left-hand side select the tab for Physical Architecture;
- Select the Architecture Flows (information 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 (information 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 8 – Bristol Region 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 Sign (DMS)
	NTCIP 1204	Object Definitions for Environmental Sensor Stations (ESS)
	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control
	NTCIP 1207	Object Definitions for Ramp Meter Control (RMC) Control
	NTCIP 1208	Object Definition for Closed Circuit Switching (CCTV) Camera Switching
	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems (TSS)
	NTCIP 1210	Field Management Stations (FMS) – Part 1: Object Definitions for Signal System Masters (SCP)
	NTCIP 1211	Object Definitions for Signal Control and Prioritization
	NTCIP 1214	Object Definitions for Conflict Monitors (CMU)
	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 (TCP/IP) and Universal Datagram Protocol/Internet Protocol (UDP/IP) 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 (TMDD) and Message Sets for External TMC Communications (MS/ETMCC)
APTA	APTA TCIP-S-001 3.0.4	Standard for Transit Communications Interface Profiles
ASTM	ASTM E2158-01	Standard Specification for Dedicated Short Range Communications (DSRC) Physical Layer using Microwave in the 902-928 MHz Band

Table 8 – Bristol Region Applicable ITS Standards (continued)

SDO	Document ID	Title
ASTM (continued)	ASTM E2213-03	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems – 5 GHz Band Dedicated Short Range Communication (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications
	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems
	ASTM E2665-08	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data
IEEE	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 1609.11-2010	Standard for Wireless Access in vehicular Environments (WAVE) – Over-the-Air Electronic Payment Data Exchange Protocol for Intelligent Transportation Systems (ITS)
	IEEE 1609.12-2012	Standard for Wireless Access in vehicular Environments (WAVE) – Identifier Allocations
	IEEE 1609.2-2013	Standard for Wireless Access in vehicular Environments (WAVE) – Security Services for Applications and Management Messages
	IEEE 1609.3-2010	Standard for Wireless Access in vehicular Environments (WAVE) – Networking
	IEEE 1609.4-2010	Standard for Wireless Access in vehicular Environments (WAVE) – Multi-Channel Operation
	IEEE 802.11-2012	Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific requirements – Part II: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification
	IEEE P1609.0-2013	Standard for Wireless Access in vehicular Environments (WAVE) – Architecture
	IEEE P1512.4	Standard for Common Traffic Incident Management Message Sets for Use in Entities External to Centers
SAE	SAE J2266	Location Referencing Message Specification (LRMS)
	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 (RDS) Phrase Lists
	SAE J2540/2	(ITIS) International Traveler Information Systems Phrase Lists
	SAE J2540/3	National Names Phrase List

5.5 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 Architecture. The services covered are:

- **Traffic Signal Control** – 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 Traffic Metering 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.
- **Maintenance and Construction Management** – The development of systems to manage the maintenance of roadways in the Region, including winter snow and ice clearance. Includes the managing of construction operations and coordinating construction activities.
- **Transit Management** – The development of systems to more efficiently manage fleets of transit vehicles or transit rail. Includes systems to provide transit traveler information both pre-trip and during the trip.
- **Traveler Information** – The development of systems to provide static and real-time transportation information to travelers.
- **Archived Data Management** – The development of systems to collect transportation data for use in non-operational purposes (e.g., planning and research).

Table 9 identifies the roles and responsibilities of key stakeholders for a range of transportation services.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Traffic Signal Management	City of Bristol TN	Maintain communication network for traffic signals.
		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 signal 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 Bristol VA	Maintain communication network for traffic signals.
		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 signal preemptions.
		Provide traffic signal preemption for emergency vehicles.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
	Municipal/County Government	Operate and maintain traffic signal systems within their jurisdiction.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle signal preemptions.
	Town of Abingdon VA	Operate and maintain traffic signal systems within the Town.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on roadways within the Town 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 signal preemptions.
		Provide traffic signal preemption for emergency vehicles.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Traffic Signal Management (continued)	VDOT	Operate and maintain traffic signal systems on state highways.
		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.
Freeway Management	TDOT	Operate dynamic message signs (DMS) and highway advisory radio (HAR) for the distribution of traffic information and roadway conditions to travelers on the roadway.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on state roadways.
		Operate motorist assistance patrol (HELP) to facilitate special event traffic control and incident management.
		Operate dynamic roadway warning equipment for wrong-way driver detection and warning.
		Operate ramp metering equipment to manage vehicles entering a controlled access facility
		Operate ramp queue detection and warning system.
		Operate variable speed limit signs based on weather and traffic conditions.
		Operate overheight vehicle detection equipment and DMS to provide active advanced warnings of low overhead structures.
		Operate and control reversible lane equipment on interstates and state highways.
	VDOT	Operate DMS, HAR, and Wizard CB Radio 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.
		Operate overheight vehicle detection equipment and DMS to provide active advanced warnings of low overhead structures.
		Operate motorist assistance patrol (SSP) to facilitate special event traffic control and incident management.
		Operate ramp queue detection system and traffic signals.
Incident Management (Traffic)	City of Bristol TN	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.
		Operate DMS to distribute incident information to travelers on the roadway.
		Responsible for coordination with other traffic and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Traffic) (continued)	City of Bristol VA	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.
		Operate DMS for the distribution of incident information to travelers on the roadway.
		Responsible for coordination with other traffic 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 traffic and emergency management agencies for coordinated incident management.
		Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.
	Town of Abingdon	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 and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	VDOT	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.
		Operate DMS, HAR, and Wizard CB Radio to distribute incident information to travelers on the roadway.
		Responsible for coordination with other traffic and emergency management agencies for coordinated incident management.
		Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Emergency)	Bristol TN 911 Dispatch	Dispatch public safety vehicles to incidents.
		Coordinate incident response with the City of Bristol TN TOC and the TDOT SmartWay Center in Knoxville for incidents on state facilities as well as with other emergency dispatch agencies including the City of Bristol VA, Tennessee Highway Patrol, and Sullivan County TN.
	Bristol VA 911 Dispatch	Dispatch public safety vehicles to incidents.
		Coordinate incident response with the City of Bristol VA TOC, VDOT Bristol District, and VDOT TOC in Salem for incidents on state facilities as well as with other emergency dispatch agencies including the City of Bristol VA, Virginia State Police, and Washington County VA.
	Sullivan County TN 911 Dispatch	Dispatch public safety vehicles to incidents.
		Coordinate incident response with the City of Bristol TN TOC and the TDOT SmartWay Center in Knoxville for incidents on state facilities as well as with other emergency dispatch agencies including the City of Bristol TN and the Tennessee Highway Patrol.
	THP Dispatch	Dispatch public safety vehicles for incidents.
		Coordinate incident response with other public safety and traffic management agencies as well as the TDOT SmartWay Center in Knoxville for incidents on state facilities.
	VSP Dispatch	Dispatch public safety vehicles for incidents.
		Coordinate incident response with other public safety and traffic management agencies, the VDOT Bristol District and VDOT TMC in Salem for incidents on state facilities.
	Washington County VA 911 Dispatch	Dispatch public safety vehicles to incidents.
		Coordinate incident response with emergency dispatch agencies, the City of Bristol VA TOC, VDOT Bristol District, and VDOT TMC in Salem for incidents on state facilities.
Emergency Management	Bristol TN 911 Dispatch	Responsible for emergency call-taking for the City of Bristol TN 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.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Bristol VA 911 Dispatch	Responsible for emergency call-taking for the City of Bristol VA 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.
	Sullivan County TN 911 Dispatch	Responsible for emergency call-taking for Sullivan County outside the City of Bristol TN and the City of Kingsport TN 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.
	Sullivan County TN EMA	Operates the EOC for Sullivan County TN 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.
	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.
		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.
		Responsible for coordination with adjacent states, including the State of Virginia as needed to support emergency management.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Tennessee Bureau of Investigation	Responsible for the initiation of AMBER Alerts.
	THP 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.
	VDEM	Operates the EOC for the Commonwealth of Virginia 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.
		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.
		Responsible for coordination with adjacent states, including the State of Tennessee, as needed to support emergency management.
	VSP 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.
	VSP Missing Children Clearinghouse	Responsible for the initiation of AMBER Alerts.
	Washington County VA 911 Dispatch	Responsible for emergency call-taking for Washington County including the Town of Abingdon.
		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.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Washington County VA Department of Emergency Services	Operates the EOC for Washington County VA 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.
Maintenance and Construction Management	City of Bristol TN Public Works Department	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.
		Disseminates work zone activity schedules and current asset restrictions to other agencies.
	City of Bristol VA Public Works Department	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.
		Disseminates work zone activity schedules and current asset restrictions to other agencies.
	Municipal/County Maintenance	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.
		Disseminates work zone activity schedules and current asset restrictions to other agencies.
	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.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	TDOT (continued)	Responsible for entering and updating work zone information in SWIFT
		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.
	Town of Abingdon VA	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.
		Disseminates work zone activity schedules and current asset restrictions to other agencies.
	VDOT	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 Virginia 511.
		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	Abingdon Public Transit	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 and demand response transit vehicles.
		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 Virginia 511 system.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
		Coordinate transit service with other regional transit providers.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	BTT	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 and demand response transit vehicles.
		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 Tennessee 511 system.
		Operates 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.
		Coordinate transit service with other regional transit providers.
	BVT	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 and demand response transit vehicles.
		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 Virginia 511 system.
		Operates 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.
		Coordinate transit service with other regional transit providers.
	NET Trans	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 Tennessee 511 system.

Table 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	NET Trans (continued)	Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
		Coordinate transit service with other regional transit providers.
	Washington County VA Public Transit	Operates demand response transit services from a central dispatch facility responsible for tracking vehicle location and status.
		Provide transit passenger electronic fare payment on transit vehicles.
		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 Virginia 511 system.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
		Coordinate transit service with other regional transit providers.
Traveler Information	City of Bristol TN	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 Bristol VA	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, special event, and weather information to travelers via the Tennessee 511 system.
		Provide transportation network condition data to private sector information service providers.
	Town of Abingdon VA	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 9 – Bristol Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Traveler Information (continued)	VDOT	Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, special event, and weather information to travelers via the Virginia 511 system.
		Provide transportation network condition data to private sector information service providers.
Archived Data Management	Abingdon Public Transit	Collect and maintain transit archive data.
	Bristol MPO	Collect and maintain data from regional traffic and transit management agencies.
	BTT	Collect and maintain data from regional traffic and transit management agencies.
	BVT	Collect and maintain data from regional traffic and transit management agencies.
	NET Trans	Collect and maintain transit archive data.
	TDOT	Collect and maintain traffic archive data.
	THP	Collect and maintain crash record information from regional emergency management agencies.
	VDOT	Collect and maintain traffic archive data.
	VSP	Collect and maintain crash record information from regional emergency management agencies.
	Washington County VA Public Transit	Collect and maintain transit archive data.

5.6 Potential Agreements

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

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

Agreements should avoid being specific with regards to technology when possible. Technology is likely to change, and changes to technology could require an update of the agreement if the agreement was not technology neutral. The focus of the agreement should be on the responsibilities of the agencies and the high level information that needs to be exchanged. Depending on the type of agreement being used, agencies need to be prepared for the process to complete an agreement to take several months to years. Agencies must first reach consensus on the content of an agreement and then proceed through the approval process. The approval process for formal agreements varies

by agency. The process often is lengthy; agencies should 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 each 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 that 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 10 provides a list of existing and potential agreements for the Bristol Region based on the interfaces identified in the Regional ITS Architecture. It is important to note that as ITS services and systems are implemented in the Region, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations. It is likely that any future agreements will be drafted and formalized on a project-by-project basis as projects necessitating agreements are implemented.

In **Appendix E**, copies of the existing agreements that were available have been included. These agreements include:

- Memorandum of Understanding among TDOT, TDOSHS, and local governments for the quick clearance of incidents along the State Highway System;
- Agreement developed by TDOT for live CCTV video access and information sharing for governmental agency users; and
- Agreement developed by TDOT for live CCTV video access for private entity users.
- Agreement developed by TDOT for live CCTV video access for responder entity users.

Table 10 – Bristol Region Existing and Potential Agreements

Status	Agreement and Agencies	Agreement Description
Existing	**Data Sharing and Usage (Public-Private)** –TDOT and Media	Agreement to 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 is also part of the agreement.
Existing	**Data Sharing and Usage (Public-Public)** –TDOT and Local Responder Entity Users	Agreement to define the parameters, guidelines, and policies for inter-agency ITS data sharing between public sector agencies including CCTV camera feeds. Allows local governmental agencies the ability to view live TDOT SmartWay cameras through TDOT's SmartView Program. Local governments are required to share traffic related information with TDOT that may negatively impact interstates or state routes in addition to attending incident management training.
Existing	**Open Roads Policy (Public-Public)** – TDOT, THP (TDOSHS), and Municipalities/Counties	Memorandum of Understanding among TDOT, THP (TDOSHS), and local governments that establishes guidelines to accelerate the removal of vehicles or debris on the State Highway System to restore the flow of traffic following an incident.
Future	**Data Sharing and Usage (Public-Private)** – (TDOT, VDOT, City of Bristol TN, City of Bristol VA, Town of Abingdon, Media)	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.
Future	**Data Sharing and Usage (Public-Public)** – (TDOT, VDOT, City of Bristol TN, City of Bristol VA, Town of Abingdon)	Agreement would define the parameters, guidelines, and policies for inter-agency ITS data sharing between the 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** – (City of Bristol TN, City of Bristol VA, VDOT)	Agreement would define the parameters, guidelines, and policies for inter-agency traffic signal timing sharing between cities, counties, and any other agencies that might maintain their traffic signal system.
Future	**Incident Data Sharing and Usage** – (TDOT, VDOT, City of Bristol TN, City of Bristol VA, Bristol TN 911 Dispatch, Bristol VA 911 Dispatch, Sullivan County TN 911 Dispatch, Washington County VA 911 Dispatch, THP, VSP)	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.

Table 10 – Bristol Region Existing and Potential Agreements (continued)

Status	Agreement and Agencies	Agreement Description
Future	**Joint Operations Agreements –** (TDOT, VDOT, City of Bristol TN, City of Bristol VA, Bristol TN 911 Dispatch, Bristol VA 911 Dispatch, Sullivan County TN 911 Dispatch, Washington County VA 911 Dispatch, THP, VSP)	Agreement to operate the system from a shared control facility that could include traffic, transit, and emergency management. Examples could include a regional TMC or a combined TMC and EOC. Agreement will need to identify such issues as sharing of data and control of devices, cost sharing of the facilities, and standard operating procedures. Shared field equipment, such as a CCTV camera that can be accessed by multiple agencies could also be covered under this type of agreement.
Future	**Shared Maintenance Agreements** – (City of Bristol TN, City of Bristol VA, Municipal/County)	Agreement that would allow multiple public agencies to pool their funding together to hire a single maintenance contractor to maintain ITS devices throughout the Region. This type of agreement may reduce the cost of maintenance particularly for agencies with a limited number of ITS devices deployed. By combining all maintenance into a single contract the need for each agency to provide specialized training and equipment to staff is eliminated.

5.7 Phases of Implementation

The Bristol Regional ITS Architecture will be implemented over time through a series of projects. 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 timeframes were identified in the Bristol Regional ITS Deployment Plan presented in Section 6. These projects were sequenced over a time period that coincides with the 2040 Long Range Transportation Plan, with projects identified for deployment in the short-term (0 to 5 years), mid-term (5 to 10 years), and long-term (beyond 10 years.)

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

- ATMS01 – Network Surveillance;
- ATMS02 – Traffic Probe Surveillance;
- ATMS03 – Traffic Signal Control;
- ATMS06 – Traffic Information Dissemination;
- ATMS07 – Regional Traffic Management;
- ATMS08 – Traffic Incident Management System;
- MC01 – Maintenance and Construction Vehicle Equipment Tacking;
- MC03 – Road Weather Data Collection;
- MC04 – Weather Information Processing and Distribution;
- MC09 – Winter Maintenance;
- APTS02 – Transit Fixed-Route Operations;
- APTS03 – Demand Response Transit Operations;
- APTS07 – Multi-modal Coordination;
- APTS08 – Transit Traveler Information;
- APTS11 – Multimodal Connection Protection;
- ATIS02 – Interactive Traveler Information; and
- AD1 – ITS Data Mart.

6. REGIONAL ITS DEPLOYMENT PLAN

The Regional ITS Deployment Plan serves as a tool for the Bristol Region to identify specific projects that should be deployed in order to achieve the desired functionality identified in the Regional ITS Architecture. The Regional ITS Deployment Plan builds on the Regional ITS Architecture by outlining specific ITS project recommendations and strategies for the Region and identifying deployment timeframes so that the recommended projects and strategies can be implemented over time.

The Regional ITS Deployment Plan also shows the correlation between each project and the Regional ITS Architecture by identifying the ITS service packages that correspond to each project. If projects were identified that did not correspond to an ITS service package, the ITS service packages in the Regional ITS Architecture were revised while the Regional ITS Architecture was still in draft format; therefore, the resulting ITS deployment projects are supported by the Regional ITS Architecture.

The Bristol Regional ITS Deployment Plan provides stakeholders with a list of regionally significant ITS projects that are consistent with the Regional ITS Architecture and assists with addressing transportation needs in the Region. It is important to note that the Regional ITS Deployment Plan is not fiscally constrained. The projects in the plan represent those projects that stakeholders would like to implement; however, funding will still be needed in order for these projects to actually be implemented.

6.1 Project Development and Selection

An overview of the process used to develop the Regional ITS Deployment Plan is provided in **Figure 8**. This figure demonstrates that a variety of inputs were used to gather information and develop a set of ITS projects for selection by stakeholders, including a review of the regional needs, ITS service package priorities, and regional and local plans.

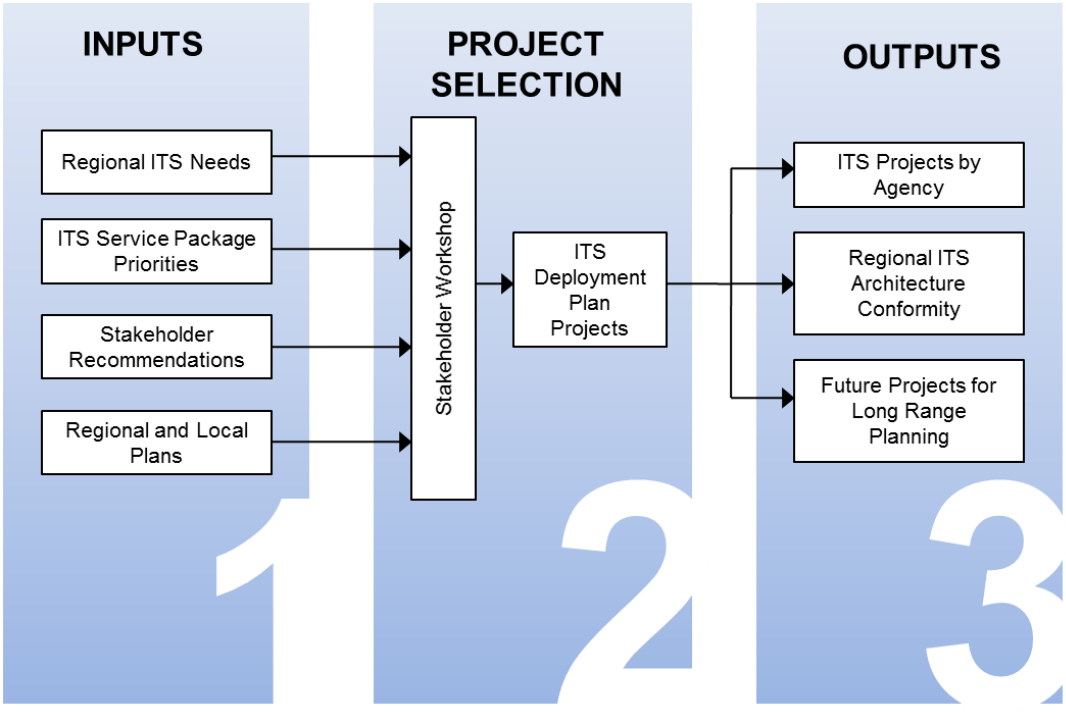


Figure 8 – Project Development and Selection Process

Stakeholder input in Step 1 was gathered through a stakeholder workshop where the regional ITS needs, ITS service package priorities, and planned ITS projects were discussed. A series of interviews were also conducted to discuss this same information in more detail with key agencies in the Region. A review of regional and local plans was conducted as well to identify potential project ideas.

The inputs in Step 1 led to the project selection in Step 2. Project selection was completed through a combination of a stakeholder workshop held in January 2017 as well as stakeholder review of the Regional ITS Architecture Report.

The outputs of the plan, shown in Step 3, will provide stakeholders and the Bristol MPO with a list of priority ITS projects for the Bristol Region. Each of the projects recommended in the plan has been checked against the Bristol Regional ITS Architecture to ensure they are in conformance. This should assist agencies deploying these projects in the future with meeting FHWA and FTA requirements for ITS architecture conformity. The projects in the plan could also feed into the long-range planning process and provide agencies with a list of priority ITS projects for consideration during future calls for projects from the TPO.

6.2 ITS Project Recommendations

In order to achieve the ITS deployment levels outlined in their Regional ITS Architecture, a region must deploy carefully developed projects that provide the functionality and interoperability identified in their Regional ITS Architecture. A key step toward achieving the Bristol Region's ITS vision, as established in the Regional ITS Architecture, is the development of an ITS Deployment Plan that identifies specific projects, timeframes, and responsible agencies.

Input from all stakeholders is required for stakeholders to have ownership of the ITS Deployment Plan and to ensure that the plan has realistically identified projects and timeframes for deployment. Cost is another important factor—cost can vary a great deal for many ITS elements, depending on the level of deployment, maturity of the technology, type of communications, etc. For example, freeway network surveillance could be adequately achieved for one region by the deployment of still frame CCTV cameras only at freeway interchanges. In another region, full motion cameras may be deployed at one-mile intervals to provide complete coverage of the freeway. The infrastructure and telecommunications costs for these two projects would vary a great deal, yet either one could be suitable for a particular region.

Regional projects are identified in **Table 11** through **Table 14**. The tables are divided by the primary responsible agency as follows:

Table 11 – State ITS Deployment Plan Projects

Table 12 – Local ITS Deployment Plan Projects

Table 13 – Transit ITS Deployment Plan Projects

Table 14 – Other ITS Deployment Plan Projects

The projects identified in the tables represent priority projects for each agency that are needed in order to implement the ITS services that were identified as part of the Regional ITS Architecture development. Projects that have been funded using federal transportation funds from the highway trust fund will be included in the Regional Transportation Improvement Plan (TIP). Projects that are funded with non-federal funding may also be included in the TIP, but are not required to be included. Many of the projects identified in the plan do not yet have funding. Identification of a funding source will likely be the most significant challenge in getting the projects implemented.

For each project, the following categories are discussed:

- **Project** – Identifies the project name including the agency responsible for implementation where applicable.
- **Description** – Provides a description of the project including notes on time-frames for deployment and costs if applicable. The level of detail in the project descriptions varies depending on the implementing agency and how much detail they wanted to include regarding a project. In some cases, projects had not been discussed beyond a very high conceptual level and there was limited or no information available on cost and scale of the potential project.
- **Deployment Timeframe and Responsible Agency** – Provides a recommended timeframe for deployment for each project. Timeframes have been identified as short-term (deployment recommended in 0-5 years), mid-term (deployment recommended in 5-10 years), and long-term (deployment recommended beyond 10 years). Recommendations for deployment timeframes were based on input from each agency and considered the project priority, possibility of funding, and dependency on other project deployments.
- **Funding Status** – Indicates whether funding has been identified or is still needed for the project.
- **Applicable ITS Service Packages** – Identifies the ITS service packages from the Regional ITS Architecture that each project will assist in implementing. Knowing which ITS service packages each project identifies is an important part of an ITS architecture conformance review.

Table 11 – State ITS Deployment Plan Projects

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
Combined TDOT and VDOT Projects				
TDOT/VDOT Combined Regional TMC	Establish a combined TMC for the Tri-Cities Region that will be jointly operated by TDOT and VDOT with coordination with the cities of Bristol, TN; Bristol, VA; Johnson City, and Kingsport.	Long-Term: TDOT/VDOT and Municipal Government	Funding Identified: No	ATMS07 – Regional Traffic Management
TDOT Projects				
TDOT HELP Vehicle Service Area Expansion	Expand the TDOT Region 1 HELP service area to include vehicles stationed in the Bristol Region. HELP vehicles stationed in the area would facilitate incident management as well as special event management.	Mid to Long-Term: TDOT	Funding Identified: No	EM04 – Roadway Service Patrols
TDOT CCTV Camera Expansion	Install additional CCTV cameras along I-81 at each interchange.	Mid to Long -Term: TDOT	Funding Identified: No	ATMS01 – Network Surveillance ATMS07 – Regional Traffic Management
TDOT SmartView Access for Local Governments	SmartView is a software program that is used internally by TDOT to view real-time CCTV camera video in addition to other functions. This program also allows local government agencies the ability to view TDOT CCTV cameras feeds and offer additional viewing capabilities that are not available to the general public on the SmartWay website.	Short-Term: TDOT and Counties/ Municipalities	Funding Identified: Yes	ATMS01 – Network Surveillance ATMS07 – Regional Traffic Management
TDOT DMS Deployment	Install dynamic message signs (DMS) on I-81 in the Bristol Region. Desired locations include I-81 southbound in Virginia, just before the Tennessee state line, and I-81 northbound before Exit 69.	Long-Term: TDOT	Funding Identified: No	ATMS06 – Traffic Information Dissemination

Table 11 – State ITS Deployment Plan Projects (continued)

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
TDOT Weather Detection	Implement additional weather detection in the Bristol Region for snow and ice detection. The bridges on I-81 were identified as priority needs because these bridges are most likely to freeze during winter storms.	Mid-Term: TDOT	Funding Identified: No	MC03 – Road Weather Data Collection MC04 – Weather Information Processing and Distribution MC06 - Winter Maintenance
TDOT Overheight Detection	Install overheight detection equipment in strategic locations to warn driver of low height crossings to prevent damage to existing infrastructure.	Long-Term: TDOT	Funding Identified: No	ATMS19 – Speed Warning and Enforcement ATMS24 – Dynamic Roadway Warning
TDOT Variable Speed Limit Implementation	Implement variable speed limits at certain locations for the races at Bristol Motor Speedway.	Mid to Long-Term: TDOT and Counties/ Municipalities	Funding Identified: No	ATMS22 – Variable Speed Limits
TDOT Smart Work Zones	Continue to implement smart work zone technologies for maintenance and construction projects where appropriate	Short-Term: TDOT	Funding Identified: No	MC07 – Roadway Maintenance and Construction MC08 – Work Zone Management MC09 – Work Zone Safety Monitoring
VDOT Projects				
VDOT Bristol District Office Satellite TOC	Establish a traffic operations center in the Bristol Region to supplement the Salem TOC that allow the Bristol District Office to monitor and control closed circuit television (CCTV) cameras, vehicle detection, dynamic message signs (DMS) and traffic signals.	Short to Mid-Term: VDOT	Funding Identified: No	ATMS07 – Regional Traffic Management
VDOT Closed Circuit Television (CCTV) Cameras Expansion on I-81	Install additional CCTV cameras on I-81 in the Bristol Region at least every five miles or at frequent crash locations.	Short-Term: VDOT	Funding Identified: No	ATMS01 – Network Surveillance

Table 11 – State ITS Deployment Plan Projects (continued)

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
VDOT SSP Service Area Expansion	Expand the VDOT Safety Service Patrol (SSP) service area as well as the hours in which they operate. Initially seven days a week then 24 hours a day.	Short to Mid-Term: VDOT	Funding Identified: No	EM04 – Roadway Service Patrol
VDOT Ramp Queue Vehicle Detection Deployment	Continue the installation of vehicle detection equipment at CCTV camera locations and entrance and exit ramps on I-81.	Short-Term: VDOT	Funding Identified: Yes	ATMS01 – Network Surveillance
VDOT Detour Route Implementations	Implement CCTV cameras and DMS on designated detour routes to be used during closures of I-81. Coordination of signals on corridors connecting I-81 and US 11/US 19 may also be included as part of the detour route implementation.	Mid-Term: VDOT	Funding Identified: No	ATMS01 – Network Surveillance ATMS03 – Traffic Signal Control ATMS06 – Traffic Information Dissemination
VDOT Signal Controllers	Implement a statewide traffic signal controller platform for better uniformity and coordination among agencies.	Long-Term VDOT and Municipal Government	Funding Identified: No	ATMS03 – Traffic Signal Control
VDOT Emergency Vehicle Preemption	Implement emergency vehicle preemption for fire, police, and EMS at traffic signals where appropriate.	Short to Mid-Term: VDOT	Funding Identified: No	ATMS03 – Traffic Signal Control EM02 – Emergency Routing
VDOT Snow Plow Vehicle Location	Continue the installation of automatic vehicle location (AVL) technology on snow plows and provide this information to the public in VDOT's Bristol District	Short-Term: VDOT	Funding Identified: Yes	MC01 – Maintenance and Construction Vehicle and Equipment Tracking
VDOT Drone Network Surveillance	Use emerging drone technology to dynamically monitor locations instead of installing static CCTV cameras on poles.	Mid-Term: VDOT	Funding Identified: No	ATMS01 – Network Surveillance

[1]Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years

Table 12 – Local ITS Deployment Plan Projects

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
City of Bristol, TN Projects				
City of Bristol TN Centrally Controlled Signal System	Implement a centrally controlled signal system that will allow the City of Bristol TN TOC operators to monitor and control traffic signals in the City.	Short-Term: City of Bristol TN	Funding Identified: No	ATMS03 – Traffic Signal Control
City of Bristol TN TOC	Establish a Traffic Operations Center (TOC) in coordination with City of Bristol 911 Dispatch. The TOC will manage the traffic signal system, monitor closed circuit television (CCTV) cameras, and vehicle detection. This project could be completed in coordination with Bristol TN.	Mid-Term: City of Bristol TN	Funding Identified: No	ATMS01 – Network Surveillance ATMS03 – Traffic Signal Control ATMS07 – Regional Traffic Management EM01 – Emergency Call-Taking and Dispatch EM02 – Emergency Routing
City of Bristol TN Signal System Upgrades	Upgrade City of Bristol TN traffic signals and controllers to allow signal coordination and incorporation into a closed loop signal system that is centrally controlled. Signal system upgrades should be coordinated with Bristol VA, especially along State Street.	Short-Term: City of Bristol TN	Funding Identified: No	ATMS03 – Traffic Signal Control
City of Bristol TN Emergency Vehicle Signal Preemption	Implement emergency vehicle signal preemption capabilities at traffic signals in the City of Bristol TN to improve incident response times and emergency responder safety. This project could be completed in coordination with Bristol TN.	Short to Mid-Term: City of Bristol TN	Funding Identified: No	ATMS03 – Traffic Signal Control EM02 – Emergency Routing
City of Bristol TN Public Works Department and Emergency Responder AVL	Implement automated vehicle location (AVL) on City of Bristol TN Public Works Department vehicles, Police, and Fire vehicles.	Short to Mid-Term: City of Bristol TN	Funding Identified: No	EM01 – Emergency Routing MC01 – Maintenance and Construction Vehicle and Equipment Tracking

Table 12 – Local ITS Deployment Plan Projects (continued)

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville	Establish a communications connection between the City of Bristol TOC and the TDOT Region 1 TMC in Knoxville for the coordination of traffic information.	Short to Mid-Term: City of Bristol TN and TDOT	Funding Identified: No	ATMS07 – Regional Traffic Management
City of Bristol TN CCTV Cameras	Implement additional CCTV cameras on key sections of roadway within the City of Bristol. CCTV cameras can be used to monitor traffic conditions and to aid in incident management. High priority locations for deployment include US 11E from Bluff City to Bristol VA and SR 394 from I-81 to approximately 4 miles east of the Bristol Motor Speedway. Such a system would need to interconnect with a CCTV system along US 11E/Commonwealth Avenue in Bristol VA.	Mid-Term: City of Bristol TN	Funding Identified: No	ATMS01 – Network Surveillance
City of Bristol TN DMS	Deploy DMS in the City of Bristol to provide traveler information, incident management, and special event management capabilities. Priority locations include SR 394 eastbound and westbound between I-81 and US 11E/19W. The primary purpose of the DMS will be for Bristol Motor Speedway event management but they can also be used for daily traffic management.	Mid-Term: City of Bristol TN	Funding Identified: No	ATMS06 – Traffic Information Dissemination
City of Bristol TN Railroad Grade Crossing Improvements TIP# TI-2	Implement advanced warning signs at railroad crossings to alert motorists of road blockages due to stopped trains. The crossing on East Cedar Street at 5th Street will have Railroad preemption as part of a roadway reconstruction project.	Mid-Term: City of Bristol TN	Funding Identified: Yes – Surface Transportation Block Grant (STBG) Funds Project Cost: $7,550,059	ATMS13 – Standard Railroad Grade Crossing

Table 12 – Local ITS Deployment Plan Projects (continued)

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
City of Bristol, VA Projects				
City of Bristol VA Centrally Controlled Signal System	Implement a centrally controlled signal system that will allow the City of Bristol VA TOC operators to monitor and control traffic signals in the City.	Short-Term: City of Bristol VA	Funding Identified: No	ATMS03 – Traffic Signal Control
City of Bristol VA TOC	Establish a Traffic Operations Center (TOC) for the City of Bristol VA. The TOC will manage the closed loop traffic signal system, monitor and control closed circuit television (CCTV) cameras, vehicle detection. This project could be completed in coordination with Bristol TN.	Short to Mid-Term: City of Bristol VA	Funding Identified: No	ATMS01 – Network Surveillance ATMS03 – Traffic Signal Control ATMS07 – Regional Traffic Management
City of Bristol VA Signal System Upgrades	Upgrade City of Bristol VA traffic signals and controllers to allow signal coordination and incorporation into a closed loop signal system that is centrally controlled. Signal system upgrades should be coordinated with Bristol TN, especially along State Street.	Short-Term: City of Bristol VA	Funding Identified: No	ATMS03 – Traffic Signal Control
City of Bristol VA Emergency Vehicle Signal Preemption	Implement emergency vehicle signal preemption capabilities at traffic signals in the City of Bristol VA to improve incident response times and emergency responder safety. This project could be completed in coordination with Bristol TN.	Short-Term: City of Bristol VA	Funding Identified: No	ATMS03 – Traffic Signal Control EM02 – Emergency Routing
City of Bristol VA Overheight Detection and Warning System	Implement an overheight detection and warning system at the railroad overpasses on Piedmont Avenue and East Valley Drive.	Short-Term: City of Bristol VA	Funding Identified: No	ATMS26 – Dynamic Roadway Warning
City of Bristol VA Emergency Responder AVL	Implement automated vehicle location (AVL) on City of Bristol VA Police and Fire Department vehicles.	Short-Term: City of Bristol VA	Funding Identified: No	EM02 – Emergency Routing

Table 12 – Local ITS Deployment Plan Projects (continued)

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
City of Bristol VA CCTV Cameras	Implement closed circuit television (CCTV) cameras on key sections of roadway within the City of Bristol VA. Priority locations include Commonwealth Avenue to operate in conjunction with the Bristol TN CCTV camera system for special events at the Bristol Motor Speedway.	Mid-Term: City of Bristol VA	Funding Identified: No	ATMS01 – Network Surveillance
City of Bristol VA DMS	Deploy DMS in the City of Bristol VA to provide travel, incident, and special event information.	Mid-Term: City of Bristol VA	Funding Identified: No	ATMS06 – Traffic Information Dissemination
City of Bristol VA Railroad Grade Crossing Improvements	Implement advanced warning signs at railroad crossings to alert motorists of road blockages due to stopped trains.	Mid-Term: City of Bristol VA	Funding Identified: No	ATMS13 – Standard Railroad Grade Crossing
City of Bristol VA Public Works Department AVL	Implement AVL on City of Bristol VA Public Works Department vehicles.	Mid-Term: City of Bristol VA	Funding Identified: No	MC01 – Maintenance and Construction Vehicle and Equipment Tracking
City of Bristol VA TOC Coordination with VDOT TMC in Salem	Establish a communications connection between the City of Bristol VA TOC and the VDOT Traffic Operations Center (TOC) in Salem for the coordination of traffic information.	Mid-Term: City of Bristol VA	Funding Identified: No	ATMS07 – Regional Traffic Management
City of Bristol VA TOC Coordination with VDOT Bristol District	Establish a communications connection between the City of Bristol VA TOC and the VDOT Bristol District for the coordination of traffic information.	Mid-Term: City of Bristol VA	Funding Identified: No	ATMS07 – Regional Traffic Management

Table 12 – Local ITS Deployment Plan Projects (continued)

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
Municipal/County Government Projects				
Sullivan County 911 Dispatch and EOC CCTV Camera Image Sharing	Establish a connection to share TDOT and City of Bristol, TN closed circuit television (CCTV) camera images with the Sullivan County 911 Dispatch and Emergency Operations Center (EOC).	Mid-Term: Sullivan County 911, City of Bristol TN, and TDOT	Funding Identified: No	ATMS01 – Network Surveillance ATMS07 – Regional Traffic Management EM01 – Emergency Call-Taking and Dispatch EM02 – Emergency Routing
Town of Abingdon Projects				
Town of Abingdon VA TOC	Establish a Traffic Operations Center (TOC) in the Town of Abingdon to manage the closed loop traffic signal system, monitor and control closed circuit television (CCTV) cameras, vehicle detection	Short to Mid-Term: Town of Abingdon VA	Funding Identified: No	ATMS01 – Network Surveillance ATMS03 – Traffic Signal Control ATMS07 – Regional Traffic Management EM01 – Emergency Call-Taking and Dispatch EM02 – Emergency Routing
Town of Abingdon VA Centrally Controlled Signal System	Implement a centrally controlled signal system that will allow the Town of Abingdon VA TOC operators to monitor and control traffic signals in the City.	Short-Term: Town of Abingdon VA	Funding Identified: No	ATMS03 – Traffic Signal Control
Town of Abingdon VA CCTV Cameras	Implement closed circuit television (CCTV) cameras on key sections of roadway within the Town of Abingdon VA.	Short to Mid-Term: Town of Abingdon VA	Funding Identified: No	ATMS01 – Network Surveillance
Town of Abingdon VA Emergency Vehicle Signal Preemption	Implement emergency vehicle signal preemption capabilities at traffic signals in the Town of Abingdon VA to improve incident response times and emergency responder safety.	Short to Mid-Term: Town of Abingdon VA	Funding Identified: No	ATMS03 – Traffic Signal Control EM02 – Emergency Routing
Town of Abingdon VA Railroad Grade Crossing Improvements	Implement advanced warning signs at railroad crossings to alert motorists of road blockages due to stopped trains.	Mid to Long-Term: Town of Abingdon VA	Funding Identified: No	ATMS13 – Standard Railroad Grade Crossing

[1]Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years

Table 13 – Transit ITS Deployment Plan Projects

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
Bristol Tennessee Transit Projects				
BTT AVL, MDTs and Mayday Alarms	Install automated vehicle location (AVL) for real-time vehicle location of the Bristol Tennessee Transit (BTT) fleet. The system will include a global positioning system (GPS) unit and a communication link between vehicle and dispatcher. Also included in the implementation are mobile data terminals (MDTs) and Mayday alarms.	Short-Term: BTT	Funding Identified: No	APTS01 – Transit Vehicle Tracking
BTT On-Board Security Monitoring	Implement video surveillance on BTT vehicles to improve patron and driver safety. Cameras will be for local recording only.	Mid-Term: BTT	Funding Identified: No	APTS05 – Transit Security
BTT Automatic Passenger Counters	Implement passenger counters on BTT vehicles to record boardings and alightings.	Long-Term: BTT	Funding Identified: No	APTS10 – Transit Passenger Counting
Bristol Virginia Transit Projects				
BVT AVL, MDTs and Mayday Alarms	Install automated vehicle location (AVL) for real-time vehicle location of the Bristol Virginia Transit (BVT) fleet. The system will include a global positioning system (GPS) unit and a communication link between vehicle and dispatcher. Also included in the implementation are mobile data terminals (MDTs) and Mayday alarms.	Short-Term: BVT	Funding Identified: No	APTS01 – Transit Vehicle Tracking
BVT On-Board Security Monitoring	Implement video surveillance on BVT vehicles to improve patron and driver safety. Cameras will be for local recording only.	Mid-Term: BVT	Funding Identified: No	APTS05 – Transit Security
BVT Automatic Passenger Counters	Implement passenger counters on BVT vehicles to record boardings and alightings.	Long-Term: BVT	Funding Identified: No	APTS10 – Transit Passenger Counting

Table 13 – Transit ITS Deployment Plan Projects (continued)

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
NET Trans				
NET Transit Vehicle Fleet Maintenance	Implement a system that provides automatic transit vehicle maintenance scheduling and monitoring. The system will provide maintenance technicians and operators of mechanical conditions on the transit vehicle.	Short to Mid-Term NET Trans	Funding Identified: No	APTS06 – Transit Fleet Management
NET Trans Website Update	Update the existing NET Trans website to include additional information for riders regarding schedule and route and payment information.	Short-Term: NET Trans	Funding Identified: No	APTS08 – Transit Traveler Information
NET Trans Regional Route Planning	Create a platform to allow passengers to plan their trips from on location to another that is integrated with other transit providers in the Region.	Short-Term: NET Trans	Funding Identified: No	APTS08 – Transit Traveler Information

[1]Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years

Table 14 – Other ITS Deployment Plan Projects

Project	Project Description	Deployment Timeframe and Responsible Agency[1]	Funding Status	Applicable ITS Service Packages
Bristol MPO Projects				
Bristol MPO Archive Data Warehouse	Establish a data warehouse to archive data from cities and transit agencies in the metropolitan planning organization (MPO) service area for use in regional planning. Cost for this project represents an average range for developing a data warehouse system.	Long-Term: Bristol MPO	Funding Identified: No	AD2 – ITS Data Warehouse

[1]Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years

7. USE AND MAINTENANCE PLAN

The Regional ITS Architecture developed for the Bristol Region 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 Bristol 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 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.

In 2001 the FHWA issued Final Rule 23 CFR 940, which required that ITS projects using federal funds from the highway trust fund (or ITS projects that integrate with systems that were deployed with federal funds) conform to a regional ITS architecture and also be developed using a systems engineering process. The purpose of this Section is to discuss how the Bristol Regional ITS Architecture can be used to support meeting the ITS architecture conformity and systems engineering requirements. A process for maintaining the Regional ITS Architecture, including the Regional ITS Deployment Plan which has been incorporated as Section 6 of the Regional ITS Architecture, is also presented. In Section 7.2 the systems engineering analysis requirements and the guidance provided by TDOT and the FHWA Tennessee Division are discussed. In Section 7.3, the process for determining ITS architecture conformity of an ITS project is presented.

The Regional ITS Architecture is considered a living document. Shifts in regional focus and priorities, changes and new developments in technology, and changes to the National ITS Architecture will necessitate that the Bristol Regional ITS Architecture be updated to remain a useful resource for the Region. In the Regional ITS Architecture, a process for maintaining the plan was developed in coordination with stakeholders. The process covers both major updates to the Regional ITS Architecture that will happen approximately every four years as well as minor changes that may be needed between major updates of the documents. These processes have been included in this document in Sections 7.3 and 7.4.

7.1 Incorporation into the Regional Planning Process

The Bristol Regional ITS Architecture is one of several documents that address transportation plans for the region. These documents should be compatible with one another and guided by similar overarching goals and objectives related to the regional transportation network. Federal agencies require that ITS projects using federal funding from the highway trust fund conform to the Regional ITS Architecture, so it is important that ITS elements, which are going to be incorporated into other regional plans, are incorporated according to the Regional ITS Architecture. Section 7.1 describes how the Regional ITS Architecture can be used to guide the incorporation of ITS elements into the Long Range Transportation Plan (LRTP) and Transportation Improvement Programs (TIP). Section 7.2 provides insights into how the Regional ITS Architecture can be used to improve or streamline efforts for transportation operations project selection and implementation throughout the Region.

Stakeholders invested a considerable amount of effort in the development of the Regional ITS Architecture for the Bristol Region. The plan should 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 so that the Region remains eligible for federal funding. Many metropolitan or

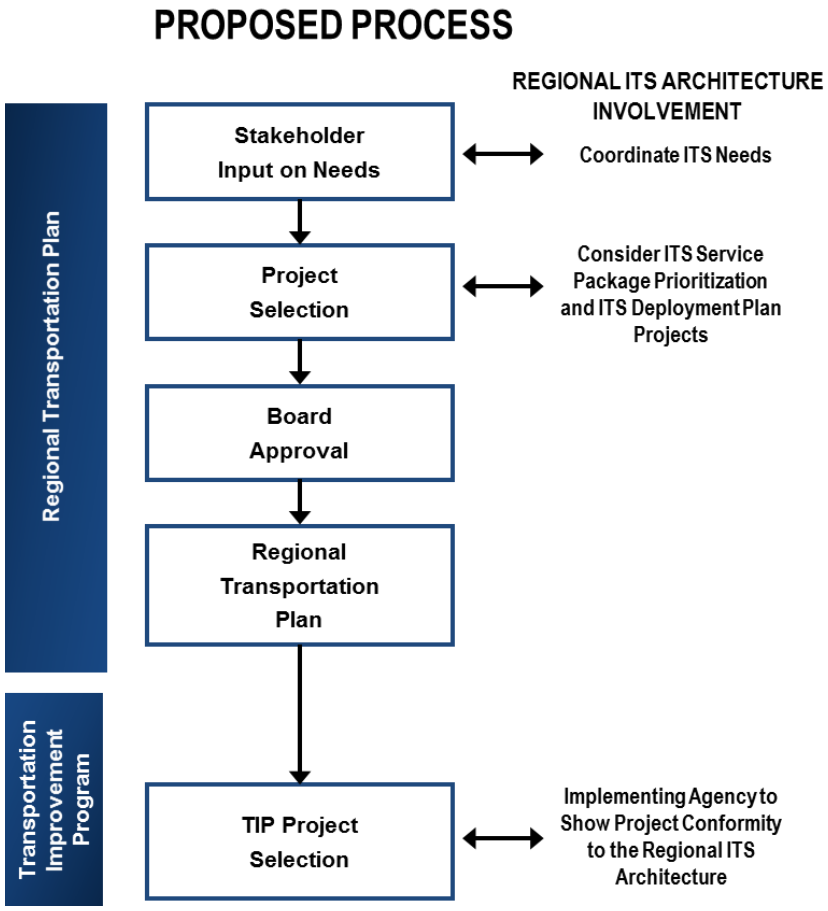
transportation planning organizations around the country now require that an agency certify that a project with ITS elements conforms to the Regional ITS Architecture before allowing the project to be included in the TIP.

Although no formal process is in place in the Bristol Region, many other MPOs require that as projects are submitted for inclusion in the TIP, each project be evaluated by the submitting agency to determine if the project includes any ITS elements. If the project contains ITS elements, a determination needs to be made if those elements are in conformance with the Regional ITS Architecture. The submitting agency should perform this evaluation as part of the planning process using the procedure outlined in Section 7.3. The Bristol MPO would review each project to confirm that it does conform to the Regional ITS Architecture and assist agencies as they perform this evaluation as part of the project application process.

An additional tool that could be utilized by the Bristol MPO in evaluating ITS projects is TDOT's "ITS Project Development Guidelines," which requires all agencies with projects related to ITS (including certain non-ITS traffic operations improvements) to complete the Tennessee ITS Project Identification Form. TDOT will then validate whether or not a project is considered an ITS project and the risk associated with implementing the project, which will determine the next steps to be taken. The Bristol MPO could require Tennessee agencies to complete TDOT's form when submitting projects for inclusion in the TIP. Although VDOT has not created statewide guidelines for the ITS project development process, they do evaluate projects on an individual basis to determine if the project has ITS components. The Bristol MPO could be included in VDOT's evaluation process before projects are added to the TIP.

Figure 9 provides a diagram that details the proposed steps for consideration of the Regional ITS Architecture in Bristol's regional planning process. In this figure, the TIP project selection process includes a review of the Regional ITS Architecture to ensure that projects containing ITS elements are in conformity with the regional ITS needs identified by the architecture.

Figure 9 – Proposed Regional Planning Process and ITS Architecture Involvement



7.2 Systems Engineering Analysis

In order to assist agencies with meeting the requirements of the FHWA's Final Rule 23 CFR 940, TDOT's Traffic Operations Division developed a guidance document entitled "ITS Project Development Guidelines." The document indicates that unless projects are categorically excluded, a systems engineering analysis must be performed for all ITS projects. Categorically excluded projects are those that are not centrally controlled, do not share data with another agency, or are expansions or enhancements to existing systems that do not add any new functionality. For example, installation of an isolated traffic signal or expansion of a freeway management system through the deployment of additional CCTV cameras would be categorically excluded and not require a systems engineering analysis.

The goal of performing a systems engineering analysis is to systematically think through the project deployment process, and show that thorough, upfront planning has been shown to help control costs and ensure schedule adherence. In Tennessee, a project's level of risk will determine if a simplified systems engineering analysis form (SSEAF) is sufficient, or if a more detailed systems engineering analysis report (SEAR) is necessary.

VDOT's process of completing systems engineering analyses is not outlined in a formal document but adheres to the FHWA guidelines. All projects within the state that utilize funds from the highway trust fund follow a systems engineering process. However, the degree to which the analysis is performed is proportionate to the nature of the proposed project. VDOT's Northern Virginia District has created a document titled "Using Systems Engineering and Regional ITS

Architecture for ITS Projects," to help move a project from the ITS planning process through the project development process. Although this document has not been adopted statewide, many of the steps outlined within the document are followed by VDOT's district offices.

Both Tennessee and Virginia follow FHWA's requirement that the following should be included in a systems engineering analysis:

- Identification of portions of the Regional ITS Architecture being implemented;
- Identification of participating agencies roles and responsibilities;
- Definition of system requirements;
- Analysis of alternative system configurations and technology options that meet the system requirements;
- Identification of various procurement options;
- Identification of applicable ITS standards and testing procedures; and
- Documentation of the procedures and resources necessary for operations and management of the system.

The Bristol Regional ITS Architecture and associated Turbo Architecture database can supply information for many of the required components for a systems engineering analysis. These include:

- Portions of the Regional ITS Architecture being implemented (discussed in Section 7.3);
- Participating agencies roles and responsibilities;
- Definition of system requirements (identified in the Bristol Regional ITS Architecture Turbo Architecture database equipment packages); and
- Applicable ITS standards (identified using the ITS service package information flows from the Bristol Regional ITS Architecture document and the National standards associated with the ITS service package information flows).

Many projects are categorically excluded from the systems engineering analysis requirements. Categorically excluded projects are those that are not centrally controlled, do not share data with another agency, or are expansions or enhancements to existing systems that do not add any new functionality. For example, installation of an isolated traffic signal or expansion of a freeway management system through the development of additional CCTV camera would be categorically exclude and not require a systems engineering analysis. Other projects are subject to the systems engineering analysis, either in an abbreviated sense through the use of a form, or in a detailed sense through the preparation of a full report. TDOT and the FHWA Tennessee Division have established a method for determining the necessary documentation for each project, based on the project's risk factors and complexity. This method is shown in the flow chart in **Figure 10** and is described in detail in the *TDOT ITS Development Guidelines* developed by the TDOT Traffic Operations Division (https://tn.gov/tdot/topic/its-project-development).

To determine what level of analysis is necessary for a project, a Tennessee ITS Project Identification Form must be completed. This form confirms whether the proposed project should actually be considered an ITS project and labels the project either "Low Risk" or "High Risk." Many projects that may have some connection to ITS elements or functions are actually non-ITS projects because they do not add any new functionality to the ITS architecture. The form identifies those projects, which require no further systems engineering analysis and can proceed through the traditional road building project process. In determining risk of projects, the Project Identification Form takes into account project factors including:

- Number of jurisdictions and modes;
- Extent of software creation;
- Extent of proven hardware and communications technology used;
- Number and complexity of new interfaces to other systems;
- Level of detail in requirements and documentation;
- Level of detail in operating procedures and documentation; and
- Service life of technology applied to equipment and software.

Projects which are identified as "High-Risk" on the Project Identification Form will require a systems engineering analysis report (SEAR). Projects which are identified as "Low Risk" or as requiring more information to determine risk on the Project Identification Form are subject to an abbreviated analysis. In these cases, contracting agencies must fill out a Simplified Systems Engineering Analysis Form (SSEAF). This form is submitted to TDOT, which reviews the form and informs the agency and project sponsor of risk determination. If TDOT determines the project to be "High Risk", a SEAR is required. If TDOT determines the project to be "Low Risk", the project can follow the traditional road building project process for other non-ITS projects.

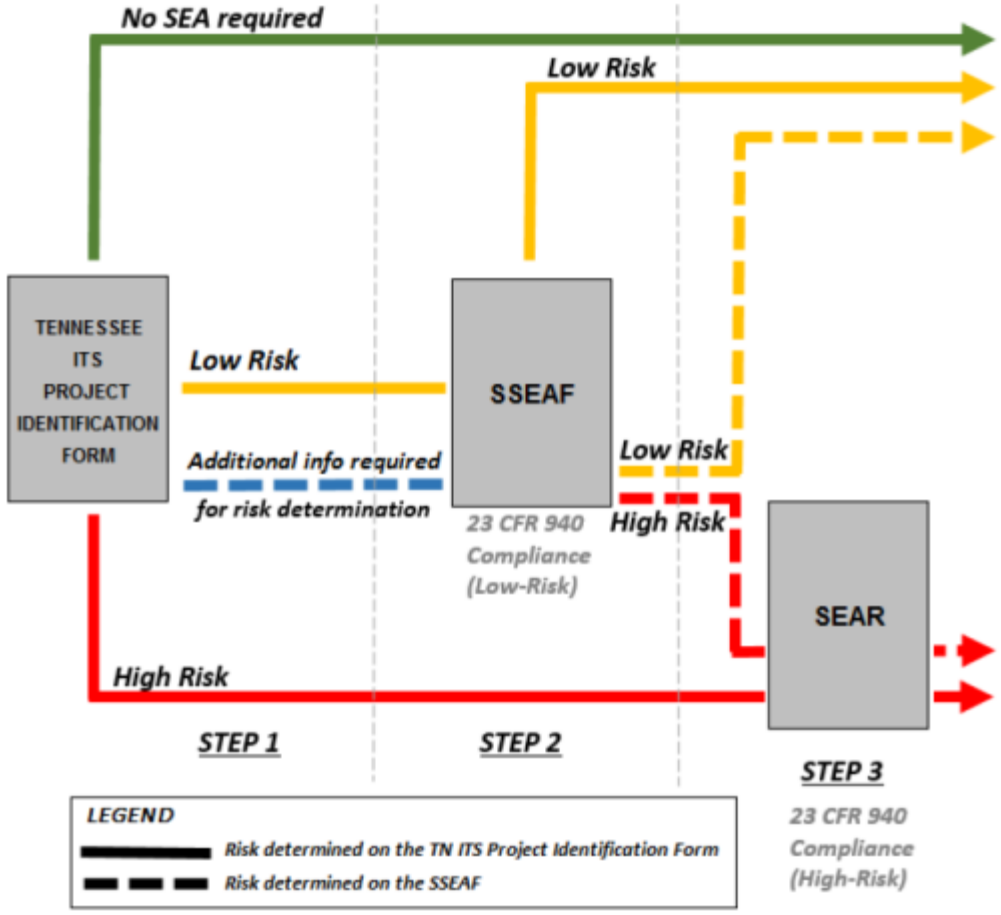


Figure 10 – Systems Engineering Analysis Project Flow Chart

The Vee Diagram, shown as **Figure 11**, is frequently used in systems engineering discussions to demonstrate where the Regional ITS Architecture and systems engineering process fits into the life

cycle of an ITS project. The Regional ITS Architecture is shown unattached from the rest of the diagram because it is not specifically project related and an undetermined amount of time can pass between the architecture development and the beginning of project implementation. Traveling along the diagram the systems engineering process addresses concept exploration, the systems engineering management plan framework, concept of operations, and systems requirements.

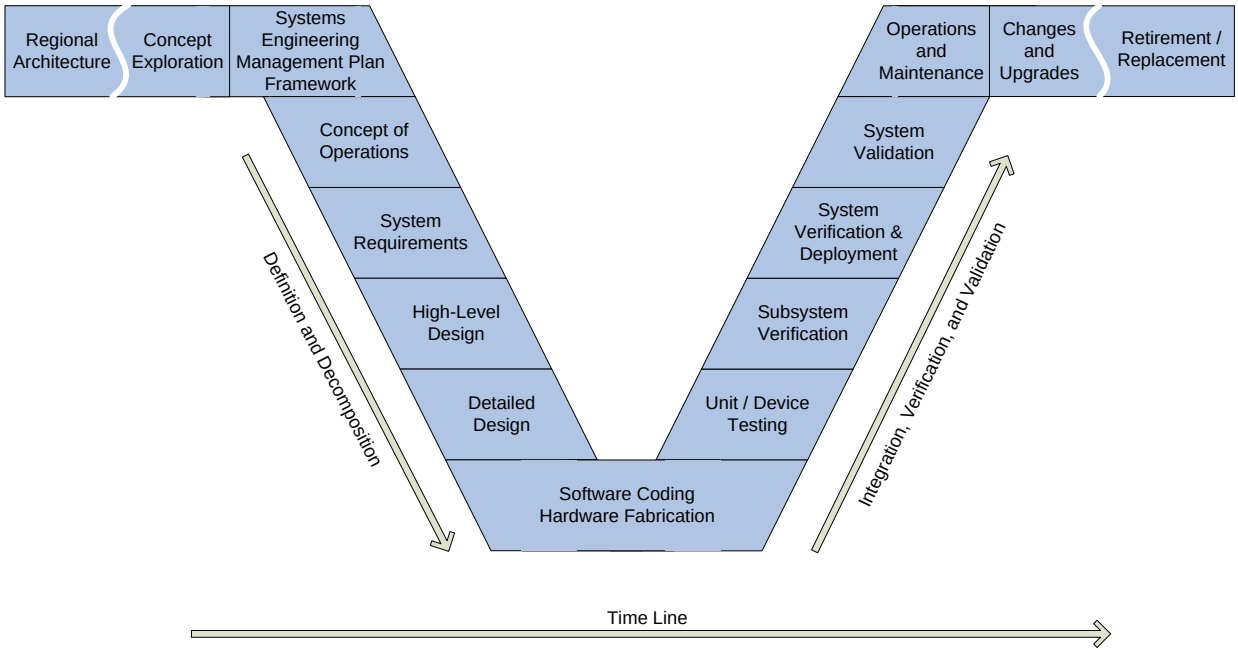


Figure 11 – Systems Engineering Vee Diagram

The Tennessee guidance document contains an example worksheet to aid in the preparation of a systems engineering analysis. During the process, if it is determined that a project is not adequately addressed in the Regional ITS Architecture, the Regional ITS Architecture maintenance process should be used to document the necessary changes.

7.3 Process for Determining ITS Architecture Conformity

The Bristol Regional ITS Architecture documents the customized service packages that were developed as part of the ITS architecture process. To satisfy FHWA and FTA requirements and remain eligible to use federal funds from the highway trust fund, a project must be accurately documented within the architecture. TDOT's "ITS Project Development Guidelines" specify that ITS projects need to be reviewed by MPOs to determine if the proposed ITS elements are in conformance with the regional ITS architecture. The steps of determining regional architecture conformity are as follows:

- Identify the ITS components in the project;
- Identify the corresponding service packages(s) from the Regional ITS Architecture;
- Locate the component within the service 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 Service Packages

If a project was included in the list of projects identified in the Bristol Regional ITS Deployment Plan, then the applicable service package(s) for that project were also identified. However, ITS projects are not required to be included in the ITS Deployment Plan in order to be eligible for federal funding; therefore, service packages might need to be identified for projects that have not been covered in the ITS Deployment Plan. In that case, the service packages selected and customized for the Bristol Region should be reviewed to determine if they adequately cover the project. Service packages selected for the Bristol Region are identified in **Table 6** of this document and detailed service package definitions are located in **Appendix A**.

Step 3 – Identify the Component within the Service Package

The customized service packages for the Bristol Region are located in **Appendix B**. Once the element is located within the appropriate service package, the evaluator should determine if the element name used in the service package is accurate or if a change to the name is needed. For example, a future element called Municipal TOC was included in the Bristol Regional ITS Architecture. Detailed planning for this center has not begun and it would not be unusual for the city or county to select a different name for the TOC once planning and implementation is underway. Such a name change should be documented using the process outlined in Section 7.5.

Step 4 – Evaluate the Connections and Flows

The connections and information flows documented in the service 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 service package. These changes in the project should be documented in the ITS service packages using the process outlined in Section 7.5.

Step 5 – Document Required Changes

If any changes are needed to accommodate the project under review, Section 7.5 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 service package(s) should be modified so that the connections and information flows are consistent with the project.

7.4 Regional ITS Architecture Maintenance Process

The Bristol MPO will be responsible for leading the process to update the Bristol Regional ITS Architecture in coordination with the TDOT Traffic Operations Division. **Table 15** summarizes the maintenance process agreed upon by stakeholders in the Region.

Table 15 – Bristol Regional ITS Architecture Maintenance Summary

Maintenance Details	Regional ITS Architecture and Deployment Plan	
	Minor Update	**Full Update**
Timeframe for Updates	As needed	Review in coordination with the update to the Long Range Transportation Plan
Scope of Update	Review and update service packages to satisfy architecture compliance requirements of projects or to document other changes that impact the Regional ITS Architecture.	Entire Regional ITS Architecture and Deployment Plan
Lead Agency	Bristol MPO in Coordination with TDOT	
Participants	Stakeholders impacted by service package modifications	Entire stakeholder group
Results	ITS service package or other change(s) documented for next complete update	Updated Regional ITS Architecture and Deployment Plan document, Appendices, and Turbo Architecture database

It was agreed that a review of the Regional ITS Architecture should occur in the same cycle as the Long Range Transportation Plan (LRTP) update to determine if a full update of the Regional ITS Architecture is necessary. The LRTP is updated every five years if the Bristol Region is designated in attainment; however, the update occurs every four years if the Region is designated non-attainment. The need for an update will depend on the level of ITS implemented in the Region since the previous update as well as changes that may have occurred in the National ITS Architecture. The Bristol MPO will coordinate with TDOT to determine if an update is required.

By completing a full update of the Regional ITS Architecture in coordination with an LRTP update (if an update is needed), 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 Bristol MPO, in coordination with the TDOT Traffic Operations Division, will be responsible for completing the full update. 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 and Deployment Plan should occur as needed between full updates of the plan. In Section 7.5 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.

7.5 Procedure for Submitting ITS Architecture Changes between Major Updates

Updates to the Bristol Regional ITS Architecture will occur on a regular basis as described in Section 7.4 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 7.3 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 F**. 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 service packages in the Regional ITS Architecture. Examples include changes to stakeholder or element names, element status, or information flow status.
- Functional Change – Single Agency: Structural changes to the ITS service packages that impact only one agency in the Regional ITS Architecture. Examples include the addition of a new ITS service package or changes to information flow connections of an existing service package. The addition or change would only impact a single agency.
- Functional Change – Multiple Agencies: Structural changes to the ITS service packages that have the potential to impact multiple agencies in the Regional ITS Architecture. Examples include the addition of a new ITS service package or changes to information flow connections of an existing ITS service 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 Section of the Regional ITS Architecture.

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

Service packages being impacted by the change: Each of the ITS service 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 service package, then the agency completing the ITS Architecture Maintenance Documentation Form is asked to include a sketch of the new or modified service 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 service packages that will be included as part of the Regional ITS Architecture.

The Bristol MPO will review and accept the proposed changes and forward the form to the TDOT Traffic Operations 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 – SERVICE PACKAGE DEFINITIONS

Service Package	Service 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	Traffic Signal Control	Provides the central control and monitoring equipment, communication links, and the signal control equipment that support traffic control at signalized intersections. This service package is consistent with typical traffic signal control systems.
ATMS04	Traffic Metering	Includes central monitoring and control, communications, and field equipment that support metering of traffic. It supports the complete range of metering strategies including ramp, interchange, and mainline metering.
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 service 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 Decision Support and Demand Management	Recommends courses of action to traffic operations personnel based on an assessment of current and forecast road network performance. All recommendations are based on historical evaluation, real-time assessment, and forecast of the roadway network performance based on predicted travel demand patterns. This service package also collects air quality, parking availability, transit usage, and vehicle occupancy data to support TDM, where applicable.
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 service 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.

Service Package	Service Package Name	Description
Traffic Management Service Area (continued)		
ATMS16	Parking Facility Management	Provides enhanced monitoring and management of parking facilities. Service 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 Warning and Enforcement	Monitors vehicle speeds and supports warning drivers when their speed is excessive. Also the service includes notifications to an enforcement agency to enforce the speed limit of the roadway.
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. Service package covers general road closures applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other service packages.
ATMS22	Variable Speed Limits	Sets variable speed limits along a roadway to create more uniform speeds, to promote safer driving during adverse conditions (such as fog), and/or to reduce air pollution. Also known as speed harmonization, this service monitors traffic and environmental conditions along the roadway.
ATMS23	Dynamic Lane Management and Shoulder Use	Includes the field equipment, physical overhead lane signs and associated control electronics that are used to manage and control specific lanes and/or the shoulders along a roadway. This equipment can be used to change the lane configuration on the roadway according to traffic demand and lane destination along a typical roadway section or on approach to or access from a border crossing, multimodal crossing or intermodal freight depot. This package can be used to allow temporary or interim use of shoulders as travel lanes.
ATMS24	Dynamic Roadway Warning	Includes systems that dynamically warn drivers approaching hazards on a roadway. These dynamic roadway warning systems can alert approaching drivers via warning signs, flashing lights, in-vehicle messages, etc. Such systems can increase the safety of a roadway by reducing the occurrence of incidents.
ATMS25	VMT Road User Payment	Facilitates charging fees to roadway vehicle owners for using specific roadways with potentially differential payment rates based on time-of-day, which specific roadway is used, and class of vehicle (a local policy decision by each roadway owner).
ATMS26	Mixed Use Warning Systems	Supports the sensing and warning systems used to interact with pedestrians, bicyclists, and other vehicles that operate on the main vehicle roadways, or on pathways which intersect the main vehicle roadways. These systems could allow automated warning or active protection for this class of users.
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.

Service Package	Service Package Name	Description
Emergency Management Service Area (continued)		
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 service 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.
EM09	Evacuation and Reentry Management	Supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. This service 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 service package. This service 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.

Service Package	Service Package Name	Description
Maintenance and Construction Management Service Area (continued)		
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.
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 service package.
APTS09	Transit Signal Priority	Determines the need for transit priority on routes 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.
APTS11	Multi-modal Connection Protection	Supports the coordination of multimodal services to optimize the travel time of travelers as they move from mode to mode (or to different routes within a single mode).

Service Package	Service Package Name	Description
Commercial Vehicle Operations Service Area		
CVO01	Carrier Operations and Fleet Management	Provides the capabilities to manage a fleet of commercial vehicles. Vehicle routing and tracking as well as notification of emergency management of any troublesome route deviations (such as a HAZMAT vehicle) are part of this service 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 Safety	Provides for on-board commercial vehicle safety monitoring and reporting, and includes support for collecting on-board safety data via transceivers or other means. The on-board safety data are assessed by an off-board system. In some cases the monitoring and safety assessment may occur remotely (i.e., not at a roadside site).
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.
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 service 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.

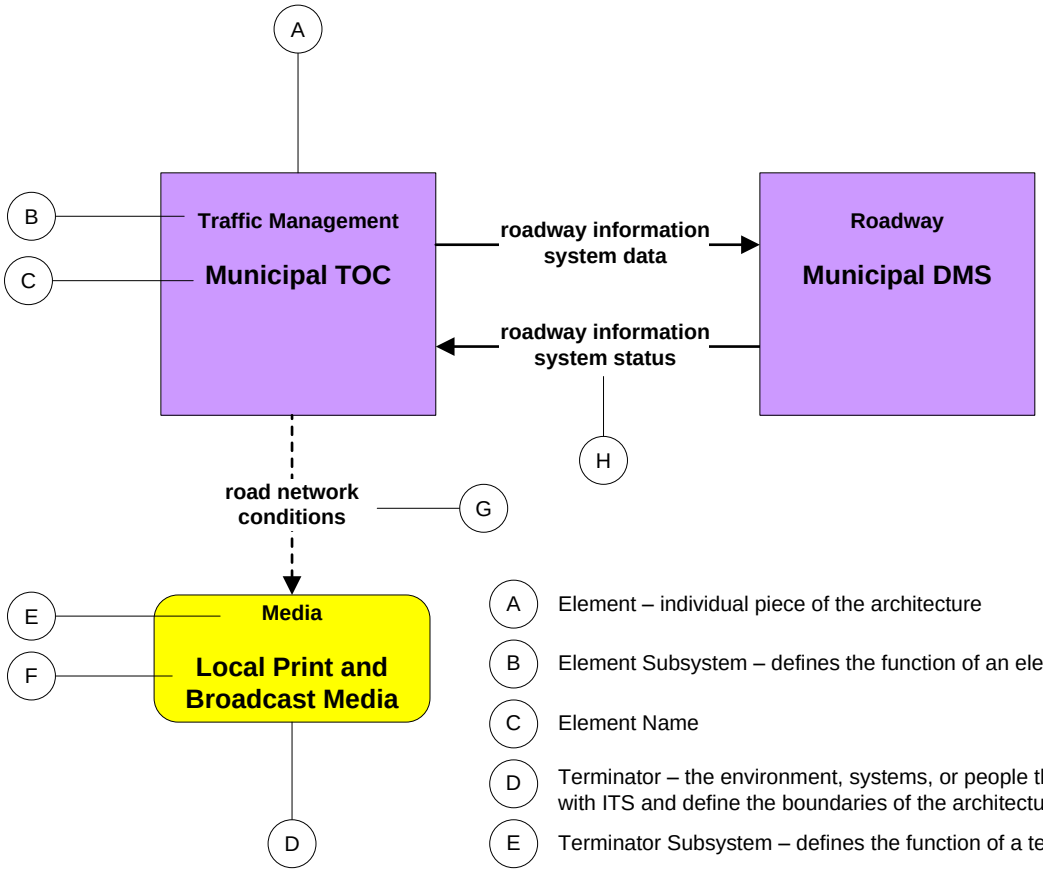
Service Package	Service Package Name	Description
Traveler Information Service Area		
ATIS06	Transportation Operations Data Sharing	Collects, processes, and stores current information on traffic and travel conditions and other information about the current state of the transportation network and makes the information available to transportation system operators.
ATIS07	Travel Service Information and Reservation	Provides travel information and reservation services to the user. This service package provides multiple ways for accessing information either while en route in a vehicle using wide-area wireless communications or pre-trip via fixed-point to fixed-point connections.
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	Short Range Communications Traveler Information	Provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility applications for connected vehicles. Delivers real-time traveler information including travel times, incident information, road conditions, and emergency traveler information to vehicles as they pass DSRC roadside equipment along their route.
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 Service Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed.
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 service 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.

Service Package	Service Package Name	Description
Vehicle Safety Service Area (continued)		
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 service 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 Vehicle Operations	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 ITS SERVICE PACKAGES

APPENDIX B

ITS SERVICE 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

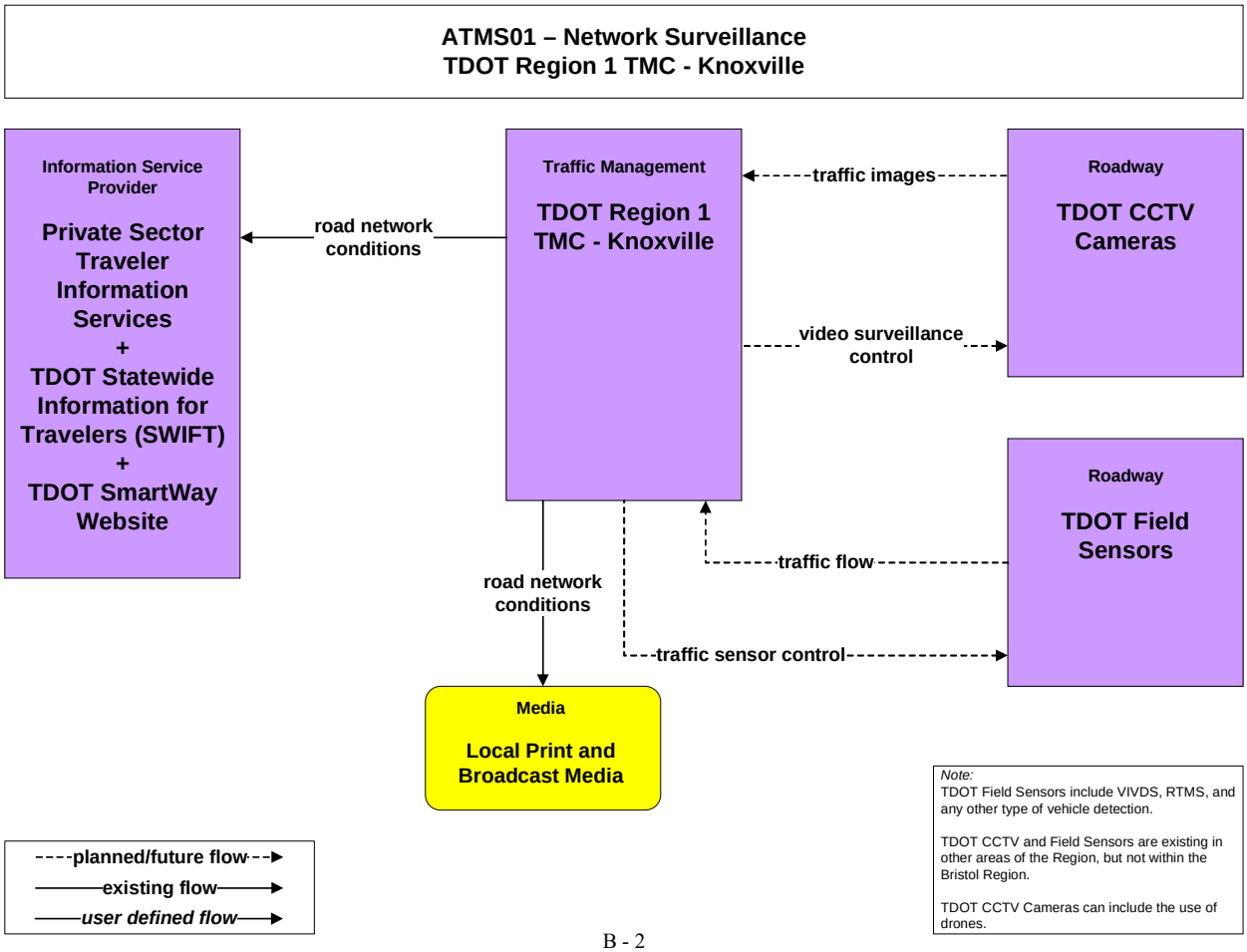
G – Future/Planned Architecture Flow – data that will be exchanged between subsystems and terminators in the future

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

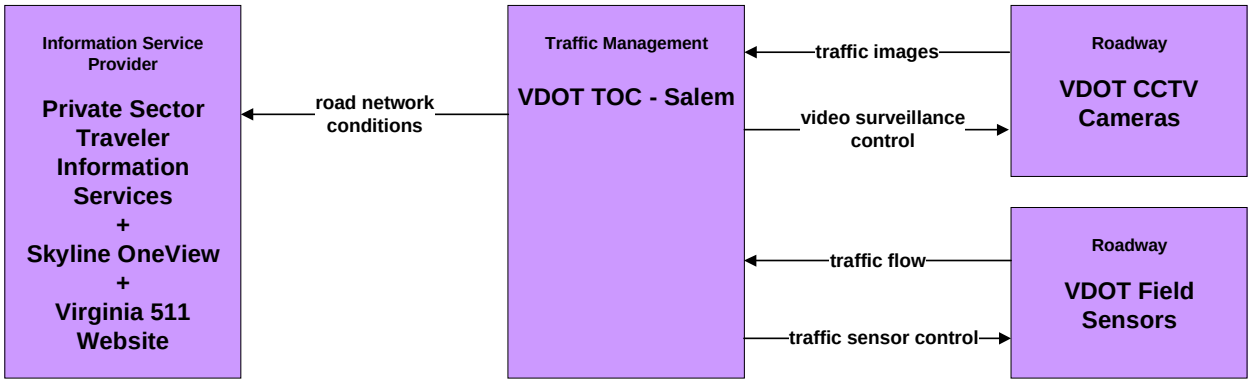
Bristol Regional ITS Architecture
Service Packages

May 2017

Advanced Traffic Management System



ATMS01 – Network Surveillance
VDOT TOC - Salem

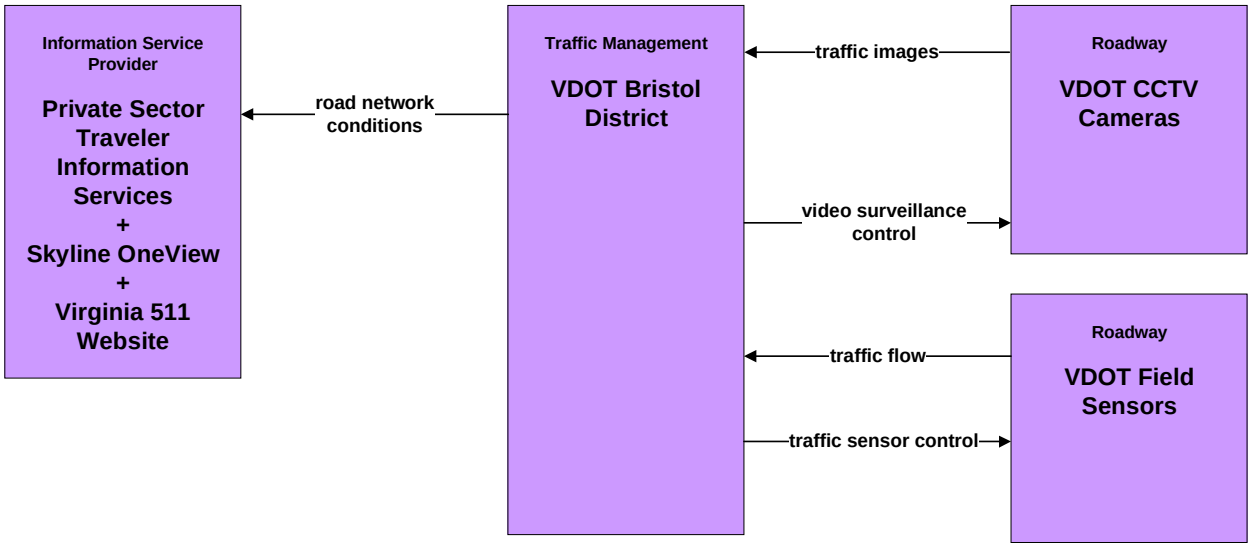


planned/future flow
existing flow
user defined flow

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

VDOT CCTV Cameras can include the use of drones.

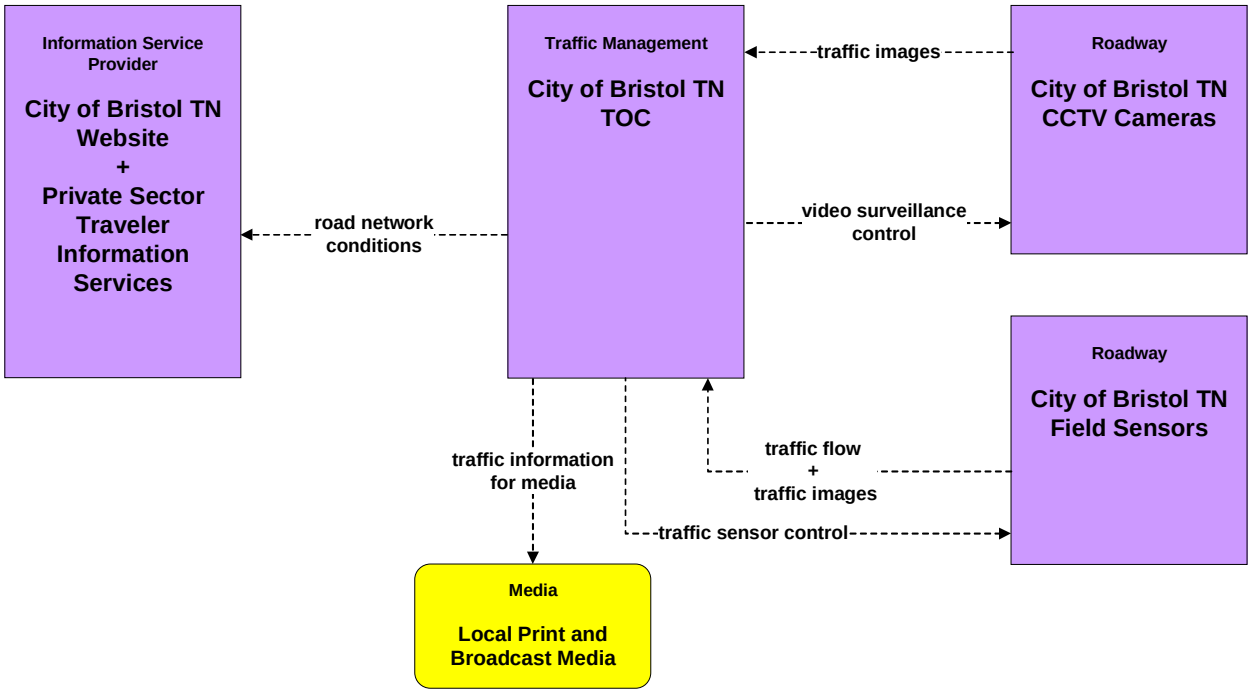
ATMS01 – Network Surveillance
VDOT Bristol District



planned/future flow
existing flow
user defined flow

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

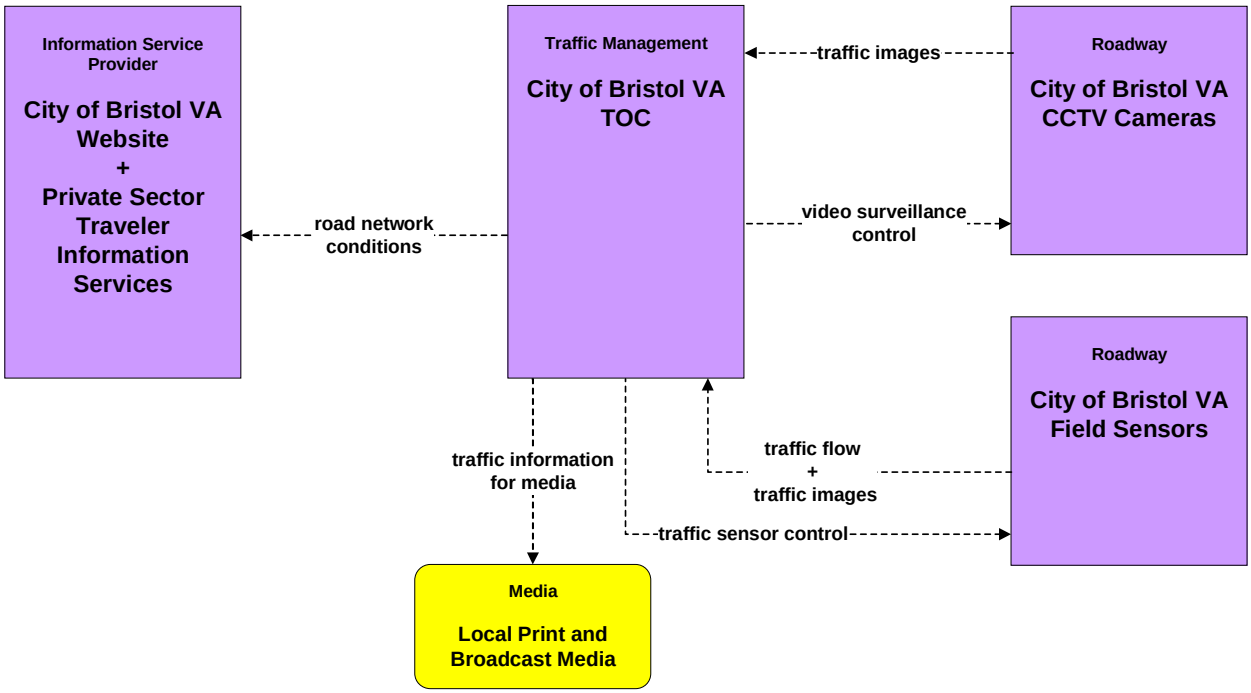
ATMS01 – Network Surveillance
City of Bristol TN



planned/future flow
existing flow
user defined flow

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

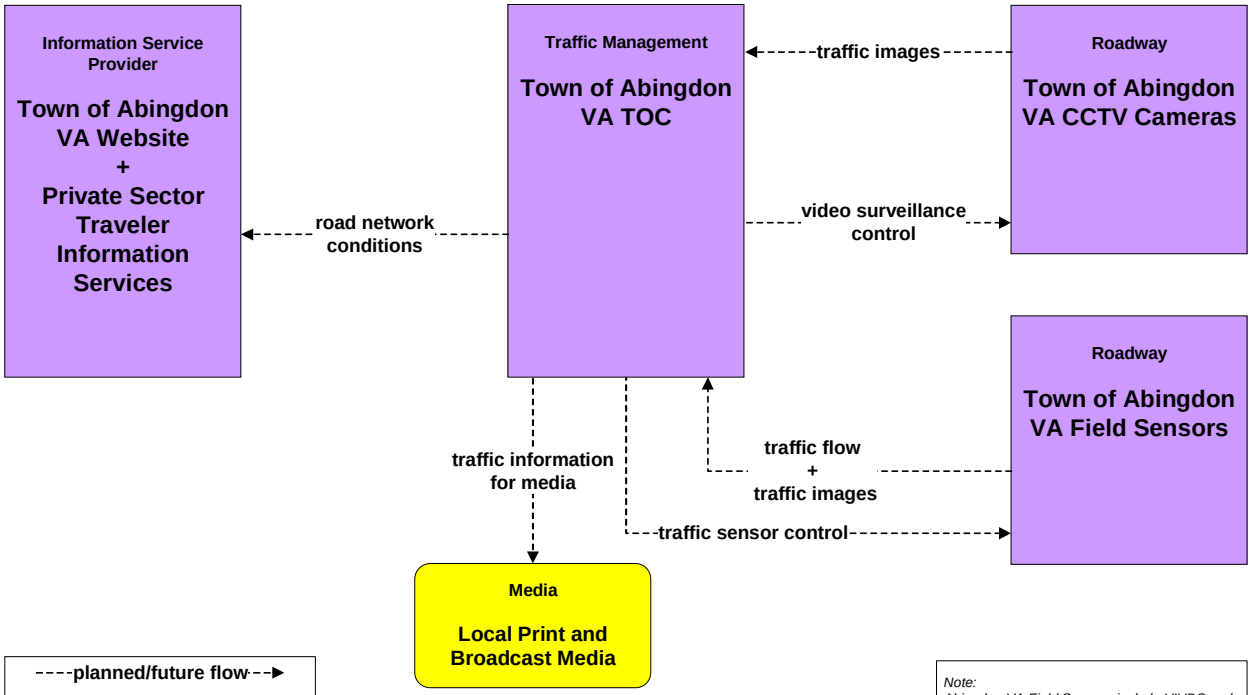
ATMS01 – Network Surveillance
City of Bristol VA



planned/future flow
existing flow
user defined flow

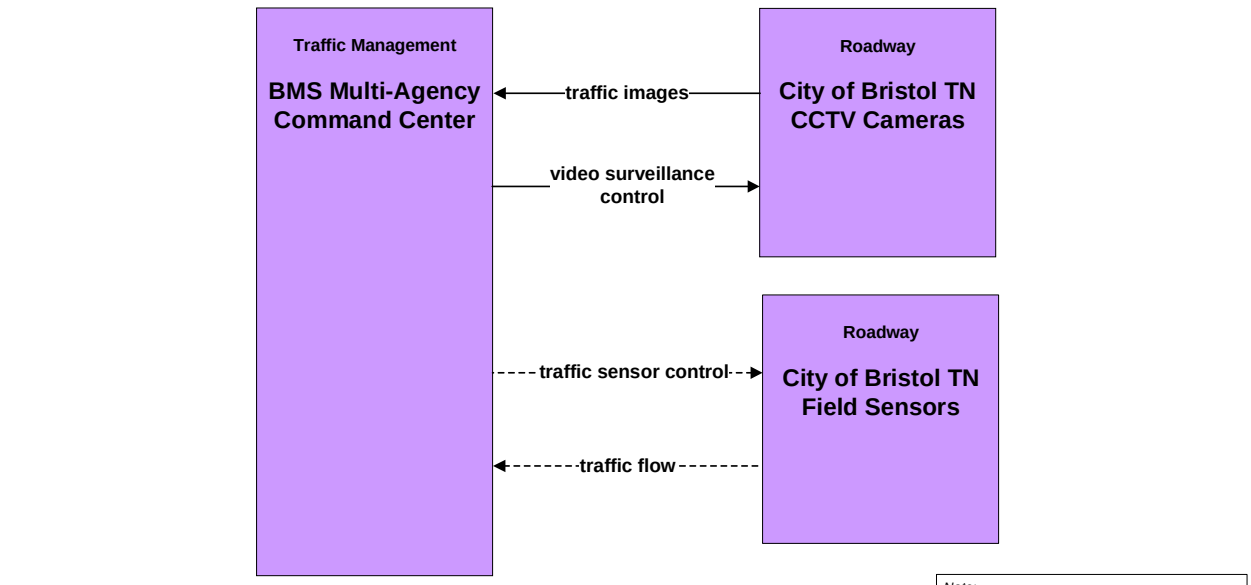
Note:
Bristol VA Field Sensors include VIVDS and any other type of vehicle detection.

ATMS01 – Network Surveillance
Town of Abingdon VA



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

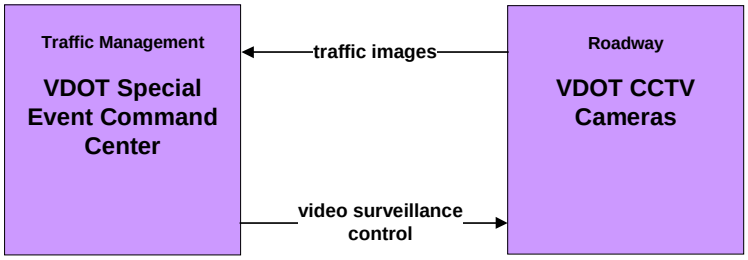
ATMS01 – Network Surveillance
Bristol Motor Speedway Operations - Tennessee



Note:
CCTV cameras shown as existing in this instance are used only during BMS events and primarily for crowd surveillance although several of them can be positioned to view adjacent roadways.

Note:
Coordination between BMS Multi-Agency Command Center and VDOT Special Event Management Command Center is shown in ATMS07.

ATMS01 – Network Surveillance
Bristol Motor Speedway Operations - Virginia

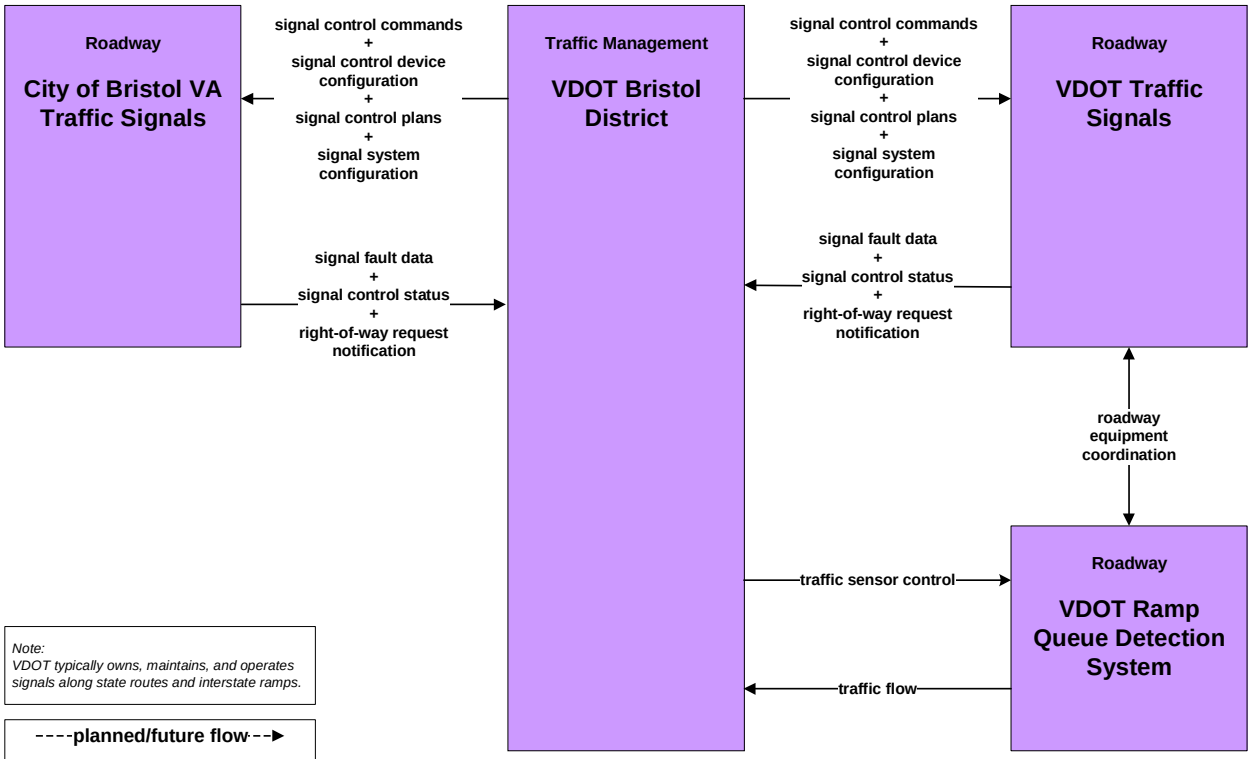


Note:
Coordination between BMS Multi-Agency Command Center and VDOT Special Event Management Command Center is shown in ATMS07.

Note:
CCTV cameras in this instance are portable devices deployed in the Bristol area on race weekends.

planned/future flow
existing flow
user defined flow

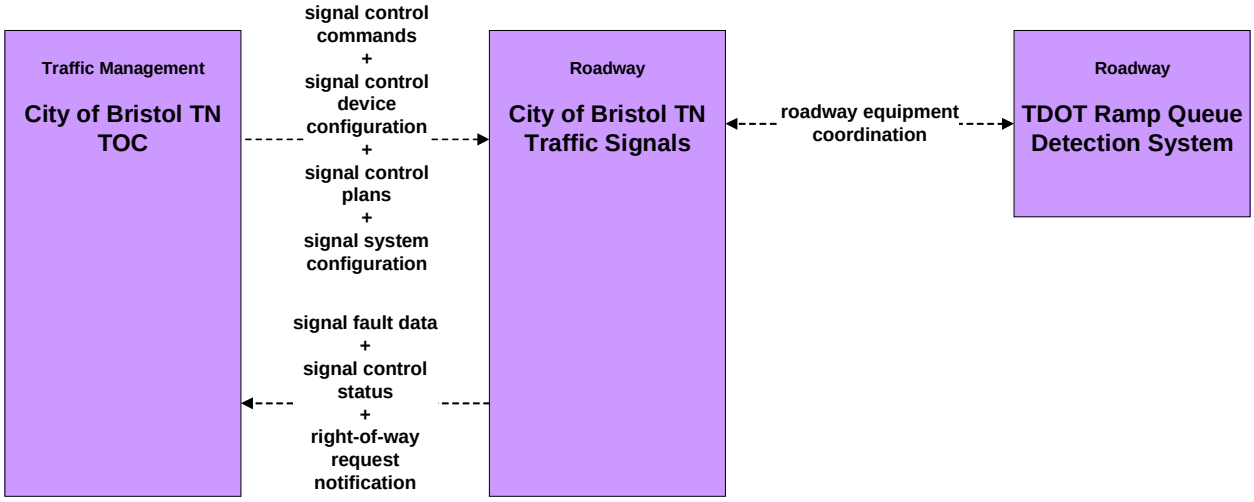
ATMS03 – Traffic Signal Control
VDOT Signal System

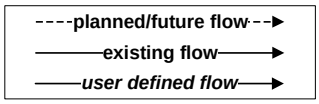


Note:
VDOT typically owns, maintains, and operates signals along state routes and interstate ramps.

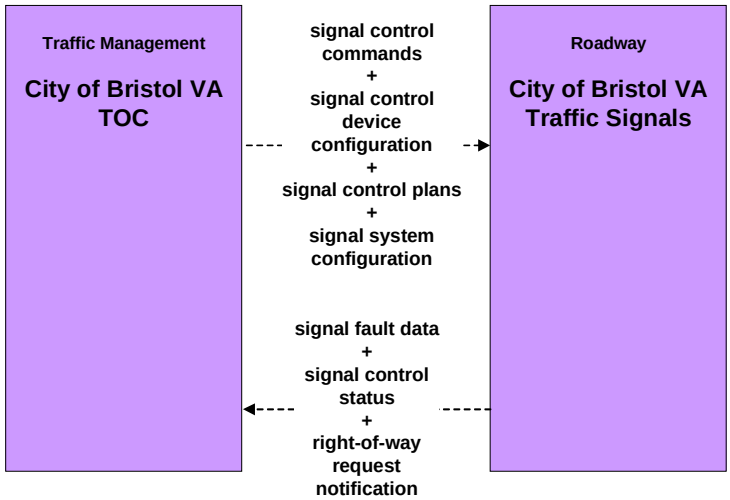
planned/future flow
existing flow
user defined flow

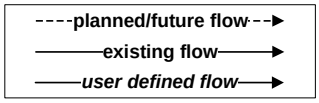
ATMS03 – Traffic Signal Control
City of Bristol TN Signal System



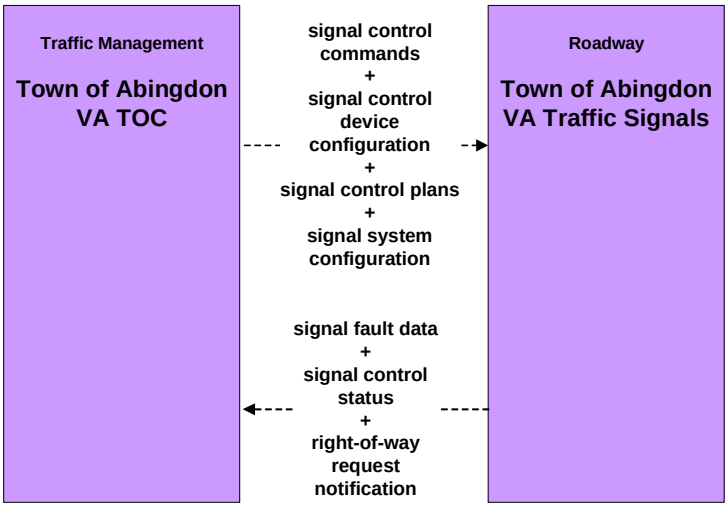


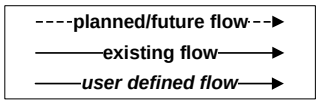
ATMS03 – Traffic Signal Control
City of Bristol VA Signal System



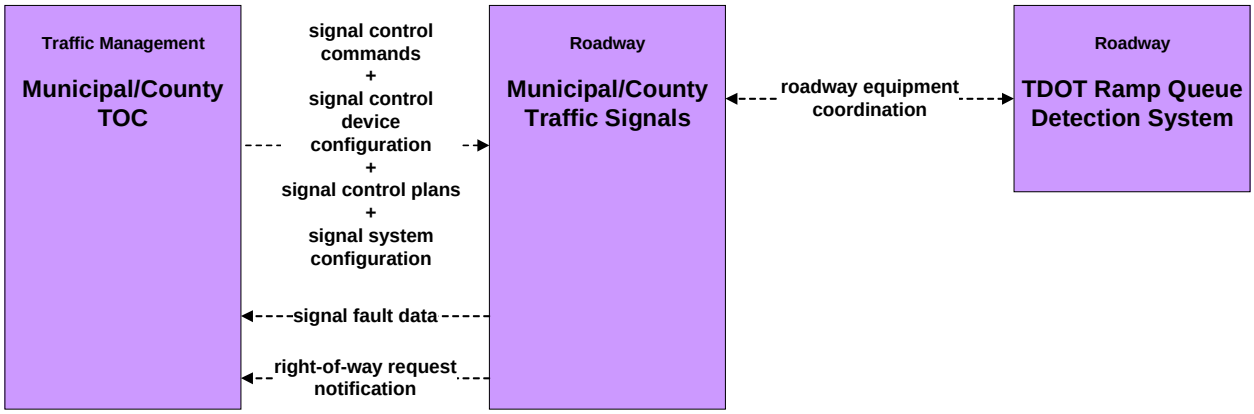


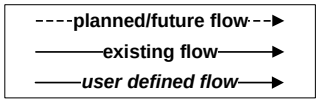
ATMS03 – Traffic Signal Control
Town of Abingdon VA Signal System





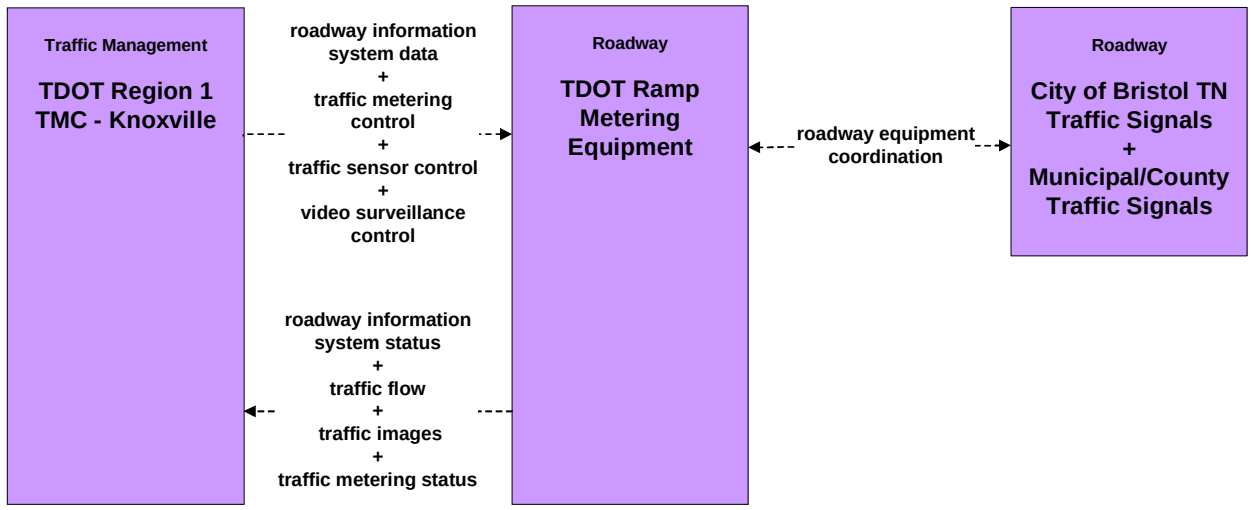
ATMS03 – Traffic Signal Control
Municipal/County Signal System

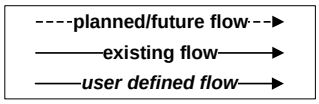




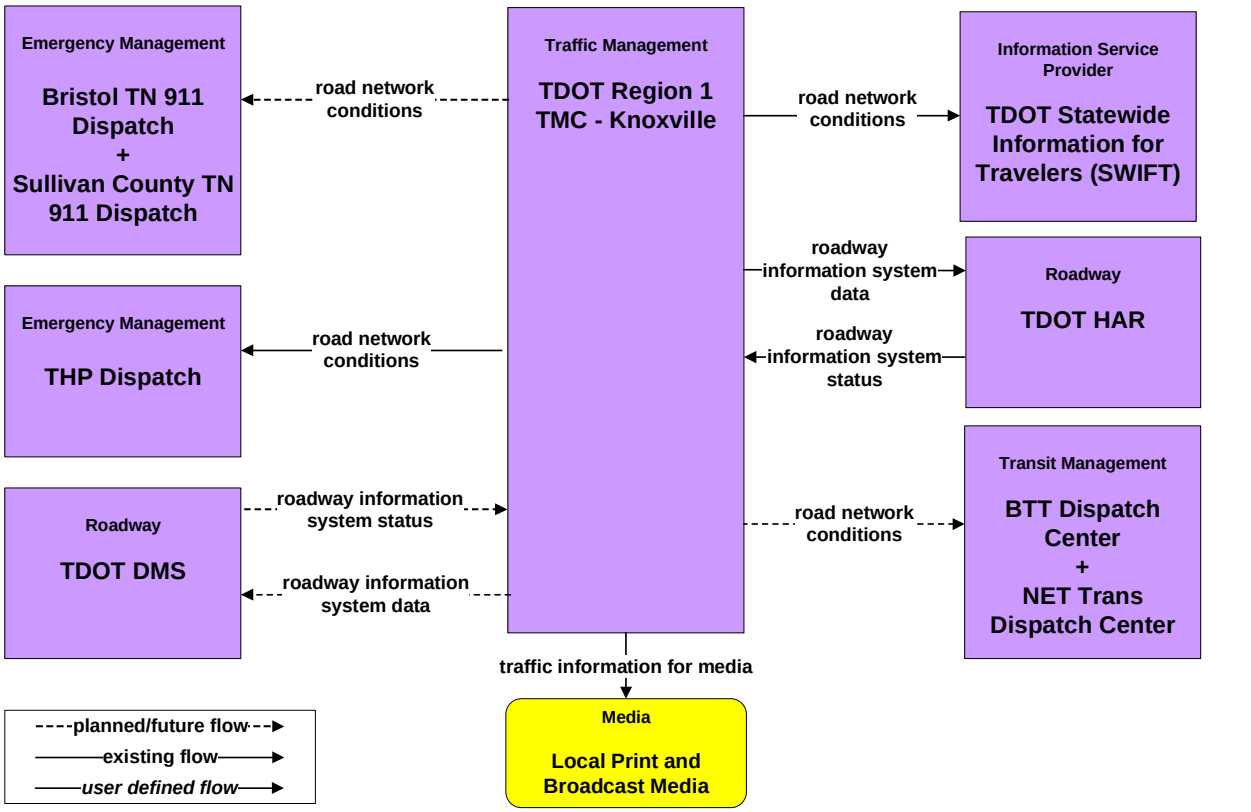
Note:
Municipal/County includes Sullivan County TN and Washington County VA..

ATMS04 – Traffic Metering
TDOT Region 1 TMC - Knoxville

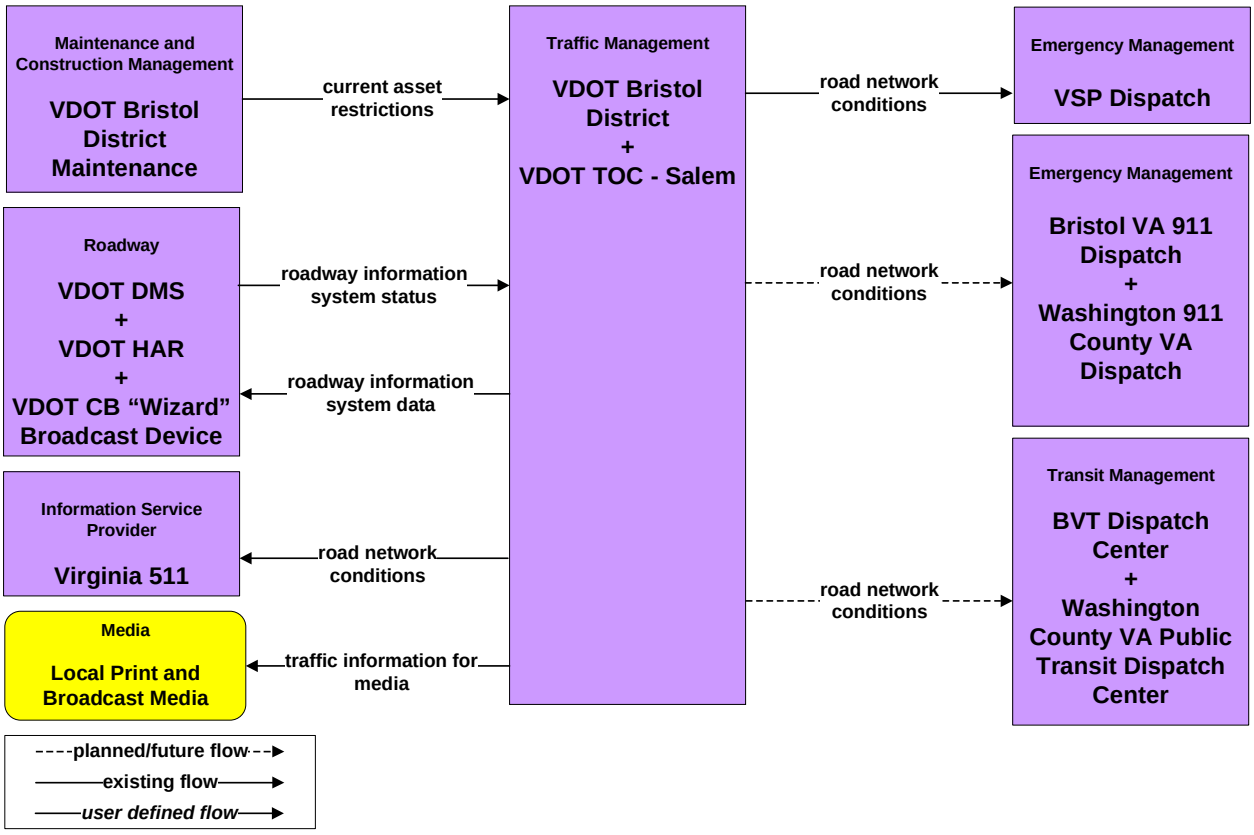




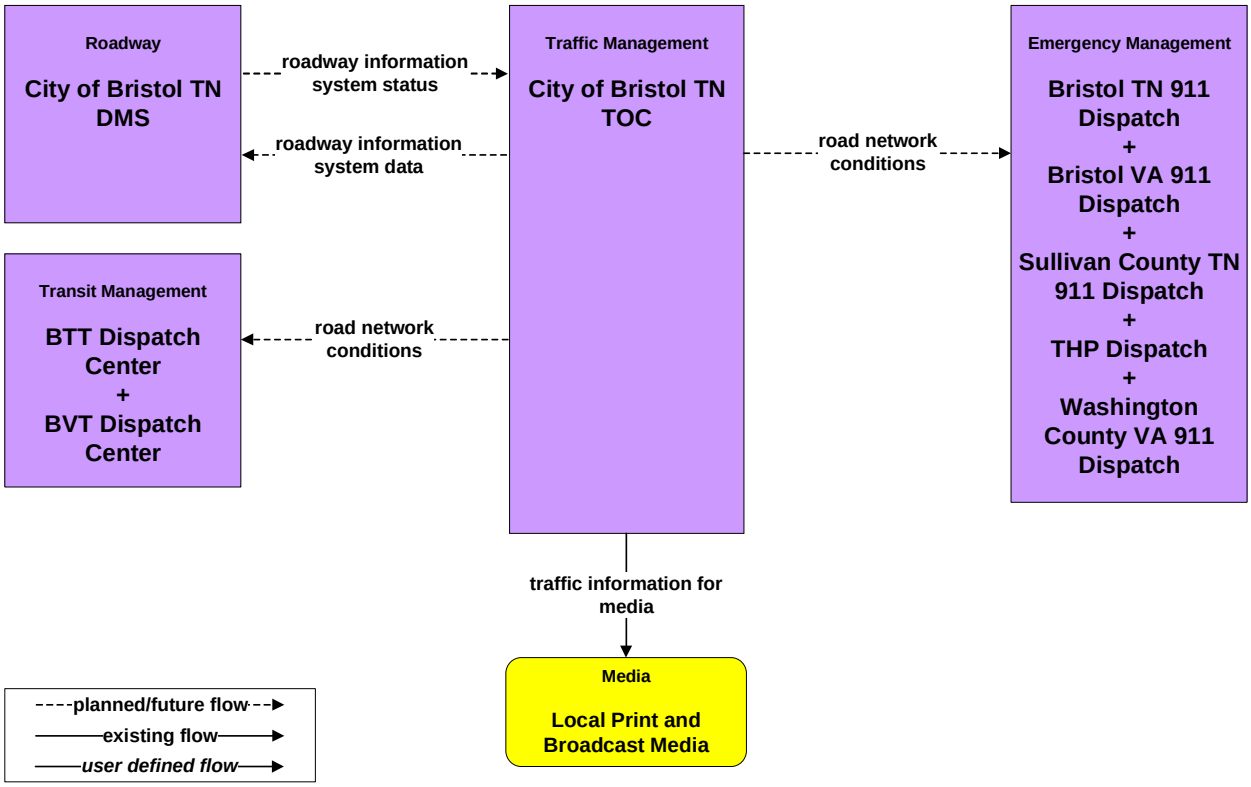
ATMS06 – Traffic Information Dissemination
TDOT Region 1 TMC - Knoxville



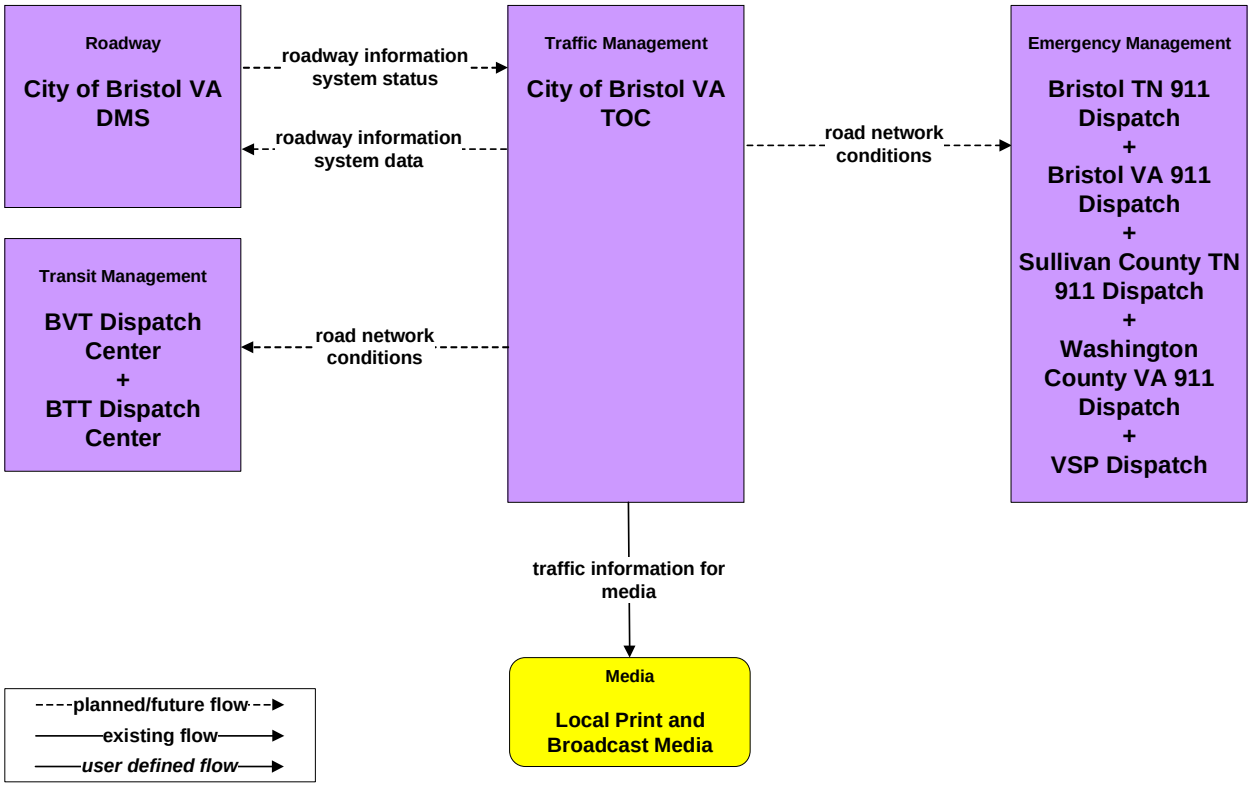
ATMS06 – Traffic Information Dissemination
VDOT Bristol District



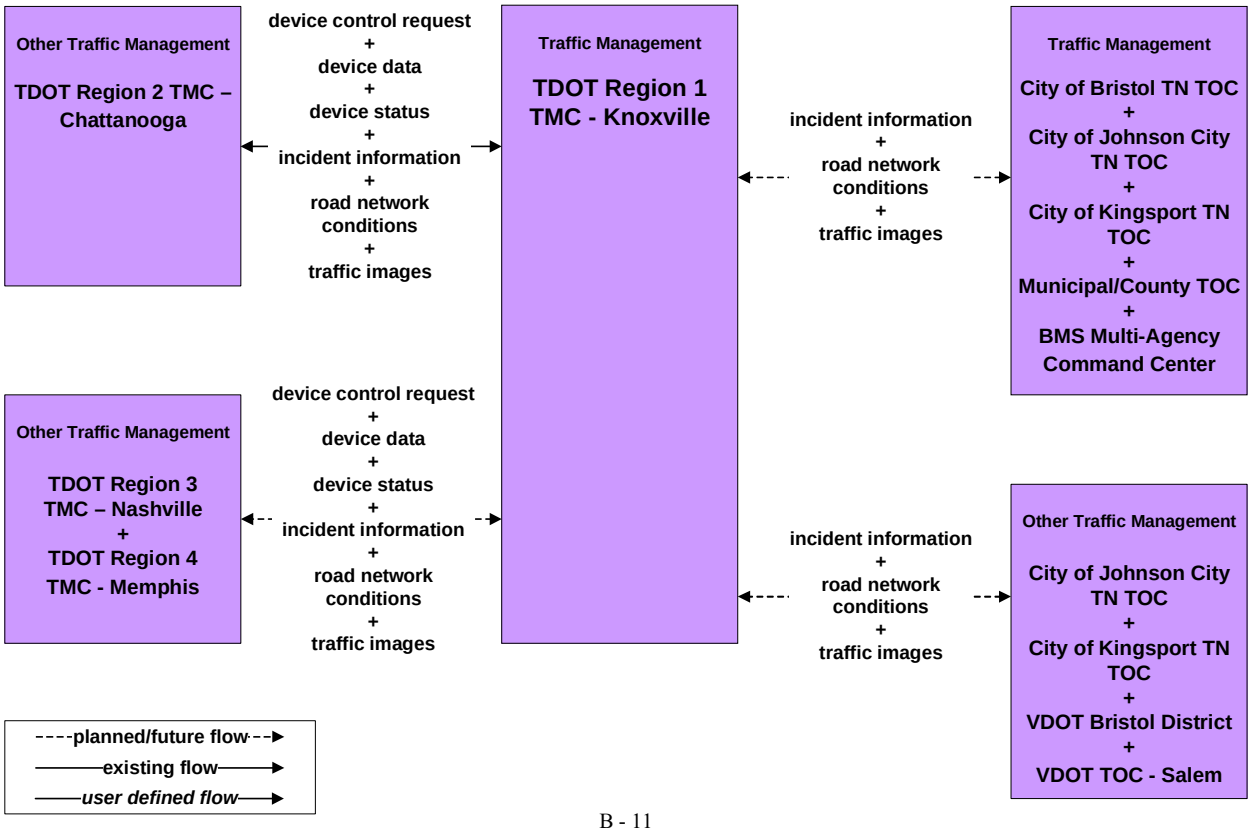
ATMS06 – Traffic Information Dissemination
City of Bristol TN



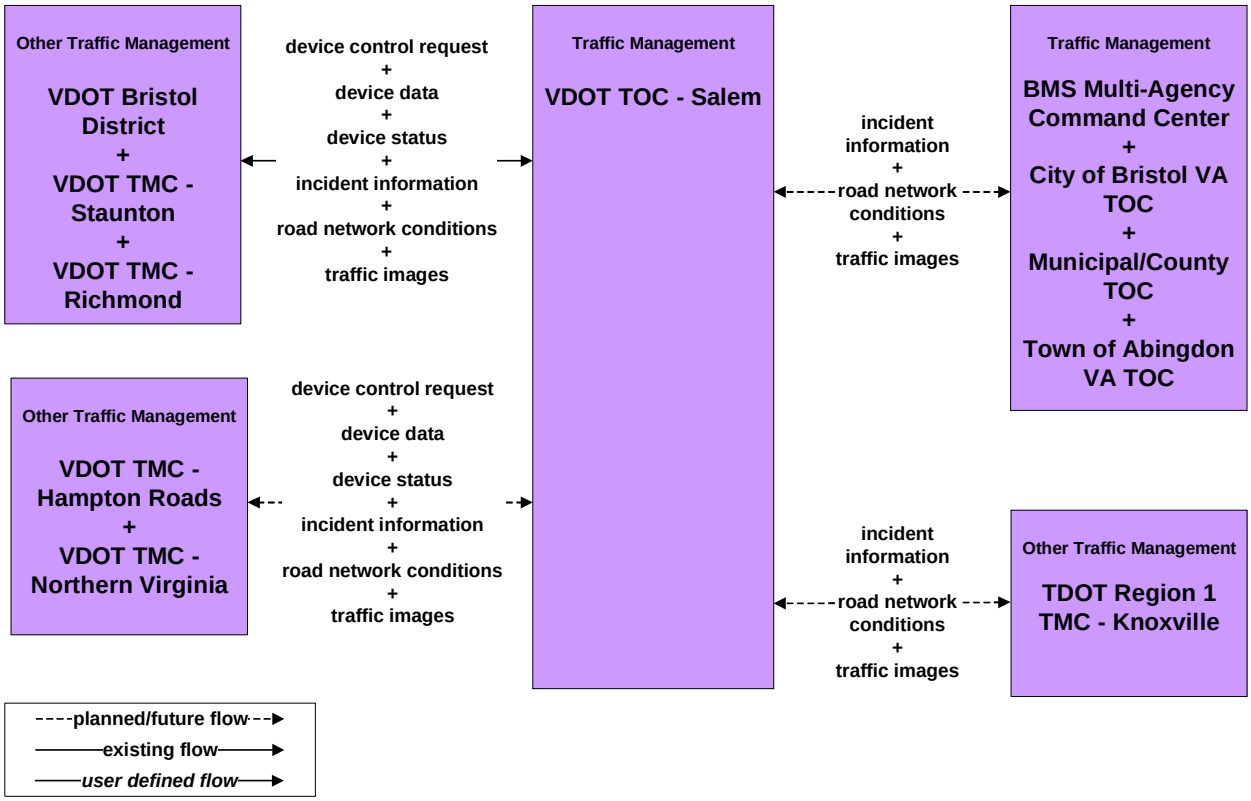
ATMS06 – Traffic Information Dissemination
City of Bristol VA



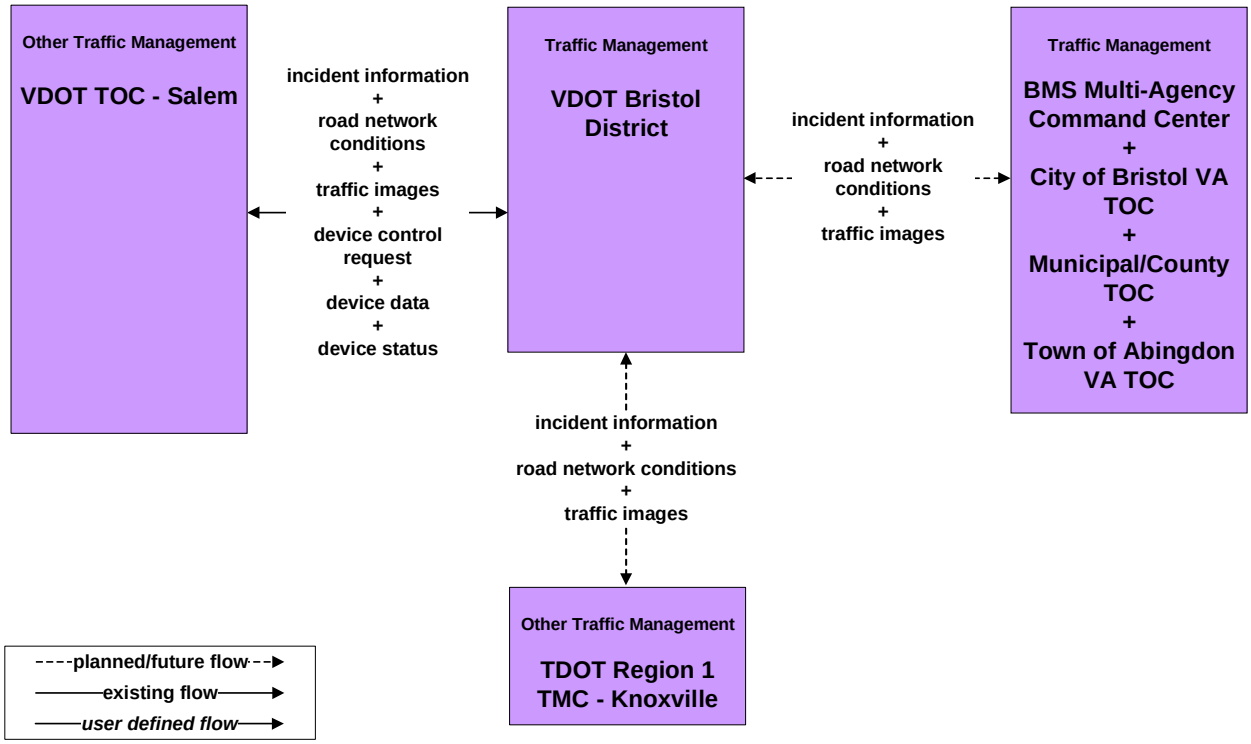
ATMS07 - Regional Traffic Management
TDOT Region 1 TMC - Knoxville



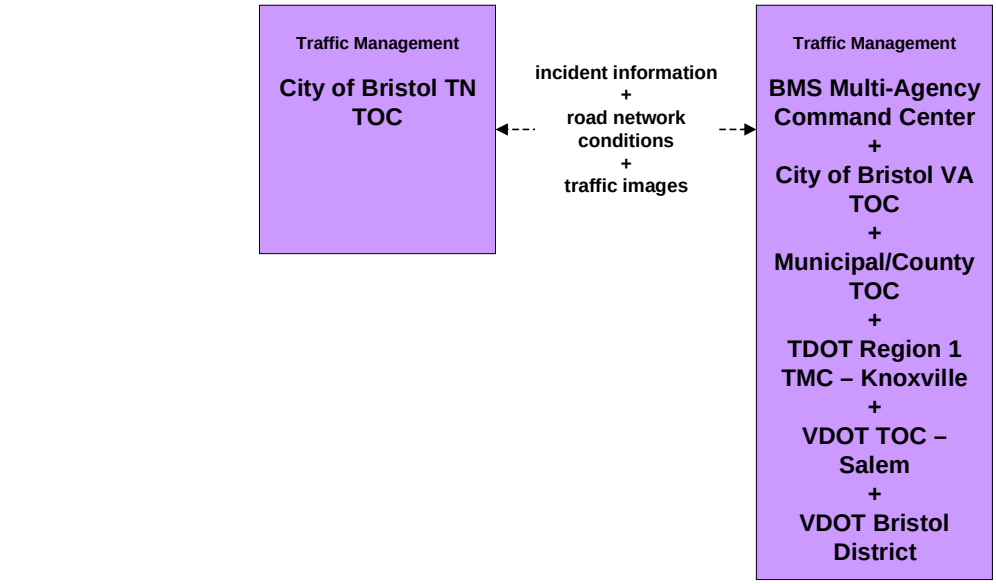
ATMS07 - Regional Traffic Management
VDOT TMC – Salem

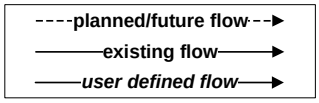


ATMS07 - Regional Traffic Management
VDOT Bristol District

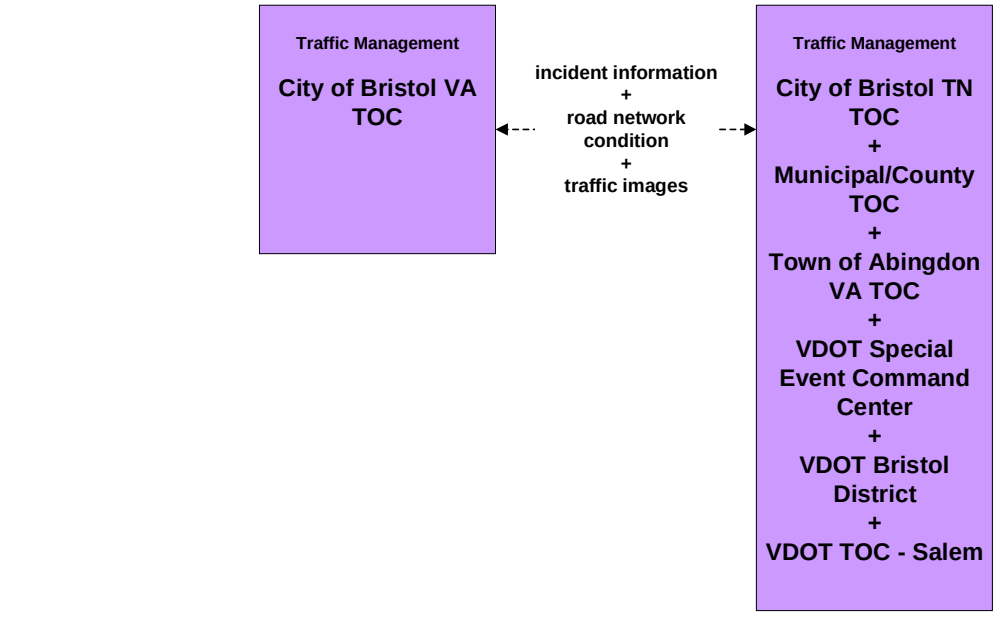


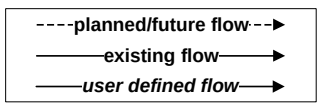
ATMS07 – Regional Traffic Management
City of Bristol TN



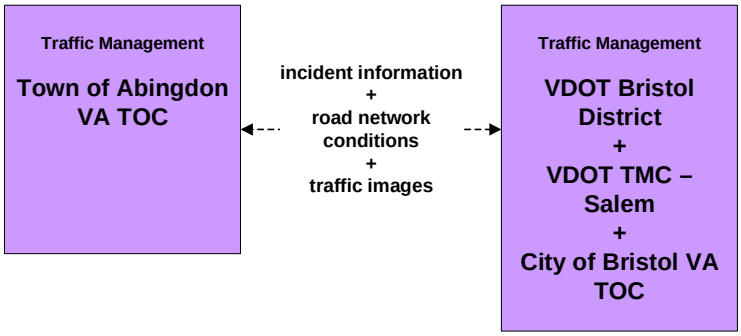


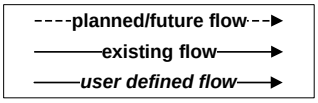
ATMS07 – Regional Traffic Management
City of Bristol VA



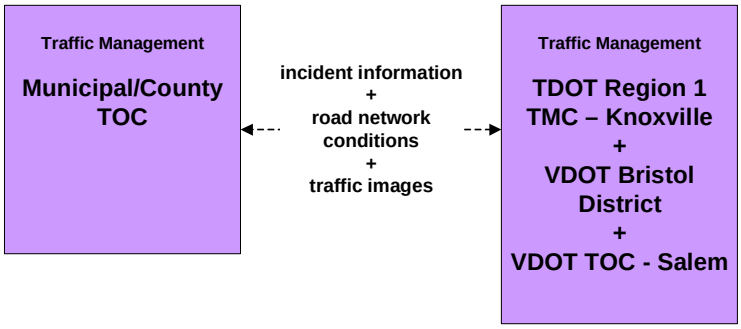


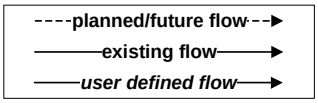
ATMS07 – Regional Traffic Management
Town of Abingdon VA



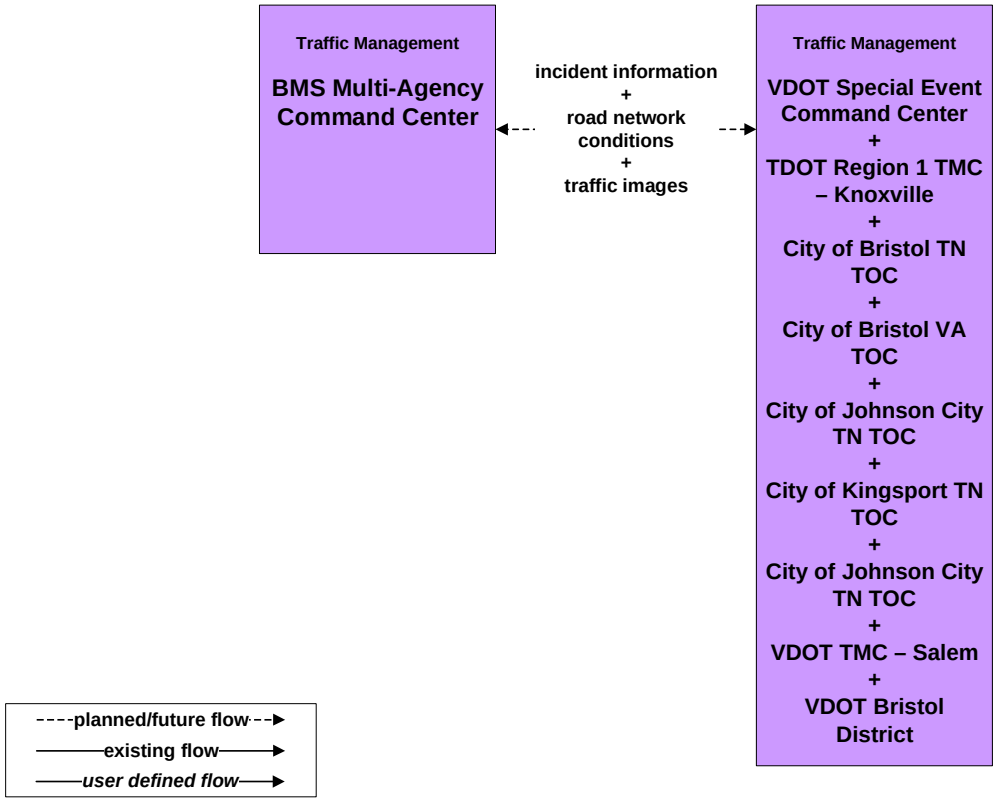


ATMS07 – Regional Traffic Management
Municipal/County

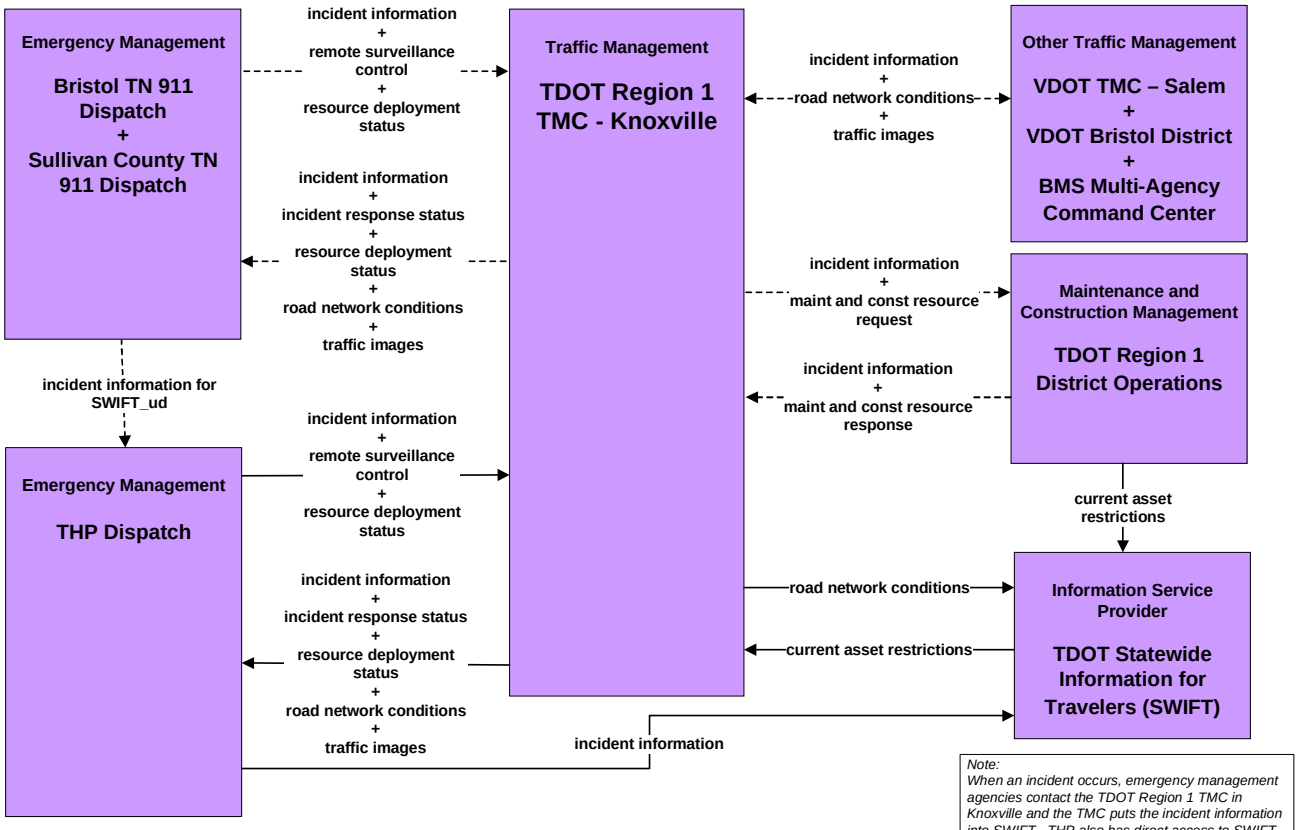




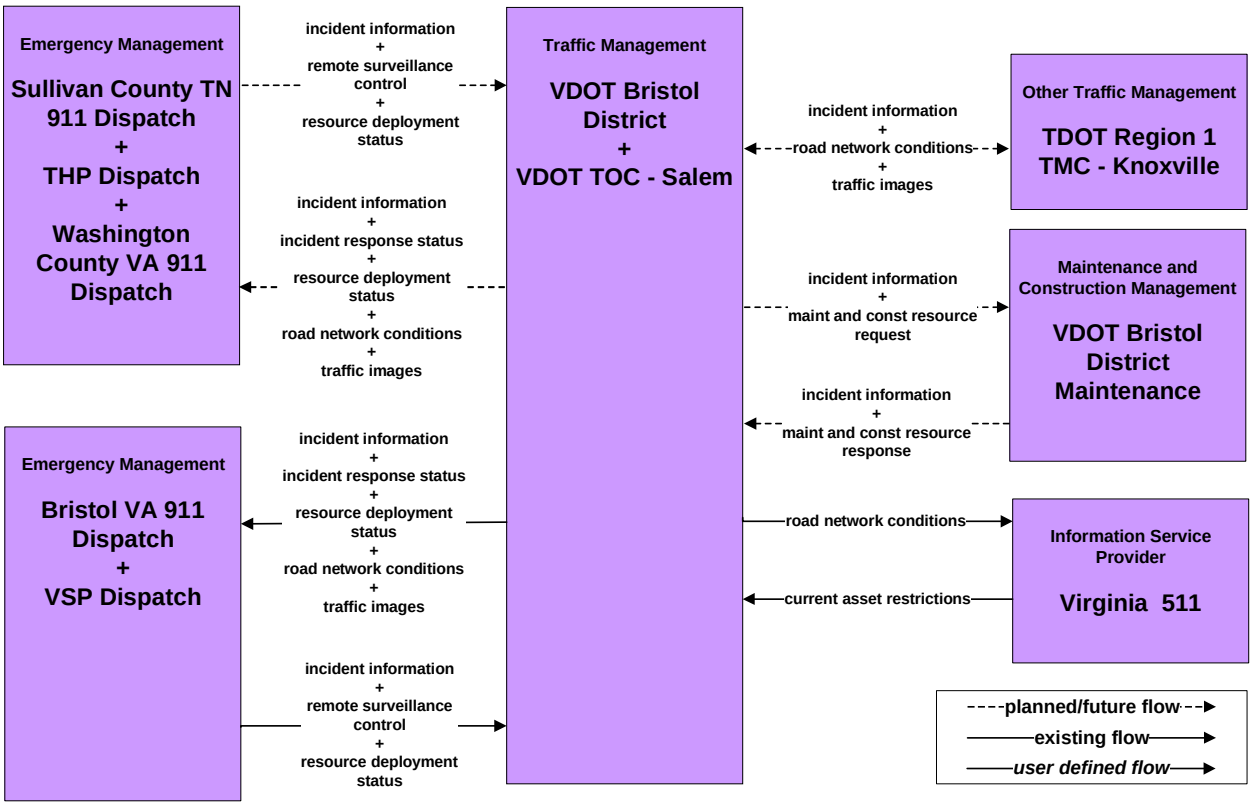
ATMS07 – Regional Traffic Management
Bristol Motor Speedway Operations



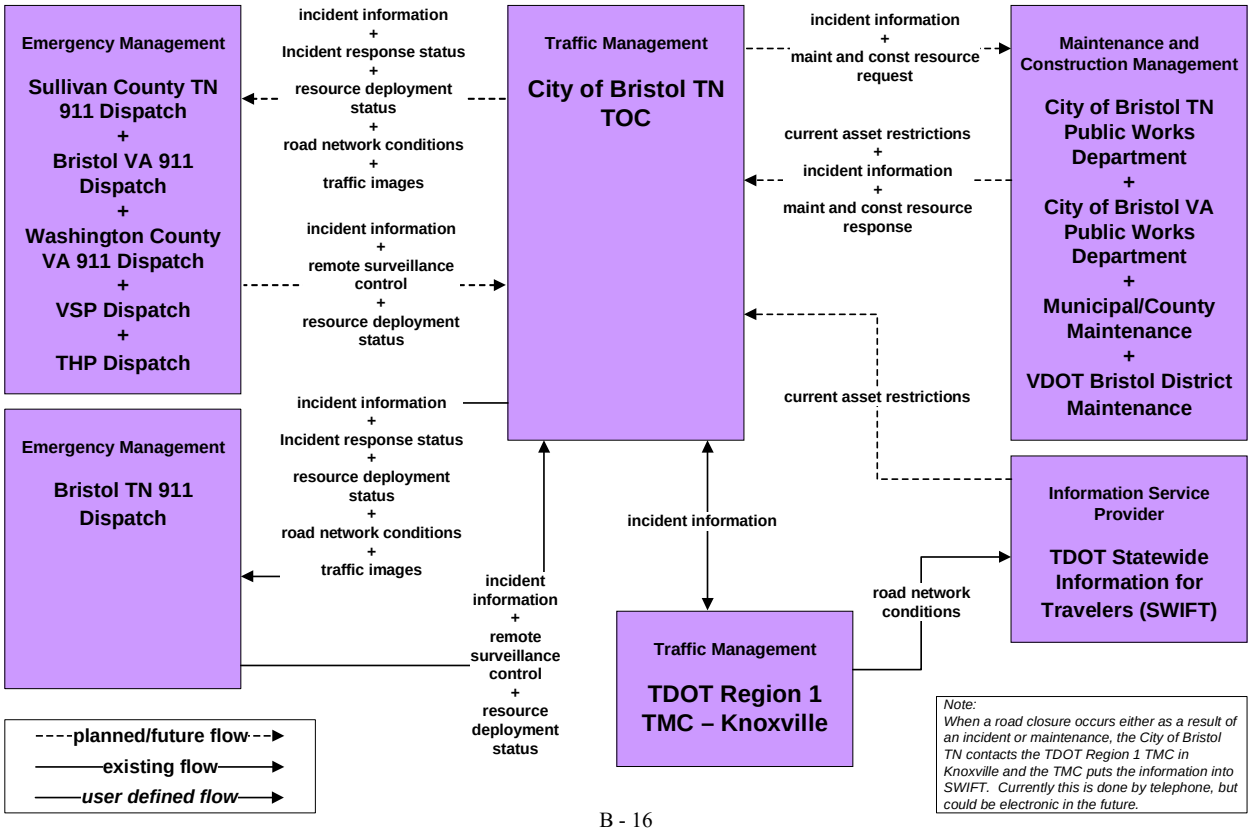
ATMS08 - Traffic Incident Management System
TDOT Region 1 TMC - Knoxville



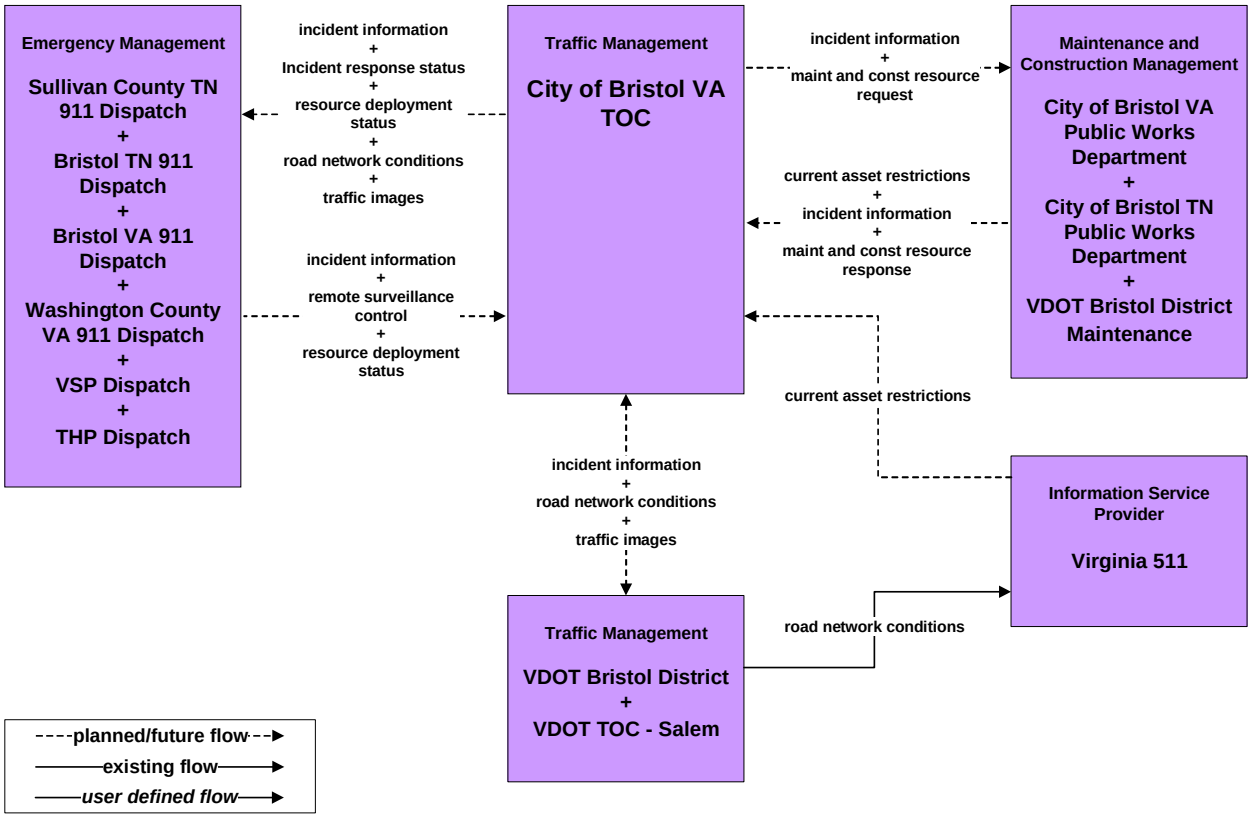
ATMS08 - Traffic Incident Management System
VDOT TMC – Salem and Bristol District



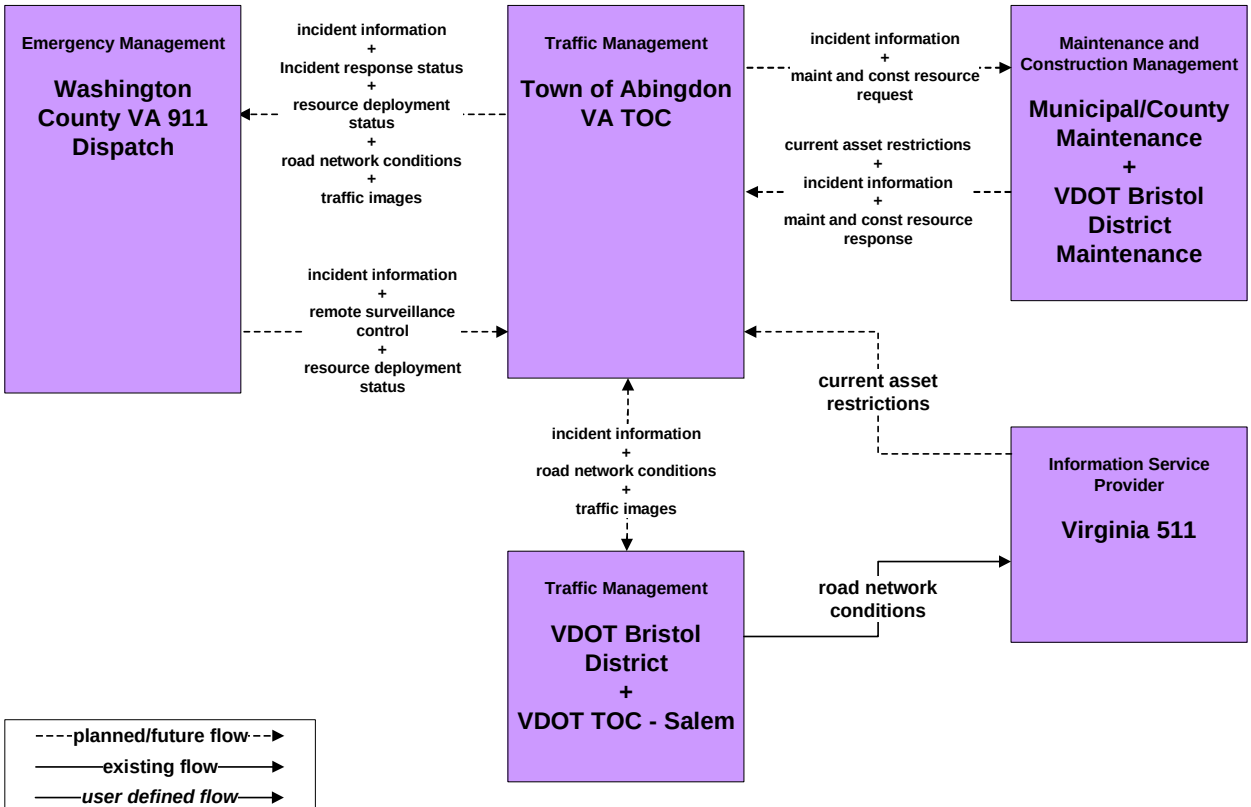
ATMS08 - Traffic Incident Management System
City of Bristol TN



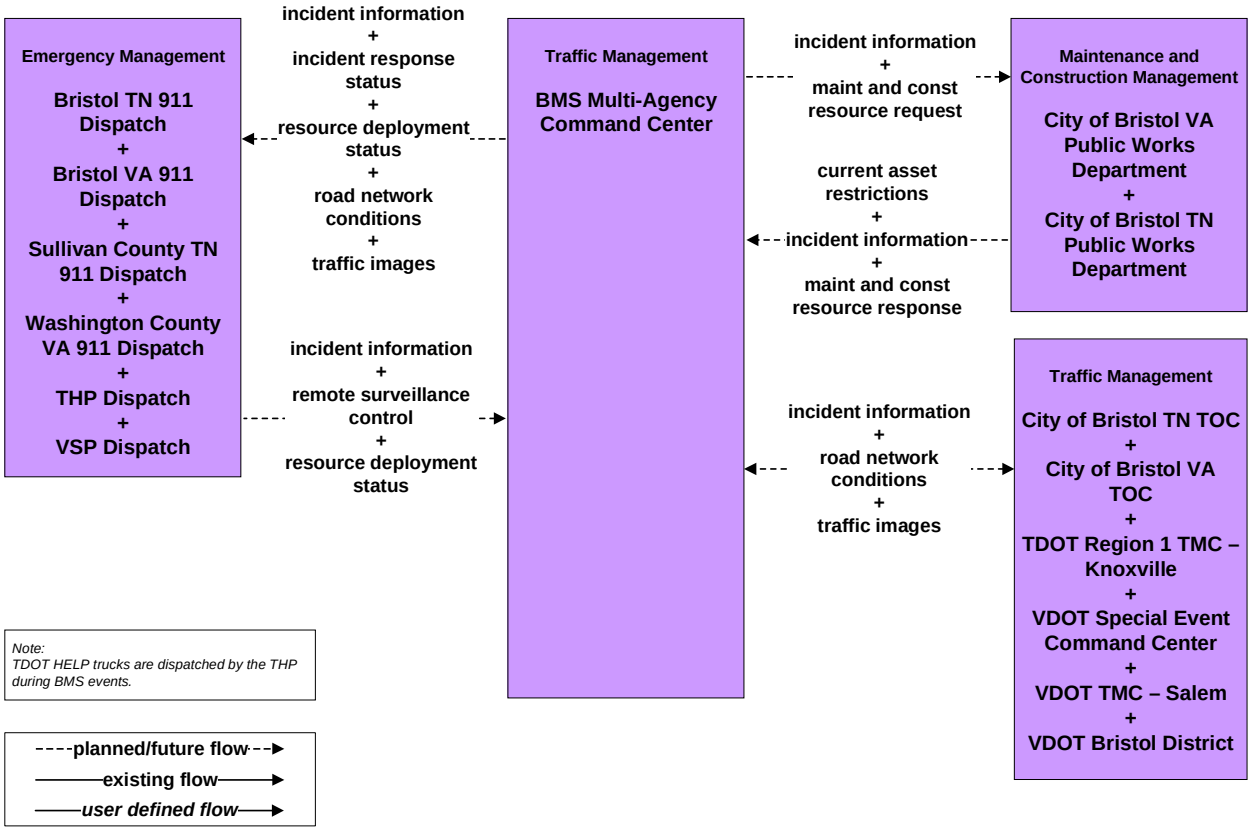
ATMS08 - Traffic Incident Management System
City of Bristol VA



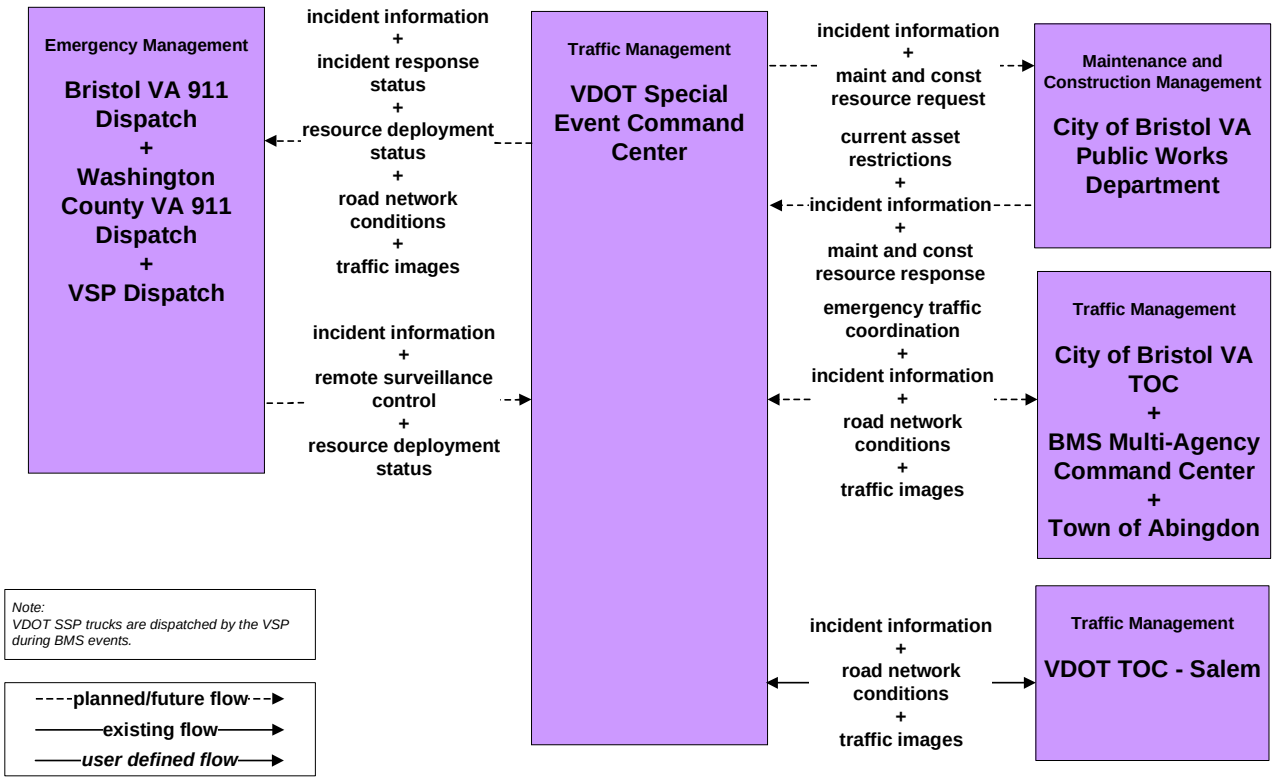
ATMS08 - Traffic Incident Management System
Town of Abingdon VA



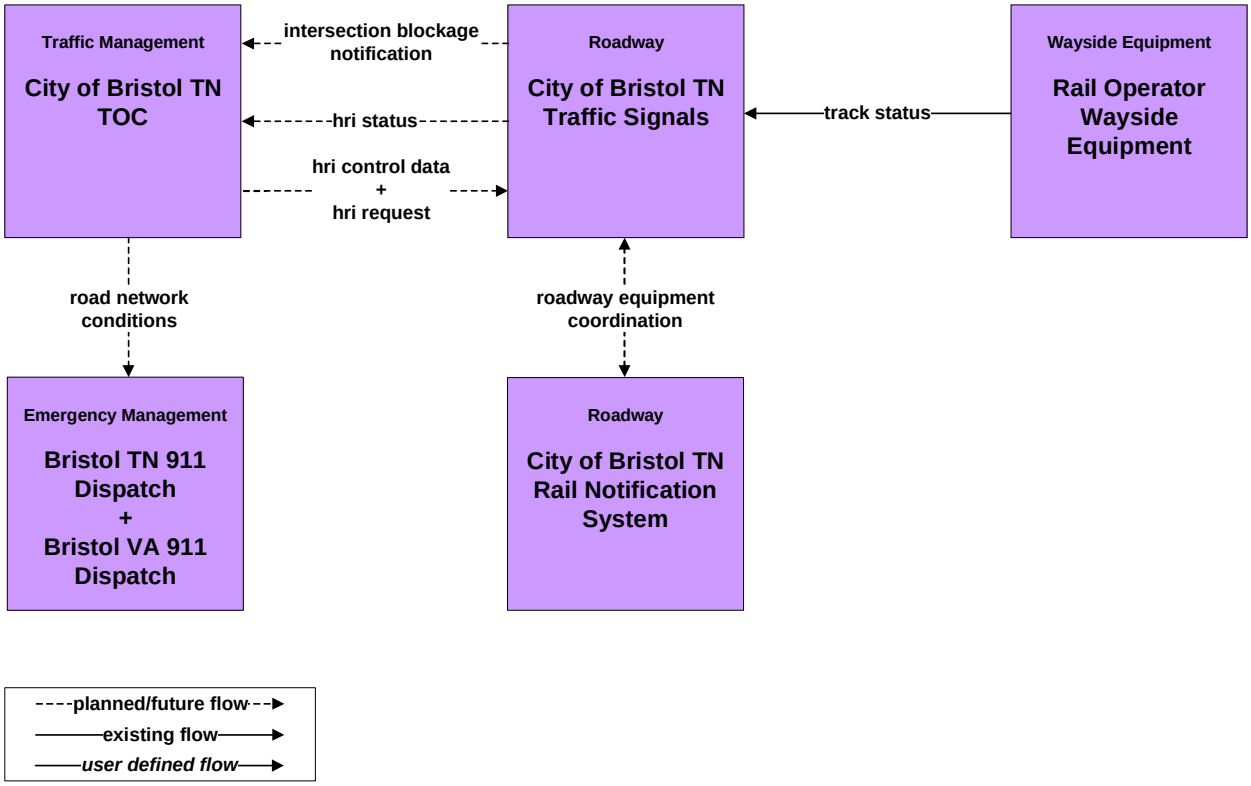
ATMS08 - Traffic Incident Management System
Bristol Motor Speedway Operations - Tennessee



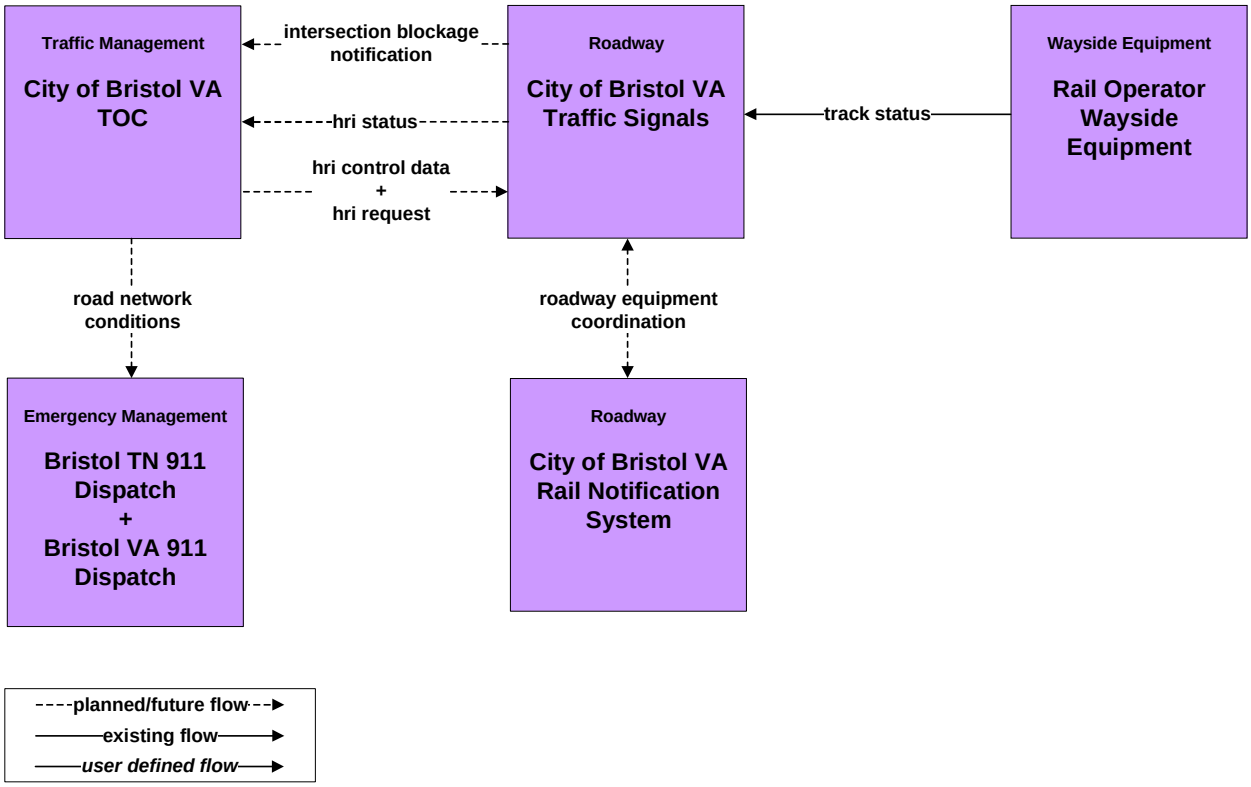
ATMS08 - Traffic Incident Management System
Bristol Motor Speedway Operations - Virginia



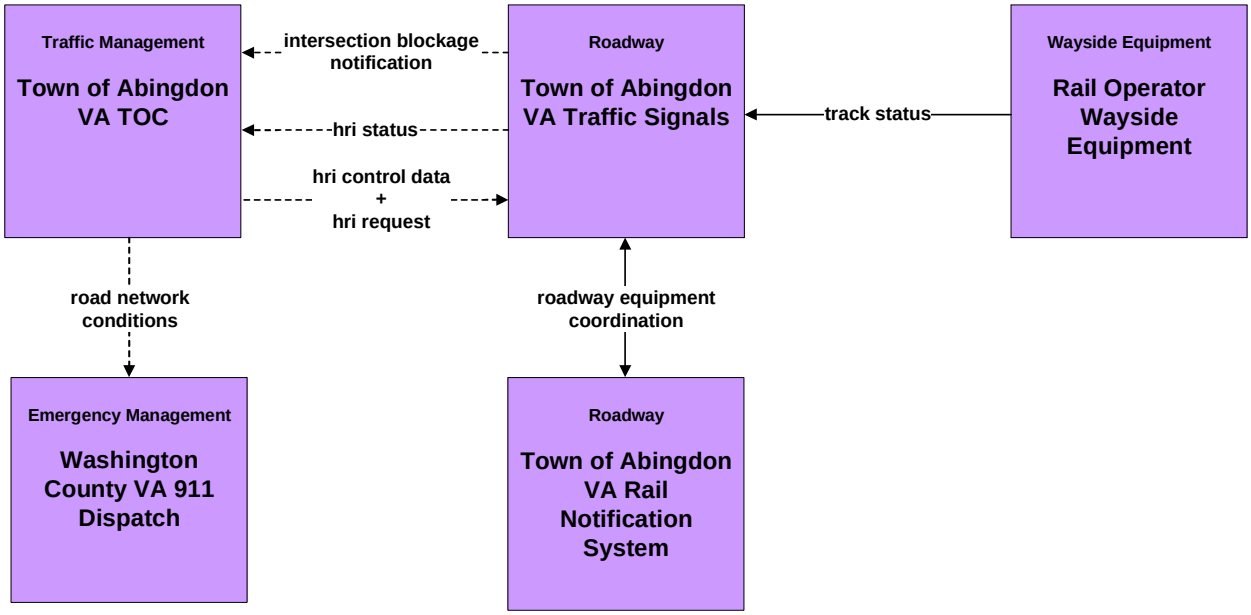
ATMS13 – Standard Railroad Grade Crossing
City of Bristol TN



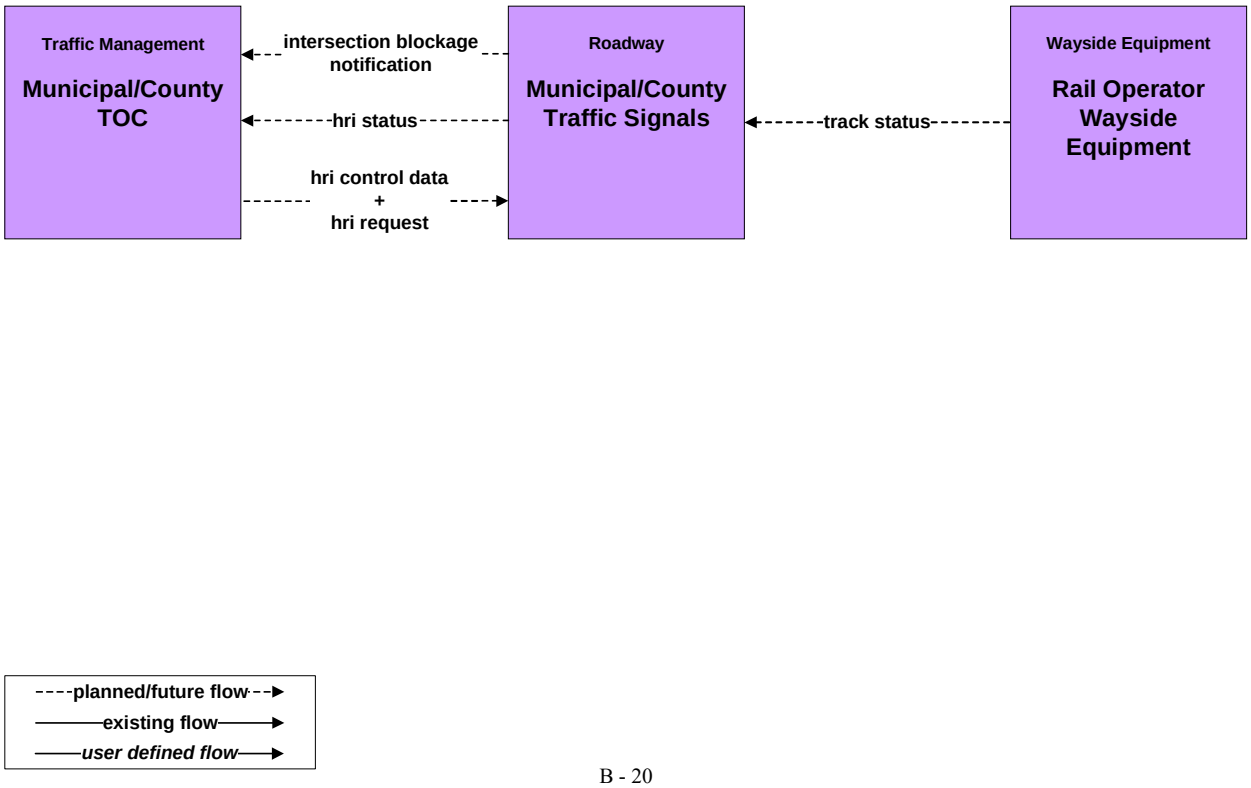
ATMS13 – Standard Railroad Grade Crossing
City of Bristol VA



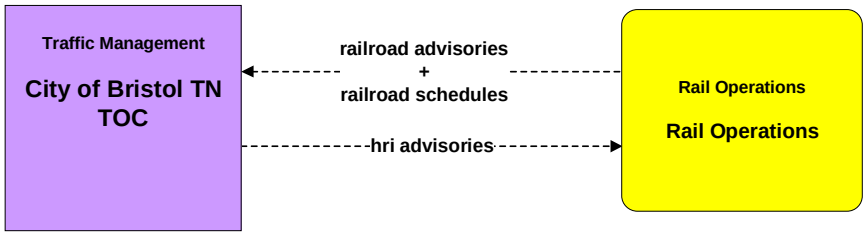
ATMS13 – Standard Railroad Grade Crossing
Town of Abingdon VA

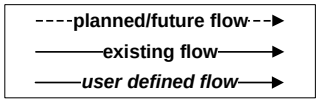


ATMS13 – Standard Railroad Grade Crossing
Municipal/County

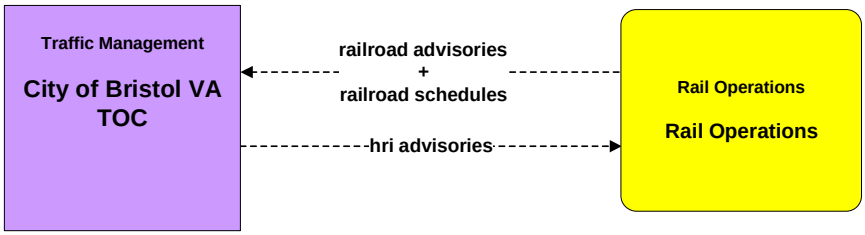


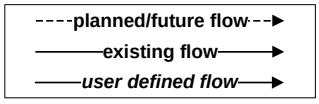
ATMS15 – Railroad Operations Coordination
City of Bristol TN



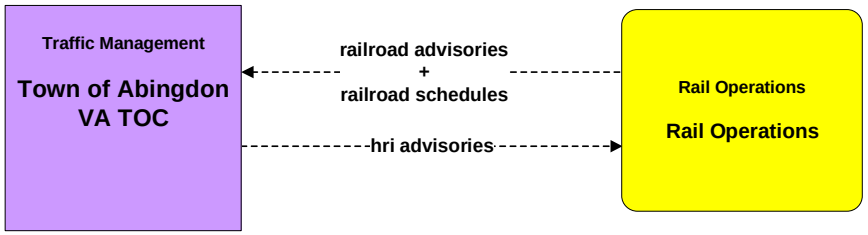


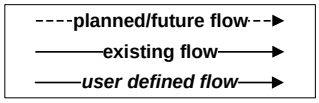
ATMS15 – Railroad Operations Coordination
City of Bristol VA



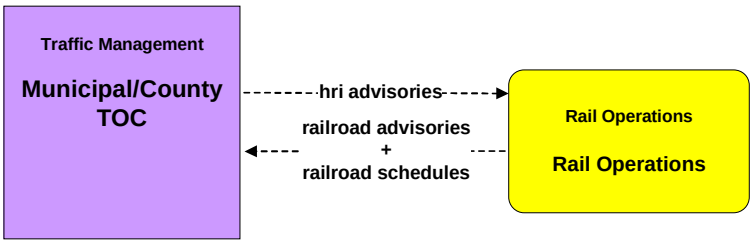


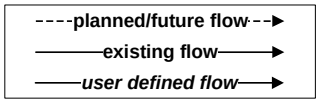
ATMS15 – Railroad Operations Coordination
Town of Abingdon VA



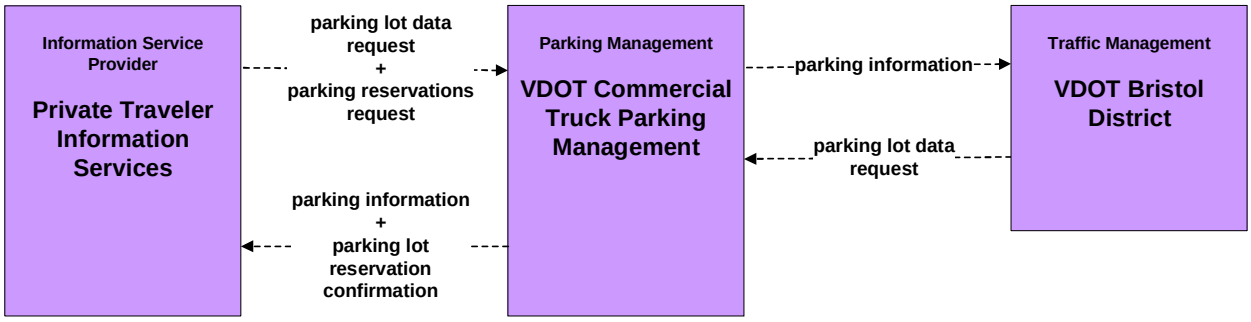


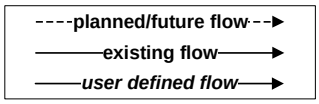
ATMS15 – Railroad Operations Coordination
Municipal/County



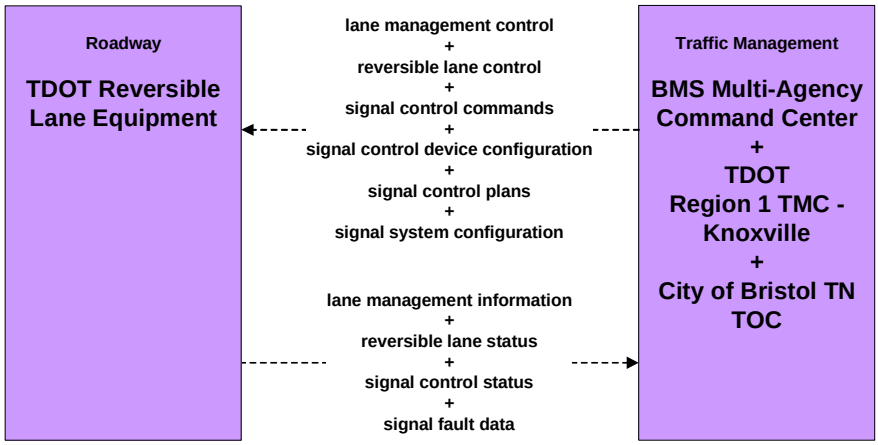


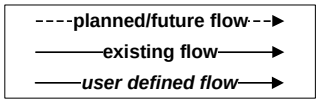
ATMS17 – Regional Parking Management
VDOT Bristol District



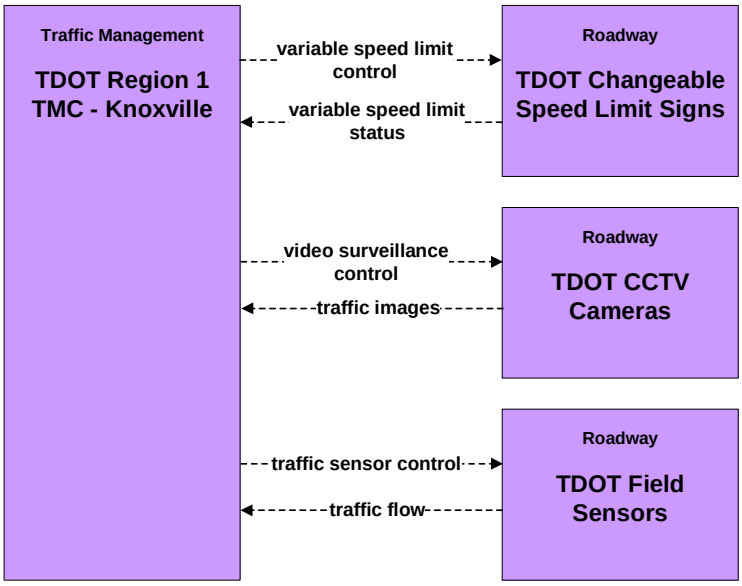


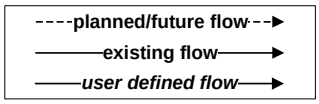
ATMS18 – Reversible Lane Management
TDOT



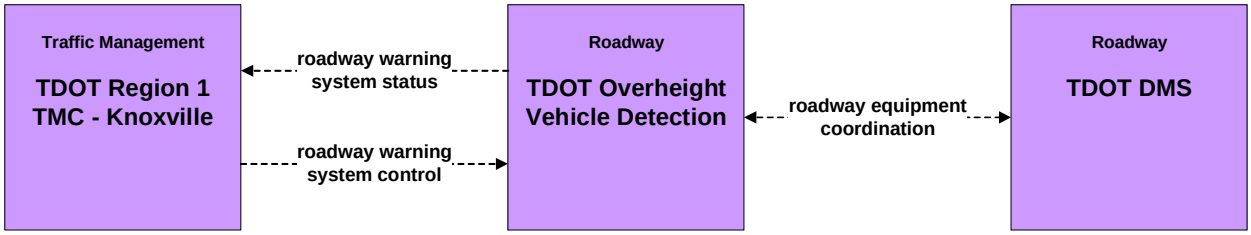


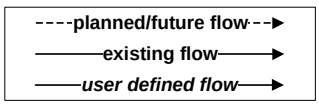
ATMS22 – Variable Speed Limits
TDOT Region 1 TMC - Knoxville



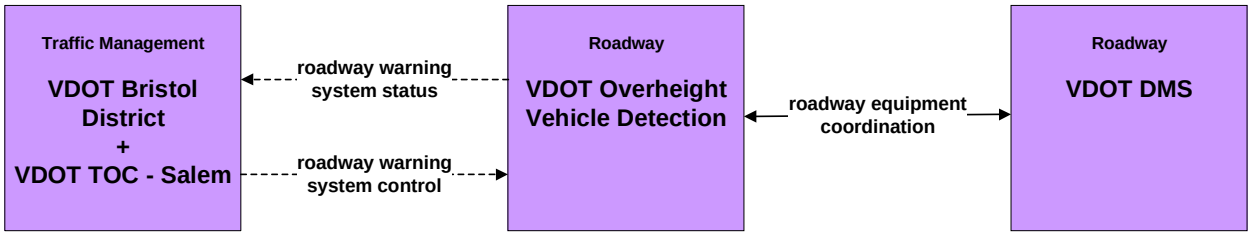


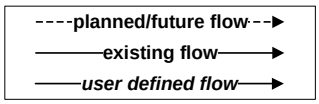
ATMS24 – Dynamic Roadway Warning
TDOT Overheight Vehicle Detection



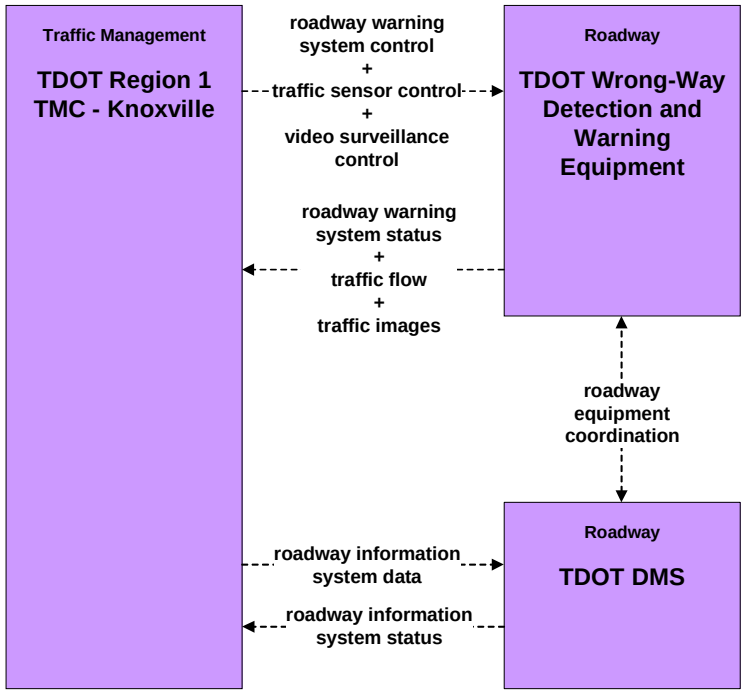


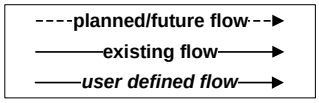
ATMS24 – Dynamic Roadway Warning
VDOT Overheight Vehicle Detection



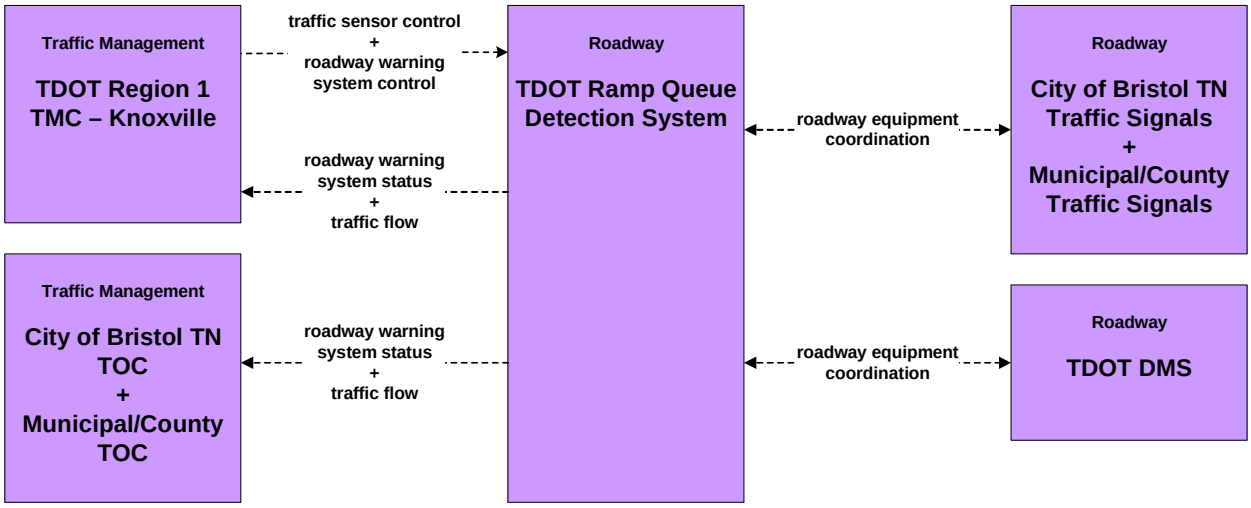


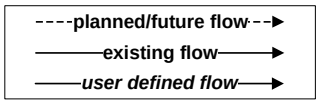
ATMS24 – Dynamic Roadway Warning
TDOT Wrong Way Detection and Warning



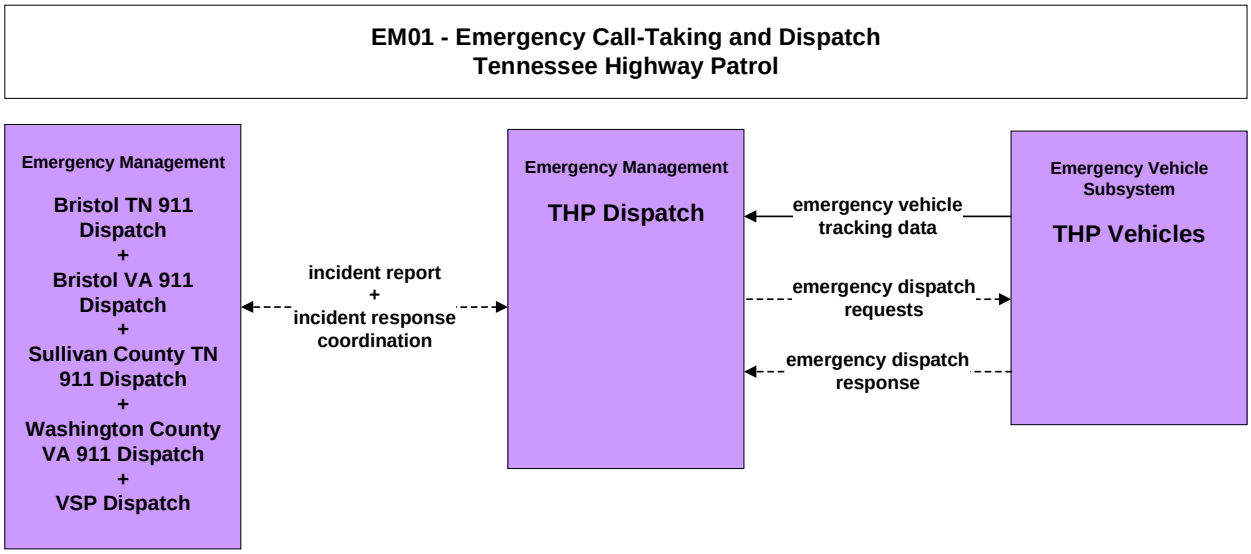


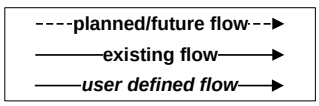
ATMS24 – Dynamic Roadway Warning
TDOT Ramp Queue Detection System



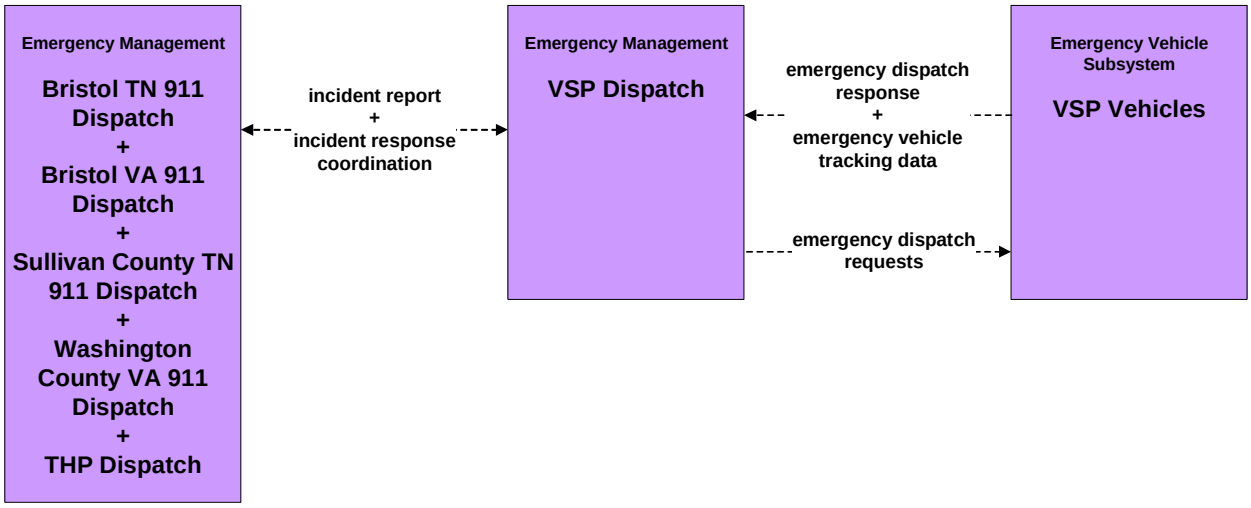


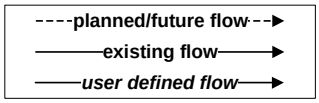
Emergency Management



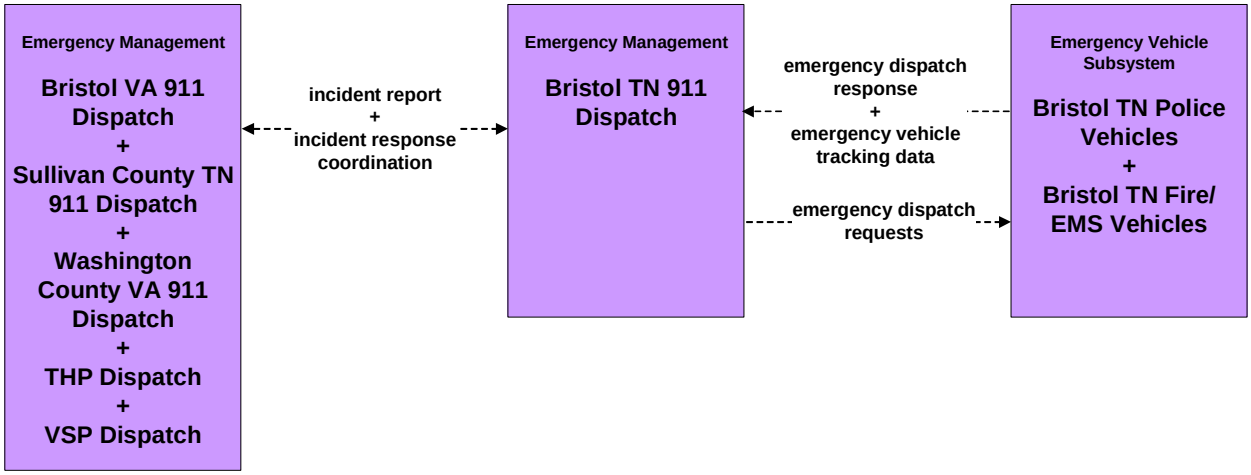


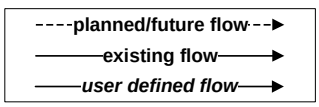
EM01 - Emergency Call-Taking and Dispatch
Virginia State Police



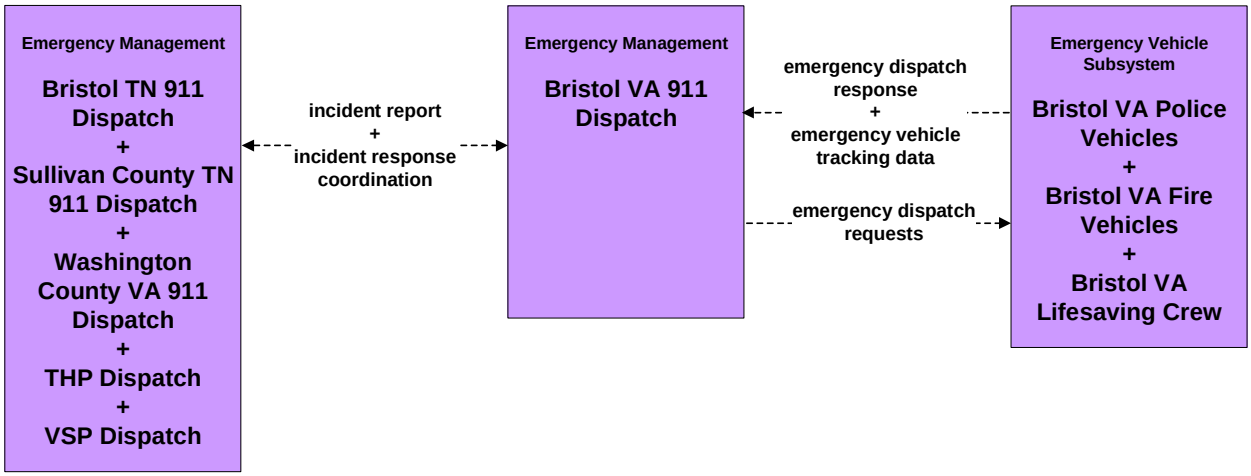


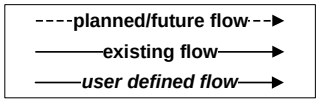
EM01 - Emergency Call-Taking and Dispatch
Bristol TN 911 Dispatch



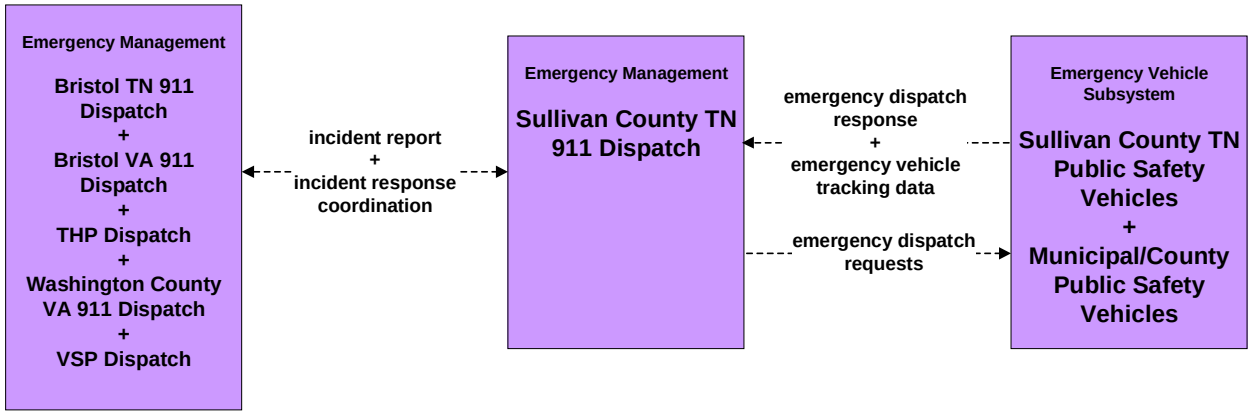


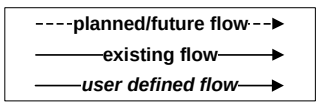
EM01 - Emergency Call-Taking and Dispatch
Bristol VA 911 Dispatch





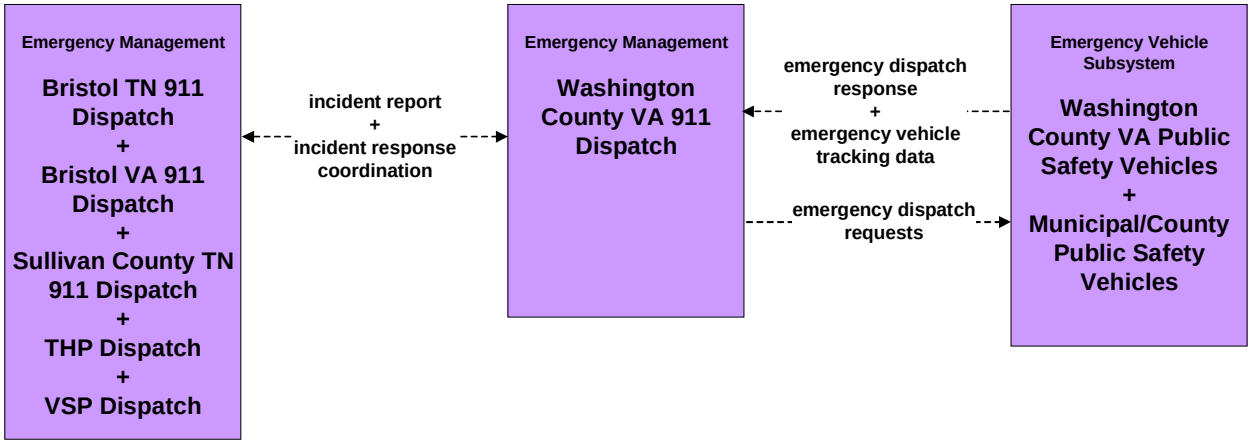
EM01 - Emergency Call-Taking and Dispatch
Sullivan County TN 911 Dispatch





Note:
Sullivan County TN Public Safety Vehicles include Sullivan County TN Sheriff and EMS vehicles. Municipal/County Public Safety Vehicles include police, fire and and/or EMS for municipalities within Sullivan County TN such as Bluff City.

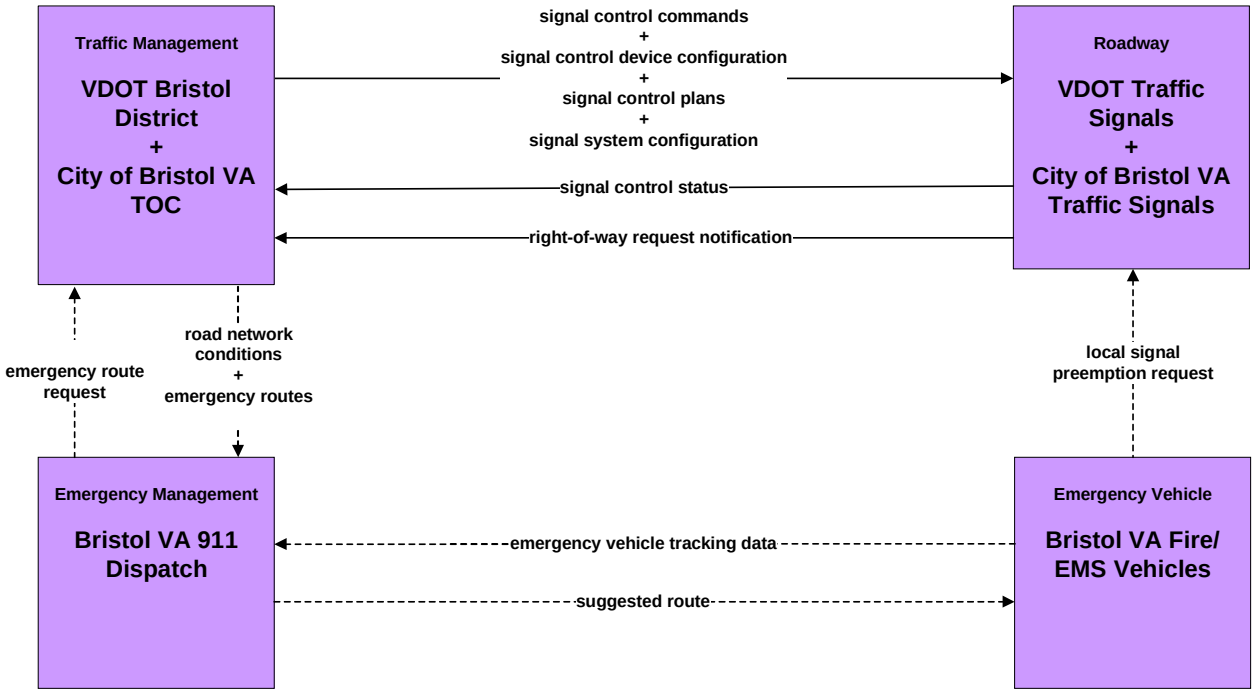
EM01 - Emergency Call-Taking and Dispatch
Washington County VA 911 Dispatch



planned/future flow
existing flow
user defined flow

Note:
Washington County Public Safety Vehicles include Washington County Sheriff and EMS vehicles. Municipal/County Public Safety Vehicles include police, fire and and/or EMS for municipalities within Washington County including Abingdon.

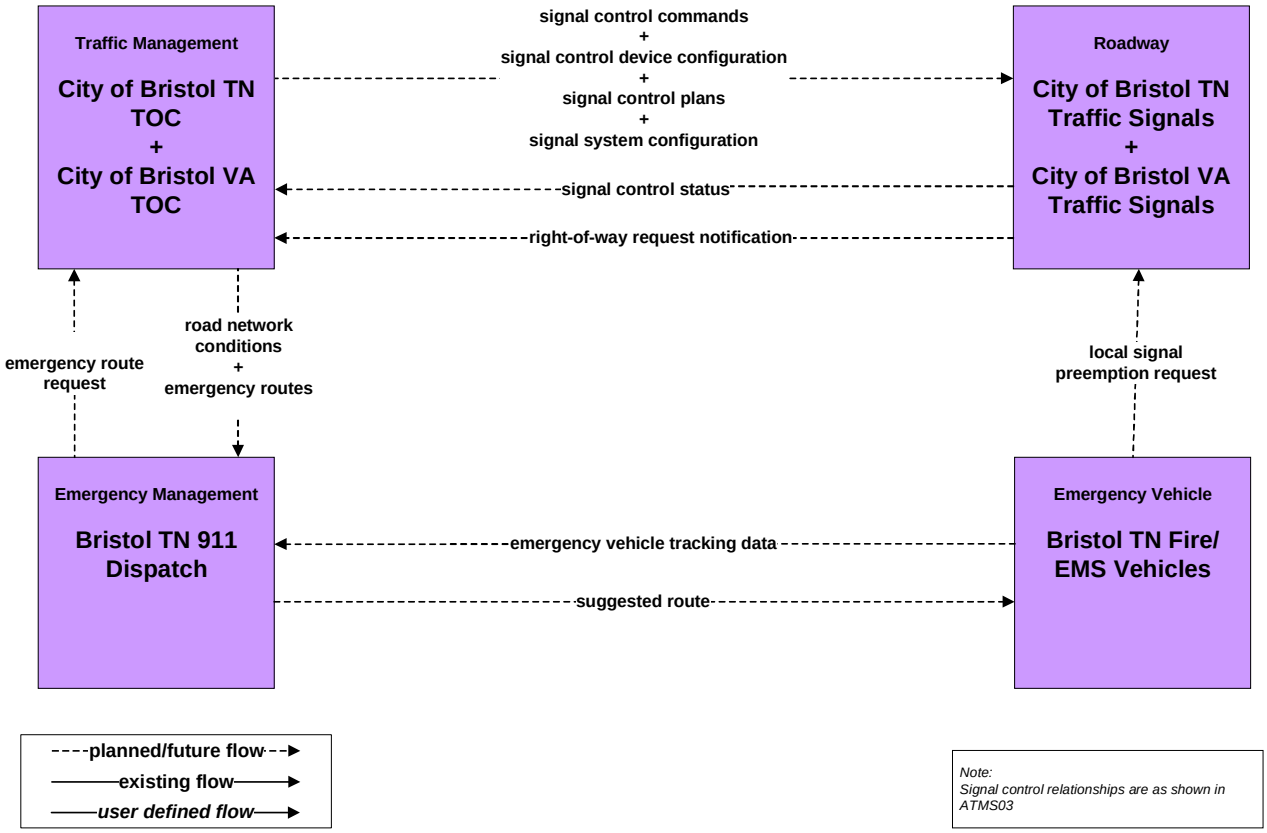
EM02 – Emergency Routing
VDOT



planned/future flow
existing flow
user defined flow

Note:
The flows between City of Bristol VA TOC and City of Bristol VA Traffic Signals are planned. There are no connections between City of Bristol VA TMC and VDOT

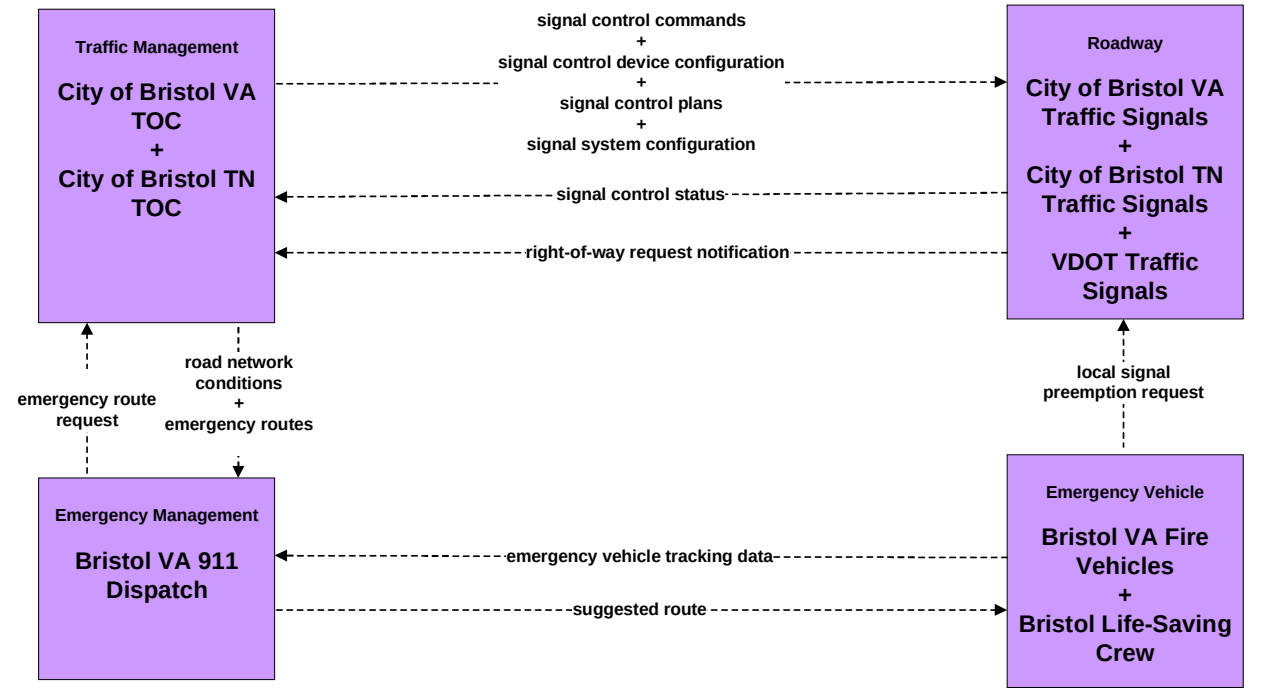
EM02 – Emergency Routing
Bristol TN



planned/future flow
existing flow
user defined flow

Note:
Signal control relationships are as shown in ATMS03

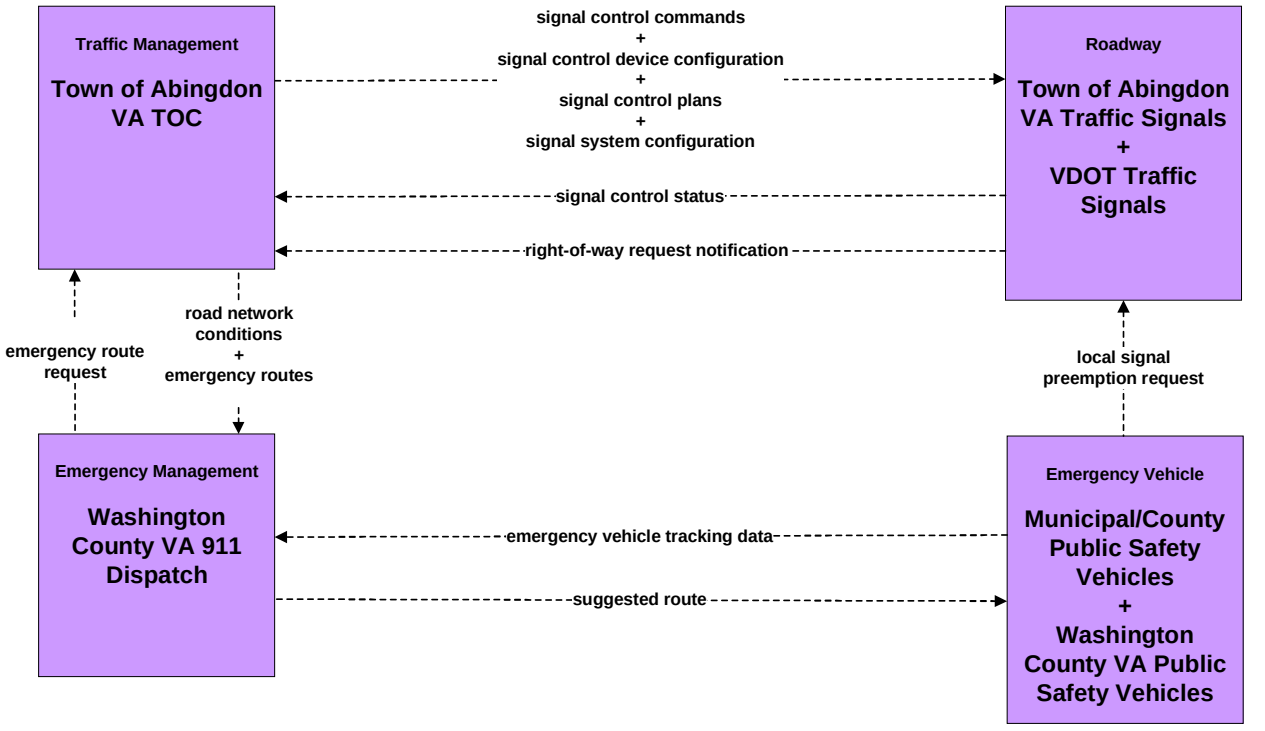
EM02 – Emergency Routing
Bristol VA



planned/future flow
existing flow
user defined flow

Note:
Signal control relationships are as shown in ATMS03

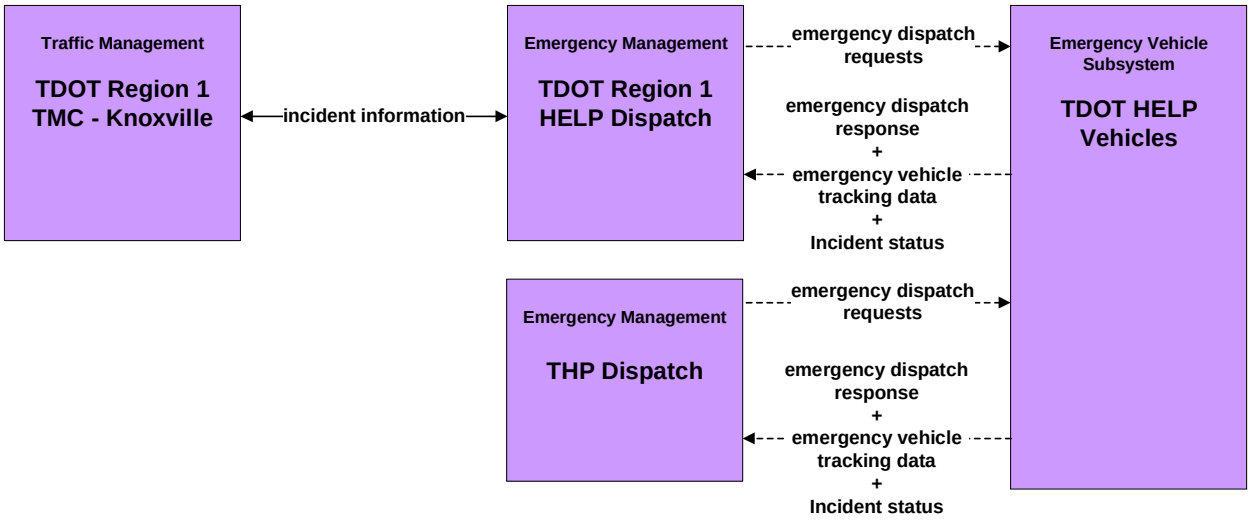
EM02 – Emergency Routing
Abingdon VA



planned/future flow
existing flow
user defined flow

Note:
Signal control relationships are as shown in ATMS03

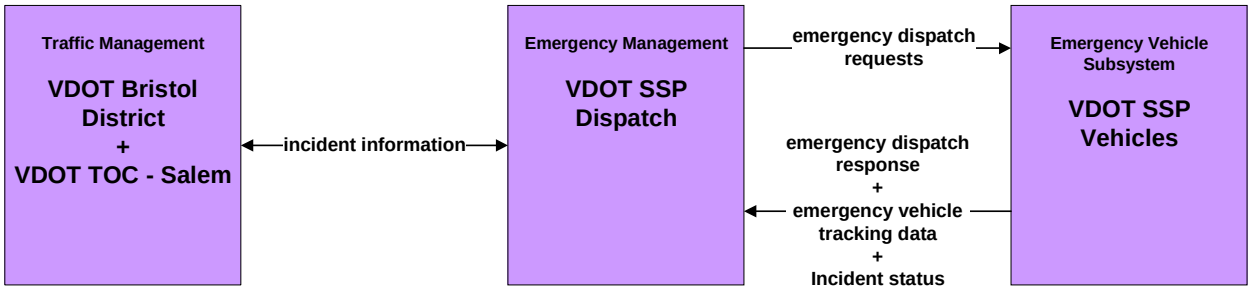
EM04 - Roadway Service Patrols
HELP

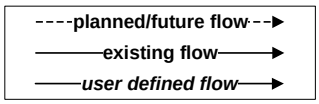


planned/future flow
existing flow
user defined flow

Note:
HELP Dispatch is located in the TDOT Region 1 TMC in Knoxville. HELP vehicles come to Bristol during special events, such as NASCAR races at the Bristol Motor Speedway, and are dispatched by THP during the event. Stakeholders identified a need for permanent presence of HELP vehicles in the Bristol and Kingsport Regions.

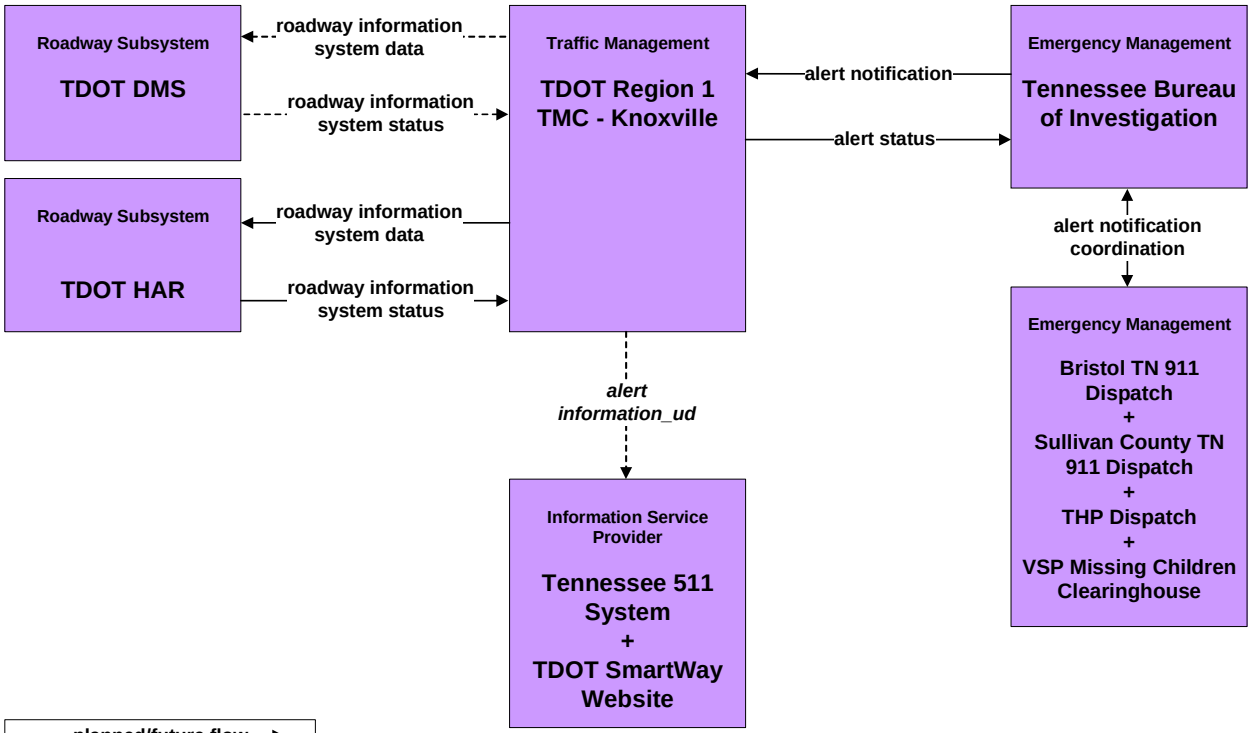
EM04 - Roadway Service Patrols
VDOT Safety Service Patrol

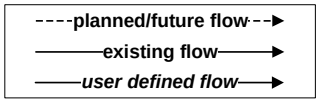




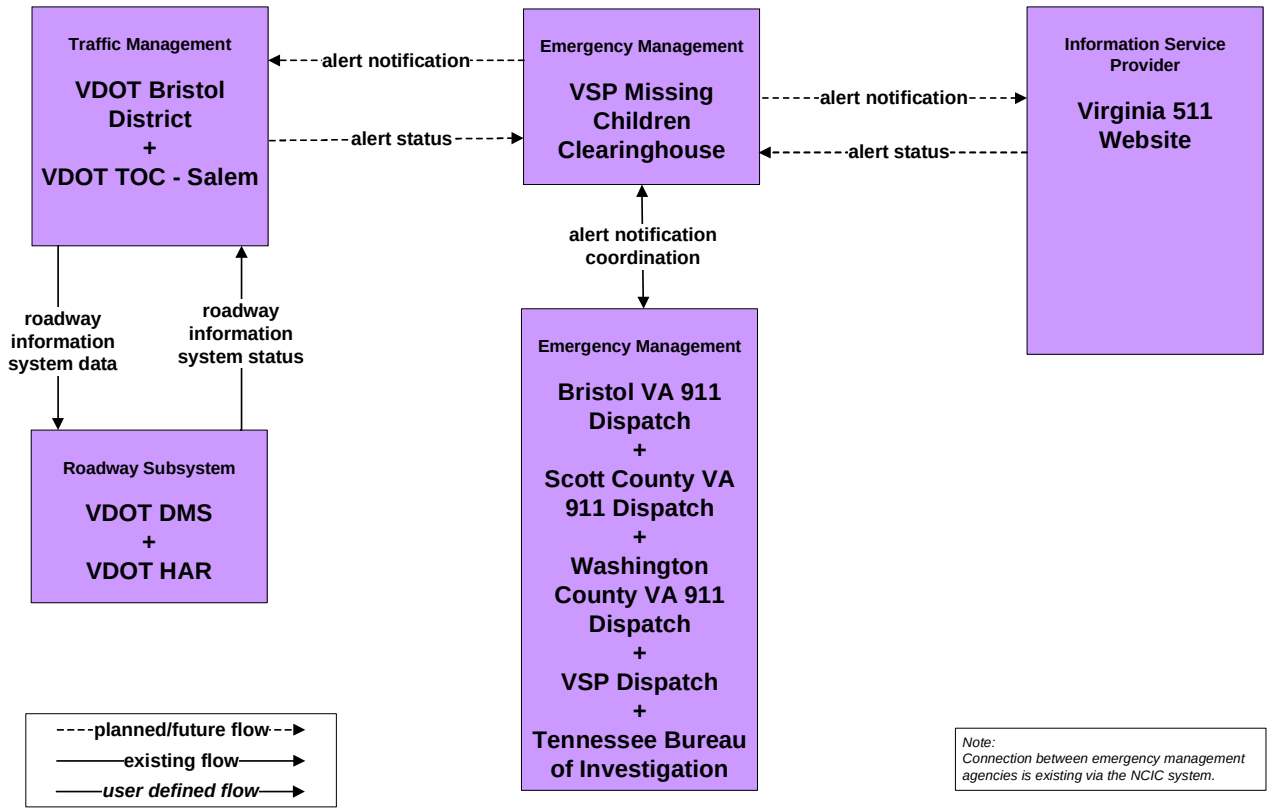
Note:
SSP trucks come to the Bristol Region during special events such as NASCAR. Stakeholders identified a need for permanent presence of SSP trucks in the Bristol Region.

EM06 - Wide-Area Alert
Tennessee AMBER Alert

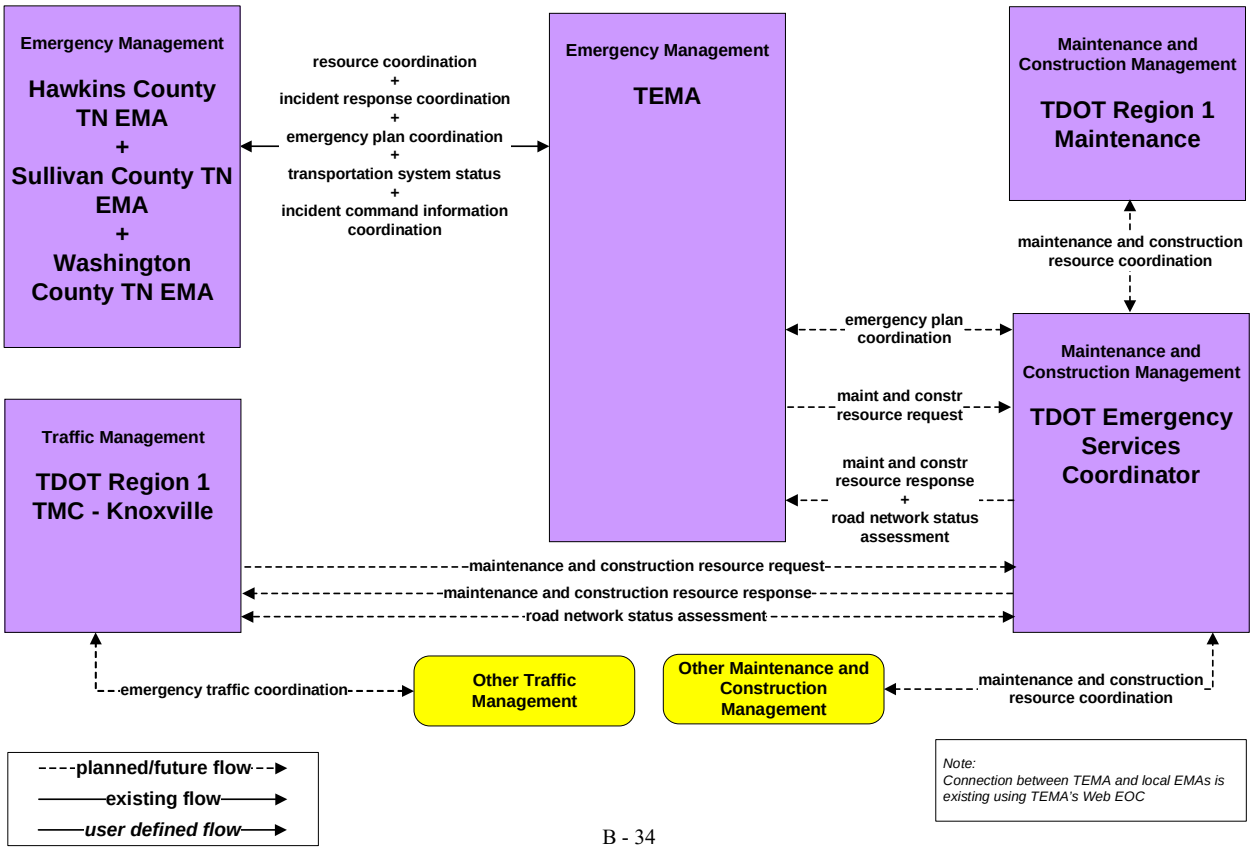




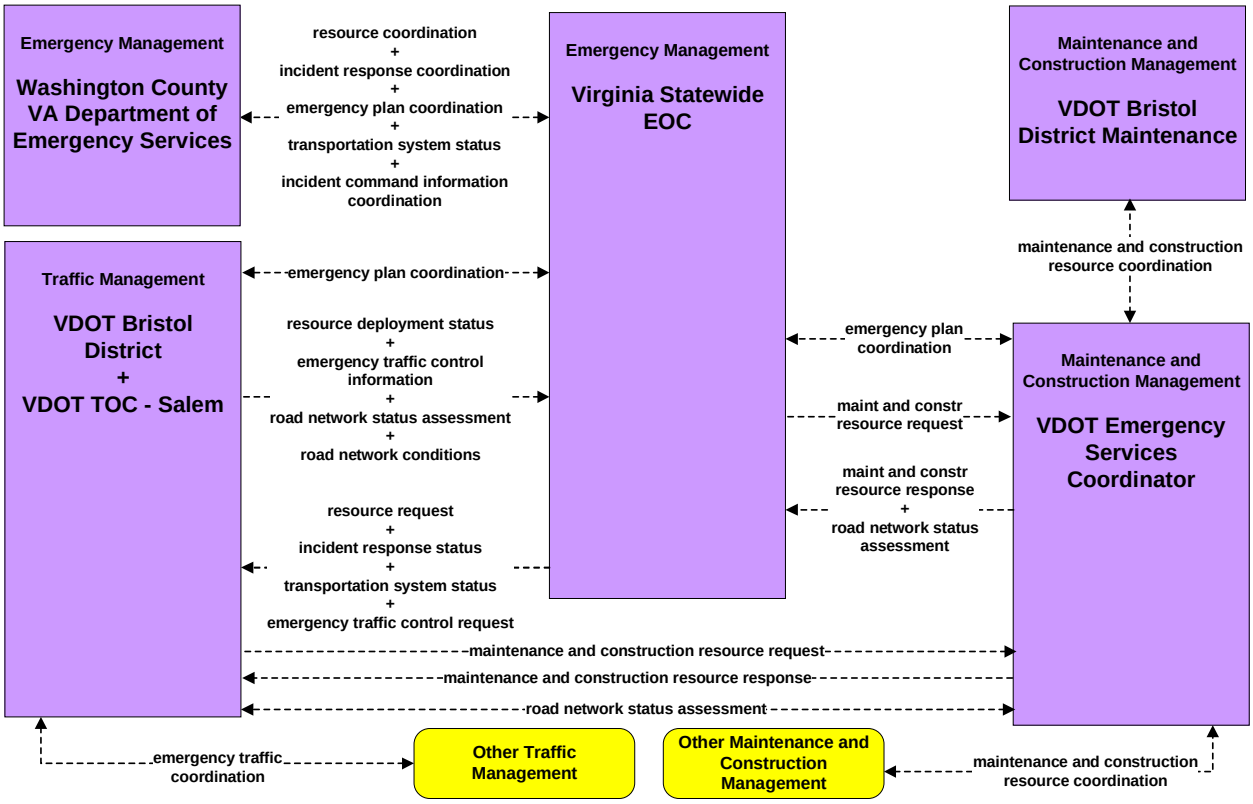
EM06 - Wide-Area Alert
Virginia AMBER Alert



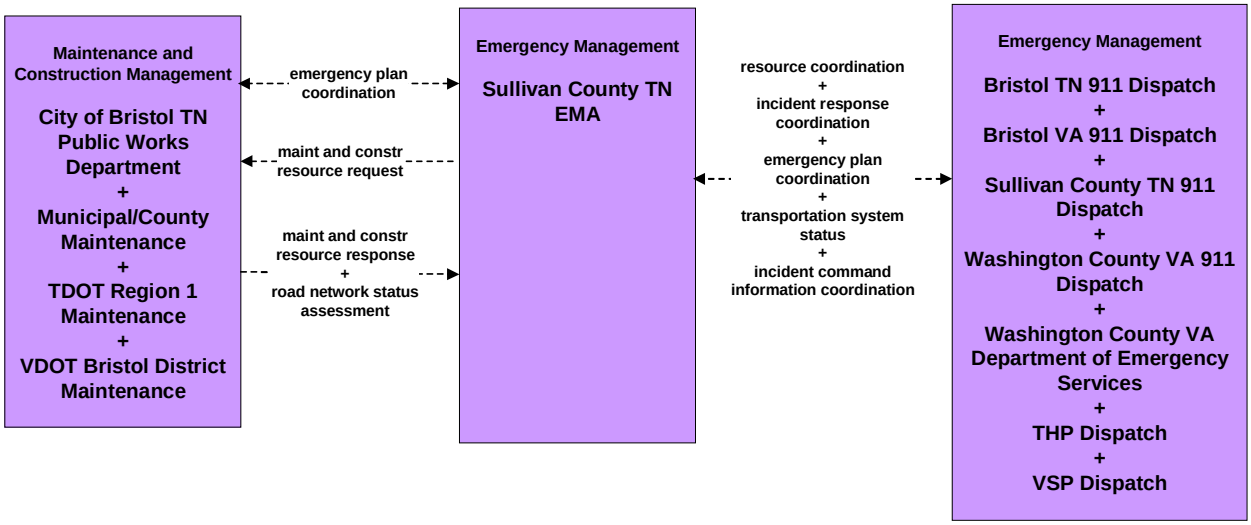
EM08 - Disaster Response and Recovery
TEMA

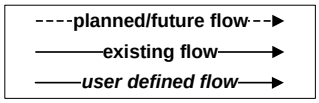


EM08 - Disaster Response and Recovery
Virginia Statewide Emergency Operations

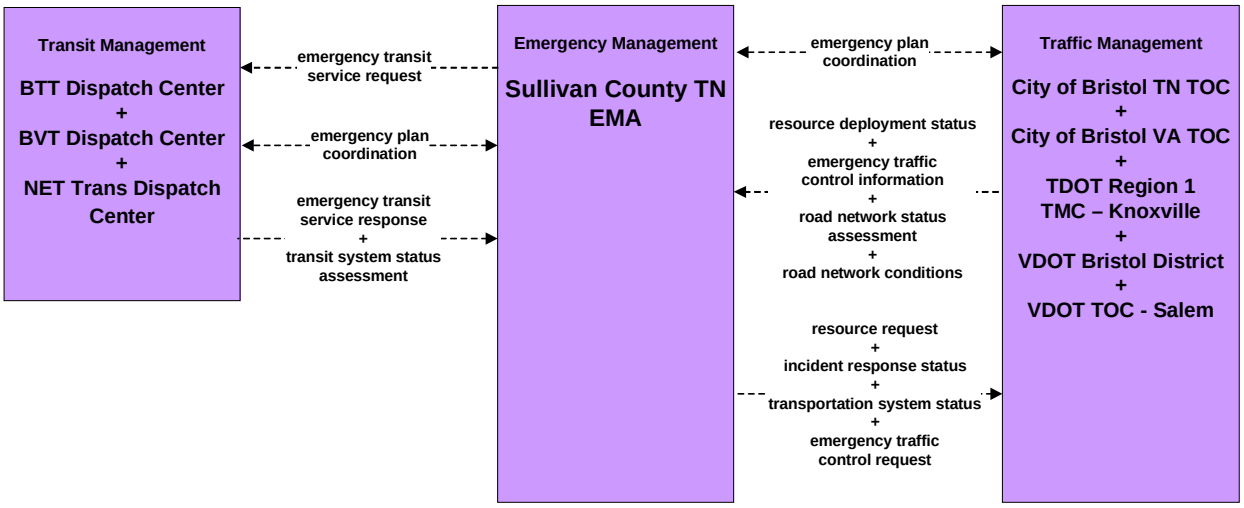


EM08 - Disaster Response and Recovery
Sullivan County TN EMA (1 of 2)



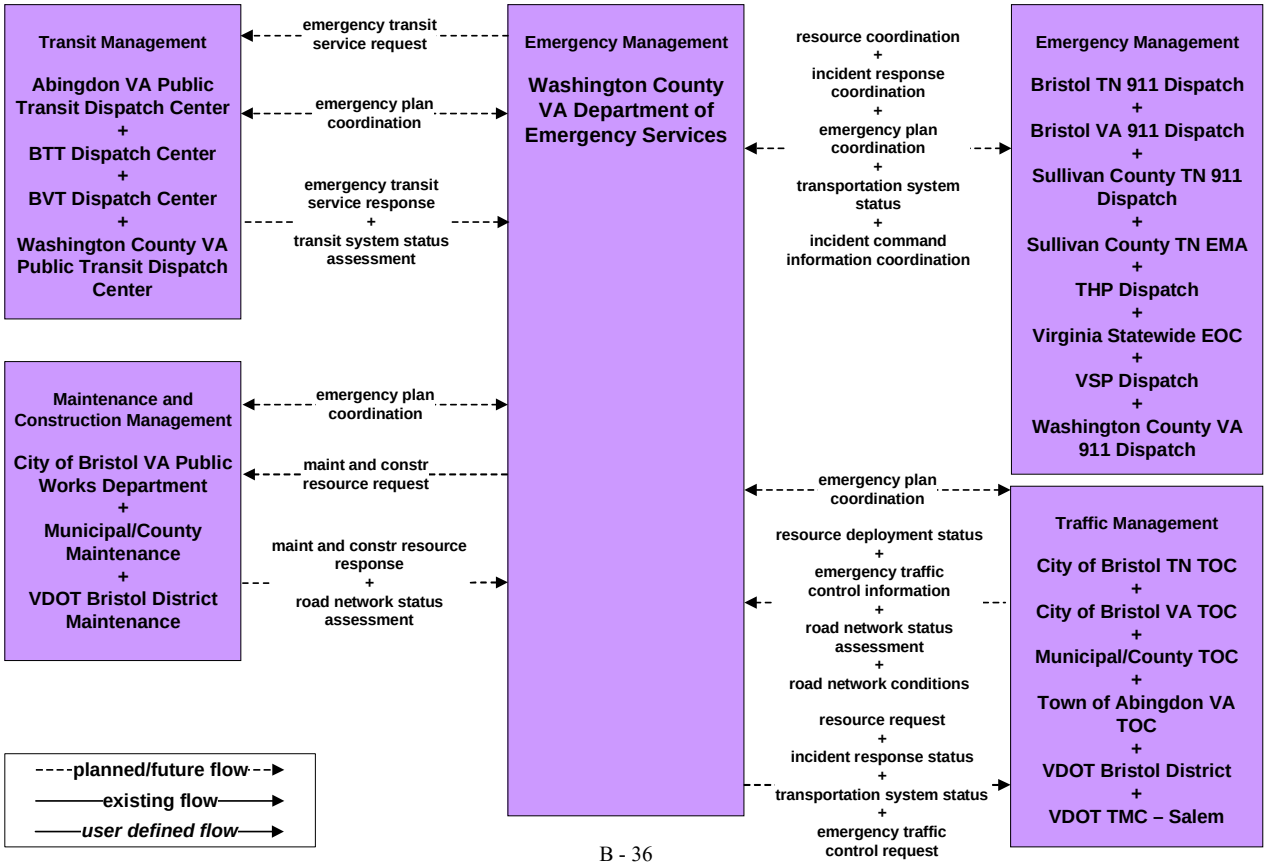


EM08 - Disaster Response and Recovery
Sullivan County TN EMA (2 of 2)



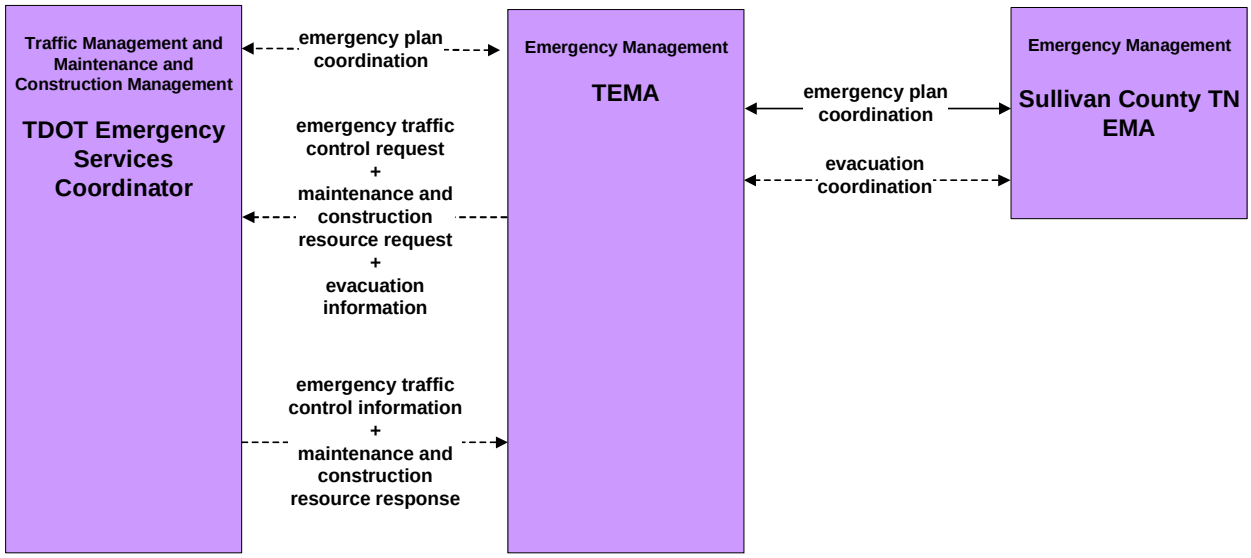
planned/future flow
existing flow
user defined flow

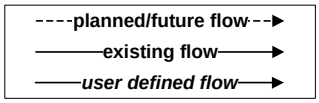
EM08 - Disaster Response and Recovery
Washington County VA Department of Emergency Services



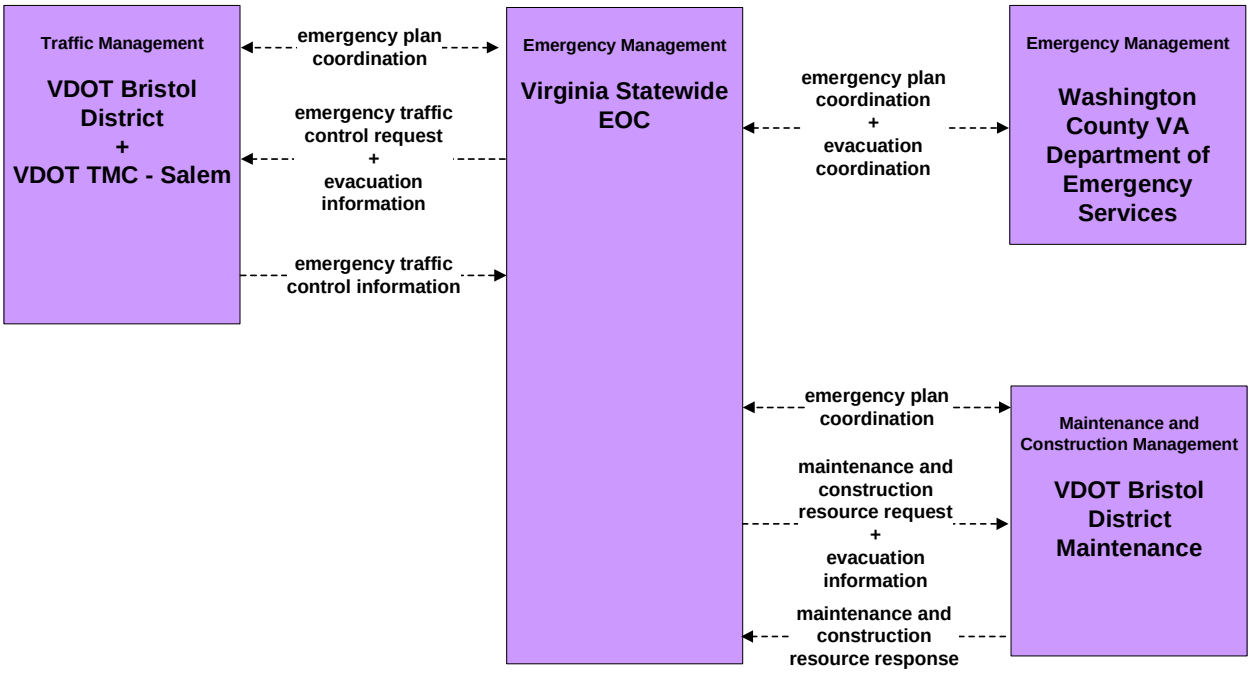
planned/future flow
existing flow
user defined flow

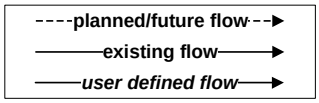
EM09 - Evacuation and Reentry Management
TEMA



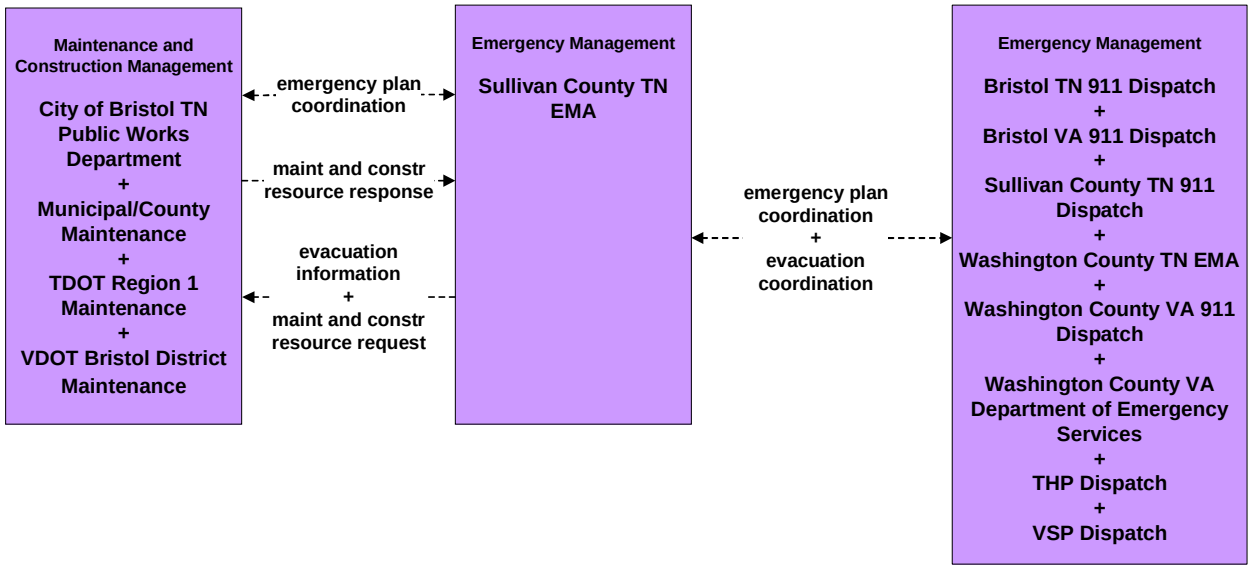


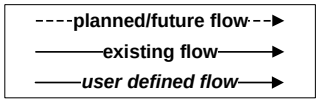
EM09 - Evacuation and Reentry Management
Virginia Statewide EOC



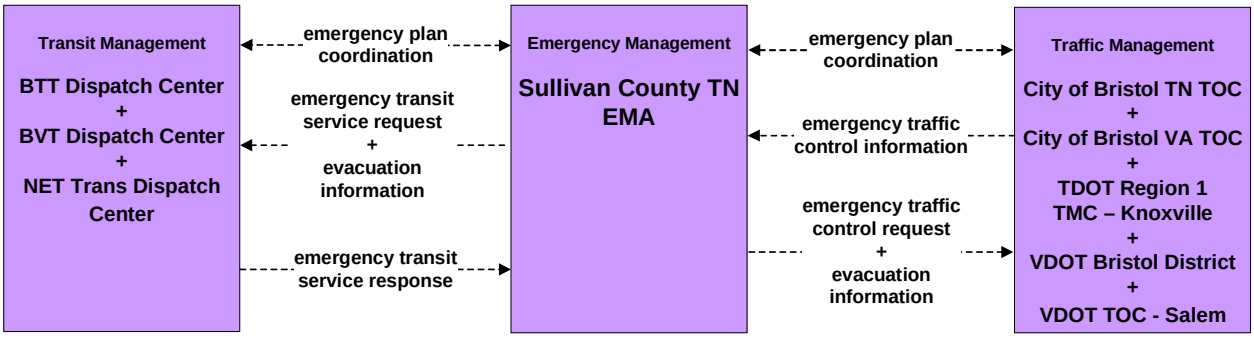


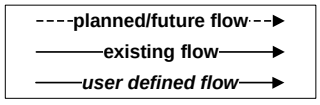
EM09 - Evacuation and Reentry Management
Sullivan County TN EMA (1 of 2)



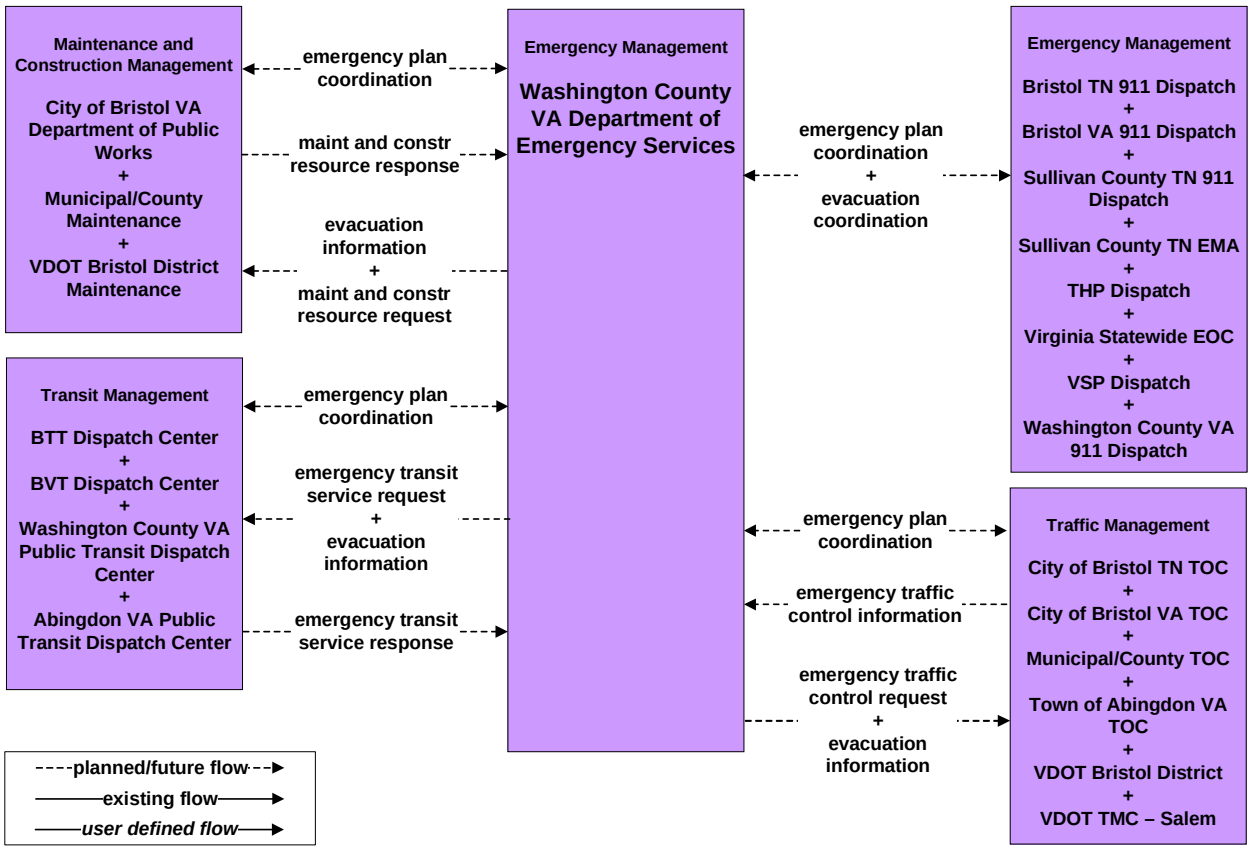


EM09 - Evacuation and Reentry Management
Sullivan County TN EMA (2 of 2)

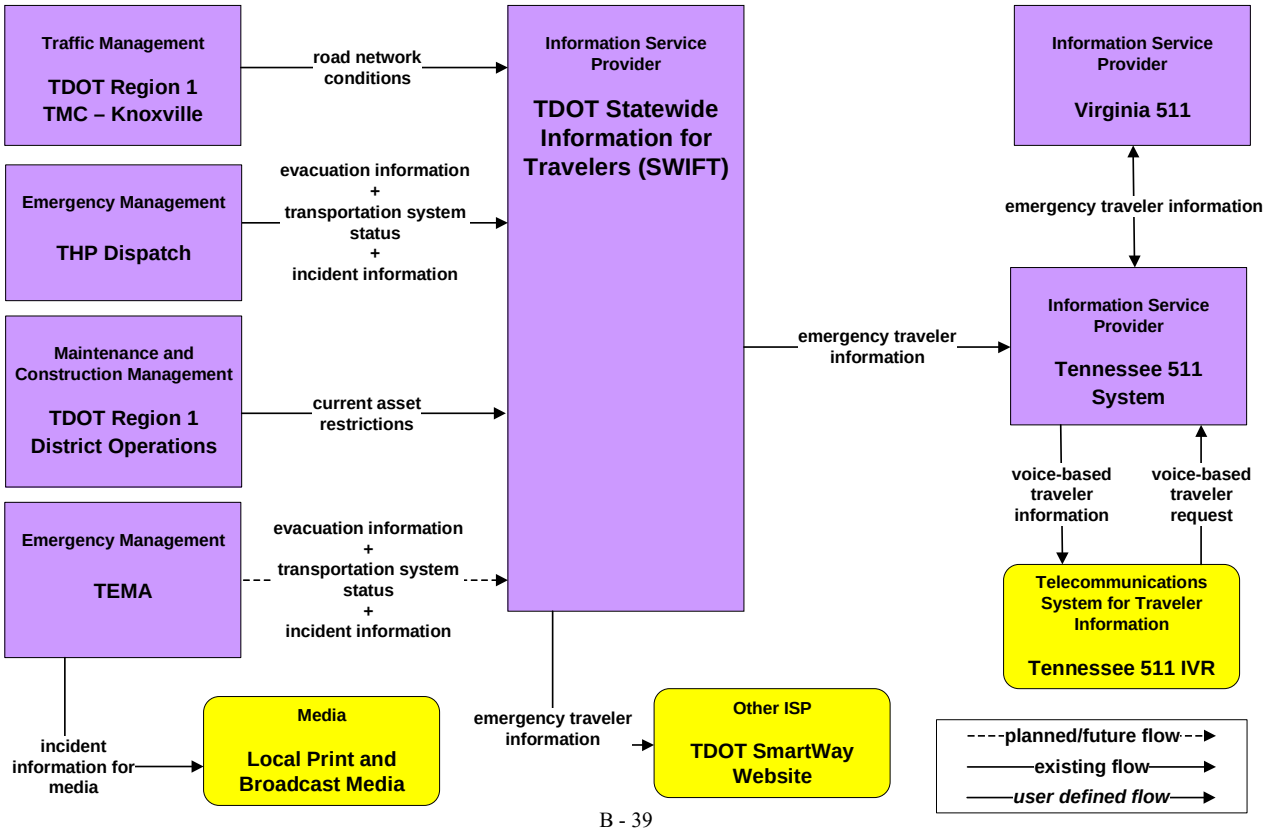




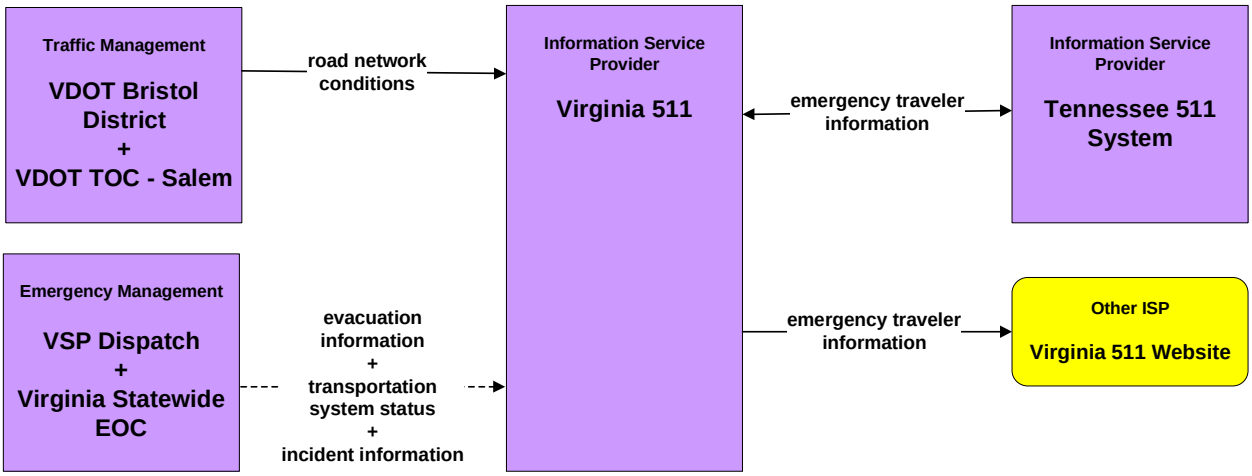
EM09 - Evacuation and Reentry Management
Washington County VA Department of Emergency Services

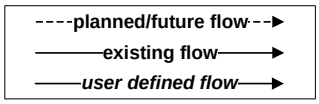


EM10 – Disaster Traveler Information
Tennessee 511 and SWIFT

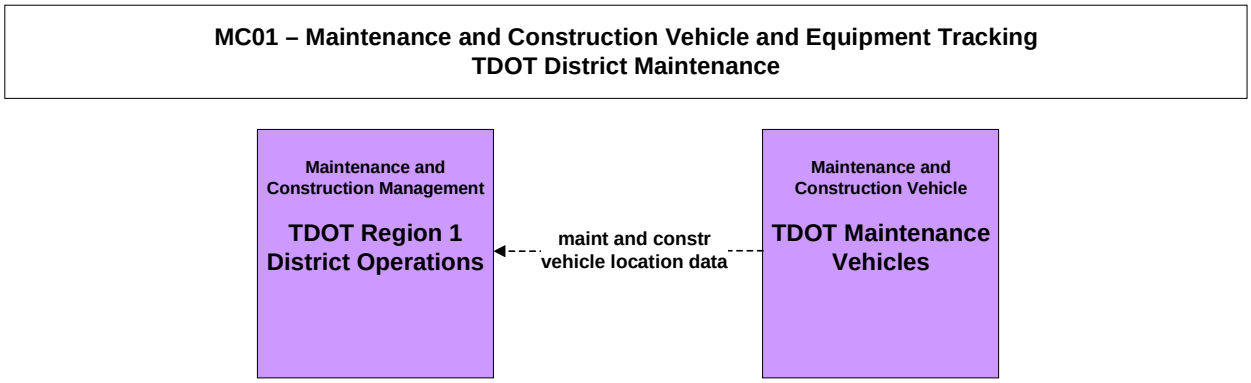


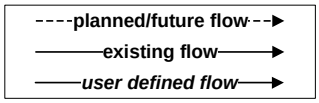
EM10 – Disaster Traveler Information
Virginia 511



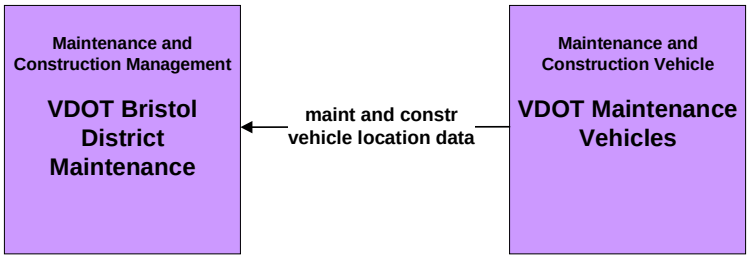


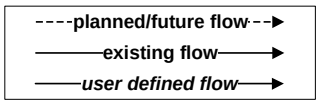
Maintenance and Construction Management



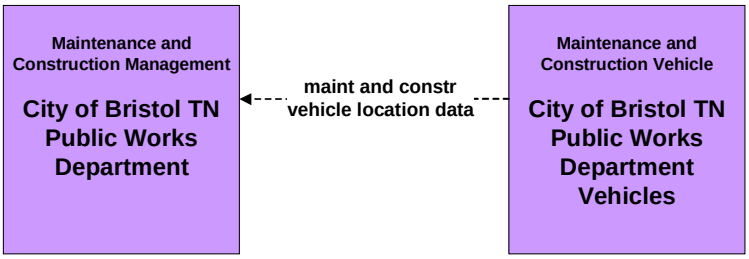


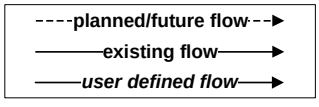
MC01 – Maintenance and Construction Vehicle and Equipment Tracking
VDOT Bristol District Maintenance



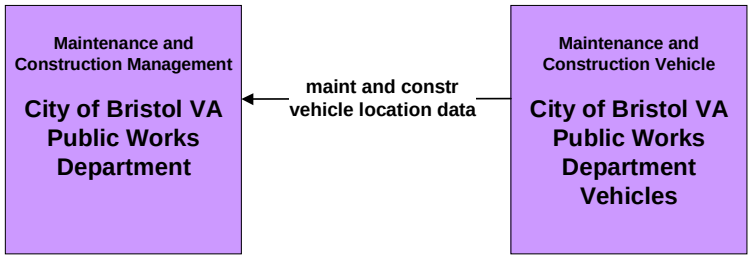


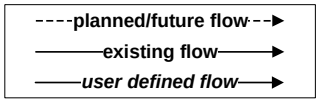
MC01 – Maintenance and Construction Vehicle and Equipment Tracking
City of Bristol TN



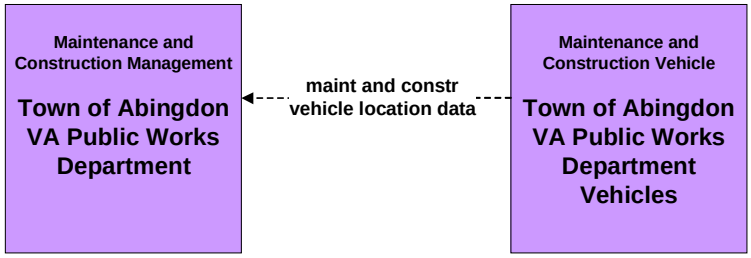


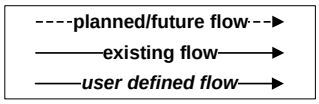
MC01 – Maintenance and Construction Vehicle and Equipment Tracking
City of Bristol VA



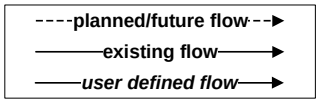


MC01 – Maintenance and Construction Vehicle and Equipment Tracking
Town of Abingdon VA

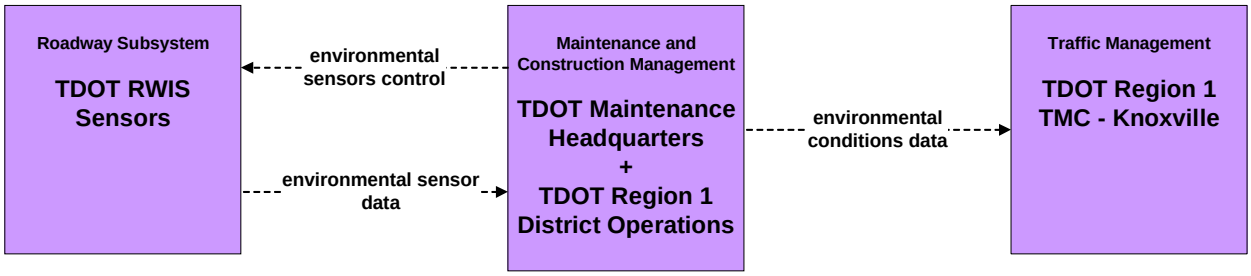


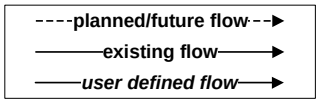


MC01 – Maintenance and Construction Vehicle and Equipment Tracking
Municipal/County Maintenance

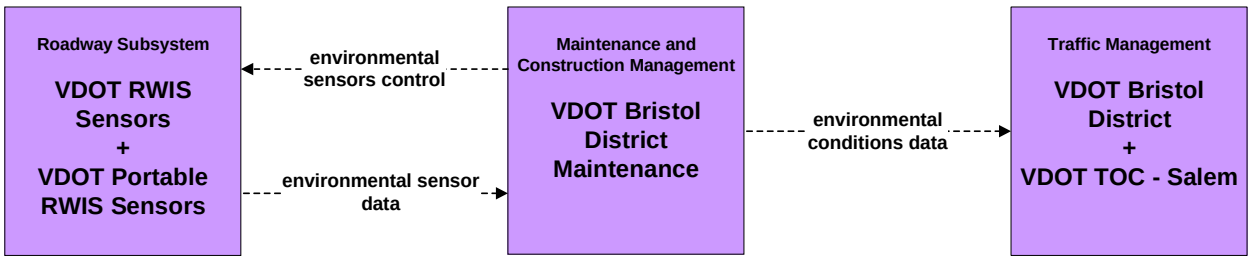


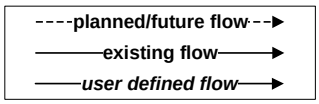
MC03 – Road Weather Data Collection
TDOT RWIS



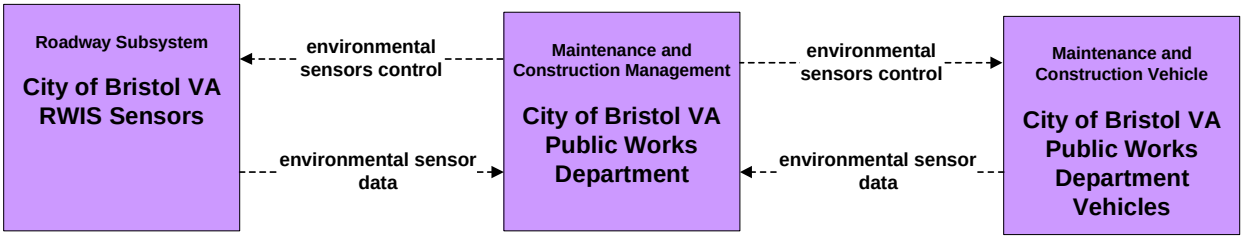


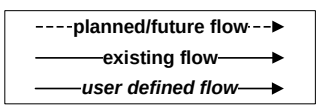
MC03 – Road Weather Data Collection
VDOT RWIS





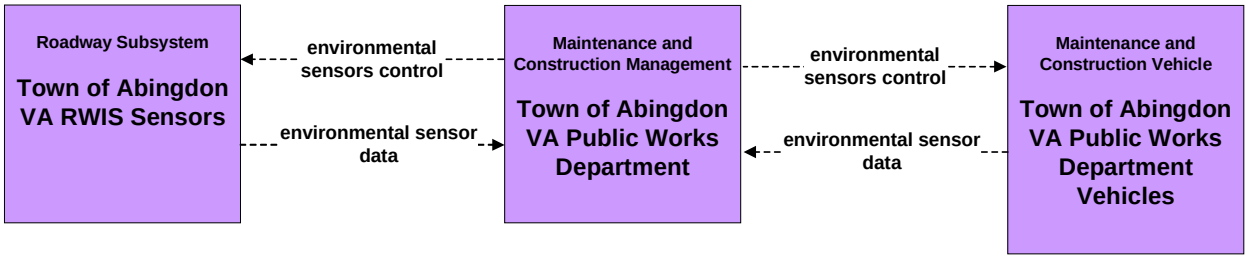
MC03 – Road Weather Data Collection
City of Bristol TN and City of Bristol VA

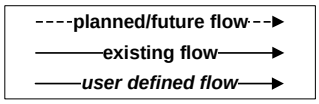




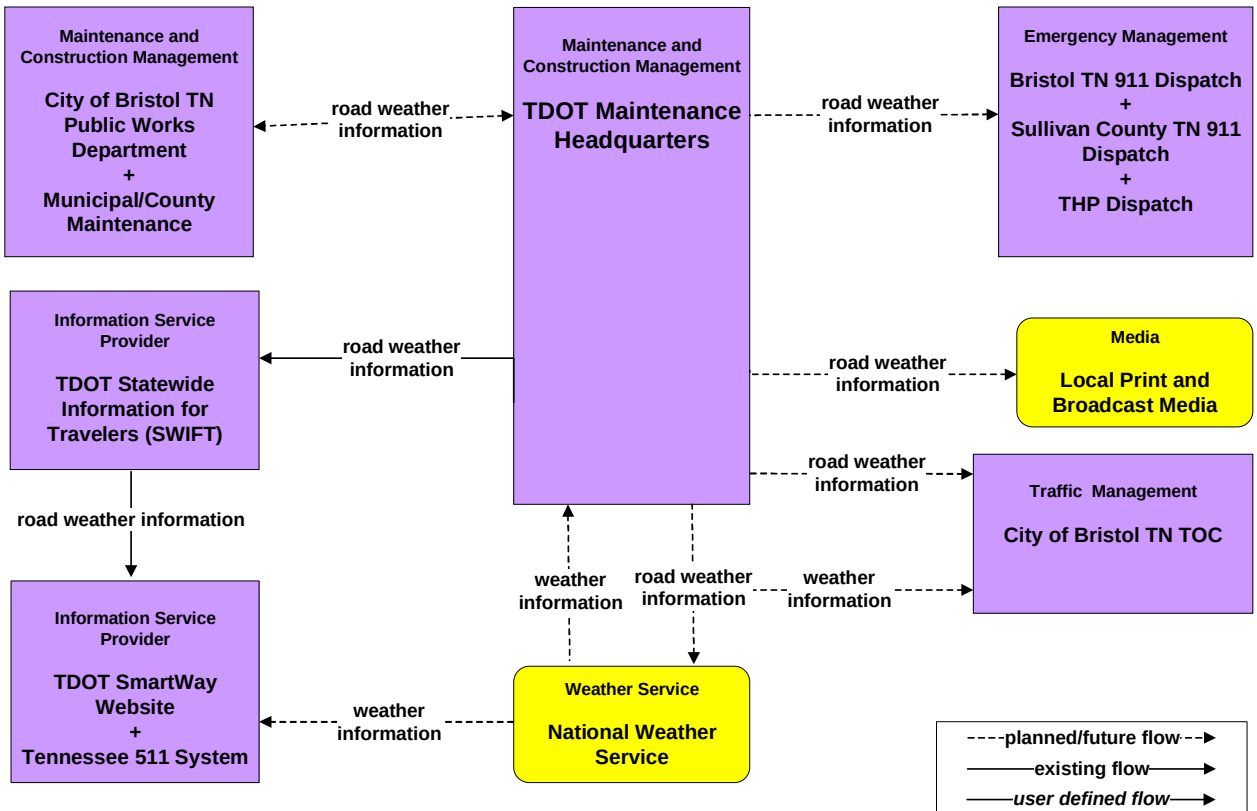
Note:
Temperature sensors are existing on City of Bristol TN maintenance vehicles but the information is currently used for driver decision making and not brought back to dispatch.

MC03 – Road Weather Data Collection
Town of Abingdon VA

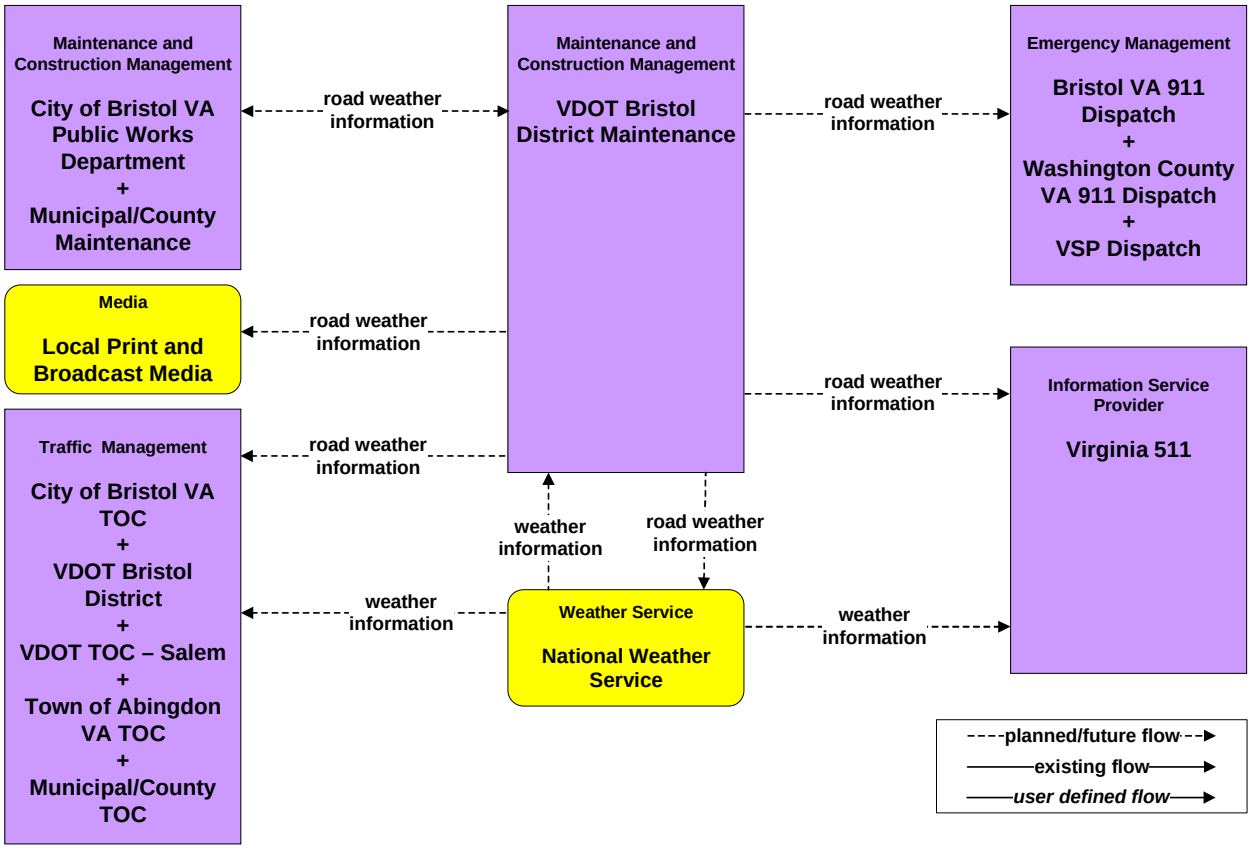




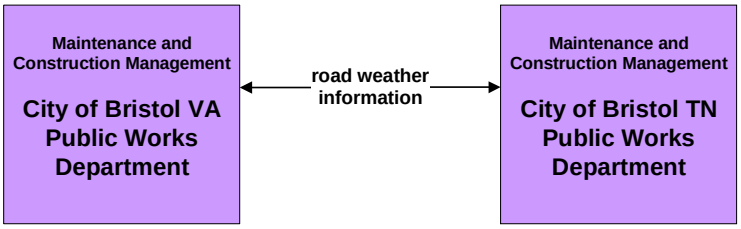
MC04 – Weather Information Processing and Distribution
TDOT Region 1 Maintenance

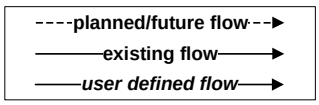


MC04 – Weather Information Processing and Distribution
VDOT Bristol District Maintenance

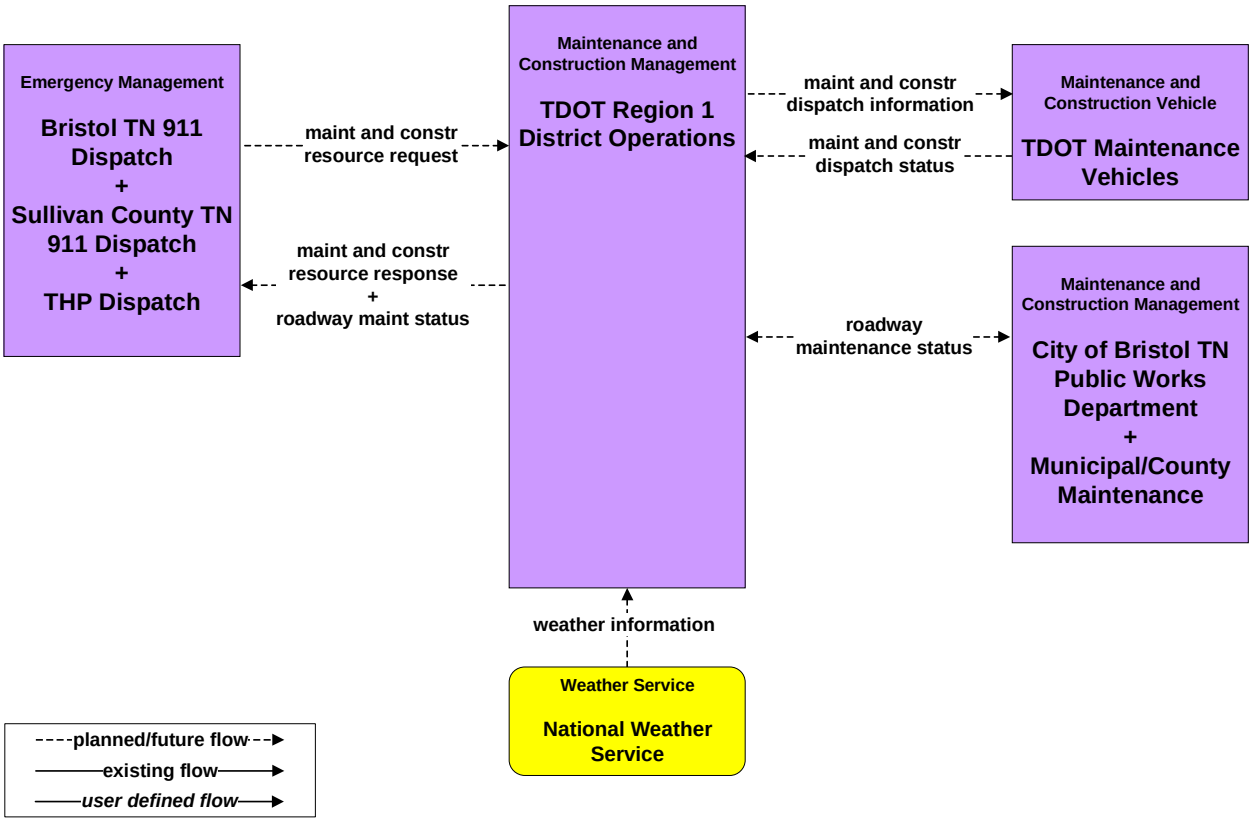


MC04 – Weather Information Processing and Distribution
City of Bristol TN and City of Bristol VA

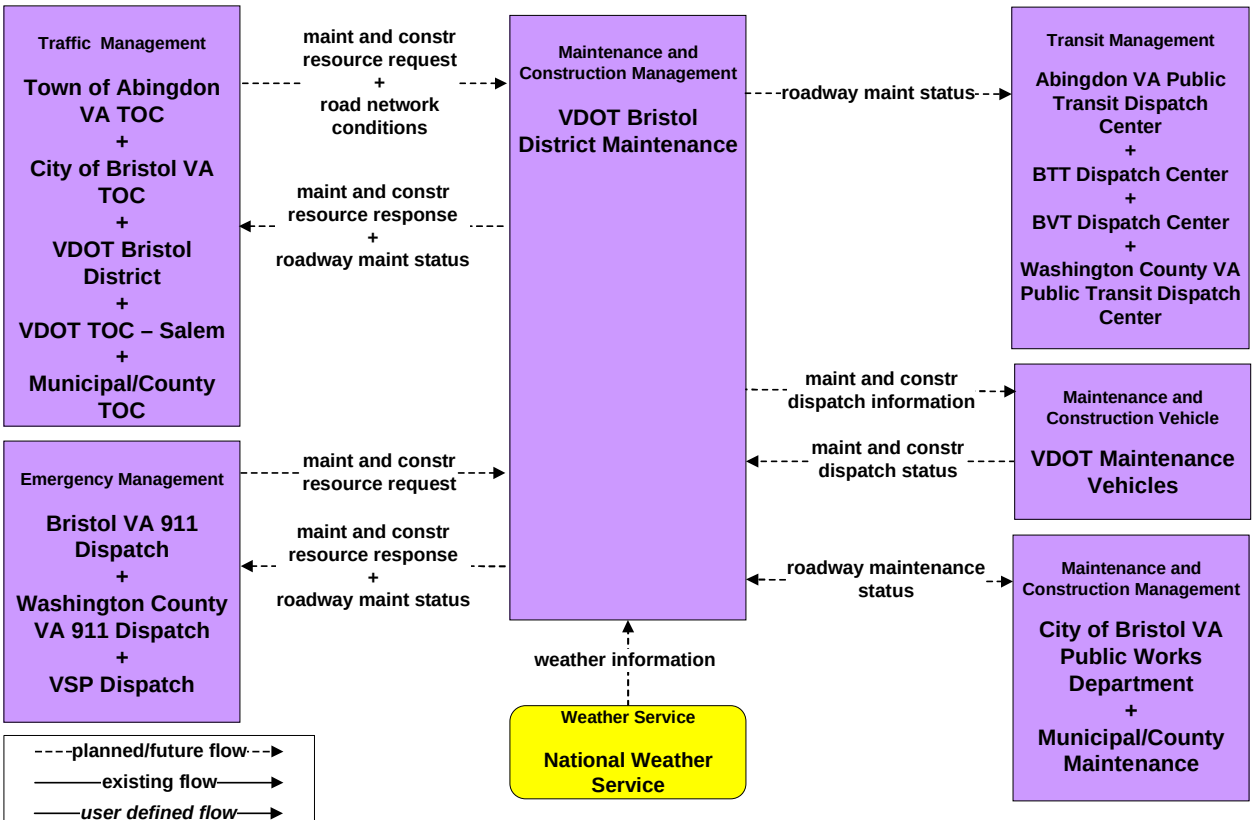




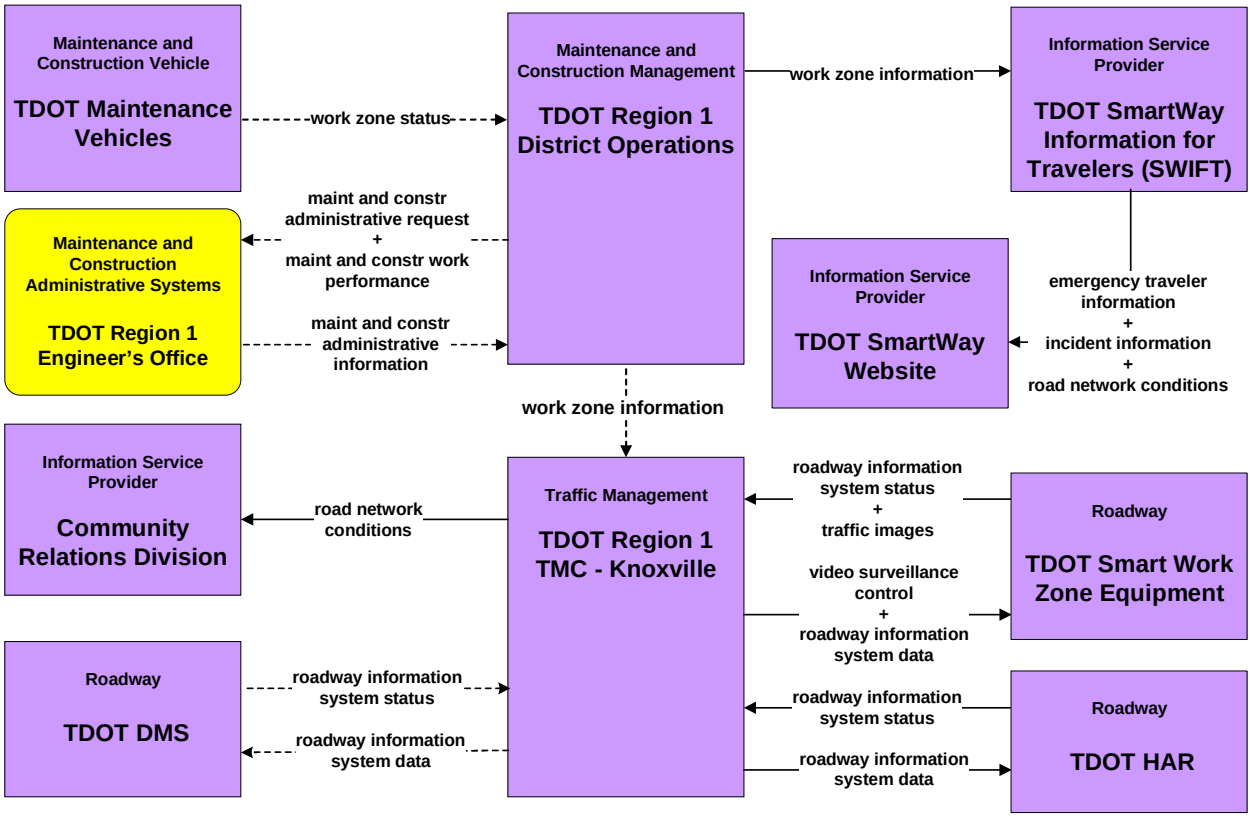
MC06 – Winter Maintenance
TDOT



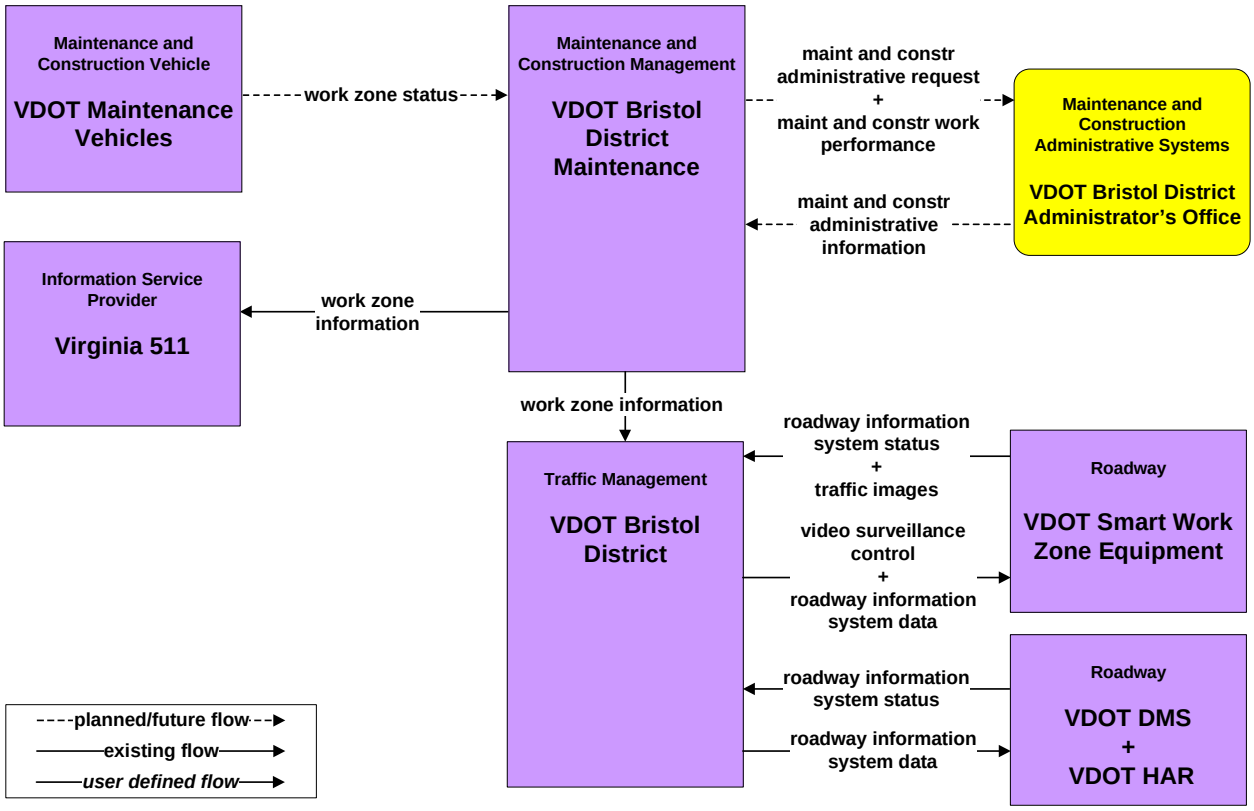
MC06 – Winter Maintenance
VDOT



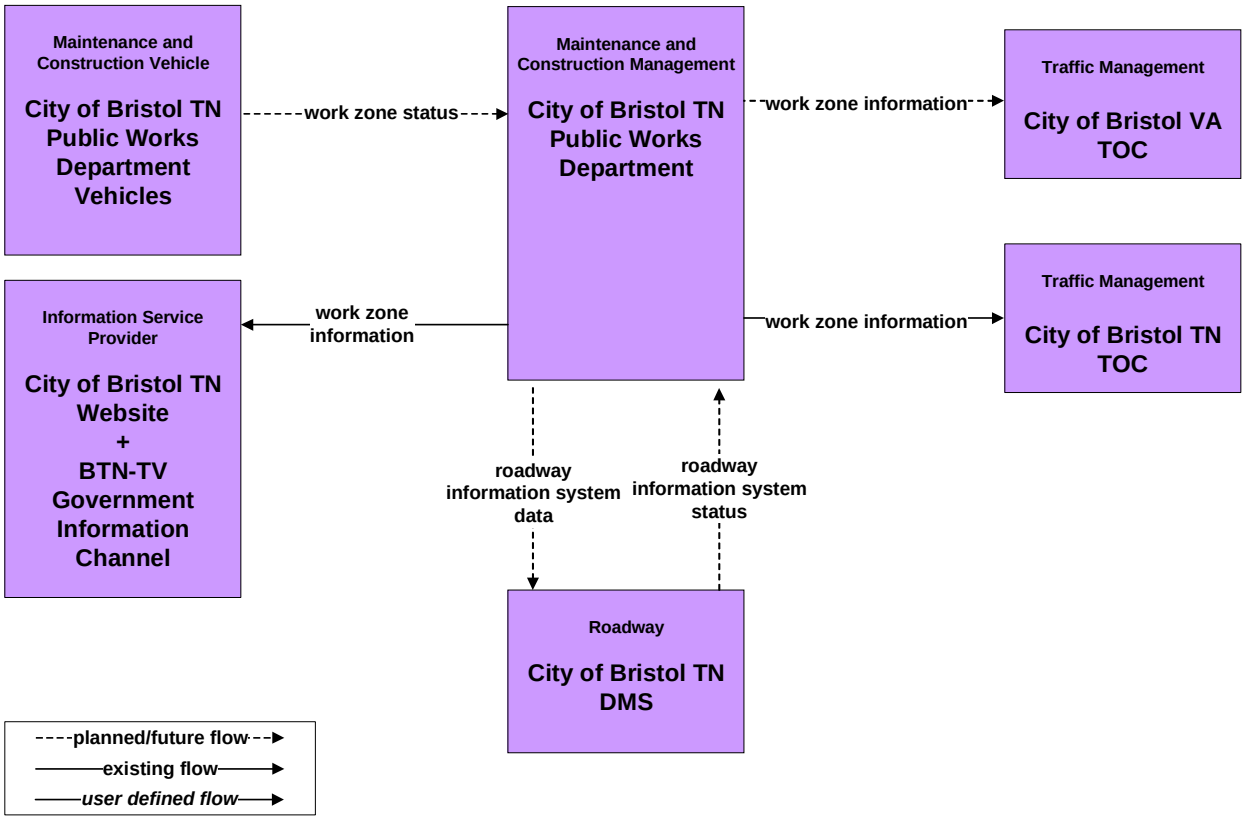
MC08 – Work Zone Management
TDOT Region 1 District Operations



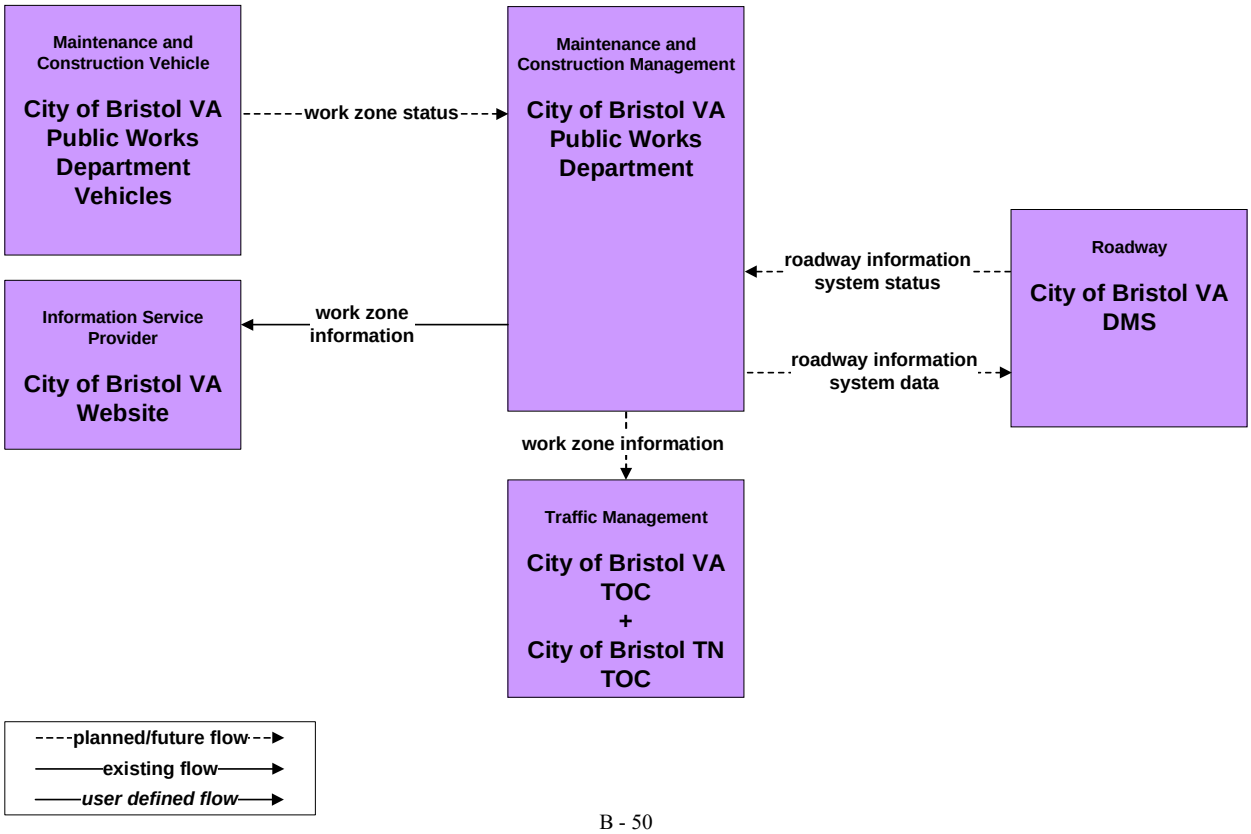
MC08 – Work Zone Management
VDOT District Maintenance

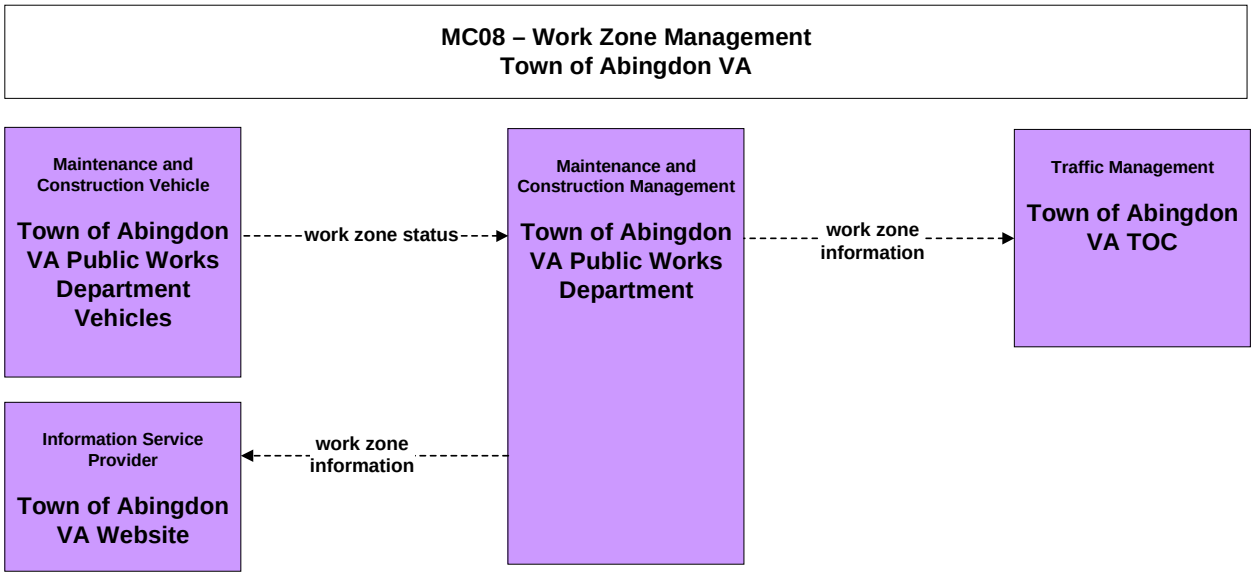


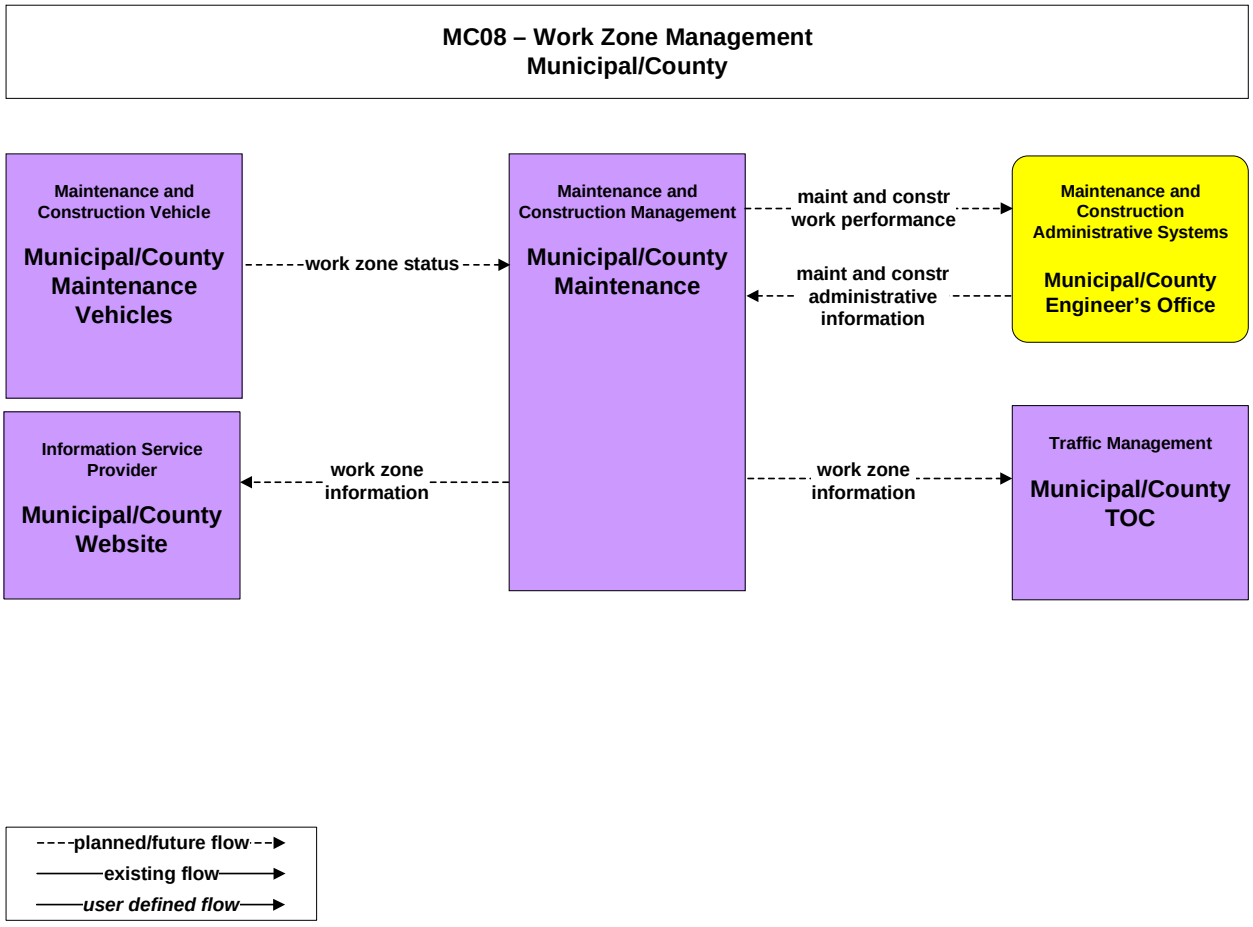
MC08 – Work Zone Management
City of Bristol TN



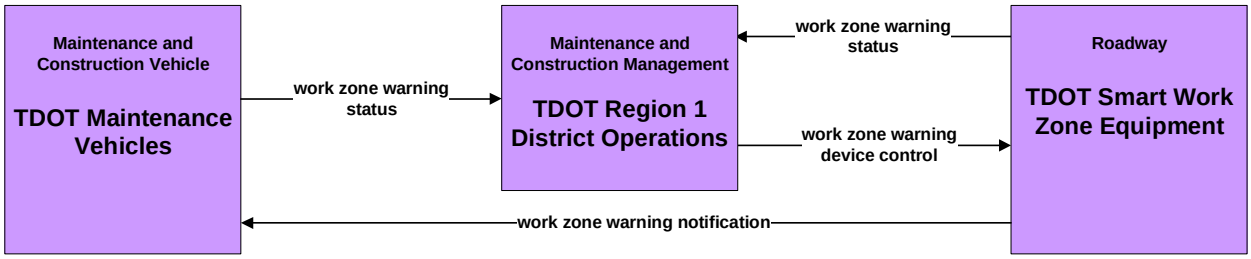
MC08 – Work Zone Management
City of Bristol VA

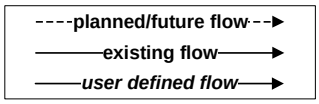



MC08 – Work Zone Management
Town of Abingdon VA
Maintenance and Construction Vehicle
Town of Abingdon VA Public Works Department Vehicles
work zone status
Maintenance and Construction Management
Town of Abingdon VA Public Works Department
work zone information
Traffic Management
Town of Abingdon VA TOC
Information Service Provider
Town of Abingdon VA Website
work zone information
planned/future flow
existing flow
user defined flow

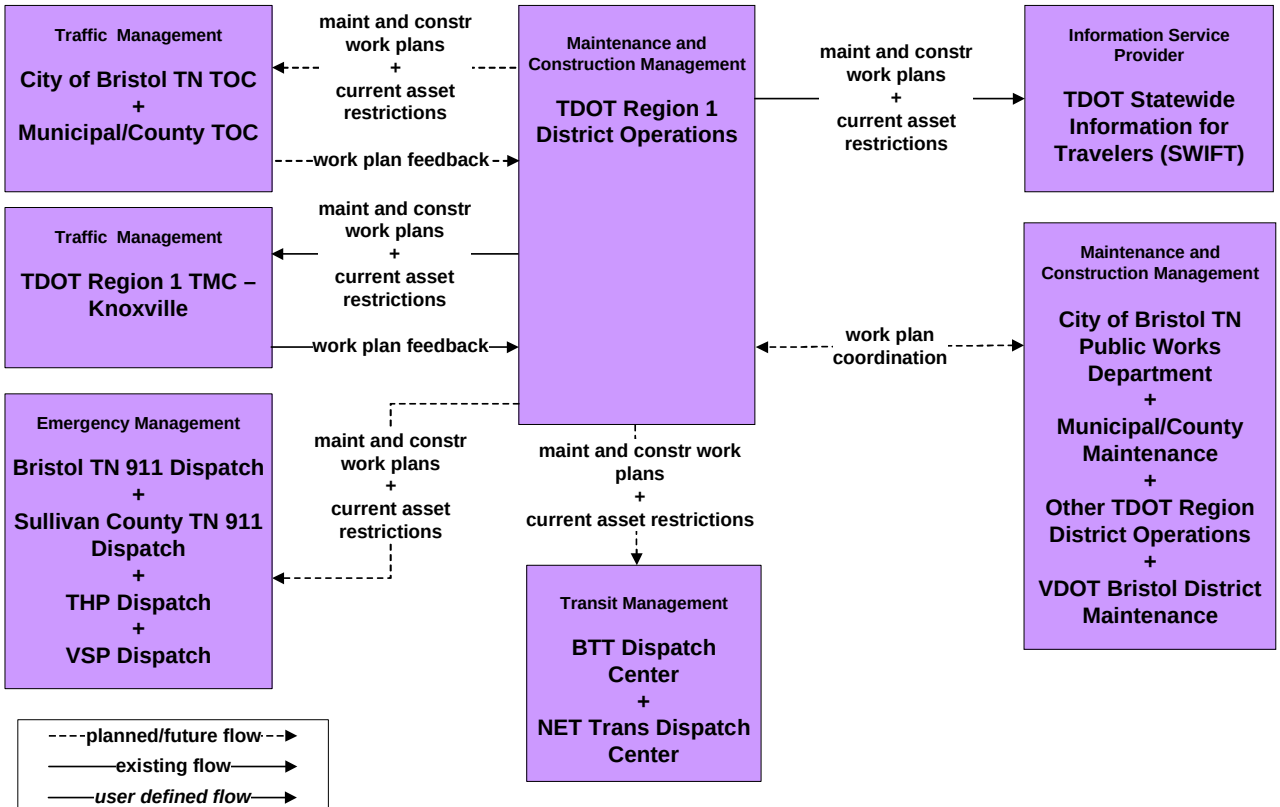

MC08 – Work Zone Management
Municipal/County
Maintenance and Construction Vehicle
Municipal/County Maintenance Vehicles
work zone status
Maintenance and Construction Management
Municipal/County Maintenance
maint and constr work performance
maint and constr administrative information
Maintenance and Construction Administrative Systems
Municipal/County Engineer's Office
Information Service Provider
Municipal/County Website
work zone information
work zone information
Traffic Management
Municipal/County TOC
planned/future flow
existing flow
user defined flow

MC09 – Work Zone Safety Monitoring
TDOT Region 1 District Operations

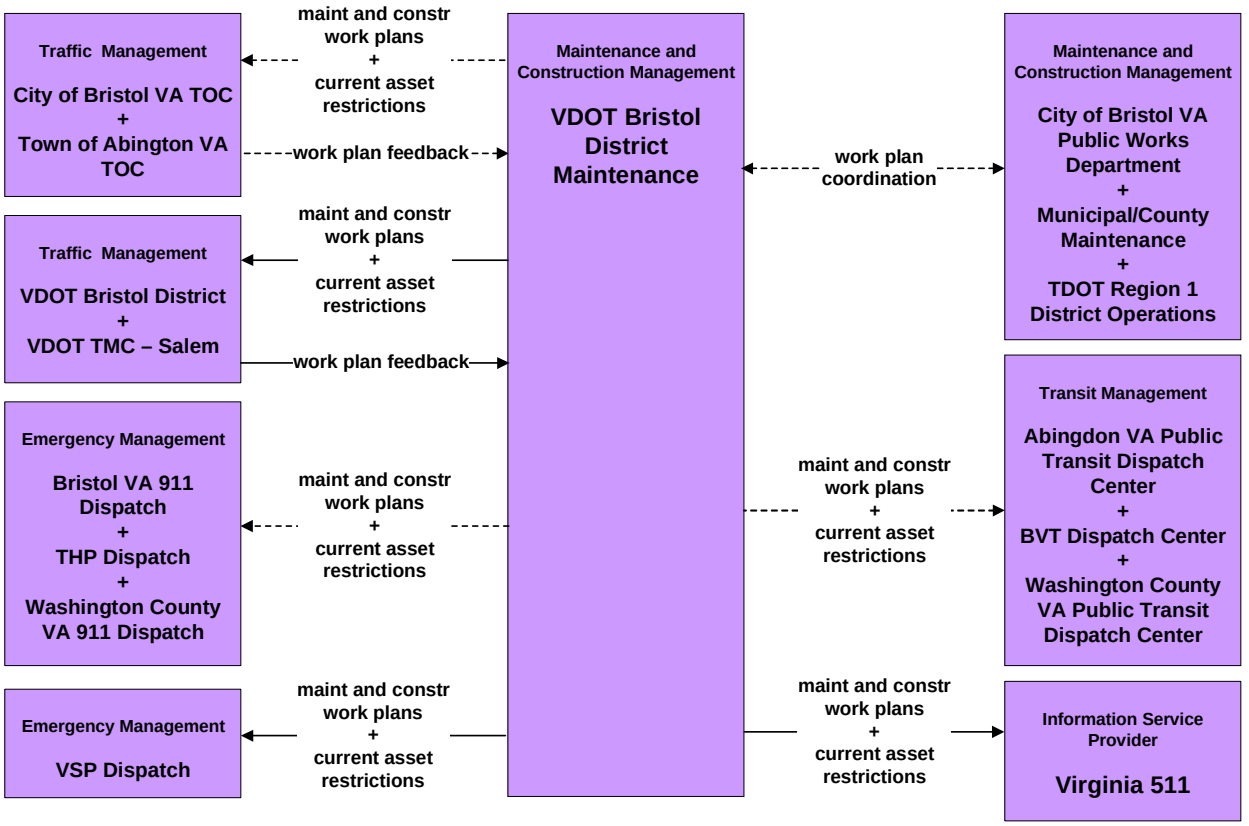




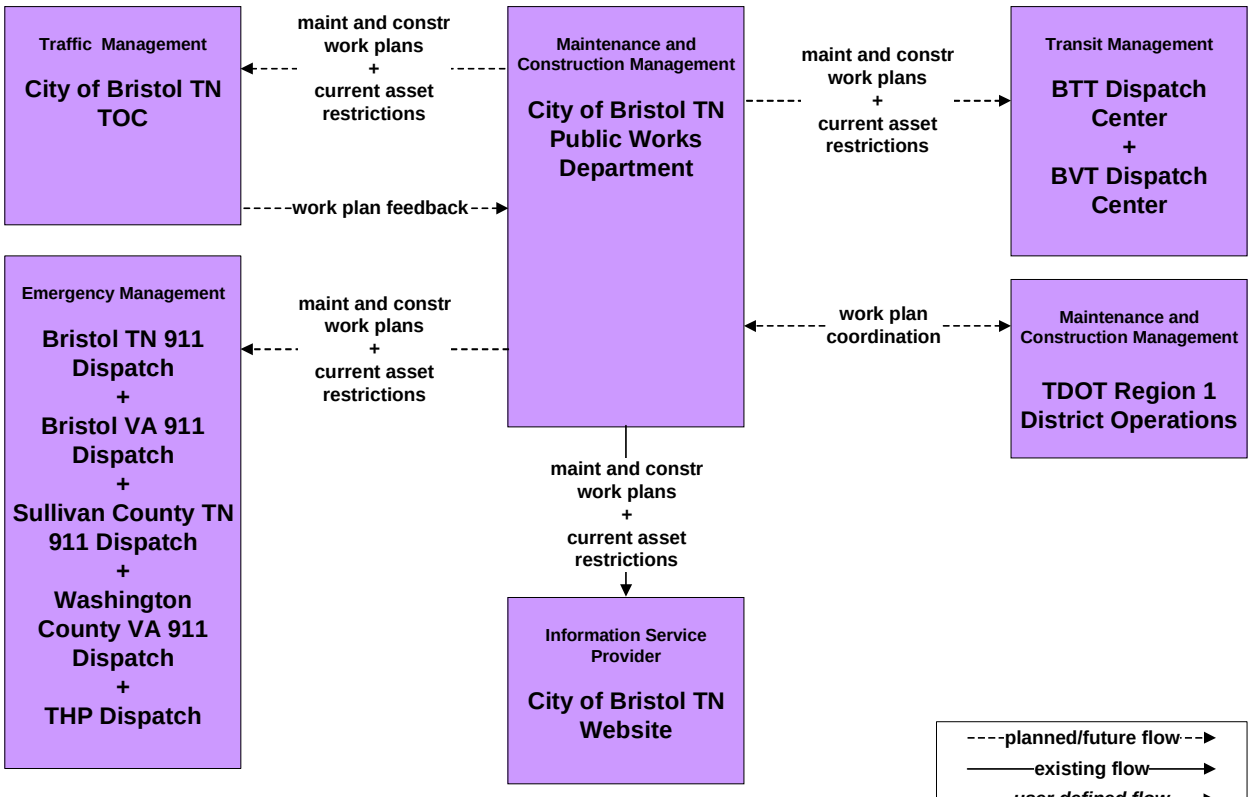
MC10 – Maintenance and Construction Activity Coordination
TDOT



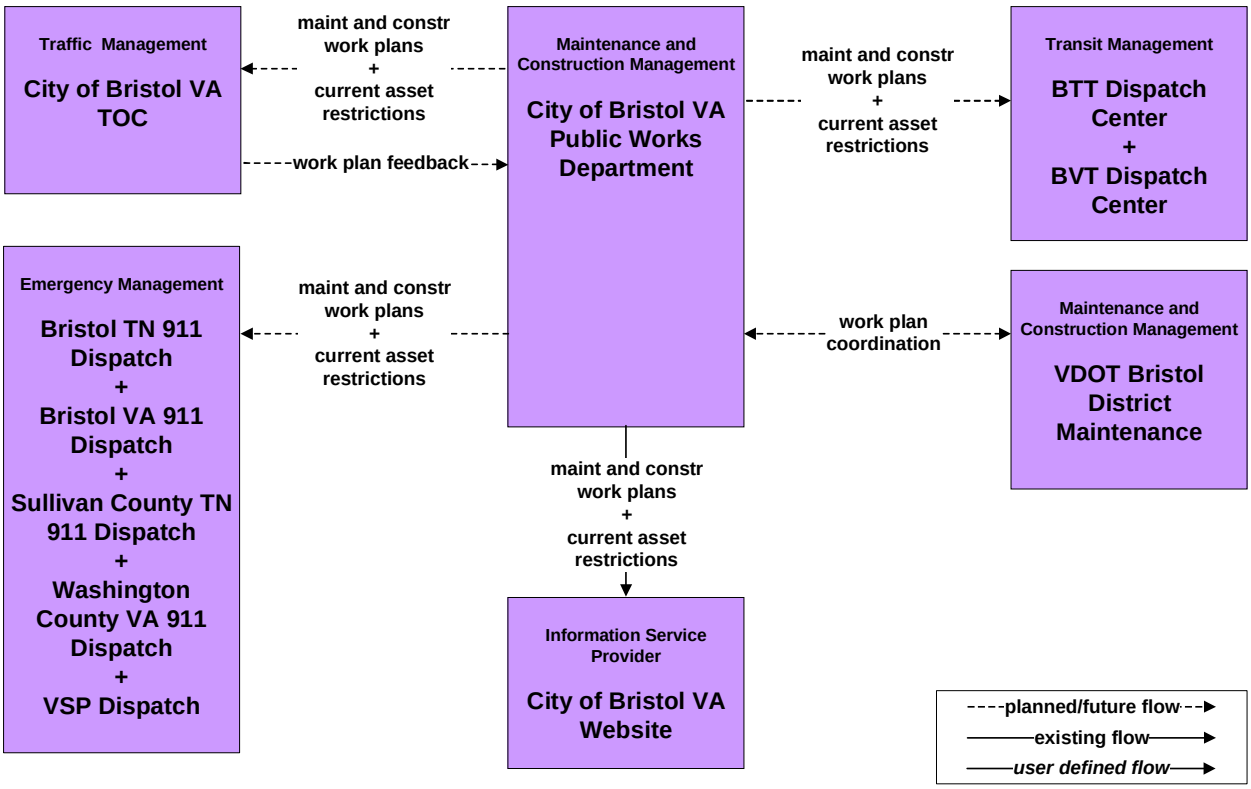
MC10 – Maintenance and Construction Activity Coordination
VDOT



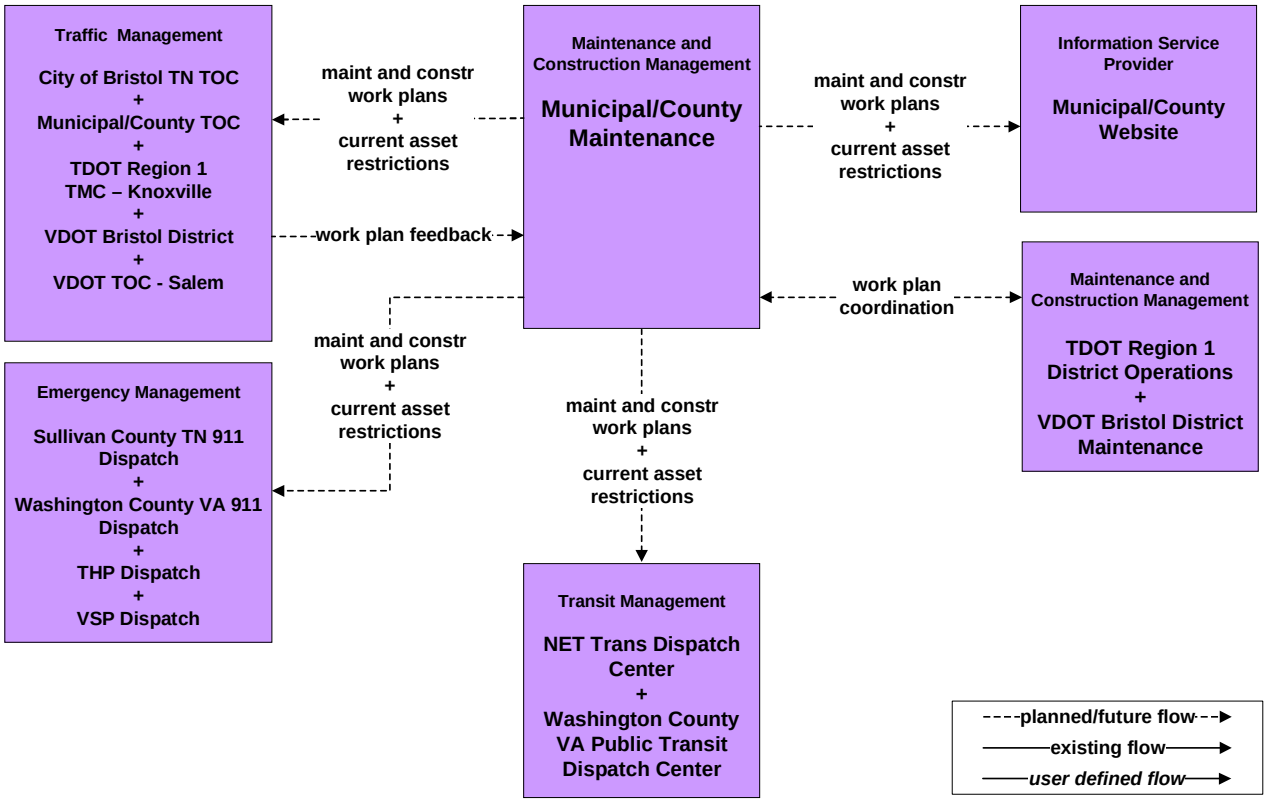
MC10 – Maintenance and Construction Activity Coordination
City of Bristol TN



MC10 – Maintenance and Construction Activity Coordination
City of Bristol VA

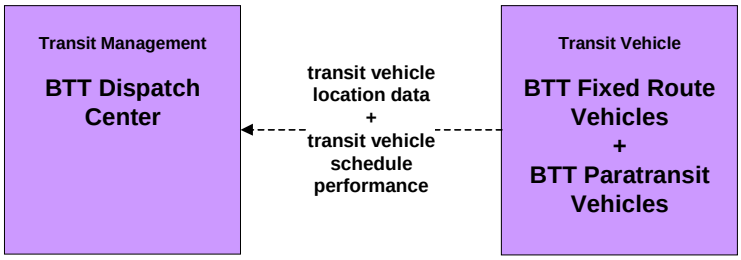


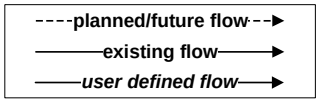
MC10 – Maintenance and Construction Activity Coordination
Municipal/County



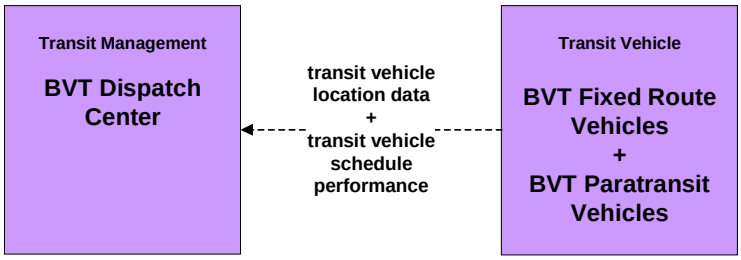
Advanced Public Transportation Systems

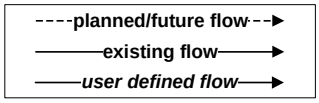
APTS01 – Transit Vehicle Tracking
Bristol TN Transit



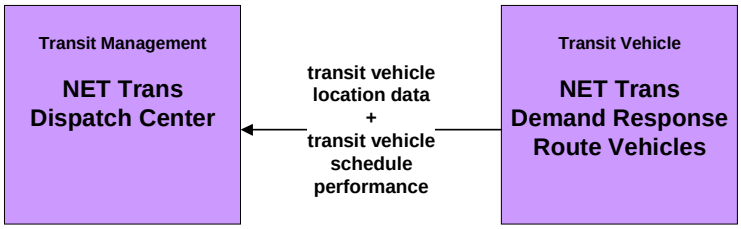


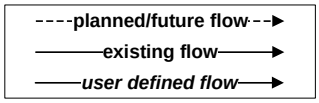
APTS01 – Transit Vehicle Tracking
Bristol VA Transit





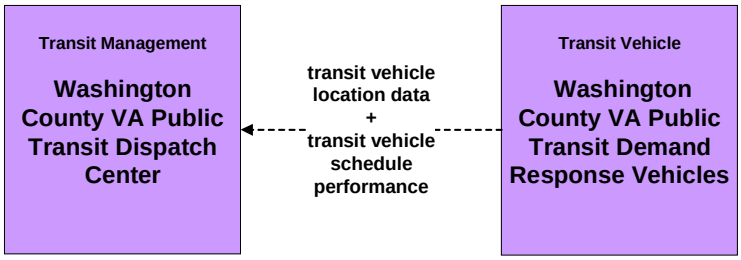
APTS01 – Transit Vehicle Tracking
NET Trans

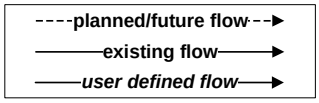




Note:
The First Tennessee Human Resource Agency operates NET Trans.

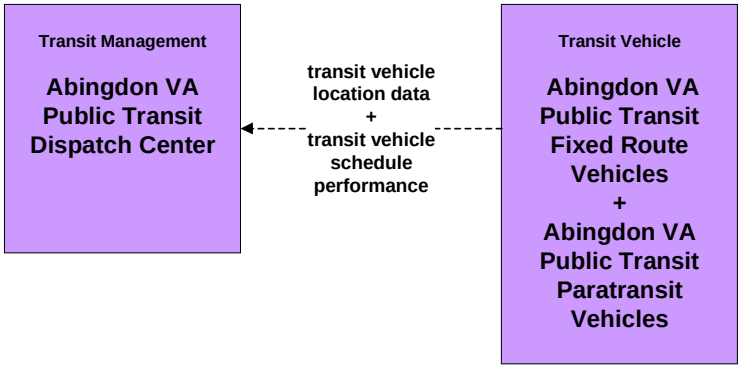
APTS01 – Transit Vehicle Tracking
Washington County VA Public Transit

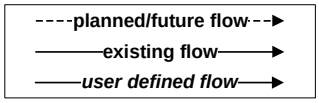




Note:
The District Three Governmental Cooperative operates Washington County VA Public Transit.

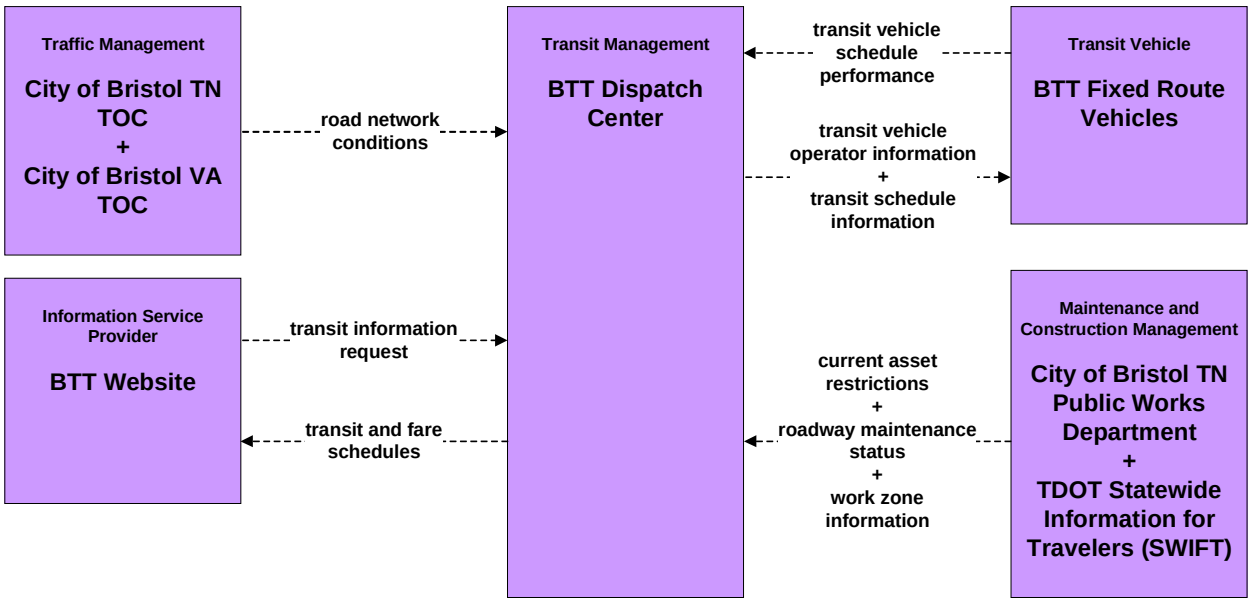
APTS01 – Transit Vehicle Tracking
Abingdon VA Public Transit

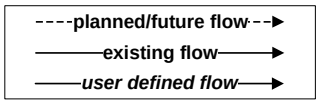




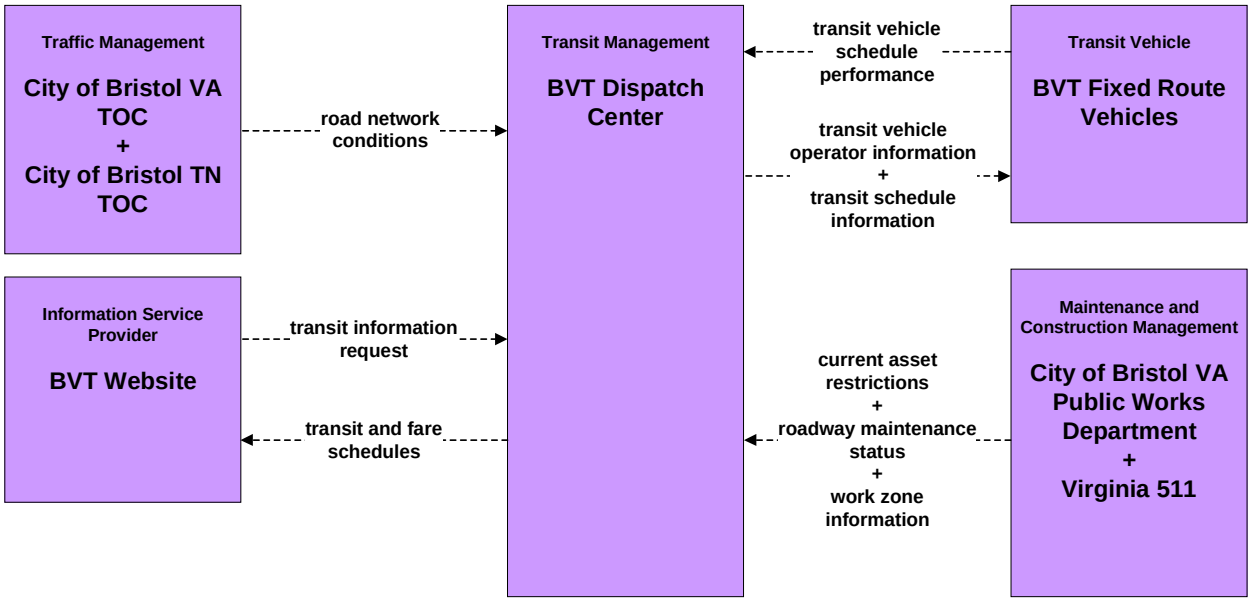
Note:
The District Three Governmental Cooperative operates Abingdon VA Public Transit.

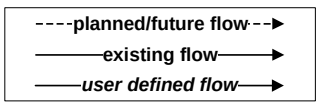
APTS02 – Transit Fixed-Route Operations
Bristol TN Transit



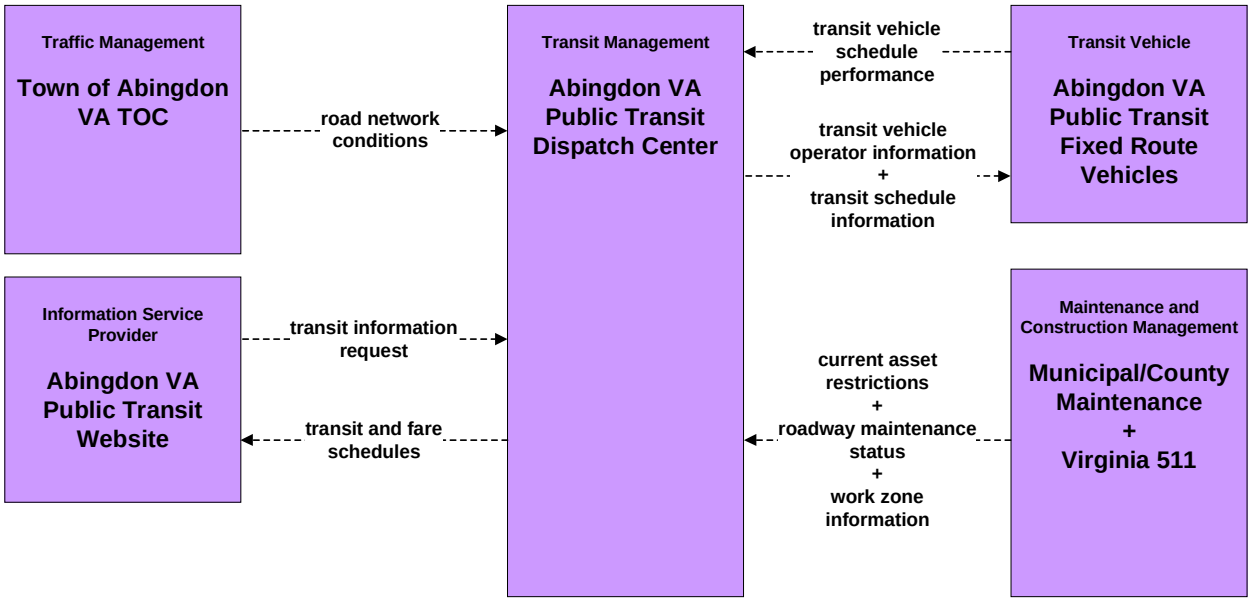


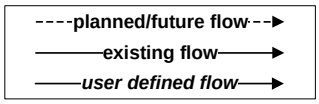
APTS02 – Transit Fixed-Route Operations
Bristol VA Transit





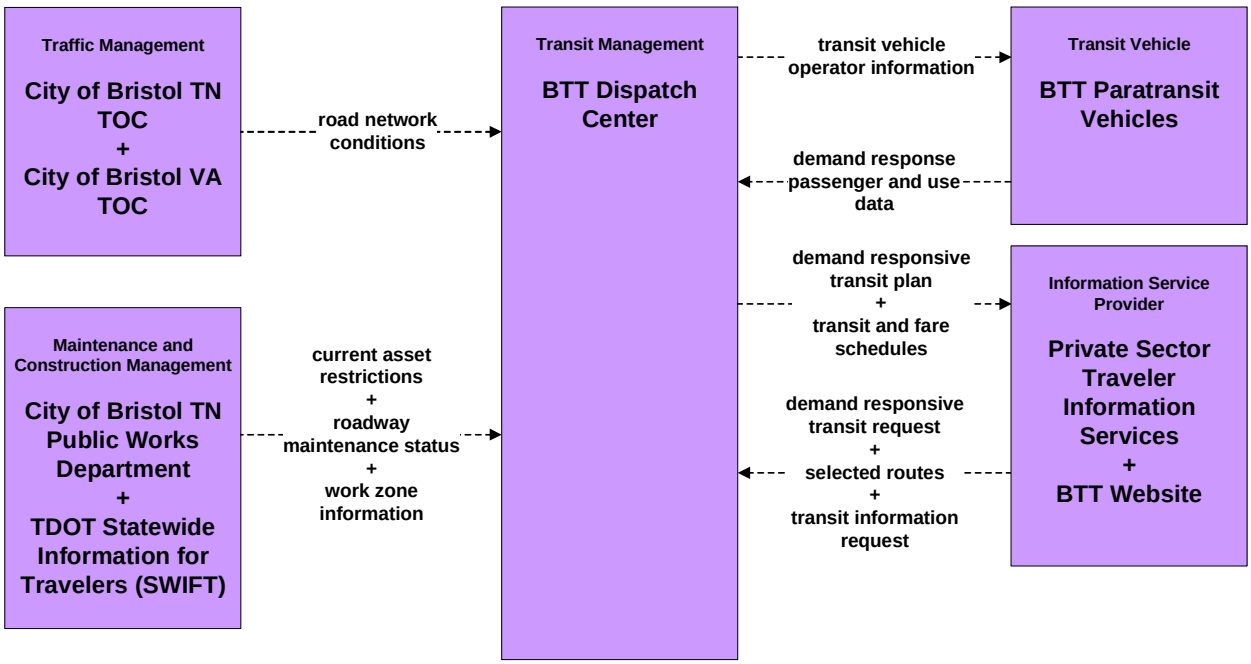
APTS02 – Transit Fixed-Route Operations
Abingdon VA Public Transit

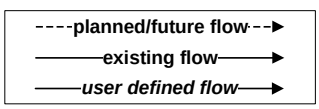




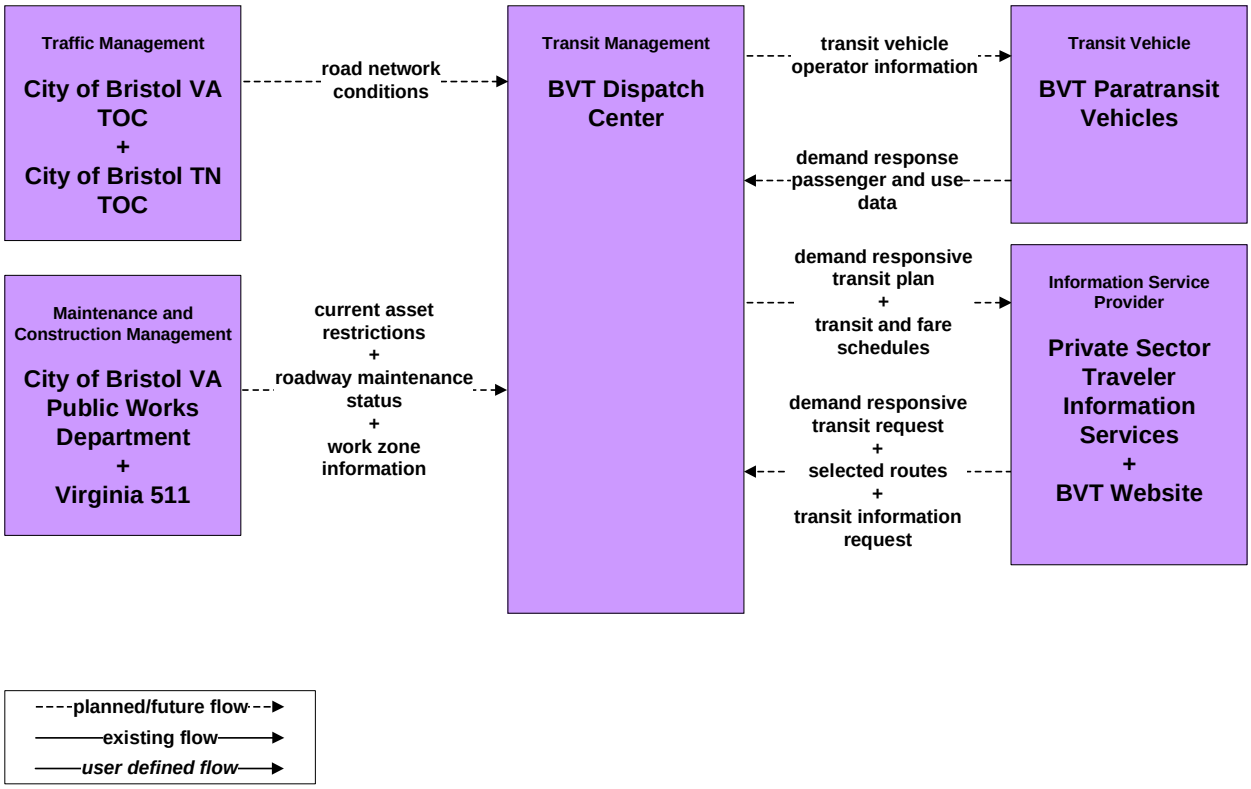
Note:
The District Three Governmental Cooperative operates Abingdon VA Public Transit.

APTS03 – Demand Response Transit Operations
Bristol TN Transit

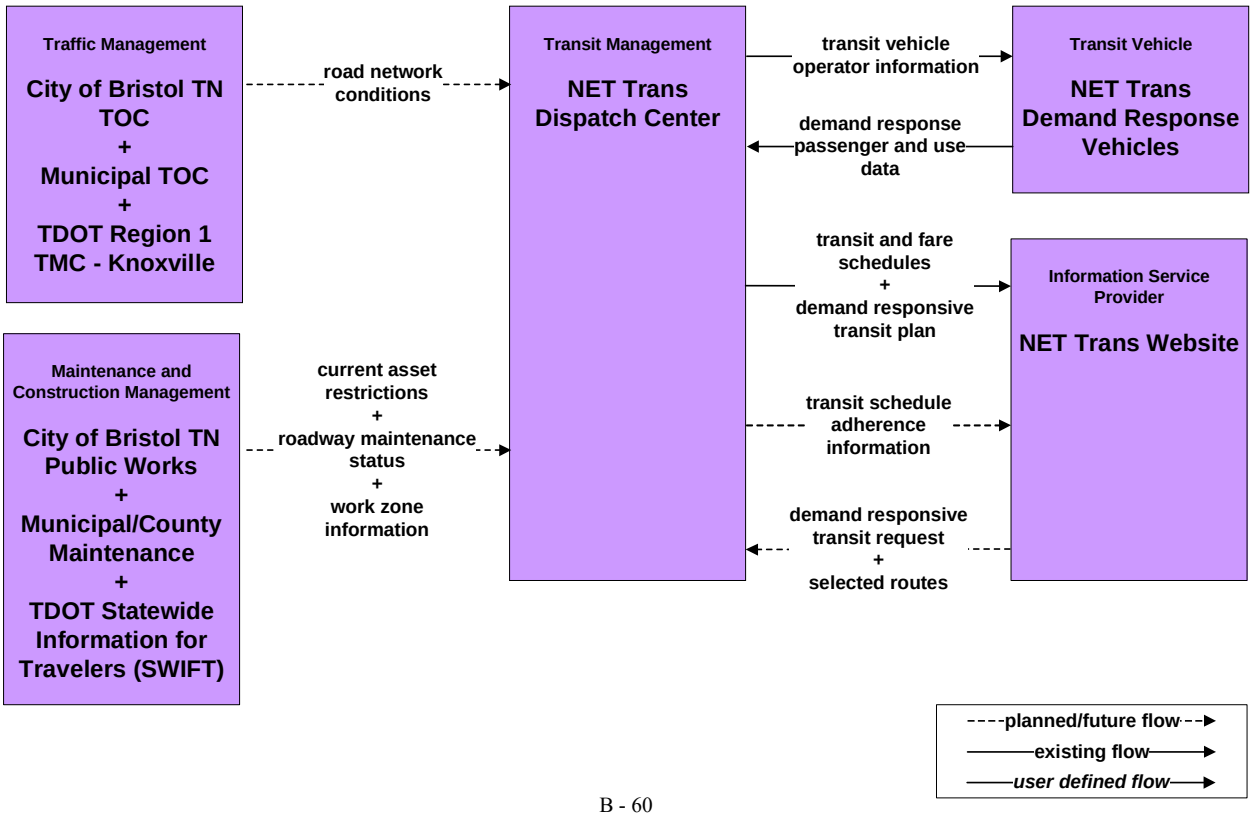




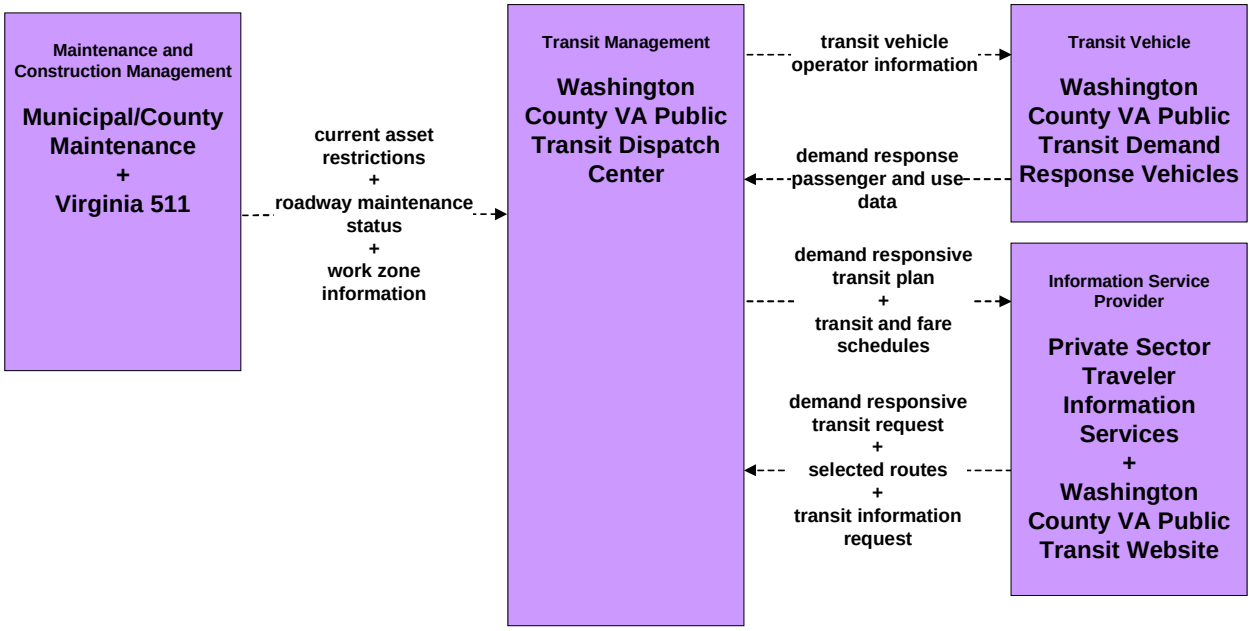
APTS03 – Demand Response Transit Operations
Bristol VA Transit



APTS03 – Demand Response Transit Operations
NET Trans



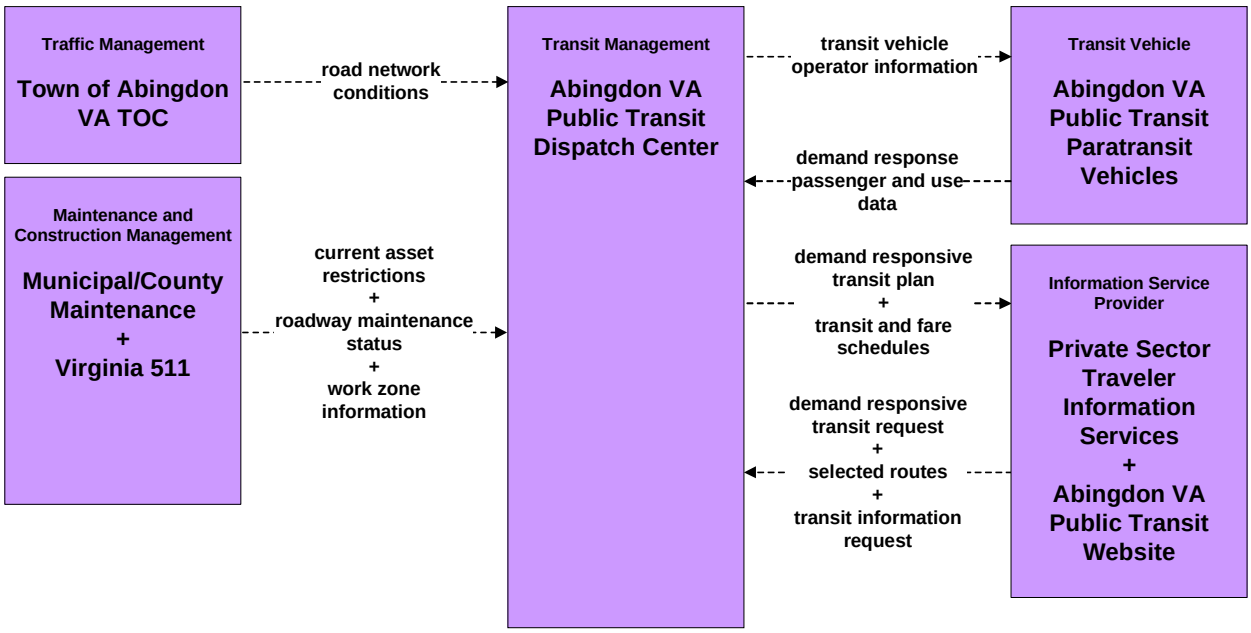
APTS03 – Demand Response Transit Operations
Washington County VA Public Transit



planned/future flow
existing flow
user defined flow

Note:
The District Three Governmental Cooperative operates Washington County VA Public Transit.

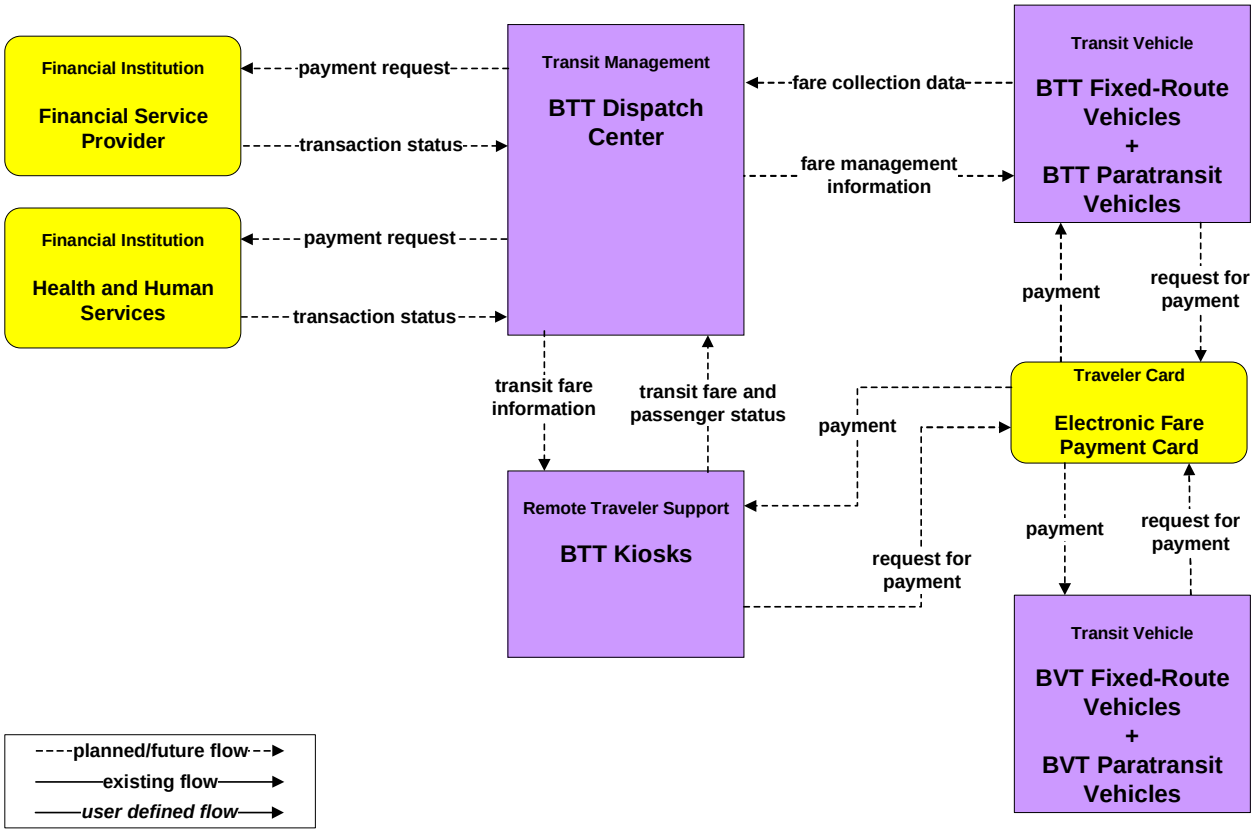
APTS03 – Demand Response Transit Operations
Abingdon VA Public Transit



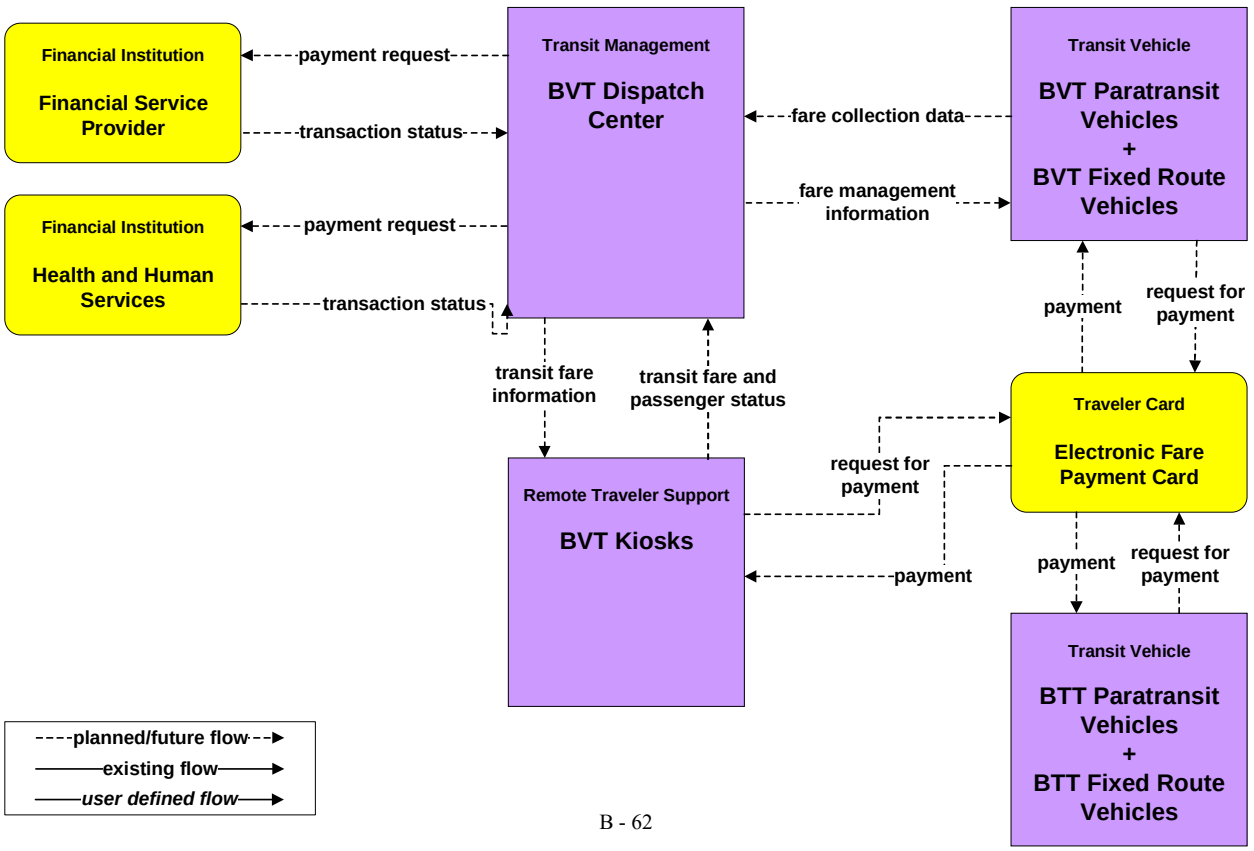
planned/future flow
existing flow
user defined flow

Note:
The District Three Governmental Cooperative operates Abingdon VA Public Transit.

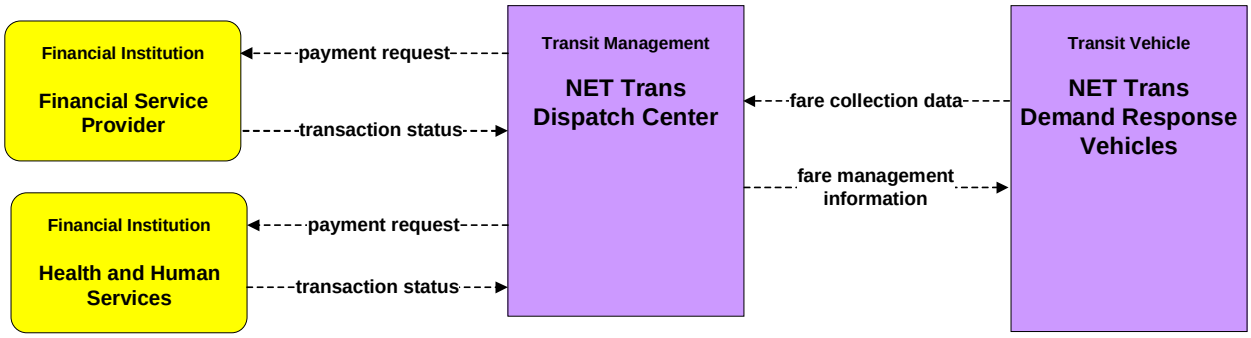
APTS04 – Transit Fare Collection Management
Bristol TN Transit

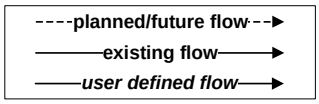


APTS04 – Transit Fare Collection Management
Bristol VA Transit

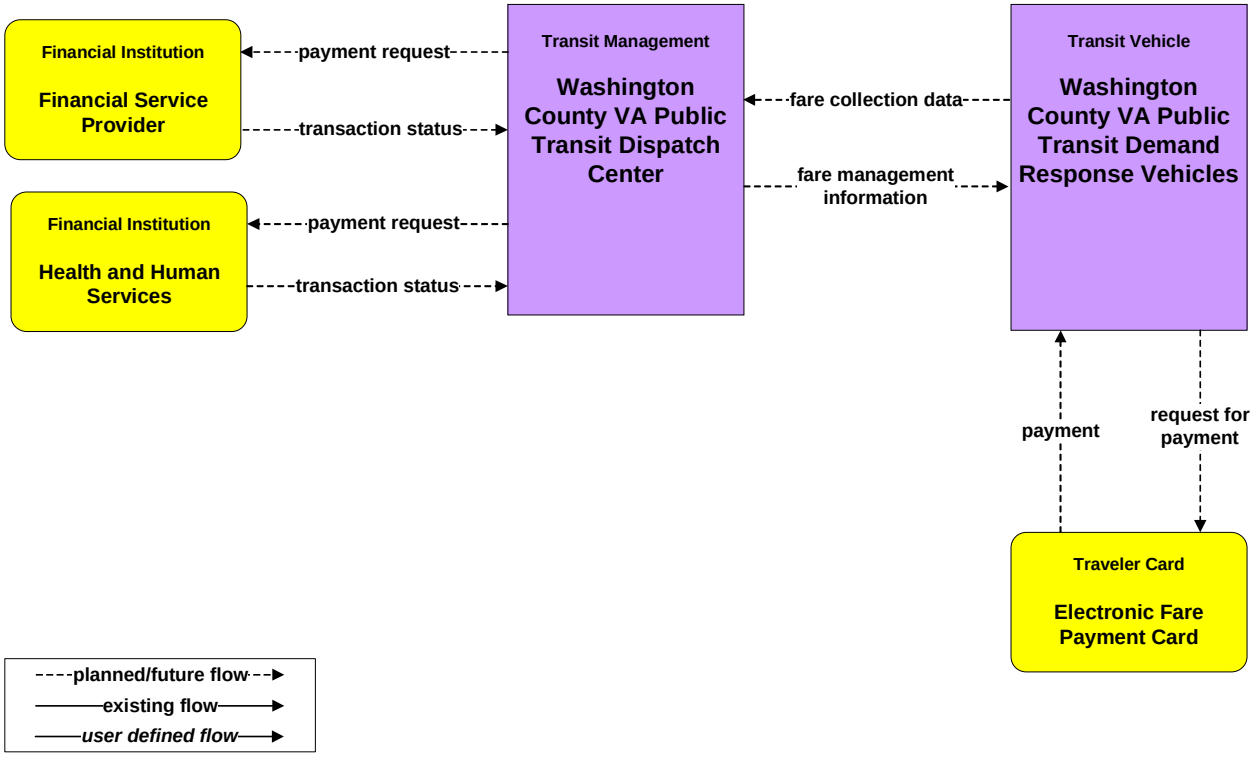


APTS04 – Transit Fare Collection Management
NET Trans

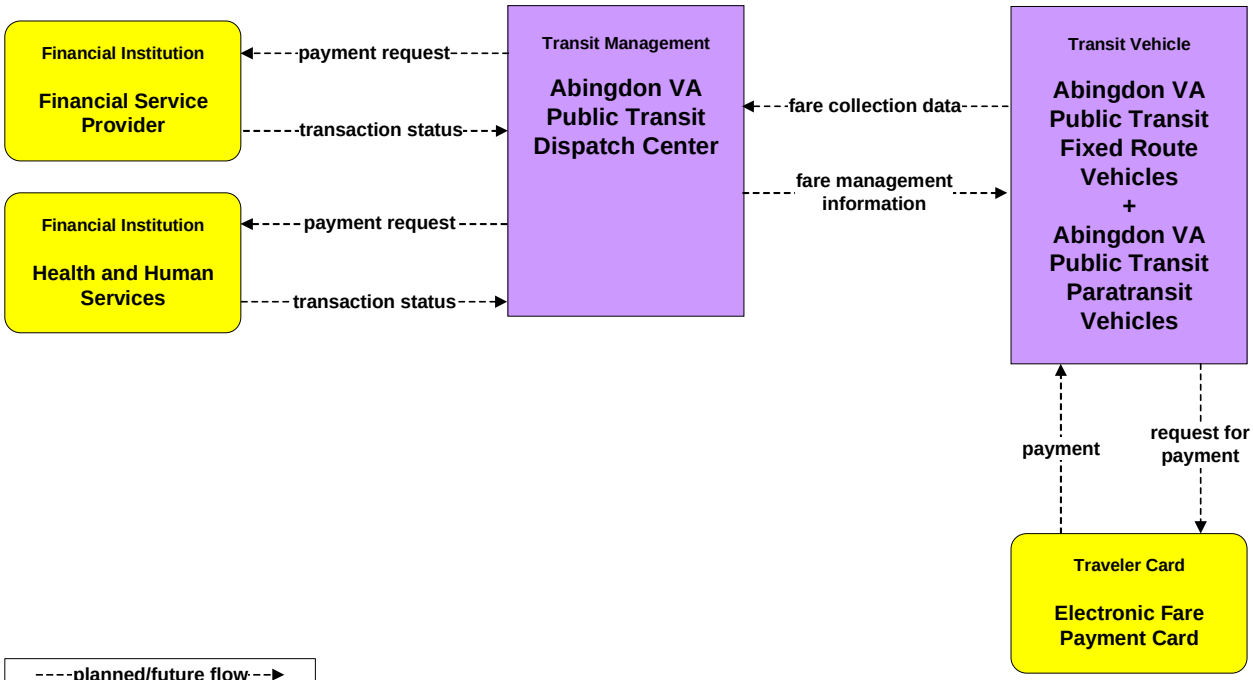




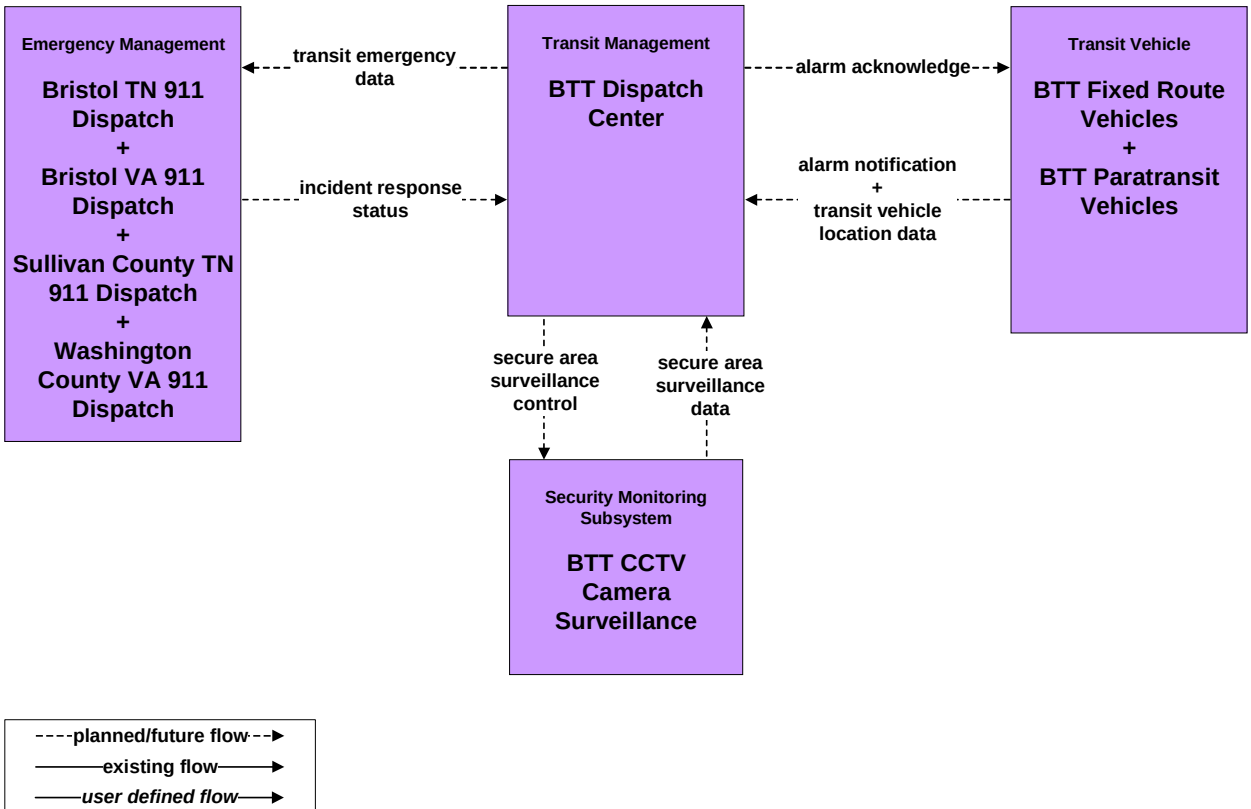
APTS04 – Transit Fare Collection Management
Washington County VA Public Transit



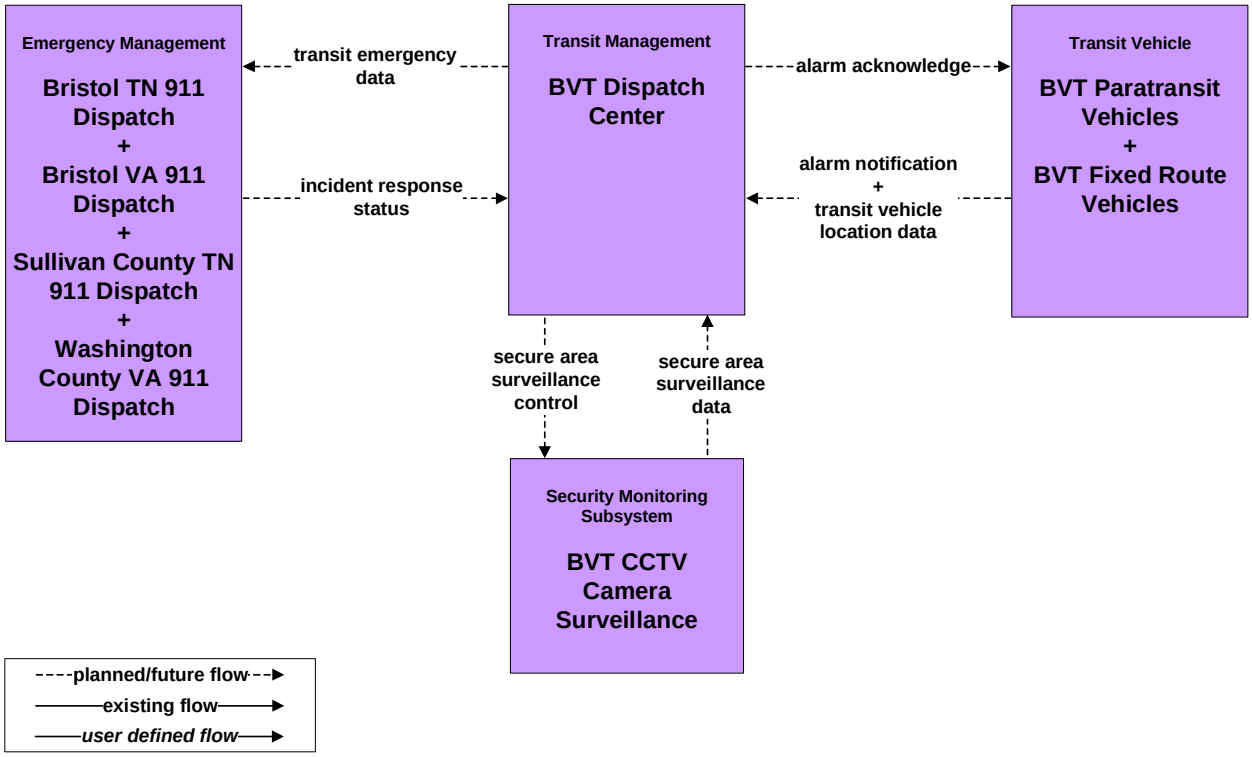
APTS04 – Transit Fare Collection Management
Abingdon VA Public Transit



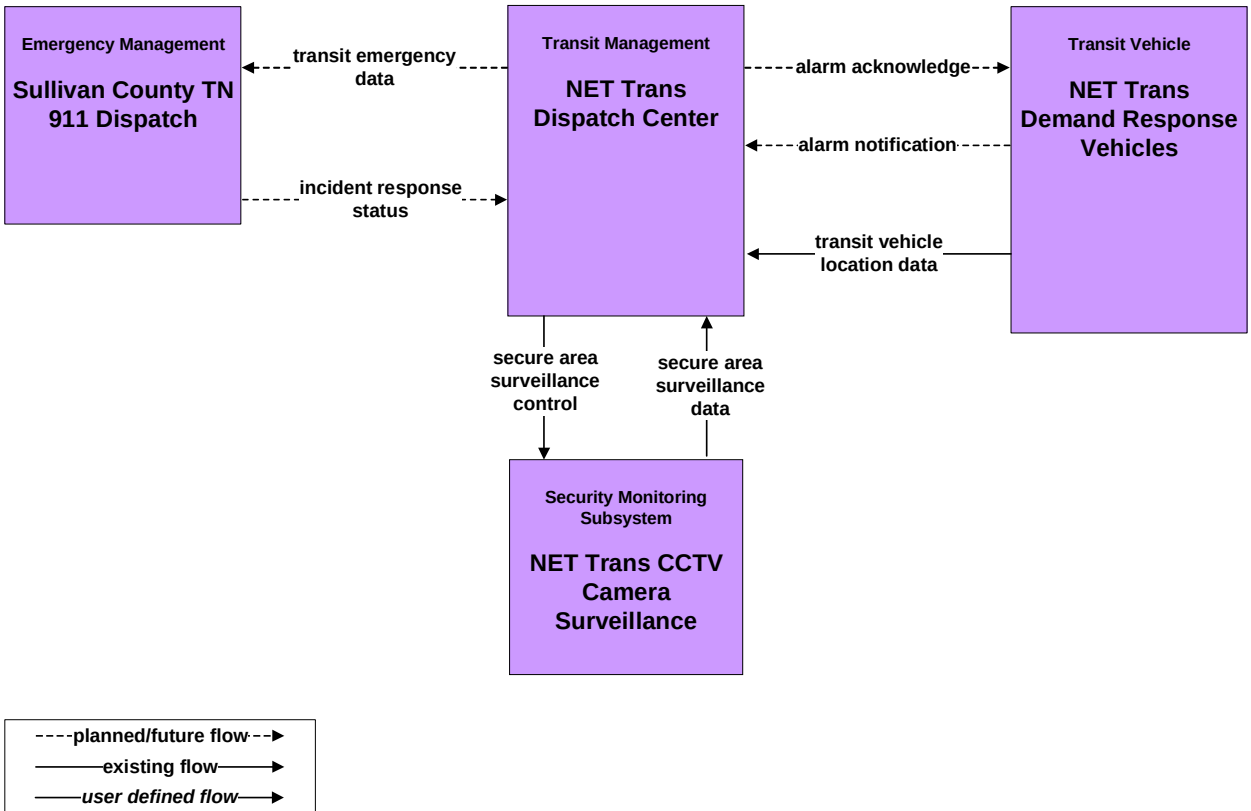
APTS05 – Transit Security
Bristol TN Transit



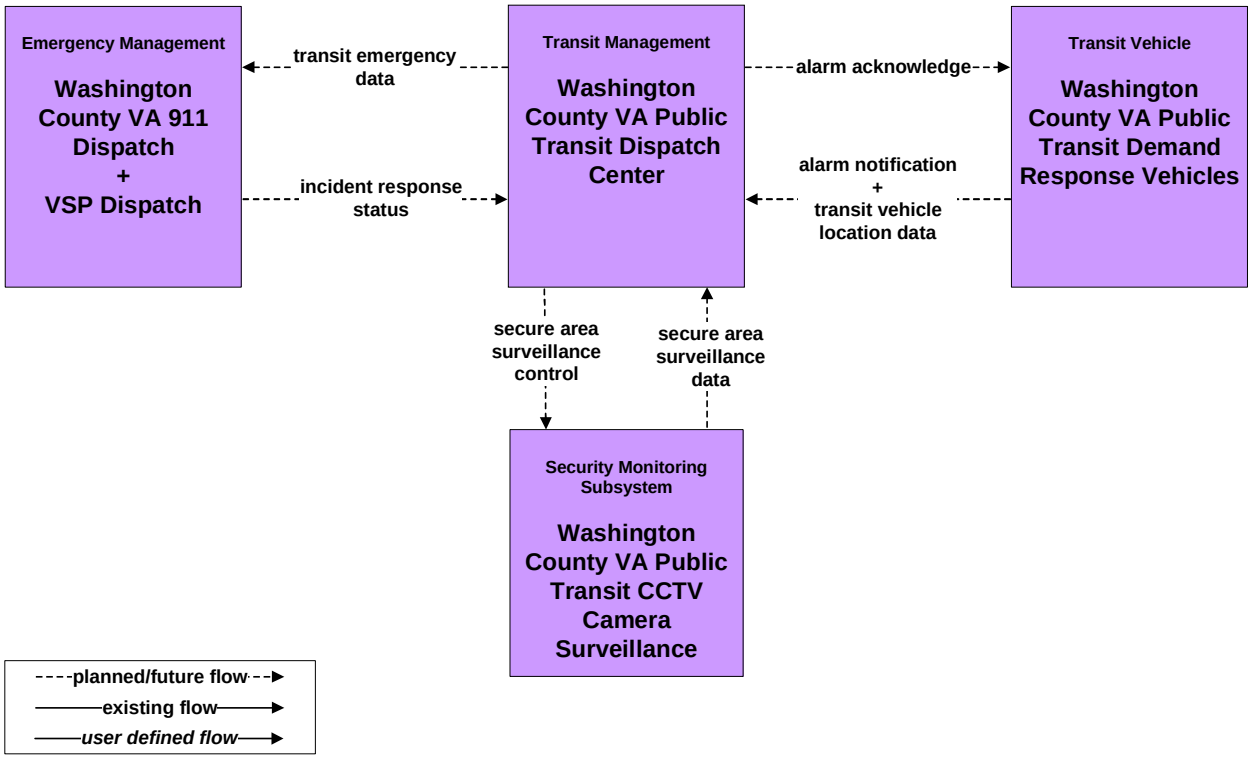
APTS05 – Transit Security
Bristol VA Transit



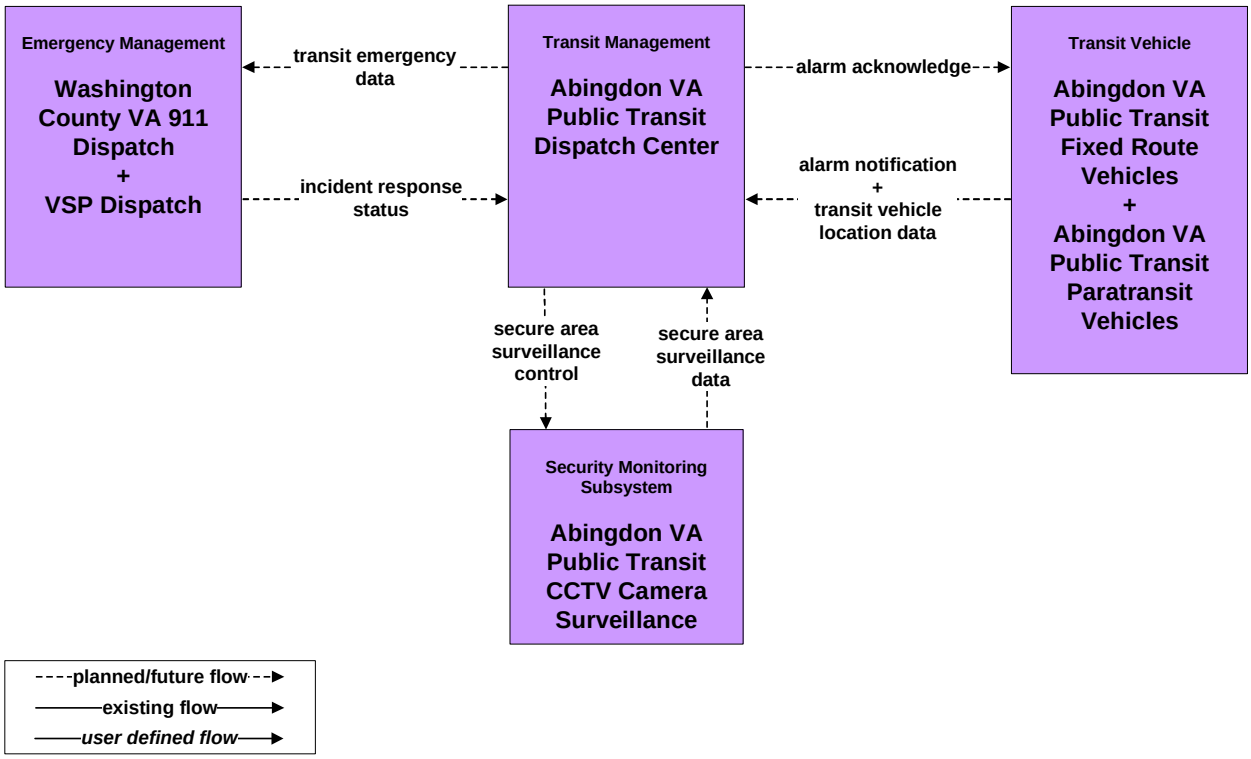
APTS05 – Transit Security
NET Trans



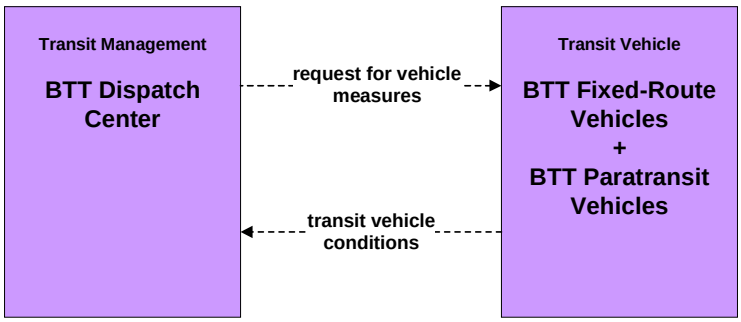
APTS05 – Transit Security
Washington County VA Public Transit

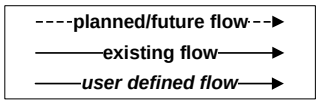


APTS05 – Transit Security
Abingdon VA Public Transit

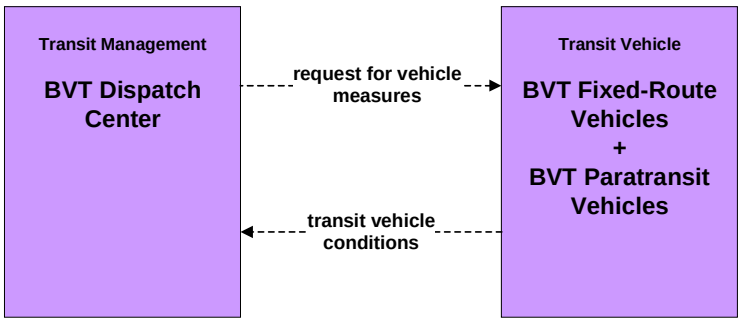


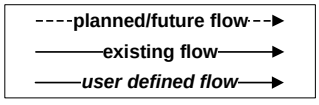
APTS06 – Transit Fleet Management
Bristol TN Transit



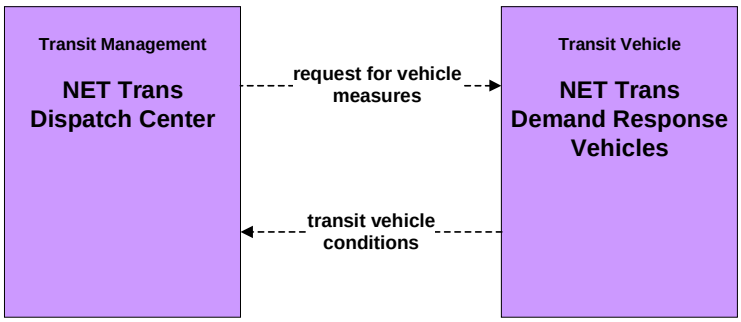


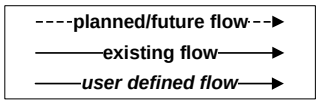
APTS06 – Transit Fleet Management
Bristol VA Transit



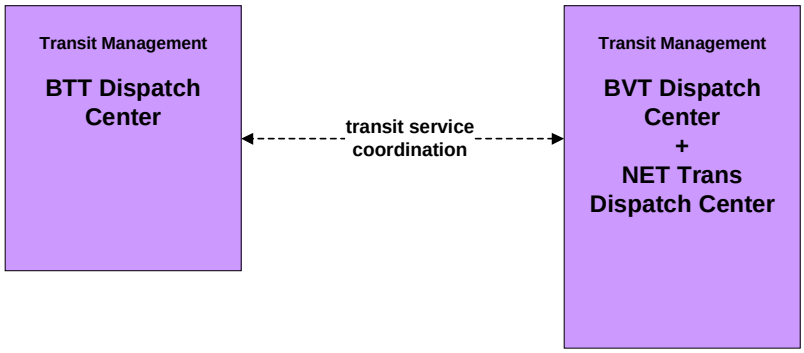


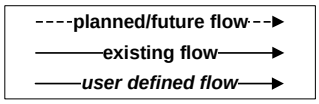
APTS06 – Transit Fleet Management
NET Trans



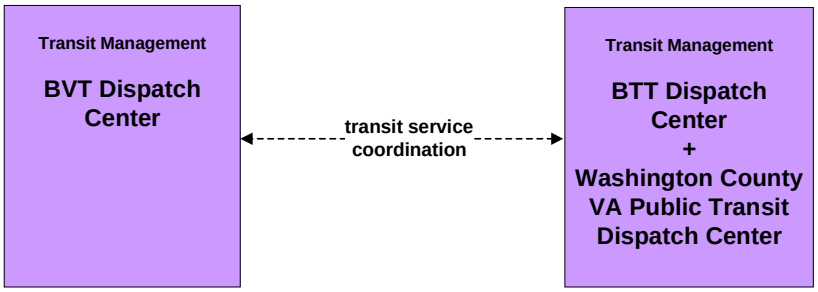


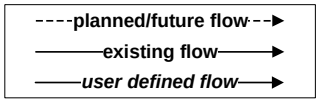
APTS07 – Multi-modal Coordination
Bristol TN Transit



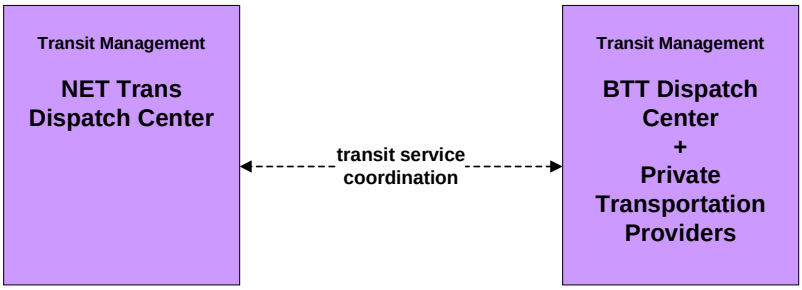


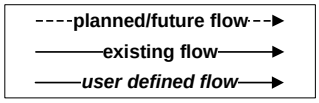
APTS07 – Multi-modal Coordination
Bristol VA Transit



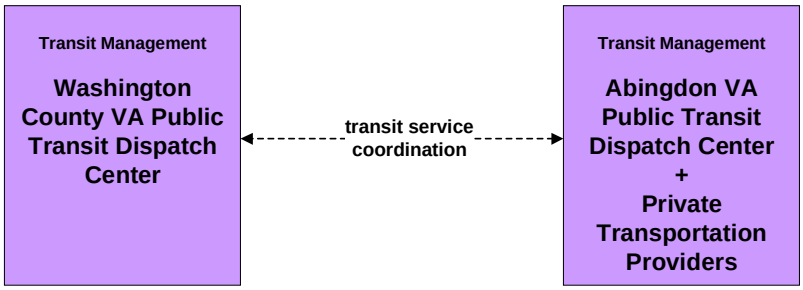


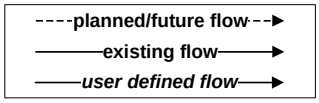
APTS07 – Multi-modal Coordination
NET Transit



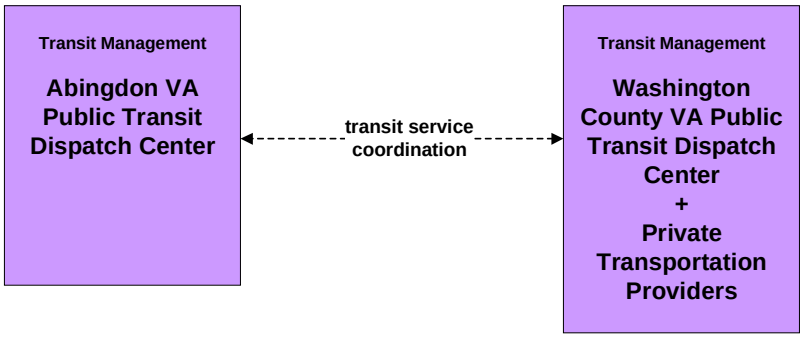


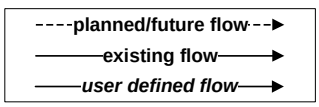
APTS07 – Multi-modal Coordination
Washington County VA Public Transit



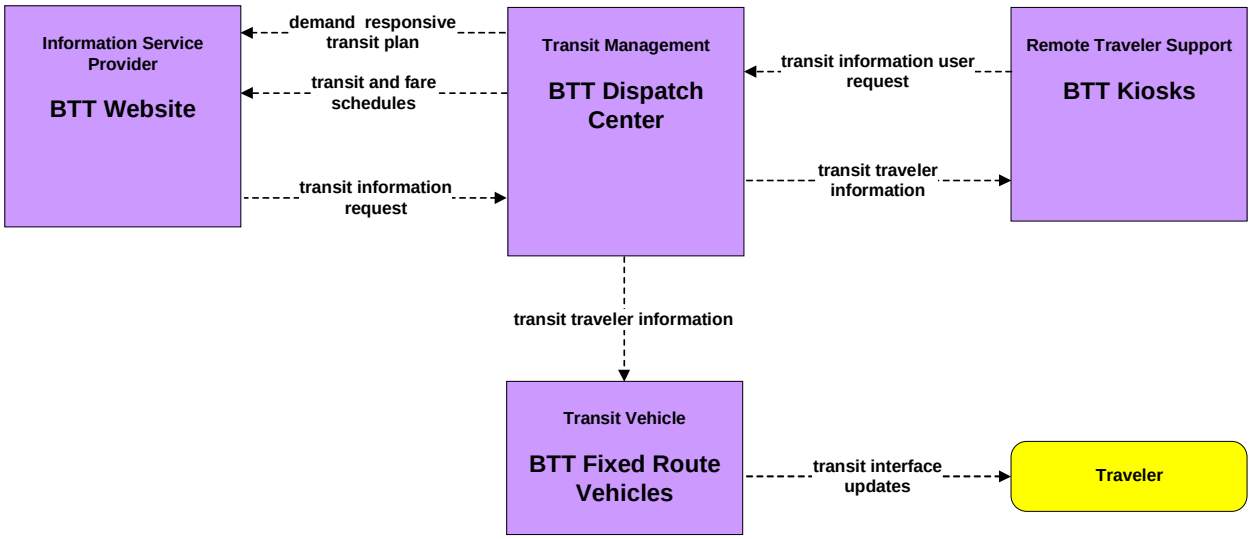


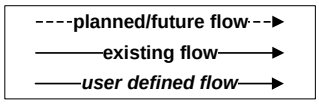
APTS07 – Multi-modal Coordination
Abingdon VA Public Transit



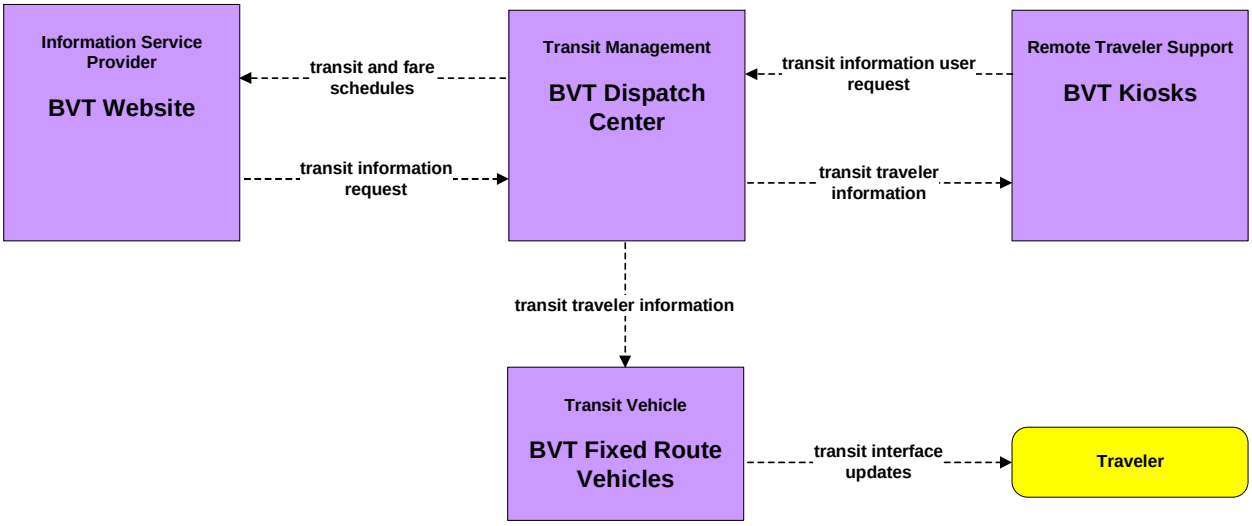


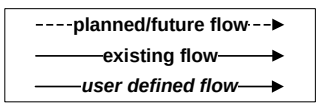
APTS08 – Transit Traveler Information
Bristol TN Transit



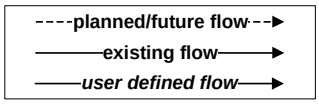


APTS08 – Transit Traveler Information
Bristol VA Transit

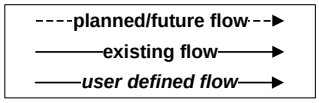




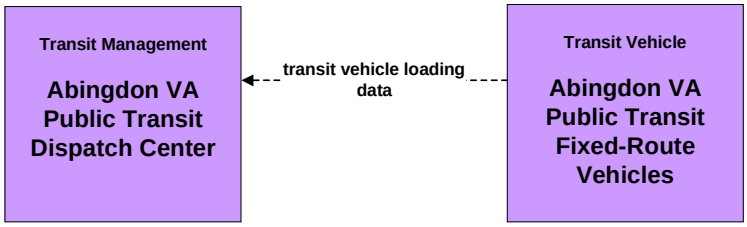
APTS10 – Transit Passenger Counting
Bristol TN Transit and Bristol VA Transit

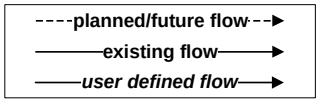


APTS10 – Transit Passenger Counting
Bristol VA Transit

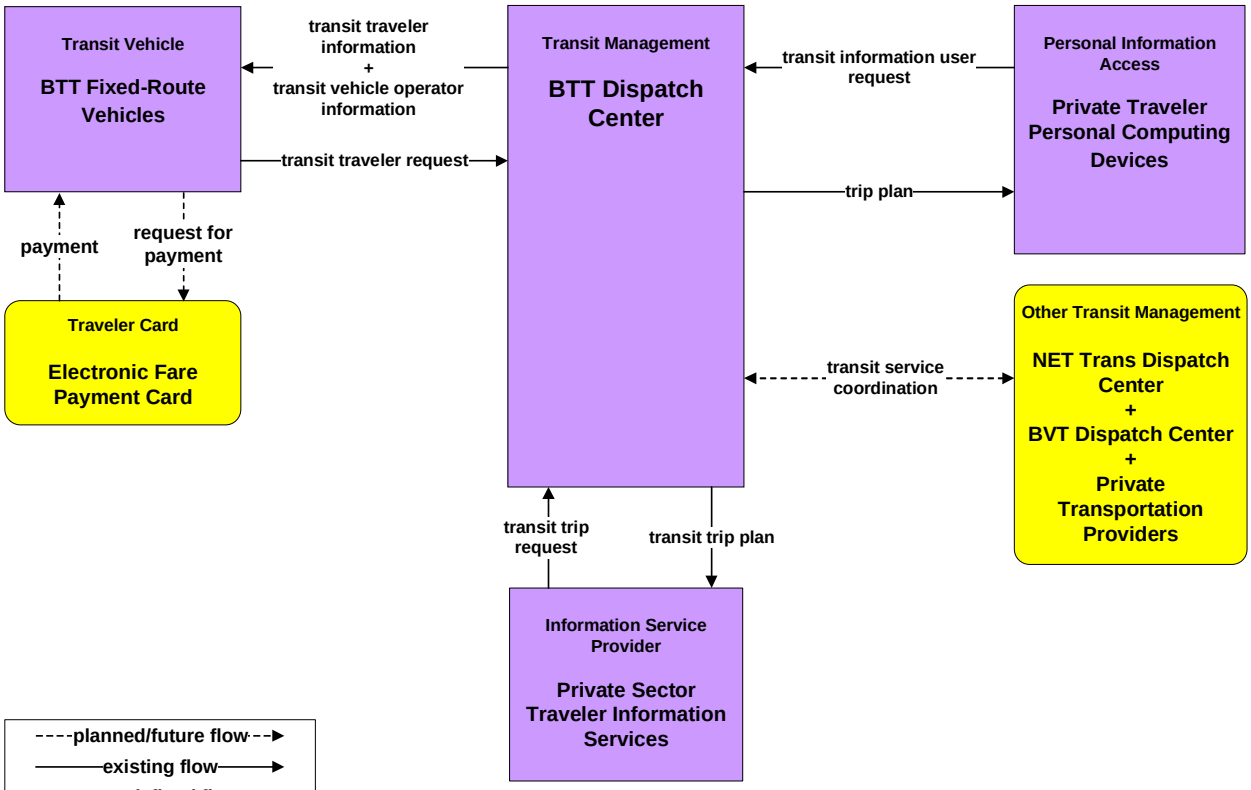


APTS10 – Transit Passenger Counting
Abingdon VA Public Transit

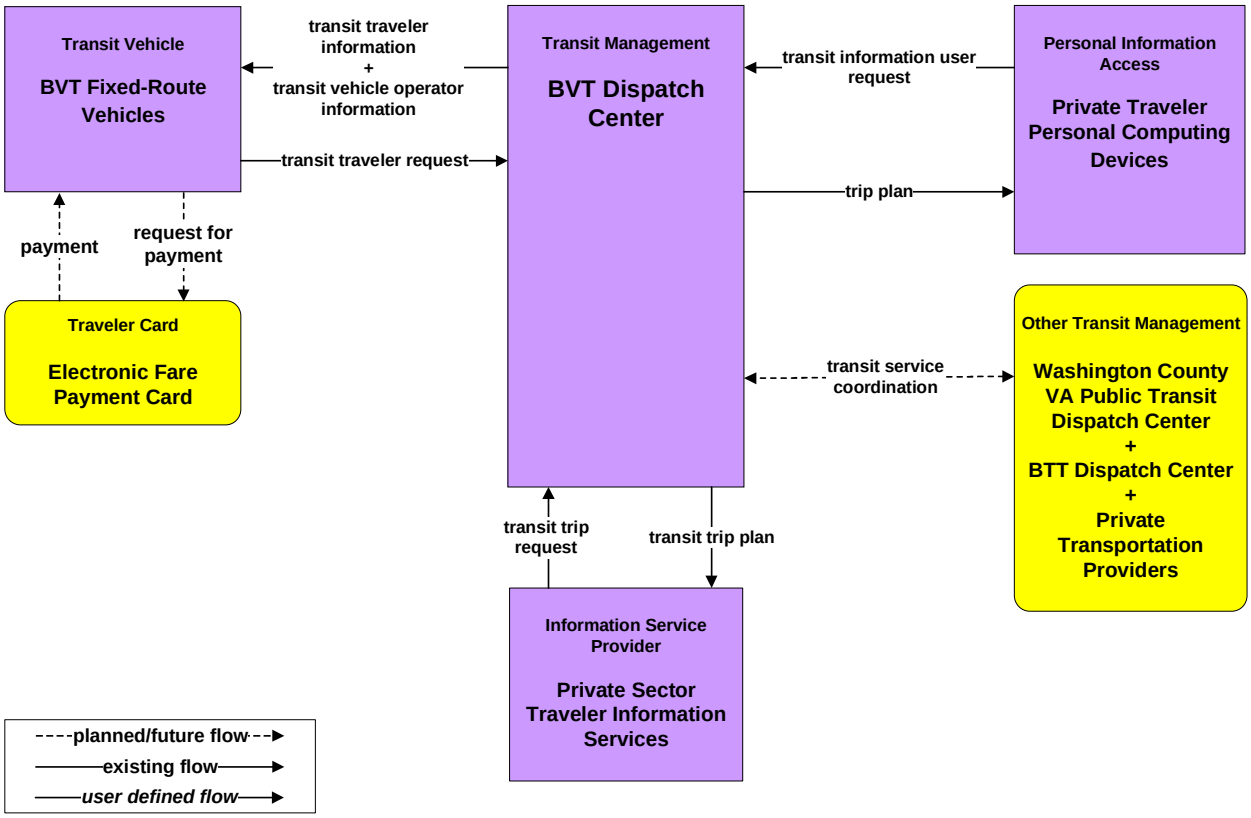




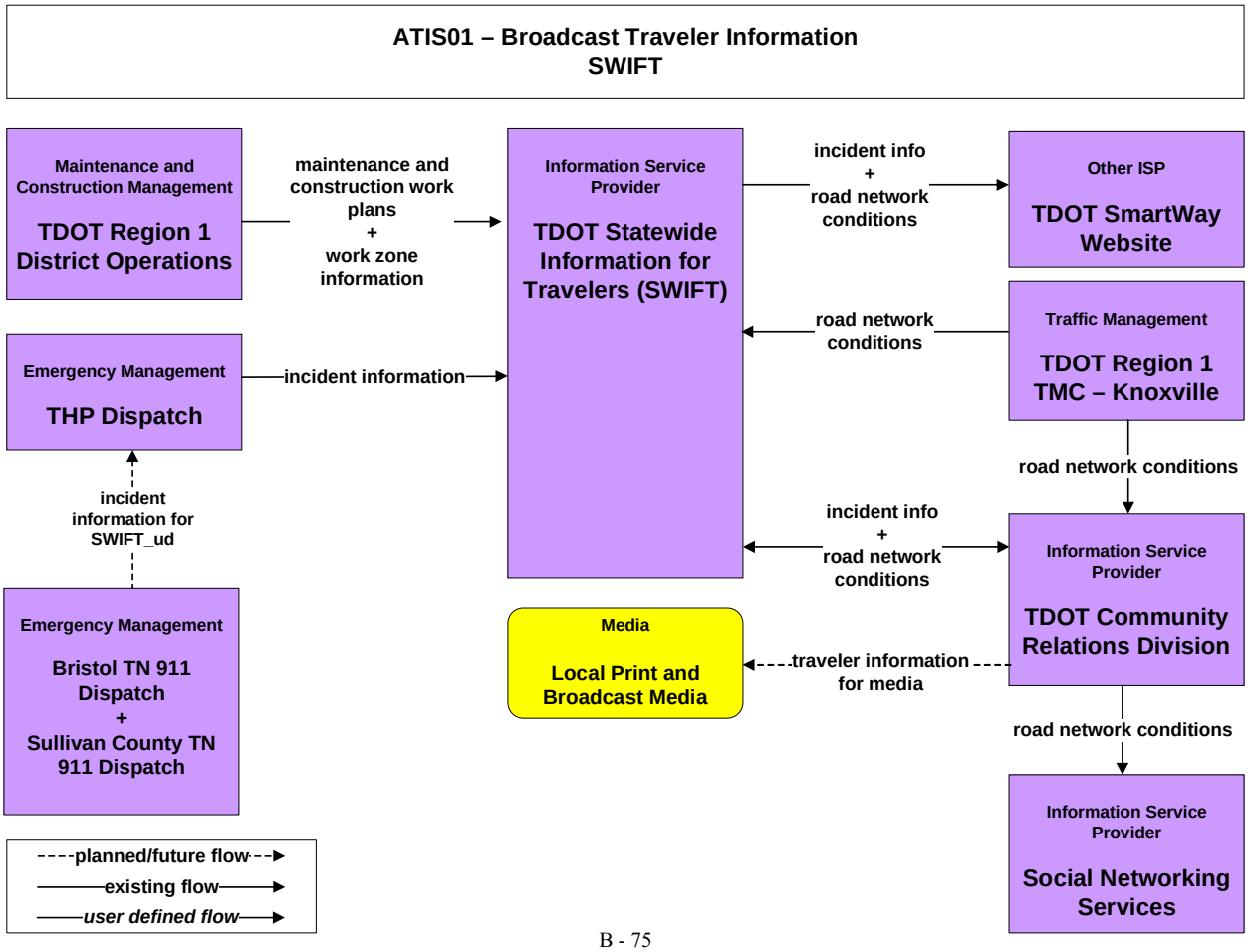
APTS11 – Multimodal Connection Protection
Bristol TN Transit



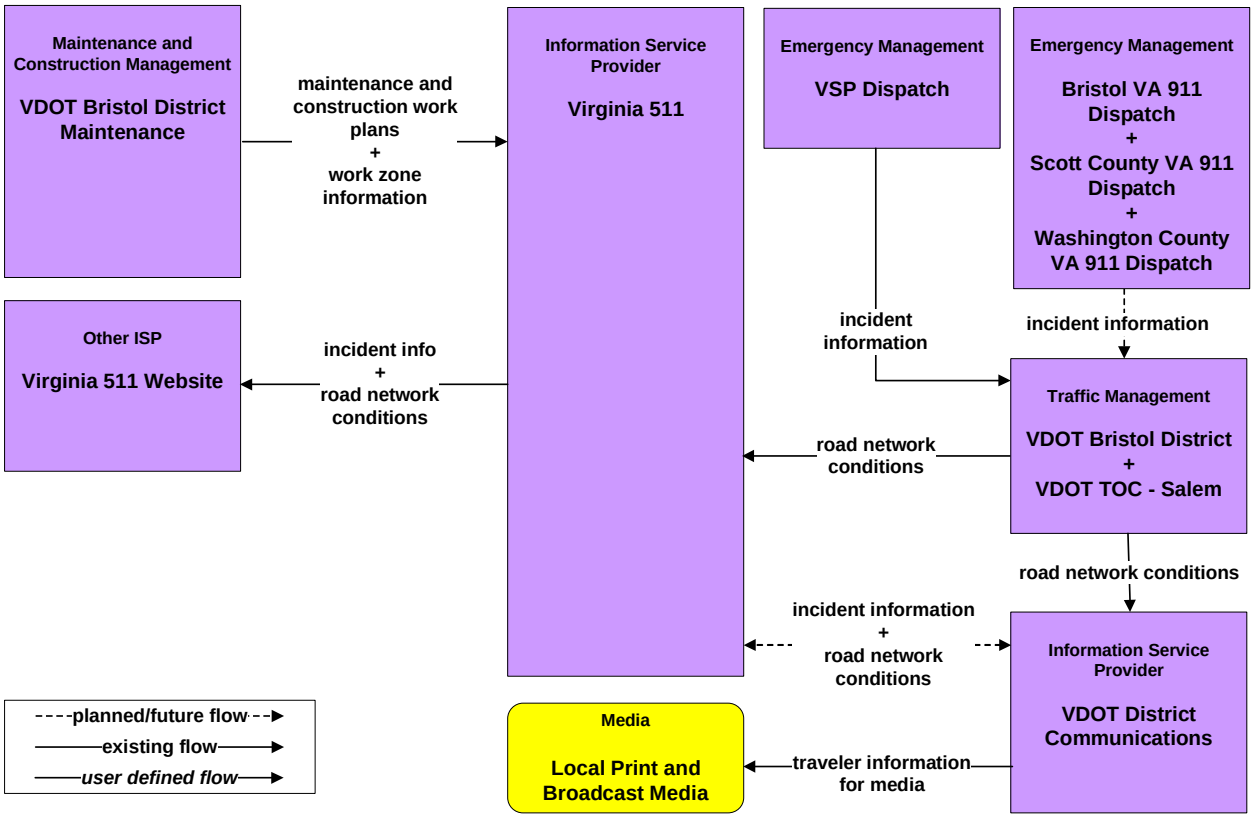
APTS11 – Multimodal Connection Protection
Bristol VA Transit



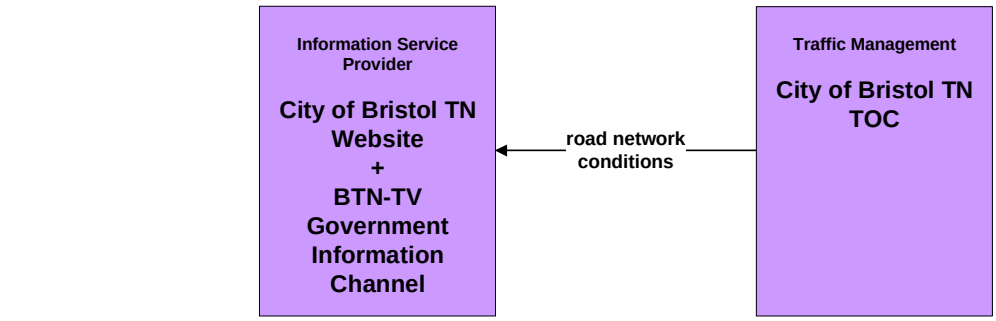
Advanced Traveler Information System



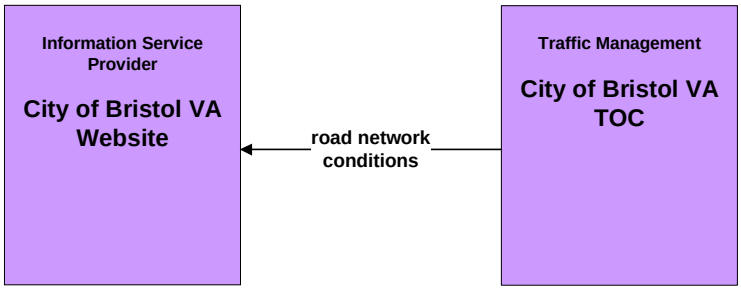
ATIS01 – Broadcast Traveler Information
Virginia 511

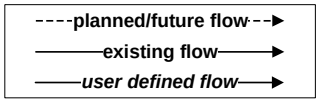


ATIS01 – Broadcast Traveler Information
City of Bristol TN

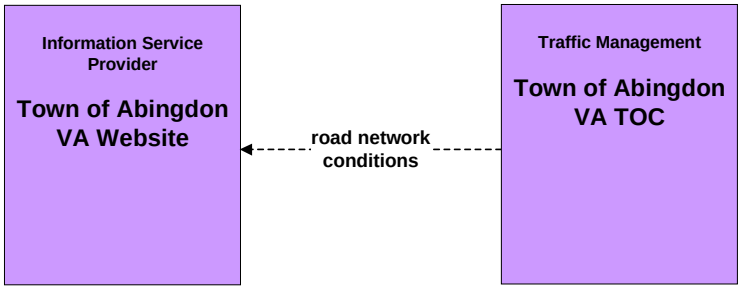


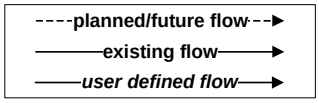
ATIS01 – Broadcast Traveler Information
City of Bristol VA

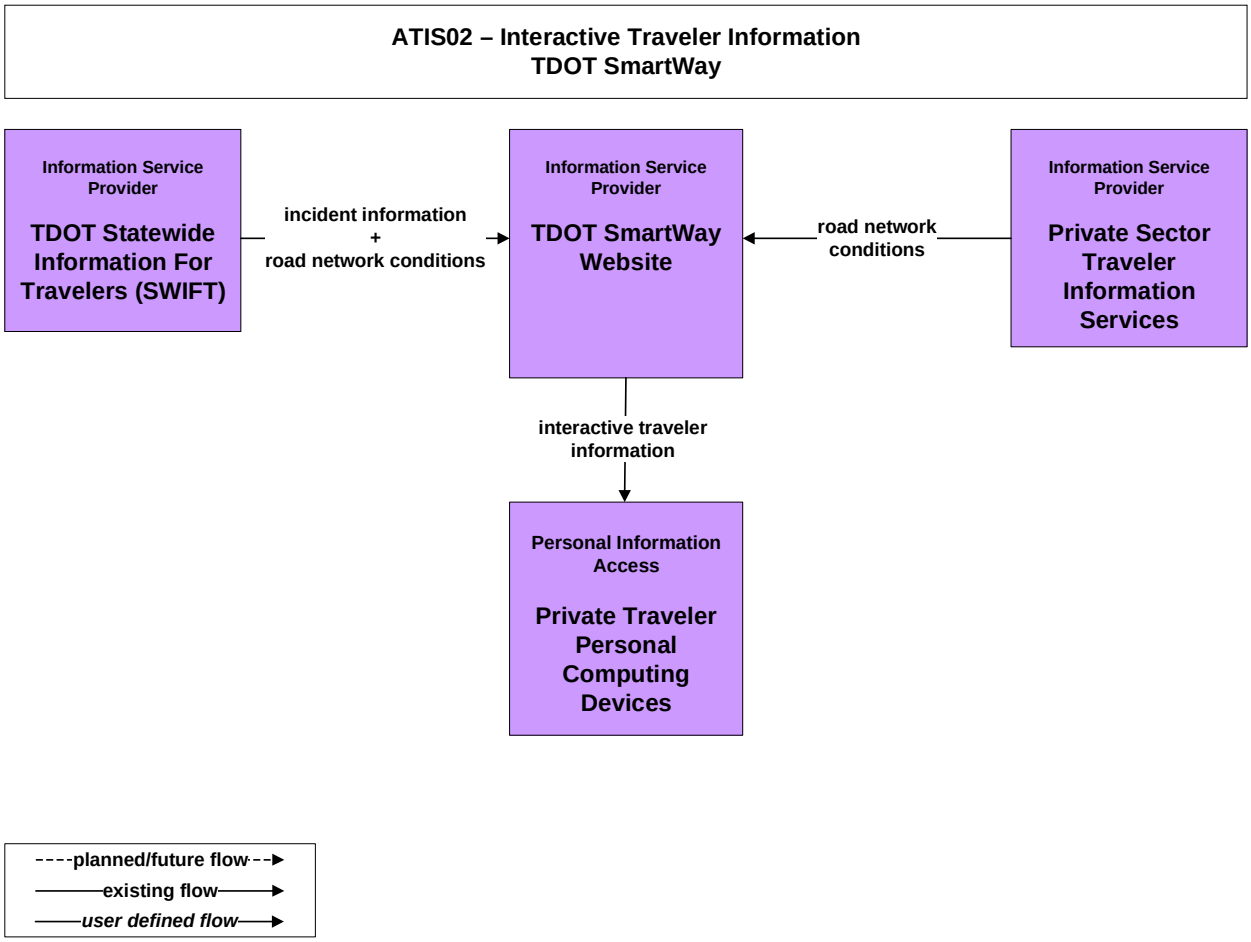


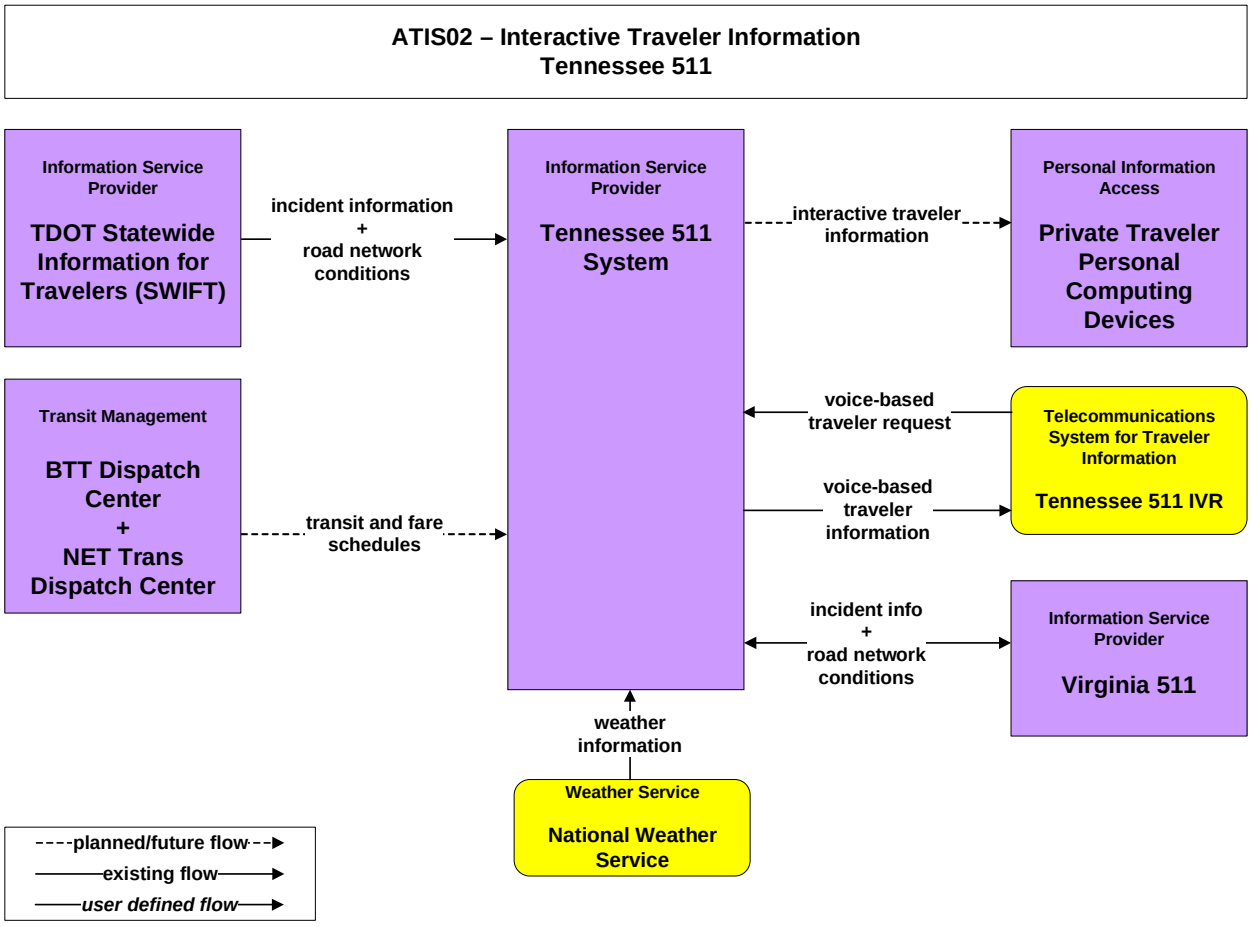


ATIS01 – Broadcast Traveler Information
Town of Abingdon VA

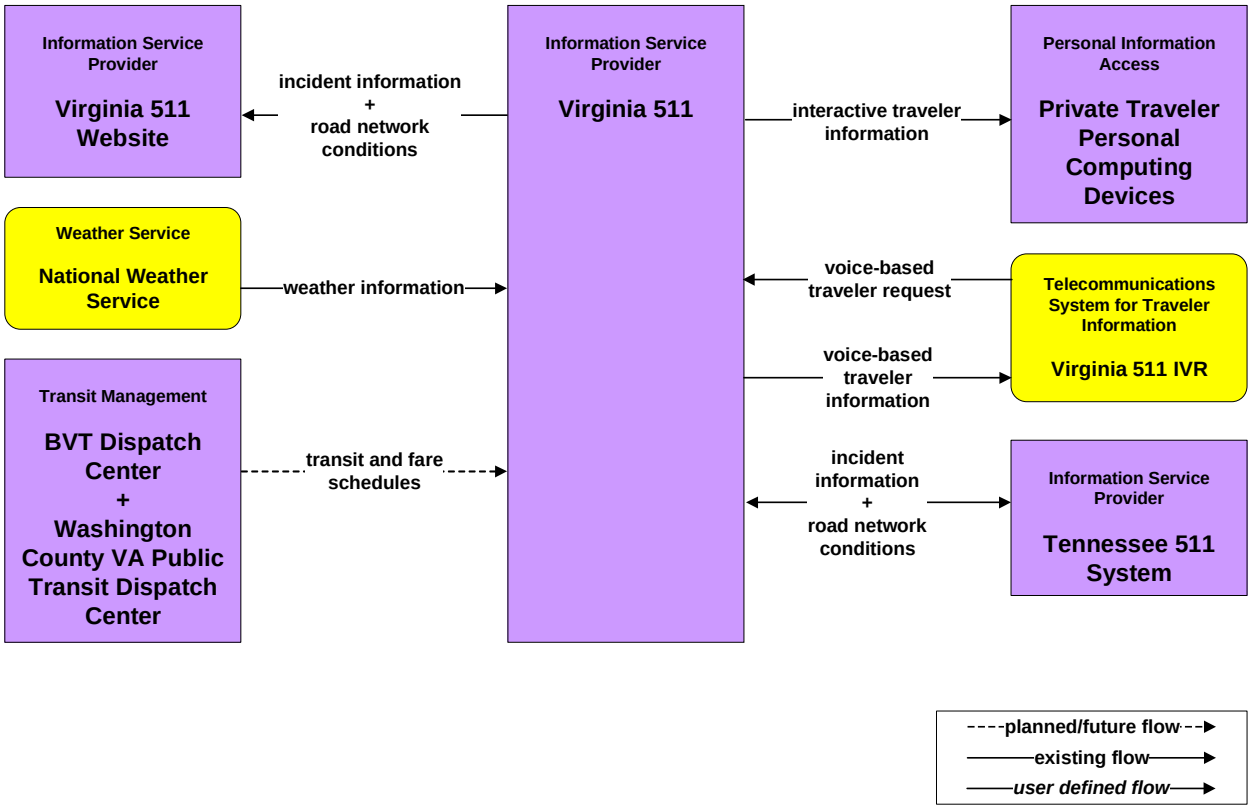




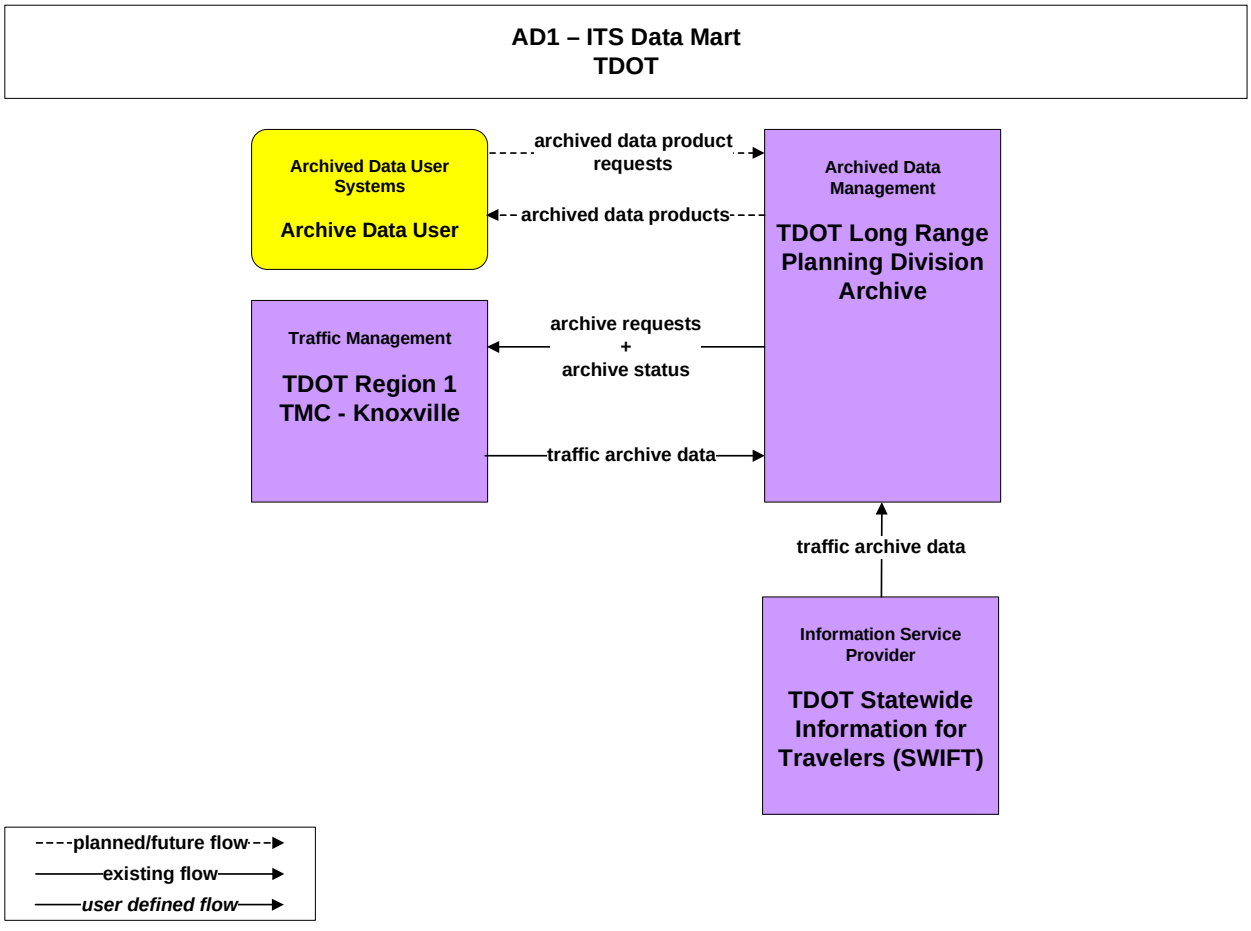

ATIS02 – Interactive Traveler Information
TDOT SmartWay
Information Service Provider
TDOT Statewide Information For Travelers (SWIFT)
incident information
+
road network conditions
Information Service Provider
TDOT SmartWay Website
road network conditions
Information Service Provider
Private Sector Traveler Information Services
interactive traveler information
Personal Information Access
Private Traveler Personal Computing Devices
planned/future flow
existing flow
user defined flow


ATIS02 – Interactive Traveler Information
Tennessee 511
Information Service Provider
TDOT Statewide Information for Travelers (SWIFT)
incident information
+
road network conditions
Information Service Provider
Tennessee 511 System
interactive traveler information
Personal Information Access
Private Traveler Personal Computing Devices
Transit Management
BTT Dispatch Center
+
NET Trans Dispatch Center
transit and fare schedules
voice-based traveler request
voice-based traveler information
Telecommunications System for Traveler Information
Tennessee 511 IVR
incident info
+
road network conditions
Information Service Provider
Virginia 511
weather information
Weather Service
National Weather Service
planned/future flow
existing flow
user defined flow

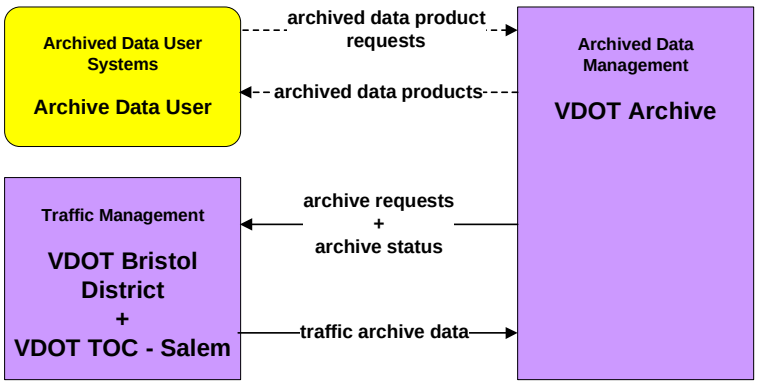
ATIS02 – Interactive Traveler Information
Virginia 511

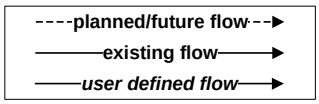


Archived Data

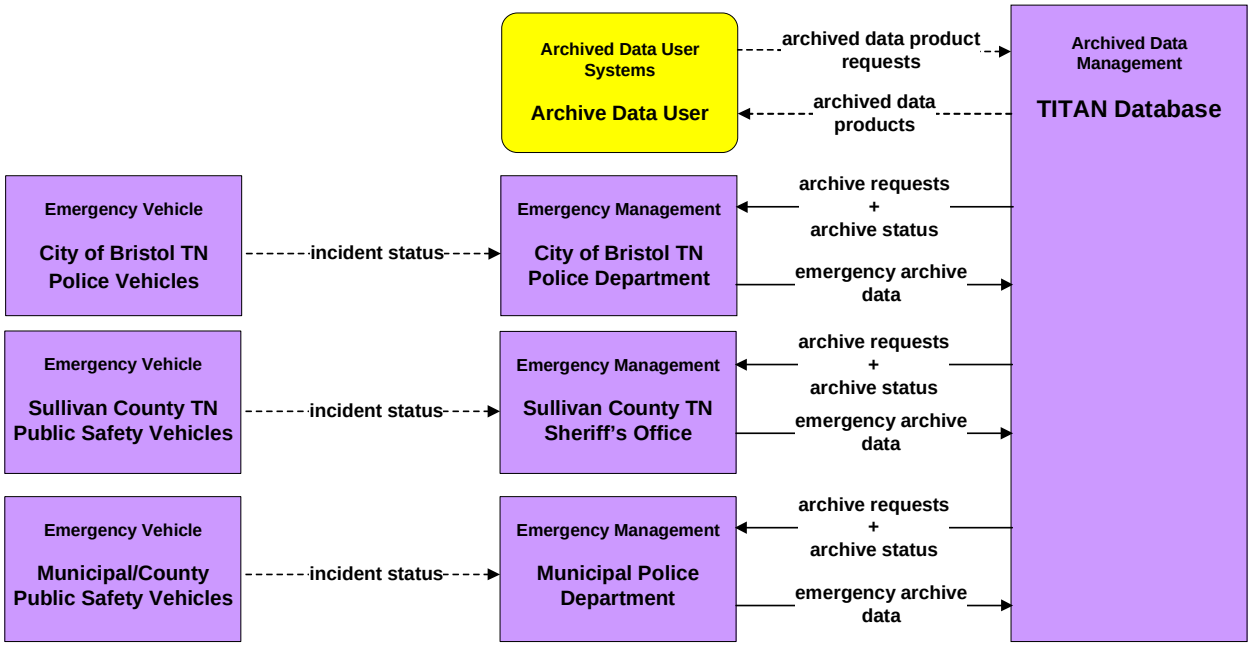


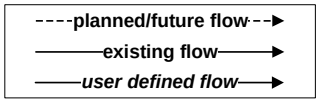
AD1 – ITS Data Mart
VDOT





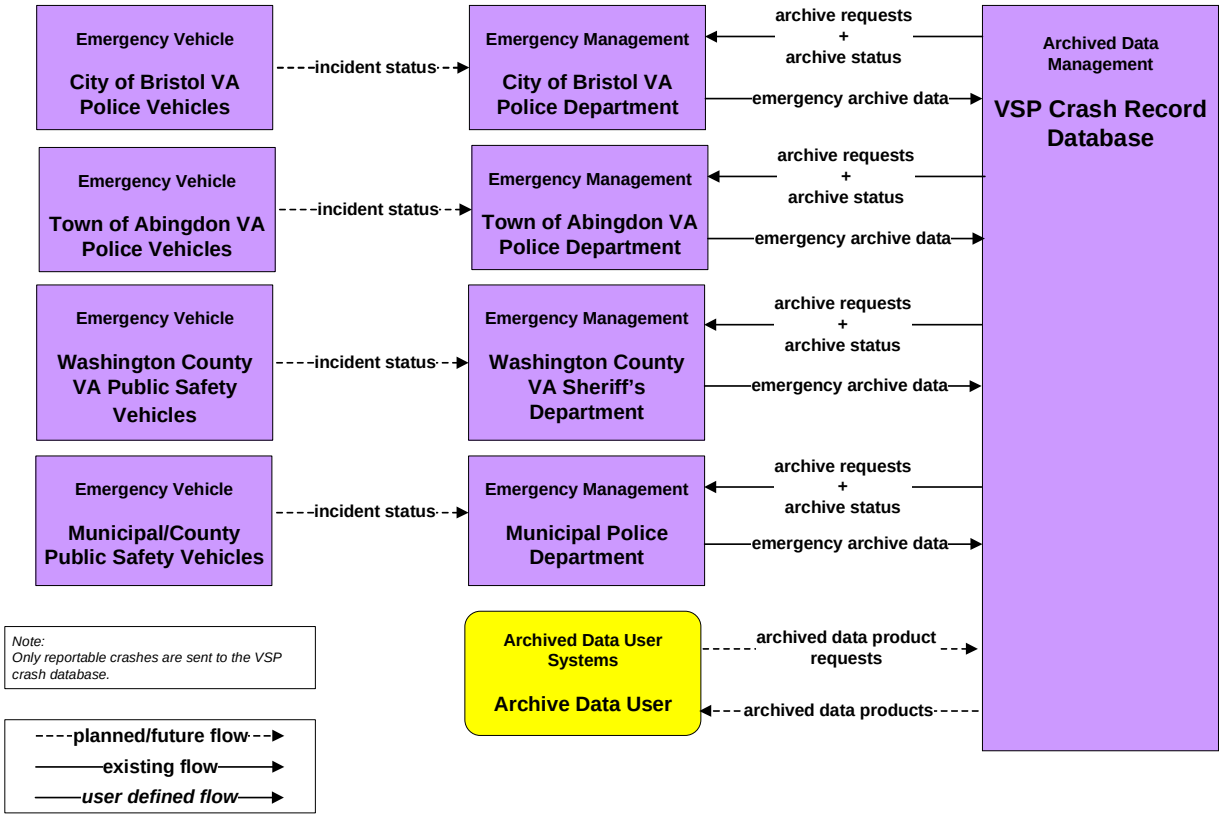
AD1 – ITS Data Mart
TITAN



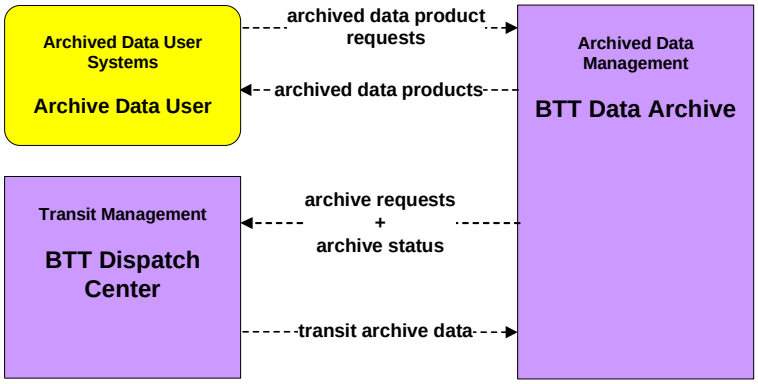


Note:
Only reportable crashes are sent to the TITAN database.

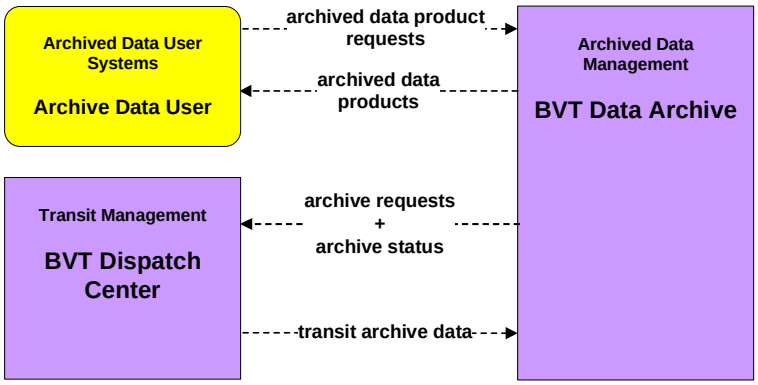
AD1 – ITS Data Mart
VSP Crash Record Database



AD1 – ITS Data Mart
Bristol TN Transit



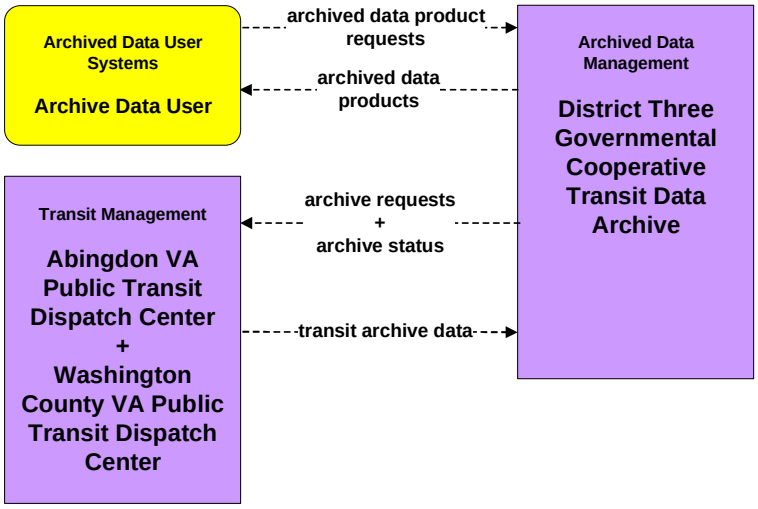
AD1 – ITS Data Mart
Bristol VA Transit



planned/future flow
existing flow
user defined flow

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

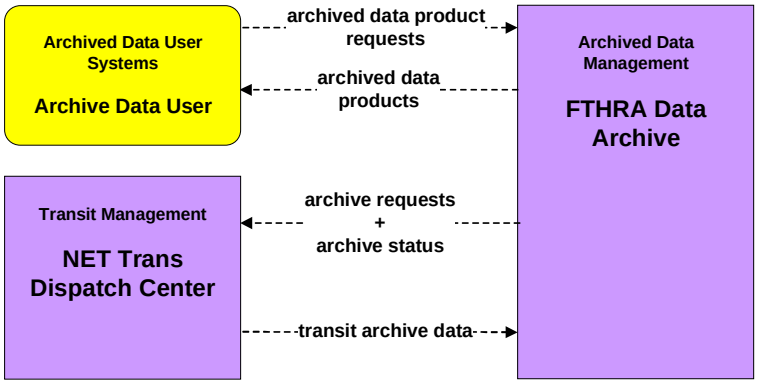
AD1 – ITS Data Mart
District Three Governmental Cooperative Transit Data Archive

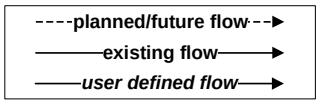


planned/future flow
existing flow
user defined flow

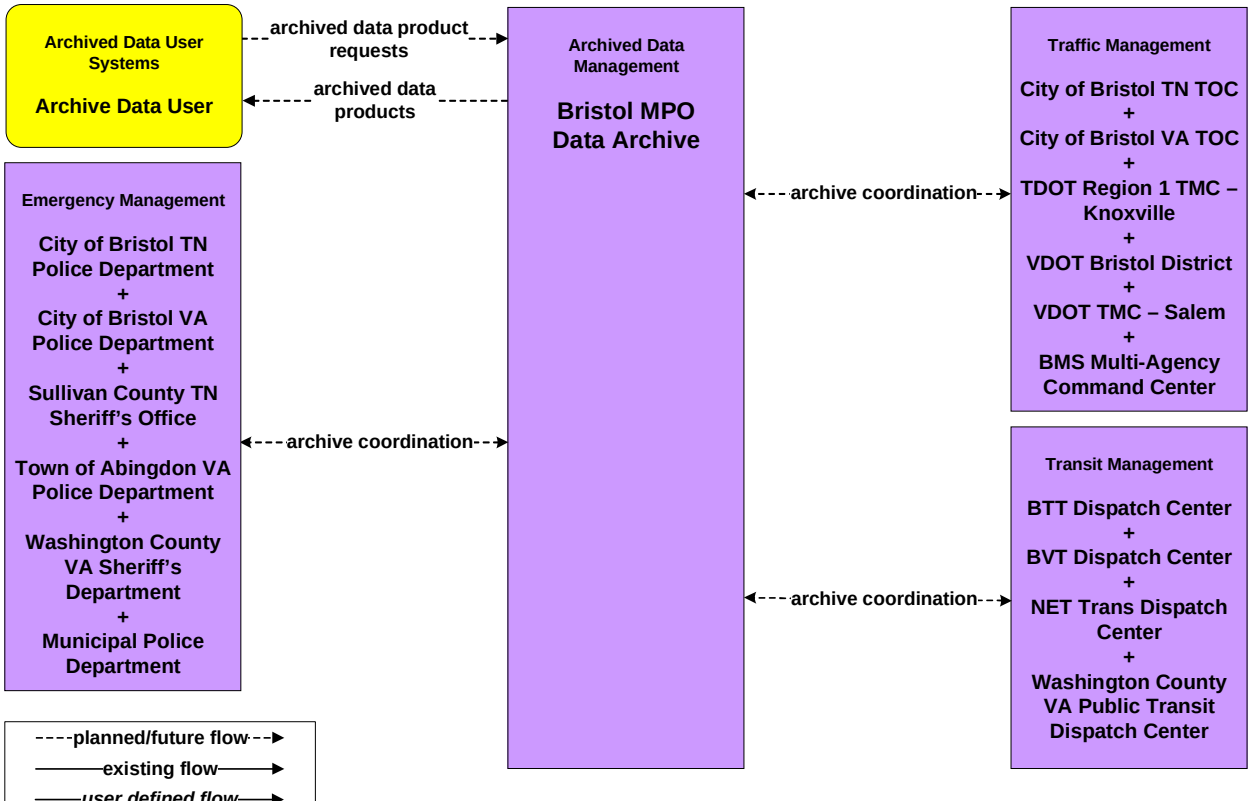
Note:
Data archive used by the National Transit Database, FTA, and VDOT Office of Public Transportation.

AD1 – ITS Data Mart
First Tennessee Human Resource Agency





AD2 – ITS Data Warehouse
Bristol MPO



APPENDIX C – ELEMENT FUNCTIONS

Element Name	Equipment Package (Function)
Abingdon VA Public Transit CCTV Camera Surveillance	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
Abingdon VA Public Transit Dispatch Center	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Transit Center Fare Management
	Transit Center Fixed-Route Operations
	Transit Center Multi-Modal Coordination
	Transit Center Paratransit Operations
	Transit Center Passenger Counting
	Transit Center Security
	Transit Center Vehicle Tracking
	Transit Data Collection
	Transit Evacuation Support
Abingdon VA Public Transit Fixed Route Vehicles	On-board Passenger Counting
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Trip Monitoring
Abingdon VA Public Transit Paratransit Vehicles	On-board Paratransit Operations
	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Trip Monitoring
Abingdon VA Public Transit Website	Basic Information Broadcast
	Infrastructure Provided Trip Planning
	Interactive Infrastructure Information
BMS Multi-Agency Command Center	Collect Traffic Surveillance
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Signal Control
Bristol MPO Data Archive	Government Reporting Systems Support
	ITS Data Repository
BTN-TV Government Information Channel	Basic Information Broadcast
BTT CCTV Camera Surveillance	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
BTT Data Archive	Government Reporting Systems Support
	ITS Data Repository
BTT Dispatch Center	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Transit Center Fare Management

Element Name	Equipment Package (Function)
BTT Dispatch Center (continued)	Transit Center Fixed-Route Operations
	Transit Center Information Services
	Transit Center Multi-Modal Coordination
	Transit Center Paratransit Operations
	Transit Center Passenger Counting
	Transit Center Security
	Transit Center Vehicle Tracking
	Transit Data Collection
	Transit Evacuation Support
BTT Fixed Route Vehicles	On-board Passenger Counting
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Transit Information Services
	On-board Transit Security
	On-board Transit Trip Monitoring
BTT Kiosks	Remote Transit Fare Management
	Remote Transit Information Services
BTT Paratransit Vehicles	On-board Paratransit Operations
	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Trip Monitoring
BTT Website	Infrastructure Provided Trip Planning
BVT CCTV Camera Surveillance	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
BVT Data Archive	Government Reporting Systems Support
	ITS Data Repository
BVT Dispatch Center	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Transit Center Fare Management
	Transit Center Fixed-Route Operations
	Transit Center Information Services
	Transit Center Multi-Modal Coordination
	Transit Center Paratransit Operations
	Transit Center Passenger Counting
	Transit Center Security
	Transit Center Vehicle Tracking
	Transit Data Collection
	Transit Evacuation Support

Element Name	Equipment Package (Function)
BVT Fixed Route Vehicles	On-board Passenger Counting
	On-board Schedule Management
	On-board Transit Fare Management
	On-board Transit Information Services
	On-board Transit Security
	On-board Transit Trip Monitoring
BVT Kiosks	Remote Transit Fare Management
	Remote Transit Information Services
BVT Paratransit Vehicles	On-board Paratransit Operations
	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Trip Monitoring
BVT Website	Infrastructure Provided Trip Planning
City of Bristol TN 911 Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Response Management
	Emergency Routing
	Incident Command
City of Bristol TN CCTV Cameras	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
City of Bristol TN DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
City of Bristol TN Field Sensors	Roadway Basic Surveillance
	Roadway Equipment Coordination
City of Bristol TN Fire/EMS Vehicles	On-board EV En Route Support
City of Bristol TN Police Department	Emergency Data Collection
	Emergency Dispatch
	Emergency Routing
City of Bristol TN Police Vehicles	On-board EV En Route Support
City of Bristol TN Public Works Department	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management

Element Name	Equipment Package (Function)
City of Bristol TN Public Works Department Vehicles	MCV Environmental Monitoring
	MCV Vehicle Location Tracking
	MCV Work Zone Support
City of Bristol TN Rail Notification System	Roadway Equipment Coordination
	Standard Rail Crossing
City of Bristol TN RWIS Sensors	Roadway Environmental Monitoring
City of Bristol TN TOC	Collect Traffic Surveillance
	HRI Traffic Management
	Rail Operations Coordination
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
	Traffic Data Collection
	Traffic Maintenance
City of Bristol TN Traffic Signals	Roadway Equipment Coordination
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
City of Bristol TN Website	Basic Information Broadcast
	ISP Traveler Data Collection
City of Bristol VA 911 Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Response Management
	Emergency Routing
	Incident Command
City of Bristol VA CCTV Cameras	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
City of Bristol VA DMS	Roadway Equipment Coordination
	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
City of Bristol VA Field Sensors	Roadway Basic Surveillance
	Roadway Equipment Coordination
City of Bristol VA Fire Vehicles	On-board EV En Route Support
City of Bristol VA Lifesaving Crew	On-board EV En Route Support

Element Name	Equipment Package (Function)
City of Bristol VA Police Department	Emergency Data Collection
City of Bristol VA Police Vehicles	On-board EV En Route Support
City of Bristol VA Public Works Department	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
City of Bristol VA Public Works Department Vehicles	MCV Environmental Monitoring
	MCV Vehicle Location Tracking
	MCV Work Zone Support
City of Bristol VA Rail Notification System	Roadway Equipment Coordination
	Standard Rail Crossing
City of Bristol VA RWIS Sensors	Roadway Environmental Monitoring
City of Bristol VA TOC	Collect Traffic Surveillance
	HRI Traffic Management
	Rail Operations Coordination
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
	Traffic Data Collection
	Traffic Maintenance
City of Bristol VA Traffic Signals	Roadway Equipment Coordination
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
City of Bristol VA Website	Basic Information Broadcast
	ISP Traveler Data Collection
City of Johnson City TN TOC	TMC Regional Traffic Management
City of Kingsport TN TOC	TMC Regional Traffic Management

Element Name	Equipment Package (Function)
City of Kingsport TN TOC (continued)	
District Three Governmental Cooperative Transit Data Archive	Government Reporting Systems Support
	ITS Data Repository
FRHRA Data Archive	Government Reporting Systems Support
	ITS Data Repository
Municipal Police Department	Emergency Data Collection
Municipal/County Maintenance	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
Municipal/County Maintenance Vehicles	MCV Vehicle Location Tracking
	MCV Work Zone Support
Municipal/County Public Safety Vehicles	On-board EV Route Support
Municipal/County TOC	Collect Traffic Surveillance
	HRI Traffic Management
	Rail Operations Coordination
	TMC Evacuation Support
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Signal Control
	TMC Work Zone Traffic Management
	Traffic Maintenance
Municipal/County Traffic Signals	Roadway Equipment Coordination
	Roadway Signal Controls
	Standard Rail Crossing
Municipal/County Website	Basic Information Broadcast
	ISP Emergency Traveler Information
	ISP Traveler Data Collection
NET Tran CCTV Camera Surveillance	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
NET Trans Demand Response Vehicles	On-board Maintenance
	On-board Paratransit Operations
	On-board Transit Security
	On-board Transit Trip Monitoring

Element Name	Equipment Package (Function)
NET Trans Dispatch Center	Transit Center Multi-Modal Coordination
	Transit Data Collection
	Transit Evacuation Support
NET Trans Website	Basic Information Broadcast
	Infrastructure Provided Trip Planning
	Interactive Infrastructure Information
Other TDOT Region District Operations	MCM Incident Management
	MCM Work Activity Coordination
	MCM Work Zone Management
Private Sector Traveler Information Services	Infrastructure Provided Trip Planning
	Interactive Infrastructure Information
	ISP Emergency Traveler Information
Private Transportation Providers	Transit Center Multi-Modal Coordination
Private Traveler Personal Computing Devices	Personal Interactive Information Reception
Rail Operator Wayside Equipment	Roadway Equipment Coordination
	Standard Rail Crossing
Skyline OneView	ISP Data Collection
	ISP Traveler Data Collection
Social Networking Services	Basic Information Broadcast
	ISP Traveler Information Alerts
Sullivan County TN 911 Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
Sullivan County TN EMA	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
Sullivan County TN Public Safety Vehicles	On-board EV En Route Support
Sullivan County TN Sheriff's Office	Emergency Data Collection
TDOT CCTV Cameras	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
TDOT Changeable Speed Limit Signs	Roadway Equipment Coordination
	Roadway Speed Monitoring and Warning
	Roadway Variable Speed Limits
TDOT Community Relations Division	Basic Information Broadcast
	ISP Traveler Data Collection
TDOT DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control

Element Name	Equipment Package (Function)
TDOT Emergency Services Coordinator	MCM Incident Management
	MCM Roadway Maintenance and Construction
	TMC Evacuation Support
	TMC Incident Dispatch Coordination/Communication
TDOT Field Sensors	Roadway Basic Surveillance
	Roadway Equipment Coordination
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 Long Range Planning Division Archive	Government Reporting Systems Support
	ITS Data Repository
	Traffic Data Collection
TDOT Maintenance Headquarters	MCM Environmental Information Collection
	MCM Environmental Information Processing
TDOT Maintenance Vehicles	MCV Vehicle Location Tracking
	MCV Winter Maintenance
	MCV Work Zone Support
TDOT Overheight Vehicle Detection	Roadway Basic Surveillance
	Roadway Traffic Information Dissemination
	Roadway Warning
TDOT Ramp Metering Equipment	Roadway Basic Surveillance
	Roadway Equipment Coordination
	Roadway Traffic Metering
TDOT Ramp Queue Detection System	Roadway Basic Surveillance
TDOT Region 1 District Operations	MCM Incident Management
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
TDOT Region 1 HELP Dispatch	Service Patrol Management
TDOT Region 1 TMC – Knoxville	Collect Traffic Surveillance
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Freeway Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management

Element Name	Equipment Package (Function)
TDOT Region 1 TMC – Knoxville (continued)	Traffic Data Collection
	Traffic Maintenance
TDOT Region 2 TMC – Chattanooga	TMC Regional Traffic Management
TDOT Region 3 TMC – Nashville	TMC Regional Traffic Management
TDOT Region 4 TMC – Memphis	TMC Regional Traffic Management
TDOT Reversible Lane Equipment	Roadway Equipment Coordination
	Roadway Reversible Lanes
TDOT RWIS Sensors	Roadway Environmental Monitoring
TDOT Smart Work Zone Equipment	Roadway Work Zone Traffic Control
TDOT SmartWay Website	Basic Information Broadcast
	Interactive Infrastructure Information
	ISP Emergency Traveler Information
	ISP Traveler Data Collection
TDOT Statewide Information for Travelers (SWIFT)	Basic Information Broadcast
	Interactive Infrastructure Information
	ISP Emergency Traveler Information
	ISP Traveler Data Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Work Activity Coordination
	MCM Work Zone Management
TDOT Wrong-Way Detection and Warning Equipment	Roadway Basic Surveillance
	Roadway Equipment Coordination
	Roadway Warning
TEMA	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
Tennessee 511 IVR	Traveler Telephone Information
Tennessee 511 System	Interactive Infrastructure Information
	ISP Emergency Traveler Information
	ISP Traveler Data Collection
	Traveler Telephone Information
Tennessee Bureau of Investigation	Emergency Early Warning System
Tennessee GoSmart Kiosks	Remote Interactive Information Reception
THP Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
	Service Patrol Management

Element Name	Equipment Package (Function)
THP Vehicles	On-board EV En Route Support
TITAN Database	Government Reporting Systems Support
	ITS Data Repository
	Virtual Data Warehouse Services
Town of Abingdon VA CCTV Cameras	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
Town of Abingdon VA Field Sensors	Roadway Basic Surveillance
	Roadway Equipment Coordination
Town of Abingdon VA Police Department	Emergency Data Collection
Town of Abingdon VA Police Department Vehicles	On-board EV En Route Support
Town of Abingdon VA Public Works Department Vehicles	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
Town of Abingdon VA Public Works Department Vehicles	MCV Environmental Monitoring
	MCV Roadway Maintenance and Construction
	MCV Vehicle Location Tracking
	MCV Winter Maintenance
	MCV Work Zone Support
Town of Abingdon VA Rail Notification System	Roadway Traffic Information Dissemination
	Standard Rail Crossing
Town of Abingdon RWIS Sensors	Roadway Environmental Monitoring
Town of Abingdon VA TOC	Collect Traffic Surveillance
	HRI Traffic Management
	Rail Operations Coordination
	TMC Evacuation Support
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Signal Control
	TMC Work Zone Traffic Management
	Traffic Maintenance

Element Name	Equipment Package (Function)
Town of Abingdon VA Traffic Signals	Roadway Basic Surveillance
	Roadway Equipment Coordination
	Roadway Signal Controls
	Roadway Signal Priority
	Standard Rail Crossing
Town of Abingdon VA Website	Basic Information Broadcast
	ISP Traveler Data Collection
VDEM	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
VDOT Archive	Government Reporting Systems Support
	ITS Data Repository
VDOT Bristol District	Collection Traffic Surveillance
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Traffic Metering
	TMC Work Zone Traffic Management
	Traffic Data Collection
	Traffic Equipment Maintenance
VDOT Bristol District Maintenance	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance and Construction
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
VDOT CB Wizard Broadcast Device	Roadway Traffic Information Dissemination
VDOT CCTV Cameras	Roadway Basic Surveillance
	Roadway Infrastructure Monitoring
VDOT Commercial Truck Parking Management	Parking Coordination
	Parking Data Collection
	Parking Management
	Parking Short Range Traveler Information Communications

Element Name	Equipment Package (Function)
VDOT District Communications	Basic Information Broadcast
	ISP Traveler Data Collection
VDOT DMS	Roadway Equipment Coordination
	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
VDOT Emergency Services Coordinator	MCM Incident Management
	MCM Roadway Maintenance and Construction
VDOT Field Sensors	Roadway Basic Surveillance
	Roadway Equipment Coordination
VDOT HAR	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
VDOT Maintenance Vehicles	MCV Vehicle Location Tracking
	MCV Winter Maintenance
	MCV Work Zone Support
VDOT Overheight Vehicle Detection	Roadway Basic Surveillance
	Roadway Equipment Coordination
VDOT Portable RWIS Sensors	Roadway Environmental Monitoring
VDOT Ramp Queue Detection System	Roadway Basic Surveillance
VDOT RWIS Sensors	Roadway Environmental Monitoring
VDOT Smart Work Zone Equipment	Roadway Work Zone Traffic Control
VDOT Special Event Command Center	Collect Traffic Surveillance
	TMC Freeway Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Signal Control
VDOT SSP Dispatch	Service Patrol Management
VDOT SSP Vehicles	On-board EV En Route Support
	On-board EV Incident Management Communication
VDOT TMC – Hampton Roads	TMC Regional Traffic Management
VDOT TMC – Northern Virginia	TMC Regional Traffic Management
VDOT TMC – Richmond	TMC Regional Traffic Management
VDOT TMC – Salem	Collect Traffic Surveillance
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Freeway Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Regional Traffic Management
	TMC Signal Control

Element Name	Equipment Package (Function)
VDOT TMC – Salem (continued)	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
	Traffic Data Collection
	Traffic Maintenance
VDOT TMC – Staunton	TMC Regional Traffic Management
VDOT Traffic Signals	Roadway Basic Surveillance
	Roadway Equipment Coordination
	Roadway Signal Controls
	Roadway Signal Priority
Virginia 511	Basic Information Broadcast
	Interactive Infrastructure Information
	ISP Emergency Traveler Information
	ISP Traveler Data Collection
	Traveler Telephone Information
Virginia 511 IVR	Traveler Telephone Information
Virginia 511 Website	ISP Emergency Traveler Information
	ISP Traveler Data Collection
Virginia Statewide EOC	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
VSP Crash Record Database	Government Reporting Systems Support
	ITS Data Repository
VSP Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
VSP Missing Children Clearinghouse	Emergency Early Warning System
VSP Vehicles	On-board EV En Route Support
Washington County TN 911 Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Response Management
	Emergency Routing
	Incident Command
Washington County TN EMA	Emergency Evacuation Support
	Emergency Response Management
	Incident Command

Element Name	Equipment Package (Function)
Washington County VA 911 Dispatch	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Response Management
	Emergency Routing
	Incident Command
Washington County VA Department of Emergency Services	Emergency Evacuation Support
	Emergency Response Management
	Incident Command
Washington County VA Public Safety Vehicles	On-board EV En Route Support
Washington County VA Public Transit CCTV Camera Surveillance	Field Secure Area Surveillance
Washington County VA Public Transit Demand Response Vehicles	On-board Paratransit Operations
	On-board Paratransit Operations
	On-board Transit Fare Management
	On-board Transit Security
	On-board Transit Trip Monitoring
Washington County VA Public Transit Dispatch Center	Center Secure Area Alarm Support
	Center Secure Area Surveillance
	Transit Center Fare Management
	Transit Center Multi-Modal Coordination
	Transit Center Paratransit Operations
Washington County VA Public Transit Dispatch Center (continued)	Transit Center Security
	Transit Center Vehicle Tracking
	Transit Data Collection
	Transit Evacuation Support
Washington County VA Public Transit Website	Basic Information Broadcast
	ISP Traveler Data Collection
Washington County VA Sheriff's Department	Emergency Data Collection

APPENDIX D – STAKEHOLDER DATABASE

Bristol Regional ITS Architecture
Stakeholder Participation

Invitees			Attendance		
Organization	First Name	Last Name	Kick-off Workshop	Interview	Stakeholder Review Workshop
Bristol TN/VA MPO	David	Metzger			X
Bristol TN/VA MPO	Rex	Montgomery	X	X	X
City of Bristol, TN - 911	Virginia	Smelser			
City of Bristol, TN - City Schools	Gary	Lilly			
City of Bristol, TN - Fire Rescue	Bob	Barnes			
City of Bristol, TN - Police Department	Blaine	Wade			
City of Bristol, TN - Public Works	Tim	Beavers	X	X	X
City of Bristol, TN - Transit	Wes	Richie			
City of Bristol, VA - City Engineer	Wallace	McCulloch		X	
City of Bristol, VA - City Manager	Tabaitha	Crowder			
City of Bristol, VA - Fire Department	Mike	Armstrong			
City of Bristol, VA - Police Department	John	Austin			
City of Bristol, VA - Transit	Janice	Hall			
City of Bristol, VA - Transit	Jay	Detrick	X		
FHWA Tennessee	Nicholas	Renna	X		
FHWA Virginia	Iris	Rodriguez			
FHWA Virginia	Kevin	Jones			
First TN RPO	Cory	Osborne	X	X	
Johnson City MTPO	Glenn	Berry			
Mount Rogers Planning District Commission	Aaron	Sizemore			
NET Trans	Candace	Gump		X	
Sullivan County Emergency Management	Jim	Bean			

Bristol Regional ITS Architecture
Stakeholder Participation

Invitees			Attendance		
Organization	First Name	Last Name	Kick-off Workshop	Interview	Stakeholder Review Workshop
Sullivan County EMS	Jerry	Perry			
Sullivan County Highway Department	Jim	Belgeri			
Sullivan County Schools	Evelyn	Rafalowski			
Sullivan County Sheriff's Office	Gary	Medlin			
TDOT - Region 1	Mark	Best	X	X	
TDOT - Region 1 Traffic	Andrew	Padgett		X	X
TDOT - Region 1 Traffic	Nathan	Vatter			X
TDOT - Long Range Planning	Rashad	Pinckney	X		
TDOT - Long Range Planning	Joseph	Roach	X		X
TDOT - Region 1 OCT	Jerome	Joiner			
TDOT - Region 1 OCT	Michelle	Christian	X		
TDOT - Traffic Operations	Eric	Flora	X		X
TDOT - Traffic Operations	Khuzaima	Mahdi	X		X
Tennessee Highway Patrol - District 5 Fall Branch	Jarrett	Ramsey			
Tennessee Highway Patrol - District 5 Fall Branch	Stephen	Street			
Town of Abington, VA - Fire Department	John	McCormick			
Town of Abington, VA - Police Department	Tony	Sullivan			
Town of Abington, VA - Public Works	John	Dew	X		
Town of Abington, VA - Public Works	Tyler	Vencill			
VDOT - Bristol District	Donny	Necessary	X	X	X
VDOT - Bristol District	Mike	Phipps			
VDOT - Operations Division	Paul	Szatkowski			

Bristol Regional ITS Architecture
Stakeholder Participation

Invitees			Attendance		
Organization	First Name	Last Name	Kick-off Workshop	Interview	Stakeholder Review Workshop
VDOT - Operations Division	Chris	Francis			
VDOT - Southwestern Region	Joe	Hamed			
VDOT - Southwestern Region	Ken	King			
VDOT - Southwestern Region	Brett	Randolph	X	X	
VDOT - Southwestern Region	Tim	Martin		X	
VDOT	Brian	Holt			
VDOT	Chris	McDonald			
Washington County, VA - Emergency Management	Tim	Estes			
Washington County, VA - Schools	Brian	Ratliff			
Washington County, VA - Sheriff's Office	Fred	Newman			

APPENDIX E – AGREEMENTS

TDOT, TDOSHS, AND LOCAL GOVERNMENT "OPEN ROADS POLICY" (QUICK CLEARANCE FOR SAFETY AND MOBILITY) MEMORANDUM OF UNDERSTANDING

TDOT LIVE CCTV VIDEO AND INFORMATION SHARING AGREEMENT FOR LOCAL RESPONDER ENTITY USERS

TDOT LIVE CCTV VIDEO ACCESS AGREEMENT FOR PRIVATE ENTITY USERS

TDOT FOR LIVE CCTV VIDEO ACCESS AND INFORMATION SHARING FOR GOVERNMENTAL AGENCY USERS

Tennessee's
"OPEN ROADS POLICY"
Quick Clearance for Safety and Mobility

Sullivan County Sheriff's Office
City/County Agency

By: [signature]

Printed Name: Andy Seabolt

Title: Captain

Date: 10-2-15

ADDITIONAL SIGNATORIES

[signature] Em. Mgmt Director 10/2/15
Name Title Date

Name		Date
	Emergency Management Director serves as signatory for rescue and fire agencies.	
Name		Date
Name		Date

State of Tennessee

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

Between the Tennessee Department of Transportation,

Tennessee Department of Safety and Homeland Security, and

Tennessee Counties and Cities

This Memorandum of Understanding (MOU) by and between the Tennessee Department of Transportation (TDOT), the Tennessee Department of Safety and Homeland Security (TDOSHS), County/City Law Enforcement and Fire and Rescue Agencies (City/County Agencies), establishes a policy for the Tennessee Highway Patrol (THP), TDOT, City/County Agencies to expedite the removal of vehicles, cargo, and debris from roadways on the State Highway System (roadways) to restore, in an URGENT MANNER the safe and orderly flow of traffic following a motor vehicle crash or incident on Tennessee's roadways. This MOU is intend to complement the existing Memorandum of Understanding between TDOT and TDOSHS entered into on February 16, 2012, and does not supersede or circumvent any of the components of that document between the two State departments.

Whereas: Public safety is the highest priority and must be maintained especially when injuries or hazardous materials are involved. The quality of life in the State of Tennessee is heavily dependent upon the free movement of people, vehicles, and commerce. THP, TDOT, and City/County Agencies share the responsibility for achieving and maintaining the degree of order necessary to make this free movement possible. THP, TDOT, and City/County Agencies have the responsibility to do whatever is reasonable to reduce the risk to responders, secondary crashes, and delays associated with incidents, crashes, roadway maintenance, construction, and enforcement activities.

The following operating standards are based on the philosophy that the State Highway System will not be closed or restricted any longer than is absolutely necessary.

Be it resolved: Roadways will be cleared of damaged vehicles, spilled cargo, and debris as soon as it is safe to do so. It is understood that damage to vehicles or cargo may occur as a result of clearing the roadway on an urgent basis. While reasonable attempts to avoid such damage shall be taken, the highest priority is restoring traffic to normal conditions. Incident caused congestion has an enormous cost to society. This cost is significantly greater than the salvage value of an already damaged vehicle and its cargo.

Tennessee Highway Patrol Responsibilities

Members of the THP who respond to the scene of traffic incidents will make clearing the travel portion of the roadway a high priority. When an investigation is required, it will be conducted in as expedient a manner as possible considering the severity of the collision. Non-critical portions of the investigation may be delayed until lighter traffic conditions allow completion of those tasks. The THP will only close those lanes absolutely necessary to conduct the investigation safely. THP will coordinate with TDOT representatives to set up appropriate traffic control, establish alternate routes, expedite the safe movement of traffic trapped at the scene, and restore the roadway to normal as soon as possible.

Whenever practical, crashes on access controlled roadways will be removed to off ramps, accident investigation sites or other safe areas for completion of investigations to reduce the delays associated with motorists slowing to "gawk". Tow trucks will be requested a soon as it is evident that they will be needed to clear the roadway. THP will assure that all authorized tow operators have met established competency levels and that the equipment is of appropriate size, capacity and design meeting the standards for the State of Tennessee.

The THP will not unnecessarily cause the delay in reopening all or part of a roadway to allow a company to dispatch their own equipment to off-load cargo or recover a vehicle or load that is impacting traffic during peak traffic hours or creating a hazard to the public. The THP and TDOT will cooperate in planning and implementing clearance operations in the most safe and expeditious manner.

Tennessee Department of Transportation Responsibilities

When requested by the THP or City/County Agencies, TDOT will respond and deploy resources to major traffic incidents 24 hours a day, 7 days per week. Each TDOT District will develop and implement response procedures to meet the goal of providing initial traffic control within **30 minutes** of notification during normal working hours and **60 minutes** after hours and on weekends.

TDOT, in cooperation with the THP, will determine and deploy the necessary heavy equipment and manpower to reopen the roadway if clearance of the travel lanes are being delayed or is determined that the task is beyond the capabilities of the wrecker service on scene. If cargo or non-hazardous spilled loads are involved, TDOT will make every effort to assist in the relocation of the materials in the shortest possible time, using whatever equipment necessary. All such materials or any vehicles relocated by TDOT will be moved as short a distance as possible to eliminate the traffic hazard.

TDOT personnel will document all hours and equipment used for traffic control, roadway clearance, and debris clean up. TDOT will place traffic control devices at the scene should any damaged vehicles or cargo remain adjacent to the travel lanes on the shoulder for removal at a later time.

The THP and TDOT will continually work together to ensure that the needs of motorists on our roadways are being met in the most professional, safe, and efficient manner.

Local Law Enforcement, Fire and Rescue Department Responsibilities

Members of City/County Agencies who respond to the scene of traffic incidents will make clearing the travel portion of the roadway a high priority. When investigating an incident, the investigation will be conducted in as expedient a manner as possible considering the severity of the collision (serious injuries, fatality, or hazardous materials). City/County Agencies will close only those lanes absolutely necessary to safely conduct the fire/rescue operations. City/County Agencies will coordinate with TDOT representatives to set up appropriate traffic control, establish alternate routes, expedite the safe movement of traffic trapped at the scene, and restore the roadway to normal conditions as soon as possible. As soon as TDOT has set up appropriate traffic control for the safety of the responders and travelers, City/County Agencies will move any fire/rescue apparatus or vehicles initially used to shield responders to appropriate areas.

Therefore, it is agreed as follows:

The THP, TDOT, and City/County Agencies, will evaluate and continually update and modify their operating policies, procedures, rules, and standards to assure they are consistent with this **"OPEN ROADS POLICY"** MOU.

The THP, TDOT, and City/County Agencies, will research, evaluate and conduct training in the most advanced technologies, equipment, and approved methods for the documentation and investigation of crash or incident scenes. THP and City/County Agencies will prioritize the investigative tasks and reopen travel lanes upon completion of tasks that must be conducted, without the impediment of traffic flowing.

Roadways will be cleared as soon as possible. It is the goal of THP, TDOT, and City/County Agencies that **all incidents be cleared from the roadway within 90 minutes of the arrival of the first responding officer.** This goal is being made with the understanding that a more complex scenario may require additional time for complete clearance. Incidents that extend beyond the 90 minute goal will be assessed every 30 minutes to determine an expected clearance time and reported to the appropriate communications center.

City/County Agencies will determine the well-being of motorists in the event of a lengthy traffic queue and /or roadway closure and provide assistance to motorists within the stopped traffic queue whenever possible.

City/County Agencies will establish a local Highway Incident Management Committee that will include Local Law Enforcement, Fire and Rescue Departments and all other City/County agencies that respond to roadway incidents for the purpose of optimizing communication, coordination and collaboration at roadway incident scenes. The Committee will meet at least bi-monthly

It is further agreed that:

The THP, TDOT, and City/County Agencies, will actively solicit and enlist other state, county, and local agencies, political subdivisions, industry groups, and professional associations to endorse and become party to this **"OPEN ROADS POLICY"** for the State of Tennessee.

MOU Execution: ***Use of Counterpart Signature Pages***

This MOU, and any amendments hereto may be simultaneously executed in multiple counterparts, each of which so executed shall be deemed to be an original, and such counterparts together shall constitute one and the same instrument. Notwithstanding any other provision herein to the contrary, this MOU shall constitute an agreement amongst the parties that have executed a counterpart and parties listed but not executing shall not be deemed to be parties to the MOU.

In witness whereof, each party hereto has caused this document to be executed in its name and on its behalf by it's duly authorized Chief Executive.

TENNESSEE DEPARTMENT OF TRANSPORTATION

By: _____
Commissioner

Date: 10/12/2012

TENNESSEE DEPARTMENT OF SAFETY AND HOMELAND SECURITY

By: Bill Gibbons
Commissioner

Date: 9/19/12

Tennessee Department of Transportation

TRAFFIC OPERATIONS PROGRAM POLICY

Effective Date:

Title: Access to Live Video feeds and Information Sharing

POLICY

The Tennessee Department of Transportation (TDOT) will make live video of traffic conditions from Closed Circuit Television (CCTV) available to the public. CCTV feeds from the Regional Transportation Management Centers (RTMC), located in Nashville, Knoxville, Chattanooga, and Memphis, will be supplied through TDOT's SmartView CCTV web site. The video feeds provided are those made available by the RTMC Operators from the images on the traffic surveillance monitors within the RTMC and that are consistent with the objectives of traffic management.

Live video feeds will generally be made available upon request to other government and public agencies to better coordinate traffic management strategies on incidents and crashes, and to private news media and other organizations for their use in providing traffic information to the public or their customers.

A non-exclusive access Agreement is required in order for governmental and private interests to receive access to live video. Costs associated with the access connection, if any, will be determined by TDOT and may become the responsibility of the USER.

BACKGROUND

In order to gather real-time traffic condition information, TDOT has constructed and operates four Regional Traffic Management Centers located in Nashville, Knoxville, Chattanooga, and Memphis. The RTMC is the central collection point for roadway condition information. The RTMC support systems gather and disseminate traffic information using the latest technologies.

CCTV has proven to be a significant management and delay-reduction tool for the identification and verification of incidents and crashes, thereby enabling a proper and timely response. The sharing of video information enhances the communication of current traffic conditions, thereby aiding travelers in planning their trip times, routes, and travel mode using the latest available information. TDOT will operate and maintain the CCTV system for the purpose of enhancing traffic incident response on the Tennessee roadway system. TDOT wishes to share that traffic information with other transportation operating agencies, incident response agencies and the public.

Tennessee Department of Transportation
And
Responder Entity USERs

ACCESS AGREEMENT FOR LIVE VIDEO AND INFORMATION SHARING

This Access Agreement for Live Video and Information Sharing is an Agreement between the Tennessee Department of Transportation (TDOT) and _____hereafter referred to as the "USER."

The effective date of this Agreement is _____.

The "Access to Live Video" is that video provided by a Closed Circuit Television (CCTV) system developed for traffic management and provided by the Tennessee Department of Transportation Regional Transportation Management Centers (RTMC) operated by TDOT. The CCTV feeds will show live traffic conditions including crashes, stalled vehicles, road hazards, weather conditions, traffic congestion, maintenance work, and repair work locations.

The purpose of providing the USER with Access to Live Video is to detect and disseminate real-time traffic information to motorists and improve incident response and recovery. The following provisions of this Agreement are intended to ensure that the CCTV system is accessed and its information is used for this purpose and this purpose alone.

Information Sharing, as defined in this agreement, is that information provided or discovered by the USER which has an adverse traffic impact on any Tennessee Interstate, State Route, and that which adversely affects travelers. Any information that falls within this definition will be shared with the TDOT RTMC within 10 minutes of receiving such information. See section 2.I.

The USER hereby acknowledges and agrees that other matters not specifically addressed in this Agreement may arise and that TDOT shall have the right to make changes in this Agreement, by adding provisions, deleting provisions, and/or changing existing provisions when in TDOT's opinion circumstances require such changes. TDOT shall provide prior written notice of any such changes to this Agreement to the USER at which time the USER may or may not accept the revisions. Not accepting future revisions may result in the USER being denied access to the live video feeds.

USER shall also retain the right to terminate this Agreement as provided herein.

1. **GENERAL INFORMATION:**

A. TDOT will operate and maintain the CCTV system as a traffic management tool and, consistent with this purpose, TDOT agrees to provide the USER with Access to Live Video and Information Sharing. TDOT does not guarantee the continuity of this access, and TDOT does not warrant the quality of any video image or the accuracy of any image or information provided. Any reliance on such images or information is at the risk of the USER.

B. TDOT will not record video feeds except for staff training purposes, and no files will be made available to the USER under this Agreement.

C. TDOT will maintain exclusive control of the information and images released from the CCTV system to the USER, including but not limited to determining whether and when to provide a CCTV system feed, from what location, and for what duration. No feed will deploy the cameras' zoom capabilities, and no image will focus on vehicle license plates, drivers, or other personal identification of individuals involved in any traffic-related incident. No image will focus on any property or person outside the TDOT right-of-way. Access via feed will not be provided for events that are not, in the opinion of TDOT personnel, traffic-related. The decision whether to activate, and upon activation to terminate the access, is exclusively at the discretion of TDOT personnel.

D. TDOT RTMC personnel will not accept requests that specific CCTV cameras are operated or repositioned.

E. TDOT will provide each USER the same video feed from the CCTV system as any other USER participating in this Agreement. This Agreement in no way limits or restricts TDOT from providing video information to any other potential USER.

F. TDOT reserves the right to terminate this video access program or to change the areas, times, or levels of access within the RTMC at any time.

G. TDOT will provide training opportunities to all entities named in this Agreement and encourage participation in said training.

2. **USER'S RESPONSIBILITIES:**

A. USER is exclusively responsible for any costs related to the purchase and installation of the equipment necessary to receive the live video feed. User will be required to remove previously installed equipment from the RTMC (if any). USER is exclusively responsible for any costs related to the removal of this equipment. USER must give RTMC personnel

reasonable advance notice to schedule an appointment to remove equipment and RTMC personnel reserve the right to schedule such at a time and in such a manner so as to not interrupt or otherwise obstruct RTMC operations. USER staff at the RTMC shall be under the general direction of the RTMC Manager for routine conduct, privileges, and protocols within the RTMC.

B. USER shall maintain the security and integrity of the CCTV system by limiting use of the system to trained and authorized individuals within their agency, and by insuring the system is used for the specific purpose stated in this Agreement. No feed shall be purposely broadcast live or rebroadcast that is zoomed in on an incident where individuals or license numbers are recognizable.

C. USER accepts all risks inherent with the live video feeds, including, but not limited to, interruptions in the video feeds, downtime for maintenance, or unannounced adjustments to the camera displays. TDOT is providing the video feeds as a convenience to the USER and agrees to provide a good faith effort to maintain the video feed from TDOT equipment. The USER agrees to hold TDOT harmless, including TDOT employees and TDOT designated agents, from any damages caused to USER by loss of a video signal due to equipment failure or any act or omission on their part.

D. USER agrees to provide TDOT with a technical contact person and with a list of all USER personnel trained to operate the TDOT SmartView system. USER shall limit technical calls to the RTMC for monitoring, diagnosing problems or otherwise performing any minor service on the SmartView system.

E. USER agrees to acknowledge that the video feeds are provided by the Tennessee Department of Transportation.

F. USER agrees to display the SMARTWAY logo in the upper left hand corner of any view provided outside of the agency.

G. USER agrees to actively participate in the National Traffic Incident Management Responder Training Program. USER agrees that any employee of the agency reporting to the scene of an incident shall attend one 4-hour, in-person, National Traffic Incident Responder Training Program session within one year of the signing of this document. Training sessions will be provided for free and coordinated between the USER and TDOT.

H. USER agrees to support and abide by the concept of a safe and quick clearance approach to traffic incidents and events, as defined by the National Traffic Incident Responder Training Program.

I. USER agrees to provide timely, accurate information and assistance to TDOT or other agencies, responders and roadway users about roadway conditions, major and minor incidents and alternate routes through the use of any USER resources.

i. USER agrees to notify the RTMC of their surrounding TDOT Region of any unexpected incidents that are expected to have an adverse impact on traffic operations of Interstate or State Routes, within 10 minutes of first notification to the USER. This applies to any incident where TDOT or the Tennessee Highway Patrol is not already on-scene. Unexpected incidents may include, but are not limited to: traffic crashes, disabled vehicles, roadway debris, hazardous weather conditions, traffic queues, or traffic signal failures.

ii. USER agrees to collaborate with TDOT with respect to traffic management of planned events that are expected to have an adverse impact on traffic operations of Interstate or State Routes. Planned events include temporary traffic generating events (such as concerts or fairs) and roadway work zone activities (such as construction or maintenance activities). Collaboration and information sharing between USER and TDOT should occur as early as possible.

J. USER agrees to actively participate in quarterly Regional Traffic Incident Management meetings. USER agrees to provide the names of a primary and alternate individual with the authority to speak on behalf of the USER at these quarterly meetings.

3. **LIABILITY AND INDEMNITY PROVISIONS:**

A. USER agrees to defend, indemnify, and hold TDOT harmless from and against any and all liability and expense, including defense costs and legal fees, caused by any negligent or wrongful act or omission of the USER, or its agents, officers, and employees, in the use, possession, or dissemination of information made available from the CCTV system to the extent that such expenses or liability may be incurred by TDOT, including but not limited to, personal injury, bodily injury, death, property damage, and/or injury to privacy or reputation.

B. The liability obligations assumed by the USER pursuant to this Agreement shall survive the termination of the Agreement, as to any and all claims including without limitation liability for any damages to TDOT property or for injury, death, property damage, or injury to personal reputation or

privacy occurring as a proximate result of information made available from the CCTV system.

4. **TERMINATION:**

A. TDOT or USER may terminate this Agreement at any time for any reason by providing written notice of termination.

State of Tennessee
Department of Transportation

Approved as to Form:

By:_____ _____
John Schroer John Reinbold
Commissioner General Counsel

Date:_____

USER AGENCY_____

By_____

(Print Name)_____

(Title)_____

Date:_____

Approved by Legal Counsel for USER AGENCY

By_____

(Print Name)_____

(Title)_____

Date:_____

Live CCTV Video Access Agreement Between
Tennessee Department of Transportation
And
Private Entity Users

Tennessee Department of Transportation
And
Private Entity Users

ACCESS AGREEMENT FOR LIVE VIDEO

This Access Agreement for Live Video (Agreement), is an agreement between the Tennessee Department of Transportation (TDOT) and InterLink USA, hereinafter referred to as the "USER."

The effective date of this Agreement is Jan. 1, 2013.

The "Access to Live Video" is that video provided by a Closed Circuit Television (CCTV) system developed for traffic management and provided by the Knoxville Transportation Management Center (TMC) which is operated by TDOT. The CCTV images will show live traffic conditions including crashes, stalled vehicles, road hazards, weather conditions, traffic congestion, and maintenance and repair work locations.

The purpose of providing the USER with Access to Live Video is to disseminate real-time traffic information to motorists and public safety agencies. The following provisions of this Agreement are intended to ensure that the CCTV system is accessed and its information used for this purpose, and this purpose alone.

The USER hereby acknowledges that other matters not addressed in this Agreement may arise after the signing of this agreement. Therefore, TDOT reserves the right to amend this Agreement, by adding provisions, deleting provisions, and/or changing existing provisions when in TDOT's opinion circumstances require such changes. TDOT shall provide prior written notice of any such changes in this Agreement. USER shall retain the right to terminate this Agreement as provided hereinbelow.

A. GENERAL INFORMATION:

1. TDOT will operate and maintain the CCTV system as a traffic management tool and, consistent with this purpose, TDOT agrees to provide the USER with Access to Live Video. TDOT does not guarantee the continuity of this access, and TDOT does not warrant the quality of any video image or the accuracy of any image or information provided. Any reliance on such images or information is at the risk of the USER.

2. TDOT will not record video images except for staff training purposes, and no videotapes will be made available to the USER under this Agreement.

3. TDOT will maintain exclusive control of the information and images released from the CCTV system to the USER, including but not limited to determining whether and when to provide a CCTV system feed, from what location, and for what duration. No feed will deploy the cameras' zoom capabilities, and no image will focus on vehicle license plates, drivers, or other personal identification of individuals involved in any traffic-related incident. No image will focus on any property or person outside the TDOT right-of-way. Access via feed will not be provided for events that are not, in the opinion of TDOT personnel, traffic-related. The decision whether to activate, and upon activation to terminate the access, is exclusively at the discretion of TDOT personnel.

4. TMC personnel will not accept requests that specific CCTV cameras be operated or that cameras be repositioned.

5. Each USER will receive the same video feed from the CCTV system as any other USER participating in this Agreement. This Agreement in no way limits or restricts TDOT from providing video information to any other potential USER.

6. TDOT reserves the right to terminate this video access program or to change the areas, times, or levels of access within the TMC at any time.

7. TDOT cannot guarantee camera availability to USER.

8. TDOT will provide approximately 10 units of rack space and up to six 120 volt electrical outlets for USER equipment. The electrical outlets will be on a UPS of sufficient size to handle a total load of fifteen amperes. The space and electrical will be provided at the Knoxville Transportation Management Center.

9. TDOT will provide up to two 10/100 Megabit ports on the main network switch located at Knoxville Transportation Management Center for connection of up to two MPEG video decoder(s) appliances. Any additional ports will have to be approved by TDOT prior to connection.

10. TDOT will allow USER to access the video multicast streams from all TDOT Region 1 cameras unless there is an operational reason not to do so. TDOT expressly prohibits USER from attempting to gain any other type of access to the cameras including, but not limited to, taking operational control of the cameras or any other TDOT owned device.

11. TDOT reserves the right, for operational reasons, to temporarily block camera images/streams from going to the internet. TDOT may use any method it deems necessary to accomplish this, including the removal of USER's network connection(s). TDOT agrees that the preferred method would be a software solution provided by USER at no cost to TDOT.

B. USER'S RESPONSIBILITIES:

1. USER may install necessary equipment at the TMC in order to obtain the video feed; the USER is exclusively responsible for any costs related to the purchase and installation of the equipment. TDOT personnel shall determine at what location within the TMC the equipment is to be placed, and TDOT reserves the right to inspect all installation of equipment. Under no circumstances shall the placement and installation of USER's equipment interfere with TMC equipment or activities of TMC personnel. The responsibility for the service, maintenance, and upkeep of the installed equipment is exclusively that of the USER. USER must give TMC personnel reasonable advance notice of any maintenance/repair visits, and TMC personnel reserves the right to schedule such visits at a time and in such a manner so as to not interrupt or otherwise obstruct TMC operations. USER assumes any and all liability for the cost of any repair and/or other damages to TDOT's CCTV system caused in any manner by the installation, servicing or maintenance of the USER's equipment or by the equipment once installed. USER staff at the TMC shall be under the general direction of the TMC Manager for routine conduct, privileges, and protocols within the TMC.

2. USER shall maintain the security and integrity of the CCTV system by limiting use of the system to trained and authorized individuals, and by insuring the system is used for the specific purpose stated in this Agreement. No feed shall be purposely broadcast live or rebroadcast that is zoomed in on an accident where individuals or license numbers are recognizable.

3. USER agrees to move or alter, at its own expense, any of its equipment, hardware, or software, as TDOT deems necessary to accommodate future alterations, improvements, or other changes to the TMC equipment or facilities.

4. USER accepts all risks inherent with the live video feeds, including, but not limited to, interruptions in the video feed, downtime for maintenance, or unannounced adjustments to the camera displays. TDOT is providing the video feeds as a convenience to the private media company and agrees to provide a good faith effort to maintain the video feed from TDOT equipment. The USER agrees to hold TDOT harmless, including TDOT employees and TDOT-designated agents, from any damages caused by loss of a video signal due to equipment failure or any unintentional act on their part.

5. USER agrees to provide TDOT with a technical contact person and with a list of all USER's owned and supplied equipment connected to the TMC, including the basic operational capabilities of such equipment. USER shall limit calls to the TMC for monitoring, diagnosing problems or otherwise performing any minor service on USER owned and supplied equipment.

6. USER agrees to acknowledge the video images are provided by the Tennessee Department of Transportation both verbally and by including the vertical or horizontal orientation of the TDOT SmartWay logo on the camera image.

7. USER will provide TDOT with an easily accessible mechanism to block one or more camera images/streams from the internet.

8. USER will only have access to the Region 1 TMC equipment room when accompanied by a TDOT employee. USER will schedule access by calling TMC personnel ahead of time.

9. USER will be allowed to place up to two rack mounted video MPEG decoder appliances, each capable of decoding one video stream at a time, into the provided rack space at the Knoxville Transportation Management Center. Any additional decoders will have to be approved by TDOT prior to connection.

10. USER will be allowed to place up to two rack mounted servers into the provided rack space at the Knoxville Transportation Management Center. These servers will not be connected to the TDOT network. They will access video streams only via an analog connection to the decoder(s) placed by USER. Any additional servers will have to be approved by TDOT prior to connection.

C. LIABILITY AND INDEMNITY PROVISIONS:

1. The USER agrees to defend, indemnify, and hold TDOT harmless from and against any and all liability and expense, including defense costs and legal fees, caused by any negligent or wrongful act or omission of the USER, or its agents, officers, and employees, in the use, possession, or dissemination of information made available from the CCTV system to the extent that such expenses or liability may be incurred by TDOT, including but not limited to, personal injury, bodily injury, death, property damage, and/or injury to privacy or reputation.

2. The liability obligations assumed by the USER pursuant to this Agreement shall survive the termination of the Agreement, as to any and all claims including without limitation liability for any damages to TDOT property or for injury, death, property damage, or injury to personal reputation or privacy occurring as a proximate result of information made available from the CCTV system.

D. TERMINATION:

1. TDOT or USER may terminate this Agreement at any time for any reason by providing written notice of termination.

2. Upon termination of this Agreement by either party, the USER shall promptly remove its equipment from the TMC as directed by TDOT.

State of Tennessee
Department of Transportation

By:_____ Date: FEB 2 0 2013
JOHN SCHROER
Commissioner

Approved as to Form:

By:_____ Date: 2/8/13
General Counsel

InterLink USA

By_____

(Print Name) Jeffrey R. Dobson, Ph.D.

(Title) President

Date: Jan. 29, 2013

Approved by Legal Counsel for USER AGENCY

By_____

(Print Name)_____

(Title)_____

Date:_____

Tennessee Department of Transportation

TRAFFIC OPERATIONS PROGRAM POLICY

Effective Date:

Title: Access to Live Video feeds and Information Sharing

POLICY

The Tennessee Department of Transportation (TDOT) will make live video of traffic conditions from Closed Circuit Television (CCTV) available to the public. CCTV feeds from the Regional Transportation Management Centers (RTMC), located in Nashville, Knoxville, Chattanooga, and Memphis, will be supplied through TDOT's SmartView CCTV web site. The video feeds provided are those made available by the RTMC Operators from the images on the traffic surveillance monitors within the RTMC and that are consistent with the objectives of traffic management.

Live video feeds will generally be made available upon request to other government and public agencies to better coordinate traffic management strategies on incidents and crashes, and to private news media and other organizations for their use in providing traffic information to the public or their customers.

A non-exclusive access Agreement is required in order for governmental and private interests to receive access to live video. Costs associated with the access connection, if any, will be determined by TDOT and may become the responsibility of the USER.

BACKGROUND

In order to gather real-time traffic condition information, TDOT has constructed and operates four Regional Traffic Management Centers located in Nashville, Knoxville, Chattanooga, and Memphis. The RTMC is the central collection point for roadway condition information. The RTMC support systems gather and disseminate traffic information using the latest technologies.

CCTV has proven to be a significant management and delay-reduction tool for the identification and verification of incidents and crashes, thereby enabling a proper and timely response. The sharing of video information enhances the communication of current traffic conditions, thereby aiding travelers in planning their trip times, routes, and travel mode using the latest available information. TDOT will operate and maintain the CCTV system for the purpose of enhancing traffic incident response on the Tennessee roadway system. TDOT wishes to share that traffic information with other transportation operating agencies, incident response agencies and the public.

Tennessee Department of Transportation
And
Government Entity USERs

ACCESS AGREEMENT FOR LIVE VIDEO AND INFORMATION SHARING

This Access Agreement for Live Video and Information Sharing is an Agreement between the Tennessee Department of Transportation (TDOT) and _____ hereafter referred to as the "USER."

The effective date of this Agreement is _____.

The "Access to Live Video" is that video provided by a Closed Circuit Television (CCTV) system developed for traffic management and provided by the Tennessee Department of Transportation Regional Transportation Management Centers (RTMC) operated by TDOT. The CCTV feeds will show live traffic conditions including crashes, stalled vehicles, road hazards, weather conditions, traffic congestion, maintenance work, and repair work locations.

The purpose of providing the USER with Access to Live Video is to detect and disseminate real-time traffic information to motorists and improve incident response and recovery. The following provisions of this Agreement are intended to ensure that the CCTV system is accessed and its information is used for this purpose and this purpose alone.

Information Sharing, as defined in this agreement, is that information provided or discovered by the USER which has an adverse traffic impact on any Tennessee Interstate, State Route, and that which adversely affects travelers. Any information that falls within this definition will be shared with the TDOT RTMC within 10 minutes of receiving such information pursuant to section 2.I.

The USER hereby acknowledges and agrees that other matters not specifically addressed in this Agreement may arise and that TDOT shall have the right to make changes in this Agreement, by adding provisions, deleting provisions, and/or changing existing provisions when in TDOT's opinion circumstances require such changes. TDOT shall provide prior written notice of any such changes to this Agreement to the USER at which time the USER may or may not accept the revisions. Not accepting future revisions may result in the USER being denied access to the live video feeds.

USER shall also retain the right to terminate this Agreement as provided herein.

1. **GENERAL INFORMATION:**

A. TDOT will operate and maintain the CCTV system as a traffic management tool and, consistent with this purpose, TDOT agrees to provide the USER with Access to Live Video and Information Sharing. TDOT does not guarantee the continuity of this access, and TDOT does not warrant the quality of any video image or the accuracy of any image or information provided. Any reliance on such images or information is at the risk of the USER.

B. TDOT will not record video feeds except for staff training purposes, and no files will be made available to the USER under this Agreement.

C. TDOT will maintain exclusive control of the information and images released from the CCTV system to the USER, including but not limited to determining whether and when to provide a CCTV system feed, from what location, and for what duration. No feed will deploy the cameras' zoom capabilities, and no image will focus on vehicle license plates, drivers, or other personal identification of individuals involved in any traffic-related incident. No image will focus on any property or person outside the TDOT right-of-way. Access via feed will not be provided for events that are not, in the opinion of TDOT personnel, traffic-related. The decision whether to activate, and upon activation to terminate the access, is exclusively at the discretion of TDOT personnel.

D. TDOT RTMC personnel will not accept requests that specific CCTV cameras are operated or repositioned.

E. TDOT will provide each USER the same video feed from the CCTV system as any other USER participating in this Agreement. This Agreement in no way limits or restricts TDOT from providing video information to any other potential user.

F. TDOT reserves the right to terminate this video access program or to change the areas, times, or levels of access within the RTMC at any time.

G. TDOT will provide training opportunities to all entities named in this Agreement and encourage participation in said training.

2. **USER'S RESPONSIBILITIES:**

A. USER is exclusively responsible for any costs related to the purchase and installation of the equipment necessary to receive the live video feed. User will be required to remove previously installed equipment from the RTMC (if any). USER is exclusively responsible for any costs related to the removal of this equipment. USER must give RTMC personnel reasonable advance notice to schedule an appointment to remove equipment and RTMC personnel reserve the right to schedule such at a time and in such a manner so as to not interrupt or otherwise obstruct RTMC operations. USER staff at the RTMC shall be under the

general direction of the RTMC Manager for routine conduct, privileges, and protocols within the RTMC.

B. USER shall maintain the security and integrity of the CCTV system by limiting use of the system to trained and authorized individuals within their agency, and by insuring the system is used for the specific purpose stated in this Agreement. No feed shall be purposely broadcast live or rebroadcast that is zoomed in on an incident where individuals or license numbers are recognizable.

C. USER accepts all risks inherent with the live video feeds, including, but not limited to, interruptions in the video feeds, downtime for maintenance, or unannounced adjustments to the camera displays. TDOT is providing the video feeds as a convenience to the USER and agrees to provide a good faith effort to maintain the video feed from TDOT equipment. USER agrees that it shall not seek to hold TDOT, including TDOT employees and TDOT designated agents, liable for any damages caused to USER by loss of a video signal due to equipment failure or any act or omission on their part.

D. USER agrees to provide TDOT with a technical contact person and with a list of all USER personnel trained to operate the TDOT SmartView system. USER shall limit technical calls to the RTMC for monitoring, diagnosing problems or otherwise performing any minor service on the SmartView system.

E. USER agrees to acknowledge that the video feeds are provided by the Tennessee Department of Transportation.

F. USER agrees to display the SMARTWAY logo in the upper left hand corner of any view provided outside of the agency.

G. USER agrees to actively participate in the National Traffic Incident Management Responder Training Program. USER agrees that any employee of the agency reporting to the scene of an incident shall attend one 4-hour, in-person, National Traffic Incident Responder Training Program session within one year of the signing of this document. Training sessions will be provided for free and coordinated between the USER and TDOT.

H. USER agrees to support and abide by the concept of a safe and quick clearance approach to traffic incidents and events, as defined by the National Traffic Incident Responder Training Program.

I. USER agrees to provide timely, accurate information and assistance to TDOT or other agencies, responders and roadway users about roadway conditions, major and minor incidents and alternate routes through the use of any USER resources.

   i. USER agrees to notify the RTMC of their surrounding TDOT Region of any unexpected incidents that are expected to have an adverse impact on traffic operations of Interstate or State Routes, within 10 minutes of first notification to the USER. This applies to any incident where TDOT or the

Tennessee Highway Patrol is not already on-scene. Unexpected incidents may include, but are not limited to: traffic crashes, disabled vehicles, roadway debris, hazardous weather conditions, traffic queues, or traffic signal failures.

ii. USER agrees to collaborate with TDOT with respect to traffic management of planned events that are expected to have an adverse impact on traffic operations of Interstate or State Routes. Planned events include temporary traffic generating events (such as concerts or fairs) and roadway work zone activities (such as construction or maintenance activities). Collaboration and information sharing between USER and TDOT should occur as early as possible.

J. USER agrees to actively participate in quarterly Regional Traffic Incident Management meetings. USER agrees to provide the names of a primary and alternate individual with the authority to speak on behalf of the USER at these quarterly meetings.

3. **LIABILITY AND INDEMNITY PROVISIONS:**

A. To the extent permitted by applicable law, USER agrees that it shall be solely responsible for any and all liability and expense, including defense costs and legal fees, caused by any negligent or wrongful act or omission of the USER, or its agents, officers, and employees, in the use, possession, or dissemination of information made available from the CCTV system, including but not limited to, personal injury, bodily injury, death, property damage, and/or injury to privacy or reputation.

B. To the extent permitted by applicable law, the liability obligations assumed by the USER pursuant to this Agreement shall survive the termination of the Agreement, as to any and all claims arising under paragraph 3.A., including without limitation liability for any damages to TDOT property or for injury, death, property damage, or injury to personal reputation or privacy occurring as a proximate result of information made available from the CCTV system.

4. **TERMINATION:**

A. TDOT or USER may terminate this Agreement at any time for any reason by providing written notice of termination.

State of Tennessee
Department of Transportation

By: _____ _____
John Schroer Date
Commissioner

Approved as to Form:

By: _____ _____
John Reinbold Date
General Counsel

USER AGENCY_____

By: _____

(Print Name): _____

(Title): _____

Date: _____

Approved by Legal Counsel for USER AGENCY

By: _____

(Print Name): _____

(Title): _____

Date: _____

Technical Contact Person:

(Please Print)

Name: _____

Email: _____

Phone: _____

Other Contact Person (Optional**):**

Name: _____

Email: _____

Phone: _____

Other Contact Person (Optional**):**

Name: _____

Email: _____

Phone: _____

APPENDIX F – REGIONAL ITS ARCHITECTURE MAINTENANCE FORM

Bristol Regional ITS Architecture
Maintenance Form

Please complete the following form to document changes to the 2017 Bristol Regional ITS Architecture. Forms should be submitted to the Bristol Metropolitan Planning Organization (MPO) for review and acceptance. All accepted changes will be kept on file by the MPO and shared with the TDOT Traffic Operations Division. Changes will be incorporated into the 2017 Bristol 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 service 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 service packages that impact only one agency in the Regional ITS Architecture.
  Examples include: Addition of a new ITS service package or changes to data flow connections of an existing ITS service package. The addition or changes would only impact a single agency.
- ☐ Functional Change – Multiple Agencies: Structural changes to the ITS service packages that have the potential to impact multiple agencies in the Regional ITS Architecture.
  Examples include: Addition of a new ITS service package or changes to data flow connections of an existing ITS service 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:

Bristol Metropolitan Planning Organization
104 8th Street
Bristol, TN 37621
Phone: 423-989-5519
E-mail: rmontgomery@bristoltn.org

Form Submittal Date: _____

Bristol Regional ITS Architecture
Maintenance Form

Question 1 Describe the requested change to the Regional ITS Architecture or Deployment Plan.	
Question 2 Are any of the Regional ITS Architecture service packages impacted by the proposed change?	☐ Yes: Please complete Questions 2A and 2B ☐ No: Please proceed to Question 3 ☐ Unknown: Please coordinate with the Bristol MPO to determine impacts of the change to the Regional ITS Architecture
Question 2A List all of the ITS service packages impacted by the proposed change.	
Question 2B Include a copy of the ITS service packages impacted by the proposed change and mark any proposed modifications to the ITS service packages. Add any additional notes on proposed changes in this section.	
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 Bristol 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.	
Question 3B Describe the coordination that has occurred with the stakeholder agencies and the results of the coordination?	

Bristol Region
Regional ITS Architecture
Maintenance Form (Example of Completed 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 service packages impacted by the proposed change?	☑ Yes: Please complete Questions 2A and 2B ☐ No: Please proceed to Question 3 ☐ Unknown: Please coordinate with the Bristol MPO to determine impacts of the change to the Regional ITS Architecture
Question 2A List all of the ITS service packages impacted by the proposed change.	*Example: ATMS08 – Traffic Incident Management System* *ATMS01 – Network Surveillance*
Question 2B Include a copy of the ITS service packages impacted by the proposed change and mark any proposed modifications to the ITS service packages. Add any additional notes on proposed changes in this section.	*Example: A sketch of the ATMS08 – Traffic Incident Management System service 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 service package diagram. (Note: The ITS service 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 Bristol 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.*