State of Texas
ITS Architectures and Deployment Plans

Waco Region

Executive Summary

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PROJECT APPROACH

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

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

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

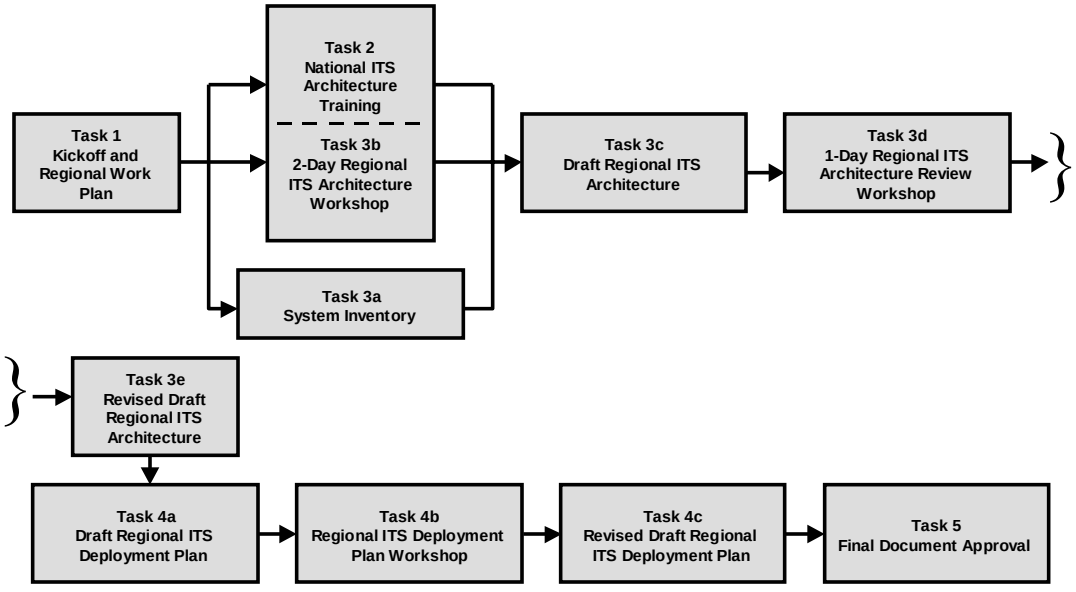


Figure 1 – Waco Regional ITS Architecture and Deployment Plan Development Process

OVERVIEW OF THE WACO REGION

The Waco Region is bordered by the TxDOT Dallas and Fort Worth Districts to the north, the TxDOT Austin District to the south, the TxDOT Bryan District to the east, and the TxDOT Brownwood District to the west. For the Waco Regional ITS Architecture and Deployment Plan, the study area included all eight counties that comprise the TxDOT Waco District as well as Freestone County which is part of the Bryan District. **Figure 2** illustrates the Regional boundaries.

The Waco Region has an extensive transportation infrastructure. The primary roadway facilities include I-35, US-77, US-84, US-190, SH-6, and SH-95.

I-35 is a north-south, divided interstate highway. The effective operation of this highway is critical to the movement of goods and people through the State of Texas and the United States. I-35 is a North American Free Trade Agreement (NAFTA) corridor and extends from the border with Mexico in Laredo to the Canadian border. Blockages along I-35 can have serious implications on drive-time for commercial vehicles and motorists alike due to the lack of obvious alternate routes. Knowing the road and travel conditions within this transportation corridor and having the ability to disseminate this information to motorists are important elements for this project. For example, if I-35 has been closed due to a major incident or weather, and motorists are informed of the closure in advance, they can alter their travel plans with an alternate route or wait to begin their travels.

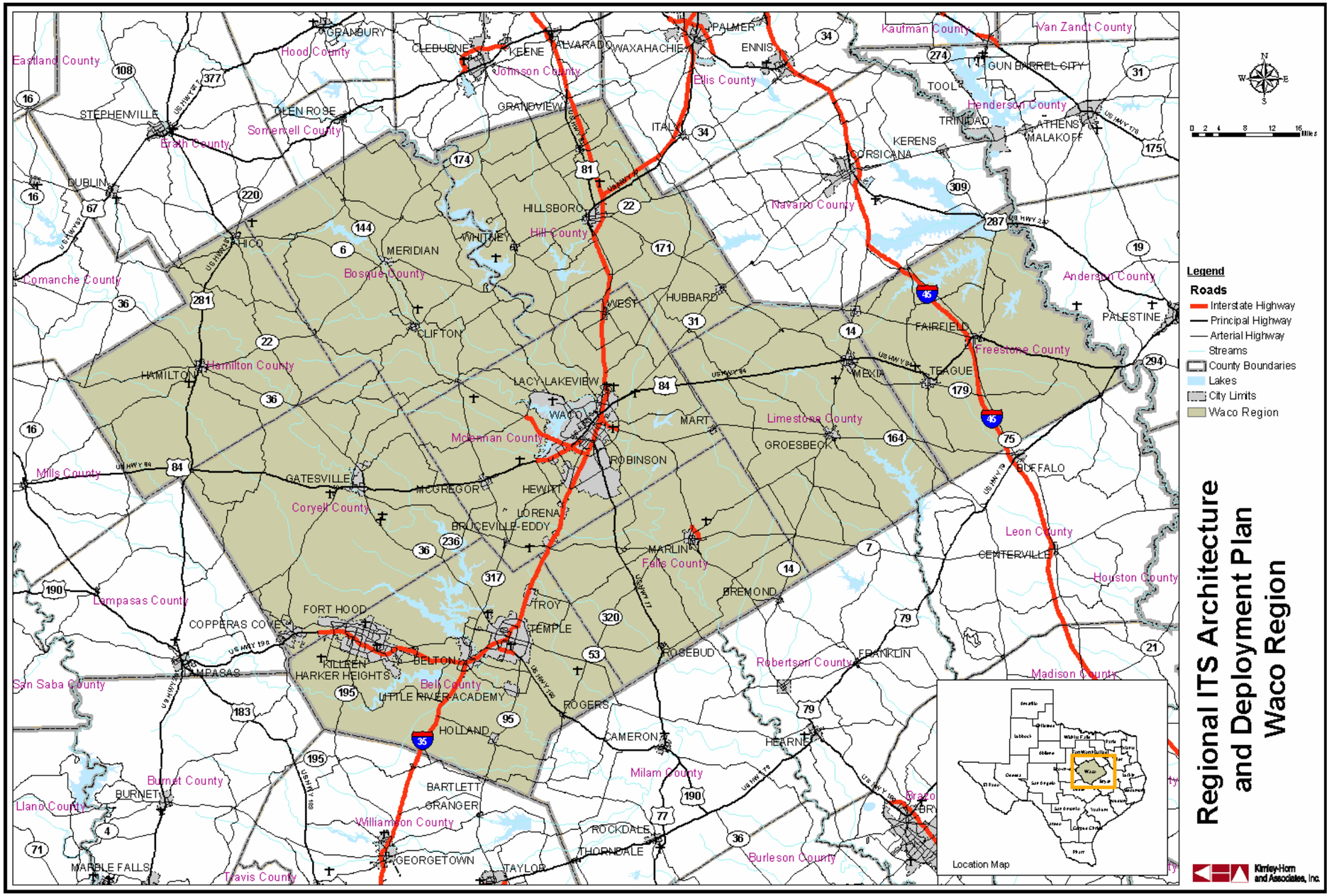


Figure 2 – Waco Region Map

WACO REGION STAKEHOLDERS

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

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

- Bell County;
- City of Waco;
- City of Waco Transit;
- Federal Highway Administration;
- Fort Hood;
- Heart of Texas Council of Governments (HOTCOG);
- Hill Country Transit District;
- Killeen-Temple Urban Transportation Study (K-TUTS)/Central Texas Council of Governments;
- McLennan County;
- TxDOT Public Transportation Division;
- TxDOT Waco District;
- TxDOT Traffic Operations Division (Austin);
- Waco Metropolitan Planning Organization (MPO); and
- Waco/McLennan County Emergency Management.

WACO REGIONAL ITS ARCHITECTURE

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

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

Inventory and Needs in the Region

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

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

Table 1 – Waco Region: Summary of ITS Needs

Waco Region

Summary of ITS Needs
Waco Regional ITS Architecture and Deployment Plan Kick-Off Meeting
September 11, 2003

Travel and Traffic Management Needs

- Need Traffic Management Center (TMC) Expansion for City of Waco
- Need to share information between TxDOT and the City of Waco
- Need dynamic message signs (DMS) in the City of Waco
- Need detour planning
- Need travel time information (vehicle detection and DMS)
- Need to continue to integrate fiber optics in other transportation projects
- Need automated vehicle credentialing for entry to Ft. Hood
- Need DMS for traffic information at Ft. Hood entrances
- Need event management plans for Ft. Hood
- Need improved incident information dissemination in Bell County

Public Transportation Management Needs

- Need electronic fare payment for City of Waco Transit
- Need real time access to video feeds from buses for City of Waco Transit
- Need automated vehicle location (AVL) and security cameras in new buses as fleet is replaced for City of Waco Transit
- Need automated scheduling expansion for HOTCOG
- Need AVL for HOTCOG, City of Waco and Hill Country Transit vehicles
- Need mobile data terminals (MDTs) for Hill Country Transit
- Need computer aided dispatch (CAD) for Hill Country Transit
- Need automated passenger counters (APCs) for Hill Country Transit

Electronic Payment Needs

None Identified

Commercial Vehicle Operations Needs

None identified

Emergency Management Needs

- Need emergency operations center (EOC) connection to the Department of Public Safety (DPS)
- Need AVL on emergency vehicles
- Need flood detection

Advanced Vehicle Safety Systems Needs

None Identified

Information Management Needs (Data Archiving)

None identified

Maintenance and Construction Management Needs

None identified

Market Packages

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

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

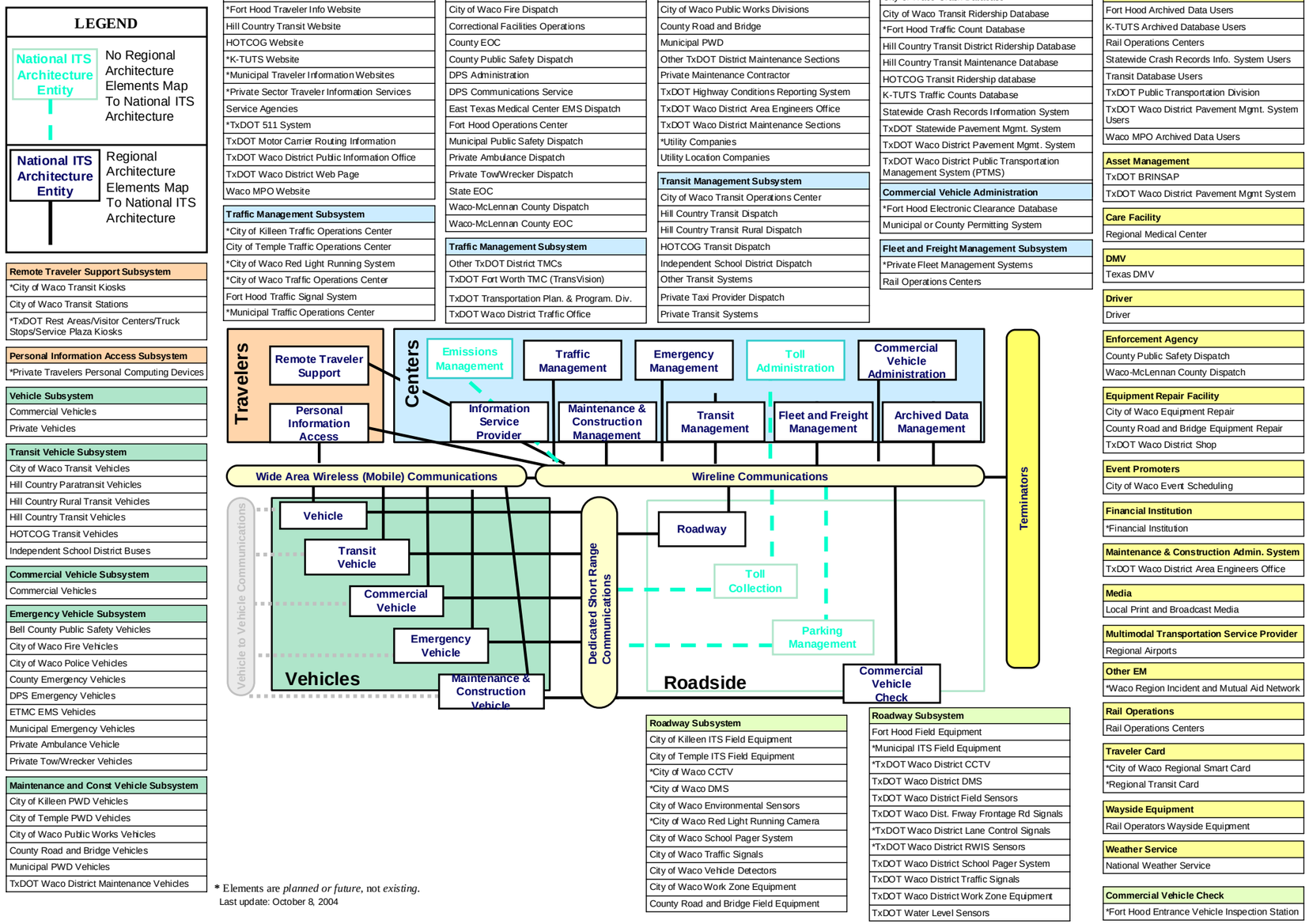
At the 2-Day ITS Architecture Workshop, stakeholders selected the market packages that corresponded to the desired services and functions identified for the Region, and then customized these market packages. They included services and functions such as Network Surveillance, Traffic Information Dissemination, and Emergency Response as well as market packages to address coordination needs, including an Incident Management System and Regional Traffic Control and Coordination. Because market packages are groups of services and functions, they can be deployed incrementally and over time. Of the 75 market packages in the National ITS Architecture, stakeholders identified 33 as being applicable to the Waco Region. Two custom market packages were added for Red Light Running and Military Base Entrance Electronic Clearance.

Interconnects, Interfaces, and Standards

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

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

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



Remote Traveler Support Subsystem
*City of Waco Transit Kiosks
City of Waco Transit Stations
*TxDOT Rest Areas/Visitor Centers/Truck Stops/Service Plaza Kiosks

Personal Information Access Subsystem
*Private Travelers Personal Computing Devices

Vehicle Subsystem
Commercial Vehicles
Private Vehicles

Transit Vehicle Subsystem
City of Waco Transit Vehicles
Hill Country Paratransit Vehicles
Hill Country Rural Transit Vehicles
Hill Country Transit Vehicles
HOTCOG Transit Vehicles
Independent School District Buses

Commercial Vehicle Subsystem
Commercial Vehicles

Emergency Vehicle Subsystem
Bell County Public Safety Vehicles
City of Waco Fire Vehicles
City of Waco Police Vehicles
County Emergency Vehicles
DPS Emergency Vehicles
ETMC EMS Vehicles
Municipal Emergency Vehicles
Private Ambulance Vehicle
Private Tow/Wrecker Vehicles

Maintenance and Const Vehicle Subsystem
City of Killeen PWD Vehicles
City of Temple PWD Vehicles
City of Waco Public Works Vehicles
County Road and Bridge Vehicles
Municipal PWD Vehicles
TxDOT Waco District Maintenance Vehicles

Information Service Provider Subsystem
Baylor University Traveler Information Website
City of Waco Website
*Fort Hood Traveler Info Website
Hill Country Transit Website
HOTCOG Website
*K-TUTS Website
*Municipal Traveler Information Websites
*Private Sector Traveler Information Services
Service Agencies
*TxDOT 511 System
TxDOT Motor Carrier Routing Information
TxDOT Waco District Public Information Office
TxDOT Waco District Web Page
Waco MPO Website

Traffic Management Subsystem
*City of Killeen Traffic Operations Center
City of Temple Traffic Operations Center
*City of Waco Red Light Running System
*City of Waco Traffic Operations Center
Fort Hood Traffic Signal System
*Municipal Traffic Operations Center

Emergency Management Subsystem
Bell County Communications Center/EOC
*City of Temple Automated Calling System
City of Waco Fire Dispatch
Correctional Facilities Operations
County EOC
County Public Safety Dispatch
DPS Administration
DPS Communications Service
East Texas Medical Center EMS Dispatch
Fort Hood Operations Center
Municipal Public Safety Dispatch
Private Ambulance Dispatch
Private Tow/Wrecker Dispatch
State EOC
Waco-McLennan County Dispatch
Waco-McLennan County EOC

Traffic Management Subsystem
Other TxDOT District TMCs
TxDOT Fort Worth TMC (TransVision)
TxDOT Transportation Plan. & Program. Div.
TxDOT Waco District Traffic Office

Maintenance & Construction Management
City of Killeen PWD
City of Temple PWD
City of Waco Public Works Divisions
County Road and Bridge
Municipal PWD
Other TxDOT District Maintenance Sections
Private Maintenance Contractor
TxDOT Highway Conditions Reporting System
TxDOT Waco District Area Engineers Office
TxDOT Waco District Maintenance Sections
*Utility Companies
Utility Location Companies

Transit Management Subsystem
City of Waco Transit Operations Center
Hill Country Transit Dispatch
Hill Country Transit Rural Dispatch
HOTCOG Transit Dispatch
Independent School District Dispatch
Other Transit Systems
Private Taxi Provider Dispatch
Private Transit Systems

Archived Data Management Subsystem
City of Waco Crash Database
City of Waco Transit Ridership Database
*Fort Hood Traffic Count Database
Hill Country Transit District Ridership Database
Hill Country Transit Maintenance Database
HOTCOG Transit Ridership database
K-TUTS Traffic Counts Database
Statewide Crash Records Information System
TxDOT Statewide Pavement Mgmt. System
TxDOT Waco District Pavement Mgmt. System
TxDOT Waco District Public Transportation Management System (PTMS)

Commercial Vehicle Administration
*Fort Hood Electronic Clearance Database
Municipal or County Permitting System

Fleet and Freight Management Subsystem
*Private Fleet Management Systems
Rail Operations Centers

Archived Data User Systems
Fort Hood Archived Data Users
K-TUTS Archived Database Users
Rail Operations Centers
Statewide Crash Records Info. System Users
Transit Database Users
TxDOT Public Transportation Division
TxDOT Waco District Pavement Mgmt. System Users
Waco MPO Archived Data Users

Asset Management
TxDOT BRINSAP
TxDOT Waco District Pavement Mgmt System

Care Facility
Regional Medical Center

DMV
Texas DMV

Driver
Driver

Enforcement Agency
County Public Safety Dispatch
Waco-McLennan County Dispatch

Equipment Repair Facility
City of Waco Equipment Repair
County Road and Bridge Equipment Repair
TxDOT Waco District Shop

Event Promoters
City of Waco Event Scheduling

Financial Institution
*Financial Institution

Maintenance & Construction Admin. System
TxDOT Waco District Area Engineers Office

Media
Local Print and Broadcast Media

Multimodal Transportation Service Provider
Regional Airports

Other EM
*Waco Region Incident and Mutual Aid Network

Rail Operations
Rail Operations Centers

Traveler Card
*City of Waco Regional Smart Card
*Regional Transit Card

Wayside Equipment
Rail Operators Wayside Equipment

Weather Service
National Weather Service

Commercial Vehicle Check
*Fort Hood Entrance Vehicle Inspection Station

Roadway Subsystem
City of Killeen ITS Field Equipment
City of Temple ITS Field Equipment
*City of Waco CCTV
*City of Waco DMS
City of Waco Environmental Sensors
*City of Waco Red Light Running Camera
City of Waco School Pager System
City of Waco Traffic Signals
City of Waco Vehicle Detectors
City of Waco Work Zone Equipment
County Road and Bridge Field Equipment

Roadway Subsystem
Fort Hood Field Equipment
*Municipal ITS Field Equipment
*TxDOT Waco District CCTV
TxDOT Waco District DMS
TxDOT Waco District Field Sensors
TxDOT Waco Dist. Frway Frontage Rd Signals
*TxDOT Waco District Lane Control Signals
*TxDOT Waco District RWIS Sensors
TxDOT Waco District School Pager System
TxDOT Waco District Traffic Signals
TxDOT Waco District Work Zone Equipment
TxDOT Water Level Sensors

* Elements are *planned or future*, not *existing*.
Last update: October 8, 2004

Figure 3 – Waco Regional System Interconnect Diagram

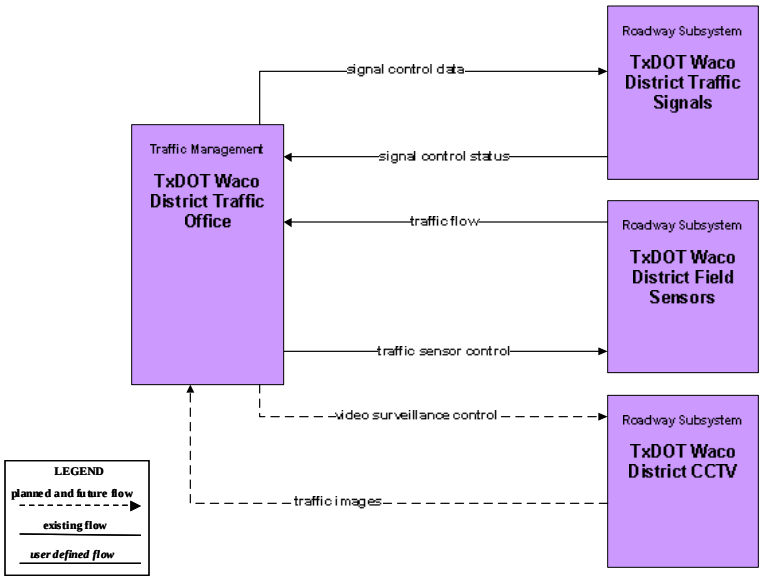


Figure 4 – Waco Surface Street Control Customized Market Package

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

While it is important to identify the various systems and stakeholders as part of a regional ITS, a primary purpose of the architecture is to identify the connectivity between transportation systems in the Waco Region. There are 151 different elements identified as part of the Waco Regional ITS Architecture. These elements include local and state traffic management/operations centers, transit vehicles, dispatch systems, emergency management agencies, and others – essentially all of the existing and planned physical components that contribute to a Regional ITS. Interfaces have been identified for each element in the Waco Regional ITS Architecture, and each element has been mapped to those other elements with which it must interface.

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

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

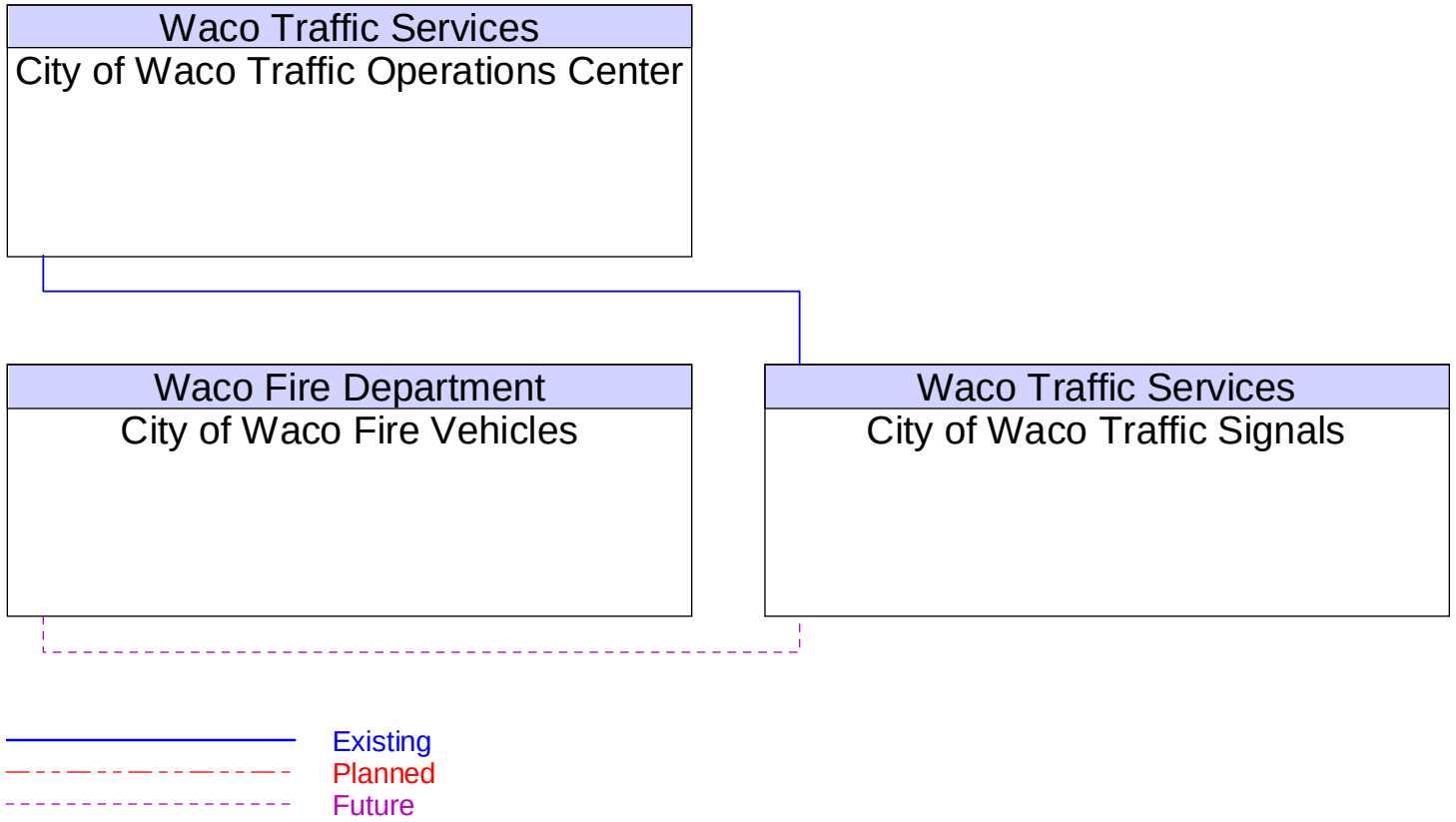


Figure 5 – City of Waco Traffic Signals Interfaces

An example of the architecture flows between two elements is shown in **Figure 6**. In this interface, the flows between the TxDOT Waco District Traffic Office and City of Killeen Traffic Operations Center show information that must go from the Waco District Office to other traffic operations centers, as well as information that the District Office needs from devices. Similar to the interfaces, architecture flows also are defined as existing, planned, or future. All of the architecture flows between elements have been included on the project website.

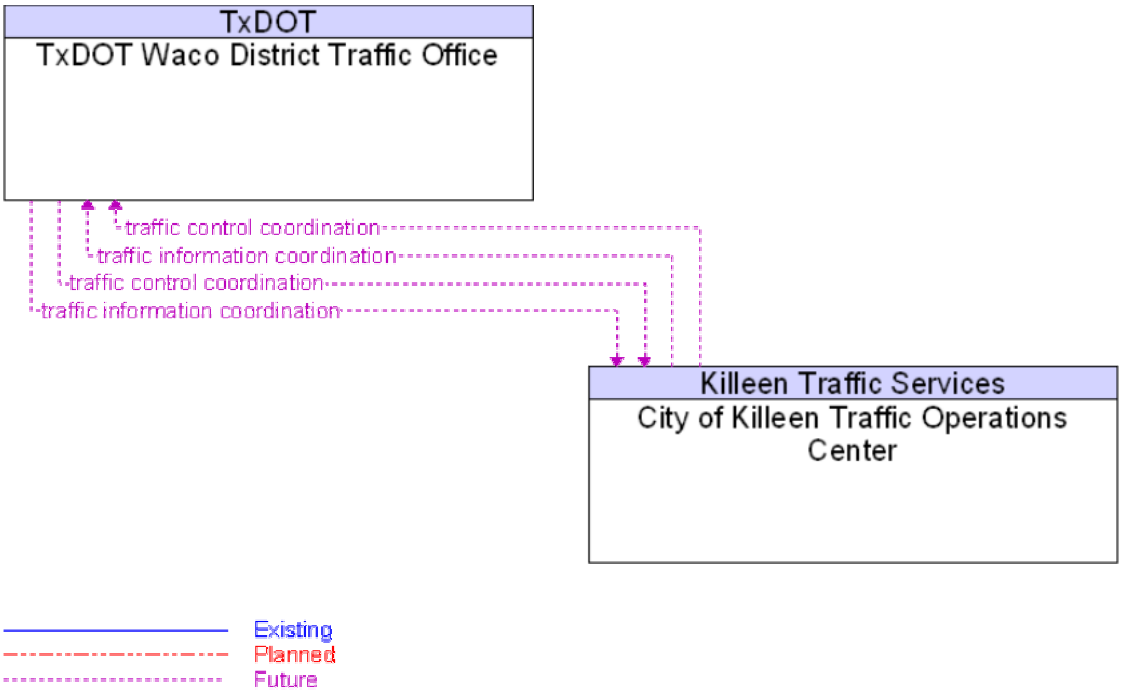


Figure 6 – TxDOT Waco District Traffic Office to City of Killeen Traffic Operations Center Architecture Flows

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

Operational Concept and Scenarios

An operational concept for the Waco Region was developed as part of the architecture process to illustrate how systems, components, and agencies will be integrated and function as a result of the framework provided by the Regional ITS Architecture. For the Waco Region, two concepts were illustrated. The first describes how ITS technologies could be used to manage a multi-vehicle crash on I-35 within the City of Waco city limits on Thanksgiving weekend. The operational concept shows how ITS technologies are used to detect an accident on the road, and assist in implementing strategies to divert traffic, inform motorists, and dispatch emergency vehicles. The second scenario describes road construction along I-35 just north of the City of Waco that is

expected to result in the long-term closure of one lane of traffic as well as the shoulders. The operational concept shows how through enhanced coordination transportation agencies are able to better coordinate traffic detours among traffic management.

Agreements

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

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

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

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

It is important to note that as ITS services and systems are implemented in the Region, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations.

ITS Architecture Documentation

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

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

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

WACO ITS DEPLOYMENT PLAN

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

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

Prioritized Market Packages

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

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

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

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

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

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

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

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

ITS Project Recommendations for the Waco Region

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

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

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

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

Table 3 – Recommended ITS Projects for the Waco Region

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Travel and Traffic Management		
Short Term Projects 5-year Horizon	TxDOT Advanced Traffic Management System (ATMS) Implementation	Yes (TxDOT)
	TxDOT Center-to-Center Communication (Statewide)	Yes (TxDOT)
	TxDOT Dynamic Message Signs (DMS)	Yes (TxDOT)
	TxDOT Waco Vehicle Detection on I-35	No
	TxDOT Closed Loop Signal System Expansion Phase 1	No
	City of Waco Closed Loop Signal System Expansion Phase 1	No
	City of Killeen Closed Loop Signal System Continued Development Phase 1	No
	City of Temple Closed Loop Signal System Continued Development Phase 1	No
	City of Harker Heights Closed Loop Signal System Phase 1	No
	City of Killeen Traffic Operations Center (TOC)	No
	Fort Hood Automated Vehicle Credentialing	No
	Fort Hood/TxDOT Waco District Traffic Office Coordination	No
Mid Term Projects 10-year Horizon	TxDOT Waco District Traffic Office Capability Expansion	No
	TxDOT Closed Loop Signal System Expansion Phase 2	No
	TxDOT Additional DMS	No
	TxDOT Closed-Circuit Television (CCTV)	No
	TxDOT School Zone Speed Monitoring Expansion	No
	TxDOT Waco District Traffic Office/City of Waco TOC Communications Connection	No
	City of Waco TOC Expansion	No
	Media Liaison and Coordination	No
	Detour Planning	No
	Fort Hood Event Management Plans	No
	City of Waco Closed Loop Signal System Expansion Phase 2	No
	City of Killeen Closed Loop Signal System Implementation Phase 2	No
	City of Temple Closed Loop Signal System Implementation Phase 2	No
	City of Harker Heights Closed Loop Signal System Phase 2	No

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

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Travel and Traffic Management (continued)		
Mid Term Projects 10-year Horizon (continued)	City of Waco School Zone Speed Monitoring Implementation	No
	Waco Traffic Information Website	No
	Regional 511 Advanced Traveler Information System Server	No
Long Term Projects 20-year Horizon	TxDOT Closed Loop Signal System Expansion Phase 3	No
	City of Waco Closed Loop Signal System Expansion Phase 3	No
	City of Killeen Closed Loop Signal System Implementation Phase 3	No
	City of Temple Closed Loop Signal System Implementation Phase 3	No
	City of Harker Heights Closed Loop Signal System Phase 3	No
	City of Waco DMS	No
	City of Waco CCTV Camera Implementation	No
	TxDOT Waco District Traffic Office/City of Temple Communications Connection	No
	TxDOT Waco District Traffic Office/City of Killeen Communications Connection	No
	ISP-based Route Guidance	No
Emergency Management		
Short Term Projects 5-year Horizon	City of Temple Emergency Vehicle Signal Preemption Implementation	No
	City of Killeen Emergency Vehicle Signal Preemption Implementation	No
Mid Term Projects 10-year Horizon	Waco-McLennan County EOC/DPS Communications Connection	No
	City of Waco Emergency Vehicle Automated Vehicle Location (AVL)	No
	Waco-McLennan County EOC/TxDOT Waco District Traffic Office Communications Connection	No
	Waco-McLennan County EOC/State EOC Communications Connection	No
	Bell County EOC/TxDOT Waco District Traffic Office Communications Connection	No
	Bell County Sheriff Vehicle AVL	No
	City of Harker Heights Emergency Vehicle Signal Preemption Implementation	No

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

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Emergency Management (continued)		
Mid Term Projects 10-year Horizon (continued)	City of Copperas Cove Emergency Vehicle Signal Preemption Implementation	No
	McLennan County Sheriff AVL and Mobile Data Terminals (MDTs)	No
	Municipal Traffic Signal Preemption	No
Long Term Projects 20-year Horizon	City of Temple EOC/TxDOT Waco District Traffic Office Communications Connection	No
	City of Killeen EOC/TxDOT Waco District Traffic Office Communications Connection	No
Maintenance and Construction Management		
Short Term Projects 5-year Horizon	TxDOT Highway Condition Reporting System (HCRS) Enhancement	Yes (TxDOT)
	TxDOT Additional Portable DMS	No
Mid Term Projects 10-year Horizon	TxDOT Road Weather Information System (RWIS) Stations	No
	TxDOT Flood Monitoring	No
	City of Waco Portable DMS	No
	City of Harker Heights Portable DMS	No
	TxDOT Work Zone Safety Monitoring	No
Long Term Projects 20-year Horizon	City of Killeen Portable DMS	No
	City of Temple Portable DMS	No
Public Transportation Management		
Short Term Projects 5-year Horizon	HOTCOG AVL	No
	HOTCOG Web-based Ride Scheduling and Travel Data	Yes (HOTCOG)
	Hill County Transit Computer Aided Dispatch (CAD)	No
	Hill County Transit AVL and MDT's	No
	Hill County Transit Fixed Route On-board Security Cameras	Yes (Hill County Transit)
	Waco Transit AVL	No
	Waco Transit Real-time Bus Information Travel Kiosks	No
	Waco Transit On-board Security Cameras	No
	Waco Transit Electronic Fare Collection	

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

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Public Transportation Management (continued)		
Mid Term Projects 10-year Horizon	Waco Transit Operations Center/City of Waco TOC Connection	No
	HOTCOG Mobile Data Terminals	No
	Hill County Transit Demand Response On-board Security Cameras	No
	Hill County Transit Electronic Fare Collection	No
	Waco Transit Operations Center/TxDOT Waco District Traffic Office Connection	No
	Hill County Transit Operations Center/TxDOT Waco District Traffic Office Connection	No
	HOTCOG Transit Operations Center/TxDOT Waco District Traffic Office Connection	No
	Hill County Transit Automatic Passenger Counters	No
Long Term Projects 20-year Horizon	Multi-modal Coordination	No
	Hill County Transit Automated Vehicle Maintenance Tracking	No
	HOTCOG Transit Automated Vehicle Maintenance Tracking	No
	Waco Transit Automated Vehicle Maintenance Tracking	No
Commercial Vehicle Operations		
Short Term Projects 5-year Horizon	None planned at this time	N/A
Mid Term Projects 10-year Horizon	None planned at this time	N/A
Long Term Projects 20-year Horizon	None planned at this time	N/A
Archived Data		
Short Term Projects 5-year Horizon	City of Waco Automated Crash Record Database	No
	Waco MPO Data Warehouse	No
Mid Term Projects 10-year Horizon	TxDOT Traffic Data Database	No
	City of Waco Traffic Data Database	No
	HOTCOG Data Warehouse	No
	Central Texas COG Data Warehouse	No
	Killeen-Temple MPO Data Warehouse	No
Long Term Projects 20-year Horizon	None planned at this time	N/A

MAINTAINING THE REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN

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

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

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

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

MEMORANDUM OF UNDERSTANDING

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

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

- Bell County;
- City of Waco;
- Fort Hood;
- Heart of Texas Council of Governments;
- Hill Country Transit District;
- K-TUTS/Central Texas Council of Governments;
- McLennan County;
- TxDOT Waco District;
- Waco Metropolitan Planning Organization (MPO); and
- Waco/McLennan County Emergency Management.