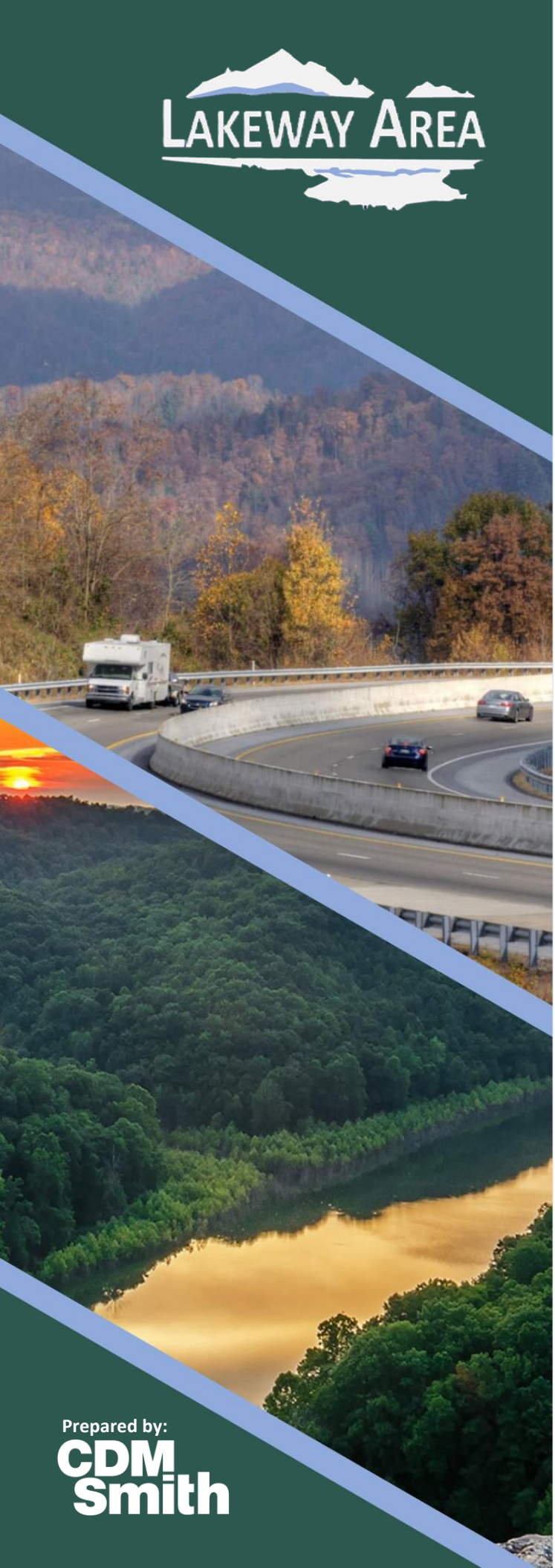

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LAKEWAY

REGIONAL INTELLIGENT TRANSPORTATION SYSTEM ARCHITECTURE & DEPLOYMENT PLAN

March 2025

Prepared for:
LAMTPO

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Acronyms and Abbreviations

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
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
ASTM	American Society for Testing and Materials
ATIS	Advanced Traveler Information System
ATM	Active Traffic Management
ATMS	Advanced Traffic Management System
AVI	Automated Vehicle Identification
CAD	Computer Aided Dispatch
CCTV	Closed Circuit Television
DMS	Dynamic Message Sign
EM	Emergency Management
EMA	Emergency Management Agency
EMS	Emergency Medical Services
EOC	Emergency Operations Center
ETHRA	East Tennessee Human Resource Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HAR	Highway Advisory Radio
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
IVR	Interactive Voice Response
LAMTPO	Lakeway Area Metropolitan Transportation Planning Organization
MC	Maintenance and Construction
MDT	Mobile Data Terminal
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
NEMA	National Electrical Manufacturers Association
NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol

PSAP	Public Safety Answering Point
RDS	Radar Detection System
RTMS	Remote Traffic Microwave Sensor
RTP	Regional Transportation Plan
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
THP	Tennessee Highway Patrol
TIP	Transportation Improvement Program
TITAN	Tennessee Integrated Traffic Analysis Network
TMC	Transportation Management Center or Traffic Management Center
TOC	Traffic Operations Center
SWIFT	TDOT Statewide Information for Travelers
USDOT	United States Department of Transportation
VIVDS	Video Image Vehicle Detection Systems

1.0 Introduction

1.1 Project Overview

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

Regional ITS Architectures are living documents and should be updated as necessary to reflect a region's needs and current guidelines. The Lakeway Regional ITS Architecture was first developed in 2008 by the Tennessee Department of Transportation (TDOT), in coordination with the Lakeway Area Metropolitan Transportation Planning Organization (LAMTPO) and was last updated in 2017. Since 2017, several ITS programs and projects have been implemented in the Lakeway Region including the installation of additional closed-circuit television (CCTV) cameras at signalized intersections and the construction of a new Traffic Operations Center (TOC) by the City of Morristown, and a fixed-route transit system was established by East Tennessee Human Resource Agency (ETHRA) and Lakeway Transit. Additionally, the National ITS Architecture, which served as the basis for the Lakeway Regional ITS Architecture, has undergone recent changes, including a new framework called Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT). To incorporate these changes TDOT, in close coordination with LAMTPO, completed an update of the Regional ITS Architecture in 2024.

The Regional ITS Architecture consists of several key components:

- ITS Needs – The needs describe the transportation related needs in the Region that could possibly be addressed by ITS.
- ITS Inventory – The inventory describes all ITS related elements that either exist or are planned for the Region.
- ITS Service Packages – The ITS service packages describe the services that stakeholders in the Region want ITS to provide. ITS service package diagrams have been developed to illustrate how each service will be deployed and operated by each agency in the Region that expressed interest in a particular service. Terminology in this document has been updated to be consistent with the terminology that is now used in Version 9.2 of the National ITS Architecture.
- Use and Maintenance Plan – The use and maintenance plan describes how to use the Regional ITS Architecture for ITS planning and design efforts, such as the development of a Systems Engineering Analysis. It also describes how the Regional ITS Architecture should be maintained in the future.

A regional ITS architecture is necessary to satisfy the ITS conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA- LU) bill passed in 2005; the Moving Ahead for Progress in the 21st Century (MAP-21) bill passed in 2012; and the Fixing America's Surface Transportation (FAST) Act bill passed in 2015. In response to Section 5206(e) of TEA-21, the FHWA issued a final rule, and the FTA issued a final policy that required regions implementing any ITS project to have an ITS architecture in place by April 2005. After that date, any ITS projects were required to demonstrate 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.

The Lakeway Regional ITS Architecture was developed with significant input from local, state, and federal officials. Two stakeholder workshops were held, and individual interviews were conducted with many of the stakeholders outside of the workshops to gather input and help ensure that the plans reflected the specific needs of the Region. Copies of the draft deployment plan were provided to all stakeholders for review during the review and revision process. The Regional ITS Architecture and Deployment Plan both provide an accurate snapshot of existing ITS project deployments and future ITS plans in the Lakeway Region. Needs and priorities of the Region will change over time, and to remain effective, this plan should be periodically reviewed and updated.

1.2 Lakeway Service Area

1.2.1 Geographic Boundaries

Located in East Tennessee, the geographic area for which LAMPTO provides planning services consists of the entirety of Hamblen County, a large area of Jefferson County, and areas of Grainger and Hawkins counties for a land area of approximately 486 square miles. The LAMPTO area was expanded in 2020 to broaden its planning area with the inclusion of the Grainger and Hawkins County areas, broadening its planning scope. The Lakeway Service Area, as shown in Figure 1-1 includes the municipalities of Morristown, Jefferson City, White Pine, Baneberry, and Bean Station. The City of Morristown is the largest municipality in the LAMPTO area with a population of 30,574, followed by Jefferson City with a population of 8,391.

ITS infrastructure for the Cumberland Gap Tunnel is within the LAMPTO service area. As the LAMPTO area includes major roads which feed into the tunnel, the Cumberland Gap Tunnel Authority is included in planning for the area although the tunnel itself is outside of the LAMPTO geographic service area.

When developing the stakeholder group, the project team coordinated with LAMTPO to include the appropriate city, county, regional, state and federal agencies. Stakeholders included representatives from the municipalities and counties with direct responsibility for implementing ITS infrastructure and services as well as representatives from TDOT, ETHRA, and the Cumberland Gap Tunnel Authority.

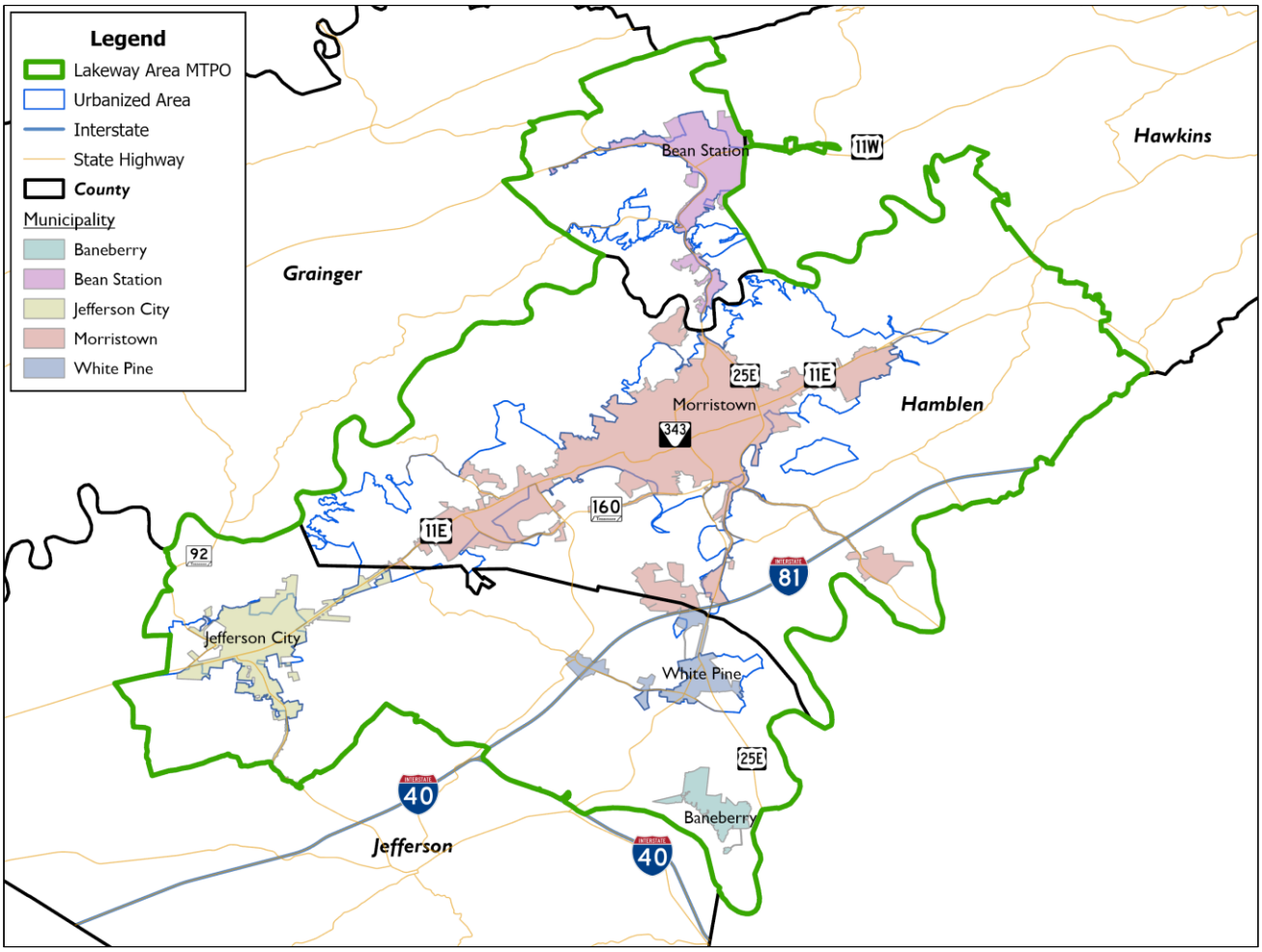

Figure 1-1 LAMPTO Planning Area Boundary

1.2.2 Transportation Infrastructure

As illustrated previously in Figure 1-1, the Region is served by several State and Federal highways. The primary roadway facilities include I-40, I-81, US 11E, US 11W, US 25E, SR 160, and SR 343.

I-40 is a divided east-west interstate highway that spans 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 ultimately terminating in New York at the United States' border with Canada. The interchange of I-81 and I-40 adjoins the LAMTPO area and is 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.

Lakeway Transit began offering fixed-route service within the City of Morristown in 2021. Paratransit and demand-response transit services are provided in the Lakeway Region by ETHRA. The Lakeway Region is also served by one Class I railroad, operated by Norfolk Southern. Norfolk Southern's rail line traverses the Region to connect to Knoxville in the west and central Virginia and eastern West Virginia to the north and east.

The Lakeway Region has seen various ITS initiatives across different transportation modes, implemented by multiple agencies. Among these efforts, multi-agency collaboration has been particularly crucial in the deployment of TDOT's SmartWay Program. This program focuses on freeway traffic management using technologies such as CCTV cameras, dynamic message signs (DMS), radar detection systems (RDS), and highway advisory radio (HAR).

In the Lakeway Region, HAR devices are positioned along I-40, while DMS devices are placed on I-81 and I-40. Through the TDOT SmartWay website, real-time traffic data—such as congestion, incidents, and construction updates—are provided, alongside live CCTV camera footage. Moreover, TDOT has developed SmartView software, offering municipalities enhanced access to video feeds compared to the public SmartWay website.

Additionally, TDOT has implemented Active ITS, a new Advanced Traffic Management System (ATMS) designed to upgrade the existing SmartWay platform. This enhancement aims to improve data-sharing capabilities and coordination with TDOT's various partners.

1.2.3 Project Participation

Intelligent Transportation Systems and their related components often extend beyond traditional transportation infrastructure, necessitating involvement from a wide range of local, state, and federal stakeholders during the architecture development and visioning process. Engaging these stakeholders is essential for defining the interfaces, integration requirements, and shaping the overall vision for ITS in any region.

Although ITS systems are regional by nature, their implementation takes place at the local level across various jurisdictions. Therefore, it is vital to gather feedback and secure the commitment of the entities involved in the Lakeway Region to ensure the effective development and deployment of ITS.

The stakeholder agencies from the Lakeway Region participated in two stakeholder workshops (kick-off and review) and/or provided input through interviews (both in-person and by virtual meetings). These stakeholders contributed valuable insights into the regional needs and concerns that need to be addressed in the Regional ITS Architecture. Other stakeholders who were invited but could not attend were sent workshop minutes and informed when reports became available for review on the project website. The following stakeholder agencies were active participants in the ITS Architecture Update:

- City of Jefferson City
- City of Morristown
- Cumberland Gap Tunnel Authority
- East Tennessee Human Resource Agency (ETHRA) / Lakeway Transit
- Hamblen County
- Hamblen County Emergency Management Agency
- Jefferson County
- Lakeway Area Metropolitan Transportation Planning Organization (LAMTPO)
- Morristown Chamber of Commerce
- Morristown Police Department
- Tennessee Department of Transportation (TDOT)
- Walters State Community College

For a comprehensive list of active stakeholders refer to **Appendix A: Lakeway Stakeholder Agencies and Contacts**. A description of each stakeholder agency is provided in **Appendix B: Lakeway Stakeholder Descriptions**.

2.0 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. Two workshops were held along with a series of stakeholder interviews to gather input, and draft documents were made available to stakeholders for review and comment.

The process followed by 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. The following tasks were undertaken to update the architecture:

Task 1. **Review of the 2017 Lakeway ITS Architecture and the Deployment Plan**: The 2017 Lakeway ITS documentation was reviewed to identify outdated material and practices. At this time the existing TURBO Architecture was updated to RAD-IT Version 9.2.

Task 2. **Kick-Off Workshop**: A stakeholder group was identified that included representatives from regional and state transportation, public works, public safety, and emergency management agencies. The group was invited to the project Kick-Off Workshop where an overview of the project was provided, the regional boundaries were defined, existing and planned ITS deployments in the Region were discussed, and ITS needs for the Region were identified.

Task 3. **Stakeholder Interviews:** Stakeholder input was gathered through the two stakeholder workshops as well as a series of interviews that were conducted with stakeholder agencies. The interviews were used to complete the system inventory for the Region, define how ITS services are currently being operated, define how ITS services could be operated in the future, and identify potential ITS projects for the Region. Interviews were conducted with City of Jefferson City, City of Morristown, Hamblen County, Hamblen County Emergency Management Agency, TDOT, and ETHRA/Lakeway Transit.

Task 4. **Develop Draft Regional ITS Architecture and Deployment Plan Update**: Following the stakeholder input, a draft report was developed which identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the ITS system, identifies projects for deployment, and establishes a maintenance plan.

Task 5. **Stakeholder Review Workshop**: A second stakeholder workshop was conducted to review the Draft Regional ITS Architecture document as well as identify priorities for ITS service packages and confirm the ITS needs and list of potential ITS projects for the Lakeway Region. Use and maintenance of the Regional ITS Architecture was also discussed.

Task 6. **Final Report**: The final Regional ITS Architecture and Deployment Plan was developed, which included an executive summary, ARC-IT Architecture database, and project website with an interactive version of the Regional ITS Architecture.

2.1 ARC-IT Architecture

ARC-IT version 9.2 was used in the development of the Lakeway Regional ITS Architecture. ARC-IT, or Architecture Reference for Cooperative and Intelligent Transportation, is a software tool developed by the United States Department of Transportation (USDOT) for documenting and maintaining ITS architectures. This framework serves as a common language that helps engineers, planners, and stakeholders from different backgrounds collaborate in designing, implementing, and envisioning ITS systems. The use of ARC-IT in regional ITS architecture development is recommended by both the FHWA and the FTA. It facilitates the planning and integration of ITS elements, ensuring consistency and clear communication across different agencies.

In the Lakeway Region, the ARC-IT database was developed based on the region's ITS service packages, which are detailed in Appendix D of the report. These service packages provide a visual representation of the services that regional stakeholders want ITS to deliver. Each service package illustrates the key elements—such as a TOC or a CCTV camera—and the data exchanged between them. ARC-IT also allows for thorough documentation of the existing and planned ITS elements and information flows in the region. Additionally, it provides quick access to relevant standards associated with these information flows and can generate reports and diagrams to assist stakeholders in reviewing the data.

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.

RAD-IT – the Regional Architecture Development for Intelligent Transportation – is the tool used to create the Regional ITS Architecture. The user interface for RAD-IT provides support for the Federal Code of Federal Regulations (CFR) 940.09 for Regional ITS Architectures and Standards, with features like:

- Stakeholders and associated Inventory
- Project Sequencing Support
- Operational Concept (i.e. Agency Roles and Responsibilities)
- Functional Requirements Support
- Support for List of Agreements, selected based on interfaces between stakeholders' elements
- User Tailored List of Standards based Communications Solutions
- Transferring project information between RAD-IT and the Systems Engineering Tool for Intelligent Transportation (SET-IT)

3.0 Regional ITS Needs

Stakeholders in the Lakeway Regional ITS Architecture Kick-off workshop and individual interviews held in July and September 2024 identified regional needs that could be addressed by ITS. Additionally, the LAMTPO's 2045 Metropolitan Transportation Plan (MTP) was reviewed to determine how to align the ITS Architecture and Deployment Plan with the broader goals of the Lakeway region. TDOT's Statewide ITS Architecture and Statewide Traffic Operations Program Plan were also reviewed to identify relevant regional ITS needs.

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

3.1 Regional Transportation Planning Efforts

The LAMTPO 2045 Metropolitan Transportation Plan (MTP) provides an investment framework for the region's transportation system over the next 25 years and is updated on a 4-year cycle. The 2045 MTP outlines six regional goals that guide future transportation decisions for the Lakeway region. These six goals correspond to the ten planning factors prescribed in the Fixing America's Surface Transportation (FAST) Act, as well as two other planning factors, improving livability and sustainability and reducing the impacts of climate change.

The list of ITS strategies for each goal in LAMTPO's MTP serves as an illustrative example of how ITS can be utilized to achieve these objectives. However, this list is not exhaustive and is intended to provide general guidance on how ITS can be integrated to support the region's transportation goals. Each goal includes several common ITS capabilities that are highlighted as examples of potential solutions. ITS strategies can help achieve a wide range of regional transportation goals, such as improving mobility, increasing safety, promoting environmental sustainability, and enhancing overall system efficiency.

Below are the regional goals and the corresponding ITS needs identified to support each goal.

2045 MTP Goal 1: Provide for an Efficient Transportation System

The goal of providing an efficient transportation system focuses on optimizing the movement of people and goods across the region while ensuring infrastructure is maintained and improved. ITS plays a vital role in enhancing traffic management, improving data collection, and providing real-time information to travelers, thereby reducing delays and improving overall system performance. Needs identified by stakeholders include:

- Need additional CCTV cameras within Morristown to monitor traffic.
- Need improved data collection systems throughout the region.
- Need signal system upgrades to enhance communication and detection capabilities in Morristown.
- Need improved dissemination of road condition information on state and local routes.
- Need to share information between Traffic Management Centers (TMCs) in Jefferson City and Morristown.

- Need ice detection (Environmental Sensor Station) on SR-160 at the interchange with I-81, with alerts for emergency and maintenance personnel.
- Need real-time regional travel information on apps for the entire region.

2045 MTP Goal 2: Improve the Safety of the Transportation System

Improving the safety of the transportation network is a top priority, with a focus on reducing crashes, improving incident response, and ensuring safer conditions for all users, including non-motorized modes of transport. ITS can help achieve this goal by deploying advanced technologies for incident detection, safety messaging, and infrastructure monitoring. Needs identified by stakeholders include:

- Need to increase the number of portable Dynamic Message Signs (DMS) for use during traffic incidents, major storms, and events.
- Need to improve incident management coordination capabilities.
- Need to add ITS features to improve work zone safety.
- Need detection and notification system for railroad crossing blockages for emergency routing.
- Need access to CCTV cameras for the region's 911 dispatch centers.
- Need to improve incident management coordination capabilities (High Priority).
- Need detection and notification system for railroad crossing blockages to support emergency routing.
- Need access to CCTV cameras for emergency response agencies and 911 dispatch centers.

2045 MTP Goal 3: Promote Security within the Transportation System

The goal of promoting security aims to enhance the resilience of the transportation system, ensuring the safety of users and protecting infrastructure from physical and cyber threats. ITS technologies, such as surveillance, communication systems, and information sharing, can help prevent incidents and coordinate emergency responses. Needs identified by stakeholders include:

- Need to provide emergency agencies with access to TDOT and local TMC cameras.
- Need improved information sharing between TDOT and 911 dispatch centers.
- Need notification from the railroad for extended crossing blockages.
- Need to increase emergency coordination capabilities for floods, tornadoes, and homeland security events.

2045 MTP Goal 4: Maintain and Improve the Quality of the Natural Environment

The goal of maintaining and improving the natural environment focuses on reducing the negative impacts of transportation on air quality, energy consumption, and the overall ecosystem. ITS can play a role in achieving this goal by enabling smarter transportation management, promoting the use of eco-friendly travel modes, and integrating environmental considerations into planning and operations. Future ITS initiatives can support sustainable transportation practices and help the region meet its environmental goals. Needs identified by stakeholders include:

- Need to expand electric vehicle (EV) infrastructure by installing additional charging stations throughout the region.
- Increase mass transit ridership.

2045 MTP Goal 5: Improve Mobility of Persons and Freight
Enhancing mobility focuses on reducing congestion and facilitating seamless travel across the region. ITS applications, such as adaptive traffic control, Mobility as a Service (MaaS), and advanced freight routing, can help improve travel times and provide efficient multimodal options for all users. Needs identified by stakeholders include:

- Need improved signal coordination on SR 343 in Morristown.
- Need monitoring capabilities and advanced notification of congestion at the I-81/US 25E interchange.
- Need improved information sharing for special event traffic.
- Need to launch a Mobility as a Service (MaaS) app to consolidate traveler services.
- Need detection and notification system for railroad crossing blockages with real-time detour information.

2045 MTP Goal 6: Effectively Manage Financial Resources for the Transportation Network
This goal emphasizes the need to use financial resources efficiently to maintain and improve the transportation system. ITS can contribute to this goal by supporting data-driven decision-making, enabling cost-effective infrastructure management, and optimizing resource allocation.

- Need to consider data archiving as ITS technologies are implemented and more data becomes available.
- Consider cost (capital, operating, and maintenance) constraints in selecting the highest priority short- and long-range improvements and programs.

3.2 State Transportation Planning Efforts

TDOT maintains the Statewide ITS Architecture, and regional ITS architectures developed in the state of Tennessee should show conformity with the TDOT Statewide ITS Architecture. The Statewide ITS Architecture was most recently updated in 2019.The TDOT Traffic Operations Program Plan promotes safety, efficiency, reliability and system reservation as the overarching goals for all transportation programs.

The 2019 TDOT Statewide ITS Architecture shares its operational goals with those that were developed as part of the 2017 TDOT Traffic Operations Program Plan. One goal focuses on system operation, while the other focuses on system preservation. Both goals can be accomplished through the implementation of ITS, as described below.

State Goal 1: System Operation - Operate and manage Tennessee's transportation system to provide a high level of safety and service for our customers and workers.
TDOT's system operation goal is centered on enhancing the safety and service quality of the transportation system through effective management practices and the deployment of ITS technologies. By implementing ITS solutions such as real-time traffic monitoring, emergency coordination, and automated incident detection, the state can achieve a safer and more responsive transportation network.

The needs listed under the Regional Goals 2, 3, and 5 indirectly support this goal by addressing safety, security, and mobility concerns across the transportation system.

State Goal 2: System Preservation - Manage the state transportation system to protect the long-term investments of our infrastructure assets.

System preservation focuses on maintaining the functionality and longevity of the transportation network by using proactive management strategies and lifecycle planning. ITS can support this goal by providing the tools necessary for infrastructure monitoring and predictive maintenance, ensuring assets are maintained cost-effectively.

This goal aligns with system preservation-related needs listed under Regional Goals 1 and 6, such as data archiving and maintaining infrastructure functionality.

4.0 Regional ITS Inventory

An important step in the architecture development process was to establish an inventory of existing ITS elements. At the Stakeholder Kick-off Workshop and interviews, stakeholders provided a list of existing, planned, and future systems that would play a role in the region's ITS architecture. These ITS systems and components are used to customize the National ITS Architecture and create the updated Regional ITS Architecture for the Lakeway Region.

Existing, planned, and future systems in the Lakeway Region were identified in the following categories:

- **Traffic Management** – includes the TDOT Region 1 Transportation Management Center (TMC) in Knoxville as well as other existing and future TMCs and traffic operations centers (TOCs), detection systems, CCTV cameras, fixed and portable dynamic message signs (DMS), and other related technologies.
- **Traveler Information and Personal Mobility** – includes broadcast traveler information, social networking services, highway advisory radio (HAR) and other related technologies such as web-based applications.
- **Public Safety** – includes emergency operations/management centers, improved information sharing among traffic and emergency services, traffic signal preemption, transportation infrastructure protection, wide-area alerts, and systems to aid in evacuations.
- **Maintenance and Construction** – includes road weather data, work zone management, and roadway maintenance and construction information.
- **Public Transportation** – includes transit and paratransit automated vehicle location (AVL), electronic fare management, transit security, multi-modal coordination, and transit travel information systems.
- **Commercial Vehicle Operations** – includes hazardous material (HAZMAT) management and coordination with Commercial Vehicle Information System Networks (CVISN) efforts.
- **Data Management** – includes electronic data management and archiving systems.
- **Sustainable Travel** – includes services that help to reduce the environmental impact of regional transportation, such as traffic signals with connected vehicle technology that enable eco-approach and departure to reduce vehicle emissions.
- **Weather** – includes services that help to collect, process, and distribute weather and environmental condition data and information that is relevant to the traveling public.

A detailed inventory of existing and planned ITS elements in Lakeway is provided by stakeholder agency in **Appendix C: Lakeway Regional ITS Inventory**. The ITS inventory is documented in the Regional ITS Architecture as elements. The table includes the status of the element. In many cases, an element classified as existing might still need to be enhanced to attain the service level desired by the Region. The naming convention used for elements in the 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.

5.0 Regional ITS Architecture

Upon completion of the system inventory, the next step in the development of the Regional ITS Architecture was to identify the transportation services that are important to the Lakeway Region.

5.1 ITS Service Packages

In the National ITS Architecture, transportation services that are provided by ITS are referred to as ITS service packages. A service package is a detailed description of an ITS service that is available to be delivered to customers. A service package includes a service-level package and one or more core services and supporting services. Service packages can include several stakeholders and elements that work together to provide a service in the region. Examples of service packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking.

There are currently a total of 156 service packages identified in the National ITS Architecture, Version 9.2.2, which was the latest version available at the time of this effort. For the Lakeway ITS Inventory, 43 Services Packages were identified as relevant. A list of those service packages and a description of each is provided in **Appendix D: Service Package Descriptions**.

5.1.1 Overview of ITS Service Package Structure

An ITS service package is made up of elements and information flows. Each identified system or component in the Lakeway Regional ITS Inventory, which is documented in the previous section, was mapped to a more generic physical object in the National ITS Architecture. Physical objects represent the various functional categories that define the role of an element in ITS and the regional architecture. The elements are connected by information flows that document the existing and planned flow of information. Explanation of the terminology used with service package can be found in Table 5-1.

Table 5-1 Summary of ITS Architecture Terminology

Term	Definition	Notes	Examples
Element	Component of the ITS inventory for the Region. Also known as Physical Object.	Mapped to a physical object (see below)	Municipal TOC, Municipal DMS, TDOT HELP Vehicles
Physical Object	Person, place, or thing that participates in ITS. Each element from the region is mapped to a physical object.	Grouped into five major classes: Center, Field, Support, Personal, and Vehicle	Traffic Management Center, Archived Data System, ITS Roadway Equipment
Subsystem	Physical object with defined functionality.	Inside the ARC-IT system boundary.	Field Maintenance Equipment, Vehicle Onboard Equipment
Terminator	Physical object without defined functionality.	Outside the ARC-IT system boundary.	Broadcast Media, National Weather Service, Traffic Operations Personnel

Term	Definition	Notes	Examples
Functional Object	Building blocks of the Physical Objects that represent an implementable set of transportation functions.	Multiple functional objects within a physical object.	Traffic Information Dissemination, Roadway Basic Surveillance, Roadway Signal Preemption
Information Flow	Information that is exchanged between Physical Objects.	Connect elements to one another and to terminators	Road network conditions, Incident response status, Work zone information

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

Physical objects are the highest-level building blocks of physical architecture, and the National ITS Architecture groups them into five major classes: Center, Field, Support, Personal, and Vehicles. Each of these major classes includes various functional objects that represent a set of implementable transportation functions (or processes). Each set of functions is grouped under one agency, jurisdiction, or location and corresponds to physical elements such as: traffic operations centers, traffic signals, or vehicles. Each element is assigned to one physical object, and each physical object contains one or more functional object.

Every physical object is either a subsystem or a terminator. Subsystems are the physical objects with defined functionality that sit inside of the National ITS Architecture, such as roadway ITS equipment. Terminators are the people, systems, other facilities, and environmental conditions outside of ITS that need to communicate or interface with ITS subsystems. Terminators help define the boundaries of the National ITS Architecture as well as a regional system. Examples of terminators include drivers, weather services, and information service providers.

Information flows serve as a crucial framework for documenting the transfer of data between different systems, elements, or organizations. They can be depicted as either existing or planned/future flows, depending on the status of the connection.

- Existing flows: These represent connections where some information is already being shared between systems, even if the full functionality isn't yet realized. For example, in the context of traffic management, existing flows might indicate that video images are being shared between agencies, but the transfer of other critical data, such as incident reports, may still be pending or planned.
- Future/planned flows: These signify potential connections where information transfer hasn't started yet but is anticipated in future expansions. They help visualize the desired state of data sharing, aiding in planning and coordination.

Importantly, technical specifications (standards) often accompany these information flows. These standards ensure that the data being exchanged conforms to a specified format, enabling interoperability

between systems. For instance, video feeds, traffic incident reports, and real-time traffic data must adhere to particular standards to ensure smooth communication between systems and accurate, timely information exchange.

5.1.2 Service Package Prioritization

In the Lakeway Region, the National ITS Architecture service packages were reviewed by the stakeholders and selected based on regional needs, feasibility, likelihood of deployment, and overall contribution of the service packages to the goals for ITS functionality. These priorities identified the key ITS services that are desired by stakeholders in the Lakeway Regions, as well as the interfaces that need to be established to provide integrated functionality and establish communication between elements. Stakeholders prioritized the selected service packages during the kick-off workshop and interviews, and the table organizes the service packages into service areas and priority groupings.

The high, medium, and long-term prioritization corresponds roughly to the intended time frames for deployment:

- high-priority is within the next five years
- medium-priority is within the next ten years, and
- long-term priority is within the next twenty years.

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

Forty-three services packages were selected for implementation in the Lakeway Region. They are identified in Table 5-2 and sorted by functional area and priority.

5.1.3 Customization of the Service Packages

In the Lakeway Region, ITS service packages have been customized to reflect the area's unique systems, subsystems, and terminators. Terminators represent the people, systems, and broader environment that interact with ITS. These service packages illustrate integrated transportation services designed to manage traffic, enhance safety, and facilitate information flow across local agencies.

Each service package is graphically depicted, showing the service name, the local agencies involved, and the associated information flows. These flows are categorized as either existing or planned/future. Existing flows indicate that part of the service is operational within at least one area of the region, though this does not mean the service is fully deployed or functional across the entire jurisdiction. In many cases, these flows highlight areas where the service is operational but requires expansion to cover additional locations.

By incorporating both existing and planned flows, these tailored service packages help guide the future development of ITS in the Lakeway Region. They ensure that system integration and expansion needs are clearly documented and addressed over time, supporting the region's long-term ITS capabilities.

Table 5-2 Lakeway Region ITS Service Package Prioritization by Functional Area

High Priority ITS Service Packages		Medium Priority ITS Service Packages		Long-Term Priority ITS Service Packages	
Traffic Management					
TM01	Infrastructure-Based Traffic Surveillance	TM13	Standard Railroad Grade Crossing	TM15	Railroad Operations Coordination
		TM17	Speed Warning & Enforcement		
TM02	Vehicle-Based Traffic Surveillance				
TM03	Traffic Signal Control				
TM04	Connected Vehicle Traffic Signal System				
TM06	Traffic Information Dissemination				
TM07	Regional Traffic Management				
TM08	Traffic Incident Management System				
Public Safety					
PS01	Emergency Call-Taking and Dispatch	PS03	Emergency Vehicle Preemption	PS12	Disaster Response & Recovery
PS02	Emergency Response	PS08	Roadway Service Patrols	PS13	Evacuation & Reentry Management
		PS10	Wide-Area Alert		
		PS14	Disaster Traveler Information		
Maintenance and Construction Management					
MC06	Work Zone Management	MC01	Maintenance and Construction Vehicle & Equipment Tracking	MC02	Maintenance & Construction Vehicle Maintenance
MC08	Maintenance & Construction Activity Coordination	MC04	Winter Maintenance		
		MC05	Roadway Maintenance & Construction		
		MC07	Work Zone Safety Monitoring		
Public Transportation Management					
PT01	Transit Vehicle Tracking	PT04	Transit Fare Collection Management		
PT02	Transit Fixed-Route Operations	PT06	Transit Fleet Management		
PT03	Dynamic Transit Operations	PT07	Transit Passenger Counting		
PT05	Transit Security	PT14	Multi-Modal Coordination		
PT08	Transit Traveler Information				
Sustainable Travel					
		ST08	Eco-Approach & Departure at Signalized Intersections		
Traveler Information					
TI01	Broadcast Traveler Information				
TI02	Personalized Traveler Information				
Commercial Vehicle Operations					
CVO03	Electronic Clearance	CVO13	Roadside HAZMAT Security Detection & Mitigation		
		CVO12	HAZMAT Management		
Archived Data Management					
DM01	ITS Data Warehouse				
Weather					
WX02	Weather Information Processing & Distribution	WX01	Weather Data Collection		

Figure 5-1 is an example of a Public Transportation service package for dynamic transit service that has been customized for the Region. This instance focuses on the activities of ETHRA. The ITS service package shows the relevant ITS inventory elements and the information flows between the subsystems indicate what information is being shared. For example, information flowing between the ETHRA Transit Dispatch Center and the ETHRA Demand-Response Vehicles includes transit vehicle operator information and demand response passenger and use data.

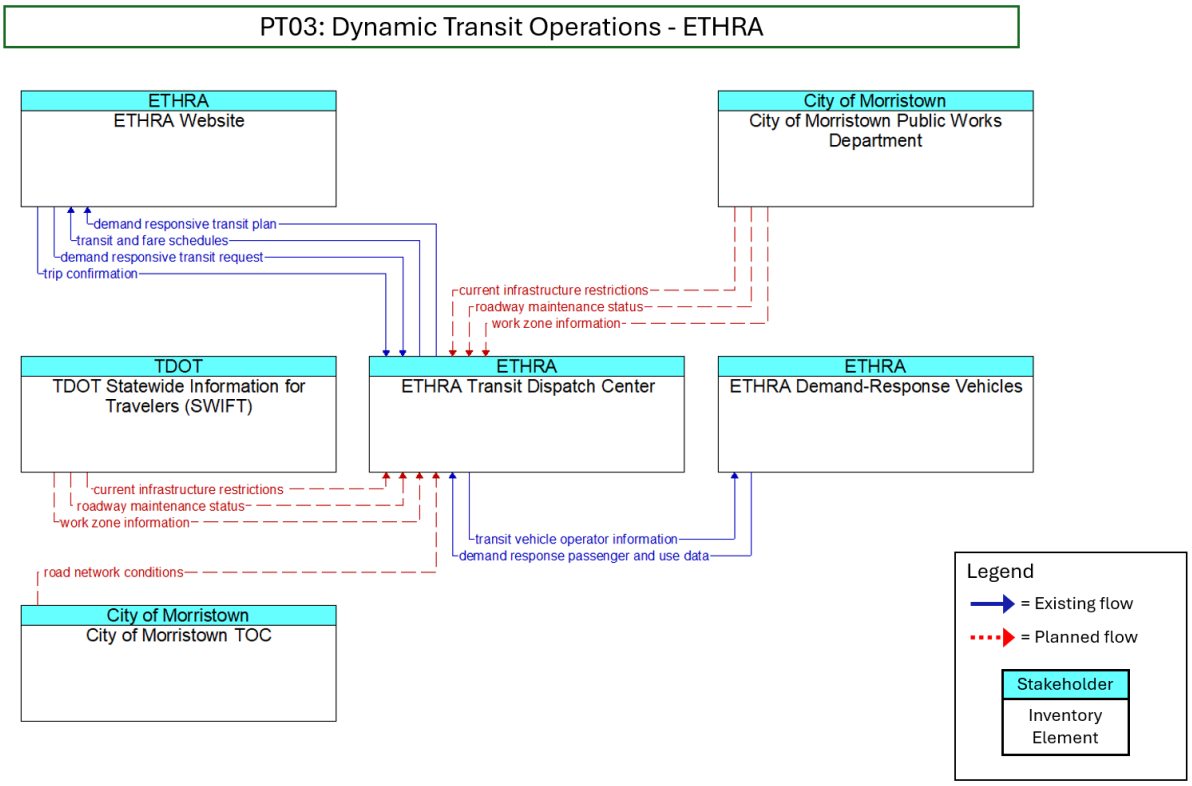

Figure 5-1 Example ITS Service Package Diagram: PT03 – Dynamic Transit Operations (ETHRA)

Service Packages that were customized for the Lakeway Region are shown in **Appendix E: Lakeway Customized Service Packages**. In the appendix, service packages are grouped by functional area.

5.1.4 Regional Needs and Corresponding ITS Service Packages

Input received from stakeholders at the Lakeway Regional ITS Architecture workshops provided valuable input for the ITS service package customization process. The needs identified by stakeholders in the ITS Architecture workshops are identified in Table 5-3. The table also identifies which ITS service packages could be implemented to address the particular need.

Table 5-3 Regional Stakeholder ITS Needs and Related ITS Service Packages

ITS Need	ITS Service Package
Traffic Management	
Need additional CCTV cameras within the City of Morristown to monitor traffic **(High Priority)**	TM01 Infrastructure-Based Traffic Surveillance
Need improved data collection systems, such as detectors, throughout the region **(High Priority)**	TM01 Infrastructure-Based Traffic Surveillance TM02 Vehicle-Based Traffic Surveillance TM17 Speed Warning and Enforcement
Need improved signal coordination on SR 343 in the City of Morristown **(High Priority)**	TM03 Traffic Signal Control TM07 Regional Traffic Management
Need signal system upgrade to improve communication and detection capabilities in the City of Morristown **(High Priority)**	TM03 Traffic Signal Control
Need to share information between TMCs in City of Jefferson City and City of Morristown **(High Priority)**	TM07 Regional Traffic Management
Need improved dissemination of road conditions information on state and local routes **(High Priority)**	TM06 Traffic Information Dissemination TM08 Traffic Incident Management System TI01 Broadcast Traveler Information TI02 Personalized Traveler Information WX02 Weather Information Processing and Distribution
Need improved monitoring capabilities and advance notification of congestion at the I- 81/US 25E interchange	TM01 Infrastructure-Based Traffic Surveillance TM02 Vehicle-Based Traffic Surveillance TM06 Traffic Information Dissemination
Need improved information sharing between TDOT and 911 dispatch centers	TM08 Traffic Incident Management System
Need detection and notification system for railroad crossing blockages with real-time detour information	TM13 Standard Railroad Grade Crossing
Need improved information sharing for special event traffic	TM07 Regional Traffic Management TM08 Traffic Incident Management System
Public Safety	
Need to increase the number of portable DMS for use during extended closures and for traffic control during traffic incidents, major storms, and major events **(High Priority)**	TM06 Traffic Information Dissemination MC06 Work Zone Management MC08 Maintenance and Construction Activity Coordination
Need to improve incident management coordination capabilities **(High Priority)**	TM08 Traffic Incident Management System PS01 Emergency Call-Taking and Dispatch PS02 Emergency Response
Need add links to provide all emergency response agencies with video from TDOT and local jurisdiction TMC video cameras **(High Priority)**	TM08 Traffic Incident Management System PS01 Emergency Call-Taking and Dispatch
Need detection and notification system for railroad crossing blockages to support emergency routing around railroad closures	TM13 Standard Railroad Grade Crossing

ITS Need	ITS Service Package
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	TM15 Railroad Operations Coordination
Need to increase emergency coordination capabilities for floods, tornadoes, homeland security, etc.	PS10 Wide-Area Alert PS11 Early Warning System PS12 Disaster Response and Recovery PS13 Evacuation and Reentry Management PS14 Disaster Traveler Information
Need access to CCTV cameras for the Region's 911 dispatch centers	TM08 Traffic Incident Management System
Maintenance and Construction Management	
Need ice detection on SR-160 at the interchange with Interstate 81, with notification of ice conditions disseminated to emergency management as well as maintenance personnel	WX01 Weather Data Collection WX02 Weather Information Processing and Distribution
Need improved dissemination of road maintenance status during snow conditions	MC04 Winter Maintenance
Need to add ITS to improve work zone safety	MC05 Roadway Maintenance and Construction MC07 Work Zone Safety Monitoring
Public Transportation Management	
Need to launch a Mobility as a Service (MaaS) for transit riders **(High Priority)**	TI02 Personalized Traveler Information
Commercial Vehicles	
Need improved HAZMAT information for commercial vehicles and rail	CVO12 HAZMAT Management CVO13 Roadside HAZMAT Security Detection and Mitigation
Traveler Information	
Need to provide a real-time regional information on apps for travelers for the whole Region **(High Priority)**	TI01 Broadcast Traveler Information
Data Management	
Need data archiving to support infrastructure management and planning	DM01 ITS Data Warehouse

5.2 Architecture Interfaces

A key goal of the ITS architecture is not only to identify the systems and stakeholders involved but to emphasize the connectivity between transportation systems within a specific region, like the Lakeway Region. This connectivity is crucial for ensuring that the various transportation-related systems can communicate effectively, facilitating integrated and efficient operations.

The system interconnect diagram plays an essential role in visualizing this connectivity. It presents a high-level view of the relationships between the subsystems (e.g., traffic management, emergency services)

and terminators (external systems or endpoints, like travelers or external databases) in the region. This diagram helps in understanding how the various components interact, providing insight into the overall structure and flow of information within the regional ITS.

In essence, the ITS architecture outlines how subsystems interact, defines the roles of each stakeholder, and ensures that the services deployed can work together as an integrated capability to improve transportation and incident management in the Lakeway Region.

5.2.1 Top Level Regional System Interconnect Diagram

A system interconnect diagram 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 5-2 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.

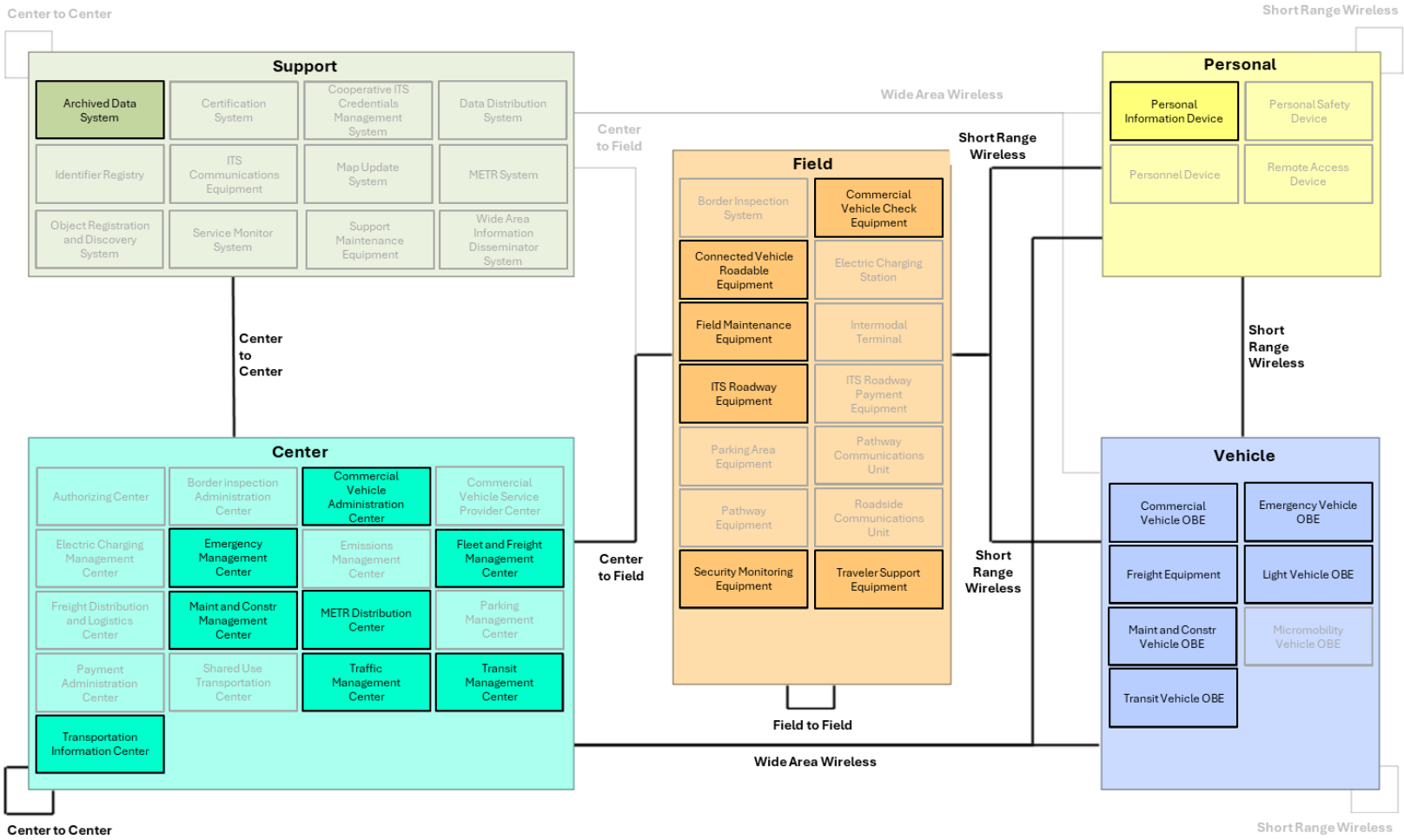

Figure 5-2 Lakeway Regional System Interconnect Diagram

5.2.2 Element Connections

The Lakeway Regional ITS Architecture encompasses a variety of physical elements that contribute to the region's transportation system. These elements include both existing and planned components, all of which play critical roles in managing and improving transportation services. The key elements identified include transportation management centers, transit vehicles, dispatch systems, emergency management agencies, and media outlets. For each of these elements, interfaces have been identified within the Lakeway Regional ITS Architecture. These interfaces describe how each element connects and communicates with other elements, ensuring an integrated flow of information and operations. Each element is mapped to the other elements it must interface with to deliver services effectively.

These interconnections form the backbone of the regional ITS, ensuring that transportation management, emergency response, and public communication are all working together seamlessly to improve traffic flow, safety, and overall efficiency in the Lakeway Region. The RAD-IT software can generate interconnect diagrams for each element in the Region that show which elements are connected to one another. Figure 5-3 is an example of an interconnect diagram from the RAD-IT database output. This interconnect diagram is for ETHRA's dynamic transit service (PT03 – Dynamic Transit Operations). The diagram shows existing connections in addition to connections that could be made in the future.

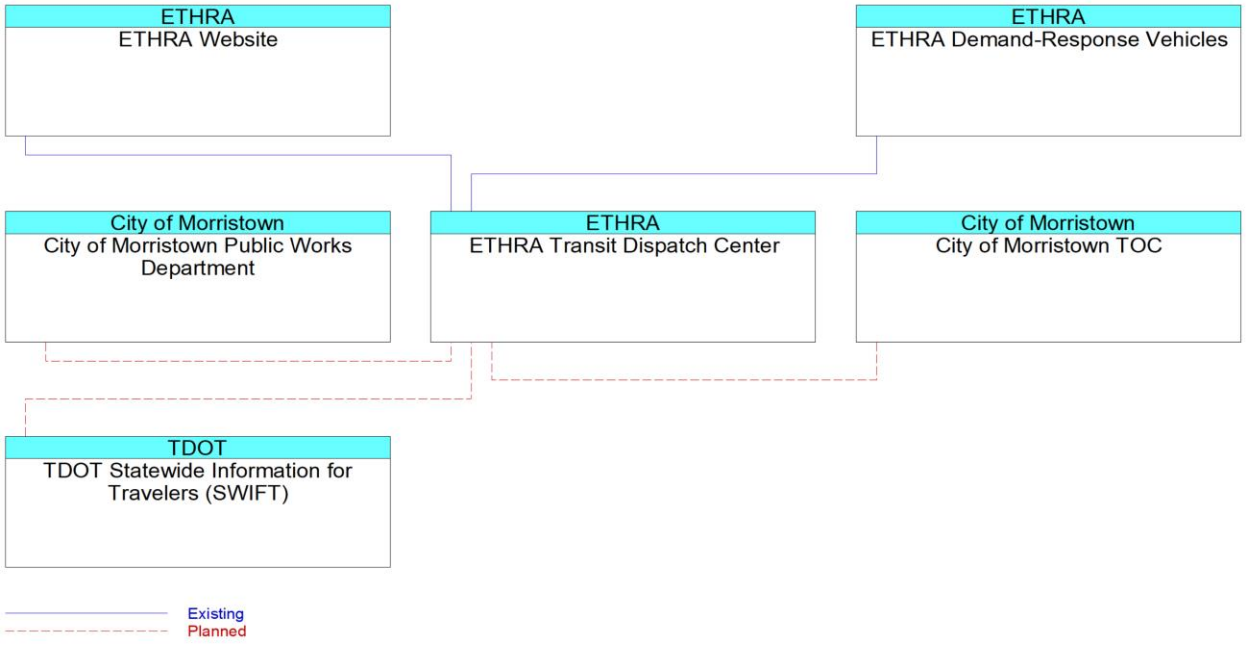

Figure 5-3 Example Interconnect Diagram: ETHRA Demand-Response Service

5.2.3 Information Flows Between Elements

In the service package diagrams, flows between the subsystems and terminators define the specific information (data) that is exchanged between the elements and the direction of each exchange. The information flows can be requests for information, alerts and messages, status requests, broadcast advisories, event messages, confirmations, electronic credentials, or other key information requirements. RAD-IT can be used to output flow diagrams and can be filtered by service package for ease of interpretation. A flow diagram for ETHRA's demand response service has been filtered for the PT03 – Dynamic Transit Operations service package. The diagram, shown in Figure 5-4, complements the interconnect diagram introduced previously. The diagram shows existing and planned information flows between elements that support demand-response transit operations.

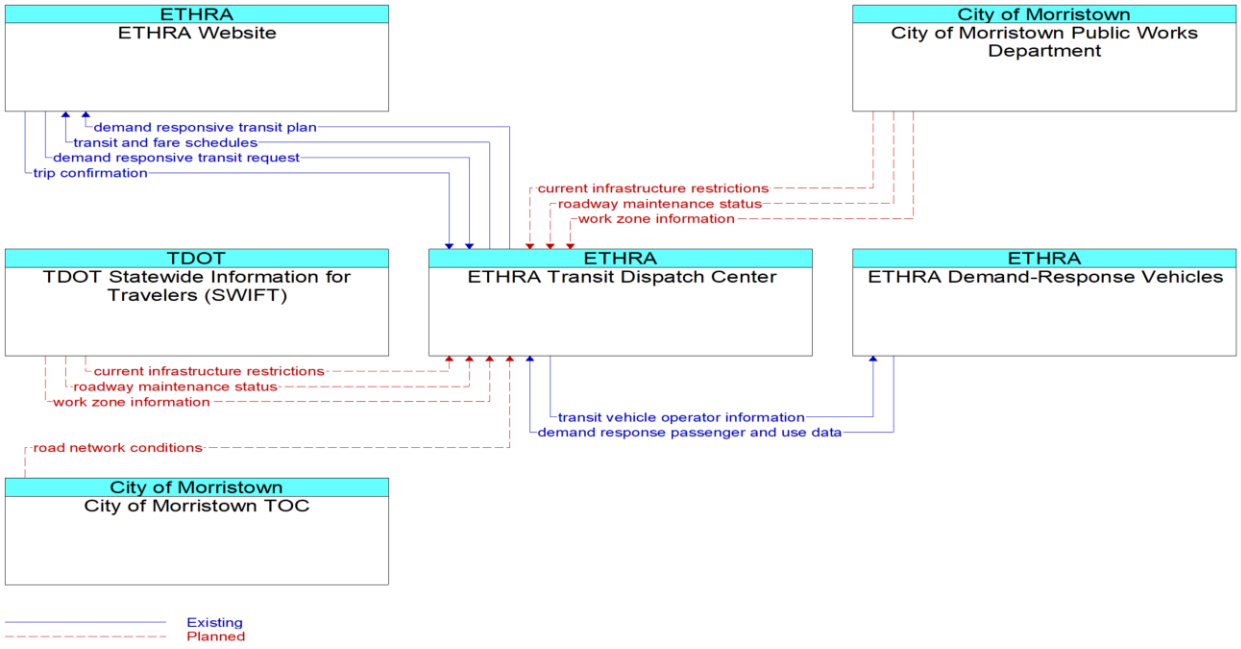

Figure 5-4 Example Flow Diagram: PT03 - Transit Demand-Response Operations

6.0 Application of the Regional Architecture

Once Lakeway Region identified the desired components of the ITS architecture and established which agencies and systems need to be connected, the National ITS Architecture structure assists with the region's planning and implementation. 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 Architecture. The ITS Architecture and ITS Deployment Plan, which were developed as part of this process, will be incorporated into the existing planning process, ensuring that the region will achieve the maximum benefit from the development effort.

6.1 Functional Requirements

Functions are a description of what a system must 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 service packages describe the services that ITS needs to provide in the region and the architecture flows between the elements. These service packages and data flows describe what the ITS system in LAMTPO must 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 F: Lakeway ITS Element Functions** contains a table that summarizes the functions by element.

6.2 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 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. **Appendix G: Lakeway Applicable ITS Standards** identifies each of the ITS standards that could apply to ITS deployments in the Lakeway Region. These standards are based on the physical subsystem architecture flows.

6.3 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 RAD-IT, in the operation of the Regional ITS Architecture. 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 EOC operations.
- **Maintenance and Construction** – The development of systems to manage the maintenance of roadways in the Region, including winter snow and ice clearance. Includes management of construction operations and coordination of construction activities.
- **Transit Services** – The development of systems to more efficiently manage fleets of transit vehicles or transit rail. Includes systems to provide transit traveler information both pre- trip and during the trip.
- **Traveler Information** – The development of systems to provide static and real-time transportation information to travelers.
- **Commercial Vehicle Operations** – The development of systems to assist with the management and routing of commercial vehicles.
- **Archived Data Systems** – The development of systems to collect transportation data for use in non-operational purposes (e.g., planning and research).

Appendix H: Lakeway Stakeholder Roles and Responsibilities identifies the roles and responsibilities of key stakeholders in each of these transportation services.

6.4 Potential Agreements

The Regional ITS Architecture has identified several 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 Lakeway Region will require agreements among agencies that establish parameters for sharing agency information to support traffic management, incident management, provide traveler information, and other functions identified in the Regional ITS Architecture.

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

APPENDIX I: Lakeway Region Existing & Potential Agreements 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.

6.5 Phases of Implementation

The Lakeway Regional ITS Architecture will be implemented over time through a series of projects led by both public sector and private sector agencies. Key foundation systems will need to be implemented to support other dependent systems that have been identified in the Regional ITS Architecture. The deployment of all the systems required to achieve the final Regional ITS Architecture build out will occur over many years.

A sequence of projects and their respective timeframes were identified in the Lakeway Regional ITS Deployment Plan. These projects were sequenced over a time period that coincides with the 2045 RTP, with projects identified for deployment in the short-term (within 5 years), mid-term (5 to 10 years), and long-term (beyond 10 years.)

Some of the key service packages that will provide the functions for the foundation systems in the Lakeway Region identified in Section 5.1.2 as “high-priority.” Projects associated with these, and other service packages are identified in Section 7.

7.0 Regional ITS Development Plan

The Regional ITS Deployment Plan serves as a vital tool for the Lakeway Region, helping to identify specific projects necessary to achieve the desired functionality outlined in the Regional ITS Architecture. It builds upon the architecture by detailing specific ITS project recommendations and strategies for the region, as well as by identifying appropriate timeframes for deployment. This approach allows the recommended projects and strategies to be implemented progressively over time.

Additionally, the Regional ITS Deployment Plan demonstrates the connection between each project and the Regional ITS Architecture by correlating each project with the ITS service packages it supports. If a project was identified that did not align with an existing service package, the ITS service packages within the architecture were revised while it was still in draft form. As a result, all ITS deployment projects in the plan are fully supported by the Regional ITS Architecture.

The Lakeway Regional ITS Deployment Plan provides stakeholders with a comprehensive list of regionally significant ITS projects that are aligned with the architecture and are designed to address the region's transportation needs. It is important to note, however, that the plan is not fiscally constrained. While the projects listed reflect what stakeholders would like to implement, additional funding will be required for these projects to become reality.

7.1 Project Development and Selection

An overview of the process used to develop the Regional ITS Deployment Plan is provided in Figure 7-1. This figure demonstrates that a variety of inputs were used to gather information and develop a set of ITS projects for selection by stakeholders, including a review of the regional needs, ITS service package priorities, and regional and local plans.

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

The inputs in Step 1 led to the project selection in Step 2. Project selection was completed through a combination of a stakeholder workshop held in July 2024, stakeholder interviews in September 2024, and stakeholder review of the Regional ITS Architecture Report in October 2024.

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

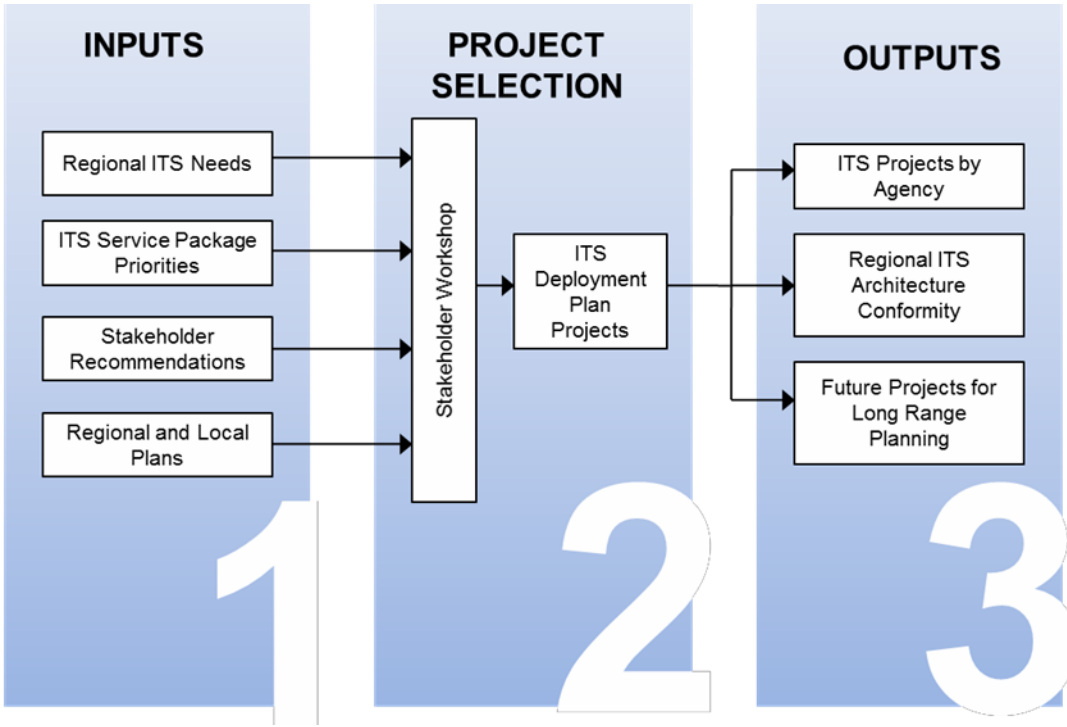

Figure 7-1 Project Development and Selection Process

7.2 ITS Project Recommendations

To achieve the ITS deployment levels outlined in their Regional ITS Architecture, a region must carefully develop and implement projects that provide the necessary functionality and interoperability. A crucial step in reaching the Lakeway Region's ITS vision, as established in its Regional ITS Architecture, is the creation of an ITS Deployment Plan. This plan must identify specific projects, establish timeframes for deployment, and designate responsible agencies.

Input from all stakeholders is essential to ensure that they take ownership of the ITS Deployment Plan and that the projects and timeframes identified are realistic. A collaborative approach helps to align regional goals and creates a sense of responsibility for executing the plan. Another important factor is cost, which can vary significantly depending on the scale of deployment, the maturity of the technology, and the type of communications used.

For instance, a region may achieve adequate freeway network surveillance by deploying still-frame CCTV cameras at freeway interchanges. In contrast, another region might install full-motion cameras at one-mile intervals to provide comprehensive coverage. The costs for infrastructure and telecommunications for these two approaches would vary substantially, yet both could be equally suitable depending on the region's specific needs. Thus, careful consideration of cost and technological requirements is necessary when developing an ITS Deployment Plan.

Regional projects are identified in Table 7-1 through Table 7-7. The tables are divided by the primary responsible agency as follows:

- Table 7-1. City of Jefferson City Project Recommendations;

Table 7-2. City of Morristown Project Recommendations;

- Table 7-3. Hamblen County Project Recommendations;
- Table 7-4. Jefferson County Project Recommendations;
- Table 7-5. Lakeway MTPO Project Recommendations;
- Table 7-6. Other Municipalities Project Recommendations; and
- Table 7-7. Regional Project Recommendations.

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

For each project, the following categories are discussed:

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

Table 7-1. City of Jefferson City Project Recommendations

Project	Description	Funding Status	Deployment Timeframe *	Applicable ITS Service Packages
City of Jefferson City TOC Coordination with TDOT Region 1 TMC - Knoxville	Establish a communications connection between the City of Jefferson City TOC and the TDOT Region 1 TMC - Knoxville for the coordination of traffic information. This sharing will facilitate the inclusion of regional information in the Tennessee 511 System as well as the sharing of video feeds and weather information as additional TDOT deployments are made in the Region.	Funding Identified: No	Long-term	TM07
City of Jefferson City TOC Coordination with Jefferson County 911 Dispatch	Establish a connection to allow the City of Jefferson City TOC to share traffic information, railroad crossing closure status, and other information with the Jefferson County 911 Dispatch. This project could also include the integration of the 911 Dispatch Computer Aided Dispatch (CAD) system and the TOC to allow the TOC to receive automated notification about incidents that might affect the roadway network. Integration of the 911 Dispatch CAD system could also allow the TOC to provide 911 Dispatch with real-time traffic and road conditions for use in emergency vehicle dispatch.	Funding Identified: No	Mid-Term	TM08 PS01 PS02
City of Jefferson City Public Works Department Vehicle AVL	Implement automated vehicle location (AVL) on the City of Jefferson City Public Works Department vehicles.	Funding Identified: No	Short-Term	MC01
City of Jefferson City Fire Department Traffic Signal Preemption	Implement emergency vehicle signal preemption for the City of Jefferson City Fire Department to improve incident response times and emergency responder safety.	Funding Identified: No	Short Term	TM03 PS03

Table 7-2. City of Morristown Project Recommendations

Project	Description	Funding Status	Deployment Timeframe *	Applicable ITS Service Packages
City of Morristown Traffic Signal System Upgrades	Upgrade and expand the City of Morristown traffic signal system, to include improving traffic signal communications to allow real time monitoring of traffic signals, incorporating signal preemption capabilities into traffic signals, and updating signals from loop or video detection to radar detection. Project implementation will be phased and done by corridor, with implementation corridors selected and prioritized by the city on an as-needed basis. The city has identified upgrades to traffic signals along the SR 343 corridor as a priority.	Funding Identified: No	Short-term	TM01 TM03
City of Morristown CCTV Cameras	Implement additional CCTV cameras on key sections of roadway within the City of Morristown. CCTV cameras can be used to monitor traffic conditions and to aid in incident management. Video feeds can be shared with emergency management agencies to facilitate emergency response and to identify priority locations if any.	Funding Identified: No	Short-term	TM01
City of Morristown DMS	Deploy DMS in the City of Morristown to provide traveler information, incident management, and special event management capabilities. DMS can be used for general information dissemination purposes, to provide alternate routing to travelers in the case of a major traffic incident, and to disseminate vehicle restrictions for critical infrastructure such as the Cumberland Gap Tunnel.	Funding Identified: No	Mid-term	TM06
City of Morristown Weather Detection	Implement weather detection sensors at various locations in the City of Morristown to monitor roadway temperatures, roadway flooding, aid in determining the correct abatement process (salt, brine, etc.), and prioritize locations for treatment.	Funding Identified: No	Mid-term	WX01
City of Morristown Real- Time Traveler Information Website	Add real-time traveler information, such as incident locations, road weather information, speed, and CCTV camera images to the City of Morristown Public Works Department website. The City currently manually updates the website and social media with information.	Funding Identified: No	Short to Mid-term	TM06 PS10
City of Morristown TOC Coordination with TDOT Region 1 TMC - Knoxville	Establish a communications connection between the City of Morristown TOC and the TDOT Region 1 TMC - Knoxville for the coordination of traffic information. This sharing will facilitate the inclusion of regional information in the Tennessee 511 System as well as the sharing of video feeds and	Funding Identified: No	Mid-term	TM07 TM08

Project	Description	Funding Status	Deployment Timeframe *	Applicable ITS Service Packages
	weather information as additional TDOT and City of Morristown deployments are made in the Region.			
City of Morristown TOC Coordination with Hamblen County 911 Dispatch	Establish a connection to allow the City of Morristown TOC to share CCTV camera images, railroad crossing closure status, and other information with Hamblen County 911 Dispatch to aid in incident management. This project could also include the integration of the 911 Dispatch computer aided dispatch (CAD) system and the TOC to allow the TOC to receive automated notification about incidents that might affect the roadway network. Integration of the 911 Dispatch CAD system could also allow the TOC to provide 911 Dispatch with real-time traffic and road conditions for use in emergency vehicle dispatch.	Funding Identified: No	Short-term	TM08 PS01 PS02 MC08

Table 7-3. Hamblen County Project Recommendations

Project	Description	Funding Status	Deployment Timeframe *	Applicable ITS Service Packages
Hamblen County 911 Dispatch CCTV Camera Image Sharing	Establish a connection to share TDOT and City of Morristown closed circuit television (CCTV) camera images with the Hamblen County 911 Dispatch. Connecting to the City of Morristown TOC will allow the Hamblen County 911 Dispatch access to TDOT video once the Traffic Operations Center (TOC) is connected to TDOT.	Funding Identified: No	Mid-term	TM08 PS01 PS02 MC08
Hamblen County Road Department Weather Detection	Implement weather detection systems for snow, ice, flooding, and other severe weather conditions at various locations in Hamblen County, including SR 160.	Funding Identified: No	Mid-term	WX01

Table 7-4. Jefferson County Project Recommendations

Project	Description	Funding Status	Deployment Timeframe *	Applicable ITS Service Packages
Jefferson County EMS AVL and MDTs	Implement automated vehicle location (AVL) and mobile data terminals (MDTs) on Jefferson County Emergency Medical Services (EMS) vehicles.	Funding Identified: No	Short-term	PS02
Jefferson County EMS Traffic Signal Preemption	Implement emergency vehicle signal preemption for Jefferson County EMS to improve incident response times and emergency responder safety.	Funding Identified: No	Short-term	TM03 PS03
Jefferson County 911 Dispatch CCTV Camera Image Sharing	Establish a connection to share TDOT closed circuit television (CCTV) camera images with the Jefferson County 911 Dispatch.	Funding Identified: No	Short-term	TM08 PS01 PS02 MC08

Table 7-5. Lakeway MTPO Project Recommendations

Project	Description	Funding Status	Deployment Timeframe *	Applicable ITS Service Packages
Lakeway MTPO Archive Data Warehouse	Establish a data warehouse to archive data from cities and future transit agencies in the LAMTPO service area for use in regional planning. Cost could vary widely depending on the level of detail and functionality of the system as well as the amount of development that is done in-house by LAMTPO.	Funding Identified: No	Long-term	DM01

Table 7-6. Other Municipalities Project Recommendations

Project	Description	Funding Status	Deployment Timeframe *	Applicable ITS Service Packages
Town of White Pine Fire and Police Department Traffic Signal Preemption	Implement emergency vehicle signal preemption for the Town of White Pine Fire Department and Police Department to improve incident response times and emergency responder safety. The Town of White Pine has identified the traffic signal at Maple Street and Main Street as the highest priority for traffic signal preemption.	Funding Identified: No	Short-term	TM03 PS03

Table 7-7. Regional Project Recommendations

Project	Description	Funding Status	Deployment Timeframe *	Applicable ITS Service Packages
Regional Media Coordination	Develop agreements and enhanced coordination with local media to improve information sharing and dissemination. If the media desires to gather data, such as closed circuit television (CCTV) camera video feeds, from the transportation agencies in the Region then it is expected that the media will be responsible for any costs. Responsible Agencies: City of Morristown, City of Jefferson City, TDOT.	Note: Funding not applicable	Mid-term	TM06 PS10
ETHRA Transit Fare Collection Management	Develop system that manages transit fare collection on-board transit vehicles and at transit stops using electronic means. System will allow transit users to use a traveler card or other electronic payment device. Readers located either in the infrastructure or on-board the transit vehicle allow electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem. As of October 2024, the system is currently being designed and is estimated to be deployed during the first quarter of 2025.	Funding Identified: Yes	Short-term	PT04
ETHRA and TDOT Personalized Traveler Information	Develop an app for travelers those aggregates and summarizes traveler information across all transportation modes and services in the region, using the mobility as a service model. Information in the app should be personalized depending on the traveler's origin, destination, and travel preferences.	Funding Identified: Yes	Mid-term	TI02
Regional EV Charging Infrastructure	Integrate EV charging infrastructure into existing and future transportation plans, ensuring that charging stations are accessible and well-distributed throughout the Lakeway Area. Collaborate with utility companies and private developers to promote sustainable infrastructure investment and usage.	Funding Identified: No	Mid-term	ST05*

* ST05 has not yet been added to either the regional or statewide ITS architectures

7.3 Consideration of Emerging Technologies

As the transportation landscape continues to evolve, emerging technologies offer numerous opportunities to enhance the effectiveness, safety, and efficiency of the Lakeway Area's transportation system. Incorporating these advancements into the regional ITS architecture can supplement current high-priority ITS projects and ensure the Lakeway Area stays at the forefront of intelligent transportation solutions. Below are key emerging technologies identified for consideration and recommendations for their integration into future ITS planning efforts.

7.3.1 Connected and Autonomous Vehicles (CAVs)

The introduction of connected and autonomous vehicles (CAVs) presents an opportunity to enhance safety and mobility through signal infrastructure-to-vehicle communications and real-time traffic management. CAV technologies will allow vehicles to communicate with infrastructure to reduce collisions, improve traffic flow, and enhance overall road safety.

Recommendation: Future ITS deployments should explore implementing vehicle-to-infrastructure (V2I) communication technologies that enable real-time interactions between CAVs and traffic signal systems. Pilot programs could be developed to test CAV integration at key intersections or corridors, preparing the region for full-scale adoption in the future. The following documents can be considered and used as guidance:

1. *Plan to Accelerate V2X Deployment*, which was published by FHWA in October 2023. The Plan discusses the transition from Dedicated Short Range Communications (DSRC) to Cellular Vehicle to Everything (C-V2X).

2. *TDOT CV Readiness Plan* documenting the strategy, roles, responsibilities, and partners to advance TDOT CV vision technologies throughout the state.

7.3.2 Pedestrian and Bicyclist Detection, Notification, and Warnings

Improving safety for vulnerable road users, such as pedestrians and cyclists, is a growing concern. Detection systems that can monitor crosswalks and bike lanes and provide real-time alerts to drivers can significantly reduce incidents involving non-motorized transportation users.

Recommendation: Incorporate pedestrian and bicyclist detection technologies at high-traffic intersections and areas with heavy non-motorized traffic. Implement flashing warning systems, in-roadway lighting, and real-time notifications to enhance safety in these areas.

7.3.3 System Resiliency – Weather and Flood Warning Systems

Extreme weather events, such as floods, pose a significant risk to transportation systems. Implementing weather and flood warning systems can enhance system resiliency by providing real-time updates on hazardous conditions and allowing for proactive traffic management.

Recommendation: Deploy weather and flood monitoring technologies in areas prone to flooding or adverse weather conditions. Integrate these systems with existing ITS infrastructure to provide real-time updates to drivers and enable rerouting and evacuation strategies.

7.3.4 Automated Traffic Signal Performance Monitoring (ATSPM)

ATSPM systems enable real-time performance monitoring and optimization of traffic signals, improving traffic flow and reducing congestion. This technology provides detailed data on signal performance, enabling operators to make data-driven adjustments in real time.

Recommendation: Integrate ATSPM systems into the existing ITS framework, focusing on high-priority corridors where traffic congestion and delays are frequent. Leverage the data collected to continuously improve traffic signal performance and reduce travel times.

7.3.5 End-of-Queue Warning System

End-of-queue warning systems alert drivers to upcoming traffic congestion or stopped traffic, preventing rear-end collisions and enhancing safety during peak traffic periods. These systems are especially effective in high-speed areas or work zones.

Recommendation: Deploy end-of-queue warning systems in areas where abrupt stops and congestion are common, such as near construction zones or heavily trafficked freeways. These systems should be integrated with dynamic message signs to provide real-time warnings to drivers.

By considering these emerging technologies and aligning them with the region's existing high-priority ITS projects, the Lakeway Area can ensure that its transportation system remains adaptable, resilient, and prepared for future advancements. Ongoing stakeholder collaboration and pilot testing will be essential to successfully implementing these technologies and addressing the evolving transportation needs of the region.

8.0 Use and Maintenance Plan

The Lakeway Regional ITS Architecture is one of several documents that address transportation plans for the region. These documents should be compatible with one another and guided by similar overarching goals and objectives related to the regional transportation network. Federal agencies require that ITS projects using federal funding from the Highway Trust Fund conform to the Regional ITS Architecture, so it is important that ITS elements, which are going to be incorporated into other regional plans, are incorporated according to the Regional ITS Architecture. Section 8.1 describes how the Regional ITS Architecture can be used to guide the incorporation of ITS elements into the Long-Range Transportation Plan (LRTP) and Transportation Improvement Programs (TIP). Section 8.2 provides insights into how the Regional ITS Architecture can be used to improve or streamline efforts for transportation operations project selection and implementation throughout the Region.

The Regional ITS Architecture is considered a living document. Shifts in regional focus and priorities, changes and new developments in technology, and changes to the National ITS Architecture will necessitate that the Lakeway Regional ITS Architecture be updated to remain a useful resource for the Region. In the Regional ITS Architecture, a process for maintaining the plan was developed in coordination with stakeholders. The process covers both major updates to the Regional ITS Architecture that will happen approximately every five years (or as needed) as well as minor changes that may be needed between major updates of the documents. These processes have been included in this document in Sections 9.4 and 9.5.

8.1 Incorporation of ITS into the Regional Planning Process

Stakeholders invested significant effort in developing the Regional ITS Architecture for the Lakeway Region. To ensure the region's ITS vision is considered in future ITS projects and to remain eligible for federal funding, the plan should be integrated into the regional planning process. Across the country, many metropolitan planning organizations (MPOs) or transportation planning organizations require agencies to certify that any project with ITS elements conforms to the Regional ITS Architecture before it can be included in the Transportation Improvement Program (TIP).

Although no formal process exists in the Lakeway Region, many other MPOs mandate that agencies evaluate projects submitted for inclusion in the TIP to determine whether the project includes any ITS elements. If ITS elements are present, the submitting agency must ensure that these elements conform to the Regional ITS Architecture. This evaluation should be performed during the planning phase, following the procedure outlined in Section 8.2. The Lakeway Area Metropolitan Transportation Planning Organization (LAMTPO) would then review each project to verify conformance with the Regional ITS Architecture and assist agencies with the evaluation as part of the project application process.

An additional tool that LAMTPO could use when evaluating ITS projects is TDOT's "ITS Project Development Guidelines." This guideline requires agencies involved in ITS-related projects (including certain non-ITS traffic operations improvements) to complete the Tennessee ITS Project Identification Form. TDOT will validate whether a project qualifies as an ITS project and assess the risk associated with its implementation, which will determine the next steps. LAMTPO could require stakeholder agencies to submit this form when proposing projects for inclusion in the TIP.

Figure 8-1 outlines the proposed steps for incorporating the Regional ITS Architecture into Lakeway's regional planning process. This diagram details how the TIP project selection process includes a review of the Regional ITS Architecture to ensure that projects containing ITS elements align with the regional ITS needs. By including this step, the TIP project selection process ensures that projects with ITS components conform to the vision and requirements established by the regional architecture.

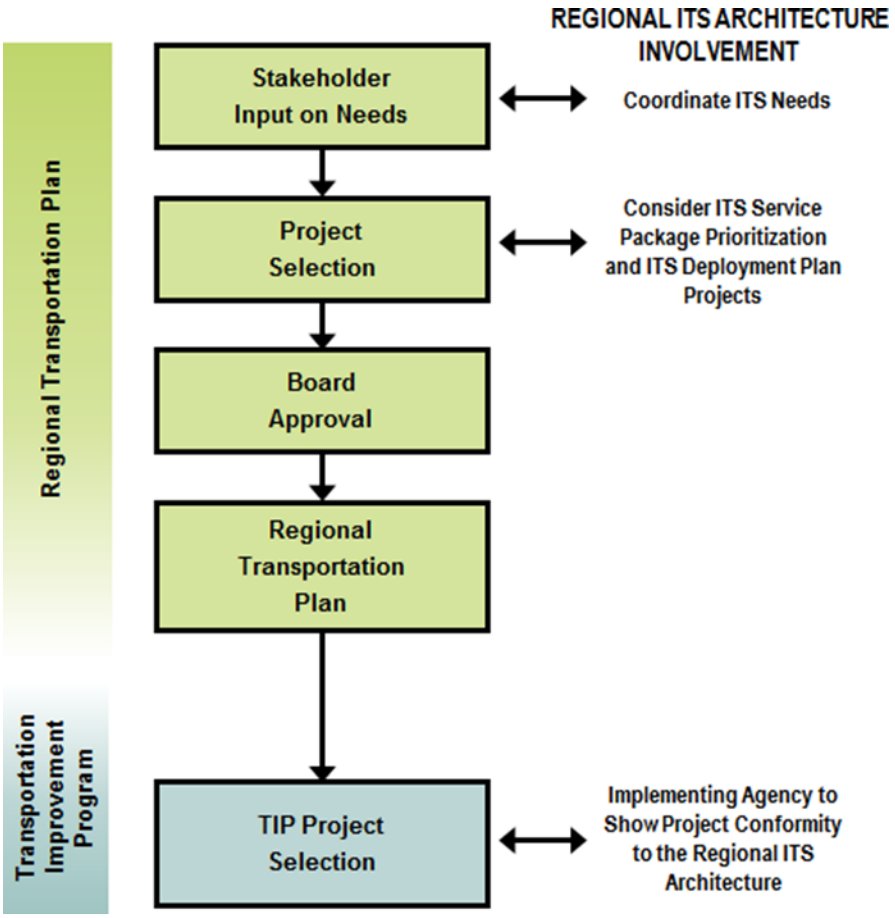

Figure 8-1 Proposed Regional Planning Process and ITS Architecture Involvement

In addition to the Lakeway Regional ITS Architecture, TDOT also has developed and continues to maintain a Statewide ITS Architecture. The TDOT Statewide ITS Architecture was last updated in 2019 and amended in 2024, and includes both statewide and regional TDOT elements, such as the TDOT Region 1 TMC outside of Knoxville as well as the ITS devices the TMC operates. While the statewide architecture shows how TDOT's ITS elements exchange information flows, the Lakeway Regional ITS architecture also needs to include these TDOT ITS elements to show how they currently or will eventually exchange information with other ITS elements that are maintained by local agencies and other stakeholders within the Lakeway Region.

TDOT also completed a statewide Traffic Operations Program Plan in 2017. The plan outlines strategies related to Transportation Systems Management and Operations (TSMO) that TDOT may choose to invest in to improve traffic operations statewide. TSMO strategies incorporate the management and use of ITS

elements to better address common traffic challenges including traffic incident management, work zone management, and road weather management.

Beyond the use of ITS, the TDOT statewide Traffic Operations Program Plan outlines recommended changes to TDOT business processes, performance measurement strategies, staff organization and workforce plans, and practices for collaboration with local agency partners. For example, one recommendation from the Traffic Operations Program Plan involved increasing staff coverage in the TDOT Region 1 TMC to allow for 24-hour operations. This recommendation has been implemented since the previous Lakeway Regional ITS Architecture update was completed. While this staff organization change does not have any impact on the information flows shown in the Lakeway Regional ITS Architecture, the increase in level of traffic management coverage would still benefit the Region's roadway network by allowing for coordinated traffic management activities and ITS device control to occur even outside of standard business hours or peak travel periods.

8.2 Systems Engineering Analysis

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

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

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

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

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

- Portions of the Regional ITS Architecture being implemented;

- Participating agencies and their roles and responsibilities;
- Definition of system requirements (identified in the Lakeway Regional ITS Architecture Turbo Architecture database equipment packages); and
- Applicable ITS standards (identified using ITS service package information flows present in the Turbo Architecture Database and their associated national standards).

Many projects are categorically excluded from the systems engineering analysis requirements. Categorically excluded projects are those that do not utilize a centralized control, do not share data with another agency, or are expansions or enhancements to existing systems that do not add any new functionality. For example, installation of an isolated traffic signal or upgrades to an existing signal that does not introduce new functional capabilities would be categorically excluded. Other projects are subject to the systems engineering analysis, either in an abbreviated sense using a form, or in a detailed sense through the preparation of a full report. TDOT and the FHWA Tennessee Division have established a method for determining the necessary documentation for each project, based on the project's risk factors and complexity. This method is shown in the flow chart in Figure 8-2 and is described in detail in the TDOT ITS Development Guidelines developed by the TDOT Traffic Operations Division (https://www.tn.gov/tdot/traffic-design/intelligent-transportation-systems/its-project-development.html).

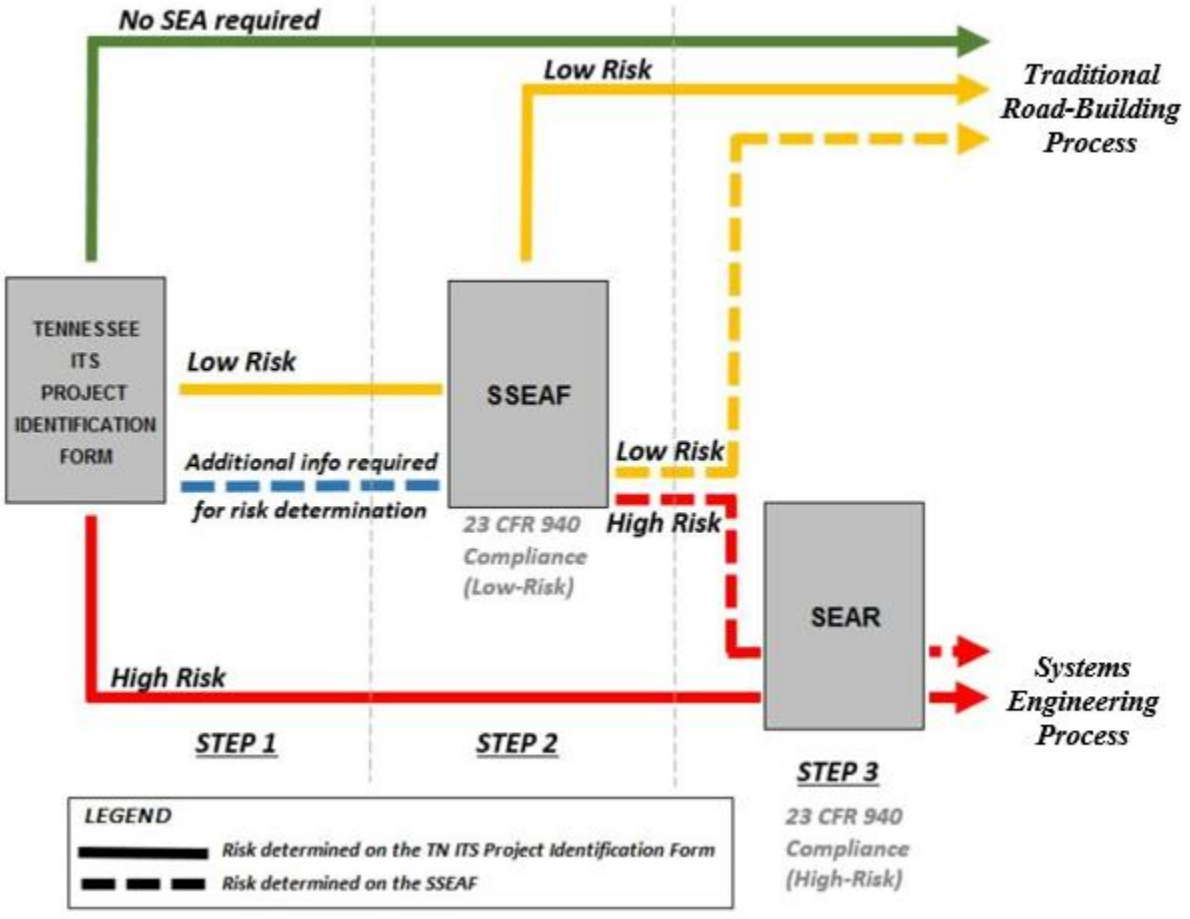

Figure 8-2 Systems Engineering Analysis Project Flow Chart

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

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

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

The Vee Diagram, shown in Figure 8-3, is frequently used in systems engineering discussions to demonstrate where the Regional ITS Architecture and systems engineering process fits into the life cycle of an ITS project. The Regional ITS Architecture is shown unattached from the rest of the diagram because it is not specifically project related and an undetermined amount of time can pass between the architecture development and the beginning of project implementation. Moving from left to right along the diagram, the systems engineering process addresses concept exploration, the systems engineering management plan framework, concept of operations, and systems requirements.

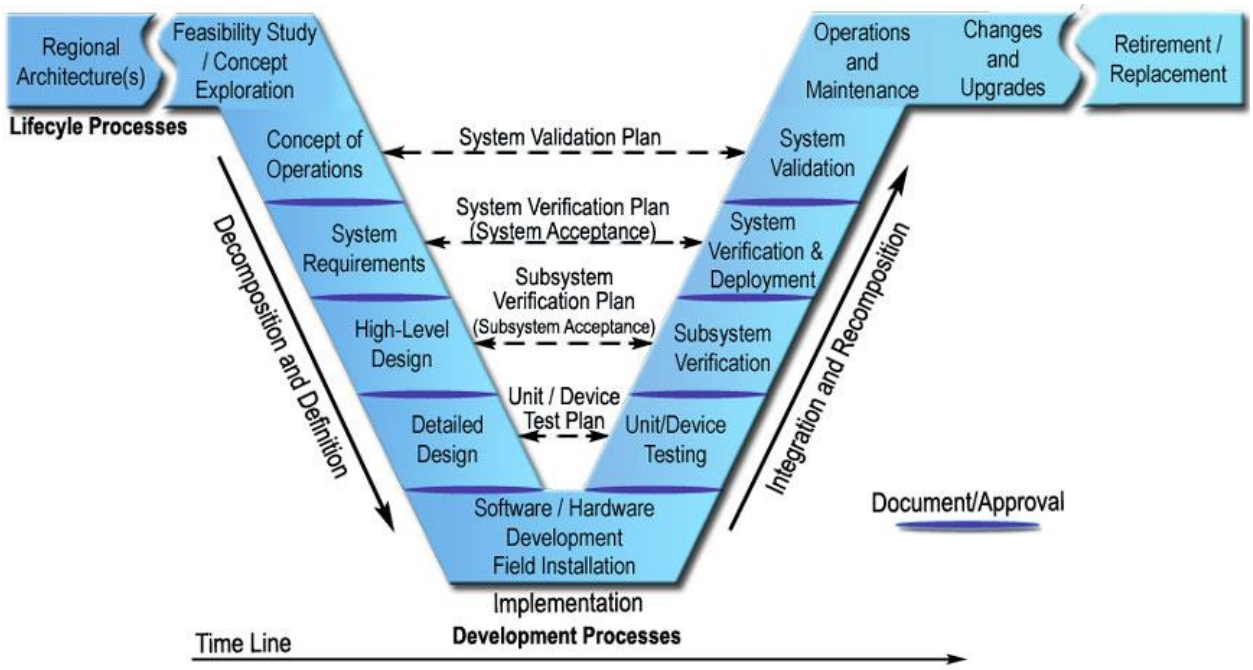

Figure 8-3 Systems Engineering Vee Diagram from FHWA

The Tennessee guidance document contains reference material to aid in the preparation of a systems engineering analysis. During the process, if it is determined that a project is not adequately addressed in the Regional ITS Architecture, the Regional ITS Architecture maintenance process (described in Section 8.5) should be used to document the necessary changes.

8.3 Process for Determining ITS Architecture Conformity

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

Step 1 – Identify the ITS Components

ITS components can be fairly apparent in an ITS focused project such as CCTV or DMS deployments but could also be included in other types of projects where they are not as apparent. For example, an arterial widening project could include the installation of signal system interconnect, signal upgrades, and the incorporation of the signals in the project limits into a city's closed loop signal system. These are all ITS functions and should be included in the ITS Architecture. As mentioned in Section 8.1, stakeholders can make use of the TDOT ITS Project Identification Form that was filled out upon project submission to the TIP to help identify ITS components of a given project.

Step 2 – Identify the Corresponding Service Packages

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

Step 3 – Identify the Component within the Service Package

The customized service packages for the Lakeway Region are in Appendix E. Once the element is located within the appropriate service package, the evaluator should determine if the element name used in the service package is accurate or if a change to the name is needed. For example, a future element called Municipal TOC was included in the Lakeway Regional ITS Architecture. Detailed planning for this center has not begun and it would not be unusual for the city or county to select a different name for the TOC once planning and implementation is underway. Such a name change should be documented using the process outlined in Section 8.4.

Step 4 – Evaluate the Connections and Flows

The connections and information flows documented in the service package diagrams were selected based on the information available at the time the Regional ITS Architecture was developed. As the projects are designed, decisions will be made on the system layout that might differ from what is shown in the service package. These changes in the project should be documented in the ITS service packages using the process outlined in Section 8.4.

Step 5 – Document Required Changes

If any changes are needed to accommodate the project under review, Section 8.4 describes how those changes should be documented. Any changes will be incorporated during the next Regional ITS Architecture update. Conformance will be accomplished by documenting how the service package(s) should be modified so that the connections and information flows are consistent with the project.

8.4 Regional ITS Architecture Maintenance Process

TDOT served as the lead agency for developing the Lakeway Regional ITS Architecture and Deployment Plan in 2009 and for updating the plan in 2017 and 2024. Stakeholders agreed that future updates, as well as maintenance of the plan, will be the responsibility of LAMPTO and that LAMPTO will coordinate closely with TDOT and other stakeholders. Table 8-1 summarizes the maintenance process agreed upon by stakeholders in the Region.

Table 8-1 Lakeway Regional ITS Architecture Maintenance Summary

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

It was agreed that the Regional ITS Architecture should be reviewed on the same cycle as the Regional Transportation Plan (RTP) update to determine if a full update is necessary. In the Lakeway Region, the RTP is updated every five years if the region is designated as attainment for air quality standards; however, the update occurs every four years if the region is designated non-attainment**.** The need for future updates to the Regional ITS Architecture will depend on the level of ITS deployment since the last update, as well as any changes in the National ITS Architecture. LAMTPO will coordinate with TDOT to determine whether an update is necessary.

By completing a full update of the Regional ITS Architecture in coordination with an RTP update (if needed), stakeholders will have the opportunity to assess the region's ITS needs and prioritize the most critical projects. This process will also ensure that these needs and projects are documented for consideration during the development of the RTP. LAMTPO, working with the TDOT Traffic Operations Division, will be responsible for leading the update. During the update process, all stakeholder agencies involved in the original development of the Regional ITS Architecture and Deployment Plan should be included, along with any new agencies involved in or impacted by ITS projects.

Minor updates to the Regional ITS Architecture and Deployment Plan should be made as needed between full updates. Section 8.5 of this document outlines the procedure for submitting changes to the Regional ITS Architecture. It is particularly important to document changes when a project is being deployed that requires modifications to the Regional ITS Architecture to maintain conformity.

8.5 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 8.4 to maintain the architecture as a useful planning tool. Between major plan updates, smaller modifications

will likely be required to accommodate ITS projects in the Region. Section 8.3 contains step by step guidance for determining whether a project requires 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 J. Architecture Maintenance Documentation Form**. This form should be completed and submitted to the architecture maintenance contact person identified on the form whenever a change to the Regional ITS Architecture is proposed. There are several key questions that need to be answered when completing the Architecture Maintenance Documentation Form including those described below.

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

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

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

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

Impact of proposed change on other stakeholders: If a proposed change is expected to impact other stakeholders in the region, those stakeholders should be included on the ITS Architecture Maintenance Documentation Form. Additionally, the form should contain a description of any coordination that has taken place with stakeholders who may be affected by the change. Ideally, all impacted stakeholders should be contacted to reach a consensus regarding any new or modified ITS service packages that will be incorporated into the Regional ITS Architecture.

LAMTPO will review and accept the proposed changes, subsequently forwarding the form to the TDOT Traffic Operations Division for their records. When a major update occurs, all documented changes should be integrated into the Regional ITS Architecture to ensure it accurately reflects the current state of ITS deployment and stakeholder needs.