State of Texas
ITS Architectures and Deployment Plans

Brazos Valley 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 for 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.

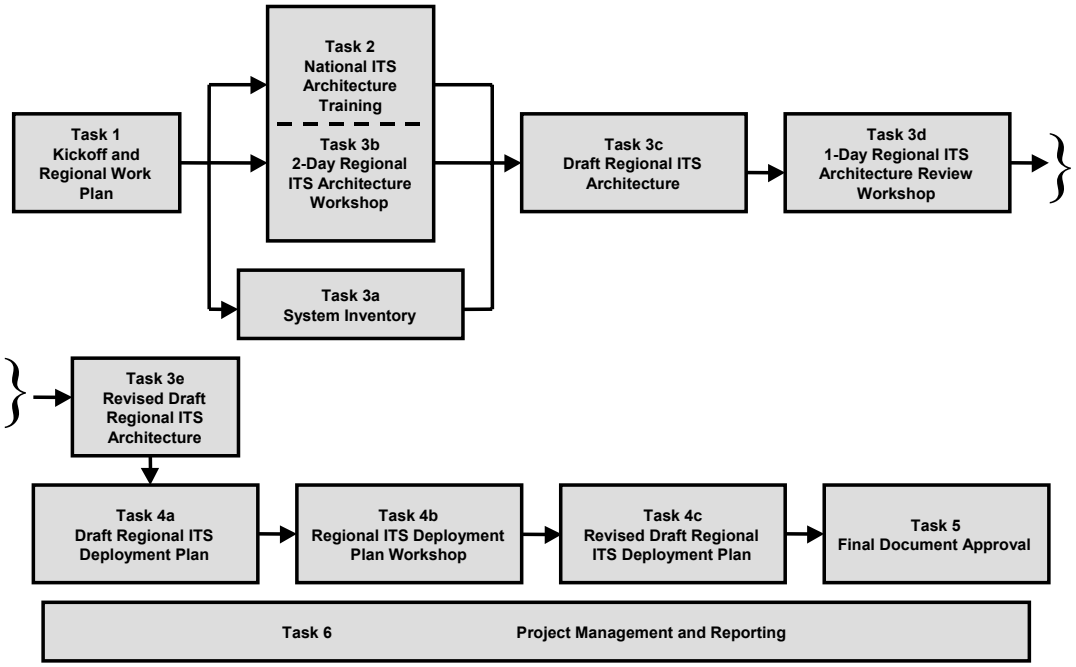


Figure 1 – Brazos Valley Regional ITS Architecture and Deployment Plan Development Process

OVERVIEW OF THE BRAZOS VALLEY REGION

The Brazos Valley Region is located in central Texas, and is bordered by the TxDOT Waco and Dallas Districts to the north, the TxDOT Austin District to the west, the TxDOT Tyler and Lufkin Districts to the east, and the TxDOT Yoakum and Houston Districts to the south. For the Brazos Valley Regional ITS Architecture and Deployment Plan, the study area included all ten counties that comprise the TxDOT Bryan District. **Figure 2** illustrates the Regional boundaries.

The Brazos Valley Region has an extensive transportation infrastructure. The primary roadway facilities include I-45, US-77, US-79, US-190, US-290, SH-6, and SH-105.

I-45 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. I-45 extends from Galveston on the Texas Gulf Coast to Dallas. Blockages along I-45 can have serious implications for 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-45 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.

In addition to roadway infrastructure, the Easterwood Airport serves as the commercial airport for the Brazos Valley Region.

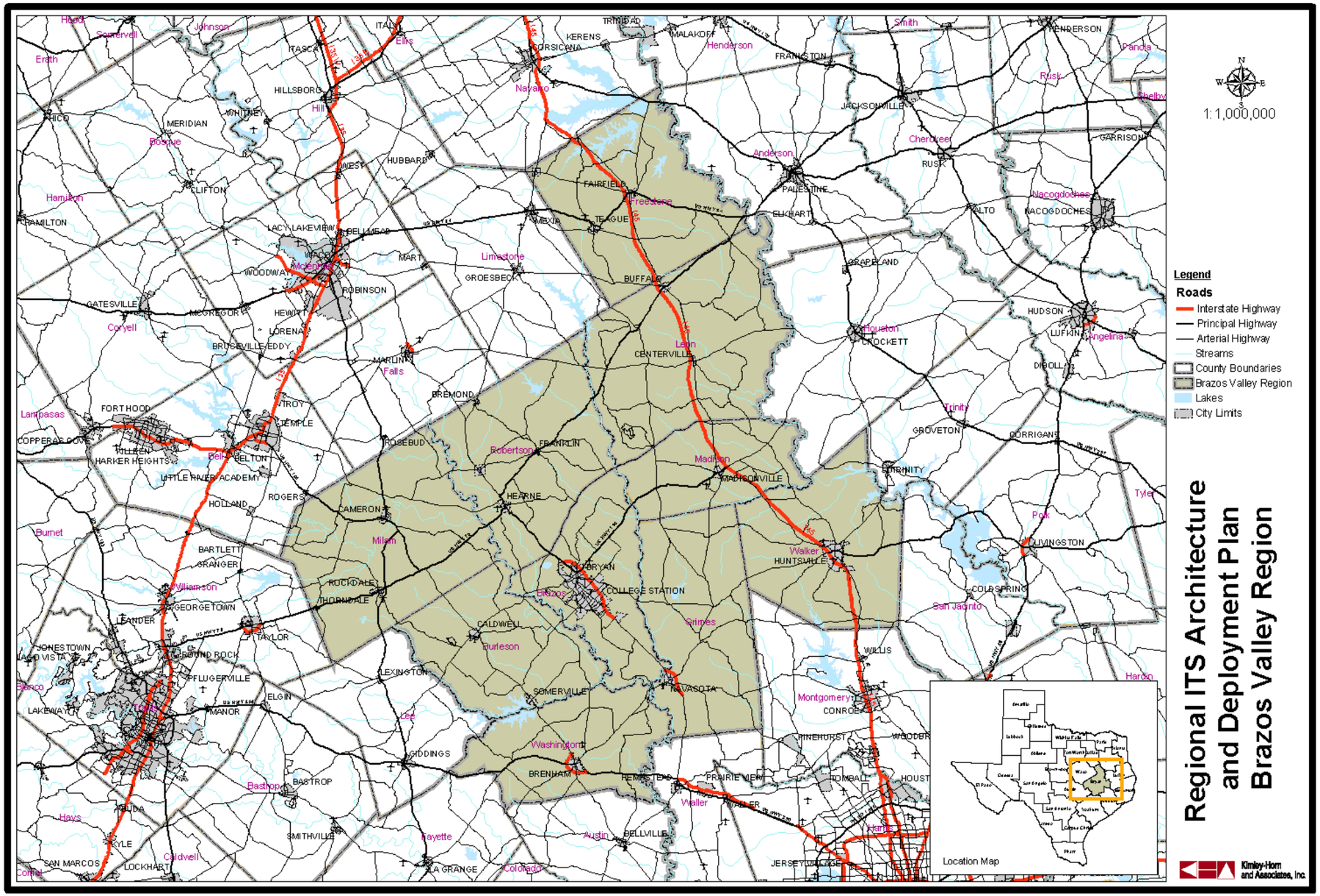


Figure 2 – Brazos Valley Region Map

BRAZOS VALLEY 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 Brazos Valley Region and neighboring Regions participated in the development of the Brazos Valley Regional ITS Architecture and Deployment Plan. Key participants included representatives from TxDOT, the City of College Station, City of Bryan, Brazos County, Metropolitan Planning Organization, and Council of Governments. 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.

Brazos Valley Region stakeholders included:

- Blinn College Police Department;
- Brazos County;
- Brazos Transit;
- Brazos Valley Council of Governments;
- Bryan/College Station Chamber of Commerce;
- Bryan/College Station Metropolitan Planning Organization (MPO);
- City of Bryan;
- City of College Station;
- City of Huntsville;
- College Station Independent School District;
- Easterwood Airport;
- Sam Houston State University;
- Texas A&M University;
- Texas Transportation Institute;
- TxDOT Bryan District; and
- TxDOT Traffic Operations Division (Austin).

BRAZOS VALLEY REGIONAL ITS ARCHITECTURE

The process for developing the Regional ITS Architecture for the Brazos Valley 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 Brazos Valley 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 Brazos Valley Regional ITS Architecture began with a project kick-off meeting in April of 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 highest priority needs focused on improving traveler information (particularly for closures of major routes), incident management, and enhancing coordination and communication among local and state agencies within the Region as well as with neighboring TxDOT Districts. 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 Brazos Valley Region stakeholders were categorized into functional areas, and are shown in **Table 1**.

Table 1 – Brazos Valley Region: Summary of ITS Needs

Brazos Valley Region

Summary of ITS Needs
Brazos Valley Regional ITS Architecture and Deployment Plan Kick-Off Meeting
April 15, 2003

Institutional Issues/Needs

- Need access to test bed locations within the Region for research purposes

Traffic Management Needs

- Need improved safety at rural intersections
- Need flood detection/monitoring
- Need to integrate Bryan/College Station/TxDOT signal systems to help traffic flow across jurisdictional boundaries
- Need to improve management of student traffic and commuter traffic in Huntsville
- Need improved special event management and information distribution
- Need traffic monitoring capabilities in City of College Station
- Need dynamic lane assignment capability in the City of College Station
- Need signal system communications upgrade in City of Bryan
- Need VIVDS in City of Bryan (loops fail frequently due to expansive soils)

Traveler Information Needs

- Need improved traffic information dissemination

Public Transportation Management Needs

- Need real-time train location data and notification of trains blocking the roadway
- Need AVL on Texas A&M buses
- Need security cameras on Texas A&M buses
- Need connections to emergency management responders for improved coordination in situations such as evacuations
- Need to improve reliability of Brazos Valley Transit
- Need AVL on Brazos Valley Transit vehicles
- Need MDTs on Brazos Valley Transit vehicles
- Need signal priority for Brazos Valley Transit vehicles
- Need public transportation service in Huntsville
- Need AVL and a Mayday system on College Station ISD buses
- Need additional security cameras on College Station ISD buses
- Need improved coordination between Brazos Valley Transit and Texas A&M Transit to facilitate cross ridership
- Need real-time campus transit info kiosks for Texas A&M Transit
- Need common fare payment system for Brazos Valley Transit and Texas A&M Transit to facilitate cross ridership

Commercial Vehicle Operations Needs

- Need improved truck routing in Huntsville

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

Emergency Management Needs

- Need inter-regional communications connections to improve coordination when receiving evacuees from other regions
- Need common radio frequency for Bryan Police, College Station Police, DPS and the Sheriff's Department
- Need CAD system integration
- Need automated call-out system with coverage in College Station
- Need AVL on police, fire, EMS and large equipment for the City of College Station and the City of Bryan

Archived Data Management Needs

- Need improved data collection from rural areas for COG analysis (traffic counts, roadway hazards)
- Need traffic count information for off-system roadways in College Station

Maintenance and Construction Management Needs

- Need ice detection and notification for improved maintenance response
- Need improved construction information available to local businesses

Market Packages

A 2-Day ITS Architecture Workshop was held in College Station in June 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 Brazos Valley Regional ITS Architecture.

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

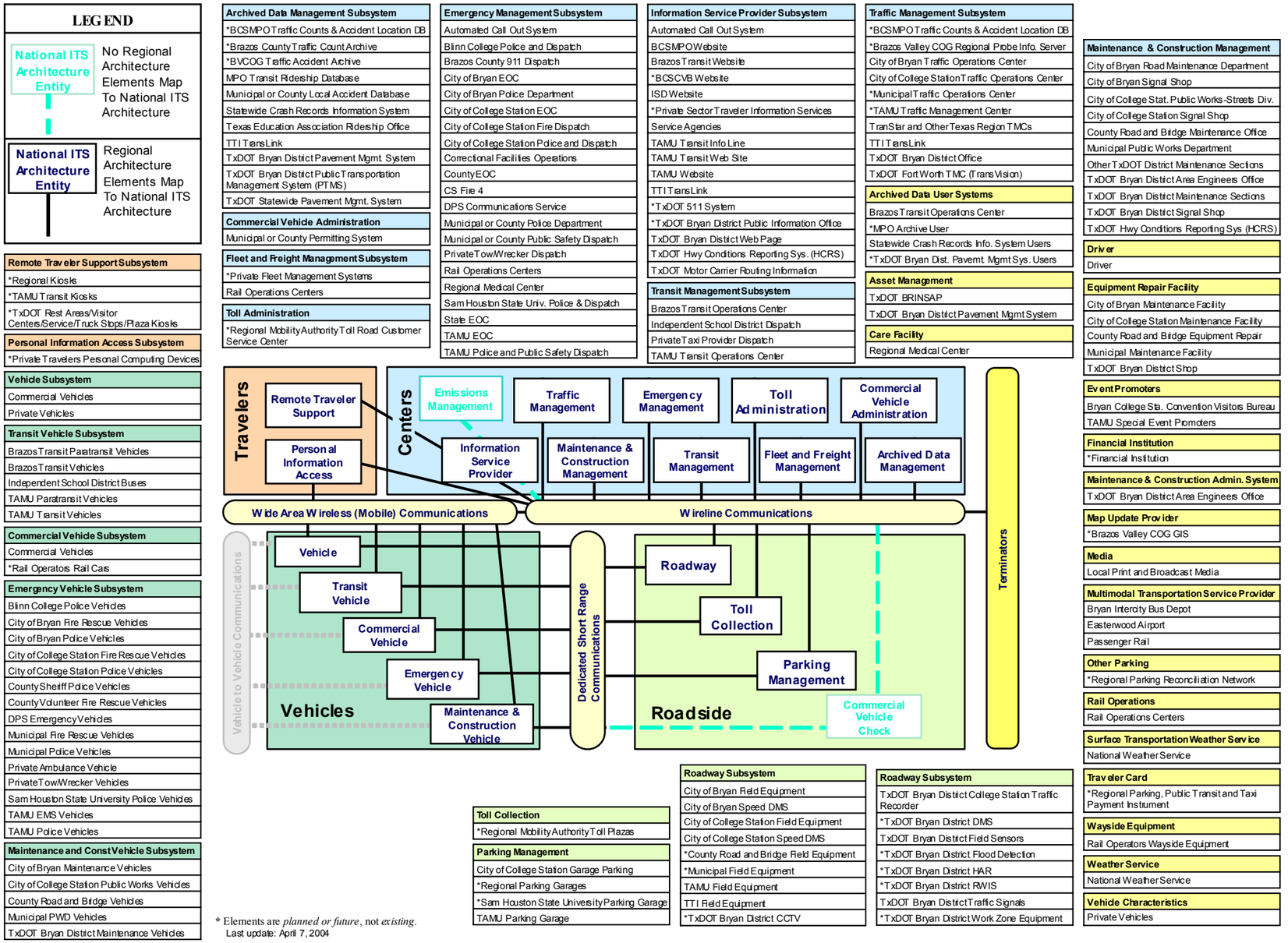
At the 2-Day ITS Architecture Workshop, stakeholders selected the market packages that corresponded to the desired services and functions identified for the Region, and then customized these market packages. They included services and functions such as Network Surveillance, Traffic Information Dissemination, and Emergency Response as well as market packages to address coordination needs, including an Incident Management System and Regional Traffic Control and Coordination. Because market packages are groups of services and functions, they can be deployed incrementally and over time. Of the 75 market packages in the National ITS Architecture, stakeholders identified 35 as being applicable to the Brazos Valley Region. A 36th market package, Emergency Evacuation by Transit, which does not currently exist in the National ITS Architecture, was created for the Brazos Valley Region to address the needs of stakeholders.

Interconnects, Interfaces, and Standards

Stakeholders also began the process of mapping existing and planned ITS elements in Brazos Valley 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 Brazos Valley 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 Brazos Valley Region.

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

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



Remote Traveler Support Subsystem
*Regional Kiosks
*TAMU Transit Kiosks
*TxDOT Rest Areas/Visitor Centers/Service/Truck Stops/Plaza Kiosks

Personal Information Access Subsystem
*Private Travelers Personal Computing Devices

Vehicle Subsystem
Commercial Vehicles
Private Vehicles

Transit Vehicle Subsystem
Brazos Transit Paratransit Vehicles
Brazos Transit Vehicles
Independent School District Buses
TAMU Paratransit Vehicles
TAMU Transit Vehicles

Commercial Vehicle Subsystem
Commercial Vehicles
*Rail Operators Rail Cars

Emergency Vehicle Subsystem
Blinn College Police Vehicles
City of Bryan Fire Rescue Vehicles
City of Bryan Police Vehicles
City of College Station Fire Rescue Vehicles
City of College Station Police Vehicles
County Sheriff Police Vehicles
County Volunteer Fire Rescue Vehicles
DPS Emergency Vehicles
Municipal Fire Rescue Vehicles
Municipal Police Vehicles
Private Ambulance Vehicle
Private Tow/Wrecker Vehicles
Sam Houston State University Police Vehicles
TAMU EMS Vehicles
TAMU Police Vehicles

Maintenance and Const Vehicle Subsystem
City of Bryan Maintenance Vehicles
City of College Station Public Works Vehicles
County Road and Bridge Vehicles
Municipal PWD Vehicles
TxDOT Bryan District Maintenance Vehicles

Archived Data Management Subsystem
*BCSMPO Traffic Counts & Accident Location DB
*Brazos County Traffic Count Archive
*BVCOG Traffic Accident Archive
MPO Transit Rideship Database
Municipal or County Local Accident Database
Statewide Crash Records Information System
Texas Education Association Rideship Office
TTI TransLink
TxDOT Bryan District Pavement Mgmt. System
TxDOT Bryan District Public Transportation Management System (PTMS)
TxDOT Statewide Pavement Mgmt. System

Commercial Vehicle Administration
Municipal or County Permitting System

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

Toll Administration
*Regional Mobility Authority Toll Road Customer Service Center

Emergency Management Subsystem
Automated Call Out System
Blinn College Police and Dispatch
Brazos County 911 Dispatch
City of Bryan EOC
City of Bryan Police Department
City of College Station EOC
City of College Station Fire Dispatch
City of College Station Police and Dispatch
Correctional Facilities Operations
County EOC
CS Fire 4
DPS Communications Service
Municipal or County Police Department
Municipal or County Public Safety Dispatch
Private Tow/Wrecker Dispatch
Rail Operations Centers
Regional Medical Center
Sam Houston State Univ. Police & Dispatch
State EOC
TAMU EOC
TAMU Police and Public Safety Dispatch

Information Service Provider Subsystem
Automated Call Out System
BCSMPO Website
Brazos Transit Website
*BCSCVB Website
ISD Website
*Private Sector Traveler Information Services
Service Agencies
TAMU Transit Info Line
TAMU Transit Web Site
TAMU Website
TTI TransLink
*TxDOT 511 System
*TxDOT Bryan District Public Information Office
TxDOT Bryan District Web Page
TxDOT Hwy Conditions Reporting Sys. (HCRS)
TxDOT Motor Carrier Routing Information

Transit Management Subsystem
Brazos Transit Operations Center
Independent School District Dispatch
Private Taxi Provider Dispatch
TAMU Transit Operations Center

Traffic Management Subsystem
*BCSMPO Traffic Counts & Accident Location DB
*Brazos Valley COG Regional Probe Info. Server
City of Bryan Traffic Operations Center
City of College Station Traffic Operations Center
*Municipal Traffic Operations Center
*TAMU Traffic Management Center
TranStar and Other Texas Region TMCs
TTI TransLink
TxDOT Bryan District Office
TxDOT Fort Worth TMC (TransVision)

Archived Data User Systems
Brazos Transit Operations Center
*MPO Archive User
Statewide Crash Records Info. System Users
*TxDOT Bryan Dist. Pavemt. Mgmt Sys. Users

Asset Management
TxDOT BRINSAP
TxDOT Bryan District Pavement Mgmt System

Care Facility
Regional Medical Center

Maintenance & Construction Management
City of Bryan Road Maintenance Department
City of Bryan Signal Shop
City of College Stat. Public Works-Streets Div.
City of College Station Signal Shop
County Road and Bridge Maintenance Office
Municipal Public Works Department
Other TxDOT District Maintenance Sections
TxDOT Bryan District Area Engineers Office
TxDOT Bryan District Maintenance Sections
TxDOT Bryan District Signal Shop
TxDOT Hwy Conditions Reporting Sys (HCRS)

Driver
Driver

Equipment Repair Facility
City of Bryan Maintenance Facility
City of College Station Maintenance Facility
County Road and Bridge Equipment Repair
Municipal Maintenance Facility
TxDOT Bryan District Shop

Event Promoters
Bryan College Sta. Convention Visitors Bureau
TAMU Special Event Promoters

Financial Institution
*Financial Institution

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

Map Update Provider
*Brazos Valley COG GIS

Media
Local Print and Broadcast Media

Multimodal Transportation Service Provider
Bryan Intercity Bus Depot
Easterwood Airport
Passenger Rail

Other Parking
*Regional Parking Reconciliation Network

Rail Operations
Rail Operations Centers

Surface Transportation Weather Service
National Weather Service

Traveler Card
*Regional Parking, Public Transit and Taxi Payment Instrument

Wayside Equipment
Rail Operators Wayside Equipment

Weather Service
National Weather Service

Vehicle Characteristics
Private Vehicles

Toll Collection
*Regional Mobility Authority Toll Plazas

Parking Management
City of College Station Garage Parking
*Regional Parking Garages
*Sam Houston State University Parking Garage
TAMU Parking Garage

Roadway Subsystem
City of Bryan Field Equipment
City of Bryan Speed DMS
City of College Station Field Equipment
City of College Station Speed DMS
*County Road and Bridge Field Equipment
*Municipal Field Equipment
TAMU Field Equipment
TTI Field Equipment
*TxDOT Bryan District CCTV

Roadway Subsystem
TxDOT Bryan District College Station Traffic Recorder
*TxDOT Bryan District DMS
TxDOT Bryan District Field Sensors
*TxDOT Bryan District Flood Detection
*TxDOT Bryan District HAR
*TxDOT Bryan District RWIS
TxDOT Bryan District Traffic Signals
*TxDOT Bryan District Work Zone Equipment

* Elements are *planned or future*, not *existing*.
Last update: April 7, 2004

Figure 3 – Brazos Valley Regional System Interconnect Diagram

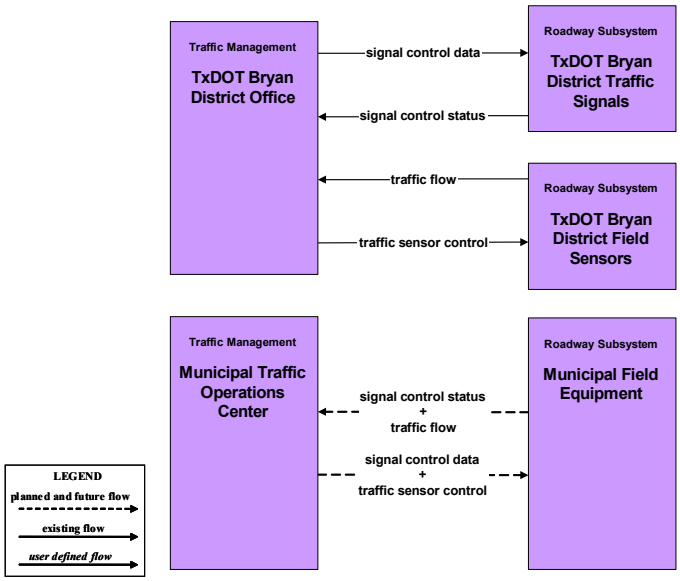


Figure 4 – Brazos Valley Surface Street Control Customized Market Package

More detailed interfaces were developed which identified the connectivity between the systems and elements. Each element identified in the ITS architecture for the Brazos Valley 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 Brazos Valley Region. There are 148 different elements identified as part of the Brazos Valley 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 Brazos Valley Regional ITS Architecture, and each element has been mapped to those other elements with which it must interface.

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

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

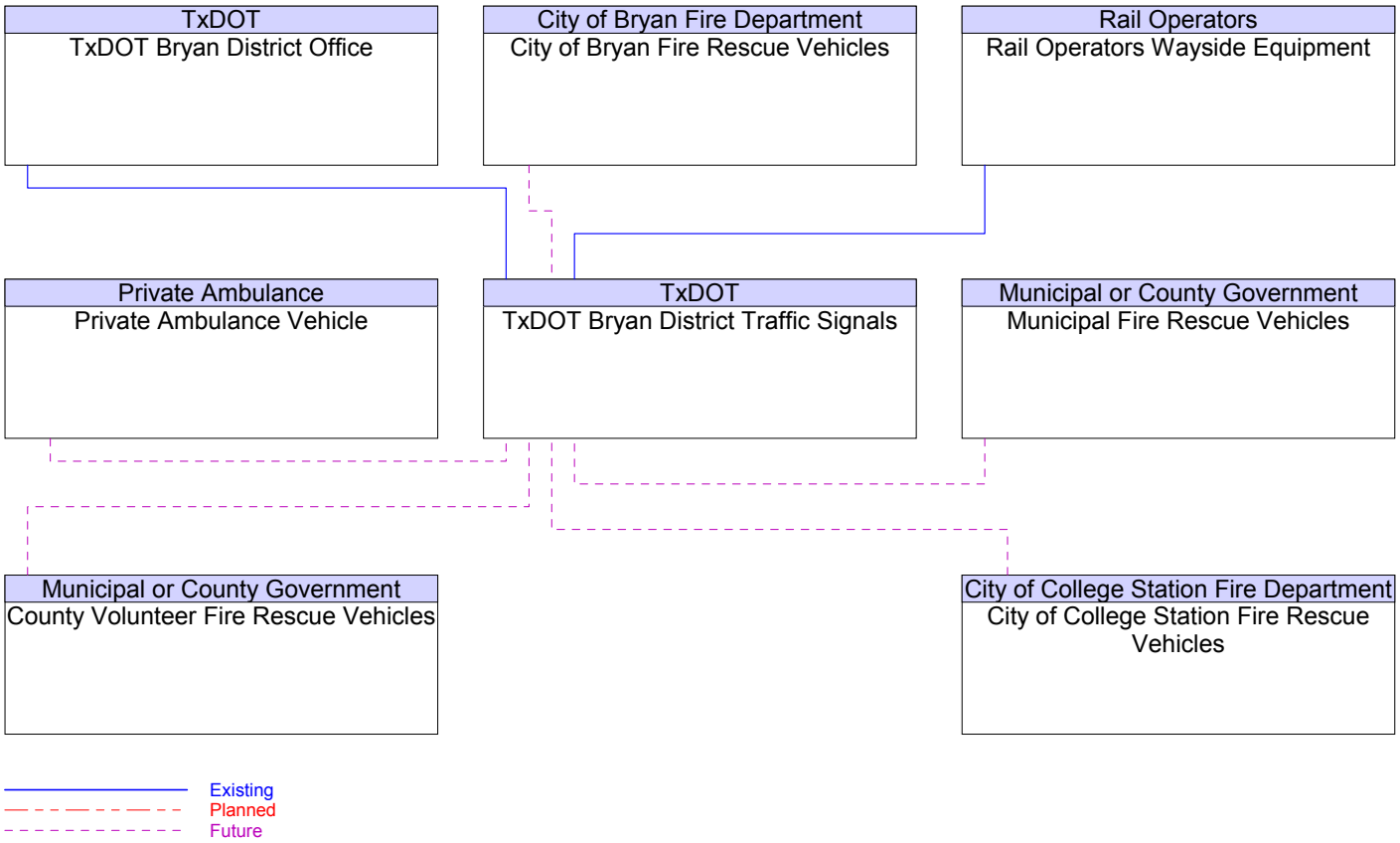


Figure 5 – TxDOT Bryan District Traffic Signals Interfaces

An example of the architecture flows between two elements is shown in **Figure 6**. In this interface, the flows between the TxDOT Bryan District Office and TranStar and Other Texas Region TMCs show information that must go from the Bryan District Office to other Texas TMCs, 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.

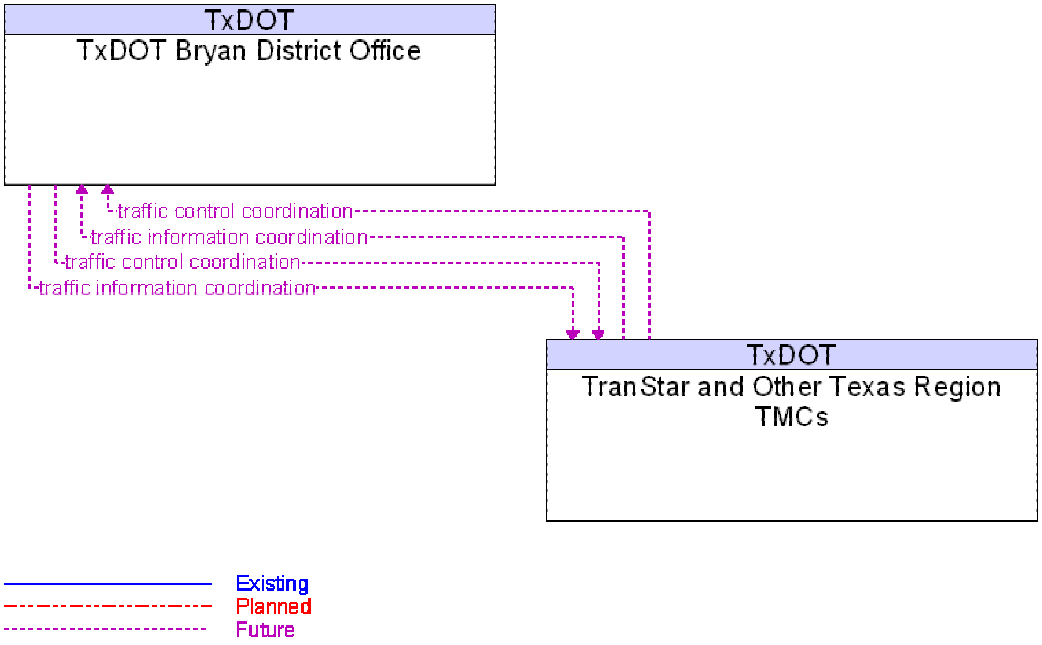


Figure 6 – TxDOT Bryan District Office to TranStar and Other Texas Region TMCs Architecture Flows

With the required interfaces and interconnections identified, standards that could potentially be applied to the Brazos Valley Region were identified. Standards are an important tool that will allow efficient implementation of the elements in the Brazos Valley 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 Brazos Valley 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 Brazos Valley Region, two concepts were illustrated. The first describes how ITS technologies could be used to manage a HAZMAT spill in the Region. The operational concept shows how through enhanced coordination and real-time travel information agencies are able to better coordinate traffic detours among traffic management and public safety. The second scenario describes an ice storm. In this scenario, ITS technologies are used to rapidly detect the formation of ice on roadways, and assist transportation agencies in implementing strategies to divert traffic, inform motorists, and coordinate with emergency response crews.

Agreements

Interfaces and data flows among public and private entities in the Brazos Valley 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.

There are several existing agreements in place in the Brazos Valley Region for signal control, communications resource sharing, and ITS integration. The City of College Station and the City of Bryan each have signal maintenance agreements with the TxDOT Bryan District. The City of College Station also has an agreement with Texas A&M University for the interconnect of City of College Station and Texas A&M fiber optic cable for the purpose of data sharing. There are several additional agreements between local agencies to work together in the implementation of ITS technologies in the Region as well as an agreement that provided the support for this ITS architecture planning project. These agreements have been included in Appendix C of the Brazos Valley Regional ITS Architecture document. 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 additional formal agreements will be needed.

The following is a list of potential agreements for the Brazos Valley 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;
- 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 Bryan, City of College Station, 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 Brazos Valley 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 Brazos Valley 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 Brazos Valley 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 Brazos Valley. TxDOT plans to permanently host the site in the future at www.dot.state.tx.us/trf/its.

BRAZOS VALLEY REGIONAL ITS DEPLOYMENT PLAN

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

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

Table 2 – Summary of Prioritized Market Packages for the Brazos Valley Region

High Priority	Medium Priority	Low Priority
▪ Network Surveillance ▪ Surface Street Control ▪ Traffic Information Dissemination ▪ Regional Traffic Control ▪ Incident Management System ▪ Standard Railroad Grade Crossing ▪ Railroad Operations Coordination ▪ Emergency Response ▪ Emergency Routing ▪ Transit Vehicle Tracking ▪ Transit Fixed-Route Operations ▪ Transit Passenger and Fare Management ▪ Transit Traveler Information ▪ HAZMAT Management ▪ Broadcast Traveler Information ▪ ITS Data Mart ▪ ITS Data Warehouse	▪ Parking Facility Management ▪ Reversible Lane Management ▪ Speed Monitoring ▪ Road Weather Data Collection ▪ Weather Information Processing and Distribution ▪ Roadway Maintenance and Construction ▪ Work Zone Management ▪ Maintenance and Construction Activity Coordination ▪ Demand Response Transit Operations ▪ Transit Security ▪ Multi-Modal Coordination	▪ Probe Surveillance ▪ Electronic Toll Collection ▪ Emergency Evacuation by Transit ▪ Maintenance and Construction Vehicle Tracking ▪ Maintenance and Construction Vehicle Maintenance ▪ Work Zone Safety Monitoring ▪ CV Administrative Processes ▪ 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 or additional new needs to bring the market package to the desired level of functionality in the Brazos Valley 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 Brazos Valley 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 Brazos Valley 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 Brazos Valley Region was developed. These projects were refined and additions and deletions were made by the Regional stakeholders at the ITS Deployment Plan Workshop in October 2003.

Recommended ITS projects for the Brazos Valley 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 Brazos Valley 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 Brazos Valley 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 Brazos Valley 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 Brazos Valley 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 TxDOT District Communications)	Yes (TxDOT)
	TxDOT Closed Loop Signal System Expansion Phase 1	No
	TxDOT DMS	Yes (TxDOT)
	TxDOT CCTV	Yes (TxDOT)
	TxDOT Bryan TMC Expansion	No
	TxDOT Bryan TMC/Translink Communications Connection	Yes (TxDOT, TTI)
	City of Bryan Closed Loop Signal System Expansion Phase 1	No
	City of College Station Closed Loop Signal System Expansion Phase 1	No
	City of College Station Additional CCTV Cameras	No
	Texas A&M University Parking Information and Reservation System	No
	Media Liaison and Coordination	N/A
	Brazos Valley Regional ITS Telecommunications Master Plan	No
Mid Term Projects 10-year Horizon	TxDOT Closed Loop Signal System Expansion Phase 2	No
	TxDOT Additional DMS	No
	TxDOT Additional CCTV	No
	Special Event Management Reversible Lane System	No
	City of Bryan Closed Loop Signal System Expansion Phase 2	No
	City of Bryan CCTV Camera Implementation	No
	City of Bryan TOC Expansion	No
	City of College Station Closed Loop Signal System Expansion Phase 2	No
	City of College Station TOC Expansion	No
	Texas A&M University Traffic Management Center	No
	City of Bryan Rail Crossing Warning System	No

Table 3 – Recommended ITS Projects for the Brazos Valley 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 College Station Rail Crossing Warning System	No
	City of Bryan TOC/City of College Station TOC Communications Connection	No
	City of Bryan TOC/TxDOT Bryan TMC Communications Connection	No
	City of College Station TOC/TxDOT Bryan TMC Communications Connection	No
	City of Bryan TOC/Translink Communications Connection	No
	City of College Station TOC/Translink Communications Connection	No
	Municipal Closed Loop Signal System Implementation	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 Bryan Closed Loop Signal System Expansion Phase 3	No
	City of College Station Closed Loop Signal System Expansion Phase 3	No
	Municipal Closed Loop Signal System Expansion	No
	Sam Houston State University Parking Information and Reservation System	No
	Municipal TOC/TxDOT TMC Communications Connection	No
	ISP Based Route Guidance	No
Emergency Management		
Short Term Projects 5-year Horizon	DPS/TxDOT Bryan TMC Connection	No
	Texas A&M EOC/TxDOT Bryan TMC Connection	No
	State EOC/TxDOT Bryan TMC Communications Connection	No
	City of Bryan EOC/TxDOT Bryan TMC Connection	No
	City of College Station EOC/TxDOT Bryan TMC Connection	No
	City of Bryan Emergency Vehicle AVL	No
	City of College Station Emergency Vehicle AVL	No
	Brazos Valley Region Automated Emergency Call-Out System Expansion	Yes (Regional Emergency Management Agencies)

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

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Emergency Management (continued)		
Short Term Projects 5-year Horizon (continued)	Brazos County Virtual EOC	Yes (Brazos Valley COG)
	TxDOT Bryan Emergency Vehicle Signal Preemption Implementation	No
	City of Bryan Emergency Vehicle Signal Preemption Expansion	No
	City of College Station Emergency Vehicle Signal Preemption Expansion	No
Mid Term Projects 10-year Horizon	City of College Station Dispatch/City of College Station TOC Communications Connection	No
	Brazos County 911/City of Bryan TOC Communications Connection	No
	Brazos County 911/TxDOT Bryan TMC Communications Connection	No
	Computer Aided Dispatch Upgrade and Regional Integration	No
	Other Brazos Valley COG Counties Virtual EOCs	No
	Sam Houston State University Parking Management Enforcement and Security System	No
Long Term Projects 20-year Horizon	Municipal Traffic Signal Preemption	No
	Municipal/County EOC/TxDOT Bryan TMC Communications Connection	No
Maintenance and Construction Management		
Short Term Projects 5-year Horizon	TxDOT HCRS Enhancement	Yes (TxDOT Statewide)
Mid Term Projects 10-year Horizon	TxDOT RWIS Stations	No
	TxDOT Portable DMS	No
	City of Bryan Portable DMS	No
	City of College Station Portable DMS	No
	City of College Station Maintenance Vehicle and Equipment AVL	No
Long Term Projects 20-year Horizon	TxDOT Additional RWIS Stations	No
	TxDOT Work Zone Safety Monitoring	No
	Municipal/County Maintenance and Construction Vehicle AVL	No
	TxDOT Bryan Maintenance and Construction Vehicle AVL	No
	City of Bryan Maintenance and Construction Vehicle AVL	No

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

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Public Transportation Management		
Short Term Projects 5-year Horizon	Regional Traveler Card	No
	Brazos Transit/Texas A&M Transit Communication Connection	No
	Brazos Transit AVL and Mobile Data Terminals	Yes (Brazos Transit)
	Texas A&M Transit Computer Aided Dispatch (CAD)	No
	Texas A&M Transit AVL and Mobile Data Terminals	No
	Texas A&M Transit Web-based Ride Scheduling and Travel Data	No
	Brazos Transit/TxDOT Bryan District Communications Connection	No
	Brazos Transit Web-based Ride Scheduling and Travel Data Phase 1	No
Mid Term Projects 10-year Horizon	Brazos Transit/City of Bryan TOC Communications Connection	No
	Brazos Transit/City of College Station TOC Communications Connection	No
	Brazos Transit Web-based Ride Scheduling and Travel Data Phase 2	No
	Texas A&M Transit/City of College Station TOC Communications Connection	No
	Texas A&M Transit/Translink Communications Connection	No
	Texas A&M Transit Real-time Bus Information Travel Kiosks	No
	Brazos Transit Real-time Bus Information Travel Kiosks	No
	College Station ISD AVL	No
	College Station ISD On-board Transit Security System	No
Long Term Projects 20-year Horizon	Brazos Transit Automatic Passenger Counters	No
	Texas A&M Transit/City of Bryan TOC Communications Connection	No
	Texas A&M Transit On-board Transit Security Cameras	No
	Brazos Transit/Municipal TOC Communications Connection	No

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

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Commercial Vehicle Operations		
Short Term Projects 5-year Horizon	HAZMAT Incident Notification System	No
	HAZMAT Rail Incident Notification System	No
Mid Term Projects 10-year Horizon	N/A	N/A
Long Term Projects 20-year Horizon	N/A	N/A
Archived Data		
Short Term Projects 5-year Horizon	Brazos Valley COG ITS Data Warehouse	No
	MPO Data Warehouse	No
	Translink ITS Data Warehouse	No
Mid Term Projects 10-year Horizon	N/A	N/A
Long Term Projects 20-year Horizon	N/A	N/A

MAINTAINING THE REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN

The Brazos Valley 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 Brazos Valley 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 October 2003, stakeholders recommended that a meeting be held every two years to review the existing Regional ITS Architecture and ITS Deployment Plan. Any new market packages that have been added to the National Architecture should be reviewed to see if they are applicable to the Brazos Valley 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 be updated 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 Brazos Valley 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 Brazos Valley 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 Brazos Valley 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 Brazos Valley Region. Also included in the MOU was a pledge to provide TxDOT with the information necessary to maintain the Regional ITS Architecture and ITS Deployment Plan.

Those stakeholders that were asked to sign the MOU represented agencies that will have the greatest impact in the Region in terms of ITS deployments and system operations. Stakeholder agencies that were asked to sign the MOU for the Brazos Valley Regional ITS Architecture and Deployment Plan included the following:

- Blinn College;
- Brazos County;
- Brazos Transit;
- Brazos Valley Council of Governments;
- Bryan/College Station MPO;
- City of Bryan;
- City of College Station;
- College Station ISD;
- Easterwood Airport;
- Sam Houston State University;
- St. Joseph Regional Health Center;
- Texas A&M University;
- Texas Department of Transportation; and
- Texas Transportation Institute.