



State of Texas
ITS Architectures and Deployment Plans

San Angelo Region

Executive Summary

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

PROJECT APPROACH.....	1
OVERVIEW OF THE SAN ANGELO REGION.....	2
SAN ANGELO REGION STAKEHOLDERS	4
SAN ANGELO REGIONAL ITS ARCHITECTURE	5
Inventory and Needs in the Region.....	5
Market Packages	7
Interconnects, Interfaces, and Standards.....	7
Operational Concept and Scenarios	11
Agreements	12
ITS Architecture Documentation.....	12
SAN ANGELO ITS DEPLOYMENT PLAN.....	13
Prioritized Market Packages.....	13
ITS Project Recommendations for the San Angelo Region.....	15
MAINTAINING THE REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN	20
MEMORANDUM OF UNDERSTANDING	21

TABLE OF CONTENTS

EXECUTIVE SUMMARY

LIST OF FIGURES

Figure 1 – San Angelo Regional ITS Architecture and Deployment Plan Development Process ...	1
Figure 2 – San Angelo Region Map	3
Figure 3 – San Angelo Regional System Interconnect Diagram	8
Figure 4 – San Angelo Surface Street Control Customized Market Package	9
Figure 5 – TxDOT San Angelo District Traffic Signals Interfaces	10
Figure 6 – TxDOT San Angelo District TMC to Other TxDOT Districts TMCs Architecture Flows.....	11

LIST OF TABLES

Table 1 – San Angelo Region: Summary of ITS Needs	6
Table 2 – Summary of Prioritized Market Packages for the San Angelo Region.....	14
Table 3 – Recommended ITS Projects for the San Angelo Region.....	16

PROJECT APPROACH

The Federal Highway Administration (FHWA) issued a final rule to implement Section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21) in January of 2001. This final rule requires that Intelligent Transportation System (ITS) projects funded through the Highway Trust Fund conform to the National ITS Architecture and applicable standards. FHWA has further established a deadline of April 2005 for regions to have an ITS architecture in place.

To meet these requirements and ensure future federal funding eligibility for ITS, the Texas Department of Transportation (TxDOT) initiated the development of regional ITS architectures and deployment plans throughout the State of Texas. There are several metropolitan areas in the state that already have ITS architectures in place or under development. The focus of the State of Texas Regional ITS Architectures and Deployment Plans program is to develop architectures in those areas outside of the Austin, Houston, Dallas, Fort Worth, and San Antonio Regions. TxDOT expanded upon the ITS architecture requirements outlined in the FHWA Final Rule, and included an ITS deployment plan as part of the Regional efforts. The regional ITS architecture provides a framework for ITS systems, services, integration, and interoperability, and the regional ITS deployment plan identifies specific projects and timeframes for ITS implementation to support the vision developed by stakeholders in the architecture.

TxDOT's process for developing the regional ITS architectures and deployment plans followed a consensus-based approach to meeting the requirements in the FHWA Final Rule and supporting guidelines. This process was further tailored to meet the specific multi-agency needs of these Regional plans, and was structured around stakeholder input and involvement. The addition of an ITS deployment plan provides a tangible road map for regional ITS deployment and integration. **Figure 1** shows the development process for each of the State of Texas Regional ITS Architectures and Deployment Plans.

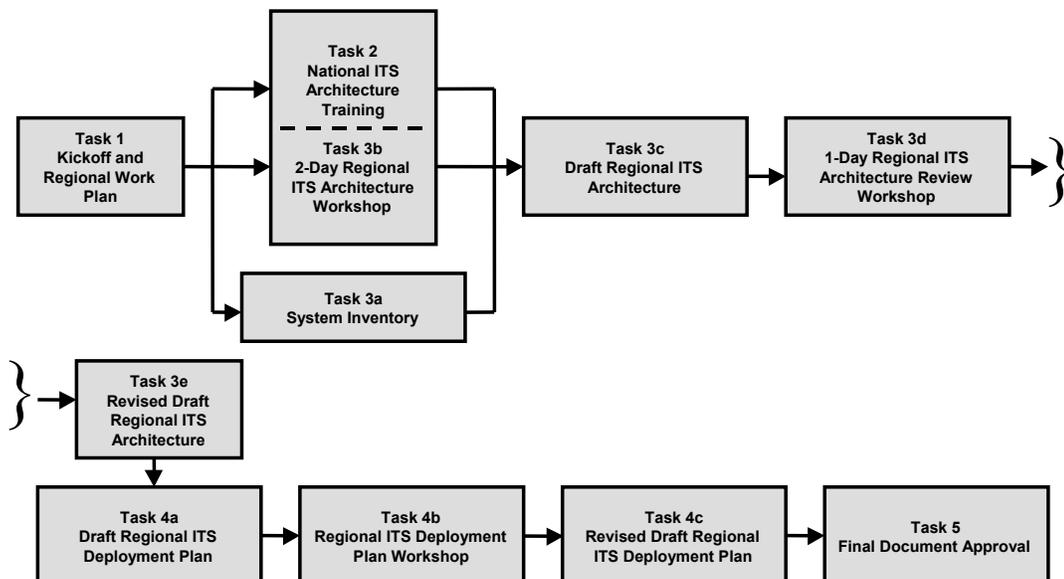


Figure 1 – San Angelo Regional ITS Architecture and Deployment Plan Development Process

OVERVIEW OF THE SAN ANGELO REGION

The San Angelo Region is bordered by the TxDOT Abilene District to the north, the TxDOT Laredo and San Antonio Districts to the south, the TxDOT Brownwood and Austin Districts to the east, and the TxDOT Odessa District to the west. For the San Angelo Regional ITS Architecture and Deployment Plan, the study area included all 15 counties that comprise the TxDOT San Angelo District. **Figure 2** illustrates the Regional boundaries.

San Angelo is one of the largest cities in the United States that does not benefit from direct access to an Interstate Highway. U.S. and State Highways provide excellent access to the area from I-10, 64 miles to the south, and I-20, approximately 80 miles to the north.

The San Angelo Region has an extensive transportation infrastructure. The primary roadway facilities include I-10, US-67, US-83, US-87, US-190, US-277, and US-377.

I-10 is an east-west, divided interstate highway. The effective operation of this highway is critical to the movement of goods and people through the State of Texas and the United States. I-10 starts in Jacksonville, Florida at I-95 and ends in Santa Monica, California at the Pacific Ocean. Blockages along I-10 can have serious implications for drive-time for commercial vehicles and motorists alike due to the lack of obvious alternate routes. Knowing the road and travel conditions within this transportation corridor and having the ability to disseminate this information to motorists are important elements for this project. For example, if I-10 has been closed due to a major incident or weather, and motorists are informed of the closure in advance, they can alter their travel plans with an alternate route or wait to begin their travels.

San Angelo is served by the Texas Pacifico Nuevo Railroad, a shortline railroad operating between the major United States railroads in Fort Worth and the United States/Mexico border crossing at Presidio, Texas, and Ojinaga, Mexico in the State of Chihuahua.

The San Angelo Street Railroad Company is operated by the City of San Angelo. In addition, San Angelo is served by two motor bus lines with direct schedules to all major cities in Texas and the nation, which include Kerrville Bus Lines and Sunset Stages. Concho Coaches provides daily van service to the Midland-Odessa Airport.

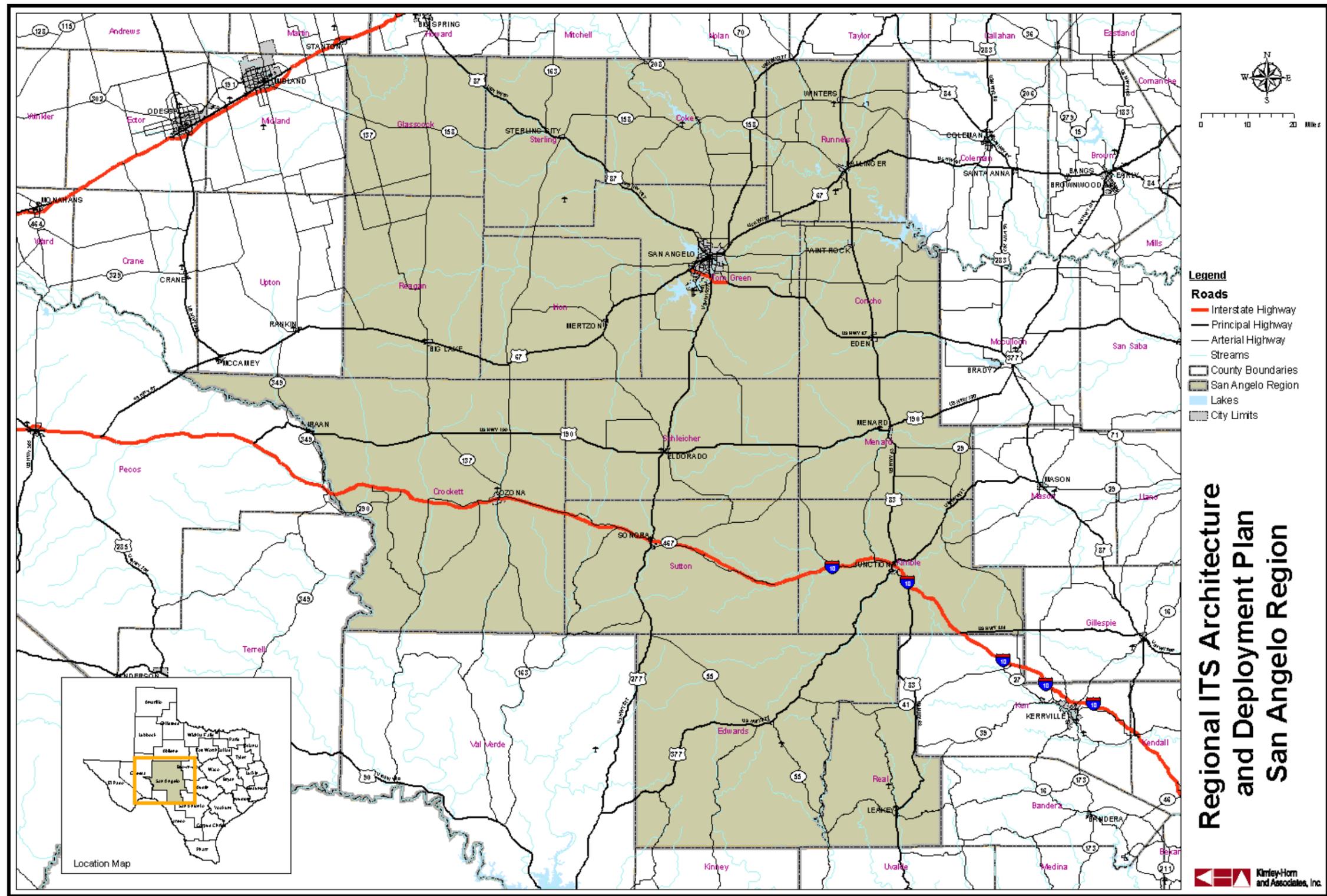


Figure 2 – San Angelo Region Map

SAN ANGELO REGION STAKEHOLDERS

Involving a range of perspectives in the development of a regional ITS architecture and deployment plan, and obtaining consensus on the vision and recommendations are key components to the process. Stakeholders from throughout the San Angelo Region participated in the development of the San Angelo Regional ITS Architecture and Deployment Plan. Key participants included representatives from TxDOT, cities, counties, transit agencies, the metropolitan planning organization and council of governments, and federal agencies. These stakeholders provided input and review at key steps in the development process, including a project kick-off meeting, architecture development and review workshops, a deployment plan workshop, and review of the final project documentation.

The following is a list of stakeholders in the San Angelo Region who have participated in the project workshops or provided input to the study team as to the needs and issues that should be considered as part of the San Angelo Regional ITS Architecture and Deployment Plan:

- Angelo State University;
- City of Fort Stockton;
- City of San Angelo;
- Concho County;
- Concho Valley Council of Governments;
- Concho Valley Rural Transit District;
- Goodfellow Air Force Base;
- Irion County;
- Kimble County;
- National Weather Service;
- San Angelo Community Medical Center;
- San Angelo Metropolitan Planning Organization (SAMPO);
- Tom Green County;
- TxDOT Odessa District;
- TxDOT Public Transportation Division;
- TxDOT San Angelo District;
- TxDOT San Antonio District;
- TxDOT Traffic Operations Division; and
- US Geological Survey (USGS).

SAN ANGELO REGIONAL ITS ARCHITECTURE

The process for developing the Regional ITS Architecture for the San Angelo Region included several key steps:

- Preparing an inventory of planned and existing systems in the Region;
- Identifying needs in the Region that could be addressed by ITS deployment or integration;
- Customizing and prioritizing market packages to address the specific needs and services identified by stakeholders;
- Developing interconnects and interfaces for system elements to map out data flows and agency links;
- Preparing an operational concept to illustrate how the systems, components, and agencies will be integrated and function as a result of the architecture framework;
- Identifying high-level functional requirements;
- Identifying standards that could be applicable to the San Angelo Region; and
- Outlining potential agreements that would be needed to facilitate information or resource sharing as a result of ITS implementation.

Inventory and Needs in the Region

The San Angelo Regional ITS Architecture began with a project kick-off meeting in October 2003. At that meeting, stakeholders provided information about existing and planned ITS elements in the Region. A diverse range of needs were identified by stakeholders who attended. The inventory of planned and existing ITS infrastructure provided the basis for the architecture development. Needs that could be addressed by ITS technologies guided the selection of market packages, data flows, and integration requirements.

The needs identified by the San Angelo Region stakeholders were categorized into functional areas, and are shown in **Table 1**.

Table 1 – San Angelo Region: Summary of ITS Needs

San Angelo Region Summary of ITS Needs San Angelo Regional ITS Architecture and Deployment Plan Kick-Off Meeting October 2, 2003
Travel and Traffic Management Needs <ul style="list-style-type: none">▪ Need pager activated school zone flashers▪ Need low water crossing flood detection system in southern area of Region▪ Need DMS on I-10, US 87 and other key routes in area▪ Need highway advisory radio (HAR) improvements▪ Need signage to educate driving public about ways to obtain more information on roadway conditions▪ Need ice detection▪ Need increased public information/education/awareness▪ Need weather stations (coordinate with USGS)▪ Need road condition information available at rest areas▪ Need increased media coordination for information dissemination▪ Need improved coordination with NOAA▪ Need interagency communication
Public Transportation Management Needs <ul style="list-style-type: none">▪ Need electronic fare payment for San Angelo Street Railroad Company▪ Need automated vehicle location (AVL) for Thunderbird Transit
Electronic Payment Needs <p>None Identified</p>
Commercial Vehicle Operations Needs <ul style="list-style-type: none">▪ Commercial Vehicle Information Systems and Networks (CVISN) will address commercial vehicle operations needs for the Region
Emergency Management Needs <ul style="list-style-type: none">▪ Need communication with Texas Forest Service▪ Need automated call out system for Concho Valley COG area▪ Need Regional Emergency Management Plan (in progress)▪ Need Regional Emergency Operations Center (EOC)▪ Need communications connection from EOC to TxDOT▪ Need to improve interagency communications
Advanced Vehicle Safety Systems Needs <p>None Identified</p>
Information Management Needs (Data Archiving) <ul style="list-style-type: none">▪ Need to coordinate with USGS to maximize use of available data▪ Need improved accident data management▪ Need to coordinate data sharing between agencies, possibly a web-based clearinghouse
Maintenance and Construction Management Needs <ul style="list-style-type: none">▪ Need semi-permanent DMS▪ Need additional portable DMS▪ Need ice detection information

Market Packages

A 2-Day ITS Architecture Workshop was held in San Angelo in December 2003. At this workshop, stakeholders were provided with architecture training that included background information about the National ITS Architecture and the process that would be used to develop the San Angelo Regional ITS Architecture.

The next step in developing the San Angelo Regional ITS Architecture was to identify the services that would be needed to address the stakeholder needs. In the National ITS Architecture, services are referred to as market packages. Market packages may include several stakeholders and elements that work together to provide a service in the Region. Examples of market packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are a total of 75 market packages identified in the National ITS Architecture Version 4.0.

At the 2-Day ITS Architecture Workshop, stakeholders selected the market packages that corresponded to the desired services and functions identified for the Region, and then customized these market packages. They included services and functions such as Network Surveillance, Traffic Information Dissemination, and Emergency Response as well as market packages to address coordination needs, including an Incident Management System and Regional Traffic Control. Because market packages are groups of services and functions, they can be deployed incrementally and over time. Of the 75 market packages in the National ITS Architecture, stakeholders identified 34 as being applicable to the San Angelo Region.

Interconnects, Interfaces, and Standards

Stakeholders also began the process of mapping existing and planned ITS elements in San Angelo to the subsystems in the National ITS Architecture. These elements included agencies, systems, and essentially all of the ITS components in the Region. Subsystems are the highest level building blocks of the physical architecture, and the National ITS Architecture groups them into four major classes: Centers, Roadside, Vehicles, and Travelers. This mapping resulted in an interconnect diagram for the San Angelo Region, which is shown in **Figure 3** on the following page. This architecture diagram, also referred to as the “sausage diagram” shows the relationship of existing, planned, and future systems in the San Angelo Region.

The market packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the San Angelo Region. Each market package was shown graphically, with the market package name, San Angelo Region specific element, and the unique agency and system identifiers within the subsystems and terminators.

Figure 4 is an example of an advanced traffic management system (ATMS) market package for Surface Street Control that has been customized for the San Angelo Region. This market package shows the three subsystems, Traffic Management, Roadway, and Information Service Provider and the associated entities (TxDOT San Angelo District Traffic Signals, TxDOT San Angelo District Field Sensors, etc.) for the TxDOT San Angelo District signal system. The solid data flow lines in this market package indicate existing information flows and the dashed lines indicate planned or future flows. All of the San Angelo Region market package diagrams are included in the Regional ITS Architecture report.

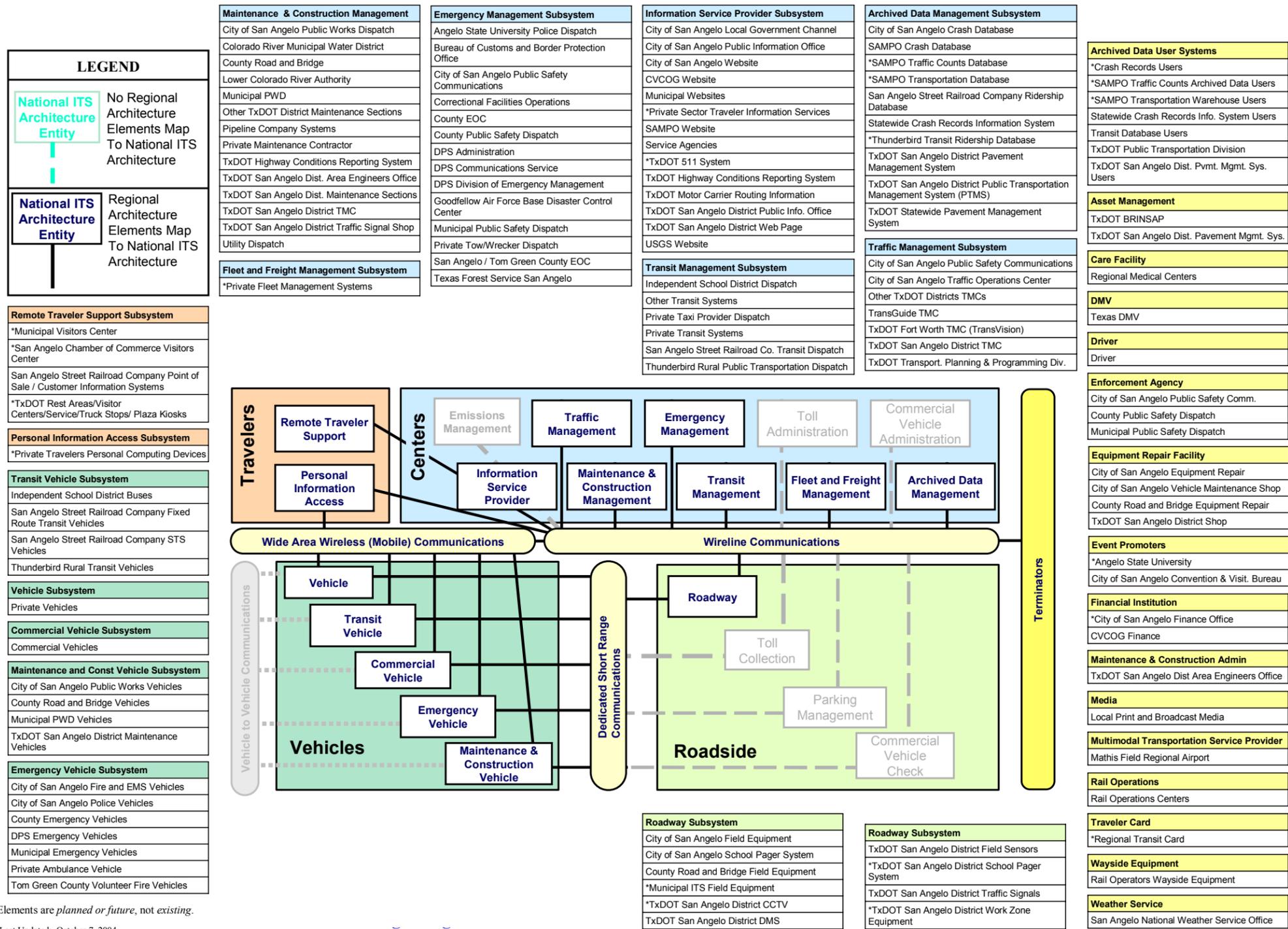


Figure 3 – San Angelo Regional System Interconnect Diagram

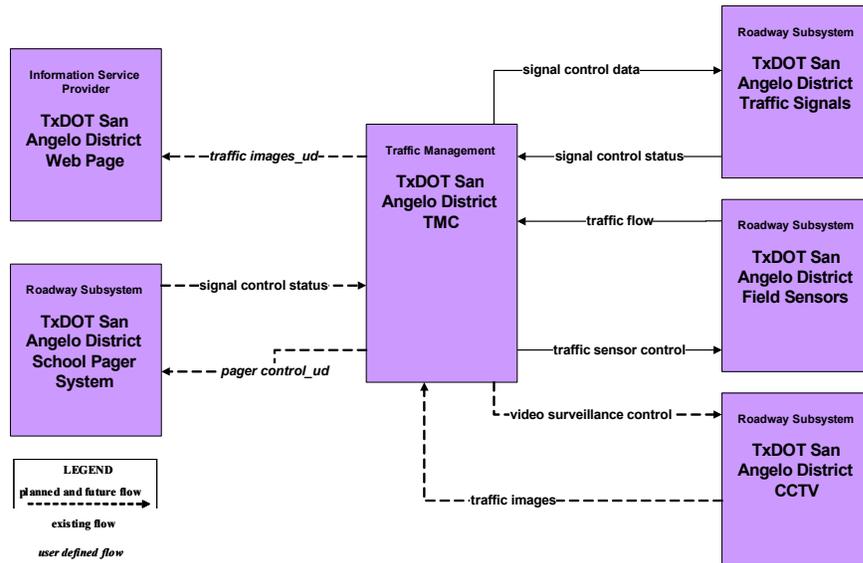


Figure 4 – San Angelo Surface Street Control Customized Market Package

More detailed interfaces were developed which identified the connectivity between the systems and elements. Each element identified in the ITS architecture for the San Angelo Region was mapped to the other elements that it must interface with. These interfaces were further defined by architecture data flows between individual elements that specify the information to be exchanged. The data flows include requests for information, alerts and messages, status requests, confirmations, and other information requirements.

While it is important to identify the various systems and stakeholders as part of a regional ITS, a primary purpose of the architecture is to identify the connectivity between transportation systems in the San Angelo Region. There are 122 different elements identified as part of the San Angelo Regional ITS Architecture. These elements include local and state traffic management/operations centers, transit vehicles, dispatch systems, emergency management agencies, and others – essentially all of the existing and planned physical components that contribute to a Regional ITS. Interfaces have been identified for each element in the San Angelo Regional ITS Architecture, and each element has been mapped to those other elements with which it must interface.

An example of one of the system interfaces is included as **Figure 5**. This graphic shows the TxDOT San Angelo District traffic signals and the existing and planned interfaces with other elements throughout the Region. These interfaces are shown as existing, planned, or future. Interfaces defined as planned have funding identified, while future interfaces are desired by stakeholders but funding has not yet been identified.

Architecture flows between the subsystems and terminators define the specific information (data) that is exchanged between subsystems and terminators. Each architecture flow has one or more data flows that specify what information is exchanged and the direction of the exchange.

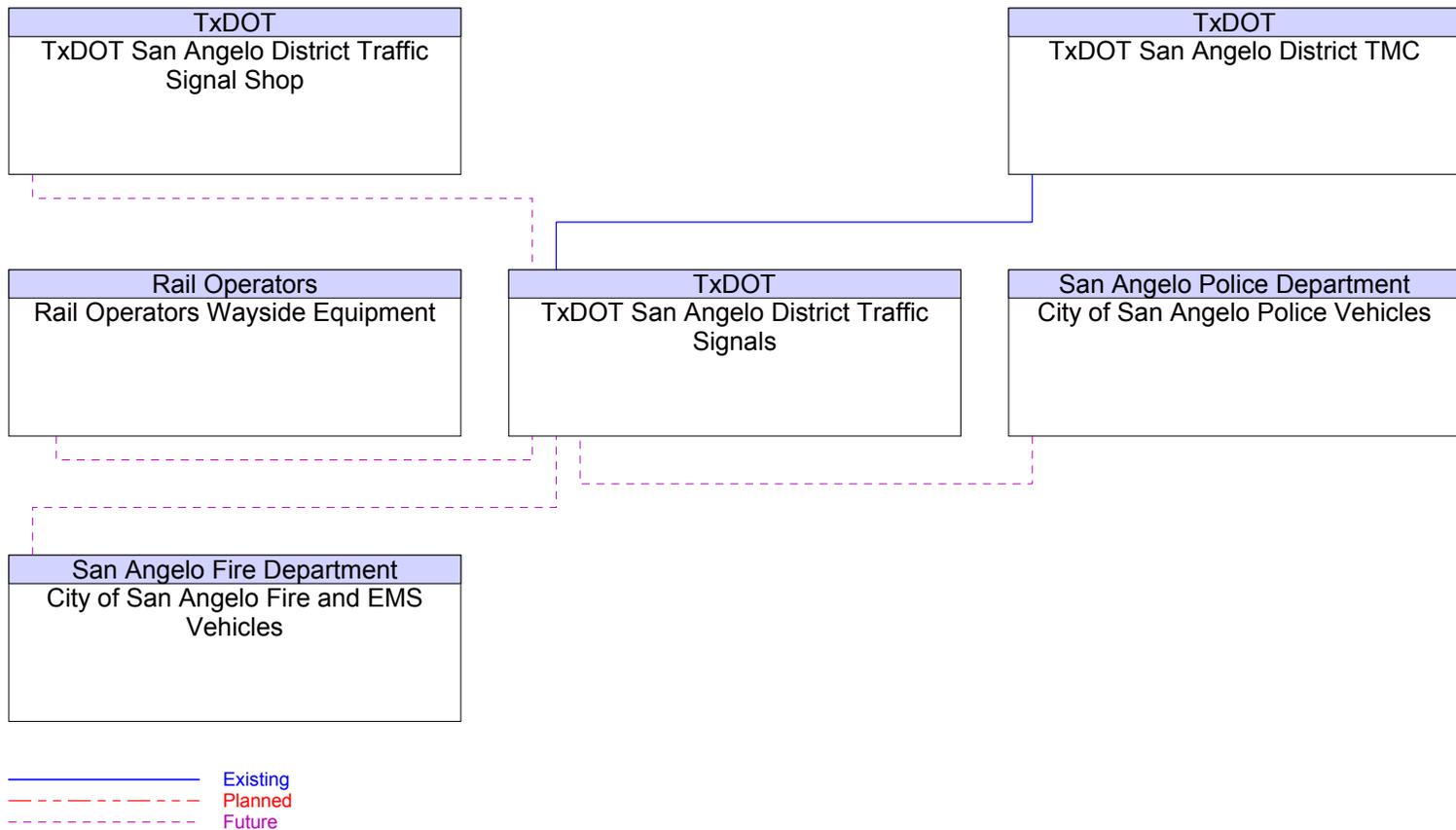


Figure 5 – TxDOT San Angelo District Traffic Signals Interfaces

An example of the architecture flows between two elements is shown in **Figure 6**. In this interface, the flows between the TxDOT San Angelo District TMC and Other TxDOT Districts TMCs show information that must go from the San Angelo District TMC to other TxDOT TMCs, as well as information that the District TMC needs from devices. Similar to the interfaces, architecture flows also are defined as existing, planned, or future. All of the architecture flows between elements have been included on the project website.

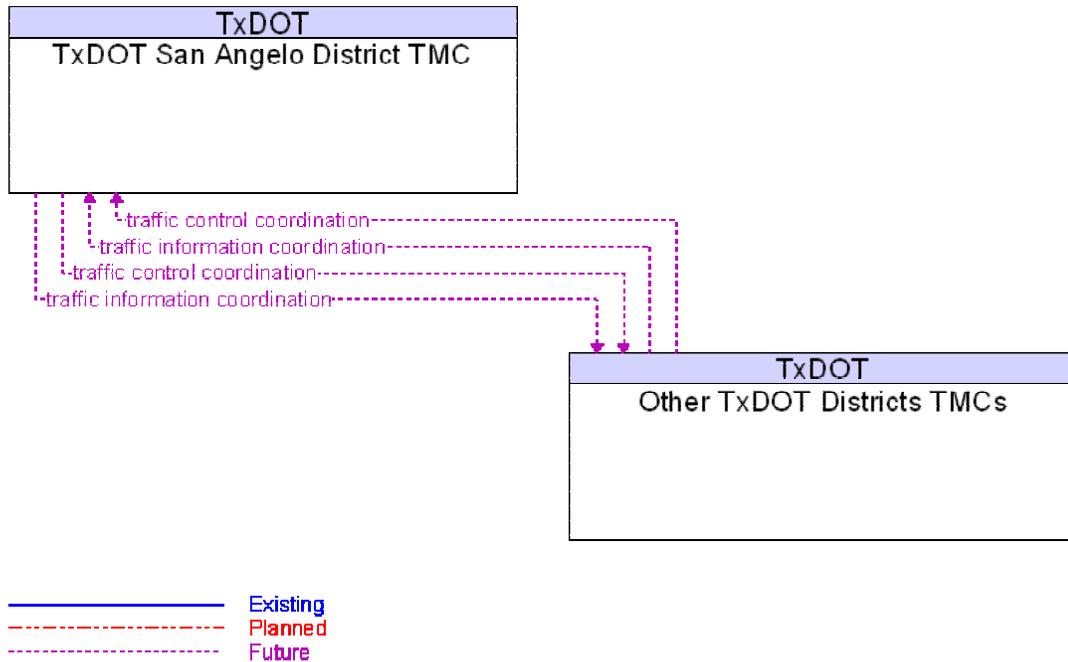


Figure 6 – TxDOT San Angelo District TMC to Other TxDOT Districts TMCs Architecture Flows

With the required interfaces and interconnections identified, standards that could potentially be applied to the San Angelo Region were identified. Standards are an important tool that will allow efficient implementation of the elements in the San Angelo Regional ITS Architecture over time. They facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve.

Operational Concept and Scenarios

An operational concept for the San Angelo Region was developed as part of the architecture process to illustrate how systems, components, and agencies will be integrated and function as a result of the framework provided by the Regional ITS Architecture. For the San Angelo Region, two concepts were illustrated. The first describes how ITS technologies could be used to manage a multi-vehicle crash on I-10 some 60 miles south of San Angelo. The operational concept shows how ITS technologies are used to detect an accident on the road, and assist in implementing strategies to divert traffic, inform motorists, and dispatch emergency vehicles. The second scenario describes road construction along US 87 just north of the City of San Angelo that is expected to result in the long-term closure of one lane of traffic as well as the shoulders. The

operational concept shows how through enhanced coordination transportation agencies are able to better coordinate traffic detours among traffic management.

Agreements

Interfaces and data flows among public and private entities in the San Angelo Region will require agreements among agencies that establish parameters for sharing agency information to support traffic and incident management, provide traveler information, and perform other functions identified in the Regional ITS Architecture. Recommended projects will result in systems and interfaces that will require inter-agency agreements, both public and private, to facilitate the exchange of information.

Currently, there are no formal agreements in place in the San Angelo Region. Stakeholders indicated that while there is a high degree of cooperation among agencies, there hasn't been a need for formal agreements to facilitate multi-jurisdictional resource sharing, cooperation, or mutual aid. With the implementation of ITS technologies, integration of systems from one or more agencies, and the anticipated level of information exchange identified in the architecture, it is likely that formal agreements may be needed in the future.

The following is a list of potential agreements for the San Angelo Region based on the interfaces identified in the Regional ITS Architecture and recommended ITS projects in the Deployment Plan:

- Data sharing and usage agreements among public agencies;
- Data sharing and usage agreements among public and private media and information service providers;
- Shared video monitoring agreements between TxDOT, the City of San Angelo and public safety agencies;
- Mutual aid agreements among public sector agencies, primarily fire, police, emergency services, DPS, and TxDOT; and
- Joint operations/shared control agreements between TxDOT, City of San Angelo, and possibly DPS.

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.

ITS Architecture Documentation

The Regional ITS Architecture for the San Angelo Region is documented in a final report. Stakeholders were brought together to review the Regional ITS Architecture and provide feedback. The final report was not prepared until after completion of the San Angelo Regional ITS Deployment Plan, to allow for modifications based on information and input received for the ITS Deployment Plan recommendations.

A website with all of the Regional ITS Architectures also was maintained. The website allowed stakeholders to review the architecture and provide comments directly to the project team through the website. At the time this report was published, the San Angelo Regional ITS Architecture website was being hosted at www.consystec.com. The site can be accessed by selecting the link

to Texas, and then the link to San Angelo. TxDOT plans to permanently host the site in the future at www.dot.state.tx.us/trf/its.

SAN ANGELO ITS DEPLOYMENT PLAN

Although development of an ITS deployment plan was not required by the FHWA Final Rule for the architecture, the Final Rule does request a sequence of projects required for implementation. Capitalizing on the momentum and interagency dialogue established during the development of the San Angelo Regional ITS Architecture, TxDOT chose to expand on the project sequence requirement to develop a formal ITS deployment plan for the Region.

The San Angelo Regional ITS Architecture provided the framework and prioritized the key functions and services desired by stakeholders in the Region. The San Angelo ITS Deployment Plan builds on the architecture by prioritizing market packages, outlining specific ITS project recommendations and strategies for the Region, and identifying deployment timeframes so that the recommended projects and strategies can be implemented over time. Agency responsibilities for implementing and operating the systems also are a key component of the ITS Deployment Plan.

Prioritized Market Packages

Market packages for the San Angelo Region previously identified as part of the architecture were categorized into high, medium, and low priorities by stakeholders. The market package prioritization was a key factor in developing recommendations for ITS deployment and integration in the San Angelo Region. These priorities identified the key needs and services that are desired in the Region, as well as the interfaces that need to be established to provide integrated functionality and establish communication between elements.

It is important to note that the high, medium, and low priorities were not directly related to anticipated deployment timeframes (such as 5, 10, or 20 year deployment horizon). For example, a market package can be a high priority, but because of funding or prerequisite project requirements, it might not be feasible for deployment for several years. Maturity and availability of technology was another factor for prioritizing the market packages. Because market packages often represent groups of technologies or services to deliver a particular functionality, certain components of the market package could be identified as a high priority or existing capability, while other components would have a lower priority. Other considerations included whether or not the market package was better suited for deployment and operations by the private sector rather than public agencies in the Region.

Table 2 shows the prioritization of the selected market packages for the San Angelo Region. The majority of these market packages fall into the high priority category. This category also includes market packages (or portions of market packages) that are already deployed in the San Angelo Region, such as surface street control and traffic information dissemination.

Table 2 – Summary of Prioritized Market Packages for the San Angelo Region

High Priority	Medium Priority	Low Priority
<ul style="list-style-type: none"> ▪ Network Surveillance ▪ Surface Street Control ▪ Traffic Information Dissemination ▪ Regional Traffic Control ▪ Incident Management System ▪ Emergency Response ▪ Emergency Vehicle Routing ▪ Road Weather Data Collection ▪ Weather Information Processing and Distribution ▪ Work Zone Safety Monitoring ▪ Maintenance and Construction Activity Coordination ▪ Transit Vehicle Tracking ▪ Transit Fixed-Route Operations ▪ Demand Response Transit Operations ▪ Multi-modal Coordination ▪ Transit Traveler Information ▪ HAZMAT Management ▪ Broadcast Traveler Information Systems ▪ ITS Data Mart 	<ul style="list-style-type: none"> ▪ Standard Railroad Grade Crossing ▪ Railroad Operations Coordination ▪ Speed Monitoring ▪ Red Light Running ▪ Maintenance and Construction Vehicle Maintenance ▪ Roadway Maintenance and Construction ▪ Work Zone Management ▪ Transit Passenger and Fare Management ▪ Transit Security ▪ Transit Maintenance ▪ ITS Data Warehouse 	<ul style="list-style-type: none"> ▪ Probe Surveillance ▪ Maintenance and Construction Vehicle Tracking ▪ Winter Maintenance ▪ ISP Based Route Guidance

Each of the prioritized market packages was assessed from the perspective of deployment status (which components, if any, were already existing in the Region), as well as any planned projects or additional new projects needed to fully implement the market package in the San Angelo Region. Each market package analysis included:

- A brief definition of the market package (modified from the National ITS Architecture definitions);
- Any infrastructure or components from that market package that is already existing in the San Angelo Region;
- Agencies currently operating or maintaining systems that apply to that market package;

- Planned projects that will address some or all of the services that are contained in the market package; and
- Any additional needs to bring the market package to the desired level of deployment or functionality.

ITS Project Recommendations for the San Angelo Region

Using the needs, market package priorities, and any planned projects identified by the stakeholders during the architecture process, a list of recommended ITS projects for the San Angelo Region was developed. These projects were refined and additions and deletions were made by the Regional stakeholders at the ITS Deployment Plan Workshop in April 2004.

Recommended ITS projects for the San Angelo Region were categorized into short-, medium-, and long-term timeframes for programming in the 5, 10, and 20 year horizons. This was done based on current status if the project had previously been identified and planned by the Region, market package priority, and dependency on other project completions. The majority of the short term or 5-year recommendations serve as “foundation” projects to implement basic functionality, infrastructure, and interfaces, with the intent of continuing to build out those foundation projects over the 10 and 20 year timeframes. Most projects for the San Angelo Region are infrastructure based; however, there are some recommendations that focus more on institutional practices and interconnectivity to enhance coordination and communications.

Each recommended project for the San Angelo Region was included in a short-, medium-, or long-term table. These tables provided the name of the project, primary operating/implementing agency, a planning level estimate of probable cost, an indication of whether or not funding had been identified for that specific project, and an estimated project duration. Following each table, detailed descriptions of each project were developed, which also included associated market packages and any pre-requisite project requirements.

Table 3 summarizes the ITS projects recommended for the San Angelo Region. This summary is divided into the major program areas and subdivided by timeframe. As can be seen from this summary, the majority of the project recommendations focus on the Travel and Traffic Management category, which would implement surface street traffic management, traveler information, and inter-agency coordination elements.

Table 3 – Recommended ITS Projects for the San Angelo Region

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
<i>Travel and Traffic Management</i>		
Short Term Projects 5-year Horizon	TxDOT Dynamic Message Signs (DMS) on I-10	No
	TxDOT Advanced Traffic Management System (ATMS) Implementation	Yes (TxDOT)
	TxDOT Center-to-Center Communication	Yes (TxDOT)
	TxDOT San Angelo District Traffic Management Center (TMC) Upgrades	No
	TxDOT Closed Loop Signal System Implementation Phase 1	No
	TxDOT Video Image Vehicle Detection Systems (VIVDS)	No
	TxDOT Rest Area Kiosks Phase 1	No
	City of San Angelo Closed Loop Signal System Implementation Phase 1	No
	City of San Angelo VIVDS	No
Mid Term Projects 10-year Horizon	TxDOT San Angelo District Webpage Customization and Enhancement	No
	TxDOT Additional DMS	No
	TxDOT Closed-Circuit Television (CCTV) Camera Implementation	No
	TxDOT Highway Advisory Radio	No
	TxDOT Closed Loop Signal System Implementation Phase 2	No
	TxDOT School Zone Flasher Pager System	No
	City of San Angelo School Zone Flasher Pager System	No
	TxDOT Rest Area Kiosks Phase 2	No
	City of San Angelo Traffic Operations Center (TOC)/TxDOT TMC Communications Connection	No
	City of San Angelo DMS	No
	City of San Angelo Closed Loop Signal System Implementation Phase 2	No
	City of San Angelo TOC Enhancements	No
	City of San Angelo Rail Crossing Warning System	No
	Railroad Operations Coordination	No
	Regional 511 Advanced Traveler Information System Server Implementation	No
Media Liaison and Coordination	N/A	

Table 3 – Recommended ITS Projects for the San Angelo Region (continued)

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
<i>Travel and Traffic Management (continued)</i>		
Long Term Projects 20-year Horizon	TxDOT Closed Loop Signal System Implementation Phase 3	No
	City of San Angelo CCTV Cameral Implementation	No
	City of San Angelo Closed Loop Signal System Implementation Phase 3	No
<i>Emergency Management</i>		
Short Term Projects 5-year Horizon	Emergency Call-Out System	Yes (Concho Valley COG)
	Mobile Command Centers for Emergency Operations	Yes (Concho Valley COG)
	Evacuation/Detour Route Planning	No
Mid Term Projects 10-year Horizon	San Angelo Regional Emergency Operations Center (EOC)/TxDOT San Angelo TMC Communications Connection	No
	San Angelo Regional EOC/City of San Angelo TOC Communications Connection	No
	City of San Angelo Public Safety Communications/City of San Angelo TOC Communications Connection	No
Long Term Projects 20-year Horizon	TxDOT Emergency Vehicle Traffic Signal Preemption Implementation	No
	Rural Fire Department Automated Vehicle Location (AVL) and Mobile Data Terminals (MDTs)	No
<i>Maintenance and Construction Management</i>		
Short Term Projects 5-year Horizon	TxDOT Road Weather Information System (RWIS) Station	No
	TxDOT Additional Portable DMS	No
	TxDOT Highway Condition Reporting System (HCRS) Enhancements	Yes (TxDOT Statewide)
	TxDOT Work Zone Intrusion Detection System	No
	TxDOT San Angelo District/National Oceanic and Atmospheric Administration (NOAA) Communications Connection	No
Mid Term Projects 10-year Horizon	TxDOT San Angelo District/United States Geological Survey (USGS) Communications Connection	No
	TxDOT Flood Detection	No
	TxDOT Low Water Crossing Flashing Beacon Warning Signs	No
	City of San Angelo Flood Detection	No
	City of San Angelo Low Water Crossing Flashing Beacon Warning Signs	No

Table 3 – Recommended ITS Projects for the San Angelo Region (continued)

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
<i>Maintenance and Construction Management (continued)</i>		
Long Term Projects 20-year Horizon	TxDOT Automated Maintenance Vehicle Maintenance Tracking	No
	County Automated Maintenance Vehicle Maintenance Tracking	No
<i>Public Transportation Management</i>		
Short Term Projects 5-year Horizon	San Angelo Street Railroad Company Paratransit Online Trip Reservations	No
	San Angelo Street Railroad/Thunderbird Transit Communications Connection	No
	San Angelo Street Railroad Company AVL and MDTs	No
	San Angelo Street Railroad Company Silent Alarms	No
	Thunderbird Transit Central Dispatch with Computer Aided Dispatch (CAD) System	No
	Thunderbird Transit AVL and MDTs	No
	Thunderbird Transit Silent Alarms	No
	Thunderbird Transit Online Trip Reservations	No
Mid Term Projects 10-year Horizon	San Angelo Street Railroad Company Electronic Fare Payment	No
	San Angelo Street Railroad Company/City of San Angelo TOC Communications Connection	No
	Thunderbird Transit Electronic Fare Payment	No
	Thunderbird Transit/City of San Angelo TOC Communications Connection	No
	Thunderbird Transit/TxDOT TMC Communications Connection	No
Long Term Projects 20-year Horizon	San Angelo Street Railroad Company Security Cameras at Bus Depot	No
	San Angelo Street Railroad Company On-board Security Cameras	No
	San Angelo Street Railroad Company Vehicle Maintenance System	No
	San Angelo Street Railroad Company Smart Bus Stops	No

Table 3 – Recommended ITS Projects for the San Angelo Region (continued)

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
<i>Public Transportation Management (continued)</i>		
Long Term Projects 20-year Horizon (continued)	Thunderbird Transit On-board Security Cameras	No
	Thunderbird Transit Vehicle Maintenance System	No
<i>Commercial Vehicle Operations</i>		
Short Term Projects 5-year Horizon	Hazardous Materials (HAZMAT) Incident Notification System	No
Mid Term Projects 10-year Horizon	None planned at this time	N/A
Long Term Projects 20-year Horizon	None planned at this time	N/A
<i>Archived Data</i>		
Short Term Projects 5-year Horizon	None planned at this time	N/A
Mid Term Projects 10-year Horizon	San Angelo Metropolitan Planning Organization (MPO) Data Warehouse	No
	San Angelo Automated Crash Record Database	No
Long Term Projects 20-year Horizon	None planned at this time	N/A

MAINTAINING THE REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN

The San Angelo Regional ITS Deployment Plan is a living document. The recommended projects and their timeframes for implementation reflect the needs of the Region at the time the plan was developed. It is expected that the needs of the Region will change as ITS deployments are put into place, population, and travel patterns change, and as new technology is developed. In order for the ITS Deployment Plan to remain a useful document for Regional stakeholders, the plan must be updated over time.

TxDOT will serve as the lead agency for maintaining both the San Angelo Regional ITS Architecture and the ITS Deployment Plan; however, these plans will continue to be driven by stakeholder consensus rather than a single stakeholder.

At the ITS Deployment Plan Meeting in April 2004, stakeholders recommended that the group meet every two years to correspond with the Transportation Improvement Plan update process to review the Regional ITS Architecture and Deployment Plan. Any new market packages that have been added to the National Architecture should be reviewed to see if they are applicable to the San Angelo Region. Data flows in existing market packages should also be reviewed to determine if any planned/future flows have been implemented. The Deployment Plan will also be updated at that time to reflect projects that have been deployed, new projects that are necessary, and to reprioritize projects currently shown in the plan. Projects that are added to the ITS Deployment Plan should also be reviewed closely to determine if they fit into the ITS Architecture for the San Angelo Region. If a new project does not fit into the ITS Architecture, then the ITS Architecture will need to be revised to include the necessary links and data flows for the project. Any changes to the geographic scope of the Region should be agreed upon by the stakeholders.

Both the San Angelo Regional ITS Architecture and the ITS Deployment Plan were developed with a consensus approach from the stakeholders. In order for these documents to continue to reflect the needs of the Region, changes in the documents will need to be driven by consensus of all of the stakeholders.

MEMORANDUM OF UNDERSTANDING

As a final step in the development of the San Angelo Regional ITS Architecture and Deployment Plan, a Memorandum of Understanding (MOU) was prepared for the participating stakeholder agencies. The MOU was developed for stakeholders to acknowledge their participation and approval of the plan, and pledge their support in the implementation and operation of intelligent transportation systems in the San Angelo Region. Also included in the MOU was a pledge to provide TxDOT with the information necessary to maintain the Regional ITS Architecture and ITS Deployment Plan.

Those stakeholders that were asked to sign the MOU represented agencies that participated in the planning process. In most cases these agencies will have the greatest impact in the Region in terms of ITS deployments and system operations. Stakeholder agencies that were asked to sign the MOU for the San Angelo Regional ITS Architecture and Deployment Plan included the following:

- Angelo State University;
- City of San Angelo;
- Concho County;
- Concho Valley Council of Governments;
- Concho Valley Rural Transit District;
- Goodfellow Air Force Base;
- Irion County;
- Kimble County;
- National Weather Service;
- San Angelo Metropolitan Planning Organization;
- Tom Green County;
- Texas Department of Transportation; and
- US Geological Survey.