State of Texas
ITS Architectures and Deployment Plans

Amarillo Region

Executive Summary

Prepared by:

Kimley-Horn
and Associates, Inc.

ConSysTec Corp

January 31, 2003
068510001

TABLE OF CONTENTS
EXECUTIVE SUMMARY

TABLE OF CONTENTS
EXECUTIVE SUMMARY

LIST OF FIGURES

LIST OF TABLES

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 Regions in the state that already have ITS architectures in place or under development. The focus of the TxDOT Regional ITS Architecture and Deployment Plan 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 a Deployment Plan provides for a tangible road map for regional ITS deployment and integration. **Figure 1** shows the development process for each of the Regional ITS Architectures and Deployment Plans.
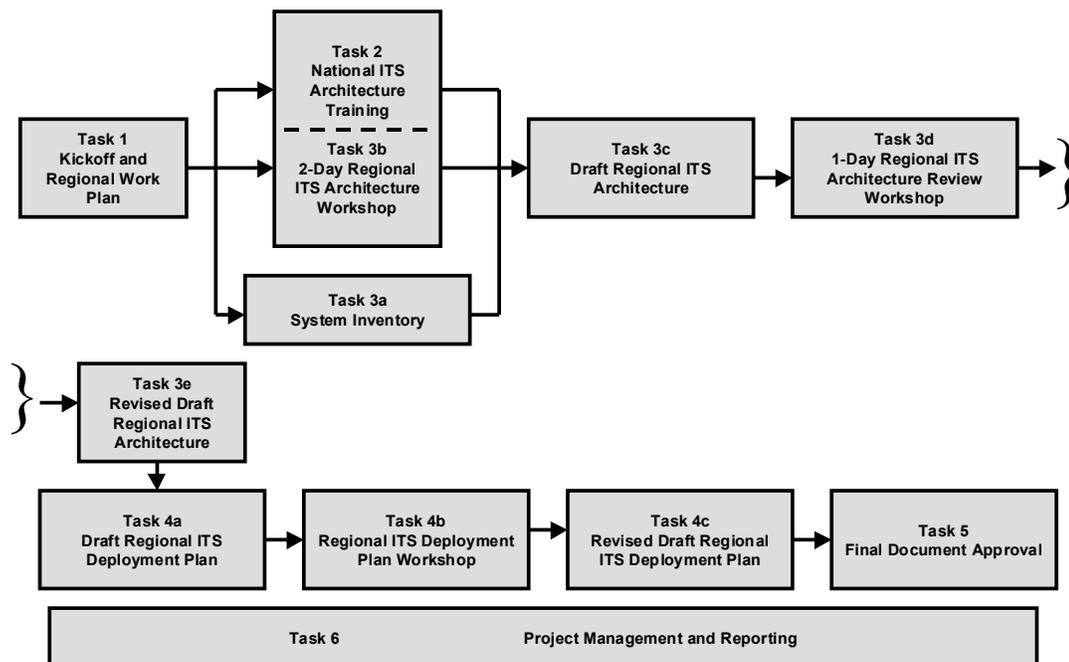

Figure 1 – Amarillo Regional ITS Architecture and Deployment Plan Development Process

OVERVIEW OF THE AMARILLO REGION

The Amarillo Region is located in the Texas Panhandle and is bordered to the west by the state of New Mexico and by Oklahoma to the north and east. The Region corresponds to the 17-county TxDOT Amarillo District, and includes the cities of Amarillo, Pampa, Borger, Hereford, Dalhart, Dumas, and Perryton. **Figure 2** illustrates the Regional boundaries.

The Amarillo Region is predominantly rural in nature, with the City of Amarillo serving as the major population center in the Region. Primary interstate and state routes that traverse the Region include I-40, I-27, US Highway 87/287, US 60, US 83, US 385 and Loop 335. These corridors are key links for inter- and intra-state movement of people and goods. I-40 is one of the most heavily traveled truck routes in the United States. In Texas, I-40 extends from the Texas/New Mexico border, through the City of Amarillo and to the Texas/Oklahoma border. This corridor is not only a primary east-west route through the Panhandle, but is also a key connector for several other major routes in the area. Incidents, hazardous weather conditions, or major delays along I-40 will impact several other routes, and potentially I-40 motorists in neighboring states. There are also long stretches of this corridor through the Region that are not convenient to any alternate routes.

Unique to the Amarillo Region is the US Department of Energy's BWXT Pantex Plant, which is located in Carson County approximately 17 miles northeast of the City of Amarillo. Pantex functions as a weapons evaluation, assembly and disassembly facility, conducts research and development of high explosives, and also serves as an interim plutonium pit storage. Pantex has its own warning system and fire and emergency services units, but due to the nature of this facility it poses significant challenges and safety concerns for evacuation and emergency routing in the Region in the event of a nuclear accident.

In the fall of 2002, the Amarillo Region completed Phase 1 of its ITS implementation, which includes:

- A transportation management center (TMC) at the TxDOT Amarillo District Office;
- ATMS software, developed by TxDOT, to manage and control the system from the TMC;
- Five dynamic message signs (DMS) for motorist information on I-40, I-287 and US 287/87 (all are located near the City of Amarillo);
- Highway advisory radio (HAR), also to provide motorist information;
- Ten closed-circuit television (CCTV) cameras on I-40, I-287 and US 287/87; and
- Telecommunications infrastructure.

With this initial phase in place, there is a foundation for continued ITS deployment and integration in the Region.
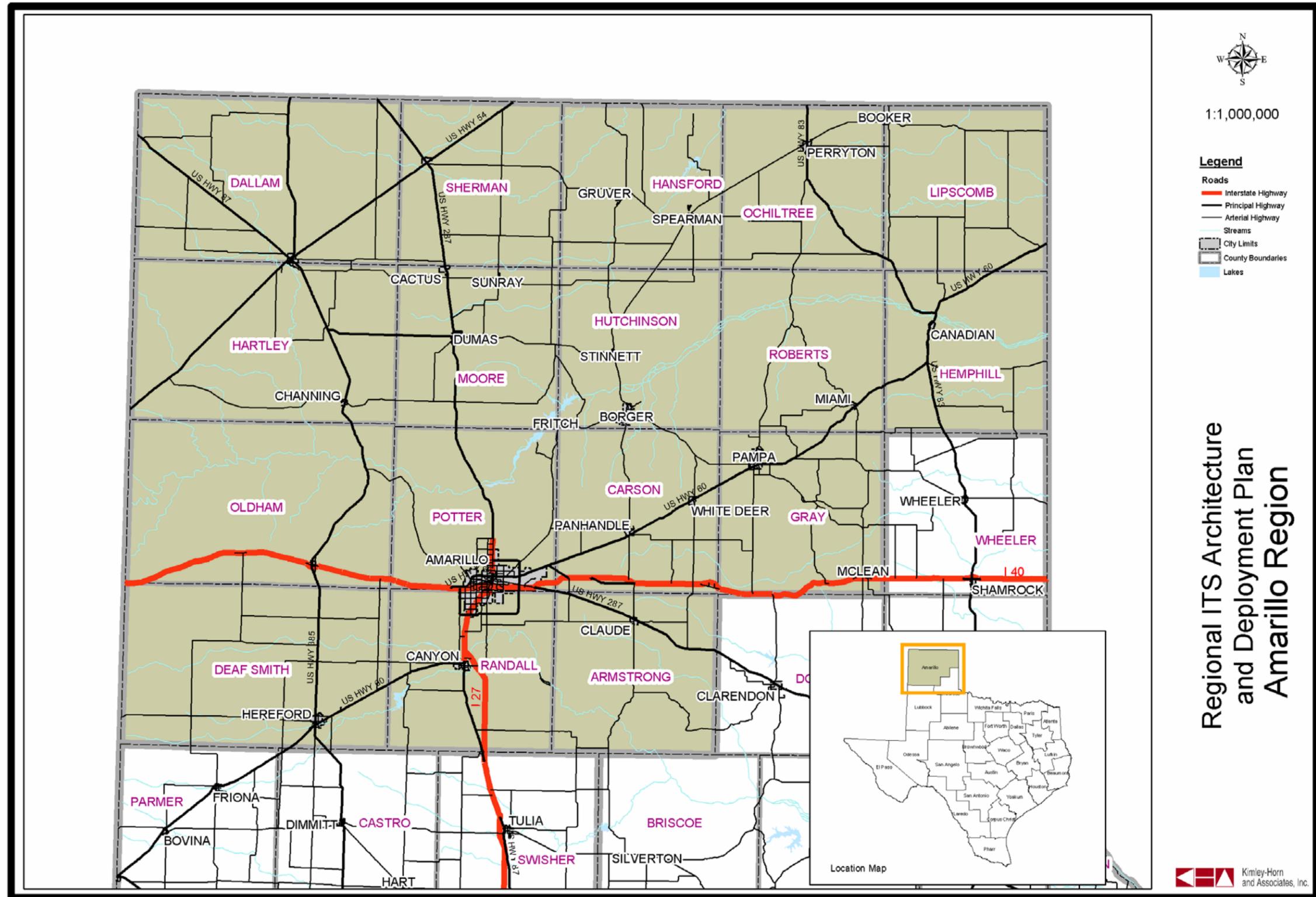
Figure 2 – Amarillo Region

AMARILLO 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 Amarillo Region participated in the development of the Regional ITS Architecture and Deployment Plan, including representatives from TxDOT, Federal Highway Administration, cities, counties, the Texas Department of Public Safety (TxDPS), transit agencies, police and fire, and BWXT Pantex. Stakeholders also included representatives from neighboring states. 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.

Amarillo Region stakeholders included:

- Amarillo Metropolitan Planning Organization (MPO);
- Amarillo/Potter/Randall Department of Emergency Management;
- Arizona Department of Transportation;
- BWXT Pantex Plant (Department of Energy);
- City of Amarillo Fire;
- City of Amarillo Police;
- City of Amarillo Traffic Engineering;
- City of Amarillo Transit;
- City of Dalhart;
- Oldham County;
- FHWA, Texas Division;
- FHWA, Southern Resource Center;
- New Mexico State Highway and Transportation Department;
- Texas Department of Public Safety;
- TxDOT Amarillo District;
- TxDOT Childress District;
- TxDOT Lubbock District;
- TxDOT Witchita Falls District; and
- TxDOT Traffic Operations Division.

AMARILLO REGIONAL ITS ARCHITECTURE

The process for developing the Regional ITS Architecture for Amarillo 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 Amarillo 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

Amarillo's Regional ITS Architecture began with a project kick-off meeting in February of 2002. At that meeting, stakeholders provided information about existing ITS elements deployed in the Region, as well as those that would be completed during the course of the architecture development process, including Phase 1 of Amarillo's ITS program and the ATMS software. A diverse range of needs were identified by stakeholders in the Region. The highest priority needs focused on improving traveler information (particularly during hazardous weather and for closures of major routes), incident management, and enhancing coordination and communication among local and state agencies within the Region as well as with neighboring TxDOT Districts and states. 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 Amarillo Region stakeholders were categorized into functional areas, and are shown in **Table 1**.

Table 1 – Amarillo Region: Summary of ITS Needs

Amarillo Region
Summary of ITS Needs
Amarillo Regional ITS Architecture and Deployment Plan Kick-Off Meeting
February 19, 2002

Institutional Issues and Needs

▪   Need coordination with neighboring states (NM and OK) to share information (closures, restrictions, etc.)

Traffic Management Needs

▪   Need detours for weather and emergencies
▪   Need road closure/detour plans - TxDOT has road closure plan for I-40 only
▪   Need to know locations of trains when stopped
▪   Need flood warning systems, especially for underpasses

Traveler Information Needs

▪   Need to communicate better with travelers (for example, need a way to communicate to motorists about amenities, routes and detours for major closures on I-40)
▪   Need to identify next steps for 511 implementation
▪   Need to reach travelers while en-route
▪   Need more DMS to use for en-route information
▪   Need to provide ramp closure information to travelers
▪   Need to tie in with NOAA for most current weather information

Data Needs (Collecting, Sharing)

▪   Need volume information in and out of specific areas
▪   Need permanent count stations
▪   Need to share road information interstate and interdistrict
▪   Need to coordinate information on freeways and arterials
▪   Need to push data to those that need it

Public Transportation Management Needs

▪   Need for transit operators/agencies to have access to information about closures, maintenance, weather, etc.
▪   Need AVL on vehicles
▪   Need automated fare boxes
▪   Need automated passenger counters
▪   Need to make information available to transit passengers at stops as well as from home or office
▪   Need to notify transit agencies of how many passengers are at stops

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

Commercial Vehicle Operations Needs

- Need early notification and communication with CVO about closures, restrictions, etc. (just-in-time delivery has made this more critical)
- Need Regional study for HAZMAT shipping and routing
- Need to look at possibility of implementing some electronic screening - CVISN is under development

Emergency Management Needs

- Need a center like TranStar to collocate DPS/EOC/Transportation Dispatch
- Need centralized dispatch for Potter and Randall Counties
- Need a common radio frequency for emergency service providers (police, fire, ambulance, TxDPS, EOC, others)
- Need better access and use of CCTV camera systems for emergency agencies
- Need Total Station units for incident investigation in the City of Amarillo (DPS already uses)
- Need a system like LifeLink to share video between ambulance and trauma centers

Maintenance and Construction Operations Needs

- Need automatic guidance for snowplows
- Need speed warnings for work zones
- Need to coordinate Maintenance with Traffic Operations during closures

Other Needs

- Need to look for opportunities to tie the Architecture and Deployment Plan into Homeland Defense/Security where possible
- Need a central, physical location for communications infrastructure sharing
- Need a Telecommunications Study to look at information sharing throughout the state and interstate

Market Packages

A 2-Day ITS Architecture Workshop was held in Amarillo in April 2002. At this workshop, stakeholders were provided with architecture training, including background information about the National ITS Architecture, the purpose and benefits of a regional ITS architecture, as well as the process that would be used to develop the Amarillo Regional ITS Architecture.

The next step in developing the Amarillo Regional ITS Architecture was to identify the services that would be needed to address the stockholder 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,

Surface Street Control, Freeway Control, and Road Weather Data Collection, 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, stakeholders identified 33 as being applicable to the Amarillo Region. A new market package, Emergency Evacuation and Detour Routing, was developed specifically for the Amarillo Region to address evacuation and emergency routing, particularly for incidents near the Pantex plant. This market package brings the total to 34 market packages applicable to the Region.

Interconnects, Interfaces, and Standards

Stakeholders also began the process of mapping existing and planned ITS elements in Amarillo 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 Amarillo Region, which 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 Amarillo.

Kimley-Horn and Associates, Inc.

ConSysTec Corp

Amarillo

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

Information Service Provider Subsystem
- Amarillo City Communicator System
- *Private Sector Traveler Information Services
- SchoolNet Web Server and Web Page
- TxDOT Highway Condition Reporting System
- TxDOT Motor Carrier Routing Information
- TxDOT TMC Amarillo District Webpage

Traffic Management Subsystem
- City of Amarillo TOC
- Other States TMCs
- Other TxDOT District TMCs
- TxDOT Amarillo TMC

Maintenance & Construction Management
- City of Amarillo Maintenance
- County Road and Bridge
- Other States Maintenance Sections
- Private Maintenance Dispatchers
- TxDOT Amarillo District Office
- TxDOT Area Engineering
- TxDOT Rural Maintenance Sections
- TxDOT Urban Maintenance Sections

Emergency Management Subsystem
- Amarillo/Potter/Randall EOC
- City of Amarillo Fire Dispatch
- City of Amarillo Police Dispatch
- DPS Communications Service
- Local City/County EOC
- Local Law Enforcement Dispatch
- Other States EMS
- Other Public Safety Comm, Dispatch Centers and EOCs
- Panhandle Emerg. Medical Services Sys. (PEMSS)
- Pantex EOC
- Prison Operations Centers
- Private Tow/Wrecker Dispatch
- Private Vehicle Emergency Systems
- State EOC
- *TxDOT Courtesy Service Patrol Dispatch

Transit Management Subsystem
- Amarillo City Transit System Dispatch Center
- *Amarillo Transit Information System
- Independent School District Transit Dispatch
- Panhandle Transit Dispatch

Fleet and Freight Management Subsystem
- Private Commercial Vehicle Fleet Mgmt

Archived Data Management Subsystem
- TxDOT Crash Record Information System
- TxDOT Traffic Count Archive

Remote Traveler Support Subsystem
- *Rest Areas/Visitor Centers/Service Plaza Kiosks
- *Transit Kiosks

Personal Information Access Subsystem
- Private Traveler Personal Access Devices

Vehicle Subsystem
- Private Vehicles

Transit Vehicle Subsystem
- Amarillo City Transit Vehicles
- Panhandle Transit Vehicle
- School District Buses

Commercial Vehicle Subsystem
- Commercial Vehicles

Emergency Vehicle Subsystem
- City of Amarillo Fire Vehicles
- City of Amarillo Police Vehicles
- EMS Vehicles
- Highway Patrol Vehicles
- Local Law Enforcement Vehicles
- *TxDOT Courtesy Service Patrol Vehicles

Maint & Const Vehicle Subsystem
- City of Amarillo Maintenance Vehicles
- TxDOT Maintenance and Construction Vehicles

Archived Data User Systems
- TxDOT Amarillo TMC

Asset Management
- BRINSAP - Bridge Inventory Inspection System

Care Facility
- Regional Hospitals

Emergency Telecommunications Systems
- Telco 911 Call Routing

Equipment Repair Facility
- TxDOT District Shop

Event Promoters
- Amarillo Convention and Visitors Bureau Scheduling
- *Local Venue Event Scheduling System

Maintenance and Construction Adm. Sys.
- TxDOT Amarillo District Office
- TxDOT Area Engineering

Media
- Emergency Alerting System
- Print and Broadcast Media

Multimodal Transp. Service Provider
- *Amtrak Passenger Train Terminal

Rail Operations
- Rail Operations

Surface Transportation Weather Service
- *Private Weather Service

Traveler Info Phone System
- *511 System
- Amarillo City Communicator System

Weather Service
- National Weather Service

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

Archived Data User Systems
Asset Management
Care Facility
Emergency Telecom System
Equipment Repair Facility
Event Promoters
Maintenance & Construction Adm. Sys.
Media
Multimodal Transp. Service Provider
Rail Operations
Surface Transp. Weather Svc
Traveler Info Phone System
Weather Service

Wide Area Wireless (Mobile) Communications

Wireline (Fixed-Point to Fixed-Point) Communications

Vehicles
- Vehicle
- Transit Vehicle
- Commercial Vehicle
- Emergency Vehicle
- Maint &Const Vehicle

Vehicle to Vehicle Communications

Dedicated Short Range Communications

Roadside
- Roadway
- Toll Collection
- Parking Management
- Commercial Vehicle Check

Roadway Subsystem
- City of Amarillo Field Equipment
- Pantex Emergency Warning and Notification System
- SchoolNet Weather Station
- TxDOT Amarillo CCTV
- TxDOT Amarillo DMS
- TxDOT Amarillo Field Sensors
- TxDOT Amarillo HAR

Roadway Subsystem
- TxDOT Traffic Signals
- *TxDOT Flood Warning System
- *TxDOT Portable Field Devices
- *TxDOT Roadside Anti-Icing System

Parking Management Subsystem
- *City of Amarillo Airport Parking Management System

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

Figure 3 – Amarillo Regional System Interconnect Diagram

The market packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the Amarillo Region. Each market package was shown graphically, with the market package name, Amarillo-specific element, and with 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 Amarillo Region. This market package shows the two subsystems, Traffic Management and Roadway, and the associated entities (City of Amarillo TOC, and City of Amarillo Field Equipment and TxDOT Amarillo Traffic Signals, respectively) and equipment packages. The equipment packages are the rectangles inside of the subsystems, and represent the functions that deliver a particular service to support the market package. Data flows between the subsystems and the terminators (Other Roadway) indicate what information is being shared. The data flow lines are solid in this market package, which means that these are existing functions and information flows. All of the Amarillo Region market package diagrams are included in the Regional ITS Architecture report.
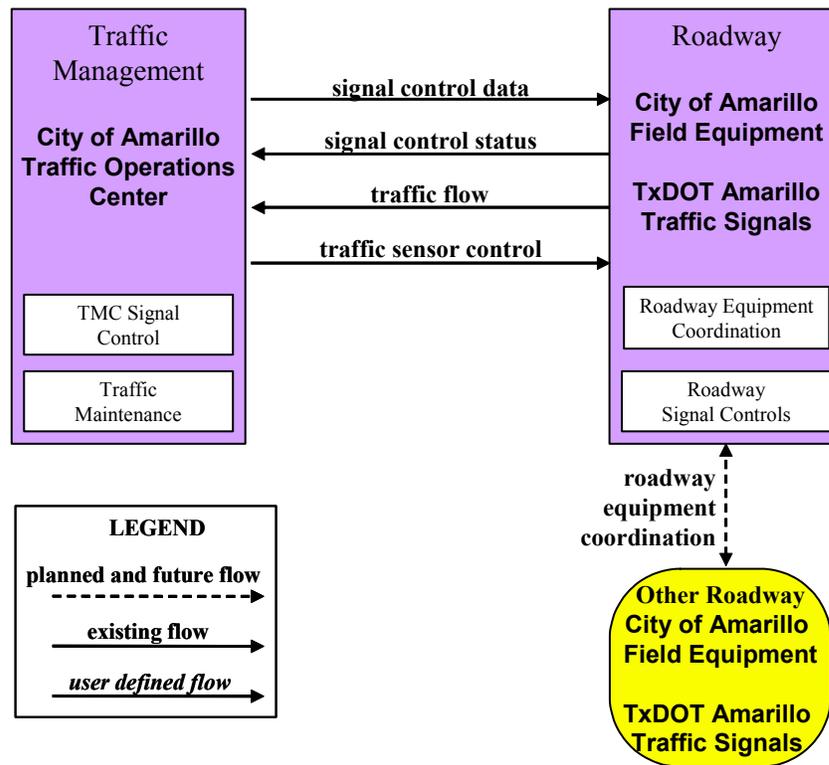
Figure 4 – Customized Market Package for Amarillo Surface Street Control

More detailed interfaces were developed which identified the connectivity between the systems and elements. Each element identified in the ITS Architecture for the Amarillo 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 Amarillo Region. There are 81 different elements identified as part of the Amarillo Regional ITS Architecture. These elements include local and state traffic operations centers, transit vehicles, dispatch systems, emergency management agencies, media outlets, and others – essentially, all of the existing and planned physical components that contribute to the regional intelligent transportation system. Interfaces have been identified for each element in the Amarillo 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** on the following page. This graphic shows the TxDOT Amarillo DMS, and the 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.
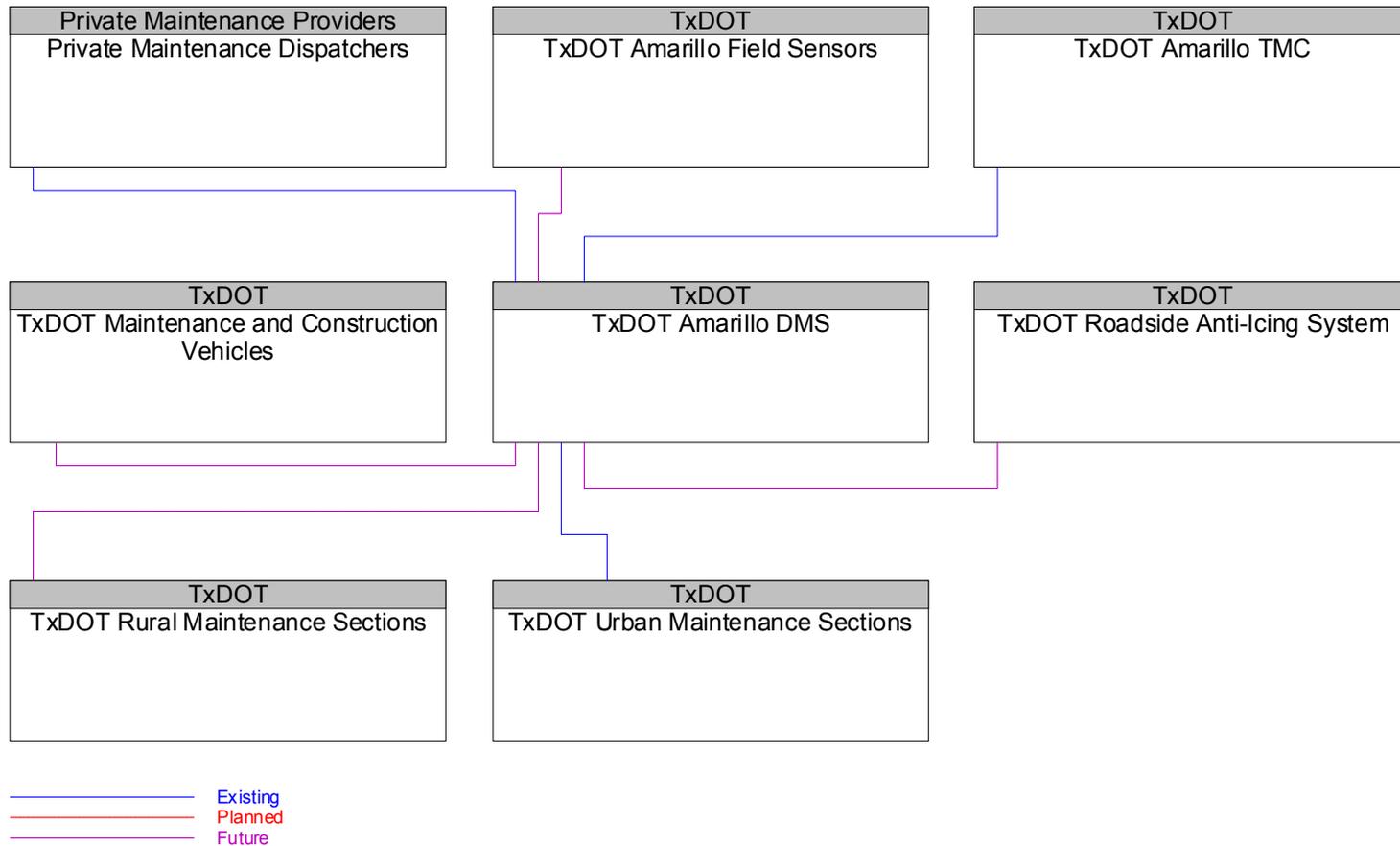
Figure 5 – TxDOT Amarillo DMS Interfaces

An example of the architecture flows between two elements is shown in **Figure 6**. In this interface, the flows between the City of Amarillo Traffic Operations Center (TOC) and the Pantex Emergency Operations Center (EOC) show information that must go from the City of Amarillo TOC to the Pantex EOC, as well as information that the TOC needs from the EOC. 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.
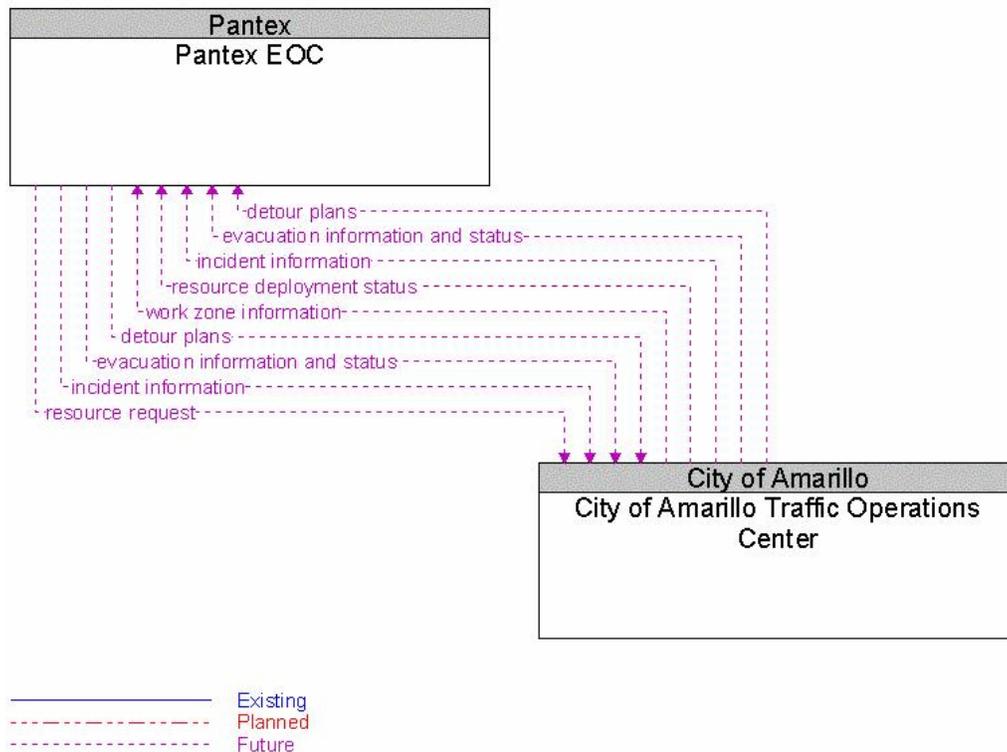
Figure 6 – City of Amarillo TOC to Pantex EOC Architecture Flows

With the required interfaces and interconnections identified, standards that could potentially be applied to the Amarillo Region were identified. Standards are an important tool that will allow efficient implementation of the elements in the Amarillo 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 Amarillo 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 Amarillo Region, two concepts were illustrated. The first was a major winter storm in the Panhandle causing hazardous driving conditions along I-40 and other routes. The operational concept shows, through ITS deployment, agency information sharing, and regional connectivity, agencies are able to work

together and benefit from the technologies and systems in place to proactively manage the Region's transportation system in the event of a major incident and icy driving conditions. The second concept illustrates a sequence of events during a tornado, and how TxDOT, emergency services, public safety, and other key agencies can put pre-determined strategies into effect as well as utilize technology and communications infrastructure to alert residents and respond effectively.

Agreements

Interfaces and data flows among public and private entities in the Amarillo 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 Amarillo 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 Amarillo Region based on the interfaces identified in the Regional ITS Architecture and recommended ITS projects in the Deployment Plan:

- Update the current Municipal Maintenance Agreements between TxDOT and cities in the Region;
- 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 emergency services agencies;
- Mutual Aid Agreements among public sector agencies, primarily fire, police, emergency services and TxDOT; and
- Joint Operations and Shared Control Agreements between TxDOT and the City of Amarillo.

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 Amarillo 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 Amarillo 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 Architecture was also 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 Amarillo 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 Amarillo. TxDOT plans to permanently host the site in the future at www.dot.state.tx.us/trf/its.

AMARILLO 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 Amarillo Regional ITS Architecture, TxDOT chose to expand on the project sequence requirement to develop a formal ITS Deployment Plan for the Region.

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

Prioritized Market Packages

Market packages for the Amarillo 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 Amarillo Region. These priorities identified the key needs and services that are desired in the Amarillo 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 five, ten or twenty 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 Amarillo 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 Amarillo Region, such as network surveillance, surface street control, freeway control and traffic information dissemination.

Table 2 – Summary of Prioritized Market Packages for the Amarillo Region

High Priority	Medium Priority	Low Priority
▪ Network Surveillance	▪ Standard Railroad Grade Crossing	▪ Probe Surveillance
▪ Surface Street Control	▪ Railroad Operations Coordination	▪ Parking Facility Management
▪ Freeway Control	▪ Maintenance and Construction Vehicle Maintenance	▪ Roadway Maintenance and Construction
▪ Traffic Information Dissemination	▪ Winter Maintenance	▪ ISP-based Route Guidance
▪ Regional Traffic Control and Coordination	▪ Transit Fixed-Route Operations	▪ Mayday Support
▪ Incident Management System	▪ Demand Response Transit Operations	▪ Roadway Service Patrol
▪ Road Weather Data Collection	▪ Transit Passenger and Fare Management	▪ Work Zone Safety Monitoring
▪ Weather Information Processing and Distribution		
▪ Work Zone Management		
▪ Maintenance and Construction Vehicle Tracking		
▪ Maintenance and Construction Activity Coordination		
▪ Roadway Automated Treatment		
▪ Transit Vehicle Tracking		
▪ Transit Security		
▪ Transit Traveler Information		
▪ Broadcast Traveler Information		
▪ Emergency Response		
▪ Emergency Routing		
▪ Emergency Evacuation and Detour Routing		
▪ 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 Amarillo Region. Each market package analysis included:

▪ A brief definition of the market package (modified from the National ITS Architecture definitions);

▪ Any infrastructure from that market package that is already existing in the Amarillo 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 Amarillo 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 Amarillo Region was developed. These projects were refined and additions and deletions were made by the Regional stakeholders at the Deployment Plan Workshop in August of 2002.

Recommended ITS projects for the Amarillo 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 Amarillo Region are infrastructure based; however, there are some recommendations, such as enhanced coordination with local media, interstate coordination, Communications Master Plan, and others that focus more on planning or institutional practices rather than deploying specific technologies.

Each recommended project for the Amarillo 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 Amarillo 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 freeway and arterial management, traveler information, and inter-agency coordination elements.

Table 3 – Recommended ITS Projects for the Amarillo Region

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Travel and Traffic Management		
Short Term Projects 5-year Horizon	TxDOT Amarillo TMC Expanded Operations	No
	TxDOT Amarillo Phase 2 ITS Implementation	No
	TxDOT Closed Loop Signal System Expansion Phase 1	No
	TxDOT Rest Area Traveler Information Signs	No
	TxDOT Center-to-Center Communications	Yes (TxDOT)
	Interstate Coordination Phase 1	No
	Amarillo TOC/TxDOT TMC Fiber Connection	No
	Amarillo Traffic Control System Expansion Phase 1	Yes (TxDOT)
	Amarillo Video Image Vehicle Detectors (VIVDS) Expansion Phase 1	No
	Amarillo Regional Communications Master Plan	No
	Media Liaison and Coordination	N/A
	Rural Texas School Flashers Paging System	No
	TxDOT Flood Detection Stations	No
	Amarillo Flood Detection Stations	No
Mid Term Projects 10-year Horizon	TxDOT Amarillo Phase 3 ITS Implementation	No
	TxDOT Amarillo Phase 4 ITS Implementation	No
	TxDOT Closed Loop Signal System Expansion Phase 2	No
	Amarillo Traffic Control System Expansion Phase 2	No
	Interstate Coordination Phase 2	No
	Regional 511 Advanced Traveler Information System Server	No
	Amarillo School Flashers Paging System	No
	Amarillo VIVDS Expansion Phase 2	No
	Route 87/Dalhart RR Crossing Enhancements	No
	Parking and Event Management System Phase 1	No
Long Term Projects 20-year Horizon	TxDOT Amarillo ITS Implementation (Additional Phases beyond Phase 4)	No
	TxDOT Closed Loop Signal System Expansion Phase 3	No
	I-40 Alternate Route Detection	No
	Amarillo Traffic Control System Phase 3	No
	ISP-Based Route Guidance Support	No
	Parking and Event Management System Phase 2	No
	Probe Surveillance	No

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

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Emergency Management		
Short Term Projects 5-year Horizon	Amarillo/Randall/Potter Emergency Operation Center (EOC)/TxDOT TMC Connection	No
	TxDPS/TxDOT TMC Connection	No
	TxDPS Automated Accident Investigation System	No
	Amarillo Fire/TxDOT TMC Connection	No
	Amarillo Police/TxDOT TMC Connection	No
	Amarillo Police Automated Accident Investigation System	No
	Pantex/TxDOT TMC Connection	No
	Inter-agency Common Radio Frequency	No
Mid Term Projects 10-year Horizon	TxDOT Computer Aided Dispatch (CAD)	No
	Emergency Vehicle Traffic Signal Preemption	No
	Agency Collocation	No
	Roadway Service Patrol	No
Long Term Projects 20-year Horizon	TxDPS Computer Aided Dispatch (CAD)	No
	Mayday Support	No
Maintenance and Construction Operations		
Short Term Projects 5-year Horizon	TxDOT Highway Condition Reporting System (HCRS) Enhancements	Yes (TxDOT)
	TxDOT Road Weather Information Systems (RWIS) Expansion	No
	Automated Anti-Icing Treatment	No
	TxDOT Work Zone Speed Trailers	No
	TxDOT CB Wizard Alert System	No
	TxDOT/SchoolNet Link	No
	Amarillo Road Weather Information Systems (RWIS)	No
Mid Term Projects 10-year Horizon	TxDOT Maintenance Vehicle AVL	No
	TxDOT Computer Aided Snowplow Dispatching	No
Long Term Projects 20-year Horizon	Automated Snowplows	No

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

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Public Transportation Management		
Short Term Projects 5-year Horizon	Amarillo City Transit Security Cameras	Yes (Amarillo City Transit)
	Amarillo City Transit Automatic Vehicle Location (AVL)	No
	Panhandle Community Services Transit Operations Center (TOC) with Computer Aided Dispatch (CAD) System	No
	Panhandle Community Services Automatic Vehicle Location (AVL) and Mobile Data Terminals (MDT)	No
Mid Term Projects 10-year Horizon	Amarillo City Transit Transfer Station Traveler Information	No
	Amarillo City Transit Electronic Fare Collection System	No
	Panhandle Community Services Transit Security Cameras	No
	Panhandle Community Services Electronic Fare Collection System	No
Long Term Projects 20-year Horizon	Amarillo City Transit Traveler Information System	No
	Panhandle Community Services Transit Traveler Information System/Travel Data and Route Guidance	No
	Panhandle Community Services Automatic Passenger Counters	No
Information Management		
Short Term Projects 5-year Horizon	ITS Data Mart	No
Mid Term Projects 10-year Horizon	None Identified	No
Long Term Projects 20-year Horizon	None Identified	No

MAINTAINING THE REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN

With the substantial amount of effort invested by stakeholders in the Amarillo Region to develop both the Regional ITS Architecture and the Deployment Plan, developing a plan for maintaining these important tools was a key component of the process.

At the Comment Resolution Meeting held in Amarillo in December 2002, stakeholders agreed that both the Regional ITS Architecture and Deployment Plan would need to be periodically reviewed and potentially updated in order to reflect current deployment status as well as re-evaluate priorities. A two-year timeframe was selected by the stakeholders for this review to correspond with the Amarillo MPO's Transportation Improvement Plan updates. The TxDOT Amarillo District was identified as the agency that should take the lead in maintaining and updating the Region's ITS Architecture and Deployment Plan, with support from a multijurisidictional committee in the Region. This group would also provide input to the Amarillo MPO TIP planning process.

New market packages are added to the National ITS Architecture every few years, and with the increasing emphasis on homeland security issues, it is envisioned that there will be additional market packages focused on addressing homeland security and emergency management. New federal initiatives, such as AMBER Alert and 511, could also generate a new or updated category of market packages within the National ITS Architecture. Amarillo stakeholders agreed that it would be beneficial to review any modifications to the National ITS Architecture as well as any USDOT/FHWA guidance on an as-needed basis, and identify any additions or modifications that should be considered for the Amarillo Regional ITS Architecture.

Stakeholders in the Region placed a stronger emphasis on reviewing the Regional ITS Deployment Plan in order to determine which of the short-term projects have the highest priority for the Region, as well as to update the status of short-term projects. This review would be particularly beneficial if funding opportunities arise. As part of the review, projects can be removed that are already underway or deployed, and priorities can be assessed again as more ITS infrastructure is put in place.

MEMORANDUM OF UNDERSTANDING

As a final step in the development of the Amarillo Regional ITS Architectures 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 system in the Amarillo 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.

Although there were a number of other very important stakeholders participating in the project, 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. These stakeholders had also signed a MOU developed prior to the start of the project that was necessary to obtain the federal funding to complete the Regional ITS Architecture and Deployment Plan. Stakeholder agencies that were asked to sign the MOU for the Amarillo Regional ITS Architecture and Deployment Plan included the following:

- Amarillo MPO;
- City of Amarillo;
- New Mexico State Highway and Transportation Department;
- Texas Department of Public Safety; and
- Texas Department of Transportation.