State of Texas
ITS Architectures and Deployment Plans

Lower Rio Grande 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 regions in the state that already have ITS architectures in place or under development. The focus of the TxDOT Regional ITS Architecture and Deployment Plan program is to develop architectures in those areas outside of the Austin, Houston, Dallas, Fort Worth, and San Antonio Regions. TxDOT expanded upon the ITS architecture requirements outlined in the FHWA Final Rule, and included an ITS deployment plan as part of the regional efforts. The Regional ITS Architecture provides a framework for ITS systems, services, integration, and interoperability, and the Regional ITS Deployment Plan identifies specific projects and timeframes for ITS implementation to support the vision developed by stakeholders in the architecture.

TxDOT's process for developing the regional ITS architectures and deployment plans followed a consensus-based approach to meeting the requirements in the FHWA Final Rule and supporting guidelines. This process was further tailored to meet the specific multi-agency needs of these Regional plans, and was structured around stakeholder input and involvement. The addition of 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 regional ITS architectures and deployment plans.
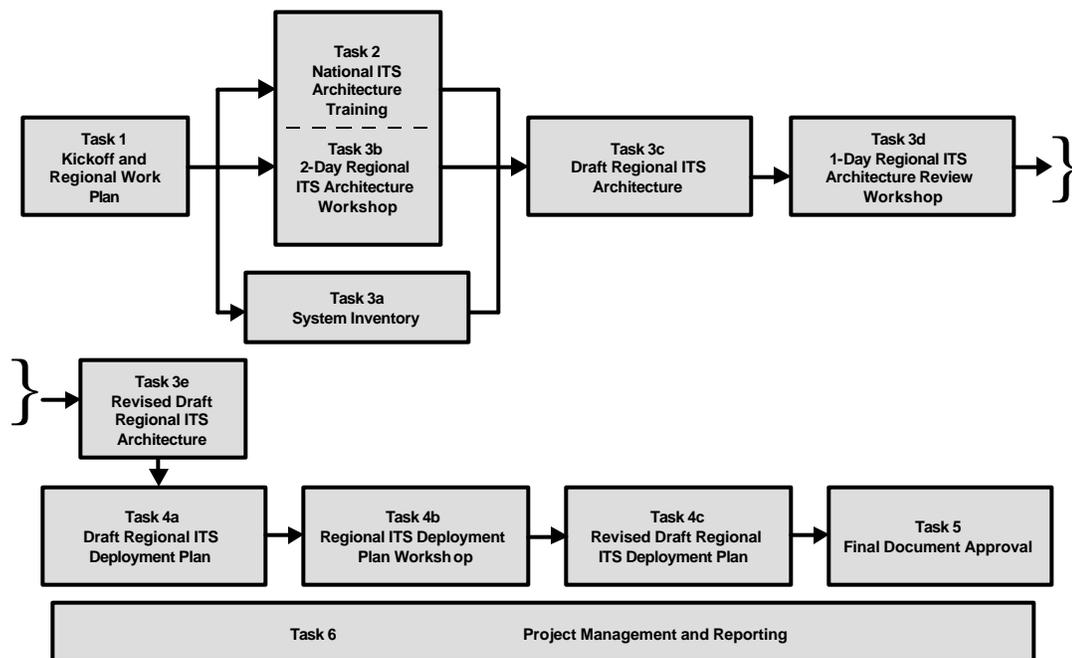

Figure 1 – Lower Rio Grande Valley Regional ITS Architecture and Deployment Plan Development Process

OVERVIEW OF THE LOWER RIO GRANDE VALLEY REGION

The Lower RGV Region is located in the southernmost tip of Texas. The ITS stakeholders defined the regional boundaries to correspond with the boundaries of the TxDOT Pharr District. **Figure 2** illustrates the Regional boundaries. There are eight counties included in the Lower Rio Grande Valley Region, which comprise the TxDOT Pharr District:

- Brooks;
- Cameron;
- Hildago;
- Jim Hogg;
- Kenedy;
- Starr;
- Willacy; and
- Zapata.

Unlike other Regions in the state of Texas, no single city in the Lower RGV Region stands out as the main city in the Region. There are several major cities within the Region, including the cities of Brownsville, Edinburg, Harlingen, McAllen, Mission, Pharr, San Benito, and South Padre Island on the United States side, and several cities immediately adjacent to the Region on the Mexico side including the cities of Reynosa and Matamoros.

The Lower RGV Region connects major cities of the United States to Mexico through a number of routes in the valley. The roadway network is well developed but lacks a route designated as an Interstate. The primary facilities include US 77, US 83, US 281, and Mexico's State Route 2. These corridors are key links for inter- and intra-state as well as international movement of people and goods. The effective operation of these highways is critical to the movement of goods and people.

Agencies in the Lower RGV Region have already deployed several ITS technologies and are in the process of additional deployments. Current ITS elements in the Region include:

- Closed loop signal systems are existing in several cities and TxDOT maintained roadways;
- Commercial Vehicle Information Systems and Network (CVISN) elements such as weigh-in-motion and automatic vehicle identification; and
- Fiber optic connectivity.
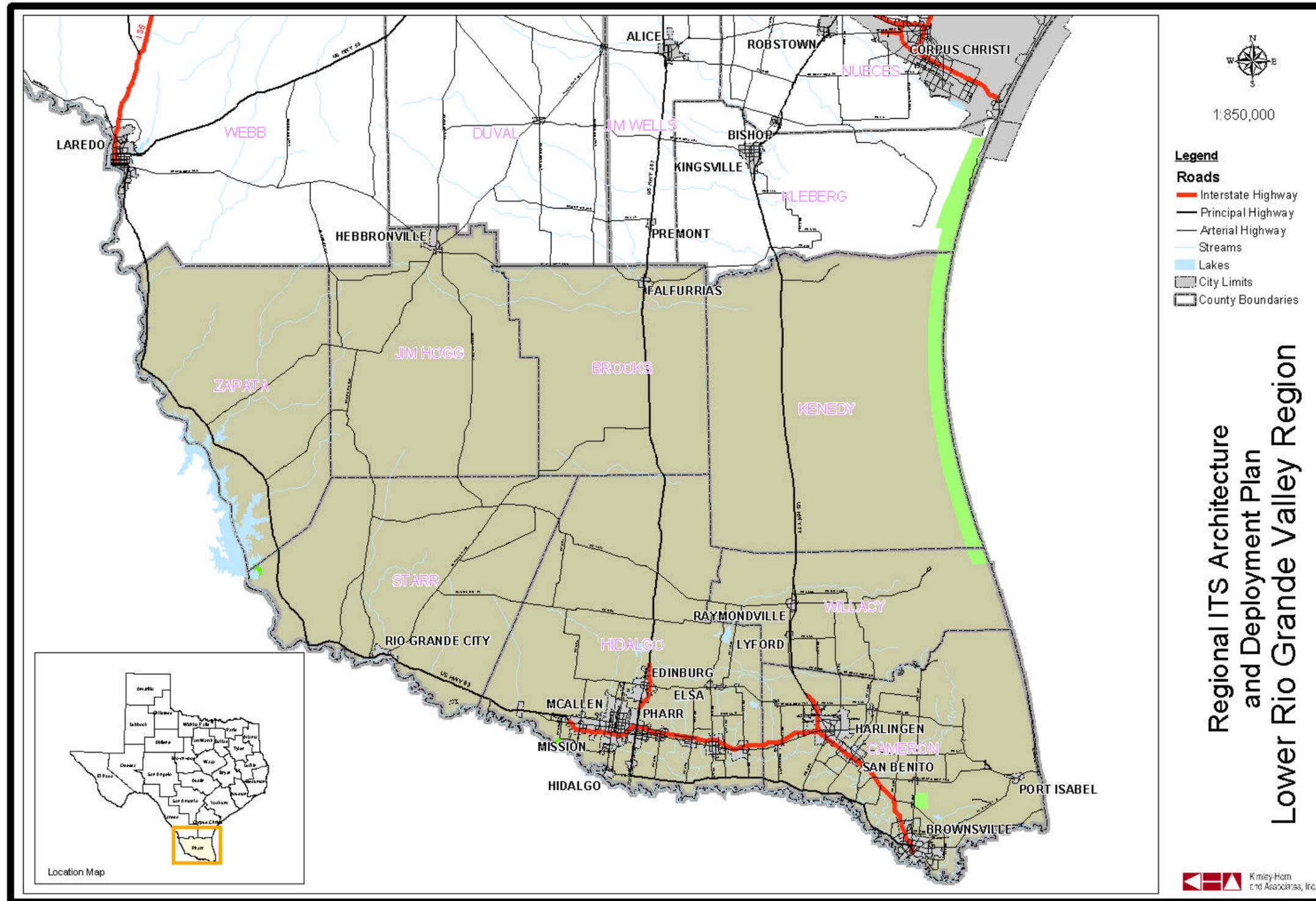
Figure 2 – Lower Rio Grande Valley Region

LOWER RIO GRANDE 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 Lower RGV Region participated in the development of the Regional ITS Architecture and Deployment Plan, including representatives from TxDOT, the Federal Highway Administration, cities, counties, MPOs, transit agencies, Texas Department of Public Safety (DPS), U.S. Border Patrol, and U.S. Customs. 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.

Lower Rio Grande Valley Region stakeholders included:

- Brownsville MPO;
- Cameron County;
- City of Brownsville;
- City of Edinburg;
- City of Harlingen;
- City of McAllen;
- City of Mission;
- City of Pharr Fire;
- City of San Benito;
- Harlingen Emergency Services;
- Harlingen-San Benito MPO;
- Hidalgo County Sheriff's Office;
- Hidalgo County MPO;
- McAllen-Miller Airport;
- Texas Department of Public Safety;
- TxDOT Pharr District;
- TxDOT Traffic Operations Division (Austin);
- U.S. Border Patrol;
- U.S. Customs; and
- U.S. Immigration and Naturalization Service.

LOWER RIO GRANDE VALLEY REGIONAL ITS ARCHITECTURE

The process for developing the Regional ITS Architecture for the Lower RGV 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 Lower Rio Grande 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 Lower RGV Regional ITS Architecture began with a project kick-off meeting in July of 2002. At that meeting, stakeholders provided information about existing and planned ITS elements in the Region. A diverse range of needs were identified by Regional stakeholders. The highest priority needs focused on improving traveler information (particularly for traffic traveling to border crossings), incident management, enhancing coordination and communication between local and state agencies within the Region, and improving transit operations. 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 Lower RGV Region stakeholders were categorized into functional areas, and are shown in **Table 1**.

Table 1 – Lower Rio Grande Valley Region: Summary of ITS Needs

Lower Rio Grande Valley Region
Summary of ITS Needs
Lower Rio Grande Valley Regional ITS Architecture and Deployment Plan Kick-Off Meeting
July 10, 2002

Institutional Issues/Needs

- Need a regional TMC
- Need to consider how cities will take on O&M role for signals once they reach the TxDOT 50,000 population threshold
- Need agency to provide bridge operations
- Need improved coordination with border sites to share information (closures, restrictions, etc.)
- Need improved coordination with railroads
- Need coordination with CVISN
- Need to develop a regional telecommunications plan

Traffic Management Needs

- Need to coordinate the five major city signal systems with TxDOT
- Need to tie international traffic to local traffic
- Need ATMS for congestion management
- Need to develop diversion routing
- Need detours for hurricane evacuation
- Need to develop plans for multiple road closure/detour plans
- Need to know locations of trains when stopped

Corridor Control/Freeway Control Systems

- Need improved traffic coordination
- Need expressway control
- Need additional DMS
- Need additional CCTV
- Need additional VIVDs and detectors
- Need improved congestion management
- Need improved incident detection

Diversion Planning

- Need to tie the international bridge crossings together to minimize queuing
- Need to divert traffic around major work zones
- Need to divert traffic around railroad grade crossings

Table 1 – Lower Rio Grande Valley: Summary of ITS Needs (continued)

Traveler Information Needs

- Need advanced transit management (In-vehicle security, electronic payment, route information)
- Need to provide prioritization of bus movements through coordinated signals
- Need preemption for fire and emergency vehicles
- Need to communicate better with travelers and general public
- Need to identify next steps for 511 implementation
- Need to use DMS to provide en-route information
- Need to provide ramp closure information to travelers
- Need to coordinate information on international bridges along the border (fiber)
- Need English and International symbols on DMS
- Need coordination with Mexico for major events

Data Needs (Collecting, Sharing)

- Need real-time data
- Need volume information
- Need permanent count stations
- Need system traffic management and flow information
- Need to provide information on bridge crossings on Military Road
- Need surveillance/CCTV at intersections
- Need traveler information on routes leading to bridges (approximately 14)
- Need more detectors
- Need upgrades to video detection
- Need VIVDs and CCTVs
- Need volume information
- Need permanent count stations
- Need to coordinate information on freeways and arterials
- Need improved system traffic management and flow information

High Speed Communications

- Need ring of fiber
- Need to be sure that all data that communicates into systems is usable
- Need improved GIS data throughout the Valley that all agencies can use

Public Transportation Management Needs

- Need computer aided dispatch for paratransit
- Need coordinated jitney service
- Need improved transition from public bus to private services
- Need access to information about closures, maintenance, weather, etc. for transit operators/agencies
- Need AVL on vehicles
- Need to add automated fare boxes
- Need to make information available to transit passengers at stops as well as from home or office
- Need security system for drivers and passengers

Table 1 – Lower Rio Grande Valley: Summary of ITS Needs (continued)

Electronic Payment Needs

- Need to consider parking fare collection in future
- Need Smart Fare collection on buses
- Need electronic payment for border crossings
- Need to add CVISN common transponder

Commercial Vehicle Operations Needs

- Need commercial vehicle coordination (where do vehicles go, what is the optimum route, etc.)
- Need to separate through traffic from local traffic
- Need electronic screening - CVISN is under development – will implement some electronic screening
- Need to consider Card Swipe Technology for ID of Auto/CVO Crossing
- Need to add counters at bridges - McAllen south bound bridge is only one that currently has counters
- Need to add detection system on all bridge crossings
- Need early notification and communication with CVO about closures, restrictions, etc. (just-in-time delivery has made this more critical)
- Need regional study for HAZMAT shipping and routing

Emergency Management Needs

Hurricane Evacuation Plans
- Need to coordinate with each City and County
- Need reversible lane management

Hazardous Materials Notification
- Need to improve public information on spills
- Need to improve HAZMAT routing
- Need a center to collocate EOC and transportation personnel
- Need emergency management coordination
- Need a system like LifeLink to share video between emergency (ambulance) and trauma centers
- Need security for TMC/EOC and places that handle emergencies

Advanced Vehicle Safety Systems Needs

- None identified

Information Management Needs (Data Archiving)

- Need shared database for data archiving
- Need policy for use of video and data with media
- Need policy for shared telecommunications facility maintenance and operations

Special Event Management and Planning

- Need to provide traffic information and coordination during the following events:
    - Sombrero Festival
    - South Padre Island (Spring Break)
- Need to provide transit Information

Table 1 – Lower Rio Grande Valley: Summary of ITS Needs (continued)

Maintenance and Construction Management Needs

- Need to coordinate Maintenance with Traffic Operations during closures

Other Needs

- Need to look for opportunities to tie the ITS Architecture and Deployment Plan into Homeland Defense/Security where possible
- Need to enhance border safety and security
- Need transportation improvements for continued economic development
- Need a central, physical location for communications infrastructure sharing
- Need to facilitate congestion management on freeways and arterials

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Market Packages

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

The next step in developing the Lower RGV 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, Surface Street Control, Freeway Control, and Road Weather Data Collection, as well as market packages to address coordination needs, including an Incident Management System and Regional Traffic Control and Coordination. Because market packages are groups of services and functions, they can be deployed incrementally and over time.

Of the 75 market packages in the National ITS Architecture, stakeholders identified 39 as being applicable to the Lower RGV Region. These market packages were then customized for the Lower RGV Region.

Interconnects, Interfaces, and Standards

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

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

LEGEND

National ITS Architecture Entity — No Regional Architecture Elements Map To National ITS Architecture

National ITS Architecture Entity — Regional Architecture Elements Map To National ITS Architecture

Archived Data Management Subsystem
BUS Transit Planning System
*Cameron County Congestion Management System
Hidalgo County Congestion Management Sys
Hidalgo County Pavement Management Sys
*Lower RGV Development Council Transit Planning System
*Lower RGV MPO Transportation Data Archival System
*Rainbow Lines Transit Planning System
*The Wave Transit Planning System
TxDOT Pharr District Pavement Management Sys
TxDOT Pharr District Transportation Operational Data Archive
TxDOT/DPS Crash Record Information System
*TxDOT/International Bridges Corridor System

Maintenance & Construction Management
County Road and Bridge
Municipal Public Works Department
TxDOT Pharr District Maintenance Sections

Traffic Management Subsystem
*Brownsville MPO Traffic Management System
Cameron County International Bridge Management System
*City of Brownsville TMC
*City of Harlingen TMC
City of McAllen TMC
City of Pharr TMC
*Hidalgo/ReynosaBridge Management System
*Lower RGV Regional Traffic Information Network
Mexico DOT (SCT)
*Pharr/Reynosa Bridge Management System
*Private International Bridge Management Systems
*TxDOT Pharr District TMC
US Border Patrol Video Surveillance System

Toll Administration Subsystem
City of Pharr and B/M Bridge Electronic Toll Collection System
*Lower RGV Bridge Toll Collection Systems

Information Service Provider Subsystem
BUS Transit Web Site
Lower RGV Development Council Transit Web Site
*Major Employers/Academic Institutions Ride Sharing Web Site
*Private Sector Traveler Information Services
Rainbow Lines Transit Web Site
The Wave Transit Web Site
*TxDOT 511 System
TxDOT Motor Carrier Routing Information System
TxDOT Pharr HCRS (Highway Conditions Reporting System)
TxDOT Pharr District Web Page

Transit Management Subsystem
BUS Transit Dispatch
*BUS Transit Electronic Fare Collection System
Independent School District Dispatch
Lower RGV Development Council Transit Dispatch
Private Transit Systems
*Rainbow Lines Transit Dispatch
*The Wave Transit Dispatch

Emergency Management Subsystem
Airport Public Safety
City/County EOC
City/County Police and Fire Dispatch
DPS Administration
DPS Communications Dispatch
IBWC Rio Grande River Flood Monitoring Sys
*Lower RGV Incident and Mutual Aid Network
Mexico Emergency Management Systems
Port of Brownsville
Public/Private EMS Dispatch
State EOC
*TxDOT Courtesy Patrol Dispatch
US Border Patrol Dispatch
US Coast Guard Causeway Management Sys
US Customs

Commercial Vehicle Administration
TxDOT Credentials Administration and Safety Information Exchange

Fleet and Freight Management Subsystem
Commercial Vehicle Operator Systems

Archived Data User Systems
*BUS Transit Planning System Users
*Cameron County Congestion Management System Users
*Hidalgo County Archived Data System Users
*Lower RGV Development Council Transit Planning System Users
*Lower RGV MPO Transportation Data Archival System Users
*Rainbow Lines Transit Planning System Users
*The Wave Transit Planning System Users
*TxDOT/DPS Crash Record Information System Users
*TxDOT Pharr District Pavement Management System Users
*TxDOT Pharr District Transportation Operational Data Archive System Users
*TxDOT/International Bridges Corridor System Users

Asset Management
TxDOT BRINSAP - Bridge Inventory Inspection System

Care Facility
Regional Hospitals

Emergency Telecommunications Systems
Telco 911 Call Routing

Enforcement Agency
DPS License and Weights Division
US Customs
US DOT Inspections

Equipment Repair Facility
County Road and Bridge Equipment Repair
Municipal Public Works Department Equipment Repair
TxDOT District Shop

Event Promoters
Tourism and Event Information Systems

Financial Institution
Financial Institution

Media
Print and Broadcast Media

Private Freight Shipper
Private Freight Shippers

Rail Operations
Rail Operators

Storage Facility
County Road and Bridge Maintenance Yard
Municipal Public Works Department Maintenance Yard
TxDOT Pharr District Maintenance Section Yard

Traveler Card
Lower RGV Trade Tag
*Lower RGV Transit Fare Card

Remote Traveler Support Subsystem
*Lower RGV Transit Kiosk and Information Displays

Personal Information Access Subsystem
Private Traveler Personal Computing Devices

Transit Vehicle Subsystem
BUS Transit Vehicles
Independent School District Buses
Lower RGV Development Council Transit Vehicles
Rainbow Lines Transit Vehicles
The Wave Transit Vehicles

Vehicle Subsystem
Private Vehicles
Lower RGV Trade Tag

Commercial Vehicle Subsystem
Commercial Vehicles
Rail Cars

Emergency Vehicle Subsystem
City/County Police and Fire Vehicles
DPS Vehicles
Public/Private EMS Vehicles
*TxDOT Courtesy Patrol Vehicles

Maint & Const Vehicle Subsystem
County Road and Bridge Vehicles
*Municipal Public Works Department Vehicles
TxDOT Pharr District Maintenance Vehicles

Parking Management Subsystem
*City and Community Parking Management Systems

Toll Collection Subsystem
City of Pharr and B/M Bridge ETC Equipment
*Lower RGV Bridge ETC Equipment

Travelers

Centers

Remote Traveler Support
Personal Information Access

Emissions Management
Traffic Management
Emergency Management
Toll Administration
Commercial Vehicle Administration

Information Service Provider
Maintenance & Construction Management
Transit Management
Fleet and Freight Management
Archived Data Management

Wide Area Wireless (Mobile) Communications
Wireline Communications

Vehicle to Vehicle Communications

Terminators

Vehicle
Transit Vehicle
Commercial Vehicle
Emergency Vehicle
Maintenance & Construction Vehicle

Roadway
Toll Collection
Parking Management
Commercial Vehicle Check

Vehicles

Dedicated Short Range Communications

Roadside

Roadway Subsystem
*Brownsville MPO Field Equipment
*Cameron County International Bridge Field Equipment
*Cameron County Traffic Data Collection System
City of Brownsville Field Equipment
City of Harlingen Field Equipment
City of McAllen Field Equipment
City of Pharr Field Equipment
*County Road and Bridge Field Equipment
*Hidalgo County Field Equipment

Roadway Subsystem
*Hidalgo County Pavement Data Collection System
Hidalgo County Traffic Data Collection Sys
*Hidalgo/ReynosaBridge Field Equipment
Municipal Public Works Department Field Equipment
*Pharr/Reynosa Bridge Field Equipment
*Private International Bridge Field Equipment
*TxDOT Pharr District Bridge Corridor Sys
*TxDOT Pharr District CCTV

Roadway Subsystem
*TxDOT Pharr District DMS
TxDOT Pharr District Field Sensors
*TxDOT Pharr District Flood Monitoring Sys
*TxDOT Pharr District HAR
*TxDOT Pharr District Lane Control Signals
TxDOT Pharr District Pavement Data Collection System
TxDOT Pharr District Traffic Signals
*TxDOT Pharr District Work Zone Equipment
US Border Patrol Field Equipment

Commercial Vehicle Check
DPS Electronic Screening Stations
TxDOT Weigh-in-Motion Sites
TxDOT/BND Overweight Corridor System

Wayside Equipment
Rail Operators Wayside Equipment

Weather Service
National Weather Service

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

Figure 3 – Lower Rio Grande Valley Regional System Interconnect Diagram

Figure 4 is an example of an ATMS market package for Surface Street Control that has been customized for the Lower RGV Region. This market package shows the two subsystems, Traffic Management and Roadway, and the associated entities (City of Pharr Street Services TMC and City of Pharr Field Equipment). Data flows between the subsystems and the terminators (Other Roadway) indicate what information is being shared. All of the Lower RGV Region market package diagrams are included in the Lower RGV Regional ITS Architecture report.
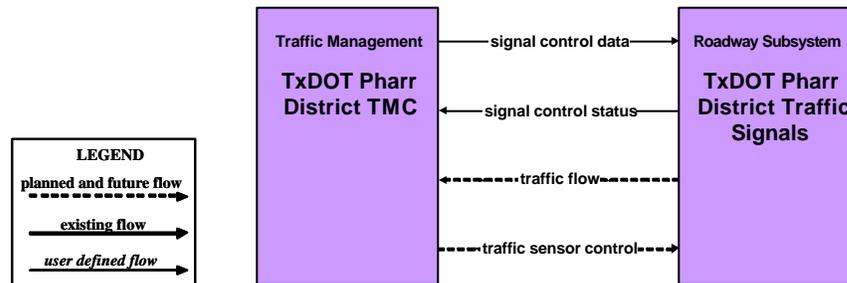
Figure 4 – Custom Market Package for Pharr Surface Street Control

More detailed interfaces were developed which identified the connectivity between the systems and elements. Each element identified in the ITS architecture for the Lower RGV Region was mapped to the other elements with which it must interface. 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 architecture, a primary purpose of the architecture is to identify the connectivity between transportation systems in the Lower RGV Region. There are 145 different elements identified as part of the Lower RGV Regional ITS Architecture. These elements include local and state traffic operations centers, transit vehicles, dispatch systems, emergency management agencies, media outlets, and others – essentially, all of the existing and planned physical components that contribute to the Regional intelligent transportation system. Interfaces have been identified for each element in the Lower RGV Regional ITS Architecture, and each element has been mapped to those other elements with which it must interface.

An example of one of the system interfaces is included as **Figure 5** on the following page. This graphic shows the TxDOT Pharr 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.

Public/Private EMS Providers
Public/Private EMS Vehicles

Rail Operators
Rail Operators Wayside Equipment

TxDOT
TxDOT Pharr District TMC

TxDOT
TxDOT Pharr District Traffic Signals

Existing
Planned
Future
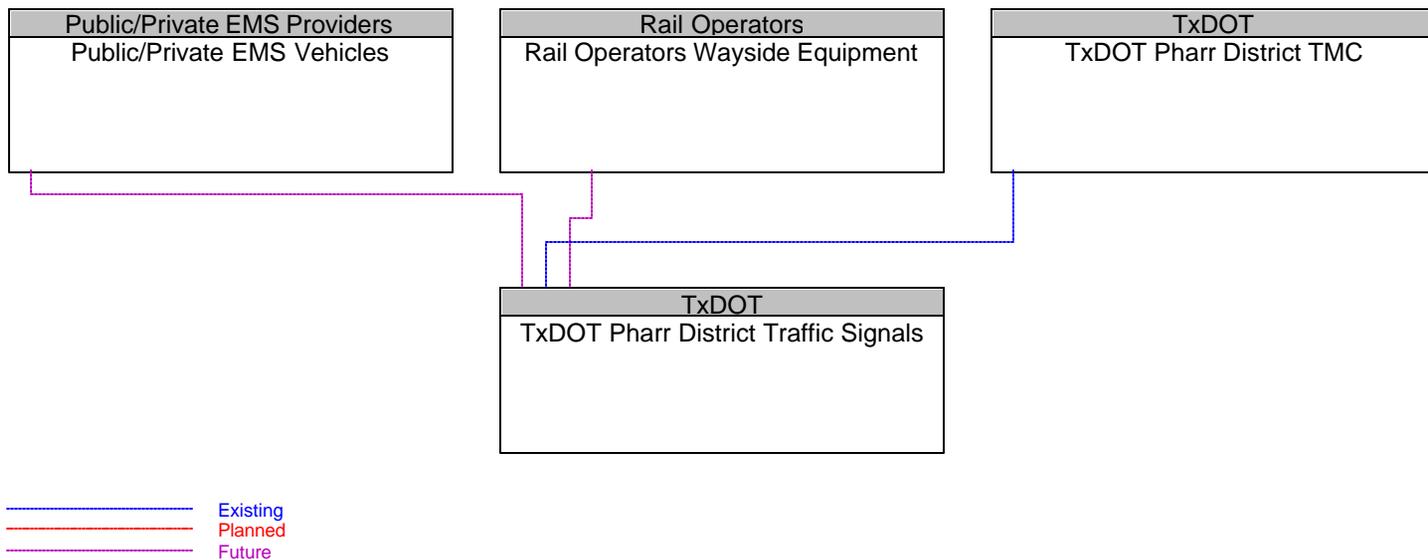
Figure 5 – TxDOT Pharr Traffic Signals Interfaces

An example of the architecture flows between two elements is shown in **Figure 6**. In this interface, the flows between the City of Pharr Traffic Management Center (TMC) and the City of Pharr Field Equipment show information that must go from the Pharr TMC to Pharr Field Equipment, as well as information that the TMC needs from the field elements. 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.
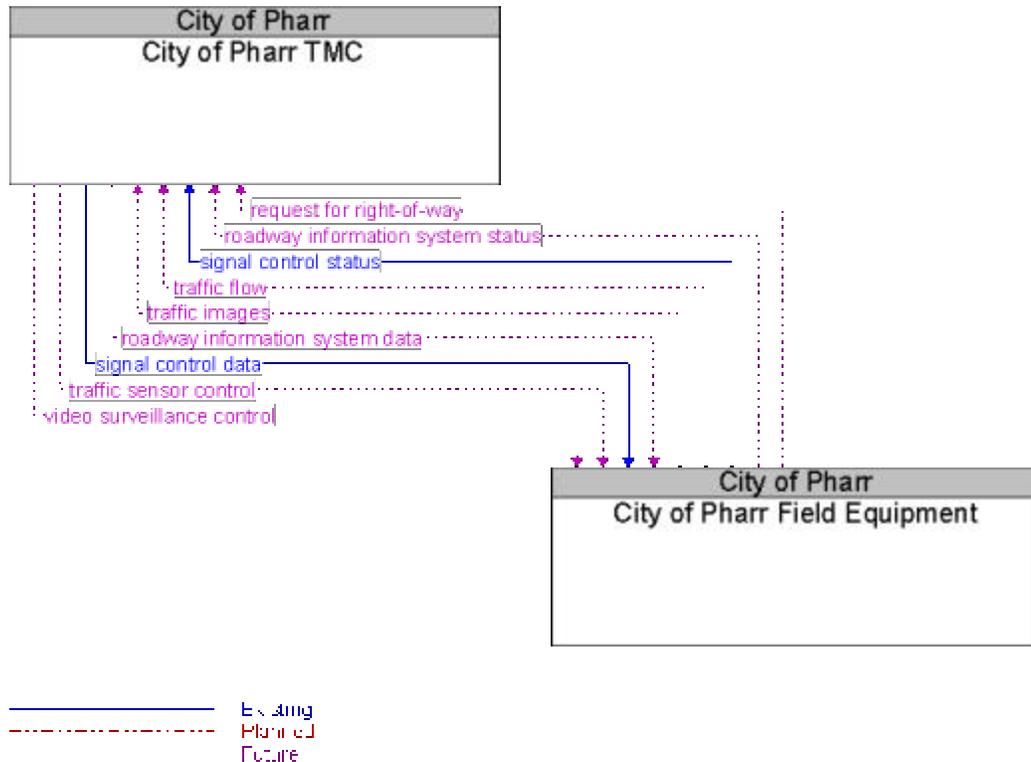
Figure 6 – Pharr TMC to Field Equipment Architecture Flows

With the required interfaces and interconnections identified, standards that could potentially be applied to the Lower RGV Region were identified. Standards are an important tool that will allow efficient implementation of the elements in the Lower RGV 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 Lower RGV 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 Lower RGV Region, three concepts were illustrated. The first concept illustrates a sequence of events during a multi-vehicle accident along US 281 just as the afternoon rush hour is about to begin, and how TxDOT, emergency services, public safety, and other key agencies can put pre-determined strategies into effect as well as utilize technology and communications infrastructure to respond effectively and

minimize traffic impacts. The second scenario describes how the integrated elements of the Lower RGV Region's ITS program will function together in the event of a major incident caused by an overturned truck that has spilled flammable materials on US 281 approaching the border crossing. The operational concepts show that through ITS deployment, agency information sharing, and regional connectivity, agencies are able to work together and benefit from the technologies and systems in place to proactively manage the Region's transportation system and coordinate emergency operations in either of these scenarios or any number of other potential incidents.

Agreements

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

Currently, there are few formal agreements in place in the Lower RGV Region. Stakeholders indicated that while there is a high degree of cooperation among agencies, there hasn't been a need for formal agreements to facilitate multi-jurisdictional resource sharing, cooperation or mutual aid. With the implementation of ITS technologies, integration of systems from one or more agencies, and the anticipated level of information exchange identified in the architecture, it is likely that more formal agreements will be needed.

The following is a list of potential agreements for the Lower RGV 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 and private media and information service providers;
- Shared video monitoring agreements between TxDOT and emergency services agencies; and
- Mutual aid agreements among public sector agencies, primarily fire, police, emergency services and TxDOT.

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 Lower RGV 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 Lower RGV Regional ITS Deployment Plan, to allow for modifications based on information and input received for the ITS Deployment Plan recommendations.

A website with all of the Regional ITS Architecture was also maintained. The website allowed stakeholders to review the architecture and provide comments directly to the project team through the website. At the time this report was published, the Lower RGV 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 Lower Rio Grande Valley. TxDOT plans to permanently host the site in the future at www.dot.state.tx.us/trf/its.

LOWER RIO GRANDE 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 Lower RGV Regional ITS Architecture, TxDOT chose to expand on the project sequence requirement to develop a formal ITS Deployment Plan for the Region.

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

Prioritized Market Packages

Market packages for the Lower RGV 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 Lower RGV Region. These priorities identified the key needs and services that are desired in the Lower RGV Region, as well as the interfaces that need to be established to provide integrated functionality and establish communication between elements.

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

Table 2 shows the prioritization of the selected market packages for the Lower RGV 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 Lower RGV Region, such as network surveillance, surface street control, and traffic information dissemination.

Table 2 – Summary of Prioritized Market Packages for the Lower Rio Grande Valley Region

High Priority	Medium Priority	Low Priority
▪ Network Surveillance	▪ Probe Surveillance	▪ Maintenance and Construction Vehicle Tracking
▪ Surface Street Control	▪ Electronic Toll Collection	▪ Maintenance and Construction Vehicle Maintenance
▪ Freeway Control	▪ Parking Facility Management	▪ Roadway Maintenance and Construction
▪ Traffic Information Dissemination	▪ Regional Parking Management	▪ Fleet Administration
▪ Regional Traffic Control	▪ Road Weather Data Collection	▪ Freight Administration
▪ Incident Management System	▪ Weather Information Processing and Distribution	
▪ Standard Railroad Grade Crossing	▪ Work Zone Safety Monitoring	
▪ Advanced Railroad Grade Crossing	▪ Dynamic Ridesharing	
▪ Railroad Operations Coordination	▪ Commercial Vehicle Administrative Processes	
▪ Work Zone Management		
▪ Transit Vehicle Tracking		
▪ Transit Fixed-Route Operations		
▪ Demand Response Transit Operations		
▪ Transit Passenger and Fare Management		
▪ Transit Security		
▪ Transit Traveler Information		
▪ Broadcast Traveler Information		
▪ Electronic Clearance		
▪ International Border Electronic Clearance		
▪ Weigh-in-Motion		
▪ HAZMAT Management		
▪ Emergency Response		
▪ Emergency Routing		
▪ ITS Data Mart		
▪ ITS Virtual Data Warehouse		

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 Lower RGV Region. Each market package analysis included:

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

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

Recommended ITS projects for the Lower RGV 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 Lower RGV Region are infrastructure based; however, there are some recommendations, such as enhanced coordination with local media, emergency response plans, and others that focus more on planning or institutional practices rather than deploying specific technologies.

Each recommended project for the Lower RGV 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 Lower RGV 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 and Public Transportation Management categories, which would implement freeway and arterial management, transit management, traveler information, and inter-agency coordination elements.

Table 3 – Recommended ITS Projects for the Lower Rio Grande Valley Region

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Travel and Traffic Management		
Short Term Projects 5-year Horizon	TxDOT Interim Regional Transportation Management Center	No
	TxDOT Center-to-Center Communications (Statewide)	No
	TxDOT TMC to Local TMC Communication	No
	City of Harlingen Traffic Signal System Upgrades	Partial (City of Harlingen)
	City of Edinburg Traffic Signal System Upgrades	Partial (City of Edinburg)
	City of Brownsville Traffic Signal System Upgrades	No
	Regional Integrated Closed Loop Signal Systems	No
	TxDOT Regional CCTV Deployment	No
	City of McAllen CCTV Deployment	Yes (City of McAllen)
	City of Harlingen CCTV Deployment	No
	US Border Patrol Video Surveillance	Yes (US Border Patrol)
	Cameron County Dynamic Message Sign (DMS) Deployment	No
	Hidalgo County DMS Deployment	No
	US Customs Solar Powered DMS	No
	TxDOT Conduit Installation	Yes (TxDOT)
	Lower RGV Regional Communications Master Plan	No
	Regional Bridge Coordination System	Yes (TxDOT)
	Cameron County Bridge Coordination System	No
	Brownsville/Matamoros Electronic Toll Collection	Partial (City of Brownsville)
	Incident Management Plans	No
	MPOs/Cities/TxDOT Webpage	No
	TxDOT District Webpage	Yes (TxDOT)
	Media Liaison and Coordination	N/A
	TxDOT Highway/Rail Coordination	No
	City of McAllen Highway/Rail Crossings	No
	City of Harlingen Highway/Rail Coordination	No
	City of San Benito Highway/Rail Coordination	No
	ITS Element Implementation as Part of West Rail Relocation	Yes (Brownsville MPO)

Table 3 – Recommended ITS Projects for the Lower Rio Grande 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	TxDOT Regional Transportation Management Center	No
	TxDOT Freeway Communications Network	No
	TxDOT Lane Control Signals	No
	TxDOT TMC to Local TMC Communication for Smaller Cities	No
	Regional 511 Advanced Traveler Information System	No
	City of Brownsville TMC	No
	City of Harlingen TMC	No
	City of McAllen DMS Deployment	No
	Hidalgo/Reynosa Bridge Management System	No
	Pharr/Reynosa Bridge Management System	No
Long Term Projects 20-year Horizon	Railroad Operations Coordination	No
	ISP Based Route Guidance	No
Emergency Management		
Short Term Projects 5-year Horizon	Computer Aided Dispatch (CAD)	No
	AVL on Emergency Vehicles	No
	Fire Mobile Data System	Yes (Fire Agencies)
	Emergency Vehicle Signal Preemption	No
	Hurricane Evacuation Plan	No
	Emergency Response Plans	No
Mid Term Projects 10-year Horizon	Emergency Vehicle Signal Preemption Expansion	No
	Fire/EMS/HAZMAT Management	No
Long Term Projects 20-year Horizon	None Identified	No
Maintenance and Construction Management		
Short Term Projects 5-year Horizon	TxDOT Flood Detection Stations	No
	TxDOT Workzone Management	No
Mid Term Projects 10-year Horizon	Work Zone Safety Monitoring (Engineering)	No
	Work Zone Safety Monitoring (Equipment)	No
	Maintenance and Construction Vehicle AVL	No
Long Term Projects 20-year Horizon	Maintenance and Construction Vehicle Maintenance	No

Table 3 – Recommended ITS Projects for the Lower Rio Grande Valley Region (continued)

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Public Transportation Management		
Short Term Projects 5-year Horizon	BUS Automatic Vehicle Location (AVL) Expansion and Mobile Data Terminals (MDTs)	Yes (BUS)
	BUS Electronic Fare Collection	Yes (BUS)
	BUS Computer Aided Dispatch (CAD) and Transit Operations Center	Yes (BUS)
	BUS Kiosks and Information Displays	Yes (BUS)
	BUS Smart Stop	Yes (BUS)
	BUS Public Announcement	Yes (BUS)
	McAllen Express AVL and MDTs	No
	McAllen Express Electronic Fare Collection	No
	McAllen Express CAD and Transit Operations Center	No
	McAllen Express Kiosks and Information Displays	No
	McAllen Express Smart Stop	No
	McAllen Express Public Announcement	No
	Rio Metro AVL and MDTs	No
	Rio Metro Electronic Fare Collection	No
	Rio Metro CAD and Transit Operations Center	No
	Rio Metro Kiosks and Information Displays	No
	Rio Metro Smart Stop	No
	Rio Metro Public Announcement	No
	Harlingen Express AVL and MDTs	No
	Harlingen Express Electronic Fare Collection	No
	Harlingen Express CAD and Transit Operations Center	No
	Rio Transit AVL and MDTs	No
	Rio Transit Electronic Fare Collection	No
	Rio Transit CAD and Transit Operations Center	No
	Rio Transit Kiosks and Information Displays	No
	Rio Transit Smart Stop	No
	Rio Transit Public Announcement	No
	The Wave AVL and MDTs	No
	The Wave Electronic Fare Collection	No
	The Wave CAD and Transit Operations Center	No
	The Wave Kiosks and Information Displays	No

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Public Transportation Management (continued)		
Short Term Projects 5-year Horizon (continued)	The Wave Smart Stop	No
	The Wave Public Announcement	No
	Rainbow Lines AVL and MDTs	No
	Rainbow Lines Electronic Fare Collection	No
	Rainbow Lines CAD and Transit Operations Center	No
	Rainbow Lines Kiosks and Information Displays	No
	Rainbow Lines Smart Stop	No
	Rainbow Lines Public Announcement	No
Mid Term Projects 10-year Horizon	BUS On Board Video Security System	No
	McAllen Express On Board Video Security System	No
	Rio Metro On Board Video Security System	No
	Harlingen Express On Board Video Security System	No
	Rio Transit On Board Video Security System	No
	The Wave On Board Video Security System	No
	Rainbow Lines On Board Video Security System	No
	Ridesharing Website	No
Long Term Projects 20-year Horizon	BUS Automatic Passenger Counters	No
	BUS Transit Traveler Information System/Travel Data and Route Guidance	No
	McAllen Express Automatic Passenger Counters	No
	McAllen Express Transit Traveler Information System/Travel Data and Route Guidance	No
	Rio Metro Automatic Passenger Counters	No
	Rio Metro Transit Traveler Information System/Travel Data and Route Guidance	No
	Harlingen Express Automatic Passenger Counters	No
	Harlingen Express Transit Traveler Information System/Travel Data and Route Guidance	No
	Rio Transit Automatic Passenger Counters	No
	Rio Transit Traveler Information System/Travel Data and Route Guidance	No
	The Wave Automatic Passenger Counters	No
	The Wave Transit Traveler Information System/Travel Data and Route Guidance	No
	Rainbow Lines Automatic Passenger Counters	No
	Rainbow Lines Transit Traveler Information System/Travel Data and Route Guidance	No

Project Time Frame	Project Name	Funding Identified (Funding Agency if Applicable)
Commercial Vehicle Operations		
Short Term Projects 5-year Horizon	CVISN Cameras	No
	CVISN Fiber Connection	No
	Electronic Clearance Sites	Yes (US Customs)
	City of Pharr Bridge AVI System	Yes (City of Pharr)
	Border Checkpoints	Yes (US Border Patrol)
	Overweight Commercial Vehicle Payment Verification System	No
	Internet Enable IRP Registration	Yes (TxDOT/US DOT)
	Internet Enabled Motor Carrier Registration	Yes (TxDOT/USDOT/DPS)
	Internet Enabled International Fuel Tax Agreement Registration	Yes (USDOT)
	US Customs HAZMAT Management	Yes (US Customs)
Mid Term Projects 10-year Horizon	CVISN Expansion	Yes (TxDOT)
Long Term Projects 20-year Horizon	Fleet Administration	No
	Freight Administration	No
Information Management		
Short Term Projects 5-year Horizon	Regional Transportation Data Archival System	No
	TxDOT TMC Database Query System	No
Mid Term Projects 10-year Horizon	None Identified	No
Long Term Projects 20-year Horizon	None Identified	No

MAINTAINING THE REGIONAL ITS ARCHITECTURE AND DEPLOYMENT PLAN

The Lower RGV Regional ITS Deployment Plan is a living document. The recommended projects and the 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 Lower RGV 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.

The Lower RGV stakeholders recommended that the ITS Deployment Plan be reviewed on a quarterly basis as part of the Traffic Management Team meeting. The Traffic Management Team meetings are an on-going series of meetings hosted by TxDOT that allow transportation stakeholders an opportunity to meet in a regional forum to discuss operational issues. At these meetings, stakeholders will 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 Lower RGV 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.

While the Lower RGV Regional ITS Architecture and ITS Deployment Plan will be reviewed on a quarterly basis, the plans themselves should be updated every two years prior to the TIP update. At that time, input and changes agreed upon at the quarterly traffic management team meetings will be incorporated into the document.

Both the Lower RGV 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 Lower RGV Regional ITS Architecture and Deployment Plan, a Memorandum of Understanding (MOU) was prepared for the participating stakeholder agencies. The MOU was developed for stakeholders to acknowledge their participation and approval of the plan, and pledge their support in the implementation and operation of ITS in the Lower RGV 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.