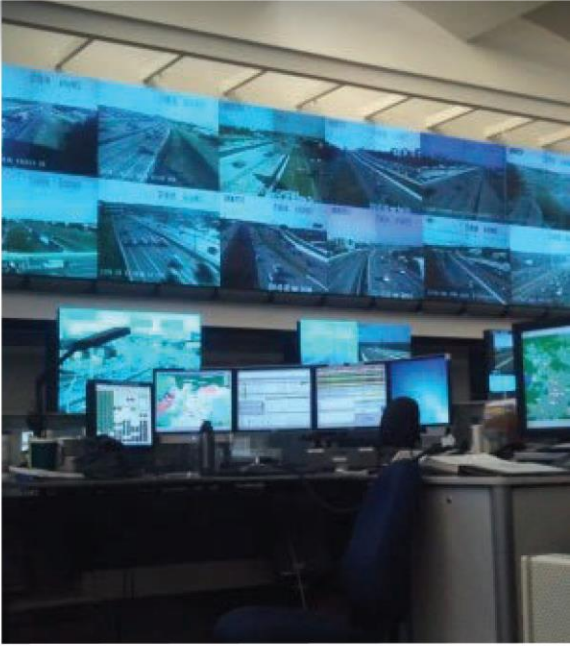


# Austin Regional Intelligent Transportation Systems

## Architecture and Deployment Plan

Draft Report



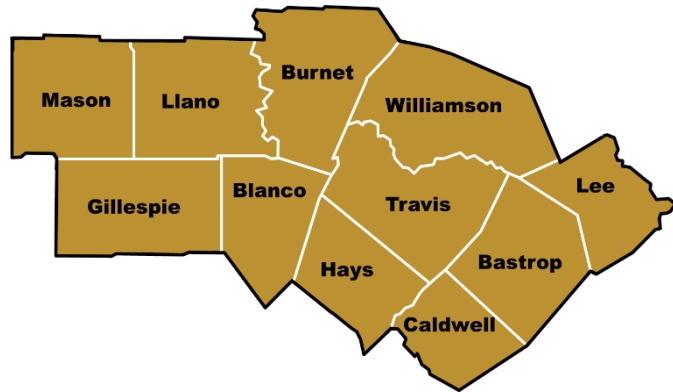
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# Austin

## REGIONAL ITS ARCHITECTURE

2018 UPDATE

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## Draft Regional Intelligent Transportation Systems Architecture and Deployment Plan

Prepared by the **Texas Department of Transportation** in coordination with stakeholder agencies throughout the TxDOT Austin District

DECEMBER 2018

Kimley»»Horn

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## LIST OF ACRONYMS

### AUSTIN REGIONAL ITS ARCHITECTURE

AASHTO	American Association of State Highway and Transportation Officials
ABIA	Austin Bergstrom International Airport
AIMHigh	Austin-area Incident Management for Highways
AMBER	America's Missing: Broadcast Emergency Response
APCO	Association of Public Safety Communications Officials
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
ASTM	American Society for Testing and Materials
ATIS	Advanced Travel Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
CAD	Computer Aided Dispatch
CAV	Connected and Autonomous Vehicles
CAMPO	Capital Area Metropolitan Planning Organization
CARTS	Capital Area Rural Transportation System
CCTV	Closed-Circuit Television
CTECC	Combined Transportation and Emergency Communications Center
CTRMA	Central Texas Regional Mobility Authority
CVISN	Commercial Vehicle Information Systems and Networks
CVRIA	Connected Vehicle Reference Implementation Architecture
DEM	Department of Emergency Management
DMS	Dynamic Message Sign
DOT	Department of Transportation
DPS	Department of Public Safety
DSRC	Dedicated Short Range Communication
EMC	Emergency Management Center
EMS	Emergency Medical Services
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FTP	File Transfer Protocol
HAR	Highway Advisory Radio

## LIST OF ACRONYMS

### AUSTIN REGIONAL ITS ARCHITECTURE

HAZMAT	Hazardous Materials
HCRS	Highway Conditions Reporting System
HRI	Highway Rail Intersection
IEEE	Institute of Electrical and Electronics Engineers
IMMS	Incident Management Message Sets
ITE	Institute of Transportation Engineers
ITIS	International Traveler Information Systems
ITS	Intelligent Transportation System
ISD	Independent School District
ISO	International Standards Organization
LCRA	Lower Colorado River Authority
LED	Light Emitting Diode
LRMS	Location Referencing Message Specification
L RTP	Long Range Transportation Plan
MAC	Medium Access Control
MDT	Mobile Data Terminal
MPO	Metropolitan Planning Organization
NEMA	National Electrical Manufacturers Association
NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol
OER	Octet Encoding Rules
PIO	Public Information Office
PSAP	Public Safety Answering Point
PTMS	Public Transportation Management System
PWD	Public Works Department
RDMT	Radio, Dispatch, Mobile Data, Transportation
RAD-IT	Regional Architecture Development for Intelligent Transportation
RDS	Radio Data Systems
RTP	Regional Transportation Plan
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users

## LIST OF ACRONYMS

### AUSTIN REGIONAL ITS ARCHITECTURE

SDO	Standards Development Organization
SET-IT	Systems Engineering Tool for Intelligent Transportation
STMF	Simple Transportation Management Framework
STS	Special Transit Service
TCEQ	Texas Commission on Environmental Quality
TEA-21	Transportation Equity Act for the 21st Century
TIP	Transportation Involvement Plan
TMC	Traffic Management Center
TMDD	Traffic Management Data Directory
TOC	Traffic Operations Center
TOD	Toll Operations Division
TxDOT	Texas Department of Transportation
USDOT	United States Department of Transportation
USGS	United States Geological Survey
UT	University of Texas
VIVDS	Video Imaging Vehicle Detection System



# 1. INTRODUCTION

## 1.1 Project Overview

The Regional Intelligent Transportation System (ITS) Architecture provides a long-range plan for the deployment, integration, and operation of ITS in the Austin Region. The Regional ITS Architecture allows stakeholders to plan for what they want their system to look like in the long term. It also organizes the regional ITS network into smaller pieces 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. Completing and regularly updating the plan is also required by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) to use federal transportation funds for ITS projects in the Region.

The 2018 update to the Austin Regional ITS Architecture focuses primarily on building a connected region. Many of the stakeholders in the Austin Region have made significant investments in ITS and operations within their jurisdictions. However, most noted that to fully optimize operations there is additional connectivity needed between agencies to operation the transportation system as one seamless integrated system. Emphasis in the Austin Region includes improved sharing of data, video images, incident information, performance metrics and archived data, and planning for connected and autonomous vehicle (CAV) deployments.

In the Austin Region, the first regional plan for ITS was the Austin Area-Wide Intelligent Vehicle Highway System (IVHS) Plan and IH-35 Corridor Deployment Plan, which was developed in 1996. This plan served as the predecessor to the first Austin Regional ITS Architecture which was developed in 2002. Since that time many new ITS projects have been implemented and the National ITS Architecture, which served as the basis for the Austin Regional ITS Architecture, has been updated. In order to reflect these changes, the Texas Department of Transportation (TxDOT) Austin District, working closely with stakeholders throughout the Region, completed an update of the Regional ITS Architecture in 2007 and most recently in 2015.

The Regional ITS Architecture consists of several key components:

**ITS Needs** – The needs describe the transportation related needs in the Region that could possibly be addressed by ITS.

**ITS Inventory** – The inventory describes all of the ITS related elements that either exist or are planned for the Region.

**ITS Service Packages** – The ITS service packages describe the services that stakeholders in the region want ITS to provide. ITS service package diagrams have been developed to illustrate how each service will be deployed and operated by each agency in the Region that expressed interest in a particular service. In previous versions of the Austin Regional ITS Architecture, ITS service packages were referred to as ITS market packages. The name change has been made to be consistent with the terminology that is now used in Version 8.1 of the National ITS Architecture.

**ITS Deployment Plan** – The deployment plan documents planned and potential ITS projects that could be implemented to provide the ITS services that stakeholders identified as important to the Region.

**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.

Regional ITS architectures are necessary to satisfy the ITS conformity requirements first established in the Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) bill passed in 2005. 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 this date, any ITS projects must show conformance with their regional ITS architecture in order to be eligible for funding from FHWA or FTA. In order to demonstrate this conformance, it is important that regions deploying ITS have an updated regional ITS architecture in place.

The geographic boundaries of the original architecture for the Region were those of the Capital Area Metropolitan Planning Organization (CAMPO) area and included Travis, Williamson, and Hays Counties. However, the boundaries were expanded in the 2007 update to include the boundaries of the eleven-county TxDOT Austin District. The stakeholders developed the Regional ITS Architecture and Deployment Plan based on a vision of how they wanted to implement and operate ITS through the year 2040 in the Austin Region. The ITS Architecture and Deployment Plan identifies projects that have been recommended by the stakeholders as priority projects for their agency that will help achieve the vision of the Regional ITS Architecture. Additionally, a project website was developed which contains all of the project documents as well as an interactive version of the Regional ITS Architecture. The website is located at [www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com).

The Austin Regional ITS Architecture and the Austin Regional ITS Deployment Plan were both developed with significant input from local, state, and federal officials. A series of workshops were held with all stakeholders and individual interviews were conducted with many stakeholders in addition to the workshop to request input and ensure that the plan would reflect the unique needs of the Region. Copies of the draft reports were made available to all stakeholders through the project website. The Regional ITS Architecture and Deployment Plan strives to present an accurate snapshot of existing ITS deployment and future ITS plans in the Region. However, needs and priorities of the Region will change over time, and in order to remain effective, this plan should be periodically reviewed and updated.

## 1.2 Austin Region

### 1.2.1 GEOGRAPHIC BOUNDARIES

The Austin Region is comprised of Bastrop, Blanco, Burnet, Caldwell, Gillespie, Hays, Lee, Llano, Mason, Travis, and Williamson Counties. These boundaries correspond with the boundaries of the TxDOT Austin District, which is shown in **Figure 1**. The Region encompasses approximately 9,489 square miles in central Texas and has a population of approximately 2.24 million according to 2017 population estimates. The CAMPO Region includes six counties, all of which are located within the TxDOT Austin District. The six county CAMPO Region is comprised of Bastrop, Burnet, Caldwell, Hays, Travis and Williamson Counties.

When developing the stakeholder group, the project team coordinated with the TxDOT Austin District to invite the appropriate city, county, regional, state and federal agencies. Stakeholders included representatives from traffic, transit, public safety, emergency management, and toll agencies in the Austin Region.

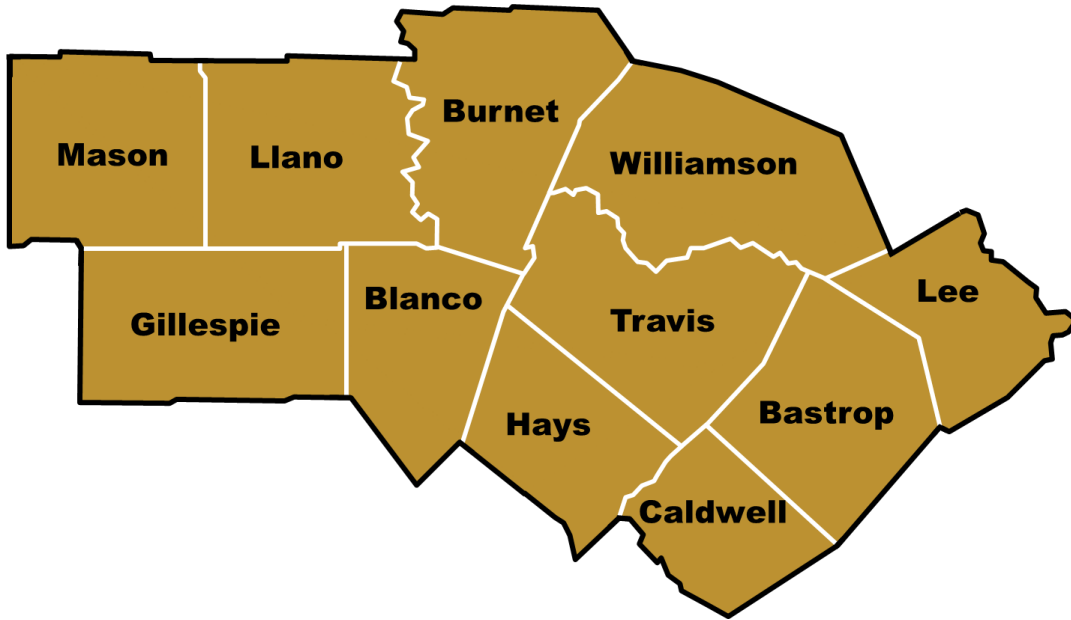


Figure 1 – Austin Regional Boundaries

1.2.2 TRANSPORTATION INFRASTRUCTURE

The Austin Region is served by a significant number of State and Federal highways. The primary access-controlled facilities include I-35, US 183, US 290, SH 45, SH 71, SH 130, SH Loop 1 (MoPac), Toll Road 183A and Toll Road 290 (Manor Expressway). Several of those facilities are either tolled for their entire length (Toll Road 183A) or have sections that are tolled (Toll Road 290, SH 45, SH 130 and SH Loop 1 (SH Loop 1 has a single managed lane in each direction.)). Toll roads in the Region are either managed by the Central Texas Regional Mobility Authority (CTRMA) or the TxDOT Toll Operations Division (TOD).

I-35 is the primary highway in the Region; I-35, US 183, and SH 130 generally run from north to south. SH 71, US 290, and SH 45 generally run from east to west. The effective operation of I-35 is critical to the movement of goods and people through the State of Texas as well as the United States. I-35 extends from Laredo, Texas on the U.S.-Mexico border to Duluth, Minnesota. Construction and incidents along I-35 can have a severe impact on commercial vehicle traffic and motorists traveling through the Region on this significant cross-country thoroughfare. Through the Mobility35 program, I-35 will be reconstructed through Williamson, Travis and Hays Counties over approximately the next 10 years.

US 183, US 290, SH 71, SH 45, and SH 183A serve several rapidly growing communities north, south, and east of the City of Austin. Most of the traffic along these roadways is daily commuter traffic, and these traffic volumes are anticipated to continue growing in coming years.

Fixed-route and paratransit services are provided in Travis County and portions of Williamson County by the Capital Metropolitan Transportation Authority (CapMetro). The Capital Area Rural Transportation System (CARTS) also provides fixed-route and paratransit services in several counties including Bastrop, Caldwell, Hays, Lee, Travis, and Williamson Counties. Demand response service in the Austin Region is provided primarily by CapMetro and CARTS in the same areas in which they provide fixed-route service. Additionally, Texas State University operates a fixed-route bus service for students in the City of San Marcos, and CapMetro operates the UT Shuttle in the City of Austin near the University of Texas Campus. Commuter rail is provided by CapMetro and serves the City of Austin, the City of Cedar Park and the City of Leander.

The Austin Region has already deployed several ITS programs. These programs have come from multiple agencies and cover a range of transportation modes. Multi-agency participation has been present

on some of these ITS initiatives. The following are some of the larger ITS initiatives underway or existing within the Austin Region.

**AIMHigh** – The Austin-area Incident Management for Highways (AIMHigh) coalition is made up of representatives from transportation and public safety agencies in the Austin Region. The group meets on a regular basis to review the response to recent incidents and to discuss incident management initiatives or other projects that could impact incident management.

**Capital Metropolitan Transportation Authority (CapMetro) ITS** – CapMetro has developed an extensive ITS program that includes automated vehicle location (AVL), automated passenger counters, security cameras both on buses and at multimodal stations, transit signal priority for bus rapid transit routes, and automated transit fleet monitoring for fixed-route and paratransit vehicles. Additionally, CapMetro has developed a mobile phone application that allows riders to purchase tickets and use their phone as their bus pass. The mobile application also provides trip planning, general information, and real-time bus location tracking. CapMetro staff said they would like to develop a regional fare card or mobile phone application that allows riders to purchase passes for other regional transit management providers in Houston, Dallas/Fort Worth, and San Antonio.

**CARTS ITS** – CARTS provides fixed-route and demand response transit service over a nine-county area in the Austin Region. CARTS buses include AVL, automated passenger counters, and security systems. Real-time information on bus location is available and CARTS is working to bring this information to the public. A strong need exists to create a regional fare payment system that would allow users to ride CARTS and Capital Metro buses using the same payment system.

**City of Austin Traffic Management** – The City of Austin has increased the hours of operations and capabilities of their Traffic Management Center (TMC), which includes extended weekday hours as well as coverage of weekends and special events. They have updated their advanced traffic management system software that is used to monitor and operate traffic signals, dynamic message signs (DMS), field sensors, and closed-circuit television (CCTV) cameras. The City has also installed Bluetooth devices to obtain vehicle speeds along certain arterial corridors. Additional projects include adaptive traffic signals along Lamar, expansion of traffic signal preemption, and the addition of DMS or installation of graphic route information panels (GRIPs) for dynamic route assignment information for travelers. The City is also exploring pilot projects to test connected and autonomous vehicles in the City of Austin.

**City of Round Rock ITS** – The City of Round Rock has implemented a TMC that includes the capability to remotely monitor and implement traffic signal timing changes as well as monitor and control CCTV cameras at various locations throughout the City for traffic surveillance. Additionally, the City of Round Rock Transportation Department is exploring the possibility of sharing video feeds with the City of Round Rock Police Department.

**City of Georgetown ITS** – The City of Georgetown is preparing to take over maintenance and operations of their traffic signal system from TxDOT in the near future. The City's fixed route and demand response transit service, GoGeo, also shares transit data with Capital Metro and CARTS.

**City of Cedar Park ITS** – The City of Cedar Park has implemented a City traffic operations center (TOC) that includes signal control and monitoring capabilities, pan-tilt-zoom CCTV cameras, and Bluetooth readers for collecting arterial travel time information. City staff are exploring options that could be used to provide travel information to the public, including enhanced traveler information features on the City's website.

**City of Pflugerville ITS** – The City of Pflugerville is preparing to take over maintenance and operations of their traffic signal system from TxDOT in the near future. City staff are currently exploring the possibility of managing traffic signals remotely from a workstation at their Public Works facility in the next five years.

**City of San Marcos ITS** – The City of San Marcos has implemented a traffic signal system that includes signal monitoring and control capabilities as well as pan-tilt-zoom CCTV cameras and GPS-based emergency vehicle preemption.

**Combined Transportation, Emergency and Communications Center (CTECC)** – CTECC is a partnership between the City of Austin, Travis County, TxDOT, and Capital Metro. The building includes the TxDOT Traffic Management Center (TMC) for the Austin District, City of Austin 911 and 311 answering and dispatch, CapMetro dispatch, and the Region's Emergency Operations Center. Agencies located in CTECC include the following:

- City of Austin – Austin-Travis County Emergency Medical Services, Austin Fire Department, Austin Police Department, Office of Homeland Security and Emergency Management
- Travis County – Travis County Sheriff's Office, Travis County Constable, Office of Emergency Management
- Texas Department of Transportation – Traffic Management Center and HERO dispatch
- CapMetro – Transit Dispatch

**CTRMA Toll Facilities** – CTRMA operates two tolled, controlled access highways in the Austin Region that use an open road tolling system. The 183A toll road extends from north of RM 620 to US 183 south of San Gabriel Parkway. The limits of the 290 toll road (Manor Expressway) are from US 183 to east of SH 130 near the City of Manor. The SH 71 toll lanes are a limited-access toll road running parallel to SH 71 from the Austin Bergstrom International Airport to SH 130 at Onion Creek. CTRMA also operates newly constructed express lanes along MoPac from Cesar Chavez Street to Parmer Lane. The express lanes are barrier separated from the general-purpose lanes and motorists pay a variable toll rate that is dependent upon the level of congestion. Public transit buses, registered van pools, and emergency vehicles are not required to pay a toll on the MoPac express lanes.

**TxDOT Highway Emergency Response Operator (HERO) Program** – TxDOT operates the HERO Program, which is a safety service patrol program that provides roadside assistance and incident management services along 138 miles of I-35, US 183, US 290, SH 71, and Loop 1 (Mopac). In 2017 and 2018 TxDOT hired a new contractor to operate the program and expanded the hours, geographic coverage, and capabilities of the fleet. For example, under the new contract HERO trucks were equipped with push bumpers to remove disabled vehicles from travel lanes.

**TxDOT Toll Operations Division ITS** – The TxDOT Toll Operations Division (TOD) operates multiple toll roads in the Austin Region including the northern section of SH Loop 1 (MoPac), SH 45 both north and south of Austin, and SH 130. All facilities utilize automated open road tolling which eliminates the need for toll plazas and allows vehicles to maintain highway speeds. The TxDOT TOD also manages the TxTag program, in which transponders allow the electronic readers to identify individual vehicles. TxTags are compatible with CTRMA facilities and other toll facilities throughout Texas. The TxDOT TOD operates its own courtesy patrol, which operates 24/7 along TOD facilities.

### 1.2.3 STAKEHOLDERS

Since ITS often transcends traditional transportation infrastructure, it is important to involve a wide range of local, state, and federal stakeholders in the ITS architecture development and visioning process. Input from these stakeholders is a critical part of defining the interfaces, integration needs, and overall vision for ITS in a region. In the Austin Region, stakeholders that participated included not just representatives from transportation and public transit agencies, but also stakeholders that represented public safety, health, and aviation.

**Table 1** contains a listing of stakeholders for the Austin Region who participated in the project workshop or interviews to provide input to the study team as to the needs and issues that should be considered as part of the Regional ITS Architecture. Other stakeholders that were invited to participate but were not able to attend were provided minutes of workshops and notified when copies of reports were available for review on the project website to encourage their participation as much as possible. A complete listing of stakeholders invited to participate in the project and workshop attendance records is included in the stakeholder database in **Appendix A**.

**Table 1 – Austin Stakeholder Agencies and Contacts**

Agency	Name	Email Address
CAMPO	Ashby Johnson	ashby.johnson@campotexas.org
CAMPO	Nirav Ved	nirav.ved@campotexas.org
Capital Area Rural Transportation System (CARTS)	Adrian Elliott	adrian@RideCARTS.com
Capital Area Rural Transportation System (CARTS)	Dave Marsh	Dave@RideCARTS.com
Capital Metro	Tony Lynch	tony.lynch@capmetro.org
Capital Metro	Kris Turner	kris.turner@capmetro.org
Capital Metro	Chad Valentine	chad.valentine@capmetro.org
Capital Metro	Daryl Weinberg	daryl.weinberg@capmetro.org
City of Austin CTECC	Stephanie McClintock	stephanie.mcclintock@austintexas.gov
City of Austin Transportation Department	Joshil Bhatpuria	joshil.bhatpuria@austintexas.gov
City of Austin Transportation Department	Jim Dale	Jim.Dale@austintexas.gov
City of Austin Transportation Department	Jen Duthie	Jen.Duthie@austintexas.gov
City of Austin Transportation Department - Smart Mobility	Jason JonMichael	jason.jonmichael@austintexas.gov
City of Austin Transportation Department - Smart Mobility	Jorge Riveros	jorge.riveros@austintexas.gov
City of Cedar Park	Stephen Hanuscin	stephen.hanuscin@cedarparktexas.gov
City of Georgetown	Joshua Canter	josh.canter@georgetown.org
City of Georgetown	Octavio Garza	octavio.garza@georgetown.org
City of Georgetown	Brian Mikulencak	brian.mikulencak@georgetown.org
City of Georgetown	Ed Polasek	ed.polasek@georgetown.org
City of Pflugerville	Trey Fletcher	treyf@pflugervilletx.gov
City of Pflugerville	Chad Wood	chadw@pflugervilletx.gov
City of Round Rock	Gary Hudder	ghudder@roundrocktexas.gov
City of Round Rock	Brian Kuhn	bkuhn@roundrocktexas.gov
City of Round Rock	David Walther	davidw@roundrocktexas.gov
City of Round Rock Police Department	Andy McKinney	amckinney@roundrocktexas.gov
City of Round Rock Police Department	Ben Hill	bhall@roundrocktexas.gov
City of San Marcos Engineering Department	Sabas Avila	savila@sanmarcostx.gov
CTRMA	Greg Mack	gmack@ctrma.org
FHWA - Texas Division	Steve Ratke	stephen.ratke@dot.gov
Hays County	Alex Flores	alex.flores@co.hays.tx.us
Travis County Transportation & Natural Resources	Brian Burk	brian.burk@traviscountytexas.gov
TxDOT - Austin District	Roxana Ene	raluca.ene@txdot.gov
TxDOT - Austin District	Adam Kaliszewski	adam.kaliszewski@txdot.gov
TxDOT - Austin District	John Nevares	john.nevares@txdot.gov
TxDOT - TMC (Serco)	Joe Snyder	joseph.snyder@serco-na.com
TxDOT - Toll Operations Division	Jimmy Bailey	jimmy.bailey@txdot.gov

**Table 1 – Austin Stakeholder Agencies and Contacts (Continued)**

Agency	Name	Email Address
TxDOT - Toll Operations Division	Linda Sexton	linda.sexton@txdot.gov
TxDOT - Toll Operations Division	Brian Smallwood	Brian.Smallwood@txdot.gov
TxDOT - Traffic Safety Division	Marco Cameron	marco.cameron@txdot.gov
TxDOT - Traffic Safety Division	Brian Fariello	Brian.Fariello@txdot.gov
TxDOT - Traffic Safety Division	Jianming Ma	jianming.ma@txdot.gov
TxDOT - Traffic Safety Division	David McDonald	david.mcdonald@txdot.gov
TxDOT - Traffic Safety Division	Alex Power	alex.power@txdot.gov
TxDOT - Traffic Safety Division	Barbara Russell	barbara.russell@txdot.gov
TxTag Austin	Jason Nine	jason.nine@txtag.gov
Williamson County	Bob Daigh	bdaigh@wilco.org

## 1.3 Document Overview

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

### **Section 1 – Introduction**

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

### **Section 2 – Regional ITS Architecture Development Process**

This section provides an overview of the key steps involved in developing the ITS architecture for the Austin Region as well as an overview of the RAD-IT Architecture database and reports.

### **Section 3 – Regional ITS Needs**

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

### **Section 4 – Regional ITS Inventory**

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

### **Section 5 – Regional ITS Architecture**

This section describes how the National ITS Architecture was customized to meet the ITS needs, plans, and visions for the Austin Region. The ITS service packages that are included in this section and interconnects are presented, including the “sausage diagram” showing the relationships of the key subsystems and elements in the Region. Functional requirements and standards that apply to the Region, as indicated by the Regional ITS Architecture, are also presented. Operational concepts identifying stakeholder roles and responsibilities have been prepared and potential agreements to support the sharing of data and resources have been identified.

### **Section 6 – Regional ITS Deployment Plan**

This section describes the recommended regional ITS deployments for the Austin Region. Six deployment areas are identified:

- Regional Platform for Camera and DMS Sharing
- Regional Platform for Incident Information Sharing
- Integrated Corridor Management
- Regional Transit Fare System
- Data Management Program Implementation
- Connected and Autonomous Vehicle Technology Framework

For each deployment area, a description of the following is provided: basis of need, stakeholders involved, deployment components, best practices and current trends, and regional ITS architecture conformance.

### **Section 7 – Use and Maintenance of the Regional ITS Architecture**

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



The Austin Regional ITS Architecture also contains five appendices:

**Appendix A – Stakeholder Database**

**Appendix B – Service Package Definitions**

**Appendix C – Architecture Maintenance Documentation Form**

#### **Interactive Regional ITS Architecture**

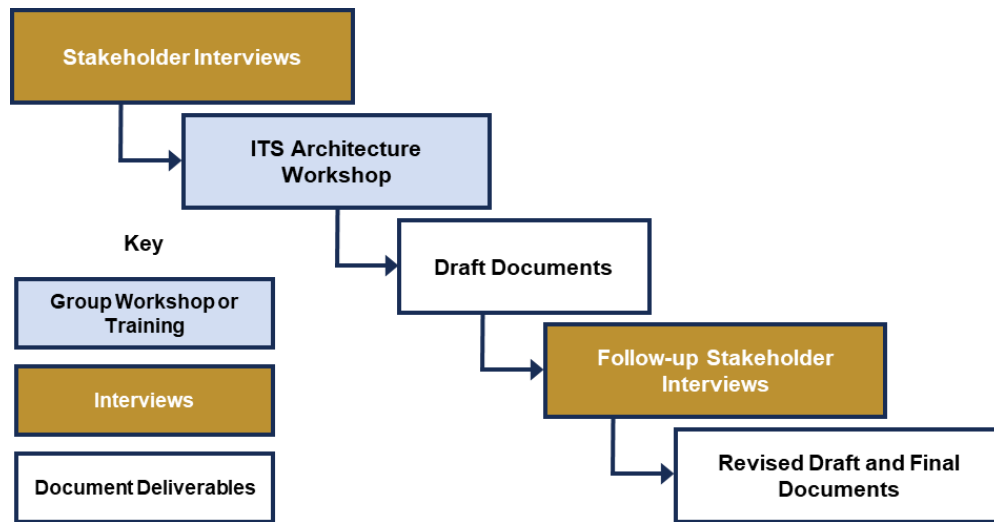
A corresponding website was also developed for the Austin Regional ITS Architecture which contains electronic versions of all documents, meeting minutes, and an interactive version of the RAD-IT Architecture database. The website is located at the following address:

[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

## 2. REGIONAL ITS ARCHITECTURE DEVELOPMENT PROCESS

The update of the Regional ITS Architecture and Deployment Plan for the Austin Region relied heavily on stakeholder input to ensure that the architecture reflected regional needs. A workshop was held with stakeholders to gather input and conduct training, interviews were conducted with representatives from many of the regional stakeholder agencies, and a website was developed with the draft and final documents for the Regional ITS Architecture. The website also had an interactive version of the Regional ITS Architecture generated from RAD-IT Architecture and contained additional guidance on the use and maintenance of the Regional ITS Architecture.

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



**Figure 2 – Austin Regional ITS Architecture and Deployment Plan Development Process**

### 2.1 Stakeholder Involvement

Stakeholders were involved in the development of the Austin Regional ITS Architecture and Deployment Plan at every step in the process. The key components of the development process are described below.

**Stakeholder Interviews:** A stakeholder group was identified that included representatives from regional transportation, transit, public safety, emergency management, and rail agencies. Stakeholder input was first gathered through a series of interviews that were conducted with stakeholder agencies. The interviews were used to develop 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.

**ITS Architecture Workshop:** The stakeholder group was invited to the project workshop, where an overview of the project was provided, the regional boundaries were defined, existing and planned ITS deployments in the Region were reviewed, ITS needs for the Region were identified, and regional ITS deployments recommended by stakeholders in interviews were discussed. The workshop concluded with a review and tutorial of how to navigate the online version of the ITS architecture.

**Draft Documents:** Following the stakeholder input through interviews and the workshop, a draft report was developed which identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the ITS system, identifies projects for deployment, and establishes a maintenance plan. Additionally, the project website was updated to allow stakeholders access to an

interactive version of the ITS architecture and documents such as reports, meeting minutes, presentations, and the RAD-IT architecture database. Once completed, the draft report was shared with project stakeholders for their review and comments.

**Follow-Up Stakeholder Interviews:** Follow-up interviews were conducted with stakeholders as needed to resolve outstanding questions about ITS services and project deployments prior to finalizing the Austin Regional ITS Architecture and Deployment Plan.

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

## 2.2 RAD-IT Architecture

Regional Architecture Development for Intelligent Transportation (RAD-IT) Version 8.1 was used to develop the Austin Regional ITS Architecture. Formerly referred to as Turbo Architecture, RAD-IT is a software application that was developed by the United States Department of Transportation (USDOT) to be used as a tool for documenting and maintaining ITS architectures. Version 8.1 of RAD-IT was released in April 2018 and was developed to support Version 8.1 of the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT), the National ITS Architecture framework. The Systems Engineering Tool for Intelligent Transportation (SET-IT) Version 8.1 was used to generate service package diagrams for this Regional ITS Architecture and could be used in greater detail by Austin Region agencies to develop project architectures for ITS deployments, pilots, and test beds. Both FHWA and FTA recommend using RAD-IT and SET-IT software in development of regional ITS architectures.

In the Austin Region, the RAD-IT architecture database for the Regional ITS Architecture was based on the ITS service packages, which are provided in the online interactive RAD-IT database at [www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com). The ITS service packages provide a graphical representation of the services that stakeholders in the Region would like ITS to provide. Each service package shows relevant ITS elements, such as a TMC or a CCTV camera, and the data that is shared between them. RAD-IT allows the Region to document all of the elements and data flows that exist or are planned in the Region. SET-IT allows the user to quickly access any standards that are associated with the data flows and to generate reports and diagrams that assist in reviewing the data. Some examples of the useful reports and diagrams that may be generated using RAD-IT and SET-IT software are included in **Table 2**.

RAD-IT saves data in Microsoft Access compatible data files. RAD-IT files can be accessed using Microsoft Access, although use of Access will not provide the same amount of capabilities as accessing the files using the RAD-IT software. With the release of Version 4.1 of Turbo Architecture (the software package that preceded RAD-IT and SET-IT), the USDOT began offering the Turbo Architecture software free of charge and provided a link for downloading the software on the National ITS Architecture website. RAD-IT and SET-IT were also offered free of charge and were available for download from the ARC-IT website. At the time this report was written, that site was located at [www.arc-it.net](http://www.arc-it.net) and Version 8.1.67 was the most recent version available.

**Table 2 – RAD-IT and SET-IT Reports and Diagrams**

Report or Diagram Name	Functions
<b><i>RAD-IT</i></b>	
Stakeholder Summary	Provides a description of the stakeholder and the associated elements for each stakeholder in the Regional ITS Architecture.
Inventory Summary	Provides a description and status for each element in the Regional ITS Architecture.
Service Packages Summary	Identifies each of the service packages selected for the Region and the elements associated with each service package.
Interconnect Report	Identifies for each element all of the other elements that are connected and the status of each connection.
Standards Activities Report	Identifies relevant standards associated with each of the data flows used in the Regional ITS Architecture.
Subsystem Diagram	Identifies the subsystems from the National ITS Architecture that are included in the Regional ITS Architecture.
Interconnect Diagrams	Identifies for each element all of the other elements that are connected and the status of each connection. The Interconnect Diagrams can be customized to show all elements in the Regional ITS Architecture or a single element can be selected so that only the connections it has with other elements are shown. Interconnect Diagrams can also be viewed by individual service packages to view all of the elements and connections in each service package.
Context Diagrams	Context Diagrams show all of the data flows coming to and from a center (such as a Traffic Management Center), physical object, functional object, or a terminator (such as a vehicle). (Context diagrams can also be exported from SET-IT.)
Flow Diagrams	Flow Diagrams are similar to Interconnect Diagrams; however, the actual data flows that are part of each connection between elements are also shown.
Website	RAD-IT generates a customized regional architecture website with a hyperlinked database of stakeholders, ITS elements, data standards, and other elements of the architecture for reference.
<b><i>SET-IT</i></b>	
Enterprise Diagrams	Enterprise Diagrams show functional relationships between users of the transportation system.
Summary Physical Diagrams	Summary Physical Diagrams show data connections between centers (such as a Traffic Management Center), terminators (such as a TMC operator), and physical objects (such as a vehicle).
Context Diagrams	Context Diagrams show all of the data flows coming to and from a center (such as a Traffic Management Center), physical object, functional object, or a terminator (such as a vehicle). (Context diagrams can also be exported from RAD-IT.)
Communications Diagrams	Communications Diagrams are a graphical representation of data standards that apply to a given data flow.
Concept of Operations	SET-IT creates a Concept of Operations document by populating a standardized outline with SET-IT data. The document template is customizable.

### 3. REGIONAL ITS NEEDS

Regional needs that could be addressed by ITS were identified by stakeholders in the Stakeholder ITS Architecture workshop held in October 2018. Additionally, interviews with individual stakeholders were conducted prior to the Stakeholder ITS Architecture Workshops. The Capital Area Metropolitan Planning Organization's (CAMPO) 2040 Regional Transportation Plan (RTP) was also reviewed to determine other regional needs that could possibly be addressed in some way through ITS. CAMPO is currently updating their RTP, and the new plan will be referred to as the 2045 Regional Transportation Plan.

#### **CAMPO 2040 Regional Transportation Plan**

The CAMPO 2040 RTP outlines twelve (12) goals that correspond with the guidelines that were established under SAFETEA-LU, the federal transportation bill passed in 2005. Of the twelve goals, ITS can address five of them directly as described below:

**Safety and Security** – Network surveillance utilizing CCTV cameras and vehicle field sensors can provide a real-time view of conditions to improve incident detection times. Once detected, agencies can provide advanced warning of incidents or other potential safety issues that might impact travelers. Road service patrols such as the TxDOT Highway Emergency Response Operator (HERO) Program aid in making highways safer by assisting emergency responders, removing disabled vehicles from the roadway and shoulder, clearing debris from the roadway, and aiding motorists. ITS can also be used to monitor infrastructure, especially key components such as bridges and tunnels and monitor operations and riders on public transit vehicles and transit centers. Emergency alerts including missing children, missing elderly, or suspected criminals can be broadcast to the public.

**Mobility and Access** – ITS can support the movement and the regulation of commercial vehicles that carry essential goods to consumers in addition to hazardous materials. ITS can also benefit especially vulnerable road users such as pedestrians and bicyclists by alerting motor vehicles of their presence.

**Connectivity** – ITS in transit operations can improve the multimodal connections between transit vehicles and transit agencies. ITS can also assist transit users by providing accurate information for trip planning across multiple modes of transportation and providing travelers with real-time information about the status of each mode of their trip.

**Efficiency** – ITS provides freeways, arterials, and transit systems with the tools to better operate. ITS also allows transportation system managers to coordinate with one another and with other agencies, such as public safety, that play a critical role in operations.

**Air Quality and Energy** – ITS can be used to reduce the idle time of vehicles through coordinated signals and adaptive signal timing. As a result, these technologies help reduce energy consumption and air pollution.

The needs identified through the Regional ITS Architecture development process as well as the 2040 RTP help determine which ITS service packages should be included in the Regional ITS Architecture.

#### **Austin Regional ITS Needs**

Regional ITS needs were defined based on stakeholder input gathered through the Regional ITS Architecture workshop and interviews, as well as review of existing studies and reports in the Region such as the CAMPO 2040 RTP and the TxDOT Survey of ITS Service Areas discussed earlier in this section. The Austin regional ITS needs are presented in **Table 3**, organized by ITS service area.

**Table 3 – Regional ITS Needs**

ITS Need
<b><i>Traffic Management Service Area</i></b>
Improve communication and coordination between agencies (State-Local, Local-Local) for traffic operations and incident management
Implement additional strategies for active traffic management
<b><i>Traveler Information Service Area</i></b>
Improve the accuracy, timeliness, and availability of regional travel information
Collect and make available additional travel time information along controlled access facilities and arterials
Implement Integrated Corridor Management (ICM) strategies
<b><i>Public Safety Service Area</i></b>
Improve emergency vehicle movements with traffic signal preemption
<b><i>Public Transportation Service Area</i></b>
Implement a regional or statewide transit fare payment system that could accommodate the transfer of passengers between modes and agencies
Optimize transit passenger travel times and establish coordination among transit agencies
Expand traffic signal priority for transit vehicles
<b><i>Weather Service Area</i></b>
Monitor roadway weather conditions to minimize the effects of adverse conditions on traffic
<b><i>Data Management Service Area</i></b>
Improve data sharing among agencies for both operational and planning initiatives
<b><i>Vehicle Safety Service Area</i></b>
Plan for and adapt to changes in vehicle safety technologies such as connected vehicles
<b><i>General ITS Needs</i></b>
Ensure that the Austin Region remains at the forefront of new technological advancements in transportation
Provide additional training to operators to ensure that deployments of ITS are fully utilized

## 4. REGIONAL ITS INVENTORY

The inventory and needs documented at the stakeholder interviews and workshop were the starting point for developing this ITS architecture update. These ITS systems and components were used to customize the National ITS Architecture and create the Regional ITS Architecture for the Austin Region.

When developing customized elements in the 2007 update, the Austin stakeholder group agreed to create individual traffic, maintenance, and emergency management elements for the following municipalities: City of Austin, City of Cedar Park, City of Georgetown, City of Round Rock, and City of San Marcos. With recent growth in the Region, the Austin stakeholder group determined that individual ITS elements should also be created for the City of Pflugerville and City of Leander as part of the 2018 update. These two cities are approaching the 50,000 population threshold to take over control of traffic signals within their city limits that are currently operated by TxDOT. The other smaller communities in the Region were documented as part of the municipal elements. This documentation allows the communities to be included in the Regional ITS Architecture, and therefore eligible to use federal funds for future ITS deployments, even if there are no specific plans for ITS implementation at this time. Similarly, of the eleven counties in the Austin Region only Hays, Travis, and Williamson Counties are identified with individual elements in the Regional ITS Architecture.

Individual customized elements were created for many of the other stakeholder agencies in the Region, including TxDOT, CTRMA, Capital Metro, CARTS, and CAMPO.

### 4.1 Stakeholders

Each element included in the Austin Regional ITS Architecture is associated with a stakeholder agency. A listing of stakeholders as identified in the Austin Regional ITS Architecture can be found in **Table 4** along with a description of the stakeholder. Rather than individually documenting each of the smaller municipalities in the Region, a single stakeholder was created for general; municipal agencies. This stakeholder entry represents the cities, towns, and counties not specifically called out in the architecture.

**Table 4 – Austin Stakeholder Descriptions**

Stakeholder	Stakeholder Description
Amtrak	Passenger rail services provider with stations in San Marcos, Austin, and Taylor.
Archive Data Users	Users (and their systems) of general archive data within the Region.
Army Corps of Engineers	The US Army Corps of Engineers is the regulatory agency responsible for reservoirs and waterways including Lake Georgetown and Lake Granger.
Austin/Travis County Office of Emergency Management	City of Austin/Travis County joint department that coordinates the citywide and countywide response to large-scale emergencies and disasters. This includes planning and activities for preparedness, response, and recovery phases of a disaster. The Austin/Travis County Emergency Operations Center (EOC) is part of the Office of Emergency Management.
Capital Area MPO	Metropolitan planning organization (MPO) for the Austin metropolitan area that currently includes Travis, Williamson, Hays, Bastrop, Burnet, and Caldwell Counties.
CapMetro	Capital Metropolitan Transportation Authority provides fixed-route and paratransit service in the City of Austin and several surrounding jurisdictions.
CARTS	Capital Area Rural Transportation System provides fixed-route, commuter route, and demand response transit in portions of Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Lee, Travis, and Williamson Counties.
Cellular Providers	Represents cellular service providers in the Austin Region.
City of Austin	Municipal government for the City of Austin. Includes both traffic and maintenance sections for the City as well as the Watershed department.
City of Austin and Travis County	Emergency medical services provider for Travis County, including the City of Austin.
City of Austin Aviation Department	City of Austin department responsible for the operation of Austin-Bergstrom International Airport.
City of Austin Fire Department	City of Austin department responsible for fire dispatch and response. Dispatched out of CTECC.
City of Austin Police Department	City of Austin department responsible for police dispatch. Dispatched out of CTECC.
City of Cedar Park	Municipal government for the City of Cedar Park. Includes both traffic and maintenance sections for the City.
City of Georgetown	Municipal government for the City of Georgetown. Includes both traffic and maintenance sections for the City.
City of Leander	Municipal government for the City of Leander. Includes both traffic and maintenance sections for the City.
City of Pflugerville	Municipal government for the City of Pflugerville. Includes both traffic and maintenance sections for the City.
City of Round Rock	Municipal government for the City of Round Rock. Includes both traffic and maintenance sections for the City.
City of Round Rock Public Safety	City of Round Rock department responsible for police and fire dispatch as well as operating the Round Rock EOC.
City of San Marcos	Municipal government for the City of San Marcos. Includes both traffic and maintenance sections for the City.



**Table 4 – Austin Stakeholder Descriptions (Continued)**

Stakeholder	Stakeholder Description
Commercial Information Provider	Private provider of regional transportation information, usually on a subscription basis.
Commercial Vehicle Fleet Operations	Private commercial vehicle operations that operate within the Region.
County Departments	County government departments such as road and bridge.
County Emergency Management Agencies	Agencies that coordinate their county's response to large-scale emergencies and disasters. This includes planning and activities for preparedness, response, and recovery phases of a disaster.
County Public Safety	County public safety dispatch and emergency response. Dispatch includes County Sheriff and any other county public safety services such as emergency medical services (EMS). In many counties responsibilities also include dispatch of Department of Public Safety troopers.
CTRMA	The Central Texas Regional Mobility Authority is responsible for the construction, maintenance and operation of several toll roads in the Region (i.e. US 183A).
Department of Public Safety	State public safety agency whose responsibilities include issuing AMBER Alerts.
Financial Institution	Banks involved in the transfer of funds for fare collection as well as for other fee-based transportation services.
Hays County	Represents the county offices and stakeholders of Hays County.
Independent School Districts	Public school districts within the Region. The districts have been included primarily for their role in emergency evacuations where school buses are utilized.
Intercity Carriers	Private bus carriers that carry passengers to/from intercity terminals (e.g. Greyhound).
Local Media	Includes both print (newspaper) and broadcast (TV, radio) news media.
Lower Colorado River Authority	Manages the water supply of the lower Colorado River basin. LCRA generates electricity, operates the Mansfield Dam, the dam on Lake Buchanan as well as several smaller dams in the Region.
Municipalities	Municipalities located within the Region that are not specifically called out by the ITS architecture (i.e. Fredericksburg, Marble Falls, and Burnet). In some instances, this also includes counties not specifically called out.
NOAA	National Oceanic and Atmospheric Administration (includes the National Weather Service).
Other Regional Communications Providers	Intended to be a placeholder for other regional communications providers that operate on either 800 MHz or 900 MHz.
Other Transit Management Agencies	Includes regional transit agencies in the State of Texas including Corpus Christi, Dallas, Fort Worth, Houston, and San Antonio.
Private Concierge Service Provider	Private company who provides mayday support to vehicles through a subscription service.
Private Information Provider	Private sector business responsible for the gathering and distribution of traveler information. This service is typically provided on a subscription basis.
Private Rail Operations	Companies that operate freight rail within the Region.
Private Tow/Wrecker Providers	Private companies that provide tow or wrecker services for the Region.
Private Transportation Providers	Private transportation service providers such as taxis, shuttle services, and the Texas State University bus system that operates within the Region.

**Table 4 – Austin Stakeholder Descriptions (Continued)**

Stakeholder	Stakeholder Description
Private Travelers	Traveling public accessing various modes of transportation, including surface streets, air, rail/transit, and non-motorized.
Public/Private Ambulance Providers	EMS providers located within the Region.
Radio Network Users	All current and future users of the radio network. This includes TMCs, maintenance dispatch and vehicles, emergency dispatches and vehicles, transit management/dispatch and vehicles, toll facilities, and multi-modal transportation service providers. The vision for the radio system is that in the future all members of these service groups will have interoperable voice and data radio systems to facilitate a coordinated response during an incident.
Regional Event Promoter	Group that promotes events within the Region, such as a Chamber of Commerce or Visitor's Bureau.
Regional Medical Centers	Hospital/trauma centers in the Region.
Regional Utility Companies	Utility companies that operate in the Region.
Rural Fire Departments	Rural fire departments that operate using paid, volunteer, or a combination of paid and volunteer staff. These departments are usually dispatched by the County Sheriff or other area public safety answering point (PSAP).
Service Agencies	State and Federal agencies who subsidize the funding of paratransit and other demand response transit providers.
Statewide Toll Authorities	Own and operate the statewide HUB system for toll collection and reconciliation.
TCEQ – Texas Commission on Environmental Quality	The Texas Commission on Environmental Quality that is responsible for measuring and evaluating the emissions data for cities within the state of Texas.
Texas DEM	The Texas Department of Emergency Management is a division of the Texas Department of Public Safety responsible for the response to large-scale emergencies and disasters.
Travis County Public Safety	Public safety and emergency response agencies for Travis County. Includes the Travis County Sheriff and Austin/Travis County EMS.
Travis County Transportation and Natural Resources Department	Department responsible for the construction and maintenance of county roads in Travis County.
TxDMV	Texas Department of Motor Vehicles. Responsible for the titling, registration, and licensing of all vehicles in the state and issuing permits for commercial vehicles to operate.
TxDOT	Texas Department of Transportation. Responsible for the maintenance and construction of interstates, state routes, and other state roadway facilities in Texas. This general TxDOT stakeholder includes all elements not part of the TxDOT Austin District.
TxDOT Austin District	Austin District of TxDOT. Includes traffic, maintenance, and planning and programming. The District includes Mason, Gillespie, Llano, Burnet, Blanco, Hays, Travis, Williamson, Caldwell, Bastrop, and Lee Counties.
TxDOT TOD	The TxDOT Toll Operations Division that is responsible for the construction, maintenance and operations of toll facilities in the region not managed by CTRMA.
TxDOT Travel Division	Represents the Travel Division for TxDOT.
University of Texas	The University of Texas (UT) at Austin. Includes all departments of the University, including the UT events department and the UT Police Department.

**Table 4 – Austin Stakeholder Descriptions (Continued)**

Stakeholder	Stakeholder Description
USGS	The US Geological Survey collects and analyzes environmental data in the region including water level data.
Williamson County Public Safety	Public safety and emergency response agencies for Williamson County. Includes the Williamson County Sheriff and Williamson County EMS.
Williamson County Road Department	Department responsible for the construction and maintenance of county roads in Williamson County.

## 4.2 ITS Elements

The ITS inventory is documented in the Regional ITS Architecture as elements. **Table 5** sorts the inventory by stakeholder so that each stakeholder can easily identify and review all of the architecture elements associated with their agency. The table includes a description of the element and the status of the element, which is indicated as either existing or planned. In many cases, an element classified as existing might still need to be enhanced to attain the service level desired by the Region.

**Table 5 – Austin Inventory of ITS Elements**

Stakeholder	Element Name	Element Description	Status
Amtrak	Amtrak Dispatch	The dispatch function for Amtrak.	Existing
Archive Data Users	Archive Data Users	Any user of archive data products from any Regional archive management system. This may include individual users, computer applications, or modeling systems utilizing the archived data.	Existing
Army Corps of Engineers	Army Corps of Engineers Flood Detectors	Flood monitoring equipment owned and operated by the Army Corps of Engineers. Used to determine water elevations of rivers, causeways, etc. and report it back to local agencies (traffic, transit, emergency management, maintenance, etc.).	Existing
	Army Corps of Engineers Flood Monitoring Center	Represents the control center for the Army Corps of Engineers where flood monitoring equipment sends data to.	Existing
Austin/Travis County Office of Emergency Management	Austin/Travis County EOC (CTECC)	The emergency operations center (EOC) for the City of Austin and Travis County that is located in the CTECC building in Austin.	Existing
Capital Area MPO	Capital Area MPO Archive	Archive management system for the Metropolitan Planning Organization for the City of Austin and surrounding areas.	Planned
CapMetro	CapMetro Barrier System	Barrier system used to close parking lots when at capacity, as well as at exit points for payment collection.	Planned
	CapMetro Electric Vehicle Charging Station	Provides access to electric vehicle supply equipment that is used to charge hybrid and all-electric vehicles. This includes public charging stations that support consumers, workplace charging stations, and fleet charging stations.	Planned
	CapMetro Fixed-Route Operations Center	Dispatches all fixed-route transit vehicles for CapMetro. Includes fixed-route service to the University of Texas.	Existing
	CapMetro Fixed-Route Vehicles	Fixed-route vehicles owned and operated by CapMetro including MetroBus, MetroExpress, MetroFlyer, and UT Shuttles.	Existing
	CapMetro Freight and Passenger Rail Operations Center	The operations center for freight and passenger rail track owned and managed by CapMetro.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
CapMetro (continued)	CapMetro Lessee Freight Cars	Freight rail vehicles operating on CapMetro’s track.	Existing
	CapMetro Maintenance Garages	The maintenance and equipment repair facilities for CapMetro.	Existing
	CapMetro MetroAccess Paratransit Operations Center	Dispatches all MetroAccess vehicles for CapMetro.	Existing
	CapMetro MetroAccess Paratransit Vehicles	Demand response vehicles owned and operated by CapMetro.	Existing
	CapMetro MetroRail Passenger Rail Vehicles	Passenger rail vehicles owned and operated by CapMetro.	Existing
	CapMetro MetroRapid BRT Operations Center	Dispatches all MetroRapid Bus Rapid Transit (BRT) vehicles for CapMetro.	Existing
	CapMetro MetroRapid BRT Vehicles	Bus Rapid Transit (BRT) vehicles owned and operated by CapMetro.	Existing
	CapMetro Mobile App	Mobile phone ticketing application used for transit fares and also provides trip planning and real-time arrival information.	Existing
	CapMetro Multimodal Stations	Multimodal stations for CapMetro that may include any combination of park and ride lots, bike shelters and service from any of the following: MetroAccess, MetroBus, MetroExpress, MetroFlyer, MetroRail, and MetroRapid.	Existing
	CapMetro Parking Facility Equipment	Parking equipment owned by CapMetro that monitors parking lots, determines the availability of parking spaces, closes a barrier system when the lot is full, and opens a barrier system after a customer has paid for their parking fee.	Planned
	CapMetro Passenger Information Display System	Dynamic message signs (DMS) owned and operated by CapMetro. Located at MetroRail stations and MetroRapid BRT stations.	Existing
	CapMetro Passes	Fare cards used for transit service on CapMetro vehicles.	Existing
	CapMetro Security Monitoring Field Equipment	Secure area monitoring devices owned and operated by CapMetro. Includes monitoring systems on buses, park and ride lots, or at transit terminals (including commuter rail).	Existing
CapMetro Ticket Vending Machine	Transit fare kiosks owned and operated by CapMetro located at MetroRail stations that sell CapMetro Passes.	Existing	
CapMetro Wayside Equipment	Wayside equipment owned and operated by CapMetro to support their freight and passenger rail operations.	Existing	

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
CapMetro (continued)	CapMetro Website	The website for CapMetro where fare and schedule information may be found and CapMetro Passes can be purchased.	Existing
	Regional Fare Card	A single electronic card that would be used primarily for transit fares throughout the state. Additional uses could include payment for parking and tolls.	Planned
	Transit Operations Personnel	CapMetro personnel that are responsible for various roles including passenger counting.	Existing
CARTS	CARTS Barrier System	Barrier system used to close parking lots when at capacity, as well as at exit points for payment collection.	Existing
	CARTS Demand Response Vehicles	Demand response vehicles owned and operated by the Capital Area Rural Transportation System (CARTS).	Existing
	CARTS Electric Vehicle Charging Station	Provides access to electric vehicle supply equipment that is used to charge hybrid and all-electric vehicles. This includes public charging stations that support consumers, workplace charging stations, and fleet charging stations.	Planned
	CARTS Fare Card	A pre-paid rechargeable card that can be purchased online and used on certain CART routes.	Existing
	CARTS Fixed-Route Vehicles	Fixed-route vehicles owned and operated by CARTS.	Existing
	CARTS Maintenance Garage	The equipment maintenance garage for CARTS that performs the maintenance of all CART vehicles.	Existing
	CARTS Parking Facility Equipment	Parking equipment owned by CARTS that monitors parking lots, determines the availability of parking spaces, and closes a barrier system when the lot is full (and prior to paying for an exit).	Planned
	CARTS Passenger Information Display System	Dynamic message signs (DMS) owned and operated by CARTS.	Existing
	CARTS Security Monitoring Field Equipment	Secure area monitoring devices owned and operated by CARTS. Includes monitoring systems on buses, at bus stops, and at bus terminals.	Existing
	CARTS Transit Kiosks	Transit kiosks owned and operated by CARTS.	Existing
	CARTS Transit Operations Center	The transit dispatch function for CARTS. Dispatches all fixed-route vehicles and demand response vehicles.	Existing
CARTS Website	The website for CARTS where fare and schedule information may be found. In the future you may be able to request and pay for a demand response transit trip. Includes interactive voice response services.	Existing	

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
Cellular Providers	Cellular Communications Device Systems	The radio or voice communications network that is owned and operated by Cellular companies. Radio and voice networks used to transfer voice and data communications between agencies.	Existing
City of Austin	City of Austin Air Quality Division	The emissions management division for the City of Austin.	Existing
	City of Austin Asset Management System	This element represents a place-holder element for an asset management system for the City of Austin (e.g. bridge restrictions, pavement management, etc.).	Planned
	City of Austin Bicycle Detection App	Mobile phone application that allows cyclists to be detected by a traffic signal as they approach it.	Existing
	City of Austin CCTV Cameras	Closed circuit television (CCTV) cameras owned and operated by the City of Austin.	Existing
	City of Austin Changeable Speed Limit Signs	City of Austin roadway equipment used to lower speed limits on the roadway.	Planned
	City of Austin Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	City of Austin Convention and Visitors Bureau	The City of Austin department of tourism responsible for attracting various travelers, conventions, etc. to the City of Austin.	Existing
	City of Austin DMS	Dynamic message signs (DMS) owned and operated by the City of Austin.	Existing
	City of Austin Dynamic Lane Assignment Signals	Dynamic signals used to change lane configuration.	Existing
	City of Austin Electric Vehicle Charging Station	Provides access to electric vehicle supply equipment that is used to charge hybrid and all-electric vehicles. This includes public charging stations that support consumers, workplace charging stations, and fleet charging stations.	Planned
	City of Austin Emissions Monitoring Field Equipment	Emissions monitoring field equipment owned and operated by the City of Austin.	Existing
	City of Austin Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Existing
City of Austin Fleet Services	The maintenance shop for all roadside equipment owned and operated by the City of Austin. Also provides maintenance to City of Austin vehicles.	Existing	

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Austin (continued)	City of Austin Flood Closure Gates	Modified railroad closure gates operated by the City of Austin that are intended to keep traffic from flooded areas/roadways.	Existing
	City of Austin Flood Detectors	Flood warning systems for the City of Austin that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions and may be interconnected with other roadway equipment such as DMS to alert motorists.	Existing
	City of Austin Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Existing
	City of Austin In-Vehicle Parking Meters	Portable device that allows for the payment of on-street parking through the City of Austin Website without the use of on-street parking meters.	Existing
	City of Austin Parking Enterprise	City of Austin office that manages on-street parking and regulates private transportation service providers.	Existing
	City of Austin Parking Meters	On-street parking meters in the City of Austin that are managed by the City of Austin Parking Enterprise.	Existing
	City of Austin Pavement Management System	The City of Austin's Pavement Management System that assists in storing, retrieving, analyzing and reporting information to help with pavement-related decision-making processes.	Existing
	City of Austin Pedestrian Hybrid Beacons	A beacon that grants right of way to crossing pedestrians at a marked crosswalk.	Existing
	City of Austin Permit Issuing Department	Issues permits for parades, demonstrations, marathons, etc.	Planned
	City of Austin Permitting System	The City of Austin's commercial vehicle permitting system for hazardous materials (HAZMAT) and oversize/overweight permits.	Existing
	City of Austin Public Information Office	The office provides the official interface between the City of Austin traffic and maintenance departments and interests outside the departments such as the media.	Existing
	City of Austin Public Works Dispatch	The maintenance and construction division for the City of Austin. Operates as the dispatch function for the City of Austin maintenance and construction vehicles.	Existing
	City of Austin Public Works Vehicles	Maintenance and construction vehicles for the City of Austin.	Existing



**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Austin (continued)	City of Austin Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Existing
	City of Austin RWIS	Road weather information systems (RWIS) that are owned and operated by the City of Austin.	Planned
	City of Austin School Programmable Flasher System	School zone warning system installed in the City of Austin school zones to warn drivers. System includes pagers, flashers and DMS installed at flasher locations. Pagers are used to download/upload messages to the DMS and to activate/deactivate the flashers.	Existing
	City of Austin Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Austin TMC	The traffic management center (TMC) located in Austin that controls the traffic signal systems and other field equipment owned by the City of Austin.	Existing
	City of Austin Traffic Database	The archive data management system for traffic operations and traffic information for the City of Austin.	Planned
	City of Austin Traffic Signals	Traffic signal systems owned and operated by the City of Austin.	Existing
	City of Austin Variable LED Streetlights	Streetlights that control lighting for transportation facilities and infrastructure.	Planned
	City of Austin Watershed Protection	Department within the City of Austin that is responsible for monitoring floods within the City and getting the information out to other agencies as well as the traveling public.	Existing
	City of Austin Website	Transportation information web page for the City of Austin. Currently offers information on on-street parking availability. In the future will include real-time construction, work zone, special event, incident, and traffic information.	Existing
City of Austin and Travis County	City of Austin/Travis County 911 Dispatch Center (CTECC)	The 911 public safety answering point (PSAP) for the City of Austin. Also dispatches emergency medical services (EMS) and County Sheriff for all of Travis County. Collocated with the TxDOT Austin District TMC – Combined Transportation and Emergency Communications Center (CTECC).	Existing
	City of Austin/Travis County Radio Systems	The radio communications network that is owned and operated by Travis County. Radio networks used to transfer voice and data communications between agencies.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Austin Aviation Department	ABIA (Airport) Police Dispatch	Police dispatch for the airport grounds at Austin Bergstrom International Airport (ABIA).	Existing
	ABIA (Airport) Police Vehicles	Police vehicles owned and operated by ABIA. Includes MDTs in police cruisers.	Existing
	Austin Bergstrom International Airport	The international airport that serves the Austin area.	Existing
City of Austin Fire Department	City of Austin Fire/EMS Vehicles	Fire vehicles owned and operated by the City of Austin. ITS technologies on-board fire vehicles include MDTs, AVL, signal pre-emption devices, etc. Also includes HAZMAT vehicles dispatched within the City limits.	Existing
City of Austin Police Department	City of Austin Crash Records Database	Crash or incident records database collected by the City of Austin.	Existing
	City of Austin Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Austin Police Vehicles	Police vehicles owned and operated by the City of Austin. ITS technologies on-board cruisers include MDTs, AVL, etc.	Existing
City of Cedar Park	City of Cedar Park CCTV Cameras	Closed circuit television (CCTV) cameras owned and operated by the City of Cedar Park.	Existing
	City of Cedar Park Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	City of Cedar Park DMS	Dynamic message signs (DMS) owned and operated by the City of Cedar Park.	Planned
	City of Cedar Park Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Existing
	City of Cedar Park Fire/EMS Vehicles	City of Cedar Park Fire Department and Emergency Medical Services vehicles.	Existing
	City of Cedar Park Flood Closure Gates	Gates operated by the City of Cedar Park that are intended to keep traffic from flooded areas/roadways.	Planned

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Cedar Park (continued)	City of Cedar Park Flood Detectors	Flood warning systems for the City of Cedar Park that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions and may be interconnected with other roadway equipment such as warning beacons to alert motorists.	Planned
	City of Cedar Park Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Planned
	City of Cedar Park Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Cedar Park Police Vehicles	City of Cedar Park Police Department vehicles.	Existing
	City of Cedar Park Public Information Office	The office provides the official interface between the City of Cedar Park traffic and maintenance departments and interests outside the departments such as the media.	Existing
	City of Cedar Park Public Works Dispatch	The maintenance and construction division for the City of Cedar Park. Operates as the dispatch function for the City of Cedar Park maintenance and construction vehicles.	Existing
	City of Cedar Park Public Works Vehicles	Maintenance and construction vehicles for the City of Cedar Park.	Existing
	City of Cedar Park Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Existing
	City of Cedar Park RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	City of Cedar Park School Programmable Flasher Systems	School zone warning system installed in the City of Cedar Park school zones to warn drivers. System includes pagers, flashers and DMS installed at flasher locations. Pagers are used to download/upload messages to the DMS and to activate/deactivate the flashers	Existing
	City of Cedar Park Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Cedar Park TMC	The Traffic Management Center (TMC) located in Cedar Park that controls the traffic signal systems and other field equipment owned by the City of Cedar Park.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Cedar Park (continued)	City of Cedar Park Traffic Signals	Traffic signal systems owned and operated by the City of Cedar Park.	Existing
	City of Cedar Park Website	Website for the City of Cedar Park. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
	City of Cedar Park CCTV Cameras	Closed circuit television (CCTV) cameras owned and operated by the City of Cedar Park.	Existing
	City of Cedar Park DMS	Dynamic message signs (DMS) owned and operated by the City of Cedar Park.	Planned
	City of Cedar Park Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Existing
	City of Cedar Park Flood Closure Gates	Gates operated by the City of Cedar Park that are intended to keep traffic from flooded areas/roadways.	Planned
	City of Cedar Park Flood Detectors	Flood warning systems for the City of Cedar Park that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions and may be interconnected with other roadway equipment such as warning beacons to alert motorists.	Planned
	City of Cedar Park Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Planned
	City of Cedar Park Public Information Office	The office provides the official interface between the City of Cedar Park traffic and maintenance departments and interests outside the departments such as the media.	Existing
	City of Cedar Park Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Existing
City of Cedar Park School Programmable Flasher Systems	School zone warning system installed in the City of Cedar Park school zones to warn drivers. System includes pagers, flashers and DMS installed at flasher locations. Pagers are used to download/upload messages to the DMS and to activate/deactivate the flashers	Existing	

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Cedar Park (continued)	City of Cedar Park TMC	The Traffic Management Center (TMC) located in Cedar Park that controls the traffic signal systems and other field equipment owned by the City of Cedar Park.	Existing
	City of Cedar Park Traffic Signals	Traffic signal systems owned and operated by the City of Cedar Park.	Existing
City of Georgetown	City of Georgetown CCTV Cameras	Closed circuit television (CCTV) cameras owned and operated by the City of Georgetown.	Planned
	City of Georgetown Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	City of Georgetown DMS	Dynamic message signs (DMS) owned and operated by the City of Georgetown.	Planned
	City of Georgetown Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Existing
	City of Georgetown Flood Closure Gates	Gates operated by the City of Georgetown that are intended to keep traffic from flooded areas/roadways.	Planned
	City of Georgetown Flood Detectors	Flood warning systems for the City of Georgetown that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions, and may be interconnected with other roadway equipment such as beacons to alert motorists that the roadway is flooded ahead.	Existing
	City of Georgetown Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Planned
	City of Georgetown Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Georgetown Police Vehicles	City of Georgetown Police Department vehicles.	Existing
	City of Georgetown Public Information Office	The office provides the official interface between the City of Georgetown traffic and maintenance departments and interests outside the departments such as the media.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Georgetown (continued)	City of Georgetown Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Georgetown RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	City of Georgetown School Programmable Flasher Systems	School Zone warning system installed in the City of Georgetown school zones to warn drivers. System includes pagers, flashers and DMS installed at flasher locations. Pagers are used to download/upload messages to the DMS and to activate/deactivate the flashers.	Existing
	City of Georgetown Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Georgetown TOC	The TOC located in Georgetown that controls the traffic signal systems and other field equipment owned by the City of Georgetown.	Planned
	City of Georgetown Traffic Signals	Traffic signal systems owned and operated by the City of Georgetown.	Existing
	City of Georgetown Website	Website for the City of Georgetown. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
City of Leander	City of Leander CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Leander Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	City of Leander DMS	Dynamic message signs for traffic information dissemination.	Planned
	City of Leander Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems (VIVDS), remote traffic microwave sensors (RTMS), or traditional loops. Also includes sensors to detect train lengths and speeds to estimate the anticipated duration of closures.	Planned

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Leander (continued)	City of Leander Fire/EMS Vehicles	City of Leander Fire Department and Emergency Medical Services vehicles.	Existing
	City of Leander Flood Closure Gates	Gates operated by the City of Round Rock that are intended to keep traffic from flooded areas/roadways.	Planned
	City of Leander Flood Detectors	Flood warning systems for the City of Leander that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions and may be interconnected with other roadway equipment such as warning beacons to alert motorists.	Existing
	City of Leander Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Planned
	City of Leander Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Leander Police Vehicles	City of Leander Police Department vehicles.	Planned
	City of Leander Public Information Office	The office provides the official interface between the City of Leander traffic and maintenance departments and interests outside the departments such as the media.	Planned
	City of Leander Public Works Dispatch	The maintenance and construction division for the City of Leander. Operates as the dispatch function for the City of Leander maintenance and construction vehicles.	Existing
	City of Leander Public Works Vehicles	Maintenance and construction vehicles for the City of Leander.	Existing
	City of Leander Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Leander RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	City of Leander School Programmable Flasher Systems	School Zone warning system installed in the City of Leander school zones to warn drivers. System includes pagers, flashers and DMSs installed at flasher locations. Pagers are used to download/upload messages to the DMSs and to activate/deactivate the flashers.	Planned

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Leander (continued)	City of Leander Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Leander TMC	The traffic management center located in Leander that controls the traffic signal systems and other field equipment owned by the City of Leander.	Planned
	City of Leander Traffic Signals	Traffic signal system operated by the City of Leander.	Existing
	City of Leander Website	Website for the City of Leander. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
City of Pflugerville	City of Pflugerville CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	City of Pflugerville Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	City of Pflugerville DMS	Dynamic message signs for traffic information dissemination.	Planned
	City of Pflugerville Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems (VIVDS), remote traffic microwave sensors (RTMS), or traditional loops. Also includes sensors to detect train lengths and speeds to estimate the anticipated duration of closures.	Planned
	City of Pflugerville Fire/EMS Vehicles	City of Pflugerville Fire Department and Emergency Medical Services vehicles.	Existing
	City of Pflugerville Flood Closure Gates	Gates operated by the City of Pflugerville that are intended to keep traffic from flooded areas/roadways.	Planned
	City of Pflugerville Flood Detectors	Flood warning systems for the City of Pflugerville that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions and may be interconnected with other roadway equipment such as warning beacons to alert motorists.	Existing
	City of Pflugerville Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Planned



**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Pflugerville (continued)	City of Pflugerville Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Pflugerville Police Vehicles	City of Pflugerville Police Department vehicles.	Planned
	City of Pflugerville Public Information Office	The office provides the official interface between the City of Pflugerville traffic and maintenance departments and interests outside the departments such as the media.	Planned
	City of Pflugerville Public Works Dispatch	The maintenance and construction division for the City of Pflugerville. Operates as the dispatch function for the City of Pflugerville maintenance and construction vehicles.	Existing
	City of Pflugerville Public Works Vehicles	Maintenance and construction vehicles for the City of Pflugerville.	Existing
	City of Pflugerville Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Pflugerville RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	City of Pflugerville School Programmable Flasher Systems	School Zone warning system installed in the City of Pflugerville school zones to warn drivers. System includes pagers, flashers and DMSs installed at flasher locations. Pagers are used to download/upload messages to the DMSs and to activate/deactivate the flashers.	Planned
	City of Pflugerville Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Pflugerville TMC	The traffic management center located in Pflugerville that controls the traffic signal systems and other field equipment owned by the City of Pflugerville.	Planned
	City of Pflugerville Traffic Signals	Traffic signal system operated by the City of Pflugerville.	Planned
	City of Pflugerville Website	Website for the City of Pflugerville. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Planned

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Round Rock	City of Round Rock CCTV Cameras	Closed circuit television (CCTV) cameras that are owned and operated by the City of Round Rock.	Existing
	City of Round Rock Communications Division	The office provides the official interface between the City of Round Rock traffic and maintenance departments and interests outside the departments such as the media.	Existing
	City of Round Rock Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	City of Round Rock Convention and Visitors Bureau	The City of Round Rock department of tourism responsible for attracting various travelers, conventions, etc. to the City of Round Rock.	Existing
	City of Round Rock DMS	Dynamic message signs (DMS) owned and operated by the City of Round Rock.	Planned
	City of Round Rock Equipment Repair Facility	The maintenance shop for all roadside equipment owned and operated by the City of Round Rock. Also provides maintenance to City of Round Rock vehicles.	Existing
	City of Round Rock Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Existing
	City of Round Rock Flood Closure Gates	Gates operated by the City of Round Rock that are intended to keep traffic from flooded areas/roadways.	Existing
	City of Round Rock Flood Detectors	Flood warning systems for the City of Round Rock that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions, and may be interconnected with other roadway equipment such as beacons to alert motorists that the roadway is flooded ahead.	Existing
	City of Round Rock Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Planned
City of Round Rock Office of Emergency Management	Office responsible for emergency preparedness and coordination. Also monitors low water crossings in the City of Round Rock.	Existing	

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Round Rock (continued)	City of Round Rock Pavement Management System	The City of Round Rock's Pavement Management System that assists in storing, retrieving, analyzing and reporting information to help with pavement-related decision-making processes.	Existing
	City of Round Rock Permitting System	The City of Round Rock's commercial vehicle permitting system for HAZMAT and oversize/overweight permits.	Existing
	City of Round Rock Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of Round Rock Portable DMS	Portable dynamic message signs (DMS) owned and operated by the City of Round Rock.	Planned
	City of Round Rock Public Works Dispatch	The maintenance and construction division for the City of Round Rock. Operates as the dispatch function for the City of Round Rock's maintenance and construction vehicles.	Existing
	City of Round Rock Public Works Vehicles	Maintenance and construction vehicles for the City of Round Rock.	Existing
	City of Round Rock Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of Round Rock Rectangular Rapid Flash Beacons	High intensity LEDs that enhance a warning sign to alert motorist of potential conflicts within the roadway, particularly cyclist and pedestrians.	Existing
	City of Round Rock RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	City of Round Rock School Programmable Flasher Systems	School Zone warning system installed in the City of Round Rock school zones to warn drivers. System includes pagers, flashers and DMS installed at flasher locations. Pagers are used to download/upload messages to the DMS and to activate/deactivate the flashers.	Planned
	City of Round Rock Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of Round Rock TMC	The TMC located in Round Rock that controls the traffic signal systems and other field equipment owned by the City of Round Rock.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of Round Rock (continued)	City of Round Rock Traffic Signals	Traffic signal systems owned and operated by the City of Round Rock.	Existing
	City of Round Rock Website	Transportation information website for the City of Round Rock. In the future will include real-time construction, work zone, special event, incident, and traffic information.	Existing
City of Round Rock Public Safety	City of Round Rock Communications Center	Local PSAP for the City of Round Rock.	Existing
	City of Round Rock Crash Records Database	Crash or incident records database collected by the City of Round Rock.	Existing
	City of Round Rock EOC	The emergency operations center for the City of Round Rock that is activated in the event of a natural or man-made disaster, or anytime a major threat is determined to exist.	Existing
	City of Round Rock Fire/EMS Vehicles	Fire vehicles owned and operated by the City of Round Rock. ITS technologies on-board fire vehicles include MDTs, AVL, signal preemption devices, etc.	Existing
	City of Round Rock Police Vehicles	Police vehicles owned and operated by the City of Round Rock. ITS technologies on-board cruisers include MDTs, AVL, etc.	Existing
City of San Marcos	City of San Marcos CCTV Cameras	CCTV cameras owned and operated by the City of San Marcos.	Existing
	City of San Marcos Communications Office	The office provides the official interface between the City of San Marcos traffic and maintenance departments and interests outside the departments such as the media.	Existing
	City of San Marcos Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	City of San Marcos DMS	Dynamic message signs (DMS) owned and operated by the City of San Marcos.	Planned
	City of San Marcos Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems, remote traffic microwave sensors, or traditional loops.	Existing
	City of San Marcos Fire/EMS Vehicles	City of San Marcos Fire Department and Emergency Medical Services vehicles.	Planned

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of San Marcos (continued)	City of San Marcos Flood Closure Gates	Gates operated by the City of San Marcos that are intended to keep traffic from flooded areas/roadways.	Planned
	City of San Marcos Flood Detectors	Flood warning systems for the City of San Marcos that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions, and may be interconnected with other roadway equipment such as beacons to alert motorists.	Planned
	City of San Marcos Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Planned
	City of San Marcos Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Existing
	City of San Marcos Police Vehicles	City of San Marcos Police Department vehicles.	Existing
	City of San Marcos Rail Notification System	Roadway equipment used to alert motorists that a crossing is currently blocked by a train.	Planned
	City of San Marcos Rectangular Rapid Flash Beacons	High intensity LEDs that enhance a warning sign to alert motorist of potential conflicts within the roadway, particularly cyclist and pedestrians.	Existing
	City of San Marcos RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	City of San Marcos School Programmable Flasher Systems	School Zone warning system installed in the City of San Marcos school zones to warn drivers. System includes pagers, flashers and DMS installed at flasher locations. Pagers are used to download/upload messages to the DMS and to activate/deactivate the flashers.	Existing
	City of San Marcos Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	City of San Marcos TOC	A virtual traffic management center that controls the traffic signal systems and other field equipment owned by the City of San Marcos.	Existing
	City of San Marcos Traffic Signals	Traffic signal systems owned and operated by the City of San Marcos.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
City of San Marcos (continued)	City of San Marcos Website	Website for the City of San Marcos. Includes information on City departments and in the future it is envisioned that the website may have real-time information about roadway conditions, including traffic images.	Existing
Commercial Information Provider	Private Sector Traveler Information Services	Private traveler information providers serving the region. This element could, in the future, provide support to the National Traveler Information 511 number since it collects information from a broad array of operating centers. Could also include a website.	Existing
Commercial Vehicle Fleet Operations	Commercial Vehicles	Privately owned commercial vehicles that travel throughout the Region. Included in the architecture to cover HAZMAT incident reporting.	Existing
	Private Fleet Management Systems	Includes private commercial fleet management operations in the Region.	Existing
County Departments	County Asset Management System	This element represents a place-holder element for an asset management system for the counties within the Region (e.g. bridge restrictions, pavement management, etc.).	Planned
	County Equipment Repair Garage	The maintenance shop for all roadside equipment owned and operated by the counties within the Region.	Existing
	County ITS Field Equipment	Represents ITS field equipment owned and operated by the counties not expressly called out in this Architecture, but that are within the Region. Includes CCTV cameras, portable DMS traffic sensors, traffic signals, etc.	Existing
	County Maintenance and Construction Operations Dispatch	The maintenance and construction division for the unnamed Counties within the Region. Operates as the dispatch function for and County's maintenance and construction vehicles.	Existing
	County Maintenance and Construction Vehicles	Maintenance and construction vehicles for the unnamed Counties within the Region.	Planned
County Emergency Management Agencies	Austin Region Incident and Mutual Aid Network	The regional incident and mutual aid network where all emergency management providers can share or gather information regarding an incident.	Planned
	County EOC	County EOCs, which represents the EOCs in each of the counties in the Region.	Planned

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
County Public Safety	County Public Safety Dispatch and PSAP	Dispatch center for sheriff, fire and EMS at the county level in the TxDOT Austin Region.	Existing
	County Public Safety Vehicles	County emergency vehicles including sheriff and EMS. Some preemption for EMS vehicles.	Existing
CTRMA	CTRMA CCTV Cameras	Closed circuit television (CCTV) cameras owned and operated by the Central Texas Regional Mobility Authority (CTRMA).	Existing
	CTRMA Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	CTRMA DMS	Dynamic message signs (DMS) owned and operated by CTRMA.	Existing
	CTRMA Field Sensors	Field sensors owned and operated by CTRMA.	Existing
	CTRMA Operations Center	The customer service center for the CTRMA. This represents the backend systems of the Toll Authority.	Existing
	CTRMA Ramp Metering Equipment	Roadway equipment used in the operation of a ramp metering system. Includes the signals and any other ITS equipment.	Planned
	CTRMA Ramp Queue Detection System	Vehicle detection system that monitors queues at exit ramps and can either warn drivers approaching the queue through DMS or warning beacons or the system can interact with the traffic signal system to clear the queue.	Planned
	CTRMA Toll Collection SmartHUB	A HUB device owned and operated by CTRMA that relays toll collection information to toll authorities throughout the Region.	Existing
	CTRMA Toll Plazas	Toll plazas owned and operated by CTRMA.	Existing
	CTRMA Toll Reconciliation Office	The CTRMA office that reconciles toll payments with the TxDOT Toll Operations Division (TOD). It is intended that TOD does the toll collection for the CTRMA. This office coordinates that collection through CTRMA toll plazas.	Existing
CTRMA Website	Website owned and operated by CTRMA. Contains toll information and vehicle tag information posted in the website.	Existing	

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
Department of Public Safety	DPS and Other Public Safety Spectrum Systems	The radio communications network that is owned and operated by the Department of Public Safety (DPS) and other public safety providers. Spectrum system is used to transfer voice and data communications between agencies.	Existing
	DPS Communications	Dispatches Highway Patrol Vehicles using two-way radio communication. Responsible for regional evacuation coordination.	Existing
	DPS Emergency Vehicles	Highway Patrol vehicles that provide public safety services on state owned roads and highways.	Existing
	State Office of Emergency Management	State office that coordinates threat activities for the Texas Department of Public Safety (DPS).	Existing
	Statewide EOC	The statewide emergency operations center (EOC).	Existing
Financial Institution	Financial Institution	Represents the financial institutions the regional transit agencies will use as part of electronic fare payment systems. Includes Health Services through TxDOT.	Existing
Hays County	Hays County Flood Closure Gates	Gates operated by the City of Austin that are intended to keep traffic from flooded areas/roadways.	Planned
	Hays County Flood Detectors	Flood warning systems for Hays County that detect flood events at low water crossings (dips) throughout the county. System includes monitoring and alerting functions, and may be interconnected with other roadway equipment such as DMS to alert motorists that the roadway is flooded ahead.	Existing
	Hays County Flood Warning Beacons	Flashing beacons that are activated to warn motorists that water may be on a section of the roadway.	Existing
	Hays County Office of Emergency Management	The Hays County agency that is responsible for communications and coordination of local resources during a disaster or large scale incident or other hazards.	Existing
	Hays County Radio Systems	The radio communications network that is owned and operated by Hays County. Radio networks used to transfer voice and data communications between agencies.	Existing
Independent School Districts	Independent School District Buses	Buses owned and operated by the independent school districts. May come equipped with security measures.	Existing



**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
Independent School Districts (continued)	Independent School District Dispatch	Dispatch function for each of the independent school districts in the Region. Includes radio communication with school buses.	Existing
	Independent School District Police	A private police force that patrols and responds to incidents on independent school district buses.	Existing
Intercity Carriers	Intercity Buses	The buses owned and operated by the intercity bus companies.	Planned
	Intercity Carrier Dispatch	The dispatch function for intercity bus systems (e.g. Greyhound).	Planned
Local Media	Local Print and Broadcast Media	Local TV (including cable TV), radio, and newspapers.	Existing
Lower Colorado River Authority	LCRA Flood Monitoring Center	The regional office/control center that monitors flood detection devices and provides real-time flood information to regional transportation providers.	Existing
	LCRA Flood Monitoring Field Equipment	Flood monitoring field equipment owned and operated by the Lower Colorado River Authority (LCRA) at the dams in the Region.	Existing
	LCRA Radio Systems	The radio communications network that is owned and operated by the Lower Colorado River Authority (LCRA). Radio networks used to transfer voice and data communications between agencies.	Existing
Municipalities	Municipal Asset Management System	This element represents a place-holder element for an asset management system for the municipalities within the Region (e.g. bridge restrictions, pavement management, etc.).	Planned
	Municipal CCTV Cameras	Closed circuit television cameras for traffic surveillance and incident management.	Planned
	Municipal Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	Municipal Convention and Visitors Bureau	The municipal department of tourism that is responsible for attracting various travelers, conventions, etc. to the municipality.	Existing
	Municipal DMS	Dynamic message signs (DMS) owned and operated by the local municipality.	Planned
	Municipal EOCs	The emergency operations centers owned and operated by the municipalities throughout the Region.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
Municipalities (continued)	Municipal Equipment Repair Garage	The maintenance shop for all roadside equipment owned and operated by the municipalities not specifically called out in this architecture. Also provides maintenance to the same municipality's vehicles.	Existing
	Municipal Field Sensors	Roadway equipment used to detect vehicle volumes and/or speeds. Includes equipment such as video image vehicle detection systems (VIVDS), remote traffic microwave sensors (RTMS), or traditional loops.	Planned
	Municipal Fire/EMS Vehicles	Municipal fire vehicles, including preemption capabilities through the cities and the municipalities within the Region.	Existing
	Municipal Flood Closure Gates	Gates operated by the local municipality that are intended to keep traffic from flooded areas/roadways.	Planned
	Municipal Flood Detectors	Flood warning systems for the City of San Marcos that detect flood events at low water crossings (dips) throughout the city. System includes monitoring and alerting functions, and may be interconnected with other roadway equipment such as DMS to alert motorists.	Planned
	Municipal or County Permitting System	Every city (including Austin) that has a commercial vehicle HAZMAT and oversize/overweight permitting process.	Existing
	Municipal Pavement Management System	The Pavement Management System for all municipalities within the region (including Cedar Park, Georgetown, and San Marcos) that assists in storing, retrieving, analyzing, and reporting information to help with pavement-related decision-making processes.	Existing
	Municipal Police Department	911 Public Safety Answering Point (PSAP) responsible for answering all 911 calls made within the City and dispatching emergency responders. Non-emergency functions include the collection of crash data and enforcement of speed limits and commercial vehicles.	Planned
	Municipal Public Information Office	The office provides the official interface between municipal traffic and maintenance departments and interests outside the departments such as the media.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
Municipalities (continued)	Municipal Public Safety Dispatch and PSAP	This is a general element that is meant to represent the 911 dispatch centers (dispatching police, fire and EMS) for the cities or municipalities within the Region that are not specifically called out in the architecture.	Existing
	Municipal Public Safety Vehicles	Municipal emergency vehicles including police, fire, and EMS. Some preemption for fire and EMS vehicles.	Existing
	Municipal PWD Vehicles	Maintenance and construction vehicles for the unnamed municipalities within the Region.	Existing
	Municipal Rail Notification System	Rail notification system equipment owned and operated by the local municipality to support their freight rail operations.	Planned
	Municipal RWIS Sensors	Road weather information system sensors to monitor weather conditions at the roadway.	Planned
	Municipal School Programmable Flasher Systems	School Zone warning system installed in the municipalities within the Region at school zones to warn drivers. System includes pagers, flashers and DMS installed at flasher locations. Pagers are used to download/upload messages to the DMS and to activate/deactivate the flashers.	Planned
	Municipal Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	Municipal Traffic Database	The archive data management system for traffic operations and traffic information for the municipalities within the Region.	Existing
	Municipal Traffic Signals	Municipal traffic signal systems within the Austin Region.	Planned
	Municipal Website	Transportation information website for each municipality. In the future will include real-time construction, work zone, special event, incident, and traffic information.	Planned
	Municipal/County Crash Records Database	Crash records database collected by the municipalities or counties within the Region.	Existing
	Municipal/County PWD	The maintenance and construction division for the municipalities or counties within the Region. Operates as the dispatch function for the municipal or maintenance and construction vehicles.	Existing
	Municipal/County Traffic Operations Center	Municipal centers that operate traffic signal systems within the municipalities not specifically called out within the Region.	Planned

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
Municipalities (continued)	Municipal/County Transit Operations Center	Municipal centers that operate transit systems within the municipalities not specifically called out within the Region. This element includes services such as the Round Rock Demand Response Bus Service.	Existing
NOAA	National Weather Service	Service for national, regional, and local weather information.	Existing
Other Regional Communications Providers	Other 800 MHz Communications Systems	Intended to represent the other 800 MHz communications systems that are not specifically identified in the architecture.	Planned
	Other 900 MHz Communications Systems	Intended to represent the other 900 MHz communications systems that are not specifically identified in the architecture.	Planned
Other Transit Management Agencies	Other Transit Management Agencies	Includes regional transit management agencies in the State of Texas including the Cities of Corpus Christi, Dallas, Fort Worth, Houston and San Antonio.	Existing
Private Concierge Service Provider	Private Concierge Service Provider	This element represents the private concierge (mayday) service providers in some private and commercial vehicles (e.g. OnStar).	Existing
Private Information Provider	Private Sector Traveler Information Services	Traveler information service operated by a private entity.	Existing
	Social Media Networking Services	Subscription based services operated by private providers that provide an option for real-time traveler information dissemination. Examples of such services include Facebook or Twitter.	Existing
Private Rail Operations	Rail Operations Centers	The dispatch centers for major railroads in the region (e.g. Union Pacific in Omaha, NE).	Existing
	Rail Operators Rail Cars	Rail-based commercial vehicles.	Existing
	Rail Operators Wayside Equipment	The rail operated equipment at highway rail intersections. Interconnect with traffic control.	Existing
Private Tow/Wrecker Providers	Private Tow/Wrecker Dispatch	Dispatch function for privately owned tow or wrecker service. Based on a rotation list.	Existing
	Private Tow/Wrecker Vehicles	The tow or wrecker vehicles in the Region.	Existing
Private Transportation Providers	Private Parking Facilities	Privately owned public parking facilities that typically charge a fee for parking.	Existing
	Private Transportation Provider Demand Response Vehicles	Demand response vehicles owned and operated by private transportation providers.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
Private Transportation Providers (continued)	Private Transportation Provider Fixed-route Vehicles	Fixed-route vehicles that are owned and operated by private transportation providers.	Existing
	Private Transportation Provider Kiosks	Kiosks that are owned and operated by private transportation providers. May include LED displays at bus stops, fare card purchasing, etc.	Planned
	Private Transportation Provider Operations	Private transportation providers that dispatch private taxis, shuttles, and Texas State University transportation services in the Region.	Existing
	Private Transportation Provider Operations Website	Local website for private transportation providers. May be able to request a demand response service from the agency website.	Planned
Private Travelers	Bicyclists	Individuals operating a vehicle that is powered by humans through pedaling with two or more wheels in tandem.	Existing
	Pedestrians	Individuals afoot or using a motorized or non-motorized wheelchair.	Existing
	Private Travelers Personal Computing Device	Includes personal and office computers, cell phones, and other devices used by travelers to receive ITS information.	Existing
	Private Vehicles	Vehicles owned by private individuals that traverse the Region.	Existing
Public/Private Ambulance Providers	Public/Private Ambulance Dispatch	Dispatch functions for public/private ambulance services within the Region.	Existing
	Public/Private Ambulance Vehicles	The vehicles dispatched by public or private ambulance companies.	Existing
Radio Network Users	Radio Network Users	This element represents the radio system for the Austin Region. The ultimate goal of this system is to provide interoperable voice and data radio communications to agencies in the Region.	Existing
Regional Event Promoter	Special Event Sponsors and Promoters	Promoters and sponsors of special events. They coordinate with traffic and emergency providers.	Existing
Regional Medical Centers	Regional Medical Centers	Medical facilities (public and private) found in the Region.	Existing
Regional Utility Companies	Regional Utility Companies	Utility companies that operate in the region and coordinate with maintenance activities of the local jurisdictions for right of way issues or service issues. Could also be contacted in the event of an incident where a certain utility could be threatened.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
Rural Fire Departments	Rural Fire Department Dispatch	Volunteer fire departments dispatch. Frequently this is done by the County Sheriff's office.	Existing
	Rural Fire Department Vehicles	Fire vehicles owned and operated by volunteer fire departments.	Existing
Service Agencies	Service Agencies	Agencies that help subsidize the funding for paratransit operations for special case citizens to ensure that these citizens have transportation to and from where they need to go (generally to medical appointments).	Existing
Statewide Toll Authorities	Statewide Toll Collection SmartHUB	HUB system operated by toll authorities around the state for the reconciliation of tolls between toll authorities.	Existing
TCEQ – Texas Commission of Environmental Quality	TCEQ Field Emissions Monitors	Emissions monitoring field equipment owned and operated by the Texas Commission of Environmental Quality (TCEQ).	Existing
	TCEQ Monitoring Operations Section	The section that is responsible for regional field equipment monitoring and testing.	Existing
	TCEQ State Headquarters	State headquarters for TCEQ that collects all emissions data from around the state and prepares a report for the federal government.	Existing
Texas DEM	Texas DEM Disaster District Information System	The disaster information system run by the Division of Emergency Management in the event of a natural or man-made disaster.	Planned
Travis County Public Safety	Travis County Public Safety Vehicles	Sheriff, fire, or EMS vehicles owned and operated by Travis County. Onboard ITS systems include MDTs, AVL, cameras, etc.	Existing
Travis County Transportation and Natural Resources Department	Travis County Equipment Repair Garage	The maintenance shop for all roadside equipment owned and operated by Travis County. Also provides maintenance to Travis County vehicles.	Existing
	Travis County Maintenance and Construction Operations Dispatch	The maintenance and construction division for Travis County. Operates as the dispatch function for Travis County's maintenance and construction vehicles.	Existing
	Travis County Maintenance and Construction Vehicles	Maintenance and construction vehicles for Travis County.	Existing
TxDMV	TxDMV Central Permitting Office	The central permitting office for TxDMV. Coordinates permits with other states and acts as a data repository for regional permits.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
TxDMV (continued)	TxDMV Motor Carrier Routing Information	This on-line system allows motor carriers to view routing and roadway information, including load restricted bridges, low vertical clearance locations, metro lane closures, and permit restrictions. Bridge restriction information includes TxDOT as well as local agency bridges. Low vertical clearance, permit restriction, and metro lane closure information is available by TxDOT District.	Existing
	TxDMV Other Permitting Systems	Localized permitting systems in other regions.	Existing
TxDOT	Statewide Crash Records Information System	Statewide database of vehicle crash records. Input to system provided by elements in the Region.	Existing
	TxDOT Regional Traveler Information Platform	Future platform to host regional traveler information.	Planned
	TxDOT Austin District Ramp Metering Equipment	Roadway equipment used in the operation of a ramp metering system. Includes the signals and any other ITS equipment.	Planned
	TxDOT BRINSAP	TxDOT Bridge Inspection and Inventory System. Statewide system holding information regarding the inventory and inspection status of all bridges.	Existing
	TxDOT Demand Response Transit Intake Center	The center owned and operated by TxDOT where residents can either call in or go online and request and pay for a demand responsive transit plan.	Existing
	TxDOT HERO Vehicles	Roadway service patrol vehicles. Currently operate primarily on controlled access highways in Travis County and are dispatched elsewhere in the Region for large incidents.	Existing
	TxDOT Other District Maintenance Sections Dispatch	Municipal, county, and TxDOT Maintenance sections in neighboring regions.	Existing
	TxDOT Other District TMCs	Traffic Management Centers in other TxDOT Districts (i.e. TranStar, Stratus, DalTrans, TransVision, TransVista and Pegasus).	Existing
	TxDOT Rest Areas/Visitor Centers/Truck Stops/Service Plaza Kiosks	This represents the rest areas and visitor centers with varied amenities that are existing or planned by TxDOT. Tourist information, emergency evacuation information, and general traffic information could be provided in the future.	Planned
	TxDOT San Antonio District TMC (TransGuide)	TransGuide serves as the TMC for the San Antonio District and also initiates AMBER Alert procedures in the other TxDOT Districts at the direction of the DPS.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
TxDOT (continued)	TxDOT Statewide Emergency Management Coordinator	TxDOT representative at State EOC who communicates information to the TxDOT maintenance sections and TxDOT traffic sections.	Existing
	TxDOT Statewide Pavement Management System	Statewide Pavement Management System that has an interface to the district Pavement Management System. This information is made available on the Internet.	Existing
	TxDOT Statewide Roadway Data Collection System	Collects roadway data across the state for TxDOT.	Existing
TxDOT Austin District	TxDOT Austin District Active Traffic Management	Lane control signals owned and operated by TxDOT Austin.	Existing
	TxDOT Austin District Area Engineers Office	Construction design and supervision (schedules and plans) for the Austin District. Provide content to TMC's for maintenance and construction road status.	Existing
	TxDOT Austin District Automated Roadway Treatment Equipment	Equipment used for the automated application on anti-icing chemicals at locations prone to freezing.	Planned
	TxDOT Austin District CCTV Cameras	Closed Circuit Television Cameras (CCTV) owned and operated by TxDOT Austin.	Existing
	TxDOT Austin District Changeable Speed Limit Signs	City of Austin roadway equipment used to raise or lower speed limits on the roadway.	Planned
	TxDOT Austin District Connected Vehicle Roadside Equipment	Field devices that are able to send information to and receive information from adjacent vehicles that are equipped with digital short-range communications (DSRC) or other wireless communications technology.	Planned
	TxDOT Austin District DMS	Dynamic Message Signs (DMS) owned and operated by TxDOT Austin.	Existing
	TxDOT Austin District Field Sensors	Traffic and vehicle sensors owned and operated by TxDOT Austin.	Existing
	TxDOT Austin District Flood Detectors	Flood warning systems owned and operated by TxDOT that detect flood events at low water crossings on TxDOT roads. System includes monitoring and alerting functions, and may be interconnected with other roadway equipment such as DMS or beacons to alert motorists that a roadway is flooded ahead.	Planned



**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
TxDOT Austin District (continued)	TxDOT Austin District HAR	Highway Advisory Radio (HAR) owned and operated by TxDOT Austin.	Existing
	TxDOT Austin District Historical Traffic Database	The archive data management system for traffic operations and traffic information for the TxDOT Austin District.	Existing
	TxDOT Austin District Infrastructure Monitoring Equipment	Equipment that monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure using both fixed and vehicle-based sensors and cameras. Sensors collect information such as vibration, stress, temperature, and continuity.	Planned
	TxDOT Austin District ITS Field Equipment	ITS field equipment not specifically called out in the architecture. Includes speed monitoring equipment, barrier system equipment, etc.	Existing
	TxDOT Austin District Maintenance and Construction Vehicles	Maintenance and construction vehicles for the TxDOT Austin District.	Existing
	TxDOT Austin District Maintenance Office	Office in charge of construction and maintenance operations for the TxDOT Austin district.	Existing
	TxDOT Austin District Maintenance Sections Dispatch	TxDOT maintenance sections for Austin Region. Dispatches maintenance vehicles and equipment for maintaining road and ITS equipment owned by TxDOT.	Existing
	TxDOT Austin District Mechanic Shop	This facility provides repair and maintenance services for TxDOT maintenance vehicles and equipment (e.g. portable DMS).	Existing
	TxDOT Austin District Mobility35 TIS	Mobility35 Traveler Information System Traffic Management Center operated to assist with managing traffic during I-35 construction closures.	Existing
	TxDOT Austin District Office of Law Enforcement CVO Enforcement	Texas Department of Transportation commercial vehicle operations inspection and enforcement.	Existing
	TxDOT Austin District Office of Law Enforcement Truck Weigh and Inspection Stations	Commercial vehicle inspection station with the capability to weigh commercial vehicles and evaluate their credentials.	Existing
	TxDOT Austin District Office of Law Enforcement Weigh-in-Motion	TxDOT facilities with the capability to weigh commercial vehicles while they are traveling at highway speeds.	Existing
	TxDOT Austin District Oversize Vehicle Detection	Measures the size and weight of passing vehicles and displays warnings to vehicles if the size exceeds the current infrastructure restrictions.	Planned

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
TxDOT Austin District (continued)	TxDOT Austin District Pavement Management System	District Pavement Management System that assists in storing, retrieving, analyzing and reporting information to help with pavement-related decision-making processes.	Existing
	TxDOT Austin District Public Information Office	The office provides the official interface between the TxDOT traffic and maintenance departments and interests outside the departments such as the media.	Existing
	TxDOT Austin District Public Transportation Management System (PTMS)	Maintains a Transit Vehicle Inventory for public transit vehicles that receive federal and state funds. Also able to generate ridership information such as cost per mile, revenues per mile, total revenues, etc.	Existing
	TxDOT Austin District Ramp Metering Equipment	Roadway equipment used in the operation of a ramp metering system. Includes the signals and any other ITS equipment.	Planned
	TxDOT Austin District Ramp Queue Detection System	Vehicle detection system that monitors queues at exit ramps and can either warn drivers approaching the queue through DMS or warning beacons or the system can interact with the traffic signal system to clear the queue.	Planned
	TxDOT Austin District RWIS	Road weather information systems that are owned and operated by TxDOT Austin.	Planned
	TxDOT Austin District Security Monitoring Field Equipment	Security equipment owned and operated by the TxDOT Austin District.	Planned
	TxDOT Austin District Signal Server	The traffic management center (server) that controls the traffic signal systems owned and operated by TxDOT Austin.	Existing
	TxDOT Austin District Signals	Traffic signals owned and operated by TxDOT Austin.	Existing
	TxDOT Austin District Speed Monitoring Equipment	Field equipment used for monitoring roadway speeds.	Planned
	TxDOT Austin District TMC (CTECC)	The traffic management center for the TxDOT Austin District. Controls all TxDOT ITS field equipment except signal systems. Located in CTECC, the Combined Transportation Emergency Communications Center.	Existing
	TxDOT Austin District Website	Transportation information website for the Austin district. In the future it will include real-time construction, work zone, special event, incident, and traffic information. (Handled by the Information Resource Office.)	Existing
	TxDOT Austin District Smart Work Zone Equipment	Smart work zone monitoring and alerting equipment used on TxDOT Austin District projects.	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
TxDOT Travel Division	TxDOT Highway Conditions Reporting System	Provides detailed construction closures, detours, restrictions, permit and weather information. Compiled by District Public Information staff and area maintenance personnel. Accessible to the public on the internet at <a href="http://www.dot.state.tx.us/hcr/main.htm">www.dot.state.tx.us/hcr/main.htm</a> . The system provides access to information by route, county, or roadway condition. Includes contact information, Phone (800-452-9292) for construction, closures, hazards and detour information.	Existing
TxDOT TOD	Toll Payment Device	A device by which travelers can pay a toll – a Regional Smartcard system.	Existing
	TxDOT TOD CCTV Cameras	Closed-circuit television (CCTV) cameras operated along TxDOT TOD facilities.	Existing
	TxDOT TOD DVAS	Digital Video Auditing System (DVAS) cameras that are activated by passing vehicles. TOD uses these images for auditing purposes only.	Existing
	TxDOT TOD Customer Service Center	The customer service center for the TxDOT Toll Operations Division. This represents the backend systems of the Turnpike.	Existing
	TxDOT TOD Dispatch Center	Dispatch Center for the TxDOT Toll Operations Division.	Existing
	TxDOT TOD DMS	DMS owned and operated by TxDOT Toll Operations Division.	Planned
	TxDOT TOD Field Sensors	Field sensors (for traffic) owned and operated by the TxDOT Toll Operations Division.	Planned
	TxDOT TOD Service Patrol Vehicles	Service patrol vehicles operating on TxDOT TOD roadways.	Existing
	TxDOT TOD Toll Collection SmartHUB	A HUB device owned and operated by the TxDOT Toll Operations Division that relays toll collection information to toll authorities throughout the region for reconciliation of tolls.	Existing
	TxDOT TOD Toll Collection Website	Website for the Toll Operations Division.	Existing
TxDOT TOD Toll Plazas	The toll plazas on TxDOT owned highways that include automated toll collection systems, tag readers, or other ITS devices.	Existing	
University of Texas	UT Events Office	The event office at the University of Texas that coordinates with regional traffic systems for large events (football games, etc.).	Existing
	UT Police Dispatch	The police dispatch for the University Police Department.	Existing
	UT Police Vehicles	Police vehicles owned and operated by the University of Texas at Austin. Includes the ITS equipment installed on the cruisers (AVL, MDTs, etc.).	Existing

**Table 5 – Austin Inventory of ITS Elements (Continued)**

Stakeholder	Element Name	Element Description	Status
USGS	USGS Flood Monitoring Center	Flood warning devices owned and operated by the USGS in waterways in the Region including the Colorado River, Bull Creek, Barton Creek, and Onion Creek among numerous others.	Existing
	USGS Flood Monitoring Devices	Flood warning devices owned and operated by the USGS.	Existing
Williamson County Public Safety	Williamson County Emergency Communications Center	The local 911 dispatch center (rural) for Williamson County that dispatched Williamson County Sheriff, fire, EMS, rural fire department, and all municipal public safety vehicles). Has coordinated computer-aided dispatch (CAD) system with City of Round Rock.	Existing
	Williamson County EOC	The Williamson County emergency operations center (EOC).	Planned
	Williamson County Public Safety Vehicles	Sheriff, fire, or EMS vehicles owned and operated by Williamson County. Onboard ITS systems include MDTs, AVL, cameras, etc.	Existing
	Williamson County Radio Systems	The radio communications network that is owned and operated by Williamson County. Radio networks used to transfer voice and data communications between agencies.	Existing
Williamson County Road Department	Williamson County Equipment Repair Facility	The maintenance shop for all roadside equipment owned and operated by Williamson County. Also provides maintenance to Williamson County vehicles.	Existing
	Williamson County Maintenance and Construction Operations	The maintenance and construction division for Williamson County. Operates as the dispatch function for Williamson County maintenance and construction vehicles.	Existing
	Williamson County Maintenance and Construction Vehicles	Maintenance and construction vehicles for Williamson County.	Existing

## 5. REGIONAL ITS ARCHITECTURE

Upon completion of the system inventory, the next step in the development of the Regional ITS Architecture was to identify the ITS services that are important to the Austin Region. The National ITS Architecture has the twelve groups of ITS service areas shown in **Table 6**. Each service area is shown in the table with the current level of deployment in the Region and the level of regional interest based on stakeholder feedback aggregated from the interviews and workshop. Existing, planned, and future systems in the Region were considered in each of the service areas.

**Table 6 – Austin Regional ITS Architecture Service Areas**

Service Area	Description	Level of Deployment	Level of Interest
Traffic Management	Example service packages include Traffic Signal Control, Traffic Incident Management System, Variable Speed Limit Signs, and Ramp Metering.	High	High
Traveler Information	Example service packages include Broadcast Traveler Information, Dynamic Route Guidance, and In-Vehicle Signage.	Medium	High
Public Safety	Example service packages include Emergency Vehicle Preemption, Roadway Service Patrols, and Disaster Response and Recovery.	Medium	High
Maintenance and Construction	Example service packages include Maintenance Vehicle and Equipment Tracking, Infrastructure Monitoring, and Roadway Automated Treatment.	Medium	High
Commercial Vehicle Operations	Example service packages include Electronic Clearance, HAZMAT Management, and Roadside and Virtual Weigh-in-Motion.	Medium	High
Sustainable Travel	Example service packages include Emissions Monitoring, HOV/HOT Lane Management, and Electric Charging Stations Management.	Low	Medium
Public Transportation	Example service packages include Transit Vehicle Tracking, Transit Traveler Information, and Transit Signal Priority.	Medium	High
Weather	Example service packages include Weather Data Collection, Weather Information Processing and Distribution, and Spot Weather Impact Warning.	Medium	Medium
Data Management	Example service packages include ITS Data Warehouse and Performance Monitoring.	Low	High
Support	Catch-all category for systems supporting transportation operations. Example service packages include Map Management, Data Distribution, and Security and Credentials Management.	Medium	Medium
Parking Management	Example service packages include Parking Space Management, Parking Electronic Payment, and Smart Park and Ride System.	Medium	Medium
Vehicle Safety	Example service packages include Connected Vehicle Queue Warning, Connected Vehicle Curve Speed Warning, and Automated Vehicle Operations.	Low	High

## 5.1 ITS Service Packages

In the National ITS Architecture, services that are provided by ITS are referred to as service packages. ITS service packages provide a visual representation of how ITS services are deployed and how information is shared. ITS 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 139 ITS service packages identified in the National ITS Architecture Version 8.1, which was the most recent version available of the National ITS Architecture at the time of the Austin Regional ITS Architecture update. It should be noted that in previous versions of the Austin Regional ITS Architecture, ITS service packages were referred to as ITS market packages. The name change has been made to be consistent with the terminology that is now used since the release of Version 7.0 of the National ITS Architecture. Previous versions of the Austin Regional ITS Architecture refer to the 97 total service packages previously provided, as opposed to the set of 139 total service packages now available.

### 5.1.1 OVERVIEW OF ITS SERVICE PACKAGE STRUCTURE

A service package is made up of elements and data flows. Each identified system or component in the Austin regional ITS inventory, which is documented in the previous section, was mapped to a subsystem or terminator in the National ITS Architecture. Subsystems and terminators represent the various functional categories that define the role of an element in ITS and the regional architecture. The elements are connected together by architecture flows that document the existing and planned flow of 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.

*Subsystems* are the highest-level building blocks of the physical architecture, and the National ITS Architecture groups them into four major classes: Centers, Fields, Vehicles, and Travelers. Each of these major classes includes various subsystems that represent a set of transportation functions (or processes). Each set of functions is grouped under one agency, jurisdiction, or location, and corresponds to physical elements such as: traffic operations centers, traffic signals, or vehicles. Each element is assigned to one or more subsystems.

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

*Architecture Flows* provide a standardized method for documenting the types of information that flow between elements. A flow can be shown as either existing or future/planned. Existing flows indicate a connection that has already been established to share at least a portion of the desired information, but showing a flow as existing is not meant to imply that the function is complete. For example, the traffic information coordination flow between traffic management agencies includes the sharing of video images, incident information and other relevant data. The flow could be shown as existing to capture the sharing of video images while incident information is still a future desired expansion of functionality. Many of the architecture flows have associated technical specifications, known as standards, which define the format of the data being shared.

### 5.1.2 SELECTION AND PRIORITIZATION OF REGIONAL SERVICE PACKAGES

In the Austin Region, the National ITS Architecture service packages were reviewed by the stakeholders and selected based on the relevance of the functionality that the ITS service package could provide to the Region. Stakeholders selected 87 ITS service packages for implementation in the Region. The selected service packages are identified in **Table 7** and are organized by the applicable ITS Service Area from the National ITS Architecture and implementation priority. Detailed descriptions of each service package in the National ITS Architecture are located in **Appendix B**.

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

While the Support Service Area has some level of existing regional deployment and continues to draw some interest from Regional stakeholders, the service packages within the service area generally applied most directly to existing private-sector services, many of which are operating their services in regions throughout the United States. As a result, the Support Service Area service packages are not included in the Austin Regional ITS Architecture and will instead be described at the project architecture level if needed for future projects that may use these services.

**Table 7 – Austin ITS Service Package Prioritization by Functional Area**

High Priority Service Packages	Medium Priority Service Packages	Low Priority Service Packages
<b>Traffic Management</b>		
TM01 – Infrastructure-Based Traffic Surveillance TM03 – Traffic Signal Control TM06 – Traffic Information Dissemination TM07 – Regional Traffic Management TM08 – Traffic Incident Management System TM10 – Electronic Toll Collection TM12 – Dynamic Roadway Warning TM19 – Roadway Closure Management TM22 – Dynamic Lane Management and Shoulder Use	TM02 – Vehicle-Based Traffic Surveillance TM04 – Connected Vehicle Traffic Signal System TM13 – Standard Railroad Grade Crossing TM17 – Speed Warning and Enforcement TM20 – Variable Speed Limits TM21 – Speed Harmonization	TM05 – Traffic Metering TM15 – Railroad Operations Coordination TM16 – Reversible Lane Management
<b>Traveler Information</b>		
TI01 – Broadcast Traveler Information TI02 – Personalized Traveler Information	TI07 – In-Vehicle Signage	TI04 – Infrastructure-Provided Trip Planning and Route Guidance TI06 – Dynamic Ridesharing and Shared Use Transportation
<b>Public Safety</b>		
PS01 – Emergency Call-Taking and Dispatch PS03 – Emergency Vehicle Preemption PS07 – Incident Scene Safety Monitoring PS08 – Roadway Service Patrols PS10 – Wide-Area Alert PS11 – Early Warning System	PS04 – Mayday Notification PS12 – Disaster Response and Recovery PS13 – Evacuation and Reentry Management PS14 – Disaster Traveler Information	PS09 – Transportation Infrastructure Protection
<b>Maintenance and Construction</b>		
MC03 – Roadway Automated Treatment MC05 – Roadway Maintenance and Construction MC06 – Work Zone Management MC08 – Maintenance and Construction Activity Coordination	MC01 – Maintenance and Construction Vehicle and Equipment Tracking MC07 – Work Zone Safety Monitoring MC09 – Infrastructure Monitoring	MC02 – Maintenance and Construction Vehicle Maintenance MC04 – Winter Maintenance
<b>Commercial Vehicle Operations</b>		
CVO03 – Electronic Clearance	CVO12 – HAZMAT Management CVO08 – Smart Roadside and Virtual WIM	CVO04 – CV Administrative Processes
<b>Sustainable Travel</b>		
ST06 – HOV/HOT Lane Management	ST02 – Eco-Traffic Signal Timing ST04 – Roadside Lighting ST05 – Electric Charging Stations Management	ST01 – Emissions Monitoring ST03 – Eco-Traffic Metering



**Table 7 – Austin ITS Service Package Prioritization by Functional Area (Continued)**

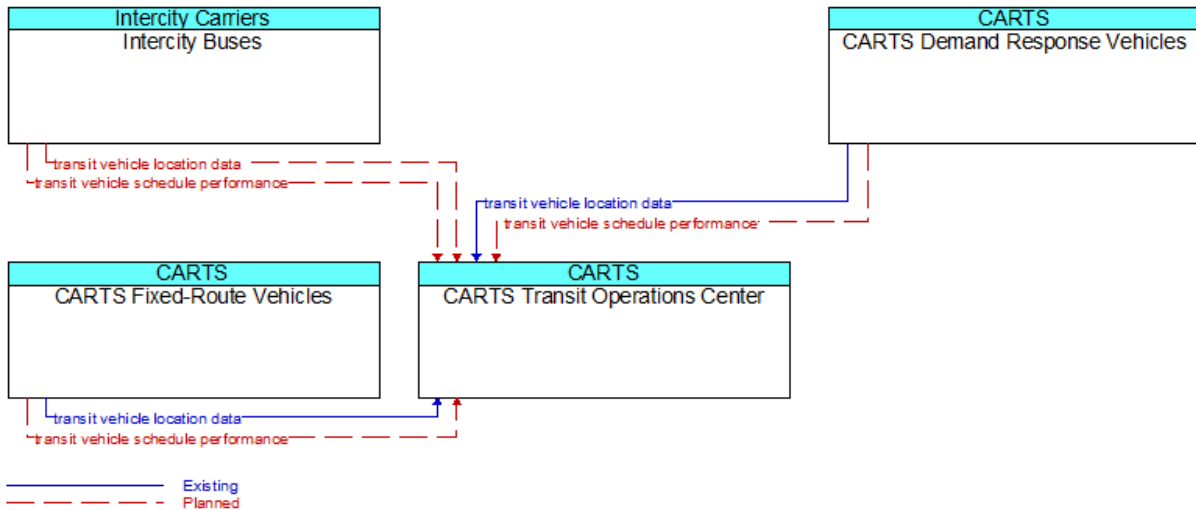
High Priority Service Packages	Medium Priority Service Packages	Low Priority Service Packages
<b>Public Transportation</b>		
PT01 – Transit Vehicle Tracking PT02 – Transit Fixed Route Operations PT03 – Dynamic Transit Operations PT04 – Transit Fare Collection Management PT05 – Transit Security PT06 – Transit Fleet Management PT07 – Transit Passenger Counting PT08 – Transit Traveler Information PT09 – Transit Signal Priority PT10 – Intermittent Bus Lanes PT11 – Transit Pedestrian Detection PT14 – Multi-modal Coordination	PT12 – Transit Vehicle at Station/Stop Warnings PT15 – Transit Stop Request PT17 – Transit Connection Protection PT18 – Integrated Multi-modal Electronic Payment	
<b>Weather</b>		
WX01 – Weather Data Collection	WX02 – Weather Information Processing and Distribution	
<b>Data Management</b>		
DM01 – ITS Data Warehouse DM02 – Performance Monitoring		
<b>Parking Management</b>		
PM01 – Parking Space Management PM03 – Parking Electronic Payment		PM04 – Regional Parking Management
<b>Vehicle Safety</b>		
VS05 – Curve Speed Warning VS07 – Road Weather Motorist Alert and Warning VS08 – Queue Warning VS09 – Reduced Speed Zone Warning/Lane Closure VS12 – Pedestrian and Cyclist Safety VS13 – Intersection Safety Warning and Collision Avoidance	VS06 – Stop Sign Gap Assist VS10 – Restricted Lane Warnings VS11 – Oversize Vehicle Warning VS16 – Automated Vehicle Operations	VS15 – Infrastructure Enhanced Cooperative Adaptive Cruise Control

5.1.3 CUSTOMIZATION OF REGIONAL ITS SERVICE PACKAGES

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

**Figure 3** is an example of a Public Transportation (PT) service package that was developed to describe how CARTS transit vehicles would exchange information with the transit operations center to track vehicle location. The information flows in blue represent connections that are currently existing, while the information flows in red represent planned connections. While CARTS currently collects location data from its fixed-route and demand-response vehicles, it does not yet collect schedule performance

information. CARTS indicated a desire for this capability in the future, so these flows show as planned in the current version of the ITS architecture.



**Figure 3 – Example Service Package Diagram: Transit Vehicle Tracking**

### Interactive Regional ITS Architecture

The remainder of the service packages that were customized for the Austin Region are provided in the online interactive RAD-IT database at:

[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

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

Some service packages are created for a specific agency, while others are more general and apply to all municipalities in the Region, for example. **Table 8** lists all service packages and includes whether they apply to a specific agency or a more general category. The service package diagrams for each of the service packages listed in **Table 8** contain ITS elements that are described and organized by each one’s owner stakeholder agency in **Table 5**.

**Table 8 – Regional Service Packages with Corresponding Agency**

Service Package	Service Package Name	Agency / Agencies
<b>Commercial Vehicle Operations Service Area</b>		
CVO03	Electronic Clearance	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
CVO04	CV Administrative Processes	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Round Rock</li> <li>• Municipal or County</li> <li>• TxDMV</li> </ul>
CVO08	Smart Roadside and Virtual WIM	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
CVO12	HAZMAT Management	<ul style="list-style-type: none"> <li>• Commercial Vehicles</li> <li>• Rail Operations</li> </ul>
<b>Data Management Service Area</b>		
DM01	ITS Data Warehouse	<ul style="list-style-type: none"> <li>• Capital Area MPO</li> <li>• City of Austin Crash Records</li> <li>• City of Austin Pavement Management</li> <li>• City of Austin Traffic Database</li> <li>• City of Round Rock Crash Records</li> <li>• City of Round Rock Pavement Management</li> <li>• Municipal Pavement Management</li> <li>• Municipal/County Crash Records</li> <li>• Statewide Crash Records</li> <li>• TxDOT Pavement Management</li> <li>• TxDOT Public Transportation Management</li> <li>• TxDOT Roadway Data Collection</li> <li>• TxDOT Traffic Database</li> </ul>
DM02	Performance Monitoring	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
<b>Maintenance and Construction Service Area</b>		
MC01	Maintenance and Construction Vehicle and Equipment Tracking	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Round Rock</li> <li>• Counties</li> <li>• Municipalities</li> <li>• Travis County</li> <li>• TxDOT Austin District</li> <li>• Williamson County</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Maintenance and Construction Service Area</b>		
MC02	Maintenance and Construction Vehicle Maintenance	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Round Rock</li> <li>• County</li> <li>• Municipal</li> <li>• Travis County</li> <li>• TxDOT Austin District</li> <li>• Williamson County</li> </ul>
MC03	Roadway Automated Treatment	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
MC04	Winter Maintenance	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
MC05	Roadway Maintenance and Construction	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• County</li> <li>• Municipal</li> <li>• Travis County</li> <li>• TxDOT Austin District</li> <li>• Williamson County</li> </ul>
MC06	Work Zone Management	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Round Rock Communications Division</li> <li>• City of Round Rock Public Works</li> <li>• County</li> <li>• Municipal Public Information</li> <li>• Municipal/County Public Works</li> <li>• Travis County</li> <li>• TxDOT Austin District Maintenance Sections</li> <li>• TxDOT Austin District Mobility35 TIS</li> <li>• TxDOT Austin District Work Zone Information Dissemination</li> <li>• Williamson County</li> </ul>
MC07	Work Zone Safety Monitoring	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Round Rock</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> <li>• TxDOT Austin District Mobility35 TIS</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Maintenance and Construction Service Area</b>		
MC08	Maintenance and Construction Activity Coordination	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Round Rock</li> <li>• County</li> <li>• Municipal</li> <li>• Regional Utility Companies</li> <li>• Travis County</li> <li>• TxDOT Austin District</li> <li>• Williamson County</li> <li>• TxDOT Austin District Mobility35 TIS</li> </ul>
MC09	Infrastructure Monitoring	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
<b>Parking Management Service Area</b>		
PM01	Parking Space Management	<ul style="list-style-type: none"> <li>• City of Austin</li> </ul>
PM03	Parking Electronic Payment	<ul style="list-style-type: none"> <li>• City of Austin</li> </ul>
PM04	Regional Parking Management	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> <li>• City of Austin</li> </ul>
<b>Public Safety Service Area</b>		
PS01	Emergency Call-Taking and Dispatch	<ul style="list-style-type: none"> <li>• Austin/Travis County EOC</li> <li>• City of Austin/Travis County (CTECC)</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• County EOC</li> <li>• County Public Safety and PSAP</li> <li>• DPS</li> <li>• Municipal</li> <li>• Public/Private Ambulance</li> <li>• Regional</li> <li>• Williamson County Emergency Communications Center</li> <li>• Williamson County EOC</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Public Safety Service Area</b>		
PS03	Emergency Vehicle Preemption	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• County</li> <li>• DPS</li> <li>• Municipal</li> <li>• Public/Private Ambulance</li> <li>• Regional Medical Center</li> <li>• Travis County</li> <li>• UT Police</li> <li>• Williamson County</li> </ul>
PS04	Mayday Notification	<ul style="list-style-type: none"> <li>• Private Concierge Service Provider</li> </ul>
PS07	Incident Scene Safety Monitoring	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
PS08	Roadway Service Patrols	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> <li>• TxDOT TOD</li> </ul>
PS09	Transportation Infrastructure Protection	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
PS10	Wide-Area Alert	<ul style="list-style-type: none"> <li>• Austin/Travis County</li> <li>• County</li> <li>• Municipal</li> <li>• Statewide Amber Alert</li> <li>• Williamson County</li> </ul>
PS11	Early Warning System	<ul style="list-style-type: none"> <li>• Army Corps of Engineers</li> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• LCRA</li> <li>• TxDOT Austin District</li> <li>• USGS</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Public Safety Service Area</b>		
PS12	Disaster Response and Recovery	<ul style="list-style-type: none"> <li>• Austin/Travis County</li> <li>• City of Round Rock</li> <li>• County</li> <li>• Municipal</li> <li>• Williamson County</li> </ul>
PS13	Evacuation and Reentry Management	<ul style="list-style-type: none"> <li>• Austin/Travis County</li> <li>• City of Round Rock</li> <li>• County</li> <li>• Municipal</li> <li>• Statewide</li> <li>• Williamson County</li> </ul>
PS14	Disaster Traveler Information	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT</li> </ul>
<b>Public Transportation Service Area</b>		
PT01	Transit Vehicle Tracking	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> <li>• Independent School District</li> <li>• Private Transportation</li> </ul>
PT02	Transit Fixed-Route Operations	<ul style="list-style-type: none"> <li>• CapMetro Fixed-Route</li> <li>• CapMetro MetroRail</li> <li>• CapMetro MetroRapid</li> <li>• CARTS</li> <li>• Independent School District</li> <li>• Private Transportation</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Public Transportation Service Area</b>		
PT03	Dynamic Transit Operations	<ul style="list-style-type: none"> <li>• CapMetro MetroAccess</li> <li>• CARTS</li> <li>• Private Transportation Provider</li> <li>• TxDOT</li> </ul>
PT04	Transit Fare Collection Management	<ul style="list-style-type: none"> <li>• CapMetro Fixed-Route</li> <li>• CapMetro MetroAccess</li> <li>• CapMetro MetroRail</li> <li>• CapMetro MetroRapid</li> <li>• CARTS</li> <li>• Private Transportation Provider</li> </ul>
PT05	Transit Security	<ul style="list-style-type: none"> <li>• CapMetro Fixed-Route</li> <li>• CapMetro MetroAccess</li> <li>• CapMetro MetroRail</li> <li>• CapMetro MetroRapid</li> <li>• CARTS</li> <li>• Independent School Provider</li> <li>• Private Transportation Provider</li> </ul>
PT06	Transit Fleet Management	<ul style="list-style-type: none"> <li>• CapMetro Fixed-Route</li> <li>• CapMetro MetroAccess</li> <li>• CapMetro MetroRail</li> <li>• CapMetro MetroRapid</li> <li>• CARTS</li> <li>• Private Transportation Providers/Independent Schools Districts</li> </ul>
PT07	Transit Passenger Counting	<ul style="list-style-type: none"> <li>• CapMetro Fixed-Route</li> <li>• CapMetro MetroRail</li> <li>• CapMetro MetroRapid</li> <li>• CARTS</li> <li>• Private Transportation Operations</li> </ul>
PT08	Transit Traveler Information	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> <li>• Private Transportation Provider</li> </ul>
PT09	Transit Signal Priority	<ul style="list-style-type: none"> <li>• CapMetro</li> </ul>
PT10	Intermittent Bus Lanes	<ul style="list-style-type: none"> <li>• CapMetro</li> </ul>
PT11	Transit Pedestrian Indication	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> </ul>



**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Public Transportation Service Area</b>		
PT12	Transit Vehicle at Station/Stop Warnings	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> </ul>
PT14	Multi-modal Coordination	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> <li>• Private Transportation Providers</li> <li>• Regional</li> </ul>
PT15	Transit Stop Request	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> </ul>
PT17	Transit Connection Protection	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> </ul>
PT18	Integrated Multi-Modal Electronic Payment	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> <li>• CTRMA</li> </ul>
<b>Sustainable Travel Service Area</b>		
ST01	Emissions Monitoring	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• TCEQ</li> </ul>
ST02	Eco-Traffic Signal Timing	<ul style="list-style-type: none"> <li>• City of Austin</li> </ul>
ST03	Eco-Traffic Metering	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
ST04	Roadside Lighting	<ul style="list-style-type: none"> <li>• City of Austin</li> </ul>
ST05	Electric Charging Stations Management	<ul style="list-style-type: none"> <li>• CapMetro</li> <li>• CARTS</li> <li>• City of Austin</li> </ul>
ST06	HOV/HOT Lane Management	<ul style="list-style-type: none"> <li>• CTRMA</li> <li>• TxDOT TOD</li> </ul>
<b>Traveler Information Service Area</b>		
TI01	Broadcast Traveler Information	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Traveler Information Service Area</b>		
TI02	Personalized Traveler Information	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT</li> </ul>
TI04	Infrastructure-Provided Trip Planning and Route Guidance	<ul style="list-style-type: none"> <li>• TxDMV</li> </ul>
TI06	Dynamic Ridesharing and Shared Use Transportation	<ul style="list-style-type: none"> <li>• Private Sector Transportation Services</li> </ul>
TI07	In-Vehicle Signage	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
<b>Traffic Management Service Area</b>		
TM01	Infrastructure-Based Traffic Surveillance	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• CTRMA</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> <li>• TxDOT Austin District Mobility35 TIS</li> <li>• TxDOT TOD</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Traffic Management Service Area</b>		
TM02	Vehicle-Based Traffic Surveillance	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• CTRMA</li> <li>• Municipal/County</li> <li>• TxDOT Austin District</li> </ul>
TM03	Traffic Signal Control	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> <li>• TxDOT Austin District Mobility35 TIS</li> </ul>
TM04	Connected Vehicle Traffic Signal System	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
TM05	Traffic Metering	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Traffic Management Service Area</b>		
TM06	Traffic Information Dissemination	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• CTRMA</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> <li>• TxDOT Austin District Mobility35 TIS</li> <li>• TxDOT TOD</li> </ul>
TM07	Regional Traffic Management	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• CTRMA</li> <li>• Municipal/County</li> <li>• TxDOT Austin District</li> <li>• TxDOT Austin District Mobility35 TIS</li> <li>• TxDOT TOD</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Traffic Management Service Area</b>		
TM08	Traffic Incident Management System	<ul style="list-style-type: none"> <li>• ABIA</li> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• County</li> <li>• CTRMA</li> <li>• DPS</li> <li>• Municipal</li> <li>• Private Tow</li> <li>• Public/Private Ambulance</li> <li>• Rail Operations</li> <li>• Regional Utility Companies</li> <li>• Rural Fire</li> <li>• Travis County</li> <li>• TxDOT Austin District</li> <li>• TxDOT TOD</li> <li>• UT</li> <li>• Williamson County</li> </ul>
TM10	Electronic Toll Collection	<ul style="list-style-type: none"> <li>• CTRMA</li> <li>• TxDOT TOD</li> </ul>
TM12	Dynamic Roadway Warning	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• County</li> <li>• Hays County</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Traffic Management Service Area</b>		
TM13	Standard Railroad Grade Crossing	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
TM15	Railroad Operations Coordination	<ul style="list-style-type: none"> <li>• City and Municipal TMCs or TOCS</li> <li>• TxDOT Austin District</li> </ul>
TM16	Reversible Lane Management	<ul style="list-style-type: none"> <li>• City of Austin</li> </ul>
TM17	Speed Warning and Enforcement	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
TM19	Roadway Closure Management	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• County</li> <li>• Hays County</li> <li>• Municipal</li> </ul>
TM20	Variable Speed Limits	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• TxDOT Austin District</li> </ul>
TM21	Speed Harmonization	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• TxDOT Austin District</li> </ul>
TM22	Dynamic Lane Management and Shoulder Use	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• TxDOT Austin District</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Vehicle Safety Service Area</b>		
VS05	Curve Speed Warning	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
VS06	Stop Sign Gap Assist	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
VS07	Road Weather Motorist Alert and Warning	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
VS08	Queue Warning	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
VS09	Reduced Speed Zone Warning / Lane Closure	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> </ul>

**Table 8 – Regional Service Packages with Corresponding Agency (Continued)**

Service Package	Service Package Name	Agency / Agencies
<b>Vehicle Safety Service Area</b>		
VS10	Restricted Lane Warnings	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• TxDOT Austin District</li> </ul>
VS11	Oversize Vehicle Warning	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
VS12	Pedestrian and Cyclist Safety	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
VS13	Intersection Safety Warning and Collision Avoidance	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT Austin District</li> </ul>
VS15	Infrastructure Enhanced Cooperative Adaptive Cruise Control	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
VS16	Automated Vehicle Operations	<ul style="list-style-type: none"> <li>• TxDOT Austin District</li> </ul>
<b>Weather Service Area</b>		
WX01	Weather Data Collection	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• City of Cedar Park</li> <li>• City of Georgetown</li> <li>• City of Leander</li> <li>• City of Pflugerville</li> <li>• City of Round Rock</li> <li>• City of San Marcos</li> <li>• Municipal</li> <li>• TxDOT</li> </ul>
WX02	Weather Information Processing and Distribution	<ul style="list-style-type: none"> <li>• City of Austin</li> <li>• TxDOT</li> </ul>



#### 5.1.4 REGIONAL NEEDS AND CORRESPONDING SERVICE PACKAGES

Input received from stakeholders at the Austin Regional ITS Architecture workshop provided valuable input for the service package customization process. The needs identified in the ITS Architecture workshops, as well as needs from the CAMPO 2040 RTP are identified in **Table 9**. The table also identifies which service packages address each ITS need.

The last three needs that are identified generally cannot be addressed through ITS service packages in the Region, however stakeholders felt it was important to document these needs for the Regional ITS Architecture.

##### **Interactive Regional ITS Architecture**

A complete list of stakeholder needs along with their corresponding service packages is provided in the online RAD-IT database located at:

[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

To access the Stakeholder Needs table, from the website select the “Interactive Architecture” link from the Interactive Architecture website tab, then select the “Needs” page from the left sidebar, then click the desired Service Package Name.

**Table 9 – Austin Regional ITS Needs and Corresponding Service Packages**

ITS Need	Corresponding Service Package
Improve communication and coordination between agencies (State-Local, Local-Local) for traffic operations and incident management	TM01 – Infrastructure-Based Traffic Surveillance TM06 – Traffic Information Dissemination TM07 – Regional Traffic Management TM08 – Traffic Incident Management System TI01 – Broadcast Traveler Information WX02 – Weather Information Processing and Distribution
Implement additional strategies for active traffic management	TM01 – Infrastructure-Based Traffic Surveillance TM03 – Traffic Signal Control TM04 – Connected Vehicle Traffic Signal System TM05 – Traffic Metering TM07 – Regional Traffic Management TM08 – Traffic Incident Management System TM12 – Dynamic Roadway Warning TM16 – Reversible Lane Management TM17 – Speed Warning and Enforcement TM19 – Roadway Closure Management TM20 – Variable Speed Limits TM21 – Speed Harmonization TM22 – Dynamic Lane Management and Shoulder Use ST06 – HOV/HOT Lane Management
Improve the accuracy, timeliness, and availability of regional travel information	TM06 – Traffic Information Dissemination TI01 – Broadcast Traveler Information TI02 – Personalized Traveler Information PS14 – Disaster Traveler Information
Collect and make available additional travel time information along controlled access facilities and arterials	TM01 – Infrastructure-Based Traffic Surveillance TM02 – Vehicle-Based Traffic Surveillance TM06 – Traffic Information Dissemination TI01 – Broadcast Traveler Information TI02 – Personalized Traveler Information
Implement Integrated Corridor Management (ICM) strategies	TM06 – Traffic Information Dissemination TM07 – Regional Traffic Management TM10 – Electronic Toll Collection TM22 – Dynamic Lane Management and Shoulder Use TI01 – Broadcast Traveler Information TI02 – Personalized Traveler Information TI04 – Infrastructure-Provided Trip Planning and Route Guidance ST06 – HOV/HOT Lane Management PT08 – Transit Traveler Information PT09 – Transit Signal Priority PM04 – Regional Parking Management
Improve emergency vehicle movements with traffic signal preemption	TM03 – Traffic Signal Control PS03 – Emergency Vehicle Preemption

**Table 9 – Austin Regional ITS Needs and Corresponding Service Packages (Continued)**

ITS Need	Corresponding Service Package
Implement a regional or statewide transit fare payment system that could accommodate the transfer of passengers between modes and agencies	PT04 – Transit Fare Collection Management PT14 – Multi-modal Coordination PT18 – Integrated Multi-modal Electronic Payment
Optimize transit passenger travel times and establish coordination among transit agencies	PT01 – Transit Vehicle Tracking PT08 – Transit Traveler Information PT09 – Transit Signal Priority PT10 – Intermittent Bus Lanes PT14 – Multi-modal Coordination PT17 – Transit Connection Protection
Expand traffic signal priority for transit vehicles	PT09 – Transit Signal Priority PT10 – Intermittent Bus Lanes
Monitor roadway weather conditions to minimize the effects of adverse conditions on traffic	WX01 – Weather Data Collection WX02 – Weather Information Processing and Distribution
Improve data sharing among agencies for both operational and planning initiatives	DM01 – ITS Data Warehouse DM02 – Performance Monitoring
Plan for and adapt to changes in vehicle safety technologies such as connected vehicles	VS07 – Road Weather Motorist Alert and Warning VS09 – Reduced Speed Zone Warning/Lane Closure VS13 – Intersection Safety Warning and Collision Avoidance VS15 – Infrastructure Enhanced Cooperative Adaptive Cruise Control VS16 – Automated Vehicle Operations
Ensure that the Austin Region remains at the forefront of new technological advancements in transportation	There were no specific ITS service packages identified to meet this need.
Provide additional training to operators to ensure that deployments of ITS are fully utilized	There were no specific ITS service packages identified to meet this need.

## 5.2 Architecture Interfaces

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

### 5.2.1 TOP LEVEL REGIONAL SYSTEM INTERCONNECT DIAGRAM

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

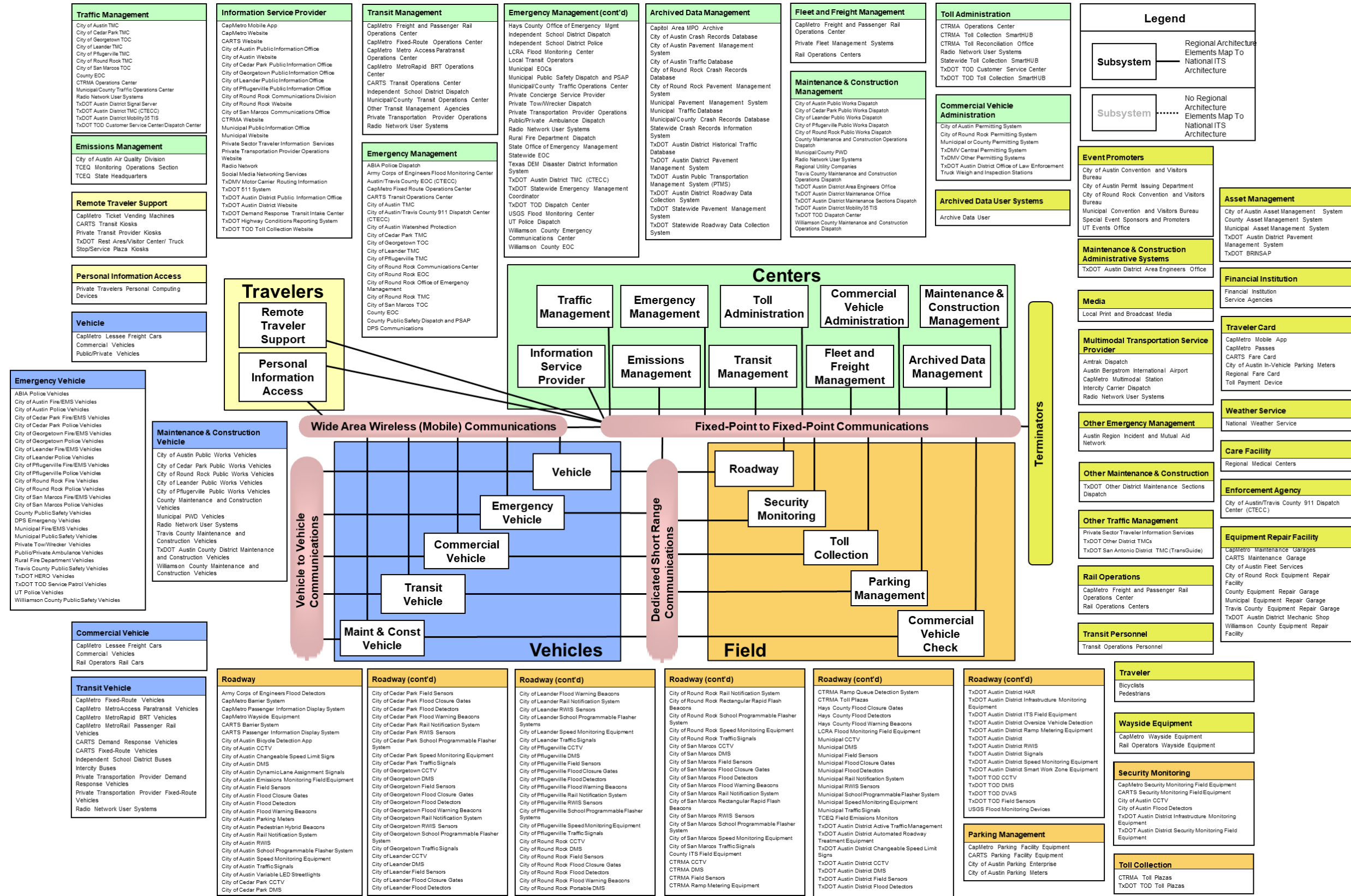


Figure 4 – Austin Regional System Interconnect Diagram

**Interactive Regional ITS Architecture**

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

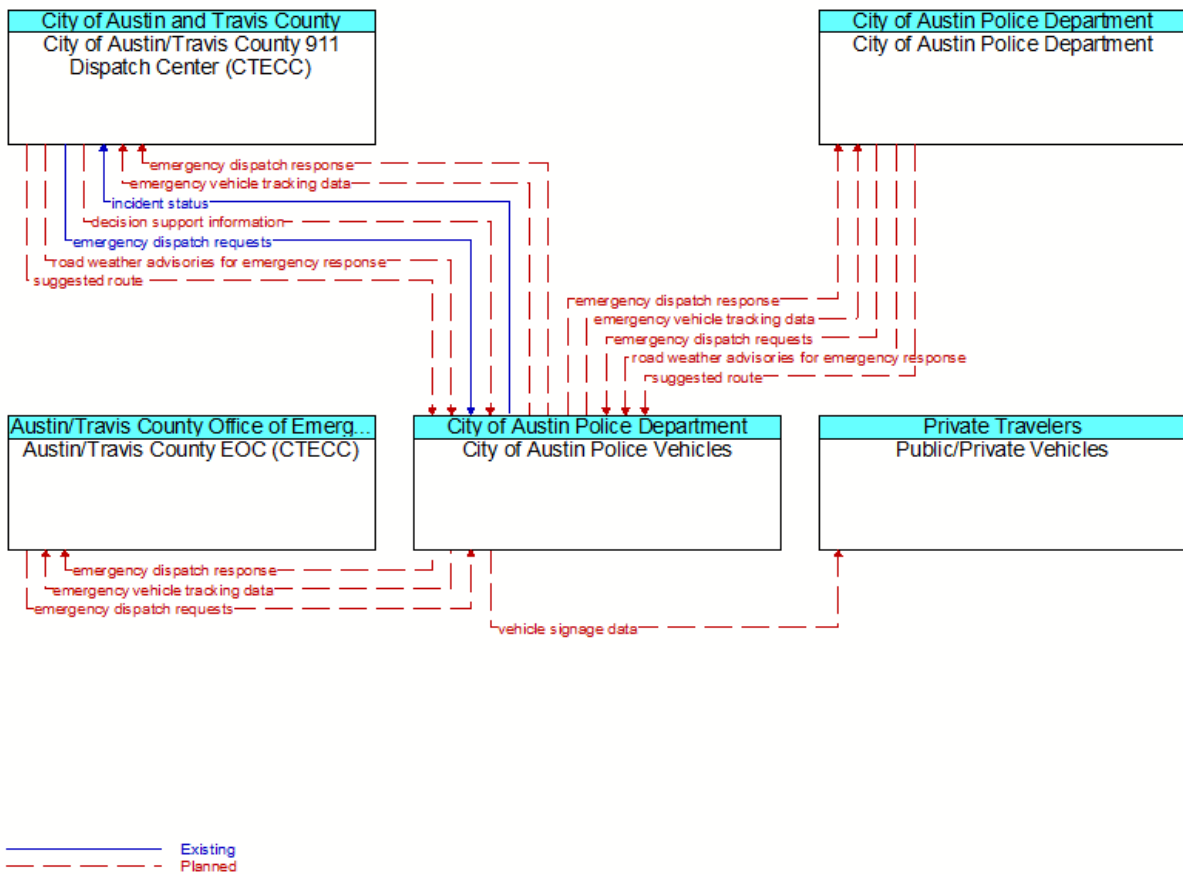
[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

To access this information, from the website select the “Interactive Architecture” link from the Interactive Architecture website tab, then select the “Inventory” page from the left sidebar. Select an Element from the table to learn more about it. Users can also sort elements by physical object or by stakeholder using the corresponding sidebar options.

**5.2.2 DATA FLOWS BETWEEN ELEMENTS**

In the service package diagrams, flows between the subsystems and terminators define the specific information (data) that is exchanged between the elements and the direction of the exchange. The data flows could be requests for information, alerts and messages, status requests, broadcast advisories, event messages, confirmations, electronic credentials, and other key information requirements.

A sample context diagram that has been filtered for City of Austin Police Vehicles is shown in **Figure 5**.



**Figure 5 – Sample Context Diagram – City of Austin Police Vehicles**

Context diagrams show the data flows between elements of the architecture. For example, **Figure 5** shows existing connections between City of Austin Police Vehicles and CTECC's 911 Dispatch Center. The diagram also shows many of these same connections, including dispatch request and response and emergency vehicle tracking data, do not yet exist but are planned between these vehicles and the City of Austin Police Department.

#### Interactive Regional ITS Architecture

While service package diagrams contain data flow information, this information can also be filtered by element in the online interactive RAD-IT database at:

[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

To access these element-specific context diagrams, from the website select the "Interactive Architecture" link from the Interactive Architecture website tab, then select the "Interfaces" page from the left sidebar, then click the desired interfacing element pair. The links in the second column will pull up specific context diagrams.

### 5.3 Functional Requirements

Functions are a description of what the system has to do. In the National ITS Architecture, functions are defined at several different levels, ranging from general subsystem descriptions through somewhat more specific equipment package descriptions to Process Specifications that include substantial detail. Guidance from the USDOT on developing a Regional ITS Architecture recommends that each Region determine the level of detail of the functional requirements for their Region. In the Austin 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 Austin Regional ITS Architecture, functional requirements have been identified at two levels. The customized service packages, discussed previously in Section 5.1.3, describe the services that ITS needs to provide in the Region and the architecture flows between the elements. These service packages and data flows describe what ITS in the Austin Region has to do and the data that needs to be shared among elements.

At a more detailed level, functional requirements for the Austin Region are described in terms of functions that each element in the architecture performs or will perform in the future. These functions can be found in the online version of the architecture.

#### Interactive Regional ITS Architecture

Element functions can be found in the online interactive RAD-IT database at:

[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

To access these element-specific functions, from the website select the "Interactive Architecture" link from the Interactive Architecture website tab, then select the "Inventory" page from the left sidebar, then click on the link for the desired element in the table. The links under the "Functionality" heading on the element page will lead to descriptions of functionality for the element in question.

## 5.4 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Austin Regional ITS Architecture over time. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve. The USDOT's ITS Joint Program Office is supporting Standards Development Organizations (SDOs) with an extensive, multi-year program of accelerated, consensus-based standards developed to facilitate successful ITS deployment in the United States. **Table 10** identifies each of the ITS standards that could apply to the Austin Regional ITS Architecture. These standards are based on the physical subsystem architecture flows previously identified in Section 5.2.2.

While **Table 10** does not match the standards to specific architecture flows, that information is available through the National ITS Architecture website and Turbo Architecture. Since the website is updated more frequently than the software and links directly to additional information about the applicable standard, the website is the preferred method for determining which standards apply to a particular architecture flow. To locate this information do the following:

- Go to the main page of the National Architecture website at <http://www.arc-it.net/>;
- Select the information flows link embedded in the second sub-bullet about Views beneath the first bulleted item, which describes the Architecture menu bar drop-down;
- From the alphabetical list of flows that appears locate and select the desired flow;
- Architecture flows are often used between multiple subsystems so scrolling may be required to find the appropriate information associated with the particular use of the flow, in the descriptive information any applicable standards will be identified; and
- For additional information on the applicable standards, the information flow name is a link that when selected leads to a more detailed description of the standards. The Communication Diagrams tab contains a graphic with applicable standards for the communication solution that satisfies the information flow.

### Interactive Regional ITS Architecture

Relevant standards are also provided in the online interactive RAD-IT database at:

[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

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

**Table 10 – Austin Regional ITS Standards**

SDO	Document ID	Title	
AASHTO/ITE	ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	
AASHTO/ITE/NEMA	NTCIP 1201	Global Object Definitions	
	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller Units	
	NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)	
	NTCIP 1204	Object Definitions for Environmental Sensor Stations	
	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control	
	NTCIP1206	Object Definitions for Data Collection and Monitoring (DCM) Devices	
	NTCIP 1207	Object Definitions for Ramp Meter Control (RMC) Units	
	NTCIP 1208	Object Definition for CCTV Camera Switching	
	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems	
	NTCIP 1210	Field Management Stations – Part 1: Object Definitions for Signal System Masters	
	NTCIP 1211	Object Definitions for Signal Control and Prioritization	
	NTCIP 1213	Object Definitions for Electrical and Lighting Management Systems (ELMS)	
	NTCIP 1214	Object Definitions for Conflict Monitor Units (CMU)	
	NTCIP Center to Center Standards Group		
	NTCIP 1102	Octet Encoding Rules Base Protocol	
	NTCIP 1104	Center-to-Center Naming Convention Specification	
	NTCIP 2104	Ethernet Subnetwork Profile	
	NTCIP 2202	Internet (TCP/IP and UDP/IP) Transport Profile	
	NTCIP 2303	File Transfer Protocol (FTP) Application Profile	
	NTCIP 2304	Application Profile for DATEX-ASN (AP-DATEX)	
	NTCIP 2306	Application Profile for XML Message Encoding and Transport in ITS Center-to-Center Communications (C2C XML)	
	NTCIP Center-to-Field Standards Group		
	NTCIP 1102	Octet Encoding Rules Base Protocol	
	NTCIP 1103	Transportation Management Protocols (TMP)	
	NTCIP 2101	Point to Multi-Point Protocol Using RS-232 Subnetwork Profile	
	NTCIP 2102	Point to Multi-Point Protocol Using FSK Modem Subnetwork Profile	
	NTCIP 2103	Point-to-Point Protocol Over RS-232 Subnetwork Profile	
	NTCIP 2104	Ethernet Subnetwork Profile	
	NTCIP 2201	Transportation Transport Profile	
	NTCIP 2202	Internet (TCP/IP and UDP/IP) Transport Profile	
	NTCIP 2301	Simple Transportation Management Framework (STMF) Application Profile	
	NTCIP 2302	Trivial File Transfer Protocol (TFTP) Application Profile	
	NTCIP 2303	File Transfer Protocol (FTP) Application Profile	
APTA	APTA TCIP-S-001 3.0.4	Standard for Transit Communications Interface Profiles	



**Table 10 – Austin Regional ITS Standards (Continued)**

SDO	Document ID	Title
ASTM	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems
	ASTM E2665-08	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data
	Dedicated Short Range Communication at 915 MHz Standards Group	
	ASTM E2158-01	Standard Specification for Dedicated Short Range Communication (DSRC) Physical Layer using Microwave in the 902-928 MHz Band
ASTM/IEEE/SAE	Dedicated Short Range Communication at 5.9 GHz Standards Group	
	ASTM E2213-03	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems - 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications
	IEEE 1609.1 – 2006	Standard for Wireless Access in Vehicular Environments (WAVE) – Resource Manager
	IEEE 1609.2 – 2006	Standard for Wireless Access in Vehicular Environments (WAVE) - Security Services for Applications and Management Messages
	IEEE 1609.3	Standard for Wireless Access in Vehicular Environments (WAVE) – Networking Services
	IEEE 1609.4 – 2006	Standard for Wireless Access in Vehicular Environments (WAVE) - Multi-Channel Operation
	IEEE 802.11p	Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part II: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification
	IEEE P1609.0	Standard for Wireless Access in Vehicular Environments (WAVE) - Architecture
IEEE	IEEE 1455-1999	Standard for Message Sets for Vehicle/Roadside Communications
	IEEE 1570-2002	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection
	IEEE P1609.11	Standard for Wireless Access in Vehicular Environments (WAVE) - Over-the-Air Data Exchange Protocol for Intelligent Transportation Systems (ITS)
	Incident Management Standards Group	
	IEEE 1512-2006	Standard for Common Incident Management Message Sets for use by Emergency Management Centers
	IEEE 1512.1-2006	Standard for Traffic Incident Management Message Sets for use by Emergency Management Centers
	IEEE 1512.2-2004	Standard for Public Safety Traffic Management Message Sets for use by Emergency Management Centers
	IEEE 1512.3-2006	Standard for Hazardous Material Incident Management Sets for use by Emergency Management Centers
	IEEE P1512.4	Standard for Common Traffic Incident Management Message Sets for use in Entities External to Centers

**Table 10 – Austin Regional ITS Standards (Continued)**

SDO	Document ID	Title
SAE	SAE J2735	Dedicated Short Rang Communications (DSRC) Message Set Directory
	Advanced Traveler Information Systems (ATIS) Bandwidth Limited Standards Group	
	SAE J2266	Location Referencing Message Specification (LRMS)
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)
	SAE J2369	Standard for ATIS Message Sets Delivered Over Reduced Bandwidth Media
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards
	SAE J2540/1	RDS (Radio Data System) Phrase Lists
	SAE J2540/2	ITIS (International Traveler Information Systems) Phrase Lists
	SAE J2540/3	National Names Phrase List
	Advanced Traveler Information Systems (ATIS) General Use Standards Group	
	SAE J2266	Location Referencing Message Specification (LRMS)
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards
	SAE J2540/1	RDS (Radio Data System) Phrase Lists
	SAE J2540/2	ITIS (International Traveler Information Systems) Phrase Lists
	SAE J2540/3	National Names Phrase List
	On-board Vehicle Mayday Standards Group	
	SAE J2266	Location Referencing Message Specification (LRMS)
	SAE J2313	On-board Land Vehicle Mayday Reporting Interface
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards
	SAE J2540/1	RDS (Radio Data System) Phrase Lists
	SAE J2540/2	ITIS (International Traveler Information Systems) Phrase Lists
	SAE J2540/3	National Names Phrase List

### 5.5 Operational Concepts

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

**Traffic Signal 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.

**Traffic Metering Management** – The development of systems to monitor freeway traffic flow and roadway conditions and provide strategies such as ramp metering or lane access control to improve the flow of traffic on the freeway. Includes systems to provide information to travelers on the roadway.

**Incident Management** – The development of systems to provide rapid and effective response to incidents. Includes systems to detect and verify incidents, along with coordinated agency response to the incidents.

**Emergency Management** – The development of systems to provide emergency call taking, public safety dispatch, and emergency operations center operations.

**Maintenance and Construction Management** – The development of systems to manage the maintenance of roadways in the Region, including winter snow and ice clearance. Also includes the management of construction operations and coordination of construction activities.

**Transit Management** – The development of systems to more efficiently manage fleets of transit vehicles or transit rail. Includes systems to provide transit traveler information both pre-trip and during the trip.

**Traveler Information** – The development of systems to provide static and real-time transportation information to travelers.

**Commercial Vehicle Operations** – The development of systems to facilitate the management of commercial vehicles (e.g., electronic clearance).

**Archived Data Management** – The development of systems to collect transportation data for use in non-operational purposes (e.g., planning and research).

**Table 11** identifies the roles and responsibilities of key stakeholders for a range of transportation services.

**Table 11 – Austin Stakeholder Roles and Responsibilities**

Transportation Service	Stakeholder	Roles/Responsibilities
Traffic Signal Control	TxDOT	Operate traffic signal systems on state owned arterials, including traffic signals, sensor systems, and pedestrian crossing signals.
		Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on state owned arterials and City streets to facilitate traffic signal operations.
		Remotely operate traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, and emergency vehicle preemptions.
		Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
		Coordinate highway rail intersection (HRI) signal adjustments with regional and private Rail Operators.
		Provide emergency signal preemption for the City and County public safety vehicles as well as DPS vehicles.
	City of Austin	Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on City streets to facilitate traffic signal operations.
		Operate traffic signal systems on City owned streets, including traffic signals, sensor systems, and CCTV detection devices.
		Operate programmable flasher systems for City schools.
		Operate Pedestrian Hybrid Beacons for non-motorized road users.
		Coordinate HRI signal adjustments with regional and private Rail Operators.
		Operate and control reversible lanes on City owned streets.
		Provide transit signal priority for regional fixed-route transit vehicles.
	City of Cedar Park	Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on City streets to facilitate traffic signal operations.
		Operate traffic signal systems on City owned streets, including traffic signals, sensor systems, and pedestrian crossing systems.
		Operate programmable flasher systems for City schools.
		Coordinate HRI signal adjustments with regional and private Rail Operators.
		Provide emergency signal preemption for the City's Fire and EMS vehicles, the county's public safety vehicles, and public/private ambulances.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Traffic Signal Control (continued)	City of Georgetown	Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on City streets to facilitate traffic signal operations.
		Operate traffic signal systems on City owned streets, including traffic signals, sensor systems, and pedestrian crossing systems.
		Operate programmable flasher systems for City schools.
		Coordinate HRI signal adjustments with regional and private Rail Operators.
		Provide emergency signal preemption for the City's Fire and EMS vehicles, the county's public safety vehicles, and public/private ambulances.
	City of Round Rock	Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on City streets to facilitate traffic signal operations.
		Operate traffic signal systems on City owned streets, including traffic signals, sensor systems, and pedestrian crossing systems.
		Operate programmable flasher systems for City schools.
		Operate Rectangular Rapid Flash Beacons for non-motorized road users.
		Coordinate HRI signal adjustments with regional and private Rail Operators.
		Provide emergency signal preemption for the City's Fire and EMS vehicles, the county's public safety vehicles, and public/private ambulances.
	City of San Marcos	Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on City streets to facilitate traffic signal operations.
		Operate traffic signal systems on City owned streets, including traffic signals, sensor systems, and pedestrian crossing systems.
		Operate programmable flasher systems for City schools.
		Operate Rectangular Rapid Flash Beacons for non-motorized road users.
		Coordinate HRI signal adjustments with regional and private Rail Operators.
		Provide emergency signal preemption for the City's Fire and EMS vehicles, the county's public safety vehicles, and public/private ambulances.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Traffic Signal Control (continued)	Municipalities	Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on municipal streets to facilitate traffic signal operations.
		Operate traffic signal systems on municipal streets, including traffic signals, sensor systems, and pedestrian crossing systems.
		Operate programmable flasher systems for City schools.
		Coordinate HRI signal adjustments with regional and private Rail Operators.
		Provide emergency signal preemption for the municipality's Fire and EMS vehicles, the county's public safety vehicles, and public/private ambulances.
Freeway Management	TxDOT	Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on State owned highways.
		Operate active traffic management on state owned highways.
		Provide traffic information to regional transportation agencies and the general public through traffic information devices (DMS, Highway Advisory Radio, HCRS, Texas 511, etc.).
		Provide security monitoring of critical infrastructure for the State.
		Coordinate traffic information and traffic control with other regional TMCs and the statewide TMC.
	CTRMA	Operate network surveillance equipment (CCTV cameras, field sensors, etc.) on toll roads.
		Coordinate traffic information and traffic control with other regional TMCs.
		Operate and collect tolls on CTRMA tolled facilities.
		Dispatch HERO service patrol vehicles.
		Provide HOV lane management for state owned highways. Provide travelers with real-time pricing information for HOV lanes via agency DMS.
	TxDOT TOD	Operate and collect tolls on TxDOT tolled facilities.
		Coordinate traffic information and traffic control with other regional TMCs.
Incident Management – Traffic	City of Austin	Coordinate maintenance resources for incident response.
		Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Responsible for the dissemination of traffic related data to other centers and the media.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management – Traffic (continued)	City of Cedar Park	Coordinate maintenance resources for incident response.
		Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Responsible for the dissemination of traffic related data to other centers and the media.
	City of Georgetown	Coordinate maintenance resources for incident response.
		Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Responsible for the dissemination of traffic related data to other centers and the media.
	City of Round Rock	Coordinate maintenance resources for incident response.
		Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Responsible for the dissemination of traffic related data to other centers and the media.
	City of San Marcos	Coordinate maintenance resources for incident response.
		Remotely control traffic and video sensors to support incident detection and verification.
		Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
		Responsible for the dissemination of traffic related data to other centers and the media.
TxDOT Austin District	Coordinate maintenance resources for incident response.	
	Remotely control traffic and video sensors to support incident detection and verification.	
	Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.	
	Responsible for the dissemination of traffic related data to other centers and the media.	

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management – Traffic (continued)	City of Austin and Travis County (911 Dispatch)	Operate the 911 center for the City and County, with the ability to dispatch regional and statewide emergency services.
		Coordinate public safety resources for incident response with the City's traffic operations center (TOC).
		Dispatch the City's police vehicles, fire vehicles and EMS vehicles and dispatch county public safety vehicles, as well as coordinate with all other public safety agencies within the region.
		Perform incident detection and verification for the streets within the City and County, and provide this information to the City's TOC.
		Coordinate an incident response with regional rail operations for incidents involving rail.
		Coordinate maintenance resources in response to incidents within the City and within the County.
		Coordinate incident response with other emergency dispatch agencies and the TxDOT Austin District TMC (CTECC) for incidents on state facilities.
	City of Round Rock Public Safety	Coordinate incident response with the County public safety departments.
		Dispatch the City's public safety vehicles (police, fire and EMS) as well as coordinate with all other public safety agencies within the region.
		Coordinate public safety resources for incident response with regional traffic agencies, including the City's TOC and regional TMCs.
		Coordinate with ambulance services in response to incidents within the City.
		Coordinate an incident response with regional rail operations for incidents involving rail.
	County Public Safety	Receive emergency calls for incidents within the counties.
		Dispatch the County's public safety vehicles (and track their location) as well as coordinate with all other public safety agencies within the region.
		Coordinate incident response with other emergency management agencies.
		Perform incident detection and verification for the streets within the county, and provide this information to the regional TMCs.
		Coordinate an incident response with regional rail operations for incidents involving rail.
		Coordinate maintenance resources in response to incidents within the county of an adjacent municipality.



**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management – Traffic (continued)	Department of Public Safety (DPS)	Dispatch DPS Police vehicles for incidents on highways and the parkway.
	Coordinate incident response with other public safety agencies (police, fire, EMS, sheriff, etc.) as well as with TxDOT Austin District TMC (CTECC) for incidents on state facilities.	
	Perform incident detection and verification for the highways within the region, and provide this information to traffic and other public safety agencies.	
	Coordinate maintenance resources in response to incidents on state highways with regional maintenance providers.	
	Coordinate an incident response with regional rail operations for incidents involving rail.	
	Municipalities	Receive emergency calls for incidents within the municipalities.
	Coordinate public safety resources for incident response with the municipality's TOC or TMC.	
	Dispatch the municipality's police vehicles, fire vehicles and EMS vehicles as well as coordinate with all other public safety agencies within the region.	
	Perform incident detection and verification for the streets within the municipalities, and provide this information to the municipality TOCs.	
	Coordinate an incident response with regional rail operations for incidents involving rail.	
	Coordinate with ambulance services in response to incidents within the City.	
	Coordinate maintenance resources in response to incident with the municipality.	
	TxDOT Austin District	Perform incident detection and verification for the state highways, and provide this information to the municipality TOCs.
	Coordinate maintenance resources in response to incidents on state highways with regional maintenance providers.	
	Coordinate an incident response with regional rail operations for incidents involving rail.	
	Coordinate public safety resources for incident response with municipal I traffic agencies.	
	University of Texas	Receive emergency calls for incidents within the University.
	Dispatch the University Police vehicles as well as coordinate with all other public safety agencies within the region (City and County level).	
	Coordinate incident response with the City Police.	
	Perform incident detection and verification for the streets within the University, and provide this information to the regional and City TMC.	
Coordinate maintenance resources in response to incident within the University.		

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management	CapMetro	Track vehicle location on all agency fixed-route transit vehicles, demand response vehicles, and commuter rail.
		Provide transit schedule and fare information to the agency's website, mobile app, the TxDOT 511 system, regional traveler information providers, and private sector traveler information service providers.
		Provide fixed-route bus service for the agency's defined service area through fixed-route transit vehicles and commuter rail.
		Provide demand response bus service (MetroAccess paratransit) for the agency's defined service area, with the ability to provide a demand response transit plan on the agency's website.
		Provide transit passenger electronic fare payment on all agency fixed-route, MetroRapid BRT, MetroAccess Paratransit, and MetroRail Passenger Rail transit vehicles.
		Provide transit security on all agency transit vehicles through silent alarms, sensors, AVL, and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle condition reports on all agency fixed-route, MetroRapid BRT, MetroAccess Paratransit, and MetroRail Passenger Rail transit vehicles.
		Obtain traffic signal priority from the municipalities in the agency's service area through the municipality's field equipment for all MetroRapid BRT transit vehicles.
		Coordinate transit service with all other agency transit vehicles.
		Coordinate transit service with other regional transit providers, as well as regional intermodal terminals, AMTRAK stations, and regional airports.
		Provide real-time CapMetro vehicle arrival status boards at MetroRapid BRT bus stops and MetroRail Passenger Rail stations and location information on the CapMetro Website and Cap Metro Mobile App.
		Operate on-board systems to provide next stop annunciation.
		Coordinate emergency plans with Municipal, County, and Statewide EOCs and provide emergency transit services for evacuations, fires, and disasters (including re-entry).
	CARTS	Track vehicle location and evaluate schedule performance on all agency fixed-route transit vehicles and demand response transit vehicles.
		Provide transit schedule and fare information to the agency's website, the TxDOT 511 system, regional traveler information providers, and private sector traveler information service providers.
		Provide fixed-route bus service for the agency defined service area.
		Provide demand response bus service for the agency defined service area, with the ability to provide a demand response transit plan from the agency website.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	CARTS (continued)	Provide transit passenger electronic fare payment on all agency fixed-route and demand response transit vehicles.
		Provide transit security on all agency transit vehicles through silent alarms and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle condition reports on all agency fixed-route and demand response transit vehicles.
		Coordinate transit service with other regional transit providers, as well as regional intermodal terminals, AMTRAK stations, and regional airports.
		Provide transit traveler information to the agency website as well as making it available on all transit information kiosks and transit vehicles.
		Coordinate emergency plans with Municipal, County, and Statewide EOCs and provide emergency transit services for evacuations, fires, and disasters (including re-entry).
	Independent School Districts	Track vehicle location and evaluate schedule performance on all school district vehicles.
		Provide school bus schedule and route information to the school district website.
		Provide fixed-route school bus service for the cities, municipalities, and counties within the State of Texas.
		Provide transit security on all transit vehicles through silent alarms and surveillance systems.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Independent School District buses.
		Coordinate emergency plans with Municipal, County, and Statewide EOCs and provide emergency transit services for evacuations, fires, and disasters (including re-entry).
	Private Transportation Providers	Track vehicle location and evaluate schedule performance on all agency fixed-route transit vehicles and demand response transit vehicles.
		Provide transit schedule and fare information to the agency's website, the TxDOT 511 system, regional traveler information providers, and private sector traveler information service providers.
		Provide fixed-route bus service for the agency defined service area.
		Provide demand response service for the agency defined service area.
		Provide transit passenger electronic fare payment on all agency fixed-route and demand response transit vehicles.
		Provide transit passenger electronic fare payment on all agency fixed-route and demand response transit vehicles.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Management (continued)	Private Transportation Providers (continued)	Coordinate transit service with other regional transit providers, as well as regional intermodal terminals, AMTRAK stations, and regional airports.
		Provide transit traveler information to the agency website as well as making it available on all transit information kiosks and transit vehicles.
		Coordinate emergency plans with Municipal, County, and Statewide EOCs and provide emergency transit services for evacuations, fires, and disasters (including re-entry).
		Coordinate transit service with other regional transit providers, as well as regional intermodal terminals, AMTRAK stations, and regional airports.
		Provide automated transit maintenance scheduling through automated vehicle condition reports on all agency fixed-route and demand response transit vehicles.
		Provide transit security on all agency transit vehicles through silent alarms and surveillance systems.
	TxDOT	Provide a demand-response intake center to aid the traveling public in coordinating with demand response transit vehicles.
		Provide the ability to determine a demand response transit plan.
Traveler Information	TxDOT	Operate the state 511 system.
		Collect traffic, incident, transit schedule, road maintenance, and weather information various agencies in the region and provide it to the media and private travelers.
		Provide broadcast information to travelers.
		Coordinate and share traveler information with all other traveler information providers within the region.
		Provide traveler information to private travelers (in vehicle, personal computing device, or kiosk) upon request.
		Provide traveler information to the media.
		Provide a route guidance system for private commercial fleets based on information gathered from HCRS.
		Provide traffic information reports to regional and private information service providers as well as the Texas 511 System (through the highway conditions reporting system [HCRS]).
		Provide traffic information to regional agencies including transit, emergency management, maintenance and construction, and the media. Provide traffic information to travelers through state owned DMS.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management	Department of Public Safety	Dispatch State Police vehicles (and track their location) as well as coordinate with all other public safety agencies within the region.
		Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Operate PSAP for statewide services, but has the ability to dispatch regional and statewide emergency services.
		Coordinate with regional medical centers regarding the status of the care facility as well as the patient status en route to the medical center.
		Receive signal preemption from regional traffic signals.
		Receive and respond to threat information from the City's TMC regarding critical infrastructure.
		Receive AMBER Alert and other Wide-Area Alert information from the State Office of Emergency Management.
		Generate AMBER Alerts and distribute them to regional emergency management agencies, transit agencies, traffic agencies, and the media.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.
	Receive Wide-Area Alert information from the Regional EOCs.	
	City of Austin Police Department	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Dispatch the City's police vehicles (and track their location) as well as coordinate with all other public safety agencies within the City and region.
		Perform incident detection and verification for streets within the City.
		Receive AMBER Alert and other Wide-Area Alert information from the Department of Public Safety (DPS).
		Receive Wide-Area Alert information from the Regional EOCs.
Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.		

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	City of Austin Fire Department	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Dispatch the City's fire vehicles (and track their location) as well as coordinate with all other public safety agencies within the City and region.
		Perform incident detection and verification for streets within the City.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.
	City of Round Rock Public Safety	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Operates 911 center for the City and County, with the ability to dispatch regional and statewide emergency services.
		Dispatch the City's police vehicles (and track their location) as well as coordinate with all other public safety agencies within the City and region.
		Coordinates with regional medical centers regarding the status of the care facility as well as the patient status en route to the medical center.
		Receive signal preemption from City's traffic signals, and regional traffic signals.
		Perform incident detection and verification for streets within the City.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
	Municipalities	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Operates PSAP for the municipalities, with the ability to dispatch regional and statewide emergency services.
		Dispatch the municipality's public safety vehicles (and track their location) as well as coordinate with all other public safety agencies within the municipality and the region.
		Coordinates with regional medical centers regarding the status of the care facility as well as the patient status en route to the medical center.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Municipalities (continued)	Receive signal preemption from municipality and City traffic signals, as well as regional traffic signals.
		Perform incident detection and verification for streets within the municipalities of the region.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.
		Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
	County Public Safety	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Operate 911 center for the County, with the ability to dispatch regional and statewide emergency services.
		Dispatch the County sheriff's vehicles (and track their location) and county public safety vehicles and coordinate with all other public safety agencies within the county and region.
		Receive signal preemption for county public safety vehicles from regional traffic signals.
		Perform incident detection and verification for streets within the counties of the state as well as on county roads.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.
	Travis County Public Safety	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Dispatch the County's public safety vehicles (and track their location) as well as coordinate with all other public safety agencies within the county and region.
		Coordinates with regional medical centers regarding the status of the care facility as well as the patient status en route to the medical center.
		Receive signal preemption from regional traffic signals.
		Perform incident detection and verification for county roads.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Travis County Public Safety (continued)	Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.
	Williamson County Public Safety	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Operate a PSAP for the County, with the ability to dispatch regional and statewide emergency services.
		Dispatch the County's public safety vehicles (and track their location) as well as coordinate with all other public safety agencies within the county and region.
		Coordinates with regional medical centers regarding the status of the care facility as well as the patient status en route to the medical center.
		Receive signal preemption from municipal traffic signals as well as regional traffic signals.
		Perform incident detection and verification on county roads.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Generate and coordinate wide-area alerts and distribute them to regional emergency management agencies, transit agencies, traffic agencies, regional information service providers, and the media.
		Plan and coordinate region wide emergency plans, evacuation and reentry plans, and disaster management plans dealing with HAZMAT incidents.
		Provide regional traffic, transit, emergency management, and maintenance operations with disaster information to disseminate to the traveling public.
	County Emergency Management Agencies	Responsible for the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Coordinates with regional medical centers regarding the status of the care facility as well as the patient status en route to the medical center.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Generate and coordinate wide-area alerts and distribute them to regional emergency management agencies, transit agencies, traffic agencies, regional information service providers, and the media.
		Plan and coordinate region wide emergency plans, evacuation and reentry plans, and disaster management plans dealing with HAZMAT incidents.
		Provide regional traffic, transit, emergency management, and maintenance operations with disaster information to disseminate to the traveling public.



**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	City of Austin and Travis County (911 Dispatch)	Operate 911 center for the City and County, with the ability to dispatch regional and statewide emergency services.
		Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Dispatch City fire vehicles with suggested route information and track the vehicles to the incident.
		Receive and respond to threat information from regional transportation infrastructure protection equipment.
		Dispatch all city, county, municipality, and DPS vehicles to incidents within the region.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.
	Austin/Travis County Office of Emergency Management (EOC)	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Operates PSAP for the City and the County, with the ability to dispatch regional and statewide emergency services.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Generate and coordinate wide-area alerts and distribute them to regional emergency management agencies, transit agencies, traffic agencies, regional information service providers, and the media.
		Plan and coordinate region wide emergency plans, evacuation and reentry plans, and disaster management plans dealing with HAZMAT incidents.
		Provide regional traffic, transit, emergency management, and maintenance operations with disaster information to disseminate to the traveling public.
	City of Austin Aviation Department	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	Public/Private Ambulance Providers	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Coordinates with regional and statewide emergency services to dispatch and track their own vehicles.
		Coordinates with regional medical centers regarding the status of the care facility as well as the patient status en route to the medical center.
		Dispatch ambulance vehicles with suggested route information and track the vehicles to the incident.
		Receive signal preemption from municipal and City traffic signals as well as regional traffic signals.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.
	University of Texas	Participates in the incident response, coordination, and reporting of the Statewide Mutual Aid and Incident Management Network in a coordination effort only (no dispatch function).
		Dispatch Special Police vehicles (and track their location) as well as coordinate with all other public safety agencies within the City.
		Perform incident detection and verification for streets within the specified area of responsibility.
		Receive AMBER Alert and other Wide-Area Alert information from DPS.
		Receive Wide-Area Alert information from the Regional EOCs.
		Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management plans.
	Army Corps of Engineers	Receive flood monitoring information from its own field equipment.
		Provide flood warning information to regional TMCs/TOCs and regional transit agencies.
	Lower Colorado River Authority	Receive flood monitoring information from its own field equipment.
		Provide flood warning information to regional TMCs/TOCs and regional transit agencies.
	TxDOT	Receive flood monitoring information from its own field equipment.
		Provide flood warning information to regional TMCs/TOCs, regional transit agencies, regional maintenance agencies, and the media.
		Provide flood warning information to the traveling public through DMS and with flood gates.
		Provide disaster traveler information to regional emergency management agencies, regional traffic agencies, and regional transit agencies.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	US Geological Survey	Receive flood monitoring information from its own field equipment.
		Provide flood warning information to regional TMCs/TOCs and regional transit agencies.
	City of Austin	Receive flood monitoring information from its own field equipment (water level monitors and CCTV cameras).
		Provide flood warning information to regional TMCs/TOCs, regional transit agencies, regional maintenance agencies, and the media.
		Provide flood warning information to the traveling public through DMS and with flood gates.
		Provide disaster traveler information to regional emergency management agencies, regional traffic agencies, and regional transit agencies.
	City of Cedar Park	Receive flood monitoring information from its own field equipment (water level monitors and CCTV cameras).
		Provide flood warning information to regional TMCs/TOCs, regional transit agencies, regional maintenance agencies, and the media.
		Provide flood warning information to the traveling public through DMS and with flood gates.
		Provide disaster traveler information to regional emergency management agencies, regional traffic agencies, and regional transit agencies.
	City of Georgetown	Receive flood monitoring information from its own field equipment (water level monitors and CCTV cameras).
		Provide flood warning information to regional TMCs/TOCs, regional transit agencies, regional maintenance agencies, and the media.
		Provide flood warning information to the traveling public through DMS and with flood gates.
		Provide disaster traveler information to regional emergency management agencies, regional traffic agencies, and regional transit agencies.
	City of Round Rock	Receive flood monitoring information from its own field equipment (water level monitors and CCTV cameras).
		Provide flood warning information to regional TMCs/TOCs, regional transit agencies, regional maintenance agencies, and the media.
Provide flood warning information to the traveling public through DMS and with flood gates.		
Provide disaster traveler information to regional emergency management agencies, regional traffic agencies, and regional transit agencies.		

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management (continued)	City of San Marcos	Receive flood monitoring information from its own field equipment (water level monitors and CCTV cameras).
		Provide flood warning information to regional TMCs/TOCs, regional transit agencies, regional maintenance agencies, and the media.
		Provide flood warning information to the traveling public through DMS.
		Provide disaster traveler information to regional emergency management agencies, regional traffic agencies, and regional transit agencies.
Maintenance and Construction Management	TxDOT	Receive a request for maintenance resources for incident response from regional emergency management agencies.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive vehicle location information from agency maintenance and construction vehicles.
		Receive vehicle maintenance conditions from agency maintenance and construction vehicles and coordinate fleet maintenance with the agency's district mechanic shop.
		Collect road weather information with agency field equipment and distribute it to regional traffic, maintenance and transit agencies as well as the national weather service and the media.
		Provide maintenance of state highways within the region, including pavement maintenance and all construction activities.
		Coordinate maintenance activities with the agency's district engineer and with the agency's asset management system.
		Dispatch agency maintenance vehicles and get operations status from these vehicles.
		Provide maintenance to all field equipment owned and operated by the agency.
		Manage work zones on all agency maintenance and construction activities, as well as monitors work zone safety with agency field devices and vehicles.
		Provide maintenance status and notification information to the traveling public through agency owned DMS.
		Monitor the safety of maintenance and construction activities through early warning systems and sensors on maintenance and construction field equipment.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, emergency operations, transit providers, rail operations, and the media.		

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	City of Austin	Collect road weather information with agency field equipment and distribute it to regional traffic, maintenance and transit agencies as well as the national weather service and the media.
		Receive a request for maintenance resources for incident response from regional emergency management agencies.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive vehicle location information from agency maintenance and construction vehicles.
		Receive vehicle maintenance conditions from agency maintenance and construction vehicles and coordinate fleet maintenance with agency's fleet services.
		Provide maintenance of streets within the city, including pavement maintenance and all construction activities.
		Coordinate maintenance activities with the agency's TMC and with the agency's asset management system.
		Dispatch agency maintenance vehicles and get operations status from these vehicles.
		Provide maintenance to all field equipment owned and operated by the City.
		Manage work zones on City streets, and monitors the safety of work zones status with City owned vehicles and field equipment.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, emergency operations, rail operations, and the media.
		City of Round Rock
	Coordinate maintenance resources for incidents with other regional maintenance providers.	
	Receive vehicle location information from agency maintenance and construction vehicles.	
	Receive vehicle maintenance conditions from agency maintenance and construction vehicles and coordinate fleet maintenance with agency's equipment repair facility.	
	Provide maintenance of streets within the city, including pavement maintenance and all construction activities.	
	Coordinate maintenance activities with the agency's TMC and with the agency's asset management system.	
	Dispatch agency maintenance vehicles and get operations status from these vehicles.	
	Provide maintenance to all field equipment owned and operated by the City.	

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	City of Round Rock (continued)	Manage work zones on City streets, and monitors the safety of work zones status with City owned vehicles and field equipment.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, emergency operations, rail operations, and the media.
	Municipalities	Receive a request for maintenance resources for incident response from regional emergency management agencies.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive vehicle location information from agency maintenance and construction vehicles.
		Receive vehicle maintenance conditions from agency maintenance and construction vehicles and coordinate fleet maintenance with agency's equipment repair garage.
		Provide maintenance of streets within the municipalities, including pavement maintenance and all construction activities.
		Coordinate maintenance activities with the municipal TOC and with the agency's asset management system.
		Dispatch agency maintenance vehicles and get operations status from these vehicles.
		Provide maintenance to all field equipment owned and operated by the municipality.
		Manage work zones on municipal streets.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, emergency operations, rail operations, and the media.
	Travis County Transportation and Natural Resources Department	Receive a request for maintenance resources for incident response from regional emergency management agencies.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive vehicle location information from agency maintenance and construction vehicles.
		Receive vehicle maintenance conditions from agency maintenance and construction vehicles and coordinate fleet maintenance with agency's equipment repair garage.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	Travis County Transportation and Natural Resources Department (continued)	Provide maintenance of streets within the county, including pavement maintenance and all construction activities.
		Coordinate maintenance activities with regional traffic operations and with the agency's asset management system.
		Dispatch agency maintenance vehicles and get operations status from these vehicles.
		Provide maintenance to all field equipment owned and operated by the county.
		Manage work zones on county streets.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, emergency operations, rail operations, and the media.
	Williamson County Road Department	Receive a request for maintenance resources for incident response from regional emergency management agencies.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive vehicle location information from agency maintenance and construction vehicles.
		Receive vehicle maintenance conditions from agency maintenance and construction vehicles and coordinate fleet maintenance with agency's equipment repair facility.
		Provide maintenance of streets within the county, including pavement maintenance and all construction activities.
		Coordinate maintenance activities with regional traffic operations and with the agency's asset management system.
		Dispatch agency maintenance vehicles and get operations status from these vehicles.
		Provide maintenance to all field equipment owned and operated by the county.
		Manage work zones on county streets.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, emergency operations, rail operations, and the media.

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction Management (continued)	County Departments	Receive a request for maintenance resources for incident response from regional emergency management agencies.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive vehicle location information from agency maintenance and construction vehicles.
		Receive vehicle maintenance conditions from agency maintenance and construction vehicles and coordinate fleet maintenance with agency's equipment repair garage.
		Provide maintenance of streets within the county, including pavement maintenance and all construction activities.
		Coordinate maintenance activities with regional traffic operations and with the agency's asset management system.
		Dispatch agency maintenance vehicles and get operations status from these vehicles.
		Provide maintenance to all field equipment owned and operated by the county.
		Manage work zones on county streets.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, emergency operations, rail operations, and the media.
Parking Management	CapMetro	Monitor parking lots and determine the availability of parking spaces at transit facilities.
		Operate a barrier system to control access to parking lots.
		Provide parking lot information through mobile app, website, and DMS to transit riders.
	CARTS	Monitor parking lots and determine the availability of parking spaces at transit facilities.
		Operate a barrier system to control access to parking lots.
		Provide parking lot information through mobile app, kiosks, and DMS to transit riders.
	City of Austin	Monitor parking lots and on-street spaces to determine the availability of parking spaces.
		Provide parking lot information through website and DMS to motorist.
		Provide electronic parking payment through field parking meters or in-vehicle parking meters.



**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Archived Data Management	TxDOT	Collect and archive transit and ridership information for the region's transit agencies.
		Collect and archive pavement management/maintenance information from regional maintenance sections and provide the information to the statewide system.
		Collect and archive emergency and crash information from regional emergency management agencies and DPS.
		Collect and archive emergency and crash information from regional archives.
		Collect and archive traffic information from the agency's regional TMC and traffic signal system.
	City of Austin	Collect and archive pavement management/maintenance information from its own field equipment and maintenance section and provide the information to regional and statewide systems.
		Collect and archive emergency and crash information from regional emergency management agencies and regional public safety agencies and provide this information to the statewide system.
		Collect and archive traffic information from the agency's maintenance section.
	City of Round Rock	Collect and archive pavement management/maintenance information from its own field equipment and maintenance section and provide the information to regional and statewide systems.
		Collect and archive emergency and crash information from regional emergency management agencies and regional public safety agencies and provide this information to the statewide system.
	Municipalities	Collect and archive pavement management/maintenance information from its own field equipment and maintenance section and provide the information to regional and statewide systems.
		Collect and archive emergency and crash information from regional emergency management agencies and regional public safety agencies and provide this information to the statewide system.
	Capital Area MPO	Collect and archive traffic information from regional traffic management providers, emergency information from regional public safety providers, transit information from regional transit agencies, toll information from regional toll authorities, and parking information from regional parking providers for planning purposes.
		Serve as a data warehouse for regional traffic, emergency, transit, toll, and parking management agencies.
		Serve as a virtual data warehouse for all archive systems in the region.
CapMetro	Collect and archive transit and ridership information.	
Department of Public Safety	Collect and maintain crash record information from regional and statewide emergency management agencies.	

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Commercial Vehicle Operations	City of Austin	Provide for commercial vehicle permits (oversize/overweight) through the agency website and through coordination with other regional permitting systems.
		Provide credential verification and route restrictions for regional commercial vehicles.
		Coordinate fee and credential information and payment with regional and municipal permitting systems.
	City of Round Rock	Provide for commercial vehicle permits (oversize/overweight) through the agency website and through coordination with other regional permitting systems.
		Provide credential verification and route restrictions for regional commercial vehicles.
		Coordinate fee and credential information and payment with regional and municipal permitting systems.
	Commercial Vehicle Fleet Operations	Provide emergency notification and HAZMAT information to regional emergency management providers through a concierge service provider.
		Provide HAZMAT information to regional emergency management providers.
		Provide emergency notification and HAZMAT information to regional emergency management providers through a concierge service provider.
		Provide HAZMAT information to regional emergency management providers.
	Municipalities	Provide for commercial vehicle permits (oversize/overweight) through the agency website and through coordination with other regional permitting systems.
		Provide credential verification and route restrictions for regional commercial vehicles.
		Coordinate fee and credential information and payment with regional and municipal permitting systems.
	Texas DEM	Coordinate and provide alert or evacuation information for commercial vehicle incidents (accidents or HAZMAT spills).
	TxDMV	Provides an electronic (web based) credentials interface for commercial vehicle credentials applications.
Coordinate fee and credential information and payment with regional and municipal permitting systems.		
Provide route information to regional and statewide information service providers, including 511 and HCRS.		
TxDOT	Provide route information to regional and statewide information service providers, including 511 and HCRS.	

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Connected Vehicle Management	City of Austin	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	City of Cedar Park	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	City of Georgetown	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	City of Leander	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	City of Pflugerville	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	City of Round Rock	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	City of San Marcos	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	Counties	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	Municipalities	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
Travis County Transportation and Natural Resources Department	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.	
	Provide information to connected vehicles concerning the existing network conditions.	

**Table 11 – Austin Stakeholder Roles and Responsibilities (Continued)**

Transportation Service	Stakeholder	Roles/Responsibilities
Connected Vehicle Management	TxDOT	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	TxDOT Austin District	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	University of Texas	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.
	Williamson County Road Department	Monitor and operate equipment used to communicate with vehicles traveling along the roadway.
		Provide information to connected vehicles concerning the existing network conditions.

## 5.6 Potential Agreements

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

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

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

When implementing an agreement for ITS, it is recommended that as a first step any existing agreements are reviewed to determine whether they can be amended or modified to include the additional requirements that will come with deploying a system. If there are no existing agreements that can be

modified or used for ITS implementation, then a new agreement will need to be developed. The formality and type of agreement used is a key consideration. If the arrangement will be in effect for an extended duration or involve any sort of long-term maintenance, then written agreements should be used. Often during long-term operations, staff may change and a verbal agreement between agency representatives may be forgotten by new staff.

Common agreement types and potential applications include:

**Handshake Agreement:** Handshake agreements are often used in the early stage of a project. This type of informal agreement depends very much on relationships between agencies and may not be appropriate for long term operations where staff is likely to change.

**Memorandum of Understanding (MOU):** A MOU demonstrates general consensus but is not typically very detailed. MOUs often identify high-level goals and partnerships.

**Interagency and Intergovernmental Agreements:** These agreements between public agencies can be used for operation, maintenance, or funding projects and systems. They can include documentation on the responsibility of each agency, functions they will provide, and liability.

**Funding Agreements:** Funding agreements document the funding arrangements for ITS projects. At a minimum, funding agreements include a detailed scope, services to be performed, and a detailed project budget. Agency funding expectations or funding sources are also typically identified.

**Master Agreements:** Master agreements include standard contract language for an agency and serve as the main agreement between two entities which guides all business transactions. Use of a master agreement can allow an agency to do business with another agency or private entity without having to go through the often-lengthy development of a formal agreement each time.

**Table 12** provides a list of existing and potential agreements for the Austin 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. Copies of existing regional agreements can be found in the online version of the architecture. Text for the Electronic Toll Interoperability agreement in **Table 12** can be found at the TeamTexas website located at <http://www.team-tx.org/Interoperability/>.

#### Interactive Regional ITS Architecture

Copies of existing regional agreements are provided in the online interactive ITS architecture:

[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

To access these agreements, from the website select the “Agreements” tab and click on the link to the desired agreement.

Table 12 – Austin Regional Agreements

Status	Agreement and Agencies	Agreement Description
Existing	<p><b>Austin-Area Incident Management for Highways</b> <b>(Public-Public)</b></p> <p>CAMPO, City of Austin, City of Georgetown, City of Round Rock, DPS, Municipalities/Counties, Travis County, TxDOT, Williamson County, Austin Towing Association, and HERO program contractors</p>	<p>Memorandum that outlines regional coordination among the State, local agencies, and private entities within the Austin Region regarding traffic incident management. Agencies and entities have established very effective interagency communication through the Austin-area Incident Management for Highways (AIMHigh) cooperative.</p>
Existing	<p><b>Data Sharing and Usage</b> <b>(Public-Private)</b></p> <p>TxDOT Austin District and Media</p>	<p>License agreements to access and broadcast TxDOT CCTV camera video feeds.</p>
Existing	<p><b>Electronic Toll Interoperability</b> <b>(Public-Public)</b></p> <p>TxDOT TOD, CTRMA, Other Texas Regional Tolling Authorities</p>	<p>Agreements to define electronic toll collection interoperability between TxDOT TOD, CTRMA, and other Texas regional tolling authorities such as the North Texas Tollway Authority and Harris County Toll Road Authority.</p>
Existing	<p><b>Fatal Crash Agency Coordination</b> <b>(Public-Public)</b></p> <p>City of Austin and Travis County</p>	<p>Agreement outlines the procedures that must be followed by TxDOT personnel, police, and other first responders who are knowledgeable of the medical examiner's office processes when clearing the roadway (without the presence of a representative from the medical examiner's office) once a fatal crash has occurred.</p>
Existing	<p><b>Joint Operations/Shared Control Memorandum (911 RDMT Project)</b> <b>(Public-Public)</b></p> <p>TxDOT Austin District, Travis County, City of Austin, CapMetro, Austin ISD, ABIA</p>	<p>Provides for the development of a unified public safety communication system that could include 911 operations, CAD, mobile data information transfer, public safety and public service radio communications, and ITS management, all of which might be operated from a fully integrated combined center.</p>
Existing	<p><b>Railroad Right-of-Way</b> <b>(Public-Private)</b></p> <p>TxDOT and Public or Private Railroad Operators</p>	<p>Agreement allows TxDOT to install and maintain fiber optic cable within the railroad right-of-way.</p>
Existing	<p><b>Sharing Fiber Optic Cable and/or related Infrastructure</b> <b>(Public-Public)</b></p> <p>TxDOT Austin District and Municipalities</p>	<p>Agreement for the connection and sharing of fiber optic cable and/or related infrastructure owned by either TxDOT or a local municipality for the use of sending and receiving transportation related data.</p>
Existing	<p><b>Standard Operating Procedures</b> <b>(Public-Public)</b></p> <p>CTECC Partners</p>	<p>CTECC partner agencies have developed standard operating procedures to cover the many different aspects of operating the center. Agreements are categorized into function codes that cover the following areas:</p> <ul style="list-style-type: none"> <li>Function Code 00 – SOP Process</li> <li>Function Code 01 – General Office</li> <li>Function Code 02 – Facility Maintenance</li> <li>Function Code 03 – Building Security/Building Emergency</li> <li>Function Code 05 – System Security/Application Administration</li> <li>Function Code 07 – Radio Function Code 08 – CTECC Administration</li> </ul>

Table 12 – Austin Regional Agreements (Continued)

Status	Agreement and Agencies	Agreement Description
Existing	<b>Traffic Signal Operation and Maintenance</b> (Public-Public) City of Austin and Travis County	Agreement that the City of Austin will plan for, design, install, maintain and upgrade traffic control devices within the county of county roadways.
Existing	<b>Traffic Signal Operation and Maintenance</b> (Public-Public) TxDOT and City of San Marcos.	Memorandum that the City of San Marcos will operate and maintain forty (40) interconnected TxDOT traffic signals within the City with financial support from TxDOT for certain signals. The City of San Marcos will also maintain the integrated traffic control system that was installed to control the interconnected traffic signals.
Existing	<b>Transit Signal Priority</b> (Public-Public) City of Austin, CapMetro	Agreement between the City of Austin and CapMetro regarding transit signal priority at specific signals that are along CapMetro MetroRapid BRT routes.
Future	<b>Data Sharing and Usage</b> (Public-Private) TxDOT Austin District and Private Information Service Provider	Agreements would define the parameters, guidelines, and policies for private sector (such as the media or other information service providers) use of ITS data. This type of agreement is recommended to define terms of use for broadcasting public-agency information regarding traffic conditions, closures, restrictions, as well as video images. Agreements can also include requirements for the media to 'source' the information (i.e., using the providing agencies logo on all video images broadcast).
Future	<b>Data Sharing and Usage</b> (Public-Public) TxDOT Austin District and Williamson County	Agreement would define the parameters, guidelines, and policies for inter-agency ITS data sharing between the TxDOT TMC at CTECC and Williamson County operations center that is currently in the planning phase.
Future	<b>Frequent Training of Key Personnel</b> (Public-Public) TxDOT Austin District, City of Austin, City of Round Rock, City of Georgetown, City of Cedar Park, City of Round Rock, City of San Marcos, CapMetro, CARTS, CTRMA, County Departments, TxDOT TOD, DPS Municipalities.	Agreement would provide on-going training for key personnel at various agencies regarding incident response, maintenance, and operations of the transportation system.
Future	<b>Incident Data Sharing and Usage</b> (Public-Public) TxDOT Austin District and Emergency Management Agencies	Agreement would define the parameters, guidelines, and policies for inter-agency sharing of incident data between TxDOT and emergency management agencies in the Region. Incident information could be sent directly to CAD systems and include information on lane closures, travel delays, and weather.
Future	<b>ITS and Traffic Signal Timing Data Sharing and Usage</b> (Public-Public) TxDOT Austin District, City of Austin, City of Cedar Park, City of Georgetown, City of Round Rock, and City of San Marcos	Agreement would define the parameters, guidelines, and policies for inter-agency ITS and traffic signal timing sharing between the TxDOT TMC at CTECC and cities that are at or near 50,000 in population and maintaining their own traffic signal systems.

**Table 12 – Austin Regional Agreements (Continued)**

Status	Agreement and Agencies	Agreement Description
Future	<b>Operations and Maintenance Agreement (Public-Public)</b> TxDOT Austin District, TxDOT TOD, and CTRMA	Agreement to operate ITS equipment on TxDOT TOD and CTRMA facilities as well as dispatch courtesy patrol vehicles. The agreement will need to address funding of these services.

### 5.7 Phases of Implementation

The services identified in the Austin Regional ITS Architecture will be implemented over time through a series of projects. Though TxDOT, CTRMA, CapMetro, and many of the larger municipalities have already made significant ITS deployments in the Region, key foundation systems will need to be implemented for agencies with few existing ITS deployments to support other systems that have been identified in the Regional ITS Architecture. The deployment of all of the systems required to achieve the final Regional ITS Architecture build out will occur over many years.

Some of the key service packages that will provide the functions for the foundation systems in the Austin Region are listed below. Service packages that support the primary needs identified in the Austin Region are also identified. Existing deployments and regional projects associated with these and other service packages identified for the Region have been included in the Austin Regional ITS Deployment Plan. Anticipated deployment timeframes for the regional projects are also included in the deployment plan.

- TM01 – Infrastructure-Based Traffic Surveillance
- TM06 – Traffic Information Dissemination
- TM07 – Regional Traffic Management
- TM08 – Traffic Incident Management System
- TI01 – Broadcast Traveler Information
- TI02 – Personalized Traveler Information
- PS01 – Emergency Call-Taking and Dispatch
- PS08 – Roadway Service Patrols
- MC08 – Maintenance and Construction Activity Coordination
- ST06 – HOV/HOT Lane Management
- PT04 – Transit Fare Collection Management
- PT08 – Transit Traveler Information
- PT09 – Transit Signal Priority
- PT18 – Integrated Multi-modal Electronic Payment
- DM01 – ITS Data Warehouse
- DM02 – Performance Monitoring
- VS13 – Intersection Safety Warning and Collision Avoidance



## 6. REGIONAL ITS DEPLOYMENT PLAN

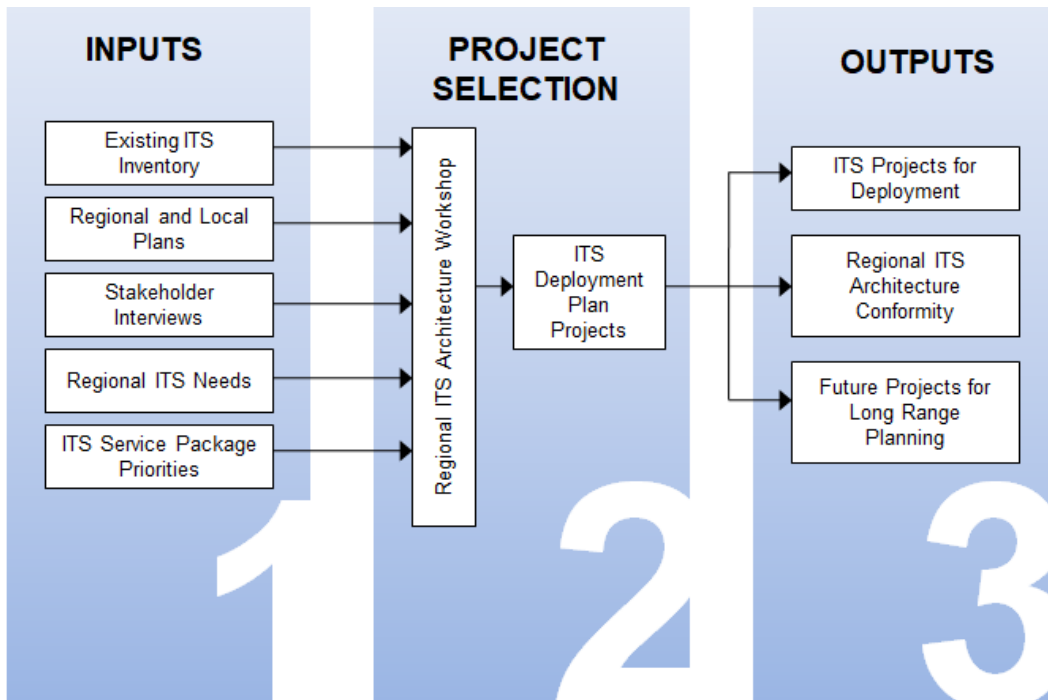
The Regional ITS Deployment Plan serves as a tool for the Austin Region to identify regional projects that should be deployed in order to achieve the desired functionality identified in the Regional ITS Architecture. The Regional ITS Deployment Plan builds on the Regional ITS Architecture by outlining project recommendations and strategies for the Region, potential stakeholders, and deployment timeframes.

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

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

### 6.1 Deployment Plan Project Development

An overview of the process used to develop the Regional ITS Deployment Plan is provided in **Figure 6**. This figure demonstrates that a variety of inputs were used to gather information and develop a set of regional ITS projects for selection by stakeholders.



**Figure 6 – Project Development and Selection Process**

Stakeholder input in Step 1 was gathered through a review of existing ITS inventory and deployments as well as a review of regional and local plans. Stakeholders provided input through agency interviews that included discussions on local and regional ITS needs for projects. The regional needs identified in the Regional ITS Architecture, as well as the prioritized list of ITS service packages, also contributed to project identification and selection in the ITS Deployment Plan.

The inputs in Step 1 led to the project selection in Step 2. Regional project selection was completed through a combination of the stakeholder workshop held in November 2018 as well as stakeholder review of the Regional ITS Architecture Report.

The outputs of the plan, shown in Step 3, will yield a list of priority regional ITS projects for the Austin Region. Each of the projects recommended in the plan has been checked against the Austin 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 Capital Area Metropolitan Planning Organization (CAMPO).

## 6.2 Existing Local ITS Deployments

The Austin Region has made significant investments in the deployment of ITS throughout the Region. In **Table 13**, a summary of ITS deployments by state and regional, municipal, and transit agencies is provided.

The section in the table for state and regional agencies focuses on existing and planned ITS elements owned by the TxDOT Austin District, TxDOT Toll Operations Division, CTRMA, and CAMPO. The section for municipalities focuses on larger municipalities that currently operate their own signal system as well as municipalities that are approaching 50,000 in population and may be operating their signal systems in the next few years depending on the results of the 2020 census. Many of the larger municipalities in the Austin Region have deployed TMC/TOCs, centralized traffic signal systems, field sensors, and CCTV cameras.

The regional transit agencies are Capital Metro and CARTS. Both agencies already deploy many ITS services including automated fare collection, transit vehicle tracking, operations center management, and automated passenger counting. Capital Metro additionally offers several bus rapid transit routes and has equipped its fixed-route buses with transit signal priority technology.



### 6.3 Regionally Significant ITS Project Deployments

Although most agencies are actively deploying ITS within the Austin Region, stakeholders noted a strong need for the implementation of regional systems and programs to meet regional needs. Regional needs generally focused on traveler information, incident management, improved communications and information sharing between agencies, and enhancements to transit service.

Stakeholders identified six regional deployment projects for ITS in the Region. These six projects do not encompass all of the regional ITS needs within the Austin Region, however stakeholders recommended that emphasis be placed on implementation related to these six areas in order to provide the greatest benefit to travelers. The six projects are:

- Regional Platform for Camera and DMS Sharing
- Regional Platform for Incident Information Sharing
- Integrated Corridor Management
- Regional Transit Fare System
- Data Management Program Implementation
- Connected and Autonomous Vehicle Technology Framework

A summary of each of the six regional projects is provided in this section. For each, the following information is provided:

*Basis of Need* – Describes how the regional deployment project or program meets one of more of the regional ITS needs that were identified in the Regional ITS Architecture.

*Stakeholders* – Identifies the stakeholder agencies that would be involved in the implementation of projects related to each deployment area. If possible, a lead agency is identified.

*Deployment Components* – Describes the projects, programs, initiatives, or training that is required to fully implement each of the six regional deployments.

*Timeframe* – Describes the approximate timeframe it may take to develop and implement each project.

*Regional ITS Architecture Conformance* – Identifies the ITS service packages from the Austin Regional ITS Architecture that are related to each of the regional deployment areas. Conformance of ITS projects with the Regional ITS Architecture is important in order for any ITS project or program to be eligible for federal ITS funding.

### 6.3.1 REGIONAL PLATFORM FOR CAMERA AND DMS SHARING

Stakeholders noted that the development of a regional platform for CCTV camera and DMS capability sharing would benefit the Austin Region by allowing agencies to more capably respond to planned and unplanned events that have significant traffic impacts. These events could include regularly scheduled major road construction, severe traffic incidents, or special events such as sporting events and festivals. A regional platform to share surveillance and traveler information resources would allow agencies to develop a seamless, corridor-wide approach to alerting traffic management personnel, emergency responders, and the travelling public to events such as these.

This sharing platform would be developed to allow differing levels of access and control to ITS equipment based on the user. For example, one set of users may only have the ability to view CCTV footage being broadcast from ITS field devices in another part of the region, while the agency who owns those field devices would have the additional ability to adjust the camera position through pan/tilt/zoom control to view a different part of the roadway network. Similarly, DMS units could be access-controlled so that some agencies have the ability to post messages, while others are only able to view the message being posted so that they can update their DMS units accordingly to ensure uniform communications along a corridor.

In addition to the stakeholder discussion, this regional project was also identified as a need in the CAMPO Regional Incident Management Strategic Plan and Performance Assessment completed in 2018.

#### **Basis of Need**

Stakeholders expressed concerns that a lack of data sharing between agencies within the Region could lead to less organized responses to major events that impact traffic along the Austin Region’s most heavily traveled corridors, such as I-35 and MoPac (SL 1). This regional project deployment would provide agencies with on-demand access to traffic conditions and traveler information messaging at points throughout the Region. Stakeholders identified several needs that could be addressed through the development of a regional platform for camera and DMS sharing, including:

- Improve communication and coordination between agencies (State-State and State-Local) for traffic operations and incident management;
- Improve the accuracy, timeliness, and availability of regional travel information; and
- Improve data sharing among agencies for both operational and planning initiatives.

#### **Stakeholders**

Primary stakeholders include those with existing CCTV and DMS units that are actively deployed, such as TxDOT, CTRMA, City of Austin, City of Round Rock, City of Cedar Park, and City of San Marcos. This stakeholder list will grow as other municipalities in the Austin Region begin to deploy ITS components.

### **Regional Platform for Camera and DMS Sharing**

A regional platform for CCTV camera and DMS sharing would allow individual agencies to access or control ITS field infrastructure throughout the region to improve agency coordination in response to planned and unplanned events that impact traffic.

Primary stakeholders in the effort include those with existing ITS field devices, such as TxDOT, CTRMA, and the Cities of Austin, Round Rock, Cedar Park, and San Marcos.

A regional camera and DMS sharing platform would meet stakeholder needs of improved interagency communication and coordination, improved availability of regional travel information, and improved data sharing among agencies.



### ***Deployment Components***

A camera and DMS sharing platform would require the development of an interface for the various CCTV and DMS technologies that have been adopted by the Austin Region's agencies and municipalities. Such a platform could be developed so that it requires credentials for use that determine what controls each user has access to. Provided that the necessary interagency data-sharing agreements are signed by the agencies that would use this platform, access could be controlled to reflect the permissions agreed upon by the agencies that would be using the technology.

The platform would be developed so that it would be accessible to both regional interagency and local agency TOC operators using each TOC's existing equipment. Designing the project in this way would allow operators to view or control their own ITS devices as well as those owned by other agencies all from the same access point.

### ***Timeframe***

It is recommended that a concept of operations document for a Regional Platform for Camera and DMS Sharing be developed in the next two years. Pending the conclusions of the document, a sharing platform should be developed for use within the next four years.

### ***Regional ITS Architecture Conformance***

A regional platform for camera and DMS sharing relies upon several aspects of ITS. First, the surveillance and DMS field technology needs to be present in the field to collect and disseminate traffic information. Second, traffic operations managers from across the Region need to be able to easily communicate and share information pertaining to major traffic events. Lastly, the data sharing capabilities and interagency agreements need to be in place to allow the exchange of information and access that this regional project would require.

The following ITS service packages in the Austin Regional ITS Architecture provide the necessary field technology for this project deployment:

- TM01 – Infrastructure-Based Traffic Surveillance
- TM02 – Vehicle-Based Traffic Surveillance
- TM06 – Traffic Information Dissemination
- WX01 – Weather Data Collection

Other ITS service packages in the architecture relate to existing or planned connectivity, information dissemination, and sharing capabilities between agencies that a regional platform for camera and DMS sharing would rely upon. These service packages include:

- TM07 – Regional Traffic Management
- TM08 – Traffic Incident Management System
- TI01 – Broadcast Traveler Information
- TI02 – Personalized Traveler Information
- PS14 – Disaster Traveler Information
- MC08 – Maintenance and Construction Activity Coordination
- WX02 – Weather Information Processing and Distribution

### 6.3.2 REGIONAL PLATFORM FOR INCIDENT INFORMATION SHARING

Traffic incidents are one of the major sources of non-recurring traffic congestion in the Austin Region. Often, incidents occur on freeways that pass through multiple jurisdictions, and the incident response effort generally requires coordination between several traffic management and emergency management agencies. Stakeholders identified a desire to develop a system that integrates operational data from first responders at an incident scene with data being processed by traffic management agencies and private transportation operations companies. Such a system could provide useful information to regional municipalities, freight companies, and the travelling public as severe traffic incidents develop.

The regional platform for incident information sharing will be capable of interfacing with CAD data sources from emergency responders throughout the region, anonymizing the data and using it and other historical information to predict an incident duration that can then be shared with private transportation operators and via existing traffic information dissemination tools such as DMS and traveler information websites. Such a system could also include tools that are used by first responders from different agencies responding to the same major incident to enhance coordination and improve incident clearance times.

In addition to the stakeholder discussion, this regional project was also identified as a need in the CAMPO Regional Incident Management Strategic Plan and Performance Assessment completed in 2018.

#### ***Basis of Need***

Traffic incidents are a major factor impacting travel time reliability throughout the Austin Region. When incidents occur, the timely and accurate dissemination of incident information can enhance incident response and alert transportation network users of available alternate routes, both strategies for improving travel time reliability.

Stakeholders identified several needs related to improved incident response through a regional information sharing platform, including:

- Improve communication and coordination between agencies (State-State and State-Local) for traffic operations and incident management;
- Collect and make available additional travel time information along controlled access facilities and arterials; and
- Improve data sharing among agencies for both operational and planning initiatives.

#### ***Stakeholders***

Stakeholders for a regional platform for incident management sharing would include TxDOT, CTRMA, municipal transportation departments, and local emergency management agencies (including local fire and police departments). A lead agency for this effort has not yet been identified, though the City of Austin has

### **Regional Platform for Incident Information Sharing**

A regional platform for incident information sharing would allow for traffic management agencies and emergency response agencies to better coordinate incident response. The platform would also allow for improved quality of incident information being shared with private transportation operators as well as the travelling public.

Primary stakeholders in this effort include TxDOT, CTRMA, local municipal transportation departments, and local emergency responders (including fire and police).

A regional platform for incident information sharing would meet the needs of agencies to improve communication and coordination, to make better incident-related travel time information available, and to improve data sharing efforts.



showed interest in leading the deployment of such a project through their efforts to apply for a federal grant to fund such a system.

### ***Deployment Components***

A regional platform for incident information sharing would have the following components:

- An open data framework that incorporates both traffic incident management data from local and regional traffic management agencies as well as emergency response CAD data that has been stripped of sensitive or personally identifying information.
- A mobile and web-based application that allows first responders and traffic operations personnel to share information related to the management of a major incident.
- Coordination with traffic management agencies that control traveler information resources and with private transportation operators that would benefit from up-to-date traffic incident location and predicted duration information.
- Data-sharing with private transportation information providers (for example, INRIX or Waze) to disseminate incident information quickly and to a wider audience, and to better track traffic impacts that result from the incident and its response.

### ***Timeframe***

The development of the system described above will require coordination among agencies with differing standards for data security and maintenance, and therefore the development of the necessary agreements and data connections to make a regional incident information sharing system possible may take several years. It is recommended that a regional incident information sharing system be developed in the next five years, beginning with an exploration of the necessary steps for development of such a program.

### ***Regional ITS Architecture Conformance***

A regional platform for incident data sharing relies upon both the open flow of information between traffic management and emergency response agencies as well as the efficient dissemination of any essential incident information to other local agencies, private transportation operators, and the motoring public.

ITS service packages in the Austin Regional ITS Architecture that provide the necessary services for a regional platform for incident data sharing include:

- TM01 – Infrastructure-Based Traffic Surveillance
- TM06 – Traffic Information Dissemination
- TM07 – Regional Traffic Management
- TM08 – Traffic Incident Management System
- TI01 – Broadcast Traveler Information
- TI02 – Personalized Traveler Information
- PS07 – Incident Scene Safety Monitoring
- DM01 – ITS Data Warehouse



### 6.3.3 INTEGRATED CORRIDOR MANAGEMENT

Integrated Corridor Management (ICM) consists of a set of strategies that seek to reduce congestion and improve travel time reliability along a defined corridor. ICM strategies generally include at least two or more modes of transportation, including freeway travel, arterial travel, bus, and rail, and provide real-time information on each mode to travelers using the corridor. If a mode experiences unusual delay on a particular day, other modes can be adjusted. For example, if a freeway along an ICM corridor is closed due to an incident, arterial signal timing can be adjusted to accommodate additional demand and transit bus service may add additional buses to accommodate increased ridership. ICM relies on close monitoring of each mode, communication between agencies that operate each mode, and accurate, timely, and reliable real-time information to travelers on the condition of each mode.

The Austin Region received a grant from the FHWA in 2015 to fund the development of a concept of operations for an ICM along the I-35 corridor through the City of Austin. The concept of operations was completed in 2015. Initial plans for ICM involve incorporating existing ITS services such as the HERO patrol, arterial signal timing capabilities, and increased coordination and data sharing between TxDOT and municipalities to improve travel time reliability in the corridor. Eventually, transit services will also be incorporated into the ICM program. Austin Region stakeholders would also like to consider additional corridors for implementation of ICM in the future. These corridors will likely include other cities in addition to Austin, as well as TxDOT, CTRMA, and Capital Metro.

#### **Basis of Need**

Congestion and travel time reliability are both challenges in the Austin Region. Stakeholders identified a number of needs that relate to both of these that can be addressed to some extent through the implementation of ICM. ICM strategies address the following needs that were identified in the Regional ITS Architecture by stakeholders:

- Improve communication and coordination between agencies (State-Local, Local-Local) for traffic operations and incident management;
- Collect and make available additional travel time information along controlled access facilities and arterials;
- Implement Integrated Corridor Management (ICM) strategies; and
- Improve data sharing among agencies for both operational and planning initiatives.

#### **Stakeholders**

ICM stakeholders for the existing I-35 ICM plans include the TxDOT Austin District, CTRMA, City of Austin, and Capital Metro. Additional stakeholders for future phases may include the same stakeholders as well as other municipalities located on major corridors in urban areas, including Round Rock and Cedar Park.

### **Integrated Corridor Management**

ICM provides real-time travel information to travelers for multiple modes along a corridor, including freeway, arterials, and transit. Improvements to modes can also be made to accommodate unusual demands, such as implementing new signal timing plans on an arterial to accommodate additional traffic due to a freeway closure. In Austin the first ICM effort is focused on the I-35 corridor through the City of Austin.

Primary stakeholders in the I-35 ICM effort includes TxDOT, CTRMA, Capital Metro, and the City of Austin. TxDOT is the lead agency. Future ICM efforts may include other cities in the Region.

ICM efforts meet several needs identified by stakeholders, including a need identified specifically for ICM implementation.



### ***Deployment Components***

ICM in the Austin Region will include the following components:

- Integration of operational decisions for all modes along the corridor. Modes on the I-35 corridor could include I-35, MoPac, SH 130, major arterials in the City of Austin, and Capital Metro services including MetroBus, MetroRapid (bus rapid transit) and MetroRail.
- Increased use of alternate routes and modes especially during peak travel times or times.
- Increased use of active transportation and demand management to maximize existing facilities, including dynamic lane assignment, dynamic speed limits, queue warning, congestion pricing, and adaptive signal control.
- Establishment of data-sharing capabilities between all participating transportation agencies.
- Encouraged changes in travel behavior such as alternating work hours or telecommuting.
- Use of private sector technology for information sharing.

These program components will be implemented first along the I-35 corridor in the City of Austin as specified in the concept of operations document. Future implementation may occur along other heavy travel corridors in the Austin Region.

### ***Timeframe***

It is recommended that ICM implementation begin in the I-35 corridor as soon as possible, including the pursuit of appropriate funding sources for ICM strategies, given that a concept of operations has already been developed. Following successful implementation of ICM in the I-35 corridor, focus should expand to other corridors.

### ***Regional ITS Architecture Conformance***

Integrated corridor management relies on a combination of capabilities including the ability to monitor real-time conditions on a number of modes of transportation, the ability to share information between stakeholders, and the ability to provide real-time information to travelers regarding a particular corridor both pre-trip and while en route.

ITS service packages in the Austin Regional ITS Architecture that provide the monitoring capabilities that ICM relies upon include:

- TM01 – Infrastructure-Based Traffic Surveillance
- TM02 – Vehicle-Based Traffic Surveillance
- WX01 – Weather Data Collection
- PT01 – Transit Vehicle Tracking

ITS service packages that provide the ability to share information between stakeholders include:

- TM07 – Regional Traffic Management
- PT14 – Multi-modal Coordination

ITS service packages that pertain to pre-trip and en-route traveler information include:

- TM06 – Traffic Information Dissemination
- WX02 – Weather Information Processing and Distribution
- MC08 – Maintenance and Construction Activity Coordination
- PT08 – Transit Traveler Information
- TI01 – Broadcast Traveler Information
- TI02 – Personalized Traveler Information

ICM could also include strategies to improve corridor operations during periods of unusual traffic, such as an incident that causes freeway traffic to divert onto arterials. ITS service packages that provide the ability to control and improve corridor operations, and could possibly be incorporated into future ICM strategies include:

- TM03 – Traffic Signal Control
- TM05 – Traffic Metering
- TM20 – Variable Speed Limits
- TM22 – Dynamic Lane Management and Shoulder Use
- PS08 – Roadway Service Patrols
- PT09 – Transit Signal Priority

#### 6.3.4 REGIONAL TRANSIT FARE SYSTEM

Both Capital Metro and CARTS noted the need to develop a combined fare payment system for transit users that use both systems. Currently, there are routes which require both Capital Metro and CARTS services, and riders need to pay separately for utilizing the two systems.

##### ***Basis of Need***

The Regional Transit Fare System meets the need identified during the development of the Austin Regional ITS Architecture for a combined fare payment system. This need stated: Implement a regional or statewide transit fare payment system that could accommodate the transfer of passengers between modes and agencies.

##### ***Stakeholders***

The primary stakeholders in the Austin Region are Capital Metro and CARTS. Other transit providers, such as the Cities of Round Rock, San Marcos, and Georgetown, may also participate.

##### ***Deployment Components***

Capital Metro and CARTS currently have separate payment systems that are not compatible.

Capital Metro payment systems include transit passes that can be purchased for a set number of days or a stored value card that stores a prepaid amount. Capital Metro also has a mobile ticketing application that allows users to purchase a ticket from their smart phone.

CARTS allows users to purchase fare cards through their website with a stored value. The fare cards can be used for Curb-to-Curb service (also known as Country Bus), but eventually CARTS would like to implement fare cards for all services.

The system architecture of the combined payment system has not been determined yet, but Capital Metro and CARTS should continue working together to develop such a system. There are some existing routes that combine both Capital Metro and CARTS services on a single bus, but riders have to pay twice while on the route using separate fare boxes. CARTS noted the need to implement a shared payment system on this route, where riders could pay with either a Capital Metro or CARTS card and then Capital Metro and CARTS could reconcile payment. This would make transit use easier for riders by not requiring separate payment systems.

##### ***Timeframe***

Capital Metro and CARTS both indicated an immediate need for a combined transit payment system. This development and deployment should begin as soon as possible.

### **Regional Transit Fare System**

Regional payment systems would allow transit users that use both Capital Metro and CARTS to pay with a single fare card or other system. This type of system is needed to simplify transit ridership and encourage more use of transit throughout the Austin Region.

Primary stakeholders for a regional transit payment system include Capital Metro and CARTS. A combined transit payment system meets the need identified by the Austin Region stakeholders to develop a regional or statewide transit fare payment system.



***Regional ITS Architecture Conformance***

The implementation of a Regional Transit Fare System conforms to the Austin Regional ITS Architecture through two ITS service packages that were identified in the plan:

- PT04 – Transit Fare Collection Management
- PT14 – Multi-modal Coordination

The PT04 Transit Fare Collection Management ITS service package identified a need for a regional fare card payment system that could be used for Capital Metro's MetroBus, Metro Access, MetroRapid, and MetroRail service as well as for CARTS. The PT14 Multi-modal Coordination ITS service package identifies the general coordination between Capital Metro and CARTS that both agencies would like to improve.

### 6.3.5 DATA MANAGEMENT PROGRAM IMPLEMENTATION

As stakeholders throughout the Austin Region implement various components of ITS, a need for managing the data collected by ITS technologies has become more important. Archived data can include volumes, speeds, congestion levels, reliability, incidents, weather information, arterial performance, and more. Certain agencies, including TxDOT, CTRMA, and the City of Austin, currently maintain data management systems. Executive guidance at the federal, state, and regional levels has also dictated that transportation data be available so that agencies can more reliably track performance of a transportation network.

No regionwide data management program currently exists, and such a system would enable improved decision making for transportation concerns of a regional nature. As a result, stakeholders identified the development of a regional data management program as a priority.

#### ***Basis of Need***

During the development of the Austin Regional ITS Architecture, stakeholders noted the need to access data from other agencies, both for real-time operations as well as for planning purposes. Archived data can be utilized for research, transportation studies, and to predict future conditions. There were two needs identified in the Austin Regional ITS Architecture that are supported by the implementation of an archived data warehouse:

- Improve data sharing among agencies for both operational and planning initiatives; and
- Improve communication and coordination between agencies (State-Local, Local-Local) for traffic operations and incident management.

#### ***Stakeholders***

Stakeholders include all agencies within the Austin Region that currently deploy or plan to deploy ITS technologies. The lead agency for the implementation of a regional data management program should most likely be CAMPO since they serve as the regional planning agency for the Austin Region. The TxDOT Austin District, with its jurisdiction including all of the Austin Region, could also serve as the lead agency.

#### ***Deployment Components***

Regional data management programs generally take one of two forms. They can be developed as a warehouse, which consolidates all archived information into a single location, or as a virtual warehouse in which stakeholder agencies store their data within their own servers and the virtual data warehouse provides an interface to that data.

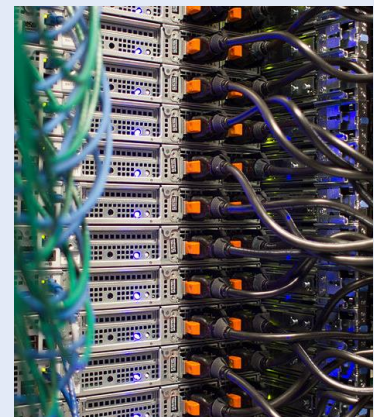
The most feasible system for the Austin Region archived data warehouse has not been determined. It is recommended that a feasibility study be completed prior to beginning the implementation of an archived data warehouse server to determine the system that would work best for Austin.

### **Data Management Program Implementation**

As the Austin Region implements more robust and integrated ITS systems, the need for managing the data collected by ITS technologies has become more important. This data can help improve decision making and measure performance of the transportation network, two common priorities of agency executives.

Primary stakeholders include CAMPO, who was identified as the most likely agency to lead the implementation of an archived data warehouse, as well as all agencies that have deployed ITS and could provide archived data into a data management program.

A data management program meets the regional needs to improve data sharing, communication, and general coordination between transportation agencies in the Region.



***Timeframe***

The development of a data management program relies on the availability of data from ITS deployments throughout the Region, some of which are included as high-priority regional deployments in this section of the report. While data management program is important, implementation within the next five years would be sufficient to meet the Region's needs and incorporate data from newly deployed technologies.

***Regional ITS Architecture Conformance***

The implementation of a data management program for the Austin Region would conform to two ITS service packages in the Austin Regional ITS Architecture:

- DM01 ITS Data Warehouse
- DM02 Performance Monitoring

The first service package shows how transportation data from the many agencies throughout the Austin Region would be able to share their data with a central agency responsible for maintaining the database (and with other agencies that could benefit from the information). The second service package shows how that data, once collected, could be used to track the performance of the Region's transportation network.

### 6.3.6 CONNECTED AND AUTONOMOUS VEHICLE TECHNOLOGY FRAMEWORK

During the stakeholder workshop, several stakeholders mentioned that, while the Austin Region had no detailed autonomous vehicle programs planned for implementation, the growth of this technology warranted that the Region develop a framework to be put in place that could monitor, manage, and react to advancements in connected and autonomous vehicle (CAV) technology. Several agencies, including TxDOT and City of Austin, have begun to research CAV applications, but no regionwide approach has been developed yet.

A regional CAV framework would allow agencies to remain informed of shifts in CAV technologies and any associated ITS infrastructure that those agencies could implement to enhance or assist in the deployment of those CAV technologies locally. It could also be used as a basis of cooperation between agencies within the Region in future attempts to entice public- and private-sector test deployments of CAV programs, or to hasten the incorporation of CAV technology in a more general, widespread deployment.

***Basis of Need***

Stakeholders agreed that CAV technology would continue to become more prevalent in transportation networks as the technology became more sophisticated, and that in response the Region should try to improve its readiness to incorporate these technologies. In the formal need statements described in Section 3, stakeholders defined this as a need to “plan for and adapt to changes in vehicle safety technologies such as connected vehicles.”

***Stakeholders***

By nature, a regional CAV technology framework would require input from all transportation agencies within the Austin Region. A lead agency has not yet been identified for this effort, but the lead would most likely be either the City of Austin or TxDOT.

***Deployment Components***

Since this project involves developing a framework based on limited existing regional agreements or research into the system, future deployment components related to CAV technology are still to be determined.

***Timeframe***

Development of such a framework can begin immediately. If the Region prioritizes CAV technology and research investments and seeks to become a testbed region for these technologies, deployment of early CAV technologies could happen in the next 2 to 3 years. More realistically, ITS deployments related to CAV technologies are likely to occur in the Austin Region within the next 5 to 10 years

**Connected and Autonomous Vehicle Technology Framework**

The purpose of a CAV technology framework is to monitor, manage, and react to advancements in connected and autonomous vehicle (CAV) technology that could benefit the Austin Region.

A regional CAV framework would allow agencies to remain informed of shifts in CAV technologies and any associated ITS infrastructure that those agencies could implement to enhance or assist in the deployment of those CAV technologies locally.





***Regional ITS Architecture Conformance***

CAV technology relies upon many of the service packages contained in the Vehicle Safety service area of the National ITS Architecture. Since the deployment components of this regional priority project are not yet known, it is not possible to determine exactly which service packages will be the most relevant for this project deployment in the Austin Regional ITS Architecture. Service packages that are likely to be important include:

- VS13 – Intersection Safety Warning and Collision Avoidance
- VS15 – Infrastructure Enhanced Cooperative Adaptive Cruise Control
- VS16 – Automated Vehicle Operations

## 7. USE AND MAINTENANCE OF THE REGIONAL ITS ARCHITECTURE

The Austin Regional ITS Architecture addresses the Region's vision for ITS implementation at the time the plan was developed. With the growth of the Region, needs will change and as technology progresses, new ITS opportunities will arise. Shifts in regional needs and focus as well as changes in the National ITS Architecture will necessitate that the Austin Regional ITS Architecture be updated periodically to remain a useful resource for the Region. As projects are developed and deployed, it will be important that those projects conform to the Regional ITS Architecture so that they are consistent with both the Region's vision for ITS as well as the national standards described in the Regional ITS Architecture. In some cases, if projects do not conform, it may be necessary to modify the Regional ITS Architecture to reflect changes in the Region's vision for ITS rather than modify the project. In this Section, a process for determining architecture conformity of projects is presented and a plan for how to maintain and update the Regional ITS Architecture is described.

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

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

### 7.1 Incorporation into the Regional Planning Process

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

The Regional ITS Architecture can serve as a valuable resource in the development of the Regional Transportation Plan (RTP), formally known as Long Range Transportation Plan (LRTP). **Figure 7** illustrates the CAMPO planning process and the involvement of the ITS Architecture in that process. The CAMPO Congestion Management Process and ITS Working Group provides input into the RTP on ITS needs for the Region. The needs identified in the ITS Architecture should be considered by the Working Group when providing this input. During the project selection process, the service package prioritization developed by stakeholders during the ITS architecture development process should be utilized to facilitate the selection of projects for inclusion in the RTP.

As projects transition from the RTP to the Transportation Improvement Program (TIP), each project should be evaluated to determine if the project includes any ITS elements. If the project contains an ITS element, then the Regional ITS Architecture needs to be reviewed to ensure that the project is in conformance. TxDOT or CAMPO will assist agencies as they perform this examination as part of the project application process using the procedure outlined in Section 7.3

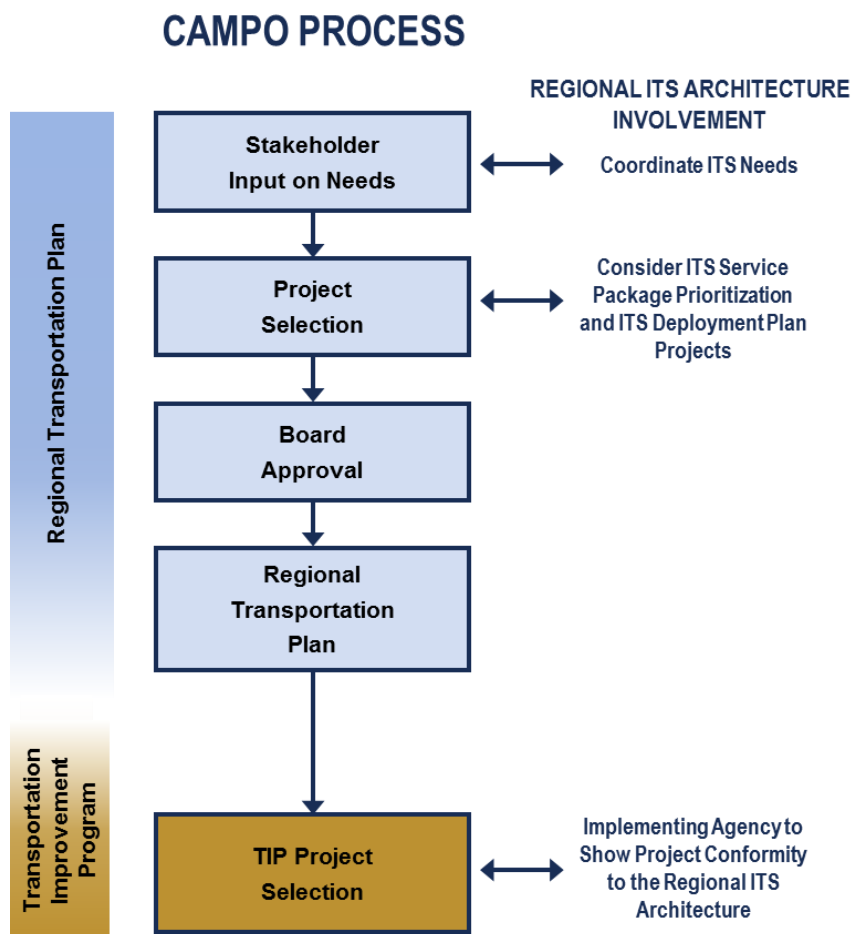


Figure 7 – CAMPO Regional Planning Process and ITS Architecture Involvement

## 7.2 Process for Determining ITS Architecture Conformity

The Austin 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. The steps of the process are as follows:

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

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

### Step 1 – Identify the ITS Components

ITS components can be fairly apparent in an ITS focused project such as CCTV or DMS deployments, but could also be included in other types of projects where they are not as apparent. For example, an arterial

widening project could include the installation of signal system interconnect, signal upgrades, and the incorporation of the signals in the project limits into a city's closed loop signal system. These are all ITS functions and should be included in the ITS Architecture.

### **Step 2 – Identify the Corresponding Service Packages**

If a project was included in the list of projects in the Austin Regional ITS Deployment Plan, then the applicable service package(s) for that project were also identified. However, ITS projects are not required to be included in the ITS Deployment Plan in order to be eligible for federal funding; therefore, service packages might need to be identified for projects that have not been covered in the ITS Deployment Plan. In that case, the service packages selected and customized for the Austin Region should be reviewed to determine if they adequately cover the project. Service packages selected for the Austin Region are identified in **Table 7** of this document and detailed service package definitions are located in **Appendix B**.

### **Step 3 - Identify the Component within the Service Package**

The customized service packages for the Austin Region are provided in the online interactive RAD-IT database at [www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com). 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 TxDOT Austin District Changeable Speed Limit Signs was included in the Austin Regional ITS Architecture for future implementation of variable speed limits along controlled-access highways operated by TxDOT. Detailed planning has not begun, and TxDOT Austin District may select a different name for the system once planning and implementation are underway. Such a name change in the project should be documented using the process outlined in Section 7.4.

### **Step 4 – Evaluate the Connections and Flows**

The connections and architecture 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.

### **Step 5 – Document Required Changes**

If any changes are needed to accommodate the project under review, Section 7.4 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 data flows are consistent with the project.

## **7.3 Regional ITS Architecture Maintenance Process**

CAMPO will lead the effort to maintain the Regional ITS Architecture for the six county Region within the MPO planning boundary, which is comprised of Bastrop, Burnet, Caldwell, Hays, Travis, and Williamson Counties. TxDOT will be responsible for maintaining the other five counties included in the Austin Regional ITS Architecture. These counties lie outside of the CAMPO planning boundaries, but within the TxDOT Austin District boundary, and include Blanco, Gillespie, Lee, Llano, and Mason Counties. A summary of the maintenance plan for the Regional ITS Architecture and Deployment Plan is presented in **Table 13**.

**Table 14 – Austin Regional ITS Architecture and Deployment Plan Maintenance Summary**

Maintenance Details	Regional ITS Architecture and Deployment Plan	
	Modification	Complete Update
<b>Timeframe for Updates</b>	As needed	Review prior to update of Regional Transportation Plan (RTP) to determine need for update. Review annually if not updated in conjunction with the RTP update.
<b>Scope of Update</b>	Update ITS service packages to satisfy architecture conformity requirements of projects. Other changes to the Regional ITS Architecture and Deployment Plan as required.	Entire Regional ITS Architecture and Deployment Plan
<b>Lead Agency</b>	CAMPO - Responsible for Bastrop, Burnet, Caldwell, Hays, Travis, and Williamson Counties  TxDOT – Responsible for Blanco, Gillespie, Lee, Llano, and Mason Counties	Joint TxDOT and CAMPO led effort
<b>Participants</b>	Stakeholders impacted by modifications to ITS service packages	Entire stakeholder group
<b>Results</b>	Documentation of changes to ITS service packages or other components of the Regional ITS Architecture and Deployment Plan	Updated Austin Regional ITS Architecture and Deployment Plan document, Appendices, and Turbo Architecture database

Stakeholders should document any changes to the Regional ITS Architecture that are necessary for project conformity and provide those changes to TxDOT or CAMPO so they can retain a record of requested changes. The changes that are kept by CAMPO and TxDOT will be incorporated into the Regional ITS Architecture and Deployment Plan during the next complete update.

The need for a full update of the plan will be considered prior to the update of the CAMPO Regional Transportation Plan (RTP), which should occur approximately four years after the completion of the Regional ITS Architecture and Deployment Plan. By completing a full update in the year prior to the RTP update, stakeholders will be able to determine the ITS needs and projects that are most important to the Region and document those needs and projects for consideration when developing the RTP. TxDOT and CAMPO will review the Regional ITS Architecture to determine if an update is needed based on the status of ITS deployments in the Region, as well as changes to the National ITS Architecture. If it is determined that an update of the Regional ITS Architecture and Deployment Plan is not needed at that time, TxDOT and CAMPO will review the Regional ITS Architecture and Deployment Plan on an annual basis to determine when an update will be required.

Minor changes to the Regional ITS Architecture and Deployment Plan should occur as needed between full updates of the plan. In Section 7.4 the procedure for submitting a change to the Regional ITS Architecture is documented. Documentation of changes to the Regional ITS Architecture is particularly important if a project is being deployed and requires a change to the Regional ITS Architecture in order to establish conformity.

The Regional ITS Architecture and Deployment Plan is a living document. Beyond making project changes or service packages changes to the architecture, the maintainers of the architecture should also regularly check for new relevant stakeholder agencies to involve in future updates, or whether new funding availability

or completion of certain ITS projects might warrant changes to listed project priority levels. Regularly updating these aspects as a part of document maintenance will keep the architecture current, even as local transportation priorities and technologies may be rapidly changing. The architecture's maintainers also have a responsibility to evaluate and monitor the effectiveness of the ITS architecture. The maintainers must confirm that projects being implemented conform to all relevant aspects of the existing ITS architecture, or else that any changes to the system are identified and are carried throughout all relevant aspects of the existing ITS architecture. The maintainer can verify consistency in the face of project changes by checking the architecture document against the maintained RAD-IT database to ensure that both representations of the architecture match.

## 7.4 Procedure for Submitting ITS Architecture Changes Between Scheduled Updates

Updates to the Austin Regional ITS Architecture will occur on a regular basis as described in Section 7.3 to maintain the architecture as a useful planning tool. Between major plan updates, smaller modifications will likely be required to accommodate ITS projects in the Region. Section 7.2 contains step by step guidance for determining whether a project requires architecture modifications to the Regional ITS Architecture.

For situations where a change is required, an ITS Architecture Maintenance Documentation Form was developed and is included in **Appendix C**. 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 data flow status.
- Functional Change – Single Agency: Structural changes to the ITS service packages that impact only one agency in the Regional ITS Architecture. Examples include the addition of a new ITS service package or changes to data 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 data flow connections of an existing ITS service package. The addition or changes would impact multiple agencies and require coordination between the agencies.
- Project Change – Addition, modification, or removal of a project in the Regional ITS Deployment Plan Section of the Regional ITS Architecture.

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

**Impact of proposed change on other stakeholders:** If the proposed change is expected to have any impact on other stakeholders in the Region, then those stakeholders should be listed on the ITS Architecture Maintenance Documentation Form. A description of any coordination that has occurred with other stakeholders that may be impacted by the change should be also included. Ideally all stakeholders that may be impacted by the change should be contacted and consensus should be reached on any new or modified ITS service packages that will be included as part of the Regional ITS Architecture.

CAMPO will review and accept the proposed changes. When a major update is performed by CAMPO or TxDOT, all of the documented changes will be incorporated into the architecture. This documentation will most likely be performed in conjunction with project conformance documentation as part of the TIP project application process; however, changes could be documented at other times as agencies are planning for future projects using the same form.

**Interactive Regional ITS Architecture**

A copy of the ITS Architecture Maintenance Documentation Form is available for review and download from the online interactive ITS architecture at:

[www.AustinITSArchitecture.com](http://www.AustinITSArchitecture.com)

To access this form, from the website select the “Use and Maintenance” tab. At the bottom of the page under the Maintenance of Regional ITS Architecture heading, click on the “Architecture Maintenance Documentation Form” link.

## APPENDIX A – STAKEHOLDER INVITATION DATABASE



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## APPENDIX B – SERVICE PACKAGE DEFINITIONS

Service Package	Service Package Name	Description
<b>Commercial Vehicle Operations Service Area</b>		
CVO01	Carrier Operations and Fleet Management	This service package manages a fleet of commercial vehicles. The Fleet and Freight Management Center monitors the vehicle fleet and can provide routes using either an in-house capability or an external provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). A route is electronically sent to the Commercial Vehicle with any appropriate dispatch instructions. The location of the Commercial Vehicle can be monitored by the Fleet and Freight Management Center and routing changes can be made depending on current road network conditions. This service package also supports maintenance of fleet vehicles with on-board monitoring equipment. Records of vehicle mileage, preventative maintenance and repairs are maintained.
CVO02	Freight Administration	This service package tracks the movement of cargo and monitors the cargo condition. Interconnections are provided to intermodal freight shippers and intermodal freight depots for tracking of cargo from origin to destination. In addition to exceptions that are reported, on-going indications of the state of the various freight equipment are reported to the Fleet and Freight Management Center.
CVO03	Electronic Clearance	This service package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration Center to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using vehicle to infrastructure (V2I) Communications. Results of roadside clearance activities will be passed on to the Commercial Vehicle Administration Center. The roadside check facility may be equipped with Automated Vehicle Identification (AVI), weighing sensors, communications equipment, and computer workstations. Communications may be implemented using a range of technologies from transponder data readers through connected vehicle short range communications.
CVO04	CV Administrative Processes	<p>This service package supports program administration and enrollment and provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in a variety of programs including electronic clearance and wireless inspection programs which allow commercial vehicles to be screened at mainline speeds. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration Center and snapshots of this data are made available to the roadside check facilities. Current program status is maintained and made available to carriers, drivers, and other authorized users of the data. Enrolled carriers are provided the option to review and challenge the collected data.</p> <p>Commercial Vehicle Administration Centers can share current program status and credential information with other Centers, so that it is possible for any Commercial Vehicle Administration Center to have access to all credentials, credential fees, credentials status and safety status information. In addition, it is possible for one Commercial Vehicle Administration Center to collect HAZMAT route restrictions information from other Commercial Vehicle Administration Centers and then act as a clearinghouse for this route restrictions information.</p>

Service Package	Service Package Name	Description
<b>Commercial Vehicle Operations Service Area (continued)</b>		
CVO05	International Border Electronic Clearance	This service package provides for automated clearance at international border crossings. It augments the Electronic Clearance service package by allowing interface with border administration and border inspection related functions. This service package processes the entry documentation for vehicle, cargo, and driver, checks compliance with import/export and immigration regulations, handles duty fee processing, and reports the results of the crossing event to manage release of commercial vehicle, cargo, and driver across an international border. It interfaces with administrative systems used by customs and border protection, immigration, carriers, and service providers (e.g., brokers) and inspection systems at international border crossings to generate, process, and store entry documentation.
CVO06	Freight Signal Priority	The Freight Signal Priority service package (FSP) provides traffic signal priority for freight and commercial vehicles traveling in a signalized network. The goal of the freight signal priority service package is to reduce stops and delays to increase travel time reliability for freight traffic, and to enhance safety at intersections.
CVO07	Roadside CVO Safety	This service package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at roadside check locations. The basic option, directly supported by this service package, facilitates safety inspection of vehicles that have been pulled off the highway, perhaps as a result of the automated screening process provided by the Electronic Clearance (CVO03) service package. In this scenario, only basic identification data and status information is read from the electronic tag on the commercial vehicle. The identification data from the tag enables access to additional safety data maintained in the infrastructure which is used to support the safety inspection, and may also inform the pull-in decision if system timing requirements can be met. More advanced implementations collect additional data from commercial vehicles. This service package focuses on manned inspection locations. See CVO08 for remote monitoring options using smart roadside infrastructure at unmanned, virtual inspection stations.
CVO08	Smart Roadside and Virtual WIM	This service package includes the delivery of capabilities related to wireless roadside inspections and electronic screening/virtual weigh stations. Wireless roadside inspection is defined by a safety screening capability that employs communications technologies to obtain information from a commercial vehicle that will allow safety screening of the vehicle and its driver. This capability provides for the interrogation at mainline speeds of a commercial vehicle when it has entered a control segment or geofenced area. Vehicle identification and driver information are provided to the roadside unit. The information communicated can be used to verify compliance with safety requirements, allowing a decision to be made regarding whether the vehicle should pull in to a roadside check station. A more advanced version of this service package would download safety information measured on the vehicle including driver related information such as the driver log allowing real time evaluation that the vehicle and driver are meeting safety requirements. The electronic screening/virtual weigh stations capability employs communications technologies to obtain information from a commercial vehicle that will allow verification of permits or credentials for the vehicle. The information communicated is used to verify compliance with safety requirements, allowing a decision to be made regarding whether the vehicle should pull in to a roadside check station. This service package can also be used to verify that the commercial vehicle meets vehicle weight (via weigh in motion capability) or dimension requirements.

Service Package	Service Package Name	Description
<b>Commercial Vehicle Operations Service Area (continued)</b>		
CVO09	Freight-Specific Dynamic Travel Planning	This service package provides both pretrip and enroute travel planning, routing, and commercial vehicle related traveler information, which includes information such as truck parking locations and current status. The information will be based on data collected from the commercial fleet as well as general traffic data collection capabilities. The information, both real time and static can be provided directly to fleet managers, to mobile devices used by commercial vehicle operators, or directly to in vehicle systems as commercial vehicles approach roadway exits with key facilities such as parking. The service package can also provide oversize/ overweight permit information to commercial managers.
CVO10	Road Weather Information for Freight Carriers	The service package is a special case of the Road Weather Advisories and Warnings for Motorists service package that focuses on Freight Carrier users. It provides the capability to collect road weather data from connected vehicles and using that data to develop short term warnings or advisories that can be provided to individual commercial vehicles or to commercial vehicle dispatchers. The information may come from either vehicles operated by the general public and commercial entities (including passenger cars and trucks) or specialty vehicles and public fleet vehicles (such as snowplows, maintenance trucks, and other agency pool vehicles). The raw data will be processed in a controlling center to generate road segment-based data outputs. The processing will also include a road weather commercial vehicle alerts algorithm to generate short time horizon alerts that will be pushed to user systems and available to commercial vehicle dispatchers. In addition the information collected can be combined with observations and forecasts from other sources to provide medium (next 2-12 hours) or long term (more than 12 hours) advisories through a variety of interfaces including web based and connected vehicle based interfaces.
CVO11	Freight Drayage Optimization	This service package covers the information exchanges between all intermodal parties to provide current drayage truck load matching and container availability and appointment scheduling at railroad and steamship line terminals. It includes a link from drivers and freight management systems dispatchers to an intermodal terminal reservation system and integrates an appointment function with Terminal Queue Status and Load Matching. The service package provides information to the dispatcher and driver concerning the availability status for pickup of a container at an intermodal terminal. It also provides drivers and dispatchers with both intermodal terminal queue length, and estimated time from the back of the queue to the gate.
CVO12	HAZMAT Management	This service package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Center. The Emergency Management Center is notified by the Commercial Vehicle if an incident occurs and coordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Center. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.
CVO13	Roadside HAZMAT Security Detection and Mitigation	This service package provides the capability to detect and classify security sensitive HAZMAT on commercial vehicles using roadside sensing and imaging technology. Credentials information can be accessed to verify if the commercial driver, vehicle and carrier are permitted to transport the identified HAZMAT. If the credentials analysis and sensed HAZMAT information do not agree, the vehicle can be signaled to pull off the highway, and if required, an alarm can be sent to Emergency Management to request they monitor, traffic stop or disable the vehicle.

Service Package	Service Package Name	Description
<b>Commercial Vehicle Operations Service Area (continued)</b>		
CVO14	Fleet and Freight Security	This service package provides the ability for Fleet and Freight Management to detect when an unauthorized commercial vehicle driver attempts to drive their vehicle based on stored driver identity information. If an unauthorized driver has been detected, Fleet and Freight Management can activate commands to safely disable the commercial vehicle. Alarms can also be sent to emergency management to inform them of a potential commercial vehicle hijacking or theft and potential hazardous situation. In addition, Emergency Management can request Fleet and Freight Management to disable a specific vehicle in their fleet.
CVO15	Electronic Work Diaries	This service package provides enhanced security for commercial vehicle fleets and freight. Internal and external alerts and advisories are monitored to identify potential threats to the safety and security of the fleet and freight. It provides for the planning and tracking of three aspects of commercial vehicle shipments. For each shipment, the commercial vehicle, the freight equipment, and the commercial vehicle driver are monitored for consistency with the planned assignment. Any unauthorized changes are determined by the Fleet and Freight Management Center and then the appropriate people and Centers are notified. As the freight is shipped and tracked, security and public safety agencies may also interrogate the freight container to determine if it has been breached and to identify container contents. Once a route has been assigned, changes must be coordinated. Commercial Vehicle Drivers are alerted to any changes in route from the planned route and given an opportunity to justify a rerouting. Any unauthorized or unexpected route changes by the Commercial Vehicle will register a route deviation alert with the Fleet and Freight Management Center, which can notify local public safety agencies of the route deviation when appropriate (e.g., if there is safety sensitive HAZMAT being carried). Freight managers may decide to take further action on the alerts and/or provide responses that explain that the alerts are false alarms. If no explanation is received, the Fleet and Freight Management Center may notify the Emergency Management Center.
CVO16	Intelligent Access Program	The Electronic Work Diaries service package is designed to collect information salient to the operation of a commercial vehicle, to log driver activity (work), and to report that information to regulators as well as fleet managers, while operating under various privacy regimes including that of the fleet manager, the local government and the national government.
CVO17	Intelligent Access Program - Weight Monitoring	The Intelligent Access Program service package enables commercial vehicle operators simplified access to permit operations in exchange for remote compliance monitoring.
CVO18	Intelligent Speed Compliance	The Intelligent Access Program - Weight Monitoring service package enables commercial vehicle operators simplified access to permit operations in exchange for remote weight monitoring.
CVO19	Carrier Operations and Fleet Management	The Intelligent Speed Compliance service package uses the Global Navigation Satellite System (GNSS) to independently monitor the speed of a heavy vehicle and provide that information to regulatory authorities. It can be used to verify that commercial vehicles are not exceeding a set speed threshold, and/or to detect faulty speed limiter devices.

Service Package	Service Package Name	Description
<b>Data Management Service Area</b>		
DM01	ITS Data Warehouse	This service package provides access to transportation data to support transportation planning, condition and performance monitoring, safety analysis, and research. Configurations range from focused repositories that house data collected and owned by a single agency, district, private sector provider, or research institution to broad repositories that contain multimodal, multidimensional data from varied data sources covering a broader region. Both central repositories and physical distributed ITS data repositories are supported. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse service package may be parsed by the local repository and dynamically translated to requests to other repositories that relay the data necessary to satisfy the request.
DM02	Performance Monitoring	The Performance Monitoring service package uses information collected from detectors and sensors, connected vehicles, and operational data feeds from centers to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data information obtained from vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including accident data, road condition data, road closures and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data.
<b>Maintenance and Construction Service Area</b>		
MC01	Maintenance and Construction Vehicle and Equipment Tracking	This service package tracks the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. Checks can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.
MC02	Maintenance and Construction Vehicle Maintenance	This service package performs vehicle maintenance scheduling and manages both routine and corrective maintenance activities on vehicles and other maintenance and construction equipment. It includes on-board sensors capable of automatically performing diagnostics for maintenance and construction vehicles, and the systems that collect this diagnostic information and use it to schedule and manage vehicle and equipment maintenance.
MC03	Roadway Automated Treatment	This service package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The service package includes the environmental sensors that detect adverse conditions, the automated treatment system itself, and driver information systems (e.g., dynamic message signs) that warn drivers when the treatment system is activated.
MC04	Winter Maintenance	This service package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.



Service Package	Service Package Name	Description
<b>Maintenance and Construction Service Area (continued)</b>		
MC05	Roadway Maintenance and Construction	This service package supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.
MC06	Work Zone Management	This service package manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using CCTV cameras and controlled using dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers. Work zone information is coordinated with other groups (e.g., TIC, traffic management, other maintenance and construction centers). Work zone speeds and delays are provided to the motorist prior to the work zones. This service package provides control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.
MC07	Work Zone Safety Monitoring	This service package provides warnings to maintenance personnel within a work zone about potential hazards within the work zone. It enables vehicles or the infrastructure to provide warnings to workers in a work zone when a vehicle is moving in a manner that appears to create an unsafe condition (e.g., moving at high speed or entering the work zone).
MC08	Maintenance and Construction Activity Coordination	This service package supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations, or to Transportation Information Centers who can provide the information to travelers. Center to center coordination of work plans supports adjustments to reduce disruption to regional transportation operations.
MC09	Infrastructure Monitoring	This service package monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts) using both fixed and vehicle-based infrastructure monitoring sensors. Fixed sensors monitor vibration, stress, temperature, continuity, and other parameters and mobile sensors and data logging devices collect information on current infrastructure condition. This service package also monitors vehicle probes for vertical acceleration data and other probe data that may be used to determine current pavement condition.
<b>Parking Management Service Area</b>		
PM01	Parking Space Management	This service package monitors and manages parking spaces in lots, garages, and other parking areas and facilities. It assists in the management of parking operations by monitoring parking lot ingress and egress, parking space occupancy and availability. Infrastructure-based detectors and/or connected vehicles may be used to monitor parking occupancy. The service package shares collected parking information with local drivers and information providers for broader distribution.
PM02	Smart Park and Ride System	This service package provides real-time information on Park and Ride capacity and supports traveler's decision-making on where best to park and make use of transit alternatives. Transit operators are provided arrival information to support efficient pickup and drop offs and drivers switching to transit are offered current transit information.
PM03	Parking Electronic Payment	This service package supports electronic collection of parking fees. It collects parking fees from in-vehicle equipment, contact or proximity cards, or any smart payment device. User accounts may be established to enhance services offered to frequent customers.

Service Package	Service Package Name	Description
<b>Parking Management Service Area (continued)</b>		
PM04	Regional Parking Management	This service package supports communication and coordination between equipped parking facilities and also supports regional coordination between parking facilities and traffic and transit management systems. This service package also shares information with transit management systems and information service providers to support multimodal travel planning, including parking reservation capabilities. Information including current parking availability, system status, and operating strategies are shared to enable local parking facility management that supports regional transportation strategies.
PM05	Loading Zone Management	This service package manages the occupancy of spaces in a loading/unloading zone. It monitors the current status of each loading/unloading zone space under its control and makes this information available to arriving vehicles. The service package also operates a reservation system for loading zones, providing the capability for loading zone users, including commercial vehicle drivers or fleet operators, to reserve and pay for future use of a loading/unloading space. Interfaces to the general Vehicle OBE are included since loading zones may be used by any vehicle, though commercial vehicles are the most frequent users.
<b>Public Safety Service Area</b>		
PS01	Emergency Call-Taking and Dispatch	This service package provides basic public safety call-taking and dispatch services. It includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Centers supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Center and an Emergency Vehicle supports dispatch and provision of information to responding personnel.
PS02	Routing Support for Emergency Responders	This service package provides information to support dynamic routing of emergency vehicles. Traffic information, road conditions, and weather advisories are provided to enhance emergency vehicle routing. The Emergency Management Center provides routing information based on real-time conditions and has the option to request an ingress/egress route from the Traffic Management Center.
PS03	Emergency Vehicle Preemption	This service package provides signal preemption for public safety first responder vehicles. Both traditional signal preemption systems and new systems based on connected vehicle technology are covered. In more advanced systems, movement of public safety vehicles through the intersection can be facilitated by clearing queues and holding conflicting phases. In addition, this SP also covers the transition back to normal traffic signal operations after providing emergency vehicle preemption.
PS04	Mayday Notification	This service package provides the capability for a vehicle to automatically transmit an emergency message when the vehicle has been involved in a crash or other distress situation. An automatic crash notification feature transmits key data on the crash recorded by sensors mounted in the vehicle (e.g. deployment of airbags) without the need for involvement of the driver. The emergency message is sent to emergency response services, which determines and carries out the appropriate response. This service package allows passing vehicles to receive and forward mayday requests in areas where no communications infrastructure exists. Emergency notifications from personal devices are also supported.

Service Package	Service Package Name	Description
<b>Public Safety Service Area (continued)</b>		
PS05	Vehicle Emergency Response	The Vehicle Emergency Response service package provides arriving public safety vehicles with information from connected vehicles involved in a crash. Emergency responders need information about the vehicles involved in a crash to respond safely and effectively to the vehicle crash. Information such as HAZMAT data can assist the responders. Information about air bag activations and other measures indicating the severity of the crash can provide useful input to ambulance staff. In addition information about the power system of the vehicle (e.g. hybrid, electric, or internal combustion engine) can affect the response.
PS06	Incident Scene Pre-Arrival Staging Guidance for Emergency Responders	This service package will provide situational awareness to and coordination among emergency responders - upon dispatch, while en route to establish incident scene work zones, upon initial arrival and staging of assets, and afterward if circumstances require additional dispatch and staging. It collects a variety of data from emergency, traffic, and maintenance centers. It includes a vehicle and equipment staging function that supplies the en-route responders with additional information about the scene of an incident that they can use to determine where to stage personnel and equipment prior to their arrival on-scene. The service package also includes a dynamic routing function which provides emergency responders with real-time navigation instructions to travel from their base to the incident scene, accounting for traffic conditions, road closures, and snowplow reports if needed. In addition it includes an emergency responder status reporting function which continuously monitors the location of the en-route responder vehicles as well as the vehicles already on-scene. The function develops and maintains the current position of the responder's vehicles and provides updates for estimated time of arrival (ETA).
PS07	Incident Scene Safety Monitoring	This service package employs communications technologies to provide warnings and alerts relating to incident zone operations. One aspect of the service is an in-vehicle messaging system that provides drivers with merging and speed guidance around an incident. Another aspect is providing in-vehicle incident scene alerts to drivers, both for the protection of the drivers as well as incident zone personnel. A third aspect is a warning system for on-scene workers when a vehicle approaching or in the incident zone is being operated outside of safe parameters for the conditions.
PS08	Roadway Service Patrols	This service package supports roadway service patrol vehicles that monitor roads and aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median). The service package monitors service patrol vehicle locations and supports vehicle dispatch to identified incident locations. Incident information collected by the service patrol is shared with traffic, maintenance and construction, and traveler information systems.

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

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

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

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

Service Package	Service Package Name	Description
<b>Public Transportation Service Area (continued)</b>		
PT03	Dynamic Transit Operations	The Dynamic Transit Operations service package allows travelers to request trips and obtain itineraries using a personal device such as a smart phone, tablet, or personal computer. The trips and itineraries cover multiple transportation services (public transportation modes, private transportation services, shared-ride, walking and biking). This service package builds on existing technology systems such as computer-aided dispatch/ automated vehicle location (CAD/AVL) systems and automated scheduling software, providing a coordination function within and between transit providers that would dynamically schedule and dispatch or modify the route of an in-service vehicle by matching compatible trips together. T106 covers other shared use transportation options.
PT04	Transit Fare Collection Management	This service package manages transit fare collection on-board transit vehicles and at transit stops using electronic means. It allows transit users to use a traveler card or other electronic payment device such as a smart phone. Readers located either in the infrastructure or on-board the transit vehicles enable electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Center.
PT05	Transit Security	<p>This service package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment performs surveillance and sensor monitoring in order to identify potentially hazardous situations. The surveillance equipment includes video (e.g., CCTV cameras), audio systems and/or event recorder systems. The sensor equipment includes threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). Transit user or transit vehicle operator activated alarms are provided on-board. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition this service package provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as, intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring).</p> <p>Most of the surveillance and sensor data that is collected by this service package may be monitored by either the Emergency Management Center or the Transit Management Center, providing two possible approaches to implementing this service package. This service package also supports remote transit vehicle disabling and transit vehicle operator authentication by the Transit Management Center.</p>
PT06	Transit Fleet Management	This service package supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to the Transit Management Center. The Transit Management Center processes this data and schedules preventative and corrective maintenance. The service package also supports the day to day management of the transit fleet inventory, including the assignment of specific transit vehicles to blocks and the assignment of transit vehicle operators to runs.
PT07	Transit Passenger Counting	This service package counts the number of passengers entering and exiting a transit vehicle using sensors mounted on the vehicle and communicates the collected passenger data back to the management center. The collected data can be used to calculate reliable ridership figures and measure passenger load information at particular stops.



Service Package	Service Package Name	Description
<b>Public Transportation Service Area (continued)</b>		
PT08	Transit Traveler Information	This service package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this service package.
PT09	Transit Signal Priority	The Transit Signal Priority service package uses transit vehicle to infrastructure communications to allow a transit vehicle to request priority at one or a series of intersections. The service package provides feedback to the transit driver indicating whether the signal priority has been granted or not. This service package can contribute to improved operating performance of the transit vehicles by reducing the time spent stopped at a red light.
PT10	Intermittent Bus Lanes	This service package provides dedicated bus lanes during peak demand times to enhance transit operations mobility. An intermittent bus lane is a lane that can change its status from regular lane (accessible for all vehicles) to bus lane, for the time strictly necessary for a bus or set of buses to pass. The status of the IBL is communicated to drivers using roadside message signs and through in-vehicle signage. The creation and removal of dedicated bus lanes is managed through coordination between traffic and transit centers.
PT11	Transit Pedestrian Indication	The Transit Pedestrian Indication service package provides vehicle to device communications to inform pedestrians at a station or stop about the presence of a transit vehicle. In addition, this service package would inform the transit vehicle operator about the presence of pedestrians nearby and those waiting for the bus. It would help prevent collisions between transit vehicles and pedestrians.
PT12	Transit Vehicle at Station/Stop Warnings	The Transit Vehicle at Station/Stop Warnings service package inform nearby vehicles of the presence of a transit vehicle at a station or stop. The service package also indicates the intention of the transit vehicle in terms of pulling into or out of a station/stop.
PT13	Vehicle Turning Right in Front of a Transit Vehicle	The Vehicle Turning Right in Front of a Transit Vehicle (VTRFTV) service package determines the movement of vehicles near to a transit vehicle stopped at a transit stop and provides an indication to the transit vehicle operator that a nearby vehicle is pulling in front of the transit vehicle to make a right turn. This service package will help the transit vehicle determine if the area in front of it will not be occupied as it begins to pull away from a transit stop.
PT14	Multi-modal Coordination	This service package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.
PT15	Transit Stop Request	This service package allows a transit passenger to send a stop request to an approaching transit vehicle. The transit vehicle receives the request and notifies the vehicle operator of the stop request.
PT16	Route ID for the Visually Impaired	This service package assists visually impaired travelers to identify the appropriate bus and route to their intended destination. It provides information from bus stop infrastructure to visually impaired travelers portable devices that can be converted to audible information regarding the appropriate bus and route. It also allows the visually impaired traveler to query the portable device to identify route options.

Service Package	Service Package Name	Description
<b>Public Transportation Service Area (continued)</b>		
PT17	Transit Connection Protection	This service package allows travelers to initiate a request for connection protection anytime during the trip using a personal device or on-board equipment and receive a confirmation indicating whether the request is accepted. Connection protection uses real time data to examine the arrival status of a transit vehicle and to transmit a hold message to a vehicle or other mode of transportation (e.g. rail) in order for the traveler to make a successful transfer from one vehicle to another. Connection protection can be performed within a single agency, across multiple agencies, and across multiple modes. In an intermodal, multimodal or interagency environment, a transfer request brokerage system, represented by the Transit Management System, can be used to determine the feasibility of a connection protection request and support schedule coordination between agencies.
PT18	Integrated Multi-Modal Electronic Payment	The Integrated Multi-Modal Electronic Payment service package provides electronic payment capability for transit fares, tolls, road use, parking, and other areas requiring electronic payments.
<b>Sustainable Travel Service Area</b>		
ST01	Emissions Monitoring	This service package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the Emissions Management Center for processing. Both area wide air quality monitoring and point emissions monitoring are supported by this service package. For area wide monitoring, this service package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this service package collects data from on-board diagnostic systems and measures tail pipe emissions to identify vehicles that exceed emissions standards and/or clean vehicles that could be released from standard emissions tests, depending on policy and regulations. Summary emissions information or warnings can also be displayed to drivers. The gathered information can be used to implement environmentally sensitive travel demand management (TDM) programs, policies, and regulations.
ST02	Eco-Traffic Signal Timing	The Eco-Traffic Signal Timing service package is similar to current adaptive traffic signal control systems; however, the service package's objective is explicitly to optimize traffic signals for the environment rather than the current adaptive systems' objective, which is to enhance the intersection level of service or throughput, which might improve the intersection's environmental performance. The Eco-Traffic Signal Timing service package processes real-time and historical connected vehicle data at signalized intersections to reduce fuel consumption and overall emissions at the intersection, along a corridor, or for a region. It evaluates traffic and environmental parameters at each intersection in real time and adapts so that the traffic network is optimized using available green time to serve the actual traffic demands while minimizing the environmental impact.
ST03	Eco-Traffic Metering	The Eco-Traffic Metering service package determines the most environmentally efficient operation of traffic signals at freeway on-ramps to manage the rate of entering automobiles. This service package collects traffic and environmental data from roadside sensors and connected vehicles to allow on-ramp merge operations that minimize overall emissions, including traffic and environmental conditions on the ramp and on the freeway upstream and downstream of the ramp. Using this information, the service package determines a timing plan for the ramp meter based on current and predicted traffic and environmental conditions.

Service Package	Service Package Name	Description
<b>Sustainable Travel Service Area (continued)</b>		
ST04	Roadside Lighting	The Roadside Lighting service package is a connected vehicle version of the automated roadside lighting systems that uses the presence of vehicles based on V2I communications as an input to control of roadside lighting systems. The service package can use the presence of vehicles to alter roadside lighting levels, and can use environmental data obtained from the vehicles as an input to support adjustment of the lighting based on adverse weather conditions such as fog, rain, or snow.
ST05	Electric Charging Stations Management	The Electric Charging Station Management service package provides an exchange of information between the electric vehicle and charging station to manage the charging operation. The agency or company operating the charging station can use vehicle information such as the capability of the vehicle (e.g. operational status of the electrical system, how many amps can the vehicle handle, and % charge complete) to determine that the charge is being properly applied and determine an estimated time to complete charging.
ST06	HOV/HOT Lane Management	This service package manages high-occupancy vehicle (HOV) and high-occupancy toll (HOT) lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals. Preferential treatment is given to HOV lanes using special bypasses, reserved lanes, and exclusive rights-of-way that may vary by time of day. Vehicle occupancy can be detected to verify HOV compliance and to notify enforcement agencies of violations. For HOT lane configurations, tolls are collected for vehicles that do not meet the high-occupancy criteria for the lane.
ST07	Eco-Lanes Management	The Eco-Lanes Management service package supports the operations of eco-lanes – dedicated lanes similar to high-occupancy vehicle (HOV) or high-occupancy toll (HOT) lanes, but optimized for the environment. The service package employs communication technology to gather traffic and environmental information from multiple sources including infrastructure, vehicles, and other systems. The service package then processes these data and determines whether an eco-lane should be created or decommissioned along a roadway. These decisions would be in response to real-time traffic and environmental conditions. While the eco-lanes would have the capability to be flexible and more dynamic, it is envisioned that these parameters would change only as needed to ensure that travelers do not become confused by a system that is too dynamic in nature. Travelers would need to assume some level of consistency with their trip and should not be surprised by constant changing of the eco-lane's parameters. The Eco-Lanes Management service package establishes parameters and defines or geo-fences the eco-lanes boundaries. Eco-lanes parameters may include the types of vehicles allowed in the eco-lanes, emissions parameters for entering the eco-lanes, the number of lanes, and the start and end of the eco-lanes. The service package also conveys this information about eco-lanes to traveler information centers so those centers can provide the information to travelers.
ST08	Eco-Approach and Departure at Signalized Intersections	The Eco-Approach and Departure at Signalized Intersections service package uses wireless data communications sent from a connected vehicle roadside equipment (RSE) unit to connected vehicles to encourage "green" approaches to and departures from signalized intersections. The vehicle collects intersection geometry information and signal phase movement information using V2I communications and data from nearby vehicles using V2V communications. Upon receiving this information, the service package performs calculations to provide speed advice to the driver, allowing the driver to adapt the vehicle's speed to pass the next traffic signal on green or to decelerate to a stop in the most eco-friendly manner. The service package also considers a vehicle's acceleration as it departs from a signalized intersection. Finally, the service package may perform engine adjustments that provide increased fuel efficiency.

Service Package	Service Package Name	Description
<b>Sustainable Travel Service Area (continued)</b>		
ST09	Connected Eco-Driving	The Connected Eco-Driving service package provides customized real-time driving advice to drivers so that they can adjust their driving behavior to save fuel and reduce emissions. Eco-driving advice includes recommended driving speeds, optimal acceleration, and optimal deceleration profiles based on prevailing traffic conditions, interactions with nearby vehicles, and upcoming road grades. The service package also provides feedback to drivers on their driving behavior to encourage drivers to drive in a more environmentally efficient manner. Finally, the service package may include vehicle-assisted strategies where the vehicle automatically implements the eco-driving strategy (e.g., changes gears, switches power sources, or reduces its speed in an eco-friendly manner).
ST10	Low Emissions Zone Management	The Low Emissions Zone Management service package supports the operation of a low emissions zone that is responsive to real-time traffic and environmental conditions. Low emissions zones are geographic areas that seek to restrict or deter access by specific categories of high-polluting vehicles into the area to improve the air quality within the geographic area. The service package uses data collected from vehicles using connected vehicle technologies and from roadside equipment as input to the system. The Low Emissions Zone Management service package supports the geo-fencing of a cordon that may be scalable and moveable (e.g., created for a day, removable, flexible in its boundaries) and would be less dependent on conventional ITS infrastructure. The service package would establish parameters including the types of vehicles permitted to enter the zone, exemptions for transit vehicles, emissions criteria for entering the zone, fees or incentives for vehicles based on emissions data collected from the vehicle, and geographic boundaries for the low emissions zone. The service package would also include electronic toll collection functions that support payments of fees or collection of incentives for registered vehicles using connected vehicle technologies. Finally, this service package provides information about the low emissions zone to traveler information centers, including information about criteria for entering the zone, expected fees and incentives, current and predicted traffic conditions, and geographic boundaries of the zone.
<b>Support Service Area</b>		
SU01	Connected Vehicle System Monitoring and Management	This service package provides monitoring, management and control services necessary to other applications and/or devices operating within the Connected Vehicle Environment. This service package maintains and monitors the performance and configuration of the connected vehicle system. This includes tracking and management of the infrastructure configuration as well as detection, isolation, and correction of infrastructure service problems. It also includes monitoring of performance of the infrastructure and mobile equipment, which includes RSEs, OBEs, the back office applications, as well as the communication links that connect the system.
SU02	Core Authorization	This service package manages the authorization mechanisms to define roles, responsibilities and permissions for connected vehicle applications. This allows system administrators to establish operational environments where different connected vehicle system users may have different capabilities. For instance, some Mobile elements may be authorized to request signal priority, or some Centers may be permitted to use the geographic broadcast service, while those without those permissions would not.
SU03	Data Distribution	This service package manages the distribution of data from data providers to data consumers and protects those data from unauthorized access. It informs data providers of how to provide data, manages data subscriptions, and provides data forwarding capabilities. The service package also maintains a directory of System Users that want data and supports multiple distribution mechanisms including publish-subscribe and directly from data provider to data consumer. It allows data consumers to specify (and change the specification of) data they wish to receive.

Service Package	Service Package Name	Description
<b>Support Service Area (continued)</b>		
SU04	Map Management	This service package defines interfaces that can be used download or update all types of map data used to support intelligent transportation systems. This map data will be accessed by centers, field, and vehicle physical objects. The service package can also be used to harness the Connected Vehicle Environment to provide rich source data that can be used to verify, refine, and enhance geographic map data.
SU05	Location and Time	This service package identifies the external systems and interfaces that provide accurate location and time to intelligent transportation system devices and systems.
SU06	Object Registration and Discovery	<p>This service package provides registration and lookup services necessary to allow objects to locate other objects operating within the Connected Vehicle Environment.</p> <p>An object registry is like a phone book for all the connected centers, systems, and equipment in the transportation system (the "objects"). In this service package, each object registers itself with the ORDS and tells the registry where it lives in the communication network (e.g., host, port, node name) and information about the services it provides - information that other objects can use to determine the type of service, the geographic scope of the service, and other information that helps users of the registry to make informed decisions about which object(s) support a needed service or information stream. This is the "Discovery" part of the service. Connected objects can use the registry to find (discover) objects that can be used to get needed information or services.</p>
SU07	Privacy Protection	This service package provides the privacy protection essential to the operation of connected vehicle applications. Privacy Protection obscures the network identifiers of mobile devices in order to allow communications with credentials management and other centers.
SU08	Security and Credentials Management	This service package is used to ensure trusted communications between mobile devices and other mobile devices or roadside devices and protect data they handle from unauthorized access. The service package grants trust credentials to qualified mobile devices and infrastructure devices in the Connected Vehicle Environment so that those devices may be considered trusted by other devices that receive trust credentials from the SCM service package. The service package allows credentials to be requested and revoked and secures the exchange of trust credentials between parties, so that no other party can intercept and use those credentials illegitimately. The service package provides security to the transmissions between connected devices, ensuring authenticity and integrity of the transmissions. Additional security features include privacy protection, authorization and privilege class definition, as well as non-repudiation of origin.
SU09	Center Maintenance	This service package supports maintenance of the computers, networks, video walls, and other information technology assets that are installed in a center to support center operations. Like other support service packages, this SP is drawn at a high level of abstraction so the basic interfaces and functionality associated with maintaining center IT assets can be applied to any center.

Service Package	Service Package Name	Description
<b>Support Service Area (continued)</b>		
SU10	Field Equipment Maintenance	This service package supports maintenance of ITS devices that are installed in the field. Like other support service packages, this SP is drawn at a high level of abstraction so the basic interfaces and functionality associated with maintaining field ITS assets can be applied to any field equipment. In particular, this service package supports maintenance of field subsystems like ITS Payment Equipment, Parking Management Systems, and Commercial Vehicle Check Equipment where maintenance is not covered by a more specific Service Package. Two Field subsystems have more specific service packages associated with their maintenance: See MC05 for maintenance of ITS Roadway Equipment and SU01 for more specific interfaces associated with maintaining Connected Vehicle Roadside Equipment.
SU11	Vehicle Maintenance	This service package identifies the interfaces and functionality that support vehicle maintenance, including maintenance of ITS equipment on board the vehicle. An interface with a Vehicle Service Center supports vehicle monitoring to support timely, effective maintenance. It also supports software configuration management and updates as part of maintenance of the software-based on-board systems. While this service package covers only maintenance of the Vehicle OBE, it is defined at the highest level of abstraction so that any center that is contemplating advanced maintenance concepts for its fleet vehicles can use this service package. Other service packages that provide maintenance support for fleet vehicles include CVO01, MC02, and PT06.
SU12	Traveler Device Maintenance	This service package supports maintenance of ITS personal devices and public devices that are installed in traveler environments like transit stations and other public areas frequented by travelers. Like other device maintenance service packages, this SP is drawn at a high level of abstraction to cover the basic interfaces and functionality associated with maintaining traveler-oriented personal and public devices. For personal devices, the focus is on devices that are used by transportation professionals. The maintenance of smart phones, tablets, laptops, and other general purpose devices that are used by travelers is coordinated between the travelers and the providers of the devices and communications services, which is beyond the scope of the architecture.
<b>Traveler Information Service Area</b>		
TI01	Broadcast Traveler Information	<p>This service package provides a digital broadcast service that disseminates traveler information to all equipped travelers within range. It collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadcasts the information to travelers using technologies such as FM subcarrier, satellite radio, cellular data broadcasts, and Internet streaming technologies.</p> <p>This service package also provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility service packages for connected vehicles. DSRC is used to deliver real-time traveler information including travel times, incident information, road conditions, and emergency traveler information to vehicles as they pass connected vehicle roadside equipment along their route. This service package provides public information that is available to all equipped vehicles in the vicinity of the roadside equipment.</p>

Service Package	Service Package Name	Description
<b>Traveler Information Service Area (continued)</b>		
TI02	Personalized Traveler Information	This service package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications with the traveler. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal and web pages via smart phone, tablet, personal computer, and a variety of in-vehicle devices.
TI03	Dynamic Route Guidance	This service package offers advanced route planning and guidance that is responsive to current conditions. The package augments a user's navigation system equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information, which is used by the user equipment to provide real-time route guidance that factors in current conditions.
TI04	Infrastructure-Provided Trip Planning and Route Guidance	This service package offers the user trip planning and en-route guidance services. It generates a trip plan, including a multimodal route and associated service information (e.g., parking information), based on traveler preferences and constraints. Routes may be based on static information or reflect real time network conditions. Unlike TI03, where the user equipment determines the route, the route determination functions are performed by the center in this service package. The trip plan may be confirmed by the traveler and advanced payment and reservations for transit and alternate mode (e.g., airline, rail, and ferry) trip segments, and ancillary services are accepted and processed. The confirmed trip plan may include specific routing information that can be supplied to the traveler as general directions or as turn-by-turn route guidance depending on the level of user equipment.
TI05	Travel Services Information and Reservation	This service package provides travel service information and reservation services to the traveler pre-trip and while en route. This includes information for tourist attractions, lodging, dining, service stations, parking, emergency services, and other services and businesses of interest to the traveler.
TI06	Dynamic Ridesharing and Shared Use Transportation	<p>This service package addresses dynamic ridesharing/ride matching services to travelers and other forms of shared use transportation. Dynamic ridesharing allows travelers to arrange carpool trips through a personal device with a wireless connection to a ride matching system (e.g., a web-based application). It uses inputs from both passengers and drivers pre-trip, during the trip, and post-trip . These inputs are then translated into "optimal" pairings between passengers and drivers to provide both with a convenient route between their two origin and destination locations. After the trip, information is provided back to the service package to improve the user's experience for future trips.</p> <p>The shared use aspect of the service package addresses three types of shared use that may be arranged using an internet connected personal device. In the first type, a traveler arranges for the temporary use of a vehicle. In the second type of shared use, a traveler arranges for a vehicle to pick them up at a specific location and take them to another location. The second type of shared use may be implemented as a ride matching or ridesharing service, including those provided by Uber and Lyft. The third type of shared use is a bikeshare capability.</p>

Service Package	Service Package Name	Description
<b>Traveler Information Service Area (continued)</b>		
TI07	In-Vehicle Signage	This service package augments regulatory, warning, and informational signs and signals by providing information directly to drivers through in-vehicle devices. The information provided would include static sign information (e.g., stop, curve warning, guide signs, service signs, and directional signs) and dynamic information (e.g., current signal states including highway intersection and highway-rail intersection status and local conditions warnings identified by local environmental sensors). This service package also includes the capability for maintenance and construction, emergency, and transit vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in areas such as work zones, around incidents, and at bus stops.
<b>Traffic Management Service Area</b>		
TM01	Infrastructure-Based Traffic Surveillance	This service package includes traffic detectors, other surveillance equipment, the supporting field equipment, and Center to Field communications to transmit the collected data back to the Traffic Management Center. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Center). The data generated by this service package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Traveler Information Center physical object.
TM02	Vehicle-Based Traffic Surveillance	This service package uses probe data information obtained from vehicles in the network to support traffic operations, including incident detection and the implementation of localized operational strategies. Since traffic data is collected from vehicles, travel times and other related traffic performance measures are available. This service package includes the capability to collect data from Connected Vehicles so that "probe" data can be collected from all equipped vehicles, providing access to a large vehicle population as penetration increases. Incident detection enables transportation agencies to determine the location of potential incidents so the agencies can respond more quickly to the incident and mitigate any negative impacts to the transportation network. Vehicle data that can be used to detect potential incidents include changes in vehicle speeds indicating the disruption of traffic flow, when a vehicle's safety systems have been activated or deployed, or sudden vehicle turns or deceleration at a specific location (indicating a potential obstacle in the roadway).
TM03	Traffic Signal Control	This service package provides the central control and monitoring equipment, communication links, and the signal control equipment that support traffic control at signalized intersections. A range of traffic signal control systems are represented by this service package ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. This service package is generally an intra-jurisdictional package. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would also be represented by this package. Coordination of traffic signal systems using real-time communications is covered in the TM07-Regional Traffic Management service package. This service package is consistent with typical traffic signal control systems.



Service Package	Service Package Name	Description
<b>Traffic Management Service Area (continued)</b>		
TM04	Connected Vehicle Traffic Signal System	This service package uses both vehicle location and movement information from connected vehicles as well as infrastructure measurement of non-equipped vehicles to improve the operations of traffic signal control systems. The service package utilizes the vehicle information to adjust signal timing for an intersection or group of intersections in order to improve traffic flow, including allowing platoon flow through the intersection. Other service packages provide related mobility services such as Transit Signal Priority, Freight Signal Priority, Emergency Vehicle Preemption, and Pedestrian Mobility to maximize overall arterial network performance.
TM05	Traffic Metering	This service package provides central monitoring and control, communications, and field equipment that support metering of traffic. It supports the complete range of metering strategies including ramp, interchange, and mainline metering. This package incorporates the instrumentation included in the TM01 service package (traffic sensors are used to measure traffic flow and queues) to support traffic monitoring so responsive and adaptive metering strategies can be implemented. Also included is configurable field equipment to provide information to drivers approaching a meter, such as advance warning of the meter, its operational status (whether it is currently on or not, how many cars per green are allowed, etc.), lane usage at the meter (including a bypass lane for HOVs) and existing queue at the meter.
TM06	Traffic Information Dissemination	This service package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Transportation Information Centers. A link to the Maintenance and Construction Management Center allows real time information on road/bridge closures and restrictions due to maintenance and construction activities to be disseminated.
TM07	Regional Traffic Management	This service package provides for the sharing of information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This service package advances the TM03-Traffic Signal Control and TM05-Traffic Metering service packages by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Traffic Signal Control and Traffic Metering service packages and adds hardware, software, and fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of device control between traffic management centers.

Service Package	Service Package Name	Description
<b>Traffic Management Service Area (continued)</b>		
TM08	Traffic Incident Management System	<p>This service package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The service package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as rail operations and event promoters. Information from these diverse sources is collected and correlated by this service package to detect and verify incidents and implement an appropriate response. This service package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between centers. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination service package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information service packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.</p>
TM09	Integrated Decision Support and Demand Management	<p>This service package recommends courses of action to transportation operators in a corridor, downtown area, or other heavily traveled area. Recommendations are based on an assessment of current and forecast transportation network performance and environmental conditions. Multi-modal transportation operational strategies are created that consider all modes and all roads in the travel area to correct network imbalances and effectively manage available capacity. As part of the operational strategies, this service package may also recommend lane restrictions, transit, parking, and toll strategies to influence traveler route and mode choices to support active demand management programs and policies managing both traffic and the environment. Operational strategies, including demand management recommendations, are coordinated to support operational decisions by each transportation operator that are consistent with the recommended strategy. All recommended operational strategies are based on historical evaluation, real-time assessment, and forecast of the roadway network performance based on predicted travel demand patterns. This service package also collects air quality, parking availability, transit usage, and vehicle occupancy data to support operational strategies that manage and balance capacity and demand.</p>
TM10	Electronic Toll Collection	<p>The Electronic Toll Collection service package provides toll operators with the ability to collect tolls electronically and detect and process violations. The fees that are collected may be adjusted to implement demand management strategies. Field-Vehicle Communication between the roadway equipment and the vehicle is required as well as Fixed Point-Fixed Point interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Toll violations are identified and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable broad interoperability for these services.</p>

Service Package	Service Package Name	Description
<b>Traffic Management Service Area (continued)</b>		
TM11	Road Use Charging	<p>The Road Use Charging service package supports the capability to charge fees to roadway vehicle owners for using specific roadways with potentially differential payment rates based on time-of-day, which specific roadway is used, and class of vehicle (a local policy decision by each roadway owner). These payment schemes could be forms of Vehicle Miles Traveled (VMT) or other schemes that are yet to be defined. Vehicle owners need only register with a single payment entity of their choice (a participating state, municipal, or regional DOT, an authority, or a private entity), and payments are reconciled by the entity receiving payment (and travel history) with all roadway owners that participate in the road use payment scheme, which may also include the Federal government. Vehicle owners would pay nothing for distances traveled where there are no payments required (e.g. in jurisdictions that have not implemented a distance based payment or for roadway operators that collect payment using traditional tolls), although a Federal payment rate might cover some or all roadway operations (a Federal policy decision). Basic operation depends on the vehicle tracking its own location, and periodically reporting its travel history to the registered entity receiving payment using connected vehicle communications.</p>
TM12	Dynamic Roadway Warning	<p>This service package includes systems that dynamically warn drivers approaching hazards on a roadway. Such hazards include roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway and any other transient event that can be sensed. These dynamic roadway warning systems can alert approaching drivers via warning signs, flashing lights, in-vehicle messages, etc. Such systems can increase the safety of a roadway by reducing the occurrence of incidents. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.</p> <p>Speed warnings that consider the limitations of a given vehicle for the geometry of the roadway (e.g., rollover risk for tall vehicles) are not included in this service package but are covered by the TM17 – Speed Warning and Enforcement service package.</p> <p>Roadway warning systems, especially queue warning systems are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as TM20-Variable Speed Limits and TM22-Dynamic Lane Management and Shoulder Use).</p>
TM13	Standard Railroad Grade Crossing	<p>This service package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the ITS Roadway Equipment and the Driver in the physical view.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification of an approaching train by interfaced wayside equipment. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the Traffic Management Center.</p>

Service Package	Service Package Name	Description
<b>Traffic Management Service Area (continued)</b>		
TM14	Advanced Railroad Grade Crossing	<p>This service package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This service package includes all capabilities from the Standard Railroad Grade Crossing service package and augments these with additional safety features to mitigate the risks associated with higher rail speeds and leverage Connected Vehicle technologies. The active warning systems supported by this service package include positive barrier systems that preclude entrance into the intersection when the barriers are activated. Like the Standard package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this service package, the wayside equipment provides additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and estimated duration of closure may be derived. This service package will alert and/or warn drivers who are approaching an at-grade railroad crossing if they are on a crash-imminent trajectory to collide with a crossing or approaching train. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This service package also includes additional detection capabilities that enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.</p>
TM15	Railroad Operations Coordination	<p>This service package provides an additional level of strategic coordination between freight rail operations and other transportation centers. Rail operations provides train schedules, maintenance schedules, and any other forecast events that will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations that may be used in advanced traffic control strategies or to enhance the quality of traveler information.</p>
TM16	Reversible Lane Management	<p>This service package provides for the management of reversible lane facilities. In addition to standard surveillance capabilities, this service package includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. The package includes the field equipment, physical lane access controls, and associated control electronics that manage and control these special lanes. This service package also includes the equipment used to electronically reconfigure intersections and manage right-of-way to address dynamic demand changes and special events.</p>
TM17	Speed Warning and Enforcement	<p>This service package monitors vehicle speeds and supports warning drivers when their speed is excessive. Also the service includes notifications to an enforcement agency to enforce the speed limit of the roadway. Speed monitoring can be made via spot speed or average speed measurements. Roadside equipment can display the speed of passing vehicles and/or suggest a safe driving speed. Environmental conditions and vehicle characteristics may be monitored and factored into the safe speed advisories that are provided to the motorist. For example, warnings can be generated recognizing the limitations of a given vehicle for the geometry of the roadway such as rollover risk for tall vehicles.</p> <p>This service focuses on monitoring of vehicle speeds and enforcement of the speed limit while the variable speed limits service (covered in TM20-Variable Speed Limits service package) focuses on varying the posted speed limits to create more uniform speeds along a roadway, to promote safer driving during adverse conditions (such as fog) and/or to reduce air pollution.</p>

Service Package	Service Package Name	Description
<b>Traffic Management Service Area (continued)</b>		
TM18	Drawbridge Management	<p>This service package supports systems that manage drawbridges at rivers and canals and other multimodal crossings (other than railroad grade crossings which are specifically covered by other service packages). The equipment managed by this service package includes control devices (e.g., gates, warning lights, dynamic message signs) at the drawbridge as well as the information systems that are used to keep travelers apprised of current and forecasted drawbridge status.</p>
TM19	Roadway Closure Management	<p>This service package closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, and other scenarios where access to the roadway must be prohibited. The service package includes automatic or remotely controlled gates or barriers that control access to roadway segments including ramps and traffic lanes. Remote control systems allow the gates to be controlled from a central location or from a vehicle at the gate/barrier location, improving system efficiency and reducing personnel exposure to unsafe conditions during severe weather and other situations where roads must be closed. Surveillance systems allow operating personnel to visually verify the safe activation of the closure system and driver information systems (e.g., DMS) provide closure information to motorists in the vicinity of the closure. The equipment managed by this service package includes the control and monitoring systems, the field devices (e.g., gates, warning lights, DMS, CCTV cameras) at the closure location(s), and the information systems that notify other systems of a closure. This service package covers general road closure applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other Traffic Management service packages.</p>
TM20	Variable Speed Limits	<p>This service package sets variable speed limits along a roadway to create more uniform speeds, to promote safer driving during adverse conditions (such as fog), and/or to reduce air pollution. Also known as speed harmonization, this service monitors traffic and environmental conditions along the roadway. Based on the measured data, the system calculates and sets suitable speed limits, usually by lane. Equipment over and along the roadway displays the speed limits and additional information such as basic safety rules and current traffic information. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.</p> <p>This service establishes variable speed limits and communicates the speed limits to drivers. Speed warnings and enforcement of speeds limits, including variable speed limits, is covered in the TM17-Speed Warning and Enforcement service package.</p> <p>Variable speed limits are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as TM22-Dynamic Lane Management and Shoulder Use and TM23-Dynamic Roadway Warning).</p>

Service Package	Service Package Name	Description
<b>Traffic Management Service Area (continued)</b>		
TM21	Speed Harmonization	<p>This service package determines speed recommendations based on traffic conditions and weather information and uses connected vehicle technologies to assist in harmonizing speeds to these recommendations. The speed recommendations can be regulatory (e.g. variable speed limits) or advisory. The purpose of speed harmonization is to change traffic speed on links that approach areas of traffic congestion, bottlenecks, incidents, special events, and other conditions that affect flow. Speed harmonization assists in maintaining flow, reducing unnecessary stops and starts, and maintaining consistent speeds. The service package utilizes connected vehicle V2I communication to detect the precipitating roadway or congestion conditions that might necessitate speed harmonization, to generate the appropriate response plans and speed recommendation strategies for upstream traffic, and to broadcast such recommendations to the affected vehicles. The speed recommendations can be provided in-vehicle for connected vehicles, or through roadside signage for non-connected vehicles.</p>
TM22	Dynamic Lane Management and Shoulder Use	<p>This service package provides for active management of travel lanes along a roadway. The package includes the field equipment, physical overhead lane signs and associated control electronics that are used to manage and control specific lanes and/or the shoulders. This equipment can be used to change the lane configuration on the roadway according to traffic demand and lane destination along a typical roadway section or on approach to or access from a border crossing, multimodal crossing or intermodal freight depot. This package can be used to allow temporary or interim use of shoulders as travel lanes. The equipment can be used to electronically reconfigure intersections and interchanges and manage right-of-way dynamically including merges. Also, lanes can be designated for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc. Prohibitions or restrictions of types of vehicles from using particular lanes can be implemented.</p> <p>The lane management system can be centrally monitored and controlled by a traffic management center or it can be autonomous. This service also can include automated enforcement equipment that notifies the enforcement agency of violators of the lane controls.</p> <p>Dynamic lane management and shoulder use is an Active Traffic Management (ATM) strategy and is typically used in conjunction with other ATM strategies (such as TM20-Variable Speed Limits and TM12-Dynamic Roadway Warning).</p>
TM23	Border Management Systems	<p>This service package provides international border crossing management for passenger vehicles and other non-commercial travelers crossing the border. This service package manages traffic at the border crossing, provides technology to support expedited processing of trusted travelers, and collects and disseminates border wait times.</p>
<b>Vehicle Safety Service Area</b>		
VS01	Autonomous Vehicle Safety Systems	<p>This service package improves vehicle safety using on-board sensors that monitor the driving environment surrounding the vehicle. All levels of driving automation are supported ranging from basic warning systems that warn the driver through full automation where the vehicle controls the steering and acceleration/deceleration in all scenarios and environments, without driver intervention. Unlike other Vehicle Safety service packages, this service package includes autonomous capabilities that rely only on on-board systems without communication with other vehicles or the infrastructure.</p>

Service Package	Service Package Name	Description
<b>Vehicle Safety Service Area (continued)</b>		
VS02	V2V Basic Safety	This service package exchanges basic safety messages with surrounding Connected Vehicles to support and augment the safety warning and control automation features identified in VS01. These exchanges support Connected Vehicle safety applications defined in SAE J2945/1: Emergency Electronic Brake Lights, Forward Crash Warning, Blind Spot Warning/Lane Change Warning, Intersection Movement Assist, Left Turn Assist, and Control Loss Warning. It also supports Do Not Pass Warning, Motorcycle Approaching indication, Tailgating Advisory, Stationary Vehicle, and Pre-Crash Actions applications from CVRIA.
VS03	Situational Awareness	This service package shares information about potentially hazardous road conditions or road hazards with other vehicles to support enhanced driver warnings and control automation. Vehicles broadcast relevant road condition information that is collected by the vehicle, such as fog or icy roads. This service package supports the capability for connected vehicles to share situational awareness information even in areas where no roadside communications infrastructure exists. It can be useful to vehicles that are not fully equipped with sensors, or vehicles entering an area with hazardous conditions. Roadside communications infrastructure, if available, can extend the situational awareness range to cover wrong way vehicles where closing rates can require notification beyond DSRC communications range.
VS04	V2V Special Vehicle Alert	This service package alerts the driver about the location of and the movement of public safety vehicles responding to an incident, slow moving vehicles, oversized vehicles, and other special vehicles that may require special attention from the driver. These public safety, commercial, and maintenance vehicles share their current status and location with surrounding vehicles so that other drivers in the vicinity can avoid interfering with their actions and avoid collisions.
VS05	Curve Speed Warning	This service package allows connected vehicles to receive information that it is approaching a curve along with the recommended speed for the curve. This capability allows the vehicle to provide a warning to the driver regarding the curve and its recommended speed. In addition, the vehicle can perform additional warning actions if the actual speed through the curve exceeds the recommended speed.
VS06	Stop Sign Gap Assist	This service package is intended to improve safety at non-signalized intersections where only the minor road has posted stop signs. It includes both onboard (for connected vehicles) and roadside signage warning systems (for non-equipped vehicles). The service package helps drivers on a minor road stopped at an intersection understand the state of activities associated with that intersection by providing a warning of unsafe gaps on the major road. The SSGA service package collects all available sensor information (major road, minor road, and median sensors) data and computes the dynamic state of the intersection in order to issue appropriate warnings and alerts.
VS07	Road Weather Motorist Alert and Warning	This service package collects road weather data from connected vehicles and uses that data to develop short term warnings or advisories that can be provided to individual motorists. The information may come from either vehicles operated by the general public and commercial entities (including passenger cars and trucks) or specialty vehicles and public fleet vehicles (such as snowplows, maintenance trucks, and other agency pool vehicles). The raw data will be processed in a controlling center to generate road segment-based data outputs. The processing will also include a road weather motorist alerts algorithm to generate short time horizon alerts that will be pushed to user systems and available to commercial service providers. In addition the information collected can be combined with observations and forecasts from other sources to provide medium (next 2-12 hours) or long term (more than 12 hours) advisories through a variety of interfaces including web based and connected vehicle based interfaces.

Service Package	Service Package Name	Description
<b>Vehicle Safety Service Area (continued)</b>		
VS08	Queue Warning	This service package utilizes connected vehicle technologies, including vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications, to enable vehicles within the queue event to automatically broadcast their queued status information (e.g., rapid deceleration, disabled status, lane location) to nearby upstream vehicles and to centers (such as the TMC). The infrastructure will broadcast queue warnings to vehicles in order to minimize or prevent rear-end or other secondary collisions. This service package is not intended to operate as a crash avoidance system. In contrast to such systems, this service package will engage well in advance of any potential crash situation, providing messages and information to the driver in order to minimize the likelihood of his needing to take crash avoidance or mitigation actions later. It performs two essential tasks: queue determination (detection and/or prediction) and queue information dissemination using vehicle-based, infrastructure-based, or hybrid solutions.
VS09	Reduced Speed Zone Warning / Lane Closure	This service package provides connected vehicles that are approaching a reduced speed zone with information on the zone's posted speed limit and/or if the configuration of the roadway is altered (e.g., lane closures, lane shifts). Reduced speed zones include (but are not be limited to) construction/work zones, school zones, pedestrian crossing areas, and incorporated zones (e.g., rural towns). The connected vehicle uses the revised speed limit along with any applicable changed roadside configuration information to determine whether to provide an alert or warning to the driver. Additionally, to provide warnings to non-equipped vehicles, infrastructure equipment measures the speed of the approaching vehicles and if greater than the reduced speed zone posted speed limit will provide warning signage. It will provide an alert to drivers in advance when aggressive braking is required to reduce to the posted speed limit.
VS10	Restricted Lane Warnings	This service package provides the connected vehicle with restriction information about the travel lanes, such as if the lane is restricted to high occupancy vehicles (HOV), transit, or public safety vehicles only or has defined eco-lane criteria. A connected vehicle can use this information to determine if the vehicle is in a lane that has lane restrictions.
VS11	Oversize Vehicle Warning	This service package uses external measurements taken by the roadside infrastructure, and transmitted to the vehicle, to support in-vehicle determination of whether an alert/warning is necessary. Specifically, the infrastructure data equipment detects and measures the approaching vehicle's height and width. The infrastructure component of the service package transmits the vehicle measurements, along with bridge, overpass, or tunnel geometry, to the oversize vehicle. The vehicle application utilizes this data to determine whether the vehicle can clear the bridge or tunnel. If deemed necessary, the driver is alerted to the impending low height and/or narrow horizontal clearance bridge or tunnel prior to a decision point, enabling the vehicle to reroute and avoid a collision. If the driver ignores the alert and continues along the route, the vehicle will generate a warning indicating an impending collision at a point near the bridge or tunnel approach. To support unequipped vehicles the infrastructure will display warning or reroute information when the measurements indicate that a vehicle does not have adequate height or width clearance. This service package can be expanded to consider weight as well as height and width.



Service Package	Service Package Name	Description
<b>Vehicle Safety Service Area (continued)</b>		
VS12	Pedestrian and Cyclist Safety	This service package supports the sensing and warning systems used to interact with pedestrians, cyclists, and other non-motorized users that operate on the main vehicle roadways, or on pathways that intersect the main vehicle roadways. These systems allow automated warning or active protection for this class of users. It integrates traffic, pedestrian, and cyclist information from roadside or intersection detectors and new forms of data from wirelessly connected, non-motorized traveler-carried mobile devices to request right-of-way or to inform non-motorized travelers when to cross and how to remain aligned with the crosswalk or pathway based on real-time Signal Phase and Timing (SPaT) and MAP information. In some cases, priority will be given to non-motorized travelers, such as persons with disabilities who need additional crossing time, or in special conditions (e.g., weather) where non-motorized travelers may warrant priority or additional crossing time. This service package will enable a service call to be routed to the traffic controller from a mobile device of a registered person with disabilities after confirming the direction and orientation of the roadway that the individual is intending to cross. It also provides warnings to the non-motorized user of possible infringement of the crossing or pathway by approaching vehicles.
VS13	Intersection Safety Warning and Collision Avoidance	This service package enables a connected vehicle approaching an instrumented signalized intersection to receive information from the infrastructure regarding the signal timing and the geometry of the intersection. The vehicle uses its speed and acceleration profile, along with the signal timing and geometry information to determine if it appears likely that the vehicle will be able to pass safely through the intersection without violating the signal or colliding with other vehicles. If the vehicle determines that proceeding through the intersection is unsafe, a warning is provided to the driver and/or collision avoidance actions are taken, depending on the automation level of the vehicle.
VS14	Cooperative Adaptive Cruise Control	This service package adds vehicle to vehicle (V2V) communications to adaptive cruise control (ACC) systems, which provides enhanced information so that groups or 'strings' of CACC-equipped vehicles can follow a lead vehicle with better accuracy, quicker response, and shorter time gaps, enhancing traffic flow stability. In ACC systems, sensors (e.g., radar or lidar) and longitudinal control automation are used to measure and maintain a safe distance from the lead vehicle. V2V communications enables direct communication between the vehicles so that acceleration and deceleration can be more directly coordinated between vehicles in the string.
VS15	Infrastructure Enhanced Cooperative Adaptive Cruise Control	This service package adds Infrastructure to Vehicle (I2V) communications to Cooperative Adaptive Cruise Control systems so that strings of compatible CACC-equipped vehicles can be more efficiently formed and cooperating vehicles gain access to speed recommendations and traffic control status from the infrastructure, further enhancing traffic flow stability and improving highway capacity and throughput. Speed recommendations provided by the infrastructure can be used to stabilize traffic flow, reducing speed differentials and enhancing throughput along a route that includes a bottleneck. Access to traffic control information such as signal phase and timing enables synchronized starts by adjacent CACC-equipped strings of vehicles, increasing intersection throughput. The infrastructure can also assist with broader coordination between CACC-equipped vehicles, enabling strings of vehicles to be more efficiently formed that share performance parameters and destinations.

Service Package	Service Package Name	Description
<b>Vehicle Safety Service Area (continued)</b>		
VS16	Automated Vehicle Operations	This service package provides full vehicle automation, controlling both the steering and acceleration/deceleration on areas of the highway system that support full automation. Communications between vehicles and between the vehicles and supporting infrastructure equipment supports cooperative check-in to the automated portion of the system and transition to automated mode, coordination of maneuvers between vehicles in automated mode, and checkout from the automated system. This service package is distinguished from the most advanced CACC systems in that full longitudinal and lateral control automation are supported, enabling closely spaced, tightly coupled platoons of vehicles to operate with short fixed gaps, providing greatly enhanced highway capacity and throughput with enhanced efficiency since aerodynamic drag is reduced.
VS17	Traffic Code Dissemination	This service package disseminates current local statutes, regulations, ordinances, and rules that have been adopted by local, state, and federal authorities that govern the safe, orderly operation of motor vehicles, bicycles, and pedestrians on public roads. The focus of this service package is electronic distribution to automated vehicles and their drivers so that automated vehicles can safely operate in compliance with the traffic or motor vehicle code for the current state and locality, though this information would also be useful to human drivers.
<b>Weather Service Area</b>		
WX01	Weather Data Collection	This service package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway. It also collects data from vehicles in the road network that can be used to directly measure or infer current environmental conditions. It leverages vehicle on-board systems that measure temperature, sense current weather conditions (rain and sun sensors) and also can monitor aspects of the vehicle operational status (e.g., use of headlights, wipers, and traction control system) to gather information about local environmental conditions. In addition, environmental sensor systems located on Maintenance and Construction Vehicles are also potential data sources. The collected environmental data is used by the Weather Information Processing and Distribution service package to process the information and make decisions on operations. The collected environmental data may be aggregated, combined with data attributes and sent to meteorological systems for data qualification and further data consolidation. The service package may also request and receive qualified data sets from meteorological systems.
WX02	Weather Information Processing and Distribution	This service package processes and distributes the environmental information collected from the Weather Data Collection service package. This service package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so operational centers and decision support systems can make decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination service package, and aid operators in scheduling work activity.

Service Package	Service Package Name	Description
<b>Weather Service Area (continued)</b>		
WX03	Spot Weather Impact Warning	<p>This service package will alert drivers to unsafe conditions or road closure at specific points on the downstream roadway as a result of weather-related impacts, which include, but are not limited to high winds, flood conditions, ice, or fog. The service packages is designed to use standalone weather systems to warn drivers about inclement weather conditions that may impact travel conditions. Real time weather information is collected from fixed environmental sensor stations and vehicle based sensors. The information is processed to determine the nature of the alert or warning to be delivered and then communicated to connected vehicles. If the warning includes road closure then diversion information can be provided. For non-equipped vehicles the alerts or warnings will be provided via roadway signage. In addition, the roadway equipment may calculate the appropriate speed for current weather conditions and provide this information to the connected vehicle or on roadway signage.</p>

## APPENDIX C – ARCHITECTURE MAINTENANCE DOCUMENTATION FORM

# Austin Regional ITS Architecture

## Architecture Maintenance Documentation Form

**Please complete the following questionnaire to document changes to the Austin Regional ITS Architecture. Modifications will be made during the next update of the Regional ITS Architecture.**

### Contact Information

Agency	
Agency Contact Person	
Street Address	
City	
State, Zip Code	
Telephone	
Fax	
E-Mail	

### Change Information

Please indicate the type of change to the Regional ITS Architecture or Deployment Plan:

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

### Submittal

Please submit ITS Architecture Maintenance Documentation form to one of the following agencies:

CAMPO – Submit form to CAMPO for changes related to projects located in Bastrop, Burnet, Caldwell, Hays, Travis, and Williamson Counties

TxDOT Austin District – Submit form to TxDOT Austin District for changes related to projects located in Blanco, Gillespie, Lee, Llano, and Mason Counties

Form Submittal Date: \_\_\_\_\_

# Austin Regional ITS Architecture

## Architecture Maintenance Documentation Form

<p><b>Question 1</b> Describe the requested change to the Regional ITS Architecture or Deployment Plan.</p>	
<p><b>Question 2</b> Are any of the Regional ITS Architecture service packages impacted by the proposed change?</p>	<p><input type="checkbox"/> Yes: Please complete Questions 2A and 2B  <input type="checkbox"/> No: Please proceed to Question 3  <input type="checkbox"/> Unknown: Please coordinate with the TxDOT Austin District or CAMPO to determine the impacts of proposed change on the Regional ITS Architecture</p>
<p><i>Question 2A</i> <i>List all of the ITS service packages impacted by the proposed change.</i></p>	
<p><i>Question 2B</i> <i>Include a copy of the ITS service packages impacted by the proposed change and mark any proposed modifications to the ITS service packages. Add any additional notes on proposed changes in this section.</i></p>	
<p><b>Question 3</b> Does the proposed change impact any stakeholder agencies other than the agency completing this form?</p>	<p><input type="checkbox"/> Yes: Please complete Questions 3A and 3B  <input type="checkbox"/> No: Form is complete  <input type="checkbox"/> Unknown: Please coordinate with the TxDOT Austin District or CAMPO to determine the impacts of proposed change on the Regional ITS Architecture</p>
<p><i>Question 3A</i> <i>Identify the stakeholder agencies impacted by the change and a contact person for each agency.</i></p>	
<p><i>Question 3B</i> <i>Describe the coordination that has occurred with the stakeholder agencies and the results of the coordination?</i></p>	

# Austin Regional ITS Architecture

## Architecture Maintenance Documentation Form

### Example of Completed Documentation Form

<p><b>Question 1</b> Describe the requested change to the Regional ITS Architecture or Deployment Plan.</p>	<p><i>Example: City A is planning to deploy CCTV cameras for network surveillance on arterial streets. In the Regional ITS Architecture, the City A Traffic Operations Center (TOC) is shown as the only center controlling the CCTV cameras. The City A TOC is now planning to provide images and control of the CCTV cameras to the City A Police Department for use during incidents.</i></p>
<p><b>Question 2</b> Are any of the Regional ITS Architecture service packages impacted by the proposed change?</p>	<p><input checked="" type="checkbox"/> Yes: Please complete Questions 2A and 2B  <input type="checkbox"/> No: Please proceed to Question 3  <input type="checkbox"/> Unknown: Please coordinate with the TxDOT Austin District or CAMPO to determine the impacts of proposed change on the Regional ITS Architecture</p>
<p><b>Question 2A</b> <i>List all of the ITS service packages impacted by the proposed change.</i></p>	<p><i>Example: TM08 – Traffic Incident Management System  TM01 – Infrastructure-Based Traffic Surveillance</i></p>
<p><b>Question 2B</b> <i>Include a copy of the ITS service packages impacted by the proposed change and mark any proposed modifications to the ITS service packages. Add any additional notes on proposed changes in this section.</i></p>	<p><i>Example: A sketch of the TM08 – Traffic Incident Management System ITS service package diagram for City A is attached. Changes have been marked by hand to indicate the new data connections that will be established to allow the City A TOC to send traffic images to the City A Police Department, and for the City A Police Department to control the CCTV cameras. The deployment of the CCTV cameras will also result in several of the data flows in TM01 – Infrastructure-Based Traffic Surveillance being changed from planned to existing. These have also been marked on the ITS service package diagram. (Note: The ITS service package diagrams can be found in Appendix B of the Regional ITS Architecture.)</i></p>
<p><b>Question 3</b> Does the proposed change impact any stakeholder agencies other than the agency completing this form?</p>	<p><input checked="" type="checkbox"/> Yes: Please complete Questions 3A and 3B  <input type="checkbox"/> No: Form is complete  <input type="checkbox"/> Unknown: Please coordinate with the TxDOT Austin District or CAMPO to determine the impacts of the proposed change on the Regional ITS Architecture</p>
<p><b>Question 3A</b> <i>Identify the stakeholder agencies impacted by the change and a contact person for each agency.</i></p>	<p><i>Example: The City A TOC and City A Police Department are the two agencies impacted by this change. (Note: Assuming the City A TOC representative is completing this form, the contact person from the City A Police Department working on this project should be listed.)</i></p>
<p><b>Question 3B</b> <i>Describe the coordination that has occurred with the stakeholder agencies and the results of the coordination?</i></p>	<p><i>Example: The City A TOC and City A Police Department have had several meetings in the last year to discuss the operations of the arterial CCTV cameras. An agreement for the joint operations of the CCTV cameras is currently being developed.</i></p>