



State of Texas
Regional ITS Architectures and Deployment Plans

Beaumont Region

Regional ITS Architecture Report

Prepared by:



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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
ATIS	Advanced Travel Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
BRINSAP	Bridge Inventory Inspection System
CC	Control Center
CCTV	Closed-Circuit Television
CPT	Common Public Transportation
CVO	Commercial Vehicle Operations
DARC	Data Radio Channel
DMS	Dynamic Message Sign
DPS	Department of Public Safety
DSRC	Dedicated Short Range Communications
EIA	Electronic Industries Association
EOC	Emergency Operations Center
ETMCC	External TMC Communication
EV	Emergency Vehicle
FC	Fare Collection
FHWA	Federal Highway Administration
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HCRS	Highway Condition Reporting System
HRI	Highway-Rail Intersections
I/F	Interface
IM	Incident Management
IMMS	Incident Management Message Sets
ISP	Information Service Provider

LIST OF ACRONYMS

ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
LADOTD	Louisiana Department of Transportation and Development
LEPC	Local Emergency Planning Commissions
MAMB	Mutual Aid Mont Belvieu
MCM	Maintenance and Construction Management
MCV	Maintenance and Construction Vehicle
MOU	Memorandum of Understanding
MS	Message Sets
NEMA	National Electrical Manufacturers Association
NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol
OB	Onboard
PI	Passenger Information
PTMS	Public Transportation Management System
SAE	Society of Automotive Engineers
SDO	Standards Development Organization
SETRPC	Southeast Texas Regional Planning Commission
SP	Spatial Representation
STIC	Subcarrier Traffic Information Channel
TCEQ	Texas Commission on Environmental Quality
TCIP	Transit Communication Interface Protocol
TEA-21	Transportation Equity Act for the 21st Century
TM	Traffic Management
TMC	Traffic Management Center
TMDD	Traffic Management Data Directory
TxDOT	Texas Department of Transportation
USDOT	United States Department of Transportation
VIVDS	Video Image Vehicle Detector System

SUMMARY

In January 2001, the Federal Highway Administration (FHWA) issued a final rule to implement Section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21) requiring that Intelligent Transportation System (ITS) projects funded through the Highway Trust Fund conform to the National ITS Architecture and applicable standards.

To meet these requirements, in 2001 the Texas Department of Transportation (TxDOT) initiated the development of Regional ITS Architectures and Deployment Plans throughout the State of Texas. The Beaumont Region was the eighth in the series of Regional ITS Architectures to be prepared as part of this initiative.

The Beaumont Region is located in southeastern Texas, and is bordered by Louisiana and the Gulf of Mexico to the east and south. The Beaumont Region also is bordered by the Lufkin and Houston TxDOT Districts.

The Architecture for the Beaumont Region followed a comprehensive process focused on stakeholder outreach and education, identifying market packages and interfaces tailored to the needs of the Beaumont Region, and developing a consensus-based architecture for the Region. This architecture provides a framework for ITS infrastructure to be deployed and integrated in the Beaumont Region over the next 20 years.

Stakeholders from throughout the Region participated in the development of the Regional ITS Architecture, including representatives from TxDOT, the Texas Department of Public Safety (DPS), Southeast Texas Regional Planning Commission (SETRPC), cities, counties, transit agencies, and Kansas City Southern Railway operators. Louisiana Department of Transportation and Development (LADOTD) also has participated. These stakeholders provided input and review at key steps in the architecture development process, including a project kick-off meeting, architecture development, and review workshops, and final review of the architecture documentation.

An inventory of existing and planned ITS infrastructure in the Region provided the basis for the architecture development. Stakeholder needs that could be addressed by ITS technologies guided the selection of market packages, data flows, and integration requirements. A diverse range of needs were identified by stakeholders in the Region. High priority needs focused on evacuation management for hurricanes, as well as HAZMAT and petrochemical emergencies. Coordinating between the Beaumont Region and the TxDOT Houston District, and with LADOTD also were cited as priority needs. There are several highway/rail intersections within the Beaumont Region, and train arrival/warning systems and coordinating with rail operators were identified as key needs by several stakeholders.

Market packages were selected that corresponded to the desired services and functions identified for the Region, and were customized for Beaumont Region agencies and equipment. These market packages included high priority ‘foundation’ services and functions, such as network surveillance and traveler information, as well as market packages to address coordination needs, including incident management and regional emergency response. Stakeholders then prioritized these market packages as high, medium, and low. These priorities were used in the second phase of the project to develop the ITS Deployment Plan for the Beaumont Region.

An interconnect, or “Sausage Diagram” was developed for the Beaumont Region which provided a top-level overview of system functions and primary interconnects. More detailed interfaces were then developed which identified the connectivity between the systems and elements. Each element identified in the ITS architecture for the Beaumont 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. These data flows could include requests for information, alerts and messages, status requests, confirmations, and other information requirements.

Functional requirements for the Beaumont Region were identified through customized market packages and data flows, and the equipment packages that deliver specific capabilities. The equipment packages that were identified provide more detailed descriptions of functionality and can be deployed incrementally. Standards that could apply to the Beaumont Region also were identified as part of the architecture development process.

An Operational Concept for the Beaumont Region was developed to illustrate how systems, components, and agencies will be integrated and function as a result of the framework provided by the Regional ITS Architecture. The purpose of the Operational Concept is to demonstrate the roles and responsibilities of the various stakeholders in the Beaumont Region. Potential agreements that could be required for maintenance and operations, data sharing (among agencies and with the private sector), or joint operations are listed.

The Regional ITS Architecture for the Beaumont Region is documented in the final report. In addition, a companion web site was developed that contains all of the architecture information, stakeholders, regional inventory, customized market packages, interfaces, and standards.

1. INTRODUCTION

1.1 Project Overview

In January 2001, FHWA issued a final rule to implement Section 5206(e) of the TEA-21. This rule required that ITS projects funded through the Highway Trust Fund conform to the National ITS Architecture and applicable standards. The rule requests that the National ITS Architecture be used to develop a local implementation of the National ITS Architecture, which is referred to as a “Regional ITS Architecture.”

In order to meet these requirements, TxDOT initiated the development of Regional ITS Architectures and Deployment Plans throughout the State of Texas. In addition to meeting the federal requirements for funding, the development of regional ITS architectures provides a framework for implementing ITS on a regional level, encourages interoperability and resource sharing, identifies applicable standards, and allows for cohesive long range planning among stakeholders in the Region. Although not required by the FHWA final rule, TxDOT also sought to have an ITS deployment plan developed for each Region. An ITS deployment plan identifies and prioritizes projects that are needed to implement the ITS architecture on a short-, medium-, and long-term basis.

A key goal in the development of the regional ITS architectures was to develop a consensus-based architecture with as many stakeholders as possible involved. Each stakeholder had an equal voice in determining the direction of the architecture for the Region. Stakeholders included representatives from TxDOT, cities, counties, MPOs, rail operations, transit agencies, and LADOTD. A series of five meetings were held with the ITS stakeholders to discuss the development and gather input into the Beaumont Regional ITS Architecture and Deployment Plan. In addition, a project web site was developed which contains all of the information on the Beaumont Regional ITS Architecture and provides stakeholders with an opportunity to review and comment on the architecture directly from the web.

The result is an ITS architecture that establishes a vision and direction for the Region. ITS needs of the Beaumont Region were established early in the project. Existing and planned elements of the architecture have been identified and the key agencies required to develop the ITS services, or market packages as they are referred to in the National ITS Architecture, for the Beaumont Region have been identified. An operational concept has been developed that focuses on the roles and responsibilities of the various agencies involved in the Beaumont Region. A separate ITS Deployment Plan was developed that identifies projects in the Beaumont Region that are required to implement the architecture.

1.2 Document Overview

The Beaumont Regional ITS Architecture report is organized into five key sections:

Section 1 – Introduction

This section provides an overview of the State of Texas ITS Architectures and Deployment Plan Program, the ITS Architecture for the Beaumont Region, as well as an overview of some of the key features and stakeholders in the Beaumont Region.

Section 2 – Integration Strategy

This section discusses Beaumont Region stakeholder needs and issues, regional ITS initiatives and potential regional ITS programs, and opportunities for integration to achieve regional goals and contribute to regional and national ITS interoperability. Stakeholders and their contact information are also included.

Section 3 – Regional ITS Architecture Development Process

An overview of the key steps involved in developing the ITS architecture for the Beaumont Region is provided in this section. It includes a discussion of the methodology, stakeholder involvement, architecture workshops, and architecture development process.

Section 4 – Conceptual Design

The conceptual design contains the key sections of the Beaumont Regional ITS Architecture. The inventory of existing and planned systems is presented in Section 4, and is sorted by both stakeholder as well as by entity for easy reference. The market packages that were selected for the Beaumont Region are also included in this section, as are the system functional requirements. The Beaumont Region interconnects are presented, including the “Sausage Diagram” showing the relationships of the key subsystems and elements in the Region, system interfaces, and the physical subsystem architecture flows. Standards that apply to the Beaumont Regional ITS Architecture also are listed.

Section 5 – Operational Concept

An Operational Concept has been prepared that discusses the key functions and services of the envisioned ITS for the Beaumont Region. As part of this concept, operational scenarios are described and roles and responsibilities of stakeholders are discussed. Potential public-public and public-private agreements also have been identified.

The Beaumont Regional ITS Architecture also contains two appendices:

- Appendix A – Customized Market Packages; and
- Appendix B – Interface Diagrams.

A web site has been established that contains the architecture documentation, inventories, interconnects, market packages, interfaces, and functional requirements. This web site can be accessed from www.consystem.com, and by selecting the link to the Texas Regional ITS Architecture Home Page, and then Beaumont Region. The web site provides hyperlinks to more detailed information about the Beaumont Regional ITS Architecture than what could feasibly be included in the printed document. In certain sections of the document, readers are referred to the web site for additional information and details. At the time this report was published, the Beaumont Regional ITS Architecture web site was being hosted at www.consystem.com. TxDOT plans to permanently host the site in the future at www.dot.state.tx.us/trf/its.

1.3 The Beaumont Region

1.3.1 Geographic Overview

The Beaumont Region is bordered by the TxDOT Lufkin District to the north, the TxDOT Houston District to the west, Louisiana to the east, and the Gulf of Mexico to the south. For the Beaumont Regional ITS Architecture and Deployment Plan, the study area included all eight counties that comprise the TxDOT Beaumont District. The geographic boundaries of the Beaumont Region are highlighted in **Figure 1**. The TxDOT Beaumont District was used as a basis for the project Region. The City of Baytown, which is not a part of the TxDOT Beaumont District, also was included in the Regional boundaries.

The counties included in the Beaumont Region area:

- Chambers;
- Hardin;
- Jasper;
- Jefferson;
- Liberty;
- Newton;
- Orange; and
- Tyler.

TxDOT partners with local governments for roadway construction, maintenance, and traffic operations support, and serves as the responsible agency for on-system roadways in cities with populations less than 50,000. The Cities of Beaumont, Port Arthur and Baytown are the only cities in the project Region with populations that exceed the 50,000 threshold.

1.3.2 Transportation Infrastructure

As illustrated in **Figure 1**, the Beaumont Region has an extensive transportation infrastructure. The primary roadway facilities include I-10, US-90, US-96, US-69, US-190, US-287, SH-87, SH-61, SH-65, and SH-105.

I-10 is an east-west, four-lane divided interstate highway. The effective operation of this highway is critical to the movement of goods and people across the United States. I-10 extends from Florida in the east to California in the west. Within the Beaumont Region, the frontage roads are not always continuous. Blockages along I-10 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-10 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 Beaumont Region has a commercial airport, the Southeast Texas Regional Airport and three major ports. The Port of Beaumont, the Port of Orange, and the Port of Port Arthur all serve local and national shipping needs.

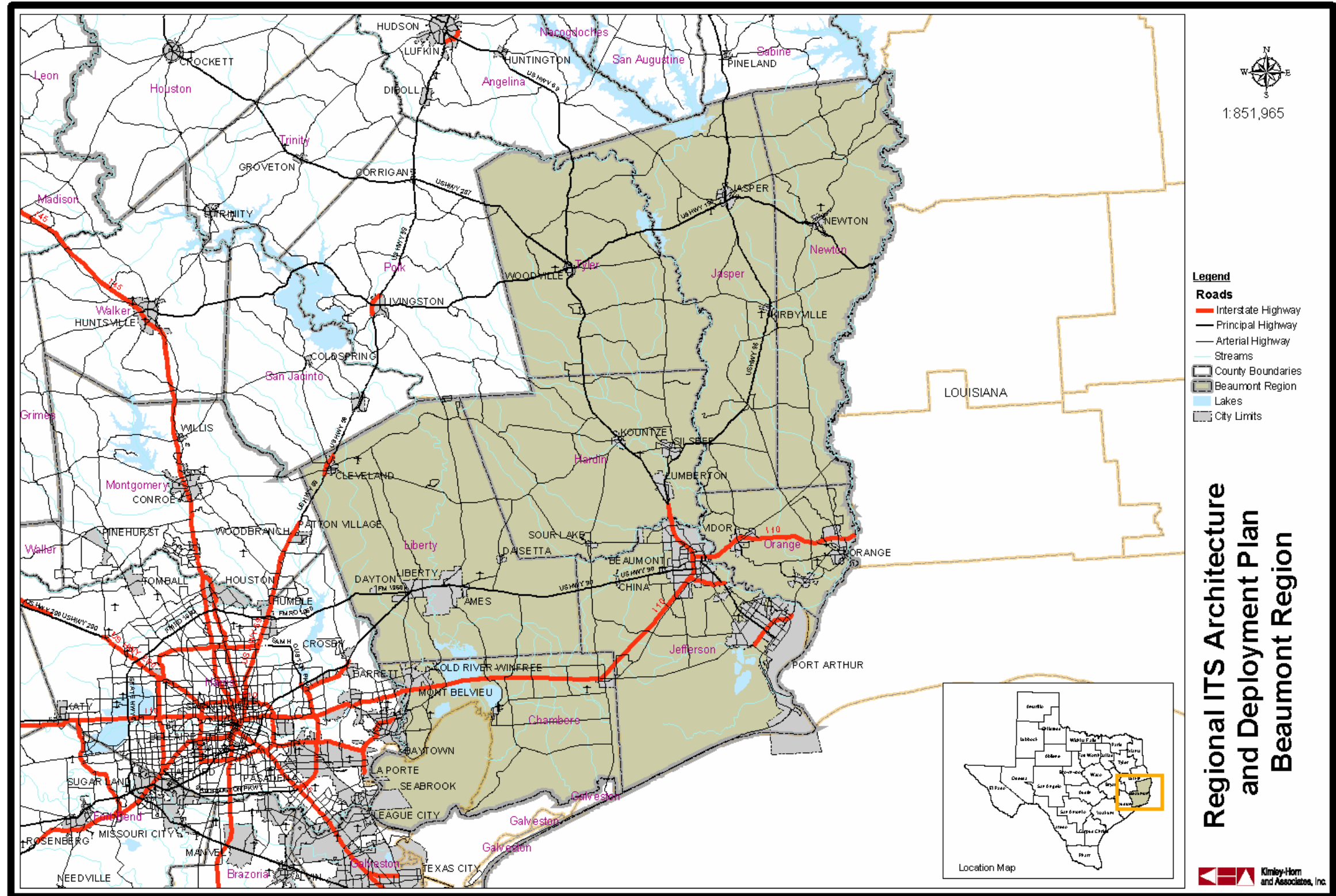


Figure 1 – Beaumont Region Map

1.3.3 Beaumont Region ITS Plans

There are several agencies in the Beaumont Region that already have deployed ITS components. It is important to recognize the initial deployment of ITS infrastructure in a Region because federal requirements mandate that a Region, in order to secure future funding for ITS projects, must have an ITS architecture in place within four years of the initial deployment of ITS strategies and components. As the Beaumont Region pursues funding opportunities for proposed projects, it will be necessary to show that the proposed project fits within the ITS architecture developed for the Region.

Currently, the Beaumont Region has several ITS components deployed in the field including dynamic message signs (DMS), closed loop signal systems with video image vehicle detection systems (VIVDS), highway advisory radio (HAR), signal preemption for emergency vehicles, flooding detection and automated vehicle location (AVL). The following sections discuss these deployments.

Dynamic Message Signs

TxDOT currently has several DMS in the Beaumont Region along I-10. These are controlled by the TxDOT Beaumont District Office and are used to display incident and construction related messages. This includes construction/closure information on I-10 in the Beaumont Region, as well as any construction on I-10 across the border in Louisiana, which could impact eastbound traffic. Houston TranStar plans to install DMS for ferry information in the Beaumont Region. These signs would be operated by TranStar, but could be used by the Beaumont Region for other messages.

Video Detection

TxDOT is using VIVDS at several intersections within the Region. Unlike loop detection, VIVDS will not be affected by paving operations, and the detection zone of a VIVDS can be quickly changed to accommodate lane shifts during construction. VIVDS can detect vehicles approaching or stopping at a signalized intersection, and, under actuated conditions, place a call for the service of the appropriate phase for that vehicle.

Highway Advisory Radio

The TxDOT Beaumont District has deployed HAR in the City of Beaumont. At this time there is one HAR transmitter located in the center of the City of Beaumont. Incident and construction information is broadcast on the HAR station as needed. When TxDOT is not utilizing the HAR for traffic information, the National Oceanic and Atmospheric Administration (NOAA) broadcasts weather information from the station.

Signal Preemption for Emergency Vehicles

Currently, the City of Beaumont has signal preemption installed at several intersections within the city limits for fire and emergency vehicles. Emergency vehicle preemption works when a vehicle equipped with a preemption emitter approaches an intersection and the detector activates a change in signal timing to allow fast and safe passage. The SETRPC is currently working on a project that would install preemption on 150 signals in the Hardin/Jefferson/Orange County areas.

Flooding Detection

TxDOT and other agencies have deployed flood detection equipment to warn motorists of unsafe water levels at several locations prone to flooding. When water reaches a certain level in these locations, such as an underpass where it could be difficult to determine the amount of water present and make a decision as to whether it is safe to drive through, a warning light illuminates to notify motorists of the flooding condition.

Automated Vehicle Location

The City of Beaumont is utilizing an AVL system on City Police, Fire and EMS vehicles. This system allows dispatchers to determine the location of all emergency response vehicles and ensure that the closest vehicle available responds to an incident.

1.3.4 Evacuation Plans and HAZMAT Incident Response in the Beaumont Region

The Beaumont Region is home to numerous chemical and petrochemical companies that rely on the Region's roadways, waterways, railways, and pipelines for transporting potentially dangerous cargo both in and out of the Region. Exxon-Mobil, DuPont, ATOFINA, and Goodyear Tire and Rubber are just a few of the major companies in the Region. Local agencies, from the public and private sector, have long-standing emergency and HAZMAT management plans in place to deal with major HAZMAT incidents, either on the roads, rails or at any number of industrial sites. Mutual Aid Mont Belvieu (MAMB) is an alliance of petrochemical companies in the area that is focused on emergency management/response for incidents or evacuations as a result of a major incident involving the petrochemical sites. MAMB routinely coordinates with DPS, local police, sheriff, fire, and other agencies in the Region, and these entities collectively conduct drills to sharpen their emergency plans. There are Local Emergency Planning Commissions (LEPC) in Orange and Beaumont. These are planning entities for petrochemical incidents and evacuations. There are established plans in place that could be enhanced by ITS deployment and integration among key emergency and incident responders in the Region.

Hurricanes on the Gulf Coast have forced several evacuations in the Beaumont Region, or have necessitated evacuations in other areas that have impacted the Beaumont Region. Hurricane evacuation routes are posted on the City of Beaumont's web site and are available via other sources (brochures, media, etc.), and static signs also are posted on evacuation routes. Local media, particularly radio, is a key information source for residents trying to make their way out of the area during a major storm. ITS technologies and integration among agencies within and nearby the Beaumont Region could greatly assist with streamlining some of the information sharing and motorist warning and information systems. This would include TxDOT Houston to the south and inland, TxDOT Lufkin inland to the northwest, and Louisiana to the northeast. TxDOT Beaumont expressed a strong need to upgrade the Region's web-based information dissemination capabilities for emergency and evacuation messages and directions for motorists.

1.3.5 Stakeholders

Stakeholder coordination and involvement is one of the key elements to the development of a Regional ITS Architecture and Deployment Plan. Because ITS often transcends traditional transportation infrastructure, it is important to involve non-traditional stakeholders in the architecture development and visioning process. Input from these stakeholders, both public and private, is a critical part of defining the interfaces, integration needs, and overall vision for ITS in the Beaumont Region.

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

- Beaumont Municipal Transit;
- Chambers County;
- City of Beaumont;
- City of Pinehurst;
- City of Port Arthur;
- City of Port Arthur Transit;
- City of Port Neches;
- City of West Orange;
- City of Vidor;
- Department of Public Safety;
- Jefferson County;
- Kansas City Southern Railway;
- Louisiana Department of Transportation and Development;
- Southeast Texas Regional Planning Commission (SETRPC);
- TxDOT Beaumont District; and
- TxDOT Traffic Operations Division (Austin).

2. INTEGRATION STRATEGY

2.1 Integration Purpose

The purpose of the integration strategy is to identify the needs, stakeholders, and strategy for regional integration in the Beaumont Region.

For each operating agency or stakeholder entity identified through the development of the Regional ITS Architecture, there are operations that currently exist as a normal practice in order to accomplish the primary business goals and objectives for each stakeholder. As an example, a primary operation of the 911 dispatch is to dispatch emergency personnel to the appropriate locations when a call for help is placed within the Region. The integration of the 911 dispatch with any of the other stakeholders will not change this primary function of the dispatch or disrupt typical business practices. The integration of 911 dispatch with another agency, such as the TxDOT Beaumont District, will require that the data that will be exchanged between the two entities (such as the blockage of a lane of traffic due to a crash) meet certain requirements for that particular data type. Identifying the need for this connection between agencies and the opportunities for integration and interoperability in the Region are key purposes of this section.

This section will provide an overview of the major issues and stakeholders' needs within the Beaumont Region and the primary areas of concern that were uncovered in the preparation of the Beaumont Regional ITS Architecture. Additionally, this section will discuss the need for interregional integration with agencies external to the Beaumont Region such as the need for integration with other TxDOT Districts and possibly the LADOTD during major incidents along I-10 or evacuations along the Gulf Coast.

A key step in developing any regional ITS architecture is the identification of major stakeholders in the Region. Key stakeholder agencies that participated in the development of the Beaumont Regional ITS Architecture are listed in **Table 1**. A number of other stakeholders were identified and invited to participate. In many cases, these other stakeholders were not able to attend due to time constraints. Minutes of meetings, copies of reports, and access to the project web site was provided to these stakeholders to encourage their participation as much as possible.

Table 1 – Beaumont Stakeholder Agencies and Contacts

Stakeholder Agency	Contact	Address	Phone Number	E-Mail
Beaumont Municipal Transit	William Munson	550 Milam Street Beaumont, Texas 77701	409-835-7895	bmunson@beaumonttransit.com
Chambers County	Don Brandon	P.O. Box H Anahuac, Texas 77514	409-267-8379	dbrandon@chambers.lib.tx.us
City of Beaumont	David Redmon	801 Main, Suite 200 Beaumont, Texas 77701	409-880-3725	davidredmon@yahoo.com
City of Beaumont	Tom Warner	P.O. Box 3827 Beaumont, Texas 77704	409-880-3725	twarner@ci.beaumont.tx.us
City of Pinehurst	Ricky Trevino	3640 Mockingbird Orange, Texas 77630	409-886-3873	r_trevino@cityofpinehurst.com
City of Port Arthur	Leslie McMahan	PO Box 1089 Port Arthur, Texas 77640	409-983-8182	atsflem@portarthur.net
City of Port Arthur Transit	Tom Kestranek	PO Box 1089 Port Arthur, Texas 77640	409-983-8767	N/A
City of Port Neches	Taylor Shelton	PO Box 758 Port Neches, Texas 77651	409-719-4204	t.shelton@portnechestx.us
City of West Orange	Chris Boone	2700 Western Avenue West Orange, Texas 77630	409-883-3468	cboone@cityofwestorange.com
City of Vidor	Michael Decker	170 North Main Vidor, Texas 77662	409-769-5473	mdecker@cityofvidor.com
City of Vidor	Mike Harris	170 North Main Vidor, Texas 77662	409-769-5473	N/A
DPS	Doug Heigley	7200 Eastex Freeway Beaumont, Texas 77708	409-924-5400	N/A
Jefferson County	Bart Burrell	1149 Pearl Street Beaumont, Texas 77701	409-835-8584	bgkb@IH2000.net
Kansas City Southern Railway	M.C. "Mike" Van Tiem	4601 Blanchard Road Shreveport, LA 71107	318-676-6269	mike.van.tiem@kcsr.com
Louisiana Department of Transportation and Development	Steve Jiles	P.O. Box 1430 Lake Charles, LA 70602	337-437-9105	sjiles@dotd.state.la.us
Orange County Emergency Management	Tim Courville	106 Border Street Orange, Texas 77630	409-882-7905	N/A
S.E. Texas Regional Planning Commission	Bob Dickinson	2210 Eastex Freeway Beaumont, Texas 77703	409-899-8444 (ext. 251)	bdickinson@setrpc.org
S.E. Texas Regional Planning Commission	Paul Tiley	2210 Eastex Freeway Beaumont, Texas 77703	409-899-8444	ptiley@setrpc.org
TxDOT Beaumont District	Lynn Babin	8350 Eastex Freeway Beaumont, Texas 77708	409-892-7311	lbabin@dot.state.tx.us

Table 1 – Beaumont Stakeholder Agencies and Contacts (continued)

Stakeholder Agency	Contact	Address	Phone Number	E-Mail
TxDOT Beaumont District	Chris Hugon	8350 Eastex Freeway Beaumont, Texas 77708	409-898-5765	chugon@dot.state.tx.us
TxDOT Beaumont District	Janet Manley	8350 Eastex Freeway Beaumont, Texas 77708	409-898-5768	jmanley@dot.state.tx.us
TxDOT Beaumont District	Mitch Murrell	8350 Eastex Freeway Beaumont, Texas 77708	409-896-0266	mmurrel@dot.state.tx.us
TxDOT Traffic Operations Division	Janie Light	Attn: TRF-TM 125 East 11th Street Austin, Texas 78701-2483	512-416-3258	jlight@dot.state.tx.us
TxDOT Traffic Operations Division	Roland Merz	Attn: TRF-TM 125 E. 11th Street Austin, Texas 78701-2483	512-416-3305	rmerz@dot.state.tx.us

2.2 Regional Needs

Needs from the Region were identified in the project kick-off meeting held on December 10, 2002. Stakeholders participating in that meeting identified the needs in the Region according to the eight user service areas defined in the National ITS Architecture. The needs identified in the project kick-off meeting are documented in **Table 2**.

A major issue for the Region involves hurricane evacuations. Coordination between TxDOT Districts and especially with Louisiana is needed to provide information about road closures and detours to evacuees entering and leaving the Region. Delay conditions and incident status would also be very useful information to disseminate during an evacuation. Collaborative effort among areas has the potential to greatly facilitate evacuation efforts.

Table 2 – Beaumont Region: Summary of ITS Needs

<p style="text-align: center;">Beaumont Region Summary of ITS Needs Beaumont Regional ITS Architecture and Deployment Plan Kick-Off Meeting December 10, 2002</p> <p>Travel and Traffic Management Needs</p> <ul style="list-style-type: none">▪ Need hurricane evacuation signal coordination▪ Need congestion detection▪ Need CCTV or loops for roadway speed detection▪ Need school flashers, activated by pager or wireless▪ Need motorist Assistance Patrol▪ Need signal system upgrades▪ Need railroad crossing malfunction notification – possibly using CCTV cameras▪ Need railroad traffic signal preemption▪ Need multilingual traveler information▪ Need hurricane evacuation website with evacuation routes and road closure information▪ Need improved highway advisory radio and expanded coverage▪ Need website for information dissemination, including construction information, road closures, etc.▪ Need improved traffic information for areas south of I-10 <p>Institutional Issues/Needs</p> <ul style="list-style-type: none">▪ Need coordination with Louisiana on Amber Alerts in LA/TX border areas <p>Public Transportation Management Needs None Identified</p> <p>Electronic Payment Needs None Identified</p> <p>Commercial Vehicle Operations Needs None Identified</p> <p>Emergency Management Needs</p> <ul style="list-style-type: none">▪ Need petrochemical emergency evacuation planning▪ Need improved hurricane evacuation planning (include coordination with Louisiana)▪ Need additional automated vehicle location for emergency vehicles▪ Need to expand automated call out system <p>Advanced Vehicle Safety System Needs None Identified</p> <p>Information Management Needs (Data Archiving) None Identified</p> <p>Maintenance and Construction Management Needs</p> <ul style="list-style-type: none">▪ Need portable VMS for five rural counties

2.3 Regional Integration and Interoperability

The Beaumont Region is bordered by Louisiana to the east, the TxDOT Lufkin District to the north, and the TxDOT Houston District to the west. The Beaumont Region needs improved coordination with these surrounding areas for incident management and major roadway closures.

A vision for the Beaumont Region is to integrate systems both on an intra-regional and an inter-regional basis. Within the Beaumont Region, nearly every stakeholder identified is involved in emergency management. During a hurricane evacuation, public safety agencies, transportation agencies, transit agencies, and major employers must share information and resources in order to coordinate the evacuation and minimize traffic impacts. It is imperative that the agency leading the evacuation is cognizant of road and weather conditions in the areas to which people are being directed. Gathering information in one location and providing this information to the traveling public in another area so they know what to anticipate as they approach a potential problem is a key goal.

Incidents that occur on major roadways either in the Beaumont Region or on roadways that could impact the movement of people and goods in the Region should be shared. The integration of the State Emergency Operations Center (EOC) and the local EOC can facilitate the clearing of such an incident more efficiently. As an example, a chemical spill along I-10 west of the Beaumont Region would require a major clean-up in addition to other emergency personnel on site. Coordination between the two EOCs could identify the closest clean-up crew that could respond to the spill and dispatch them to the scene. Similarly, once on scene, the response team could provide the State EOC and the Beaumont Region EOC status reports on the clean-up and potential timing for return to normal operations.

Road closures due to maintenance or incidents also lead to a number of opportunities for improved operations through integration. TxDOT and other transportation agencies would like to be able to share this information throughout the Region so that as soon as one agency is aware of a closure, whether planned or not planned, other agencies can also be made aware of the closure and make appropriate plans.

Operators of the transportation system have many opportunities to improve performance through integration. The City of Beaumont Municipal Transit System can improve performance and schedule adherence by integrating closure information from operators of the transportation network.

In addition to the integration opportunities within the Beaumont Region, integrating the Beaumont Region with surrounding Regions and the state of Louisiana offers great opportunity for improvements to the operations of the system.

Systems such as TxDOT's Highway Condition Reporting System (HCRS) provide an integrated method to gather consistent traveler information on a statewide basis. This type of system could eventually feed into a 511 traveler information number that would provide consistent traveler information throughout the state.

The headquarters of TxDOT maintains a database of traffic counts and accident records for roadways throughout the State of Texas. On occasion, agencies within the Beaumont Region will need access to these databases either to retrieve data or supply data to the database. These data exchanges also will require integrating the agencies' data flows such that neither of the agencies' normal business operations is disturbed to share these data.

One of the primary purposes of developing an ITS architecture is to ensure that while various agencies are deploying ITS components, there are some commonalities between them that will allow and facilitate the exchange of data fairly seamlessly and automatically. This is not to say that all technologies or media that are used by the various agencies will be the same, but that there is an acknowledgement that the data that is being collected and disseminated is valuable to many different agencies; therefore, the integration strategy has to be implemented to ensure the data exchange is possible.

3. REGIONAL ITS ARCHITECTURE DEVELOPMENT PROCESS

Development of the Regional ITS Architecture and Deployment Plan for the Beaumont Region relied heavily on stakeholder input to ensure that the architecture reflected local needs. A series of five meetings was held with stakeholders to gather input, and a web site with the components of the regional architecture as well as hard copies of documents were made available to stakeholders for review and comment.

3.1 Beaumont Process

The process followed for the Beaumont Region was designed to ensure that stakeholders could provide input and review to the development of the Region’s ITS Architecture.

Prior to the first project kick-off meeting with the contractor and stakeholders, TxDOT identified relevant stakeholders in the Region to begin discussions on the development of a Regional ITS Architecture and Deployment Plan. Stakeholders signed a memorandum of understanding (MOU) stating that they would work together in the Region to develop the ITS architecture.

After selecting a contractor, the process shown in **Figure 2** was used to develop the Region’s ITS Architecture. In addition to the architecture, an ITS Deployment Plan for the Region also was developed to identify projects needed to implement the architecture.

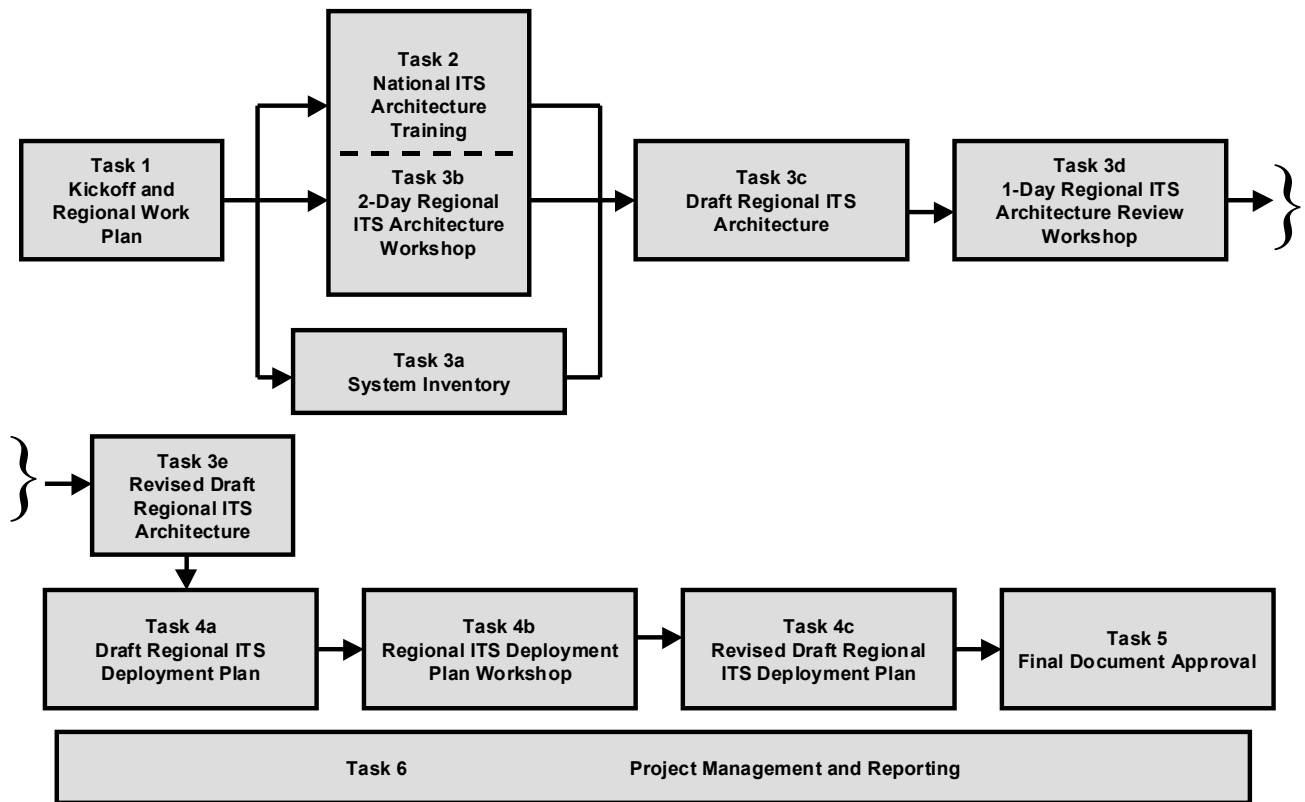


Figure 2 – Beaumont Regional ITS Architecture and Deployment Plan Development Process

A total of five meetings and workshops with stakeholders over a period of eleven months were used to develop the Beaumont Regional ITS Architecture and Deployment Plan. These meetings and workshops included:

- Kick-off and Regional Work Plan Meeting;
- 2-Day Regional ITS Architecture Workshop;
- 1-Day Regional ITS Architecture Review Workshop;
- ITS Deployment Plan Workshop; and
- Final Comment Resolution Meeting.

Key components of the process are described below:

Task 1 – Kick-Off and Regional Work Plan: Based on the initial stakeholder meeting and MOU that was signed, a number of key stakeholders were identified. Additional stakeholders that did not sign the initial MOU also were identified and invited to the project kick-off meeting. At this meeting, the regional work plan was presented to stakeholders for review and comment. Subsequent meeting dates were identified and agreed upon by the stakeholders.

As part of this meeting, a workshop was held with the stakeholders to identify three additional areas of information:

- Additional stakeholders to invite to participate in the process;
- Needs of the stakeholders in the Region; and
- Existing and planned ITS elements in the Region.

Task 2 – National ITS Architecture Training: Task 2 was the development and presentation of training on the National ITS Architecture. The purpose of the training was to familiarize stakeholders with the architecture terminology to the extent needed to allow them to provide input and review on the Beaumont Region's ITS Architecture. The National ITS Architecture training was presented in conjunction with the 2-Day Regional ITS Architecture Workshop described in Task 3B.

Task 3A – System Inventory: Collecting information for the system inventory began at the kick-off meeting through the workshop with the stakeholders to determine existing and planned ITS elements in the Region. After the kick-off meeting, follow-up calls were conducted with a number of local stakeholders to gather additional input for the architecture. To complete the inventory, stakeholders were presented with the results of the inventory in the 2-Day Regional ITS Architecture Workshop described in Task 3B.

Task 3B – 2-Day Regional ITS Architecture Workshop: The purpose of the 2-Day Regional ITS Architecture Workshop was to review the inventory with stakeholders and begin the development of the Beaumont Regional ITS Architecture. Training on the National ITS Architecture also was integrated into the workshop so that key elements of the architecture, such as market packages, could be explained prior to the selection and editing of these elements. The result of the 2-Day Regional ITS Architecture Workshop was a Regional ITS Architecture for Beaumont, which included a system inventory, interconnect diagram, customized market packages, identification of functional requirements through process specifications, system interfaces, and relevant ITS standards.

Task 3C – Draft Regional ITS Architecture: After the 2-Day Regional ITS Architecture Workshop was completed Beaumont Region information, market packages, and interfaces was uploaded to a web site with a dedicated link to the Texas Regional ITS Architecture program. Stakeholders were asked to review the web site and provide comments through an email link set up on the site. A hard copy of the Draft Regional ITS Architecture for the Beaumont Region was sent to stakeholders prior to the 1-Day Regional ITS Architecture Review Workshop.

Task 3D – 1-Day Regional ITS Architecture Review Workshop: The 1-Day Regional ITS Architecture Review workshop was designed to allow stakeholders to review the draft architecture and provide comments. The primary focus of the workshop was to review the architecture flows between elements in the market packages. Training on architecture flows as well as ITS standards also was completed.

Task 3E – Revised Draft Regional ITS Architecture: Input from stakeholders in the 1-Day Regional ITS Architecture Review Workshop, as well as comments from stakeholders reviewing the web site and hard copy document, were used to revise the Draft Regional ITS Architecture. The revisions were incorporated into the web site as well as into the hard copy document. The Revised Draft Regional ITS Architecture was mailed to stakeholders for additional review.

Task 4A – Draft Regional ITS Deployment Plan: A Draft Regional ITS Deployment Plan was developed based on the prioritization of market packages and needs expressed by the stakeholders in the Region. The Draft Regional ITS Deployment Plan included a list of recommended projects in a 5-year, 10-year, and 20-year timeframe. Each project was linked to at least one or more market packages from the Beaumont Regional ITS Architecture.

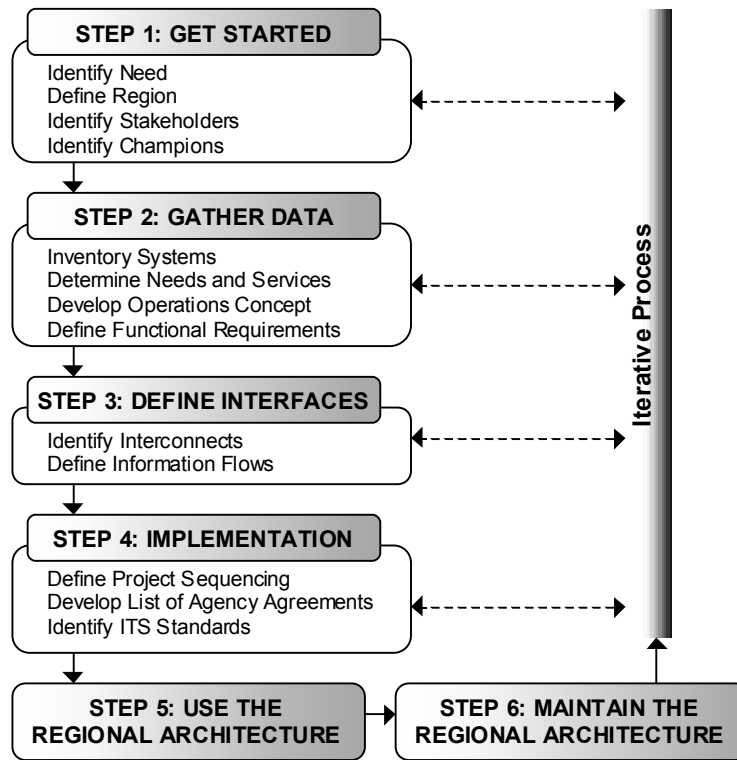
Task 4B – Regional ITS Deployment Plan Workshop: The Draft Regional ITS Deployment Plan was presented to stakeholders at the Regional ITS Deployment Plan Workshop. Stakeholders were asked to provide input on the recommended projects, priority, and deployment timeframe.

Task 4C – Revised Draft Regional ITS Deployment Plan: Based on the review and input from stakeholders at the Regional ITS Deployment Plan Workshop, as well as review comments received from stakeholders outside of the workshop, a Revised Draft Regional ITS Deployment Plan was developed and sent to stakeholders.

Task 5 – Final Document Approval: A final comment resolution meeting was held with stakeholders to review the Revised Draft Regional ITS Architecture and the Revised Draft Regional ITS Deployment Plan. Next steps for the Region were also discussed. Comments were incorporated and a final Regional ITS Architecture and Regional ITS Deployment Plan were developed.

3.2 USDOT Regional ITS Architecture Guidance

On October 12, 2001, the U.S. Department of Transportation (USDOT) issued guidance on development of a regional ITS architecture through the document “Regional ITS Architecture Guidance: Developing, Using, and Maintaining an ITS Architecture for Your Region.” **Figure 3** summarizes the guidance provided by the USDOT.



(Source: Regional ITS Architecture Guidance: Developing, Using, and Maintaining an ITS Architecture for Your Region, USDOT)

Figure 3 – USDOT Guidance on Regional ITS Architecture Development

The process used to develop the Beaumont Regional ITS Architecture and Deployment Plan follows Steps 1 through 4 of the guidance. Steps 5 and 6 are designed to provide guidance upon the completion of the development of the Regional ITS Architecture.

Step 1, Get Started, of the guidance was completed in Task 1 – Kick-off and Regional Work Plan, as well as preliminary work completed by TxDOT to identify initial stakeholders and the need to complete the architecture for the Beaumont Region. Through these efforts, the need for an architecture, appropriate stakeholders, and the Region was defined.

Step 2, Gather Data, was completed through Task 1 – Kick-off and Regional Work Plan, Task 3A – System Inventory, and Task 3B – 2-Day Regional ITS Architecture Workshop. These efforts allowed the inventory for the Beaumont Region to be completed, identified ITS needs in the Region, and led to the development of an operational concept and definition of functional requirements.

Step 3, Define Interfaces, was completed in Task 3B – 2-Day Regional ITS Architecture Workshop and Task 3D – 1-Day Regional ITS Architecture Review Workshop. These workshops engaged stakeholders in customizing Market Packages for the Region, which included identifying interconnects among elements in the architecture and reviewing and selecting data flows between elements.

Step 4, Implementation, was completed in Task 3D – 1-Day Regional ITS Architecture Review Workshop through the prioritization of market packages. Sequencing of projects began in this process and was completed in the ITS Deployment Plan. Applicable ITS standards to match the identified data flows also were identified through the 1-Day ITS Architecture Review Workshop. Based on the envisioned information exchanges and integration outlined in the Regional ITS Architecture, potential agreements were identified.

4. CONCEPTUAL DESIGN

4.1 Systems Inventory

An important initial step in the architecture development process is to establish an inventory of existing ITS elements. At the project kick-off meeting and through subsequent discussions with agency representatives throughout the Region, Beaumont stakeholders provided the team with a list of existing, planned, and future systems that would play a role in the Region's ITS architecture. "Planned" is defined as a system with funding identified while "future" is defined as a system that does not yet have funding identified.

Existing, planned, and future systems in the Beaumont Region were identified in the following categories:

- **Travel and Traffic Management** – includes the TxDOT Beaumont District Office, center-to-center links, detection systems, CCTV, fixed and portable dynamic message signs, broadcast traveler information, railroad operations coordination, and other related technologies.
- **Public Transportation Management** – includes transit and paratransit automated vehicle location, and transit travel information systems.
- **Commercial Vehicle Operations** – HAZMAT permitting and coordination with TexView (CVISN) efforts.
- **Emergency Management** – includes emergency operations/management centers, improved information sharing among traffic and emergency services, and enhanced hurricane and HAZMAT evacuation.
- **Information Management** – includes electronic data management and archiving systems.
- **Maintenance and Construction Management** – includes maintenance and construction vehicle tracking, roadway maintenance and construction information, and work zone management.

The System Inventory is a valuable task for several reasons. First, it provides a baseline of existing and planned ITS projects and systems in the Region. Second, it outlines which agencies are currently deploying and operating ITS, as well as those that are planning to implement ITS programs. Third, it provides a foundation for identifying needed elements or agency participation for the regional ITS, which will be important for subsequent tasks including the market package identification and prioritization, system interface and integration requirements in the Region, and ultimately the ITS Deployment Plan.

4.1.1 Subsystems and Terminators

Each identified system or component in the Beaumont Regional ITS inventory was mapped to a subsystem or terminator in the National ITS Architecture. Subsystems and terminators are the 'entities' that represent systems in ITS. 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. Each of these major classes includes various subsystems that represent a set of transportation functions (or processes) that are likely to be collected together under one agency, jurisdiction, or location, and correspond to physical elements, such as traffic operations centers, traffic signals, vehicles, and so on. **Figure 4** shows the National ITS Architecture subsystems. This figure, also

known as the “sausage diagram” is a standard interconnect diagram, showing the relationships of the various subsystems within the architecture; a customized interconnect diagram for the Beaumont Region is included in Section 4.3.1 of this report. Communication functions between the subsystems are represented in the ovals. It should be noted that “wireline” communication refers to fixed-point to fixed-point communications, which include not only twisted pair and fiber optic technologies, but also such wireless technologies as microwave and spread spectrum.

Terminators are the people, systems, other facilities, and environmental conditions outside of ITS that need to communicate or interface with ITS subsystems. They help to define the boundaries of the National ITS Architecture as well as a regional system. Examples of terminators include drivers, traffic operations personnel, information service providers, weather effects (rain, wind, floods), telecommunications systems, and government reporting systems, among others.

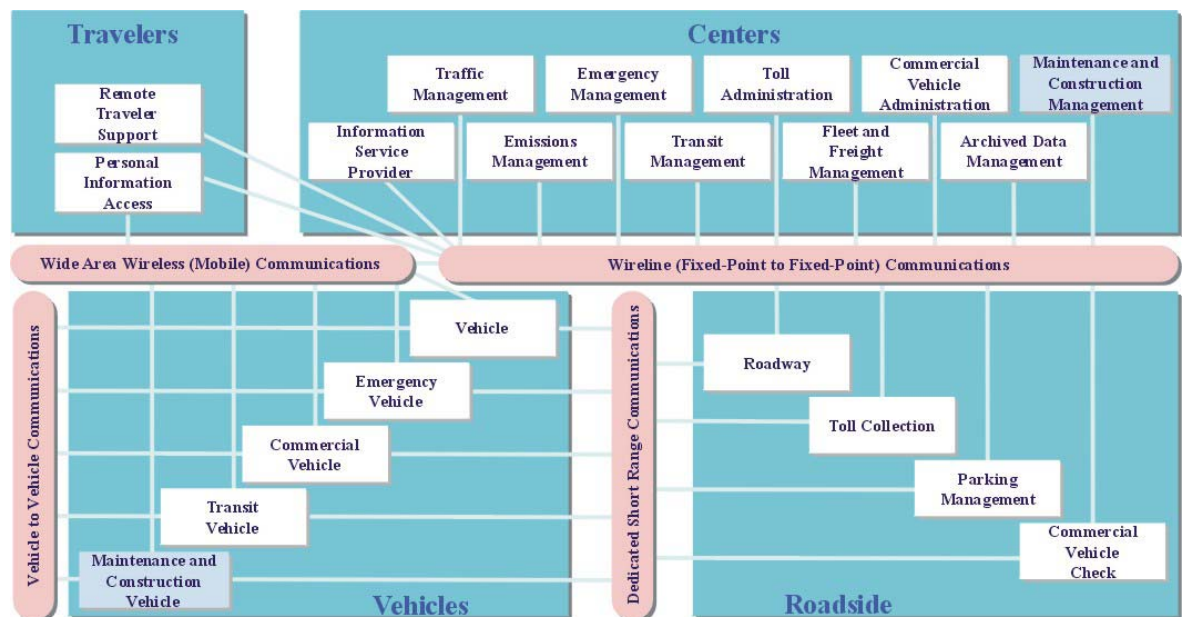


Figure 4 – Physical Subsystem Interconnect Diagram

4.1.2 Beaumont ITS Inventory by Stakeholder

Each stakeholder is associated with one or more systems or elements (subsystems and terminators) that make up the transportation system in the Beaumont Region. **Table 3** sorts the inventory by stakeholder, so each stakeholder can easily identify and review all their relevant assets that are identified in the Beaumont Regional ITS Architecture.

The information in **Table 3** also is included on the Beaumont ITS Architecture web site. Selecting the link to the Texas Regional ITS Architecture, then Beaumont Region, and then selecting the “Inventory by Stakeholder” button which will open the full inventory list. Each element in the list contains a hyperlink to more detailed information, including status, description, stakeholder, and other elements within the inventory with which it interfaces. At the time this report was published, the Beaumont Regional ITS Architecture web site

was being hosted at www.consystem.com. TxDOT plans to permanently host the site in the future at www.dot.state.tx.us/trf/its.

4.1.3 *Beaumont ITS Inventory by Entity*

The Beaumont Regional ITS Architecture inventory is made up of the transportation and communications centers, the field equipment, the vehicles, and other systems in the regional transportation system. These components have been assigned to a subsystem or terminator as defined by the National ITS Architecture. **Table 4** presents the Beaumont Region inventory using the associated National ITS Architecture subsystem or terminator. This sorts elements that perform similar functions together, so elements of a particular type can be easily identified.

This inventory also can be accessed from the Beaumont Regional ITS Architecture web site by selecting the “Inventory by Entity” button.

Table 3 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Stakeholder)

Stakeholder	Element	Entity	Status
Beaumont Municipal Transit	Beaumont Regional Smart Card	Traveler Card	Future
	BMT Transit Dispatch	Archived Data User Systems	Existing
	BMT Transit Dispatch	Transit Management Subsystem	Existing
	BMT Transit Information Display / Point of Sale	Remote Traveler Support Subsystem	Future
	BMT Transit Vehicles	Transit Vehicle Subsystem	Existing
	BMT Transit Vehicles	Vehicle Subsystem	Existing
	BMT Transit Website	Information Service Provider Subsystem	Existing
City of Beaumont Fire Department	City of Beaumont Fire and EMS Dispatch	Emergency Management Subsystem	Existing
	City of Beaumont Fire Vehicles	Emergency Vehicle Subsystem	Existing
City of Beaumont Police Department	City of Beaumont Police Dispatch and PSAP	Emergency Management Subsystem	Existing
	City of Beaumont Police Vehicles	Emergency Vehicle Subsystem	Existing
City of Beaumont Public Works Transportation Division	City of Beaumont Field Equipment	Roadway Subsystem	Existing
	City of Beaumont Maintenance	Maintenance and Construction Management Subsystem	Existing
	City of Beaumont Traffic Signal System	Traffic Management Subsystem	Existing
City of Port Arthur	City of Port Arthur Emergency Vehicles	Emergency Vehicle Subsystem	Existing
	City of Port Arthur Police/Fire Dispatch	Emergency Management Subsystem	Existing
City of Port Arthur Public Works	City of Port Arthur Field Equipment	Roadway Subsystem	Existing
	City of Port Arthur Public Works	Maintenance and Construction Management Subsystem	Existing
	City of Port Arthur Traffic Signal System	Traffic Management Subsystem	Existing

Table 3 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Stakeholder) (continued)

Stakeholder	Element	Entity	Status
City of Port Arthur Transit System	City of Port Arthur Transit Information Display / Point of Sale	Remote Traveler Support Subsystem	Future
	City of Port Arthur Transit System Dispatch	Transit Management Subsystem	Existing
	City of Port Arthur Transit Vehicles	Transit Vehicle Subsystem	Existing
	City of Port Arthur Transit Vehicles	Vehicle Subsystem	Existing
	City of Port Arthur Transit Web Site	Information Service Provider Subsystem	Existing
Coast Guard	Coast Guard Marine Safety Office	Emergency Management Subsystem	Existing
Commercial Vehicle Operators	Commercial Vehicles	Commercial Vehicle Subsystem	Existing
	Commercial Vehicles	Vehicle Subsystem	Existing
	Private Fleet Management Systems	Fleet and Freight Management Subsystem	Future
Correctional Facilities	Correctional Facilities Operations	Emergency Management Subsystem	Existing
County Emergency Management Agencies	County EOC	Emergency Management Subsystem	Existing
County Road and Bridge	County Road and Bridge	Maintenance and Construction Management Subsystem	Existing
	County Road and Bridge Equipment Repair	Equipment Repair Facility	Existing
	County Road and Bridge Field Equipment	Roadway Subsystem	Future
	County Road and Bridge Vehicles	Maintenance and Construction Vehicle Subsystem	Existing
County Sheriff	County Public Safety Dispatch and PSAP	Emergency Management Subsystem	Existing
DPS	DPS Administration	Emergency Management Subsystem	Existing
	DPS Communications Service	Emergency Management Subsystem	Existing
	DPS Communications Service	Traffic Management Subsystem	Existing
	DPS Emergency Vehicles	Emergency Vehicle Subsystem	Existing
	Statewide Crash Records Information System	Archived Data Management Subsystem	Existing
	Statewide Crash Records Information System	Information Service Provider Subsystem	Existing
	Statewide Crash Records Information System Users	Archived Data User Systems	Existing

Table 3 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Stakeholder) (continued)

Stakeholder	Element	Entity	Status
DPS Division of Emergency Management	State EOC	Emergency Management Subsystem	Existing
Financial Institution	Financial Institution	Financial Institution	Future
HAZMAT Alliance	HAZMAT Alliance Emergency Center	Emergency Management Subsystem	Existing
Independent School Districts	Independent School District Buses	Transit Vehicle Subsystem	Existing
	Independent School District Dispatch	Transit Management Subsystem	Existing
Joint TRANSTAR/TxDOT Beaumont District	TRANSTAR/Beaumont District DMS	Roadway Subsystem	Existing
KFDM Channel 6	KFDM Web Site	Information Service Provider Subsystem	Existing
LA DPS	LA DPS Troop D Dispatch	Emergency Management Subsystem	Existing
LADOTD District 7	LADOTD District 7 HQ	Maintenance and Construction Management Subsystem	Existing
	LADOTD District 7 HQ	Traffic Management Subsystem	Existing
	LADOTD Traveler Information Website	Information Service Provider Subsystem	Existing
Local Emergency Planning Commission	Orange County LEPC Center	Emergency Management Subsystem	Existing
	Orange County LEPC Emergency Flashers	Roadway Subsystem	Existing
Local Media	Local Print and Broadcast Media	Media	Existing
Lower Neches Valley Authority	Lower Neches Valley Authority	Emergency Management Subsystem	Existing
	Lower Neches Valley Flood Warning Devices	Roadway Subsystem	Existing
MAMB	MAMB Emergency Management Center	Emergency Management Subsystem	Existing
Municipal Convention and Visitors Bureau	Municipal Convention and Visitors Bureau	Event Promoters	Existing
Municipal or County Government	Municipal or County Permitting System	Commercial Vehicle Administration Subsystem	Existing
Municipal or County Public Safety	Municipal or County Emergency Vehicles	Emergency Vehicle Subsystem	Existing
	Municipal Public Safety Dispatch	Emergency Management Subsystem	Existing

Table 3 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Stakeholder) (continued)

Stakeholder	Element	Entity	Status
Municipal Public Works Department	Municipal PWD	Maintenance and Construction Management Subsystem	Existing
	Municipal PWD Vehicles	Maintenance and Construction Vehicle Subsystem	Existing
National Forest Service	Forest Service Dispatch	Emergency Management Subsystem	Future
NOAA	National Weather Service	Weather Service	Existing
Orange County Sheriff	Automated Calling System	Information Service Provider Subsystem	Existing
Private Ambulance	Private Ambulance Dispatch	Emergency Management Subsystem	Existing
	Private Ambulance Vehicle	Emergency Vehicle Subsystem	Existing
Private Information Service Providers	Private Sector Traveler Information Services	Information Service Provider Subsystem	Future
Private Taxi Providers	Private Taxi Provider Dispatch	Transit Management Subsystem	Existing
Private Tow/Wrecker Providers	Private Tow/Wrecker Dispatch	Emergency Management Subsystem	Future
Private Travelers	Private Travelers Personal Computing Devices	Personal Information Access Subsystem	Future
Rail Operators	Rail Operations Centers	Archived Data User Systems	Existing
	Rail Operations Centers	Fleet and Freight Management Subsystem	Existing
	Rail Operations Centers	Rail Operations	Existing
	Rail Operators Rail Cars	Commercial Vehicle Subsystem	Future
	Rail Operators Wayside Equipment	Wayside Equipment	Existing
Regional Airports	Regional Airports	Multimodal Transportation Service Provider	Existing
Regional Emergency and Public Safety Agencies	Beaumont Region Incident and Mutual Aid Network	Other EM	Future
Regional Medical Center	Regional Medical Center	Care Facility	Existing
Sabine River Authority of Texas	Sabine River Authority Flood Warning Devices	Roadway Subsystem	Existing
	Sabine River Authority Gulf Coast Division	Emergency Management Subsystem	Existing

Table 3 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Stakeholder) (continued)

Stakeholder	Element	Entity	Status
SETRPC	SETRPC Accident Database	Archived Data Management Subsystem	Existing
	SETRPC Accident Database User Systems	Archived Data User Systems	Existing
	SETRPC Air Quality Information Office System	Media	Existing
	SETRPC Data System	Archived Data Management Subsystem	Future
	SETRPC Data System Users	Archived Data User Systems	Future
	SETRPC Motorist Assistance Dispatch	Emergency Management Subsystem	Future
	SETRPC Motorist Assistance Vehicles	Emergency Vehicle Subsystem	Future
	SETRPC Website	Information Service Provider Subsystem	Existing
SETT	Southeast Texas Transit Participants Dispatch	Transit Management Subsystem	Existing
	Southeast Texas Transit Participants Vehicles	Transit Vehicle Subsystem	Existing
Texas Commission on Environmental Quality (TCEQ)	TCEQ Field Emissions Monitors	Roadway Subsystem	Existing
	TCEQ Monitor Operations Section	Emissions Management Subsystem	Existing
	TCEQ State HQ	Other Emissions	Existing
Trinity River Authority	Trinity River Authority Control Center	Emergency Management Subsystem	Existing
	Trinity River Authority Flood Detectors	Roadway Subsystem	Existing
TxDOT	Other TxDOT District Maintenance Sections	Maintenance and Construction Management Subsystem	Existing
	TranStar and Other Texas Region TMCs	Traffic Management Subsystem	Existing
	TxDOT 511 System	Information Service Provider Subsystem	Future
	TxDOT Beaumont District Area Engineers Office	Maintenance and Construction Administrative Systems	Existing
	TxDOT Beaumont District Area Engineers Office	Maintenance and Construction Management Subsystem	Existing
	TxDOT Beaumont District CCTV	Roadway Subsystem	Future
	TxDOT Beaumont District DMS	Roadway Subsystem	Existing
	TxDOT Beaumont District Field Sensors	Roadway Subsystem	Existing

Table 3 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Stakeholder) (continued)

Stakeholder	Element	Entity	Status
TxDOT (continued)	TxDOT Beaumont District Freeway Control Equipment	Roadway Subsystem	Future
	TxDOT Beaumont District HAR	Roadway Subsystem	Existing
	TxDOT Beaumont District Maintenance Sections	Maintenance and Construction Management Subsystem	Existing
	TxDOT Beaumont District Maintenance Vehicles	Maintenance and Construction Vehicle Subsystem	Existing
	TxDOT Beaumont District Office	Traffic Management Subsystem	Existing
	TxDOT Beaumont District Pavement Management System	Archived Data Management Subsystem	Existing
	TxDOT Beaumont District Pavement Management System	Archived Data User Systems	Existing
	TxDOT Beaumont District Pavement Management System	Asset Management	Existing
	TxDOT Beaumont District Pavement Management System Users	Archived Data User Systems	Future
	TxDOT Beaumont District Public Information Office	Information Service Provider Subsystem	Future
	TxDOT Beaumont District Public Transportation Management System (PTMS)	Archived Data Management Subsystem	Existing
	TxDOT Beaumont District School Pager System	Roadway Subsystem	Future
	TxDOT Beaumont District Shop	Equipment Repair Facility	Existing
	TxDOT Beaumont District Signal Shop	Traffic Management Subsystem	Existing
	TxDOT Beaumont District Traffic Signals	Roadway Subsystem	Existing
	TxDOT Beaumont District Web Page	Information Service Provider Subsystem	Existing
	TxDOT Beaumont District Work Zone Equipment	Roadway Subsystem	Future
	TxDOT BRINSAP	Asset Management	Existing
	TxDOT Flood Detection	Roadway Subsystem	Existing
	TxDOT Fort Worth TMC (TransVision)	Traffic Management Subsystem	Existing
TxDOT Highway Conditions Reporting System	Information Service Provider Subsystem	Existing	

Table 3 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Stakeholder) (continued)

Stakeholder	Element	Entity	Status
TxDOT (continued)	TxDOT Highway Conditions Reporting System	Maintenance and Construction Management Subsystem	Existing
	TxDOT Motor Carrier Routing Information	Information Service Provider Subsystem	Existing
	TxDOT Rest Areas/Visitor Centers/Service/Truck Stops/ Plaza Kiosks	Remote Traveler Support Subsystem	Future
	TxDOT Statewide Pavement Management System	Archived Data Management Subsystem	Existing

Table 4 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Entity)

Entity	Element	Stakeholder	Status
Archived Data Management Subsystem	SETRPC Accident Database	SETRPC	Existing
	SETRPC Data System	SETRPC	Future
	Statewide Crash Records Information System	DPS	Existing
	TxDOT Beaumont District Pavement Management System	TxDOT	Existing
	TxDOT Beaumont District Public Transportation Management System (PTMS)	TxDOT	Existing
	TxDOT Statewide Pavement Management System	TxDOT	Existing
Archived Data User Systems	BMT Transit Dispatch	Beaumont Municipal Transit	Existing
	Rail Operations Centers	Rail Operators	Existing
	SETRPC Accident Database User Systems	SETRPC	Existing
	SETRPC Data System Users	SETRPC	Future
	Statewide Crash Records Information System Users	DPS	Existing
	TxDOT Beaumont District Pavement Management System	TxDOT	Existing
	TxDOT Beaumont District Pavement Management System Users	TxDOT	Future
Asset Management	TxDOT Beaumont District Pavement Management System	TxDOT	Existing
	TxDOT BRINSAP	TxDOT	Existing
Care Facility	Regional Medical Center	Regional Medical Center	Existing
Commercial Vehicle Administration Subsystem	Municipal or County Permitting System	Municipal or County Government	Existing
Commercial Vehicle Subsystem	Commercial Vehicles	Commercial Vehicle Operators	Existing
	Rail Operators Rail Cars	Rail Operators	Future

Table 4 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Entity) (continued)

Entity	Element	Stakeholder	Status
Emergency Management Subsystem	City of Beaumont Fire and EMS Dispatch	City of Beaumont Fire Department	Existing
	City of Beaumont Police Dispatch and PSAP	City of Beaumont Police Department	Existing
	City of Port Arthur Police/Fire Dispatch	City of Port Arthur	Existing
	Coast Guard Marine Safety Office	Coast Guard	Existing
	Correctional Facilities Operations	Correctional Facilities	Existing
	County EOC	County Emergency Management Agencies	Existing
	County Public Safety Dispatch and PSAP	County Sheriff	Existing
	DPS Administration	DPS	Existing
	DPS Communications Service	DPS	Existing
	Forest Service Dispatch	National Forest Service	Future
	HAZMAT Alliance Emergency Center	HAZMAT Alliance	Existing
	LA DPS Troop D Dispatch	LA DPS	Existing
	Lower Neches Valley Authority	Lower Neches Valley Authority	Existing
	MAMB Emergency Management Center	MAMB	Existing
	Municipal Public Safety Dispatch	Municipal or County Public Safety	Existing
	Orange County LEPC Center	Local Emergency Planning Commission	Existing
	Private Ambulance Dispatch	Private Ambulance	Existing
	Private Tow/Wrecker Dispatch	Private Tow/Wrecker Providers	Future
	Sabine River Authority Gulf Coast Division	Sabine River Authority of Texas	Existing
	SETRPC Motorist Assistance Dispatch	SETRPC	Future
State EOC	DPS Division of Emergency Management	Existing	
Trinity River Authority Control Center	Trinity River Authority	Existing	
Emergency Vehicle Subsystem	City of Beaumont Fire Vehicles	City of Beaumont Fire Department	Existing
	City of Beaumont Police Vehicles	City of Beaumont Police Department	Existing
	City of Port Arthur Emergency Vehicles	City of Port Arthur	Existing

Table 4 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Entity) (continued)

Entity	Element	Stakeholder	Status
Emergency Vehicle Subsystem (continued)	DPS Emergency Vehicles	DPS	Existing
	Municipal or County Emergency Vehicles	Municipal or County Public Safety	Existing
	Private Ambulance Vehicle	Private Ambulance	Existing
	SETRPC Motorist Assistance Vehicles	SETRPC	Future
Emissions Management Subsystem	TCEQ Monitor Operations Section	Texas Commission on Environmental Quality (TCEQ)	Existing
Equipment Repair Facility	County Road and Bridge Equipment Repair	County Road and Bridge	Existing
	TxDOT Beaumont District Shop	TxDOT	Existing
Event Promoters	Municipal Convention and Visitors Bureau	Municipal Convention and Visitors Bureau	Existing
Financial Institution	Financial Institution	Financial Institution	Future
Fleet and Freight Management Subsystem	Private Fleet Management Systems	Commercial Vehicle Operators	Future
	Rail Operations Centers	Rail Operators	Existing
Information Service Provider Subsystem	Automated Calling System	Orange County Sheriff	Existing
	BMT Transit Website	Beaumont Municipal Transit	Existing
	City of Port Arthur Transit Web Site	City of Port Arthur Transit System	Existing
	KFDM Web Site	KFDM Channel 6	Existing
	LADOTD Traveler Information Website	LADOTD District 7	Existing
	Private Sector Traveler Information Services	Private Information Service Providers	Future
	SETRPC Website	SETRPC	Existing
	Statewide Crash Records Information System	DPS	Existing
	TxDOT 511 System	TxDOT	Future
	TxDOT Beaumont District Public Information Office	TxDOT	Future
	TxDOT Beaumont District Web Page	TxDOT	Existing
	TxDOT Highway Conditions Reporting System	TxDOT	Existing
TxDOT Motor Carrier Routing Information	TxDOT	Existing	

Table 4 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Entity) (continued)

Entity	Element	Stakeholder	Status
Maintenance and Construction Administrative Systems	TxDOT Beaumont District Area Engineers Office	TxDOT	Existing
Maintenance and Construction Management Subsystem	City of Beaumont Maintenance	City of Beaumont Public Works Transportation Division	Existing
	City of Port Arthur Public Works	City of Port Arthur Public Works	Existing
	County Road and Bridge	County Road and Bridge	Existing
	LADOTD District 7 HQ	LADOTD District 7	Existing
	Municipal PWD	Municipal Public Works Department	Existing
	Other TxDOT District Maintenance Sections	TxDOT	Existing
	TxDOT Beaumont District Area Engineers Office	TxDOT	Existing
	TxDOT Beaumont District Maintenance Sections	TxDOT	Existing
	TxDOT Highway Conditions Reporting System	TxDOT	Existing
Maintenance and Construction Vehicle Subsystem	County Road and Bridge Vehicles	County Road and Bridge	Existing
	Municipal PWD Vehicles	Municipal Public Works Department	Existing
	TxDOT Beaumont District Maintenance Vehicles	TxDOT	Existing
Media	Local Print and Broadcast Media	Local Media	Existing
	SETRPC Air Quality Information Office System	SETRPC	Existing
Multimodal Transportation Service Provider	Regional Airports	Regional Airports	Existing
Other EM	Beaumont Region Incident and Mutual Aid Network	Regional Emergency and Public Safety Agencies	Future
Other Emissions	TCEQ State HQ	Texas Commission on Environmental Quality (TCEQ)	Existing
Personal Information Access Subsystem	Private Travelers Personal Computing Devices	Private Travelers	Future
Rail Operations	Rail Operations Centers	Rail Operators	Existing

Table 4 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Entity) (continued)

Entity	Element	Stakeholder	Status
Remote Traveler Support Subsystem	BMT Transit Information Display / Point of Sale	Beaumont Municipal Transit	Future
	City of Port Arthur Transit Information Display / Point of Sale	City of Port Arthur Transit System	Future
	TxDOT Rest Areas/Visitor Centers/Service/Truck Stops/ Plaza Kiosks	TxDOT	Future
Roadway Subsystem	City of Beaumont Field Equipment	City of Beaumont Public Works Transportation Division	Existing
	City of Port Arthur Field Equipment	City of Port Arthur Public Works	Existing
	County Road and Bridge Field Equipment	County Road and Bridge	Future
	Lower Neches Valley Flood Warning Devices	Lower Neches Valley Authority	Existing
	Orange County LEPC Emergency Flashers	Local Emergency Planning Commission	Existing
	Sabine River Authority Flood Warning Devices	Sabine River Authority of Texas	Existing
	TCEQ Field Emissions Monitors	Texas Commission on Environmental Quality (TCEQ)	Existing
	TRANSTAR/Beaumont District DMS	Joint TRANSTAR/TxDOT Beaumont District	Existing
	Trinity River Authority Flood Detectors	Trinity River Authority	Existing
	TxDOT Beaumont District CCTV	TxDOT	Future
	TxDOT Beaumont District DMS	TxDOT	Existing
	TxDOT Beaumont District Field Sensors	TxDOT	Existing
	TxDOT Beaumont District Freeway Control Equipment	TxDOT	Future
	TxDOT Beaumont District HAR	TxDOT	Existing
	TxDOT Beaumont District School Pager System	TxDOT	Future
	TxDOT Beaumont District Traffic Signals	TxDOT	Existing
TxDOT Beaumont District Work Zone Equipment	TxDOT	Future	
TxDOT Flood Detection	TxDOT	Existing	

Table 4 – Beaumont Inventory of Regional Subsystems/Terminators (sorted by Entity) (continued)

Entity	Element	Stakeholder	Status
Traffic Management Subsystem	City of Beaumont Traffic Signal System	City of Beaumont Public Works Transportation Division	Existing
	City of Port Arthur Traffic Signal System	City of Port Arthur Public Works	Existing
	DPS Communications Service	DPS	Existing
	LADOTD District 7 HQ	LADOTD District 7	Existing
	TranStar and Other Texas Region TMCs	TxDOT	Existing
	TxDOT Beaumont District Office	TxDOT	Existing
	TxDOT Beaumont District Signal Shop	TxDOT	Existing
	TxDOT Fort Worth TMC (TransVision)	TxDOT	Existing
Transit Management Subsystem	BMT Transit Dispatch	Beaumont Municipal Transit	Existing
	City of Port Arthur Transit System Dispatch	City of Port Arthur Transit System	Existing
	Independent School District Dispatch	Independent School Districts	Existing
	Private Taxi Provider Dispatch	Private Taxi Providers	Existing
	Southeast Texas Transit Participants Dispatch	SETT	Existing
Transit Vehicle Subsystem	BMT Transit Vehicles	Beaumont Municipal Transit	Existing
	City of Port Arthur Transit Vehicles	City of Port Arthur Transit System	Existing
	Independent School District Buses	Independent School Districts	Existing
	Southeast Texas Transit Participants Vehicles	SETT	Existing
Traveler Card	Beaumont Regional Smart Card	Beaumont Municipal Transit	Future
Vehicle Subsystem	BMT Transit Vehicles	Beaumont Municipal Transit	Existing
	City of Port Arthur Transit Vehicles	City of Port Arthur Transit System	Existing
	Commercial Vehicles	Commercial Vehicle Operators	Existing
Wayside Equipment	Rail Operators Wayside Equipment	Rail Operators	Existing
Weather Service	National Weather Service	NOAA	Existing

4.2 Regional Market Packages

Upon completion of the system inventory, the next step in the development of the architecture was to identify the transportation services that are important to the Beaumont Region. In the National ITS Architecture, services are referred to as market packages. Market packages could 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 Version 4.0.

In the Beaumont Region, the National ITS Architecture market packages were reviewed by the stakeholders and selected based on the relevance of the service that the market package could provide to the Region. All of the market packages that stakeholders in the Beaumont Region selected for implementation in the Region are identified in **Table 5**, as well as the elements in the Region that serve a role in providing the market package service and the primary stakeholders responsible for implementing the market packages.

In several cases, there are multiple stakeholders in the Region that provide the same service at different levels. For example, Surface Street Control (ATMS03) could be provided on arterials by the City of Beaumont and on highways through the TxDOT Beaumont District. The market packages status is identified as existing, planned, or future for each of the primary stakeholders in the Region. In many cases market packages classified as existing might still need to be enhanced to increase the service that the market package provides and establish all of the elements associated with it.

Upon selecting the market packages that were applicable for the Region, stakeholders then reviewed each market package and the elements that could be included to customize it for the Region. This customization is discussed further in the following section.

Table 5 – Beaumont Region Selected Market Packages

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
ATMS01	Network Surveillance	City of Beaumont Field Equipment City of Beaumont Traffic Signal System City of Port Arthur Traffic Signal System City of Port Arthur Field Equipment Private Sector Traveler Information Services TxDOT Beaumont District CCTV TxDOT Beaumont District Field Sensors TxDOT Beaumont District Office TxDOT Beaumont District Signal Shop TxDOT Beaumont District Web Page	City of Beaumont	Future
			City of Port Arthur	Future
			TxDOT Beaumont District	Future
ATMS02	Probe Surveillance	BMT Transit Vehicles City of Port Arthur Transit Vehicles Commercial Vehicles TxDOT Beaumont District Field Sensors TxDOT Beaumont District Office	TxDOT Beaumont District	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
ATMS03	Surface Street Control	City of Beaumont Field Equipment City of Beaumont Traffic Signal System City of Port Arthur Traffic Signal System City of Port Arthur Field Equipment TxDOT Beaumont District Field Sensors TxDOT Beaumont District School Pager System TxDOT Beaumont District Signal Shop TxDOT Beaumont District Traffic Signals	City of Beaumont	Existing
			City of Port Arthur	Existing
			TxDOT Beaumont District	Existing
ATMS04	Freeway Control	TxDOT Beaumont District CCTV TxDOT Beaumont District Field Sensors TxDOT Beaumont District Office TxDOT Beaumont District Freeway Control Equipment	TxDOT Beaumont District	Future
ATMS06	Traffic Information Dissemination	BMT Transit Dispatch City of Beaumont Field Equipment City of Beaumont Fire and EMS Dispatch City of Beaumont Maintenance City of Beaumont Police Dispatch and PSAP City of Beaumont Traffic Signal System City of Port Arthur Police/Fire Dispatch County Public Safety Dispatch and PSAP County Road and Bridge DPS Communications Service HAZMAT Alliance Emergency Center Local Print and Broadcast Media Municipal Public Safety Dispatch Private Sector Traveler Information Services Private Tow/Wrecker Dispatch TRANSTAR/Beaumont District DMS TxDOT 511 System TxDOT Beaumont District DMS TxDOT Beaumont District HAR TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Office TxDOT Beaumont District Public Information Office TxDOT Beaumont District Web Page	TxDOT Beaumont District	Existing
			City of Beaumont	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
ATMS07	Regional Traffic Control	City of Beaumont Traffic Signal System City of Port Arthur Traffic Signal System DPS Communications Service LADOTD District 7 HQ TranStar and Other Texas Region TMCs TxDOT Beaumont District Office TxDOT Forth Worth TMC (TransVision)	TxDOT Beaumont District	Future
ATMS08	Incident Management System	Automated Calling System City of Beaumont Fire and EMS Dispatch City of Beaumont Fire Vehicles City of Beaumont Maintenance City of Beaumont Police Dispatch and PSAP City of Beaumont Police Vehicles City of Beaumont Traffic Signal System City of Port Arthur Emergency Vehicles City of Port Arthur Police/Fire Dispatch City of Port Arthur Public Works City of Port Arthur Traffic Signal System Coast Guard Marine Safety Office County EOC County Public Safety Dispatch and PSAP County Road and Bridge DPS Communications Service DPS Emergency Vehicles HAZMAT Alliance Emergency Center LADOTD District 7 HQ Local Print and Broadcast Media Lower Neches Valley Authority Lower Neches Valley Flood Warning Devices MAMB Emergency Management Center Municipal Convention and Visitors Bureau Municipal or County Emergency Vehicles Municipal Public Safety Dispatch Municipal PWD Other TxDOT District Maintenance Sections Private Ambulance Dispatch Private Ambulance Vehicle Private Tow/Wrecker Dispatch	Transportation and Emergency Management Agencies	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
ATMS08 (continued)	Incident Management System (continued)	Private Tow/Wrecker Vehicles Rail Operations Centers Sabine River Authority Flood Warning Devices Sabine River Authority Gulf Coast Division SETRPC Motorist Assistance Dispatch State EOC TranStar and Other Texas Region TMCs Trinity River Authority Control Center Trinity River Authority Flood Detectors TxDOT Beaumont District Area Engineers Office TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Office TxDOT Flood Detection TxDOT Highway Conditions Reporting System		
ATMS11	Emissions Monitoring and Management	Local Print and Broadcast Media SETRPC Air Quality Information Office System TCEQ Field Emissions Monitors TCEQ Monitor Operations Section TCEQ State HQ TxDOT Beaumont District Office	TCEQ	Future
ATMS13	Standard Railroad Grade Crossing	City of Beaumont Field Equipment City of Beaumont Traffic Signal System City of Port Arthur Field Equipment City of Port Arthur Traffic Signal System Rail Operations Centers Rail Operators Wayside Equipment TxDOT Beaumont District Signal Shop TxDOT Beaumont District Traffic Signals	City of Beaumont	Future
			City of Port Arthur	Future
			TxDOT Beaumont District	Future
ATMS15	Railroad Operations Coordination	City of Beaumont Traffic Signal System City of Port Arthur Traffic Signal System Rail Operations Centers TxDOT Beaumont District Signal Shop	City of Beaumont	Future
			City of Port Arthur	Future
			TxDOT Beaumont District	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
EM1	Emergency Response	Beaumont Region Incident and Mutual Aid Network BMT Transit Dispatch City of Beaumont Fire and EMS Dispatch City of Beaumont Police Dispatch and PSAP City of Beaumont Traffic Signal System City of Port Arthur Police/Fire Dispatch City of Port Arthur Traffic Signal System City of Port Arthur Transit System Dispatch Coast Guard Marine Safety Office Correctional Facilities Operations County EOC County Public Safety Dispatch and PSAP DPS Administration DPS Communications Service Forest Service Dispatch HAZMAT Alliance Emergency Center Independent School District Dispatch LADOTD District 7 HQ LA DPS Troop D Dispatch Lower Neches Valley Authority MAMB Emergency Management Center Municipal Public Safety Dispatch Orange County LEPC Center Orange County LEPC Emergency Flashers Private Ambulance Dispatch Private Ambulance Vehicle Private Tow/Wrecker Dispatch Sabine River Authority Gulf Coast Division Southeast Texas Transit Participants Dispatch State EOC TranStar and Other Texas Region TMCs Trinity River Authority Control Center TxDOT Beaumont District Office	Transportation and Emergency Management Agencies	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
EM2	Emergency Routing	City of Beaumont Field Equipment City of Beaumont Fire and EMS Dispatch City of Beaumont Fire Vehicles City of Beaumont Police Dispatch and PSAP City of Beaumont Police Vehicles City of Beaumont Traffic Signal System City of Port Arthur Emergency Vehicles City of Port Arthur Field Equipment City of Port Arthur Police/Fire Dispatch City of Port Arthur Traffic Signal System Private Ambulance Dispatch Private Ambulance Vehicle Regional Medical Center TxDOT Beaumont District Signal Shop TxDOT Beaumont District Traffic Signals	City of Beaumont	Future
			City of Port Arthur	Future
EM4	Roadway Service Patrols	SETRPC Motorist Assistance Dispatch SETRPC Motorist Assistance Vehicles	SETRPC	Future
MC01	Maintenance and Construction Vehicle Tracking	City of Beaumont Maintenance City of Port Arthur Public Works County Road and Bridge County Road and Bridge Vehicles Municipal PWD Municipal PWD Vehicles TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Maintenance Vehicles	TxDOT Beaumont District	Future
			County Road and Bridge	Future
			City of Beaumont	Future
			City of Port Arthur	Future
MC02	Maintenance and Construction Vehicle Maintenance	City of Beaumont Maintenance City of Port Arthur Public Works County Road and Bridge County Road and Bridge Equipment Repair County Road and Bridge Vehicles Municipal PWD Municipal PWD Vehicles TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Maintenance Vehicles TxDOT Beaumont District Shop	TxDOT Beaumont District	Future
			County Road and Bridge	Future
			City of Beaumont	Future
			City of Port Arthur	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
MC04	Weather Information Processing and Distribution	KFDM Website National Weather Service Private Travelers Personal Computing Devices TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Office	KFDM	Future
MC07	Roadway Maintenance and Construction	City of Beaumont Maintenance City of Beaumont Traffic Signal System City of Port Arthur Public Works City of Port Arthur Traffic Signal System County Road and Bridge County Road and Bridge Field Equipment County Road and Bridge Vehicles Municipal PWD Municipal PWD Vehicles Municipal Traffic Signal Systems National Weather Service TxDOT Beaumont District Area Engineers Office TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Maintenance Vehicles TxDOT Beaumont District Pavement Management System TxDOT Beaumont District Signal Shop TxDOT BRINSAP	TxDOT Beaumont District	Future
			City of Beaumont	Future
			City of Port Arthur	Future
			County Road and Bridge	Future
			Municipal PWD	Future
MC08	Work Zone Management	BMT Transit Dispatch City of Beaumont Field Equipment City of Beaumont Fire and EMS Dispatch City of Beaumont Maintenance City of Beaumont Police Dispatch and PSAP City of Beaumont Traffic Signal System City of Port Arthur Field Equipment City of Port Arthur Police/Fire Dispatch City of Port Arthur Public Works City of Port Arthur Traffic Signal System City of Port Arthur Transit System Dispatch County EOC	TxDOT Beaumont District	Future
			County Road and Bridge	Future
			City of Beaumont	Future
			City of Port Arthur	Future
			Municipal PWD	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
MC08 (continued)	Work Zone Management (continued)	County Public Safety Dispatch and PSAP County Road and Bridge County Road and Bridge Field Equipment County Road and Bridge Vehicles DPS Communications Service HAZMAT Alliance Emergency Center Independent School District Dispatch MAMB Emergency Management Center Municipal Public Safety Dispatch Municipal PWD Municipal PWD Vehicles Other TxDOT District Maintenance Sections Private Tow/Wrecker Dispatch Southeast Texas Transit Participants Dispatch State EOC TxDOT Beaumont District Area Engineers Office TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Maintenance Vehicles TxDOT Beaumont District Office TxDOT Beaumont District Web Page TxDOT Beaumont District Work Zone Equipment TxDOT Highway Conditions Reporting System		
MC09	Work Zone Safety Monitoring	City of Beaumont Maintenance	TxDOT Beaumont District	Future
		City of Beaumont Field Equipment	City of Beaumont	Future
		City of Port Arthur Field Equipment	City of Port Arthur	Future
		City of Port Arthur Public Works	County Road and Bridge	Future
		County Road and Bridge		
County Road and Bridge Field Equipment				
County Road and Bridge Vehicles				
Municipal PWD Vehicles				
TxDOT Beaumont District Maintenance Sections				

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
MC09 (continued)	Work Zone Safety Monitoring (continued)	TxDOT Beaumont District Maintenance Vehicles TxDOT Beaumont District Work Zone Equipment		
MC10	Maintenance and Construction Activity Coordination	BMT Transit Dispatch	TxDOT Beaumont District	Future
		City of Beaumont Fire and EMS Dispatch	County Road and Bridge	Future
		City of Beaumont Maintenance	City of Beaumont	Future
		City of Beaumont Police Dispatch and PSAP	City of Port Arthur	Future
		City of Beaumont Traffic Signal System	Municipal Public Works Departments	Future
		City of Port Arthur Police/Fire Dispatch		
City of Port Arthur Public Works				
City of Port Arthur Traffic Signal System				
City of Port Arthur Transit System Dispatch				
County Public Safety Dispatch and PSAP				
County Road and Bridge				
DPS Communications Service				
HAZMAT Alliance Emergency Center				
Independent School District Dispatch				
LADOTD District 7 HQ				
MAMB Emergency Management Center				
Municipal Public Safety Dispatch				
Municipal PWD				
Other TxDOT District Maintenance Sections				
Private Tow/Wrecker Dispatch				
Rail Operations Centers				
Southeast Texas Transit Participants Dispatch				
TxDOT Beaumont District Maintenance Sections				
TxDOT Beaumont District Office				
TxDOT Beaumont District Public Information Office				
TxDOT Beaumont District Web Page				
TxDOT Highway Conditions Reporting System				

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
APTS1	Transit Vehicle Tracking	BMT Transit Dispatch BMT Transit Vehicles City of Port Arthur Transit System Dispatch City of Port Arthur Transit Vehicles Southeast Texas Transit Participants Dispatch Southeast Texas Transit Participants Vehicles	Beaumont Municipal Transit	Future
			Southeast Texas Transit Participants	Future
			City of Port Arthur Transit	Future
APTS2	Transit Fixed-Route Operations	BMT Transit Dispatch BMT Transit Vehicles City of Beaumont Maintenance City of Beaumont Traffic Signal System City of Port Arthur Public Works City of Port Arthur Traffic Signal System City of Port Arthur Transit System Dispatch City of Port Arthur Transit Vehicles County Road and Bridge Independent School District Buses Independent School District Dispatch Private Sector Traveler Information Services TxDOT 511 System TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Web Page	Beaumont Municipal Transit	Future
			City of Port Arthur Transit	Future
			Independent School District	Future
APTS3	Demand Response Transit Operations	BMT Transit Dispatch BMT Transit Vehicles City of Beaumont Traffic Signal System City of Port Arthur Traffic Signal System City of Port Arthur Transit System Dispatch City of Port Arthur Transit Vehicles Private Sector Traveler Information Services Southeast Texas Transit Participants Dispatch Southeast Texas Transit Participants Vehicles TxDOT 511 System TxDOT Beaumont District Office TxDOT Beaumont District Web Page	Beaumont Municipal Transit	Future
			City of Port Arthur Transit	Future
			Southeast Texas Transit Participants	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
APTS4	Transit Passenger and Fare Management	Beaumont Regional Smart Card BMT Transit Dispatch BMT Transit Information Display/Point of Sale BMT Transit Vehicles City of Port Arthur Transit Information/Point of Sale City of Port Arthur Transit System Dispatch City of Port Arthur Transit Vehicles Financial Institution	Beaumont Municipal Transit	Future
			City of Port Arthur Transit	Future
APTS5	Transit Security	BMT Transit Dispatch BMT Transit Vehicles City of Beaumont Fire and EMS Dispatch City of Beaumont Police Dispatch and PSAP City of Port Arthur Police/Fire Dispatch City of Port Arthur Transit System Dispatch City of Port Arthur Transit Vehicles	Beaumont Municipal Transit	Future
			City of Port Arthur Transit	Future
APTS7	Multi-modal Coordination	BMT Transit Dispatch BMT Transit Vehicles City of Port Arthur Transit System Dispatch City of Port Arthur Transit Vehicles Private Taxi Provider Dispatch Regional Airports Southeast Texas Transit Participants Dispatch	Beaumont Municipal Transit	Future
			City of Port Arthur Transit	Future
APTS8	Transit Traveler Information	BMT Transit Dispatch BMT Transit Information Display/Point of Sale BMT Transit Website City of Port Arthur Transit Information Display/Point of Sale City of Port Arthur Transit System Dispatch City of Port Arthur Transit Web Site Private Travelers Personal Computing Devices TxDOT Rest Areas/Visitor Centers/Service/Truck Stops/Plaza Kiosks	Beaumont Municipal Transit	Future
			City of Port Arthur Transit	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
CVO04	CV Administrative Processes	City of Beaumont Police Dispatch and PSAP City of Beaumont Traffic Signal System County Public Safety Dispatch and PSAP DPS Communications Service Municipal or County Permitting System Municipal Public Safety Dispatch Private Fleet Management Systems TxDOT Beaumont District Office	Municipalities/Counties	Future
CVO10	HAZMAT Management	City of Beaumont Police Dispatch and PSAP City of Port Arthur Police/Fire Dispatch Commercial Vehicles County Public Safety Dispatch and PSAP DPS Communications Service Private Fleet Management Systems Rail Operations Centers Rail Operators Rail Cars	Emergency Response Agencies	Future
ATIS1	Broadcast Traveler Information	City of Beaumont Maintenance City of Beaumont Traffic Signal System City of Port Arthur Public Works City of Port Arthur Traffic Signal System County Road and Bridge LADOTD Traveler Information Website Local Print and Broadcast Media Municipal PWD Private Travelers Personal Computing Devices SETRPC Website TxDOT 511 System TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Office TxDOT Beaumont District Public Information Office TxDOT Beaumont District Signal Shop TxDOT Beaumont District Web Page TxDOT Highway Conditions Reporting System TxDOT Rest Areas/Visitor Centers/Service/Truck Stops/Plaza Kiosks	TxDOT Beaumont District	Future

Table 5 – Beaumont Region Selected Market Packages (continued)

Market Package	Market Package Name	Elements Associated with Market Package	Primary Stakeholders Responsible for Implementation	Status
ATIS5	ISP Based Route Guidance	City of Beaumont Traffic Signal System City of Port Arthur Traffic Signal System Private Fleet Management Systems TxDOT Beaumont District Office TxDOT Motor Carrier Routing Information TxDOT Rest Areas/Visitor Centers/Service/Truck Stops/Plaza Kiosks	TxDOT Motor Carrier	Future
AD1	ITS Data Mart	BMT Transit Dispatch City of Beaumont Fire and EMS Dispatch City of Beaumont Police Dispatch and PSAP City of Port Arthur Police/Fire Dispatch City of Port Arthur Transit System Dispatch County Public Safety Dispatch and PSAP DPS Administration Municipal Public Safety Dispatch SETRPC Accident Database SETRPC Accident Database User Systems Southeast Texas Transit Participants Dispatch Statewide Crash Records Information System Statewide Crash Records Information System Users TxDOT Beaumont District Maintenance Sections TxDOT Beaumont District Pavement Management System TxDOT Beaumont District Pavement Management System Users TxDOT Beaumont District Public Transportation Management System (PTMS) TxDOT Statewide Pavement Management System	TxDOT Beaumont District	Future
			DPS	Future
			SETRPC	Future
AD2	ITS Data Warehouse	BMT Transit Dispatch City of Beaumont Traffic Signal System City of Port Arthur Transit System Dispatch Rail Operations Center Regional Airports SETRPC Data System SETRPC Data System Users Southeast Texas Transit Participants Dispatch	SETRPC	Future

4.3 Interconnections

4.3.1 Top Level Regional System Interconnect Diagram

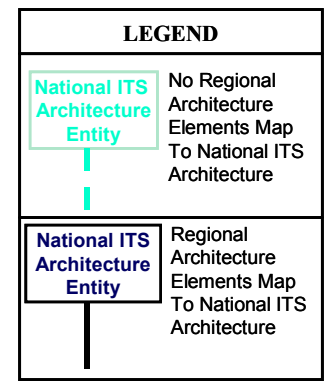
A system interconnect diagram, or sausage diagram (shown previously in **Figure 4**), shows the systems and primary interconnects in the Region. The National ITS Architecture interconnect diagram has been customized for the Beaumont Region based on the information gathered from the stakeholders and system inventory. **Figure 5** summarizes the existing, planned, and future ITS elements for the Beaumont Region in the context of a physical interconnect. Subsystems and elements specific to Beaumont are called out in the boxes surrounding the main interconnect diagram, and these are color-coded to the subsystem to which they are associated. Elements with an asterisk (*) are planned and future system elements.

4.3.2 Customized Market Packages

The market packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the Beaumont Region. Each market package is shown graphically, with the market package name, Beaumont-specific element, and with the unique agency and system identifiers within the subsystems and terminators. Market packages represent a service that will be deployed as an integrated capability. Market packages often are comprised of one or more equipment packages, which are functional capabilities that could be deployed at a specific time. Equipment packages are the most basic functions that will be developed or bought by implementers.

Figure 6 is an example of an ATMS market package for Surface Street Control that has been customized for the Beaumont Region. This market package shows the two subsystems, Traffic Management and Roadway, and the associated entities (TxDOT Beaumont District Traffic Signals, TxDOT Beaumont District Field Sensors, etc.). Data flows between the subsystems indicate what information is being shared.

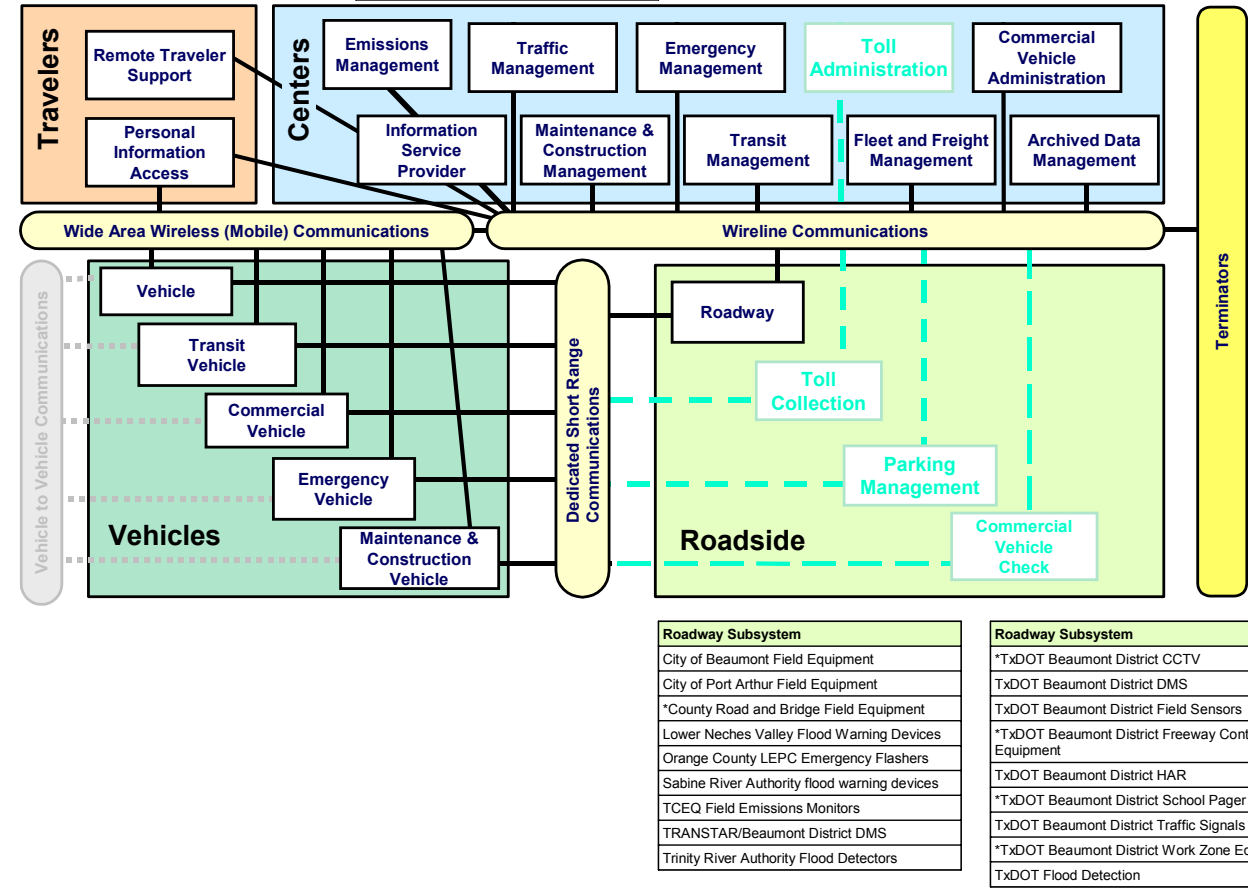
Market packages that were customized for the Beaumont Region are shown in **Appendix A**. These market packages also are included on the Beaumont Regional ITS Architecture web site by selecting the “Market Package” button. Market packages are grouped by functional area (Traffic Management, Maintenance and Construction, Public Transportation, etc.), and each of the customized market packages can be viewed by clicking on the Market Package Diagram icon under each area heading. It is important to note that while the market package table on the web site shows all of the available market packages from the National ITS Architecture, only those selected for the Beaumont Region are included in the diagrams. The selected market packages on the web site also are highlighted in the table with bold print, and are indicated as existing or planned.



Remote Traveler Support Subsystem
*BMT Transit Information Display / Point of Sale
*City of Port Arthur Transit Information Display / Point of Sale
*TxDOT Rest Areas/Visitor Centers/Service/Truck Stops/ Plaza Kiosks
Personal Information Access Subsystem
*Private Travelers Personal Computing Devices
Transit Vehicle Subsystem
BMT Transit Vehicles
City of Port Arthur Transit Vehicles
Independent School District Buses
Southeast Texas Transit Participants Vehicles
Vehicle Subsystem
BMT Transit Vehicles
City of Port Arthur Transit Vehicles
Commercial Vehicles
Commercial Vehicle Subsystem
Commercial Vehicles
*Rail Operators Rail Cars
Maintenance and Const Vehicle Subsystem
County Road and Bridge Vehicles
Municipal PWD Vehicles
TxDOT Beaumont District Maintenance Vehicles
Emergency Vehicle Subsystem
City of Beaumont Fire Vehicles
City of Beaumont Police Vehicles
City of Port Arthur Emergency Vehicles
DPS Emergency Vehicles
Municipal or County Emergency Vehicles
Private Ambulance Vehicle
*SETRPC Motorist Assistance Vehicles

* Elements are *planned or future*, not existing.
 Last Updated: December 10, 2003

Transit Management Subsystem	Emergency Management Subsystem	Information Service Provider Subsystem	Traffic Management Subsystem
BMT Transit Dispatch	City of Beaumont Fire and EMS Dispatch	Automated Calling System	City of Beaumont Traffic Signal System
City of Port Arthur Transit System Dispatch	City of Beaumont Police Dispatch and PSAP	BMT Transit Website	City of Port Arthur Traffic Signal System
Independent School District Dispatch	City of Port Arthur Police/Fire Dispatch	City of Port Arthur Transit Web Site	DPS Communications Service
Private Taxi Provider Dispatch	Coast Guard Marine Safety Office	KFDM Web Site	LADOTD District 7 HQ
Southeast Texas Transit Participants Dispatch	Correctional Facilities Operations	LADOTD Traveler Information Website	TranStar and Other Texas Region TMCs
	County EOC	*Private Sector Traveler Information Services	TxDOT Beaumont District Office
	County Public Safety Dispatch and PSAP	SETRPC Website	TxDOT Beaumont District Signal Shop
	DPS Administration	Statewide Crash Records Information System	TxDOT Fort Worth TMC (TransVision)
	DPS Communications Service	*TxDOT 511 System	
	*Forest Service Dispatch	*TxDOT Beaumont District Public Information Office	Archived Data Management Subsystem
	HAZMAT Alliance Emergency Center	TxDOT Beaumont District Web Page	SETRPC Accident Database
	LA DPS Troop D Dispatch	TxDOT Highway Conditions Reporting System	*SETRPC Data System
	Lower Neches Valley Authority	TxDOT Motor Carrier Routing Information	Statewide Crash Records Information System
	MAMB Emergency Management Center	Fleet and Freight Management Subsystem	TxDOT Beaumont District Pavement Management System
	Municipal Public Safety Dispatch	*Private Fleet Management Systems	TxDOT Beaumont District Public Transportation Management System (PTMS)
	Orange County LEPC Center	Rail Operations Center	TxDOT Statewide Pavement Management System
	Private Ambulance Dispatch	Commercial Vehicle Administration	
	*Private Tow/Wrecker Dispatch	Municipal or County Permitting System	
	Sabine River Authority Gulf Coast Division		
	*SETRPC Motorist Assistance Dispatch		
	State EOC		
	Trinity River Authority Control Center		



Roadway Subsystem
City of Beaumont Field Equipment
City of Port Arthur Field Equipment
*County Road and Bridge Field Equipment
Lower Neches Valley Flood Warning Devices
Orange County LEPC Emergency Flashers
Sabine River Authority flood warning devices
TCEQ Field Emissions Monitors
TRANSTAR/Beaumont District DMS
Trinity River Authority Flood Detectors

Roadway Subsystem
*TxDOT Beaumont District CCTV
TxDOT Beaumont District DMS
TxDOT Beaumont District Field Sensors
*TxDOT Beaumont District Freeway Control Equipment
TxDOT Beaumont District HAR
*TxDOT Beaumont District School Pager System
TxDOT Beaumont District Traffic Signals
*TxDOT Beaumont District Work Zone Equipment
TxDOT Flood Detection

Archived Data User Systems
SETRPC Accident Database User Systems
*SETRPC Data System Users
Statewide Crash Records Information System Users
TxDOT Beaumont District Pavement Management System Users
Asset Management
TxDOT Beaumont District Pavement Management System
TxDOT BRINSAP
Care Facility
Regional Medical Center
Equipment Repair Facility
County Road and Bridge Equipment Repair
TxDOT Beaumont District Shop
Event Promoters
Municipal Convention and Visitors Bureau
Financial Institution
*Financial Institution
Maintenance & Construction Admin
TxDOT Beaumont District Area Engineers Office
Media
Local Print and Broadcast Media
SETRPC Air Quality Information Office System
Multimodal Transportation Service Provider
Regional Airports
Other EM
*Beaumont Region Incident and Mutual Aid Network
Other Emissions
TCEQ State HQ
Rail Operations
Rail Operations Centers
Traveler Card
*Beaumont Regional Smart Card
Wayside Equipment
Rail Operators Wayside Equipment
Weather Service
National Weather Service

Figure 5 – Beaumont Regional System Interconnect Diagram

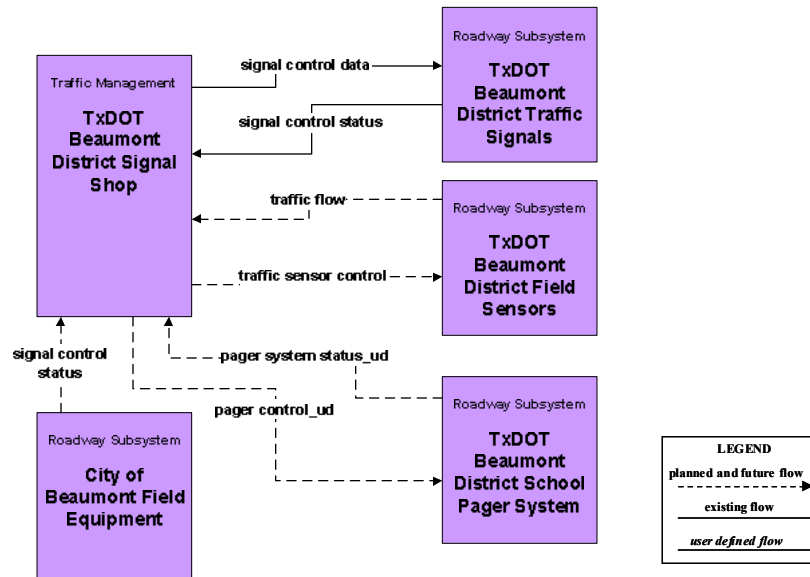


Figure 6 – Custom Market Package for Beaumont Surface Street Control

4.3.3 Beaumont Architecture Interfaces

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 Beaumont Region. The interconnect diagram shown previously in **Figure 5** showed the high-level relationships of the subsystems and terminators in the Beaumont Region and the associated local projects and systems. The customized market packages represent services that can be deployed as an integrated capability, and the market package diagrams show the information flows between the subsystems and terminators that are most important to the operation of the market packages. How these systems interface with each other is an integral part of the overall ITS architecture.

There are 119 different elements identified as part of the Beaumont Regional ITS Architecture. These elements include traffic management 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 Beaumont Regional ITS Architecture, and each element has been mapped to those other elements with which it must interface. For example, the TxDOT Beaumont District Office has existing or planned interfaces with 49 other elements in the Beaumont Region, ranging from field equipment and dispatch centers, to other TxDOT District TMCs. Other interfaces are far less complex, such as the interface between the DPS vehicles and the DPS Communications Dispatch.

An example of one of the system interfaces is shown in **Figure 7**. This graphic shows the TxDOT Beaumont 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.

Each element and its defined interfaces are listed in **Appendix B**. Elements and their interfaces also are accessible via the Beaumont Regional ITS Architecture web site by clicking on the “Interfaces” button. Elements are listed alphabetically in the column on the left, and each entry in the Interfacing Element column on the right is a link to more detailed information about the particular interface. The architecture flows between the individual element interfaces are described in more detail in the following section.

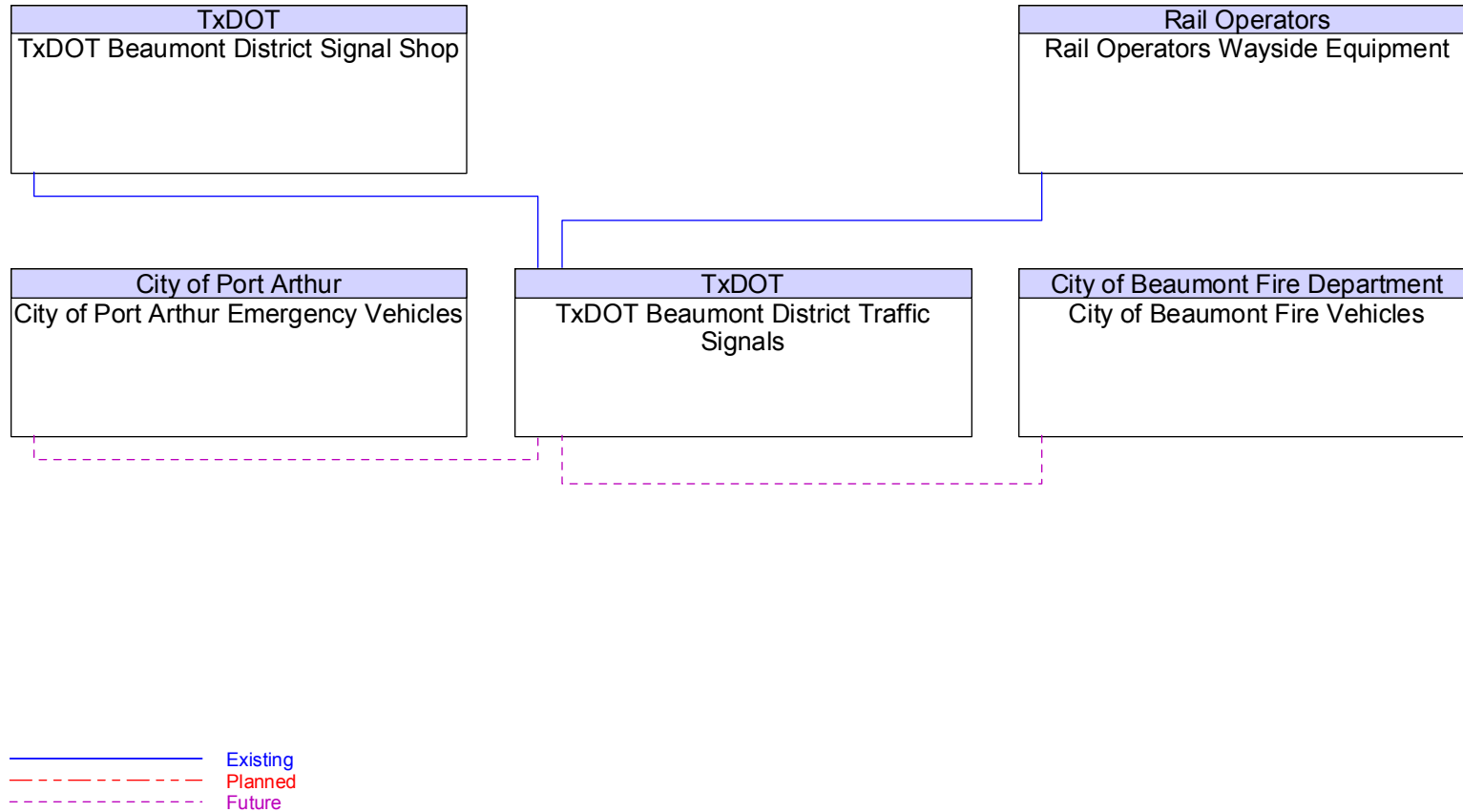


Figure 7 – TxDOT Beaumont District Traffic Signals Interfaces

4.3.4 Physical Subsystem Architecture Flows

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. These data flows could be requests for information, alerts and messages, status requests, broadcast advisories, event messages, confirmations, electronic credentials, and other key information requirements. These architecture flows define the interface requirements between the various elements in the Beaumont Regional ITS Architecture.

An example of the architecture flows between two elements is shown in **Figure 8**. In this interface, the flows between the TxDOT Beaumont District Office and TranStar and Other Texas Region TMCs show information that must go from the Beaumont 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.

Each of the individual element interfaces can be accessed on the Beaumont Regional ITS Architecture web site by clicking on the “Interfaces” button. Selecting any of the interfacing elements from the column on the right will display an interface diagram and architecture flows between two specific elements, similar to the diagram shown in **Figure 8**. Each data flow is defined, and any standards associated with that data flow are noted. Standards that apply to the Beaumont Region are discussed in more detail in Section 4.5.

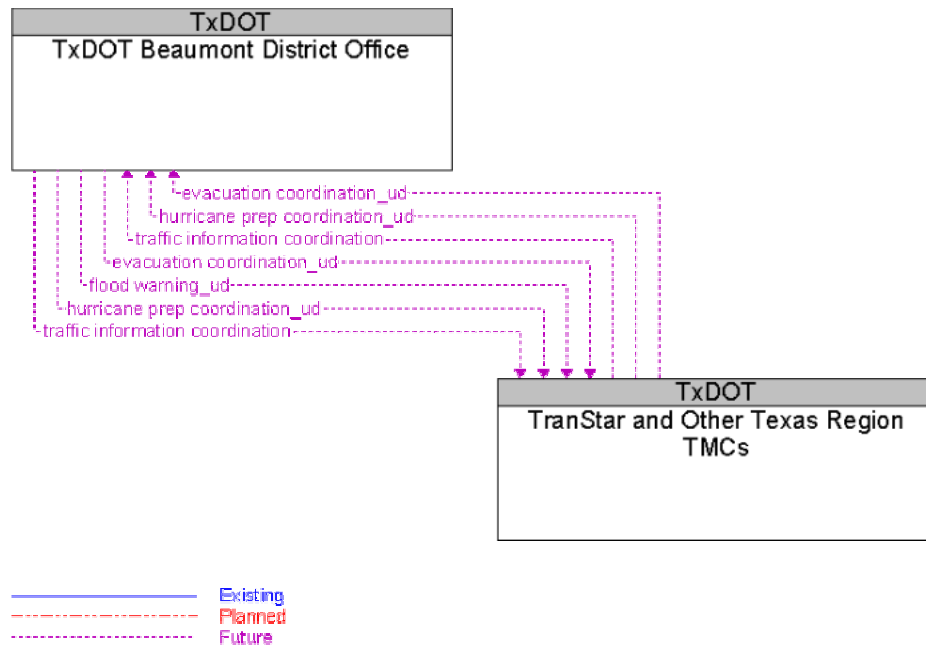


Figure 8 – TxDOT Beaumont District Office to TranStar and Other Texas Region TMCs Architecture Flows

4.4 Functional Requirements

Functions are a description of what the system has to do. In the National ITS Architecture, functions are defined at several different levels, ranging from general subsystem descriptions through somewhat more specific equipment package descriptions to Process Specifications that include substantial detail. Guidance from the USDOT on developing a Regional ITS Architecture recommends that each Region determine the level of detail of the functional requirements for their Region. In the Beaumont Region, it is recommended that the development of detailed functional requirements such as the “shall” statements included in Process Specifications for a system be developed at the project level. These detailed “shall” statements identify all functions that a project or system needs to perform.

For the Beaumont Regional ITS Architecture, functional requirements have been identified at two levels. The customized market packages, discussed previously in Section 4.3.2, describe the services that ITS needs to provide in the Region and the architecture flows between the elements. These market packages and data flows describe what the ITS system in Beaumont has to do and the data that needs to be shared among elements.

At a more detailed level, functional requirements for the Beaumont Region also are described in terms of equipment packages that are associated with one or more subsystems in the Beaumont Regional ITS Architecture as shown in **Table 6**. An equipment package is a functional capability that could be deployed at a specific time. Each equipment package can be linked in the National ITS Architecture to the Process Specifications that might be applicable. It is recommended that during the design concept stage of a project, the applicable equipment package and associated Process Specifications from the National ITS Architecture be reviewed by the implementer to determine the appropriate functional requirements for the project. A link for each equipment package is available on the Beaumont Regional ITS Architecture web site by clicking on the “Functions” button.

Table 6 – Beaumont Region Equipment Packages

Subsystem	Equipment Package
Archived Data Management Subsystem	Government Reporting Systems Support
	ITS Data Repository
	On-Line Analysis and Mining
	Traffic and Roadside Data Archival
Commercial Vehicle Administration Subsystem	Credentials and Taxes Administration
	CV Data Collection
	CV Information Exchange
Commercial Vehicle Subsystem	On-Board Cargo Monitoring
Emergency Management Subsystem	Emergency Call-Taking
	Emergency Data Collection
	Emergency Dispatch
	Emergency Environmental Monitoring
	Emergency Response Management
	Mayday Support
	Service Patrol Management

Table 6 – Beaumont Region Equipment Packages (continued)

Subsystem	Equipment Package
Emergency Vehicle Subsystem	On-board EV En Route Support
	On-board EV Incident Management Communication
Emissions Management Subsystem	Emissions Data Collection
	Emissions Data Management
Fleet and Freight Management Subsystem	Fleet Administration
	Fleet Credentials and Taxes Management and Reporting
	Fleet HAZMAT Management
Information Service Provider Subsystem	Basic Information Broadcast
	Infrastructure Provided Route Selection
	Interactive Infrastructure Information
	ISP Data Collection
	ISP Probe Information Collection
Maintenance and Construction Management Subsystem	MCM Data Collection
	MCM Environmental Information Processing
	MCM Incident Management
	MCM Maintenance Decision Support
	MCM Roadway Maintenance and Construction
	MCM Vehicle and Equipment Maintenance Management
	MCM Vehicle Tracking
	MCM Work Activity Coordination
	MCM Work Zone Management
	MCM Work Zone Safety Management
Maintenance and Construction Vehicle Subsystem	MCV Infrastructure Monitoring
	MCV Roadway Maintenance and Construction
	MCV Vehicle Location Tracking
	MCV Vehicle Safety Monitoring
	MCV Vehicle System Monitoring and Diagnostics
	MCV Work Zone Support
Parking Management Subsystem	Parking Data Collection
Personal Information Access Subsystem	Personal Basic Information Reception
	Personal Interactive Information Reception
	Personal Location Determination
	Personal Provider-Based Route Guidance
Remote Traveler Support Subsystem	Remote Basic Information Reception
	Remote Interactive Information Reception
	Remote Mayday I/F
	Remote Transit Fare Management
	Remote Transit Information Services
	Secure Area Monitoring

Table 6 – Beaumont Region Equipment Packages (continued)

Subsystem	Equipment Package
Roadway Subsystem	Roadside Data Collection
	Roadside Signal Priority
	Roadway Basic Surveillance
	Roadway Emissions Monitoring
	Roadway Equipment Coordination
	Roadway Freeway Control
	Roadway Incident Detection
	Roadway Infrastructure Monitoring
	Roadway Probe Beacons
	Roadway Signal Controls
	Roadway Traffic Information Dissemination
	Roadway Work Zone Safety
	Roadway Work Zone Traffic Control
	Standard Rail Crossing
Toll Administration Subsystem	Toll Data Collection
Traffic Management Subsystem	Collect Traffic Surveillance
	HRI Traffic Management
	Rail Operations Coordination
	TMC Environmental Monitoring
	TMC Freeway Management
	TMC Incident Detection
	TMC Incident Dispatch Coordination/Communication
	TMC Multimodal Coordination
	TMC Probe Information Collection
	TMC Regional Traffic Control
	TMC Signal Control
	TMC Traffic Information Dissemination
	TMC Work Zone Traffic Management
	Traffic Data Collection
	Traffic Maintenance
Transit Management Subsystem	Transit Center Fare and Load Management
	Transit Center Fixed-Route Operations
	Transit Center Information Services
	Transit Center Multi-Modal Coordination
	Transit Center Paratransit Operations
	Transit Center Security
	Transit Center Tracking and Dispatch
	Transit Data Collection

Table 6 – Beaumont Region Equipment Packages (continued)

Subsystem	Equipment Package
Transit Management Subsystem (continued)	Transit Environmental Monitoring
	Transit Garage Operations
Transit Vehicle Subsystem	On-board Fixed Route Schedule Management
	On-board Paratransit Operations
	On-board Transit Fare and Load Management
	On-board Transit Information Services
	On-board Transit Security
	On-board Transit Signal Priority
	On-board Transit Trip Monitoring
Vehicle Subsystem	Basic Vehicle Reception
	Vehicle Location Determination
	Vehicle Mayday I/F
	Vehicle Probe Support
	Vehicle Provider-Based Route Guidance
	Vehicle Safety Monitoring System

4.5 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Beaumont Regional ITS Architecture over time. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve. The USDOT’s ITS Joint Program Office is supporting Standards Development Organizations (SDOs) with an extensive, multi-year program of accelerated, consensus-based standards development to facilitate successful ITS deployment in the United States. **Table 7** identifies each of the ITS standards that could apply to the Beaumont Regional ITS Architecture. These standards are based on the physical subsystem architecture flows previously identified in Section 4.3.4. The connection of each standard to the applicable architecture flows between elements can be viewed on the Beaumont Regional ITS Architecture web site by clicking on the “Interfaces” or “Standards” buttons.

Table 7 – Applicable ITS Standards for the Beaumont Region

SDO	Document ID	Title	Type
AASHTO/ITE/NEMA	NTCIP 1201	Global Object Definitions	Message
	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller Units	Message
	NTCIP 1203	Object Definitions for Dynamic Message Signs	Message
	NTCIP 1204	Object Definitions for Environmental Sensor Stations and Roadside Weather Information System	Message
	NTCIP 1205	Data Dictionary for Closed Circuit Television (CCTV)	Message
	NTCIP 1206	Data Collection and Monitoring Devices	Message
	NTCIP 1207	Ramp Meter Controller Objects	Message
	NTCIP 1208	Object Definitions for Video Switches	Message
	NTCIP 1209	Transportation System Sensor Objects	Message
	NTCIP 1210	Objects for Signal Systems Master	Message
	NTCIP 1211	Objects for Signal Control Priority	Message
	NTCIP 1301	Message Set for Weather Reports	Message
	NTCIP 1401	TCIP – Common Public Transportation (CPT) Business Area Standard	Message
	NTCIP 1402	TCIP – Incident Management (IM) Business Area Standard	Message
	NTCIP 1403	TCIP – Passenger Information (PI) Business Area Standard	Message
	NTCIP 1404	TCIP – Scheduling/Runcutting (SCH) Business Area Standard	Message
	NTCIP 1405	TCIP – Spatial Representation (SP) Business Area Standard	Message
	NTCIP 1406	TCIP – Onboard (OB) Business Area Standard	Message
	NTCIP 1407	TCIP – Control Center (CC) Business Area Standard	Message
	NTCIP 1408	TCIP – Fare Collection (FC) Business Area Standard	Message
Various	NTCIP Center-to-Center Standards Group	Communication	
Various	NTCIP Center-to-Field Standards Group	Communication	
ASTM	ASTM 5 GHz Data Link	Standard Specification for 5.9 GHz Data Link Layer	Communication
	ASTM 5 GHz Phys	Standard Specification for 5.9 GHz Physical Layer	Communication
	ASTM DD 17.54.00.2	ADMS Data Dictionary Specifications	Data
	ASTM PS 105-99	Specification for Dedicated Short Range Communication (DSRC) Data Link Layer: Medium Access and Logical Link Control	Communication
	ASTM PS 111-98	Specification for Dedicated Short Range Communication (DSRC) Physical Layer using Microwave in the 902-928 MHz	Communication

Table 7 – Applicable ITS Standards for the Beaumont Region (continued)

SDO	Document ID	Title	Type
EIA/CEA	CEA/EIA-794	Data Radio Channel (DARC) System	Communication
	CEA/EIA-795	Subcarrier Traffic Information Channel (STIC) System	Communication
IEEE	IEEE P1512.1	Standard for Traffic Incident Management Message Sets for Use by EMCs	Message
	IEEE P1512.2	Standard for Public Safety IMMS for use by EMCs	Message
	IEEE P1512.3	Standard for Hazardous Material IMMS for use by EMCs	Message
	IEEE P1512.a	Standard for Emergency Management Data Dictionary	Data
	IEEE P1512-2000	Standard for Common Incident Management Message Sets (IMMS) for use by EMCs	Message
	IEEE P1556	Security/Privacy of Vehicle/RS Communications including Smart Card Communications	Communication
	IEEE P1570	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection	Message
	IEEE Std 1455-1999	Standard for Message Sets for Vehicle/Roadside Communications	Message
ITE	ITE TM 1.03	Standard for Functional Level Traffic Management Data Dictionary (TMDD)	Data
	ITE TM 2.01	Message Sets for External TMC Communication (MS/ETMCC)	Message
SAE	SAE J1746	ISP-Vehicle Location Referencing Standard	Data
	SAE J2313	On-Board Land Vehicle Mayday Reporting Interface	Message
	SAE J2353	Data Dictionary for Advanced Traveler Information System (ATIS)	Data
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)	Message
	SAE J2369	Standard for ATIS Message Sets Delivered Over Bandwidth Restricted Media	Message
	SAE J2529	Rules for Standardizing Street Names and Route IDs	Message
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards	Message

4.6 Phases of Implementation

The Regional ITS Architecture will be implemented through a series of projects led by both public sector and private sector agencies. Key foundation systems will need to be implemented in order to support other systems that have been identified in the Beaumont Regional ITS Architecture. The deployment of all of the systems required to achieve the final Regional ITS Architecture build out will occur over many years.

A sequence of projects and recommended time frames has been identified in the Beaumont Regional ITS Deployment Plan. These projects have been sequenced over a 20-year period, with projects identified for deployment in a 5-, 10-, and 20-year timeframe.

Some of the key market packages that will provide the functions for the key foundation systems in the Beaumont Region are listed below. Projects associated with these and other market packages identified for the Region have been included in the Beaumont Regional ITS Deployment Plan.

- Network Surveillance;
- Surface Street Control;
- Traffic Information Dissemination;
- Work Zone Management;
- Maintenance and Construction Activity Coordination;
- Railroad Grade Crossings and Operations Coordination; and
- HAZMAT Management.

In addition to the above market packages, the implementation of an appropriate communications system in the Region to support ITS is critical for continued deployment of projects.

5. OPERATIONAL CONCEPT

The operational concept for the Beaumont Region provides a description of the stakeholders' roles and responsibilities in the operation of the systems that exist or that are being proposed. This operational concept provides an "executive summary" view of the way the Beaumont Region's systems will work together, and it documents the roles and responsibilities for each of the services that the intelligent transportation system will provide. The approach to describing the operational concept is to present specific operational scenarios that describe and define the stakeholders' general roles in providing the services.

In addition to the operational scenarios that illustrate the roles and responsibilities of each agency, a list of the key agencies that are responsible for operations in the eight ITS areas is presented. This list will serve as a high level overview of the different roles and responsibilities in this operational concept. In addition, specific roles and coordination requirements for operations are illustrated through the customized market package diagrams presented in **Appendix A**.

With the integration, information sharing, and in some cases joint operations of systems, there will likely be a requirement for agency agreements. Descriptions of potential agreements that may be needed in the Beaumont Region are included in Section 5.3.

5.1 Operational Scenarios

Scenario 1

The first operational scenario describes how ITS technologies may be used during a major evacuation in the Beaumont Region due to a hurricane. In this operational scenario, freeways in the urban area of Beaumont have been instrumented with CCTV cameras, detectors, and DMS. Connections between the Cities of Beaumont and Port Arthur, TxDOT Beaumont District Office, DPS, counties, nearby TxDOT District, LADOTD, and other key agencies have been established. All the systems are continuously monitored using an integrated network of detection and monitoring systems providing real-time information to the Beaumont District Office where the surveillance information is assimilated and "packaged" so it can be effectively disseminated to the public through the Beaumont Region's traveler information system. Hurricane evacuation routes are posted on the Beaumont District web site, and are publicized through local radio and TV broadcasts. Agencies, including those in the Beaumont Region and in southwestern Louisiana have agreed upon one-way traffic plans in the event of a regional evacuation.

A hurricane is approaching southeast Texas and the Gulf Coast, and an alert is put out to citizens to begin evacuating the area. TxDOT monitors the freeway conditions through CCTV cameras and vehicle detectors to determine the level of congestion on roadways. Both permanent and portable DMS provide up to date information to motorists as they head inland on I-10, Highways 90, 96, and 69 and others, and HAR provides longer, more detailed messages. The arterial streets are also closely monitored by the Cities of Beaumont and Port Arthur through VIVDS at intersections as well as CCTV cameras on arterial streets. The data and camera feeds that TxDOT and the Cities have access to are shared with other key agencies, including DPS, Police and Fire, and County Sheriffs and Emergency Operations Centers. The EOCs in Jefferson and Orange Counties alert Port Arthur Transit, Beaumont Municipal Transit, school districts, and paratransit providers in the Orange/Hardin/Jefferson areas of the need to use their buses to assist with evacuations. Through AVL on the buses, all vehicles can be tracked and their location verified.

While the hurricane grows nearer bringing heavy rains, flood monitoring stations along US 69 indicate that a portion of the highway near the Hardin/Jefferson county line is flooded and will need to be closed. With motorists no longer able to access US 69 from I-10, the TxDOT Beaumont District Office issues an alert to DPS, cities, police, fire, sheriffs and the County EOCs, as well as LADOTD informing them of the closure. The Beaumont District Office immediately posts the warning on its web site, informs local media, and updates the 511, HAR and DMS messages advising motorists to take an alternate route. DPS received the initial warning, and has sent officers to the area to assist with diverting existing traffic. Through a common radio frequency, all agencies are in communication together to coordinate this effort. Due to safety concerns, TxDOT decides to evacuate personnel from the TxDOT Beaumont District Office. Monitoring and control of the TxDOT ITS infrastructure is switched to TranStar at the TxDOT Houston District. An automatic notice is sent to DPS, the Cities of Beaumont, Port Arthur, County EOCs, and the Coast Guard to let them know the status of the TxDOT Beaumont District Office.

Throughout the evacuation, data and camera feeds, as well as the US 69 closure and one-way routes have been continuously sent to the media for broadcast alerts on traffic conditions. The improved accuracy of traveler information and the ability to monitor and control the freeway and arterial systems have contributed to the successful, coordinated evacuation of the Beaumont Region.

Scenario 2

The second operational scenario describes how the integrated elements of the Beaumont Region's ITS program will function together in the event of a major incident caused by a HAZMAT truck/train collision near I-10. In this operational scenario, major rail crossings in the Beaumont Region have been instrumented with enhanced detection and warning systems. Center-to-center communications facilitate information sharing among TxDOT and local agencies. Some portions of I-10 and US 69 are instrumented with permanent DMS, some of which have CCTV cameras transmitting images from selected locations. These systems are controlled from the Beaumont District Office using the ATMS software, and the District also facilitates information sharing with other TxDOT Districts, LADOTD, as well as motorists.

The highway/rail detection system sends a signal back to the City of Beaumont that a northbound train is approaching a major switching junction south of I-10 in the City of Beaumont. This signal also activates the roadside equipment near the intersection to warn motorists on both sides of the affected arterials of the approaching train. This is a major rail crossing that is equipped with CCTV cameras to monitor the equipment operations and traffic on either side of the tracks. There is a malfunction, either on board the train or a defective piece of track, and four train cars derail as the train approaches the junction. Two stopped vehicles west of the tracks are impacted by the derailment, one of which is a truck transporting hazardous material.

The City of Beaumont has detectors near this junction which are signaling very high volumes, indicating that traffic has come to a standstill. This stands to reason as cars should be stopped for the train. A 911 call is placed and the City of Beaumont police dispatch is notified of the derailment by a motorist calling from a mobile phone who has witnessed the accident. The dispatcher logs the incident details and a notification alarm is automatically sent to DPS, which has already received a distress warning from the rail operator. Several more 911 calls come in from motorists and truck drivers who have come upon the incident. When DPS and police arrive, they see that one of the trucks involved is carrying HAZMAT, and a message is automatically routed to the DPS Dispatch, TxDOT Beaumont District Office, and the County EOC requesting

HAZMAT crews to assist with incident clearance. Although the incident is not on the freeway, the TxDOT Beaumont District Office makes a decision to close the portion of I-10 in the vicinity of the derailment due to the HAZMAT spill.

Messages are immediately placed on DMS along I-10 and US 69 to notify motorists of the closure. The City of Beaumont and County Public Works crews close down several streets near the incident, and place portable DMS on approaches to divert motorists. Local media are informed of the incident and closure, and they broadcast via radio and TV reports that several streets and a portion of I-10 will be closed for several hours. TxDOT updates the Beaumont Region web page, HAR and 511 traveler information phone number with the information. The center-to-center communications links allows for instantaneous dissemination of the same message to multiple agencies, including LADOTD. With the regional integration and notification systems, DPS's alert also is sent to local emergency response and public safety, including the County EOC, local police, and area hospitals to alert them of the incident.

5.2 Roles and Responsibilities

The operational scenarios described in the previous section illustrate the interagency cooperation and coordination that is required in two situations that might occur in the Beaumont Region. During any operational scenario, a number of agencies will be required to coordinate closely to perform their operational responsibilities. The key agencies that have a lead role or responsibility during operations are listed below for each ITS area. It is recognized that a number of other agencies will also need to be involved during a scenario in addition to the ones listed below, although it is not expected that these agencies will play as critical a role in operations.

Travel and Traffic Management

- City of Beaumont Public Works Transportation Division
- City of Port Arthur Public Works
- City Police
- County Road and Bridge
- Other Texas Department of Transportation Districts, namely Lufkin and Houston
- Texas Department of Public Safety
- Louisiana DOTD

Public Transportation Management

- Independent School Districts
- Beaumont Municipal Transit
- Port Arthur Transit
- Southeast Texas Paratransit Providers

Electronic Payment

- Not Applicable

Commercial Vehicle Operations

- Texas Department of Public Safety
- Texas Department of Transportation

Emergency Management

- Cities of Beaumont and Port Arthur (Police, Fire, Emergency Operations Center, Public Works)
- City/County Public Safety Agencies (Emergency Operations Center, Public Safety Dispatch)
- Coast Guard Marine Safety Office
- Regional Hospitals
- HAZMAT Alliance
- Mutual Aid Mont Belvieu (MAMB)
- Texas Department of Public Safety
- Texas Department of Transportation

Advanced Vehicle Safety System

- Not Applicable

Information Management

- Southeast Texas Regional Planning Commission
- Texas Department of Transportation

Maintenance and Construction Management

- City of Beaumont Public Works Transportation Division
- City of Port Arthur Public Works
- County Road and Bridge
- Texas Department of Transportation
- Louisiana DOTD

5.3 Beaumont Region Agreements

The Regional ITS Architecture for the Beaumont Region has identified several agency interfaces, information exchanges, and integration strategies that would be needed to provide the ITS services and systems identified by the stakeholders in the Region. Interfaces and data flows among public and private entities in the Beaumont Region will require agreements among agencies that establish parameters for sharing agency information to support traffic management, incident management, provide traveler information, and other functions identified in the Regional ITS Architecture.

Currently, there are no formal agreements in place in the Beaumont Region with regards to ITS. 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 and cooperation. With the implementation of ITS technologies, integrating systems from one or more

agencies, the anticipated level of information exchange identified in the architecture, it is likely that more formal agreements will be needed. These agreements, while perhaps not requiring a financial commitment from agencies in the Region, should outline specific roles, responsibilities, data exchanges, levels of authority, and other facets of regional operations. Some agreements also will outline specific funding responsibilities, where appropriate and applicable.

Table 8 provides a list of potential agreements for the Beaumont Region based on the interfaces identified in the Regional Architecture. 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.

Table 8 – Potential Agreements for the Beaumont Region

Agreement and Agencies	Status	Agreement Description	Considerations
<p>Data Sharing and Usage (Public) TxDOT Beaumont District and Public Agencies within the Region</p>	<p>Future</p>	<p>This agreement would define the parameters, guidelines and policies for inter- and intra-agency ITS data sharing. This data sharing would support regional activities related to traffic management, incident management, and traveler information, and other functions, most likely real-time or near-real-time. Data also could include video images from CCTV cameras. The terms of this agreement should generally address such items as:</p> <ul style="list-style-type: none"> ▪ Types of data and information to be shared ▪ Repository for information (i.e., TxDOT Beaumont District as central hub) ▪ How the information will be used (traffic incident management, displayed on web site for travel information, distributed to private media, etc.) ▪ Parameters for data format, quality, security 	<p>These agreements are typically zero-dollar agreements, in that there is no charge among agencies for the actual data, although there might be some cost incurred for infrastructure, systems or fiber to enable communications between agencies.</p>

Table 8 – Potential Agreements for the Beaumont Region (continued)

Agreement and Agencies	Status	Agreement Description	Considerations
<p>Data Sharing and Usage (Public-Private) TxDOT Beaumont District and Private Media/Information Service Providers</p>	<p>Future</p>	<p>This agreement would define the parameters, guidelines and policies for private media use of regional ITS-related information from TxDOT Beaumont. This type of agreement is recommended between TxDOT (data provider) and the media (data user) to define terms of use for broadcasting public-agency information regarding traffic conditions, closures, restrictions, as well as video images. Agreements can also include requirements for the media to 'source' the information (i.e., using the TxDOT logo on all video images broadcast).</p>	<p>These agreements can be zero-dollar agreements, although some agencies have stipulated identifying the information, public service announcements by the media, or other requirements as a term of use. The private media entity is typically responsible for paying any necessary costs for access (i.e., communications infrastructure to link to the TxDOT database or video switch). These agreements also typically include a sunset clause to allow the agency to periodically review the agreement and make any modifications prior to renewal.</p>
<p>Shared Video Monitoring (Public) TxDOT Beaumont District, City of Beaumont, City of Port Arthur, County EOCs, DPS Dispatch</p>	<p>Future</p>	<p>This agreement would enable shared video monitoring of TxDOT CCTV cameras by public safety and emergency services agencies in the Beaumont Region for incident management purposes. This agreement would define the parameters and policies for public safety agencies to access video images via the TxDOT video switch. It is recommended that the agreement include any TxDOT policies relating to video images (including archiving, privacy, disclaimers, use of video and redistribution) as well as processes for agency requests for specific views. Shared video monitoring does not address shared use or shared control of video equipment functions.</p>	<p>These agreements are typically zero-dollar agreements, in that there is no charge among agencies for the actual data, although there might be some cost incurred for infrastructure, systems or fiber to enable communications between agencies, particularly with the high bandwidth required for transmitting live video images.</p>
<p>Mutual Aid Agreements (Public and Private) DPS, TxDOT Beaumont District, HAZMAT Alliance, MAMB, Texas Forest Service, local police, fire and EOCs</p>	<p>Existing (Informal)</p>	<p>Mutual aid agreements currently exist as informal arrangements in the Beaumont Region, although they are a routine practice among public safety and emergency services agencies. Formal mutual aid agreements will become more important as agencies integrate systems and capabilities, particularly automated dispatch and notification.</p>	<p>These agreements are typically zero-dollar agreements, although there might be some funding required to support regional incident management activities. The agreement also would outline resource commitments that would be part of any mutual aid arrangement (personnel, equipment, facilities, etc.).</p>

Table 8 – Potential Agreements for the Beaumont Region (continued)

Agreement and Agencies	Status	Agreement Description	Considerations
<p>Joint Operations/Shared Control Agreements for Ferry DMS (Public)</p> <p>TxDOT Beaumont and TxDOT Houston (TranStar)</p>	<p>Future</p>	<p>These agreements are formal arrangements to allow joint operations or control of certain systems and equipment. TxDOT Beaumont has stated that TranStar (Houston) will be placing DMS in the Beaumont Region to provide information about ferries. When not being used specifically for ferry information, TxDOT Beaumont wants to be able to use the DMS for local traffic information. The agreement would need to define the terms of this arrangement, such as hours of operation and time of day/time of week where shared control would take effect, circumstances or incidents where shared control would take effect, notification procedures between the agencies agreeing to shared control arrangements, etc.</p>	<p>Joint operations/shared control agreements could consider some form of mutual funding for certain system elements, primarily communication links.</p>