JOHNSON CITY

Regional ITS Architecture and Deployment Plan *2022 Update*

Johnson City MTPO
Metropolitan Transportation Planning Organization

TN TDOT
Department of Transportation

Johnson City

Regional ITS Architecture and Deployment Plan

FINAL REPORT

June 2022

Prepared by:

Kimley»Horn

069223011

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
TRAFFIC OPERATIONS DIVISION
SUITE 300, JAMES K. POLK BUILDING
NASHVILLE, TENNESSEE 37243-0326

June 8, 2022

BUTCH ELEY
COMMISSIONER

BILL LEE
GOVERNOR

Melissa Furlong
Operations Program Specialist
FHWA Tennessee Division Office
404 BNA Drive, Building 200, Suite 508
Nashville, TN 37217

Subject: Johnson City Regional ITS Architecture and Deployment Plan 2022 Update

Dear Ms. Furlong,

The subject Regional ITS Architecture has been reviewed by TDOT staff and has been found to be "Ready for Use".

TDOT requests that your office review the Johnson City Regional ITS Architecture and concur with our findings by signing below.

Sincerely,

Lee J. Smith
Lee Smith (Jun 8, 2022 10:46 CDT)

Lee Smith
Interim Director of Traffic Operations Division

U.S. Department of Transportation
Federal Highway Administration

Tennessee Division

404 BNA Drive, Suite 508
Nashville, Tennessee 37217
Phone (615) 781-5770

June 8, 2022

In Reply Refer To:
HTS-TN

Mr. Lee Smith
Interim Director of Traffic Operations Division
Tennessee Department of Transportation
James K. Polk Building, Suite 700
Nashville, TN 37243

Subject: Regional ITS Architecture (RITSA) Ready For Use
2022 Johnson City Regional ITS Architecture and Deployment Plan 2022 Update

Dear Mr. Smith:

In response to your letter dated June 8, 2022, the Federal Highway Administration (FHWA) has reviewed the final RITSA documents for the subject project in accordance with 23 CFR 940. The RITSA documents are in compliance with the CFR requirements, therefore the request is approved and the associated documents are considered "ready for use."

If you have questions regarding this approval, please contact me at (615) 781-5769.

Sincerely,

MELISSA FURLONG

Digitally signed by MELISSA FURLONG
Date: 2022.06.08 12:11:01 -05'00'

Melissa Furlong, P.E.
Operations Program Specialist

TABLE OF CONTENTS

Johnson City Regional ITS Architecture and Deployment Plan

TABLE OF CONTENTS

Johnson City Regional ITS Architecture and Deployment Plan

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

Johnson City Regional ITS Architecture and Deployment Plan

ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
CAD	Computer Aided Dispatch
CALM	Communications Access for Land Mobiles
CCTV	Closed-Circuit Television
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
DM	Data Management
DMS	Dynamic Message Sign
DSRC	Dedicated Short-Range Communication
EMA	Emergency Management Agency
EMS	Emergency Medical Services
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FTHRA	First Tennessee Human Resource Agency
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
IVR	Interactive Voice Response
JCT	Johnson City Transit
MAP-21	Moving Ahead for Progress in the 21st Century
MC	Maintenance and Construction
MOU	Memorandum of Understanding
MPA	Metropolitan Planning Area
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan
MTPO	Metropolitan Transportation Planning Organization
NEMA	National Electrical Manufacturers Association
NET Trans	Northeast Tennessee Transit
NOAA	National Oceanic and Atmospheric Administration
NOCoE	National Operations Center for Excellence
NTCIP	National Transportation Communications for ITS Protocol
PM	Parking Management

ACRONYMS

PS	Public Safety
PSAP	Public Safety Answering Point
PT	Public Transportation
PTSS	Portable Traffic Signal Systems
RAD-IT	Regional Architecture Development for Intelligent Transportation
RDS	Radar Detection System
RTMS	Remote Traffic Microwave Sensor
RWIS	Road Weather Information System
SAFETEA-LU	Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users
SDO	Standards Development Organization
SEAR	Systems Engineering Analysis Report
SSEAF	Simplified Systems Engineering Analysis Form
ST	Sustainable Travel
SU	Support
SWCS	SmartWay Central Software
TDOSHS	Tennessee Department of Safety and Homeland Security
TDOT	Tennessee Department of Transportation
TEA-21	Transportation Equity Act for the 21st Century
TEMA	Tennessee Management Emergency Agency
TI	Traveler Information
TIP	Transportation Improvement Plan
THP	Tennessee Highway Patrol
TITAN	Tennessee Integrated Traffic Analysis Network
TM	Traffic Management
TMC	Transportation Management Center (or Traffic Management Center)
TOC	Traffic Operations Center
TraCS	Traffic and Criminal Software
USDOT	United States Department of Transportation
VIVDS	Video Image Vehicle Detection Systems
VS	Vehicle Safety
WX	Weather

EXECUTIVE SUMMARY

Originally developed in 2006, the Johnson City Regional Intelligent Transportation System (ITS) Architecture and Deployment Plan provides a framework for implementing ITS projects within the Johnson City Region, which is defined by the area within the Johnson City Metropolitan Transportation Planning Organization's (MTPO) Metropolitan Planning Area (MPA) boundary. ITS is the application of electronic technologies and communications to improve the operation of a transportation network. ITS can improve safety, support transit and ridesharing, improve reliability, and support environmental sustainability by reducing delay and emissions resulting from delay. A regional ITS architecture encourages interoperability and resource sharing among agencies, identifies applicable standards to apply to ITS projects, and allows for cohesive long-range planning among regional stakeholders.

This 2022 update to the Johnson City Regional ITS Architecture and Deployment Plan allows the Region's transportation stakeholders to plan for what they want their transportation network to look like in the long-term with respect to the incorporation of ITS technology. The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) require that ITS projects show conformance with the Regional ITS Architecture to be eligible for federal funding from either agency. In order to show this conformance, it is important that any region deploying ITS have an updated Regional ITS Architecture and Deployment Plan in place.

The Johnson City Region is comprised of the majority of Washington County, the northern and western portions of Carter County, a northern portion of Unicoi County, and a southern portion of Sullivan County. Other municipalities within the Johnson City Region include the Town of Jonesborough, Town of Watauga, City of Elizabethton, City of Bluff City, and Town of Unicoi. The Johnson City MTPO and the Tennessee Department of Transportation (TDOT) identified stakeholders from the appropriate city, county, regional, state, and federal agencies from throughout the Region to guide the update of the Johnson City Regional ITS Architecture and Deployment Plan. The identified stakeholders included city, county, and regional representatives, as well as representatives from TDOT Region 1, TDOT Traffic Operations Division in Nashville, and the FHWA Tennessee Division Office.

Input was first gathered through a Stakeholder Kick-Off Workshop in November 2021 and series of Stakeholder Input Interviews that were conducted with stakeholder agencies in December 2021. The stakeholder group was then invited to a Stakeholder Review Workshop held in February 2022 where ITS needs for the Johnson City Region were identified, existing and planned ITS technologies in the Region were reviewed, and regional ITS deployments recommended by stakeholders in interviews were discussed with the group as a whole.

Stakeholders developed the update for the Johnson City Regional ITS Architecture and Deployment Plan based on a vision of how they wanted to implement and operate ITS through the next approximately 20 years, with the primary focus on the next five to ten years. The deployment of ITS will also support the Johnson City MTPO 2050 Metropolitan Transportation Plan (MTP) vision and the four goals identified in the plan, including goals related to safety and reliability throughout the transportation system.

The Johnson City Regional ITS Architecture and Deployment Plan will support the vision and goals established in the MTP.

Johnson City MTPO 2050 MTP Goals Supported by the Regional ITS Architecture and Deployment Plan

- Improve Safety and Security Throughout the MTPO area transportation system.
- Mitigate Traffic Congestion along Major Routes in the MTPO Area
- Promote Economic Growth and Livability by Enhancing the Transportation System
- Enhance Regional Access to and from the MTPO Area

The Johnson City Regional ITS Architecture and Deployment Plan summarizes regional transportation needs that could be addressed in some way through ITS and an inventory of existing and planned ITS elements that would be necessary to implement desired ITS technologies. The Johnson City Regional ITS Architecture and Deployment Plan also identifies the ITS services that were important to stakeholders in the Johnson City Region. Stakeholders selected a total of 48 ITS service packages from the National ITS Architecture for implementation in the Johnson City Region. The service packages in the National ITS Architecture were customized to reflect regional transportation needs and desired project deployments in the Johnson City Region.

The 2022 update to the Johnson City Regional ITS Architecture and Deployment Plan includes a Regional ITS Deployment Plan section. The Regional ITS Deployment Plan section builds on the Regional ITS Architecture by outlining specific ITS project recommendations and strategies for the Johnson City Region. The Regional ITS Deployment Plan section includes discussion of local agency and TDOT ITS projects and programs, as well as projects of a regional nature that would require interagency coordination for successful implementation. Stakeholders identified specific projects that include a recommended timeframe for deployment, funding status, and the corresponding ITS service packages that support the deployment.

The Johnson City Regional ITS Architecture and Deployment Plan needs to 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 Johnson City Regional ITS Architecture and Deployment Plan so that they are consistent with both the Johnson City MTPO 2050 MTP vision and goals, and the national standards described in the Johnson City Regional ITS Architecture and Deployment Plan. Therefore, prior to a project deployment, it is the responsibility of that project's lead stakeholder agency to evaluate the Johnson City Regional ITS Architecture and Deployment Plan to confirm that the project conforms or else to request the necessary changes to the architecture. It is then Johnson City MTPO's responsibility to accept or reject the requested changes to the architecture. Finally, TDOT will review submitted projects for concurrence with the regional architecture.

Stakeholders agreed that a full update of the Johnson City Regional ITS Architecture and Deployment Plan should occur on an as needed basis. The Johnson City MTPO will work with the TDOT Traffic Operations Division and the FHWA Tennessee Division to determine if there have been enough changes to warrant a full update and complete the full update. Minor changes should occur as needed between full updates of the plan. For situations where a change is required, an Architecture

Maintenance Documentation Form has been developed. This form should be completed and submitted to the architecture maintenance contact person identified on the form whenever a change to the Johnson City Regional ITS Architecture and Deployment Plan is proposed.

A corresponding website was also developed for the Johnson City Regional ITS Architecture and Deployment Plan which contains electronic versions of all documents, meeting minutes, and an interactive version of the architecture database known as RAD-IT (Regional Architecture Development for Intelligent Transportation). The website is located at the following address:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

1 INTRODUCTION

The Johnson City Regional Intelligent Transportation System (ITS) Architecture and Deployment Plan provides a long-range plan for the deployment, integration, and operation of ITS in the Johnson City Region. The Johnson City Regional ITS Architecture and Deployment Plan allows stakeholders to plan for what they want their system to look like in the long term and then break the system into smaller projects that can be implemented over time as funding permits. Development of a Regional ITS Architecture and Deployment Plan 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) to use federal transportation funds for ITS projects in the Region.

ITS can be defined as the application of electronic technologies and communications to improve the operation of the transportation system. Examples of ITS technologies and systems include traffic detectors, closed-circuit television (CCTV) cameras, dynamic message signs (DMS), and real-time information on traffic and transit conditions. ITS often includes interrelated systems from multiple agencies and jurisdictions that work together to deliver transportation services. To support planning and integration of these systems, regional ITS architectures are developed. A regional ITS architecture is a framework for institutional agreement and technical integration in a region. An architecture defines the links between the pieces of the system and the information that is exchanged on each connection. An architecture is important because it allows integration options to be considered prior to investment in the design and development of elements of a system. An architecture defines functions but not specific technologies, which allow the architecture to remain effective over time. Architectures define what must be done, but not how it will be done from a technology standpoint.

1.1 Project Overview

Regional ITS architectures are living documents and should be updated as necessary to reflect a region's needs and current guidelines. The Johnson City Regional ITS Architecture and Deployment Plan was first developed in 2006. Since that time, a number of ITS programs and projects have been implemented in the Johnson City Region including the City of Johnson City's traffic management center (TMC), advanced traffic management system (ATMS), CCTV cameras, and the Johnson City Transit System's automated vehicle location (AVL) system which allows the agency to display real-time bus location information on their website. Additionally, the National ITS Architecture, which served as the basis for the Johnson City Regional ITS Architecture and Deployment Plan, was updated several times, with the most recent update occurring in 2019. In order to incorporate changes in the Region and the National ITS Architecture, the Tennessee Department of Transportation (TDOT) and the Johnson City Metropolitan Transportation Planning Organization (MTPO) completed this update of the Johnson City Regional ITS Architecture and Deployment Plan in 2022.

The Johnson City Regional ITS Architecture and Deployment Plan consists of several key components:

- **ITS Needs** – The needs describe the transportation related needs in the Johnson City Region that could possibly be addressed by ITS.
- **ITS Inventory** – The inventory describes all 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 Johnson City 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.
- **Use and Maintenance Plan** – The use and maintenance plan describes how to use the Johnson City Regional ITS Architecture and Deployment Plan for ITS planning and design efforts, such as the development of a Systems Engineering Analysis. It also describes how the Johnson City Regional ITS Architecture and Deployment Plan 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 and the Moving Ahead for Progress in the 21st Century (MAP-21) bill passed in 2012. In response to Section 5206(e) of TEA-21, FHWA issued a final rule and the 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 update of the Johnson City Regional ITS Architecture and Deployment Plan includes the same geographic boundaries as the Johnson City MTPO's Metropolitan Planning Area (MPA). The stakeholders developed the update of the Johnson City Regional ITS Architecture and Deployment Plan based on a vision of how they wanted to implement and operate ITS through the year 2050 in the Johnson City Region. Additionally, the Johnson City Regional ITS Architecture and Deployment Plan includes a Regional ITS Deployment Plan, which identifies projects that have been recommended by the stakeholders as priority projects for their agency that will help achieve the vision of the Johnson City Regional ITS Architecture and Deployment Plan.

The update of the Johnson City Regional ITS Architecture and Deployment Plan 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 additional input and ensure that the plans reflected the unique needs of the Region. Copies of the draft reports were provided to all stakeholders. The Johnson City Regional ITS Architecture and Deployment Plan update 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 Johnson City Region

1.2.1 Geographic Boundaries

For the Regional ITS Architecture and Deployment Plan Update project, the Johnson City Region corresponds to the Johnson City MTPO's MPA boundary and is shown in **Figure 1**. The MPA boundary is comprised of the majority of Washington County, the northern and western portions of Carter County, a northern portion of Unicoi County, and a southern portion of Sullivan County. Other municipalities within the Region include the Town of Jonesborough, Town of Watauga, City of

Elizabethton, City of Bluff City, and Town of Unicoi. Johnson City is also a principal city in northeast Tennessee. The other principal cities include Kingsport, TN and Bristol, TN (in addition to Bristol, VA which shares a central business district across the State border from Bristol, TN). The cities of Kingsport and Bristol are each in a separate metropolitan planning organization (MPO).

The Johnson City MTPO and TDOT identified stakeholders from the appropriate city, county, regional, state, and federal agencies from throughout the Johnson City Region to guide the development of this update for the Johnson City Regional ITS Architecture and Deployment Plan. The identified stakeholders included city, county, and regional representatives, as well as representatives from TDOT Region 1, TDOT Traffic Operations Division in Nashville, and the FHWA Tennessee Division Office.

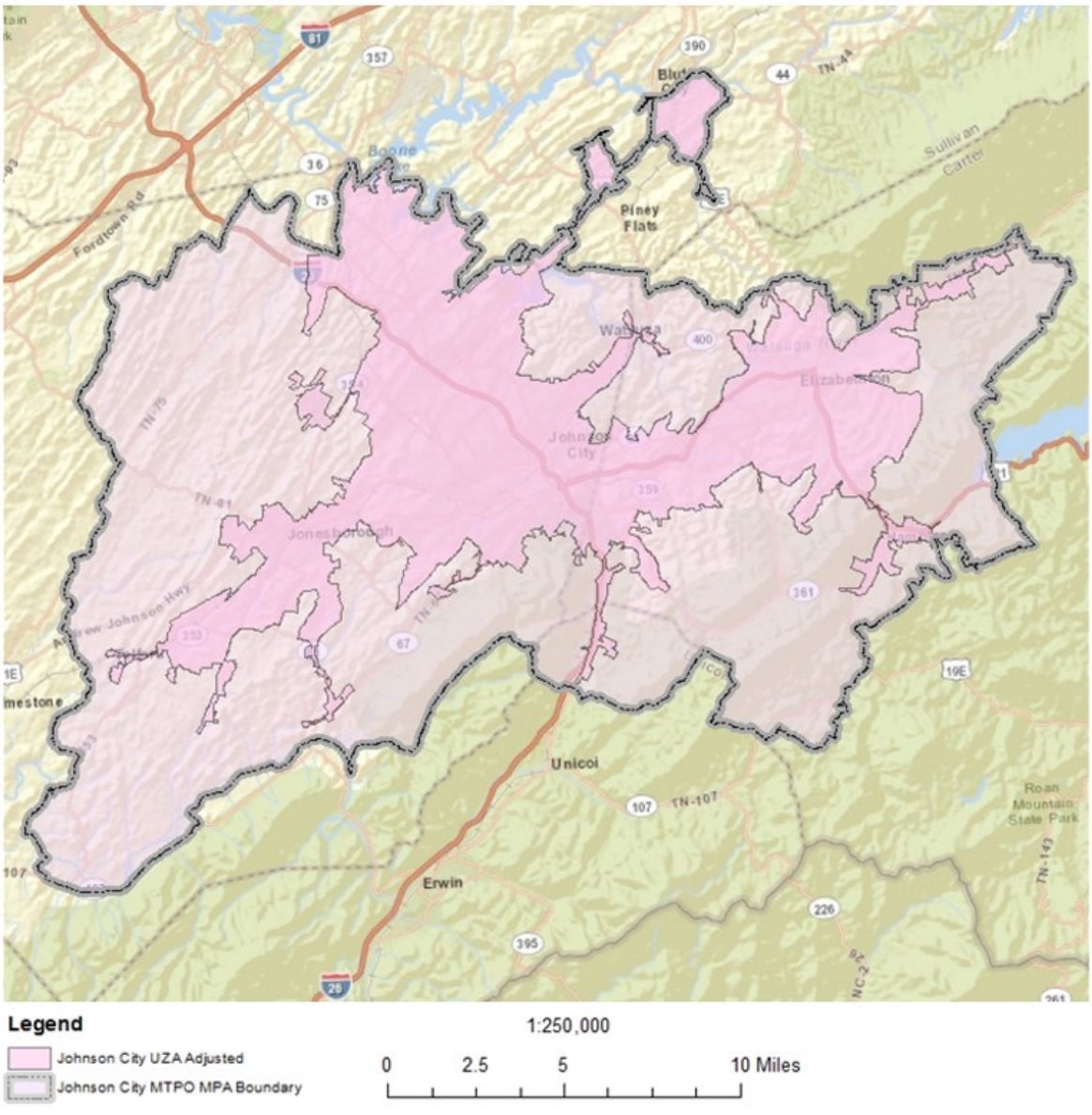

Figure 1 – Johnson City MTPO Regional Boundary

1.2.2 Transportation Infrastructure

The Johnson City Region is served by a number of significant State and Federal Highways. The primary access-controlled facilities are I-26. I-26 is designated as an east-west route, connecting the Region with the City of Kingsport and southwest Virginia to the west and to the east with the City of Asheville, North Carolina, eventually ending at Charleston, South Carolina, which serves the Port of Charleston. I-81, which runs just north of the Johnson City Region boundaries, is also an east-west route that connects to I-40 and the City of Knoxville to the west and the Bristol, TN and VA region to the northeast. TDOT has designated I-81 and I-26 as the official detour route in the event I-40 from Knoxville to Asheville, North Carolina is closed for an event such as a landslide or other occurrence. As such, the interchange of I-81 and I-26 is of strategic importance to transportation.

Major arterials in the Johnson City Region include SR 34/US 11E/US 321 which connects the City of Johnson City with the Town of Jonesborough and the City of Greeneville to the west, SR 67/US 321 which connects the City of Johnson City to the City of Elizabethton in the east, and SR 34/US 11E/ US 19W which connects the City of Johnson City to the City of Bristol to the northeast. SR 381 (State of Franklin Road) is a semi-circumferential route that serves as a major commercial corridor, links to other major routes including I-26, and serves the campus of East Tennessee State University. Other federal highways that traverse the Johnson City Region include US 23 and US 19E.

Fixed-route and paratransit services are provided in the City of Johnson City by the Johnson City Transit (JCT) System. Northeast Tennessee Transit (NET Trans), a division of the First Tennessee Human Resource Agency (FTHRA), operates a demand response service in the Johnson City Region.

The Johnson City Region is also served by two Class I railroads operated by Norfolk Southern and CSX. Norfolk Southern's rail line connects to Greeneville and Knoxville to the west and the Bristol Region to the northeast. The CSX rail line approximately follows I-26 through Tennessee, connecting to the City of Kingsport in the north and western North Carolina to the south.

The development of a ten-mile bicycle and pedestrian rails-to-trails project, called the Tweetsie Trail, along an abandoned rail line that connects the City of Johnson City and City of Elizabethton was completed in 2015. Carter County is currently considering extending the trail four miles through Hampton, and possibly to Roan Mountain in the future. The cities of Johnson City, Jonesborough, and Elizabethton are developing other dedicated bicycle and multipurpose paths as part of various corridor and greenway projects.

The Johnson City Region has undertaken several deployments of ITS programs throughout the Region. These programs are led by a variety of agencies and cover multiple transportation modes. Multi-agency participation has been present on many of these ITS initiatives. The following are a few of the larger ITS programs underway or existing within the Johnson City Region:

- **TDOT SmartWay Program** – TDOT's SmartWay platform is predominately a freeway traffic management platform comprised of CCTV cameras, DMS, and radar detection systems (RDS). CCTV cameras and DMS are currently located along I-81 near the interchange of I-26. Although these elements are not within the Region's boundaries, their close proximity allows the Johnson City Region to benefit significantly from their presence. TDOT's SmartWay website provides congestion, incident, and construction information, in addition

to live video from CCTV cameras in the Johnson City Region. The TDOT Region 1 SmartWay TMC is located in Knoxville and operates 24 hours a day, 7 days a week.

- **TDOT Rural Assist Trucks** – The TDOT HELP program recently began piloting a Rural Assist Truck program to provide assistance coverage in rural areas, including along I-26 and I-81 in the Johnson City Region. The Rural Assist Truck program trucks patrol freeways and assist motorists with minor repairs such as flat tire changes and refueling. Rural Assist operators also assist with traffic control and detours during major incidents.
- **City of Johnson City Traffic Management –** The City of Johnson City has installed CCTV cameras supporting real-time monitoring of the roadway network including along I-26 and at many of the traffic signals within the City. The Johnson City TMC monitors traffic signals throughout the region as well as the CCTV camera. The City also shares traffic signal data with a private data company, which then share information such as time until green at a signal and ideal speeds for progression along a corridor. A majority of the traffic signals also have emergency vehicle preemption installed. For closures, the City partners with Waze to provide advanced notice of planned road closures.
- **City of Elizabethton Traffic Management –** The City of Elizabethton is planning to implement a TMC, connect traffic signals to allow for centralized traffic signal control, and install a fiber communication link in the City to support interconnectivity. The City is also interested in deploying CCTV cameras and update and expand emergency vehicle traffic signal preemption on signals.
- **Johnson City Transit ITS** – Johnson City Transit (JCT) has implemented or plans to implement a number of programs. All JCT fixed-route and demand response vehicles include AVL systems. Additionally, riders can view real-time bus locations on the JCT website or text a specific code located at each bus stop to receive next bus departure times. A DMS unit at the JCT Transit Center also displays bus arrival and departure information. JCT has implemented a paratransit trip scheduling software, Paraplan, that allows paratransit drivers to use iPads or Android devices to receive schedules and send out automatic calls the day before a scheduled pickup to confirm appointments. Future initiatives include a mobile phone application, an electronic fare payment card, DMS boards at bus stops, and a second, more northern transfer center.

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. Two stakeholder workshops were conducted to update the Johnson City Regional ITS Architecture and Deployment Plan and several interviews were conducted with individual stakeholder agencies in the Region. The Johnson City MTPO and TDOT led the update but federal, state, and local agencies were involved in all steps. Section 2 of this document describes the development process in more detail and identifies all of the participating stakeholders.

1.3 Document Overview

The Johnson City Regional ITS Architecture and Deployment Plan report is organized into seven key sections:

Section 1 – Introduction

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

Section 2 – Regional ITS Architecture and Deployment Plan Update Process

This section provides an overview of the key steps involved in updating the Johnson City Regional ITS Architecture and Deployment Plan as well as an overview of the RAD-IT architecture database and reports.

Section 3 – Regional ITS Needs

This section contains a summary of regional needs for the Johnson City 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 Johnson City or Johnson City 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 Johnson City 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 Johnson City Regional ITS Architecture and Deployment Plan, are also presented. Operational concepts identifying stakeholder roles and responsibilities are discussed and agreements to support the sharing of data and resources are 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 Johnson City Regional ITS Architecture and Deployment Plan. 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 Plan

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

Appendix

The Johnson City Regional ITS Architecture and Deployment Plan contains six appendices:

- Appendix A – Stakeholder Involvement and Information Database
- Appendix B – ITS Service Package Definitions

- Appendix C – System Functional Requirements Table (From RAD-IT)
- Appendix D – Copies of Existing Regional ITS Agreements
- Appendix E – TDOT ITS Project Identification Form
- Appendix F – Regional ITS Architecture Maintenance Documentation Form

Website

A corresponding website was also developed for the Johnson City Regional ITS Architecture and Deployment Plan which contains electronic versions of all documents and an interactive version of the RAD-IT architecture database. The website is located at the following address:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

2 REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN UPDATE PROCESS

The update of the Johnson City Regional ITS Architecture and Deployment Plan 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 additional input, and draft documents were made available to stakeholders for review and comment.

2.1 Stakeholder Engagement

2.1.1 Stakeholder Input Process

The process followed for the Johnson City Region was designed to ensure that stakeholders could provide input and review the update of the Johnson City Regional ITS Architecture and Deployment Plan. **Figure 2** illustrates the process followed.

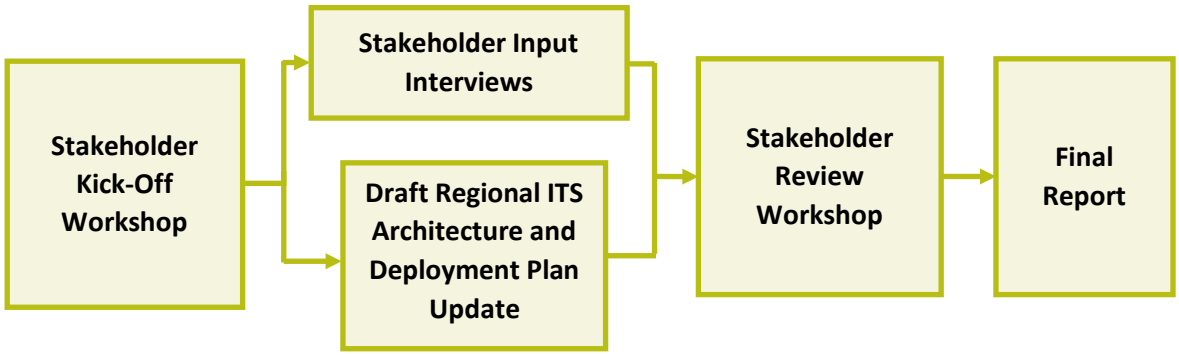

Figure 2 – Johnson City Regional ITS Architecture and Deployment Plan Development Process

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

- Stakeholder 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 update of the Johnson City Regional ITS Architecture and Deployment Plan. Key components of the process are described below:

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

Stakeholder Input Interviews and System Inventory: Stakeholder input was gathered through a series of interviews that were conducted with individual 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 initial 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 RAD-IT Architecture database.

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

Final Report: The final document of the updated Johnson City Regional ITS Architecture and Deployment Plan was developed, which included an executive summary, project report, RAD-IT Architecture database, and project website with an interactive version of the Johnson City Regional ITS Architecture and Deployment Plan.

A corresponding website was also developed for the updated Johnson City Regional ITS Architecture and Deployment Plan which contains electronic versions of all documents, meeting minutes, and an interactive version of the RAD-IT Architecture database. The website is located at the following address:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

2.1.2 Johnson City Region Stakeholders

The Johnson City MTPO and TDOT identified stakeholders from the appropriate city, county, regional, state, and federal agencies from throughout the Johnson City Region to guide the development of the update of the Johnson City Regional ITS Architecture and Deployment Plan. Since 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 Johnson City Region who have participated in the project workshops or provided input to the study team as to the needs and issues to be considered as part of the Johnson City Regional ITS Architecture and Deployment Plan. Attendance records and a complete listing of participating stakeholders is included in **Appendix A**.

Table 1 – Johnson City Region Stakeholder Agencies and Contacts

Agency	Representative	Contact Information
Carter County Emergency Management Agency	Billy Harrell Director	harrellb@cartercountytn.gov
City of Elizabethton	Matthew Balogh GIS and Engineering Manager	mbalogh@cityofelizabethton.org
City of Elizabethton	Logan Engle Director of Planning & Economic Development	lengle@cityofelizabethton.org
City of Johnson City Public Works Department – Traffic Division	Anthony Todd Traffic Engineering Manager	anthonytodd@johnsoncitytn.org
City of Johnson City Public Works Department – Traffic Division	Tyler Morris Civil Engineer	tmorris@johnsoncitytn.org
City of Johnson City Fire Department	David Bell Fire Chief	dbell@johnsoncitytn.org
FHWA – Tennessee Division	Pamela Heimsness Safety & Traffic Operations Team Leader	pamela.heimsness@dot.gov
FHWA – Tennessee Division	Melissa Furlong Operations Program Manager	melissa.furlong@dot.gov
FHWA – Tennessee Division	Sean Santalla Planning & Air Quality Specialist	sean.santalla@dot.gov
First Tennessee Development District	Chase Milner Rural Planning Organization Coordinator	cmilner@ftdd.org
Johnson City Metropolitan Transportation Planning Organization	Glenn Berry Transportation Coordinator	glennberry@jcmpo.org
Johnson City Metropolitan Transportation Planning Organization	Mary Butler Transportation Planner	marybutler@jcmpo.org
Johnson City Transit System	Jeff Rawles Assistant Transit Director	jrawles@johnsoncitytransit.org
Tennessee Emergency Management Agency – East Region Office	Michelle Matson Emergency Management Coordinator	michelle.matson@tn.gov
Tennessee Department of Transportation – Long Range Planning Division	Troy Ebbert Planning Supervisor, Region 1	troy.j.ebbert@tn.gov
Tennessee Department of Transportation – Long Range Planning Division	Ronda Sawyer Transportation Planning Specialist, Region 1	ronda.j.sawyer@tn.gov
Tennessee Department of Transportation – Region 1	Mark Best ITS/ Traffic Manager	mark.best@tn.gov
Tennessee Department of Transportation – Region 1	Michael Dick District Engineer	michael.dick@tn.gov
Tennessee Department of Transportation – Region 1	Jason Farmer District Operations Manager	jason.farmer@tn.gov

Agency	Representative	Contact Information
Tennessee Department of Transportation – Region 1	Andrew Padgett Region 1 Traffic Engineer	andrew.padgett@tn.gov
Tennessee Department of Transportation – Region 1, District 17	Brian Ramsey Operations District Supervisor	brian.ramsey@tn.gov
Tennessee Department of Transportation – Traffic Operations Division	Murad AlQurishee Transportation Project Specialist	murad.alqurishee@tn.gov
Tennessee Department of Transportation – Traffic Operations Division	Said El Said ITS Program Manager	said.elsaid@tn.gov
Tennessee Department of Transportation	Jake Wilson Operations District Specialist	jake.wilson@tn.gov
Washington County – Johnson City Emergency Management Agency	Rusty Sells Emergency Management Director	rsells@washingtoncountytn.org

2.2 RAD-IT Architecture Software

RAD-IT Architecture Version 9.0 was used to develop the update of the Johnson City Regional ITS Architecture and Deployment Plan. RAD-IT 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 9.0 of RAD-IT Architecture was released in March 2021 and was developed to support Version 9.0 of the National ITS Architecture. Use of the RAD-IT Architecture software in development of regional ITS architectures is recommended by both the FHWA and FTA.

In the Johnson City Region, the RAD-IT 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 Johnson City 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. RAD-IT Architecture allows the Region to document all of the elements and data flows that exist or are planned in the Region. RAD-IT Architecture also allows the user to quickly access any standards that are associated with the data flows as well as generate reports and diagrams to assist in reviewing the data. Some examples of the useful reports and diagrams that may be generated using the RAD-IT Architecture software are included in **Table 2**.

RAD-IT Architecture saves data in Microsoft Access compatible data files. RAD-IT 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 RAD-IT Architecture software. The USDOT offers the RAD-IT 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://www.arc-it.net/ and Version 9.0 was the most recent version available.

Table 2 – RAD-IT 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 Johnson City Regional ITS Architecture.
Inventory Report	Provides a description and status for each element in the Johnson City Regional ITS Architecture.
Service Packages Report	Identifies each of the service packages selected for the Johnson City 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 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 Johnson City Regional ITS Architecture.
Subsystem Diagram	Identifies the subsystems from the National ITS Architecture that are included in the Johnson City Regional ITS Architecture.
Interconnect Diagrams	Identifies for each element all the other elements that are connected and the status of each connection. The Interconnect Diagrams can be customized to show all elements in the Johnson City 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 the elements and connections in each service package.
Flow Diagrams	Flow Diagrams are like 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 Stakeholder Kick-Off Workshop held in November 2021 and individual stakeholder agency interviews conducted in December 2021. In addition, the Johnson City MTPO 2050 Metropolitan Transportation Plan (MTP) was reviewed to determine other regional needs that could possibly be addressed in some way through ITS.

Within the Johnson City MTPO 2050 MTP, there are four regional goals that were identified to help direct future decisions regarding transportation for the Johnson City Region.

MTP Goal – Improve Safety and Security throughout the MTPO Area Transportation System: ITS can be used to monitor infrastructure, improve incident detection time, and provide advanced warning of incidents or other potential safety issues that might impact travelers. Emergency management agencies can benefit from ITS through emergency vehicle traffic signal preemption and emergency vehicle routing.

MTP Goal – Mitigate Traffic Congestion along Major Routes of the MTPO: ITS can be used to provide real-time network conditions information to travelers that allow them to make informed decisions regarding route or mode choice. Additionally, measures such as variable speed limits, ramp metering, and adaptive traffic signal control systems, which can respond to changing traffic patterns, are strategies that can help reduce congestion. ITS is also a critical part of incident management, such as the use of the TDOT HELP vehicles and Rural Assist Trucks to manage traffic during an incident. Incidents make up a large part of the congestion experienced in most urban areas, and improved incident management can reduce non-recurring congestion.

MTP Goal – Promote Economic Growth and Livability by Enhancing the Transportation System: While ITS does not support this goal as directly as the safety and congestion goals, a more reliable transportation system with accurate information to travelers about current and future conditions can support economic growth and livability. ITS technologies such as CCTV cameras to identify incidents and other events, flood detection to detect water on roadways, DMS to provide information to travelers, and enhanced statewide traveler information systems will improve livability.

MTP Goal – Enhance Regional Access to and from the MTPO Area: ITS deployed outside the Region, such as the DMS and detectors on I-81 near the I-26 interchange, will provide information directly to travelers entering and leaving the Johnson City Region.

The investment needs identified through the Johnson City Regional ITS Architecture and Deployment Plan update process as well as the Johnson City MTPO 2050 MTP regional goals provided guidance for determining which service packages should be included in the architecture. Stakeholders identified ITS needs for the Johnson City Region in the following areas:

- Data management;
- Maintenance and construction;
- Parking management;
- Public safety;
- Public transportation;

- Traffic management;
- Traveler information;
- Vehicle safety; and
- Weather.

In Section 5.1.4 a 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.) A summary of these needs is presented in **Table 3**.

Table 3 – Summary of Johnson City Regional ITS Needs

Data Management Needs
Need to archive data gathered through ITS to make it more accessible to regional stakeholders
Need to store spatial data to allow for better analysis of crashes and other spatial transportation data
Maintenance and Construction Needs
Need better coordination between TDOT and local agencies during maintenance and construction
Need to monitor and improve tracking for winter road maintenance activities and vehicles
Parking Management Needs
Need to monitor and display real-time parking availability information
Public Safety Needs
Need better coordination among various agencies during large-scale events
Need to assist emergency vehicle movement with traffic signal preemption and monitoring
Need to expand roadway service patrols for motorist assistance and incident management
Public Transportation Needs
Need to improve coordination among transit agencies
Need Johnson City Transit to implement scheduling software for paratransit vehicle
Need to monitor bus passenger boarding and alighting
Need to implement smart card system for fixed-route and demand response vehicles that is compatible with other transit agencies
Traffic Management Needs
Need to reduce traffic congestion along major routes within the MTPO area
Need to improve coordination and the sharing of information between TDOT and Johnson City
Need Johnson City traffic to provide Johnson City emergency management agencies with roadway network conditions
Need to implement adaptive traffic signal control along congested corridors
Need to expand the interconnected traffic signal system network
Need to expand CCTV camera coverage areas throughout the Region
Need to monitor rail crossing and convey blockages to drivers
Traveler Information Needs
Need to convey information to drivers through DMS, social media, television, or other methods
Need to continue to improve the dissemination of real-time transit information for riders through mobile phone application, bus stop DMS, and website
Vehicle Safety Needs
Need to provide a transportation system that supports vulnerable road users
Weather Needs
Need to monitor roadway weather conditions and provide accurate dissemination to agencies and travelers

4 REGIONAL ITS INVENTORY

The inventory and needs documented during the Stakeholder Kick-Off Workshop and individual stakeholder agency interviews were the starting point for updating the Johnson City Regional ITS Architecture and Deployment Plan. These ITS systems and components are used to customize the National ITS Architecture and create the updated Johnson City Regional ITS Architecture and Deployment Plan.

The Johnson City Region stakeholder group agreed to create individual traffic, maintenance, and emergency management elements for the City of Johnson City and individual traffic and emergency management elements for the City of Elizabethton. The other smaller cities and towns in the Region were documented as part of the municipal elements. This documentation allows the smaller cities and towns to be included in the Johnson City Regional ITS Architecture and Deployment Plan, and therefore eligible to use federal funds 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 Johnson City Regional ITS Architecture and Deployment Plan is associated with a stakeholder agency. A list of stakeholder agencies identified in the Johnson City Regional ITS Architecture and Deployment Plan can be found in **Table 4**, along with a description of each stakeholder. Most stakeholder agencies are called out by name with exception of smaller municipalities. In the Johnson City Regional ITS Architecture and Deployment Plan, the City of Johnson City and the City of Elizabethton are called out by name, but all other municipalities are covered under the general stakeholder name municipal government.

Table 4 – Johnson City Regional Stakeholder Descriptions

Stakeholder	Stakeholder Description
Ballad Health	Health care system serving the Johnson City Region. Ballad Health operates several hospitals within the Region.
Carter County/City of Elizabethton Emergency Management Agencies	Emergency management agencies (EMAs) for the City of Elizabethton and Carter County. Includes the Carter County Sheriff's Department, City of Elizabethton Police and Fire Departments as well as emergency medical services.
City of Elizabethton	Municipal government for the City of Elizabethton, Tennessee. Covers all city departments including those that deal with traffic and public safety.
City of Johnson City	Municipal government for the City of Johnson City, Tennessee. Covers all city departments including those that deal with traffic and public safety.
Financial Institution	Handles exchange of money for transit electronic fare collection.
First Tennessee Human Resource Agency	Among other Regional social services, the human resource agency operates NET Trans. NET Trans provides demand response transit in the Region outside the Johnson City Transit service area.
Johnson City Transit System	Transit provider that operates both fixed-route and paratransit service within the City of Johnson City. Johnson City Transit also operates buses on the East Tennessee State University campus.
Media	Local media outlets. This can include television stations, newspapers, radio stations and their associated websites.
Municipal Government	Municipal government for the City of Jonesborough and other municipalities within the Johnson City Region that are not identified individually. Covers all city departments including those that deal with traffic and public safety.
NOAA	National Oceanic and Atmospheric Administration (NOAA), agency that 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.
Other States	Emergency or traffic management agencies in other states adjacent to Tennessee. In the Johnson City Region this includes North Carolina.
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.
System Users	All of the users of the transportation system.
TDOT	The Tennessee Department of Transportation (TDOT) is responsible for the construction, maintenance, and operation of roadways in the State of Tennessee.
TEMA	Tennessee Emergency Management Agency (TEMA). The 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 Tennessee.

4.2 ITS Elements

The ITS inventory is documented in the Johnson City Regional ITS Architecture and Deployment Plan as elements. **Table 5** sorts the inventory by stakeholder so that each stakeholder can easily identify and review all the architecture elements associated with their agency. The table also specifies the status of the element, whether it is planned or it already exists. 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 Johnson City Regional ITS Architecture and Deployment Plan is consistent with the naming convention used in the Statewide ITS Architecture. This consistency provides seamless connections between the Regional and Statewide ITS Architecture.

The ITS elements for the Johnson City Region can also be found in the Interactive ITS Architecture through the online RAD-IT database located at:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

To access the elements and definitions from the website, select the "Johnson City Interactive ITS Architecture", then select the "Inventory" page from the left sidebar, then click the desired element name. To see a list of the ITS elements sorted by the stakeholder that owns the element, select "Inventory by Stakeholder" from the left sidebar.

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Ballad Health	Ballad Health - Johnson City Medical Center	Level 1 trauma center located in Johnson City.	Existing
	Ballad Health - Sycamore Shoals Hospital	Hospital located in the City of Elizabethton. The hospital has a 24-hour emergency department.	Existing
	Wings Air Rescue Flight Operations	Regional medical communications center that dispatches EMS as well as air rescue services.	Existing
Carter County/City of Elizabethton Emergency Management	Carter County 911 Communications District	The City of Elizabethton operates the Carter County 911 Communications District. The 911 Public Safety Answering Point (PSAP) answers and dispatches all 911 calls within the County.	Existing
	Elizabethton/Carter County EMA	Emergency management agency for all of Carter County, including the City Elizabethton. Responsible for communications with TEMA and coordination of local resources during a disaster or large scale incident.	Existing
	Carter County/Elizabethton Public Safety Vehicles	Carter County Sheriff vehicles, City of Elizabethton Police and Fire Vehicles and EMS vehicles operating within the County and the City.	Existing
City of Elizabethton	City of Elizabethton CCTV Cameras	Closed-circuit television cameras operated by the City of Elizabethton TMC for traffic condition monitoring and management of incidents.	Planned
	City of Elizabethton Connected Vehicle Roadside Equipment	City of Elizabethton devices that are used to send messages to, and receive messages from, nearby vehicles using wireless communications technologies.	Planned
	City of Elizabethton DMS	Dynamic message signs for traffic information dissemination operated by the City of Elizabethton TMC.	Planned
	City of Elizabethton Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. This information is used in the operation of the traffic signal system.	Existing
	City of Elizabethton Fire Department Surveillance Cameras	Surveillance cameras for transportation infrastructure protection.	Existing
	City of Elizabethton Fire Dispatch	Emergency dispatch functions for the Fire Department.	Existing
	City of Elizabethton Government Information Channel	A government cable television channel operated by the City of Elizabethton that provides residents with important information.	Existing

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
City of Elizabethton (Continued)	City of Elizabethton Mayor's Office	The office of the Mayor of the City of Elizabethton is responsible for communicating with the media regarding incidents or construction affecting the roadway network. They are also responsible for placing these same types of information on the City of Elizabethton Website.	Existing
	City of Elizabethton Police Department	Police department for the City of Elizabethton. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Elizabethton Streets and Sanitation Department	The Streets and Sanitation Department is responsible for the maintenance of roadways in the City of Elizabethton.	Existing
	City of Elizabethton Streets and Sanitation Department Vehicles	Vehicles used in maintenance operations including snow removal.	Existing
	City of Elizabethton Flashing Beacons	High intensity rapid flashing beacons used to alert motorists of pedestrian crossings.	Existing
	City of Elizabethton Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds in the City of Elizabethton.	Planned
	City of Elizabethton TMC	Traffic management center for the City of Johnson City. Responsible for operating the traffic signal system, closed-circuit television cameras and dynamic message signs.	Planned
	City of Elizabethton Traffic Signals	Traffic signal system operated by the City of Elizabethton TMC.	Existing
	City of Elizabethton Website	Website for the City of Elizabethton. Includes information on various departments and in the future it is envisioned that the website will have real-time information about roadway conditions.	Existing
City of Johnson City	City of Johnson City - City Engineers Office	Responsible for administration of maintenance and construction projects within the City.	Existing
	City of Johnson City CCTV Cameras	Closed-circuit television cameras operated by the City of Johnson City TMC for traffic condition monitoring and management of incidents.	Existing
	City of Johnson City Community Relations	The office of community relations for the City of Johnson City. The office is responsible for communicating with the media regarding incidents or construction affecting the roadway network. They are	Existing

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
		also responsible for placing these same types of information on the City of Johnson City Website.	
City of Johnson City (Continued)	City of Johnson City Connected Vehicle Roadside Equipment	City of Johnson City devices that are used to send messages to, and receive messages from, nearby vehicles using wireless communications technologies.	Planned
	City of Johnson City DMS	Dynamic message signs for traffic information dissemination operated by the City of Johnson City TMC.	Planned
	City of Johnson City Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. The data collected from these devices is used to evaluate the performance of the roadway network and for the operation of the traffic signal system.	Existing
	City of Johnson City Flood Detectors	Flood warning systems for the City of Johnson City that detect flood events at low water crossings throughout the city.	Planned
	City of Johnson City Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Planned
	City of Johnson City Parking Availability DMS	Dynamic message signs for parking availability information dissemination operated by the City of Johnson City Parking Management Center.	Planned
	City of Johnson City Parking Management Center	Future group that assists with parking availability management.	Planned
	City of Johnson City Police Department	Police department for the City of Johnson City. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Johnson City Portable DMS	Portable dynamic message signs used for traffic information dissemination during maintenance and construction activities, special events, or incidents.	Existing
	City of Johnson City Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Existing
	City of Johnson City Rectangular Rapid Flashing Beacons	High intensity rapid flashing beacons used to alert motorists of pedestrian crossings.	Existing
	City of Johnson City Road Closure Gates	City of Johnson City roadway equipment that is used to close roads during inclement weather conditions.	Planned

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
City of Johnson City (Continued)	City of Johnson City RWIS Sensors	Road weather information systems installed in the field to gather information about the roadways such as temperature and moisture levels.	Planned
	City of Johnson City Speed Monitoring Equipment	Field equipment used for monitoring Johnson City roadway speeds. Speed monitoring equipment is owned by the City of Johnson City Police Department.	Existing
	City of Johnson City Stormwater Management Division	The Stormwater Management Division is responsible for managing stormwater runoff.	Existing
	City of Johnson City Stream Gauges	Field sensors used to measure water levels.	Existing
	City of Johnson City Street Division	The Street Division is responsible for the maintenance of roadways in the City of Johnson City.	Existing
	City of Johnson City Street Division Vehicles	Vehicles used in maintenance operations including snow removal.	Existing
	City of Johnson City TMC	Traffic management center for the City of Johnson City. Responsible for operating the traffic signal system, closed-circuit television cameras, and dynamic message signs. Traffic signal system operations are an existing function.	Existing
	City of Johnson City Traffic Signals	Traffic signal system operated by the City of Johnson City TMC.	Existing
	City of Johnson City Website	Website for the City of Johnson City. This website is existing in a static format. The City envisions that at some point the site will provide real-time information.	Existing
	Johnson City MTPO Data Archive	Metropolitan Transportation Planning Organization for Johnson City, Tennessee. The agency is responsible for transportation planning in the Region including development of the Metropolitan Transportation Plan (MTP) and Transportation Improvement Plan (TIP) for the Region.	Planned
	City of Johnson City 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
Financial Institution	Financial Service Provider	Handles exchange of money for transit electronic fare collection.	Planned
First Tennessee Human Resources Agency	FTHRA Data Archive	First Tennessee Human Resource Agency data archive for transit data.	Planned

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
First Tennessee Human Resources Agency (Continued)	NET Trans Demand Response Vehicles	Transit vehicles for demand response transit operations.	Existing
	NET Trans Dispatch Center	Responsible for the dispatch and scheduling of demand response transit trips in the Region outside of the Johnson City Transit service area.	Existing
	NET Trans Fixed-Route Vehicles	Transit vehicles that operate on fixed routes in the Region.	Existing
	NET Trans Website	Website with information on fares and schedules and provides the ability to schedule rides online.	Existing
Johnson City Transit	Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	Johnson City Transit Bus Stop DMS	Johnson City Transit real-time next bus arrival information boards.	Existing
	Johnson City Transit Center CCTV Surveillance	Closed-circuit television cameras for surveillance at the Johnson City Transit Center.	Existing
	Johnson City Transit Data Archive	Transit data archive for Johnson City Transit, that includes passenger count data. The archive can be used by FTA, NTD, and the TDOT Office of Public Transportation.	Existing
	Johnson City Transit Demand Response Vehicles	Transit vehicles for demand response transit operations.	Existing
	Johnson City Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Johnson City Transit.	Existing
	Johnson City Transit Fixed-Route Vehicles	Transit vehicles that operate on fixed routes within Johnson City.	Existing
	Johnson City Transit Kiosks	Kiosks used for the purchase and recharging of electronic fare payment cards.	Planned
	Johnson City Transit Mobile Phone App	Johnson City Transit mobile phone application that allows users to view transit service information, real-time bus location, and create a transit trip plan.	Planned
	Johnson City Transit Trip Planner	Johnson City Transit online routing application that assists travelers in developing a customized transit plan for an upcoming trip.	Existing
	Johnson City Transit Website	Website with information about fares and schedules.	Existing
	Transit Operations Personnel	Transit personnel responsible for fleet management, maintenance, and operations of the transit system.	Existing

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Media	Local Print and Broadcast Media	Local media that provide traffic or incident information to the public.	Existing
Municipal Government	Municipal CCTV Cameras	Municipal closed circuit television cameras for traffic surveillance and incident management.	Planned
	Municipal Field Sensors	Municipal 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.	Planned
	Municipal Police Department	Police department for the municipalities. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	Municipal Public Safety Dispatch	Responsible for the dispatch of municipal public safety vehicles.	Existing
	Municipal Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	Municipal Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	Municipal TMC	Municipal Traffic Management Center responsible for municipal signal system operations.	Planned
	Municipal Traffic Signals	Municipal traffic signal systems.	Planned
	Municipal Website	Municipal 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
	Municipal/County Maintenance	Department responsible for maintenance of municipal or county roadway facilities.	Existing
	Municipal/County Public Safety Vehicles	Municipal or County law enforcement, fire, and EMS vehicles.	Existing
NOAA	National Weather Service	Provides official US weather, marine, fire and aviation forecasts, warnings, meteorological products, climate forecasts and information about meteorology.	Existing
Other Agencies	Other Maintenance and Construction Management Agencies	Additional maintenance and construction operations with which information is shared for coordination in an emergency situation.	Planned

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Other Agencies (Continued)	Other Traffic Management Agencies	Additional traffic management agencies with which information is shared for coordination in an emergency situation.	Planned
	Private Transportation Providers	Transportation providers such as taxi companies that pick up at the transit center and long distance bus companies like Greyhound.	Planned
Other States	NCDOT Division 13 Maintenance and Construction	NCDOT entity responsible for the oversight of construction and maintenance in Division 13.	Existing
	North Carolina 511 System	North Carolina 511 traveler information system central server.	Existing
	North Carolina DOT	North Carolina Department of Transportation, responsible for the maintenance and operation of roadways in the State of North Carolina. Included for coordination purposes.	Existing
Private Information Provider	Private Sector Traveler Information Services	Private travel information service provider.	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
Rail Operators	Rail Operator Wayside Equipment	Equipment located along the tracks including railroad crossing gates, bells, and lights as well as the interface to the traffic signal controller indicating the presence of a train.	Existing
System Users	Archived Data User	Those who request information from the data archive systems.	Planned
	Pedestrians	Individuals afoot or using a motorized or non-motorized wheelchair.	Existing
	Public/Private Vehicles	Public or private vehicles that traverse the region.	Existing
	Private Traveler Personal Computing Devices	Computing devices that travelers use to access public information.	Existing
	Traveler	Users 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 that can change the speed limit depending on roadway and traffic conditions.	Planned

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
TDOT (Continued)	TDOT Community Relations Division	TDOT department responsible for the dissemination of traffic information to the media and the public.	Existing
	TDOT Connected Vehicle Roadside Equipment	TDOT devices that are used to send messages to, and receive messages from, nearby vehicles using wireless communications technologies.	Planned
	TDOT DMS	Dynamic message signs for traffic information dissemination.	Existing
	TDOT Emergency Services Coordinator	Emergency service coordinator from TDOT who serves in the TEMA emergency operations group. During a disaster this coordinator acts as a liaison between TEMA and the various TDOT TMCs and maintenance groups.	Existing
	TDOT 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.	Planned
	TDOT HAR	Highway Advisory Radio for traffic information dissemination.	Existing
	TDOT Long Range Planning Division Archive	Data archive for the Long Range Division. The Division is responsible for traffic data collection and analysis.	Existing
	TDOT Maintenance Headquarters	TDOT statewide maintenance headquarters in Nashville.	Existing
	TDOT Maintenance Vehicles	Tennessee Department of Transportation vehicles used in maintenance operations including snow removal.	Existing
	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 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 Region 1 District Operations	Each TDOT Region contains several TDOT district maintenance offices. These district offices handle most of the routine roadway maintenance and respond to incidents when their services are requested by local emergency management.	Existing

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
TDOT (Continued)	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 PIO.	Planned
	TDOT Region 1 HELP and Rural Assist Dispatch	Roadway service patrol dispatch center located in the TDOT Region 1 TMC in Knoxville. Provides dispatch services for the TDOT HELP and Rural Assist vehicles.	Existing
	TDOT Region 1 TMC - Knoxville	Traffic 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. The Johnson City Region is located within TDOT Region 1.	Existing
	TDOT Region 2 TMC - Chattanooga	Traffic 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	Traffic 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	Traffic 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 Rural Assist Trucks	Roadway service patrol vehicles that provide services along I-26 including assistance for disabled vehicles, assistance with quick clearance of incident scenes, and assistance with queue protection.	Existing
	TDOT RWIS Sensors	Road weather information system sensors to monitor road conditions.	Existing
	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 closed-circuit television, vehicle detection, and/or DMS.	Existing

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
TDOT (Continued)	TDOT SmartWay Central Software (SWCS)	SWCS 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). SWCS feeds the Statewide 511 system and SmartWay website.	Existing
	TDOT SmartWay Mobile App	Mobile phone application that allows users to view traffic images, receive incident information, and monitor traffic speeds.	Existing
	TDOT SmartWay Website	TDOT SmartWay website providing road network conditions including incident and construction information and camera views. Much of the data for the website comes from SmartWay Central Software.	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 (IVR). TDOT contracts the IVR operation to a vendor. The IVR accepts 511 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 Amber Alerts in Tennessee.	Existing
THP	THP Dispatch	Tennessee Highway Patrol dispatch center. There are several THP dispatch centers around the State.	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 Traffic and Criminal Software (TraCS) system.	Existing

Table 5 – Johnson City Regional Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
Tennessee Department of Health and Human Services	Service Agency	Agency responsible for payment of transit fares for medical transportation as part of government subsidized medical care. This includes TennCare, Medicare and VA programs.	Planned
Washington County/City of Johnson City Emergency Management	Washington County Emergency Communications District	The 911 Public Safety Answering Point (PSAP) answers and dispatches all 911 calls within the County including the City of Johnson City and Town of Jonesborough.	Existing
	Washington County Sheriff's Office	Law enforcement agency for Washington County. The emergency dispatch functions for the Sheriff's Office are included in the Washington County Emergency Communications District. Non-emergency functions include the collection of crash data.	Existing
	Washington County/Johnson City EMA	Emergency management agency for all of Washington County, including Johnson City. Responsible for communications with TEMA and coordination of local resources during a disaster or large-scale incident.	Existing
	Washington County/Johnson City Public Safety Vehicles	Washington County Sheriff vehicles, City of Johnson City Police and fire Vehicles and EMS vehicles operating within the County and the City.	Existing

5 REGIONAL ITS ARCHITECTURE

Upon completion of the system inventory, the next step in update process for the Johnson City Regional ITS Architecture and Deployment Plan is to identify the ITS services that are important to the Johnson City Region. The National ITS Architecture has the following twelve groups of ITS service areas:

- **Commercial Vehicle Operations** – includes THP weigh-in-motion and inspection capabilities.
- **Data Management** – includes electronic data management and archiving systems.
- **Maintenance and Construction** – includes work zone management, roadway maintenance, and construction information systems.
- **Parking Management** – includes parking space management and electronic reservation and payment management for municipal parking garages.
- **Public Safety** – includes emergency operations/management centers, improved information sharing among traffic and emergency services, AVL systems on emergency vehicles, traffic signal preemption for emergency vehicles, and wide-area alerts.
- **Public Transportation** – includes transit and paratransit AVL, transit travel information systems, electronic fare collection, and transit security.
- **Support** – includes data distribution, map management, and vehicle maintenance.
- **Sustainable Travel** – includes systems that monitor emissions and adjusted traffic signal timings to reduce emissions generated by vehicles.
- **Traffic Management** – includes the TDOT Region 1 TMC in the City of Knoxville and the City of Johnson City TMC, as well as other existing and future TMCs, detection systems, CCTV cameras, fixed and portable DMS, and other related technologies.
- **Traveler Information** – includes broadcast traveler information, traveler information kiosks, and public and private information sources available through the Internet.
- **Vehicle Safety** – includes connected vehicle infrastructure and on-board equipment that provides safety-related warnings and guidance.
- **Weather** – includes road weather detection and warning systems.

Existing, planned, and future systems in the Johnson City Region were considered in each of the service areas. Commercial Vehicle Operations, Support, and Sustainable Travel were not included in this version of the Johnson City Regional ITS Architecture and Deployment Plan. Commercial Vehicle Operations and Sustainable Travel were 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. Support was also not included because these service packages represent basic project-level definitions and information flows that, for the purposes of this report, have already been captured in service packages from other service areas. Direction related to use and maintenance of the Johnson City Regional ITS Architecture and Deployment Plan is included in Section 7.

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 Infrastructure-Based Traffic Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are currently 150 ITS service packages identified in the National ITS Architecture Version 9.0, which was the most recent version available of the National ITS Architecture at the time of the 2022 update of the Johnson City Regional ITS Architecture and Deployment Plan.

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 Johnson City Region's 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 by information flows that document the existing and planned flow of information. **Table 6** provides a summary of this ITS architecture terminology.

Elements represent the ITS inventory for the Johnson City 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 (TOCs), traffic signals, or vehicles. Each element is assigned to one or more subsystems.

Terminators are the people, systems, other facilities, and environmental conditions outside of ITS that need to communicate or interface with ITS subsystems. Terminators help define the boundaries of the National ITS Architecture as well as a regional system. Examples of terminators include drivers, weather services, and information service providers.

Architecture Flows (or 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 6 – 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 TMC, 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 Johnson City 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 48 ITS service packages for implementation in the Johnson City Region. Stakeholders prioritized the selected service packages during the second stakeholder workshop, the Stakeholder Review Workshop. These ITS service packages are identified in **Table 7**, where they are organized into service areas and priority groupings.

The Tennessee Statewide ITS Architecture discusses TDOT's development and implementation of a commercial vehicle information system network (CVISN) program. CVISN addresses commercial vehicle operations, including ITS, on a statewide level and includes such applications as electronic clearance, safety enforcement, and registration. Unless a specific need was identified in the Johnson City Region that could be addressed locally, the commercial vehicle operations service packages were not selected and instead will be covered in the CVISN effort to ensure consistency.

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 7 – Johnson City Region ITS Service Package Prioritization by Functional Area

High Priority ITS Service Packages	Medium Priority ITS Service Packages	Low Priority ITS Service Packages
Data Management		
	DM01 – ITS Data Warehouse	
Maintenance and Construction		
MC06 – Work Zone Management MC08 – Maintenance and Construction Activity Coordination	MC01 – Maintenance and Construction Vehicle and Equipment Tracking MC04 – Winter Maintenance	
Parking Management		
		PM01 – Parking Space Management
Public Safety		
PS01 – Emergency Call-Taking and Dispatch PS02 – Emergency Response PS03 – Emergency Vehicle Preemption PS08 – Roadway Service Patrols PS10 – Wide-Area Alert PS14 – Disaster Traveler Information	PS12 – Disaster Response and Recovery PS13 – Evacuation and Reentry Management	PS09 – Transportation Infrastructure Protection PS11 – Early Warning System
Public Transportation		
PT01 – Transit Vehicle Tracking PT02 – Transit Fixed-Route Operations PT03 – Dynamic Transit Operations PT05 – Transit Security PT08 – Transit Traveler Information PT17 – Transit Connection Protection	PT04 – Transit Fare Collection Management PT07 – Transit Passenger Counting PT14 – Multi-modal Coordination	PT06 – Transit Fleet Management PT09 – Transit Signal Priority
Traffic Management		
TM01 – Infrastructure-Based Traffic Surveillance TM03 – Traffic Signal Control TM06 – Traffic Information Dissemination TM07 – Regional Traffic Management TM08 – Traffic Incident Management System	TM02 – Vehicle-Based Traffic Surveillance TM12 – Dynamic Roadway Warning TM13 – Standard Railroad Grade Crossing TM17 – Speed Warning and Enforcement	TM04 – Connected Vehicle Traffic Signal System TM05 – Traffic Metering TM19 – Roadway Closure Management TM20 – Variable Speed Limits TM25 – Wrong Way Vehicle Detection and Warning
Traveler Information		
TI01 – Broadcast Traveler Information TI02 – Personalized Traveler Information		TI07 – In-Vehicle Signage
Vehicle Safety		
VS12 – Pedestrian and Cyclist Safety		VS08 – Queue Warning
Weather		
WX01 – Weather Data Collection WX02 – Weather Information Processing and Distribution		

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 Johnson City 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 within the Region. In many cases, even though an information flow exists in a service package, a need has been identified to expand that information flow capability to additional locations.

Figure 3 is an example of a Traffic Management (TM) service package for infrastructure-based traffic surveillance that has been customized for the Johnson City Region. This instance focuses on the activities of the City of Johnson City. The ITS service package shows the collection of traffic images from the city's CCTV cameras and other data from the city's field sensors at traffic signal locations. The City of Johnson City TMC plans to allow for the sharing of this data on the City of the Johnson City website, as well as to share this data with private sector information providers someday.

The remainder of the service packages that were customized for the Johnson City Region can be found in the Interactive ITS Architecture through the online RAD-IT database located at:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

To access these diagrams from the website, select the "Johnson City Interactive ITS Architecture", then select the "Services" page from the left sidebar, then click the desired Service Package Name. The link below the "Diagram" heading will lead to the service package diagram.

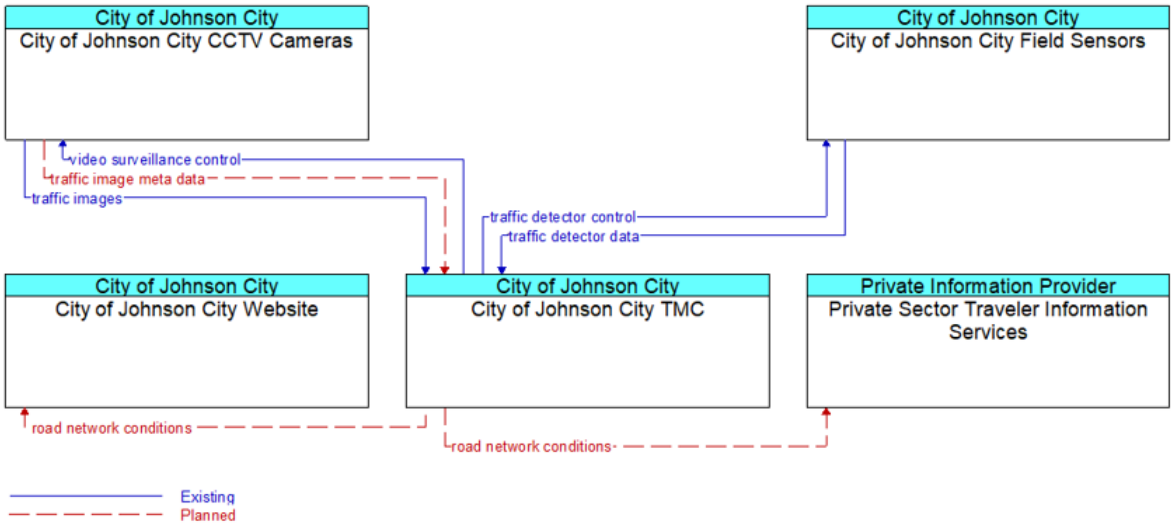

Figure 3 – Example ITS Service Package Diagram
TM01 – Infrastructure-Based Traffic Surveillance (City of Johnson City)

5.1.4 Regional Needs and Corresponding ITS Service Packages

Input received from stakeholders during the stakeholder workshops and interviews provided valuable input for the service package customization process. The needs identified during discussions with stakeholders as well as needs from the Johnson City MTPO MTP are identified in **Table 8**. The table also identifies which ITS service packages could be implemented to address the particular need.

Table 8 – Johnson City Regional ITS Needs and Corresponding ITS Service Packages

Need Description	Corresponding ITS Service Packages
Need to archive data gathered through ITS to make it more accessible to regional stakeholders	DM01 – ITS Data Warehouse
Need to store spatial data to allow for better analysis of crashes and other spatial transportation data	DM01 – ITS Data Warehouse TM07 – Regional Traffic Management TM08 – Traffic Incident Management System
Need better coordination between TDOT and local agencies during maintenance and construction.	MC06 – Work Zone Management MC08 – Maintenance and Construction Activity Coordination
Need to monitor and improve tracking for winter road maintenance activities and vehicles	MC01 – Maintenance and Construction Vehicle and Equipment Tracking MC04 – Winter Maintenance
Need to monitor and display real-time parking availability information	PM01 – Parking Space Management
Need better coordination among various agencies during large-scale events	PS01 – Emergency Call-Taking and Dispatch PS02 – Emergency Response PS12 – Disaster Response and Recovery PS13 – Evacuation and Reentry Management PS14 – Disaster Traveler Information PT14 – Multi-modal Coordination TM06 – Traffic Information Dissemination TM07 – Regional Traffic Management TM08 – Traffic Incident Management System
Need to assist emergency vehicle movement with traffic signal preemption and monitoring	PS01 – Emergency Call-Taking and Dispatch PS02 – Emergency Response TM03 – Traffic Signal Control
Need to expand roadway service patrols for motorist assistance and incident management	PS08 – Roadway Service Patrols TM08 – Traffic Incident Management System
Need to improve coordination among transit agencies	PT02 – Transit Fixed-Route Operations PT03 – Dynamic Transit Operations PT14 – Multi-modal Coordination PT17 – Transit Connection Protection
Need Johnson City Transit to implement scheduling software for paratransit vehicle	PT01 – Transit Vehicle Tracking PT03 – Dynamic Transit Operations
Need to monitor bus passenger boarding and alighting	PT07 – Transit Passenger Counting
Need to implement smart card system for both fixed-route and demand response vehicles that is compatible with other transit agencies	PT04 – Transit Fare Collection Management PT14 – Multi-modal Coordination

Need Description	Corresponding ITS Service Packages
Need to reduce traffic congestion along major routes within the MTPO area	MC06 – Work Zone Management MC08 – Maintenance and Construction Activity Coordination PS08 – Roadway Service Patrols TM01 – Infrastructure-Based Traffic Surveillance TM02 – Vehicle-Based Traffic Surveillance TM03 – Traffic Signal Control TM05 – Traffic Metering TM06 – Traffic Information Dissemination TM07 – Regional Traffic Management TM08 – Traffic Incident Management System TM12 – Dynamic Roadway Warning TM20 – Variable Speed Limits
Need to improve coordination and the sharing of information between TDOT and Johnson City	TM07 – Regional Traffic Management
Need Johnson City traffic to provide Johnson City emergency management agencies with roadway network conditions	TM06 – Traffic Information Dissemination
Need to implement adaptive traffic signal control along congested corridors	TM01 – Infrastructure-Based Traffic Surveillance TM02 – Vehicle-Based Traffic Surveillance TM03 – Traffic Signal Control
Need to expand the interconnected traffic signal system network	TM03 – Traffic Signal Control
Need to expand CCTV camera coverage areas throughout the Region	TM01 – Infrastructure-Based Traffic Surveillance
Need to monitor rail crossing and convey blockages to drivers	TM13 – Standard Railroad Grade Crossing
Need to convey information to drivers through DMS, social media, television, or other methods	TI01 – Broadcast Traveler Information TI02 – Personalized Traveler Information TM06 – Traffic Information Dissemination TM12 – Dynamic Roadway Warning
Need to continue to improve the dissemination of real-time transit information for riders through mobile phone application, bus stop DMS, and website	PT08 – Transit Traveler Information TI02 – Personalized Traveler Information
Need to provide a transportation system that supports vulnerable road users	TM03 – Traffic Signal Control VS12 – Pedestrian and Cyclist Safety
Need to monitor roadway weather conditions and provide accurate dissemination to agencies and travelers	MC04 – Winter Maintenance PS11 – Early Warning System TM06 – Traffic Information Dissemination TM12 – Dynamic Roadway Warning WX01 – Weather Data Collection WX02 – Weather Information Processing and Distribution

5.2 Architecture Interfaces

While it is important to identify the various systems and stakeholders that are part of a regional ITS architecture, a primary purpose of the ITS architecture is to identify the connectivity between transportation systems in the Johnson City Region. The system interconnect diagram shows the high-level relationships of the subsystems and terminators in the Johnson City 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 Johnson City Region based on the system inventory and information gathered from the stakeholders. **Figure 4** summarizes the existing and planned ITS elements for the Region in the context of a physical interconnect. Subsystems and elements specific to the Johnson City 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.

While no system interconnect diagram is available online, a complete list of the elements shown above in **Figure 4** and in **Table 5**, along with element definitions and other information, can be found in the Interactive ITS Architecture through the online RAD-IT database located at:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

To access this information, from the website select the "Johnson City Interactive ITS Architecture", then select the "Inventory" page from the left sidebar. Select an Element from the table to learn more about it. Users can also sort elements by physical object or by

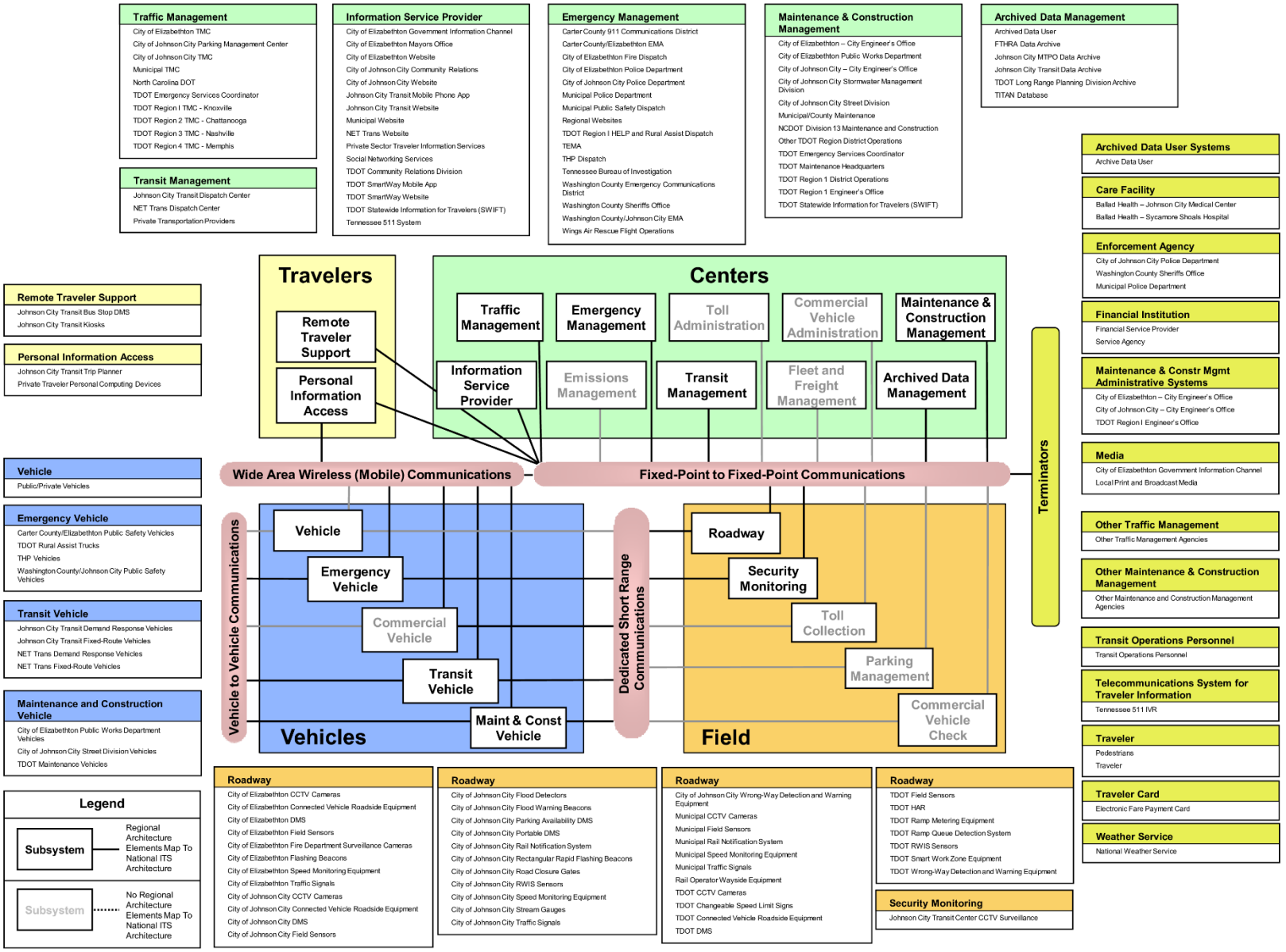

Figure 4 – Johnson City Regional ITS Subsystem and Element Key

5.2.2 *Element Connections*

Elements identified as part of the Johnson City Regional ITS Architecture and Deployment Plan include TMCs, transit vehicles, dispatch systems, emergency management agencies, media outlets, and others—essentially, all the existing and planned physical components that contribute to the Regional ITS Architecture. Interfaces have been identified for each element in the Johnson City Regional ITS Architecture and Deployment Plan and each element has been mapped to those other elements with which it must interface. The RAD-IT Architecture 9.0 software can generate interconnect diagrams that show which elements are connected to one another for each element in the Region. **Figure 5** is an example of an interconnect diagram from the RAD-IT database output. This interconnect diagram is for the City of Johnson City TMC, which shows existing connections in addition to connections that could be made in the future.

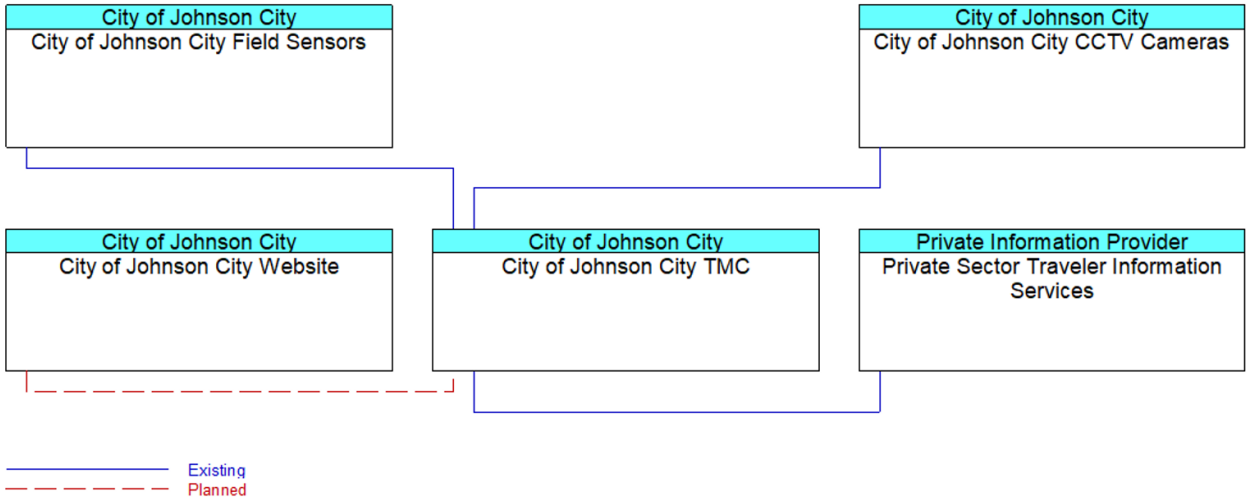

Figure 5 – Example Interconnect Diagram: City of Johnson City TMC

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 data flows could be requests for information, alerts and messages, status requests, broadcast advisories, event messages, confirmations, electronic credentials, and other key information requirements. RAD-IT 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 data 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 TM01 – Infrastructure-Based Traffic Surveillance service package is shown in **Figure 6**. The diagram shows existing and planned data flows between elements that support infrastructure-based traffic surveillance.

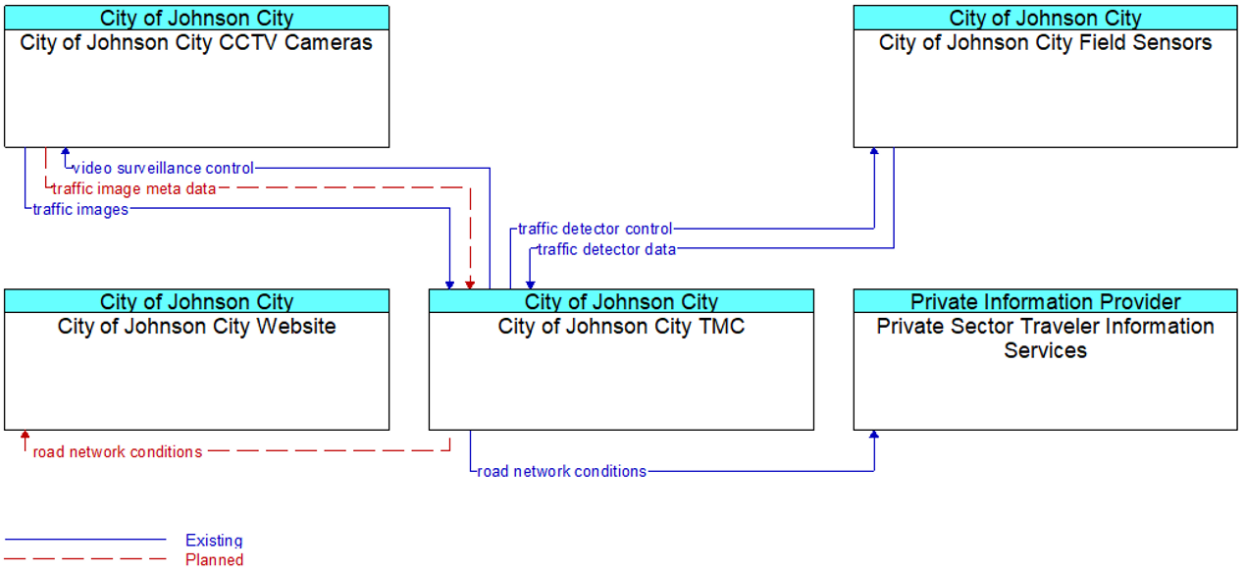

Figure 6 – Example Flow Diagram: TM01 – Infrastructure-Based Traffic Surveillance

While service package diagrams contain data flow information, this information can also be found in the Interactive ITS Architecture through the online RAD-IT database located at:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

To access these element-specific context diagrams, from the website select the "Johnson City Interactive ITS Architecture", then select the "Interfaces" page from the left sidebar, then click the desired element on the left side of the column to see the context diagram showing all of the other elements that are connected.

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 Johnson City 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 Johnson City Regional ITS Architecture and Deployment Plan, 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 Johnson City Region and the architecture flows between the

elements. These service packages and data flows describe what ITS in the Region has to do and the data that needs to be shared among elements.

At a more detailed level, functional requirements for the Johnson City 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 RAD-IT Architecture database also includes the functional requirements that have been identified for each of the elements in the Johnson City 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 Johnson City Regional ITS Architecture and Deployment Plan 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 9** identifies each of the ITS standards that could apply to the Johnson City Regional ITS Architecture and Deployment Plan. These standards are based on the physical subsystem architecture flows previously identified in Section 5.2.3 and shown in the Regional ITS Architecture service package diagrams.

While **Table 9** does not match the standards to specific information flows, that information is available through the National ITS Architecture website and RAD-IT 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. When a stakeholder agency within the Johnson City Region begins deployment of an ITS project, the agency should ensure that the technology being deployed conforms to standards that are relevant to the applicable project service packages. To locate this information, do the following:

- Go to the main page of the National Architecture website at http://www.iteris.com/itsarch/;
- In the sidebar at the top select the link 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;
- 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.

Relevant standards in the Johnson City Regional ITS Architecture and Deployment Plan can be found in the Interactive ITS Architecture through the online RAD-IT database located at:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

To access these standards, from the website select the "Johnson City Interactive ITS Architecture", then select the "Standards" page from the left sidebar, then click the desired Standard title.

Table 9 – Johnson City Regional ITS Standards

SDO	Document ID	Title
Advanced Traffic Controller Joint Committee	ITE ATC 5201	Advanced Transportation Controller
Advanced Traffic Controller Joint Committee	ITE ATC 5202	Model 2070 Controller Standard
Advanced Traffic Controller Joint Committee	ITE ATC 5301	Intelligent Transportation System (ITS) Standard Specification for Roadside Cabinets
Advanced Traffic Controller Joint Committee	ITE ATC 5401	Application Programming Interface Standard for the Advanced Transportation Controller
International Organization for Standardization	ISO 21217	Intelligent transport systems (ITS) -- Communications access for land mobiles (CALM) -- Architecture
National Electrical Manufacturers Association	NEMA TS 5	Portable Traffic Signal Systems (PTSS) Standard
National Electrical Manufacturers Association	NEMA TS 8	Cyber and Physical Security for Intelligent Transportation Systems (ITS)
National Electrical Manufacturers Association	NEMA TS2	Traffic Controller Assemblies with NTCIP Requirements
National Electrical Manufacturers Association	NEMA TS4	Hardware Standards for Dynamic Message Signs (DMS) With NTCIP Requirements
National Institute for Standards and Technology	NIST FIPS PUB 140-2	Security Requirements for Cryptographic Modules
Society of Automotive Engineers	LTE-V2X WSMP	SAE Traveler Information
Society of Automotive Engineers	WAVE WSMP	SAE Basic Safety Messages

5.5 Cyber Security

Cyber security is a key component to the resiliency of the Johnson City Regional ITS Architecture and Deployment Plan and networks that support ITS. In particular it is important for traffic signal system to have strong cyber security in order to prevent cyber events as technology integration and connectivity increases. The USDOT National ITS Reference Architecture clarifies this further: "surface transportation is now, more than ever relying on information technologies to sense, collect, process and disseminate information to improve the efficiency of moving goods and people, improve the safety of our transportation system and provide travel alternatives." (https://local.iteris.com/arc-it/html/security/security.html) As stated by the National Operations Center for Excellence (NOCoE), a cyber transportation systems framework should be flexible and sensitive to changing technology and means of communication in order to maintain system resilience against cyber threats (https://transportationops.org/cyberfmwk).

The NOCoE lists several objectives when formulating a cyber security framework. These should include "a means of rapid, secure communication of relevant cybersecurity challenges among stakeholders;" a communications platform for all stakeholders to formulate cybersecurity guidance; and these should be used to create guidance on how to respond to cybersecurity threats. NOCoE objectives are expanded upon by the National ITS Reference Architecture where cyber security threats can be addressed by securing ITS via securing physical objects, methods of information transfer, enterprise objects such as key people and organizations, and communication profiles. This is further enhanced by ITS Security Areas that determine how to recognize, address and rebound from cyber security threats using ITS technology. The ITS Security Areas listed in the National ITS Reference Architecture are listed below:

- Disaster Response and Evacuation
- Freight and Commercial Vehicle Security
- HAZMAT Security
- ITS Wide Area Alert
- Rail Security
- Transit Security
- Transportation Infrastructure Security
- Traveler Security

The creation of a cyber resiliency plan is a good start to improving cyber security. NOCoE states the following regarding creating or reviewing a cyber resiliency plan:

> "Creating or Reviewing Your Cyber Resiliency Plan: Based on recent cyber activity in public agencies that has been reported in the news, it is recommended that State and local agencies who own and operate their transportation system to review their cyber resiliency plan at the earliest possible opportunity. This includes reviewing the following steps:
>
> 1. Identify where and/or who has your IT and control system plan in response to a cyber event.
>
> 2. If necessary, familiarize yourself with the response plan procedures.
>
> 3. Review contact information with internal and external partners to make sure it is current and all partners understand their role and responsibility during a response.

4. Verify the location and condition of any backup software, database, and necessary supporting applications and files.

5. Confirm the response plan has current procedures for restoring software and systems to operating conditions."

In addition, the following standards are listed as from the National ITS Reference Architecture and can be relevant to a cyber security framework and resiliency plan:

- FIPS 140-2 – Security Requirements for Cryptographic Modules
- IEEE 1609.2 – Standard for Wireless Access in Vehicular Environments (WAVE) - Security Services for Applications and Management Messages
- IEEE 1609.2a – Standard for Wireless Access in Vehicular Environments - Security Services for Applications and Management Messages - Amendment 1
- IETF DTLS – The Datagram Transport Layer Security (DTLS) Protocol Version 1.2
- IETF FTP – File Transfer Protocol (FTP)
- ETF FTP Auth – FTP Security Extensions
- IETF SNMPv3 – Simple Network Management Protocol (SNMP) Overview, Management Framework, Protocols, Applications, Security Models and Transport
- NEMA TS 8 – Cyber and Physical Security for Intelligent Transportation Systems (ITS)

5.6 Operational Concepts

Operational concepts document each stakeholder's current and future roles and responsibilities across a range of transportation services. In the Johnson City Region, these operational concepts are documented for seven separate service areas and are described in more detail in the RAD-IT Architecture, with each area describing an aspect of the operation of an interconnected, regional ITS network. The seven service areas covered are described briefly below:

- **Archived Data System –** Operation of systems to collect and maintain archived data.
- **Emergency Management** – Operation of systems to provide emergency call taking, public safety dispatch, and emergency operations center operations.
- **Freeway Traffic Metering** – Operation of systems to provide wrong-way driving warning, variable speed limits, ramp metering, service patrols, and roadside traveler information.
- **Incident Management** – Operation of systems to provide rapid and effective response to traffic incidents. This service area includes systems to detect and verify incidents as well as coordinated agency response to the incidents.
- **Maintenance and Construction Management** – Operation of systems to monitor and manage roadside maintenance and construction work zone activities.
- **Traffic Signal Control** – Operation of traffic signal systems that react to changing traffic conditions and provide coordinated intersection timing over a corridor or an area.
- **Transit Management** – Operation of systems to manage fleets of transit vehicles and overall transit systems more efficiently.
- **Traveler Information** – Operation of systems to provide static and real-time transportation information to travelers.

- **Sustainable Travel** – The development of traffic management systems and fleet management infrastructure that reduces environmental impacts.

Additional detail on operational concept roles and responsibilities can be found in the Johnson City Interactive ITS Architecture through online RAD-IT database.

Roles and responsibilities for stakeholders related to each operational concept service area in the Johnson City Regional ITS Architecture can be found in the Interactive ITS Architecture through the online RAD-IT database located at:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

To access these roles and responsibilities, from the website select the "Johnson City Interactive ITS Architecture", then select the "Roles and Resp" page from the left sidebar.

5.7 Existing and Planned Agreements

The Johnson City Regional ITS Architecture and Deployment Plan 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 Johnson City Region. Interfaces and information 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 and incident management, provide traveler information, and perform other functions identified in the Johnson City Regional ITS Architecture and Deployment Plan.

With the implementation of ITS technologies, integrating systems from one or more agencies, and the anticipated level of information exchange identified in the Johnson City Regional ITS Architecture and Deployment Plan, 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 Johnson City Region, should outline specific roles, responsibilities, data exchanges, levels of authority, and other facets of regional operations. Some agreements may also outline specific funding responsibilities, where appropriate and applicable.

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

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. Ideally, agreements made between stakeholders should be formalized in writing, especially if the arrangement will be in effect for an extended duration or involve any sort of long-term maintenance. 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 sometimes used in the early stage of a project, most commonly between agencies that already have a well-developed relationship. Regardless of the interagency relationship, these agreements should be formalized in writing as the project moves forward.
- **Memorandum of Understanding (MOU)** – A MOU demonstrates consensus but is not typically very detailed. MOUs often identify high-level goals and partnerships.
- **Interagency and Intergovernmental Agreements** – These agreements between public agencies can be used for operation, maintenance, or funding projects and systems. They can include documentation on the responsibility of each agency, functions they will provide, and liability.
- **Funding Agreements** – Funding agreements document the funding arrangements for ITS projects. At a minimum, funding agreements include a detailed scope, services to be performed, and a detailed project budget. Agency funding expectations or funding sources are also typically identified.
- **Master Agreements** – Master agreements include standard contract language for an agency and serve as the main agreement between two entities which guides all business transactions. Use of a master agreement can allow an agency to do business with another agency or private entity without having to go through the often-lengthy development of a formal agreement each time.

Table 10 provides a list of existing and potential agreements for the Johnson City Region based on the interfaces identified in the Johnson City Regional ITS Architecture and Deployment Plan. It is important to note that as ITS services and systems are implemented in the Region, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations.

Table 10 – Johnson City Regional Agreements

Status	Agreement and Agencies	Agreement Description
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 new 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	**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	**Open Roads Policy (Public-Public)** – TDOT, THP (TDOSHS), and Municipalities/Counties	MOU 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.
Existing	**Traffic Signal Timing Data Sharing and Usage (Public-Private)** – City of Johnson City, Private Information Provider	Agreement to define the parameters, guidelines, and policies to allow private information provider access to Johnson City traffic signal timing data. The private information provider uses the data to improve connected vehicle performance and to provide information to the driver.
Future	**Data Sharing and Usage (Public-Public)** – City of Johnson City, City of Elizabethton, TDOT	Agreement would define the parameters, guidelines, and policies for inter-agency ITS data sharing between the public sector agencies. 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	**Data Sharing and Usage (Public-Private)** – City of Johnson City 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 should also be part of the agreement.
Future	**ITS and Traffic Signal Timing Data Sharing and Usage (Public-Public)** – City of Johnson City, City of Elizabethton	Agreement would define the parameters, guidelines, and policies for inter-agency ITS and traffic signal timing sharing between cities, counties, and any other agencies that might maintain their traffic signal system.
Future	**Incident Data Sharing and Usage (Public-Public)** – TDOT, City of Johnson City, City of Elizabethton, THP, Carter County, Washington County	Agreement would define the parameters, guidelines, and policies for inter-agency sharing of incident data between transportation and emergency management agencies in the Johnson City Region. Incident information could be sent directly to computer aided dispatch (CAD) systems and include information on lane closures, travel delays, and weather.

Relevant agreements in the Johnson City Regional ITS Architecture can also be found in the Interactive ITS Architecture through the online RAD-IT database located at:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

To access these standards, from the website select the "Johnson City Interactive ITS Architecture", then select the "Agreements" page from the left sidebar, then click the desired Agreement title.

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

- Agreement developed by TDOT for live CCTV video access and information sharing for governmental agency users;
- Agreement developed by TDOT for live CCTV video access for private entity users.
- MOU among TDOT, TDOSHS, and local governments for the quick clearance of incidents along the State Highway System;
- Agreement between the City of Johnson City and a private transportation information provider for sharing traffic signal timing data; and
- Agreement between the Johnson City Transit System and Johnson City MTPO defining mutual responsibilities and roles.

5.8 Phases of Implementation

The Johnson City Regional ITS Architecture and Deployment Plan will be implemented over time through a series of projects. Key foundation systems will need to be implemented in order to support other systems identified in the Johnson City Regional ITS Architecture and Deployment Plan. The deployment of all of the systems required to achieve the final Johnson City Regional ITS Architecture and Deployment Plan build out will occur over many years.

A sequence of projects and their respective time frames have been identified in the Regional ITS Deployment Plan presented in Section 6. These projects have been sequenced over a period that coincides with the Johnson City MTPO 2050 MTP, 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 Johnson City Region are listed below. Key service packages are defined as ones that were indicated as having a high implementation priority during stakeholder workshops and are associated with projects that are included in the Johnson City Regional ITS Deployment Plan in Section 6 as short-term implementation projects.

- MC01 – Maintenance and Construction Vehicle and Equipment Tracking;
- PM01 – Parking Space Management;
- PS03 – Emergency Vehicle Preemption;
- PS08 – Roadway Service Patrols;
- PT04 – Transit Fare Collection Management;

- PT08 – Transit Traveler Information;
- PT14 – Multimodal Coordination;
- PT17 – Transit Connection Protection;
- TI02 – Personalized Traveler Information;
- TM01 – Infrastructure–Based Traffic Surveillance;
- TM02 – Vehicle-Based Traffic Surveillance;
- TM03 – Traffic Signal Control;
- TM06 – Traffic Information Dissemination;
- TM07 – Regional Traffic Management; and
- TM08 – Traffic Incident Management System.

6 REGIONAL ITS DEPLOYMENT PLAN

The Regional ITS Deployment Plan serves as a tool for the Johnson City Region to identify specific projects that should be deployed to achieve the desired functionality identified in the Johnson City Region's Regional ITS Architecture. The Regional ITS Deployment Plan builds on the Regional ITS Architecture by outlining specific ITS project recommendations and strategies for the Johnson City 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 Johnson City Region's 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 Johnson City Regional ITS Architecture and Deployment Plan were revised while the document was still in draft format; therefore, the resulting ITS deployment projects are supported by the Johnson City Regional ITS Architecture and Deployment Plan.

The Johnson City Region's Regional ITS Deployment Plan provides stakeholders with a list of regionally significant ITS projects that are consistent with the Johnson City Region's 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 7**. 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.

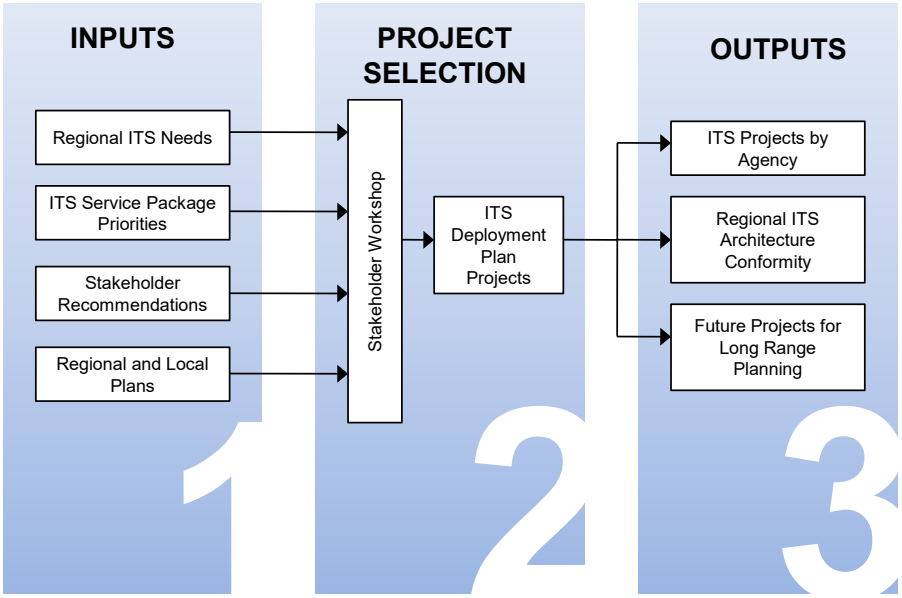

Figure 7 – Project Development and Selection Process

Stakeholder input in Step 1 was gathered through a Stakeholder Kick-Off Workshop held in November 2021, where 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 Johnson City Region. A review of regional and local plans was also conducted to identify potential project ideas.

The inputs in Step 1 led to the project selection in Step 2. Project selection was completed through a second stakeholder workshop, the Stakeholder Review Workshop, held in February 2022, as well as a stakeholder review of the Johnson City Regional ITS Architecture and Deployment Plan document.

The outputs of the plan, shown in Step 3, will provide stakeholders and the Johnson City MTPO with a list of priority ITS projects for the Johnson City Region. Each project recommended in the plan has been checked against the Johnson City Region's 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 MTPO.

6.2 Existing ITS Deployments

The Johnson City Regional Area has investments in the deployment and operation of ITS throughout the Region. In **Table 11**, a summary of ITS deployments by state, municipal, and transit agencies is provided. It is important to note that this table only identifies existing and planned deployments within the Johnson City Region. TDOT ITS deployments that exist within the TDOT Region 1 boundaries, but are outside of the Johnson City Region, are not considered existing since they do not existing within the Johnson City Region.

Table 11 – Johnson City Regional Existing ITS Deployments

Agency	Freeway and Arterial Applications																								Transit Applications										
	Archived Data	Automated Roadway Treatment Equipment	CCTV Cameras	Center-to-Center Comm. for Traffic Info.	Centralized Traffic Signal Control System	Changeable Speed Limit Signs	Dynamic Message Signs (DMS)	Emergency Vehicle Signal Preemption	Field Sensors - Arterial Intersection	Field Sensors - Freeway	Freeway Service Patrol (HELP)	Highway Advisory Radio	Lane Control Signals	Parking Management System	Pedestrian Hybrid Beacons	Portable DMS	Rail Notification System	Ramp Metering Equipment	Road Weather Information Systems (RWIS) Sensors	Real-Time Traveler Info. Website/Mobile Data	Smart Work Zones	Speed Monitoring Equipment	Traffic Management/Operations Center	Weigh-in-Motion	Archived Data	Automated Fare Payment	Automated Passenger Counters	Bus Rapid Transit	Center-to-Center Comm. for Traffic Info.	Real-Time Trav. Info. at Transit Centers/Stops	Real-Time Traveler Info. Website/Mobile Data	Transit Operations Center	Transit Facility CCTV Surveillance	Transit Signal Priority	Transit Vehicle Tracking
State																																			
TDOT	●		○	○		○	○			○	●	●				●		○	○	●	○	○	●	○											
Tennessee Counties & Municipalities																																			
City of Elizabethton	○		○	○	○	○	○	○	●						●	○					○	○	○												
City of Johnson City	○		●	○	●	○	○	●	●					○	●	●	●		○	○	○	○	●												
City of Joneborough				○	○			○	●												○		○												
Transit																																			
Johnson City Transit System																									●	○	○	○	○	●	●	●	○	○	●
NET Trans																									●				○		●		○		●

Key

Interested ○

Existing ●

6.3 ITS Project Recommendations

To achieve the ITS deployment levels outlined in its Regional ITS Deployment Plan, a region must deploy carefully developed projects that provide the functionality and interoperability identified in its Regional ITS Architecture and Deployment Plan. A key step toward achieving the Johnson City Region's ITS vision as established in the Johnson City Regional ITS Architecture and Deployment Plan 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 Johnson City Regional ITS Architecture and 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, and type of communications, in addition to other factors.

For example, freeway network surveillance could be adequately achieved for one region by the deployment of fixed 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.

The projects identified in the Regional ITS Deployment Plan are not fiscally constrained. They represent the needs in the Johnson City Region, but funding for many of the projects is yet to be determined. During the early years of ITS deployment, the FHWA made several sources available specifically for ITS funding to encourage deployment.

Regional projects are identified in **Table 12** through **Table 15**. The tables are divided by the primary responsible agency as follows:

- **Table 12** – State Department of Transportation ITS Projects
- **Table 13** – Municipal ITS Projects
- **Table 14** – Transit ITS Projects
- **Table 15** – Other ITS 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 update of the Johnson City Regional ITS Architecture and Deployment Plan. Projects that have been funded using federal transportation funds 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 Regional ITS Deployment 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 Johnson City Region's Regional ITS Architecture that each project will assist in implementing. Knowing which ITS service packages each project identifies is an important part of a regional ITS architecture conformance review.

Table 12 – State Department of Transportation ITS Projects

Project Name	Responsible Agency	Project Description	Deployment Timeframe[1]	Funding Status	Applicable ITS Service Packages
TDOT/Johnson City Coordination	TDOT & City of Johnson City	Improve coordination between TDOT and the City of Johnson City, including the exchange of future CCTV camera feeds and improved coordination during incidents. TDOT will need to establish a fiber connection with the City of Johnson City to access the City's CCTV camera feeds. TDOT's SmartWay software will have the ability to share full-motion video from their CCTV cameras with cities across the State once fully developed.	Short-Term	Funding Identified: No	TM01 – Infrastructure-Based Traffic Surveillance TM07 – Regional Traffic Management TM08 – Traffic Incident Management System
TDOT SmartWay Infrastructure Installation on I-81	TDOT	Expand SmartWay installation along I-81 from near I-26 (Exit 57) to near I(-381 in Virginia. The expansion will include installation of CCTV cameras, DMS, traffic sensors, and a fiber optic communications trunk link. Construction cost is estimated at $8.7M. Note: Although this ITS project is located outside of the MTPO Regional Boundaries, it does support the MTPO's 2050 Metropolitan Transportation Plan goal to enhance regional access to and from the MTPO area.	Short-Term	Funding Identified: Yes	TM01 – Infrastructure-Based Traffic Surveillance TM06 – Traffic Information Dissemination TM07 – Regional Traffic Management
TDOT Rural Assist Truck Deployment	TDOT	Move from the pilot phase to a permanent deployment of TDOT Rural Assist Trucks along I-26 to provide basic incident management support. Services that the TDOT Rural Assist Trucks will provide include assistance for disabled vehicles, assistance with quick clearance of incident scenes, and assistance with queue protection.	Short-Term	Funding Identified: No	PS08 – Roadway Service Patrols
TDOT SmartWay Infrastructure Installation on I-26	TDOT	Install CCTV cameras, DMS, traffic sensors and a fiber optic communication line along I-26 to support TDOT SmartWay operations.	Short to Mid-Term	Funding Identified: No	TM01 – Infrastructure-Based Traffic Surveillance TM06 – Traffic Information Dissemination TM07 – Regional Traffic Management

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

Table 13 – Municipal ITS Projects

Project Name	Responsible Agency	Project Description	Deployment Timeframe[1]	Funding Status	Applicable ITS Service Packages
City of Johnson City CCTV Camera Expansion	City of Johnson City	Install additional CCTV cameras along major arterials including along Boones Creek Road and in the Gray area in north Washington County.	Short-Term	Funding Identified: Yes	TM01 – Infrastructure-Based Traffic Surveillance
City of Johnson City Fiber Optic Expansion	City of Johnson City	Install additional fiber optic cable for traffic signal communications and CCTV camera installation.	Short-Term	Funding Identified: Yes	TM01 – Infrastructure-Based Traffic Surveillance TM03 – Traffic Signal Control
City of Johnson City Automatic Vehicle Location (AVL)	City of Johnson City	Install AVL technology on snowplows to track them during winter weather events.	Short-term	Funding Identified: No	MC01 – Maintenance and Construction Vehicle and Equipment Tracking MC04 – Winter Maintenance
City of Johnson City Smart Streetlights	City of Johnson City	Deploy smart streetlight system that will include parking space occupancy detection and provide information on parking space availability. Flood monitoring to detect water on roadway could be included as part of streetlight system.	Short to Mid-Term	Funding Identified: No	PM01 – Parking Space Management WX01 – Weather Data Collection
City of Johnson City Adaptive Traffic Signals	City of Johnson City	Install an adaptive traffic signal system to reduce congestion. This is a system wide improvement.	Mid to Long-Term	Funding Identified: Yes	TM01 – Infrastructure-Based Traffic Surveillance TM02 – Vehicle-Based Traffic Surveillance TM03 – Traffic Signal Control
City of Johnson City DMS	City of Johnson City	Install permanent DMS units along key corridors to provide motorists with roadway network conditions.	Mid to Long-Term	Funding Identified: No	TM06 – Traffic Information Dissemination
City of Johnson City Speed Monitoring System	City of Johnson City	Collect and disseminate travel time information along major corridors using Bluetooth technology.	Mid to Long-Term	Funding Identified: No	TM02 – Vehicle-Based Traffic Surveillance TM03 – Traffic Signal Control
City of Johnson City Flood Detection and Warning System	City of Johnson City	Implement a system to provide automated flood detection, road closure, and advanced warning on roads with low water crossings that frequently flood.	Mid to Long-Term	Funding Identified: No	PS11 – Early Warning System TM06 – Traffic Information Dissemination WX01 – Weather Data Collection WX02 – Weather Information Processing and Distribution
City of Johnson City RWIS	City of Johnson City	Install road weather information systems (RWIS) that include field sensors to monitor road weather conditions including ice, snow, and rain.	Long-Term	Funding Identified: No	WX01 –Weather Data Collection WX02 – Weather Information Processing and Distribution
City of Johnson City/Washington County Emergency Management CCTV Camera Sharing	City of Johnson City/Washington County	Establish a communications connection between the City of Johnson City TMC and the Washington County Emergency Operations Center to support sharing of video from the City of Johnson City CCTV cameras.	Short to Mid-Term	Funding Identified: No	TM01 – Infrastructure-Based Traffic Surveillance TM08 – Traffic Incident Management System PS12 – Disaster Response and Recovery
City of Elizabethton TMC and Signal Connectivity	City of Elizabethton	Implement a TMC for the City of Elizabethton that will allow centralized control of traffic signals and monitoring of potential future CCTV cameras and other ITS devices. Connect all traffic signals within the City of Elizabethton to a centralized TMC for operations.	Short-Term	Funding Identified: No	TM03 – Traffic Signal Control TM07 – Regional Traffic Management

Project Name	Responsible Agency	Project Description	Deployment Timeframe[1]	Funding Status	Applicable ITS Service Packages
City of Elizabethton Fiber Optic Installation	City of Elizabethton	Install fiber optic cable to connect City Hall to the nearest interconnected signalized intersection to establish a line of communication for the future TMC.	Short-Term	Funding Identified: No	TM01 – Infrastructure-Based Traffic Surveillance TM03 – Traffic Signal Control TM07 – Regional Traffic Management
City of Elizabethton CCTV Camera Deployment	City of Elizabethton	Implement CCTV cameras in the City of Elizabethton to allow City staff to monitor traffic signal operations, traffic congestion, incidents, and weather impacts throughout the City. The City of Elizabethton has identified four potential locations for CCTV deployments: • SR 67/ US 321 (W. Elk Street) at West G Street • SR 67/ US 321 (W. Elk Street) at Hudson Drive • SR 67/ US 321 (W. Elk Street) at Roane Street/Broad Street • SR 67/ US 321 (W. Elk Street) at US SR 37/19E	Short to Mid-Term	Funding Identified: No	TM01 – Infrastructure-Based Traffic Surveillance
City of Elizabethton Emergency Vehicle Traffic Signal Preemption	City of Elizabethton	Update and expand existing emergency vehicle traffic signal preemption system in the City of Elizabethton. Consider the deployment of a GPS based system that could reduce the amount of field infrastructure that must be deployed and maintained.	Short to Mid-Term	Funding Identified: No	PS03 – Emergency Vehicle Preemption

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

Table 14 – Transit ITS Projects

Project Name	Lead Agency	Project Description	Deployment Timeframe[1]	Funding Status	Applicable ITS Service Packages
Johnson City Transit Mobile Phone Application	Johnson City Transit	Develop a mobile phone application that allows users to view transit service information, real-time bus location, and create a transit trip plan. Johnson City Transit does have this service available through their website but not through a dedicated transit app.	Short to Mid-Term	Funding Identified: No	PT08 – Transit Traveler Information TI02 – Personalized Traveler Information
Johnson City Transit Smart Card Implementation	Johnson City Transit	Implement a Smart Card system to pay for Johnson City Transit. Deploy kiosks to allow passengers to renew or purchase passes for electronic fare collection on agency buses. Card could be expanded to coordinate with other City services, such as parking payment.	Short to Mid-Term	Funding Identified: No	PT04 – Transit Fare Collection Management PT14 – Multimodal Coordination
Johnson City Transit Stop DMS	Johnson City Transit	Add DMS to bus stops throughout the system to provide information to transit users on next bus arrival.	Short to Mid-Term	Funding Identified: No	PT08 – Transit Traveler Information
Johnson City Transit Northern Transfer Center	Johnson City Transit	Construct a transfer center in Johnson City Transit's northern service area to serve an expanding population. Transit center could include additional ITS elements such as transit security cameras and bus stop DMS.	Mid to Long-Term	Funding Identified: No	PT02 – Transit Fixed-Route Operations PT05 – Transit Security PT08 – Transit Traveler Information PT17 – Transit Connection Protection
Regional Transit Coordination	Johnson City Transit and NET Trans	Improve coordination within and among transit agencies to optimize transit travel times.	Short to Mid-Term	Funding Identified: No	PT14 – Multimodal Coordination PT17 – Transit Connection Protection

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

Table 15 – Other ITS Projects

Project Name	Lead Agency	Project Description	Deployment Timeframe[1]	Funding Status	Applicable ITS Service Packages
Johnson City Metropolitan Transportation Planning Organization Data Warehouse Implementation	Johnson City MTPO	Develop a transportation data warehouse that includes region-wide transportation data gathered from the ITS network and various agencies.	Long-Term	Funding Identified: No	DM01 – 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 update of the Johnson City Regional ITS Architecture and Deployment Plan addresses the Region's vision for ITS implementation at the time the updated plan was developed. Needs will change with the growth of the Region, and as technology progresses new ITS technologies will become available. Shifts in regional needs and focus as well as changes in the National ITS Architecture will necessitate that the Johnson City Regional ITS Architecture and Deployment Plan be updated periodically to remain useful to the Region. As projects are developed and deployed, it will be important that projects conform to the Johnson City Regional ITS Architecture and Deployment Plan so that they are consistent with both the Region's vision for ITS as well as applicable national standards. In some cases, if projects do not conform it may be necessary to modify the Johnson City Regional ITS Architecture and Deployment Plan 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 Johnson City Regional ITS Architecture and Deployment Plan is described.

In 2001 the FHWA issued Final Rule 23 CFR 940, which requires that ITS projects using federal funds (or ITS projects that integrate with systems that are deployed with federal funds) conform to a regional ITS architecture and are developed using a systems engineering process. This Section includes a discussion of how the Johnson City Regional ITS Architecture and Deployment Plan can be used to support meeting the ITS architecture conformity and systems engineering requirements. A process for maintaining the Johnson City Regional ITS Architecture and Deployment Plan 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 Johnson City Regional ITS Architecture and Deployment Plan 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 Johnson City Regional ITS Architecture and Deployment Plan be updated to remain a useful resource for the Region. In the Johnson City Regional ITS Architecture and Deployment Plan, a process for maintaining the plan was developed in coordination with stakeholders. The process covers both major updates to the Johnson City Regional ITS Architecture and Deployment Plan that will happen or as needed 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

Stakeholders invested a considerable amount of effort in the development of the Johnson City Regional ITS Architecture and Deployment Plan. The architecture needs to be incorporated into the regional planning process so that the ITS vision for the Johnson City Region is considered when implementing ITS projects in the future and to ensure that the Region remains eligible for federal funding for ITS projects. To ease this needed incorporation of separate documents, the regional ITS vision was developed specifically to reflect the transportation planning themes already identified in the greater regional transportation planning process.

FHWA and FTA require that any project that includes ITS elements and is implemented with federal funds conforms to the Johnson City Regional ITS Architecture and Deployment Plan. 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. In Tennessee, the TDOT Local Programs Development Office reviews ITS projects in the Transportation Improvement Program (TIP) process to ensure they are included the Regional ITS Architecture.

Stakeholders in the Johnson City Region agreed that as projects are submitted for inclusion in the TIP, each project should be evaluated by the submitting agency to determine if the project includes any ITS elements. If the project contains any ITS elements, then the project needs to be reviewed to determine if the ITS elements in the project are in conformance with the Johnson City Regional ITS Architecture and Deployment Plan. The submitting agency will perform this examination as part of the planning process using the procedure outlined in Section 7.3 and Johnson City MTPO will review each project to confirm it does conform to the Johnson City Regional ITS Architecture and Deployment Plan.

Beyond describing this architecture conformity check process, this Johnson City Regional ITS Architecture and Deployment Plan focuses on incorporation into the Regional Planning Process in two other ways. First, in Section 3, discussion is provided on ways that ITS deployments can assist the Johnson City Region in meeting the goals outlined in the Johnson City MTPO 2050 MTP. This discussion mentions specific ITS technologies, both planned and existing, and how they can help to address these regional transportation goals. In Section 6, the Regional ITS Deployment Plan identifies recommended projects for deployment and includes the relevant ITS service packages from the Regional ITS Architecture that help establish conformance for each project.

7.2 Systems Engineering Analysis

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 funded in part or whole with funds administered by TDOT. Categorically excluded projects are those that do not utilize a centralized control, 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. 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.

Agencies looking to implement an ITS project shall refer to the established *TDOT ITS Project Development Guidelines* to determine whether a systems engineering analysis is necessary and, if so, how to properly complete one. These guidelines shall be used for ITS projects that occur entirely or partly within Tennessee. 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 Johnson City Regional ITS Architecture and Deployment Plan, the Regional ITS Architecture maintenance process described in Section 7.4 of this document should be used to document the necessary changes.

The TDOT requirements indicate that the following considerations should be included in a systems engineering analysis:

- Identification of portions of the Johnson City Regional ITS Architecture and Deployment Plan being implemented;
- Identification of participating agencies and their 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 Johnson City Regional ITS Architecture and Deployment Plan and associated RAD-IT Architecture database can supply information for many of the required components for a systems engineering analysis. These include:

- Portions of the Johnson City Regional ITS Architecture and Deployment Plan being implemented;
- Participating agencies and their roles and responsibilities;
- Definition of system requirements (identified in the Johnson City Regional ITS Architecture and Deployment Plan RAD-IT Architecture database equipment packages); and
- Applicable ITS standards (identified using ITS service package information flows present in the RAD-IT Architecture Database and their associated national standards).

Many projects are categorically excluded from the systems engineering analysis requirements. Other projects are subject to the systems engineering analysis, either in an abbreviated sense using 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 8** and is described in detail in the *TDOT ITS Development Guidelines* developed by the TDOT Traffic Operations Division (https://www.tn.gov/tdot/intelligent-transportation-systems/its-project-development.html).

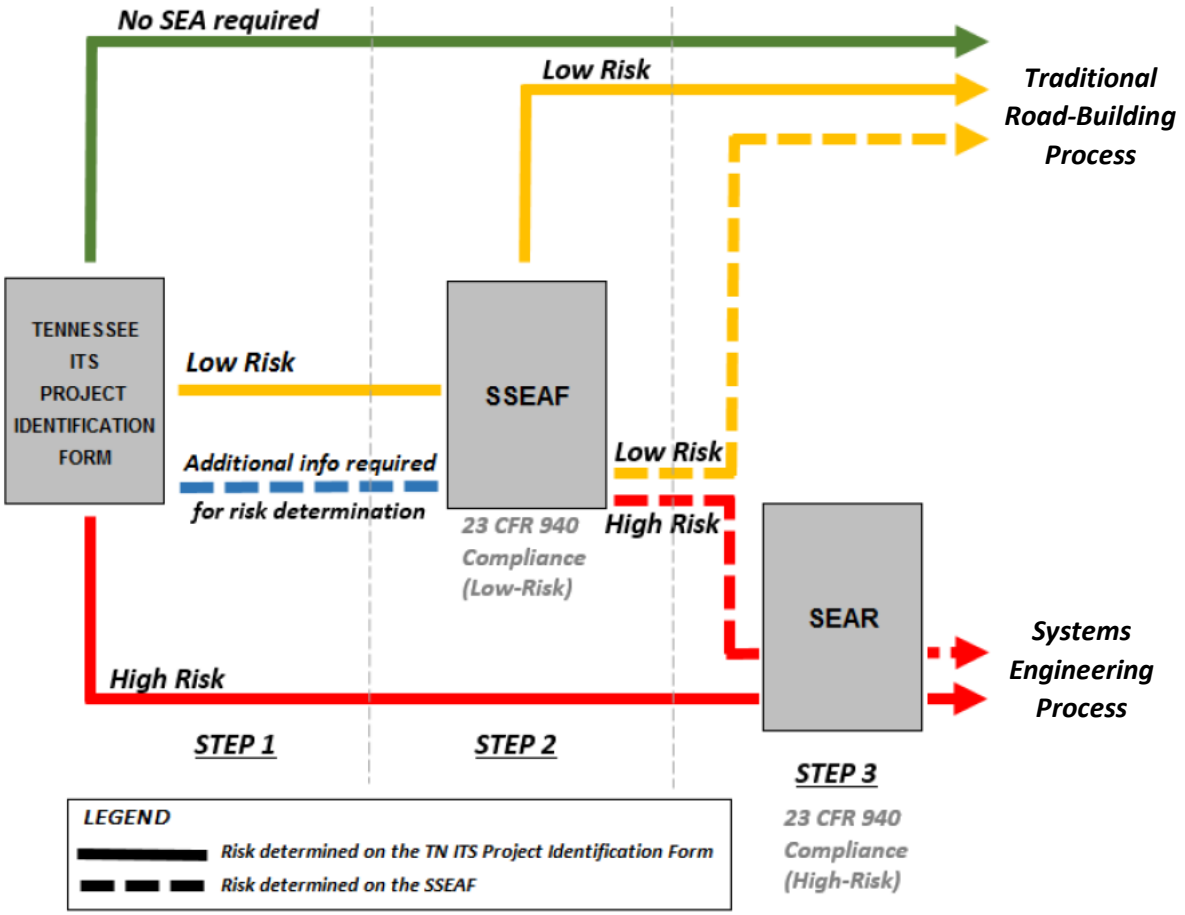

Figure 8 – Systems Engineering Analysis Project Flow Chart

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 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 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 considers 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 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 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.

The Vee Diagram, shown in **Figure 9**, 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. Moving from left to right along the diagram, the systems engineering process addresses concept exploration, the systems engineering management plan framework, concept of operations, and systems requirements.

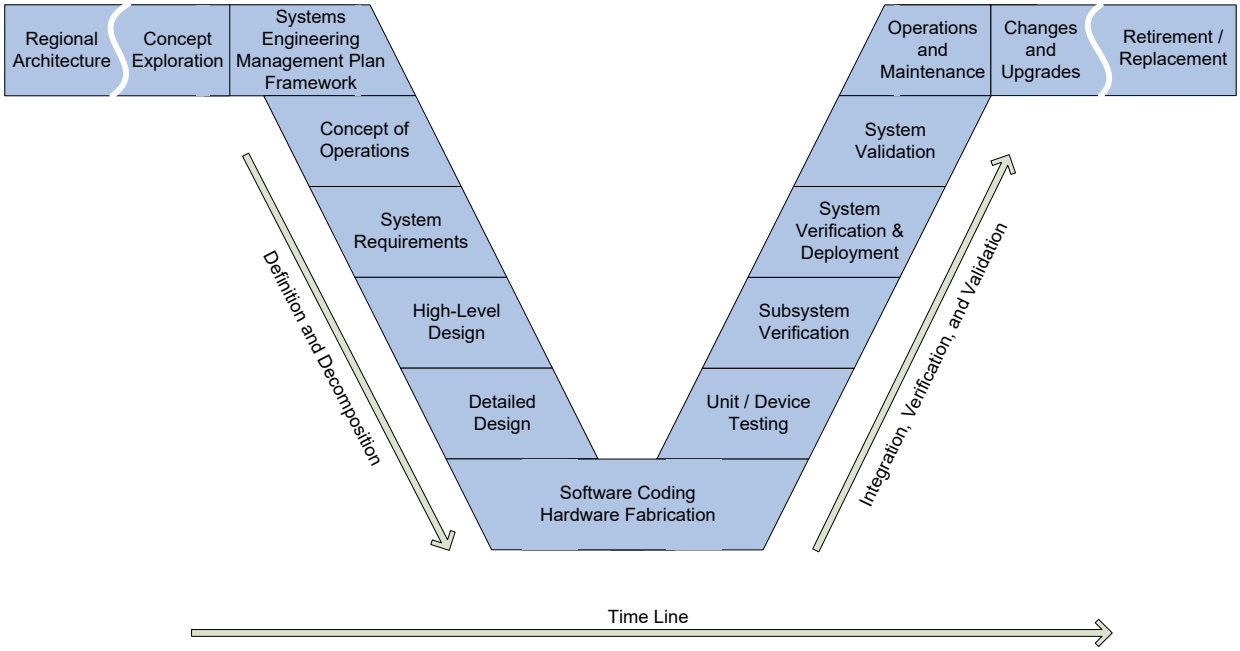

Figure 9 – Systems Engineering Vee Diagram

The Tennessee guidance document contains reference material 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 (described in Section 7.4) should be used to document the necessary changes.

7.3 Process for Determining ITS Architecture Conformity

The Johnson City Regional ITS Architecture and Deployment Plan documents the customized service packages that were developed as part of the Regional ITS Architecture update process. To satisfy FHWA and FTA requirements and remain eligible to use Federal funds, a project must be accurately documented. 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 ITS architecture conformity are as follows:

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

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 within the project limits into a city's closed loop signal system. These are all ITS functions that involve ITS components, and they should be included in the Regional ITS Architecture. Stakeholders can make use of the TDOT ITS Project Identification Form (introduced in Section 7.2) that was filled out upon project submission to the TIP to help identify ITS components of a given project.

Step 2 – Identify the Corresponding Service Packages

If a project is included in the list of projects identified in the Johnson City Region's Regional ITS Deployment Plan, then the applicable service package(s) for that project are also identified. However, ITS projects are not required to be included in the Regional ITS Deployment Plan to be eligible for federal funding; therefore, service packages might need to be identified for projects that have not been covered in the Regional ITS Deployment Plan. In that case, the service packages selected and customized for the Johnson City Region's Regional ITS Architecture should be reviewed to determine if they adequately cover the project. Service packages selected for the Region are identified in Section 5.1 of this document and detailed service package definitions are in **Appendix B**.

Step 3 – Identify the Component within the Service Package

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 the City of Elizabethton TMC was included in the Johnson City Regional ITS Architecture. Detailed planning for this center has not begun and it would not be unusual for the City to select a different name for the TMC once planning and implementation is underway. Such a name change should be documented using the process outlined in Section 7.5.

The ITS service package diagrams that were customized for the Johnson City Regional ITS Architecture and Deployment Plan are provided in the Interactive Architecture available through the online RAD-IT database at:

https://extsites.kimley-horn.com/projects/TennesseeITSArchitecture/johnsoncity.html

To access the ITS service package diagrams, from the website select the "Johnson City Interactive ITS Architecture", then select the "Services" page from the left sidebar, then click the desired Service Package Name. The link below the "Diagram" heading will lead to the service package diagram.

Step 4 – Evaluate the Connections and Flows

The connections and information flows documented in the service package diagrams are selected based on the information available when the Johnson City Regional ITS Architecture and Deployment Plan was updated. 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 Johnson City Regional ITS Architecture and Deployment Plan 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 Johnson City MTPO will be responsible for leading the process to update the Johnson City Regional ITS Architecture and Deployment Plan in coordination with the TDOT Traffic Operations Division. **Table 16** summarizes the maintenance process agreed upon by stakeholders in the Region.

Table 16 – Regional ITS Architecture and Deployment Plan Maintenance

Maintenance Details	Full Plan Update Guidance
Timeframe for Updates	Updates will occur on an as needed basis as determined by the MTPO, TDOT, and FHWA. Updates will be considered after major ITS deployments in the Region or after major updates to the National ITS Architecture. The Regional ITS Architecture and Deployment Plan will be evaluated as needed to determine if an update should be performed.
Scope of Update	Entire Regional ITS Architecture and Deployment Plan
Lead Agency	Johnson City MTPO
Participants	Entire Stakeholder Group
Results	Updated Regional ITS Architecture and Deployment Plan document, Appendices, and RAD-IT Architecture database

Stakeholders agreed that a full update of the Regional ITS Architecture should occur on an as needed basis. The Johnson City MTPO will work with the TDOT Traffic Operations Division and the FHWA Tennessee Division to determine if there have been enough changes to warrant a full update. Changes that will be considered when evaluating the need to update the Johnson City Regional ITS Architecture and Deployment Plan include:

- Major ITS deployments in the Region that add new functionality not currently covered in the Johnson City Regional ITS Architecture and Deployment Plan.
- Major updates to the National ITS Architecture that add new service packages, or substantially change existing service packages, to the extent that the Johnson City Regional ITS Architecture and Deployment Plan is no longer consistent with the National ITS Architecture.

As with all projects in the MTP, ITS projects are reviewed for compliance with all federal rules and regulations, just as non-ITS projects. If new proposed projects are found to be non-compliant corrective action will be taken or not included for federal funding.

The Johnson City MTPO, in coordination with the TDOT Traffic Operations Division and the FHWA Tennessee Division, will be responsible for completing updates of the Regional ITS Architecture and Deployment Plan when needed. During the update process, all stakeholder agencies that participated in the original development of the Johnson City Regional ITS Architecture and Deployment Plan should be included in addition to any other agencies in the Region that are deploying or may be impacted by ITS projects.

7.5 Procedure for Submitting ITS Architecture Changes Between Major Updates

Updates to the Johnson City Regional ITS Architecture and Deployment Plan will occur as described in Section 7.4 to maintain the architecture as a useful planning tool. In between updates, ITS project owners will need to submit documentation to Johnson City MTPO, the maintainer of the Johnson City Regional ITS Architecture and Deployment Plan. Section 7.3 contains step by step guidance for determining whether a project will require review and potential modifications to the Regional ITS Architecture.

For surface transportation ITS projects where a change is required, that would be funded in whole or in part through FHWA's Highway Trust Fund, project owners should complete TDOT's ITS Project Identification Form. This form is included in Appendix E. The form is divided into three sections: one to collect general project information, one to conduct a preliminary risk assessment for the project, and one to identify how the project would be funded. TDOT's form requires a signature from both the project owner's representative and an MPO representative (in the Johnson City Region the MPO is the Johnson City MTPO), which means that the form could be used to identify any needed updates to the regional ITS architecture. TDOT then evaluates the form and communicates to the project owner whether additional documentation or systems engineering is required.

Since TDOT's existing form applies only to roadway-focused ITS enhancements, other types of ITS projects will need to be documented for the Johnson City MTPO using a different form. These other types of projects could include transit vehicle or system enhancements that involve ITS, for example.

For these projects, an Architecture Maintenance Documentation Form was developed for use 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 or 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.

When a major update of the Johnson City Regional ITS Architecture and Deployment Plan is performed, all the documented changes from any submitted TDOT ITS Project Identification Forms and Architecture Maintenance Documentation Forms should be incorporated.

APPENDICES

Appendix A – Stakeholder Involvement and Information Database

Appendix B – ITS Service Package Definitions

Appendix C – System Functional Requirements Table (From RAD-IT)

Appendix D – Copies of Existing Regional ITS Agreements

Appendix E – TDOT ITS Project Identification Form

Appendix F – Regional ITS Architecture Maintenance Documentation Form

Appendix A – Stakeholder Involvement and Information Database

Agency	Representative	Contact Information	Stakeholder Kick-Off Workshop	Stakeholder Input Interview	Stakeholder Review Workshop
Carter County Emergency Management Agency	Billy Harrell Director	harrellb@cartercountytn.gov			X
City of Elizabethton	Matthew Balogh GIS and Engineering Manager	mbalogh@cityofelizabethton.org	X	X	X
City of Elizabethton	Logan Engle Director of Planning & Economic Development	lengle@cityofelizabethton.org	X		
City of Johnson City Public Works Department – Traffic Division	Anthony Todd Traffic Engineering Manager	anthonytodd@johnsoncitytn.org	X	X	X
City of Johnson City Public Works Department – Traffic Division	Tyler Morris Civil Engineer	tmorris@johnsoncitytn.org	X		X
City of Johnson City Fire Department	David Bell Interim Fire Chief	dbell@johnsoncitytn.org	X		
FHWA – Tennessee Division	Pamela Heimsness Safety & Traffic Operations Team Leader	pamela.heimsness@dot.gov	X		
FHWA – Tennessee Division	Melissa Furlong Operations Program Manager	melissa.furlong@dot.gov	X		
FHWA – Tennessee Division	Sean Santalla Planning & Air Quality Specialist	sean.santalla@dot.gov	X		
First Tennessee Development District	Chase Milner Rural Planning Organization Coordinator	cmilner@ftdd.org	X		X
Johnson City MTPO	Glenn Berry Transportation Coordinator	glennberry@jcmpo.org	X	X	X
Johnson City MTPO	Mary Butler Transportation Planner	marybutler@jcmpo.org			X
Johnson City Transit System	Jeff Rawles Assistant Transit Director	jrawles@johnsoncitytransit.org	X	X	X

Agency	Representative	Contact Information	Stakeholder Kick-Off Workshop	Stakeholder Input Interview	Stakeholder Review Workshop
Tennessee Emergency Management Agency – East Region Office	Michelle Matson Emergency Management Coordinator	michelle.matson@tn.gov	X		
TDOT Long Range Planning Division	Troy Ebbert Planning Supervisor, Region 1	troy.j.ebbert@tn.gov	X		
TDOT Region 1	Mark Best ITS/ Traffic Manager	mark.best@tn.gov	X		
TDOT Region 1	Michael Dick District Engineer	michael.dick@tn.gov			X
TDOT Region 1	Jason Farmer District Operations Manager	jason.farmer@tn.gov			X
TDOT Region 1	Andrew Padgett Region 1 Traffic Engineer	andrew.padgett@tn.gov	X		
TDOT Region 1	Ronda Sawyer Community Transportation Planner	ronda.j.sawyer@tn.gov	X		X
TDOT Region 1 District 17	Brian Ramsey Operations District Supervisor	brian.ramsey@tn.gov	X		
TDOT Traffic Operations Division	Murad AlQurishee Transportation Project Specialist	murad.alqurishee@tn.gov			X
TDOT Traffic Operations Division	Said El Said ITS Program Manager	said.elsaid@tn.gov	X		X
TDOT Traffic Operations Division	Jake Wilson Operations District Specialist	jake.wilson@tn.gov	X		
Washington County – Johnson City Emergency Management Agency	Rusty Sells Emergency Management Director	rsells@washingtoncountytn.org	X		

Appendix B – ITS Service Package Definitions

Service Package	Service Package Name	Service Package Description
Data Management		
DM01	ITS Data Warehouse	This service package provides access to transportation data to support transportation planning, condition and performance monitoring, safety analysis, and research. Configurations range from focused repositories that house data collected and owned by a single agency, district, private sector provider, or research institution to broad repositories that contain multimodal, multidimensional data from varied data sources covering a broader region. Both central repositories and physical distributed ITS data repositories are supported. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse service package may be parsed by the local repository and dynamically translated to requests to other repositories that relay the data necessary to satisfy the request. The repositories could include a data registry capability that allows registration of data identifiers or data definitions for interoperable use throughout a region.
Maintenance and Construction		
MC01	Maintenance and Construction Vehicle and Equipment Tracking	This service package tracks the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. Checks can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.
MC04	Winter Maintenance	This service package manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using CCTV cameras and controlled using dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers. Work zone information is coordinated with other groups (e.g., TIC, traffic management, other maintenance and construction centers). Work zone speeds and delays are provided to the motorist prior to the work zones. This service package provides control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.
MC06	Work Zone Management	This service package manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using CCTV cameras and controlled using dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers. Work zone information is coordinated with other groups (e.g., TIC, traffic management, other maintenance and construction centers). Work zone speeds and delays are provided to the motorist prior to the work zones. This service package provides control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.
MC08	Maintenance and Construction Activity Coordination	This service package supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations, or to Transportation Information Centers who can provide the information to travelers. Center to center coordination of work plans supports adjustments to reduce disruption to regional transportation operations.
Parking Management		

Service Package	Service Package Name	Service Package Description
PM01	Parking Space Management	This service package monitors and manages parking spaces in lots, garages, and other parking areas and facilities. It assists in the management of parking operations by monitoring parking lot ingress and egress, parking space occupancy and availability. Infrastructure-based detectors and/or connected vehicles may be used to monitor parking occupancy. The service package shares collected parking information with local drivers and information providers for broader distribution.
Public Safety		
PS01	Emergency Call-Taking and Dispatch	This service package provides basic public safety call-taking and dispatch services. It includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Centers supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Center and an Emergency Vehicle supports dispatch and provision of information to responding personnel. This service package also provides information to support dynamic routing of emergency vehicles. Traffic information, road conditions, and weather advisories are provided to enhance emergency vehicle routing. The Emergency Management Center provides routing information based on real-time conditions and has the option to request an ingress/egress route from the Traffic Management Center.
PS02	Emergency Response	This service package supports emergency/ incident response by personnel in the field. It includes emergency vehicle equipment used to provide response status as well as video or images from either the vehicle or from emergency personnel in the field. Wide area wireless communications between the Emergency Management Center, Emergency Personnel and Emergency Vehicles supports a sharing of emergency response information. The service package also includes tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders at or near the incident scene to support local management of an incident, including the functions and interfaces commonly supported by a mobile command center.
PS03	Emergency Vehicle Preemption	This service package provides signal preemption for public safety-first responder vehicles. Both traditional signal preemption systems and new systems based on connected vehicle technology are covered. In more advanced systems, movement of public safety vehicles through the intersection can be facilitated by clearing queues and holding conflicting phases. In addition, this SP also covers the transition back to normal traffic signal operations after providing emergency vehicle preemption.
PS08	Roadway Service Patrols	This service package supports roadway service patrol vehicles that monitor roads and aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median). The service package monitors service patrol vehicle locations and supports vehicle dispatch to identified incident locations. Incident information collected by the service patrol is shared with traffic, maintenance and construction, and traveler information systems.

Service Package	Service Package Name	Service Package Description
PS09	Transportation Infrastructure Protection	This service package includes the monitoring of transportation infrastructure (e.g., bridges, tunnels and management centers) for potential threats using sensors and surveillance equipment and barrier and safeguard systems to control access, preclude an incident, and mitigate the impact of an incident if it occurs. Threats can result from acts of nature (e.g., hurricanes, earthquakes), terrorist attacks or other incidents causing damage to the infrastructure (e.g., stray barge hitting a bridge support). Infrastructure may be monitored with acoustic, environmental threat (such as nuclear, biological, chemical, and explosives), infrastructure condition and integrity, motion and object sensors and video and audio surveillance equipment. Data from such sensors and surveillance equipment may be processed in the field or sent to a center for processing. The data enables operators at the center to detect and verify threats. When a threat is detected, agencies are notified. Detected threats or advisories received from other agencies result in an increased level of system preparedness. In response to threats, barrier and safeguard systems may be activated to deter an incident, control access to an area or mitigate the impact of an incident. Barrier systems include gates, barriers and other automated and remotely controlled systems that manage entry to transportation infrastructure. Safeguard systems include blast shields, exhaust systems and other automated and remotely controlled systems that mitigate impact of an incident.
PS10	Wide-Area Alert	This service package uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies, and other situations that pose a threat to life and property. The alert includes information and instructions for transportation system operators and the traveling public, improving public safety and enlisting the public's help in some scenarios. The ITS technologies will supplement and support other emergency and homeland security alert systems such as the Emergency Alert System (EAS). When an emergency situation is reported and verified and the terms and conditions for system activation are satisfied, a designated agency broadcasts emergency information to traffic agencies, transit agencies, information service providers, toll operators, and others that operate ITS systems. The ITS systems, in turn, provide the alert information to transportation system operators and the traveling public using ITS technologies such as dynamic message signs, highway advisory radios, in-vehicle displays, transit displays, 511 traveler information systems, and traveler information websites.
PS11	Early Warning System	This service package monitors and detects potential, looming, and actual disasters including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and acts of terrorism including nuclear, chemical, biological, and radiological weapons attacks). The service package monitors alerting and advisory systems, ITS sensors and surveillance systems, field reports, and emergency call-taking systems to identify emergencies and notifies all responding agencies of detected emergencies.

Service Package	Service Package Name	Service Package Description
PS12	Disaster Response and Recovery	This service package 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. All types of disasters are addressed including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and national security emergencies such as nuclear, chemical, biological, and radiological weapons attacks).The service package supports coordination of emergency response plans, including general plans developed before a disaster as well as specific tactical plans with short time horizon that are developed as part of a disaster response. The service package provides enhanced access to the scene for response personnel and resources, provides better information about the transportation system in the vicinity of the disaster, and maintains situation awareness regarding the disaster itself. In addition, this service package tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response. The service package identifies the key points of integration between transportation systems and the public safety, emergency management, public health, and other allied organizations that form the overall disaster response. In this service package, the Emergency Management Center represents the federal, regional, state, and local Emergency Operations Centers and the Incident Commands that are established to respond to the disaster. The interface between the Emergency Management Center and the other centers provides situation awareness and resource coordination among transportation and other allied response agencies. In its role, traffic management implements special traffic control strategies and detours and restrictions to effectively manage traffic in and around the disaster. Maintenance and construction provides damage assessment of road network facilities and manages service restoration. Transit management provides a similar assessment of status for transit facilities and modifies transit operations to meet the special demands of the disaster. As immediate public safety concerns are addressed and disaster response transitions into recovery, this service package supports transition back to normal transportation system operation, recovering resources, managing on-going transportation facility repair, supporting data collection and revised plan coordination, and other recovery activities. This service package builds on the basic traffic incident response service that is provided by TM08, the Traffic Incident Management service package. This service package addresses the additional complexities and coordination requirements that are associated with the most severe incidents that warrant an extraordinary response from outside the local jurisdictions and require special measures such as the activation of one or more emergency operations centers. Many users of ARC-IT will want to consider both TM08 and this service package since every region is concerned with both day-to-day management of traffic-related incidents and occasional management of disasters that require extraordinary response. Disaster Response and Recovery is also supported by PS14, the "Disaster Traveler Information" service package that keeps the public informed during a disaster response. See that service package for more information.

Service Package	Service Package Name	Service Package Description
PS13	Evacuation and Reentry Management	This service package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The service package addresses evacuations for all types of disasters, including disasters like hurricanes that are anticipated and occur slowly, allowing a well-planned orderly evacuation, as well as disasters like terrorist acts that occur rapidly, without warning, and allow little or no time for preparation or public warning. This service package supports coordination of evacuation plans among the federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation. All affected jurisdictions (e.g., states and counties) at the evacuation origin, evacuation destination, and along the evacuation route are informed of the plan. Information is shared with traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. Reversible lanes, shoulder use, closures, special signal control strategies, and other special strategies may be implemented to maximize capacity along the evacuation routes. Transit resources play an important role in an evacuation, removing many people from an evacuated area while making efficient use of limited capacity. Additional shared transit resources may be added and managed in evacuation scenarios. Resource requirements are forecast based on the evacuation plans, and the necessary resources are located, shared between agencies if necessary, and deployed at the right locations at the appropriate times. Evacuations are also supported by PS14, the "Disaster Traveler Information" service package, which keeps the public informed during evacuations. See that service package for more information.

Service Package	Service Package Name	Service Package Description
PS14	Disaster Traveler Information	This service package 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. This service package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations. The collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems. A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This service package keeps the public informed in these scenarios, using all available means to provide information about the disaster area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules, and real-time information on traffic conditions and transit system performance in and around the disaster. This service package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this service package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination, and evacuee-specified evacuation requirements and route parameters. This service package augments the Traveler Information (TI) service packages that provide traveler information on a day-to-day basis for the surface transportation system. This service package provides focus on the special requirements for traveler information dissemination in disaster situations.
Public Transportation		
PT01	Transit Vehicle Tracking	This service package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time.
PT02	Transit Fixed-Route Operations	This service package performs automated dispatch and system monitoring for fixed-route and flexible-route transit services. This service performs scheduling activities including the creation of schedules, blocks and runs, as well as operator assignment. This service monitors the transit vehicle trip performance against the schedule and provides information displays at the Transit Management Center.

Service Package	Service Package Name	Service Package Description
PT03	Dynamic Transit Operations	The Dynamic Transit Operations service package allows travelers to request trips and obtain itineraries using a personal device such as a smart phone, tablet, or personal computer. The trips and itineraries cover multiple transportation services (public transportation modes, private transportation services, shared-ride, walking and biking). This service package builds on existing technology systems such as computer-aided dispatch/ automated vehicle location (CAD/AVL) systems and automated scheduling software, providing a coordination function within and between transit providers that would dynamically schedule and dispatch or modify the route of an in-service vehicle by matching compatible trips together. TI06 covers other shared use transportation options.
PT04	Transit Fare Collection Management	This service package manages transit fare collection on-board transit vehicles and at transit stops using electronic means. It allows transit users to use a traveler card or other electronic payment device such as a smart phone. Readers located either in the infrastructure or on-board the transit vehicles enable electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Center. This service supports ad-hoc payments to the transport provider (typically through the 'payment' and 'fare' flows), payments using a transport provider's account system using account-based tokens or integrated multi-provider account systems (typically through the 'account', 'secureID' and 'authorization' flows).
PT05	Transit Security	This service package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment performs surveillance and sensor monitoring in order to identify potentially hazardous situations. The surveillance equipment includes video (e.g., CCTV cameras), audio systems and/or event recorder systems. The sensor equipment includes threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). Transit user or transit vehicle operator activated alarms are provided on-board. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition, this service package provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as, intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring).Most of the surveillance and sensor data that is collected by this service package may be monitored by either the Emergency Management Center or the Transit Management Center, providing two possible approaches to implementing this service package. This service package also supports remote transit vehicle disabling and transit vehicle operator authentication by the Transit Management Center.

Service Package	Service Package Name	Service Package Description
PT06	Transit Fleet Management	This service package supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to the Transit Management Center. The Transit Management Center processes this data and schedules preventative and corrective maintenance. The service package also supports the day-to-day management of the transit fleet inventory, including the assignment of specific transit vehicles to blocks and the assignment of transit vehicle operators to runs.
PT07	Transit Passenger Counting	This service package 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. The collected data can be used to calculate reliable ridership figures and measure passenger load information at particular stops.
PT08	Transit Traveler Information	This service package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this service package.
PT09	Transit Signal Priority	The Transit Signal Priority service package uses transit vehicle to infrastructure communications to allow a transit vehicle to request priority at one or a series of intersections. The service package provides feedback to the transit driver indicating whether the signal priority has been granted or not. This service package can contribute to improved operating performance of the transit vehicles by reducing the time spent stopped at a red light.
PT14	Multi-modal Coordination	This service package establishes two-way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.
PT17	Transit Connection Protection	This service package allows travelers to initiate a request for connection protection anytime during the trip using a personal device or on-board equipment and receive a confirmation indicating whether the request is accepted. Connection protection uses real time data to examine the arrival status of a transit vehicle and to transmit a hold message to a vehicle or other mode of transportation (e.g. rail) in order for the traveler to make a successful transfer from one vehicle to another. Connection protection can be performed within a single agency, across multiple agencies, and across multiple modes. In an intermodal, multimodal or interagency environment, a transfer request brokerage system, represented by the Transit Management System, can be used to determine the feasibility of a connection protection request and support schedule coordination between agencies.
Traffic Management		

Service Package	Service Package Name	Service Package Description
TM01	Infrastructure-Based Traffic Surveillance	This service package includes traffic detectors, other surveillance equipment, the supporting field equipment, and Center to Field communications to transmit the collected data back to the Traffic Management Center. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Center). The data generated by this service package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long-range planning. The collected data can also be analyzed and made available to users and the Traveler Information Center physical object.
TM02	Vehicle-Based Traffic Surveillance	This service package uses probe data information obtained from vehicles in the network to support traffic operations, including incident detection and the implementation of localized operational strategies. Since traffic data is collected from vehicles, travel times and other related traffic performance measures are available. This service package includes the capability to collect data from Connected Vehicles so that "probe" data can be collected from all equipped vehicles, providing access to a large vehicle population as penetration increases. Incident detection enables transportation agencies to determine the location of potential incidents so the agencies can respond more quickly to the incident and mitigate any negative impacts to the transportation network. Vehicle data that can be used to detect potential incidents include changes in vehicle speeds indicating the disruption of traffic flow, when a vehicle's safety systems have been activated or deployed, or sudden vehicle turns or deceleration at a specific location (indicating a potential obstacle in the roadway).
TM03	Traffic Signal Control	This service package provides the central control and monitoring equipment, communication links, and the signal control equipment that support traffic control at signalized intersections. A range of traffic signal control systems are represented by this service package ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. This service package is generally an intra-jurisdictional package. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would also be represented by this package. Coordination of traffic signal systems using real-time communications is covered in the TM07-Regional Traffic Management service package. This service package is consistent with typical traffic signal control systems.
TM04	Connected Vehicle Traffic Signal System	This service package uses both vehicle location and movement information from connected vehicles as well as infrastructure measurement of non-equipped vehicles to improve the operations of traffic signal control systems. The service package utilizes the vehicle information to adjust signal timing for an intersection or group of intersections in order to improve traffic flow, including allowing platoon flow through the intersection. Other service package provide related mobility services such as Transit Signal Priority, Freight Signal Priority, Emergency Vehicle Preemption, and Pedestrian Mobility to maximize overall arterial network performance.

Service Package	Service Package Name	Service Package Description
TM05	Traffic Metering	This service package provides 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. This package incorporates the instrumentation included in the TM01 service package (traffic sensors are used to measure traffic flow and queues) to support traffic monitoring so responsive and adaptive metering strategies can be implemented. Also included is configurable field equipment to provide information to drivers approaching a meter, such as advance warning of the meter, its operational status (whether it is currently on or not, how many cars per green are allowed, etc.), lane usage at the meter (including a bypass lane for HOVs) and existing queue at the meter.
TM06	Traffic Information Dissemination	This service package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Transportation Information Centers. A link to the Maintenance and Construction Management Center allows real time information on road/bridge closures and restrictions due to maintenance and construction activities to be disseminated.
TM07	Regional Traffic Management	This service package provides for the sharing of information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This service package advances the TM03-Traffic Signal Control and TM05-Traffic Metering service packages by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Traffic Signal Control and Traffic Metering service packages and adds hardware, software, and fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of device control between traffic management centers.

Service Package	Service Package Name	Service Package Description
TM08	Traffic Incident Management System	This service package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The service package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as rail operations and event promoters. Information from these diverse sources is collected and correlated by this service package to detect and verify incidents and implement an appropriate response. This service package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between centers. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination service package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information service packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel. This service package is closely related with the Public Safety service packages, which focus on services that support first responders. In particular, local management of the incident using an incident command system is covered by PS02.
TM12	Dynamic Roadway Warning	This service package includes systems that dynamically warn drivers approaching hazards on a roadway. Such hazards include roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway and any other transient event that can be sensed. 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. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous. Speed warnings that consider the limitations of a given vehicle for the geometry of the roadway (e.g., rollover risk for tall vehicles) are not included in this service package but are covered by the TM17 – Speed Warning and Enforcement service package. Roadway warning systems, especially queue warning systems are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as TM20-Variable Speed Limits and TM22-Dynamic Lane Management and Shoulder Use).

Service Package	Service Package Name	Service Package Description
TM13	Standard Railroad Grade Crossing	This service package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the ITS Roadway Equipment and the Driver in the physical view.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification of an approaching train by interfaced wayside equipment. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the Traffic Management Center.
TM17	Speed Warning and Enforcement	This service package 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. Speed monitoring can be made via spot speed or average speed measurements. Roadside equipment can display the speed of passing vehicles and/or suggest a safe driving speed. Environmental conditions and vehicle characteristics may be monitored and factored into the safe speed advisories that are provided to the motorist. For example, warnings can be generated recognizing the limitations of a given vehicle for the geometry of the roadway such as rollover risk for tall vehicles. This service focuses on monitoring of vehicle speeds and enforcement of the speed limit while the variable speed limits service (covered in TM20-Variable Speed Limits service package) focuses on varying the posted speed limits to create more uniform speeds along a roadway, to promote safer driving during adverse conditions (such as fog) and/or to reduce air pollution.
TM19	Roadway Closure Management	This service package closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, and other scenarios where access to the roadway must be prohibited. The service package includes automatic or remotely controlled gates or barriers that control access to roadway segments including ramps and traffic lanes. Remote control systems allow the gates to be controlled from a central location or from a vehicle at the gate/barrier location, improving system efficiency and reducing personnel exposure to unsafe conditions during severe weather and other situations where roads must be closed. Surveillance systems allow operating personnel to visually verify the safe activation of the closure system and driver information systems (e.g., DMS) provide closure information to motorists in the vicinity of the closure. The equipment managed by this service package includes the control and monitoring systems, the field devices (e.g., gates, warning lights, DMS, CCTV cameras) at the closure location(s), and the information systems that notify other systems of a closure. This service package covers general road closure applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other Traffic Management service packages.

Service Package	Service Package Name	Service Package Description
TM20	Variable Speed Limits	This service package 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. Based on the measured data, the system calculates and sets suitable speed limits, usually by lane. Equipment over and along the roadway displays the speed limits and additional information such as basic safety rules and current traffic information. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous. This service establishes variable speed limits and communicates the speed limits to drivers. Speed warnings and enforcement of speeds limits, including variable speed limits, is covered in the TM17-Speed Warning and Enforcement service package. Variable speed limits are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as TM22-Dynamic Lane Management and Shoulder Use and TM23-Dynamic Roadway Warning).
TM25	Wrong Way Vehicle Detection and Warning	This service package detects wrong way vehicles on the main roadway and at the exit of divided freeways, tunnels, and bridges. Wrong way vehicle drivers are immediately warned. If the driver continues onto the roadway, warnings are issued to oncoming drivers of the wrong way entry and traffic management and public safety centers are notified.
Traveler Information		
TI01	Broadcast Traveler Information	This service package provides a digital broadcast service that disseminates traveler information to all equipped travelers within range. It collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadcasts the information to travelers using technologies such as FM subcarrier, satellite radio, cellular data broadcasts, and Internet streaming technologies. This service package also provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility service packages for connected vehicles. DSRC is used to deliver real-time traveler information including travel times, incident information, road conditions, and emergency traveler information to vehicles as they pass connected vehicle roadside equipment along their route. This service package provides public information that is available to all equipped vehicles in the vicinity of the roadside equipment.

Service Package	Service Package Name	Service Package Description
TI02	Personalized Traveler Information	This service package 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. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications with the traveler. A variety of interactive devices may be used by the traveler to access information prior to a trip or en-route including phone via a 511-like portal and web pages via smart phone, tablet, personal computer, and a variety of in-vehicle devices.
TI07	In-Vehicle Signage	This service package augments regulatory, warning, and informational signs and signals by providing information directly to drivers through in-vehicle devices. The information provided would include static sign information (e.g., stop, curve warning, guide signs, service signs, and directional signs) and dynamic information (e.g., current signal states including highway intersection and highway-rail intersection status and local conditions warnings identified by local environmental sensors). This service package also includes the capability for maintenance and construction, emergency, and transit vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in areas such as work zones, around incidents, and at bus stops.
Vehicle Safety		
VS08	Queue Warning	This service package utilizes connected vehicle technologies, including vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications, to enable vehicles within the queue event to automatically broadcast their queued status information (e.g., rapid deceleration, disabled status, lane location) to nearby upstream vehicles and to centers (such as the TMC). The infrastructure will broadcast queue warnings to vehicles in order to minimize or prevent rear-end or other secondary collisions. This service package is not intended to operate as a crash avoidance system. In contrast to such systems, this service package will engage well in advance of any potential crash situation, providing messages and information to the driver in order to minimize the likelihood of his needing to take crash avoidance or mitigation actions later. It performs two essential tasks: queue determination (detection and/or prediction) and queue information dissemination using vehicle-based, infrastructure-based, or hybrid solutions.

Service Package	Service Package Name	Service Package Description
VS12	Pedestrian and Cyclist Safety	This service package supports the sensing and warning systems used to interact with pedestrians, cyclists, and other non-motorized users that operate on the main vehicle roadways, or on pathways that intersect the main vehicle roadways. These systems allow automated warning or active protection for this class of users. It integrates traffic, pedestrian, and cyclist information from roadside or intersection detectors and new forms of data from wirelessly connected, non-motorized traveler-carried mobile devices to request right-of-way or to inform non-motorized travelers when to cross and how to remain aligned with the crosswalk or pathway based on real-time Signal Phase and Timing (SPaT) and MAP information. In some cases, priority will be given to non-motorized travelers, such as persons with disabilities who need additional crossing time, or in special conditions (e.g., weather) where non-motorized travelers may warrant priority or additional crossing time. This service package will enable a service call to be routed to the traffic controller from a mobile device of a registered person with disabilities after confirming the direction and orientation of the roadway that the individual is intending to cross. It also provides warnings to the non-motorized user of possible infringement of the crossing or pathway by approaching vehicles.
Weather		
WX01	Weather Data Collection	This service package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway. It also collects data from vehicles in the road network that can be used to directly measure or infer current environmental conditions. It leverages vehicle on-board systems that measure temperature, sense current weather conditions (rain and sun sensors) and also can monitor aspects of the vehicle operational status (e.g., use of headlights, wipers, and traction control system) to gather information about local environmental conditions. In addition, environmental sensor systems located on Maintenance and Construction Vehicles are also potential data sources. The collected environmental data is used by the Weather Information Processing and Distribution service package to process the information and make decisions on operations. The collected environmental data may be aggregated, combined with data attributes and sent to meteorological systems for data qualification and further data consolidation. The service package may also request and receive qualified data sets from meteorological systems.
WX02	Weather Information Processing and Distribution	This service package processes and distributes the environmental information collected from the 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 operational centers and decision support systems can make decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination service package, and aid operators in scheduling work activity.

Appendix C – System Functional Requirements Table (From RAD-IT)

Element Name	Functional Object
Archived Data User	No Functional Objects Identified
Ballad Health - Johnson City Medical Center	No Functional Objects Identified
Ballad Health - Sycamore Shoals Hospital	No Functional Objects Identified
Carter County 911 Communications District	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Incident Command
	Emergency Response Management
	Emergency Routing
Carter County/Elizabethton EMA	Emergency Evacuation Support
	Emergency Incident Command
	Emergency Response Management
Carter County/Elizabethton Public Safety Vehicles	EV On-Board En Route Support
	EV On-Board Incident Management Communication
	EV Service Patrol Vehicle Operations
City of Elizabethton CCTV Cameras	Roadway Basic Surveillance
	Roadway Incident Detection
City of Elizabethton Connected Vehicle Roadside Equipment	No Functional Objects Identified
City of Elizabethton DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
City of Elizabethton Field Sensors	Roadway Basic Surveillance
	Roadway Data Collection
	Roadway Incident Detection
City of Elizabethton Fire Department Surveillance Cameras	No Functional Objects Identified
City of Elizabethton Fire Dispatch	Emergency Response Management
	Emergency Secure Area Sensor Management
	Emergency Secure Area Surveillance
City of Elizabethton Flashing Beacons	No Functional Objects Identified
City of Elizabethton Government Information Channel	No Functional Objects Identified
City of Elizabethton Mayors Office	TIC Emergency Traveler Information
	TIC Traveler Information Broadcast
City of Elizabethton Police Department	Emergency Response Management
	Emergency Secure Area Sensor Management
	Emergency Secure Area Surveillance
City of Elizabethton Streets and Sanitation Department	MCM Incident Management
	MCM Roadway Maintenance
	MCM Vehicle Maintenance Management
	MCM Vehicle Tracking

Element Name	Functional Object
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
City of Elizabethton Streets and Sanitation Department Vehicles	MCV Roadway Maintenance and Construction
	MCV Vehicle Location Tracking
	MCV Winter Maintenance
	MCV Work Zone Support
City of Elizabethton Speed Monitoring Equipment	Roadway Data Collection
	Roadway Speed Monitoring and Warning
City of Elizabethton TMC	TMC Basic Surveillance
	TMC Data Collection
	TMC Evacuation Support
	TMC Incident Detection
	TMC Incident Dispatch Coordination
	TMC Regional Traffic Management
	TMC Roadway Equipment Monitoring
	TMC Signal Control
	TMC Speed Warning
	TMC Standard Rail Crossing Management
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
City of Elizabethton Traffic Signals	Roadway Basic Surveillance
	Roadway Mixed Use Crossing Safety
	Roadway Signal Control
	Roadway Signal Preemption
	Roadway Standard Rail Crossing
City of Elizabethton Website	TIC Data Collection
	TIC Emergency Traveler Information
	TIC Traveler Information Broadcast
City of Johnson City - City Engineers Office	No Functional Objects Identified
City of Johnson City CCTV Cameras	Roadway Basic Surveillance
	Roadway Incident Detection
City of Johnson City Community Relations	TIC Emergency Traveler Information
	TIC Traveler Information Broadcast
City of Johnson City Connected Vehicle Roadside Equipment	No Functional Objects Identified
City of Johnson City DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
City of Johnson City Field Sensors	Roadway Basic Surveillance

Element Name	Functional Object
	Roadway Data Collection
	Roadway Environmental Monitoring
	Roadway Incident Detection
City of Johnson City Flood Detectors	Roadway Basic Surveillance
	Roadway Environmental Monitoring
City of Johnson City Flood Warning Beacons	Roadway Warning
City of Johnson City Parking Availability DMS	No Functional Objects Identified
City of Johnson City Parking Management Center	No Functional Objects Identified
City of Johnson City Police Department	Emergency Data Collection
	Emergency Dispatch
	Emergency Routing
City of Johnson City Portable DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
City of Johnson City Rail Notification System	Roadway Standard Rail Crossing
City of Johnson City Rectangular Rapid Flashing Beacons	Roadway Mixed Use Crossing Safety
	Roadway Signal Control
City of Johnson City Road Closure Gates	No Functional Objects Identified
City of Johnson City RWIS Sensors	Roadway Environmental Monitoring
City of Johnson City Smart Streetlight Equipment	No Functional Objects Identified
City of Johnson City Speed Monitoring Equipment	Roadway Data Collection
	Roadway Speed Monitoring and Warning
City of Johnson City Stormwater Management Division	MCM Environmental Information Collection
	MCM Work Activity Coordination
City of Johnson City Stream Gauges	Roadway Environmental Monitoring
City of Johnson City Street Division	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
City of Johnson City Street Division Vehicles	MCV Vehicle Location Tracking
	MCV Work Zone Support
City of Johnson City TMC	TMC Basic Surveillance
	TMC Data Collection
	TMC Environmental Monitoring
	TMC Evacuation Support

Element Name	Functional Object
	TMC Incident Detection
	TMC Incident Dispatch Coordination
	TMC Regional Traffic Management
	TMC Roadway Equipment Monitoring
	TMC Roadway Warning
	TMC Signal Control
	TMC Situation Data Management
	TMC Speed Warning
	TMC Standard Rail Crossing Management
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
City of Johnson City Traffic Signals	Roadway Basic Surveillance
	Roadway Mixed Use Crossing Safety
	Roadway Signal Control
	Roadway Signal Preemption
	Roadway Standard Rail Crossing
City of Johnson City Website	TIC Data Collection
	TIC Emergency Traveler Information
	TIC Traveler Information Broadcast
City of Johnson City Wrong-Way Detection and Warning Equipment	No Functional Objects Identified
Electronic Fare Payment Card	No Functional Objects Identified
Financial Service Provider	No Functional Objects Identified
FTHRA Data Archive	Archive Data Repository
	Archive Government Reporting
Johnson City MTPO Data Archive	Archive Data Repository
	Archive Government Reporting
Johnson City Transit Bus Stop DMS	Transit Stop Information Services
Johnson City Transit Center CCTV Surveillance	Field Secure Area Surveillance
	ITS Management Support
	ITS Security Support
Johnson City Transit Data Archive	Archive Data Repository
	Archive Government Reporting
Johnson City Transit Demand Response Vehicles	Transit Vehicle On-Board Fare Management
	Transit Vehicle On-Board Information Services
	Transit Vehicle On-Board Maintenance
	Transit Vehicle On-Board Paratransit Operations
	Transit Vehicle On-Board Trip Monitoring
	Transit Vehicle Schedule Management

Element Name	Functional Object
	Transit Vehicle Security
Johnson City Transit Dispatch Center	Emergency Secure Area Alarm Support
	Emergency Secure Area Surveillance
	Transit Center Connection Protection
	Transit Center Data Collection
	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 Evacuation Support
	Transit Garage Maintenance
Johnson City Transit Fixed-Route Vehicles	Transit Vehicle On-Board Connection Protection
	Transit Vehicle On-Board Fare Management
	Transit Vehicle On-Board Information Services
	Transit Vehicle On-Board Maintenance
	Transit Vehicle On-Board Trip Monitoring
	Transit Vehicle Passenger Counting
	Transit Vehicle Schedule Management
	Transit Vehicle Security
Johnson City Transit Mobile Phone App	TIC Interactive Traveler Information
	TIC Traveler Information Broadcast
	TIC Trip Planning
Johnson City Transit Transit Kiosks	Transit Stop Information Services
	Traveler Fare Management
	Traveler Information Reception
	Traveler Interactive Information
Johnson City Transit Trip Planner	Personal Interactive Traveler Information
	Personal Local Route Guidance
	Personal Trip Planning and Route Guidance
Johnson City Transit Website	TIC Interactive Traveler Information
	TIC Traveler Information Broadcast
	TIC Trip Planning
Local Print and Broadcast Media	No Functional Objects Identified
Municipal CCTV Cameras	Roadway Basic Surveillance

Element Name	Functional Object
	Roadway Incident Detection
Municipal Field Sensors	Roadway Basic Surveillance
	Roadway Data Collection
	Roadway Incident Detection
Municipal Police Department	Emergency Data Collection
	Emergency Dispatch
	Emergency Routing
Municipal Public Safety Dispatch	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Incident Command
	Emergency Notification Support
	Emergency Response Management
	Emergency Routing
Municipal Rail Notification System	Roadway Standard Rail Crossing
Municipal Speed Monitoring Equipment	Roadway Data Collection
	Roadway Speed Monitoring and Warning
Municipal TMC	TMC Basic Surveillance
	TMC Regional Traffic Management
	TMC Roadway Equipment Monitoring
	TMC Signal Control
	TMC Standard Rail Crossing Management
	TMC Traffic Information Dissemination
Municipal Traffic Signals	Roadway Basic Surveillance
	Roadway Signal Control
	Roadway Signal Preemption
Municipal Website	TIC Data Collection
	TIC Emergency Traveler Information
	TIC Traveler Information Broadcast
Municipal/County Maintenance	MCM Incident Management
	MCM Roadway Maintenance
	MCM Work Activity Coordination
	MCM Work Zone Management
Municipal/County Public Safety Vehicles	EV On-Board En Route Support
	EV On-Board Incident Management Communication
	EV Service Patrol Vehicle Operations
National Weather Service	No Functional Objects Identified
NCDOT Division 13 Maintenance and Construction	MCM Environmental Information Processing
	MCM Incident Management

Element Name	Functional Object
	MCM Work Activity Coordination
	MCM Work Zone Management
NET Trans Demand Response Vehicles	Transit Vehicle On-Board Maintenance
	Transit Vehicle On-Board Paratransit Operations
	Transit Vehicle On-Board Trip Monitoring
	Transit Vehicle Security
NET Trans Dispatch Center	Transit Center Connection Protection
	Transit Center Data Collection
	Transit Center Fixed-Route Operations
	Transit Center Multi-Modal Coordination
	Transit Center Paratransit Operations
	Transit Center Vehicle Tracking
NET Trans Fixed-Route Vehicles	Transit Vehicle On-Board Connection Protection
	Transit Vehicle On-Board Trip Monitoring
	Transit Vehicle Schedule Management
	Transit Vehicle Security
NET Trans Website	TIC Interactive Traveler Information
	TIC Traveler Information Broadcast
	TIC Trip Planning
North Carolina 511 System	TIC Emergency Traveler Information
	TIC Interactive Traveler Information
	TIC Operations Data Collection
	TIC Traveler Information Broadcast
	TIC Traveler Telephone Information
North Carolina DOT	No Functional Objects Identified
Other Maintenance and Construction Management Agencies	No Functional Objects Identified
Other TDOT Region District Operations	MCM Incident Management
	MCM Work Activity Coordination
	MCM Work Zone Management
Other Traffic Management Agencies	No Functional Objects Identified
Pedestrians	No Functional Objects Identified
Private Sector Traveler Information Services	TIC Emergency Traveler Information
	TIC Interactive Traveler Information
	TIC Trip Planning
Private Transportation Providers	Transit Center Multi-Modal Coordination
Private Traveler Personal Computing Devices	Personal Interactive Traveler Information
	Personal Local Route Guidance
	Personal Traveler Information Reception

Element Name	Functional Object
	Personal Trip Planning and Route Guidance
Public/Private Vehicles	Vehicle Situation Data Monitoring
Rail Operator Wayside Equipment	Roadway Standard Rail Crossing
Service Agency	No Functional Objects Identified
Social Networking Services	TIC Traveler Information Broadcast
TDOT CCTV Cameras	Roadway Basic Surveillance
	Roadway Incident Detection
	Roadway Work Zone Traffic Control
TDOT Changeable Speed Limit Signs	Roadway Speed Monitoring and Warning
	Roadway Variable Speed Limits
TDOT Community Relations Division	TIC Emergency Traveler Information
	TIC Traveler Information Broadcast
	TIC Traveler Telephone Information
TDOT Connected Vehicle Roadside Equipment	No Functional Objects Identified
TDOT DMS	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
TDOT Emergency Services Coordinator	MCM Incident Management
	MCM Roadway Maintenance
	TMC Evacuation Support
	TMC Incident Dispatch Coordination
TDOT Field Sensors	Roadway Basic Surveillance
	Roadway Data Collection
	Roadway Incident Detection
	Roadway Speed Monitoring and Warning
TDOT HAR	Roadway Traffic Information Dissemination
	Roadway Work Zone Traffic Control
TDOT Long Range Planning Division Archive	Archive Data Repository
	Archive Government Reporting
	Archive Situation Data Archival
	TMC 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 Ramp Metering Equipment	Roadway Basic Surveillance
	Roadway Traffic Metering
TDOT Ramp Queue Detection System	No Functional Objects Identified

Element Name	Functional Object
TDOT Region 1 District Operations	MCM Data Collection
	MCM Environmental Information Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Roadway Maintenance
	MCM Vehicle Tracking
	MCM Winter Maintenance Management
	MCM Work Activity Coordination
	MCM Work Zone Management
TDOT Region 1 Engineers Office	No Functional Objects Identified
TDOT Region 1 HELP and Rural Assist Dispatch	Emergency Evacuation Support
	Emergency Incident Command
TDOT Region 1 TMC - Knoxville	TMC Basic Surveillance
	TMC Data Collection
	TMC Environmental Monitoring
	TMC Evacuation Support
	TMC Incident Detection
	TMC Incident Dispatch Coordination
	TMC Regional Traffic Management
	TMC Roadway Equipment Monitoring
	TMC Roadway Warning
	TMC Situation Data Management
	TMC Speed Warning
	TMC Traffic Information Dissemination
	TMC Traffic Metering
	TMC Variable Speed Limits
	TMC Work Zone Traffic Management
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 Rural Assist Trucks	EV On-Board En Route Support
	EV On-Board Incident Management Communication
	EV Service Patrol Vehicle Operations
TDOT RWIS Sensors	Roadway Environmental Monitoring
TDOT Smart Work Zone Equipment	Roadway Basic Surveillance
	Roadway Incident Detection
	Roadway Traffic Information Dissemination
	Roadway Variable Speed Limits

Element Name	Functional Object
	Roadway Work Zone Safety
	Roadway Work Zone Traffic Control
TDOT SmartWay Central Software	MCM Data Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Work Activity Coordination
	MCM Work Zone Safety Management
	TIC Data Collection
	TIC Emergency Traveler Information
	TIC Operations Data Collection
	TIC Traveler Information Broadcast
	TIC Traveler Telephone Information
TDOT SmartWay Mobile App	TIC Data Collection
	TIC Emergency Traveler Information
	TIC Interactive Traveler Information
TDOT SmartWay Website	TIC Data Collection
	TIC Emergency Traveler Information
	TIC Interactive Traveler Information
TDOT Wrong-Way Detection and Warning Equipment	Roadway Basic Surveillance
	Roadway Warning
TEMA	Emergency Evacuation Support
	Emergency Incident Command
	Emergency Response Management
Tennessee 511 IVR	TIC Traveler Telephone Information
Tennessee 511 System	TIC Data Collection
	TIC Emergency Traveler Information
	TIC Interactive Traveler Information
	TIC Traveler Information Broadcast
	TIC Traveler Telephone Information
Tennessee Bureau of Investigation	Emergency Incident Command
	Emergency Response Management
THP Dispatch	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Incident Command
	Emergency Response Management
	Emergency Routing
THP Vehicles	EV On-Board En Route Support
	EV On-Board Incident Management Communication

Element Name	Functional Object
	EV Service Patrol Vehicle Operations
TITAN Database	Archive Data Repository
	Archive Government Reporting
Transit Operations Personnel	No Functional Objects Identified
Traveler	No Functional Objects Identified
Vehicle OBE	No Functional Objects Identified
Vehicle Operator	No Functional Objects Identified
Washington County Emergency Communications District	Emergency Call-Taking
	Emergency Dispatch
	Emergency Evacuation Support
	Emergency Incident Command
	Emergency Response Management
	Emergency Routing
Washington County Sheriffs Office	Emergency Data Collection
	Emergency Dispatch
	Emergency Incident Command
	Emergency Response Management
Washington County/Johnson City EMA	Emergency Evacuation Support
	Emergency Incident Command
	Emergency Response Management
Washington County/Johnson City Public Safety Vehicles	EV On-Board En Route Support
	EV On-Board Incident Management Communication
	EV Service Patrol Vehicle Operations
Wings Air Rescue Flight Operations	Emergency Dispatch
	Emergency Environmental Monitoring
	Emergency Evacuation Support
	Emergency Incident Command
	Emergency Response Management
	Emergency Routing

Appendix D – Copies of Existing Regional ITS Agreements

TDOT Agreement for Live CCTV Video Access and Information Sharing – Government Entity Users

TDOT Agreement for Live CCTV Video Access – Private Entity Users

TDOT, TDOSHS, and Local Governments MOU for Quick Clearance of Incidents

City of Johnson City Agreement for Traffic Signal Timing Data Sharing – Private Entity User

Johnson City MTPO and Johnson City Transit System Agreement Defining Mutual Responsibilities and Roles

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:_____

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's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

Johnson City Police Department
Local Agency

By: _____

Print/Type Name: Mark Sirois

Title: Chief of Police

Date: 4-6-14

ADDITIONAL SIGNATORIES

Name	Title	Date

Tennessee's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

Washington County Sheriffs Office
Local Agency

By: Ed Grayberal Jr

Print/Type Name: ED GRAYBERAL JR

Title: Sheriff

Date: 9-10-13

ADDITIONAL SIGNATORIES

Name	Title	Date
Les Lenton	Director W.C.EMA	9 Sept 2013

Name Title Date

Name Title Date

Name Title Date

Tennessee's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

Johnson City Fire Department
Local Agency

By: Mark A. Scott

Print/Type Name: Mark A. Scott

Title: Chief

Date: 11/07/2013

ADDITIONAL SIGNATORIES

Name	Title	Date
Name	Title	Date
Name	Title	Date
Name	Title	Date

Tennessee's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

FALL BRANCH VOLUNTEER FIRE DEPARTMENT
Local Agency

By: James M. Dawson, Operations Chief

Print/Type Name: JAMES M. DAWSON

Title: OPERATIONS CHIEF

Date: 10/1/13

ADDITIONAL SIGNATORIES

Name	Title	Date
Name	Title	Date
Name	Title	Date
Name	Title	Date

Tennessee's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

Sulphur Springs Vol. Fire Department
Local Agency

By: [signature]

Print/Type Name: Bruce Brocklebank

Title: Assistant Chief

Date: October 1, 2013

ADDITIONAL SIGNATORIES

Name	Title	Date

Tennessee's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

Em Breeville Volunteer Fire Dept.
Local Agency

By: Earl Greene

Print/Type Name: Earl Greene

Title: Chief

Date: 10-2-2013

ADDITIONAL SIGNATORIES

Name	Title	Date
Peter Jackson	Captain	10-2-2013

Tennessee's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

Nolichuckey Valley Volunteer Fire Department
Local Agency

By: Charles A. Baines

Print/Type Name: Charles A. Baines

Title: Chief

Date: Oct. 1, 2013

ADDITIONAL SIGNATORIES

Name	Title	Date
Name	Title	Date
Name	Title	Date
Name	Title	Date

Tennessee's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

Limestone Vol Fire Dept
Local Agency

By: Stephen Archer

Print/Type Name: Stephen Archer

Title: Chief

Date: 10-01-2013

ADDITIONAL SIGNATORIES

Name	Title	Date
Name	Title	Date
Name	Title	Date
Name	Title	Date

Tennessee's

"OPEN ROADS POLICY"

Quick Clearance for Safety and Mobility

GRAY VOL. FIRE DEPT.

Local Agency

By: Chris Rogers

Print/Type Name: CHRIS ROGERS

Title: CHIEF

Date: 10-01-13

ADDITIONAL SIGNATORIES

Name	Title	Date
Name	Title	Date
Name	Title	Date
Name	Title	Date

Authorization for TTS Access to Agency Traffic Signal Data

This is an agreement between the City of Johnson City, Tennessee ("Agency") and Traffic Technology Services, Inc. ("TTS"). Both the Agency and TTS are each sometimes referred in the agreement as "Party" and both the Agency and TTS are sometimes referred in this Agreement together as "Parties".

Recitals

Whereas, TTS is in the business of developing technologies, strategies, and systems for use in maximizing the efficiency of transportation end users and thus the overall capacity of existing transportation networks; and

Whereas, Agency collects Real Time Traffic Signal Data and other related data; and

Whereas, TTS has a significant business interest to access Real Time Traffic Signal Data as the input into its proprietary and patented processes; and

Whereas, these Agency Data may be made available to TTS at minimal or no cost to Agency; and

Whereas, these Agency Data are not confidential, nor identify any transportation end user specifically in any manner; and

Whereas, TTS desires permission to obtain access to the Real Time Traffic Signal Data for use in conjunction with its business; and

Whereas, TTS agrees to provide related inventories, signal performance metrics, and other formatted data products in exchange for access to these Real Time Traffic Signal Data; and

Whereas, the Agency agrees to provide TTS with Real Time Traffic Data and to TTS subject to the terms and conditions in this Agreement;

Now therefore, TTS and the Agency agree as follows:

Agreement

Section 1. Definitions

"Agency Data" means collectively, Real Time Traffic Signal Data, Traffic Signal Timing Plan, and any other data provided to TTS by Agency under this Agreement.

"Real Time Traffic Signal Data" means signal status and states, demand status and states, and other information available from the traffic signal controller or Agency's central signal system or Agency's Advanced Traffic Management System (ATMS).

"Traffic Signal Timing Data" means signal timing plans, as-built intersection design, traffic signal plans, signal control plans, or other documents that identify the time-of-day plans.

"Product" means the data derived from the Real Time Traffic Signal Data and Traffic Signal Timing Data, marketed, distributed, and sold as "Personal Signal Assistant" or related products.

Section 2. Authorized Representatives

M Denis Peterson is designated by Agency as an authorized representative (Agency Agent).

The Chief Executive Officer, Chief Marketing Officer, or Director of Government Accounts are designated by TTS as authorized representatives (TTS Agent).

Section 3. Purpose and Scope

TTS desires access to the Real Time Traffic Signal Data, to include signal status and states, demand status and states, and other information available from traffic signal controller or ATMS. In addition, TTS desires access to time of day signal timing parameters. TTS will use these data in patented, proprietary processes to produce Product for use by TTS customers and other interested parties.

The intended use of the Product is for connected vehicle applications to improve the vehicle performance or efficiency, improve ride comfort for driver or operator and passengers, provide information to the driver or operator, monitor driving behaviors, or apply to automated features. TTS shall limit its customers' applications of the derived Product for applications that do not violate local, state, or federal laws, or uses that will not be used in a manner to encourage undesirable driver behavior for the Agency.

The Product is not permitted for traffic law enforcement.

Section 4. Access of Traffic Signal Timing Data

Agency hereby grants TTS access to Traffic Signal Timing Data. TTS will work with Agency Agent to obtain data in the most efficient and non-intrusive manner from Agency, which may include access to Agency central system or ATMS. TTS will be provided with access to this Traffic Signal Timing Data at no cost, except TTS will be responsible for any costs associated with making the data available.

Section 5. Access of Real Time Traffic Signal Data

Agency hereby grants TTS non-exclusive, non-transferable, non-sublicensable, limited, and royalty free access to obtain and utilize its Real Time Traffic Signal Data. TTS will be provided with access to this Real Time Signal Data at no cost, except TTS will be responsible for any costs associated with making the data available. TTS will be responsible for all vendor costs associated with Agency's ATMS vendor making system modifications to make the Real Time Signal Data available. TTS shall have the right to use the data in any manner it deems appropriate in furtherance of its business purposes, including without limitation providing the derivatives of the data and Product to third parties, subject to the terms of this Agreement. Agency reserves the right to make available the same data for other parties that request access to Agency Data.

Section 6. Ownership of and Rights to Data

The Agency retains all rights to the raw data, or Real Time Traffic Signal Data, being provided to TTS. TTS shall own all rights to Product and any formatted, predictive, or derivative data generated from the raw data.

Section 7. Reporting

TTS shall provide Agency with periodic reports, at least quarterly, of traffic signal performance metrics of Product.

Section 8. Indemnification

TTS will indemnify, defend, save, and hold harmless the Agency and its elected officials, employees, and agents from all claims, including but not limited to claims that arise from or relate to (i) a breach of TTS' representations and warranties, (ii) any personal injury, death or property damage caused by any alleged act, omission, error, fault, mistake or negligence of TTS, its employees, agents, or representatives in connection with or incident to TTS' performance under or related to this Agreement, and (iii) the infringement of any patent, copyright, trademark, trade secret or other proprietary right of any third party by TTS' use of the Agency Data provided under this Agreement.

Section 9. Representations and Warranties

Agency makes no warranties concerning the quality or accuracy of the data provided under this Agreement. Agency does not warrant it will be able to continuously provide the data without interruption and expressly reserves the right to discontinue the data stream at any time. Notwithstanding anything to the contrary herein, Agency reserves the right to immediately discontinue the Agency Data stream without notice and at Agency discretion upon evidence of tampering or other unauthorized interference with the Agency Data. Except as expressly provided for herein, Agency makes no other representations or warranties.

Section 10. Limitation of Liability

Nothing in this Agreement excludes or limits either Party's liability for: (a) fraud or fraudulent misrepresentation; (b) breach of confidentiality; (c) indemnification obligations under Section 8(ii) or Section 8(iii) above; (d) claims for personal injury, including death, or damage to real property or tangible personal property arising from the negligence, reckless conduct or intentional acts of a Party, its officers, employees or agents; or (e) matters that cannot be excluded or limited under applicable law .

Section 11. Term

Unless terminated earlier in accordance with Section 12, this Agreement will begin on the latest date of the authorized agent signature (the "Effective Date") and continue for one (1) year (the "Initial Term"). This Agreement will automatically renew on the anniversary of the Effective Date for successive one (1) year periods unless either party provides written notice of non-renewal at least thirty (30) days before the end of the then-current term (collectively, "Renewal Terms"). The "Term" will consist of the Initial Term and all Renewal Terms, if any.

Section 12. Termination

Each Party shall have the right to terminate this Agreement by providing written notice to the other Party within thirty (30) days, unless identified otherwise in this Agreement.

Section 13. Data Destruction

Upon termination of this Agreement, TTS shall destroy all raw data whatever form or medium, including all copies thereof. TTS shall destroy the data no later than thirty (30) days following termination of this Agreement.

Section 14. Notices

Absent notice to the contrary in writing, all communications to TTS shall be sent to:

Traffic Technology Services, Inc.
Attn: Contracts & Agreements
17933 NW Evergreen Pkwy, Suite 240
Beaverton, OR 97006

or email: suppliers@traffictechserivces.com

Absent notice to the contrary in writing, all communications to the Agency shall be sent to:

M Denis Peterson

601 East Main Street

Johnson City, TN 37601

or at any other address as any Party may, from time to time, designate by notice given in compliance with this Section.

Section 15. Assignment

Neither Party shall assign, transfer, subcontract, or delegate all or any part of this Agreement, or any interest therein, without the other Party's prior written consent, which shall not be unreasonably withheld.

Section 16. Agreement Binding

This Agreement shall be binding upon the successors of Agency Agent, TTS Agent, TTS, or Agency and assigns of the Parties hereto.

Section 17. Personal Liability

Nothing in this Agreement may be construed to create any personal liability on the part of any officer or agent of either Party to this Agreement.

Section 18. Choice of Law

This Agreement shall be governed in all respects by and construed under the laws of the State in which Agency resides as such laws are applied to agreements between residents of that State entered into and to be performed entirely within that State.

Section 19. Choice of Forum

The Parties agree to institute any litigation concerning the enforcement or interpretation of the Agreement in the courts of jurisdiction for the Agency, unless the claim must be brought in a federal forum, in which case it must be brought and adjudicated exclusively within the United States District Court for the District of Greeneville, Tennessee. TTS hereby consents to the personal jurisdiction of these courts, waives any objection to venue in these courts, and waives any claim that either of these courts is an inconvenient forum. In no way may this section or any other term of this Agreement be construed as a waiver by the Agency of any form of defense or immunity, whether it is sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States, or otherwise, from any Claim or from the jurisdiction of any court.

Section 20. Waiver

Any waiver of any breach of any condition or covenant herein contained to be kept and performed by either Party shall not be deemed or considered as a continuing waiver, and shall not operate to bar or prevent the non-breaching Party from declaring a default for any succeeding breach, either of the same condition or covenant or otherwise.

Section 21. Severability

If any term (or part of a term) of this Agreement is invalid, illegal, or unenforceable, the rest of the Agreement will remain in effect.

Section 22. Interpretation of the Agreement

The Parties acknowledge that each of the Parties have participated in the drafting of this Agreement. No Party shall be considered to be the drafter of this Agreement for the purposes of interpretation.

Section 23. Parties in Interest

Nothing herein shall be construed to be to the benefit of any third party, nor is it intended that any provision shall be for the benefit of any third party.

Section 24. Force Majeure

Neither Party will be liable for failure or delay in performance to the extent caused by circumstances beyond reasonable control.

Section 25. Entire Agreement

This Agreement constitutes the entire agreement between the Parties. This Agreement supersedes all proposals and oral and written agreements between the Parties on this subject. No modifications, alterations, changes, or waiver to this Agreement or any of its terms shall be valid or binding unless accomplished by a written amendment signed by both Parties.

The remainder of this page intentionally left blank.

IN WITNESS OF THIS, the Parties hereby execute this Agreement through their authorized representatives.

AGENCY		**TTS**	
M Denis Peterson 24 July 2018			07/25/2018
Authorized Signature	Date	Authorized Signature	Date
M Denis Peterson		Kristian Milster	
Printed Name		Printed Name	
City Manager – City of Johnson City, Tennessee		Director of Government Accounts	
Title		Title	

Approved By:

AGREEMENT BETWEEN THE

JOHNSON CITY TRANSIT SYSTEM

AND THE

JOHNSON CITY METROPOLITAN PLANNING ORGANIZATION

This Agreement defines mutual responsibilities and roles between the City of Johnson City Transit System (JCT) and the Johnson City Metropolitan Planning Organization (MPO) related to carrying out the Metropolitan Planning process under the urban planning requirements as defined under SAFETEA-LU.

1. The Director of the Johnson City Transit System shall be a permanent member of the Executive Staff of the Johnson City Metropolitan Planning Organization with equivalent status to any other voting member of the Executive Staff.

2. Johnson City Transit relies on the MPO Public Participation Process. The MPO will develop a Long-Range Transportation Plan which will include a section on area public and private transportation providers, including the Johnson City Transit system. The MPO public participation process allows interested parties (including transit employees and representatives of users of public transportation) with a reasonable opportunity to comment on the long-range transportation plan. Copies of the long-range transportation plan will be made available to the public in written (at JCMPO offices, Johnson City Public Library, and area agencies as stipulated in the *Johnson City MPO Public Involvement Policy*) and electronic format (www.jcmpo.org), with Spanish summaries available upon request. Public comments may be submitted to the MPO Coordinator in writing or by e-mail, and will be taken into consideration by MPO staff, with adjustments made as appropriate.

3. The JCT staff and MPO staff shall jointly prepare work tasks and share responsibilities for work performed under the Unified Planning Work Program which includes financial participation from Sections 5503 and 5307 of the Federal Transit Administration's (FTA) assistance for transit planning.

4. The JCT staff and MPO staff shall jointly prepare the annual Transportation Improvement Program (TIP), with the JCT staff providing the list of JCT projects to be included in the TIP. These projects will include capital and operating budgets and grant requests related to public

transportation services. JCT, in cooperation with TDOT and the MPO, will develop estimates of funds reasonably expected to support the proposed projects in the TIP, and these funds will be listed by funding source and project in the TIP. The MPO staff will coordinate submittal of the TIP for inclusion in the State of Tennessee's Transportation Improvement Program (STIP).

5. The MPO staff and JCT staff shall jointly work to implement the Job Access and Intelligent Transportation Systems projects developed under the guidance of SAFETEA-LU. JCT staff shall serve on technical and other relevant project committees established by the MPO Executive Board and Executive Staff.

6. Development of transportation plans and studies related to public transit services will be joint responsibilities of the JCT and MPO staffs with final review authority on staff recommendations vested with the JCT Director, subject to public comment and review provisions applicable for each study or project.

7. All transportation planning and project activities and projects in the UPWP shall be considered in an intermodal framework with respect to the important role public transportation services have for a significant portion of the elderly, handicapped, and disadvantaged population.

Date: March 17, 2008

Eldonna Janutolo

Eldonna Janutolo, Director, Johnson City Transit System

Glenn Berry, Transportation Planning Coordinator
Johnson City Metropolitan Planning Organization

Appendix E – TDOT ITS Project Identification Form

Tennessee ITS Project Identification Form

INSTRUCTIONS: Refer to Section 4.2 of the TDOT ITS Project Development Guidelines. Attach or make available any documents referenced in this form when submitting.

SECTION 1 – PROJECT INFORMATION

Agency: _____

Agency Information (Address, phone number, e-mail, etc):

_____

Project Name and Location:

_____

☐ New Project
☐ Modification Project
☐ Expansion Project

Nature of Work:

☐ Planning
☐ Design Software / Integration
☐ Operations
☐ Evaluation
☐ Scoping
☐ Construction
☐ Maintenance (Equipment Replacement)
☐ Other: _____

Please provide the following background information. In most cases, 1-3 sentences will be sufficient for each item.

Brief Description of ITS project objectives – (What is the purpose of the project? What needs are being addressed?):

_____

_____

Project Summary – (What solutions will address the needs? What major elements will be installed? What major function(s) will be performed?)

_____

_____

Work to Date: (Any preliminary planning, investigation of options, associated internal or external systems examined?)

_____

SECTION 2 – RISK ASSESSMENT

(For each question, answer Yes, No, Not Sure or N/A for not applicable):

1 – Will the project depend on **only your agency** to implement and operate?

_____

2 - Will the project use only software proven elsewhere, with **no** new software writing?

_____

3 - Will the project use only hardware and communications **proven** elsewhere?

_____

4 - Will the project use only **existing interfaces** (no new interfaces to other systems)?

_____ (If YES include reference)

5 - Will the project use only **existing system requirements** that are well documented?

_____ (If YES include reference)

6 - Will the project use only **existing operating procedures** that are well documented?

_____ (If YES include reference)

7 - Will the project use only technologies with service life **longer** than 2-4 years?

_____

SECTION 3 – FUNDING

Identify all that apply: ☐ Local Agency ☐ State ☐ Federal Funds

TIP/STIP Identification and Description:

_____

_____ _____ _____

Agency Representative Signature Date

_____ _____ _____

MPO/RPO Representative Signature Date

FOR TDOT USE ONLY:

☐ No additional documentation required ☐ Inconclusive risk level determination (SSEAF is required)

☐ Low Risk (SSEAF is required) ☐ High Risk (SEAR is required)

_____ _____ _____

TDOT Representative Signature Date

Appendix F – Regional ITS Architecture Maintenance Documentation Form

Johnson City
Regional ITS Architecture and Deployment Plan
Maintenance Form

Please complete the following form to document changes to the 2022 Johnson City Regional ITS Architecture and Deployment Plan. Forms should be submitted to the Johnson City Metropolitan Transportation Planning Organization (MTPO) for review and acceptance. All accepted changes will be kept on file by the MTPO and shared with the TDOT Traffic Operations Division. Changes will be incorporated into the Johnson City 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:

Johnson City Metropolitan Transportation Planning Organization
137 West Market Street
Johnson City, TN 37604
Phone: 423-434-6272
E-mail: jcmpo@jcmpo.org

Form Submittal Date: _____

Regional ITS Architecture Maintenance Form
Version 1.0 - June 2022

Johnson City
Regional ITS Architecture and Deployment Plan
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 Johnson City MTPO 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 Johnson City MTPO 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?	

Regional ITS Architecture Maintenance Form
Version 1.0 - June 2022

Johnson City Region
Regional ITS Architecture and Deployment Plan
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 Management Center (TMC) is shown as the only center controlling the CCTV cameras. The City A TMC 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 Johnson City MTPO 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: TM01 – Infrastructure-Based Traffic Surveillance* *TM08 – Traffic Incident Management System*
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 TM08 – 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 TMC 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 TM01 – Infrastructure-Based Traffic Surveillance being changed from planned to existing. These have also been marked on the service package diagram.*
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 Johnson City MTPO 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 TMC and City A Police Department are the two agencies impacted by this change. (Note: Assuming the City A TMC 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 TMC 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.*

Regional ITS Architecture Maintenance Form
Version 1.0 - June 2022