



Tennessee Department of Transportation
Regional ITS Architectures and Deployment Plans

Bristol Region

Regional ITS Deployment Plan

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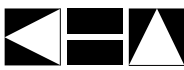
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LIST OF ACRONYMS

AD	Archived Data
APTS	Advanced Public Transportation System
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
BTT	Bristol Tennessee Transit
BVT	Bristol Virginia Transit
CAD	Computer Aided Dispatch
CCTV	Closed Circuit Television
DMS	Dynamic Message Sign
EM	Emergency Management
EMA	Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GPS	Global Positioning System
HAR	Highway Advisory Radio
HRI	Highway Rail Intersection
ITS	Intelligent Transportation System
MC	Maintenance and Construction
MDT	Mobile Data Terminal
MP	Milepost
MPO	Metropolitan Planning Organization
SSP	Safety Service Patrol
TDOT	Tennessee Department of Transportation
TMC	Transportation Management Center or Traffic Management Center
TN	Tennessee
TOC	Traffic Operations Center
TSIS	TDOT SmartWay Information System
VA	Virginia
VDOT	Virginia Department of Transportation

1. INTRODUCTION

1.1 Project Overview

The Bristol Region has developed a Regional Intelligent Transportation System (ITS) Architecture under the direction of the Tennessee Department of Transportation (TDOT) with support from the Bristol Metropolitan Planning Organization (MPO) and Virginia Department of Transportation (VDOT). ITS architectures provide a framework for implementing ITS projects, encourage interoperability and resource sharing among agencies, identify applicable standards to apply to projects, and allow for cohesive long-range planning among regional stakeholders. The Bristol Regional ITS Architecture focuses on the functionality that ITS provides in the Region as well as how those functions can operate for agencies in and around the Bristol Region. The Regional ITS Architecture also satisfies an important requirement from the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) regarding transportation funding. An FHWA Final Rule and an FTA Final Policy issued in 2001 require that regions develop an ITS architecture and show how ITS projects conform to that regional ITS architecture in order to receive federal funding.

The ITS Deployment Plan, while not required by FHWA and FTA, is a useful tool for regions to identify specific projects that are able to be deployed in order to implement their ITS Architecture. The ITS Deployment Plan builds on the 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 ITS Deployment Plan also shows the correlation between each project and the ITS Architecture by identifying the market packages that correspond with each project. If projects are identified that do not correspond to a market package, the ITS Architecture can be revised while in draft format; therefore, the resulting ITS deployment projects from this effort should be clearly supported by the ITS Architecture.

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

1.2 Document Overview

The Bristol Regional ITS Deployment Plan is organized into four key sections:

Section 1 – Introduction

This section provides an overview of the Bristol Regional ITS Deployment Plan and the key features and stakeholders in the Bristol Region.

Section 2 –Regional ITS Architecture Market Package Implementation

A summary of the market packages selected and prioritized for the Region is provided in this section. Each market package is defined and is accompanied by a listing of projects that support implementation of the market package services.

Section 3 – Project Recommendations

This section contains project recommendations to address stakeholder needs and goals for ITS implementation in the Region. Each project includes a description of the project, the responsible agency or agencies, an opinion of probable cost and whether or not funding was identified, deployment timeframe, and a listing of market packages associated with the project.

Section 4 – Maintaining the Regional ITS Deployment Plan

A brief description of the maintenance procedure for the Regional ITS Deployment Plan is provided in this section.

1.3 Bristol Region

1.3.1 Region Overview

The Bristol Region is defined by the boundaries of the Bristol MPO (which contains the eastern part of Sullivan County Tennessee and the southern portion of Washington County Virginia) plus the remainder of Washington County in Virginia. Included within the regional boundaries are: the City of Bristol, Tennessee; the City of Bristol, Virginia; and the Town of Abingdon, Virginia.

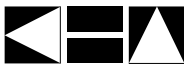
The Bristol Region is adjacent to the Johnson City Region and the Kingsport Region. The Johnson City Regional ITS Architecture was completed in 2006 and the Kingsport Regional ITS Architecture was developed concurrently with the Bristol Region. The close proximity to the Kingsport Region and the fact that both Regions are located in TDOT Region 1 and Sullivan County, Tennessee created an overlap in many of the stakeholders. As detailed in the Regional ITS Architecture, three of the four workshops held during the development process were conducted in coordination with workshops being held for the Kingsport Region to facilitate coordination and consistency.

1.3.2 Stakeholders

ITS often extends beyond traditional transportation infrastructure; therefore, the involvement of non-traditional stakeholders, such as police and fire, is important in the architecture development and visioning process. Input from these stakeholders, both public and private, is a crucial part of defining the interfaces, integration needs, and overall vision for ITS in a region.

The following stakeholder agencies have participated in the Bristol Region project workshops or provided input to the study team:

- Bristol MPO;
- City of Bristol TN;
- City of Bristol TN Fire Department;
- City of Bristol TN Police Department;
- City of Bristol VA;
- Federal Highway Administration – Tennessee Division;
- Johnson City Metropolitan Transportation Planning Organization;
- Sullivan County Sheriff's Office;
- Tennessee Department of Transportation – Long-Range Planning Division;
- Tennessee Department of Transportation – Region 1;
- Tennessee Highway Patrol;



- Virginia Department of Transportation – Bristol District;
- Virginia Department of Transportation – Operations and Securities Division;
- Virginia Department of Transportation – Southwestern Region;
- Virginia Department of Transportation – Southwest Regional Operations (Salem TMC);
- Virginia State Police Area 27 Office.

A more detailed list of stakeholders, including the individuals representing each agency, is provided in the Regional ITS Architecture report.

2. REGIONAL ITS ARCHITECTURE MARKET PACKAGE IMPLEMENTATION

Of the 91 market packages available in Version 6.0 of the National ITS Architecture, 32 were selected by stakeholders and customized for deployment in the Bristol Region as part of the Regional ITS Architecture development process. The market packages outline the functions that stakeholders envision ITS to perform in coming years. The Regional ITS Deployment Plan builds on those market packages through the development of project concepts to implement in the Region.

2.1 Market Package Prioritization

Stakeholders were asked to prioritize the market packages into high, medium, and low priorities based on regional needs, feasibility, likelihood of deployment, and overall contribution of the market package to the goals and vision for ITS functionality in the Region. A summary of these prioritized market packages is shown in **Table 1**. More detail on the market packages is provided in the Bristol Regional ITS Architecture report.

Table 1 – Bristol Market Package Prioritization by Functional Area

High Priority Market Packages		Medium Priority Market Packages		Low Priority Market Packages	
<i>Travel and Traffic Management</i>					
ATMS01	Network Surveillance	ATMS07	Regional Traffic Management	ATMS15	Railroad Operations Coordination
ATMS03	Surface Street Control	ATMS13	Standard Railroad Grade Crossing		
ATMS06	Traffic Information Dissemination				
ATMS08	Traffic Incident Management System				
<i>Emergency Management</i>					
EM01	Emergency Call-Taking and Dispatch	EM04	Roadway Service Patrols		
EM02	Emergency Routing	EM08	Disaster Response and Recovery		
EM06	Wide-Area Alert	EM09	Evacuation and Reentry Management		
EM10	Disaster Traveler Information				
<i>Maintenance and Construction Management</i>					
MC03	Road Weather Data Collection	MC01	Maintenance and Construction Vehicle and Equipment Tracking	MC06	Winter Maintenance
MC04	Weather Information Processing and Distribution				
MC08	Work Zone Management				
MC10	Maintenance and Construction Activity Coordination				

Table 1 – Bristol Market Package Prioritization by Functional Area (continued)

High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
Public Transportation Management		
APTS01 Transit Vehicle Tracking	APTS04 Transit Fare Collection Management	
APTS02 Transit Fixed-Route Operations	APTS07 Multi-modal Coordination	
APTS03 Demand Response Transit Operations	APTS08 Transit Traveler Information	
APTS05 Transit Security	APTS10 Transit Passenger Counting	
Traveler Information		
ATIS01 Broadcast Traveler Information		
ATIS02 Interactive Traveler Information		
Archived Data Management		
	AD1 ITS Data Mart	AD2 ITS Data Warehouse

The market package prioritization was a primary factor in developing recommendations for ITS deployment and integration in the Bristol Region. These priorities identified the key ITS services desired by stakeholders in the Bristol Region, as well as the interfaces that need to be established to provide integrated functionality and establish communication between elements. The high, medium, and low prioritization does not necessarily correspond to any specific time frame (such as five-, ten-, or twenty-year deployment horizon). For example, a market package can be a high priority, but due to funding needs or prerequisite project requirements, deployment might not be feasible for several years. Maturity and availability of technology were also considered in prioritizing the market packages along with determining if the market package was more suitable for private deployment and operations or public sector deployment.

2.2 Market Packages and Supporting Projects

In order to implement the ITS market package services in the Bristol Region, each market package was reviewed to determine which projects should be deployed. Stakeholders provided a great deal of feedback on these projects at an ITS Deployment Plan Workshop. Although the timeframe of the Regional ITS Deployment Plan extended twenty years, stakeholders generally focused on identifying shorter term projects that were more likely to be funded.

Not every market package has an associated ITS project. Several market packages were identified as being important to the Region; however, at this time stakeholders decided there were no projects feasible enough to document in the ITS Deployment Plan. In the future, additional projects will likely be added to the ITS Deployment Plan to implement these market packages.

The market packages in the following subsections are organized by service areas in the order they appear in the National ITS Architecture. Each market package includes:

- A brief definition of the market package (which were modified from the National ITS Architecture definitions);
- Stakeholder priority for the market package;

- Recommended projects that will address some or all of the services that are contained in the market package; and
- Additional projects that support the services that are contained in the market package (if applicable).

The projects listed in the Recommended Projects section of the market package tables are those that can be directly tied back to the particular market package. The projects listed in the Additional Supporting Projects section will support the market package but are not a specific part of the market package. For example, the City of Bristol TN Traffic Operations Center (TOC) Coordination with TDOT Region 1 TMC – Knoxville project will support network surveillance capabilities for the City of Bristol TN in the ATMS01 – Network Surveillance market package, but the connection between the TDOT Region 1 TMC and the City of Bristol TN TOC is not a part of the ATMS01 market package. Rather, the connection between the TDOT Region 1 TMC and the City of Bristol TN TOC is part of the ATMS07 – Regional Traffic Management market package.

2.2.1 Traffic Management Service Area

The following market packages and related projects implement the traffic management service area functions. These traffic management service areas represent some of the most commonly deployed projects, such as closed circuit television (CCTV) cameras, dynamic message signs (DMS), transportation management centers (TMCs), traffic operations centers (TOCs), and traffic signal systems. Many of the market packages in this service area are expected to be deployed prior to market packages in other service areas.

Table 2 – Traffic Management Market Packages and Projects

Network Surveillance (ATMS01)	High Priority
Includes traffic detectors, CCTV cameras, other surveillance equipment, supporting field equipment, and fixed-point to fixed-point communications to transmit the collected data back to a traffic management center.	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN CCTV Cameras ▪ City of Bristol TN TOC ▪ City of Bristol VA CCTV Cameras ▪ City of Bristol VA Overheight Detection and Warning System ▪ City of Bristol VA TOC ▪ TDOT SmartWay Deployment at the I-26/I-81 Interchange – CCTV Cameras ▪ TDOT SmartWay Deployment on I-81 – CCTV Cameras ▪ TDOT SmartWay Deployment on I-81 – Vehicle Detection ▪ VDOT Additional CCTV Cameras on I-81 ▪ VDOT Bristol District Office Satellite TMC ▪ VDOT Detour Route Implementations ▪ VDOT Vehicle Detection Deployment on I-81 	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN Railroad Grade Crossing Improvements ▪ City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville ▪ City of Bristol VA Railroad Grade Crossing Improvements ▪ City of Bristol VA TOC Coordination with VDOT Bristol District ▪ City of Bristol VA TOC Coordination with VDOT TMC in Salem 	

Table 2 – Traffic Management Market Packages and Projects (continued)

Surface Street Control (ATMS03)	High Priority
<p>Provides the central control and monitoring equipment, communication links, and signal control equipment that support local street and/or arterial traffic management. This market package is consistent with typical urban traffic signal control systems.</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN Centrally Controlled Signal System ▪ City of Bristol TN Emergency Vehicle Signal Preemption ▪ City of Bristol TN Signal System Upgrades ▪ City of Bristol TN TOC ▪ City of Bristol VA Centrally Controlled Signal System ▪ City of Bristol VA Emergency Vehicle Signal Preemption ▪ City of Bristol VA Signal System Upgrades ▪ City of Bristol VA TOC ▪ VDOT Detour Route Implementations 	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN CCTV Cameras ▪ City of Bristol VA CCTV Cameras 	

Traffic Information Dissemination (ATMS06)	High Priority
<p>Provides information to drivers using roadway equipment such as DMS or highway advisory radio (HAR). Information can include traffic and road conditions, closure and detour information, incident information, emergency alerts and driver advisories.</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN DMS ▪ City of Bristol VA DMS ▪ TDOT SmartWay Deployment on I-81 – DMS ▪ VDOT Detour Route Implementations 	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN TOC ▪ City of Bristol VA TOC ▪ VDOT Bristol District Office Satellite TMC 	

Table 2 – Traffic Management Market Packages and Projects (continued)

Regional Traffic Management (ATMS07)	Medium Priority
Facilitates the sharing of traffic information and control among traffic management centers to support a regional control strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions.	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville ▪ City of Bristol VA TOC Coordination with VDOT Bristol District ▪ City of Bristol VA TOC Coordination with VDOT TMC in Salem 	

Traffic Incident Management System (ATMS08)	High Priority
Manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. This market package includes incident detection capabilities and coordination with other agencies. It supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel.	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN TOC ▪ City of Bristol TN TOC Coordination with Bristol TN 911 ▪ City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville ▪ City of Bristol VA TOC ▪ City of Bristol VA TOC Coordination with Bristol VA 911 ▪ City of Bristol VA TOC Coordination with VDOT Bristol District ▪ City of Bristol VA TOC Coordination with VDOT TMC in Salem ▪ VDOT Bristol District Office Satellite TMC 	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN CCTV Cameras ▪ City of Bristol TN DMS ▪ City of Bristol VA CCTV Cameras ▪ City of Bristol VA DMS ▪ TDOT HELP Vehicle Service Area Expansion ▪ TDOT SmartWay Deployment at the I-26/I-81 Interchange – CCTV Cameras ▪ TDOT SmartWay Deployment on I-81 – CCTV Cameras ▪ TDOT SmartWay Deployment on I-81 – DMS ▪ TDOT SmartWay Deployment on I-81 – Vehicle Detection ▪ VDOT Additional CCTV Cameras on I-81 ▪ VDOT Detour Route Implementations ▪ VDOT SSP Service Area Expansion ▪ VDOT Vehicle Detection Deployment on I-81 	

Table 2 – Traffic Management Market Packages and Projects (continued)

Standard Railroad Grade Crossing (ATMS13)	Medium Priority
<p>Manages highway traffic at highway-rail intersections (HRIs) where rail operations speeds are less than 80 mph.</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN Railroad Grade Crossing Improvements ▪ City of Bristol VA Railroad Grade Crossing Improvements 	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN TOC Coordination with Bristol TN 911 ▪ City of Bristol VA TOC Coordination with Bristol VA 911 	

Railroad Operations Coordination (ATMS15)	Low Priority
<p>Provides an additional level of strategic coordination between freight rail operations and traffic management centers. Rail operations provide train schedules, maintenance schedules, and any other forecast events that will result in highway rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations that may be used in advanced traffic control strategies or to enhance the quality of traveler information.</p>	
<p>Recommended Projects</p> <p>No projects have been identified at this time. The Railroad Operations Coordination market package was customized and included in the ITS Architecture to reflect the desire for future coordination with railroad operations, however at this time significant institutional issues are obstacles to the development of any projects.</p>	

2.2.2 Emergency Management Service Area

The following market packages and related projects implement ITS functions that support emergency management activities. These market packages are important for incident response, coordination of the emergency management and transportation systems, traveler information during disasters, and protection of the transportation infrastructure.

Table 3 – Emergency Management Market Packages and Projects

Emergency Call-Taking and Dispatch (EM01)	High Priority
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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Bristol TN Public Works Department and Emergency Responder AVL ▪ City of Bristol VA Emergency Responder AVL 	
Additional Supporting Projects	
<ul style="list-style-type: none"> ▪ City of Bristol TN TOC Coordination with Bristol TN 911 ▪ City of Bristol VA TOC Coordination with Bristol VA 911 	

Emergency Routing (EM02)	High Priority
Supports automated vehicle location (AVL) 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.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Bristol TN Emergency Vehicle Signal Preemption ▪ City of Bristol TN Public Works Department and Emergency Responder AVL ▪ City of Bristol TN TOC Coordination with Bristol TN 911 ▪ City of Bristol VA Emergency Responder AVL ▪ City of Bristol VA Emergency Vehicle Signal Preemption ▪ City of Bristol VA TOC Coordination with Bristol VA 911 	

Roadway Service Patrols (EM04)	Medium Priority
Supports the roadway service patrol vehicles that aid motorists, offering rapid response to minor incidents (flat tire, crashes, out of gas) to minimize disruption to the traffic stream. This market package monitors service patrol vehicle locations and supports vehicle dispatch.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ TDOT HELP Vehicle Service Area Expansion ▪ VDOT SSP Service Area Expansion 	



Table 3 – Emergency Management Market Packages and Projects (continued)

Wide-Area Alert (EM06)	High Priority
<p>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.</p>	
<p>Recommended Projects</p> <p>No projects have been identified at this time specifically for wide area alerts. Disseminating this information is a high priority for the Region and is supported by several deployments that, although primarily implemented for traffic management purposes, could also be used for the dissemination of wide area alert information.</p>	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN DMS ▪ City of Bristol VA DMS ▪ TDOT SmartWay Deployment on I-81 – DMS ▪ VDOT Detour Route Implementations 	
Disaster Response and Recovery (EM08)	Medium Priority
<p>Enhances the ability of the surface transportation system to respond to and recover from disasters. It addresses the most severe incidents that require an extraordinary response from outside the local community.</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ Sullivan County EMA CCTV Camera Image Sharing 	



Table 3 – Emergency Management Market Packages and Projects (continued)

Evacuation and Reentry Management (EM09)	Medium Priority
<p>Supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. This market package supports both anticipated, well-planned, and orderly evacuations such as for a hurricane, as well as sudden evacuations with little or no time for preparation or public warning such as a terrorist act. Employs a number of strategies to maximize capacity along an evacuation route including coordination with transit.</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ Sullivan County EMA CCTV Camera Image Sharing 	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN CCTV Cameras ▪ City of Bristol TN DMS ▪ City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville ▪ City of Bristol VA CCTV Cameras ▪ City of Bristol VA DMS ▪ City of Bristol VA TOC Coordination with VDOT Bristol District ▪ City of Bristol VA TOC Coordination with VDOT TMC in Salem ▪ TDOT HELP Vehicle Service Area Expansion ▪ TDOT SmartWay Deployment at the I-26/I-81 Interchange – CCTV Cameras ▪ TDOT SmartWay Deployment on I-81 – CCTV Cameras ▪ TDOT SmartWay Deployment on I-81 – DMS ▪ TDOT SmartWay Deployment on I-81 – Vehicle Detection ▪ VDOT Additional CCTV Cameras on I-81 ▪ VDOT Detour Route Implementations ▪ VDOT SSP Service Area Expansion ▪ VDOT Vehicle Detection Deployment on I-81 	

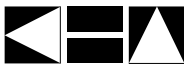


Table 3 – Emergency Management Market Packages and Projects (continued)

Disaster Traveler Information (EM10)	High Priority
<p>Uses 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.</p>	
<p>Recommended Projects</p> <p>No projects have been identified at this time specifically for disaster traveler information. Traveler information during an emergency is a high priority for the Region and is supported by several deployments that, although primarily implemented for traffic management purposes, would also provide a disaster traveler information benefit during an emergency.</p>	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN DMS ▪ City of Bristol VA DMS ▪ TDOT SmartWay Deployment on I-81 – DMS ▪ VDOT Detour Route Implementations 	

2.2.3 Maintenance and Construction Management Service Area

The following market packages and related projects implement maintenance and construction management ITS functions. The priorities identified for the Region were maintenance and construction activity coordination and AVL for public works department vehicles.

Table 4 – Maintenance and Construction Management Market Packages and Projects

Maintenance and Construction Vehicle and Equipment Tracking (MC01)	Medium Priority
Tracks the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ City of Bristol TN Public Works Department and Emergency Responder AVL ▪ City of Bristol VA Public Works Department AVL 	

Road Weather Data Collection (MC03)	High Priority
Collects current road weather conditions using data collected from environmental sensors deployed on and about the roadway.	
Recommended Projects	
No projects have been identified at this time for implementation in the Region.	

Weather Information Processing and Distribution (MC04)	High Priority
Processes and distributes the environmental information collected from the Road Weather Data Collection market package. This market package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so system operators can make decisions on corrective actions to take.	
Recommended Projects	
No projects have been identified at this time for implementation in the Region.	
Additional Supporting Projects	
<ul style="list-style-type: none"> ▪ City of Bristol VA TOC Coordination with VDOT Bristol District ▪ City of Bristol VA TOC Coordination with VDOT TMC in Salem ▪ City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville 	

Winter Maintenance (MC06)	Low Priority
Supports winter road maintenance. Monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities.	
Recommended Projects	
No projects have been identified at this time for implementation in the Region.	

Table 4 – Maintenance and Construction Management Market Packages and Projects (continued)

Work Zone Management (MC08)	High Priority
<p>Directs activity in work zones, controlling traffic through portable DMS and informing other groups of activity for better coordination management. Also provides speed and delay information to motorists prior to the work zone.</p>	
<p>Recommended Projects</p> <p>No projects have been identified at this time although this market package is a high priority for the Region. Several projects have been listed below that will support traffic management in work zones, but ultimately most work zone traffic control is primarily managed by the contractor as part of each individual construction contract.</p>	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN DMS ▪ City of Bristol VA DMS ▪ TDOT SmartWay Deployment on I-81 – DMS ▪ VDOT Detour Route Implementations 	

Maintenance and Construction Activity Coordination (MC10)	High Priority
<p>Supports the dissemination of maintenance and construction activity information to centers that can utilize it as part of their operations. (i.e., traffic management, transit, emergency management).</p>	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol TN TOC Coordination with Bristol TN 911 ▪ City of Bristol VA TOC Coordination with Bristol VA 911 	
<p>Additional Supporting Projects</p> <ul style="list-style-type: none"> ▪ City of Bristol VA TOC Coordination with VDOT Bristol District ▪ City of Bristol VA TOC Coordination with VDOT TMC in Salem ▪ City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville 	

2.2.4 Public Transportation Management Service Area

The following market packages and related projects implement public transportation management ITS functions. Many of these market packages were considered high priority and plans are underway for several implementations in the near future. Public transportation projects for Bristol Tennessee Transit (BTT) and Bristol Virginia Transit (BVT) should be closely coordinated since the two systems operate coordinated service.

Table 5 – Public Transportation Management Market Packages and Projects

Transit Vehicle Tracking (APTS01)	High Priority
Monitors current transit vehicle location using an AVL system. Location data may be used to determine real time schedule adherence and update the transit system's schedule in real time.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ BTT AVL, MDTs and Mayday Alarms ▪ BVT AVL, MDTs and Mayday Alarms 	
Transit Fixed-Route Operations (APTS02)	High Priority
Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for fixed-route and flexible-route transit services.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ BTT AVL, MDTs and Mayday Alarms ▪ BVT AVL, MDTs and Mayday Alarms 	
Demand Response Transit Operations (APTS03)	High Priority
Performs vehicle routing and scheduling, as well as operator assignment and system monitoring for demand responsive transit services.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ BTT AVL, MDTs and Mayday Alarms ▪ BVT AVL, MDTs and Mayday Alarms 	
Transit Fare Collection Management (APTS04)	Medium Priority
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.	
Recommended Projects	
At this time no specific projects were identified for electronic fare collection. The regional transit agencies felt that other projects were a higher priority at this time and that electronic fare collection was still several years away from being seriously considered. At such time as planning does begin BTT and BVT will need to work closely together, possibly implementing one system since most patrons regularly access each agency's services.	

**Table 5 – Public Transportation Management Market Packages and Projects
(continued)**

Transit Security (APTS05)	High Priority
Provides for the physical security of transit passengers and transit vehicle operators. Includes on-board security cameras and panic buttons.	
Recommended Projects	
<ul style="list-style-type: none"> ▪ BTT On-Board Security Monitoring ▪ BVT On-Board Security Monitoring 	
Multi-modal Coordination (APTS07)	Medium Priority
Establishes two way communications between multiple transit and traffic agencies to improve service coordination.	
Recommended Projects	
No projects have been identified at this time. Stakeholders expressed an interest in several of the technologies available but determined that this market package was not a high enough priority to develop specific project recommendations.	
Transit Traveler Information (APTS08)	Medium Priority
Provides transit users at transit stops and on board transit vehicles with ready access to transit information. Services include stop annunciation, imminent arrival signs, and real-time transit schedule displays. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.	
Recommended Projects	
No projects have been identified at this time. Stakeholders expressed an interest in several of the technologies available but determined that this market package was not a high enough priority to develop specific project recommendations.	

**Table 5 – Public Transportation Management Market Packages and Projects
(continued)**

Transit Passenger Counting (APTS10)	Medium Priority
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.	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ BTT Automatic Passenger Counting ▪ BVT Automatic Passenger Counting 	

2.2.5 Traveler Information Service Area

The following market packages and related projects implement traveler information ITS functions. Traveler information service area projects address market packages that make traveler information available to the public over a wide area such as the 511 traveler information phone number. Traveler information provided at a specific locations on the roadway, such as DMS, is addressed in the ATMS06 – Traffic Information Dissemination market package in Section 2.2.1.

Table 6 – Traveler Information Market Packages and Projects

Broadcast Traveler Information (ATIS01)	High Priority
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.).	
Recommended Projects	
<ul style="list-style-type: none"> ▪ Regional Media Liaison and Coordination 	
Interactive Traveler Information (ATIS02)	High Priority
Provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. 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.	
Recommended Projects	
No projects were specifically identified for local implementation. 511 traveler information phone and web-based services are being provided on a statewide level in both Tennessee and Virginia.	
Additional Supporting Projects	
<ul style="list-style-type: none"> ▪ City of Bristol VA TOC Coordination with VDOT Bristol District ▪ City of Bristol VA TOC Coordination with VDOT TMC in Salem ▪ City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville 	

2.2.6 Archived Data Management Service Area

The following market packages and related projects implement archived data management ITS functions. Data collected through ITS deployments can be housed in several different formats. The market packages selected by stakeholders will allow data from a specific agency to be housed by that agency, or data from throughout the Region can be sent to a site to be housed together. Data housed by an agency as part of an ITS data mart would likely be part of another project deployment and are not selected separately in this section. For example, DMS implementation might include software to archive all of the messages placed on the DMS over a period of time.

Table 7 – Archived Data Management Market Packages and Projects

ITS Data Mart (AD1)	Medium Priority
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.	
<p>Recommended Projects</p> <p>No projects have been identified at this time. As ITS deployments come on line and the quantity of available data increases it is likely that stakeholder agencies might develop data mart projects.</p>	
ITS Data Warehouse (AD2)	Low Priority
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.	
<p>Recommended Projects</p> <ul style="list-style-type: none"> ▪ Bristol MPO Archive Data Warehouse 	

3. 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 ITS architecture. A key step toward achieving the Bristol Region's ITS goals 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.

To achieve input from stakeholders, a workshop was held in the Bristol Region on February 6, 2008 to discuss potential projects. Each project recommended for the Regional ITS Deployment Plan was discussed, and consensus was reached by the stakeholders on the project description and the timeframe for deployment.

In the following sections all of the projects that were recommended for deployment by stakeholders are discussed. In Section 3.1 maps that identify locations of field elements for many of the priority projects in the Bristol Region are presented. In Section 3.2 tables are provided with the ITS projects that have been identified for the stakeholder agencies in the Region.

3.1 ITS Infrastructure Deployment Maps

Existing, planned and future ITS infrastructure in the Bristol Region is shown on the ITS infrastructure deployment maps included in this section. **Figure 1** depicts field element deployments for state agencies and **Figure 2** covers local agency deployments. Some of the field element deployments on the maps are already fully implemented and are not shown in the project tables in Section 3.2.

The ITS infrastructure deployment maps do not represent a design of the system. Prior to the deployment of any of the ITS field elements, the location of each of the field elements should be reviewed. The maps were developed with significant stakeholder input to assist the Region in developing an initial concept of how ITS can be deployed throughout the Region.

ITS field elements are typically shown as existing or future. Existing elements have either been fully deployed or were in the process of being deployed at the time this report was developed. Future elements are those elements that are not part of a funded project but have been identified as important to the Region. Each of the future elements shown in **Figures 1 and 2** are part of the projects described in the project tables in Section 3.2.

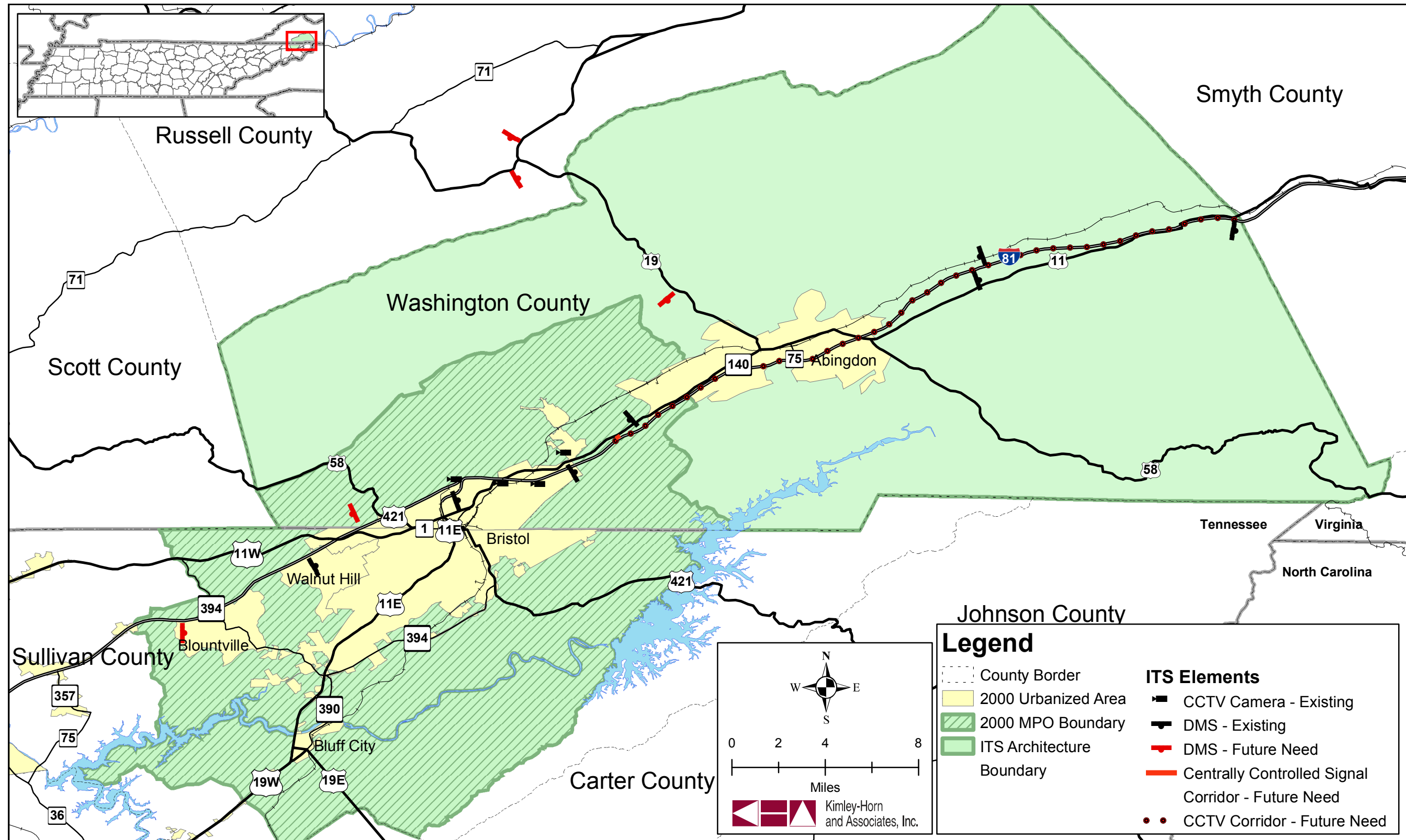


Figure 1 – State Agency ITS Field Element Deployments

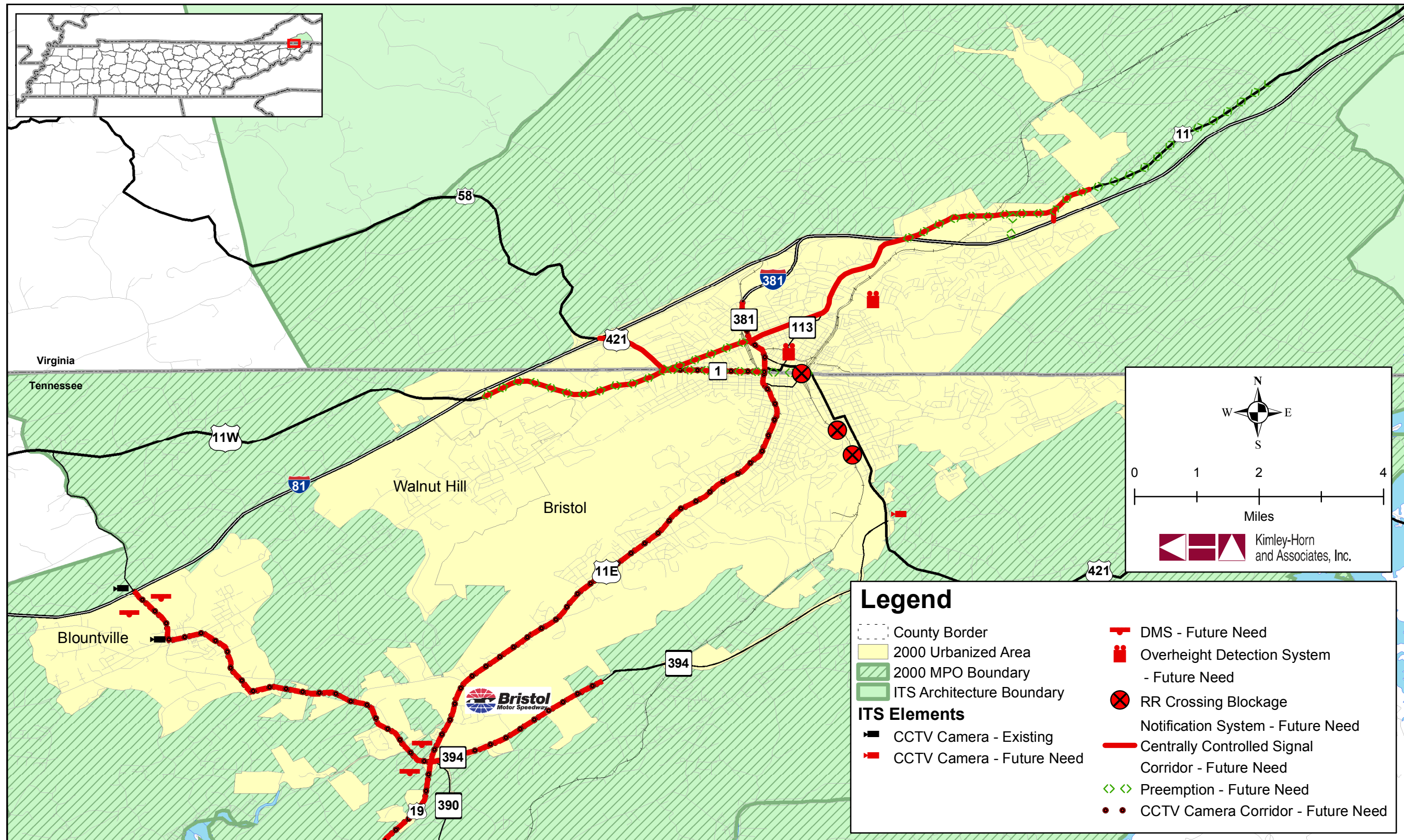


Figure 2 – Local Agency ITS Field Element Deployments

3.2 Regional Projects

Regional projects are identified in **Table 8** through **Table 15**. The tables are divided by primary responsible agency as follows:

- **Table 8** – Bristol MPO;
- **Table 9** – Bristol Tennessee Transit;
- **Table 10** – Bristol Virginia Transit;
- **Table 11** – City of Bristol Tennessee;
- **Table 12** – City of Bristol Virginia;
- **Table 13** – Sullivan County Tennessee;
- **Table 14** – Tennessee Department of Transportation;
- **Table 15** – Virginia Department of Transportation; and
- **Table 16** – Bristol Region.

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. A majority of the projects identified are not funded and 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.
- **Description** – Provides a description of the project including notes on deployment locations and costs. 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 while in other cases an agency had begun detailed planning for a project implementation and more detail is provided in the description. **Figures 1 and 2** support the project descriptions by showing the location of many of the existing, planned, and future field components.
- **Opinion of Probable Cost and Funding Status** – Provides an opinion of probable cost of each project. Because design has not been undertaken for any projects, the opinion of probable cost should not be considered an estimate and should only be used for planning purposes. Costs are presented either as a total project cost when the project has been defined in more detail or as a unit cost per element when a project is at a higher conceptual level and has not been defined to the point where a total project cost opinion can be provided. For each project it is also noted whether funding has been identified or is still needed.
- **Deployment Timeframe** – 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.
- **Applicable Market Packages** – Identifies the ITS market packages from the Regional ITS Architecture that each project will assist in implementing. Knowing which market packages each project identifies is an important part of an ITS architecture conformance review.

3.2.1 Bristol Metropolitan Planning Organization

Table 8 – Bristol Metropolitan Planning Organization Project Recommendations

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
Bristol MPO Archive Data Warehouse	<p>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. Cost could vary widely depending on the level of detail and functionality of the system as well as the amount of development that is done in-house by the Bristol MPO.</p> <p>The Bristol MPO is currently managing the traffic count database for the Region.</p>	<p>\$50,000 to \$100,000 Funding Identified: No</p>	<p>Long-term</p>	<p>AD2</p>

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2.2 Bristol Tennessee Transit

Table 9 – Bristol Tennessee Transit Project Recommendations

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
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.	\$12,000/vehicle Funding Identified: Yes	Short-term	APTS01 APTS02 APTS03
BTT On-Board Security Monitoring	Implement video surveillance on BTT vehicles to improve patron and driver safety. Cameras will be for local recording only.	\$3,000/vehicle Funding Identified: No	Mid-term	APTS05
BTT Automatic Passenger Counters	Implement passenger counters on BTT vehicles to record boardings and alightings.	\$5,000-\$10,000/vehicle Funding Identified: No	Long-term	APTS10

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2.3 Bristol Virginia Transit

Table 10 – Bristol Virginia Transit Project Recommendations

Project	Description	Opinion of Probable Cost¹ and Funding Status	Deployment Timeframe²	Applicable Market Packages
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.	\$12,000/vehicle Funding Identified: No	Short-term	APTS01 APTS02 APTS03
BVT On-Board Security Monitoring	Implement video surveillance on BVT vehicles to improve patron and driver safety. Cameras will be for local recording only.	\$3,000/vehicle Funding Identified: No	Mid-term	APTS05
BVT Automatic Passenger Counters	Implement passenger counters on BVT vehicles to record boardings and alightings.	\$5,000-\$10,000/vehicle Funding Identified: No	Long-term	APTS10

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2.4 City of Bristol Tennessee

Table 11 – City of Bristol Tennessee Project Recommendations

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
City of Bristol TN TOC	<p>Establish a Traffic Operations Center (TOC) for the City of Bristol TN. The TOC will manage the closed loop traffic signal system, monitor closed circuit television (CCTV) cameras and vehicle detection, and control dynamic message signs (DMS). The TOC will facilitate day to day traffic management in addition to special event management.</p> <p>Cost represents equipment costs and those costs associated with modifying space in an existing facility for use as a TOC.</p>	<p>\$150,000 Funding Identified: No</p>	Short-term	<p>ATMS01 ATMS03 ATMS08</p>
City of Bristol TN Centrally Controlled Signal System	<p>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. The signal system will allow timing plans to be adjusted remotely and reduce the need for police officers to manually control traffic signals during incidents or special events. Priority corridors for the centrally controlled signal system have been identified in Figure 2.</p> <p>Cost includes central signal control software and equipment. Future signal upgrades will tie signalized intersections into the centrally controlled signal system as part of a separate project.</p>	<p>Signal System Software: \$150,000- \$500,000 Funding Identified: No</p>	Short-term	ATMS03
City of Bristol TN Signal System Upgrades	<p>Upgrade City of Bristol TN traffic signals 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.</p> <p>Cost represents an average cost per intersection for upgrading and adding to the signal system. Cost will vary based on the level of upgrade required to integrate the signals.</p>	<p>\$20,000/intersection Funding Identified: No</p>	Short-term	ATMS03

Table 11 – City of Bristol Tennessee Project Recommendations (continued)

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
City of Bristol TN Emergency Vehicle Signal Preemption	<p>Implement emergency vehicle signal preemption capabilities at traffic signals in the City of Bristol TN to improve incident response times and emergency responder safety.</p> <p>Signal preemption will need to be coordinated with Virginia due to the fact that many signals are located on the state line and mutual aid emergency response agreements mean that the Bristol VA Fire Department frequently responds to incidents in Tennessee. This project should also be coordinated with the signal upgrade projects.</p> <p>Priority corridors for implementation include the West State Street/State Street corridor from Medical Park Boulevard to Pennsylvania Avenue/Goodson Street.</p>	<p>\$6,000/intersection \$1,500/vehicle Funding Identified: No</p>	<p>Short-term</p>	<p>ATMS03 EM02</p>
City of Bristol TN Public Works Department and Emergency Responder AVL	<p>Implement automated vehicle location (AVL) on City of Bristol TN Public Works Department vehicles, Police, and Fire vehicles. Cost represents in-vehicle equipment as well as supporting software.</p>	<p>\$3,000/vehicle Funding Identified: No</p>	<p>Short-term</p>	<p>EM01 EM02 MC01</p>
City of Bristol TN TOC Coordination with TDOT Region 1 TMC – Knoxville	<p>Establish a communications connection between the City of Bristol TOC and the TDOT Region 1 TMC in Knoxville for the coordination of traffic information. This sharing will facilitate the inclusion of regional information into the TDOT SmartWay Information System (TSIS) as well the sharing of weather information and video feeds.</p> <p>The inclusion of local information in TSIS will enable travelers to access consolidated traveler information for local roadways as well as state facilities through the TDOT SmartWay website and 511 system.</p> <p>Additional Responsible Agency: TDOT</p>	<p>Cost To Be Determined Funding Identified: No</p>	<p>Short-term</p>	<p>ATMS07 ATMS08</p>

Table 11 – City of Bristol Tennessee Project Recommendations (continued)

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
City of Bristol TN CCTV Cameras	<p>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. Video feeds can be shared with emergency management agencies to facilitate emergency response. Cost shown includes the pole and camera. The cost will be lower if the camera is installed on a signal mast arm or other existing roadside structure.</p> <p>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.</p> <p>These corridors will support Bristol Motor Speedway event management as well as daily traffic. CCTV cameras are existing within the Bristol Motor Speedway that can be used to monitor traffic on the roads surrounding the Speedway.</p>	<p>\$30,000/site Funding Identified: No</p>	<p>Mid-term</p>	<p>ATMS01</p>
City of Bristol TN DMS	<p>Deploy DMS in the City of Bristol to provide traveler information, incident management, and special event management capabilities.</p> <p>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.</p>	<p>\$100,000/sign Funding Identified: No</p>	<p>Mid-term</p>	<p>ATMS06</p>
City of Bristol TN Railroad Grade Crossing Improvements	<p>Implement advanced warning signs at railroad crossings to alert motorists of road blockages due to stopped trains. Notification that a crossing is blocked will also be sent to the TOC and from there shared with 911 Dispatch to aid in emergency vehicle dispatch and routing.</p>	<p>\$10,000 – \$20,000/site Funding Identified: No</p>	<p>Mid-term</p>	<p>ATMS13</p>

Table 11 – City of Bristol Tennessee Project Recommendations (continued)

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
City of Bristol TN TOC Coordination with Bristol TN 911	Establish a connection to allow sharing of CCTV camera images with 911 Dispatch to aid in incident management. Integration of the 911 Dispatch computer aided dispatch (CAD) system will allow the TOC to receive automated notification about incidents that might affect the roadway network and the use of real-time traffic information from the TOC in emergency vehicle dispatch.	Cost To Be Determined Funding Identified: No	Mid-term	ATMS08 EM02 MC10

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2.5 City of Bristol Virginia

Table 12 – City of Bristol Virginia Project Recommendations

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
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, and dynamic message signs (DMS). Cost represents equipment costs and those costs associated with modifying space in an existing facility for use as a TOC.	\$150,000 Funding Identified: No	Short-term	ATMS01 ATMS03 ATMS08
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. The signal system will allow timing plans to be adjusted remotely and reduce the need for police officers to manually control traffic signals during incidents or special events. Priority corridors for the centrally controlled signal system have been identified in Figure 2. Cost includes central signal control software and equipment. Future signal upgrades will tie signalized intersections into the centrally controlled signal system as part of a separate project.	Signal System Software: \$150,000- \$500,000 Funding Identified: No	Short-term	ATMS03
City of Bristol VA Signal System Upgrades	Upgrade City of Bristol VA traffic signals 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. Cost represents an average cost per intersection for upgrading and adding to the signal system. Cost will vary based on the level of upgrade required to integrate the signals.	\$20,000/intersection Funding Identified: No	Short-term	ATMS03

Table 12 – City of Bristol Virginia Project Recommendations (continued)

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
City of Bristol VA Emergency Vehicle Signal Preemption	<p>Implement emergency vehicle signal preemption capabilities at traffic signals in the City of Bristol VA to improve incident response times and emergency responder safety.</p> <p>Signal preemption will need to be coordinated with Tennessee due to the fact that many signals are located on the state line and mutual aid emergency response agreements mean that the Bristol TN Fire Department frequently responds to incidents in Virginia. This project should also be coordinated with the signal upgrade projects for the City and VDOT. Priority corridors for implementation include US 11 from the Exit 5 interchange with I-81 to Industrial Park Road in Washington County; State Street/West State Street from Euclid Avenue /Gate City Highway to Goodson Street/Pennsylvania Avenue; Euclid Avenue west of Commonwealth Avenue; and Bonham Road north of I-81.</p> <p>Additional Responsible Agency: VDOT</p>	<p>\$6,000/intersection \$1,500/vehicle Funding Identified: No</p>	Short-term	ATMS03 EM02
City of Bristol VA Overheight Detection and Warning System	<p>Implement an overheight detection and warning system at the railroad overpasses on Piedmont Avenue and East Valley Drive. The system will include detection to determine whether or not a vehicle is too tall for the underpass and a lighted blank out sign or a static sign with beacons to indicate to the driver that they need to detour to avoid striking the overpass.</p>	<p>\$30,000/system Funding Identified: No</p>	Short-term	ATMS01
City of Bristol VA Emergency Responder AVL	<p>Implement automated vehicle location (AVL) on City of Bristol VA Police and Fire Department vehicles. Cost represents in-vehicle equipment as well as supporting software.</p>	<p>\$3,000/vehicle Funding Identified: No</p>	Short-term	EM01 EM02

Table 12 – City of Bristol Virginia Project Recommendations (continued)

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
City of Bristol VA CCTV Cameras	<p>Implement CCTV cameras on key sections of roadway within the City of Bristol VA. CCTV cameras can be used to monitor traffic conditions and to aid in incident management. Video feeds can be shared with emergency management agencies to facilitate emergency response. Cost shown includes the pole and camera. The cost will be lower if the camera is installed on a signal mast arm or other existing roadside structure.</p> <p>Priority locations include Commonwealth Avenue to operate in conjunction with the Bristol TN CCTV camera system for special events at the Bristol Motor Speedway.</p>	<p>\$25,000/site Funding Identified: No</p>	<p>Mid-term</p>	<p>ATMS01</p>
City of Bristol VA DMS	<p>Deploy DMS in the City of Bristol VA to provide travel information, incident management, and special event management.</p> <p>No specific locations have been identified at this time.</p>	<p>\$100,000/site Funding Identified: No</p>	<p>Mid-term</p>	<p>ATMS06</p>
City of Bristol VA Railroad Grade Crossing Improvements	<p>Implement advanced warning signs at railroad crossings to alert motorists of road blockages due to stopped trains. Notification that a crossing is blocked will also be sent to the TOC and from there shared with 911 dispatchers to aid in emergency vehicle dispatch and routing.</p>	<p>\$10,000 – \$20,000/site Funding Identified: No</p>	<p>Mid-term</p>	<p>ATMS13</p>
City of Bristol VA Public Works Department AVL	<p>Implement AVL on City of Bristol VA Public Works Department vehicles. Cost represents in-vehicle equipment as well as supporting software.</p>	<p>\$3,000/vehicle Funding Identified: No</p>	<p>Mid-term</p>	<p>MC01</p>
City of Bristol VA TOC Coordination with VDOT TMC in Salem	<p>Establish a communications connection between the City of Bristol VA TOC and the VDOT Traffic Management Center (TMC) in Salem for the coordination of traffic information. This sharing will facilitate the inclusion of regional information in the Virginia 511 system as well the sharing of weather information and video feeds as additional VDOT deployments are made in the Bristol Area. The VDOT TMC in Salem will handle day to day operations of the ITS deployments in the Region.</p>	<p>Cost To Be Determined Funding Identified: No</p>	<p>Mid-term</p>	<p>ATMS07 ATMS08</p>

Table 12 – City of Bristol Virginia Project Recommendations (continued)

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
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. This sharing will facilitate the inclusion of regional information in the Virginia 511 system as well the sharing of weather information and video feeds as additional VDOT deployments are made in the Bristol Area. While the TMC in Salem will handle most day to day operations of ITS equipment, the Bristol District Office will primarily only take over control of the equipment during special events or a large-scale incident.	Cost To Be Determined Funding Identified: No	Mid-term	ATMS07 ATMS08
City of Bristol VA TOC Coordination with Bristol VA 911	Establish a connection to allow sharing of CCTV camera images with 911 Dispatch to aid in incident management. Integration of the 911 Dispatch computer aided dispatch (CAD) system will allow the TOC to receive automated notification about incidents that might affect the roadway network and the use of real-time traffic information from the TOC in emergency vehicle dispatch.	Cost To Be Determined Funding Identified: No	Mid-term	ATMS08 EM02 MC10

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2.6 *Sullivan County Tennessee*

Table 13 – Sullivan County Tennessee Project Recommendations

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
Sullivan County EMA 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 Emergency Management Agency (EMA). Connecting to the City of Bristol TN Traffic Operations Center (TOC) will allow the Sullivan County EMA access to TDOT video once the City of Bristol TN TOC is connected to TDOT. Additional Responsible Agencies: City of Bristol TN, TDOT	Cost To Be Determined Funding Identified: No	Mid-term	EM08 EM09

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2.7 Tennessee Department of Transportation

Table 14 – TDOT Project Recommendations

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
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.	Cost To Be Determined Funding Identified: No	Short-term	EM04
TDOT SmartWay Deployment on I-81 – CCTV Cameras	<p>Implement closed circuit television (CCTV) cameras on I-81 in the Bristol Region. CCTV cameras can be used to monitor traffic conditions and to aid in incident management. The cameras will be monitored by the TDOT Region 1 Transportation Management Center (TMC) in Knoxville and video feeds could be shared with local traffic and emergency management agencies.</p> <p>Cost shown includes the cost for a camera, pole, and controller cabinet. Communications costs are not included and can vary widely depending on available options for communication and the quality of video that is required.</p> <p>At this time the only location that has been identified is at the Exit 69 interchange.</p>	\$30,000/site Funding Identified: No	Mid-term	ATMS01
TDOT SmartWay Deployment on I-81 – DMS	Implement dynamic message signs (DMS) on I-81 in the Bristol Region to disseminate incident, weather, construction, and general traffic information. Desired locations include I-81 southbound in Virginia, just before the Tennessee state line, and I-81 northbound before Exit 69.	\$175,000/site Funding Identified: No	Mid-term	ATMS06
TDOT SmartWay Deployment on I-81 – Vehicle Detection	Implement vehicle detection technologies on I-81 to monitor speeds and volumes. The cost and capabilities will depend on the technology chosen. Cost range represents a variety of technologies from in-pavement loop detectors to non-intrusive detectors that would be mounted on an existing or new pole. Spacing in rural areas will typically be greater than spacing in urban areas.	\$5,000 – \$20,000/site	Mid-term	ATMS01

Table 14 – TDOT Project Recommendations (continued)

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
Project Recommendations Outside the Bristol Regional Boundaries				
TDOT SmartWay Deployment at the I-26/I-81 Interchange – CCTV Cameras	<p>Implement four CCTV cameras at the I-81/I-26 interchange. CCTV cameras can be used to monitor traffic conditions and to aid in incident management. The cameras will be monitored by the TDOT Region 1 TMC in Knoxville. Video feeds can be shared with emergency management agencies to facilitate emergency response. Communications costs are not included and can vary widely depending on available options for communication and the quality of video that is required.</p> <p>Although not within the geographic boundaries of the Bristol Regional ITS Architecture, this project has been included in the ITS Deployment Plan due to the impact it will have on traffic operations in the Bristol Region. This project has also been included in the Kingsport Regional ITS Deployment Plan.</p>	\$30,000/site Funding Identified: Yes	Short-term	ATMS01

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2.8 Virginia Department of Transportation

Table 15 – VDOT Project Recommendations

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
VDOT Bristol District Office Satellite TMC	<p>Expand the capabilities of the Bristol District Office to monitor and control closed circuit television (CCTV) cameras, vehicle detection, and dynamic message signs (DMS).</p> <p>Cost represents equipment costs and those costs associated with modifying space in an existing facility for use as a Traffic Management Center (TMC).</p>	<p>\$150,000</p> <p>Funding Identified: No</p>	<p>Short-term</p>	<p>ATMS01</p> <p>ATMS08</p>
VDOT Additional CCTV Cameras on I-81	<p>Implement CCTV cameras on I-81 in the Bristol Region north of MP 8. The current coverage extends from MP 3 to MP 8 and additional locations are needed within that segment to obtain complete coverage. CCTV cameras can be used to monitor traffic conditions and to aid in incident management. The cameras will be monitored by the VDOT Bristol District Office and/or VDOT TMC in Salem. Video feeds can be shared with emergency management agencies to facilitate emergency response.</p> <p>Cost shown includes the cost for a camera, pole, and controller cabinet. Communications costs are not included and can vary widely depending on available options for communication and the quality of video that is required.</p>	<p>\$30,000/site</p> <p>Funding Identified: No</p>	<p>Short-term</p>	<p>ATMS01</p>
VDOT Vehicle Detection Deployment on I-81	<p>Implement vehicle detection technologies on I-81 to monitor speeds and volumes. The cost and capabilities will depend on the technology chosen. Cost range represents a variety of technologies from in-pavement loop detectors to non-intrusive detectors that could be mounted on an existing or new pole. Spacing in rural areas will typically be greater than spacing in urban areas.</p>	<p>\$5,000 – \$20,000/site</p> <p>Funding Identified: Yes, several locations are currently planned for video detection implementation</p>	<p>Short-term</p>	<p>ATMS01</p>
VDOT SSP Service Area Expansion	<p>Expand the VDOT Safety Service Patrol (SSP) service area to include vehicles stationed in the Bristol Region. SSP vehicles stationed in the area would facilitate incident management as well as special event management.</p>	<p>Cost To Be Determined</p> <p>Funding Identified: No</p>	<p>Short-term</p>	<p>EM04</p>

Table 15 – VDOT Project Recommendations (continued)

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
VDOT Detour Route Implementations	Implement CCTV cameras and DMS on designated detour routes to be used during closures of I-81. Potential DMS locations have been shown in Figure 1. Two of the potential DMS are currently located outside of the Bristol Region geographic boundaries. Although they are not within the geographic boundaries these DMS would be controlled by the VDOT Bristol District Office Satellite TMC within the Region and would primarily serve traffic traveling to or from the Bristol Region. Coordination of signals on corridors connecting I-81 and US 11/US 19 may also be included as part of the detour route implementation.	CCTV Cameras: \$30,000/site DMS: \$75,000/site Funding Identified: No	Mid-term	ATMS01 ATMS03 ATMS06

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

3.2.9 *Bristol Region*

Table 16 – Regional Project Recommendations

Project	Description	Opinion of Probable Cost ¹ and Funding Status	Deployment Timeframe ²	Applicable Market Packages
Regional Media Liaison and Coordination	<p>Develop agreements and enhanced coordination with local media to improve information sharing and dissemination. There is no cost associated with this project. If the media desires to gather data, such as closed circuit television (CCTV) camera video feeds, from the transportation agencies in the Region then it is expected that the media would be responsible for any costs.</p> <p>Responsible Agencies: City of Bristol TN, City of Bristol VA, TDOT, VDOT</p>	<p>No Associated Cost Note: Funding not applicable</p>	Mid-term	ATIS01

¹The design has not been undertaken and thus this is only an opinion of probable cost for implementation to be used for planning purposes.

²Deployment timeframes include short-term (0-5 years), mid-term (5-10 years), and long-term (10+ years).

4. MAINTAINING THE REGIONAL ITS DEPLOYMENT PLAN

Just as the ITS Architecture developed for the Bristol Region documents the Region's goals for ITS implementation at the time it was developed, the ITS Deployment Plan addresses the projects that stakeholders agreed were necessary to implement at the time the plan was developed in order to reach their ITS deployment goals. As the Region grows, needs will change and as technology progresses new ITS opportunities will arise. Shifts in regional focus as well as changes in the National ITS Architecture will necessitate that the Bristol Regional ITS Architecture be updated to remain a useful resource for the Region. These same changes will create new project opportunities and revisions to the projects in the ITS Deployment Plan.

Stakeholders agreed upon a procedure for updating the Regional ITS Architecture and Deployment Plan. The procedure, documented in detail in the Bristol Regional ITS Architecture, outlines how to document ITS Architecture changes that may be needed for inclusion in the next plan update. While complete plan updates are scheduled to occur approximately every five years prior to the Long Range Transportation Plan update, stakeholders agreed that it would be beneficial to review the projects identified in the ITS Deployment Plan once a year. The Bristol MPO will lead the annual project reviews. The purpose of the reviews will be to update project status, remove projects that are completed, add project detail when available, and add any new projects into the ITS Deployment Plan. Any corresponding changes to the Bristol Regional ITS Architecture will be documented and retained by the Bristol MPO for inclusion during the next complete update as outlined in the Bristol Regional ITS Architecture document.