



State of Texas
ITS Architectures and Deployment Plans

Amarillo Region

Regional ITS Deployment Plan

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LIST OF ACRONYMS

AD	Archived Data
ADA	Americans with Disabilities Act
ADOT	Arizona Department of Transportation
APTS	Advanced Public Transportation Systems
ATIS	Advanced Travel Information System
ATMS	Advanced Traffic Management System
AVL	Automatic Vehicle Location
C2C	Center-to-Center
CAD	Computer Aided Dispatch
CB	Citizen Band
CCTV	Closed-Circuit Television
CDOT	Colorado Department of Transportation
DMS	Dynamic Message Sign
EM	Emergency Management
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
HAR	Highway Advisory Radio
HCRS	Highway Condition Reporting System
HRI	Highway-Rail Intersections
ISP	Information Service Provider
ITS	Intelligent Transportation System
IVU	In-Vehicle Units
KDOT	Kansas Department of Transportation
LED	Light Emitting Diode

LIST OF ACRONYMS

MC	Maintenance and Construction
MDT	Mobile Data Terminals
MPO	Metropolitan Planning Organization
NMSHTD	New Mexico State Highway Transportation Department
NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol
ODOT	Oklahoma Department of Transportation
OM&M	Operations, Management, and Maintenance
PEMSS	Panhandle Emergency Medical Services System
PSAP	Public Safety Access Point
RWIS	Road Weather Information System
TEA-21	Transportation Equity Act for the 21st Century
TM	Traffic Management
TMC	Transportation Management Center
TOC	Traffic Operations Center Transit Operations Center
TxDOT	Texas Department of Transportation
TxDPS	Texas Department of Public Safety
UDOT	Utah Department of Transportation
VIVDS	Video Image Vehicle Detection System

SUMMARY

In January 2001, 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) requiring that Intelligent Transportation System (ITS) projects funded through the Highway Trust Fund conform to the National ITS Architecture and applicable standards.

To meet these requirements the Texas Department of Transportation (TxDOT) initiated the development of Regional ITS Architectures and Deployment Plans throughout the State of Texas. Although not required by the FHWA final rule, TxDOT took the opportunity to also develop an ITS Deployment Plan for each Region. The Amarillo Region in the Texas Panhandle was the first in the series of Regional ITS Architectures and Regional ITS Deployment Plans to be prepared as part of this initiative.

The Regional ITS Deployment Plan for the Amarillo Region outlines a vision for ITS deployment, and identifies and prioritizes projects that are needed to implement the ITS architecture on a short, medium, and long-term basis. In doing so, this plan also helps the Region to prioritize funding decisions. As infrastructure is incrementally built-out over a 20-year horizon, integration among key foundation systems in the Region can occur as the system grows and expands.

Stakeholders from throughout the Region participated in the development of the Regional ITS Deployment Plan. Participants included 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 and surrounding TxDOT Districts.

Building on the dialogue, consensus and vision outlined in the Regional ITS Architecture, stakeholders in the Amarillo Region prioritized market packages and potential ITS projects for deployment in the Region. Projects were identified to correspond to the needs and priorities identified by the regional stakeholders, and were categorized into 5-year, 10-year and 20-year timeframes. During the development of the Regional ITS Deployment Plan, the TxDOT Amarillo District successfully implemented its Phase 1 ITS program, which included closed circuit television (CCTV) cameras, dynamic message signs (DMS), and a traffic management center (TMC) with advanced traffic management system (ATMS) software at the TxDOT Amarillo District Office. This initial phase provides a foundation for continued deployment of ITS in the Region.

The majority of ITS projects recommended for the Amarillo Region were identified in the following key areas:

- Traffic and Travel Management;
- Emergency Management;
- Maintenance and Construction Operations; and
- Public Transportation Management.

Recommended ITS projects in the 5-year, 10-year, and 20-year deployment timeframes were summarized in tables for each deployment horizon. This summary included the project name and a brief description, primary responsible agency, a planning level estimate of probable cost, an indication of whether or not funding had been identified for that project, as well as an estimated duration for implementation. For each recommended ITS project, more detailed project descriptions were developed which mapped each project back to applicable market packages and also identified any prerequisite project requirements.

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. 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 multijurisdictional committee in the Region. This group will also provide input to the Amarillo MPO TIP planning process.

1. INTRODUCTION

1.1 Project Overview

The FHWA final rule to implement Section 5206(e) of TEA-21 requires that ITS projects funded through the Highway Trust Fund conform to the National ITS Architecture and applicable standards. The rule requests that the National ITS Architecture be used to develop a local implementation of the National ITS Architecture, which is referred to as a “Regional ITS Architecture.”

In order to meet these requirements, TxDOT initiated the development of Regional ITS Architectures and Deployment Plans throughout the State of Texas. Although not required by the FHWA final rule, TxDOT sought to expand the project sequence requirement and have an ITS deployment plan developed for each Region. The ITS deployment plan outlines a vision for ITS deployment in the region, and identifies and prioritizes projects that are needed to implement the ITS architecture on a short, medium, and long-term basis. In doing so, this plan also helps the Region to prioritize funding decisions by having a comprehensive, phased approach to the Regional ITS programs, so that the infrastructure can be incrementally built-out over a 20-year horizon, and integration among key foundation systems in the region can occur as the system grows and expands.

The ITS Deployment Plan for the Amarillo Region was developed using the Regional ITS Architecture developed in 2002. Through the architecture development process, stakeholders reached consensus on the transportation needs in the region that could be addressed with ITS, worked with the architecture team to customize and prioritize market packages that formed the basis for the deployment plan, and identified the required interfaces to provide the desired level of integration of systems and agencies within the Amarillo 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 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.

1.2 Document Overview

The Amarillo Regional ITS Deployment Plan is organized into four key sections:

Section 1 – Introduction

This section provides a brief overview of the State of Texas Regional ITS Architectures and Deployment Plans Program, the ITS Deployment Plan for the Amarillo Region, as well as an overview of some of the key features and stakeholders in the Amarillo Region.

Section 2 – Prioritization of Market Packages

Section 2 contains the prioritized market packages for the Amarillo Region. Included in this section is an overview of the prioritization process, and detailed descriptions of the high, medium and low priority market packages.

Section 3 – Prioritization of Planned Projects

Project recommendations have been developed for the Amarillo Region to provide an incremental, phased build-out of the Region’s ITS. These projects are categorized into five, ten and twenty year deployment timeframes. Each project recommendation includes a brief description, responsible agency, associated market package, pre-requisite projects or systems, and an estimate of probable cost. These recommendations took into consideration existing as well as planned ITS deployments in the Amarillo Region.

Section 4 – Procedure for Submitting ITS Projects

A procedure for maintaining the ITS Deployment Plan and submitting new projects to add to the plan is recommended in this section.

1.3 The Amarillo Region

1.3.1 Geography and Regional Characteristics

The Amarillo Region in the Texas Panhandle corresponds with the TxDOT Amarillo District, one of 25 Districts throughout the state. The Amarillo Region is bordered by New Mexico to the west, Oklahoma to the north and east, the TxDOT Childress District to the southeast, and the TxDOT Lubbock District to the south.

There are 17 counties within this region:

- Armstrong;
- Carson;
- Dallam;
- Deaf Smith;
- Gray;
- Hansford;
- Hartley;
- Hemphill;
- Hutchinson;
- Lipscomb;
- Moore;
- Ochiltree;
- Oldham;
- Potter;
- Randall;
- Roberts; and
- Sherman.

Major cities in the Region include Amarillo, Pampa, Borger, Hereford, Dalhart, Dumas, Perryton, and Canyon.

Located in the Amarillo Region is the U.S. Department of Energy’s Pantex Plant, approximately 17 miles northeast of Amarillo. Pantex serves as a weapons evaluation and storage facility, and is responsible for assembly and disassembly, high explosive research and development, and also interim plutonium pit storage. Because of the nature of this facility, Pantex and local agencies have implemented some emergency management strategies and systems, including broadcast warnings that can be operated by the Pantex Emergency Operations Center as well as the County emergency agencies in the event of a major incident at the complex.

1.3.2 Transportation Infrastructure

Interstate 40 traverses the Panhandle and is an east/west, four-lane divided interstate highway, which expands to six lanes in the City of Amarillo. This highway is a major

interstate that is critical to the movement of people and goods not only through the Amarillo Region, but also the entire southern portion of the United States. A major incident along I-40 or hazardous weather causing treacherous conditions on the highway, be it in Texas or the neighboring corridor states of New Mexico or Oklahoma, could have a significant impact on I-40 and on the nearby state routes and corridors. Other key transportation facilities within the Region include I-27, a primary route from Amarillo to Lubbock, and US 287, an important gateway from the Region to the Dallas/Fort Worth area. To the north, US 287 coexists with US 87 until Dumas where it splits from US 87 and extends northward to Denver, Colorado.

The City of Amarillo operates a fixed-route transit system that serves the metropolitan area. Outside of the city, transit services are somewhat limited, but there are demand-responsive (or paratransit) services available through Panhandle Transit, a unit of Panhandle Community Services that serves the rural communities of north Texas and Oklahoma.

1.3.3 Existing ITS in the Amarillo Region

There are several ITS programs and initiatives underway in the Region that are in various stages of implementation. TxDOT has embarked on a multi-year program to implement traffic management and traveler information systems in the region, including DMS, Highway Advisory Radio (HAR), video surveillance, and a central control software system. The ATMS software developed by the TxDOT Traffic Operations Division in Austin integrates the various subsystems deployed in Amarillo. The software has been implemented at TxDOT's TMC in Amarillo. The TxDOT District signal shop supports video image detection and closed loop signal systems in several cities in the region. These closed loop systems are interconnected by radio to a Master controller at the signal shop.

The City of Amarillo has a Traffic Operations Center (TOC) that serves as a hub for the city's traffic control system. Technologies that are already in place include signal preemption for fire and ambulance vehicles. Video image detection is planned for several intersections. Amarillo Transit is also implementing security cameras on all fixed route transit buses and paratransit vehicles.

Emergency services and public safety agencies in the region also are utilizing technology to improve incident management and emergency response. City of Amarillo Police and Fire use computer-aided dispatch (CAD), and there are mobile data terminals in the police and fire vehicles with additional units planned for implementation. The Amarillo/Potter/Randall Emergency Operation Center (EOC) serves as a central coordinating point during major emergencies in the Amarillo urban area. Local County EOCs coordinate resources for needs in the rural areas.

1.3.4 Amarillo Stakeholders

A diverse group of stakeholders provided ongoing input and guidance to the development of the ITS Architecture and Deployment Plan for the Amarillo Region. By having input from several perspectives, including federal, state, county, local, emergency services, public safety and transit, the resulting deployment plan and vision is an accurate reflection of the needs and unique issues in the Amarillo Region. Because of Amarillo's proximity to other states and the common corridors that transcend Amarillo's geographic boundaries, it was important to have input and participation from neighboring states, including New Mexico, Oklahoma, and Arizona as well as adjacent TxDOT Districts.

The following is a list of stakeholder agencies in the Amarillo Region that have participated in the project workshops or provided input to the study team:

- Amarillo 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; and
- TxDOT Traffic Operations Division (Austin).

Representatives from other TxDOT Districts and an Area Office also attended the Amarillo kick-off meeting and provided input, but are not directly involved in the project. These included the Childress, Lubbock and Wichita Falls Districts, and the Wellington Area Office.

Key stakeholder agencies that are participating in the development of the Amarillo Regional ITS Deployment Plan are listed in **Table 1**.

Table 1 – Amarillo Stakeholders and Contacts

Stakeholder Agency	Contact	Address	Phone Number	E-mail
Amarillo MPO	Gary Holwick	P.O. Box 1971 Amarillo, Texas	(806) 378-3000, ext. 2219	gary.holwick@ci.amarillo.tx.us
Amarillo/Potter/Randall Department of Emergency Management	Walt Kelley	P.O. Box 1971 Amarillo, Texas 79105	(806) 378-3022	walt.kelley@ci.amarillo.tx.us
Arizona Department of Transportation	Jeff Swan	2407 East Navajo Boulevard Holbrook, Arizona 86025	(520) 524-6801, ext. 208	jswan@dot.state.az.us
BWXT Pantex (Dept. of Energy)	Alphonso Vaughn	P.O. Box 30020 Amarillo, Texas 79120	(806) 477-5875	avaughn@pantex.com
BWXT Pantex (Dept. of Energy)	Dennis Prather	Building 12132 P.O. Box 30030 Amarillo, Texas 79120	(806) 477-3000	dprather@pantex.com
BWXT Pantex (Dept. of Energy)	Ken Meyers	P.O. Box 30030 Amarillo, Texas 79120	(806) 477-3178	kemyers@pantex.com
City of Amarillo Fire	Joe Neeley	400 South Van Buren Street Amarillo, Texas 79101	(806) 378-3061	N/A
City of Amarillo Planning	Harold McDaniel	P.O. Box 1971 Amarillo, Texas 79105	(806) 378-3022	harold.mcdaniel@ci.amarillo.tx.us
City of Amarillo Police	Dean Coleman	200 East 3 rd Avenue Amarillo, Texas 79101	(806) 378-4250	dean.coleman@ci.amarillo.tx.us
City of Amarillo Traffic Engineering	Taylor Withrow	P.O. Box 1971 Amarillo, Texas 79105	(806) 378-4218	taylor.withrow@ci.amarillo.tx.us
City of Amarillo Transit	Judy Phelps	P.O. Box 1971 Amarillo, Texas 79105	(806) 378-3095	judy.phelps@ci.amarillo.tx.us
City of Dalhart	Tom Morris	110 Denrock Dalhart, Texas 79022	(806) 244-5454	dugsdad@hotmail.com
FHWA, Southern Resource Center	Daniel Grate, Jr.	61 Forsyth Street, Suite 17T26 Atlanta, Georgia 30303-3104	(404) 562-3912	daniel.grate@fhwa.dot.gov
FHWA, Texas Division	Mark Olson	300 East 8th Street, Room 826 Austin, Texas 78701	(512) 536-5972	mark.olson@fhwa.dot.gov
New Mexico State Highway and Transportation Depart.	Pamela Munn-Bell	1120 Cerillos Road, SB1 Santa Fe, NM 87501	(505) 827-3259	pamela.munn-bell@nmshtd. state.nm.us
New Mexico State Highway and Transportation Depart.	Terry Doyle	7500 East Frontage Road Albuquerque, NM 87109	(505) 841-2784	terrence.doyle@nmshtd. state.nm.us
Oldham County	Judge Don Allred	P.O. Box 195 Vega, Texas 79092	(806) 267-2607	dnallred@amaonline.com
Texas Department of Public Safety	Rusty Davis	4200 Canyon Drive Amarillo, Texas	(806) 468-1300	rusty.davis@txdps.state.tx.us
Texas Department of Public Safety	Robert Byrd	P.O. Box 31960 Amarillo, Texas 79120	(806) 468-1300	robert.byrd@txdps.state.tx.us
TxDOT Amarillo District	Chris Freeman	5715 Canyon Drive Amarillo, Texas 79105	(806) 356-3290	cfreema@dot.state.tx.us
TxDOT Amarillo District	Randy Hochstein	5715 Canyon Drive Amarillo, Texas 79105	(806) 356-3240	rhochst@dot.state.tx.us
TxDOT Amarillo District	Mark Tomlinson	5715 Canyon Drive Amarillo, Texas 79105	(806) 356-3201	mtomlin@dot.state.tx.us

Table 1 – Amarillo Stakeholders and Contacts (continued)

Stakeholder Agency	Contact	Address	Phone Number	E-mail
TxDOT Amarillo District	David Miller	5715 Canyon Drive Amarillo, Texas 79105	(806) 356-3291	dmiller@dot.state.tx.us
TxDOT Amarillo District	Michael Taylor	5715 Canyon Drive Amarillo, Texas 79105	(806) 356-3270	mtaylor@dot.state.tx.us
TxDOT Amarillo District	Robin Frisk	5715 Canyon Drive Amarillo, Texas 79105	(806) 356-3292	rfrisk@dot.state.tx.us
TxDOT Amarillo District	Tonya Detten	5715 Canyon Drive Amarillo, Texas 79105	(806) 356-3256	tdetten@dot.state.tx.us
TxDOT Childress District	Clyde Harper	7599 US Highway 287 Childress, Texas 79201	(940) 937-7185	charper@dot.state.tx.us
TxDOT Childress District	Craig Clark	7599 US Highway 287 Childress, Texas 79201	(940) 937-7135	ccclark3@dot.state.tx.us
TxDOT Childress District	Danny Brown	7599 US Highway 287 Childress, Texas 79201	(940) 937-7249	dbrown3@dot.state.tx.us
TxDOT Childress District	Terry Keener	7599 US Highway 287 Childress, Texas 79201	(940) 937-7147	tkeener@dot.state.tx.us
TxDOT Childress District	Tracy Cain	16215 FM 338 Wellington, Texas 79095	(806) 447-5137	tcain@dot.state.tx.us
TxDOT Lubbock District	Randy Hopmann	P.O. Box 771 Lubbock, Texas 79408	(806) 745-4411	rhopman@dot.state.tx.us
TxDOT Lubbock District	Ted Copeland	P.O. Box 771 Lubbock, Texas 79408	(806) 748-4429	tcopela@dot.state.tx.us
TxDOT Traffic Operations Division (Austin)	Bernie Walker	TRF-TM 125 E. 11 th Street Austin, Texas 78701-2483	(512) 416-3467	bwalker@dot.state.tx.us
TxDOT Traffic Operations Division (Austin)	Charles Brindell	TRF-TM 125 E. 11 th Street Austin, Texas 78701-2483	(512) 416-3268	cbrinde@dot.stat.tx.us
TxDOT Traffic Operations Division (Austin)	Janie Light	TRF-TM 125 E. 11 th Street Austin, Texas 78701-2483	(512) 416-3258	jlight@dot.state.tx.us
TxDOT Wichita Falls District	Davis Powell	1601 Southwest Parkway Wichita Falls, Texas 76302	(940) 720-7717	dpowel2@dot.state.tx.us

2. PRIORITIZATION OF MARKET PACKAGES

2.1 Prioritization Process

Of the 75 available market packages in the National ITS Architecture, 33 were selected and customized for deployment in the Amarillo Region. An additional market package, Emergency Evacuation and Detour Routing, was also created to address needs of stakeholders in the Region. Stakeholders were asked to prioritize the market packages into high, medium, and low priorities, based on regional needs, feasibility and likelihood of deployment, and overall contribution of the market package to the goals and vision for ITS functionality in the Region. A summary of these prioritized market packages is shown in **Table 2**.

The market package prioritization was a key factor in developing recommendations for ITS deployment and integration in the Amarillo Region. These priorities identified the 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 communications between elements.

This section includes detailed descriptions of the prioritized market packages for the Amarillo Region. The market packages are organized into high, medium and low priorities. It is important to note that the high, medium and low prioritization does not necessarily correspond to any specific time frame (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. Other considerations included whether or not the market package was better suited for private deployment and operations rather than public. As an example, ISP-based Route Guidance might be viewed as a valuable traveler information service for motorists in the region, but stakeholders felt this market package was best suited for deployment by a private service provider, and as such, deemed it a low priority for agencies in the Region.

Each market package in the following subsections includes:

- 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.

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

High Priority	Medium Priority	Low Priority
<ul style="list-style-type: none"> ▪ Network Surveillance ▪ Surface Street Control ▪ Freeway Control ▪ Traffic Information Dissemination ▪ Regional Traffic Control and Coordination ▪ Incident Management System ▪ Road Weather Data Collection ▪ 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 	<ul style="list-style-type: none"> ▪ Standard Railroad Grade Crossing ▪ Railroad Operations Coordination ▪ Maintenance and Construction Vehicle Maintenance ▪ Winter Maintenance ▪ Transit Fixed-Route Operations ▪ Demand Response Transit Operations ▪ Transit Passenger and Fare Management 	<ul style="list-style-type: none"> ▪ Probe Surveillance ▪ Parking Facility Management ▪ Roadway Maintenance and Construction ▪ ISP-based Route Guidance ▪ Mayday Support ▪ Roadway Service Patrol ▪ Work Zone Safety Monitoring

2.2 High Priority Market Packages

Market packages that were selected as high priorities for the Amarillo Region are listed and described in **Table 3**. These market packages typically represent systems or functions that serve as foundations for which to build regional ITS programs. Listed in this section are market packages that address baseline control and monitoring technologies for surface streets and freeways, road/weather conditions data gathering, and for coordinating incident management and emergency response services.

Many of these high priority market packages have components that are in various stages of deployment and operation in the Amarillo Region; that is, there are already systems and technologies deployed to deliver some of these high priority services and functions. For example, the City of Amarillo has a traffic signal system in place that is monitored by a TOC, which is a key component of the Surface Street Control market package. Although a signal system and TOC are in place, this market package is still listed as a high priority. There are additional capabilities and functionality as part of this market package that are planned for implementation in the near-term, thus building on the existing infrastructure and expanding the services of this particular market package in the Amarillo Region.

Stakeholders identified a need for a new market package for the Region to support evacuations and emergency detour routing, particularly for incidents at the BWXT Pantex Plant. Although this market package is not defined in the National ITS Architecture, a customized market package (Emergency Evacuation and Detour Routing) was developed and included in the high priorities.

Table 3 – High Priority Market Packages for the Amarillo Region

Network Surveillance (ATMS01)	High Priority
<p>This market package includes traffic detectors, other surveillance equipment, the supporting field equipment, and wireline communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally or remotely. The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect equipment faults, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo TMC ▪ TxDOT ATMS ▪ TxDOT Amarillo Phase 1 ITS Implementation ▪ City of Amarillo TOC ▪ TxDOT Amarillo CCTV Cameras ▪ City of Amarillo Video Image Vehicle Detectors (VIVDS) ▪ TxDOT VIVDS ▪ TxDOT Closed Loop Signal System ▪ Amarillo Traffic Control System ▪ TxDOT RWIS 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT ▪ City of Amarillo
<p>Planned Projects</p> <ul style="list-style-type: none"> ▪ Amarillo Traffic Control System Expansion Phase 1 	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo ITS Implementation, Phases 2 through 4 ▪ TxDOT Amarillo ITS Implementation Additional Phases ▪ TxDOT Amarillo TMC Expanded Operations ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ Amarillo Regional Communications Master Plan ▪ TxDOT Closed Loop Signal System Expansion, Phases 1 through 3 ▪ TxDOT Flood Detection Stations ▪ Amarillo Flood Detection Stations ▪ Amarillo Traffic Control System Expansion, Phases 2 and 3 ▪ I-40 Alternate Route Detection ▪ Amarillo VIVDS Expansion, Phases 1 and 2 ▪ TxDOT Road Weather Information System (RWIS) Expansion ▪ Amarillo Road Weather Information System (RWIS) 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Surface Street Control (ATMS03)	High Priority
<p>This market package provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management. A range of traffic signal control systems are represented by this market package ranging from static pre-timed control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. This market package is consistent with typical urban traffic signal control systems.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo TMC ▪ TxDOT Amarillo Closed Loop Signal Systems ▪ City of Amarillo TOC ▪ City of Amarillo Traffic Control System ▪ TxDOT ATMS 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT ▪ City of Amarillo
<p>Planned Projects</p> <ul style="list-style-type: none"> ▪ Amarillo Traffic Control System Expansion Phase 1 	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Closed Loop Signal System Expansion, Phases 1 through 3 ▪ TxDOT Amarillo TMC Expanded Operations ▪ Amarillo Traffic Control System Expansion, Phases 2 and 3 ▪ Amarillo VIVDS Expansion, Phases 1 and 2 ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ Emergency Vehicle Traffic Signal Preemption ▪ Rural Texas School Flashers Paging System ▪ Amarillo School Flashers Paging System ▪ Amarillo Regional Communications Master Plan ▪ I-40 Alternate Route Detection 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Freeway Control (ATMS04)	High Priority
<p>This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways. This package is consistent with typical urban traffic freeway control systems. This package incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option. This market package also includes the capability to utilize surveillance information for detection of incidents.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo TMC ▪ TxDOT Amarillo CCTV Cameras ▪ TxDOT DMS ▪ TxDOT ATMS 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT
<p>Planned Projects</p> <ul style="list-style-type: none"> ▪ TxDOT Highway Condition Reporting System (HCRS) Enhancements 	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo ITS Implementation, Phases 2 through 4 ▪ TxDOT Amarillo ITS Implementation Additional Phases ▪ TxDOT Amarillo TMC Expanded Operations ▪ Amarillo Regional Communications Master Plan ▪ I-40 Alternate Route Detection 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

<p>Traffic Information Dissemination (ATMS06)</p>	<p>High Priority</p>
<p>This market package allows traffic information and information about road/bridge closures due to construction, maintenance, and weather, to be disseminated to drivers and vehicles using roadway equipment such as dynamic message signs or highway advisory radio.</p> <p>This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Information Service Providers.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo TMC ▪ City of Amarillo TOC ▪ TxDOT Dynamic Message Signs (DMS) on I-40 and I-27 ▪ TxDOT Portable DMS ▪ TxDOT ATMS ▪ HAR along east side and west side of I-40, south side of I-27, north side of US87/287 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT ▪ City of Amarillo
<p>Planned Projects</p> <ul style="list-style-type: none"> ▪ TxDOT Highway Condition Reporting System (HCRS) Enhancements 	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ Media Liaison and Coordination ▪ TxDOT Amarillo ITS Implementation, Phases 2 through 4 ▪ TxDOT Amarillo ITS Implementation Additional Phases ▪ TxDOT Amarillo TMC Expanded Operations ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ Amarillo/Potter/Randall EOC/TxDOT TMC Connection ▪ TxDPS/TxDOT TMC Connection ▪ Amarillo Police/TxDOT TMC Connection ▪ TxDOT Rest Area Traveler Information Signs ▪ Amarillo Regional Communications Master Plan ▪ Regional 511 Advanced Traveler Information System Server 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Regional Traffic Control and Coordination (ATMS07)	High Priority
<p>This market package provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy. This package relies on roadside instrumentation supported by the Surface Street Control and Freeway Control Market Packages and adds hardware, software, and communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. The extent of information and control sharing is determined through working arrangements between jurisdictions. At the request of stakeholders in the Amarillo Region, this market package was expended to include coordination and information sharing with TxDOT Districts and neighboring states.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo TMC ▪ TxDOT Closed Loop Traffic Signal System ▪ City of Amarillo Traffic Control System ▪ TxDOT ATMS ▪ Amarillo TOC 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT ▪ City of Amarillo
<p>Planned Projects</p> <ul style="list-style-type: none"> ▪ TxDOT Highway Condition Reporting System (HCRS) Enhancements ▪ Amarillo Traffic Control System Expansion Phase 1 	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo ITS Implementation, Phases 2 through 4 ▪ TxDOT Amarillo ITS Implementation Additional Phases ▪ TxDOT Amarillo TMC Expanded Operations ▪ TxDOT Closed Loop Signal System Expansion, Phases 1 through 3 ▪ Amarillo Traffic Control System Expansion, Phases 2 and 3 ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ TxDOT Center-to-Center Communications ▪ Interstate Coordination Phase 1 (TxDOT and NMSHTD, ODOT, ADOT) ▪ Interstate Coordination Phase 2 (TxDOT and KDOT, CDOT, UDOT) ▪ Amarillo Regional Communications Master Plan ▪ TxDPS/TxDOT TMC Connection ▪ Amarillo Police/TxDOT Connection ▪ Agency Collocation 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Incident Management System (ATMS08)	High Priority		
<p>This market package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The market package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as weather service entities and event promoters. Information from these diverse sources are collected and correlated by this market package to detect and verify incidents and implement an appropriate response.</p> <p>The response may include traffic control strategy modifications or resource coordination between center subsystems. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.</p> <p>Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination, Broadcast Traveler Information or Interactive Traveler Information market packages.</p>			
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo TMC ▪ City of Amarillo TOC ▪ Amarillo/Potter/Randall EOC ▪ BWXT Pantex Operations Center – can provide emergency warnings through sirens, radio broadcasts. Sirens can be operated by EOC or Sheriff ▪ TxDOT ATMS ▪ TxDOT CCTV Cameras ▪ TxDOT HAR ▪ TxDOT DMS (permanent and portable) ▪ Automated Accident Investigation Tools (Total Station) 	<p>Agency</p> <ul style="list-style-type: none"> ▪ City of Amarillo, Randall County, Potter County ▪ BWXT Pantex ▪ TxDOT Amarillo ▪ TxDPS 		
<p>Planned Projects</p> <ul style="list-style-type: none"> ▪ TxDOT Highway Condition Reporting System (HCRS) Enhancements 			
<p>Additional Needs</p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ▪ Inter-agency Common Radio Frequency ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ Amarillo/Potter/Randall EOC/TxDOT TMC Connection ▪ TxDPS/TxDOT TMC Connection ▪ Amarillo Police/TxDOT TMC Connection ▪ Amarillo Fire/TxDOT TMC Connection ▪ TxDOT Computer Aided Dispatch ▪ TxDPS Computer Aided Dispatch </td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ▪ TxDOT Center-to-Center Communications ▪ Amarillo Regional Communications Master Plan ▪ Pantex/TxDOT TMC Connection ▪ Amarillo Police Automated Accident Investigation System ▪ TxDPS Automated Accident Investigation System ▪ I-40 Alternate Route Detection ▪ TxDOT Amarillo TMC Expanded Operations </td> </tr> </table>		<ul style="list-style-type: none"> ▪ Inter-agency Common Radio Frequency ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ Amarillo/Potter/Randall EOC/TxDOT TMC Connection ▪ TxDPS/TxDOT TMC Connection ▪ Amarillo Police/TxDOT TMC Connection ▪ Amarillo Fire/TxDOT TMC Connection ▪ TxDOT Computer Aided Dispatch ▪ TxDPS Computer Aided Dispatch 	<ul style="list-style-type: none"> ▪ TxDOT Center-to-Center Communications ▪ Amarillo Regional Communications Master Plan ▪ Pantex/TxDOT TMC Connection ▪ Amarillo Police Automated Accident Investigation System ▪ TxDPS Automated Accident Investigation System ▪ I-40 Alternate Route Detection ▪ TxDOT Amarillo TMC Expanded Operations
<ul style="list-style-type: none"> ▪ Inter-agency Common Radio Frequency ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ Amarillo/Potter/Randall EOC/TxDOT TMC Connection ▪ TxDPS/TxDOT TMC Connection ▪ Amarillo Police/TxDOT TMC Connection ▪ Amarillo Fire/TxDOT TMC Connection ▪ TxDOT Computer Aided Dispatch ▪ TxDPS Computer Aided Dispatch 	<ul style="list-style-type: none"> ▪ TxDOT Center-to-Center Communications ▪ Amarillo Regional Communications Master Plan ▪ Pantex/TxDOT TMC Connection ▪ Amarillo Police Automated Accident Investigation System ▪ TxDPS Automated Accident Investigation System ▪ I-40 Alternate Route Detection ▪ TxDOT Amarillo TMC Expanded Operations 		

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Maintenance and Construction Vehicle Tracking (MC01)	High Priority
This market package will track the location of maintenance vehicles and other equipment to ascertain the progress of their activities. These activities can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.	
Existing Infrastructure None identified at this time	Agency
Planned Projects None identified at this time	
Additional Needs <ul style="list-style-type: none"> ▪ TxDOT Maintenance Vehicle AVL ▪ TxDOT Computer-Aided Snowplow Dispatching ▪ Automated Snowplows 	

Road Weather Data Collection (MC03)	High Priority
This market package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway. In addition to fixed RWIS stations at the roadside, sensing of the roadway environment can also occur from sensor systems located on Maintenance and Construction Vehicles. The collected environmental data is used by the Weather Information Processing and Distribution Market Package to process the information and help operators make decisions on operations.	
Existing Infrastructure <ul style="list-style-type: none"> ▪ TxDOT Amarillo Region RWIS stations (5) ▪ TxDOT ATMS ▪ SchoolNet Weather Sensors (non-roadway) 	Agency <ul style="list-style-type: none"> ▪ TxDOT ▪ Local Media
Planned Projects None identified at this time	
Additional Needs <ul style="list-style-type: none"> ▪ TxDOT Road Weather Information Systems (RWIS) Expansion ▪ Amarillo Road Weather Information Systems (RWIS) ▪ Automated Anti-Icing Treatment ▪ TxDOT Flood Detection Stations ▪ Amarillo Flood Detection Stations ▪ TxDOT/SchoolNet Link ▪ Amarillo Regional Communications Master Plan 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Weather Information Processing and Distribution (MC04)	High Priority
<p>This market package processes and distributes the environmental information collected from the Road Weather Data Collection market package. This market package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, and dense fog, so system operators and decision support systems can make decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used by system operators to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination market package, and aid operators in scheduling work activity.</p>	
Existing Infrastructure <ul style="list-style-type: none"> ▪ TxDOT Amarillo Region RWIS stations (5) ▪ SchoolNet Weather Sensors (non-roadway) ▪ TxDOT Amarillo TMC ▪ TxDOT ATMS ▪ City of Amarillo TOC ▪ TxDOT HAR ▪ TxDOT DMS 	Agency <ul style="list-style-type: none"> ▪ TxDOT ▪ City of Amarillo ▪ Local Media (SchoolNet)
Planned Projects <ul style="list-style-type: none"> ▪ TxDOT Highway Condition Reporting System (HCRS) Enhancements 	
Additional Needs <ul style="list-style-type: none"> ▪ TxDOT Center-to-Center Communications ▪ Amarillo TOC/TxDOT TMC Fiber Link ▪ TxDOT Road Weather Information Systems (RWIS) Expansion ▪ Amarillo Road Weather Information Systems (RWIS) ▪ TxDOT Flood Detection Stations ▪ Amarillo Flood Detection Stations ▪ TxDOT/SchoolNet Link ▪ Media Liaison and Coordination ▪ TxDOT Rest Area Traveler Information Signs ▪ TxDOT CB Wizard Alert System ▪ Amarillo Regional Communications Master Plan 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Roadway Automated Treatment (MC05)	High Priority
<p>This market package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The market package includes the environmental sensors that detect adverse conditions, the automated treatment system itself, and driver information systems (e.g., dynamic message signs) that warn drivers when the treatment system is activated.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT RWIS ▪ TxDOT ATMS ▪ TxDOT DMS on I-40 ▪ TxDOT Highway Advisory Radio ▪ TxDOT Amarillo TMC ▪ City of Amarillo TOC 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT ▪ City of Amarillo
<p>Planned Projects</p> <p>None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Road Weather Information System (RWIS) Expansion ▪ Amarillo Road Weather Information System (RWIS) ▪ Automated Anti-Icing Treatment ▪ TxDOT Amarillo ITS Implementation, Phases 2 through 4 ▪ Amarillo TOC/TxDOT TMC Fiber Connection 	

Work Zone Management (MC08)	High Priority
<p>This market package directs activity in work zones, controlling traffic through portable DMS and informing other groups of activity (e.g., ISP, TM, other maintenance and construction centers) for better coordination management. Work zone speeds and delays are provided to the motorist prior to the work zones.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT Portable DMS ▪ TxDOT Amarillo CCTV ▪ TxDOT Amarillo TMC 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT
<p>Planned Projects</p> <ul style="list-style-type: none"> ▪ TxDOT Highway Condition Reporting System (HCRS) Enhancements 	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Work Zone Speed Trailers ▪ TxDOT Center-to-Center Communications ▪ Media Liaison and Coordination ▪ Amarillo TOC/TxDOT TMC Fiber Link ▪ TxDOT CB Wizard Alert System 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Maintenance and Construction Activity Coordination (MC10)	High Priority
<p>This market package supports the dissemination of maintenance and construction activity information to centers which can utilize it as part of their operations, or to the Information Service Providers who can provide the information to travelers.</p>	
Existing Infrastructure <ul style="list-style-type: none"> ▪ TxDOT Amarillo TMC ▪ TxDOT Web Page (statewide) 	Agency <ul style="list-style-type: none"> ▪ TxDOT
Planned Projects <ul style="list-style-type: none"> ▪ TxDOT Highway Condition Reporting System (HCRS) Enhancements 	
Additional Needs <ul style="list-style-type: none"> ▪ TxDOT Center-to-Center Communications ▪ Amarillo TOC/TxDOT TMC Fiber Link ▪ TxDOT Computer-Aided Snowplow Dispatching ▪ TxDOT Maintenance and Construction Vehicle AVL ▪ Interstate Coordination Phase 1 	

Transit Security (APTS5)	High Priority
<p>This market package provides for the physical security of transit passengers. An on-board security system is deployed to perform surveillance and warn of potentially hazardous situations. Public areas (e.g. stops, park and ride lots, stations) are also monitored.</p> <p>Information is communicated to the Transit Management Subsystem using wireless or wireline infrastructure. Security related information is also transmitted to the Emergency Management Subsystem when an emergency is identified that requires an external response. Incident information is communicated to the Information Service Provider.</p>	
Existing Infrastructure None identified at this time	Agency
Planned Projects <ul style="list-style-type: none"> ▪ Amarillo City Transit Security Cameras 	
Additional Needs <ul style="list-style-type: none"> ▪ Panhandle Community Services Transit Security Cameras 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Transit Traveler Information (APTS8)	High Priority
<p>This market package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ Static transit schedules, operating hours, routes, and fare information are available by telephone and on printed schedules 	<p>Agency</p> <ul style="list-style-type: none"> ▪ Amarillo City Transit ▪ Panhandle Community Services
<p>Planned Projects None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ Amarillo City Transit Automatic Vehicle Location (AVL) ▪ Amarillo City Transit Traveler Information System ▪ Amarillo City Transit Transfer Center Traveler Information ▪ Panhandle Community Services Automatic Vehicle Location (AVL) and Mobile Data Terminals (MDT) ▪ Panhandle Community Services Transit Traveler Information System/Travel Data and Route Guidance ▪ Panhandle Community Services Transit Operations Center (TOC) with Computer Aided Dispatch System (CAD) 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Broadcast Traveler Information (ATIS1)	High Priority
<p>This market package collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, air quality and weather information, and broadly disseminates this information through existing infrastructure and low cost user equipment (e.g., FM subcarrier, cellular data broadcast). This market package differs from the Traffic Information Dissemination market package, which provides localized HAR and DMS information capabilities.</p> <p>The information may be provided directly to travelers by an information service provider (ISP) or other traveler service providers so that they can better inform travelers of conditions. Successful deployment of this market package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ Broadcast Warning Systems – Emergency Radio Broadcast Warning Systems operated by Private Radio and Television Outlets ▪ Pantex Warning System ▪ TxDOT ATMS 	<p>Agency</p> <ul style="list-style-type: none"> ▪ Private Sector Radio and Television Stations ▪ BWXT Pantex ▪ TxDOT Amarillo
<p>Planned Projects</p> <ul style="list-style-type: none"> ▪ TxDOT Highway Condition Reporting System (HCRS) Enhancements 	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ Media Liaison and Coordination ▪ TxDOT Amarillo ITS Implementation, Phases 2 through 4 ▪ TxDOT Amarillo ITS Implementation Additional Phases ▪ TxDOT Amarillo TMC Expanded Operations ▪ Regional 511 Advanced Traveler Information System Server ▪ ISP-Based Route Guidance Support ▪ Amarillo Regional Communications Master Plan ▪ TxDOT/SchoolNet Link ▪ TxDOT CB Wizard Alert System 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Emergency Response (EM1)	High Priority
<p>This market package includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Subsystems supports emergency notification and coordinated response between agencies.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ Two-way radio communication between DPS Dispatch and Highway Patrol Vehicles ▪ City of Amarillo Police Computer Aided Dispatch System (CAD) ▪ City of Amarillo Police Mobile Data Units – provide communications with CAD System ▪ City of Amarillo Fire Dispatch – CAD System, communications between dispatch and patrol vehicles ▪ Panhandle Emergency Medical Services System (PEMSS) – CAD System and mobile data terminal dispatch from PEMSS Communications Center 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDPS ▪ City of Amarillo ▪ Panhandle Emergency Medical Services System ▪ Private Ambulance
<p>Planned Projects None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDPS Computer Aided Dispatch ▪ TxDOT Computer Aided Dispatch ▪ Agency Collocation (Amarillo/Potter/Randall EOC, TxDOT, TxDPS, City of Amarillo) ▪ Inter-agency Common Radio Frequency 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

Emergency Routing (EM2)	High Priority
<p>This market package supports automated vehicle location and dynamic routing of emergency vehicles. The service also supports coordination with the Traffic Management Subsystem, collecting detailed road network conditions and requesting special priority or other specific emergency traffic control strategies on the selected route(s). The service provides for information exchange between care facilities and both the Emergency Management Subsystem and emergency vehicles.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ CCTV on I-40 (for incident verification) ▪ TxDOT ATMS 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT
<p>Planned Projects None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Amarillo ITS Implementation, Phases 2 through 4 ▪ TxDOT Amarillo ITS Implementation Additional Phases ▪ Amarillo/Potter/Randall EOC/TxDOT TMC Connection ▪ TxDPS/TxDOT TMC Connection ▪ Amarillo Police/TxDOT TMC Connection ▪ Amarillo Fire/TxDOT TMC Connection ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ Pantex/TxDOT TMC Connection ▪ Emergency Vehicle Traffic Signal Preemption ▪ I-40 Alternate Route Detection 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

<p>Emergency Evacuation and Detour Routing (Created for Amarillo Region)</p>	<p>High Priority</p>
<p>This market package was requested by stakeholders in the Amarillo Region to address emergency evacuation near the BWXT Pantex Plant. This market package draws upon resources deployed as part of the Network Surveillance, Freeway Control, Surface Street Control, Incident Management System, Emergency Response, Emergency Routing, and Traffic Information Dissemination market packages. As part of this market package, existing emergency response and notification strategies used by Pantex and local public safety entities would be enhanced through interconnections of key Traffic Management, Emergency Operations, and Dispatch Centers to coordinate emergency traffic routing plans and implement appropriate control and advisory strategies.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ Amarillo/Potter/Randall EOC ▪ Pantex EOC ▪ Alarm/warning system and notification at rest stops ▪ Pantex notification system, including radio broadcast ▪ State EOC ▪ City of Amarillo Fire and Police Dispatch ▪ TxDPS ▪ Private Sector Radio/Television Emergency Broadcast Warning Systems ▪ TxDOT Amarillo TMC ▪ City of Amarillo TOC ▪ City of Amarillo Fire and Ambulance Vehicles ▪ TxDOT ATMS 	<p>Agency</p> <ul style="list-style-type: none"> ▪ Texas Department of Emergency Management ▪ TxDOT ▪ TxDPS ▪ Pantex ▪ City of Amarillo (including traffic and emergency services, police, and fire) ▪ Counties (Carson County, Armstrong County) ▪ Local News Media ▪ New Mexico and Oklahoma Departments of Transportation and Emergency Services ▪ Panhandle Emergency Medical Services
<p>Planned Projects None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Center-to-Center Communications ▪ TxDOT Amarillo ITS Implementation, Phases 2 through 4 ▪ TxDOT Amarillo ITS Implementation Additional Phases ▪ TxDOT Amarillo TMC Expanded Operations ▪ Interstate Coordination, Phases 1 and 2 ▪ Amarillo TOC/TxDOT TMC Fiber Connection ▪ Amarillo/Potter/Randall EOC/TxDOT TMC Connection ▪ TxDPS/TxDOT TMC Fiber Connection ▪ Amarillo Police/TxDOT TMC Connection ▪ Amarillo Fire/TxDOT TMC Connection ▪ Pantex/TxDOT TMC Connection ▪ Inter-agency Common Radio Frequency ▪ Media Liaison and Coordination ▪ I-40 Alternate Route Detection ▪ Amarillo Regional Communications Master Plan 	

Table 3 – High Priority Market Packages for the Amarillo Region (continued)

ITS Data Mart (AD1)	High Priority
<p>This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization.</p> <p>This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides general query and report access to archive data users.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ Electronic data storage (7 days) ▪ Static data of volumes/counts ▪ TxDOT ATMS 	<p>Agency</p> <ul style="list-style-type: none"> ▪ City of Amarillo ▪ TxDOT (Austin) – provided to Amarillo District ▪ TxDOT Amarillo
<p>Planned Projects</p> <p>None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ ITS Data Mart 	

2.3 Medium Priority Market Packages

Table 4 outlines market packages that were deemed medium priority by stakeholders in the Amarillo Region. These market packages were identified as useful and desirable services and functions for the Region, although very few of these market packages have existing infrastructure in place or planned over the next few years (through 2005). The feasibility of funding for these market packages also was a factor in the prioritization. Availability and maturity of technology also was a consideration, particularly for the maintenance and construction operations market packages. These market packages were recently developed and added to the National ITS Architecture, and are not yet widely deployed. It is recommended that stakeholders in the Amarillo Region review deployments of some of the maintenance and construction technologies in other areas over the next several years to assess how well they have performed, benefits, and cost-effectiveness.

Several of these medium priority market packages have components that are dependent on deployment and implementation of higher priority market packages, such as transit vehicle tracking (APTS1) to support fixed-route as well as demand-response transit services.

Table 4 – Medium Priority Market Packages for the Amarillo Region

Standard Railroad Grade Crossing (ATMS13)	Medium Priority
<p>This market package manages highway traffic at highway-rail intersections (HRIs) where rail operational speeds are less than 80 miles per hour. Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported.</p> <p>These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the traffic management subsystem.</p>	
Existing Infrastructure	Agency
None identified at this time	
Planned Projects	
None identified at this time	
Additional Needs	
<ul style="list-style-type: none"> ▪ Route 87/Dalhart Railroad Crossing Upgrade ▪ Amarillo Regional Communications Master Plan 	

Table 4 – Medium Priority Market Packages for the Amarillo Region (continued)

Railroad Operations Coordination (ATMS15)	Medium Priority
<p>This market package provides an additional level of strategic coordination between rail operations and traffic management centers. Rail operators provide train schedules, maintenance schedules, and any other forecast events that could result in highway/rail intersection closures. Traffic managers can then use that information to develop forecast HRI closure times and durations which can then be used to develop traffic management and control strategies.</p>	
Existing Infrastructure None identified at this time	Agency
Planned Projects None identified at this time	
Additional Needs <ul style="list-style-type: none"> ▪ Route 87/Dalhart Railroad Crossing Upgrade 	

Maintenance and Construction Vehicle Maintenance (MC02)	Medium Priority
<p>This market package performs vehicle maintenance scheduling and manages both routine and corrective maintenance activities on vehicles and other maintenance equipment. It includes on-board sensors capable of automatically performing diagnostics for maintenance vehicles, and the systems that collect this diagnostic information and use it to schedule and manage vehicle maintenance.</p>	
Existing Infrastructure None identified at this time	Agency
Planned Projects None identified at this time	
Additional Needs None identified at this time	

Table 4 – Medium Priority Market Packages for the Amarillo Region (continued)

Winter Maintenance (MC06)	Medium Priority
<p>This market package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ TxDOT Maintenance Vehicle Operations – Utilizes two-way communications on snowplows to communicate with drivers about conditions. Drivers report conditions back to TxDOT, and conditions are updated on web and telephone services ▪ TxDOT RWIS 	<p>Agency</p> <ul style="list-style-type: none"> ▪ TxDOT
<p>Planned Projects None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ TxDOT Road Weather Information Systems (RWIS) Expansion ▪ Amarillo Road Weather Information Systems (RWIS) ▪ TxDOT/SchoolNet Link ▪ Amarillo TOC/TxDOT TMC Fiber Link ▪ TxDOT Maintenance Vehicle AVL ▪ TxDOT Computer-Aided Snowplow Dispatching ▪ Automated Snowplows ▪ Automated Anti-Icing Treatment 	

Table 4 – Medium Priority Market Packages for the Amarillo Region (continued)

Transit Fixed-Route Operations (APTS2)	Medium Priority
<p>This market package performs vehicle routing and scheduling, as well as automatic driver assignment and system monitoring for fixed-route transit services. This service determines current schedule performance using AVL data and provides information displays at the Transit Management Subsystem. Static and real time transit data is exchanged with Information Service Providers where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules.</p>	
<p>Existing Infrastructure</p> <ul style="list-style-type: none"> ▪ Existing Buses and Dispatch Centers 	<p>Agency</p> <ul style="list-style-type: none"> ▪ Amarillo City Transit
<p>Planned Projects</p> <p>None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ Amarillo City Transit Automatic Vehicle Location (AVL) ▪ Amarillo City Transit Traveler Information System ▪ Amarillo City Transit Transfer Center Traveler Information ▪ Amarillo City Transit Electronic Fare Collection System 	

Table 4 – Medium Priority Market Packages for the Amarillo Region (continued)

Demand Response Transit Operations (APTS3)	Medium Priority
<p>This market package performs vehicle routing and scheduling as well as automatic driver assignment and monitoring for demand responsive transit services. This package monitors the current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. The Transit Management Subsystem provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. This service includes the capability for a traveler request for personalized transit services to be made through the Information Service Provider (ISP) Subsystem.</p>	
Existing Infrastructure <ul style="list-style-type: none"> ▪ Existing Paratransit Vehicles and Dispatch Centers 	Agency <ul style="list-style-type: none"> ▪ Amarillo City Transit ▪ Panhandle Community Services Transit
Planned Projects None identified at this time	
Additional Needs <ul style="list-style-type: none"> ▪ Amarillo City Transit Automatic Vehicle Location (AVL) ▪ Amarillo City Transit Traveler Information System ▪ Amarillo City Transit Transfer Center Traveler Information ▪ Amarillo City Transit Electronic Fare Collection System ▪ Panhandle Community Services Transit Travel Information System/Travel Data and Route Guidance ▪ Panhandle Community Services Electronic Fare Collection System ▪ Panhandle Community Services Automatic Vehicle Location (AVL) and Mobile Data Terminals (MDT) ▪ Panhandle Community Services Transit Operations Center (TOC) with Computer Aided Dispatch System (CAD) ▪ Panhandle Community Services Automated Passenger Counters 	

Table 4 – Medium Priority Market Packages for the Amarillo Region (continued)

Transit Passenger and Fare Management (APTS4)	Medium Priority
<p>This market package manages passenger loading and fare payments on-board vehicles using electronic means. It allows transit users to use a traveler card or other electronic payment device. Sensors mounted on the vehicle permit the driver and central operations to determine vehicle loads, and readers located either in the infrastructure or on-board the transit vehicle allow electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem.</p>	
Existing Infrastructure None identified at this time	Agency
<p>Planned Projects None identified at this time</p>	
<p>Additional Needs</p> <ul style="list-style-type: none"> ▪ Amarillo City Transit Electronic Fare Collection System ▪ Panhandle Community Services Electronic Fare Collection System ▪ Panhandle Community Services Automated Passenger Counters 	

2.4 Low Priority Market Packages

Six market packages were identified and customized for the Amarillo Region, but were ranked as low priority by stakeholders. These market packages are listed in **Table 5**. The services contained in these lower priority market packages were deemed useful and desirable for the Region, but stakeholders did not feel that public agencies should put a strong focus on these market packages in the near-term. Stakeholders also did not want to preclude these market packages from future deployment in the Region, so it was decided to keep these market packages as part of the Regional ITS Architecture.

Some of these market packages were identified as candidates for private sector deployment and operations, including the ISP-Based Route Guidance and Mayday Support. Other market packages might be more feasible for future implementation, such as Parking Facility Management. Another market package, probe surveillance, is probably better suited for deployment in a more urbanized area, due to the saturation levels needed for accurate probe data; however, with growth in the Amarillo area expected to continue, the feasibility of probe surveillance should be reviewed in the future.

Table 5 – Low Priority Market Packages for the Amarillo Region

Market Package Name	Description	Comments
Probe Surveillance (ATMS02)	<p>This market package provides an alternative approach for surveillance of the roadway network. Two general implementation paths are supported by this market package: 1) wide-area wireless communications between the vehicle and Information Service and 2) dedicated short range communications between the vehicle and roadside is used to provide equivalent information directly to the Traffic Management Subsystem.</p> <p>It requires either wide area or short-range communications equipment, roadside beacons and wireline communications for the short-range communications option, data reduction software, and utilizes wireline links between the Traffic Management Subsystem and Information Service Provider Subsystem to share the collected information. Both “Opt out” and “Opt in” strategies are available to ensure the user has the ability to turn off the probe functions to ensure individual privacy.</p>	<p>Probe surveillance was not deemed a high priority market package at the time of the initial architecture development in the Amarillo Region. For probe data to be consistent and accurately reflect current conditions, there must be a quantifiable amount of vehicles equipped with probes on the roadways at any given time.</p> <p>The Amarillo Region might want to investigate the feasibility of using probe surveillance in the future to assist with determining near-real-time volume information on roads or freeways. Two potential probe vehicle candidates could be buses or commercial vehicles.</p>

Table 5 – Low Priority Market Packages for the Amarillo Region (continued)

Market Package Name	Description	Comments
<p>Parking Facility Management (ATMS16)</p>	<p>This market package provides enhanced monitoring and management of parking facilities. It assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This market package collects current parking status, shares this data with Information Service Providers and Traffic Management, and collects parking fees using the same in-vehicle equipment utilized for electronic toll collection or contact or proximity traveler cards used for electronic payment.</p>	<p>Deployment of this market package will be limited to facility-specific parking operators (i.e., parking lots/garages in central business districts, major event venues, airports). Information gathered would support parking guidance and information systems' components of ATIS.</p>
<p>Roadway Maintenance and Construction (MC07)</p>	<p>This market package supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services would include landscape maintenance, hazard removal, routine maintenance activities, and repair and maintenance of both ITS and non-ITS equipment on the roadway. Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.</p>	<p>The Amarillo Region might want to consider this market package as a future deployment to assist with maintenance functions.</p>
<p>Work Zone Safety Monitoring (MC09)</p>	<p>This market package includes systems and strategies to improve work crew safety and reduce collisions between the motoring public and maintenance vehicles and activities. Included in this market package is detection for vehicle intrusions to the work zone and warning systems to alert workers and drivers of potential safety hazards. This market package support both stationary and mobile work zones.</p>	<p>The Amarillo Region might want to consider this market package as a future deployment to assist with maintenance functions.</p>

Table 5 – Low Priority Market Packages for the Amarillo Region (continued)

Market Package Name	Description	Comments
ISP-Based Route Guidance (ATIS6)	<p>This market package offers the user pre-trip route planning and turn-by-turn route guidance services, which are generated by an Information Service Provider. Routes may be based on static information or reflect real time network conditions. This approach simplifies the user equipment requirements and can provide the infrastructure better information on which to predict future traffic. The package includes two way data communications and optionally also equips the vehicle with the databases, location determination capability, and display technology to support turn by turn route guidance.</p>	<p>This market package is best suited for deployment and ongoing operations by a private sector ISP. Fee-based subscription services are typically required for delivery of this service.</p> <p>Because this market package is deemed a private sector initiative, it is not recommended that the public sector play a significant role, other than as a data provider to private ISPs.</p>
Mayday Support (EM3)	<p>This market package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Emergency Management Subsystem to locate the user and determine the appropriate response.</p> <p>This market package also includes general surveillance capabilities that enable the Emergency Management Subsystem to remotely monitor public areas (e.g., rest stops, parking lots) to improve security in these areas. The Emergency Management Subsystem may be operated by the public sector or by a private sector provider. The request from the traveler needing assistance may be manually initiated or automated and linked to vehicle sensors. The surveillance data and any requests for assistance are sent to the Emergency Management subsystem using both data and voice communications.</p>	<p>This market package is best suited for deployment and ongoing operations by a private sector ISP. Fee-based subscription services are typically required for delivery of this service.</p>
Roadway Service Patrol (EM4)	<p>This market package supports roadway service patrol vehicles that monitor roads that typically have incidents, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median).</p>	<p>Service patrols are planned for the Amarillo Region. It is envisioned that these patrols would serve I-40 in the metro area.</p>

3. PRIORITIZATION OF PLANNED PROJECTS

In order to achieve the vision of the Regional ITS Architecture, a Region must deploy carefully developed projects that provide the functionality and interoperability identified in the architecture. A key step in the deployment of those projects is the development of an ITS Deployment Plan that identifies specific projects, timeframes, and responsible agencies.

Input from all stakeholders is required in order for the stakeholders to have ownership of the ITS Deployment Plan and also to be sure that the plan has realistically identified projects and timeframes for the Region. Cost is another important factor. Cost can vary a great deal for many ITS elements, depending on the level of deployment, maturity of the technology, type of communications, etc. For example, freeway network surveillance could be adequately achieved for one Region by the deployment of still frame CCTV cameras only at freeway interchanges. In another Region, there may be a desire for full motion cameras deployed at every mile to provide complete coverage of the freeway. The infrastructure and telecommunications costs for these two projects would vary a great deal, yet either one could be suitable for a particular Region.

In order to achieve input from stakeholders, a workshop was held in the Amarillo Region on August 20, 2002 to present the draft Regional ITS Deployment Plan and discuss potential projects. Each project recommended for the Regional ITS Deployment Plan was discussed, and consensus was reached by the stakeholders on the project description and the timeframe for implementation.

In the following sections, projects are categorized into short-term projects (5-year deployment timeframe), mid-term projects (10-year deployment timeframe), and long-term projects (20-year deployment timeframe). For each timeframe, a summary table has been included that provides a brief project description, responsible agency, probable cost, an indication as to whether funding has been identified, and an estimated duration for the project to be designed and implemented. The agency identified as the responsible agency will be responsible for implementation, operations and maintenance unless otherwise noted. For example, TxDOT may provide funding for arterial signal implementation within the City of Amarillo, but the City will operate and maintain the signals.

Following each table, a more detailed description of individual projects is included. This section also includes the market packages associated with the project and any pre-requisite projects that are required.

3.1 Short-Term Projects (5-Year)

Table 6 provides a description of projects for the Amarillo Region in the 5-year timeframe. These projects represent the highest priority for the Region and should be strongly considered for implementation in the short-term. Immediately following **Table 6** are project descriptions for each of the short-term recommendations.

3.2 Mid-Term Projects (10-Year)

Table 7 provides a description of projects in the 10-year timeframe. Several of these projects are continuations of projects that will begin in the 5-year timeframe. These projects are important to the Region, but will need further review at the time of their deployment to ensure they are still a priority for the Region. Immediately following **Table 7** are project descriptions for each of the mid-term recommendations.

3.3 Long-Term Projects (20-Year)

Table 8 provides a description of projects in the 20-year timeframe. While these projects represent market packages and anticipated future needs identified for the Region, they will need to be closely reviewed prior to implementation. It is expected that a major update to the Region's ITS Deployment Plan will occur prior to year 10 which would allow stakeholders to reassess these long-term projects to be sure that they are still feasible for the Region. Immediately following **Table 8** are project descriptions for each of the long-term recommendations.

Table 6 – Short-Term Projects (5-Year)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
Travel and Traffic Management					
TxDOT Amarillo TMC Expanded Operations	Expand the TMC operating hours to 24/7 operations and response capability	TxDOT	\$150,000 (annual operating cost)	No	Annual Operations
TxDOT Amarillo Phase 2 ITS Implementation	Implement additional CCTV cameras, DMS, vehicle detectors, and highway advisory radios (HAR) in the Amarillo Region	TxDOT	\$2,300,000	No	2 years
TxDOT Closed Loop Signal System Expansion Phase 1	Upgrade and expand closed loop signal system on selected TxDOT intersections throughout Region	TxDOT	\$300,000 per year	No	2 years
TxDOT Rest Area Traveler Information Signs	Implement traveler information at rest areas through large screens or other signs viewable by multiple users	TxDOT	\$100,000	No	6 months
TxDOT Center-to-Center Communications	Enhance coordination with other TxDOT Districts through implementation of center-to-center communications between each TxDOT TMC	TxDOT	N/A	Yes (statewide initiative)	1 year
Interstate Coordination Phase 1	Implement communications link and information sharing between TxDOT and neighboring states including New Mexico, Oklahoma, and Arizona	TxDOT/NMSHTD/ODOT/ADOT	\$50,000	No	6 months
Amarillo TOC/TxDOT TMC Fiber Connection	Implement a fiber connection between City of Amarillo fiber (downtown) and TxDOT fiber (I-40) to allow video sharing and control, traffic data sharing, and other joint functions	TxDOT Amarillo/City of Amarillo	\$100,000	No	1 year
Amarillo Traffic Control System Expansion Phase 1	Implement a traffic control system on 72 intersections in downtown Amarillo	Implementation: TxDOT Operations: City of Amarillo Maintenance: City of Amarillo	\$3,200,000	Yes	2 years
Amarillo Video Image Vehicle Detectors (VIVDS) Expansion Phase 1	Implement VIVDS on signalized intersections in Amarillo (Note: VIVDS are to be installed as part of signal upgrades)	Implementation: TxDOT Operations: City of Amarillo Maintenance: City of Amarillo	\$200,000	No	2 years

Table 6 – Short-Term Projects (5-Year) (continued)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
<i>Travel and Traffic Management (continued)</i>					
Rural Texas School Flashers Paging System	Install paging and central system to allow remote control of school flashers	TxDOT	\$100,000	No	1 year
Media Liaison and Coordination	Develop stronger liaison and coordination with local media to disseminate traveler information	TxDOT/City of Amarillo/ TxDPS	N/A	N/A	on-going
Amarillo Regional Communications Master Plan	Develop Communications Master Plan, including needs analysis, technology alternatives, and recommendations for communications to TMC, ATMS field devices, RWIS, traffic signals, etc.	TxDOT/City of Amarillo	\$150,000	No	1 year
TxDOT Flood Detection Stations	Implement flood detection systems on Interstates and State Routes in the Amarillo Region (potential to include as part of Phase 2 ITS Implementation)	TxDOT	\$100,000	No	6 months
Amarillo Flood Detection Stations	Implement flood detection stations at arterial street locations prone to flooding	City of Amarillo	100,000	No	6 months
<i>Emergency Management</i>					
Amarillo/Potter/Randall Emergency Operation Center (EOC)/TxDOT TMC Connection	Install connection to TxDOT TMC to allow for weather sensor data sharing, CCTV and DMS shared monitoring	Amarillo/Potter/Randall EOC and TxDOT	\$50,000	No	6 months
TxDPS/TxDOT TMC Connection	Install connection to TxDOT TMC for CCTV shared monitoring	TxDOT/TxDPS	\$30,000	No	3 months
Amarillo Police/TxDOT TMC Connection	Install connection to TxDOT TMC for CCTV shared monitoring	TxDOT/City of Amarillo Police	\$30,000	No	3 months
Amarillo Fire/TxDOT TMC Connection	Install connection to TxDOT TMC for CCTV shared monitoring	TxDOT/City of Amarillo Fire	\$30,000	No	3 months

Table 6 – Short-Term Projects (5-Year) (continued)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
<i>Emergency Management (continued)</i>					
Pantex/TxDOT TMC Connection	Install connection to TxDOT TMC for CCTV shared monitoring	TxDOT/Pantex	\$30,000	No	3 months
Inter-agency Common Radio Frequency	Implement common radio frequency for use by multiple agencies for emergency management	TxDPS/TxDOT/Amarillo Fire/Amarillo Police/EOCs	\$2,000,000	No	2 years
Amarillo Police Automated Accident Investigation System	Procure one Total Station Units (Includes workstation, tripod, monopole antenna, Auto Integration, and AutoCAD software)	Amarillo Police	\$15,000	No	3 months
TxDPS Automated Accident Investigation System	Procure additional Total Station units and provide training and certification for DPS	TxDPS	\$100,000	No	6 months
<i>Maintenance and Construction Operations</i>					
TxDOT Highway Condition Reporting System (HCRS) Enhancements	This is a statewide effort	TxDOT	N/A	Yes (statewide initiative)	1 year
TxDOT Road Weather Information Systems (RWIS) Expansion	Expand to include additional RWIS in the Amarillo Region	TxDOT	\$225,000	No	1 year
Automated Anti-Icing Treatment	Install automatic anti-icing systems at selected areas (Provided initial tests of system are positive)	TxDOT	\$300,000	No	1 year
TxDOT Work Zone Speed Trailers	Procure work zone speed trailers for use by TxDOT Maintenance crews	TxDOT	\$170,000	No	6 months
TxDOT CB Wizard Alert System	Procure CB Wizards for maintenance and snow removal vehicles. CB Wizards broadcast a message to truckers over CB Radio informing them of slow moving vehicles or work zones	TxDOT	\$40,000	No	6 months
TxDOT/SchoolNet Link	Implementation of link between SchoolNet and TxDOT TMC to incorporate SchoolNet data into the ATMS	TxDOT	\$25,000	No	3 months

Table 6 – Short-Term Projects (5-Year) (continued)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
<i>Maintenance and Construction Operations (continued)</i>					
Amarillo Road Weather Information Systems (RWIS)	Implement RWIS at arterial bridge locations prone to icing	City of Amarillo	\$100,000	No	6 months
<i>Public Transportation Management</i>					
Panhandle Community Services Transit Operations Center (TOC) with Computer Aided Dispatch System (CAD)	Implement a Transit Operations Center and CAD hardware and software to optimize route and schedule planning for routine and emergency operations	Panhandle Community Services	\$100,000	No	6 months
Panhandle Community Services Transit Automatic Vehicle Location (AVL) and Mobile Data Terminals (MDT)	Install AVL and MDTs on 42 transit vehicles to provide bus location and status information to the TOC, as well as facilitate voice and/or digital communications between the TOC and vehicle	Panhandle Community Services	\$420,000	No	6 months
Amarillo City Transit Security Cameras	Install security cameras on Amarillo City Transit fixed route buses (15 buses) and paratransit vehicles (5 vehicles)	Amarillo City Transit	\$300,000	Yes	6 months
Amarillo City Transit Automatic Vehicle Location (AVL)	Install AVL on Amarillo City Transit fixed routes buses (15 buses) and paratransit (5 vehicles)	Amarillo City Transit	\$200,000	No	6 months
<i>Information Management</i>					
ITS Data Mart	Implement ITS data mart to store crash record information in the Amarillo Region	TxDOT	\$200,000	No	Ongoing
*Agency listed is responsible for implementation, operations and maintenance unless otherwise noted.					
**The design has not been undertaken and thus this is only an opinion of probable cost for planning purposes.					

Amarillo Region Short-Term Projects (5-Year)

Travel and Traffic Management

TxDOT Amarillo TMC Expanded Operations

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Freeway Control (ATMS04)
- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Incident Management System (ATMS08)
- Broadcast Traveler Information (ATIS1)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: None

Description: Expand operations of the TxDOT Amarillo TMC to 24/7 operations and response. With the implementation of the TMC and installation of ATMS at the TMC, TxDOT is in a unique position to serve in a 24-hour capacity for traffic management. This would require additional staff for the operations center trained with ATMS software, appropriate traffic management strategies, and agency coordination and notification needs. This 24-hour facility would be responsible for monitoring TxDOT field devices and traffic conditions, and will facilitate quick response to and coordination for incidents on Amarillo area freeways. As a 24-hour facility, the TMC also could serve in an after-hours capacity to assist with monitoring City of Amarillo's traffic control system. This arrangement would need to be defined in an agreement. TxDOT TMC staff could alert City staff in the event of an incident or implement traffic control strategies in accordance with a joint operations agreement between the City and TxDOT.

TxDOT Amarillo Phase 2 ITS Implementation

Associated Market Packages:

- Network Surveillance (ATMS01)
- Freeway Control (ATMS04)
- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Broadcast Traveler Information (ATIS1)
- Emergency Evacuation and Detour Routing
- Emergency Routing (EM2)
- Roadway Automated Treatment (MC05)

Prerequisite Projects: None (Phase 1 ITS and ATMS were recently implemented)

Description: Phase 2 of the TxDOT ITS will implement additional CCTV cameras and DMS, as well as traffic detectors and highway advisory radio (HAR) transmitters in the Amarillo Region. The traffic

detectors are expected to be inductive loops, which will add the capability of real-time vehicle detection at high accident and/or high traffic volume segments along highways in the Amarillo Region. HAR will allow operators at the Amarillo TMC to record travel advisory messages related to traffic, incidents, and weather for transmission at the roadside to vehicles traveling in the vicinity of the HAR transmitter. TxDOT also has indicated that flood detection stations might be part of this phase. Phase 2 is not currently funded.

TxDOT Closed Loop Signal System Expansion Phase 1

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Regional Traffic Control and Coordination (ATMS07)

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Expand the closed loop signal system by integrating additional signals and implementing VIVDS at select TxDOT intersections throughout Region. Some long-term cost savings may be realized if the Amarillo Regional Communications Master Plan is complete prior to establishing locations and routing of communications infrastructure between traffic signals and the TxDOT Amarillo TMC. Implementation of VIVDS is discussed in more detail under the VIVDS project description.

Note: The TxDOT Amarillo Region typically programs approximately \$300,000 per year for upgrades and expansion of the closed loop system. Although not currently programmed beyond 2002, TxDOT Amarillo requested that this project be kept in the ITS Deployment Plan for 2003 and 2004.

TxDOT Rest Area Traveler Information Signs

Associated Market Packages:

- Traffic Information Dissemination (ATMS06)
- Weather Information Processing and Distribution (MC04)

Prerequisite Projects: None

Description: Implement traveler information at rest areas through large screens or other signs viewable by multiple users. The information to be displayed would include:

- real-time traffic maps (when available);
- CCTV images (if applicable to that location);
- weather information from RWIS data and other weather sources, such as SchoolNet and NOAA; and
- advisories and text messages input by TxDOT Amarillo operators related to non-recurrent congestion, or planned events (such as construction, maintenance or lane restrictions).

The software may be web-based, conveying information through a simple web interface. The system would not require point-and-click operation that an interactive web site would require, but rather automatically cycle through several screens showing the information. It is envisioned some information would be displayed at all times, such as weather, CCTV images and a traffic map showing real-time

conditions and closures. Information from the TxDOT Amarillo Web Page and statewide web server would provide a database for static and near-real-time data for the rest area traveler information service. The Amarillo Phase 1 ITS and ATMS provide a foundation for this project.

This project may also include an indicator sign in advance of the rest area to alert travelers that incident-related information or advisories are available at the rest area. The indicator sign could be as simple and low-cost as a standard, static freeway information sign with flashing beacons on top that would be activated when current incident-related information is available. More advanced solutions may include an electronic blank-out sign, or a completely functional DMS. Local HAR would also include a message telling travelers where to go for more information. The HAR message can be pre-recorded and activated for announcement automatically when the rest area traveler information signs are displaying current incident information. Automation between the rest area traveler information system and the HAR module would require software module development and/or modifications. The TxDOT Phase 2 ITS implementation in the Amarillo Region should consider the needs of this project during initial project scoping and preliminary engineering.

TxDOT Center-to-Center Communications

Associated Market Packages:

- Regional Traffic Control and Coordination (ATMS07)
- Incident Management System (ATMS08)
- Weather Information Processing and Distribution (MC04)
- Work Zone Management (MC08)
- Maintenance and Construction Activity Coordination (MC10)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: None

Description: The Center-to-Center (C2C) Communications project is a logical extension of the TxDOT ATMS and Phase 1 field equipment deployments. The project will enhance coordination with TxDOT Districts (and potentially other agencies) through connection to the statewide C2C core infrastructure. A communication backbone must be developed with sufficient capacity between the TxDOT Amarillo TMC and existing C2C infrastructure. Determination of whether the backbone should be TxDOT owned, leased, or a combination thereof, should be coordinated with the Amarillo Regional Communications Master Plan development when this project is started. The software required to support C2C communications is integral with the TxDOT developed ATMS, so significant software development efforts are not anticipated. Resources will be required to oversee installation of the communications backbone and integration of existing software between the TxDOT Amarillo TMC and statewide C2C facilities. As part of connecting to the statewide C2C infrastructure, the Amarillo District will provide data to the statewide web server and statewide data archiving database. In return, access to information from other TxDOT Districts (and potentially other agencies) will be available to enhance operations throughout the Region.

Interstate Coordination Phase 1

Associated Market Packages:

- Regional Traffic Control and Coordination (ATMS07)
- Maintenance and Construction Activity Coordination (MC10)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Implement communication links and information sharing between TxDOT and neighboring states including New Mexico, Oklahoma, and Arizona. The Amarillo Region and these states share some common corridors, including I-40, US 87, US 287, US 83, US 385, and US 54. Major incidents, weather hazards, or closures and restrictions along these corridors in the Amarillo Region or neighboring states could have significant impacts on interstate travel and commerce. Sharing planned and unplanned incident information is valuable, due to the limited alternate routes and limited resources/facilities in smaller communities positioned along the corridors. The information sharing will require software development to collect data from different systems and sources, convert or translate information (if required) to a common data dictionary, and disseminate packaged information back to partner states. As an alternative, the interstate nature of the project may lend itself to a secure web-based information sharing strategy, rather than direct center-to-center communications among systems in different states. Initial tasks of the project include meeting with representatives of various partner state agencies and authorities to determine willingness to share data, technical and institutional barriers, data sharing content, transmission frequency, and next steps. Agreements will be required between project partners to clarify: use of data; privacy issues; liability issues; and data quality maintenance. This project will design the communications links and supporting software in coordination with the Amarillo Regional Communications Master Plan and existing C2C infrastructure.

Amarillo TOC/TxDOT TMC Fiber Connection

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Incident Management System (ATMS08)
- Weather Information Processing and Distribution (MC04)
- Roadway Automated Treatment (MC05)
- Winter Maintenance (MC06)
- Work Zone Management (MC08)
- Maintenance and Construction Activity Coordination (MC10)
- Emergency Routing (EM2)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: Amarillo Regional Communications Master Plan, Amarillo Traffic Control System Expansion Phase 1

Description: Implement a broadband, fiber-based connection between the City of Amarillo (downtown) and the TxDOT Amarillo TMC (I-40) to allow shared viewing of video, traffic information, and other mutually beneficial data. Shared monitoring and control capabilities provided through the connection could also allow for joint operations of City equipment (i.e., traffic signals) by TxDOT TMC staff, such as for after-hours or on weekends, if the TxDOT TMC serves a 24/7 facility. Data/video sharing and other joint operation policies need to be developed and agreed upon between TxDOT and the City of Amarillo, preferably before final design of the systems begins, because some policies may have a direct impact on design strategies.

Amarillo Traffic Control System Upgrade

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Regional Traffic Control and Coordination (ATMS07)

Prerequisite Projects: None

Description: Implement a traffic control system for 72 intersections in downtown Amarillo. The system will be designed, developed and implemented to allow centralized and remote monitoring of intersections and upload/download of timing plans. The communications system will include a combination of spread spectrum and fiber optic communications. This project is funded.

Amarillo Video Image Vehicle Detectors (VIVDS) Expansion Phase 1

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)

Prerequisite Projects: No specific pre-requisite projects, but VIVDS are installed in conjunction with traffic signals

Description: Expand current use of VIVDS and implement VIVDS at signalized intersections in Amarillo. VIVDS provide Amarillo flexibility to determine traffic detector placement at signalized intersections by installing cameras and processors that can determine change in gray scale over a predetermined detection zone within the field of vision. Typically a camera is mounted at approximately 20 – 30 feet above the roadway and is positioned to look at oncoming vehicles. A processor is then connected to the traffic signal controller and as detection zones are activated, the controller recognizes the inputs as traditional induction loops. Many agencies operating closed loop signal systems install VIVDS and do not transport that data or video to a central location. As sufficient communications bandwidth becomes available at VIVDS field locations, both raw (without detection zones) and processed (with detection zones) video could be sent to the City of Amarillo TOC to provide information to support better operational decisions, enhanced traveler information, and improved signal maintenance. Another capability of VIVDS includes various alarm features. In addition to drawing vehicle detection zones in the camera field of vision, addition zones can be created and tied to alarms. For example, if a VIVDS was located near a high vandalism area, an alarm zone could be created to assist public safety officials with protecting public property.

Rural Texas School Flashers Paging System

Associated Market Packages:

- Surface Street Control (ATMS03)

Prerequisite Projects: None

Description: Install paging and central system(s) to allow remote control of school flashers for schools in rural areas. Two-way paging systems are available for programming and troubleshooting school zone time clocks (AC or solar powered). A two-way paging system will allow programming of times for the new school year, special events, and even turn flashers in the system on during emergencies from a central location. Two-way paging also provides acknowledgement that the flasher received the message and provides routine diagnostic/operational status messages. The main benefit of a paging system is eliminating costly trips to the field to reprogram units or manually operate flashers.

Media Liaison and Coordination

Associated Market Packages:

- Traffic Information Dissemination (ATMS06)
- Broadcast Traveler Information (ATIS1)
- Weather Information Processing and Distribution (MC04)
- Work Zone Management (MC08)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: None

Description: Develop stronger liaison and coordination with local media to disseminate traveler information. Develop a link for local media to tap into CCTV camera images for dissemination of traffic and weather advisories to the public via television and radio news broadcasts. TxDOT Amarillo's Phase 1 ITS has installed several CCTV cameras along key routes, which provide a valuable visual travel information tool for pre-trip information. Most TV and radio stations are for profit entities and typically already have microwave licenses and infrastructure in place to support wireless transmission of video. Therefore, TxDOT should provide a connection point at the TMC for media providers (e.g., video switch including video images and traffic conditions map), but not design and install the entire connection between the TMC and the media. An initial task in the project will be to meet with interested news providers to determine information needs to support media interface design activities. An ATIS server, listed under the mid-term project recommendations, also could serve as the link for media and other information service providers in the future.

Amarillo Regional Communications Master Plan

Associated Market Packages:

- Broadcast Traveler Information (ATIS1)
- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Freeway Control (ATMS04)
- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Incident Management System (ATMS08)
- Standard Railroad Crossing (ATMS13)
- Road Weather Data Collection (MC03)
- Weather Information Processing and Distribution (MC04)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: None

Description: Develop a Communications Master Plan for the Amarillo Region. The Plan would include needs identification, technology alternatives analysis, and recommendations for region-wide ITS and traffic-related communications. A network to serve center-to-center needs (among traffic management centers, emergency management centers, 911 centers, both within the region and inter-state) and field-to-center links (from the TMCs out to the field devices, RWIS, traffic signals, etc.) should be defined. The report should investigate technology and transmission media options, comparing technologies, bandwidths, life cycle costs, and other requirements against the Region's needs and goals. The outcome of these efforts will be a phased plan for transportation and ITS communications throughout the region over a 20-year period. Strong coordination with public safety is encouraged since there may be significant benefits in combining capital improvement funds to install telecommunications infrastructure to support interagency coordination needs.

TxDOT Flood Detection Stations

Associated Market Packages:

- Network Surveillance (ATMS01)
- Road Weather Data Collection (MC03)
- Weather Information Processing and Distribution (MC04)

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Implement flood detection systems on flood-prone segments of Interstates and state routes in the Amarillo Region. This will enable faster response times by maintenance crews to close flooded or near flooded roadway segments as necessary. The typical flood detection station is composed of a stream gauge, a rain gauge, a temperature sensor, a wind speed sensor, and a wind direction sensor and remote communications support. Other upgrades that may support operational decision making include sensors to measure relative humidity, soil moisture content, solar radiation, and air and water quality. The flood detection systems will be monitored from the TxDOT Amarillo District TMC. Communications between the flood detection stations and the TMC can be achieved through a variety of wireless and wireline telemetry methods. There is a future module of the ATMS software planned to

support environmental sensors (i.e., RWIS), and development of this module could be extended to include the needs of flood detection stations.

Costs for this project will vary based on the number of locations and detection stations installed, as well as communications. For planning purposes, four flood detection stations at \$25,000 each (including communications) was used.

Amarillo Flood Detection Stations

Associated Market Packages:

- Network Surveillance (ATMS01)
- Road Weather Data Collection (MC03)
- Weather Information Processing and Distribution (MC04)

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Implement flood detection stations at arterial street locations prone to flooding. The systems will be remotely monitored from the City of Amarillo's TOC. This will enable faster response times by maintenance crews to close roadway segments as necessary. Automated gates to close the roadway are a supplementary device that could be implemented. The classic flood detection station is composed of a stream gauge, a rain gauge, a temperature sensor, a wind speed sensor, and a wind direction sensor and remote communications support. Other upgrades that may support operational decision making include sensors to measure relative humidity, soil moisture content, solar radiation, and air and water quality. Communications between the flood detection stations and the TOC can be achieved through a variety of wireless and wireline telemetry methods.

Costs will vary depending on the number of flood detection stations purchased. For planning purposes, four stations at \$25,000 each was used. This cost does not include automated gates, which could be up to \$100,000 per location.

Emergency Management

Amarillo/Potter/Randall Emergency Operation Center (EOC)/TxDOT TMC Connection

Associated Market Packages:

- Traffic Information Dissemination (ATMS06)
- Incident Management System (ATMS08)
- Emergency Routing (EM2)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Install a telecommunications connection from the Amarillo/Potter/Randall EOC to TxDOT TMC to share weather sensor, CCTV and DMS data. The connection will also provide information on current road conditions that could assist with incident/emergency management. It would be beneficial to design this connection concurrently with or following the completion of the Amarillo Regional Communications Master Plan.

TxDPS/TxDOT TMC Connection

Associated Market Packages:

- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Incident Management System (ATMS08)
- Emergency Routing (EM2)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Install telecommunications connection from the TxDPS dispatch center to TxDOT TMC to share weather sensor, CCTV and DMS data. The connection will also provide information on current road conditions that could assist with incident/emergency management. It would be beneficial to design this connection concurrently with or following the completion of the Amarillo Regional Communications Master Plan.

Amarillo Police/TxDOT TMC Connection

Associated Market Packages:

- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Incident Management System (ATMS08)
- Emergency Routing (EM2)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Install a telecommunications connection from the Amarillo Police dispatch center to the TxDOT TMC to share weather sensor, CCTV and DMS data. The connection will also provide information on current road conditions that could assist with incident/emergency management. In addition to sharing data between the TMC and the Police Dispatch Center, it may be beneficial to extract incident location data as it is logged into the Amarillo Computer Aided Dispatch (CAD) System. Software modifications will be required to develop the extraction of data from the Amarillo CAD. It would be beneficial to design this connection concurrently with or following the completion of the Amarillo Regional Communications Master Plan.

Amarillo Fire/TxDOT TMC Connection

Associated Market Packages:

- Incident Management System (ATMS08)
- Emergency Routing (EM2)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Install a telecommunications connection from the Amarillo Fire dispatch center to the TxDOT TMC to share weather sensor, CCTV and DMS data. The connection will also provide information on current road conditions that could assist with incident/emergency management, especially when emergency routes are blocked due to maintenance activities. In addition to sharing data from the TMC to the Fire Dispatch Center, it may be beneficial to extract incident location data as it is inserted into the Fire Computer Aided Dispatch (CAD) System. Software modifications will be required to develop the extraction of data from the Amarillo Fire CAD. It would be beneficial to design this connection concurrently with or following completion of the Amarillo Regional Communications Master Plan.

Pantex/TxDOT TMC Connection

Associated Market Packages:

- Incident Management System (ATMS08)
- Emergency Routing (EM2)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Install a telecommunications connection from the Pantex EOC to TxDOT TMC for shared monitoring of CCTV, incident and emergency broadcast updates, and for exchanging real-time information on road conditions. It would be beneficial to design this connection concurrently with or following the completion of the Amarillo Regional Communications Master Plan. Since the use of the information between the TMC and the EOC will likely occur during a large scale emergency, a significant emphasis on secondary and tertiary connection redundancy should be considered during connection design.

Inter-Agency Common Radio Frequency

Associated Market Packages:

- Incident Management System (ATMS08)
- Emergency Response (EM1)
- Emergency Evacuation/Detour Routing

Prerequisite Projects: None

Description: Implement common radio frequency for use by multiple agencies for incident and emergency management. A high-capacity, shared radio frequency among emergency first responders is critical to fast, efficient response. There are currently some shared frequencies in use in the Amarillo Region, including TxDPS with TxDOT maintenance, and TxDPS with counties (DPS is able to use county frequency, but not vice versa).

TxDPS has been legislatively mandated to implement a statewide communications frequency to support interagency communications, especially during major emergencies. There could be other initiatives and requirements under Homeland Security mandates yet to be defined. The Panhandle Regional Planning Commission was identified as the primary agency in the region for security planning, programming and funding.

TxDPS, sheriff, police departments, emergency management personnel, transit/transportation agencies, and fire departments should analyze the feasibility of and benefits of radio system interoperability. If a common, interoperable radio frequency is deemed beneficial to the region, this project will design and implement a Interagency Radio Communications Project that supports a common frequency and provides sufficient capacity and coverage to handle cross-jurisdictional and cross-boundary voice and data traffic. The communications system design would include development of an operations, management, and maintenance (OM&M) plan, a Standard Operating Procedures Manual and a Memorandum of Understanding signed by all involved agencies. Common issues in the design of interagency radio projects include finding the correct technology to support the needs of individual partners.

Amarillo Police Automated Accident Investigation System

Associated Market Packages:

- Incident Management System (ATMS08)

Prerequisite Projects: None

Description: Procure one Total Station units (includes workstation, tripod, monopole antenna, AutoIntegration, and AutoCAD software) and provide training and certification.

Total Stations are a combination of electronic distance meter and a theodolite. Measurements of accident sites are taken from a central point using an infrared beam and prism. The investigator places the Total Station at a location from which the entire site is visible. One person then holds a rod with the prism at the various points and positions to where measurements are needed. The Station can measure distance and angles to the prism relative to itself, using the average time it takes the beam to reflect from the prism. Measurements are then stored on a computer. The incident can then be recreated at the office by downloading the data to a drafting program.

The benefit of the Total Station based accident investigation is that it streamlines the accident investigation process, thereby allowing faster clearance time for the incident scene, and restoring the roadway to normal operating conditions.

TxDPS Automated Accident Investigation System

Associated Market Packages:

- Incident Management System (ATMS08)

Prerequisite Projects: None

Description: Procure additional Total Station units (includes workstation, tripod, monopole antenna, AutoIntegration, and AutoCAD software) and provide training and certification for TxDPS. TxDPS currently has two Total Station units in the Amarillo Region.

Total Stations are a combination of electronic distance meter and a theodolite. Measurements of accident sites are taken from a central point using an infrared beam and prism. The investigator places the Total Station at a location from which the entire site is visible. One person then holds a rod with the prism at the various points and positions to where measurements are needed. The Station can measure distance and angles to the prism relative to itself, using the average time it takes the beam to reflect from

the prism. Measurements are then stored on a computer. The incident can then be recreated at the office by downloading the data to a drafting program.

The benefit of the Total Station based accident investigation is that it streamlines the accident investigation process, thereby allowing faster clearance time for the incident scene, and restoring the roadway to normal operating conditions.

Maintenance and Construction Operations

TxDOT Highway Condition Reporting System (HCRS) Enhancements

Associated Market Packages:

- Freeway Control (ATMS04)
- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Incident Management System (ATMS08)
- Weather Information Processing and Distribution (MC04)
- Work Zone Management (MC08)
- Maintenance and Construction Activity Coordination (MC010)
- Broadcast Traveler Information (ATIS1)

Prerequisite Projects: None

Description: TxDOT's HCRS will be enhanced on a statewide basis. The HCRS will use data from the Amarillo TMC, both automated (ATMS) and manually entered. It is envisioned the ATMS software will enhance the data collection and consolidation processes for automated information. This is a statewide effort; Amarillo will be affected by this project, and will contribute information to the HCRS, but will not be responsible for funding the enhancements or for the implementation schedule.

TxDOT Road Weather Information Systems (RWIS) Expansion

Associated Market Packages:

- Network Surveillance (ATMS01)
- Road Weather Data Collection (MC03)
- Weather Information Processing and Distribution (MC04)
- Roadway Automated Treatment (MC05)
- Winter Maintenance (MC06)

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: The TxDOT Amarillo Region currently has five RWIS. The expansion project will include 9 additional stations to provide additional coverage throughout the Amarillo Region. The RWIS will be remotely monitored from the TxDOT Amarillo District TMC. Real time weather information improves response time, increases winter maintenance efficiency and minimizes the traveling public's exposure to hazardous weather related roadway conditions. Archived RWIS information also provides valuable historic information for planning purposes. Data including temperature (atmospheric and pavement), precipitation, wind, humidity, visibility (white out/heavy fog) and even pavement surface conditions

(i.e., ice, snow, chemical) are collected by sensors placed at the roadside (typically on a 30 foot tower) and embedded in the roadway. Remote processing units placed along the roadway communicate with various types of road and weather sensors. Data from the RPU are transmitted to the central ATMS server, via dial-up modem or other low bandwidth telecommunication methods, which will be located at the TxDOT TMC. A future module for the ATMS software will support environmental sensor data and provides collection, archiving, and distribution of the data.

In most installations, RWIS devices are installed at problem areas where rapidly changing weather has a direct, negative impact on travel conditions, such as bridges. Pavement sensors are installed in the bridge deck and approach. The variation in pavement temperatures can allow maintenance engineers to better determine appropriate pavement treatments (e.g., salt, bridge deck pre-wetting, other chemicals, etc.) and more efficiently schedule personnel/equipment based on current and forecast weather conditions. More sophisticated RWIS stations are equipped with integrated cameras to transmit snapshots or streaming video to a central control facility. In the event that streaming video is a functional requirement, a telecommunications solution supporting higher bandwidth than standard telephone dial-up is required. RWIS data also can be included as part of web or phone-based travel information systems, as well as broadcast to motorists via HAR or commercial radio broadcasts (through an Information Service Provider).

Costs will vary depending on the number of RWIS stations deployed. For planning purposes, 9 RWIS stations at \$25,000 each (including communications) was used.

Automated Anti-Icing Treatment

Associated Market Packages:

- Road Weather Data Collection (MC03)
- Roadway Automated Treatment (MC05)
- Winter Maintenance (MC06)

Prerequisite Projects: TxDOT Road Weather Information Systems (RWIS) Expansion, Amarillo Road Weather Information Systems (RWIS)

Description: Following the review of the final results of an initial test of automated anti-icing systems in rural areas, this project would install the systems at select bridge locations in the Amarillo Region. The systems would be remotely monitored from the TxDOT Amarillo District TMC.

The major problem with winter weather is the freezing moisture adhering to the roadway pavement and forming an ice/snow packed pavement surface that makes traveling extremely difficult. A permanent automated anti-icing system has an inherent time advantage over calling in maintenance crews, loading trucks, and sending them to a site. Anti-icing systems immediately apply the chemical de-icing agent to the road surface, improving safety to the motorists by reducing accidents and also freeing up valuable maintenance personnel resources to treat other areas of the road network.

Anti-icing is a technique of applying a liquid, chemical de-icing agent directly onto the surface before the temperature and humidity levels permit an ice bond to occur. This technique requires the chemical de-icing agents be applied in a timely and accurate manner. Permanent auto anti-icing systems must be activated by some means, and the level of service is directly impacted by the method that is used to activate the system. To achieve full autonomous operation (non-human intervention), the anti-icing system must be controlled by input from a Road Weather Information System (RWIS) that measures atmospheric and pavement surface conditions, accurately measures the freeze point of the

moisture/chemical solution on the road surface and in turn activates the permanent automated anti-icing system when icing conditions are imminent.

A typical permanent automated anti-icing system consists of the following general elements:

- Pump house which encloses the elements of the system;
- Pump and motor;
- Programmable system controller;
- Software programs to support flexible system operation;
- RWIS integration for automated activation/monitoring of the Anti-icing System;
- Manual pushbutton operation at the remote site;
- Communications equipment for manual remote control of the system: computer, pager and/or wireless activation;
- Chemical reservoir;
- Water-flush reservoir for flushing the system and roadway;
- Raceways (housing for chemical pressure piping and low voltage control wiring);
- Expansion joints;
- Valve panels - consisting of electromagnetic valves, control card, pressurized accumulator tank, check valve, and manual shutoff valve; and
- Nozzles – pavement flush-mounted.

Automated anti-icing systems can be installed as part of a bridge re-decking project where equipment is integrated into overall construction. Alternatively, anti-icing systems can be retrofit to existing bridges. Other features that have been included in anti-icing systems are:

- Integration of DMS in advance of locations to warn motorists of operating spray nozzles;
- CCTV to verify anti-icing operations and to monitor critical infrastructure; and
- Bridge structure monitoring (on bridges that may be forming hairline cracks).

TxDOT Work Zone Speed Trailers

Associated Market Packages:

- Work Zone Management (MC08)
- Work Zone Safety Monitoring (MC09)

Prerequisite Projects: None

Description: Procure work zone speed trailers for use by TxDOT Maintenance crews. Speed trailers are portable traffic control devices that are relatively easy to implement, operate, and dismantle. With a large LED speed display run by radar sitting atop a trailer, speed trailers are routinely used in residential neighborhoods and urban settings to slow drivers. As drivers approach, their speeds are displayed in 24-inch (typ.) numbers. Recent studies have shown speed trailers particularly suited to temporary work zones and are more effective than radar drones. They help reduce speeds throughout work zones of both large trucks and passenger vehicles.

Costs will vary depending on the number of speed zone trailers purchased. For planning purposes, 10 speed zone trailers at \$17,000 each was used to arrive at the estimate.

TxDOT CB Wizard Alert System

Associated Market Packages:

- Broadcast Traveler Information (ATIS1)
- Weather Information Processing and Distribution (MC04)
- Work Zone Management (MC08)

Prerequisite Projects: None

Description: Procure CB Wizards for maintenance and snow removal vehicles. The CB Wizard Alert System involves the use of a CB radio transmitter with a recorded message, alerting CB users that they are approaching a moving work zone with a lane closure. The transmitter device monitors citizen band (CB) radio frequencies and injects preprogrammed messages at specific intervals. The device allows drivers to take evasive action and utilize alternate routes. The CB transmission strategy is well suited for the target audience because 97% of all commercial trucks have CB radios and the radios are always on. Unlike highway advisory radio, the CB Wizard's transmission does not require driver interaction to disseminate traveler information.

Costs will vary depending on the number of units purchased. For planning purposes, 10 CB Wizards at \$4,000 each was used.

TxDOT/SchoolNet Link

Associated Market Packages:

- Road Weather Data Collection (MC03)
- Weather Information Processing and Distribution (MC04)
- Winter Maintenance (MC06)
- Broadcast Traveler Information (ATIS1)

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Implementation of link between SchoolNet and TxDOT TMC to incorporate SchoolNet data into the ATMS. SchoolNet is a system of weather sensors placed at nearly 50 schools throughout the Amarillo Region by local media. The following weather measurements are recorded at each SchoolNet site:

- Temperature;
- Dewpoint;
- Humidity;
- Rainfall;
- Wind speed;
- Wind direction;
- Wind chill; and
- Barometric pressure.

The comprehensive network allows media to collect and disseminate critical weather information to the public as necessary. Communications necessary to link to the systems will be determined by the Amarillo Regional Communications Master Plan.

Amarillo Road Weather Information Systems (RWIS)

Associated Market Packages:

- Network Surveillance (ATMS01)
- Road Weather Data Collection (MC03)
- Weather Information Processing and Distribution (MC04)
- Roadway Automated Treatment (MC05)
- Winter Maintenance (MC06)

Prerequisite Projects: Amarillo Regional Communications Master Plan

Description: Implement RWIS at arterial bridge locations in Amarillo that are prone to icing. The systems will be remotely monitored from the City of Amarillo's TOC. Real time weather information improves response time, increases winter maintenance efficiency and minimizes the traveling public's exposure to hazardous weather related roadway conditions. Archived RWIS information also provides valuable historic information for planning purposes. Data including temperature (atmospheric and pavement), precipitation, wind, visibility, humidity, and even pavement surface condition (i.e., ice, snow, chemical) are collected by sensors placed at the roadside (typically on a 30 foot tower) and embedded in the roadway. Remote processing units placed along the roadway communicate with various types of road and weather sensors. Data from the RPU is transmitted to a central system server, via dial-up modem or other low bandwidth telecommunication methods, which will be located at the Amarillo TOC.

In most installations, RWIS devices are installed at problem areas (such as bridges) where rapidly changing weather has a direct, negative impact on travel conditions. Pavement sensors are installed in the bridge deck and approach. The variation in pavement temperatures can allow maintenance engineers to better determine appropriate pavement treatments (e.g., salt, bridge deck pre-wetting, other chemicals, etc.) and more efficiently schedule personnel and equipment based on current and forecast weather conditions. More sophisticated RWIS stations are equipped with integrated cameras to transmit snapshots or streaming video to a central control facility. In the event that streaming video is a functional requirement, a telecommunications solution supporting higher bandwidth than standard telephone dial-up is required. RWIS data also can be included as part of web or phone-based travel information systems, as well as broadcast to motorists via HAR or commercial radio broadcasts (through an Information Service Provider).

Costs will vary depending on the number of RWIS stations purchased. For planning purposes, four RWIS at \$25,000 each (including communications) was used.

Public Transportation Management

Panhandle Community Services Transit Operations Center (TOC) with Computer Aided Dispatch System (CAD)

Associated Market Packages:

- Transit Vehicle Tracking (APTS1)
- Demand-Response Transit Operations (APTS3)
- Transit Traveler Information System (APTS8)

Prerequisite Projects: None

Description: Implement a centralized transit management and operations center for Panhandle Community Services, which is a demand-response transit service in the Amarillo Region. A centralized transit management center will serve as the hub for transit operations, dispatch, transit travel information (including customer call center) and other functions. Upgrading to computer-aided dispatch (CAD) will streamline communications between dispatchers and drivers. Used in conjunction with automatic vehicle location (AVL) and mobile data terminals, dispatchers can assess vehicle locations, status, route adherence, as well as communicate with one or several vehicles that are in the field. A CAD system also improves the system reporting functions, by automatically logging all communications between the dispatch center and the driver, including time, vehicle/driver, nature of the communication, and response.

Panhandle Community Services Transit Automatic Vehicle Location (AVL) and Mobile Data Terminals (MDT)

Associated Market Packages:

- Transit Vehicle Tracking (APTS1)
- Demand-Response Transit Operations (APTS3)
- Transit Traveler Information (APTS8)

Prerequisite Projects: Panhandle Community Services Transit (TOC) with Computer Aided Dispatch System (CAD)

Description: Install AVL and MDT units on 42 Panhandle Community Services vehicles. The AVL system will convey information regarding real-time vehicle location to the Panhandle Transit Operations Center, which will allow for enhanced system monitoring, scheduling, routing (or re-routing), as well as provide for precise bus location information in the event of a breakdown or emergency situation. AVL systems measure actual, real-time position of transit vehicles, and relay that information back to a transit operations center, usually via global positioning system. Used with a geographic information system (GIS) map, bus locations can be displayed for any vehicles in the fleet equipped with the on-board AVL unit. AVL, in conjunction with Computer Aided Dispatch, allows for improved bus tracking capability, as well as archiving and managing historical data. AVL systems also can be equipped with additional features, including tie-ins to alarm/security systems, vehicle component monitoring, and automatic passenger counter and fare payment systems. Information from the AVL/CAD system can be used by transit managers for real-time operations and management as well as for transit traveler information. These functions are particularly desirable for the Panhandle Community Services transit operations, due to the large, rural geographic area that is covered by Panhandle, as well as the demand-response nature

of the transportation services provided. In areas where AVL technology has been installed on buses, agencies report a 5-25% increase in on-time performance, which translates directly to improved efficiency and operations.

Mobile data terminals allow bus operators to send and receive digital messages. Mobile data terminals can be used by dispatchers to notify drivers of adverse conditions, route changes, or other impacts to the scheduled route for both fixed-route and demand-response transit operations. MDTs also can transmit information from the driver to the dispatch center, including status, disruptions, or silent alarms. An additional feature that can be built-in to the MDT is the ability for vehicle-to-vehicle digital communications, in addition to the vehicle-to-center communications.

Cost will vary depending on the number of vehicles equipped with AVL/MDT systems, as well as the functions and features designed into the systems (above the basic location and digital communication functions). For planning purposes, 42 vehicles were used at \$10,000 per vehicle.

Amarillo City Transit Security Cameras

Associated Market Packages:

- Transit Security (APTS5)

Prerequisite Projects: None

Description: Amarillo City Transit is installing security cameras on its fixed route buses (15 buses) and paratransit vehicles (5 vehicles). Cameras will be for on-board recording only, and are not envisioned to be monitored remotely from the Amarillo Transit Dispatch. Video will be stored for a pre-determined amount of time via video tape or emerging digital video recording technology. While the main objective of on-board surveillance projects has been to identify individuals committing criminal acts or creating disturbances on buses, there have been noticeable maintenance benefits such as a reduction of litter and debris. This project is funded and is expected to be completed by the end of 2003.

Amarillo City Transit Automatic Vehicle Location (AVL)

Associated Market Packages:

- Transit Vehicle Tracking (APTS1)
- Transit Fixed Route Operations (APTS2)
- Demand Response Transit Operations (APTS3)
- Transit Traveler Information (APTS8)

Prerequisite Projects: None

Description: Install AVL on Amarillo City Transit fixed routes buses (15 buses) and paratransit (five vehicles). The AVL system will convey information regarding real-time vehicle location to the Amarillo City Transit Dispatch Center, which will allow for enhanced system monitoring, scheduling, routing (or re-routing), as well as provide for precise bus location information in the event of a breakdown or emergency situation. AVL systems measure actual, real-time position of transit vehicles, and relay that information back to a transit operations center, usually via global positioning system. Used with a geographic information system (GIS) map, bus locations can be displayed for any vehicles in the fleet equipped with the on-board AVL unit. AVL, in conjunction with Computer Aided Dispatch, allows for improved bus tracking capability, as well as archiving and managing historical data. AVL systems also

can be equipped with additional features, including tie-ins to alarm/security systems, vehicle component monitoring, and automatic passenger counter and fare payment systems. Information from the AVL/CAD system can be used by transit managers for real-time operations and management as well as for transit traveler information. In areas where AVL technology has been installed on buses, agencies report a 5-25% increase in on-time performance, which translates directly to improved efficiency and operations.

Costs will vary depending on the number of vehicles equipped with the on-board AVL unit. For planning purposes, 15 fixed-route buses and 5 paratransit vehicles was used at \$10,000 each.

Information Management

ITS Data Mart

Associated Market Packages:

- ITS Data Mart (AD1)

Prerequisite Projects: None

Description: Implement an ITS data mart that will store crash record information gathered by the DPS, City of Amarillo Police, and local law enforcement. A central archived data server will be needed at the TxDOT Amarillo District TMC with connections to the DPS, City of Amarillo Police, and participating local law enforcement. The information stored in the ITS data mart will be used by TxDOT and other transportation agencies in the Region to identify locations on the transportation system with high crash rates. Access to information on the server will be jointly determined by those agencies participating in the project.

Table 7 – Mid-Term Projects (10-Year)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
Traffic and Travel Management					
TxDOT Amarillo Phase 3 ITS Implementation	Implement additional CCTV cameras, DMS, vehicle detectors, and HARs in the Amarillo Region	TxDOT	\$2,000,000	No	2 years
TxDOT Amarillo Phase 4 ITS Implementation	Implement additional CCTV cameras, DMS, and vehicle detectors in the Amarillo Region	TxDOT	\$2,000,000	No	2 years
TxDOT Closed Loop Signal System Expansion Phase 2	Continue expansion and upgrade of closed loop signal system at TxDOT intersections throughout Region	TxDOT	\$500,000	No	1 year
Amarillo Traffic Control System Expansion Phase 2	Continue expansion of traffic control system in City of Amarillo	Implementation: TxDOT Operations: City of Amarillo Maintenance: City of Amarillo	\$1,000,000	No	2 years
Amarillo VIVDS Expansion Phase 2	Continue implementation of VIVDS on signalized intersections in Amarillo	City of Amarillo/TxDOT	\$200,000	No	2 years
Regional 511 Advanced Traveler Information System Server	Implement an ATIS Server in the Amarillo TMC that will collect, consolidate and distribute travel information to 511 phone based system, web, and private Information Service Providers (ISPs)	TxDOT	To Be Determined	No	1 year
Amarillo School Flashers Paging System	Install paging and central system to allow remote control of school flashers	City of Amarillo	\$50,000	No	1 year
Parking and Event Management System Phase 1	Implement parking and event management systems (potential locations are downtown Civic Center, Tri-State Fairground, racetrack, and others)	City of Amarillo	\$500,000	No	1.5 years
Route 87/Dalhart RR Crossing Enhancements	Upgrade of railroad crossing at Route 87 and Dalhart	TxDOT	\$150,000	No	1 years
Interstate Coordination Phase 2	Implement communications link and information sharing between TxDOT and neighboring states including Colorado, Kansas, and Utah	TxDOT/CDOT/KDOT/UDOT	\$35,000	No	6 months

Table 7 – Mid-Term Projects (10-Year) (continued)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
<i>Emergency Management</i>					
Roadway Service Patrol	Implement Roadway Service Patrol within Amarillo urban boundaries	TxDOT	Implementation: \$300,000 Annual Operation: \$200,000	No	Continuous
TxDOT Computer-Aided Dispatch (CAD)	Implement CAD for TxDOT	TxDOT	\$400,000	No	1 year
Emergency Vehicle Traffic Signal Preemption	Install signal preemption for Amarillo Fire (for at least 100 intersections and at least 30 trucks)	Implementation: Amarillo Fire Operations: Amarillo Traffic Maintenance: Amarillo Traffic	\$375,000	No	1 year
Agency Collocation	Construct facility with capacity for collocation of Amarillo/Potter/Randall EOC, TxDOT, TxDPS, and City of Amarillo Traffic and Transit	Amarillo/Potter/Randall EOC TxDOT, TxDPS, City of Amarillo Traffic, Amarillo City Transit	\$7,000,000	No	5 years
<i>Maintenance and Construction Operations</i>					
TxDOT Maintenance Vehicle AVL	Install Automatic Vehicle Locating System on TxDOT maintenance vehicles	TxDOT/Other Maintenance Agencies	\$100,000	No	1 year
TxDOT Computer-Aided Snowplow Dispatching	Automate winter conditions data collection and reporting, providing decision support system for dispatching snowplows	TxDOT	\$200,000	No	2 years
<i>Public Transportation Management</i>					
Panhandle Community Services Transit Security Cameras	Install security cameras on 42 Panhandle Community Services transit vehicles	Panhandle Community Services	\$630,000	No	6 months
Panhandle Community Services Electronic Fare Collection System	Install electronic fare collection system on Panhandle Community Services transit buses to allow for smart card and electronic swipe card payments by patrons	Panhandle Community Services	\$63,000	No	3 months

Table 7 – Mid-Term Projects (10-Year) (continued)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
<i>Public Transportation Management (continued)</i>					
Amarillo City Transit Transfer Station Traveler Information	Install traveler information devices at three transit transfer stations	Amarillo City Transit	\$100,000	No	1 year
Amarillo City Transit Electronic Fare Collection System	Install electronic fare payment system on Amarillo fixed route buses to allow for smart card and electronic swipe card payments by patrons	Amarillo City Transit	\$500,000	No	1 year
*Agency listed is responsible for implementation, operations and maintenance unless otherwise noted.					
**The design has not been undertaken and thus this is only an opinion of probable cost for planning purposes.					

Amarillo Region Mid-Term Projects (10-Year)

Travel and Traffic Management

TxDOT Amarillo Phase 3 ITS Implementation

Associated Market Packages:

- Network Surveillance (ATMS01)
- Freeway Control (ATMS04)
- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Broadcast Traveler Information (ATIS1)
- Roadway Automated Treatment (MC05)
- Emergency Routing (EM2)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: TxDOT Amarillo Phase 2 ITS Implementation, Amarillo Regional Communications Master Plan

Description: Phase 3 of the TxDOT ITS in the Amarillo Region will implement additional CCTV cameras and DMS, as well as traffic detectors and highway advisory radio (HAR) transmitters in the Amarillo Region. The traffic detectors are expected to be inductive loops. Costs will vary based on the amount of field equipment deployed and the required communications infrastructure.

TxDOT Amarillo Phase 4 ITS Implementation

Associated Market Packages:

- Network Surveillance (ATMS01)
- Freeway Control (ATMS04)
- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Broadcast Traveler Information (ATIS1)
- Roadway Automated Treatment (MC05)
- Emergency Routing (EM2)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: TxDOT Amarillo Phase 2 ITS Implementation, TxDOT Amarillo Phase 3 ITS Implementation

Description: Phase 4 of the Amarillo ITS will implement additional CCTV cameras and DMS, as well as traffic detectors and HAR transmitters in the Amarillo Region. The traffic detectors are expected to be installed as inductive loops. Costs will vary based on the amount of field equipment deployed and the required communications infrastructure.

TxDOT Closed Loop Signal System Expansion Phase 2

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Regional Traffic Control and Coordination (ATMS07)

Prerequisite Projects: TxDOT Closed Loop Signal System Expansion Phase 1, Amarillo Regional Communications Master Plan

Description: Expand and upgrade the closed loop signal system by integrating additional signals and implementing VIVDS at select TxDOT intersections throughout the Region.

Amarillo Traffic Control System Expansion Phase 2

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Regional Traffic Control and Coordination (ATMS07)

Prerequisite Projects: Amarillo Traffic Control System Expansion Phase 1

Description: Continue expansion and implementation of the City of Amarillo traffic control system.

Amarillo Video Image Vehicle Detectors (VIVDS) Expansion Phase 2

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)

Prerequisite Projects: Amarillo VIVDS Expansion Phase 2

Description: Continue VIVDS installations at signalized intersections in Amarillo.

Regional 511 Advanced Traveler Information System Server

Associated Market Packages:

- Traffic Information Dissemination (ATMS06)
- Broadcast Traveler Information (ATIS1)

Pre-requisite projects: TxDOT Center-to-Center Communications, TxDOT Highway Condition Reporting System (HCRS) Enhancements, Media Liaison and Coordination

Description: Install a server dedicated to ATIS in the TxDOT Amarillo TMC. This server would be installed as part of a 511 rollout in Texas and would provide a gateway for public and private entities to access current conditions, closures, restrictions, weather, and other valuable travel information. Relevant data from the ATMS and HCRS would be sent to the ATIS server where it would be consolidated and

‘packaged’ for distribution via phone (511) and also web and to private partners who desire access to information in the Amarillo Region. These private partners could include local media and information service providers, which would link to the ATIS server to download information, or obtain real-time feeds, depending on the link provided by the private partner. Appropriate security measures and firewalls could be designed into the server to allow or restrict access to registered, authorized users. By fusing various types of data from a variety of sources (traffic management, incident management, and others), this data can be converted to usable information for travelers as well as other agencies.

Amarillo School Flashers Paging System

Associated Market Packages:

- Surface Street Control (ATMS03)

Prerequisite Projects: None

Description: Install paging and central system(s) to allow remote control of flashers for schools in City of Amarillo. Two-way paging systems are available for programming and troubleshooting school zone time clocks (AC or solar powered). A two-way paging system will allow programming of times for the new school year, special events, and even turn flashers in the system on during emergencies from a central location. Two-way paging also provides acknowledgement that the flasher received the message and provides routine diagnostic/operational status messages. The main benefit of a paging system is eliminating costly trips to the field to reprogram units or manually operate flashers.

Parking and Event Management System Phase 1

Associated Market Packages:

- Parking Facility Management (ATMS16)

Prerequisite Projects: None

Description: Install a first phase of a parking and event management system that directs motorists to available spaces. Potential installation locations include the downtown Civic Center, Tri-state Fairground, airport, racetrack, etc. Parking management systems have proven to reduce delays/congestion and improve air quality around areas where motorists may “circle” a venue in search of an available parking location. Parking and event management systems are composed of two subsystems. The first subsystem monitors the availability of parking spaces at a facility based on vehicles entering and exiting the facility based on gate counts. More sophisticated subsystems count how many spaces are available based on individual parking stall presence detectors. The second major subsystem provides motorists with dynamic parking information on the major streets approaching the venue(s). The information is routinely disseminated using a combination of static and dynamic signing.

Route 87/Dalhart Railroad Crossing Enhancements

Associated Market Packages:

- Standard Railroad Grade Crossing (ATMS13)
- Railroad Operations Coordination (ATMS15)

Prerequisite Projects: None

Description: Install railroad crossing enhancements to provide better safety and traveler information along Route 87 in Dalhart, about 90 miles north of Amarillo. The Burlington Northern Santa Fe Railroad, the Rock Island Railroad and the Union Pacific/Southern Pacific Railroad all intersect in Dalhart. The proposed improvements include a variety of traffic signal coordination modifications (including possible installation of VIVDS), gate enhancements/trapped vehicle alarm systems, and dynamic estimated time of arrival/departure signs. It is anticipated that TxDOT and local law enforcement would receive a notice when the trapped vehicle alarm has been activated.

Interstate Coordination Phase 2

Associated Market Packages:

- Regional Traffic Control and Coordination (ATMS07)
- Emergency Evacuation and Detour Routing

Prerequisite Projects: Interstate Coordination Phase 1

Description: Implement communication links and information sharing between TxDOT and nearby states, including Colorado, Kansas and Utah. Although these states are not immediately adjacent to Texas or the Amarillo Region, major incidents, weather hazards, or closures and restrictions in the Amarillo Region or nearby state could have significant impacts on interstate travel and commerce. Sharing major planned and unplanned incident information is valuable, due to the limited alternate routes. The information sharing will require software development to collect data from different systems and sources, convert or translate information (if required) to a common data dictionary, and disseminate packaged information back to partner states. As an alternative, the interstate nature of the project may lend itself to a secure web-based information sharing strategy, rather than direct center-to-center communications among systems in different states.

Emergency Management

Roadway Service Patrol

Associated Market Packages:

- Mayday Support (EM3)
- Roadway Service Patrol (EM4)

Prerequisite Projects: None

Description: Implement a Roadway Service Patrol with the Amarillo urban boundaries. The service patrol will assist in the expedited clearance of minor traffic incidents (e.g., flat tire, roadway debris,

empty gas tank, etc). The service patrol will provide traffic control support to fire/police/EMS during major incidents.

Computer Aided Dispatch for TxDOT

Associated Market Packages:

- Incident Management System (ATMS08)
- Emergency Response (EM1)

Prerequisite Projects: TxDOT Maintenance Vehicle AVL

Description: Implement a CAD system for dispatch of TxDOT maintenance and construction vehicles in the Amarillo Region. In conjunction with AVL units on-board TxDOT maintenance vehicles, a CAD system will streamline dispatch and communications between the maintenance center at the TxDOT Amarillo District office and drivers in the field. The benefits of a CAD system for maintenance functions are:

- Streamlined data entry for incidents requiring maintenance vehicles (such as snowstorms);
- Ability to pinpoint location of maintenance and construction vehicles to identify and dispatch appropriate resources;
- Maintaining maintenance activity logs for routine as well as incident-specific maintenance activities;
- Ability to prioritize maintenance resources based on demand for maintenance vehicles for routine as well as incident-specific;
- A graphical display of maintenance locations, activities, as well as vehicles; and
- Records and information management – the CAD system can archive maintenance data which can then be used for planning purposes.

Emergency Vehicle Traffic Signal Preemption

Associated Market Packages:

- Surface Street Control (ATMS03)
- Emergency Routing (EM2)

Prerequisite Projects: Amarillo Traffic Control System Expansion Phases 1 and 2, TxDOT Closed Loop Signal System Expansion Phases 1 and 2

Description: Equip approximately 100 intersections and 30 City of Amarillo Fire vehicles with traffic signal preemption equipment. Typical installations include mounting hardware at the intersection and on each vehicle authorized to preempt the signal. The intersection equipment includes a detector(s) positioned at the intersection approach(es) connected to the traffic signal controller. As a vehicle equipped with a preemption emitter approaches an intersection, the detector activates a change in signal timing to allow fast and safe passage. Preemption systems have proven to improve safety of emergency personnel and vehicles en-route to an incident.

Agency Collocation

Associated Market Packages:

- Regional Traffic Control and Coordination (ATMS07)
- Emergency Response (EM1)

Prerequisite Projects: None

Description: Construct a facility with capacity to accommodate the needs of the Amarillo/Potter/Randall EOC, TxDOT TMC, TxDPS, and City of Amarillo Traffic and Transit. Collocation of these key agencies offers several opportunities to maximize capital and facility operating costs of the different agencies, including building, land, utilities, and computer network equipment. Having these agencies in a central facility would allow them to share, in real-time and near-real-time, incident information that could lead to a faster, more coordinated response. Similarly, traffic management functions would be enhanced (i.e., modify signal operations, implement detour/alternate route plans, implement traveler information strategies) by having first-hand knowledge and involvement with the incident management process. This would be beneficial for planned events (such as special events, major construction, etc.) as well as unplanned incidents. Resource sharing, such as for operations, dispatch, and other functions, also could be achieved through cross-training staff from the various agencies.

Several agreements need to be developed prior to developing a multi-agency command and control center; there are likely numerous functional and institutional issues to be resolved considering there will be state, county and municipal entities involved. These would include state versus local processes and functions, data ownership, system security and access, and system compatibility.

Maintenance and Construction Operations

TxDOT Maintenance Vehicle AVL

Associated Market Packages:

- Maintenance and Construction Vehicle Tracking (MC01)
- Winter Maintenance (MC06)
- Maintenance and Construction Activity Coordination (MC10)

Prerequisite Projects: None

Description: Similar to the transit AVL project, the maintenance and construction AVL project includes equipping TxDOT maintenance vehicles with GPS based vehicle locators. It is envisioned that the location of the vehicle would be overlaid on a base map showing real-time positions of each equipped vehicle. The main purpose of the system is to assist dispatchers and supervisors to better manage the fleet of vehicles. For example, if a report of a spill occurred on a major roadway, a supervisor could quickly determine what vehicle is closest and best equipped to clean up the spill.

TxDOT Computer Aided Snowplow Dispatching

Associated Market Packages:

- Maintenance and Construction Vehicle Tracking (MC01)
- Winter Maintenance (MC06)
- Maintenance and Construction Activity Coordination (MC10)

Prerequisite Projects: TxDOT Maintenance and Construction Vehicle AVL, TxDOT Computer Aided Dispatch (CAD)

Description: As a logical extension of the TxDOT Maintenance and Construction AVL project, the Computer Aided Snowplow dispatching project includes equipping TxDOT snow plows/vehicles with in-vehicle units (IVU). IVUs are dashboard-mounted computer displays that provide two-way messaging between the driver and the snow plow manager. The IVUs interface with all plow and temperature sensors, and material spreaders, and transmits information to dispatch. The manager uses the IVU to send instructions and assignments from a centralized command post or in a mobile supervisor vehicle.

Typical dispatching software allows managers to obtain real-time data about the location and activities of each truck, and what and where the truck has been in the past. An interactive map is color-coded telling the manager what roads have been maintained, what was done (plowing or salting), and the time passage since the truck was there. The map also shows current status of each truck. The manager can also choose one particular truck and acquire a variety of data compiled by on-board sensors.

Typical software archives information on driver hours, salt/chemical used and truck miles that can be assembled into tables or reports. The software also allows review of storm events, so improvements can be made, and the system improved.

Public Transportation Management

Panhandle Community Services Transit Security Cameras

Associated Market Packages:

- Transit Security (APTS5)

Prerequisite Projects: None

Description: Install CCTV cameras on board Panhandle Community Services transit fleet. These cameras will allow for on-board recording only, and are not envisioned to be monitored remotely from the Panhandle Community Services Transit TOC. Video will be stored for a pre-determined amount of time via video tape or emerging digital video recording technology. While the main objective of on-board surveillance projects has been to identify individuals committing criminal acts or creating disturbances on buses, there have been noticeable maintenance benefits such as a reduction of litter and debris.

Costs will vary depending on number of on-board cameras installed. For planning purposes, security cameras for 42 vehicles at \$15,000 each was used.

Amarillo City Transit Transfer Station Traveler Information

Associated Market Packages:

- Transit Fixed Route Operations (APTS2)
- Transit Traveler Information (APTS8)

Prerequisite Projects: Amarillo City Transit Automatic Vehicle Location (AVL)

Description: Install static and real-time transit and traveler information devices at three transit transfer stations in Amarillo. The project will build on information available from the transit AVL project. Either kiosks, monitors, or dynamic signs will relay information on current bus operating conditions (e.g., Next bus – 5 minutes, on schedule, delayed 10 minutes, etc.).

Panhandle Community Services Electronic Fare Collection System

Associated Market Packages:

- Demand-Response Transit Operations (APTS3)
- Transit Passenger and Fare Management (APTS4)

Prerequisite Projects: Panhandle Community Services Transit Operations Center (TOC) with Computer Aided Dispatch System (CAD), Panhandle Community Services Transit Automatic Vehicle Location (AVL) and Mobile Data Terminals (MDT)

Description: Equip Panhandle Community Services demand-response transit buses with automated fare payment systems. There are three primary benefits of these electronic fare collection systems. The first is enhanced revenue collection ability. The second is increased security by not having large amounts of cash or tokens on the vehicle. The third is the increased convenience and security for the transit patron. The system will build on hardware and software previously provided under the transit AVL project. Specifically, fare boxes will be upgraded to accept smart cards (i.e., cards with passive RFID technology or a magnetic information strip, such as a credit card) with rider and account information. Electronic fare payment technology is rapidly advancing, and there will be several technological considerations will need to be examined, such as standards for smart cards and interoperability issues.

Cost will vary depending on fleet size over the next 5-10 years.

Amarillo City Transit Electronic Fare Collection System

Associated Market Packages:

- Transit Fixed-Route Operations (APTS2)
- Demand-Response Transit Operations (APTS3)
- Transit Passenger and Fare Management (APTS4)

Prerequisite Projects: Amarillo City Transit Automatic Vehicle Location (AVL)

Description: Equip Amarillo City transit fixed-route and demand response buses with automated fare payment systems. There are three primary benefits of these electronic fare collection systems. The first is enhanced revenue collection ability. The second is increased security by not having large amounts of cash or tokens on the vehicle. The third is the increased convenience and security for the transit patron.

The system will build on hardware and software previously provided under the transit AVL project. Specifically, fare boxes will be upgraded to accept smart cards (i.e., cards with passive RFID technology or a magnetic information strip, such as a credit card) with rider and account information. Electronic fare payment technology is rapidly advancing, and there will be several technological considerations will need to be examined, such as standards for smart cards and interoperability issues.

Cost will vary depending on fleet size over the next 5-10 years.

Table 8 – Long-Term Projects (20-Year)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
<i>Traffic and Travel Management</i>					
TxDOT Amarillo ITS Implementation (Additional phases beyond Phase 4)	Implement/upgrade CCTV cameras, DMS, vehicle detectors, and HARs in the Amarillo Region as needed	TxDOT	\$2,000,000	No	5 years
TxDOT Closed Loop Signal System Expansion Phase 3	Continue expansion and upgrade of closed loop signal system for TxDOT operated signals (including VIVDS)	TxDOT	\$500,000	No	5 years
Amarillo Traffic Control System Phase 3	Continue implementation, expansion, and upgrade of traffic control system in the City of Amarillo	Implementation: TxDOT Operations: City of Amarillo Maintenance: City of Amarillo	\$500,000	No	5 years
Parking and Event Management System Phase 2	Implement additional and expand existing parking and event management system	City of Amarillo	\$1,000,000	No	2 years
ISP-based Route Guidance Support	Provided direct support to ISP-based route guidance systems through sharing of traveler information	Public Agencies/Private Sector	Public: \$100,000	No	1 year
I-40 Alternate Route Detection	Install traffic/incident detectors on non-Interstate routes to monitor I-40 detour routes during closures (needs detection on rural routes as well as in urban routes)	TxDOT	\$400,000	No	2 years
Probe Surveillance	Implement systems to allow probe surveillance of vehicles using possible existing transponders in vehicles	TxDOT/Private Sector	\$1,000,000	No	2 years
<i>Emergency Management</i>					
TxDPS Computer Aided Dispatch (CAD)	Implement CAD for TxDPS	TxDPS	\$500,000	No	2 years
Mayday Support	Provide support to Mayday Service providers through sharing of traffic information, emergency dispatch information, etc.	Transportation and Emergency Services Agencies/Private Sector	\$100,000	No	1 year

Table 8 – Long-Term Projects (20-Year) (continued)

Program Area/Project	Description	Responsible Agency*	Probable Cost**	Funding Identified	Estimated Project Duration
<i>Maintenance and Construction Operations</i>					
Automated Snowplows	Add technology to snowplows to automate driving during white-out conditions	TxDOT	\$2,000,000	No	5 years
<i>Public Transportation Management</i>					
Panhandle Community Services Automatic Passenger Counters	Implement passive on-board systems to count passenger ridership (boardings and alightings)	Panhandle Community Services	\$84,000	No	6 months
Panhandle Community Services Transit Traveler Information System/Travel Data and Route Guidance	Implement web-based dial-a-ride and travel information systems to provide automated access to schedule, status and service information for transit patrons	Panhandle Community Services	\$500,000	No	1 year
Amarillo City Transit Traveler Information System	Provide improved transit traveler information through web based and station located real time maps and bus arrival time announcements	Amarillo City Transit	\$500,000	No	2 years
*Agency listed is responsible for implementation, operations and maintenance unless otherwise noted					
**The design has not been undertaken and thus this is only an opinion of probably cost for planning purposes.					

Amarillo Region Long-Term Projects (20-Year)

Travel and Traffic Management

TxDOT Amarillo ITS Implementation (Additional Phases)

Associated Market Packages:

- Network Surveillance (ATMS01)
- Freeway Control (ATMS04)
- Traffic Information Dissemination (ATMS06)
- Regional Traffic Control and Coordination (ATMS07)
- Broadcast Traveler Information (ATIS1)
- Emergency Evacuation and Detour Routing
- Emergency Routing (EM2)

Prerequisite Projects: TxDOT Amarillo ITS Implementation Phases 2 through 4

Description: Next phases of the Amarillo ITS will implement additional CCTV cameras and DMS, as well as traffic detectors and highway advisory radio (HAR) transmitters in the Amarillo Region.

TxDOT Closed Loop Signal System Expansion Phase 3

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Regional Traffic Control and Coordination (ATMS07)

Prerequisite Projects: Amarillo Regional Communications Master Plan, TxDOT Closed Loop Signal System Expansion Phases 1 and 2

Description: Expand and upgrade the closed loop signal system by integrating additional signals and implementing VIVDS at select TxDOT intersections throughout the Region.

Amarillo Traffic Control System Expansion Phase 3

Associated Market Packages:

- Network Surveillance (ATMS01)
- Surface Street Control (ATMS03)
- Regional Traffic Control and Coordination (ATMS07)

Prerequisite Projects: Amarillo Regional Communications Master Plan, Amarillo Traffic Control System Upgrade Expansion Phases 1 and 2

Description: Upgrade and continue to implement a traffic control system for the City of Amarillo.

Parking and Event Management System Phase 2

Associated Market Packages:

- Parking Facility Management (ATMS16)

Prerequisite Projects: Parking and Event Management System Phase 1

Description: Install a second phase of a parking and event management system that directs motorists to available spaces. Potential installation locations include the downtown Civic Center, Tri-state Fairground, airport, racetrack, and other locations.

ISP-based Route Guidance Support

Associated Market Packages:

- Broadcast Traveler Information (ATIS1)
- ISP-Based Route Guidance (ATIS6)

Prerequisite Projects: TxDOT Amarillo Phase ITS Implementation Phases 2 through 4, Amarillo TOC/TxDOT TMC Fiber Connection

Description: Provide information service providers (ISPs) with data relative to current travel conditions. The project extends current static capabilities of the OnStar, in-vehicle route guidance systems (or equivalent) currently being equipped in new vehicles (OnStar is equipped on some GM, Acura, Audi, Saab, and Subaru models). Currently, the OnStar system will help guide a motorist to a location based on static information. By providing real-time traveler information to ISPs, the guidance systems could modify the recommended route based on dynamic roadway conditions (e.g., variation on congestion levels, accidents, roadwork, etc.). The project will require a public/private sector partnership because route guidance and navigation services are typically subscription services.

I-40 Alternate Route Detection

Associated Market Packages:

- Network Surveillance (ATMS01)

Prerequisite Projects: None

Description: Install traffic/incident detectors on non-Interstate routes to monitor I-40 detour routes during closures. This information, used in conjunction with traveler information devices such as DMS and HAR, will enable TxDOT to direct motorists onto appropriate routes during I-40 closures.

Probe Surveillance

Associated Market Packages:

- Probe Surveillance (ATMS02)

Prerequisite Projects: None

Description: Obtain travel condition information from vehicles equipped with GPS devices. Since many new vehicles are being equipped with GPS based in-vehicle route guidance systems, a public/private partnership will be developed, possibly in conjunction with the ISP-based Route Guidance project, to provide location, and travel direction/speed data to TxDOT to integrate into the ATMS. Commercial vehicles are good candidate probe vehicles for this project. Software, and potentially hardware, enhancements will be required to integrate the probe information into the existing platform and user interface.

Emergency Management

TxDPS Computer Aided Dispatch (CAD)

Associated Market Packages:

- Incident Management System (ATMS08)
- Emergency Response (EM1)

Prerequisite Projects: None

Description: Implement a CAD system for dispatch of TxDPS vehicles in the Amarillo Region. Because TxDPS is a state agency, a CAD system would need to be a statewide initiative. A CAD system for TxDPS would be most effective in conjunction with AVL units on-board each of the TxDPS vehicles, to allow for vehicles in the field and their locations to be displayed on a map of the Region. When emergency calls come in through 911 or another agency, dispatchers would create an incident entry in the CAD system, including the incident location, type/nature of the incident, the CAD system would identify the nearest officer based on location information from AVL units, and generate an appropriate dispatch. The CAD system would be able to maintain records of all communications and responses between the dispatch center and the responding officer(s), and in effect, ‘track’ the incident from beginning to end.

Based on specifications created by TxDPS, there can be functions built in to the CAD to prioritize incidents (or assign priority) based on the type, severity, and other factors. A centralized, automated CAD system will allow TxDPS to manage multiple incidents, and could potentially interface with other agencies that would need to be contacted with incident details. During a major event that requires a multi-agency response, all involved agencies in the Amarillo Region would be able to work from the same incident data and immediately know what resources have been committed. The records management function of a CAD system allows for all of the incident details to be stored in a consistent format, clearly identifies the dispatcher, responding officer(s), other agencies involved, duration of the incident, actions taken, and other pertinent details.

Mayday Support

Associated Market Packages:

- Mayday Support (EM3)

Prerequisite Projects: None

Description: Provide real-time travel data to Mayday Service Providers. One of the features inherent to the emerging in-vehicle navigation systems is the use of Mayday Systems. Mayday systems send automated signals for help when sensors are activated (e.g., flat tire, collision, etc.). Alternatively, a driver can request assistance manually. Mayday calls typically are not routed to the nearest Public Safety Answering Point (PSAP), rather they are sent to private dispatch centers that coordinate requests for help. By providing real-time data from the TxDOT ATMS to the private dispatch centers, Mayday Support services will be enhanced. For example, a dispatcher will be able to provide the best route to an incident based on current travel conditions to a responding towing service.

Maintenance and Construction Operations

Automated Snowplows

Associated Market Packages:

- Maintenance and Construction Vehicle Tracking (MC01)
- Winter Maintenance (MC06)

Prerequisite Projects: TxDOT Maintenance Vehicle AVL

Description: Provide lateral guidance and collision warnings to drivers of snowplows. The project will be designed to provide a driver a means to maintain desired lane position and avoid collisions with obstacles during periods of low visibility. The system improves safety for the snow plow operator by providing the necessary cues for lane keeping and collision avoidance normally unavailable during poor visibility conditions. The technology to be used in the project will likely include a combination of GPS, magnetic pavement marking tape, radar detection, a windshield heads-up display, and several types of warning devices.

Public Transportation Management

Panhandle Community Services Automatic Passenger Counters

Associated Market Packages:

- Demand-Response Transit Operations (APTS3)
- Transit Passenger and Fare Management (APTS4)

Prerequisite Projects: Panhandle Community Services Transit Automatic Vehicle Location (AVL) and Mobile Data Terminals (MDT)

Description: Install on-board devices to collect data on passenger boardings and alightings. In conjunction with an AVL system, passenger data can be collected by time and bus location. There are three basic elements to a passenger counter system:

- A counter capable of counting each passenger as they board or alight (and the ability to distinguish between boardings and alightings)
- Location technology to determine the vehicle's location when the boardings and alightings occur
- A data management system to store passenger information which will then be transferred to the Transit Operations Center.

There are two common forms of automatic passenger counters: treadle mats and infrared beams. Treadle mats consist of at least two mats placed on the stairs into the vehicle. Placement of the mats enables the system to detect passengers boarding or leaving the bus. While this is a fairly reliable technology, the mats are subject to wear and tear, water or slush leaking into the mats, or have difficulty getting accurate counts if more than one person steps on the mat simultaneously. Infrared beams operate using essentially the same principal, although instead of mats, a pair of horizontal beams is set up in the path of boarding and alighting passengers. This technology is not as prone to wear and tear from foot traffic or weather elements as the treadle mats, but pose the same difficulty in getting accurate passenger counts if more than one person passes through the beams at any given time.

Passenger data can be transferred to the Transit TOC via disk (most economical), physical data connection, or long-range wireless connection. Because this information is typically used for planning, scheduling and analysis, it is not recommended that Panhandle consider real-time or near-real-time passenger count data transmission. Many agencies have barely enough radio capacity to transmit AVL data in real time, which typically yields more benefit for transit operations and traveler information than passenger counts.

Panhandle Community Services Transit Traveler Information System/Travel Data and Route Guidance

Associated Market Packages:

- Demand-Response Transit Operations (APTS3)
- Transit Traveler Information (APTS8)

Prerequisite Projects: Panhandle Community Services Transit Automatic Vehicle Location (AVL) and Mobile Data Terminals (MDT), Panhandle Community Services Transit Operations Center (TOC) with Computer-Aided Dispatch System (CAD)

Description: Provide enhanced transit related traveler information to Panhandle Community Services transit customers. The on-demand nature of Panhandle's transit service requires that up-to-the minute information about pick-ups, drop-offs, vehicle location, and any disruptions in service be available not only to the TOC staff, but also to transit passengers pre-trip. General (static) and near-real-time information about dial-a-ride services and status, as well as interactive trip scheduling and reservations could be made available to patrons via Internet-based travel information systems. Web-based maps could show locations of Panhandle vehicles in near-real-time. This real-time information also would be available at the Panhandle Community Services dispatch/call center for passengers who do not have access to the Internet. Coordination with TxDOT and the City of Amarillo would allow for current traffic conditions, incidents, closures and other impacts to the roadway network to be displayed with the transit route and status information.

Amarillo City Transit Traveler Information System

Associated Market Packages:

- Transit Fixed Route Operations (APTS2)
- Demand-Response Transit Operations (APTS3)
- Transit Traveler Information (APTS8)

Prerequisite Projects: Amarillo City Transit Automatic Vehicle Location (AVL)

Description: Provide up-to-date transit information for Amarillo City Transit on the Internet, by phone and at transfer stations. This project will implement web-based transit traveler information that can be accessed by patrons pre-trip to identify routes, schedules, status (delays, bus arrival times, etc. from AVL data) and other pertinent information. An integrated transit traveler information system will make this information accessible from the Internet, at kiosks or other displays at transfer stations, and via phone. This project also should provide for an interactive trip planner to allow patrons to map out their trips, including bus arrival/departure times, transfers, and help them to identify optimum routes and schedules. This trip planning system will enhance current efforts by customer service call center staff who already provide trip planning assistance to patrons by phone. Coordination with TxDOT and the City of Amarillo would allow for current traffic conditions, incidents, closures, special events, and other impacts to the roadway network to be displayed with the transit route and status information.

An on-board element of the transit traveler information system could provide passengers already on the bus with information about bus arrival, name of stop, next bus arrival, and transfer requirements. These on-board enunciators support ADA requirements.

4. PROCEDURE FOR SUBMITTING ITS PROJECTS

The Amarillo Regional ITS Deployment Plan is a living document. The recommended projects and their timeframe for their 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 Amarillo Regional ITS Architecture and the ITS Deployment Plan. These plans will continue to be driven by stakeholder consensus rather than a single stakeholder. In order for changes to occur in the plan, it is recommended that all stakeholders be invited to a consensus building meeting to discuss any proposed changes to the Regional ITS Architecture or ITS Deployment Plan.

It is also recommended that stakeholders meet on an annual basis to review the existing Regional ITS Architecture and ITS Deployment Plan. At these annual meetings, stakeholders should identify which projects in the ITS Deployment Plan have been deployed. Project status (existing, planned, or future) may have to be updated for many of the projects as they move from the future to planned to existing status. New projects that are recommended by a stakeholder for inclusion in the ITS Deployment Plan should also be discussed to ensure that the Region as a whole feels that the project agrees with regional needs and priorities. This same type of consensus building should also be used should the geographic scope need to change or should additional stakeholders need to be added to the Regional ITS Architecture and ITS Deployment Plan.

Projects that are added to the ITS Deployment Plan should also be reviewed closely to determine if they fit into the current ITS Architecture for the Amarillo 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.

Both the Amarillo 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.