Tennessee Department of Transportation
Regional ITS Architectures and Deployment Plans

Lakeway Region

Regional ITS Architecture Report

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AD	Archived Data
AMBER	America's Missing: Broadcast Emergency Response
APTA	American Public Transportation Association
APTS	Advanced Public Transportation System
ASTM	American Society for Testing and Materials
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
CCTV	Closed Circuit Television
CGTA	Cumberland Gap Tunnel Authority
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
DMS	Dynamic Message Sign
DSRC	Dedicated Short Range Communication
EM	Emergency Management
EMA	Emergency Management Agency
EMS	Emergency Medical Services
ETHRA	East Tennessee Human Resource Agency Transportation
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
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
LRTP	Long Range Transportation Plan
MC	Maintenance and Construction

LIST OF ACRONYMS

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

1. INTRODUCTION

1.1 Project Overview

Development of a regional intelligent transportation system (ITS) architecture is one of the most important steps in planning for and implementing ITS in a region. ITS architectures provide a framework for implementing ITS projects, encourage interoperability and resource sharing among agencies, identify applicable standards to apply to projects, and allow for cohesive long-range planning among regional stakeholders. The ITS architecture allows stakeholders to plan for what they want their system to look like in the long-term and then break out the system into smaller pieces that can be implemented as funding permits.

ITS architectures satisfy the conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) bill passed in 2005. In response to Section 5206(e) of TEA-21, the Federal Highway Administration (FHWA) issued a final rule and the Federal Transit Administration (FTA) issued a final policy that required regions implementing any ITS project to have an ITS architecture in place by April 2005. After this date, any ITS projects must show conformance with their regional ITS architecture in order to be eligible for funding from FHWA or FTA. Regions that had not yet deployed ITS were given four years to develop an ITS architecture after their first ITS project proceeded to final design.

In July 2008 the Tennessee Department of Transportation (TDOT), in coordination with the Lakeway Area Metropolitan Transportation Planning Organization (MTPO), began development of the Lakeway Regional ITS Architecture. The Lakeway Regional ITS Architecture included the same geographic boundaries as the Lakeway Area MTPO plus the remainder of Hamblen and Jefferson Counties. Stakeholders developed the Regional ITS Architecture based on a 20-year vision of how they wanted to implement ITS in the Region. In addition to the Regional ITS Architecture, a separate ITS Deployment Plan was developed to identify and prioritize specific ITS projects recommended for the Region in order to implement the ITS Architecture.

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

1.2 Document Overview

The Lakeway Regional ITS Architecture report is organized into five key sections:

Section 1 – Introduction

This section provides an overview of the National ITS Architecture requirements, the Lakeway Regional ITS Architecture, and the key features and stakeholders in the Lakeway Region.

Section 2 – Regional ITS Architecture Development Process

An overview of the key steps involved in developing the ITS architecture for the Lakeway Region is provided in this section. It includes a discussion of stakeholder involvement, architecture workshops, and the architecture development process.

Section 3 – Customization of the National ITS Architecture for the Lakeway Region

This section contains a summary of regional needs and details the customization of the National ITS Architecture to meet the ITS vision for the Region. The market packages that were selected for the Region are included in this section and interconnects are presented, including the "sausage diagram" showing the relationships of the key subsystems and elements in the Region.

Section 4 – Application of the Regional ITS Architecture

Functional requirements and standards that apply to the Region, as indicated by the Regional ITS Architecture, are presented in Section 4. Operational concepts identifying stakeholder roles and responsibilities have been prepared and potential agreements to support the sharing of data and resources have been identified.

Section 5 – Maintaining the Regional ITS Architecture

A maintenance plan has been developed for the Lakeway Regional ITS Architecture and is included in this section. The plan outlines the procedure for updating the ITS architecture over time.

The Lakeway Regional ITS Architecture also contains five appendices:

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

1.3 Lakeway Region

1.3.1 Geographic Boundaries

The Lakeway Region is comprised of Hamblen and Jefferson Counties in east Tennessee as shown in **Figure 1**. Municipalities include Morristown, Jefferson City, and White Pine. The regional boundaries encompass all of the Lakeway MTPO service area as well as the remaining portions of Hamblen and Jefferson Counties not included in the MTPO boundaries.

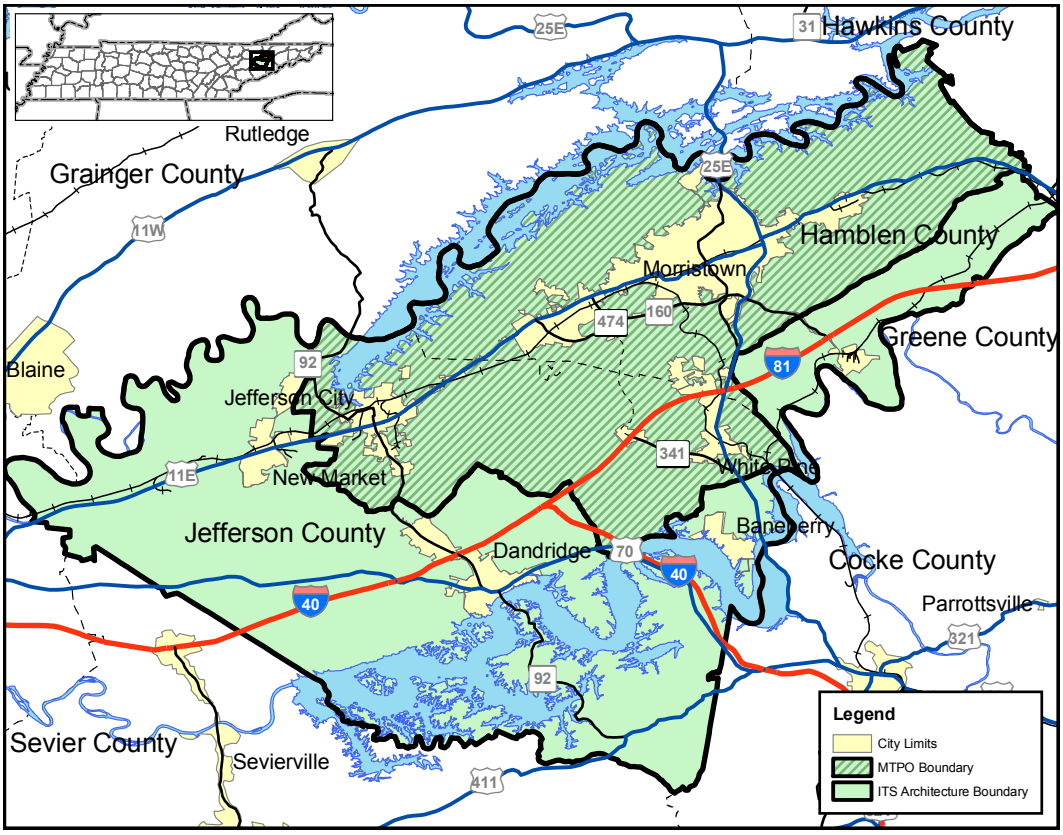

Figure 1 – Lakeway Regional Boundaries

When developing the stakeholder group, the project team coordinated with the MTPO to invite the appropriate city, county, regional, state and federal agencies. **Table 1** in Section 1.3.4 identifies the stakeholders that participated in the process.

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

1.3.2 Transportation Infrastructure

As illustrated previously in **Figure 1**, the Region is served by several State and Federal highways. The primary roadway facilities include I-40, I-81, US 11E and US 25E.

I-40 is a divided east-west interstate highway that runs the entire length of the State of Tennessee, connecting Memphis to Knoxville. I-81 begins near Dandridge, Tennessee and continues north into the Tri-Cities area and eventually into Virginia. The interchange of I-81 and I-40 is within the regional boundaries and an important decision point for many travelers. US 11E runs parallel to I-81 through most of the region and connects Jefferson City and Morristown. US 25E is a north-south facility that runs through the Region into Kentucky and includes the Cumberland Gap Tunnel at the Tennessee-Kentucky state line.

1.3.3 Lakeway Region ITS Plans

The Lakeway Region began the development of their Regional ITS Architecture in 2008 using a consulting engineering firm from TDOT's Technical Assistance for ITS Architecture On-Call Contract. Version 6.0 of the National ITS Architecture and Version 4.0 of Turbo Architecture were used in the Lakeway Regional ITS Architecture development.

It is important to recognize the initial deployment of ITS infrastructure in a region because as of April 2005, in order for a region to receive funding for ITS projects from the Highway Trust Fund, the United States Department of Transportation (USDOT) requires that the region have an ITS architecture developed. This requirement only applies to regions with existing ITS infrastructure deployed. For regions that do not have any ITS infrastructure deployed, the USDOT requires that they have an ITS architecture within four years of their first ITS project entering final design.

The Lakeway Region has several ITS components deployed in the field. Examples of implementations in the Region include closed loop signal systems with video image vehicle detection systems (VIVDS), emergency vehicle signal preemption, and computer aided dispatch for emergency vehicles. As the Lakeway Region pursues funding opportunities for proposed projects, it will be necessary to show that a project fits within the ITS Architecture developed for the Region.

The Lakeway Regional ITS Architecture, like many of the other regional ITS architectures developed in Tennessee, did not include statewide commercial vehicle operations as part of the plan. Tennessee has a separate statewide Commercial Vehicle Information Systems and Networks (CVISN) program that documents how ITS can be used consistently throughout Tennessee for statewide functions such as vehicle registration, fuel tax, or safety inspections, so only local applications of ITS functions have been included in the Regional ITS Architecture.

1.3.4 Stakeholders

Due to the fact that ITS often transcends traditional transportation infrastructure, it is important to involve non-traditional stakeholders in the ITS architecture development and visioning process. Input from these stakeholders, both public and private, is a critical part of defining the interfaces, integration needs, and overall vision for ITS in a region.

Although there is not currently an urban transit system operating in the City of Morristown, stakeholders present at the workshops felt that it was important to include the framework for a future transit system in the Regional ITS Architecture. As a result of those discussions elements for a future Morristown Transit System have been incorporated into the Architecture. Currently demand response transit needs in the Region are met by the East Tennessee Human Resource Agency (ETHRA) Transit service. The ETHRA service area covers seventeen counties in east Tennessee. Since the majority of ETHRA's operations

occur outside the Lakeway Regional boundaries, ETHRA is included in a Rural Planning Organization (RPO). TDOT decided that RPOs are covered by the Statewide Architecture; therefore, ETHRA is only included in the Lakeway Regional ITS Architecture where they interact with agencies in the Lakeway Region.

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

Table 1 – Lakeway Stakeholder Agencies and Contacts

Stakeholder Agency	Address	Contact
Bohanan's Forensic, Inc.	P.O. Box 1206 Dandridge, TN 37725	Arthur Bohanan
City of Jefferson City – Public Works Department	1032 N Highway 92 Jefferson City, TN 37760	Mike Jones
City of Jefferson City – Public Works Department	1032 N Highway 92 Jefferson City, TN 37760	Brian Rhodes
City of Morristown – Engineering Department	100 W 1st North Street Morristown, TN 37814	Jeff Branham
City of Morristown – Fire Department	P.O. Box 1499 Morristown, TN 37814	Clark Taylor
City of Morristown – Information Technology Department	100 W 1st North Street Morristown, TN 37814	Robert Neill
City of Morristown – Police Department	P.O. Box 1283 Morristown, TN 37814	Charles Letterman
City of Morristown – Police Department	P.O. Box 1283 Morristown, TN 37814	Gary Lowe
City of Morristown – Public Works Department	100 W 1st North Street Morristown, TN 37814	Bryan Fowler
Cumberland Gap Tunnel Authority	P.O. Box 1425 Middlesboro, KY 40965	John Burke
Federal Highway Administration – Tennessee Division	640 Grassmere Park Road Suite 112 Nashville, Tennessee 37211-3568	Don Gedge
Hamblen County E911	530 Long Ave Morristown, TN 37814	Jimmy Peoples
Jefferson County E911	P.O. Box 705 Jefferson City, TN 37760	Marcus Reed
Jefferson County Sheriff's Office	765 Justice Center Drive Dandridge, TN 37725	Randall Woods
Lakeway MTPO	100 W 1st North Street Morristown, TN 37814	Terren Barret
Lakeway MTPO	100 W 1st North Street Morristown, TN 37814	Rich DesGroseilliers
Morristown Utility Systems	441 West Main Street Morristown, TN 37814-0667	Jody Wigington
Norfolk Southern Corporation	1200 Peachtree Street NE, Box 123 Atlanta, GA 30309	Rick Ray

Table 1 – Lakeway Stakeholder Agencies and Contacts (continued)

Stakeholder Agency	Address	Contact
Tennessee Department of Transportation – Long Range Planning Division	505 Deadrick Street Suite 900, James K. Polk Bldg. Nashville, Tennessee 37243-0334	Deborah Fleming
Tennessee Department of Transportation – Long Range Planning Division	505 Deadrick Street Suite 900, James K. Polk Bldg. Nashville, Tennessee 37243-0334	Terry Gladden
Tennessee Department of Transportation – Long Range Planning Division	505 Deadrick Street Suite 900, James K. Polk Bldg. Nashville, Tennessee 37243-0334	Joseph Roach
Tennessee Department of Transportation – Region 1 SmartWay Center	P.O. Box 58 Knoxville, TN 37901	Mark Best
Tennessee Highway Patrol	P.O. Box 186 Fall Branch, TN 37656	Mike Higgs
Tennessee Highway Patrol	P.O. Box 186 Fall Branch, TN 37656	Walter Owenby
Town of White Pine	P.O. Box 66 White Pine, TN 37890	Stanley Wilder
Town of White Pine – Public Works Department	P.O. Box 66 White Pine, TN 37890	Todd Ellis
Walters State Community College – Information and Educational Technologies	500 South Davy Crockett Parkway Morristown, TN 37813	Joe Sargent
Walters State Community College – Police Department	500 South Davy Crockett Parkway Morristown, TN 37813	Sarah Rose

2. REGIONAL ITS ARCHITECTURE DEVELOPMENT PROCESS

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

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

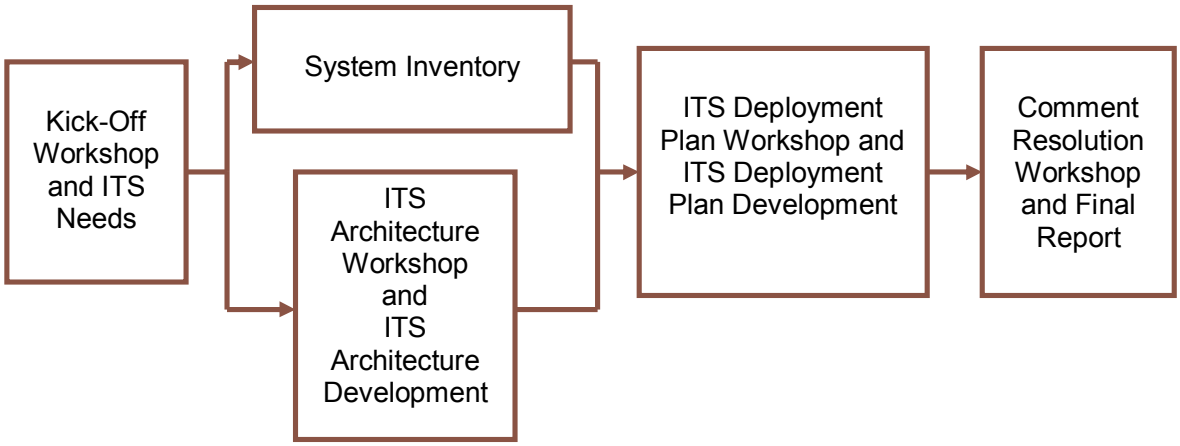

Figure 2 – Lakeway Regional ITS Architecture and Deployment Plan Development Process

2.1 Stakeholder Workshops

A total of four workshops with stakeholders over a period of five months were used to develop the Lakeway Regional ITS Architecture and Deployment Plan. These workshops included:

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

Key components of the process are described below:

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

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

Task 3 – ITS Architecture Workshop and ITS Architecture Development: The purpose of the Regional ITS Architecture Workshop was to review the system inventory with stakeholders and develop the Lakeway Regional ITS Architecture. Training on the National ITS Architecture was integrated into the workshop so that key elements of the architecture, such as market packages, could be explained prior to the selection and editing of these elements. The result of the Regional ITS Architecture Workshop was an ITS architecture for the Lakeway Region that included a system inventory, interconnect diagram, customized market packages, functional requirements, and relevant ITS standards. Following the workshop, a Draft Regional ITS Architecture document was prepared and sent to stakeholders for review and comment.

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

Task 5 – Comment Resolution Workshop and Final Report: A Comment Resolution Workshop was held with stakeholders to review the Draft Regional ITS Architecture and the Draft Regional ITS Deployment Plan. Next steps for the Region were also discussed including the use and maintenance of the Regional ITS Architecture. Comments were incorporated and a final Regional ITS Architecture and Regional ITS Deployment Plan were developed.

2.2 Turbo Architecture

Turbo Architecture Version 4.0 was used to develop the Lakeway Regional ITS Architecture. Turbo Architecture is a software application that was developed by the USDOT to be used as a tool for documenting and maintaining ITS architectures. Version 4.0 of Turbo Architecture was released in October 2007 and was developed to support Version 6.0 of the National ITS Architecture. Use of the Turbo Architecture software in development of the regional ITS architectures is recommended by both the FHWA and the FTA.

In the Lakeway Region, the Turbo Architecture database that was developed was based on the ITS market packages which are provided in **Appendix B** of this report. The ITS market packages provide a graphical representation of the services stakeholders in the Region would like ITS to provide. In each market package the elements, such as a transportation management center (TMC) or a closed-circuit television (CCTV) camera, and the data that is shared between them are shown. Turbo Architecture allows the Region to document all of the elements and data flows that exist or are planned in the Region. Turbo Architecture also allows the user to quickly access any standards that are associated with the data flows as well as generate reports and diagrams to assist in reviewing the data. Some examples of the useful reports and diagrams that may be generated using the Turbo Architecture software are included in **Table 2**.

Table 2 – Turbo Architecture Report and Diagrams

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

Turbo Architecture saves data in Microsoft Access compatible data files. Turbo Architecture files can be accessed using Microsoft Access, although use of Access will not provide nearly the same amount of capabilities as accessing the files using the Turbo Architecture software. With the release of Version 4.0 of Turbo Architecture, the USDOT began offering the Turbo Architecture software free of charge and provides a link for downloading the software on the National ITS Architecture website. At the time this report was written that site was located at www.iteris.com/itsarch/.

3. CUSTOMIZATION OF THE NATIONAL ITS ARCHITECTURE FOR THE LAKEWAY REGION

3.1 Systems Inventory

An important initial step in the architecture development process is to establish an inventory of existing ITS elements. At the Kick-Off Workshop and through subsequent discussions with agency representatives, Lakeway Region stakeholders provided the team with information about existing and planned systems that would play a role in the Regional ITS Architecture.

The National ITS Architecture has eight groups of ITS service areas. Existing, planned, and future systems in the Region were identified in the following service areas:

- ***Traffic Management*** – includes the TDOT SmartWay TMC in Knoxville as well as other existing and future TMCs and traffic operations centers (TOCs), detection systems, CCTV cameras, fixed and portable dynamic message signs (DMS), and other related technologies.
- ***Emergency Management*** – includes emergency operations/management centers, improved information sharing among traffic and emergency services, automated vehicle location (AVL) on emergency vehicles, traffic signal preemption for emergency vehicles, and wide-area alerts.
- ***Maintenance and Construction Management*** – includes work zone management, roadway maintenance and construction information, and road weather detection systems.
- ***Public Transportation Management*** – includes transit and paratransit AVL, transit travel information systems, electronic fare collection, and transit security.
- ***Commercial Vehicle Operations*** – includes coordination with CVISN efforts.
- ***Traveler Information*** – includes broadcast traveler information, traveler information kiosks, and highway advisory radio (HAR).
- ***Archived Data Management*** – includes electronic data management and archiving systems.
- ***Vehicle Safety*** – these systems were discussed, but at this time this service group is primarily a private sector initiative to incorporate technologies such as intersection collision avoidance and automated vehicle operation systems into vehicles.

3.2 Regional Needs

Needs from the Region were identified by stakeholders at the Kick-Off Workshop held in July of 2008. The needs identified provided guidance for determining which market packages should be included in the architecture. Stakeholders identified ITS needs for the Lakeway Region in the following areas:

- Traffic management;
- Emergency management;
- Maintenance and construction management;
- Public transportation management;
- Commercial vehicle operations;
- Traveler information; and
- Archived data management.

Stakeholder discussion about public transportation management needs led to the inclusion of a framework for future ITS implementations on a future transit system for the City of Morristown.

Section 3.4.3 contains additional information about the specific needs identified and relates those needs to the market packages that document the corresponding ITS service.

3.3 Element Customization

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

When developing customized elements, the stakeholder group agreed to create individual traffic, maintenance, and emergency management elements for the City of Morristown and individual traffic elements for the City of Jefferson City. The other smaller communities in the Region were documented as part of the municipal elements. This documentation allows the communities to be included in the Regional ITS Architecture, and therefore eligible to use federal monies on potential future ITS deployments even if there are no specific plans for ITS implementation at this time.

3.3.1 Subsystems and Terminators

Each identified system or component in the Lakeway Regional ITS inventory was mapped to a subsystem or terminator in the National ITS Architecture. Subsystems and terminators are the entities that represent systems in ITS.

Subsystems are the highest level building blocks of the physical architecture, and the National ITS Architecture groups them into four major classes: Centers, Field, Vehicles, and Travelers. Each of these major classes includes various subsystems that represent a set of transportation functions (or processes). Each set of functions is grouped under one agency, jurisdiction, or location, and correspond to physical elements such as: traffic operations centers, traffic signals, or vehicles. **Figure 3** shows the National ITS Architecture subsystems. This figure, also known as the "sausage diagram," is a standard interconnect diagram, showing the relationships of the various subsystems within the architecture. A customized interconnect diagram for the Lakeway Region is shown in **Figure 4** in Section 3.3.3. Communication functions between the subsystems are represented in the ovals. Fixed-point to fixed-point communications include not only twisted pair and fiber optic technologies, but also wireless technologies such as microwave and spread spectrum.

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

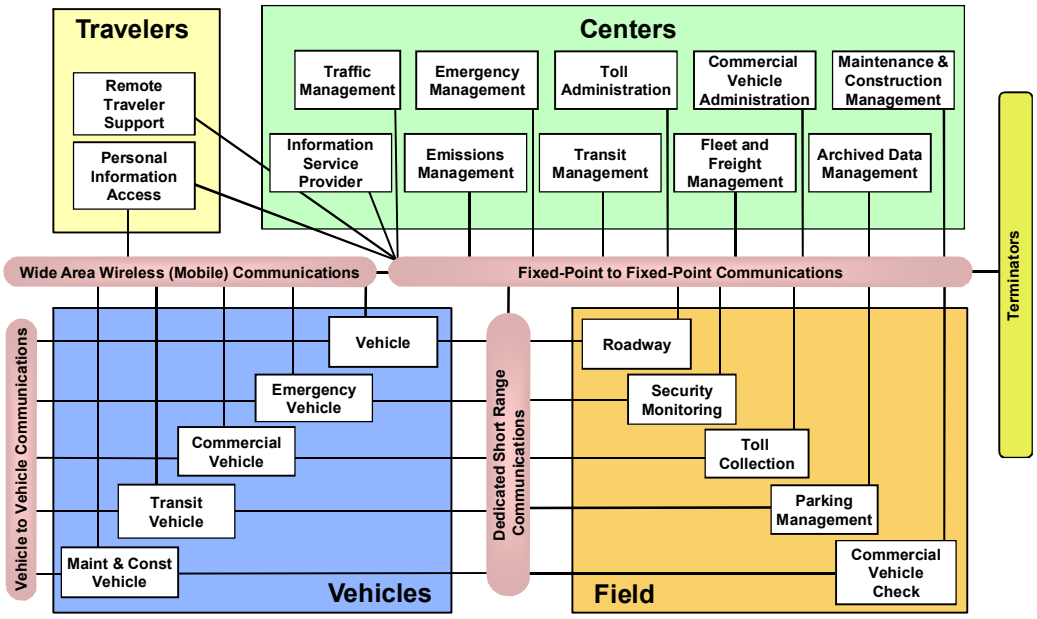

Figure 3 – National ITS Architecture Physical Subsystem Interconnect Diagram

3.3.2 ITS Inventory by Stakeholder

Each stakeholder is associated with one or more systems or elements (subsystems and terminators) that make up the transportation system in the Lakeway Region. A listing of stakeholders as identified in the Lakeway Regional ITS Architecture can be found in **Table 3** along with a description of the stakeholder. For example, rather than individually documenting each of the smaller municipalities in the Region, a single stakeholder was created for municipal agencies which represents the cities and towns not specifically called out in the architecture. **Table 4** sorts the inventory by stakeholder so that each stakeholder can easily identify and review all of the architecture elements associated with their agency. The table includes the status of the element. In many cases an element classified as existing might still need to be enhanced to attain the service level desired by the Region.

Table 3 – Lakeway Region Stakeholder Descriptions

Stakeholder	Stakeholder Description
City of Jefferson City	Municipal government for the City of Jefferson City. Covers all city departments including those that deal with traffic and public safety.
City of Morristown	Municipal government for the City of Morristown. Covers all city departments including those that deal with traffic and public safety.
Commercial Vehicle Operators	Operators of commercial vehicles.
Cumberland Gap Tunnel Authority	Agency responsible for the maintenance and operations of the Cumberland Gap Tunnel.
ETHRA	The East Tennessee Human Resource Agency provides demand response transit service in the Region.
Financial Institution	Institution that handles exchange of money for transit electronic fare collection.
Hamblen County	County government for Hamblen County. Includes all county departments including the Sheriff's Office and Highway Department as well as the Hamblen County Emergency Management Agency.
Jefferson County	County government for Jefferson County. Includes all county departments including the Sheriff's Office and Highway Department as well as the Jefferson County Emergency Management Agency.
Media	Local media outlets including television stations, newspapers, radio stations and their associated websites.
Municipal/County Government	Government for various municipalities and counties within the Region that are not specifically called out. Covers all departments including those that deal with traffic and public safety.
NOAA	The National Oceanic and Atmospheric Administration gathers weather information and issues severe weather warnings.
Other Agencies	This stakeholder represents a wide variety of agencies. The associated elements are groups of agencies or providers that do not have a primary stakeholder agency.
Private Information Provider	Private sector business responsible for the gathering and distribution of traveler information. This service is typically provided on a subscription basis.
Rail Operators	Companies that operate trains and/or are responsible for the maintenance and operations of railroad tracks.
System Users	All of the users of the transportation system.
TDOT	The Tennessee Department of Transportation is responsible for the construction, maintenance, and operation of state roadways in Tennessee.
TEMA	The Tennessee Emergency Management Agency is responsible for emergency operations during a disaster or large scale incident.
Tennessee Bureau of Investigation	Statewide law enforcement agency responsible for issuing statewide AMBER Alerts in Tennessee.
Tennessee Department of Health and Human Services	State department that manages funding for medical transportation services.
THP	The Tennessee Highway Patrol is the state law enforcement agency that enforces traffic safety laws as well as commercial vehicle regulations.

Table 4 – Lakeway Region Inventory of ITS Elements

Stakeholder	Element Name	Element Description	Status
City of Jefferson City	City of Jefferson City Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Jefferson City TOC	Traffic operations center for the City of Jefferson City. Responsible for the operation of the traffic signal system, closed-circuit television (CCTV) cameras, and any other ITS infrastructure deployed by the City of Jefferson City.	Planned
	City of Jefferson City Traffic Signals	Traffic signal system operated by the City of Jefferson City.	Existing
City of Morristown	City of Morristown CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Morristown City Engineer's Office	Responsible for the administration of maintenance and construction projects within the City.	Existing
	City of Morristown DMS	Dynamic message signs for traffic information dissemination operated by the City of Morristown.	Planned
	City of Morristown 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 sensor (RTMS), or traditional loops.	Existing
	City of Morristown Fire Vehicles	City of Morristown Fire Department vehicles.	Existing
	City of Morristown Police Department	Police department for the City of Morristown. The emergency dispatch functions for the Police Department are included in the Hamblen County 911 Dispatch. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Morristown Police Department TraCS Database	Traffic and Criminal Software database used by the City of Morristown Police Department to store crash records.	Existing
	City of Morristown Police Vehicles	City of Morristown Police Department vehicles.	Existing
	City of Morristown Public Works Department	Department that oversees the maintenance of streets, sidewalks, and roadway right-of-way.	Existing
	City of Morristown Public Works Department Asset Management System	System used to track the inventory and status of public works department assets, including pavements, bridges, signs, and vehicles.	Planned
	City of Morristown Public Works Department Vehicles	Vehicles used by the City of Morristown Public Works Department in maintenance and construction activities.	Existing

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

Stakeholder	Element Name	Element Description	Status
City of Morristown (continued)	City of Morristown Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Morristown Road Closure Notification Email System	Email notification system for distribution of City of Morristown road closure information.	Existing
	City of Morristown Roadside HAZMAT Monitoring System	Sensors located along the road or rail line that detect hazardous materials.	Planned
	City of Morristown RWIS	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	City of Morristown Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Morristown TOC	Traffic operations center for the City of Morristown. Responsible for the operation of the traffic signal system, CCTV cameras, dynamic message signs (DMS), and any other ITS infrastructure deployed by the City of Morristown.	Planned
	City of Morristown Traffic Signals	Traffic signal system operated by the City of Morristown.	Existing
	City of Morristown Vehicle Maintenance	City of Morristown vehicle repair facility.	Existing
	City of Morristown Website	Website for the City of Morristown. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
	City of Morristown Work Zone Safety Equipment	Equipment to detect intrusions into an active work zone and warn construction personnel of the potential safety hazard.	Planned
	Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
	Lakeway MTPO Data Archive	Archive for transportation information such as traffic counts or transit ridership data for use in regional transportation planning.	Planned
	Maintenance and Construction Field Personnel	Personnel working on or near the roadway.	Existing
	Morristown Transit Center CCTV Camera Surveillance	Closed circuit television camera surveillance at transit transfer centers or other transit facilities.	Planned
	Morristown Transit Data Archive	Transit data archive for Morristown Transit. Used by the National Transit Database, Federal Transit Administration, and TDOT Office of Public Transportation.	Planned

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

Stakeholder	Element Name	Element Description	Status
City of Morristown (continued)	Morristown Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling, and dispatching of fixed route and paratransit vehicles operated by Morristown Transit.	Planned
	Morristown Transit Fixed Route Vehicles	Transit vehicles that operate on fixed routes within the City of Morristown.	Planned
	Morristown Transit Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
	Morristown Transit Paratransit Vehicles	Morristown Transit vehicles that provide transit means for disabled passengers.	Planned
	Morristown Transit Website	Website with information about fares and schedules.	Planned
Commercial Vehicle Operators	Commercial Vehicles	Privately owned commercial vehicles traveling within the Region.	Existing
	Private Fleet Management Systems	Fleet and freight management for private carriers.	Existing
	Rail Freight	Rail cars traveling within the Region.	Existing
Cumberland Gap Tunnel Authority	Cumberland Gap Tunnel Authority CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management. Two of the Tunnel Authority's CCTV cameras are located within the Lakeway Region. The cameras are currently only available via dial-up connection, but when communications are improved in the future it is is likely that TDOT will be granted access to the camera images.	Existing
	Cumberland Gap Tunnel Authority DMS	Dynamic message signs for traffic information dissemination. Two of the tunnel authority's DMS are located within the Lakeway Region. TDOT has access to place messages on these signs.	Existing
	Cumberland Gap Tunnel Authority Operations Center	Operations center for the Cumberland Gap Tunnel. Responsible for operations of CCTV cameras and DMS in and around the tunnel.	Existing
ETHRA	ETHRA Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of vehicles operated by East Tennessee Human Resource Agency (ETHRA) Transit.	Existing
Financial Institution	Financial Service Provider	Service provider that handles exchange of money for transit electronic payment collection.	Existing

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

Stakeholder	Element Name	Element Description	Status
Hamblen County (continued)	Hamblen County 911 Dispatch	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the county and dispatching emergency responders.	Existing
	Hamblen County EMA	Emergency management agency for Hamblen County. Responsible for disaster planning for the County and operating the emergency operations center.	Existing
	Hamblen County EMA Vehicles	Hamblen County Emergency Management Agency (EMA) vehicles.	Existing
	Hamblen County Sheriff Vehicles	Hamblen County Sheriff's Office vehicles.	Existing
	Hamblen County Sheriff's Office	Law enforcement agency for Hamblen County. The emergency dispatch functions for the Sheriff's Office are included in the Hamblen County 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing
	Morristown-Hamblen EMS Vehicles	Emergency medical services vehicles serving the City of Morristown and Hamblen County.	Existing
Jefferson County	Jefferson County 911 Dispatch	911 PSAP responsible for answering all 911 calls made within the county and dispatching emergency responders.	Existing
	Jefferson County EMA	Emergency management agency for Jefferson County. Responsible for disaster planning for the County and operating the emergency operations center.	Existing
	Jefferson County Sheriff Vehicles	Jefferson County Sheriff's Office vehicles.	Existing
	Jefferson County Sheriff's Office	Law enforcement agency for Jefferson County. The emergency dispatch functions for the Sheriff's Office are included in the Jefferson County 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing
Media	Local Print and Broadcast Media	Local media that provide traffic or incident information to the public.	Existing
Municipal/County Government	Municipal CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	Municipal Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS, or traditional loops.	Planned

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

Stakeholder	Element Name	Element Description	Status
Municipal/County Government (continued)	Municipal Police Department	Local municipal police departments within the Region responsible for law enforcement. The emergency dispatch functions for the police departments are included in the Hamblen or Jefferson County 911 Dispatch. Non-emergency functions include the collection of crash data.	Existing
	Municipal Public Safety Vehicles	Municipal law enforcement, fire, and emergency medical services (EMS) vehicles.	Existing
	Municipal Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	Municipal TOC	Traffic operations centers responsible for the operation of municipal signal systems and any other municipal ITS infrastructure.	Planned
	Municipal Traffic Signals	Municipal traffic signal systems within the Lakeway Region. Includes White Pine and Dandridge.	Existing
	Municipal/County Engineer's Office	Responsible for the administration of maintenance and construction projects within the municipality or county.	Existing
	Municipal/County Maintenance	Department that oversees the maintenance of streets, sidewalks, and roadway right-of-way.	Existing
	Municipal/County Maintenance Vehicles	Vehicles used by Municipal/County maintenance departments in maintenance and construction activities.	Existing
	Municipal/County Portable DMS	Portable dynamic message signs used for traffic information dissemination during maintenance and construction activities, special events, or incidents.	Planned
	Municipal/County RWIS	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	Municipal/County Website	Municipal or county website that includes information on agency departments. In the future it is envisioned that the website would have real-time information about roadway conditions.	Existing
NOAA	National Weather Service	Provides official US weather, marine, fire, and aviation forecasts, warnings, meteorological products, climate forecasts, and information about meteorology.	Existing

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

Stakeholder	Element Name	Element Description	Status
Other Agencies	Greyhound Bus Service Dispatch	Provider of intercity bus service.	Existing
	Other County 911 Dispatch	911 Dispatch responsible for the dispatch and routing of emergency vehicles in nearby counties other than Hamblen or Jefferson County.	Existing
	Other Maintenance and Construction Management Agencies	Additional maintenance and construction operations agencies with which information is shared for coordination in an emergency situation.	Existing
	Other Traffic Management Agencies	Additional traffic management agencies with which information is shared for coordination in an emergency situation.	Existing
	Private Transportation Providers	Private providers of transportation services in the Region such as taxis and intercity bus service.	Existing
Private Information Provider	Private Sector Traveler Information Services	Traveler information service operated by a private entity.	Existing
Rail Operators	Rail Operations	Centers responsible for the operation and tracking of trains.	Existing
	Rail Operator Wayside Equipment	Equipment located along the tracks including railroad crossing gates, bells, and lights as well as the interface to the traffic signal controller indicating the presence of a train.	Existing
System Users	Archive Data User	Those who request information from the data archive systems.	Existing
	Personal Computing Devices	Computing devices that travelers use to access public information.	Existing
	Traveler	User of the transportation system.	Existing
	Vehicle Operator	Operator of a commercial vehicle.	Existing
TDOT	Other TDOT Region Construction Office	Other Tennessee Department of Transportation regional construction offices besides the Region 1 Construction Office.	Existing
	Other TDOT Region Maintenance	Other Tennessee Department of Transportation regional maintenance offices.	Existing
	TDOT CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	TDOT District Maintenance	Office that handles most of the routine roadway maintenance and responds to incidents when services are requested by local emergency management.	Existing
	TDOT DMS	Dynamic message signs for traffic information dissemination.	Existing

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

Stakeholder	Element Name	Element Description	Status
TDOT (continued)	TDOT Emergency Services Coordinator	Coordinator responsible for managing the Tennessee Department of Transportation response in a large scale incident or disaster in which the Tennessee Emergency Management Agency (TEMA) activates the state Emergency Operations Center (EOC).	Existing
	TDOT Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as VIVDS, RTMS, or traditional loops.	Planned
	TDOT HAR	Highway advisory radio for traffic information dissemination.	Existing
	TDOT HELP Vehicles	Roadway service patrol vehicles. Currently operate in Knoxville and are dispatched to the Region for large incidents.	Existing
	TDOT Maintenance Headquarters	The Tennessee Department of Transportation maintenance headquarters.	Existing
	TDOT Maintenance Vehicles	The Tennessee Department of Transportation vehicles used in maintenance operations.	Existing
	TDOT Project Planning Division Archive	Data archive for the Project Planning Division. The Division is responsible for traffic data collection and analysis and includes the Short Range Planning Office.	Existing
	TDOT Public Information Office	Office responsible for the dissemination of traffic information to the media and the public.	Existing
	TDOT Region 1 Construction Office	Office responsible for oversight of construction projects in Region 1.	Existing
	TDOT Region 1 Engineer's Office	Office responsible for administration of maintenance and construction projects within the Region as well as communicating work zone information to the public through the Public Information Office.	Existing
	TDOT Region 1 HELP Dispatch	Roadway service patrol dispatch center located in Knoxville. Currently service is limited to the Knoxville area except in the case of a large scale incident.	Existing
	TDOT Region 1 Maintenance	Region 1 maintenance headquarters. Responsible for maintenance operations in the Region; however, most routine maintenance is handled by the District Maintenance Offices. There are several District Maintenance Offices within the Region.	Existing

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

Stakeholder	Element Name	Element Description	Status
TDOT (continued)	TDOT Region 1 TMC – Knoxville	Transportation management center for Region 1, located in Knoxville. Responsible for the operation of the ITS equipment located in Region 1. This includes the freeway management system in Knoxville as well as rural ITS deployments.	Existing
	TDOT Region 2 TMC – Chattanooga	Transportation management center for Region 2, located in Chattanooga. Responsible for the operation of the ITS equipment located in Region 2. This includes the freeway management system in Chattanooga as well as rural ITS deployments.	Existing
	TDOT Region 3 TMC – Nashville	Transportation management center for Region 3, located in Nashville. Responsible for the operation of the ITS equipment located in Region 3. This includes the freeway management system in Nashville as well as rural ITS deployments.	Existing
	TDOT Region 4 TMC – Memphis	Transportation management center for Region 4, located in Memphis. Responsible for the operation of the ITS equipment located in Region 4. This includes the freeway management system in Memphis as well as rural ITS deployments.	Existing
	TDOT RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	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 portable CCTV cameras, vehicle detection, and DMS.	Planned
	TDOT SmartWay Information System (TSIS)	TSIS is a statewide roadway conditions database. Currently information can be entered by District and Regional maintenance personnel as well as staff at any of the TMCs and the Tennessee Highway Patrol (THP). TSIS feeds the Statewide 511 system and SmartWay website.	Existing
	TDOT SmartWay Website	Website providing road network conditions including incident and construction information and camera views. Much of the data for the website comes from TSIS.	Existing
	Tennessee 511 IVR	Tennessee 511 Interactive Voice Response. TDOT contracts the IVR operation to a vendor. The IVR accepts callers' requests and provides responses to specific traveler information needs. This is the customer interface component of the 511 phone system.	Existing
	Tennessee 511 System	511 traveler information system central server.	Existing

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

Stakeholder	Element Name	Element Description	Status
TDOT (continued)	Tennessee GoSmart Kiosks	Kiosks in rest areas that provide traveler information, including weather, road, and travel conditions.	Existing
TEMA	TEMA	The Tennessee Emergency Management Agency manages emergency operations during a disaster or large scale incident.	Existing
Tennessee Bureau of Investigation	Tennessee Bureau of Investigation	Responsible for issuing statewide America's Missing: Broadcast Emergency Response (AMBER) Alerts in Tennessee.	Existing
Tennessee Department of Health and Human Services	Health and Human Services	Provides health related services including the subsidization of transportation to obtain medical services.	Existing
THP	THP CVO Enforcement	Tennessee Highway Patrol commercial vehicle inspection and enforcement.	Existing
	THP Dispatch	Tennessee Highway Patrol dispatch center. There are several THP dispatch centers around the state of Tennessee.	Existing
	THP Truck Weigh and Inspection Station	Commercial vehicle inspection station with the capability to weigh commercial vehicles and evaluate their credentials.	Existing
	THP Vehicles	Tennessee Highway Patrol vehicles.	Existing
	THP Weigh-in-Motion	Tennessee Highway Patrol facilities with the capability to weigh commercial vehicles while they are traveling at highway speeds.	Existing
	TITAN Database	The Tennessee Integrated Traffic Analysis Network is the Tennessee Department of Safety crash record database maintained by the Tennessee Highway Patrol for the collection of crash record information. TITAN interfaces with the TraCS system.	Existing

3.3.3 Top Level Regional System Interconnect Diagram

A system interconnect diagram, or "sausage diagram" (shown previously in **Figure 3**), shows the systems and primary interconnects in the Region. The National ITS Architecture interconnect diagram has been customized for the Lakeway Region based on the system inventory and information gathered from the stakeholders. **Figure 4** summarizes the existing and planned ITS elements for the Lakeway Region in the context of a physical interconnect. Subsystems and elements specific to the Region are called out in the boxes surrounding the main interconnect diagram, and these are color-coded to the subsystem with which they are associated.

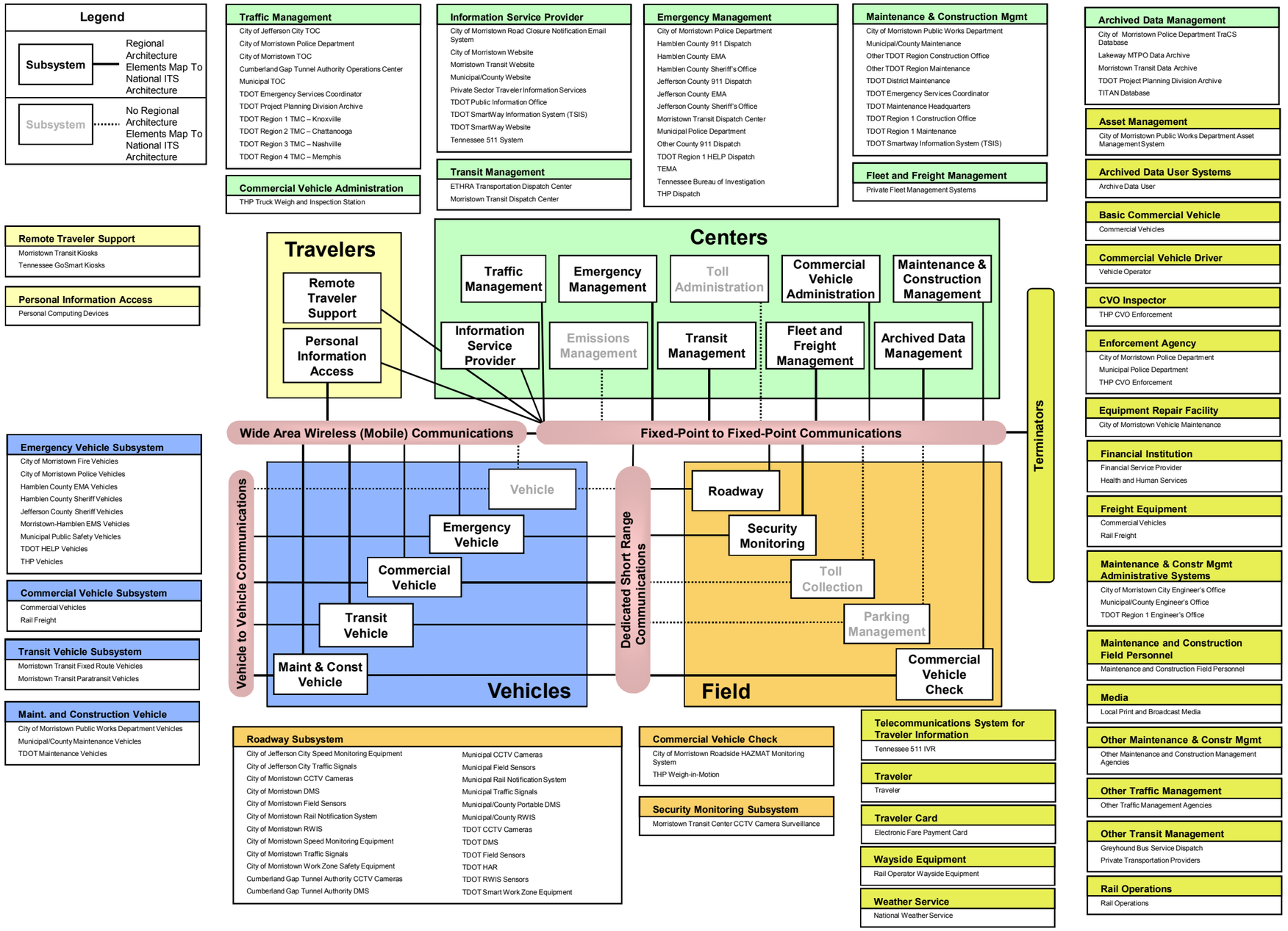

Figure 4 – Lakeway Regional System Interconnect Diagram

3.4 Market Packages

Upon completion of the system inventory, the next step in the development of the Regional ITS Architecture was to identify the ITS services that are important to the Lakeway Region. In the National ITS Architecture, services are referred to as market packages. Market packages can include several stakeholders and elements that work together to provide a service in the Region. Examples of market packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are currently a total of 91 market packages identified in the National ITS Architecture Version 6.0.

The market packages are grouped together into eight ITS service areas: Traffic Management, Emergency Management, Maintenance and Construction Management, Public Transportation Management, Commercial Vehicle Operations, Traveler Information, Archived Data Management, and Vehicle Safety. As mentioned earlier in Section 3.1, Vehicle Safety was not included in the Lakeway Regional ITS Architecture because implementation of those market packages would primarily be by private sector automobile manufacturers and information service providers.

3.4.1 Selection and Prioritization of Regional Market Packages

In the Lakeway Region, the National ITS Architecture market packages were reviewed by the stakeholders and selected based on the relevance of the service that the market package could provide to the Region. Stakeholders selected 40 market packages for implementation in the Region. They are identified in **Table 5**. Stakeholders prioritized the selected market packages during the workshop, and the table organizes the market packages into service areas and priority groupings.

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

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

Table 5 – Lakeway Region Market Package Prioritization by Functional Area

High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
Traffic Management		
ATMS01 Network Surveillance ATMS03 Surface Street Control ATMS06 Traffic Information Dissemination ATMS08 Traffic Incident Management System ATMS13 Standard Railroad Grade Crossing	ATMS07 Regional Traffic Management ATMS19 Speed Monitoring	ATMS15 Railroad Operations Coordination
Emergency Management		
EM01 Emergency Call-Taking and Dispatch EM02 Emergency Routing EM06 Wide-Area Alert	EM08 Disaster Response and Recovery EM09 Evacuation and Reentry Management EM10 Disaster Traveler Information	EM04 Roadway Service Patrols
Maintenance and Construction Management		
MC03 Road Weather Data Collection MC04 Weather Information Processing and Distribution MC08 Work Zone Management MC10 Maintenance and Construction Activity Coordination	MC01 Maintenance and Construction Vehicle and Equipment Tracking MC07 Roadway Maintenance and Construction MC09 Work Zone Safety Monitoring	MC02 Maintenance and Construction Vehicle Maintenance MC06 Winter Maintenance
Public Transportation Management		
	APTS01 Transit Vehicle Tracking APTS02 Transit Fixed-Route Operations APTS03 Demand Response Transit Operations APTS05 Transit Security APTS08 Transit Traveler Information	APTS04 Transit Fare Collection Management APTS06 Transit Fleet Management APTS07 Multi-Modal Coordination APTS10 Transit Passenger Counting
Traveler Information		
ATIS01 Broadcast Traveler Information ATIS02 Interactive Traveler Information		
Commercial Vehicle Operations		
	CVO06 Weigh-in-Motion CVO10 HAZMAT Management CVO11 Roadside HAZMAT Security Detection and Mitigation	
Archived Data Management		
	AD1 ITS Data Mart	AD2 ITS Data Warehouse

3.4.2 Customized Market Packages

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

Figure 5 is an example of an Advanced Traffic Management System (ATMS) market package for Surface Street Control that has been customized for the Region. This market package shows the two subsystems, Traffic Management and Roadway, and the associated entities (City of Morristown TOC and City of Morristown Traffic Signals) for surface street control in the Region. Data flows between the subsystems indicate what information is being shared. The remainder of the market packages that were customized for the Lakeway Region are shown in **Appendix B** along with a market package diagram component and terminology key.

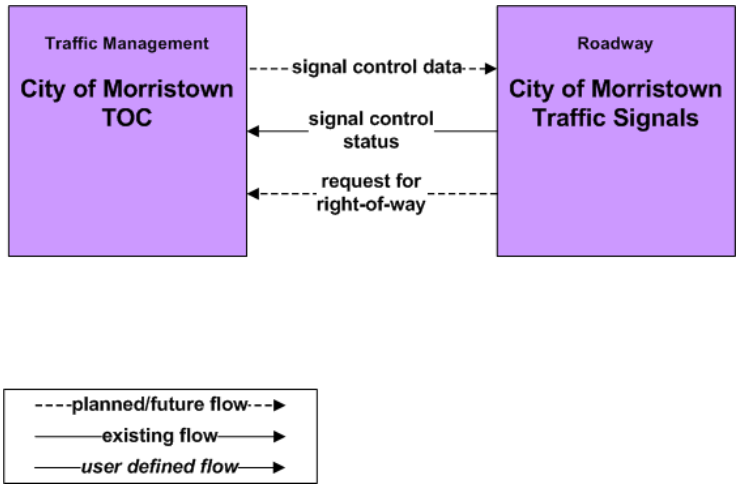

Figure 5 – Example Market Package Diagram: ATMS03 – Surface Street Control

3.4.3 Regional ITS Needs and Customized Market Packages

Input received from stakeholders at the Kick-Off Workshop provided valuable input for the market package customization process. The specific needs identified are included in **Table 6**. The table also identifies which market package documents the particular ITS need.

Table 6 – Lakeway Regional ITS Needs and Corresponding Market Packages

ITS Need	Market Package
Travel and Traffic Management	
Need CCTV cameras within the City of Morristown to monitor traffic	ATMS01
Need improved signal coordination in the Cities of Morristown and Jefferson City	ATMS03
Need signal system upgrade to improve communication capabilities in the City of Morristown	ATMS03
Need railroad signal preemption at additional locations throughout the Region	ATMS13
Need improved dissemination of road conditions information on state and local routes	ATMS06 ATMS08 MC04 MC08 ATIS01 ATIS02
Need CCTV cameras at I-40/I-81 interchange	ATMS01
Need advance notification of congestion at the I-81/US 25E interchange	ATMS01 ATMS06
Need improved sharing of information between TDOT and 911 dispatch centers	ATMS08
Need improved information sharing for race weekend traffic	ATMS07 ATMS08
Emergency Management	
Need to expand emergency vehicle traffic signal preemption to include EMS in the City of Morristown	EM02
Need emergency vehicle signal preemption on Town of White Pine traffic signals	EM02
Need AVL for Morristown-Hamblen County EMS	EM01
Need to be able to receive real-time traffic information to aid in alternate route management for emergency vehicles	EM02
Need detection and notification system for railroad crossing blockages to support emergency routing around railroad closures	ATMS13
Need notification from the railroad when a train will block a crossing for an extended period of time due to a breakdown or other issues	ATMS15
Need improved HAZMAT information for commercial vehicles and rail	CVO10 CVO11
Need improved coordination with EMS in adjacent counties entering the Region to transport patients	EM01 ATMS13
Need access to future CCTV cameras for 911 dispatch centers	ATMS08
Maintenance and Construction Management	
Need ice detection on SH 160 with notification of ice conditions disseminated to emergency management as well as maintenance personnel	MC03 MC04
Need improved dissemination of road maintenance status during snow conditions	MC06

3.5 Architecture Interfaces

While it is important to identify the various systems and stakeholders as part of a regional ITS, a primary purpose of the ITS architecture is to identify the connectivity between transportation systems in the Lakeway Region. The system interconnect diagram shown previously in **Figure 4** showed the high-level relationships of the subsystems and terminators in the Lakeway Region and the associated local projects and systems. The customized market packages represent services that can be deployed as an integrated capability and the market package diagrams show the information flows between the subsystems and terminators that are most important to the operation of the market packages. How these systems interface with each other is an integral part of the overall ITS architecture.

3.5.1 Element Connections

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

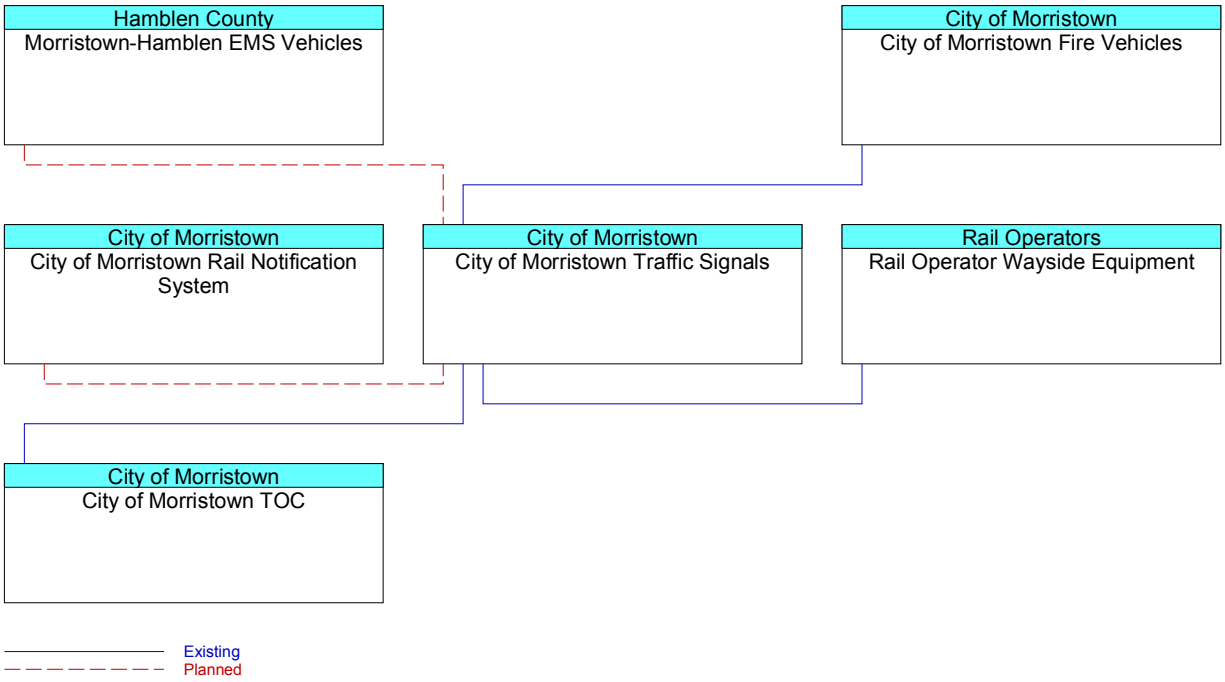

Figure 6 – Example Interconnect Diagram: City of Morristown Traffic Signals

3.5.2 Data Flows Between Elements

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

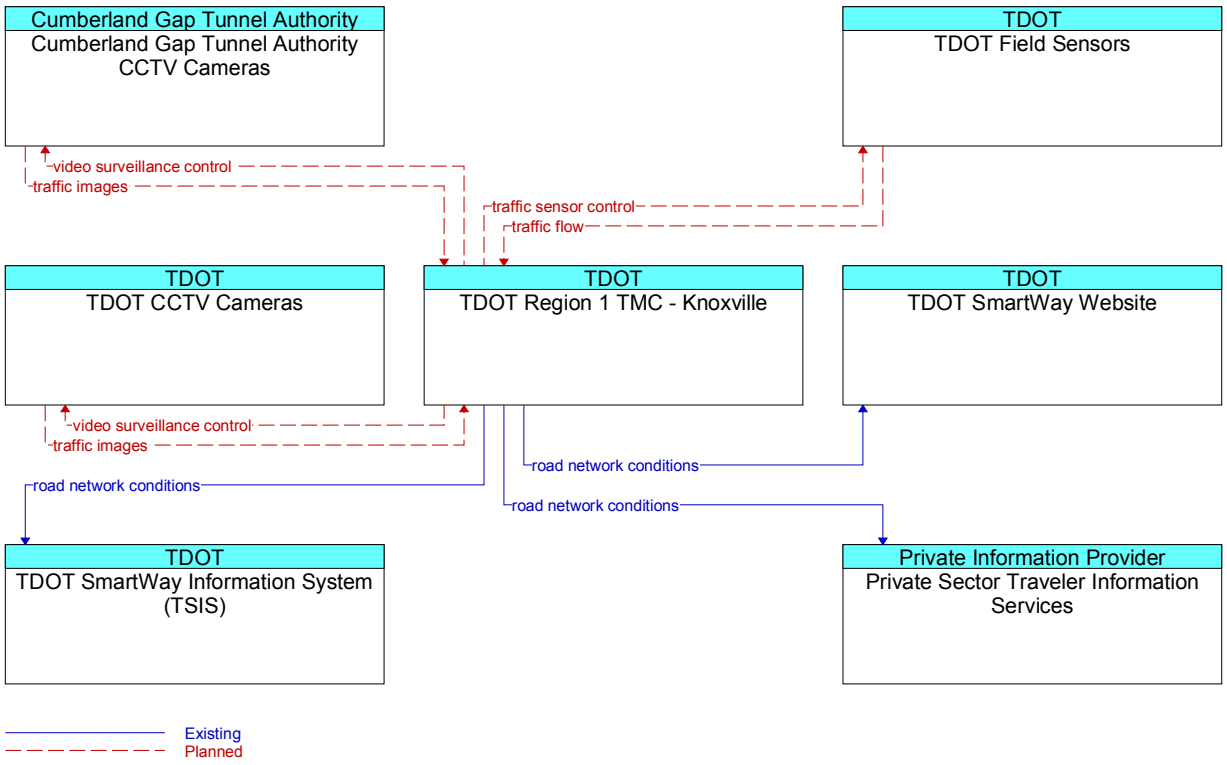

Figure 7 – Example Flow Diagram: ATMS01 – Network Surveillance

4. APPLICATION OF THE REGIONAL ITS ARCHITECTURE

Once a region has identified the desired components of ITS for their area and established which agencies and systems need to be connected, the structure of the National ITS Architecture assists with the region's ITS planning and implementation. This section addresses the application of the Regional ITS Architecture in the Lakeway Region. The National ITS Architecture provides recommendations for standards and functional requirements that should be considered when implementing ITS elements. In addition, an operational concept has been developed for the Region and documents the roles and responsibilities of stakeholders in the operation of the regional ITS. The implementation of ITS in the Lakeway Region will likely require interagency agreements. Potential agreements have been identified based on the desired data flows identified in the Lakeway Region. The Regional ITS Architecture and ITS Deployment Plan developed as part of this process will be incorporated into the existing planning process for the Region to ensure that the maximum benefit is realized from the development effort.

4.1 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 Lakeway 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 Lakeway Regional ITS Architecture, functional requirements have been identified at two levels. The customized market packages, discussed previously in Section 3.4.2, describe the services that ITS needs to provide in the Region and the architecture flows between the elements. These market packages and data flows describe what ITS in the Lakeway Region has to do and the data that needs to be shared among elements.

At a more detailed level, functional requirements for the Lakeway 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.

4.2 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Lakeway Regional ITS Architecture over time. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve. The USDOT's ITS Joint Program Office is supporting Standards Development Organizations (SDOs) with an extensive, multi-year program of accelerated, consensus-based standards development to facilitate successful ITS deployment in the United States. **Table 7** identifies each of the ITS standards that could apply to the Lakeway Regional ITS Architecture. These standards are based on the physical subsystem architecture flows previously identified in Section 3.5.2.

Table 7 – Lakeway Region Applicable ITS Standards

SDO	Document ID	Title
AASHTO/ITE/NEMA	NTCIP 1102	Octet Encoding Rules Base Protocol
	NTCIP 1103	Transportation Management Protocols
	NTCIP 1104	Center-to-Center Naming Convention Specification
	NTCIP 1201	Global Object Definitions
	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller Units
	NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)
	NTCIP 1204	Object Definitions for Environmental Sensor Stations
	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control
	NTCIP 1208	Object Definition for CCTV Camera Switching
	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems
	NTCIP 1210	Field Management Stations – Part 1: Object Definitions for Signal System Masters
	NTCIP 1211	Object Definitions for Signal Control and Prioritization
	NTCIP 2101	Point to Multi-Point Protocol Using RS-232 Subnetwork Profile
	NTCIP 2102	Point to Multi-Point Protocol Using Frequency Shift Keying Modem Subnetwork Profile
	NTCIP 2103	Point-to-Point Protocol Over RS-232 Subnetwork Profile
	NTCIP 2104	Ethernet Subnetwork Profile
	NTCIP 2201	Transportation Transport Profile
	NTCIP 2202	Internet Transmission Control Protocol/Internet Protocol and Universal Datagram Protocol/Internet Protocol Transport Profile
	NTCIP 2301	Simple Transportation Management Framework Application Profile
	NTCIP 2302	Trivial File Transfer Protocol Application Profile
	NTCIP 2303	File Transfer Protocol Application Profile
	NTCIP 2304	Application Profile for DATEX-ASN (AP-DATEX)
	NTCIP 2306	Application Profile for Extensible Markup Language (XML) Message Encoding and Transport in ITS Center-to-Center Communications
AASHTO/ITE	ITE TMDD 2.1	Traffic Management Data Dictionary and Message Sets for External TMC Communications (TMDD and MS/ETMCC)
APTA	APTA TCIP-S-001 3.0.0	Standard for Transit Communications Interface Profiles
ASTM	ASTM E2158-01	Standard Specification for Dedicated Short Range Communication (DSRC) Physical Layer using Microwave in the 902-928 MHz Band
	ASTM E2213-03	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems – 5 GHz Band DSRC Medium Access Control and Physical Layer Specifications
	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems
	ASTM WK7604	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data

Table 7 – Lakeway Region Applicable ITS Standards (continued)

SDO	Document ID	Title
IEEE	IEEE 1512-2006	Standard for Common Incident Management Message Sets for use by Emergency Management Centers
	IEEE 1512.1-2006	Standard for Traffic Incident Management Message Sets for Use by Emergency Management Centers
	IEEE 1512.2-2004	Standard for Public Safety Traffic Management Message Sets for use by Emergency Management Centers
	IEEE 1512.3-2006	Standard for Hazardous Material Incident Management Sets for Use by Emergency Management Centers
	IEEE 1570-2002	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection
	IEEE 1609.1 – 2006	Standard for Wireless Access in Vehicular Environments (WAVE) – Resource Manager
	IEEE 1609.2 – 2006	Standard for WAVE – Security Services for Applications and Management Messages
	IEEE 1609.4 – 2006	Standard for WAVE – Multi-Channel Operation
	IEEE P1609.3	Standard for WAVE – Networking Services
	IEEE P802.11p	Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part II: Wireless LAN Medium Access Control and Physical Layer Specifications
	IEEE P1512.4	Standard for Common Traffic Incident Management Message Sets for Use in Entities External to Centers
SAE	SAE J2266	Location Referencing Message Specification
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards
	SAE J2540/1	Radio Data System Phrase Lists
	SAE J2540/2	International Traveler Information Systems Phrase Lists
	SAE J2540/3	National Names Phrase List

4.3 Operational Concepts

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

- ***Surface Street Management*** – The development of signal systems that react to changing traffic conditions and provide coordinated intersection timing over a corridor, an area, or multiple jurisdictions.
- ***Freeway Management*** – The development of systems to monitor freeway traffic flow and roadway conditions, and provide strategies such as ramp metering or lane access control to improve the flow of traffic on the freeway. Includes systems to provide information to travelers on the roadway.
- ***Incident Management*** – The development of systems to provide rapid and effective response to incidents. Includes systems to detect and verify incidents, along with coordinated agency response to the incidents.

- ***Emergency Management*** – The development of systems to provide emergency call taking, public safety dispatch, and emergency operations center operations.
- ***Maintenance and Construction Management*** – The development of systems to manage the maintenance of roadways in the Region, including winter snow and ice clearance. Includes the managing of construction operations and coordinating construction activities.
- ***Transit Management*** – The development of systems to more efficiently manage fleets of transit vehicles or transit rail. Includes systems to provide transit traveler information both pre-trip and during the trip.
- ***Electronic Payment*** – The development of electronic fare payment systems for use by transit and other agencies (e.g., parking).
- ***Commercial Vehicle Operations*** – The development of systems to facilitate the management of commercial vehicles (e.g., electronic clearance).
- ***Traveler Information*** – The development of systems to provide static and real time transportation information to travelers.
- ***Archived Data Management*** – The development of systems to collect transportation data for use in non-operational purposes (e.g., planning and research).

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

Table 8 – Lakeway Region Stakeholder Roles and Responsibilities

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

Table 8 – Lakeway Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Surface Street Management (continued)	Municipal Government (continued)	Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemption requests.
		Provide traffic signal preemption for emergency vehicles.
Freeway Management	TDOT	Operate DMS and HAR to distribute traffic information and roadway conditions to travelers on the roadway.
		Operate network surveillance equipment including CCTV cameras and vehicle detection on state roadways.
Incident Management (Traffic)	City of Jefferson City	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	City of Morristown	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Operate DMS to distribute incident information to travelers on the roadway.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	City of Jefferson City	Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Coordinate maintenance resources for incident response.
	TDOT	Remotely control traffic and video sensors from the SmartWay TMC to support incident detection and verification.
		Responsible for the dissemination of traffic related data to other centers and the media.
		Operate DMS and HAR to distribute incident information to travelers on the roadway.
		Responsible for coordination with other TOCs and emergency management agencies for coordinated incident management.
		Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.

Table 8 – Lakeway Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management (Emergency)	Hamblen County	Dispatch public safety vehicles to incidents.
		Coordinate incident response with emergency dispatch agencies, the City of Morristown TOC, and the TDOT SmartWay Center in Knoxville for incidents on state facilities.
	Jefferson County	Dispatch public safety vehicles to incidents.
		Coordinate incident response with emergency dispatch agencies, the City of Jefferson City TOC, and the TDOT SmartWay Center in Knoxville for incidents on state facilities.
	THP Dispatch	Dispatch public safety vehicles to incidents.
		Coordinate incident response with other public safety and traffic management agencies as well as the TDOT SmartWay Center in Knoxville for incidents on state facilities.
Emergency Management	Hamblen County 911 Dispatch	Responsible for emergency call-taking for Hamblen County, including the City of Morristown, as the 911 PSAP.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Hamblen County EMA	Operates the EOC for Hamblen County in the event of a disaster or other large-scale emergency situation.
		Responsible for tactical decision support, resource coordination, and communications integration among emergency management agencies in the County.
		Lead regional efforts for emergency planning to support large-scale incidents and disasters.
		Lead evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Jefferson County 911 Dispatch	Responsible for emergency call-taking for Jefferson County, including the City of Jefferson City, as the 911 PSAP.
		Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.

Table 8 – Lakeway Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Jefferson County EMA	Operates the EOC for Jefferson County in the event of a disaster or other large-scale emergency situation.
		Responsible for tactical decision support, resource coordination, and communications integration among emergency management agencies in the County.
		Lead regional efforts for emergency planning to support large-scale incidents and disasters.
		Lead evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	TEMA	Operates the EOC for the State of Tennessee in the event of a disaster or other large-scale emergency situation.
		Responsible for tactical decision support, resource coordination, and communications integration among emergency management agencies in the State.
		Lead statewide efforts for emergency planning to support large-scale incidents and disasters.
		Lead evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	THP	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
		Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
		Participate in regional emergency planning to support large-scale incidents and disasters.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
	Tennessee Bureau of Investigation	Responsible for the initiation of AMBER Alerts.
Maintenance and Construction Management	City of Morristown Public Works Department	Responsible for the tracking and dispatch of maintenance vehicles.
		Supports coordinated response to incidents.
		Monitors environmental sensors and distributes information about road weather conditions.
		Supports work zone activities including the dissemination of work zone information through portable DMS and sharing of information with other groups.
		Disseminates work zone activity schedules and current asset restrictions to other agencies.
	Municipal/County Maintenance	Responsible for the tracking and dispatch of maintenance vehicles.
		Supports coordinated response to incidents.
		Monitors environmental sensors and distributes information about road weather conditions.

Table 8 – Lakeway Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	Municipal/County Maintenance (continued)	Supports work zone activities including the dissemination of work zone information through portable DMS and sharing of information with other groups.
		Disseminates work zone activity schedules and current asset restrictions to other agencies.
	TDOT	Monitors environmental sensors and distributes information about road weather conditions.
		Responsible for the tracking and dispatch of maintenance vehicles.
		Supports coordinated response to incidents.
		Supports work zone activities including the dissemination of work zone information through portable DMS, HAR, and sharing of information with other groups.
		Responsible for entering and updating work zone information in TSIS.
		Disseminates work activity schedules and current asset restrictions to other agencies.
		Operates work zone traffic control equipment including portable surveillance equipment, DMS, and HAR transmitters.
Transit Management	Morristown Transit	Operates fixed route and paratransit services from a central dispatch facility responsible for tracking their location and status.
		Provide transit passenger electronic fare payment on fixed route and demand response transit vehicles.
		Provide transit security on transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Tennessee 511 system.
		Operate on-board systems to provide next stop annunciation.
		Participate in evacuation planning and coordination to manage evacuation and reentry in the vicinity of a disaster or other emergency situation.
Traveler Information	City of Morristown	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.
	City of Jefferson City	Responsible for the collection and distribution of traveler information including incident information and maintenance and construction closure information.
		Responsible for the collection and distribution of emergency information to the traveling public, including evacuation information and wide-area alerts.

Table 8 – Lakeway Region Stakeholder Roles and Responsibilities (continued)

Transportation Service	Stakeholder	Roles/Responsibilities
Traveler Information (continued)	TDOT	Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event and weather information to travelers via the SmartWay Website and the Tennessee 511 system.
		Provide transportation information to travelers via traveler information kiosks.
		Provide transportation network condition data to private sector information service providers.
Commercial Vehicle Operations	City of Morristown	Operate equipment to detect HAZMAT leakages on commercial vehicles and rail cars traveling through the City.
	THP	Operate weigh-in-motion commercial vehicle inspection station.
		Enforce commercial vehicle regulations in the State of Tennessee.
Archived Data Management	City of Morristown Police Department	Collect and maintain crash record information for the City of Morristown.
	Lakeway MTPO	Collect and maintain data from regional traffic, transit, and emergency management agencies.
	TDOT	Collect and maintain traffic archive data.
	THP	Collect and maintain crash record information from regional emergency management agencies.

4.4 Potential Agreements

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

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

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

agreements varies by agency and can often be quite lengthy, so it is recommended that agencies plan ahead to ensure that the agreement does not delay the project.

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

Common agreement types and potential applications include:

- *Handshake Agreement:* Handshake agreements are often used in the early stage of a project. This type of informal agreement depends very much on relationships between agencies and may not be appropriate for long term operations where staff is likely to change.
- *Memorandum of Understanding (MOU):* A MOU demonstrates general consensus but is not typically very detailed. MOUs often identify high-level goals and partnerships.
- *Interagency and Intergovernmental Agreements:* These agreements between public agencies can be used for operation, maintenance, or funding projects and systems. They can include documentation on the responsibility of each agency, functions they will provide, and liability.
- *Funding Agreements:* Funding agreements document the funding arrangements for ITS projects. At a minimum, funding agreements include a detailed scope, services to be performed, and a detailed project budget. Agency funding expectations or funding sources are also typically identified.
- *Master Agreements:* Master agreements include standard contract language for an agency and serve as the main agreement between two entities which guides all business transactions. Use of a master agreement can allow an agency to do business with another agency or private entity without having to go through the often lengthy development of a formal agreement each time.

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

Table 9 – Lakeway Region Existing and Potential Agreements

Status	Agreement and Agencies	Agreement Description
Future	**Data Sharing and Usage (Public-Private)** – (TDOT, City of Morristown, City of Jefferson City, Media)	Agreement would allow private sector media and information service providers to access and broadcast public sector transportation agency CCTV camera video feeds, real time traffic speed and volume data, and incident data. Agreements should specify the control priority to allow traffic agencies first priority to control cameras during incidents or other events. The ability of the traffic agency to deny access to video and data feeds if a situation warrants such action should also be part of the agreement.
Future	**Data Sharing and Usage (Public-Public)** – (TDOT, City of Morristown, City of Jefferson City)	Agreement would define the parameters, guidelines, and policies for inter-agency ITS data sharing between public sector agencies including CCTV camera feeds. Similar to data sharing and usage agreements for public-private agencies, the agency that owns the equipment should have first priority of the equipment and the ability to discontinue data sharing if a situation warrants such action.
Future	**Traffic Signal Timing Data Sharing and Usage** – (City of Morristown, City of Jefferson City)	Agreement would define the parameters, guidelines, and policies for inter-agency traffic signal timing, including sharing of timing plans and joint operations of signals, between cities and counties.
Future	**Incident Data Sharing and Usage** – (TDOT, City of Morristown, City of Jefferson City, THP, Hamblen County 911 Dispatch, Jefferson County 911 Dispatch)	Agreement would define the parameters, guidelines, and policies for inter-agency sharing of incident data between transportation and emergency management agencies in the Region. Incident information could be sent directly to computer-aided dispatch systems and include information on lane closures, travel delays, and weather.
Future	**Shared Maintenance Agreements** – (City of Morristown, City of Jefferson City, Municipal Governments, Hamblen County, Jefferson County)	Agreement that would allow multiple public agencies to pool their funding together to hire a single maintenance contractor to maintain ITS devices throughout the Region. This type of agreement may reduce the cost of maintenance particularly for agencies with a limited number of ITS devices deployed. By combining all maintenance into a single contract the need for each agency to provide specialized training and equipment to staff is eliminated.

4.5 Phases of Implementation

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

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

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

- ATMS01 – Network Surveillance;
- ATMS03 – Surface Street Control; and
- ATMS06 – Traffic Information Dissemination.

4.6 Incorporation into the Regional Planning Process

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

Stakeholders in the Lakeway 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 Regional ITS Architecture. The submitting agency will perform this examination as part of the planning process using the procedure outlined in Section 4.6.1 and the Lakeway MTPO will review each project to confirm it does conform to the Regional ITS Architecture.

4.6.1 Process for Determining Architecture Conformity

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

- Identify the ITS components in the project;
- Identify the corresponding market packages(s) from the Regional ITS Architecture;
- Locate the component within the market package;

- Compare the connections to other agencies or elements documented in the ITS architecture as well as the information flows between them to the connections that will be part of the project; and
- Document any changes necessary to the Regional ITS Architecture or the project to ensure there is conformance.

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

Step 1 – Identify the ITS Components

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

Step 2 – Identify the Corresponding Market Packages

If a project was included in **Table 9** through **Table 16** of the Lakeway Regional ITS Deployment Plan, then the applicable market package(s) for that project are identified in a column of the tables. However, ITS projects are not required to be included in the ITS Deployment Plan in order to be eligible for federal funding; therefore, market packages might need to be identified for projects that have not been covered in the ITS Deployment Plan. In that case, the market packages selected and customized for the Lakeway Region should be reviewed to determine if they adequately cover the project. Market packages selected for the Lakeway Region are identified in **Table 5** of this document and detailed market package definitions are located in **Appendix A**.

Step 3 – Identify the Component within the Market Package

The customized market packages for the Lakeway Region are located in **Appendix B**. Once the element is located within the appropriate market package the evaluator should determine if the element name used in the market package is accurate or if a change to the name is needed. For example, an element called the City of Jefferson City TOC was included in the architecture, but at the time of deployment, the City might decide to call the TOC by a new name. This name change should be documented using the process outlined in Section 5.2.

Step 4 – Evaluate the Connections and Flows

The connections and architecture flows documented in the market package diagrams were selected based on the information available at the time the Regional ITS Architecture was developed. As the projects are designed, decisions will be made on the system layout that might differ from what is shown in the market package. These changes in the project should be documented in the ITS market packages using the process outlined in Section 5.2.

Step 5 – Document Required Changes

If any changes are needed to accommodate the project under review, Section 5.2 describes how those changes should be documented. Any changes will be incorporated during the next Regional ITS Architecture update. Conformance will be accomplished by documenting how the market package(s) should be modified so that the connections and data flows are consistent with the project.

5. MAINTAINING THE REGIONAL ITS ARCHITECTURE

The Regional ITS Architecture developed for the Lakeway Region addresses the Region's vision for ITS implementation at the time the plan was developed. With the growth of the Region, needs will change and as technology progresses new ITS opportunities will arise. Shifts in regional needs and focus as well as changes in the National ITS Architecture will necessitate that the Lakeway Regional ITS Architecture be updated periodically to remain a useful resource for the Region.

5.1 Maintenance Process

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

Table 10 – Regional ITS Architecture and Deployment Plan Maintenance Summary

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

Stakeholders agreed that a full update of the Regional ITS Architecture and Deployment Plan should occur approximately every four years in the year preceding the Long Range Transportation Plan (LRTP) update. By completing a full update in the year prior to the LRTP update, stakeholders will be able to determine the ITS needs and projects that are most important to the Region and document those needs and projects for consideration when developing the LRTP. The Lakeway MTPO, in coordination with the TDOT Long Range Planning Division,

will be responsible for completing the full updates. During the update process all of the stakeholder agencies that participated in the original development of the Regional ITS Architecture and Deployment Plan should be included as well as any other agencies in the Region that are deploying or may be impacted by ITS projects.

Minor changes to the Regional ITS Architecture should occur as needed between full updates of the plan. In Section 5.2 of this document the procedure for submitting a change to the Regional ITS Architecture is documented. Documentation of changes to the Regional ITS Architecture is particularly important if a project is being deployed and requires a change to the Regional ITS Architecture in order to establish conformity.

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

5.2 Procedure for Submitting ITS Architecture Changes Between Major Updates

Updates to the Lakeway Regional ITS Architecture will occur on a regular basis as described in Section 5.1 to maintain the architecture as a useful planning tool. Between major plan updates smaller modifications will likely be required to accommodate ITS projects in the Region. Section 4.6.1 contains step by step guidance for determining whether or not a project requires architecture modifications to the Regional ITS Architecture.

For situations where a change is required, an Architecture Maintenance Documentation Form was developed and is included in **Appendix E**. This form should be completed and submitted to the architecture maintenance contact person whenever a change to the Regional ITS Architecture is proposed. In the process of documenting the change, the stakeholder proposing the change should contact any other agency that will be impacted by the modification to obtain feedback. This communication between agencies will simplify the process of performing a major plan update. The Lakeway MTPO will review and accept the proposed changes and forward the form to the TDOT Long Range Planning Division for their records. When a major update is performed all of the documented changes will be incorporated into the Regional ITS Architecture.