State of Texas
ITS Architectures and Deployment Plans

Permian Basin 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, 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.
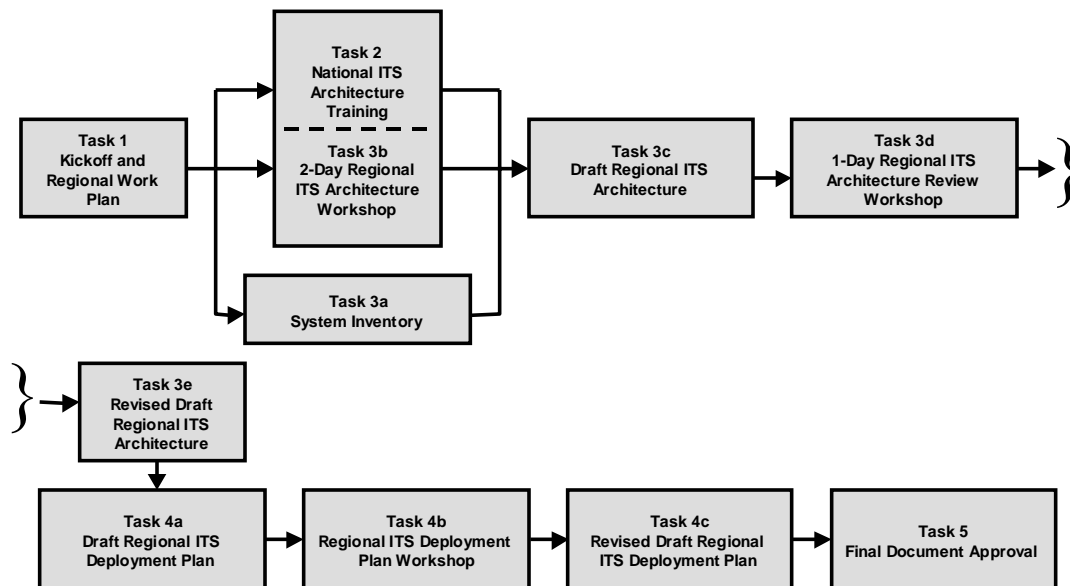

Figure 1 – Permian Basin Regional ITS Architecture and Deployment Plan Development Process

OVERVIEW OF THE PERMIAN BASIN REGION

The Permian Basin Region is bordered by the TxDOT Lubbock District to the north, the TxDOT Laredo District to the south, the TxDOT San Angelo and Abilene Districts to the east, and the TxDOT El Paso District to the west. For the Permian Basin Regional ITS Architecture and Deployment Plan, the study area included all 12 counties that comprise the TxDOT Odessa District. **Figure 2** illustrates the Regional boundaries.

The Permian Basin Region has an extensive transportation infrastructure. The primary roadway facilities include I-10, I-20, US 67, US 285, and US 385.

I-10 and I-20 are east-west divided interstate highways. Their effective operation is critical to the movement of goods and people through the State of Texas and the United States. Blockages along I-10 and I-20 can have serious implications for drive-time of 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 alter their travel plans to take an alternate route or wait to begin their travels.
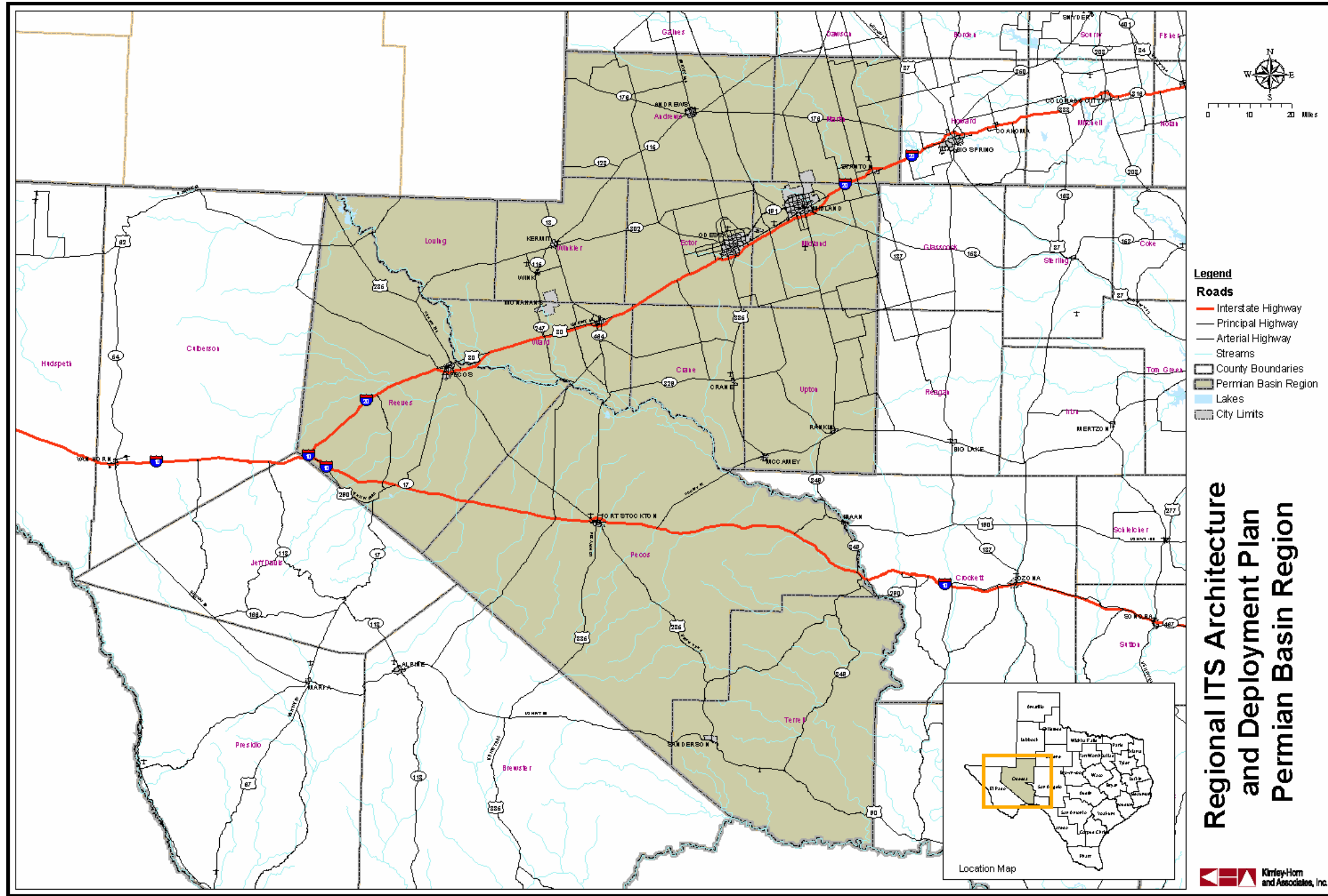
Figure 2 – Permian Basin Region Map

PERMIAN BASIN 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 Permian Basin Region participated in the development of the Permian Basin Regional ITS Architecture and Deployment Plan. Key participants included representatives from TxDOT, cities, public safety, transit agencies, and planning organizations. 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 Permian Basin 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 Permian Basin Regional ITS Architecture and Deployment Plan:

- City of Balmorhea;
- City of Fort Stockton;
- City of Midland;
- City of Odessa;
- City of Pecos;
- EZ Rider;
- Midland-Odessa Regional Transportation Study (MORTS);
- Midland-Odessa Transportation Alliance (MOTRAN);
- Permian Basin Regional Planning Commission;
- Texas Department of Public Safety;
- TxDOT El Paso District – Pecos Area Office;
- TxDOT Odessa District;
- TxDOT Traffic Operations Division (Austin); and
- West Texas Opportunities, Inc. - Permian Basin Rural Transit District.

PERMIAN BASIN REGIONAL ITS ARCHITECTURE

The process for developing the Regional ITS Architecture for the Permian Basin 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 Permian Basin 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 Permian Basin Regional ITS Architecture began with a project kick-off meeting in January 2004. 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 Permian Basin Region stakeholders were categorized into functional areas and are shown in **Table 1**.

Table 1 – Permian Basin Region: Summary of ITS Needs

Permian Basin Region
Summary of ITS Needs
Permian Basin Regional ITS Architecture and Deployment Plan Kick-Off Meeting
January 27, 2004

Travel and Traffic Management Needs

- Need dynamic message signs (DMS) on I-10 and I-20
- Need traveler information kiosks at rest areas
- Need TxDOT Traffic Management Center (TMC)
- Need to bring video image vehicle detection systems (VIVDS) images back to TxDOT TMC and Midland Traffic Operations Center (TOC)
- Need CCTV cameras on interstate and arterials
- Need advanced railroad warnings/tracking
- Need improved inter-agency coordination for sharing of traffic and weather data
- Need district wide communications plan and system upgrade
- Need center-to-center communication
- Need to bring signal data from cities back to their respective TOCs
- Need a TOC for the City of Odessa
- Need VIVDS detection
- Need closed loop signal system expansion in Midland
- Need electronic toll collection

Public Transportation Management Needs

- Need signal priority/scheduling for EZ Rider buses
- Need on-board video cameras
- Need automated vehicle location (AVL) and mobile data terminals (MDTs)
- Need on-board weather alerts for Permian Basin Rural Transit District
- Need Americans with Disabilities Act compliant stop annunciation for EZ Rider
- Need smart card electronic fare collection
- Need on-board distress button for EZ Rider
- Need kiosks with real-time transit information
- Need common communications system among Permian Basin Rural Transit District and with emergency management

Electronic Payment Needs

None Identified

Commercial Vehicle Operations Needs

None Identified

Emergency Management Needs

- Need AVL for police and fire in City of Odessa
- Need 900 MHz data transfer capability
- Need MDTs for City of Odessa Fire
- Need AVL for Midland Police
- Need MDT upgrade for Midland Police

Advanced Vehicle Safety Systems Needs

None Identified

Table 1 – Permian Basin Region: Summary of ITS Needs (continued)

Information Management Needs (Data Archiving)
None Identified

Maintenance and Construction Management Needs
- Need road weather information systems
- Need weigh-in-motion for pavement management
- Need flood detection and driver notification at low water crossings
- Need high wind/low visibility warning system
- Need AVL on TxDOT maintenance vehicles
- Need AVL on City of Odessa and Midland maintenance vehicles

Market Packages

A 2-Day ITS Architecture Workshop was held in Permian Basin in March 2004. 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 Permian Basin Regional ITS Architecture.

The next step in developing the Permian Basin 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 can include several stakeholders and elements that work together to provide a service in the Region. Examples of market packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are a total of 75 market packages identified in Version 4.0 of 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 38 as being applicable to the Permian Basin Region.

Interconnects, Interfaces, and Standards

Stakeholders also began the process of mapping existing and planned ITS elements in the Permian Basin Region 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 Permian Basin Region that is shown in **Figure 3**. This architecture diagram, also referred to as the "sausage diagram" shows the relationship of existing, planned, and future systems in the Permian Basin Region.

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ConSysTec Corp

Permian Basin

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

Remote Traveler Support Subsystem
- City of Midland HAR*
- City of Odessa HAR*
- EZ Rider Transit Kiosks*
- EZ Rider Transit Point of Sale / Customer Information Systems*
- EZ Rider Transit Transfer Stations*
- TxDOT Rest Area/Visitor Center/Service Plaza/Truck Stop Kiosks*

Personal Information Access Subsystem
- Private Travelers Personal Computing Devices

Transit Vehicle Subsystem
- EZ Rider Demand Response Vehicles
- EZ Rider Fixed Route Transit Vehicles
- Independent School District Buses
- Permian Basin Rural Transit Vehicles

Vehicle Subsystem
- Private Vehicles

Commercial Vehicle Subsystem
- Commercial Vehicles

Maintenance and Const Vehicle Subsystem
- City of Midland Development Services Vehicles
- City of Odessa Public Works Vehicles
- County Road and Bridge Vehicles
- Municipal PWD Vehicles
- TxDOT Odessa District Maintenance Vehicles

Emergency Vehicle Subsystem
- City of Midland Fire and EMS Vehicles
- City of Midland Police Vehicles
- City of Odessa Fire and EMS Vehicles
- City of Odessa Police Vehicles
- County Emergency Vehicles
- DPS Emergency Vehicles
- Municipal Emergency Vehicles

Maintenance & Construction Management
- City of Midland Development Services Dispatch
- City of Midland Traffic Signal Shop
- City of Odessa Public Works Dispatch
- City of Odessa Traffic Engineering
- County Road and Bridge
- Municipal PWD
- Other TxDOT District Maintenance Sections
- Pipeline Company Systems
- TxDOT Highway Conditions Reporting System
- TxDOT Odessa District Area Engineers Office
- TxDOT Odessa District Maintenance Sections
- TxDOT Odessa District TMC
- TxDOT Odessa District Traffic Signal Shop
- Utility Dispatch

Emergency Management Subsystem
- Bureau of Customs and Border Protection Office
- City of Midland Public Safety Communications
- City of Odessa Public Safety Communications
- Correctional Facilities Operations
- County EOC

Emergency Management Subsystem (Cont.)
- County Public Safety Dispatch
- District Disaster Committee*
- DPS Administration
- DPS Communications Service
- DPS Division of Emergency Management
- Ector County EOC
- Ector County Independent School District Police
- Midland County EOC
- Midland Independent School District Police
- Municipal Public Safety Dispatch
- National Guard/State Guard Office
- Other County Public Safety Dispatch
- Other Municipal Public Safety Dispatch
- Private Tow/Wrecker Dispatch
- Rail Police/Security
- State EOC
- Texas Forest Service Permian Basin
- University/College Police Force

Fleet and Freight Management Subsystem
- Private Fleet Management Systems*

Information Service Provider Subsystem
- City of Midland Public Information Office
- City of Midland Website
- City of Odessa Public Information Office*
- City of Odessa Web Site
- EZ Rider Website*
- Municipal Websites
- Private Sector Traveler Information Services*
- Service Agencies
- TxDOT 511 System*
- TxDOT Highway Conditions Reporting System
- TxDOT Motor Carrier Routing Information
- TxDOT Odessa District Public Information Office
- TxDOT Odessa District Web Page
- West Texas Opportunities Website*

Traffic Management Subsystem
- City of Midland Traffic Operations Center
- City of Odessa Traffic Operations Center*
- Other TxDOT Districts TMC
- Trans Vista TMC
- TxDOT Fort Worth TMC (TransVision)
- TxDOT Odessa District TMC

Transit Management Subsystem
- EZ Rider Transit Dispatch
- Independent School District Dispatch
- Other Transit Systems
- Permian Basin Rural Public Transportation Dispatch
- Private Taxi Provider Dispatch
- Private Transit Systems

Archived Data Management Subsystem
- City of Midland Accident Database
- City of Odessa Accident Database
- EZ Rider Transit Ridership Database
- Permian Basin Transit Ridership Database*
- Statewide Crash Records Information System
- TxDOT Odessa District Pavement Management System
- TxDOT Odessa District Public Transportation Management System (PTMS)
- TxDOT Statewide Pavement Management System

Commercial Vehicle Administration Subsystem
- TxDOT Credentials Administration and Safety Information Exchange*
- US BCBP Customs Product Manifest System*

Archived Data User Systems
- Crash Records Users*
- Transit Database Users
- TxDOT Odessa District Pavement Management System Users
- TxDOT Public Transportation Division

Asset Management
- TxDOT BRINSAP
- TxDOT Odessa District Pavement Management System

Care Facility
- Regional Medical Centers

Enforcement Agency
- City of Midland Public Safety Communications
- County Public Safety Dispatch
- DPS License and Weights Division*
- Municipal Public Safety Dispatch

Equipment Repair Facility
- City of Midland Equipment Repair
- City of Odessa Equipment Services
- County Road and Bridge Equipment Repair
- EZ Rider Maintenance Facility
- Private Transit Facility Maintenance Shop
- TxDOT Odessa District Equipment Shop

Event Promoters
- Regional Chambers of Commerce*
- Regional Event Promoters*

Financial Institution
- Financial Institutions

Maintenance & Construction Admin
- TxDOT Odessa District Area Engineers Office

Media
- Local Print and Broadcast Media

Multimodal Transportation Service Provider
- AMTRAK Station*
- Midland International Airport

Other CVAS
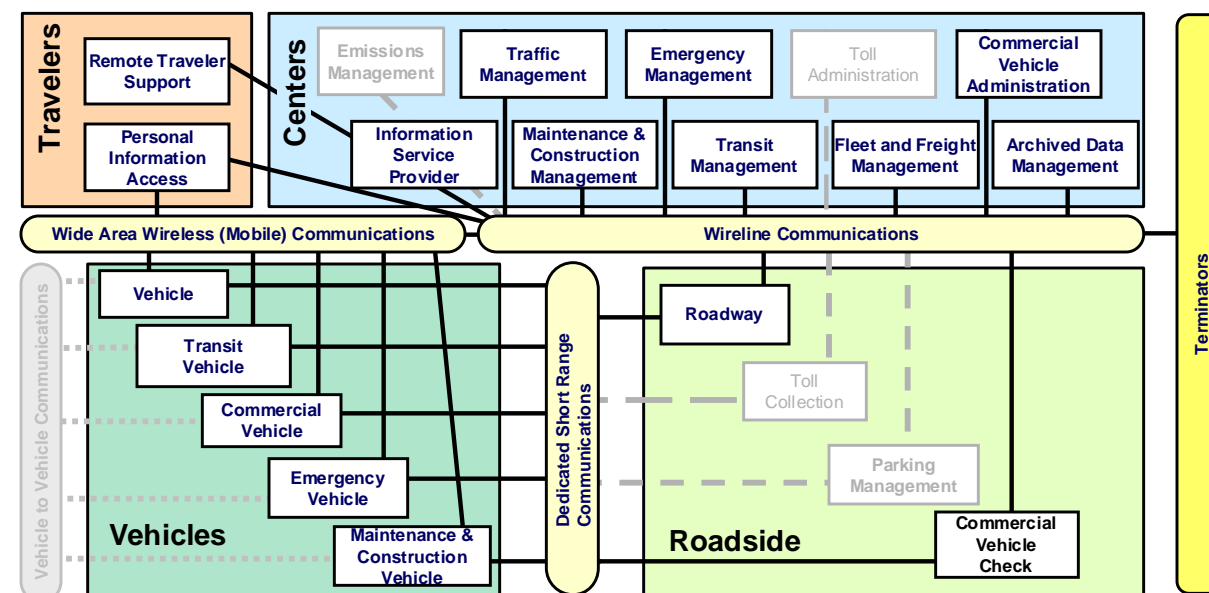- Other States Credentials Administration and Safety Systems*

Other EM
- Permian Basin Regional Incident and Mutual Aid Network*

Rail Operations
- Rail Operations Centers

Traveler Card
- Regional Transit Card*

Wayside Equipment
- Rail Operators Wayside Equipment

Weather Service
- Permian Basin National Weather Service Office

Diagram (Centers / Travelers / Vehicles / Roadside / Terminators)

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

Vehicles: Vehicle; Transit Vehicle; Commercial Vehicle; Emergency Vehicle; Maintenance & Construction Vehicle

Vehicle to Vehicle Communications / Dedicated Short Range Communications

Roadside: Roadway; Toll Collection; Parking Management; Commercial Vehicle Check

Terminators

Roadway Subsystem
- City of Midland Field Equipment
- City of Midland School Pager System
- City of Odessa Field Equipment
- City of Odessa School Pager System*
- County Road and Bridge Field Equipment
- Municipal ITS Field Equipment*
- TxDOT Odessa District CCTV*
- TxDOT Odessa District DMS*
- TxDOT Odessa District Field Sensors

Roadway Subsystem
- TxDOT Odessa District School Pager System
- TxDOT Odessa District Traffic Signals
- TxDOT Odessa District Work Zone Equipment

Commercial Vehicle Check Subsystem
- DPS Electronic Screening Stations*
- DPS Weigh in Motion*
- US BCBP Electronic Clearance System*

* Elements are *planned or future*, not *existing*.

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Figure 3 – Permian Basin Regional System Interconnect Diagram

The market packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the Permian Basin Region. Each market package was shown graphically, with the market package name, Permian Basin 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 Permian Basin Region. This market package shows the three subsystems, Traffic Management, Roadway and Information Service Provider, as well as the associated entities (TxDOT Odessa District Traffic Signals, TxDOT Odessa District Field Sensors, etc.) for the TxDOT Odessa District signal system. The solid data flow lines in this market package indicate existing information flows. Future information flows are indicated by the dashed lines. All of the Permian Basin Region market package diagrams are included in the Regional ITS Architecture report.
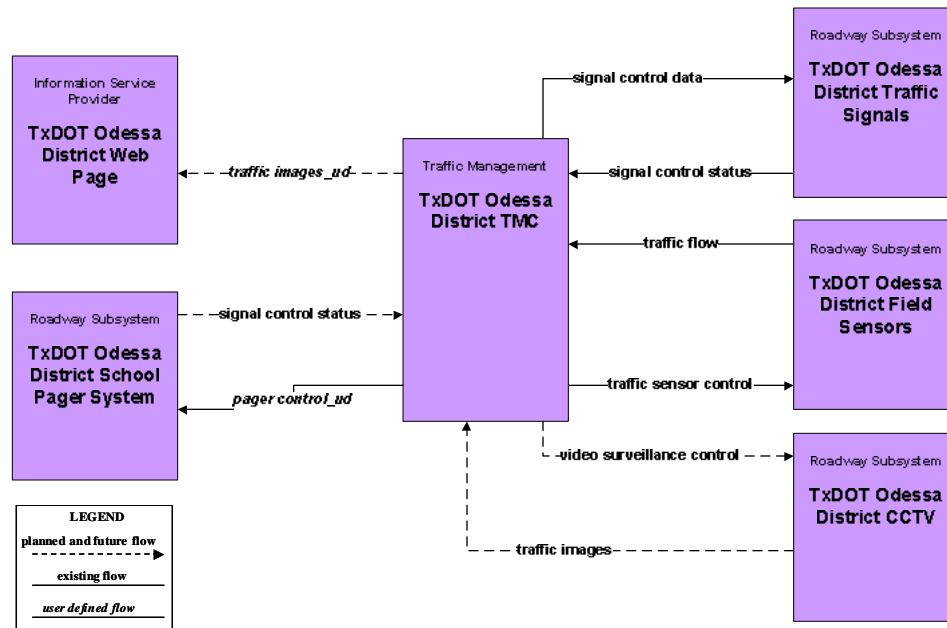

Figure 4 – TxDOT Odessa District Surface Street Control Customized Market Package

More detailed interfaces were developed which identified the connectivity between the systems and elements. Each element identified in the ITS architecture for the Permian Basin 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 Permian Basin Region. There are 137 different elements identified as part of the Permian Basin 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 Permian Basin 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 Odessa 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.

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

With the required interfaces and interconnections identified, standards that could potentially be applied to the Permian Basin Region were identified. Standards are an important tool that will allow efficient implementation of the elements in the Permian Basin 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.
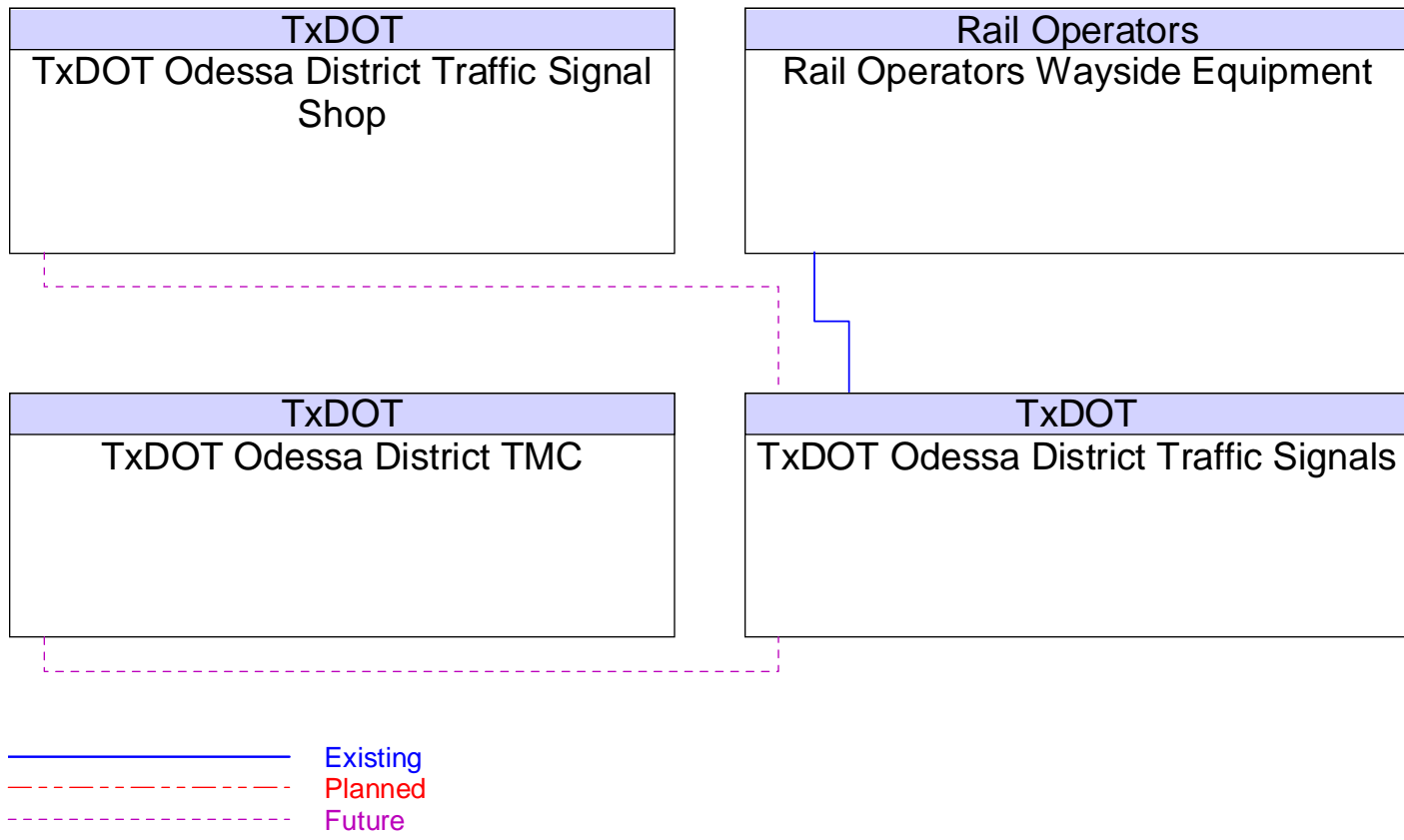
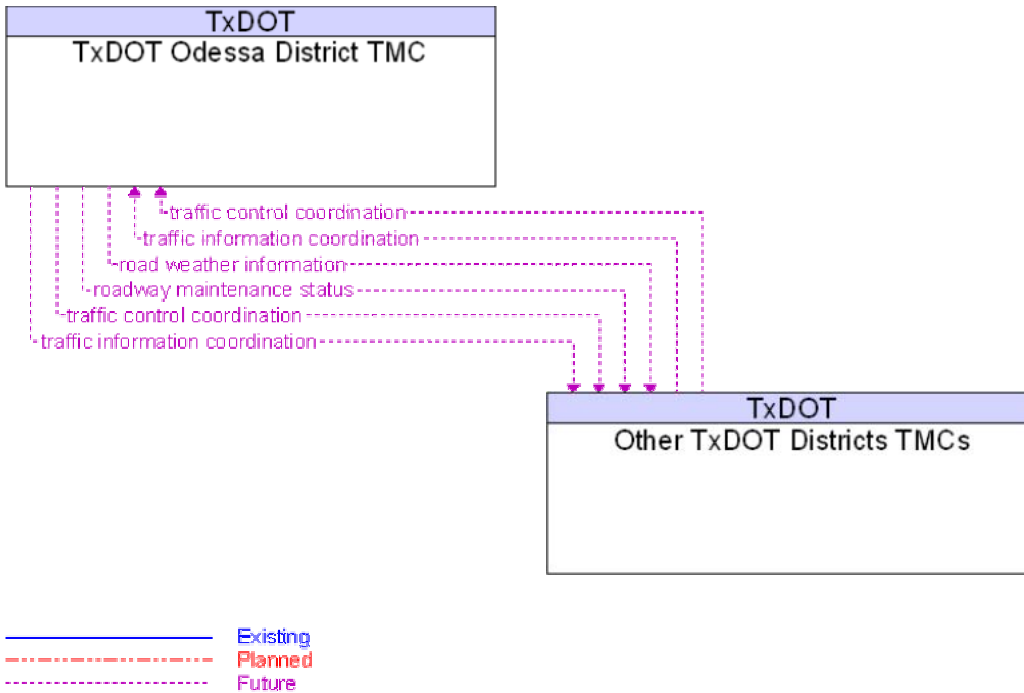**Figure 5 – TxDOT Odessa District Traffic Signals Interfaces**

Figure 6 – TxDOT Odessa District TMC to Other TxDOT District TMCs Architecture Flows

Operational Concept and Scenarios

An operational concept for the Permian Basin 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 Permian Basin Region, two concepts were illustrated. The first describes how ITS technologies could be used to manage a multi-vehicle crash on I-20 between Midland and Odessa. 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 the impacts of high winds on the Region and how deployed systems and communication links help disseminate information about dangerous driving conditions to motorists. The same systems also assist in the coordination of emergency management personnel to clear those accidents that have occurred due to the impaired visibility.

Agreements

Interfaces and data flows among public and private entities in the Permian Basin 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 Region. With the implementation of ITS technologies, integration of systems from one or more agencies, and the anticipated level of

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information exchange identified in the architecture, it is likely that formal agreements will be needed in the future.

The following is a list of potential agreements for the Permian Basin 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 agencies and private media and information service providers;
- Shared video monitoring agreements between TxDOT 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, the City of Midland, the City of Odessa, 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 Permian Basin Region is documented in a final report. Stakeholders were brought together to review the Regional ITS Architecture and provide feedback. The final architecture report was not prepared until after completion of the Permian Basin 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 Permian Basin Regional ITS Architecture website was being hosted at www.consystec.com. The site can be accessed by selecting the link to Texas Regional, and then the link to Permian Basin. TxDOT plans to permanently host the site in the future at www.dot.state.tx.us/trf/its.

PERMIAN BASIN REGIONAL 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 Permian Basin Regional ITS Architecture, TxDOT chose to expand on the project sequence requirement to develop a formal ITS deployment plan for the Region.

The Permian Basin Regional ITS Architecture provided the framework and prioritized the key functions and services desired by stakeholders in the Region. The Permian Basin Regional 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 Regional ITS Deployment Plan.

Prioritized Market Packages

Market packages for the Permian Basin 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 Permian Basin 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 Permian Basin 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 Permian Basin Region, such as surface street control and traffic information dissemination.

Table 2 – Summary of Prioritized Market Packages for the Permian Basin Region

High Priority	Medium Priority	Low Priority
■ Network Surveillance	■ Freeway Control	■ Probe Surveillance
■ Surface Street Control	■ Standard Railroad Grade Crossing	■ Maintenance and Construction Vehicle Tracking
■ Traffic Information Dissemination	■ Advanced Railroad Grade Crossing	■ Maintenance and Construction Vehicle Maintenance
■ Regional Traffic Control	■ Railroad Operations Coordination	■ Roadway Automated Treatment
■ Incident Management System	■ Emergency Vehicle Routing	■ Winter Maintenance
■ Emergency Response	■ Roadway Maintenance and Construction	■ Work Zone Safety Monitoring
■ Evacuation and Reentry Management	■ Work Zone Management	■ Transit Maintenance
■ Road Weather Data Collection	■ Transit Passenger and Fare Management	■ Multi-modal Coordination
■ Weather Information Processing and Distribution	■ Transit Security	■ Electronic Clearance
■ Maintenance and Construction Activity Coordination	■ Weigh-in-Motion	■ ISP-Based Route Guidance
■ Transit Vehicle Tracking	■ ITS Data Warehouse	
■ Transit Fixed-Route Operations		
■ Demand Response Transit Operations		
■ Transit Traveler Information		
■ 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 projects or additional new projects needed to fully implement the market package in the Permian Basin 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 Permian Basin 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 Permian Basin 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 Permian Basin Region was developed. These projects were refined and additions and deletions were made by the Regional stakeholders at the ITS Deployment Plan Workshop in July 2004.

Recommended ITS projects for the Permian Basin 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 Permian Basin 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 Permian Basin 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 Permian Basin 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 Permian Basin Region

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Travel and Traffic Management		
Short Term Projects 5-year Horizon	TxDOT Odessa TMC	No
	TxDOT ATMS Implementation	N/A
	TxDOT Center-to-Center Communications (Statewide)	N/A
	TxDOT DMS on I-20	No
	TxDOT DMS on I-10	No
	TxDOT CCTV Camera Deployment Phase 1	No
	Detour Planning	No
	TxDOT Rest Area Kiosks	No
	TxDOT Closed Loop Signal System Implementation Phase 1	Yes (TxDOT)
	City of Midland TOC	No
	City of Midland Signal System Upgrades Phase 1	Pending Approval (City of Midland)
	City of Midland Closed Loop Signal System Expansion Phase 1	Pending Approval (City of Midland)
	City of Odessa TOC	No
	City of Odessa Signal System Upgrades Phase 1	No
	City of Odessa Closed Loop Signal System Expansion Phase 1	No
Mid Term Projects 10-year Horizon	TxDOT Additional DMS Implementation	No
	TxDOT CCTV Camera Deployment Phase 2	No
	TxDOT Web Page Customization and Enhancement	No
	TxDOT Closed Loop Signal System Implementation Phase 2	No
	Regional Telecommunications Master Plan	No
	City of Midland CCTV Camera Deployment	No
	City of Midland TOC/TxDOT Odessa TMC Communications Connection	No
	City of Midland Signal System Upgrades Phase 2	No
	City of Midland Closed Loop Signal System Expansion Phase 2	No
	City of Odessa CCTV Camera Deployment	No
	City of Odessa TOC/TxDOT Odessa TMC Communications Connection	No

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Travel and Traffic Management (continued)		
Mid Term Projects 10-year Horizon (continued)	City of Odessa Signal System Upgrades Phase 2	No
	City of Odessa Closed Loop Signal System Expansion Phase 2	No
	Regional 511 Advanced Traveler Information System Server	No
	Media Liaison and Coordination	N/A
Long Term Projects 20-year Horizon	TxDOT Advance Railroad Warning System	No
	City of Midland Signal System Upgrades Phase 3	No
	City of Midland Advance Railroad Warning System	No
	City of Odessa Signal System Upgrades Phase 3	No
	City of Odessa Advance Railroad Warning System	No
	ISP-Based Route Guidance	No
Emergency Management		
Short Term Projects 5-year Horizon	TxDOT Emergency Vehicle Traffic Signal Preemption Expansion	No
	Municipal Emergency Vehicle Signal Preemption Vehicle Equipment	No
	City of Midland Police AVL and MDT Upgrade	No
	City of Midland Fire AVL and MDT Upgrade	No
	City of Midland Emergency Vehicle Traffic Signal Preemption Upgrade and Expansion	No
	City of Odessa Fire Department AVL and MDTs	No
	City of Odessa Police Department AVL and MDTs	No
	City of Odessa Emergency Vehicle Traffic Signal Preemption Upgrade and Expansion	No
Mid Term Projects 10-year Horizon	Midland County EOC/TxDOT Odessa TMC Communications Connection	No
	Ector County EOC/TxDOT Odessa TMC Communications Connection	No
	911 PSAP/TxDOT Odessa TMC Communications Connection	No
	Municipal Emergency Management AVL and MDTs	No
Long Term Projects 20-year Horizon	Municipal Emergency Vehicle Traffic Signal Preemption Implementation	No

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Maintenance and Construction Management		
Short Term Projects 5-year Horizon	TxDOT RWIS Stations Phase 1	No
	TxDOT High Wind/Low Visibility Detection	No
	TxDOT Flood Detection Stations and Low Water Crossing Warning Beacon Implementation Phase 1	No
	TxDOT HCRS Enhancements	Yes (TxDOT Statewide)
	City of Midland Flood Detection	No
Mid Term Projects 10-year Horizon	TxDOT RWIS Stations Phase 2	No
	TxDOT Additional Portable DMS	No
	TxDOT Flood Detection Stations and Low Water Crossing Warning Beacon Implementation Phase 2	No
	TxDOT Weigh-in-Motion for Pavement Management	No
	City of Midland Flood Detection Expansion	No
Long Term Projects 20-year Horizon	TxDOT Work Zone Safety Monitoring	No
	TxDOT Maintenance Vehicle AVL	No
	TxDOT Maintenance and Construction Vehicle Maintenance Tracking System	No
	TxDOT Anti-Icing Equipment Implementation	No
	City of Midland Maintenance Vehicle AVL	No
	City of Odessa Maintenance Vehicle AVL	No
Public Transportation Management		
Short Term Projects 5-year Horizon	EZ Rider AVL and Security System	No
	EZ Rider Electronic Fare Collection	No
	EZ Rider Paratransit Web-based Scheduling and Travel Data	No
	Permian Basin Rural Transit AVL and MDTs	No
	Permian Basin Rural Transit Web-based Scheduling and Travel Data	No
	Permian Basin Rural Transit/EZ Rider Communications Connection	No
	EZ Rider/City of Midland Emergency Dispatch Communications Connection	No
	EZ Rider/City of Odessa Emergency Dispatch Communications Connection	No

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Public Transportation Management (continued)		
Mid Term Projects 10-year Horizon	EZ Rider Bus Stop Annunciation	No
	EZ Rider/TxDOT Odessa TMC Communications Connection	No
	EZ Rider/Midland TOC Communications Connection	No
	EZ Rider/Odessa TOC Communications Connection	No
	EZ Rider/DPS Communications Connection	No
	EZ Rider Transit Information Kiosks at Transfer Stations	No
	Permian Basin Rural Transit Electronic Fare Collection	No
	Permian Basin Rural Transit Video Surveillance	No
	Permian Basin Rural Transit/TxDOT Odessa TMC Communications Connection	No
Long Term Projects 20-year Horizon	Permian Basin Rural Transit Information Kiosks at Transfer Stations	No
	Permian Basin Rural Transit Vehicle Maintenance Tracking System	No
Archived Data		
Short Term Projects 5-year Horizon	None identified at this time	N/A
Mid Term Projects 10-year Horizon	Permian Basin Regional Planning Commission Data Warehouse	No
Long Term Projects 20-year Horizon	None identified at this time	N/A

MAINTAINING THE REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN

The Permian Basin 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 Permian Basin 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 July 2004, stakeholders recommended that a meeting be held on an annual basis to review the existing Regional ITS Deployment Plan to update project status and include any new projects. These updates will be documented and included in the next formal revision of the plans. It was also recommended that the group meet on a two year basis to review the Regional ITS Architecture. Any new market packages that have been added to the National Architecture should be reviewed to see if they are applicable to the Permian Basin Region. Data flows in existing market packages should 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 Permian Basin 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. The complete revision of the plan on a two year basis will correspond with the Transportation Improvement Plan update process, which also occurs on a two year basis.

Both the Permian Basin 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 Permian Basin 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 ITS in the Permian Basin 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 Permian Basin Regional ITS Architecture and Deployment Plan included the following:

- City of Balmorhea;
- City of Fort Stockton;
- City of Midland;
- City of Odessa;
- City of Pecos;
- EZ Rider;
- MORTS;
- MOTRAN;
- Permian Basin Regional Planning Commission;
- Texas Department of Public Safety;
- Texas Department of Transportation; and
- West Texas Opportunities, Inc.