State of Texas
ITS Architectures and Deployment Plans

West Central
Texas Region

Executive Summary

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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. The regional ITS deployment plan also 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.
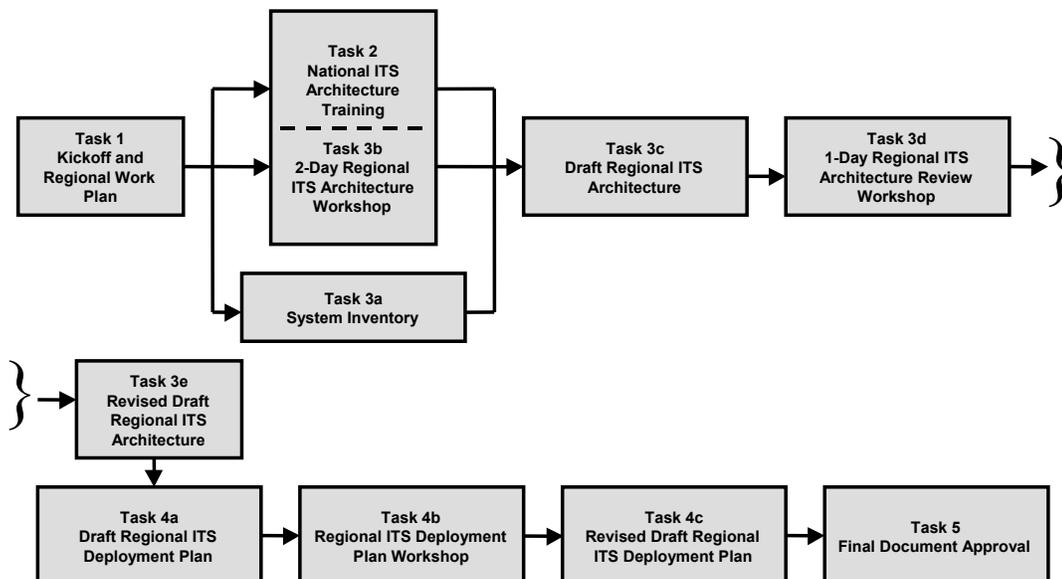
Figure 1 – West Central Texas Regional ITS Architecture and Deployment Plan Development Process

OVERVIEW OF THE WEST CENTRAL TEXAS REGION

The West Central Texas Region is bordered by the TxDOT Childress, Wichita Falls and Fort Worth Districts to the north, the TxDOT San Angelo and Austin Districts to the south, the TxDOT Waco District to the east, and the TxDOT Odessa and Lubbock Districts to the west. For the West Central Texas Regional ITS Architecture and Deployment Plan, the study area included all 13 counties that comprise the TxDOT Abilene District and the 9 counties that comprise the TxDOT Brownwood District. **Figure 2** illustrates the Regional boundaries.

The West Central Texas Region has an extensive transportation infrastructure. The primary roadway facilities include I-20, US-67, US-83, US-84, US-87, US-180, US-183, US-277, US-283, and US-377.

I-20 is as 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-20 starts in South Carolina and ends at I-10 in west Texas. Blockages along I-20 can have serious implications on 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-20 has been closed due to a major incident or weather, and motorists are informed of the closure in advance, they can take an alternate route or wait to begin their travels.
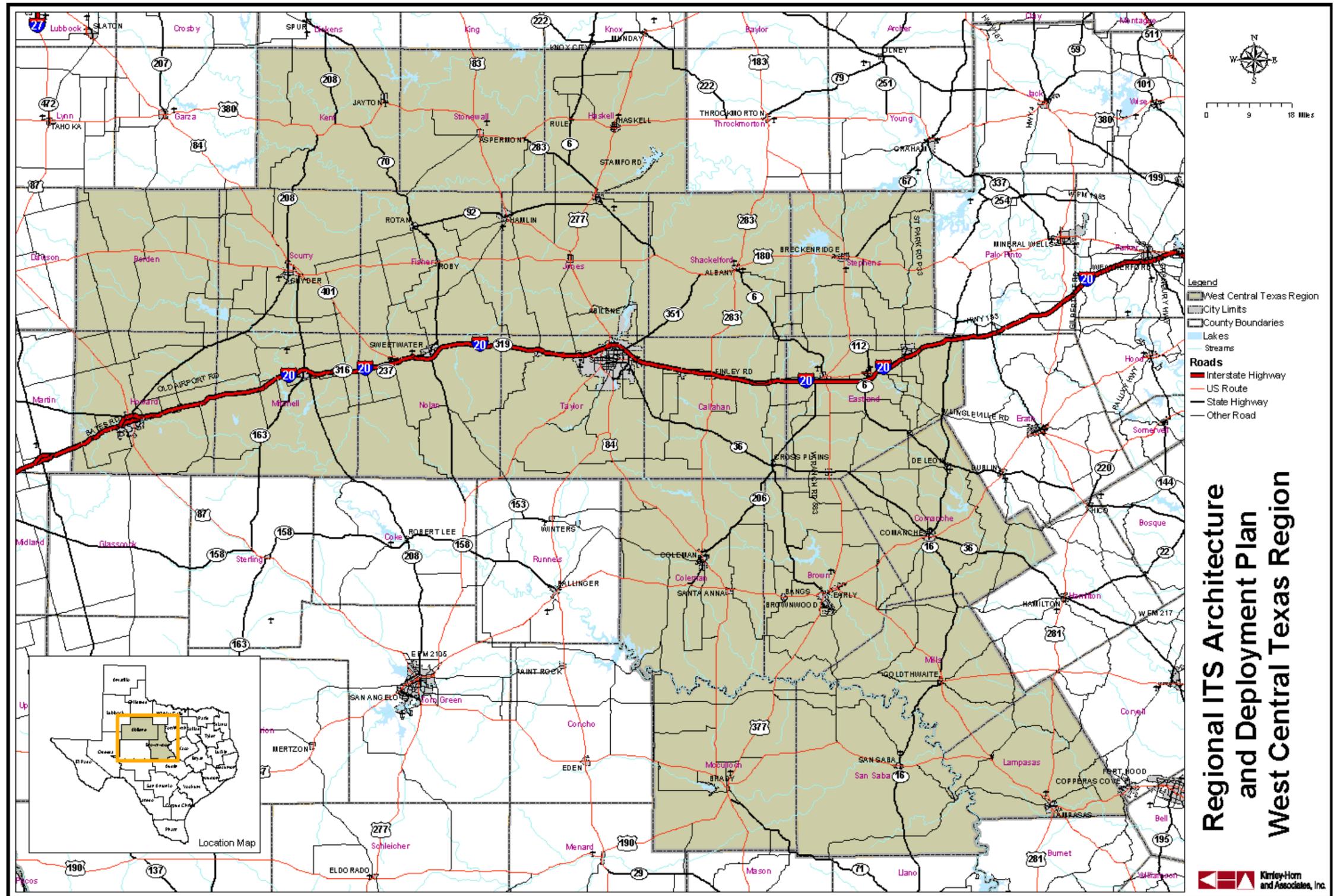
Figure 2 – West Central Texas Region Map

WEST CENTRAL TEXAS 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 West Central Texas Region and neighboring Regions participated in the development of the West Central Texas Regional ITS Architecture and Deployment Plan. Key participants included representatives from TxDOT, City of Abilene, City of Brownwood, other area cities, Department of Public Safety (DPS), and area transit 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 West Central Texas 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 West Central Texas Regional ITS Architecture and Deployment Plan:

- Abilene Regional Airport;
- Aspermont Small Business Development Center;
- Central Texas Rural Transit District;
- City of Abilene;
- City of Breckenridge;
- City of Brownwood;
- City of Comanche;
- City of Eastland;
- Department of Public Safety;
- Dyess Air Force Base;
- Federal Highway Administration;
- Hill Country Transit;
- Jones County;
- McCulloch County;
- Nolan County;
- Taylor County;
- Texas Commission on Environmental Quality;
- Texas Department of Public Safety;
- TxDOT Abilene District;
- TxDOT Brownwood District;
- TxDOT Traffic Operations Division; and
- US Geological Survey.

WEST CENTRAL TEXAS REGIONAL ITS ARCHITECTURE

The process for developing the Regional ITS Architecture for the West Central Texas 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 West Central Texas 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 West Central Texas Regional ITS Architecture began with a project kick-off meeting in September 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 West Central Texas Region stakeholders were categorized into functional areas, and are shown in **Table 1**.

Table 1 – West Central Texas Region: Summary of ITS Needs

West Central Texas Region

Summary of ITS Needs
West Central Texas Regional ITS Architecture and Deployment Plan Kick-Off Meeting
September 25, 2003

Travel and Traffic Management Needs
- Need DMS on I-20 (at Ranger Hill) and US 84, 87 and 180 (alternate routes for I-20)
- Need communications improvements
- Need ice detection
- Need water level sensors and precipitation monitors
- Need real time weather information along I-20
- Need CCTV
- Need center to center communications
- Need traffic responsive signal control in Brownwood District
- Need flood detection in City of Brownwood
- Need additional closed loop signal systems in City of Abilene (2 are already funded)
- Need City of Abilene Traffic Operations Center
- Need VIVDS in City of Abilene
- Need CCTV in the City of Abilene along the rail line and at key interchanges
- Need incident management strategies
- Need highway advisory radio on US 180
- Need school zone flasher pagers

Public Transportation Management Needs
- Need center to vehicle communication for Aspermont Small Business
- Need AVL for Aspermont Small Business and Hill Country Transit
- Need mayday on Aspermont Small Business and City Link Transit Vehicles
- Need CAD for Hill Country Transit
- Need MDTs for Hill Country Transit
- Need on-board video surveillance for Hill Country Transit and City Link
- Need electronic fare collection for Hill Country Transit and City Link
- Need AVL and MDTs for City Link
- Need transit transfer station

Commercial Vehicle Operations Needs
- Need weigh-in-motion

Emergency Management Needs
None Identified

Archived Data Management Needs
- Need improved/automated data collection for Aspermont Small Business transit agency and Hill Country Transit

Maintenance and Construction Management Needs
None Identified

Market Packages

A 2-Day ITS Architecture Workshop was held in Abilene 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 West Central Texas Regional ITS Architecture.

The next step in developing the West Central Texas 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 currently a total of 75 market packages identified in the National ITS Architecture.

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 and Coordination. 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 Version 4.0, stakeholders identified 35 as being applicable to the West Central Texas Region.

Interconnects, Interfaces, and Standards

Stakeholders also began the process of mapping existing and planned ITS elements in West Central Texas 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 West Central Texas 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 West Central Texas Region.

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

Figure 4 is an example of an ATMS market package for Surface Street Control that has been customized for the TxDOT Abilene District. This market package shows the two subsystems, Traffic Management and Roadway, and the associated entities (TxDOT Abilene District Traffic Signals, TxDOT Abilene District Field Sensors, etc.) for the TxDOT Abilene District signal system. Data flows between the subsystems indicate what information is being shared. All of the West Central Texas Region market package diagrams are included in the Regional ITS Architecture report.

LEGEND

National ITS Architecture Entity	No Regional Architecture Elements Map To National ITS Architecture
National ITS Architecture Entity	Regional Architecture Elements Map To National ITS Architecture

Archived Data Management Subsystem

- Abilene MPO Regional Traffic Count Database
- CARR - City and Rural Rides Ridership Archive
- City of Abilene Crash Database (PD)
- City of Abilene Crash Database (TE)
- CityLink Transit Ridership & Maintenance DB
- Double Mountain Coach Ridership Database
- Hill Country Transit District Ridership Database
- Hill Country Transit Maintenance Database
- K-TUTS Traffic Counts Database
- Statewide Crash Records Information System
- TxDOT Public Transportation Division
- TxDOT Statewide Pavement Management Sys.

Transit Management Subsystem

- CARR - City and Rural Rides Dispatch
- CityLink Transit Operations Center
- Double Mountain Coach Dispatch
- Hill Country Transit Rural Dispatch
- Independent School District Dispatch

Commercial Vehicle Administration

- Municipal or County Permitting System

Emergency Management Subsystem

- City of Abilene EOC
- City of Abilene Fire Dispatch
- City of Abilene Police Dispatch
- City of Brownwood EOC
- City of Brownwood Public Safety Dispatch
- County and Municipal EOCs
- County Public Safety Dispatch
- DPS Administration
- DPS Communications Service
- Dyess AFB FD Dispatch
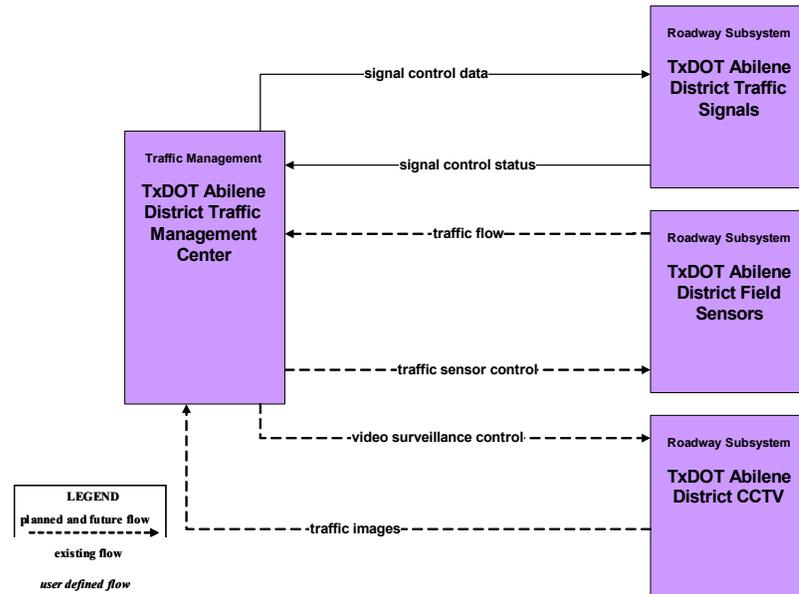- Municipal Public Safety Dispatch
- Pipeline Group
- Private & County Hospital Ambulance Dispatch
- Private Tow/Wrecker Dispatch
- State EOC
- TCEQ Monitor Operations Section
- Texas Forest Service Dispatch
- Water District/River Authority Public Safety Dispatch

Information Service Provider Subsystem

- *Abilene MPO Website
- *CARR - City and Rural Rides Web Site
- City of Abilene Website
- City of Brownwood Website
- *Double Mountain Coach Website
- Hill Country Transit Website
- K-TUTS MPO Website
- *Private Sector Traveler Information Services
- Regional Airports
- Service Agencies
- *TxDOT 511 System
- TxDOT Abilene District Public Information Office
- TxDOT Abilene District Web Page
- TxDOT Brownwood District Public Inform. Office
- TxDOT Brownwood District Web Page
- TxDOT Motor Carrier Routing Information

Fleet and Freight Management Subsystem

- *Private Fleet Management Systems

Maintenance & Construction Management

- City of Abilene Equipment Management
- City of Abilene Street Services
- City of Abilene Traffic Engineering
- City of Brownwood PWD
- County Road and Bridge
- Municipal PWD
- One Call System
- Other TxDOT District Maintenance Sections
- Private Maintenance Contractor
- TxDOT Highway Conditions Reporting System
- TxDOT West Central Texas Area Eng. Offices
- TxDOT West Central Texas Maint. Sections

Archived Data User Systems

- Abilene MPO Archived Data Users
- K-TUTS MPO Archived Database Users
- Rail Operations Centers
- Statewide Crash Records Info. System Users
- Transit Database Users
- TxDOT Abilene Dist. Pavement Mgmt Sys Users
- *TxDOT Abilene District Traffic Mgmt Center
- TxDOT Brownwood Pavement Mgmt Sys Users

Remote Traveler Support Subsystem

- *CityLink Transit Kiosks
- *CityLink Transit Stations
- *TxDOT Rest Areas/Visitor Centers/Service/Truck Stops/Plaza Kiosks

Personal Information Access Subsystem

- *Private Travelers Personal Computing Devices

Vehicle Subsystem

- Commercial Vehicles

Transit Vehicle Subsystem

- CARR - City and Rural Rides Vehicles
- CityLink Transit Vehicles
- Correctional Facilities Vehicles
- Double Mountain Coach Transit Vehicles
- Hill Country Rural Transit Vehicles
- Independent School District Buses

Commercial Vehicle Subsystem

- Commercial Vehicles

Emergency Vehicle Subsystem

- City of Abilene Fire Vehicles
- City of Abilene Police Vehicles
- City of Brownwood Fire Vehicles
- City of Brownwood Police Vehicles
- County Emergency Vehicles
- DPS Emergency Vehicles
- Dyess AFB Fire Vehicles
- Municipal Emergency Vehicles
- Private & County Hospital Ambulance Vehicle
- Private Tow/Wrecker Vehicles
- Texas Forest Service Vehicles
- *Water Dist./River Author. Pub. Safety Vehicles

Maintenance and Const Vehicle Subsystem

- City of Abilene Public Works Vehicles
- City of Brownwood PWD Vehicles
- County Road and Bridge Vehicles
- Municipal PWD Vehicles
- TxDOT West Central Texas Maint. Vehicles

Traffic Management Subsystem

- *City of Abilene Traffic Operations Center
- *City of Brownwood Traffic Operations Center
- *Municipal Traffic Operations Center
- Other TxDOT District TMCs
- TxDOT Abilene District Office
- *TxDOT Abilene District Traffic Mgmt Center
- TxDOT Brownwood District Office
- *TxDOT Brownwood Dist. Traffic Mgmt Center
- TxDOT Fort Worth TMC (TransVision)
- TxDOT Transport. Planning & Program. Div.

Asset Management

- Municipal Pavement Management System
- TxDOT Abilene District Pavement Mgmt Sys.
- TxDOT BRINSAP
- TxDOT Brownwood Dist. Pavement Mgmt Sys.
- TxDOT Maintenance & Mgmt. Info. Sys.

Care Facility

- Regional Medical Center

Driver

- Driver

Equipment Repair Facility

- City of Abilene Equipment Repair
- County Road and Bridge Equipment Repair
- TxDOT West Central District Shop

Event Promoters

- City of Abilene Police Dispatch
- City of Abilene Traffic Engineering
- City of Brownwood City Council
- TxDOT Abilene District Office
- TxDOT Brownwood District Office
- TxDOT West Central Texas Area Eng. Offices

Financial Institution

- *Financial Institution

Maintenance & Construction Admin. System

- TxDOT West Central Texas Area Eng. Offices

Media

- Local Print and Broadcast Media

Multimodal Transportation Service Provider

- Amtrak
- Regional Airports

Other EM

- West Cent. Tx. Incident & Mutual Aid Network

Rail Operations

- Rail Operations Centers

Traveler Card

- *Regional Transit Card

Wayside Equipment

- Rail Operators Wayside Equipment

Weather Service

- National Weather Service

Diagram labels:
Travelers — Remote Traveler Support; Personal Information Access
Centers — Emissions Management; Traffic Management; Emergency Management; Toll Administration; Commercial Vehicle Administration; Information Service Provider; Maintenance & Construction Management; Transit Management; Fleet and Freight Management; Archived Data Management
Wide Area Wireless (Mobile) Communications
Wireline Communications
Vehicle to Vehicle Communications
Vehicles — Vehicle; Transit Vehicle; Commercial Vehicle; Emergency Vehicle; Maintenance & Construction Vehicle
Dedicated Short Range Communications
Roadside — Roadway; Toll Collection; Parking Management; Commercial Vehicle Check
Terminators

Roadway Subsystem

- *City of Abilene CCTV
- *City of Abilene DMS
- City of Abilene Environmental Sensors
- *City of Abilene Flood Detection System
- *City of Abilene School Pager System
- City of Abilene Traffic Signals
- City of Abilene Vehicle Detectors
- City of Abilene Work Zone Equipment
- *City of Brownwood CCTV
- *City of Brownwood DMS
- *City of Brownwood Flood Detection System
- *City of Brownwood School Pager System
- *City of Brownwood Traffic Signals

Roadway Subsystem

- City of Brownwood Vehicle Detectors
- City of Brownwood Work Zone Equipment
- County Road and Bridge Field Equipment
- *Municipal ITS Field Equipment
- TxDOT Abilene District CCTV
- TxDOT Abilene District DMS
- TxDOT Abilene District Field Sensors
- *TxDOT Abilene District HAR
- *TxDOT Abilene District Lane Control Signals
- *TxDOT Abilene District School Pager System
- *TxDOT Abilene District Traffic Signals
- *TxDOT Abilene District Weigh-In-Motion Sta.
- TxDOT Abilene District Work Zone Equipment

Roadway Subsystem

- *TxDOT Brownwood District CCTV
- TxDOT Brownwood District DMS
- TxDOT Brownwood District Field Sensors
- TxDOT Brownwood District School Pager Sys.
- TxDOT Brownwood District Traffic Signals
- *TxDOT Brownwood District WIM Stations
- *TxDOT Brownwood District Work Zone Equip.
- *TxDOT West Central Environmental Sensors
- USGS Water Level Sensors
- Water Dist./River Authori. Monitoring Sensors

Commercial Vehicle Check

- *DPS Inspection Stations

* Elements are *planned or future*, not *existing*.
Last update: August 20, 2004

Figure 3 – West Central Texas Regional System Interconnect Diagram

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Figure 4 – TxDOT Abilene District 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 West Central Texas 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 West Central Texas Region. There are 165 different elements identified as part of the West Central Texas 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 West Central Texas 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 City of Abilene 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.

West
Central
Texas

Rail Operators	Abilene Fire Department
Rail Operators Wayside Equipment	City of Abilene Fire Vehicles

Abilene Traffic Engineering Division	Abilene Traffic Engineering Division
City of Abilene Traffic Operations Center	City of Abilene Traffic Signals

Existing
Planned
Future
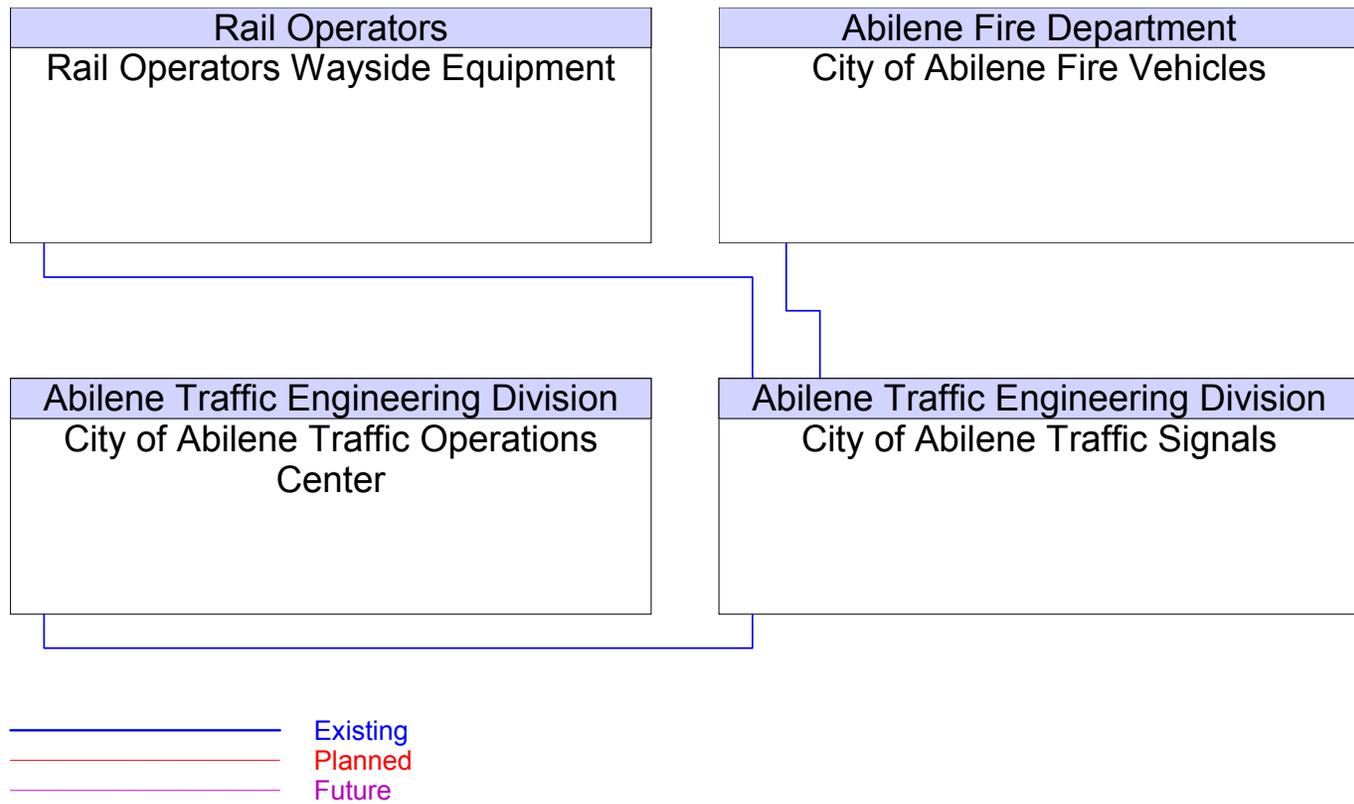
Figure 5 – City of Abilene Traffic Signals Interfaces

An example of the architecture flows between two elements is shown in **Figure 6**. In this interface, the flows between the TxDOT Brownwood District TMC and Other TxDOT District TMCs show information that must go from the Brownwood District TMC to other Texas 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.
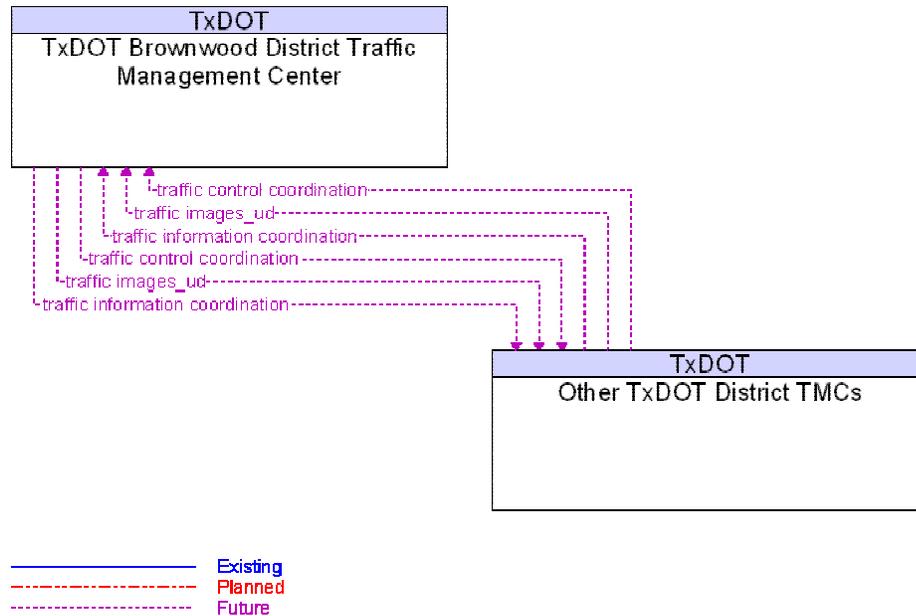
Figure 6 – TxDOT Brownwood District TMC to Other TxDOT District TMCs Architecture Flows

With the required interfaces and interconnections identified, standards that could potentially be applied to the West Central Texas Region were identified. Standards are important tools that will allow efficient implementation of the elements in the West Central Texas Regional ITS Architecture over time. They facilitate the 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 West Central Texas 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 West Central Texas Region, two concepts were illustrated. The first describes how ITS technologies could be used during a major ice storm along I-20. The operational concept shows how ITS technologies are used to detect ice on the roadway, automatically apply anti-icing chemicals, and inform motorists. The second scenario describes the management of a multi-vehicle crash on US 83 just as the afternoon rush hour begins. ITS technologies support emergency responders as fire department dispatchers are able to view the accident scene and determine the most appropriate

equipment to dispatch. The operational concept also shows how through enhanced coordination transportation and emergency management agencies are able to better coordinate traffic detours and roadway closures.

Agreements

Interfaces and data flows among public and private entities in the West Central Texas 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 few formal agreements in place in the West Central Texas 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 more formal agreements will be needed.

The following is a list of potential agreements for the West Central Texas 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 and public safety agencies; and
- 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 Abilene, 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 West Central Texas 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 West Central Texas 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 West Central Texas 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 West Central Texas. TxDOT plans to permanently host the site in the future at www.dot.state.tx.us/trf/its.

WEST CENTRAL TEXAS 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 West Central Texas Regional ITS Architecture, TxDOT chose to expand on the project sequence requirement to develop a formal ITS deployment plan for the Region.

The West Central Texas Regional ITS Architecture provided the framework and prioritized the key functions and services desired by stakeholders in the Region. The West Central Texas 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 West Central Texas 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 West Central Texas 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 West Central Texas 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 West Central Texas Region, such as surface street control and traffic information dissemination.

Table 2 – Summary of Prioritized Market Packages for the West Central Texas Region

High Priority	Medium Priority	Low Priority
▪ Network Surveillance	▪ Freeway Control	▪ Probe Surveillance
▪ Surface Street Control	▪ Speed Monitoring	▪ Maintenance and Construction Vehicle Tracking
▪ Traffic Information Dissemination	▪ Emergency Vehicle Routing	▪ Maintenance and Construction Vehicle Maintenance
▪ Regional Traffic Control	▪ Emergency Evacuation by Transit	▪ Work Zone Safety Monitoring
▪ Incident Management System	▪ Multi-modal Coordination	▪ Transit Maintenance
▪ Standard Railroad Grade Crossing	▪ Roadway Maintenance and Construction	▪ ISP Based Route Guidance
▪ Railroad Operations Coordination		▪ ITS Data Warehouse
▪ Emergency Response		
▪ Road Weather Data Collection		
▪ Weather Information Processing and Distribution		
▪ Work Zone Management		
▪ Maintenance and Construction Activity Coordination		
▪ Transit Vehicle Tracking		
▪ Transit Fixed-Route Operations		
▪ Demand Response Transit Operations		
▪ Transit Passenger and Fare Management		
▪ Transit Security		
▪ Transit Traveler Information		
▪ Weigh-in-Motion		
▪ HAZMAT Management		
▪ Broadcast Traveler Information		
▪ ITS Data Mart		

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 or additional new needs to bring the market package to the desired level of functionality in the West Central Texas 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 West Central Texas 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 West Central Texas 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 West Central Texas Region was developed. These projects were refined and additions and deletions were made by the Regional stakeholders at the ITS Deployment Plan Workshop in March 2004.

Recommended ITS projects for the West Central Texas 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 West Central Texas 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 West Central Texas 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 West Central Texas 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 West Central Texas Region

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Travel and Traffic Management		
Short Term Projects 5-year Horizon	TxDOT Center-to-Center Communication (Statewide TxDOT District Communications)	Yes (TxDOT Statewide)
	TxDOT Abilene Advanced Traffic Management System (ATMS) Implementation	Yes (TxDOT Abilene)
	TxDOT Abilene Traffic Management Center (TMC) Expansion	No
	TxDOT Abilene Closed Loop Signal System Expansion Phase 1	Yes (TxDOT Abilene)
	TxDOT Abilene Dynamic Message Sign (DMS) Implementation Phase 1	No
	TxDOT Abilene Closed Circuit Television (CCTV) Implementation Phase 1	Yes (TxDOT Abilene)
	TxDOT Brownwood ATMS Implementation	Yes (TxDOT Statewide)
	TxDOT Brownwood TMC Expansion	No
	TxDOT Brownwood Closed Loop Signal System Expansion Phase 1	Yes (TxDOT Brownwood)
	TxDOT Brownwood DMS Implementation Phase 1	No
	TxDOT Brownwood CCTV Implementation Phase 1	No
	City of Abilene Traffic Operations Center (TOC)/TxDOT Abilene TMC Communications Connection	No
	City of Abilene TOC Development/Expansion	No
	City of Abilene Closed Loop Signal System Expansion Phase 1	No
	City of Brownwood TOC/TxDOT Brownwood TMC Communications Connection	No
	City of Brownwood TOC Development/Expansion	No
	City of Brownwood Closed Loop Signal System Implementation Phase 1	No
	City of Brownwood Flooding Detour Plans	No
	West Central Texas Detour Plans	No
	Media Liaison and Coordination	N/A
Mid Term Projects 10-year Horizon	TxDOT Abilene Closed Loop Signal System Expansion Phase 2	No
	TxDOT Abilene DMS Implementation Phase 2	No
	TxDOT Abilene CCTV Implementation Phase 2	No
	TxDOT Highway Advisory Radio (HAR)	No

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Travel and Traffic Management (continued)		
Mid Term Projects 10-year Horizon (continued)	TxDOT Brownwood Closed Loop Signal System Expansion Phase 2	No
	TxDOT Brownwood DMS Implementation Phase 2	No
	TxDOT Brownwood CCTV Implementation Phase 2	No
	City of Abilene Closed Loop Signal System Expansion Phase 2	No
	City of Abilene CCTV Camera Implementation	No
	City of Abilene Railroad Operations Coordination	No
	City of Brownwood Closed Loop Signal System Implementation Phase 2	No
	Municipal Closed Loop Signal System Implementation	No
	Regional 511 Advanced Traveler Information System Server	No
Long Term Projects 20-year Horizon	TxDOT Abilene Closed Loop Signal System Expansion Phase 3	No
	TxDOT Brownwood Closed Loop Signal System Expansion Phase 3	No
	City of Abilene Closed Loop Signal System Expansion Phase 3	No
	City of Brownwood Closed Loop Signal System Implementation Phase 3	No
	TxDOT Abilene Lane Control Signals	No
	Municipal TOC/TxDOT TMC Communications Connection	No
	ISP-based Route Guidance	No
Emergency Management		
Short Term Projects 5-year Horizon	DPS/TxDOT Abilene District TMC Connection	No
	DPS/TxDOT Brownwood District TMC Connection	No
	State EOC/TxDOT Abilene TMC Communications Connection	No
	State EOC/TxDOT Brownwood TMC Communications Connection	No
	TxDOT Abilene Emergency Vehicle Signal Preemption Implementation	No
	TxDOT Brownwood Emergency Vehicle Signal Preemption Implementation	No
	City of Abilene Emergency Vehicle Signal Preemption	No

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Emergency Management (continued)		
Short Term Projects 5-year Horizon (continued)	City of Abilene Police Automated Vehicle Location (AVL)	No
	City of Abilene Emergency Operations Center (EOC)/TxDOT Abilene District TMC Connection	No
	City of Brownwood EOC/TxDOT Brownwood District TMC Connection	No
	DPS AVL and Mobile Data Terminals (MDTs)	No
Mid Term Projects 10-year Horizon	City of Brownwood Emergency Vehicle Signal Preemption	No
	Portable CCTV Emergency Command	No
Long Term Projects 20-year Horizon	N/A	N/A
Maintenance and Construction Management		
Short Term Projects 5-year Horizon	TxDOT Highway Conditions Reporting System (HCRS) Enhancement	Yes (Statewide)
	TxDOT Abilene Road Weather Information System (RWIS) Implementation Phase 1	No
	TxDOT Brownwood RWIS Implementation Phase 1	No
	City of Abilene Flood Detection Stations Phase 1	No
	City of Brownwood Flood Detection Stations Phase 1	No
Mid Term Projects 10-year Horizon	TxDOT Abilene RWIS Implementation Phase 2	No
	TxDOT Abilene Work Zone Safety Monitoring	No
	TxDOT Brownwood RWIS Implementation Phase 2	No
	TxDOT Brownwood Work Zone Safety Monitoring	No
	City of Abilene Flood Detection Stations Phase 2	No
	City of Brownwood Flood Detection Stations Phase 2	No
Long Term Projects 20-year Horizon	N/A	N/A
Public Transportation Management		
Short Term Projects 5-year Horizon	CityLink AVL and Mobile Data Terminals	Partial (CityLink)
	CityLink Automated Passenger Counters	No
	CityLink On-Board Security Cameras	No
	Hill Country Transit Computer Aided Dispatch (CAD)	No
	Hill Country Transit Emergency Silent Alarms	Yes (Hill Country)
	Hill Country Transit Automated Passenger Counters	No

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Public Transportation Management (continued)		
Short Term Projects 5-year Horizon (continued)	Hill Country Transit AVL and Mobile Data Terminals	No
	Hill Country Transit On-Board Security Cameras Phase 1	No
	CARR AVL	No
	Double Mountain Coach On-Board Security Cameras	No
Mid Term Projects 10-year Horizon	CityLink Electronic Fare Payment	No
	CityLink CCTV at Transfer Stations	No
	Hill Country Transit Electronic Fare Payment	No
	Hill Country Transit On-Board Security Cameras Phase 2	No
	CARR Mobile Data Terminals	No
	Double Mountain Coach Emergency Silent Alarms	No
	Double Mountain Coach Mobile Data Terminals	No
Long Term Projects 20-year Horizon	CityLink Maintenance System	No
	Hill Country Transit Maintenance System	No
	CARR Transit Maintenance System	No
	Double Mountain Coach AVL	No
	Double Mountain Coach Transit Maintenance System	No
	Multi-modal Coordination	No
Commercial Vehicle Operations		
Short Term Projects 5-year Horizon	TxDOT Abilene Weigh-in-Motion Phase 1	No
Mid Term Projects 10-year Horizon	TxDOT Abilene Weigh-in-Motion Phase 2	No
	TxDOT Brownwood Weigh-in-Motion Phase 1	No
Long Term Projects 20-year Horizon	TxDOT Brownwood Weigh-in-Motion Phase 2	No
Archived Data		
Short Term Projects 5-year Horizon	Hill Country Transit Data Management	No
	CARR Transit Data Management	No
Mid Term Projects 10-year Horizon	Abilene MPO Data Warehouse	No
Long Term Projects 20-year Horizon	N/A	N/A

MAINTAINING THE REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN

The West Central Texas 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 West Central Texas 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 March 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 West Central Texas 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 West Central Texas 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 West Central Texas 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 West Central Texas 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 West Central Texas 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 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 West Central Texas Regional ITS Architecture and Deployment Plan included the following:

- Aspermont Small Business Development Center, Inc;
- Central Texas Rural Transit District;
- City of Abilene;
- City of Breckenridge;
- City of Brownwood;
- City of Comanche;
- City of Eastland;
- Department of Public Safety;
- Dyess Air Force Base;
- Hill Country Transit;
- Jones County;
- Nolan County;
- Taylor County;
- Texas Commission on Environmental Quality;
- Texas Department of Transportation; and
- US Geological Survey.