HOUSTON-GALVESTON AREA COUNCIL

INTELLIGENT TRANSPORTATION SYSTEM ARCHITECTURE PLAN UPDATE

April 2025

Houston-Galveston Area Council

Table of Contents

Executive Summary ..... **vi**
ITS Architecture Update Process vi
ITS Deployment Plan vii
Use and Maintenance of the ITS Architecture vii
1. Introduction **2**
Plan Overview 2
Project Background 2
Plan Key Concepts 3
Houston-Galveston MPA 3
2. ITS Architecture Development Process **8**
Stakeholder Involvement 8
ITS Architecture Components 10
RAD-IT 13
3. Regional ITS Inventory **16**
Existing and Planned ITS Deployments 16
Existing Stakeholder Agency Agreements 22
4. Regional Transportation Goals and ITS Needs **25**
Regional Transportation Goals 25
Regional ITS Needs 27
5. ITS Architecture **30**
ITS Service Packages 30
Architecture Interfaces 33
Roles and Responsibilities 36
Standards 37
RAD-IT Database 37
6. ITS Deployment Plan **39**
Project and Program Development 39
Recommended Projects and Programs 39
7. Regional Communications Scan **50**
Existing Communications 50
H-GAC Fiber Communications 50
City of Pearland Case Study 51
8. Use and Maintenance of the ITS Architecture **54**

Process for Determining ITS Architecture Conformity....54
ITS Architecture Plan Maintenance Process....55
Procedure for Submitting ITS Architecture Changes Between Scheduled Updates....56
Next Steps....56
Appendix....57
Appendix A: Participating Stakeholders....A-1
Appendix B: 2025 H-GAC ITS Architecture Inventory....B-1
Appendix C: ITS Service Package Status....C-1
Appendix D: 2025 H-GAC ITS Architecture Roles and Responsibilities....D-1
Appendix E: Maintenance Form....E-1

List of Figures

Figure 1: H-GAC ITS Architecture Boundary....4
Figure 2: Houston-Galveston Regional Roadway Functional Classification....5
Figure 3: H-GAC ITS Architecture Development Process....8
Figure 4: Steps to View the National ITS Architecture Website Standards....13
Figure 5: H-GAC ITS Architecture Interconnect Diagram....35
Figure 6: H-GAC Existing Fiber Communications....52

List of Tables

Table 1: H-GAC ITS Architecture Stakeholders....10
Table 2: ITS Service Areas....12
Table 3: H-GAC ITS Deployment Inventory....17
Table 4: Houston-Galveston MPA Stakeholder Agreements....23
Table 5: Houston-Galveston MPA ITS Needs....28
Table 6: ITS Service Package Prioritization by Service Area....31
Table 7: Houston-Galveston MPA Needs and Corresponding ITS Service Package....34
Table 8: ITS Communication Overview....50
Table 9: H-GAC ITS Architecture Maintenance Plan....55

List of Acronyms

ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
AVL	Automated Vehicle Location
CVO	Commercial Vehicle Operations
DM	Data Management
DMS	Dynamic Message Sign
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
H-GAC	Houston-Galveston Area Council
IH	Interstate Highway
IMSA	International Municipal Signal Association
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
MC	Maintenance and Construction
METRO	Metropolitan Transit Authority Of Harris County
MPA	Metropolitan Planning Area
PM	Parking Management
PS	Public Safety
PT	Public Transportation
RAD-IT	Regional Architecture Development for Intelligent Transportation
RTP	Regional Transportation Plan
RWIS	Road Weather Information Systems
SDO	Standards Development Organizations
SET-IT	Systems Engineering Tool for Intelligent Transportation
SH	State Highway
SMART	Strengthening Mobility and Revolutionizing Transportation
ST	Sustainable Travel
SU	Support
TEA	Transportation Equity Act
TI	Traveler Information and Personal Mobility
TM	Traffic Management
TMC	Traffic Management Center
TSMO	Transportation Systems Management & Operations
TTI	Texas A&M Transportation Institute
US	US Highway
USDOT	United States Department of Transportation
VS	Vehicle Safety
WX	Weather

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Houston-Galveston Area Council (H-GAC) Intelligent Transportation System (ITS) Architecture Plan Update provides a long-range plan for the deployment, integration, and operation of ITS in the Houston-Galveston Metropolitan Planning Area (MPA). The ITS Architecture Plan allows stakeholders to plan for what they want their system to look like in the long term, then organizes the system into smaller pieces that can be implemented over time as funding permits. Development of a regional ITS architecture encourages interoperability and resource sharing among agencies and allows for cohesive long-range planning among regional stakeholders. Completing and regularly updating the plan is also required by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) to use federal transportation funds for ITS projects in the region.

The 2025 H-GAC ITS Architecture was developed by H-GAC in close coordination with stakeholders representing local and regional agencies that operate ITS in the Houston-Galveston MPA. The geographic boundaries of the H-GAC ITS Architecture include the eight counties within the H-GAC Metropolitan Planning Organization (MPO): Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties.

ITS Architecture Update Process

The update of the ITS Architecture Plan for the Houston-Galveston MPA heavily depended on input from stakeholders to ensure it addressed regional needs. Two workshops were organized with stakeholders to gather their input, interviews were held with representatives from various regional stakeholder agencies, and a website was created to share the final documents for the H-GAC ITS Architecture Update. Additionally, the H-GAC 2045 Regional Transportation Plan (RTP) was reviewed to identify other regional needs that could be addressed through ITS.

The H-GAC ITS Architecture was developed using the Regional Architecture Development for Intelligent Transportation (RAD-IT) Version 9.3. Originally known as Turbo Architecture, RAD-IT is a software application developed by the United States Department of Transportation (USDOT) for documenting and maintaining ITS architectures. Both the FHWA and the FTA) recommend using RAD-IT software for the development of regional ITS architectures.

The 2025 update to the H-GAC ITS Architecture focuses on building a connected region. Many stakeholders in the Houston-Galveston MPA have made significant investments in ITS and operations within their jurisdictions. However, most noted that additional connectivity between agencies is needed to fully optimize operations and manage the regional

ITS Architecture Website

The **H-GAC ITS Architecture**, including the **Interactive ITS Architecture**, can be accessed on the H-GAC website under the "**Programs & Services**" tab, or through the link provided below. Throughout this report, look for red call out boxes that will note key parts of the ITS Architecture Plan that can be accessed on-line via the **Interactive ITS Architecture.**

H-GAC.COM/ITS-ARCHITECTURE

transportation network as a unified system. Stakeholders reviewed and selected a total of 58 specific National ITS Architecture service packages based on their relevance and the functionality they could provide to the region.

ITS Deployment Plan

The ITS Deployment Plan section serves as a tool for the region to identify regional projects that should be deployed to achieve the desired functionality identified in the ITS Architecture Plan. The ITS Deployment Plan builds on the ITS Architecture by outlining project recommendations and strategies for the region, potential stakeholders, and deployment timeframes.

H-GAC stakeholders noted a strong need for the implementation of systems and programs to meet regional needs. Regional needs generally focused on data management, parking management, public transportation, and traffic management.

Stakeholders identified eight regional deployment projects for ITS in the region. These eight projects do not encompass all the ITS needs within the Houston-Galveston MPA, but stakeholders recommended that emphasis be placed on implementation related to these eight areas to provide the greatest benefit to the region. The eight regional deployment projects are:

- Expand CCTV Camera and DMS Coverage on Freeways and Arterials
- Develop Regional CCTV Camera Video Sharing System
- Deploy Railroad Crossing Detection and Notification System
- Expand Regional Transit Rider Application
- Expand Fiber Optic Communication Network
- Improve Signal Timing on Arterials and Across Jurisdictional Boundaries
- Automate Operational Capabilities (Including Data Sharing)
- Increase Staffing for ITS

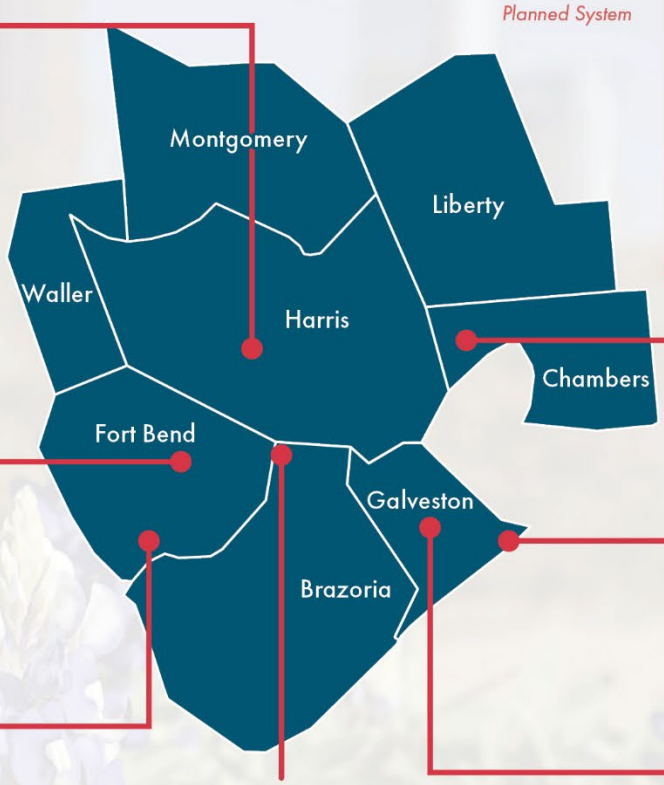
Use and Maintenance of the ITS Architecture

The H-GAC ITS Architecture is considered a living document. Changes in regional needs, as well as changes in the National ITS Architecture, will necessitate an update to the H-GAC ITS Architecture. The update process will occur on an as needed basis as determined by H-GAC and FHWA. H-GAC will review the ITS Architecture Plan after major ITS deployments in the region and evaluate if an update is needed. H-GAC will lead the effort to maintain the ITS Architecture Plan for the eight-county region.

HOUSTON-GALVESTON REGION
KEY ITS INFRASTRUCTURE AND PROGRAMS

REGIONAL INITIATIVES
- ConnectSmart (TxDOT Houston District)

KEY
Existing System
Planned System



CITY OF HOUSTON
- TMC
- CCTV Cameras
- Centralized Traffic Signal Control System
- DMS
- Emergency Vehicle Signal Preemption
- Flood Monitoring
- Railroad Detection and Notification
- Transit Signal Priority

MISSOURI CITY
- TMC
- CCTV Cameras
- Centralized Traffic Signal Control System
- DMS
- *Emergency Vehicle Signal Preemption*

CITY OF SUGAR LAND
- TMC
- CCTV Cameras
- Centralized Traffic Signal Control System
- Emergency Vehicle Signal Preemption
- Flood Monitoring
- *Railroad Detection and Notification*

CITY OF PEARLAND
- TMC
- CCTV Cameras
- Centralized Traffic Signal Control System
- Emergency Vehicle Signal Preemption

CITY OF BAYTOWN
- TMC
- CCTV Cameras
- Centralized Traffic Signal Control System

CITY OF GALVESTON
- CCTV Cameras
- *Centralized Traffic Signal Control System*
- *Emergency Vehicle Signal Preemption*

LEAGUE CITY
- *TMC*
- CCTV Cameras
- Centralized Traffic Signal Control System
- Emergency Vehicle Signal Preemption

TRAFFIC ITS INFRASTRUCTURE
- Traffic Management Center (TMC)
- Closed Circuit Television (CCTV) Cameras
- Centralized Traffic Signal System
- Comparative Travel Time Signs
- Dynamic Message Signs (DMS)
- Electronic Toll Collection
- Emergency Vehicle Signal Preemption
- Flood Monitoring
- Freeway Safety Service Patrol
- Railroad Detection and Notification
- Transit Signal Priority

TRANSIT ITS INFRASTRUCTURE
- Transit Operations Center (TOC)
- Automated Fare Payment
- Automated Passenger Counters
- Bus Rapid Transit
- Real-Time Traveler Information
- Transit Signal Priority
- Transit Vehicle Tracking

TXDOT HOUSTON DISTRICT
- TMC
- CCTV Cameras
- Comparative Travel Time Signs
- Centralized Traffic Signal System
- DMS
- Electronic Toll Collection
- Emergency Vehicle Signal Preemption
- Ramp Metering

TXDOT BEAUMONT DISTRICT
- TMC
- CCTV Cameras
- Centralized Traffic Signal System
- DMS
- Emergency Vehicle Signal Preemption
- Truck Parking Availability Systems

HOUSTON METRO
- TOC
- Automated Fare Payment
- Automated Passenger Counters
- On-Board CCTV Cameras
- Real-Time Traveler Information
- Transit Signal Priority
- Transit Vehicle Tracking

HARRIS COUNTY TRANSIT
- TOC
- Automated Fare Payment
- Automated Passenger Counters
- On-Board CCTV Cameras
- Real-Time Traveler Information
- Transit Signal Priority
- Transit Vehicle Tracking

WOODLANDS REGIONAL TRANSIT AUTHORITY
- TOC
- Automated Fare Payment
- Automated Passenger Counters
- On-Board CCTV Cameras
- Real-Time Traveler Information
- Transit Signal Priority
- Transit Vehicle Tracking

HARRIS COUNTY
- TMC
- CCTV Cameras
- Centralized Traffic Signal Control System
- Emergency Vehicle Signal Preemption
- *Flood Monitoring*
- MAP Safety Service Patrol
- Railroad Detection and Notification

HOUSTON-GALVESTON AREA COUNCIL
- Tow and Go Safety Service Patrol

1

INTRODUCTION

1. INTRODUCTION

Plan Overview

The Houston-Galveston Area Council (H-GAC) Intelligent Transportation System (ITS) Architecture Plan provides a long-range plan for the deployment, integration, and operation of ITS in the Houston-Galveston Metropolitan Planning Area. The ITS Architecture Plan allows stakeholders to plan for what they want their system to look like in the long term and breaks the system into smaller projects that can be implemented over time as funding permits. Development of a regional ITS architecture encourages interoperability and resource sharing among agencies and allows for cohesive long-range planning among regional stakeholders. A complete ITS architecture plan that is regularly updated is required by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) to use federal funds for ITS projects in the Houston-Galveston MPA. The Houston-Galveston MPA includes the eight counties within the H-GAC Metropolitan Planning Organization (MPO): Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties.

The 2025 update of the H-GAC ITS Architecture Plan focuses on fully optimizing operations of ITS devices. Many of the stakeholders within the Houston-Galveston MPA have deployed ITS equipment, but stakeholders noted the need for additional connectivity between agencies within the transportation network. Areas of interest for stakeholders within the Houston-Galveston MPA include live video sharing, interagency coordination, automated operational capabilities, and expansion of the communications system.

The H-GAC ITS Architecture Plan was developed with significant input from local and regional agencies. Individual interviews were conducted with stakeholders and two workshops were held to gather input and review the Plan's recommendations for the Houston-Galveston MPA. The Plan identifies ITS services and projects to address gaps in ITS and meet stakeholder needs. H-GAC developed an ITS Architecture website, which contains all the documents related to the 2025 update and an interactive version of the ITS Architecture.

The H-GAC ITS Architecture Plan shows existing and planned ITS deployments in the Houston-Galveston MPA. Needs and priorities of the region will change over time, so this Plan will be periodically reviewed and updated to stay effective.

ITS Architecture Website

The **H-GAC ITS Architecture**, including the **Interactive ITS Architecture**, can be accessed on the H-GAC website under the "**Programs & Services**" tab, or through the link provided below. Throughout this report, look for blue call out boxes that will note key parts of the ITS Architecture that can be accessed on-line via the **Interactive ITS Architecture**.

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Project Background

The H-GAC ITS Architecture was first developed in 2003. Since that time, several ITS programs and projects have been implemented in the Houston-Galveston MPA. To reflect the changes made within the

Houston-Galveston MPA, H-GAC has worked closely with stakeholders to update the H-GAC ITS Architecture in 2010 and 2017. Additionally, the National ITS Architecture, which serves as the basis for the H-GAC ITS Architecture Plan, has been updated several times. To incorporate recent changes made within the Houston-Galveston MPA and to the National ITS Architecture, H-GAC completed this update of the H-GAC ITS Architecture in 2025.

A regional ITS architecture is necessary to satisfy the ITS conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill passed in 1998 and continued in subsequent federal highway bills. In response to Section 5206(e) of TEA-21, FHWA issued a final rule and the FTA issued a final policy in 2001 that required regions implementing any ITS project to have an ITS architecture in place. Any ITS projects must show conformance with a routinely updated regional or statewide ITS architecture to be eligible for funding from FHWA or FTA.

Plan Key Concepts

The H-GAC ITS Architecture consists of several key components:

- **ITS Inventory** –Describes all the ITS related elements that either exist or are planned for the region.
- **ITS Needs** – Describes the transportation related needs in the Houston-Galveston MPA that could possibly be addressed by ITS.
- **ITS Architecture** –Describes the ITS services that stakeholders in the Houston-Galveston MPA want ITS to provide. ITS service package diagrams have been developed to illustrate how each service will be deployed and operated by each agency in the region interested in it. ITS service package diagrams are available in the online Interactive ITS Architecture.
- **Interactive ITS Architecture** – Available on H-GAC's website, the Interactive ITS Architecture includes the full inventory of existing, planned, and future systems, ITS service packages, roles and responsibilities for stakeholders, and associated national standards.
- **ITS Deployment Plan** – Describes potential ITS projects within the Houston-Galveston MPA. Projects were developed through needs identified during stakeholder outreach.
- **Use and Maintenance** – Describes how to use the Houston-Galveston ITS Architecture Plan for ITS planning and design efforts. It also describes how the Plan should be maintained in the future.

Houston-Galveston MPA

Geographic Boundaries

The H-GAC MPO boundary includes Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties, as shown in **Figure 1**. H-GAC's metropolitan planning area encompasses approximately 8,800 square miles and has a population of more than seven million people.

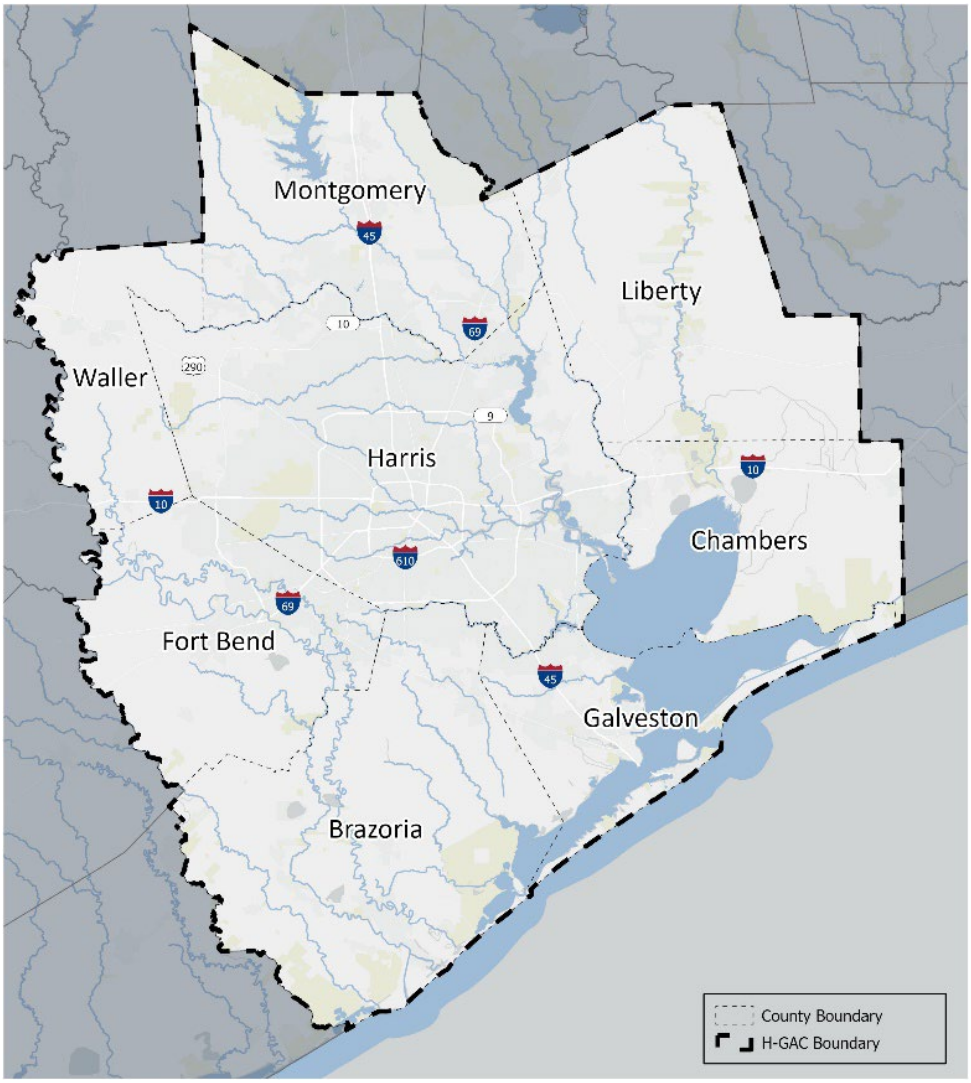


Figure 1: H-GAC ITS Architecture Boundary

Transportation Infrastructure

The Houston-Galveston MPA applies the FHWA seven functional classifications to define the mobility and accessibility of roadways. **Figure 2** displays the functional classification of the existing roadway facilities within the region.

A network of federal and state highways spans the Houston-Galveston MPA, promoting both local and long-distance travel. Key access-controlled highways include IH 10, IH 45, IH 69, IH 610, US 90, US 290, SH 6, SH 99, SH 249, and SH 288, and BW 8. Several of these highways, such as BW 8 (Sam Houston Tollway), SH 99 (Grand Parkway), and SH 249 (Tomball Tollway), operate as fully tolled roads, while others, like IH 10 (Katy Freeway), include tolled lanes. TxDOT operates the Katy Freeway and SH 288 toll roads, Fort Bend County manages the Fort Bend County Toll Road, Brazoria County oversees the Brazoria County Toll Road, and Harris County Toll Road Authority (HCTRA) handles the toll roads in Harris County.

IH 10 and IH 45 are the primary highways in the Houston-Galveston MPA. IH 10 links Houston to San Antonio and extends west to Los Angeles, California, and east to Jacksonville, Florida, serving as a corridor for cross country travel. IH 45 connects the Houston-Galveston area to the Dallas-Fort Worth Metroplex, allowing passenger and freight movement within Texas. Both highways are critical for transporting people and goods across the state. Construction and incidents along these routes can have an impact on commercial vehicle traffic and motorists traveling through the region.

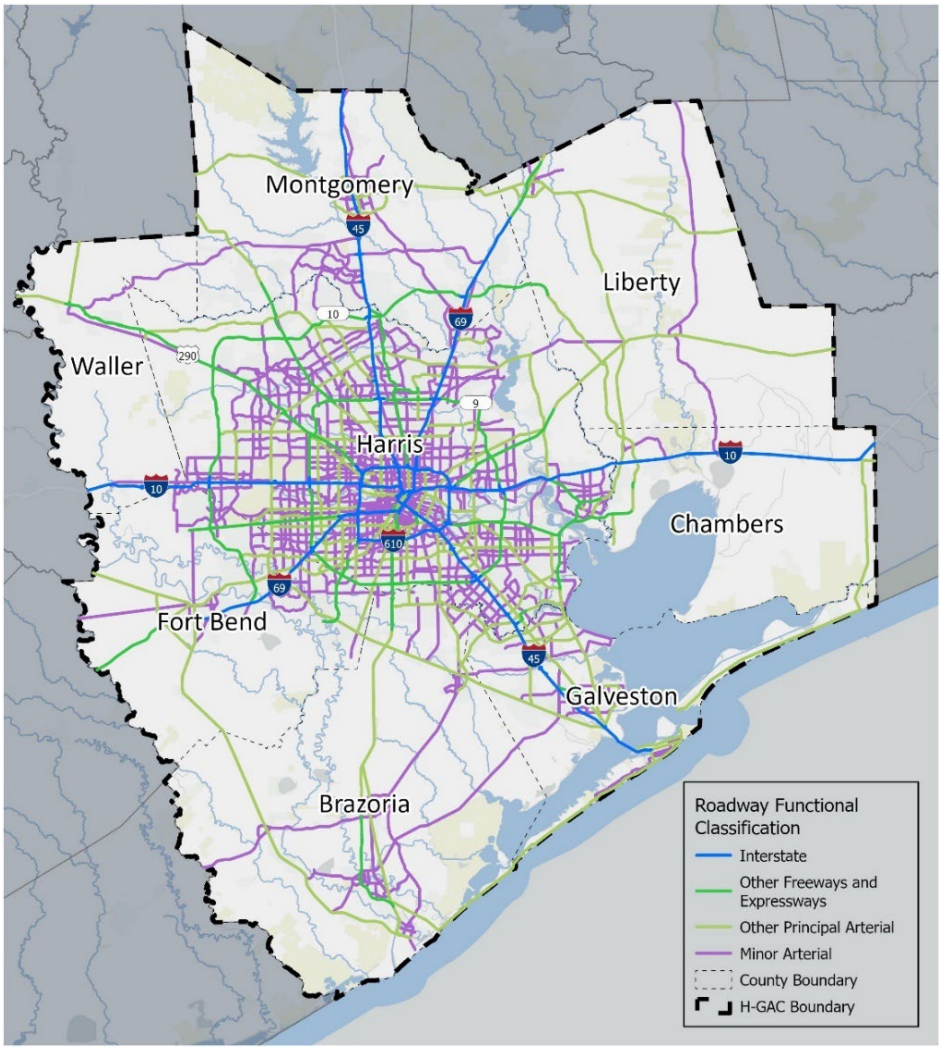


Figure 2: Houston-Galveston Regional Roadway Functional Classification

The Houston-Galveston area offers a variety of transit services throughout the region. The Houston Metropolitan Transit Authority of Harris County (METRO) operates fixed-route and paratransit services across Harris County and parts of Montgomery County, along with the METRORail light rail system and METROLift paratransit services for individuals with disabilities. METRO also manages Park & Ride facilities, enabling commuters from suburban areas to travel to and from Houston. Fort Bend County Transit offers commuter services to Houston and fixed-route options within Fort Bend County. The Woodlands Township provides fixed-

route and paratransit services for its residents, as well as a trolley service near the town center. The Brazos Transit District offers fixed-route services in parts of Liberty and Montgomery Counties. Colorado Valley Transit serves Waller County with fixed-route services. The Gulf Coast Transit District operates fixed-route services in portions of Brazoria and Galveston Counties, while Island Transit provides fixed-route, paratransit, and trolley services in the City of Galveston.

2

ITS ARCHITECTURE DEVELOPMENT PROCESS

2. ITS ARCHITECTURE DEVELOPMENT PROCESS

The H-GAC ITS Architecture Update relied heavily on stakeholder input to ensure that the architecture reflected regional needs. Interviews were conducted with individual representatives from regional stakeholder agencies to gather input, two workshops were held with stakeholders to discuss initial findings and recommendations, and an H-GAC website page was developed with the final documents for the ITS Architecture Plan. The website also has an interactive version of the ITS Architecture generated from RAD-IT Architecture and contained additional guidance on the use and maintenance of the ITS Architecture Plan.

The process followed for the region was designed to ensure that stakeholders could provide input and review for the development of the ITS Architecture Plan. **Figure 3** illustrates the process that was followed.

Stakeholder Involvement

Stakeholders were involved in the development of the updated H-GAC ITS Architecture at every step. A stakeholder group was identified consisting of city, county, and regional agencies. Stakeholders included representatives from traffic, transit, public safety, emergency management, and toll agencies within H-GAC. The key components of the development process and how stakeholders were involved are described in the following sections:

H-GAC TSMO Subcommittee Briefings

Oversight and guidance for the ITS Architecture Plan Update was provided by the H-GAC Transportation Systems Management and Operations (TSMO) Subcommittee. Regular meetings were conducted with the Subcommittee to provide updates on the project progress and to review key findings.

Stakeholder Interviews and System Inventory

Stakeholder input was first gathered through a series of interviews that were conducted with individual stakeholder agencies. The interviews were used to develop the system inventory for

Figure 3: H-GAC ITS Architecture Development Process

the region, define how ITS services are currently being operated, define how ITS services could be operated in the future, and identify potential regional ITS projects for the Houston-Galveston MPA.

Communications Scan Development

A scan of existing and planned fiber communications in the Houston-Galveston MPA was conducted and a GIS database was developed to document fiber communication locations within the region.

Stakeholder ITS Architecture Workshops

Stakeholders were invited to two Stakeholder Workshops, one held virtually, and one held in person. An overview of the update was provided, the regional boundaries were defined, existing and planned ITS deployments in the region were reviewed, ITS needs for the region were identified, and ITS projects and programs recommended by stakeholders in interviews were discussed.

Draft and Final Documents

A draft and final version of the 2025 H-GAC ITS Architecture Plan were developed, which included an executive summary, written report, RAD-IT architecture database, and ITS Architecture website with an interactive version of the ITS Architecture.

Participating Stakeholders

Since ITS often transcends traditional transportation infrastructure, it is important to involve a wide range of local, state, and federal stakeholders in the ITS architecture development and visioning process. Input from these stakeholders is a critical part of defining needs and overall vision for ITS in a region. In the Houston-Galveston MPA, stakeholders that participated included not just representatives from transportation and public transit agencies, but also stakeholders that represented public safety and health.

Table 1 contains a list of H-GAC stakeholders who participated in a stakeholder interview or workshop to provide input as to the needs and issues that should be considered in the updated of the ITS Architecture Plan. A complete listing of stakeholders invited to participate in the stakeholder interviews and workshop, as well as attendance records, is included in the stakeholder database in **Appendix A**.

Table 1: H-GAC ITS Architecture Stakeholders

County	City	Regional
Brazoria Chambers Fort Bend Galveston Harris Liberty Montgomery Waller	Baytown Bunker Hill Village Conroe Galveston Houston League City Missouri City Pasadena Pearland Sugar Land Texas City The Woodlands Township	TxDOT Houston District TxDOT Beaumont District Brazos Transit District East End District Gulf Coast Transit District Harris County Transit Houston METRO Houston TranStar Port of Freeport Port of Houston South East Texas Regional Planning Commission Texas A&M Transportation Institute Woodland Regional Transit Authority

ITS Architecture Components

An ITS architecture consists of the following components.

Stakeholders

An ITS architecture results from the consensus input of a diverse set of stakeholders, encompassing traffic, transit, public safety, and many other operating agencies at local, state, and national levels. It includes both public and private sectors and spans the organizations that manage, support, or are impacted by the surface transportation system, with particular focus on agencies that operate transportation systems in a region.

Inventory

Each stakeholder owns, operates, maintains, or plans ITS systems in the region. An ITS architecture inventory is a list of "elements" that represent all existing, planned, and future ITS systems as well as non-ITS systems that provide information to or get information from the ITS systems. The inventory can be sorted by physical object or by stakeholder.

Needs

The stakeholder needs identified in an ITS architecture determine what the system needs to provide. Needs are categorized by the ITS service packages that comprise the ITS architecture. Service packages provide an accessible, service-oriented perspective to the overall system architecture used to describe a region or project. Each of these service packages has a set of needs associated with it that can be used as the basis for stakeholder validation, setting proper expectations, and eliciting requirements for the systems and devices to be implemented.

Services

In the National ITS Architecture, ITS service packages provide a visual representation of how ITS services are deployed and how information is shared. ITS service packages can include several stakeholders and elements that work together to provide a service in a region. Service packages in the National ITS Architecture are meant to be customized to reflect unique systems, subsystems, and terminators in a region. Each service package is shown in a diagram with the service package name, agencies involved, and desired data flow.

There are currently 157 ITS service packages identified in the National ITS Architecture Version 9.3, the most recent version available at the time of writing the 2025 H-GAC ITS Architecture. The National ITS Architecture groups these service packages into 12 ITS architecture service areas, shown in **Table 2**.

Roles and Responsibilities

An ITS architecture documents the current and future roles and responsibilities of each stakeholder in the operation of the regional transportation system. It covers a range of transportation services and related support services.

Standards

Standards allow for efficient implementation of the elements in an 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 developed to facilitate successful ITS deployment in the United States.

Standards for specific architecture flows are available through the National ITS Architecture website. Since the website is updated more frequently than the software and links directly to additional information about the applicable standard, the website is the preferred method for determining which standards apply to a particular architecture flow. **Figure 4** displays the steps to view standards located on the National ITS Architecture website.

Projects and Programs

An ITS architecture identifies a series of projects and programs to meet the desired functionality identified by stakeholder input. Projects in the ITS Deployment Plan impact at least two or more stakeholders and often require a high level of planning and interagency coordination to be successfully deployed and operated.

Agreements

Agreements provide a foundation for the technical integration identified in an ITS architecture. An ITS architecture can be a tool to compile ITS related agreements between stakeholder agencies within a region.

Table 2: ITS Service Areas

Service Area	Description
Commercial Vehicle Operations (CVO)	Addresses the management of the efficiency, safety, and operation of commercial vehicle fleets and the movement of freight.
Data Management (DM)	Addresses the management of data that can be used by transportation agencies to support transportation planning, performance monitoring, safety analysis, and research.
Maintenance and Construction (MC)	Addresses the monitoring, maintaining, improving, and managing of the roadway physical condition and its associated infrastructure equipment.
Parking Management (PM)	Includes parking space management and the electronic payment for parking.
Public Safety (PS)	Includes emergency operations/management centers, improved information sharing among traffic and emergency services, AVL systems on emergency vehicles, traffic signal preemption for emergency vehicles, and wide-area alerts.
Public Transportation (PT)	Addresses the management, operations, maintenance, and security of public transportation.
Support (SU)	Includes data distribution, map management, and vehicle maintenance.
Sustainable Travel (ST)	Includes systems that monitor emissions and adjusted traffic signal timings to reduce emissions generated by vehicles.
Traveler Information and Personal Mobility (TI)	Includes the broadcasting of traveler information about the transportation network both prior to and during their trips.
Traffic Management (TM)	Addresses the management of the movement of vehicles, travelers, and pedestrians. Includes information collection, dissemination, and processing for the surface transportation system.
Vehicle Safety (VS)	Addresses the safety for automated, connected, and non-equipped vehicles. Includes the enhancement of safety, security, and efficiency in vehicle operations by warning and assisting travelers.
Weather (WX)	Addresses activities that monitor and notify users and transportation network managers of weather and environmental conditions that have an impact on the road transportation network.

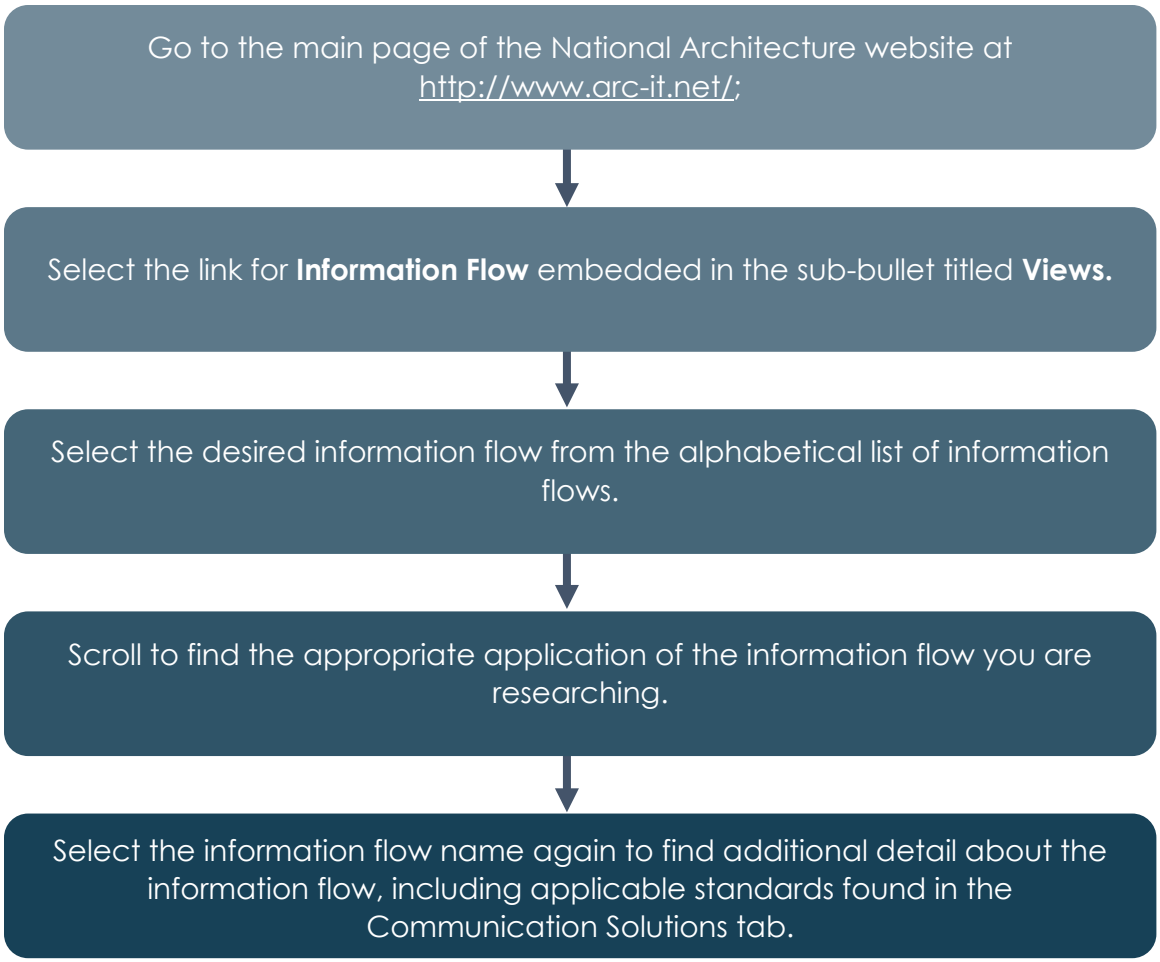


Figure 4: Steps to View the National ITS Architecture Website Standards

RAD-IT

Regional Architecture Development for Intelligent Transportation (RAD-IT) is a software application developed by the United States Department of Transportation (USDOT) to create, maintain, and implement ITS architectures. Version 9.3 of RAD-IT was released in December 2024 and was developed to support Version 9.3 of the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT), the National ITS Architecture framework. The Systems Engineering Tool for Intelligent Transportation (SET-IT) Version 9.3 can be used to generate service package diagrams for an ITS architecture and could be used in greater detail by agencies to develop project architectures for ITS deployments, pilots, and test beds. Both FHWA and FTA recommend using RAD-IT and SET-IT software in development of ITS architectures. Therefore, Version 9.3 of RAD-IT and SET-IT were utilized for the 2025 update of the H-GAC ITS Architecture.

Online Interactive ITS Architecture

RAD-IT generates and organizes an Interactive ITS Architecture database of all the components of an ITS architecture, including subsystems, data flows, interconnections, and functional requirements. The Interactive ITS Architecture allows users to easily identify applicable standards and ensure system implementations align with established guidelines.

3

REGIONAL ITS INVENTORY

3. REGIONAL ITS INVENTORY

The Houston-Galveston MPA has already deployed several ITS projects, programs, and initiatives that come from multiple agencies and cover a range of transportation modes. During the stakeholder interviews and workshop, each stakeholder identified key existing and planned ITS deployments, and larger ITS efforts underway.

Existing and Planned ITS Deployments

Table 3 shows the ITS Deployment Inventory by stakeholder. In many cases, an existing ITS deployment may still need enhancement to attain the stakeholder's desired service level. This inventory contains a majority of elements included in the ITS Architecture Plan.

Following **Table 3**, a summary of each stakeholder agency in the table is provided. A detailed list of elements within the H-GAC ITS Architecture is included in **Appendix B**.

ITS Inventory in the Interactive ITS Architecture

All ITS elements in the H-GAC ITS Architecture can be found in the online **Interactive ITS Architecture**. To access the ITS elements, select the **Inventory** link on the left side bar of the **Interactive ITS Architecture**. To search by stakeholder, select **By Stakeholder**.

H-GAC.COM/ITS-ARCHITECTURE

Table 3: H-GAC ITS Deployment Inventory

Agency	Freeway and Arterial Applications																		Transit Applications										
	Archived ITS Data	Bluetooth Detection	CCTV Cameras	Centralized Traffic Signal Control Systems	Dynamic Message Signs (DMS)	Electronic Toll Collection	Emergency Vehicle Signal Preemption	Flood Monitoring Roadside Equipment	Freeway Safety Service Patrol	Lane Control DMS	Parking Management Systems	Pedestrian Hybrid Beacons	Portable Changeable Message Signs (PCMS)	Railroad Detection and Notification System	Real-Time Traveler Info. Website/Mobile Data	Road Weather Information Systems (RWIS)	Smart Work Zones	Traffic Management/Operations Center	Vehicle Detection - Freeways	Archived Transit Data	Automated Fare Payment	Automated Passenger Counters	Bus Rapid Transit	On-Board CCTV Cameras	Real-Time Traveler Info. at Transit Centers/Stops	Real-Time Traveler Info. Website/Mobile Data	Transit Operations Center	Transit Security Systems	Transit Signal Priority	Transit Vehicle Tracking
State and Regional																													
TxDOT Beaumont District	●		●	●	●			●					●		●	●	○	●	●										
TxDOT Houston District	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●										
Harris County Toll Road Authority			●		●	●												●											
H-GAC						●			●																				
Port Freeport																													
Port Houston					●																								
Municipal																													
City of Baytown				●																									
City of Galveston		●	●	●			○								●														
City of Houston	●	●	●	●	●		●				●	●		●	●	●		●											
League City		●	●	●											●			○											
Missouri City		●	●	●	●		●								●			●											
City of Pearland		●	●	●			●								●			●											
City of Sugar Land		●	●	●	●		●							●	●			●											
Texas City				●																									
County																													
Brazoria County			●	●		●	●																						
Chambers County				●																									
Fort Bend County			○	●			●	○				○			○	○		○											
Galveston County				●																									
Harris County			●	●			●			●				●		●		●											
Liberty County				●																									
Montgomery County				●																									
Waller County				●																									
Transit																													
Fort Bend County																			●	●	●				●	●	●		●
Harris County Transit																			●	●	●		●		●	●	●		●
Houston METRO																			●	●	●	●	●	○	●	●	●	●	●
The Woodlands Regional Transit Authority																			●	●	●				●	●	●		●

● Existing ○ Planned

City of Baytown

The City of Baytown Traffic Management Center (TMC) is staffed Monday through Friday from 6 AM to 4 PM. In the event of an emergency, TMC operators have remote access to closed-circuit television (CCTV) camera feeds for after hour events if needed. The City of Baytown TMC manages ATMS software, which allows operators to control the CCTV cameras on SH 146, North Main Street, and Garth Road.

CCTV Camera Coverage – The City of Baytown is increasing its surveillance coverage of its transportation network by installing CCTV cameras at almost all signalized intersections. .The City of Baytown expressed the need to install additional CCTV cameras on water towers or other high vantage points to monitor bridge conditions during weather events.

City of Galveston

The City of Galveston recently received a Strengthening Mobility and Revolutionizing Transportation (SMART) grant from USDOT for a pilot project on Seawall Boulevard. The City will use this grant to interconnect synchronize traffic signal timing along the corridor from 57th Street to 12th Street.

Parking Availability System – The City of Galveston highlighted needs for parking availability systems near the Port of Galveston, and within the city to provide information to travelers.

Emergency Vehicle Signal Preemption – As a future long-term goal, the City of Galveston wants to deploy signal preemption on traffic signals for fire and emergency vehicles.

City of Houston

The City of Houston utilizes advanced traffic management system software to actively monitor and operate traffic signals, dynamic message signs (DMS), field sensors, and CCTV cameras. The City of Houston is a partner of Houston TranStar, which operates as the Greater Houston Transportation and Emergency Management Center.

CCTV Camera Coverage – The City of Houston owns and operates an extensive network of CCTV cameras, deployed at all major intersections. To complete the network additional cameras must be installed at minor intersections, flood-prone areas, and midblock.

Data Gathering – The City of Houston gathers data useful to their traffic management system. The City collects travel time data via Bluetooth and speed and count data via microwave detection. They also utilize data sources such as Streetlight, INRIX, and HERE technologies.

League City

League City operates an extensively connected traffic signal system, with emergency vehicle preemption installed. League City also deployed CCTV cameras at signals, and camera feeds are shared with the police and fire departments.

Traffic Management Center – League City does not have a standalone TMC, however. the League City traffic supervisor can view CCTV camera feeds on video screens in the office. Once

staffing and additional space are available, League City plans to staff a TMC during business hours.

Missouri City

In 2024, Missouri City worked on upgrading traffic signal cabinets and installing enhanced CCTV cameras and DMS. Missouri City operates a TMC at the City Hall complex on Texas Parkway.

Communication Systems – Missouri City received funding from H-GAC to upgrade their communications systems. The funding will be used to install communications towers and fiber expansion. Missouri City's installed fiber is not connected, so they rely on radio to communicate between intersections.

City of Pearland

The City of Pearland operates a TMC managed by City staff. The TMC operates CCTV cameras for viewing live traffic. The City of Pearland recently upgraded its traffic signal detection system, and their cameras now have detection with integrated radar.

Emergency Vehicle Preemption – The City of Pearland deployed a GPS-based emergency preemption system on signals, ambulances, and fire trucks.

Fiber Network – The City of Pearland operates an extensive fiber communications network, done by incorporating fiber installation into all roadway construction projects during the last 15 years.

City of Sugar Land

The City of Sugar Land utilizes many ITS devices on its transportation network. All traffic signals are equipped with CCTV cameras. Traffic signals and emergency vehicles were recently upgraded to GPS-based emergency vehicle preemption. The City of Sugar Land's TMC has over 20 screens and is operated by two operators from 6 AM through 7 PM on weekdays and remotely on Saturdays from 10 AM through 3 PM. All 311 calls within the City of Sugar Land are forwarded to operators at the TMC.

Video Detection – The City of Sugar Land deployed the NO TRAFFIC system, which uses radar video-based detection and Vision AI. The system can detect stalled vehicles, police presence, red light running, and pedestrians. The City of Sugar Land will implement this technology at 92 intersections.

ITS website – The City of Sugar Land manages a publicly available ITS website. On it, the City posts emergency weather event information, construction and maintenance activities, DMS messages, CCTV camera video feeds, rail crossing statuses, and flood gauges.

Rail Monitoring System – The City of Sugar Land is working with the Texas A&M Transportation Institute (TTI) to upgrade their railroad monitoring system to an AI/video-based solution. The current monitoring system receives a notification from the preemption. This system tells when the crossing is occupied, but not if a train is stopped. The new system will detect when a train is stopped and blocking the crossing then notify to emergency services and the public.

COUNTY AGENCIES

Brazoria County

Brazoria County has deployed CCTV cameras and emergency vehicle preemption at signals they operate and maintain. Brazoria County works in close partnership with the City of Pearland and TxDOT on traffic operations within the County.

School Zone Flashers – Brazoria County operates and maintains school zone flashers with wireless communications. The school zone flashers can be accessed via website to update flasher timings as needed and directed by the school district.

Chambers County

Chambers County operates a traffic signal system. Chambers County utilizes a portable DMS during maintenance and construction events. The County would like to install road weather information systems (RWIS) in the future, as weather monitoring is a need.

Fort Bend County

Fort Bend County is in the process of setting up a TMC in their public transportation building. Fort Bend County is also currently installing CCTV cameras and emergency vehicle preemption systems.

Wireless Communications Project – Fort Bend County Wireless Communications ITS deployment project will include 20 communication towers, the planned County TMC, 120 traffic signals, and CCTV cameras at all intersections.

Galveston County

Galveston County does not operate or maintain any ITS equipment. The County utilizes TxDOT's still frame CCTV camera website to view and monitor traffic within Galveston County.

Harris County – Harris County

utilizes advanced traffic management system software to actively monitor and operate traffic signals, field sensors, CCTV cameras, school zone flashers, emergency vehicle preemption, and railroad preemption signals. Harris County is also a partner with Houston TranStar.

Flood Warning Technology – Harris County completed a planning study for emergency systems, funded by a SMART Grant from the USDOT, which explored new technologies that can review flood levels. Harris County is working with the USDOT to install equipment at high flooding locations.

Liberty County

Liberty County maintains traffic signals and utilizes TxDOT's still frame CCTV camera website to view and monitor traffic.

Montgomery County

Montgomery County operates one DMS and no other ITS equipment. The County utilizes TxDOT's still frame CCTV camera website to view and monitor traffic within Montgomery County.

Waller County

Waller County maintains one traffic signal. The County utilizes

TxDOT's still frame CCTV camera website to view and monitor traffic.

REGIONAL AGENCIES

Harris County Transit

Harris County Transit utilizes Passio Technologies to manage automated vehicle locations (AVL) and automated passenger counters. The Passio Go Application notifies travelers when the bus will arrive. Harris County Transit buses have Wi-Fi on board for travelers.

CCTV Camera Coverage – Harris County Transit buses are equipped with CCTV cameras both inside and outside of the bus. CCTV camera footage is recorded in the event of an incident.

Automated Stop Announcements – Harris County Transit buses have automated stop announcements for riders and travelers outside the bus.

Regional Mobile Ticketing – Harris County Transit partnered with Houston METRO and Fort Bend County Transit on a regional connectivity project which includes a mobile ticketing application. The application allows travelers to purchase tickets for all three transit agencies.

Houston-Galveston Area Council

H-GAC manages the Gulf Coast Regional Tow and Go Program through funding provided by the FHWA and TxDOT. Tow and Go safely moves stalled vehicles on Houston's freeways to a nearby safe location off the freeway. Tow and Go contracted vendors will also help travelers change a flat tire.

Houston METRO

Houston METRO has developed an extensive ITS network within their transit operations which includes AVL, automated passenger counters, security cameras, and transit signal priority. Through the ConnectSmart project, Houston METRO provides trip planning to travelers.

Regional Mobile Ticketing – Houston METRO developed a regional mobile ticketing application to allow travelers using multiple transit agencies to use a singular payment system.

Project BOOST – Project BOOST is a Houston METRO initiative that will provide next bus arrival information at transit centers. DMS are being installed at every bus stop as part of Project BOOST. Additionally, Houston METRO is relocating transit stops from located before a signal to located after a signal to allow right turning vehicles to continue without delay.

Port Freeport

The Port of Freeport does not operate or maintain any ITS deployments. The Port of Freeport utilizes its website to notify the public of closures or emergencies.

Port Houston

Port Houston does not currently operate or maintain any ITS deployments. Port Houston is part of a project in conjunction with Seabrook and TxDOT which will include a DMS to provide

traveler information to commercial vehicles of alternate routes.

TxDOT Houston District

The TxDOT Houston District has implemented several emerging technologies and strategies along its facilities to actively monitor traffic operations. The TxDOT Houston District has completed Tier One projects which include installing fiber, DMS, CCTV cameras, and detection along all Tier One roadways. The TxDOT Houston District is upgrading all DMS to full-color DMS.

ConnectSmart – The ConnectSmart project began in 2019 with a goal to reduce congestion and provide mobility options for commuters within Houston-Galveston MPA. The ConnectSmart project provides mobility on demand services, where TSMO notifications are sent to users. ConnectSmart recently integrated with Houston METRO to provide trip planning services. Key features of the ConnectSmart app include school zone information for drivers, Tow and Go requests, parking information, and railroad crossing information.

Ramp Metering – The TxDOT Houston District is upgrading existing ramp meters with new controllers and software within Harris County.

TxDOT Beaumont District

The TxDOT Beaumont District maintains about 200 signals, and roughly twenty percent of them have communications. The TxDOT Beaumont District also maintains CCTV cameras and DMS. The TxDOT Beaumont District TMC, located at their headquarters, is staffed during regular business hours.

Truck Parking Availability Systems – The TxDOT Beaumont District is part of the IH 10 Corridor Coalition TPAS project. Through this TxDOT project, two TPAS will be installed along IH 10 in the TxDOT Beaumont District.

Woodland Regional Transit Authority

Woodland Regional Transit Authority has developed an extensive ITS network within their transit operations which includes AVL, automated passenger counters, security cameras, and transit signal priority. The Woodlands Regional Transit Authority bus routes are available to Google users.

Town Center Trolley – The Woodlands Regional Transit Authority also operates a trolley system. Through the Town Center Trolley application, riders can view estimated arrival times, trolley location, stop information, and service alerts.

Existing Stakeholder Agency Agreements

Interfaces and information flows among public and private entities in the region will require agreements among agencies that establish parameters for sharing agency information. These agreements will support traffic management and incident management, provide traveler information, and perform other functions identified in the ITS Architecture.

It is likely that formal agreements between agencies will be needed in the future if they do not already exist. These agreements should outline specific roles, responsibilities, data

exchanges, levels of authority, and other facets of regional operations. Some agreements may also outline specific funding responsibilities, where appropriate and applicable.

Agreements should avoid being specific regarding technology, when possible. Technology is likely to change, and changes to technology could require an update to the agreement. The agreement should focus on agency responsibilities and types of information that need to be exchanged.

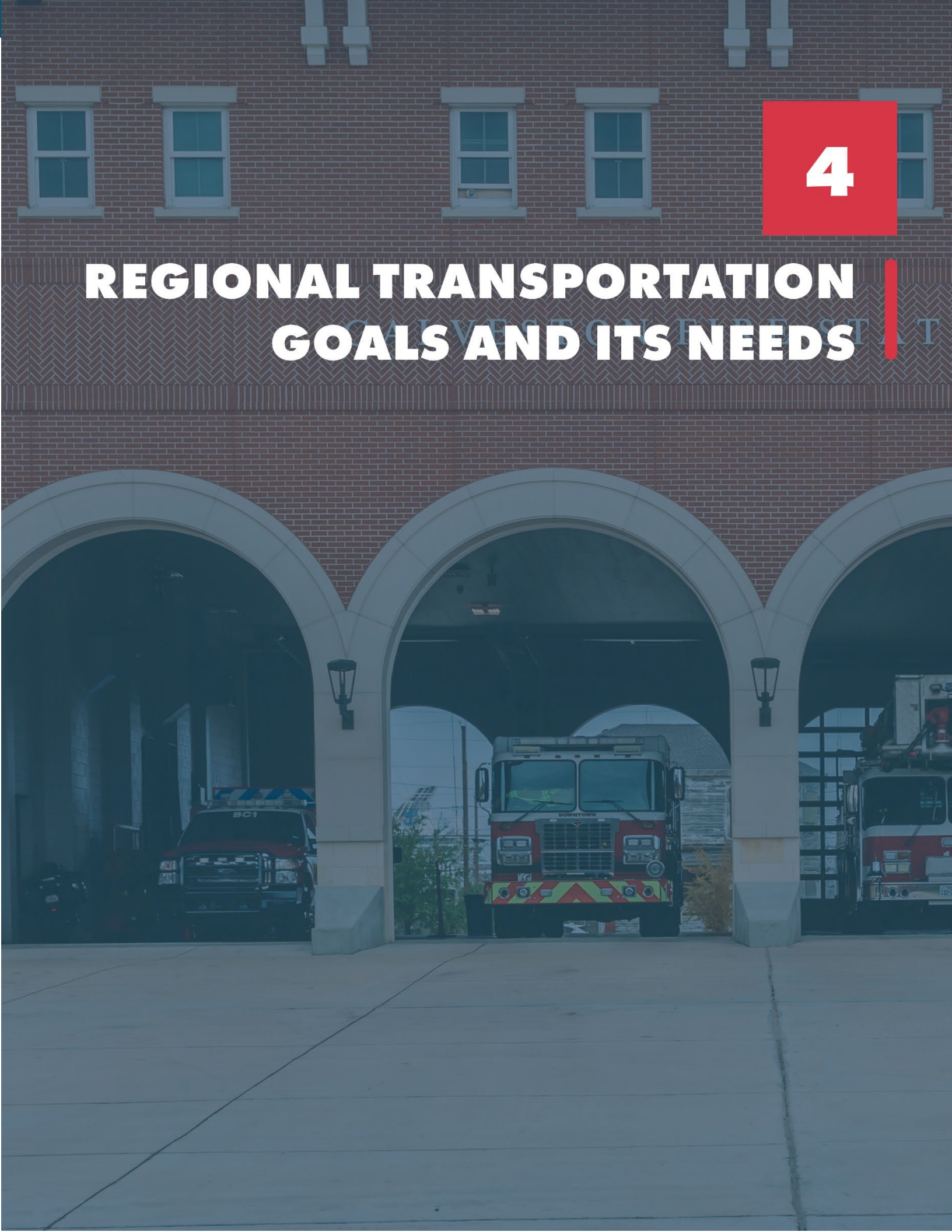
Table 4 provides a list of existing agreements between stakeholders in the Houston-Galveston MPA. As ITS services and systems are implemented in the region, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations.

Table 4: Houston-Galveston MPA Stakeholder Agreements

Agreement	Description
Brazoria County/City of Pearland Signal Maintenance	Agreement between Brazoria County and the City of Pearland for the City of Pearland to maintain 11 of Brazoria County's traffic signals.
Harris County Transit Interlocal Agreement	Harris County Transit has an interlocal agreement with the City of Baytown, the City of Galveston, Houston METRO, and the Gulf Coast Transit District to share transit information.
HCTRA Data Sharing	HCTRA shares Bluetooth data, such as traffic volume data, with TxDOT, TranStar, and TTI.
Houston METRO/Fort Bend County Transit Electronic Fare Project	Houston METRO and Fort Bend County Transit have an agreement to provide electronic fare collection through a mutual application.
TxDOT Houston District/City of Pearland Fiber Sharing	The TxDOT Houston District allows the City of Pearland to access installed fiber communications.
TxDOT Houston District/City of Sugar Land Fiber Sharing	The TxDOT Houston District allows the City of Sugar Land to access installed fiber communications.
TxDOT Houston District/Harris County Fiber Sharing	The TxDOT Houston District and Harris County allow each other to access installed fiber communications.
TxDOT Houston District/HCTRA Video Sharing	HCTRA CCTV camera video feeds are shared with the TxDOT Houston District via Lonestar.
TxDOT Houston District/Missouri City Fiber Sharing	The TxDOT Houston District allows Missouri City to access installed fiber communications.

4

REGIONAL TRANSPORTATION GOALS AND ITS NEEDS



4. REGIONAL TRANSPORTATION GOALS AND ITS NEEDS

Regional ITS needs were identified during the individual stakeholder interviews conducted between June and September 2024 and the Stakeholder Workshops held in December 2024. The H-GAC 2045 Regional Transportation Plan (RTP) Update and the TxDOT Houston and TxDOT Beaumont District's TSMO Program Plans were reviewed to determine other regional needs that could possibly be addressed through ITS. The identified needs helped determine which ITS service packages should be included in the H-GAC ITS Architecture Plan.

Regional Transportation Goals

H-GAC 2045 Regional Transportation Plan (RTP)

The 2045 Regional Transportation Plan (RTP) Update outlines five goals to achieve the overarching vision for the Houston-Galveston MPA of a safe, resilient, equitable, and reliable multimodal transportation system that contributes to a livable region.

Improve Safety – The desired outcome of improving safety is to reach zero roadway fatalities by 2050. Increasing network surveillance by utilizing CCTV cameras and vehicle field sensors can provide a live view of real time conditions to improve incident detection times. Once an incident is detected, agencies can notify the public of the incident to warn vehicles. This can deter secondary crashes from occurring. DMS may also be used to provide traveler information.

Achieve and Maintain a State of Good Repair – The desired outcome of a state of good repair is to keep roads, bridges, and transit facilities in good condition. ITS devices allow the monitoring of maintenance and construction activities. CCTV cameras can be leveraged to regularly monitor the condition of a roadway.

Move People and Goods Reliably and Efficiently – The desired outcome of moving people and goods reliably and efficiently is to provide reliable commuting options and incident response times. ITS can provide real time traveler information through DMS which can warn vehicles of delays to promote an efficient transportation network.

Strengthen Regional Economic Competitiveness – The desired outcome of strengthening regional economic competitiveness is providing reliable freight movement with alternatives to driving alone. ITS can be used to provide freight signal priority to commercial vehicles traveling through the Houston-Galveston MPA. ITS devices can also be used in HOV/HOT lane management to promote non single occupancy vehicle travel within the region.

Conserve and Protect Natural and Cultural Resources – The desired outcome of conserving and protecting natural and cultural resources to minimize impacts to natural environment and historic integrity. Traffic signals can be leveraged to implement environmentally friendly signal timings to lower the emissions.

TxDOT Transportation Systems Management and Operations (TSMO) Program Plans

TSMO is an approach that aims to improve mobility, safety, and reliability for all modes of transportation. The approach makes use of mobility solutions and ITS that can be implemented faster and at a lower cost than other projects seeking to add roadway capacity. Recognizing the need to operate the system in an integrated and coordinated fashion, the TxDOT Houston District completed its TSMO Program Plan in March 2021 and the TxDOT Beaumont District completed its TSMO Program Plan in April 2021. The TSMO Program Plans identify the strengths and needs related to transportation operations within the districts. The TxDOT Beaumont District identified six goals, and the TxDOT Houston District identified ten goals to improve operations of the transportation network. The following goals can be addressed by ITS as described:

Reliability (TxDOT Beaumont and Houston Districts) – ITS can enhance the reliability of transportation networks by improving traffic flow and reducing delays. Real-time monitoring, adaptive traffic signals, and incident detection allow for quick responses to incidents. Traveler information systems provide updates on road conditions and alternative routes, enabling travelers to make informed decisions.

Efficiency (TxDOT Beaumont and Houston Districts) – ITS can increase the efficiency of the transportation network by optimizing traffic flow. Adaptive traffic signals adjust in real-time to match demand, while incident detection systems enable quick responses to disruptions and can minimize congestion. Traveler information systems provide updates on traffic conditions and alternative routes.

Customer Service (TxDOT Beaumont and Houston Districts) – ITS can provide real-time traveler information such as upcoming work zone delays, travel time comparisons, and transit vehicle locations by utilizing sensors, Bluetooth data, or AVL. This information can be disseminated via various sources such as posting on roadside field equipment like DMS, through in-vehicle messaging, sent directly to driver's personal device, or updating information on a mobile device application.

Emergency Planning (TxDOT Houston District) – ITS can be used for emergency planning and routing. Historical ITS data collected from past emergency events can be analyzed to develop strategies and improve preparedness for future incidents. This data includes traffic patterns, roadway conditions, and response times, which provide valuable insights for effective decision-making.

Traffic Incident Management (TxDOT Houston District) – ITS can be used for traffic incident management through CCTV cameras, incident detection, and traveler information dissemination. CCTV cameras provide real-time visual monitoring, which helps identify and assess incidents. Automated incident detection systems use sensors to identify sudden stoppages, which can indicate an incident. Traveler information systems, including dynamic message signs, mobile applications, and websites, keep road users informed about incidents, delays, and alternative routes.

Technology (TxDOT Houston District) – The deployment and implementation of ITS enables real-time data collection, data processing, and ultimately decision making for not only

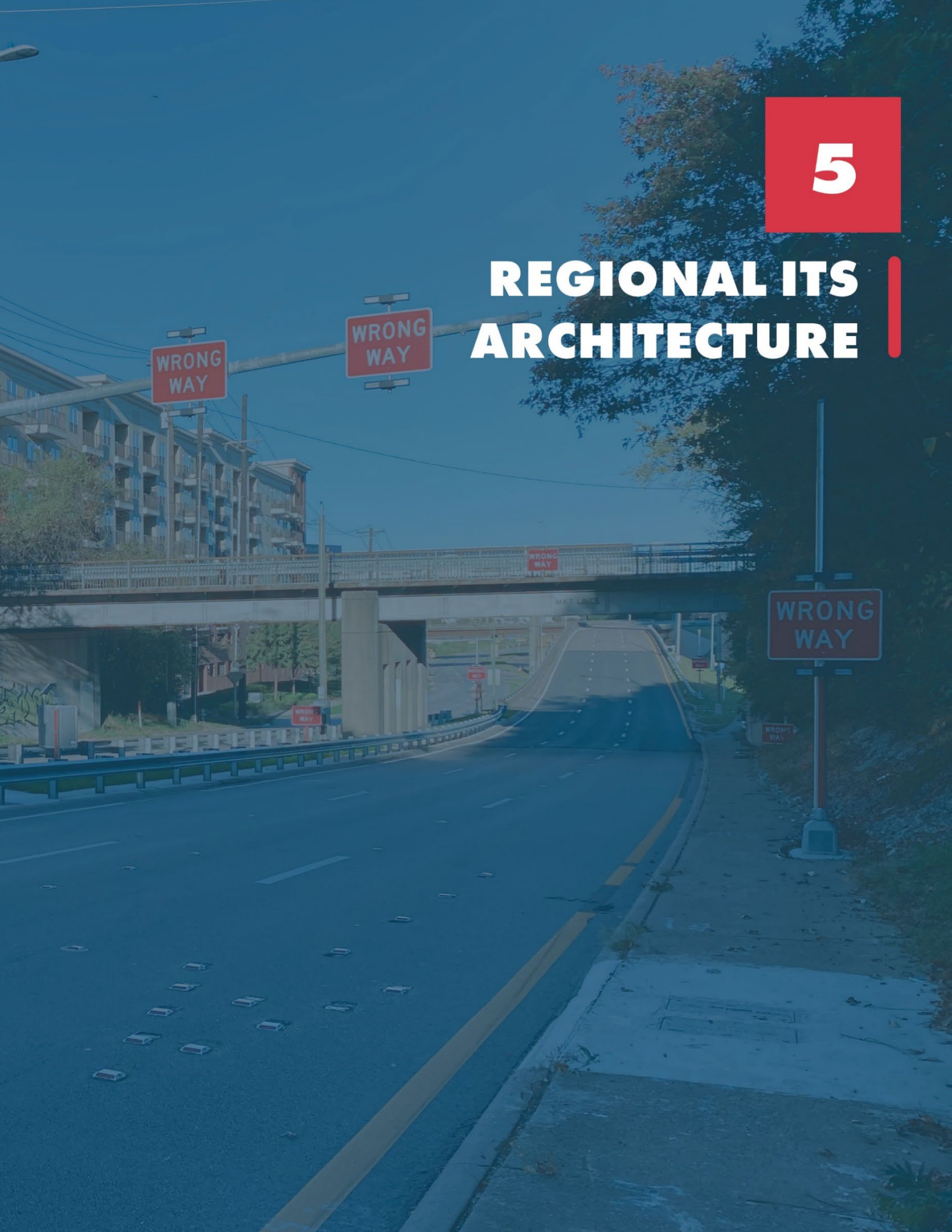
transportation agency operations staff, but for the driving public and CAVs. Additional data provides a more accurate picture of the existing traffic conditions and allows operations staff to better understand what impacts changes to the transportation network may have.

Regional ITS Needs

Regional ITS needs were identified through stakeholder input, which was gathered during individual stakeholder interviews and the stakeholder workshop. Needs were also identified through a review of the H-GAC 2045 RTP Update, the TxDOT Houston District TSMO Program Plan, and the TxDOT Beaumont District TSMO Program Plan. ITS needs for the Houston-Galveston MPA are summarized in **Table 5**, organized by ITS service area.

Table 5: Houston-Galveston MPA ITS Needs

ITS Needs	
Commercial Vehicle Operations	Deploy freight signal priority near Port Freeport and Port Houston
	Provide truck drivers with parking information and availability
Data Management	Develop data sharing agreements and expand data sharing capabilities
	Improve utilization of data through dashboards, notification, and automation
	Develop CCTV camera sharing network to share live video feeds
	Expand fiber communications
	Share fiber network where appropriate
Parking Management	Provide parking availability information for vehicles
Public Safety	Expand emergency vehicle signal preemption
Public Transportation	Install transit signal priority
	Develop a regional transit fare application
Traffic Management	Improve traffic signal timing and coordination between jurisdictions
	Expand the CCTV camera network
	Expand the DMS network (including color and arterial DMS)
	Deploy railroad monitoring system that provides notification of blockages
	Deploy wrong way driving detection and alert systems
	Improve traffic incident management
Weather	Deploy road weather information (RWIS) for flooding



5

REGIONAL ITS ARCHITECTURE

5. ITS ARCHITECTURE

ITS Service Packages

Stakeholders reviewed the National ITS Architecture and selected ITS service packages based on the relevance of the functionality to the Houston-Galveston MPA and individual agencies.

Selection and Prioritization of Service Packages

Stakeholders selected 58 different ITS service packages for implementation, identified in **Table 6** and organized by the applicable service area. National ITS Architecture service areas represent general categories of ITS service packages, such as maintenance and construction, public transportation, and traffic management.

Customization of ITS Service Packages

After selecting the ITS service packages, the packages were customized to reflect the unique systems, subsystems, and terminators in the Houston-Galveston MPA. The customized ITS service packages and ITS service package diagrams are available in the online Interactive ITS Architecture.

ITS service packages represent a service that will be deployed as an integrated capability. Each ITS service package is shown graphically with the service package name, agencies involved, and desired data flows. The data flows are shown as either existing, planned, or future. Data flows shown as existing indicate that the connection exists in at least one location within the jurisdiction. Data flows shown as existing should not be interpreted to mean that deployment of that service is complete, as there are many cases where a data flow exists in a service, but a need has been identified to expand the service to additional locations. Planned flows indicate a connection that is in the process of being established or has funding procured. Future flows indicate that the stakeholder has expressed interest in creating the connection but does not have concrete plans developed or dedicated funding to do so.

ITS Service Packages in the Interactive ITS Architecture

All ITS service packages that were customized for the H-GAC ITS Architecture can be found in the online **Interactive ITS Architecture**. To access the ITS service packages, select the **Services** link on the left side bar of the **Interactive ITS Architecture**, then click on the desired ITS service package. To see the ITS service package diagram, select the link below **Diagram**.

H-GAC.COM/ITS-ARCHITECTURE

Table 6: ITS Service Package Prioritization by Service Area

High Priority Service Packages | Medium Priority Service Packages | Low Priority Service Packages

Commercial Vehicle Operations

- CVO05 Commercial Vehicle Parking
- CVO06 Freight Signal Priority

Data Management

- DM01 ITS Data Warehouse
- DM02 Performance Monitoring

Maintenance and Construction

- MC06 Work Zone Management
- MC08 Maintenance and Construction Activity Coordination
- MC05 Roadway Maintenance and Construction
- MC01 Maintenance and Construction Vehicle and Equipment Tracking
- MC02 Maintenance and Construction Vehicle Maintenance

Parking Management

- PM01 Parking Space Management
- PM03 Parking Electronic Payment
- PM02 Smart Park and Ride System
- PM04 Regional Parking Management
- PM06 Loading Zone Management

Public Safety

- PS01 Emergency Call-Taking and Dispatch
- PS02 Emergency Response
- PS03 Emergency Vehicle Preemption
- PS08 Roadway Service Patrols
- PS10 Wide-Area Alert
- PS13 Evacuation and Reentry Management
- PS12 Disaster Response and Recovery
- PS14 Disaster Traveler Information

Public Transportation

- PT01 Transit Vehicle Tracking
- PT02 Transit Fixed-Route Operations
- PT03 Dynamic Transit Operations
- PT04 Transit Fare Collection Management
- PT05 Transit Security
- PT08 Transit Traveler Information
- PT09 Transit Signal Priority
- PT06 Transit Fleet Management
- PT07 Transit Passenger Counting
- PT11 Transit Pedestrian Indication
- PT14 Multi-modal Coordination

Sustainable Travel

- ST06 HOV/HOT Lane Management

Traffic Management

- TM01 Infrastructure-Based Traffic Surveillance
- TM03 Traffic Signal Control
- TM05 Traffic Metering
- TM06 Traffic Information Dissemination
- TM07 Regional Traffic Management
- TM08 Traffic Incident Management System
- TM10 Electronic Toll Collection
- TM25 Wrong Way Vehicle Detection and Warning
- TM04 Connected Vehicle Traffic Signal System
- TM13 Standard Railroad Grade Crossing
- TM16 Reversible Lane Management
- TM17 Speed Warning and Enforcement
- TM20 Variable Speed Limits
- TM24 Tunnel Management

Traveler Information and Personal Mobility

- TI01 Broadcast Traveler Information
- TI02 Personalized Traveler Information
- TI07 In-Vehicle Signage

Vehicle Safety

- VS08 Queue Warning
- VS17 Automated Vehicle Operations
- VS07 Road Weather Motorist Alert Warning
- VS09 Reduced Speed Zone Warning / Lane Closure

Weather

- WX01 Weather Data Collection
- WX02 Weather Information Processing and Distribution
- WX03 Spot Weather Impact Warning

The 2025 update of the H-GAC ITS Architecture Plan includes ITS service package instances for specific agencies within the region, including instances for the following agencies: TxDOT Houston, TxDOT Beaumont, Harris County, City of Houston, Houston METRO, Harris County Transit, Fort Bend County Transit, and the Woodlands Regional Transit Authority. Instances of ITS service packages are also called out for Local Agencies, which represents all cities and counties not specifically called out by an agency name. In cases where there are unique ITS service packages specific to just one agency, such as HCTRA or Port Houston, an ITS service package may also be called out for just these agencies. The status of all ITS service packages included in the H-GAC ITS Architecture Update is included in **Appendix C**, where statuses are shown as existing, planned, or future.

Regional Needs and Corresponding ITS Service Package

Table 7 identifies stakeholder needs and which ITS service packages could be implemented to address them.

Architecture Interfaces

The ITS architecture for the Houston-Galveston MPA not only identifies the various systems and stakeholders involved, but it also emphasizes the importance of connectivity between these transportation systems. To visualize these connections, the National ITS Architecture includes a system interconnect diagram that provides a high-level overview of a region's connections. The National ITS Architecture system interconnect diagram that has been customized for the Houston-Galveston MPA is shown in **Figure 5**: H-GAC ITS Architecture Interconnect Diagram. The customized system interconnect diagram is based on the system inventory and information gathered from the stakeholders. Each of the systems that are included in the H-GAC ITS Architecture have been shown in black text. Systems that are not included are shown in gray text.

Table 7: Houston-Galveston MPA Needs and Corresponding ITS Service Package

ITS Need	Corresponding Service Packages
Commercial Vehicle Operations	
Deploy freight signal priority	CVO06 Freight Signal Priority
Provide truck drivers with parking information and availability	CVO05 Commercial Vehicle Parking
Data and Information Management	
Develop data sharing agreements and expand data sharing capabilities	DM01 ITS Data Warehouse
Improve utilization of data through dashboards, notification, and automation	DM02 Performance Monitoring TM07 Regional Traffic Management
Develop CCTV camera sharing network to share live video feeds	DM01 ITS Data Warehouse TM07 Regional Traffic Management
Expand fiber network where appropriate	DM02 Performance Monitoring TM07 Regional Traffic Management
Parking Management	
Provide parking availability information for vehicles	PM01 Parking Space Management PM02 Smart Park and Ride System PM04 Regional Parking Management
Public Safety	
Expand emergency vehicle signal preemption	PS03 Emergency Vehicle Preemption
Public Transportation	
Install transit signal priority	PT09 Transit Signal Priority
Develop a regional transit fare application	PT04 Transit Fare Collection Management
Traffic Management	
Improve traffic signal timing and coordination between jurisdictions	TM03 Traffic Signal Control TM07 Regional Traffic Management
Expand the DMS network (Including color and arterial DMS)	TM06 Traffic Information Dissemination TM07 Regional Traffic Management
Deploy railroad monitoring system that provides notification of blockages	TM07 Regional Traffic Management TM13 Standard Railroad Grade Crossing
Deploy wrong way driving detection and alert systems	TM07 Regional Traffic Management TM25 Wrong Way Vehicle Detection and Warning
Improve traffic incident management	TM07 Regional Traffic Management TM08 Traffic Incident Management System
Weather	
Deploy road weather information systems (RWIS) for flood monitoring	WX01 Weather Data Collection WX03 Spot Weather Impact Warning

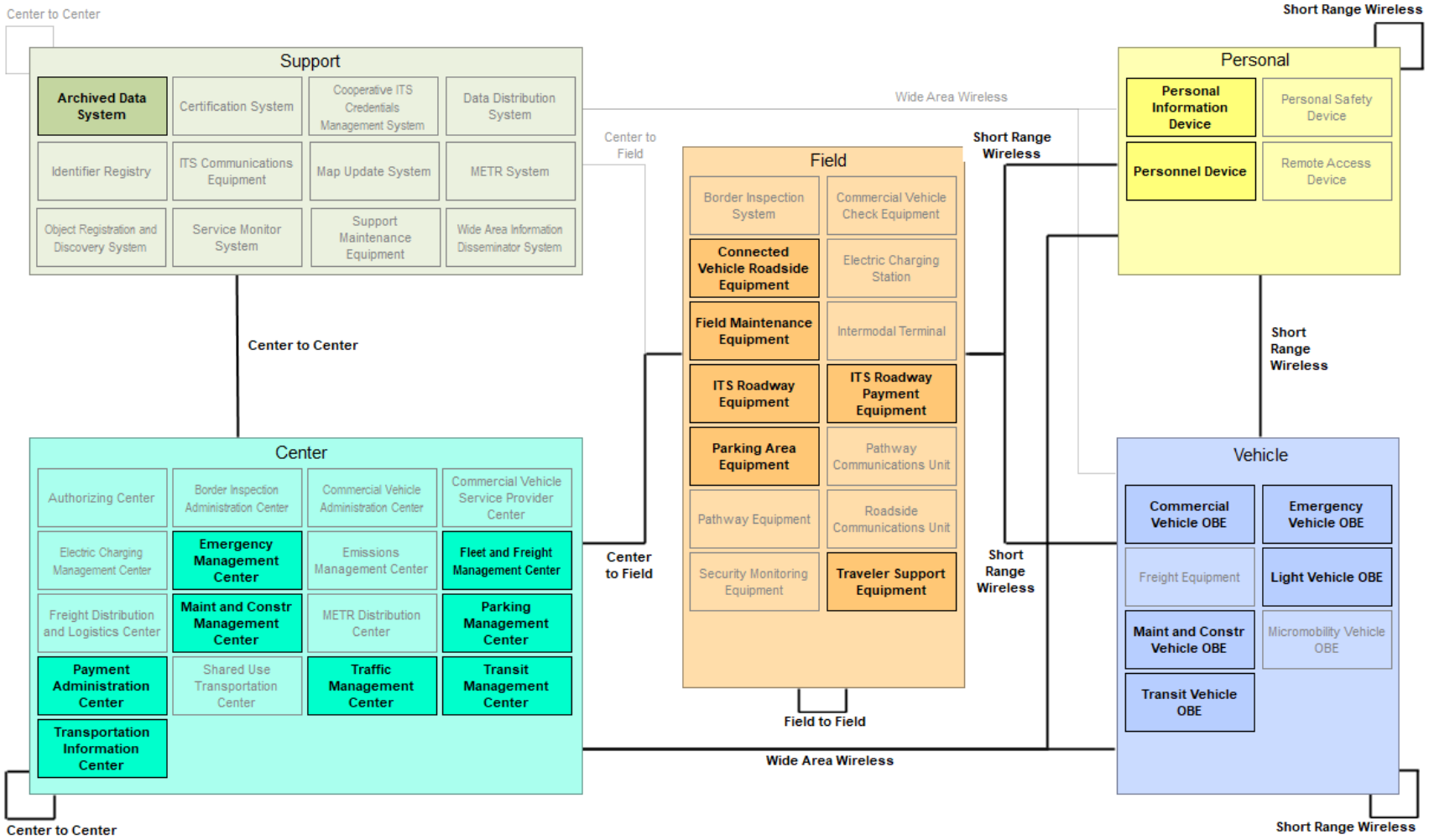


Figure 5: H-GAC ITS Architecture Interconnect Diagram

Roles and Responsibilities

In the H-GAC ITS Architecture Plan, roles and responsibilities are documented for eight separate areas, with each area describing an aspect of the operation of an interconnected, regional ITS network. The areas covered are described briefly below, but are found in more detail in the online Interactive ITS Architecture and **Appendix D**: 2025 H-GAC ITS Architecture Roles and Responsibilities.

Archived Data Systems – Operation of systems to collect and maintain archived data.

Emergency Management – Operation of systems to provide emergency call taking, public safety dispatch, and emergency operations center operations.

Freeway Management – Operation of systems to provide wrong-way driving warning, variable speed limits, service patrols, and roadside traveler information.

Incident Management – Operation of systems to provide rapid and effective response to traffic incidents. This service area includes systems to detect and verify incidents as well as coordinated agency response to the incidents.

Maintenance and Construction Management – Operation of systems to monitor and manage roadside maintenance and construction work zone activities.

Parking Management – Operations of systems for regional and local parking information dissemination.

Traffic Signal Management – Operation of traffic signal systems that react to changing traffic conditions and provide coordinated intersection timing over a corridor or an area.

Transit Services – Operation of systems to manage fleets of transit vehicles and overall transit systems more efficiently.

Traveler Information Dissemination – Operation of systems to provide static and real-time transportation information to travelers.

Roles and Responsibilities in the Interactive ITS Architecture

Roles and responsibilities in the H-GAC ITS Architecture can be found in the online **Interactive ITS Architecture**. To access the roles and responsibilities, select the **Roles and Responsibilities** link on the left side bar of the **Interactive ITS Architecture**, then click on the desired area.

H-GAC.COM/ITS-ARCHITECTURE

Standards

Standards are an important tool that will allow efficient implementation of the elements in the H-GAC 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.

The ITS standards that could apply to the H-GAC ITS Architecture are available in the online Interactive ITS Architecture. These standards are based on the physical ITS architecture flows identified in the customized ITS service packages for the Houston-Galveston MPA.

Standards in the Interactive ITS Architecture

Relevant standards in the H-GAC ITS Architecture can be found in the online **Interactive ITS Architecture**. To access the standards, select the **Standards** link on the left side bar of the **Interactive ITS Architecture**, then click on the desired Standard title.

H-GAC.COM/ITS-ARCHITECTURE

RAD-IT Database

The USDOT RAD-IT Version 9.3 was used to generate the H-GAC ITS Architecture and generate the ITS service package diagrams and other pieces of the ITS Architecture discussed in this section. The RAD-IT database can be downloaded directly from H-GAC's website. To access the file, it is recommended that the user download the free RAD-IT software directly from the USDOT National ITS Architecture website. Version 9.3 or newer will be required to view the H-GAC ITS Architecture RAD-IT database.

RAD-IT Database

The **RAD-IT** database can be downloaded directly from the H-GAC ITS Architecture website under the **ITS Architecture** section.

H-GAC.COM/ITS-ARCHITECTURE

6

REGIONAL ITS DEPLOYMENT PLAN

6. ITS DEPLOYMENT PLAN

The ITS Deployment Plan section identifies regionally significant ITS projects and programs in the Houston-Galveston MPA to achieve desired ITS functionality. The ITS Deployment Plan section expands upon the ITS Architecture by providing recommendations and strategies for projects and programs in the region, potential stakeholders involved, and proposed timelines for implementation. The section also connects each regional project and program to the ITS Architecture by identifying ITS service packages that correspond to respective projects and programs.

Project and Program Development

The ITS Deployment Plan section provides stakeholders with a comprehensive list of regional significant ITS projects and programs that align with the ITS Architecture, aim to address transportation needs in the Houston-Galveston MPA, and impact multiple agencies. ITS projects and programs identified aim to address ITS functionality of the region altogether. The included projects represent the desired implementations of stakeholders, although funding will still be required to bring these projects to fruition. This plan focuses primarily on larger, multi-agency, regional projects. Many of the stakeholders in the region have plans to expand existing system or add new systems within their agencies. These existing and planned systems are presented in the Regional ITS Inventory section of this report.

Each of the projects and programs recommended in the ITS Deployment Plan were checked against the H-GAC ITS Architecture to ensure they are in conformance. This should assist agencies deploying these projects in the future with meeting FHWA and FTA requirements for ITS architecture conformity. The projects in the plan could also feed into the long-range planning process and provide H-GAC with a list of priority ITS projects for consideration during future calls for projects.

Recommended Projects and Programs

Stakeholders identified eight regionally significant ITS deployment projects and programs for ITS in the Houston-Galveston MPA. These projects do not encompass all the regional ITS needs within the region, however stakeholders recommended that emphasis be placed on these eight to provide the greatest benefit to travelers. The eight projects and programs included are:

- Expand CCTV Camera DMS Coverage on Freeways and Arterials
- Develop Regional CCTV Camera Video Sharing System
- Deploy Regional Railroad Crossing Detection and Notification Systems
- Expand Regional Transit Rider Application
- Expand Fiber Optic Communication Network
- Improve Signal Timing on Arterials and Across Jurisdictional Boundaries
- Automate Operations Capabilities (Includes Data Sharing)
- Increase Staffing for ITS

For each, a summary is provided with:

Basis of Need – Describes how the regional deployment project or program meets one or more of the regional ITS needs that were identified in the ITS Architecture Plan.

Project/Program Description – High level overview of the project or program and how it might be implemented.

Benefits – Potential benefits that might be realized with implementation of the project or program.

Timeframe – Describes the approximate timeframe it may take to develop and implement each project.

- **Short-Term:** Within the next five years
- **Medium-Term:** Within the next six to ten years
- **Long-Term:** Anything over ten years

Lead and Supporting Agencies – The agencies identified as most likely to lead and support the implementation of the project or program.

Relevant ITS Service Packages – The ITS service packages identified in the ITS Architecture Plan that support this implementation and should be used to show ITS architecture conformity if federal funding is being used. These ITS service packages can also be used to support the development of a systems engineering analysis.

Expand CCTV Camera and DMS Coverage on Freeways and Arterials

CCTV camera and DMS coverage on freeways and arterials is becoming increasingly necessary due to growing traffic demands and the need for more efficient traffic management systems. While the region has good coverage of CCTV cameras and DMS on freeways, continued expansion of coverage on freeways and additional deployments on arterial roads offers numerous benefits for both transportation agencies and road users. The use of full color DMS should also be considered to increase visibility and provide additional messaging options to agencies. This need was noted by the TxDOT Beaumont District, stating they would like future ITS projects to include full colored DMS along IH 10 to provide additional information to travelers.

Basis of Need

Many H-GAC stakeholders highlighted the need to expand CCTV camera and DMS coverage on freeways and arterials within the region. By monitoring traffic flow and detecting any abnormalities or bottlenecks, transportation agencies can proactively respond and implement strategies to alleviate congestion. This includes adjusting signal timings, rerouting traffic, and providing timely information to drivers through DMS.

H-GAC stakeholders in more rural sections of the region also noted the lack of CCTV cameras on rural state highways and arterial streets limits their capabilities during major incidents such as flood events, extended construction, and closures due to crashes. The lack of DMS on these same roads limits their ability to provide information and advanced warnings to travelers.

Benefits

Expanding CCTV and DMS coverage on freeways can significantly improve traffic operations. Increasing CCTV camera coverage allows transportation agencies to monitor real-time traffic. As the transportation network grows, CCTV camera coverage should expand with it. CCTV cameras also enhance incident management. Agencies can detect and verify crashes on the transportation network and deploy emergency services promptly. Expanded DMS coverage allows for more effective communication with drivers. DMS can provide timely information about traffic conditions, incidents, and alternative routes. This expansion offers significant benefits in terms of improved traffic operations, enhanced safety for travelers and first responders in the field, and better traveler information.

Expand CCTV Camera and DMS Coverage on Freeways and Arterials

Timeframe
Mid-Term

Lead Agency
All H-GAC Stakeholder Agencies

Relevant ITS Service Packages
PS02 – Emergency Response
TM01 – Infrastructure-Based Traffic Surveillance
TM06 – Traffic Information Dissemination
TM07 – Regional Traffic Management
TM08 – Traffic Incident Management System

Related Efforts
TxDOT, Harris County, METRO and City of Houston share CCTV images through shared fiber agreements and systems at Houston TranStar. The TxDOT-managed LoneStar traffic management system (TMS) provides a single interface that provides command and control for CCTV and through which agency staff and the general public can view camera images.

Develop Regional CCTV Camera Video Sharing System

The development of a regional CCTV camera video sharing system for mobility and safety offers numerous benefits and addresses critical needs in urban environments. This integrated approach to system monitoring enhances mobility and public safety, improves traffic management, and facilitates more efficient emergency responses. A regional CCTV camera video sharing system would combine all deployed CCTV camera feeds onto one platform, regardless of ownership. This would allow agencies to view CCTV camera feeds from surrounding jurisdictions to improve traffic operations across jurisdictional boundaries.

Basis of Need

During stakeholder outreach efforts, numerous agencies expressed the need for a regional system to facilitate the sharing of high-resolution, full-motion video among all transportation agencies in the Houston-Galveston MPA. Currently, TxDOT operates Claris, a video management system that allows them to share video feeds with select agencies. There are limitations on how many agencies and cameras can be shared and TxDOT has prioritized sharing video with public safety agencies. Not all stakeholders are aware of TxDOT's live video sharing practices and may not have access to it. Furthermore, several cities within the region have their own CCTV cameras that are not integrated into TxDOT's system. These cities host their camera feeds on separate systems that are not connected to other agencies. For instance, the City of Sugar Land operates an ITS website called its.sugarlandtx.gov, which displays still frame CCTV camera images accessible to the public.

Benefits

While the initial investment in a regional CCTV system may be substantial, the long-term benefits often outweigh the costs. Shared infrastructure reduces redundancy and lowers maintenance expenses for individual municipalities. Additionally, the system's improved traffic management can lead to significant cost savings in law enforcement and transportation budgets.

A regional CCTV camera video sharing system offers a comprehensive solution to enhance both mobility and safety. By fostering collaboration between different agencies and leveraging advanced technologies, cities can create safer, more efficient urban environments that benefit all residents and visitors. The implementation of such a system represents a significant step towards smarter, more responsive cities of the future.

Develop Regional CCTV Camera Video Sharing System

Timeframe
Short-Term

Lead Agency
H-GAC

Relevant ITS Service Packages
PS02 – Emergency Response
TM01 – Infrastructure-Based Traffic Surveillance
TM07 – Regional Traffic Management
TM08 – Traffic Incident Management System

Related Efforts
TxDOT, Harris County, METRO, and City of Houston share CCTV images through shared fiber agreements and systems at Houston TranStar. The TxDOT-managed LoneStar traffic management system (TMS) provides a single interface that provides command and control for CCTV and through which agency staff and the public can view camera images.

Deploy Railroad Crossing Detection and Notification System

Railroad crossing detection and notification systems are designed to enhance safety by detecting when a train is approaching a crossing and alerting motorists of the blockage. Traditionally, these systems rely on sensors to identify train presence and deploy gates with flashing beacons to close the road automatically. Modern systems, however, incorporate advanced technologies such as cameras paired with artificial intelligence (AI) to improve detection accuracy and communication capabilities. These enhanced systems send automated notifications to operations staff, transit operators, and emergency personnel for more coordinated responses. Additionally, they can engage blank-out signs to restrict certain turning movements when a train occupies the crossing, update railroad crossing status online in real time, and support connected and automated vehicle (CAV) applications. By integrating with CAV systems, these technologies enable rerouting during extended blockages, reducing delays and improving traffic flow around railroad crossings.

Basis of Need

Multiple stakeholders within the Houston-Galveston MPA stated the need for more advanced warnings for railroad crossings. The City of Missouri City is upgrading their rail monitoring system due to recent motor vehicle and rail collisions. The City of Pearland has several at-grade railroad crossings that are blocked for up to three hours. The City of Pearland noted the need for a rail monitoring system that could notify residents when a train is blocking the roadway.

Benefits

Providing notifications of rail blockages provides several benefits to traffic management and public safety. Real-time traveler information related to blockages enables motorists and passengers to reroute, reducing congestion and travel delays. Additionally, having immediate information about blockages alerts the traffic management center to potential issues, such as equipment malfunctions or unexpected incidents, allowing for quicker responses and mitigation strategies.

Deploy Railroad Crossing and Detection Notification System

Timeframe
Mid-Term

Lead Agency
H-GAC and Cities in the H-GAC Region

Relevant ITS Service Packages
TM01 – Infrastructure-Based Traffic Surveillance
TM06 – Traffic Information Dissemination
TM13 – Standard Railroad Grade Crossing
TM15 – Railroad Operations Coordination

Related Efforts
The City of Sugar Land and Fort Bend County are collaborating with the Texas A&M Transportation Institute (TTI) through Fort Bend County to enhance their current rail monitoring system. They are working towards implementing an AI/video-based solution that will provide more comprehensive information about train activity at crossings.

Through the Safe Streets and Roads for All (SS4A) grant, the City of Houston has begun installing communications to rail crossings within the City. 71 rail crossings have been brought online through preemption sensors at intersections.

Expand Regional Transit Rider Application

A regional transit rider application is a platform that integrates multiple transit agencies within a region. A regional application provides transit users, especially commuters, with an easier travel experience by combining multiple transit options into a single interface. Key features of a regional transit rider application can include real-time transit bus tracking, route planning, schedule updates, and ticket payment. Combining multiple transit agencies into a singular application provides transit users with more efficient transportation. This would be especially convenient for commuters who must use multiple transit agencies to reach their destination.

Basis of Need

The need for a regional transit application arose during discussions with the Woodlands Regional Transit Authority. Mobile ticketing, GPS bus tracking, and consolidating transit service information on one platform were noted features. Stakeholders also identified a need to integrate fare payment.

TxDOT, in partnership with Houston METRO, developed ConnectSmart. This regional transit rider application includes an electronic fare collection system. Expansion of the system to all transit agencies, will fully provide the application noted as a need by stakeholders.

Benefits

Simplifying transit planning and fare purchasing can encourage transit use and help users identify optimal transit options for their trips. A regional application can provide real-time information, such as transit delays and vehicle locations, to allow users to make informed decisions on bus routes. Ultimately, increasing the use of transit can provide congestion benefit to the region by reducing single occupancy trips and fully utilizing transit capacity.

Expand Regional Transit Rider Application

Timeframe
Mid-Term

Lead Agency
TxDOT and Houston METRO

Supporting Agencies
Fort Bend County Transit, Harris County Transit, The Woodland Regional Transit Authority

Relevant ITS Service Packages
PT01 – Transit Vehicle Tracking
PT02 – Transit Fixed-Route Operations
PT04 – Transit Fare Collection Management
PT08 – Transit Traveler Information

Related Efforts
The ConnectSmart app, developed by the TxDOT Houston District in partnership with Houston METRO, is developing an electronic fare collection system that will be coordinated across transit agencies in the Houston-Galveston MPA. The system will incorporate trip planning and allow travelers to use a singular payment system for multiple transit agencies. The Fort Bend County Transit Authority and Harris County Transit, along with Houston Metro, are the three current participating agencies within the Houston-Galveston MPA. The City of Conroe and the City of Galveston are both in the process of joining the initiative. This centralized platform will eliminate the need for users to switch between multiple apps or websites, simplifying the process and encouraging greater usage of public transportation.

Expand Fiber Optic Communication Network

Fiber optic cable uses light to transmit data and video, allowing for greater data transfer rates and video capacity compared to other types of communication. ITS relies on fast and reliable transmission of large amounts of data and video, and fiber optic cable provides the necessary bandwidth and speed to support these requirements. This high-speed communication is essential for real-time monitoring and control of traffic, as well as for transmitting data between vehicles, infrastructure, and TMCs.

Basis of Need

As more ITS technologies are becoming available and deployed, greater communication bandwidth is needed. The City of Missouri City stated the installation of fiber optic cable within the city is a critical need, as they have issues will all radio towers that are currently deployed. With more ITS infrastructure being deployed in the Houston-Galveston MPA and the emergence of vehicle-to-infrastructure technologies, which also require high-speed communication, communication bandwidth needs are expected to continue to grow.

Benefits

Expanding fiber optic communications enhances reliability of ITS deployments as communications to the deployments are less likely to falter with fiber. Fiber optic communications can transfer large amounts of data from ITS deployments at high speeds back to a central hub. This data can include CCTV camera feeds, traffic sensors, and public transit systems. Having this information and data allows transportation agencies to make informed decisions based on real-time data.

Expand Fiber Optic Communications Network

Timeframe
Short-Term

Lead Agency
All H-GAC Stakeholder Agencies

Relevant ITS Service Packages
DM03 – ITS Data Warehouse
DM02 – Performance Monitoring
TM06 – Regional Traffic Management

Related Efforts
There is a new initiative for the City of Sugar Land to connect all city roadways with fiber optic cable. The City of Pearland is also in the process of connecting city infrastructure to fiber optic cable. Other agencies actively deploying or managing fiber networks include TxDOT, HCTRA, Harris County, League City, and Galveston.

Section 7 – Regional Communications Scan of this report also includes a map of existing fiber optic cable deployed in the Houston-Galveston MPA.

Improve Signal Timing on Arterials and Across Jurisdictional Boundaries

Improving signal timing on arterials and across jurisdictional boundaries is a crucial strategy for enhancing traffic flow, reducing congestion, and improving overall transportation efficiency. This approach offers numerous benefits and addresses several critical needs in urban and suburban areas. Improving signal timings involves analyzing traffic data along a corridor that connects multiple jurisdictions. By understanding peak hour traffic volumes, jurisdictions can then adjust signal phasing and timings to maximize traffic through intersections and reduce delay. Agencies can also synchronize traffic lights to create a series of green lights across intersections along a corridor. This will allow the continuous movement of vehicles through multiple intersections.

Basis of Need

Stakeholders in the Houston-Galveston MPA have emphasized the need for enhanced regional coordination to address transportation challenges. The City of Houston has been actively analyzing traffic data to pinpoint areas for traffic management improvements, with signal timing optimization identified as a focus. Both Port Houston and Port Freeport have highlighted the challenges of managing truck traffic flow into and out of the ports during peak hours, indicating a need for solutions to decrease congestion and improve efficiency.

Benefits

By properly coordinating the timing of traffic signals along a roadway, agencies can optimize traffic flow and minimize delays for motorists. One key benefit of optimized signal timing is the reduction of congestion. When traffic signals are synchronized, vehicles can move more smoothly through intersections, reducing the stop-and-go traffic that often leads to congestion. In addition to reducing congestion, optimized signal timing also improves overall traffic conditions. By adjusting signal timings based on traffic patterns and demand, agencies can prioritize traffic movement on major routes or during peak travel times. This can help to alleviate bottlenecks and distribute traffic more evenly across the roadway network.

Improving signal timing on arterials and across jurisdictional boundaries is a highly effective strategy for enhancing urban mobility. It addresses critical needs in congestion management and inter-jurisdictional coordination while offering substantial benefits in terms of reduced travel times, improved safety, and environmental sustainability. The high benefit-cost ratio and potential for significant fuel savings make it an attractive option for transportation agencies seeking to optimize their existing infrastructure.

Improve Signal Timing on Arterials and Across Jurisdictional Boundaries

Timeframe
Short-Term

Lead Agency
All H-GAC Stakeholder Agencies

Relevant ITS Service Packages
TM03 – Traffic Signal Control
TM07 – Regional Traffic Management

Related Efforts
Many agencies across the Houston-Galveston MPA are actively implementing improvements to their signal systems. The City of Pearland is working to install an adaptive traffic signal system along SH 35 through the city's boundaries. The City of Missouri City recently improved signal timings on Sienna Parkway and wants to add an adaptive module to the corridor. Additionally, League City received funding to install adaptive traffic signal functionality.

Automate Operational Capabilities

Automated operational capabilities in traffic management, including data sharing, have become increasingly important for improving efficiency, safety, and overall traffic flow in urban areas. These systems leverage advanced software, real-time data collection, and predictive analytics to enhance traffic operations management. Automating operational capabilities can include utilizing traffic sensors for detection and real-time traffic monitoring, adaptive traffic control, and automated traffic incident detection. Data sharing can help inform automated capabilities. Using historical traffic data to predict traffic patterns and potential congestion is a large focus.

Basis of Need

During the interview with the City of Sugar Land, the City emphasized the need for improved data management within their transportation system. The City of Sugar Land envisions a future where their transportation system is driven by data and operates proactively. They expressed the desire to have better ways to utilize crash data to identify problem areas and take appropriate actions, such as dashboards with crash hotspots and relevant statistics.

There is also a need for real-time updates on traffic delays and incidents within the Houston-Galveston MPA. Agencies would like to be able to receive live updates on any disruptions or incidents occurring within their transportation system, allowing them to respond promptly and effectively. This capability would enable them to proactively manage traffic and minimize disruptions.

Several agencies also noted challenges with funding staff for operations. Automating systems where possible can reduce the burden on staff to operate and manage systems.

Benefits

Automated systems enhance efficiency and reduce the need for staff by handling tasks such as collecting traffic data, controlling traffic signals, and managing incidents. Automation significantly enhances safety by providing real-time information on traffic incidents, enabling quicker responses. Predictive capabilities can forecast network traffic up to an hour ahead, enabling proactive measures to prevent congestion. Despite the initial investment, the long-term cost-effectiveness of automated systems is evident through optimized resource allocation and minimized need for staff to intervene in routine tasks.

Automate Operations Capabilities

Timeframe
Short to Mid-Term

Lead Agency
All H-GAC Stakeholder Agencies

Relevant ITS Service Packages
DM02 – Performance Monitoring
TM06 – Traffic Information Dissemination
TM07 – Regional Traffic Management

Related Efforts
The TxDOT Houston District, Harris County, Houston METRO and City of Houston have combined some operational systems through the Houston TranStar consortium. Elements of the TranStar system provide automated travel time messages to the traveling public via DMS and scenario management.

Increase Staffing for ITS

ITS has become increasingly vital for modern urban infrastructure, offering significant benefits in traffic management, safety, and efficiency. As these systems grow more complex and widespread, there is a pressing need to increase staffing for ITS operations, management, and maintenance. This expansion in personnel is crucial to fully realize the potential of ITS and address the challenges associated with their implementation and upkeep.

Basis of Need

As the transportation network grows, traffic management personnel needs to grow with it to manage the operations. The City of League City has recently requested funding for a TMC and additional staffing for operations and maintenance of ITS. The City of Pearland currently operates a TMC on Hillhouse Road within the City; however, they do not have dedicated operators to manage the center, and it is currently managed by City staff with other duties. The City of Baytown stated the need for more funding for ITS staff to maximize the utilization of ITS equipment. Harris County Transit stated the need for more staff to operate increasing transit operations. The City of Galveston noted it is difficult to hire staff qualified staff with existing knowledge of ITS systems. The Houston-Galveston MPA would benefit significantly from an increase in staffing.

Benefits

With more staff dedicated to ITS operations, the systems can be monitored and optimized more effectively. This leads to improved traffic flow, reduced congestion, and better overall transportation network performance. Skilled personnel can analyze real-time data, make informed decisions, and implement adaptive strategies to manage traffic more efficiently. Increased staffing ensures that ITS components, such as traffic signals, sensors, and communication systems, are kept in optimal working conditions. This improves the reliability of the entire system, reducing downtime and ensuring consistent performance.

Increase Staffing for ITS

Timeframe
Short to Long-Term

Lead Agency
All H-GAC Stakeholder Agencies

Relevant ITS Service Packages

TM07 – Regional Traffic Management

Related Efforts
The challenge of staffing for operations is not limited to the Houston-Galveston MPA. Agencies across Texas, and the U.S., have noted similar challenges with funding, hiring, and retaining staff to operate and maintain complex ITS deployments. Training programs from FHWA, Institute of Transportation Engineers (ITE), and the International Municipal Signal Association (IMSA) are available and have been effectively used in some regions to increase workforce competency.

7

REGIONAL COMMUNICATIONS SCAN

7. REGIONAL COMMUNICATIONS SCAN

As part of the 2025 H-GAC ITS Architecture Plan Update, existing and planned fiber optic communication locations were documented. Information for the communications scan was collected between June 2024 and September 2024, during a series of interviews that was a subset of the stakeholder outreach. Each stakeholder was asked if they had fiber optic cable communication existing, under construction, and/or planned to support their transportation network.

Existing Communications

Within the Houston-Galveston MPA, most agencies operate one or more of three different types of ITS communications: fiber optic cable communications, cellular communications, and radio communications. ITS communications are installed mostly to support communication with field infrastructure (including traffic signal systems, CCTV cameras, DMS, traffic data collecting devices such as microwave and radar detection, and toll equipment.) Communication systems are also used for intra-agency communication between departments that are not co-located but need to share data. **Table 8** provides an overview of the advantages, disadvantages, and best practice for each ITS communication type.

Table 8: ITS Communication Overview

ITS Communication	Advantages	Disadvantages	Best Practice
Fiber Optic Communications	• Advanced data transfer capabilities • Transmits large amounts of data over long distances • Can be installed while constructing roadways as a small percent of a project	• High cost when installed as a stand-alone project in urban areas	• Urban areas • Installed as part of roadway construction projects
Cellular Communications	• Cost effective for simple applications such as device monitoring and control	• Susceptible to regional power outages • Requires re-occurring costs	• Isolated locations with cell coverage • Short-term solution
Radio Communications	• Cost effective • Transmits data, voice, and video over long distances	• Requires line of sight • Unique maintenance skills required	• Rugged terrain • Bodies of water • Remote locations

H-GAC Fiber Communications

In discussions with agencies during the update of the H-GAC ITS Architecture Plan, nearly every agency expressed a desire to deploy or expand their fiber optic communications network. Cost was usually identified as the biggest barrier to deployment, although several agencies were considering fiber-sharing opportunities to partner with other agencies and

share access to fiber to share costs. Agencies were asked to share any plans for locations of future fiber deployments, but only the TxDOT Houston District had specific locations identified for deployment of fiber (all of which were currently under construction.) The locations where the TxDOT Houston District is currently deploying fiber optic cable are included in the map in **Figure 6**: H-GAC Existing Fiber Communications**.**

City of Pearland Case Study

The City of Pearland began development of their fiber network in 2011. The initial goal was to connect buildings housing essential City services, such as City Hall and the Fire Department, through a high-bandwidth and reliable communications system. As fiber coverage expanded, the City realized the benefits of integrating municipal buildings and infrastructure together, prompting a more aggressive deployment of additional fiber.

To accelerate fiber deployment, the City of Pearland targeted fiber conduit installation on all new roadway construction and roadway rehabilitation projects. This approach was cost-effective and less disruptive since it did not require new construction. At a minimum, the City deploys empty conduit during construction, but often includes fiber, given its relatively low cost compared to road construction.

The City built redundancy into the system, minimizing the impact of future fiber damage. There have been only three incidents of underground fiber damage and six incidents of above-ground fiber damage in the City of Pearland. Fortunately, redundant loops in the fiber system have prevented communication disruptions, highlighting the importance of a robust fiber network to the City Council.

Fiber communications have proven invaluable for the City of Pearland, especially during emergencies and severe weather events. Underground fiber is not affected by high winds, and the City has rarely had issues with floods disrupting service. The fiber network provides sufficient bandwidth and reliability to monitor and continuously record CCTV camera feeds, determine which roads are flooded, and monitor the transportation system during storms and hurricanes. The Police Department has also benefited, using high-quality video from CCTV cameras for tracking vehicles and notifying officers of their locations.

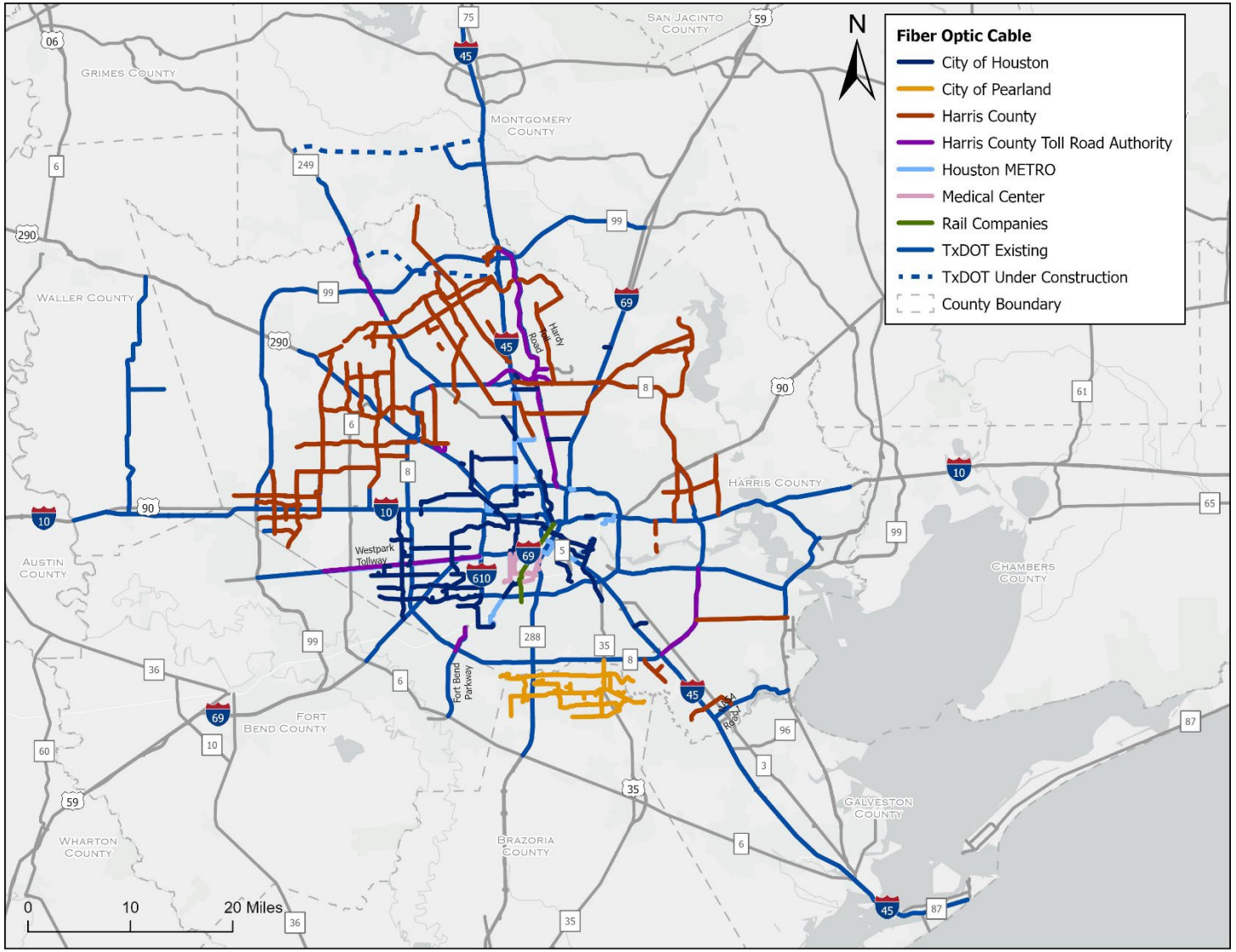


Figure 6: H-GAC Existing Fiber Communications

8
USE AND MAINTENANCE OF THE REGIONAL ITS ARCHITECTURE
H-TOWN
HOUSTON TEXANS
nrg stadium
STOP

8. USE AND MAINTENANCE OF THE ITS ARCHITECTURE

With the growth of the region, needs will change and as technology progresses, new ITS opportunities will arise. Shifts in regional needs as well as changes in the National ITS Architecture will necessitate periodic updates to the H-GAC ITS Architecture Plan. As projects are developed and deployed, it will be important those projects conform to the ITS Architecture Plan so they are consistent with both the region's vision for ITS and national standards. In some cases, if projects do not conform, it may be necessary to modify the ITS Architecture Plan to reflect changes in the region's vision for ITS rather than modify the project.

Process for Determining ITS Architecture Conformity

The H-GAC ITS Architecture Plan documents the customized ITS service packages that were developed as part of the ITS architecture update process. To satisfy FHWA and FTA requirements and remain eligible to use federal funds, a project must be accurately documented. The steps of the process are as follows:

1. Identify the ITS components in the project.
2. Identify the corresponding ITS service packages from the ITS Architecture Plan.
3. Locate the ITS components in the project within the ITS service package.
4. Compare the connections to other agencies or elements documented in the ITS architecture, as well as the information flows between them, to the connections that will be part of the project.
5. Document any changes necessary to the ITS Architecture Plan or the project to ensure there is conformance.

Step 1 – Identify the ITS Components

ITS components are often fairly apparent in an ITS focused project, such as a CCTV camera or DMS deployment, but can also be included in other types of projects where they are not as apparent. For example, an arterial widening project could include the installation of signal system interconnect or flood monitoring systems. These are ITS functions and should be included in the ITS Architecture Plan.

Step 2 – Identify the Corresponding Service Packages

If a project was included in the ITS Deployment Plan section of this report, then the applicable service packages for that project were also identified. However, ITS projects are not required to be included in the ITS Deployment Plan to be eligible for federal funding; therefore, ITS service packages might need to be identified for projects that have not been covered in the ITS Deployment Plan. In that case, the ITS service packages selected and customized for the Houston-Galveston MPA should be reviewed to determine if they adequately cover the project.

Step 3 - Identify the Component within the Service Package

Once the element is located within the appropriate service package, the evaluator should determine if the element name used in the service package is accurate or if a change to the name is needed. For example, if a general ITS service package that was developed for

the Local Agencies element is being used, the elements in that ITS service package should be renamed to match the agency that is implementing the ITS service.

Step 4 – Evaluate the Connections and Flows

The connections and flows documented in the ITS service package diagrams were selected based on the information available at the time the ITS Architecture Plan was developed. As the projects are designed, decisions will be made on the system layout that might differ from what is shown in the ITS service package. These changes in the project should be documented.

Step 5 – Document Required Changes

If any changes are needed to accommodate a project under review, the section below describes how those changes should be documented. Any changes will be incorporated during the next update of the H-GAC ITS Architecture Plan. Conformance will be accomplished by documenting how the ITS service packages should be modified so that the connections and data flows are consistent with the project.

ITS Architecture Plan Maintenance Process

H-GAC will be responsible for leading the process to update the H-GAC ITS Architecture. **Table 9** summarizes the maintenance process agreed upon by stakeholders in the region.

Table 9: H-GAC ITS Architecture Maintenance Plan

Maintenance Details	Full Plan Update Guidance
Timeframe for Updates	Updates will occur on an as needed basis as determined by H-GAC and FHWA. H-GAC will review the ITS Architecture Plan after major ITS deployments in the region and evaluate if an update is needed
Scope of Update	Entire ITS Architecture Plan
Lead Agency	H-GAC
Participants	Entire Stakeholder Group
Results	Updated ITS Architecture Plan document, Appendices, RAD-IT Architecture database, and Interactive ITS Architecture on ITS Architecture page of H-GAC's website.

Stakeholders agreed that a full update of the H-GAC ITS Architecture should occur on an as needed basis. H-GAC will work with the FHWA Texas Division to determine if there have been enough changes to warrant a full update. Changes that will be considered when evaluating the need to update the Regional ITS Architecture include:

- Major ITS deployments in the region that add new functionality not currently covered in the H-GAC ITS Architecture.
- Major updates to the National ITS Architecture that add new service packages, or substantially change existing service packages, to the extent that the H-GAC ITS Architecture is no longer consistent with the National ITS Architecture.

As with all projects in the TIP, ITS projects are reviewed for compliance with all federal rules and regulations, just as non-ITS projects. If new proposed projects are found to be non-compliant corrective action will be taken or not included for federal funding.

H-GAC will be responsible for completing updates of the ITS Deployment Plan when needed. During the update process, all stakeholder agencies that participated in the original development of the H-GAC ITS Architecture should be included in addition to any other agencies in the region that are deploying or may be impacted by ITS projects.

Procedure for Submitting ITS Architecture Changes Between Scheduled Updates

In between updates, ITS project owners will need to submit documentation of any requested change to the ITS Architecture to H-GAC, the maintainer of the H-GAC ITS Architecture.

For situations where a change is required, an ITS Architecture Maintenance Form was developed and is included in **Appendix E**. An editable version of the form is available on H-GAC's ITS Architecture Website. This form should be completed and submitted to the H-GAC contact person identified on the form whenever a change to the ITS Architecture Plan is proposed.

ITS Architecture Maintenance Form

An editable version of the **ITS Architecture Maintenance Form** can be downloaded directly from the H-GAC ITS Architecture website under the **ITS Architecture** section.

H-GAC.COM/ITS-ARCHITECTURE

Next Steps

The H-GAC ITS Architecture Plan Updates was developed to provide a long-range plan for the deployment, integration, and operation of ITS in the Houston-Galveston MPA. The plan encourages interoperability and resource sharing among agencies and supports the building of a more connected region. The plan also meets the FHWA and FTA requirements that state a region needs to have an updated regional ITS architecture and projects must conform to that ITS architecture to use federal transportation funds for ITS projects.

During the development of the plan, eight key regionally significant projects and programs were identified. These projects and programs support not only stakeholder needs identified in this plan, but also key needs from the H-GAC 2045 RTP Update. In addition to the eight projects and programs, many of the stakeholders in the Houston-Galveston MPA have identified projects that are specific to their agency and support local needs. Continued focus on implementing all the regional and local projects, as well as providing the staffing and maintenance to be sure systems are fully operational, is vitally important for the Houston-Galveston MPA to optimize the transportation system and recognize the benefits of an integrated transportation system.

APPENDIX

Appendix A: Participating Stakeholders

Agency	First Name	Last Name	Stakeholder Interview Participant	In Person Stakeholder Workshop Participant	Virtual Stakeholder Workshop Participant
Brazoria County	Matt	Hanks	✓		
	Wael	Tabara	✓		
Chambers County	Natalie	Lopez	✓		
City of Baytown	Mike	Garcia	✓		
	Kevin	Harvill	✓		
	Kevin	Hilyard	✓		
	Bradley	Lewandowski	✓		
	Juan	Macias	✓		
City of Bunker Hill Village	Gerardo	Barrera			✓
City of Galveston	Brandon	Cook			✓
	Robert	Winiecke	✓		✓
City of Houston	Mazen	Abdulrazzak			✓
	Fabio	Capillo	✓		✓
	Fernando	Gonzalez			✓
City of Pearland	Greg	Kupferer			✓
	Yolci	Ramirez	✓		✓
	Raj	Shrestha			✓
City of Sugar Land	James	Turner	✓		
Fort Bend County	Chris	Debaillon	✓		✓
	Stacy	Slawinski	✓		
Fort Bend County Transit	David	Dominguez			✓
Galveston County	Michael	Shannon	✓		
Gulf Coast Transit District	Marcus	Alexander			✓

Agency	First Name	Last Name	Stakeholder Interview Participant	In Person Stakeholder Workshop Participant	Virtual Stakeholder Workshop Participant
	Ted	Ross			✓
Harris County	Kristian	Heighway	✓		✓
	Greg	Karr	✓	✓	
	Patrick	Mandapaka	✓		
	Kenny	Payne	✓		
	Ronnie	Smith	✓		
Harris County Toll Road Authority	Christopher	Carroll	✓		
Harris County Transit	Thien	Cao			✓
	Vernon	Chambers	✓		
	David	Jones	✓		
	Christopher	Russell			✓
Houston METRO	Alan	Clark	✓		
Houston TranStar	Joshua	Schideler			✓
League City	Christopher	Sims	✓		
Missouri City	Marcus	Snell	✓		
Montgomery County	Robert	Castaneda	✓		
	Lucas	Hvasta			✓
Port Freeport	Rob	Lowe	✓		
	Jason	Miura	✓		
	Brandon	Robertson	✓		
	Phyllis	Saathoff	✓		
Port Houston	James	Atteberry			✓
	Ryan	Dixon			✓
	Bruce	Mann	✓	✓	

Agency	First Name	Last Name	Stakeholder Interview Participant	In Person Stakeholder Workshop Participant	Virtual Stakeholder Workshop Participant
South East Texas Regional Planning Commission	James	Moore			✓
Texas City	Kim	Golden			✓
Texas A&M Transportation Institute	Darrell	Borchardt			✓
The Woodlands Regional Transit Authority	Ruthanne	Haut	✓		
The Woodlands Township	Shelly	Sekura Gibbs			✓
	David	Smith			✓
TxDOT Beaumont District	Lisa	Collins	✓		
	Peter	Jungen	✓		
	Farhan	Khan	✓		
	Zach	Mckinney			✓
	Ana	Mijares	✓		
TxDOT Houston District	Brenda	Bustillos		✓	✓
	Stephan	Gage			✓
	Maurice	Johnson	✓		
	Valerie	Taylor	✓		
	Jay	Washington	✓		
Waller County	Ross	McCall	✓		

Appendix B: 2025 H-GAC ITS Architecture Inventory

Element Name	Element Description	Stakeholder	Element Status
Archived Data User	Users that request information from the data archive systems.	System Users	Existing
Automated Vehicle	Vehicles with connected on board systems that communicate to ITS devices.	System Users	Future
Brazoria County CCTV Cameras	CCTV cameras operated by Brazoria County.	City of Baytown	Existing
Brazoria County Freight Signal Priority	Signal priority dedicated to commercial vehicles within Brazoria County.	Brazoria County	Future
Brazoria County Signal Preemption	Signal preemption dedicated to Brazoria County emergency service providers.	Brazoria County	Existing
Brazoria County TMC	Brazoria County traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	Brazoria County	Future
Brazoria County Traffic Signals	Traffic signal system operated by Brazoria County.	Brazoria County	Existing
City of Baytown Traffic Signals	Traffic signal system operated by the City of Baytown.	City of Baytown	Existing
City of Conroe Traffic Signals	Traffic signal system operated by the City of Conroe.	City of Conroe	Existing
City of Galveston CCTV Cameras	CCTV cameras operated by the City of Galveston.	City of Galveston	Existing
City of Galveston DMS	City of Galveston dynamic message signs (DMS) operated for traffic information dissemination.	City of Galveston	Future

Element Name	Element Description	Stakeholder	Element Status
City of Galveston Parking Area Equipment	Sensors and detectors that provide parking systems with parking availability. Sensors can detect if a parking spot is taken or not.	City of Galveston	Future
City of Galveston Parking Management	Parking management for surface parking, parking lots, and parking garages within the City of Galveston.	City of Galveston	Future
City of Galveston Signal Preemption	Signal preemption dedicated to the City of Galveston emergency service providers.	City of Galveston	Existing
City of Galveston TMC	City of Galveston traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	City of Galveston	Future
City of Galveston Traffic Signals	Traffic signal system operated by the City of Galveston.	City of Galveston	Existing
City of Houston CCTV Cameras	CCTV cameras operated by the City of Houston.	City of Houston	Existing
City of Houston Data Archive	The City of Houston data archive for transportation related data.	City of Houston	Existing
City of Houston DMS	City of Houston dynamic message signs (DMS) operated for traffic information dissemination.	City of Houston	Future
City of Houston Emergency Vehicles	Emergency vehicles within the City of Houston, consisting of police, fire, and EMS.	City of Houston	Existing
City of Houston Field System Monitoring	Maintenance and construction field devices that monitor field conditions.	City of Houston	Existing
City of Houston Information Center	Traveler information for vehicles within the City of Houston.	City of Houston	Future

Element Name	Element Description	Stakeholder	Element Status
City of Houston ITS Detectors	ITS roadway detection.	City of Houston	Existing
City of Houston Maintenance and Construction	Maintenance and construction department for the City of Houston. Responsible for the oversight of construction and maintenance.	City of Houston	Existing
City of Houston Maintenance Vehicles	Maintenance and construction vehicles for the City of Houston.	City of Houston	Existing
City of Houston Parking Area Equipment	Sensors and detectors that provide parking systems with parking availability. Sensors can detect if a parking spot is taken or not.	City of Houston	Future
City of Houston Parking Management	Parking management for surface parking, parking lots, and parking garages within the City of Houston.	City of Houston	Future
City of Houston Public Safety Dispatch/EOC	Emergency management center for the City of Houston. Responsible for coordination of local resources during a disaster or large scale event.	City of Houston	Existing
City of Houston Rail Crossing	Standard at grade rail crossing within the City of Houston.	City of Houston	Existing
City of Houston RWIS	City of Houston road weather information system sensors to monitor road conditions.	City of Houston	Existing
City of Houston Signal Preemption	Signal preemption dedicated to the City of Houston emergency service providers.	City of Houston	Existing
City of Houston Speed Warning	City of Houston field equipment that monitors vehicles speeds and sends a visual or other type of warning to the driver if speeds are excessive.	City of Houston	Existing

Element Name	Element Description	Stakeholder	Element Status
City of Houston TMC	City of Houston traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	City of Houston	Existing
City of Houston Tow and Go Service Patrol	H-GAC freeway safety service patrol dispatch.	Houston Galveston Area Council	Existing
City of Houston Traffic Signals	Traffic signal system operated by the City of Houston.	City of Houston	Existing
City of Pearland CCTV Cameras	CCTV cameras operated by the City of Pearland.	City of Pearland	Existing
City of Pearland Signal Preemption	Signal preemption dedicated to the City of Pearland emergency service providers.	City of Pearland	Existing
City of Pearland TMC	City of Houston traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	City of Pearland	Existing
City of Pearland Traffic Signals	Traffic signal system operated by the City of Pearland.	City of Pearland	Existing
City of Sugar Land CCTV Cameras	CCTV cameras operated by the City of Sugar Land.	City of Sugar Land	Existing
City of Sugar Land Signal Preemption	Signal preemption dedicated to the City of Sugar Land emergency service providers.	City of Sugar Land	Existing
City of Sugar Land TMC	City of Sugar Land traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	City of Sugar Land	Existing
City of Sugar Land Traffic Signals	Traffic signal system operated by the City of Sugar Land.	City of Sugar Land	Existing

Element Name	Element Description	Stakeholder	Element Status
Commercial Vehicle Dispatch Center	Commercial vehicle operations center. Responsible for notifying commercial vehicles of hazards or weather that affect commercial vehicle routes.	Commercial Vehicle Operators	Existing
Commercial Vehicle Information Services	Traveler information for commercial vehicle operators.	Commercial Vehicle Operators	Existing
Commercial Vehicle Parking Management Center	Parking management for commercial vehicles. Notify commercial vehicle drivers of available lots.	Commercial Vehicle Operators	Future
Commercial Vehicles	Privately owned commercial vehicles traveling within the Region.	Commercial Vehicle Operators	Existing
Driver	Operators of vehicles.	System Users	Planned
Fort Bend County TMC	Fort Bend County traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	Fort Bend County	Future
Fort Bend County Traffic Signals	Traffic signal system operated by Fort Bend County.	Fort Bend County	Existing
Fort Bend County Transit Buses	Fort Bend County transit vehicles.	Fort Bend County	Existing
Fort Bend County Transit Data Archive	Fort Bend County data archive for transit data.	Fort Bend County	Existing
Fort Bend County Transit Dispatch Center	Fort Bend County transit operations center where buses depart.	Fort Bend County	Existing
Fort Bend County Transit Parking Area Equipment	Parking provided by Fort Bend County for transit users.	Fort Bend County	Existing

Element Name	Element Description	Stakeholder	Element Status
Fort Bend County Transit Parking Management	Parking management for surface parking, parking lots, and parking garages within Fort Bend County.	Harris County Transit	Existing
Fort Bend County Transit Passenger Counters	Fort Bend County bus passenger counter system.	Fort Bend County	Existing
Fort Bend Transit Trip Planning	Online routing application to assist travelers in developing a customized transit plan for an upcoming trip.	Fort Bend County	Existing
Harris County CCTV Cameras	CCTV cameras operated by Harris County.	Harris County	Existing
Harris County Data Warehouse	Harris County data archive for transportation related data.	Harris County	Existing
Harris County DMS	Harris County dynamic message signs operated for traffic information dissemination.	Harris County	Future
Harris County Emergency Vehicles	Emergency vehicles within the City of Houston, consisting of police, fire, and EMS.	Harris County	Existing
Harris County Field System Monitoring	Maintenance and construction field devices that monitor field conditions.	Harris County	Existing
Harris County Flood Control District Center	Flood control district for Harris County. Responsible for flood monitoring and weather monitoring.	Harris County Flood Control District	Existing
Harris County Flood Control District RWIS	Sensors that detect high waters. Alert staff of high water locations.	Harris County Flood Control District	Existing
Harris County Freight Signal Priority	Signal priority dedicated to commercial vehicles within Harris County.	Harris County	Future
Harris County ITS Detectors	ITS roadway detection.	Harris County	Existing

Element Name	Element Description	Stakeholder	Element Status
Harris County MAP Service Patrol	Harris County freeway safety service patrol dispatch.	Harris County	Existing
Harris County Public Safety Dispatch/EOC	Emergency management center for Harris County. Responsible for coordination of local resources during a disaster or large scale event.	Harris County	Existing
Harris County Public Works	Public works department for Harris County, handles the transportation system operated by Harris County.	Harris County	Existing
Harris County Public Works Vehicles	Vehicles owned and operated by Harris County.	Harris County	Existing
Harris County Rail Crossing	Standard at grade rail crossing within Harris County.	Harris County	Existing
Harris County Signal Preemption	Signal preemption dedicated to Harris County emergency service providers.	Harris County	Existing
Harris County Speed Warning	Harris County field equipment that monitors vehicles speeds and sends a visual or other type of warning to the driver if speeds are excessive.	Harris County	Existing
Harris County TMC	Harris County traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	Harris County	Existing
Harris County Traffic Signals	Traffic signal system operated by Harris County.	Harris County	Existing
Harris County Transit Buses	Harris County transit vehicles.	Harris County Transit	Existing
Harris County Transit Data Archive	Harris County data archive for transit data.	Harris County Transit	Existing

Element Name	Element Description	Stakeholder	Element Status
Harris County Transit Dispatch Center	Harris County transit operations center where buses depart.	Harris County Transit	Existing
Harris County Transit Parking Area Equipment	Parking provided by Harris County for transit users.	Harris County Transit	Existing
Harris County Transit Parking Management	Parking management for surface parking, parking lots, and parking garages within Harris County.	Harris County Transit	Existing
Harris County Transit Passenger Counters	Harris County bus passenger counter system.	Harris County Transit	Existing
Harris County Transit Trip Planning	Online routing application to assist travelers in developing a customized transit plan for an upcoming trip.	Harris County Transit	Existing
HCTRA CCTV Cameras	CCTV cameras operated by HCTRA.	HCTRA	Existing
HCTRA DMS	HCTRA dynamic message signs (DMS) operated for traffic information dissemination.	HCTRA	Existing
HCTRA TMC	HCTRA traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	HCTRA	Existing
HCTRA Toll Collection	HCTRA roadway equipment that scans toll tags and processes toll payments.	HCTRA	Existing
HCTRA Toll Payment Center	HCTRA toll operations center where toll payments are processed.	HCTRA	Existing
Houston METRO Buses	Houston METRO transit vehicles.	Houston METRO	Existing
Houston METRO Data Archive	Houston METRO data archive for transportation related data.	Houston METRO	Existing

Element Name	Element Description	Stakeholder	Element Status
Houston METRO Dispatch Center	Houston METRO transit operations center where buses depart.	Houston METRO	Existing
Houston METRO HOV Lane Control	High occupancy vehicle (HOV) lane equipment managed by Houston METRO.	Houston METRO	Existing
Houston METRO HOV Lane TMC	Traffic Management and lane management for high occupancy vehicle (HOV) lanes operated by Houston METRO.	Houston METRO	Existing
Houston METRO Parking Area Equipment	Parking provided by Houston METRO for transit users.	Houston METRO	Existing
Houston METRO Parking Management	Parking management for surface parking and parking lots for Houston METRO Park and Ride.	Houston METRO	Existing
Houston METRO Passenger Counters	Houston METRO bus passenger counter system.	Houston METRO	Existing
Houston METRO Reversible Lanes	Lanes managed by Houston METRO in which traffic may travel in either direction depending on traffic conditions or time of day.	Houston METRO	Existing
Houston METRO Toll Collection	Houston METRO roadway equipment that scans toll tags and processes toll payments.	Houston METRO	Existing
Houston METRO Toll Payment Center	Houston METRO toll operations center where toll payments are processed.	Houston METRO	Existing
Houston METRO Traveler Information Communications	Provides vehicles with HOV Lane information.	Houston METRO	Existing

Element Name	Element Description	Stakeholder	Element Status
Houston METRO Trip Planning	Online routing application to assist travelers in developing a customized transit plan for an upcoming trip.	Houston METRO	Existing
League City CCTV Cameras	CCTV cameras operated by League City.	League City	Existing
League City TMC	League City traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	League City	Existing
League City Traffic Signals	Traffic signal system operated by League City.	League City	Existing
Local Agencies CCTV Cameras	CCTV cameras operated by local agencies.	Local Agencies	Future
Local Agencies Data Archive	Local agency data archive for transportation related data.	Local Agencies	Future
Local Agencies DMS	Local Agencies dynamic message signs (DMS) operated for traffic information dissemination.	Local Agencies	Future
Local Agencies Emergency Vehicles	Emergency vehicles within Local Agencies, consisting of police, fire, and EMS.	Local Agencies	Future
Local Agencies Field System Monitoring	Maintenance and construction field devices that monitor field conditions.	Local Agencies	Future
Local Agencies Information Center	Traveler information for vehicles within Local Agencies.	Local Agencies	Future
Local Agencies ITS Detectors	ITS roadway detection owned by Local Agencies.	Local Agencies	Future
Local Agencies Maintenance and Construction	Maintenance and construction department for Local Agencies. Responsible for the oversight of construction and maintenance.	Local Agencies	Future

Element Name	Element Description	Stakeholder	Element Status
Local Agencies Maintenance Vehicles	Maintenance and construction vehicles for Local Agencies.	Local Agencies	Future
Local Agencies Parking Area Equipment	Sensors and detectors that provide parking systems with parking availability. Sensors can detect if a parking spot is taken or not.	Local Agencies	Future
Local Agencies Parking Management	Parking management for surface parking, parking lots, and parking garages within Local Agencies.	Local Agencies	Future
Local Agencies Public Safety Dispatch/EOC	Emergency management center for Local Agencies. Responsible for coordination of local resources during a disaster or large scale event.	Local Agencies	Future
Local Agencies Rail Crossing	Standard at grade rail crossing within Local Agencies.	Local Agencies	Future
Local Agencies RWIS	Local Agencies road weather information system sensors to monitor road conditions.	Local Agencies	Future
Local Agencies Signal Control	Local Agency field elements that monitor and control signalized intersections.	Local Agencies	Future
Local Agencies Signal Preemption	Signal preemption dedicated to Local Agencies emergency service providers.	Local Agencies	Future
Local Agencies Speed Warning	Local Agencies field equipment that monitors vehicles speeds and sends a visual or other type of warning to the driver if speeds are excessive.	Local Agencies	Future
Local Agencies TMC	Local Agencies traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	Local Agencies	Future

Element Name	Element Description	Stakeholder	Element Status
Local Agencies Toll Collection	Local Agencies roadway equipment that scans toll tags and processes toll payments.	Local Agencies	Future
Local Agencies Toll Payment Center	Local Agencies toll operations center where toll payments are processed.	Local Agencies	Future
Local Agencies Traffic Monitoring	Local Agencies roadside equipment that provides traffic monitoring equipment through connected vehicles.	Local Agencies	Future
Local Agencies Traffic Signals	Local Agencies traffic signals.	Local Agencies	Future
Local Agencies Wrong Way Driver Detection	Local Agencies electronic warning signs, field sensors, or other devices used in the operation of wrong-way vehicle detection and warning.	Local Agencies	Future
Local Broadcast Media	Local media that provide traffic or incident information to the public.	Media	Future
Missouri City CCTV Cameras	CCTV cameras operated by Missouri City.	Missouri City	Existing
Missouri City Signal Preemption	Signal preemption dedicated to Missouri City emergency service providers.	Missouri City	Existing
Missouri City TMC	Missouri City traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	Missouri City	Existing
Missouri City Traffic Signals	Traffic signal system operated by Missouri City.	Missouri City	Existing
National Weather Service	National Weather Services that provides weather information to travelers.	National Weather Service	Planned

Element Name	Element Description	Stakeholder	Element Status
Other Transit Management Centers	Other transit management centers in the region that require service coordination	Local Agencies	Existing
Pedestrian	A person walking along a road.	System Users	Existing
Personal Information Device	A device that provides travelers with traveler information.	System Users	Planned
Texas City Traffic Signals	Traffic signal system operated by Texas City.	Texas City	Existing
The Woodlands Regional Transit Authority Buses	The Woodlands Regional Transit Authority transit vehicles.	The Woodlands Regional Transit Authority	Existing
The Woodlands Regional Transit Authority Data Archive	The Woodlands Regional Transit Authority data archive for transportation related data.	The Woodlands Regional Transit Authority	Existing
The Woodlands Regional Transit Authority Dispatch Center	The Woodlands Regional Transit Authority transit operations center where buses depart.	The Woodlands Regional Transit Authority	Existing
The Woodlands Regional Transit Authority Parking Area Equipment	Parking provided by The Woodlands Regional Transit Authority for transit users.	The Woodlands Regional Transit Authority	Existing
The Woodlands Regional Transit Authority Parking Management	Parking management for surface parking and parking lots for The Woodlands Regional Transit Authority.	The Woodlands Regional Transit Authority	Existing
The Woodlands Regional Transit Authority Passenger Counters	The Woodlands Regional Transit Authority bus passenger counter system.	The Woodlands Regional Transit Authority	Existing

Element Name	Element Description	Stakeholder	Element Status
The Woodlands Regional Transit Authority Trip Planning	Online routing application to assist travelers in developing a customized transit plan for an upcoming trip on The Woodlands Regional Transit Authority.	The Woodlands Regional Transit Authority	Existing
The Woodlands Traffic Signals	Traffic signal system operated by The Woodlands.	The Woodlands Regional Transit Authority	Existing
Transit Traveler Fare Management	Regional transit traveler fare management system.	System Users	Existing
Traveler	User of the transportation network.	System Users	Existing
TxDOT Beaumont CCTV Cameras	CCTV cameras operated by the TxDOT Beaumont District.	TxDOT Beaumont District	Existing
TxDOT Beaumont Data Warehouse	TxDOT Beaumont District data archive for transportation related data.	TxDOT Beaumont District	Existing
TxDOT Beaumont DMS	TxDOT Beaumont District dynamic message signs (DMS) operated for traffic information dissemination.	TxDOT Beaumont District	Existing
TxDOT Beaumont Emergency Management	TxDOT Beaumont District section that handles emergency transportation operations and communications.	TxDOT Beaumont District	Existing
TxDOT Beaumont Field System Monitoring	TxDOT Beaumont District maintenance and construction field devices that monitor field conditions.	TxDOT Beaumont District	Existing
TxDOT Beaumont Information Center	Traveler information for vehicles within the TxDOT Beaumont District.	TxDOT Beaumont District	Existing

Element Name	Element Description	Stakeholder	Element Status
TxDOT Beaumont ITS Detectors	TxDOT Beaumont District ITS roadway detection.	TxDOT Beaumont District	Existing
TxDOT Beaumont Maintenance and Construction	Maintenance and construction section for TxDOT Beaumont District. Responsible for the oversight of construction and maintenance.	TxDOT Beaumont District	Existing
TxDOT Beaumont Maintenance Vehicles	Maintenance and construction vehicles for TxDOT Beaumont District.	TxDOT Beaumont District	Existing
TxDOT Beaumont Queue Warning	TxDOT Beaumont District queue warning systems that detect queuing and relay information to ITS devices.	TxDOT Beaumont District	Future
TxDOT Beaumont Rail Crossing	Standard at grade rail crossing within the TxDOT Beaumont District.	TxDOT Beaumont District	Existing
TxDOT Beaumont RWIS	TxDOT Beaumont road weather information system sensors to monitor road conditions.	TxDOT Beaumont District	Future
TxDOT Beaumont Speed Warning	TxDOT Beaumont District field equipment that monitors vehicles speeds and sends a visual or other type of warning to the driver if speeds are excessive.	TxDOT Beaumont District	Future
TxDOT Beaumont TMC	TxDOT Beaumont District traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	TxDOT Beaumont District	Existing
TxDOT Beaumont Traffic Signals	TxDOT Beaumont District traffic signals.	TxDOT Beaumont District	Existing

Element Name	Element Description	Stakeholder	Element Status
TxDOT Beaumont Truck Parking Availability Sign	TxDOT Beaumont District truck parking availability signs that provide truck drivers with information regarding available parking spaces.	TxDOT Beaumont District	Planned
TxDOT Beaumont Variable Speed Limits	TxDOT Beaumont District dynamic speed limit signs that adjust speed limits in response to changing conditions.	TxDOT Beaumont District	Future
TxDOT Beaumont Wrong Way Driver Detection	TxDOT Beaumont District electronic warning signs, field sensors, or other devices used in the operation of wrong-way vehicle detection and warning.	TxDOT Beaumont District	Future
TxDOT Houston CCTV Cameras	CCTV cameras operated by the TxDOT Houston District.	TxDOT Houston District	Existing
TxDOT Houston Data Warehouse	TxDOT Houston District data archive for transportation related data.	TxDOT Houston District	Existing
TxDOT Houston DMS	TxDOT Houston District dynamic message signs (DMS) operated for traffic information dissemination.	TxDOT Houston District	Existing
TxDOT Houston Emergency Management	TxDOT Houston District section that handles emergency transportation operations and communications.	TxDOT Houston District	Existing
TxDOT Houston Field System Monitoring	TxDOT Houston District maintenance and construction field devices that monitor field conditions.	TxDOT Houston District	Existing
TxDOT Houston Information Center	Traveler information for vehicles within TxDOT Houston District.	TxDOT Houston District	Existing
TxDOT Houston ITS Detectors	TxDOT Houston District ITS roadway detection.	TxDOT Houston District	Existing

Element Name	Element Description	Stakeholder	Element Status
TxDOT Houston Maintenance and Construction	Maintenance and construction section for TxDOT Houston District. Responsible for the oversight of construction and maintenance.	TxDOT Houston District	Existing
TxDOT Houston Maintenance Vehicles	Maintenance and construction vehicles for TxDOT Houston District.	TxDOT Houston District	Existing
TxDOT Houston Queue Warning	TxDOT Houston District queue warning systems that detect queuing and relay information to ITS devices.	TxDOT Houston District	Future
TxDOT Houston Rail Crossing	Standard at grade rail crossing within the TxDOT Houston District.	TxDOT Houston District	Existing
TxDOT Houston RWIS	TxDOT Houston District road weather information system sensors to monitor road conditions.	TxDOT Houston District	Existing
TxDOT Houston Signal Preemption	Signal preemption dedicated to emergency service providers.	TxDOT Houston District	Existing
TxDOT Houston Speed Warning	TxDOT Houston field equipment that monitors vehicles speeds and sends a visual or other type of warning to the driver if speeds are excessive.	TxDOT Houston District	Future
TxDOT Houston TMC	TxDOT Houston traffic management center that can operate city roadside equipment including traffic signal system and traffic control and management.	TxDOT Houston District	Existing
TxDOT Houston Toll Collection	TxDOT Houston roadway equipment that scans toll tags and processes toll payments.	TxDOT Houston District	Existing
TxDOT Houston Toll Payment Center	TxDOT Houston toll operations center where toll payments are processed.	TxDOT Houston District	Existing

Element Name	Element Description	Stakeholder	Element Status
TxDOT Houston Traffic Metering	Traffic management that uses signals to control the flow of vehicles entering a freeway.	TxDOT Houston District	Existing
TxDOT Houston Traffic Signals	Traffic signal system operated by TxDOT Houston.	TxDOT Houston District	Existing
TxDOT Houston Truck Parking Availability Sign	TxDOT Houston truck parking availability signs that provide truck drivers with information regarding available parking spaces.	TxDOT Houston District	Future
TxDOT Houston Variable Speed Limits	Dynamic signs that adjust speed limits in response to changing conditions.	TxDOT Houston District	Existing
TxDOT Houston Wrong Way Driver Detection	TxDOT Houston electronic warning signs, field sensors, or other devices used in the operation of wrong-way vehicle detection and warning.	TxDOT Houston District	Existing
Vehicles	User of the transportation system.	System Users	Existing
Vulnerable Road User	A person within the transportation network that is not protected by a vehicle.	System Users	Existing

Appendix C: ITS Service Package Status

ITS Service Package			Status
Commercial Vehicle Operations	CVO05	Commercial Vehicle Parking	TxDOT Beaumont - Planned TxDOT Houston - Future
	CVO06	Freight Signal Priority	Port Freeport - Future Port Houston - Future
Data Management	DM01	ITS Data Warehouse (Implementations)	City of Houston - Existing Fort Bend County Transit - Existing Harris County - Existing Harris County Transit - Existing Houston METRO - Existing Local Agencies - Existing The Woodlands Regional Transit Authority - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	DM02	Performance Monitoring (Implementations)	City of Houston - Existing Harris County - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
Maintenance and Construction	MC01	Maintenance and Construction Vehicle and Equipment Tracking	City of Houston - Existing Harris County - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston – Existing
	MC02	Maintenance and Construction Vehicle Maintenance	City of Houston - Existing Harris County - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing

ITS Service Package			Status
Maintenance and Construction (Continued)	MC05	Roadway Maintenance and Construction	City of Houston - Existing Harris County - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	MC06	Work Zone Management	City of Houston - Existing Harris County - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	MC08	Maintenance and Construction Activity Coordination	City of Houston - Existing Harris County - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
Parking Management	PM01	Parking Space Management	City of Galveston - Future City of Houston - Future
	PM02	Smart Park and Ride System	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PM03	Parking Electronic Payment	City of Galveston - Future City of Houston - Existing Local Agencies - Future
	PM04	Regional Parking Management	City of Galveston - Future City of Houston - Future
	PM06	Loading Zone Management	City of Houston - Future
Public Safety	PS01	Emergency Call-Taking and Dispatch	City of Houston - Existing Harris County - Existing Local Agencies - Existing

ITS Service Package			Status
Public Safety (Continued)	PS02	Emergency Response	City of Houston - Existing Harris County - Existing Local Agencies - Existing
	PS03	Emergency Vehicle Preemption	City of Houston - Existing Harris County - Existing Local Agencies - Future TxDOT Houston - Existing
	PS08	Roadway Service Patrols	Harris County - Existing Tow and Go - Existing
	PS10	Wide-Area Alert	City of Houston - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	PS12	Disaster Response and Recovery	City of Houston - Future Local Agencies - Future TxDOT Beaumont - Existing TxDOT Houston - Existing
	PS13	Evacuation and Reentry Management	Local Agencies - Future TxDOT Beaumont - Existing TxDOT Houston - Existing
	PS14	Disaster Traveler Information	Local Agencies - Future TxDOT Beaumont - Existing TxDOT Houston - Existing
Public Transportation	PT01	Transit Vehicle Tracking	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PT02	Transit Fixed-Route Operations	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PT03	Dynamic Transit Operations	Houston METRO - Existing

ITS Service Package			Status
Public Transportation (Continued)	PT04	Transit Fare Collection Management	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PT05	Transit Security	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PT06	Transit Fleet Management	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PT07	Transit Passenger Counting	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PT08	Transit Traveler Information	Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PT09	Transit Signal Priority	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
	PT11	Transit Pedestrian Indication	Houston METRO - Existing
	PT14	Multi-modal Coordination	Fort Bend County Transit - Existing Harris County Transit - Existing Houston METRO - Existing The Woodlands Regional Transit Authority - Existing
Sustainable Travel	ST06	HOV/HOT Lane Management	Houston METRO - Existing

ITS Service Package			Status
Traveler Information and Personal Mobility	TI01	Broadcast Traveler Information	Local Agencies - Future TxDOT Beaumont - Future TxDOT Houston - Future
	TI02	Personalized Traveler Information	TxDOT Beaumont - Future TxDOT Houston - Future
	TI07	In-Vehicle Signage	Local Agencies - Future TxDOT Beaumont - Future TxDOT Houston - Future
Traffic Management	TM01	Infrastructure-Based Traffic Surveillance	City of Houston - Existing Harris County - Existing HCTRA - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	TM03	Traffic Signal Control	City of Houston - Existing Harris County - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	TM04	Connected Vehicle Traffic Signal System	Local Agencies - Future
	TM05	Traffic Metering	TxDOT Houston - Existing
	TM06	Traffic Information Dissemination	City of Houston - Existing Harris County - Existing HCTRA - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing

ITS Service Package			Status
Traffic Management (Continued)	TM07	Regional Traffic Management	City of Houston - Existing Harris County - Existing HCTRA - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	TM08	Traffic Incident Management System	City of Houston – Existing Harris County - Existing HCTRA - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	TM10	Electronic Toll Collection	HCTRA - Existing Houston METRO - Existing Local Agencies - Future TxDOT Houston - Existing
	TM13	Standard Railroad Grade Crossing	City of Houston - Existing Harris County - Existing Local Agencies - Existing TxDOT Beaumont - Existing TxDOT Houston - Existing
	TM16	Reversible Lane Management	Houston METRO - Existing
	TM17	Speed Warning and Enforcement	City of Houston - Existing Harris County - Existing Local Agencies - Future TxDOT Beaumont - Existing TxDOT Houston - Existing
	TM20	Variable Speed Limits	TxDOT Beaumont - Planned TxDOT Houston - Existing
	TM24	Tunnel Management	Harris County - Existing

ITS Service Package			Status
Traffic Management (Continued)	TM25	Wrong Way Vehicle Detection and Warning	Local Agencies - Future TxDOT Beaumont - Existing TxDOT Houston - Existing
Vehicle Safety	VS07	Road Weather Motorist Alert and Warning	Local Agencies - Future TxDOT Beaumont - Future TxDOT Houston - Future
	VS08	Queue Warning	TxDOT Beaumont - Future TxDOT Houston - Future
	VS09	Reduced Speed Zone Warning / Lane Closure	Local Agencies - Future TxDOT Beaumont - Future TxDOT Houston - Future
	VS17	Management of Electronic Traffic Regulations	TxDOT Houston - Future
Weather	WX01	Weather Data Collection	City of Houston - Existing Harris County Flood Control District - Existing TxDOT Beaumont - Future TxDOT Houston - Existing
	WX02	Weather Information Processing and Distribution	City of Houston - Existing Harris County Flood Control District - Existing TxDOT Beaumont - Future TxDOT Houston - Existing
	WX03	Spot Weather Impact Warning	City of Houston - Existing Harris County Flood Control District - Existing TxDOT Beaumont - Future TxDOT Houston - Existing

Appendix D: 2025 H-GAC ITS Architecture Roles and Responsibilities

RR Area Name	Stakeholder	RR Description
Archived Data System for H-GAC ITS Architecture	City of Houston	Collect and maintain data from ITS deployments.
Archived Data System for H-GAC ITS Architecture	City of Houston	Share collected data from ITS deployments with regional agencies.
Archived Data System for H-GAC ITS Architecture	Fort Bend County	Collect and maintain data from ITS deployments.
Archived Data System for H-GAC ITS Architecture	Fort Bend County	Share collected data from ITS deployments with regional agencies.
Archived Data System for H-GAC ITS Architecture	Harris County	Collect and maintain data from ITS deployments.
Archived Data System for H-GAC ITS Architecture	Harris County	Share collected data from ITS deployments with regional agencies.
Archived Data System for H-GAC ITS Architecture	Harris County Transit	Share collected data from transit ITS deployments with regional transit agencies.
Archived Data System for H-GAC ITS Architecture	Harris County Transit	Collect and maintain data from transit ITS deployments.
Archived Data System for H-GAC ITS Architecture	Local Agencies	Collect and maintain data from ITS deployments.
Archived Data System for H-GAC ITS Architecture	Local Agencies	Share collected data from ITS deployments with regional agencies.
Archived Data System for H-GAC ITS Architecture	The Woodlands Regional Transit Authority	Share collected data from transit ITS deployments with regional transit agencies.

RR Area Name	Stakeholder	RR Description
Archived Data System for H-GAC ITS Architecture	The Woodlands Regional Transit Authority	Collect and maintain data from transit ITS deployments.
Archived Data System for H-GAC ITS Architecture	TxDOT Beaumont District	Collect and maintain data from ITS deployments.
Archived Data System for H-GAC ITS Architecture	TxDOT Beaumont District	Share collected data from ITS deployments with regional agencies.
Archived Data System for H-GAC ITS Architecture	TxDOT Houston District	Share collected data from ITS deployments with regional agencies.
Archived Data System for H-GAC ITS Architecture	TxDOT Houston District	Collect and maintain data from ITS deployments.
Emergency Management for H-GAC ITS Architecture	City of Houston	Participate in regional emergency planning to support large-scale incidents and disasters.
Emergency Management for H-GAC ITS Architecture	City of Houston	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
Emergency Management for H-GAC ITS Architecture	City of Houston	Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
Emergency Management for H-GAC ITS Architecture	Harris County	Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
Emergency Management for H-GAC ITS Architecture	Harris County	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
Emergency Management for H-GAC ITS Architecture	Harris County	Participate in regional emergency planning to support large-scale incidents and disasters.

RR Area Name	Stakeholder	RR Description
Emergency Management for H-GAC ITS Architecture	Harris County	Dispatch service patrol vehicles along regional freeways.
Emergency Management for H-GAC ITS Architecture	Houston Galveston Area Council	Dispatch service patrol vehicles along regional freeways.
Emergency Management for H-GAC ITS Architecture	Local Agencies	Participate in regional emergency planning to support large-scale incidents and disasters.
Emergency Management for H-GAC ITS Architecture	Local Agencies	Responsible for the dispatch of emergency vehicles to incidents and tracking of their location and status.
Emergency Management for H-GAC ITS Architecture	Local Agencies	Responsible for the routing of emergency vehicles to facilitate the safest/quickest arrival at an incident.
Emergency Management for H-GAC ITS Architecture	TxDOT Beaumont District	Participate in regional emergency planning to support large-scale incidents and disasters.
Emergency Management for H-GAC ITS Architecture	TxDOT Beaumont District	Responsible for coordination with adjacent districts as needed to support emergency management.
Emergency Management for H-GAC ITS Architecture	TxDOT Houston District	Responsible for coordination with adjacent districts as needed to support emergency management.
Emergency Management for H-GAC ITS Architecture	TxDOT Houston District	Participate in regional emergency planning to support large-scale incidents and disasters.
Emergency Management for H-GAC ITS Architecture	TxDOT Houston District	Dispatch service patrol vehicles along regional freeways in coordination with H-GAC and Harris County.
Freeway Management for H-GAC ITS Architecture	TxDOT Beaumont District	Operate network surveillance equipment including CCTV cameras and vehicle detection on state roadways.
Freeway Management for H-GAC ITS Architecture	TxDOT Beaumont District	Operate DMS to distribute traffic information and roadway conditions to travelers on the roadway.

RR Area Name	Stakeholder	RR Description
Freeway Management for H-GAC ITS Architecture	TxDOT Houston District	Operate DMS to distribute traffic information and roadway conditions to travelers on the roadway.
Freeway Management for H-GAC ITS Architecture	TxDOT Houston District	Operate network surveillance equipment including CCTV cameras and vehicle detection on state roadways.
Incident Management for H-GAC ITS Architecture	City of Houston	Coordinate maintenance resources for incident response.
Incident Management for H-GAC ITS Architecture	City of Houston	Remotely control traffic and video sensors to support incident detection and verification.
Incident Management for H-GAC ITS Architecture	City of Houston	Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
Incident Management for H-GAC ITS Architecture	City of Houston	Responsible for the dissemination of traffic related data to other centers and the media.
Incident Management for H-GAC ITS Architecture	City of Houston	Remotely control traffic from TranStar TMC to support incident detection.
Incident Management for H-GAC ITS Architecture	Harris County	Dispatch public safety vehicles to incidents.
Incident Management for H-GAC ITS Architecture	Harris County	Coordinate incident response with emergency dispatch agencies, any municipal TOCs, and the GDOT Atlanta TMC for incidents on state facilities.
Incident Management for H-GAC ITS Architecture	Harris County	Remotely control traffic from TranStar TMC to support incident detection.
Incident Management for H-GAC ITS Architecture	HCTRA	Remotely control traffic and video sensors to support incident detection and verification.

RR Area Name	Stakeholder	RR Description
Incident Management for H-GAC ITS Architecture	HCTRA	Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
Incident Management for H-GAC ITS Architecture	HCTRA	Responsible for the dissemination of traffic related data to other centers and the media.
Incident Management for H-GAC ITS Architecture	Houston Galveston Area Council	Dispatch service patrol vehicles along regional freeways.
Incident Management for H-GAC ITS Architecture	Local Agencies	Remotely control traffic and video sensors to support incident detection and verification.
Incident Management for H-GAC ITS Architecture	Local Agencies	Responsible for coordination with other traffic operations centers and emergency management agencies for coordinated incident management.
Incident Management for H-GAC ITS Architecture	Local Agencies	Responsible for the dissemination of traffic related data to other centers and the media.
Incident Management for H-GAC ITS Architecture	TxDOT Beaumont District	Operate DMS to distribute traffic information and roadway conditions to travelers on the roadway.
Incident Management for H-GAC ITS Architecture	TxDOT Beaumont District	Responsible for the dissemination of traffic related data to other centers and the media.
Incident Management for H-GAC ITS Architecture	TxDOT Beaumont District	Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.
Incident Management for H-GAC ITS Architecture	TxDOT Beaumont District	Coordinate maintenance resources for incident response.
Incident Management for H-GAC ITS Architecture	TxDOT Houston District	Remotely control traffic from TranStar TMC to support incident detection.

RR Area Name	Stakeholder	RR Description
Incident Management for H-GAC ITS Architecture	TxDOT Houston District	Coordinate maintenance resources for incident response.
Incident Management for H-GAC ITS Architecture	TxDOT Houston District	Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.
Incident Management for H-GAC ITS Architecture	TxDOT Houston District	Operate DMS to distribute traffic information and roadway conditions to travelers on the roadway.
Incident Management for H-GAC ITS Architecture	TxDOT Houston District	Responsible for the dissemination of traffic related data to other centers and the media.
Maintenance and Construction Management for the H-GAC ITS Architecture	City of Houston	Operation of systems to monitor and manage roadside maintenance.
Maintenance and Construction Management for the H-GAC ITS Architecture	City of Houston	Control and monitor traffic within construction areas by providing real-time information and dynamic traffic management strategies.
Maintenance and Construction Management for the H-GAC ITS Architecture	Harris County	Operation of systems to monitor and manage roadside maintenance.
Maintenance and Construction Management for the H-GAC ITS Architecture	Harris County	Control and monitor traffic within construction areas by providing real-time information and dynamic traffic management strategies.
Maintenance and Construction Management for the H-GAC ITS Architecture	HCTRA	Operation of systems to monitor and manage roadside maintenance.

RR Area Name	Stakeholder	RR Description
Maintenance and Construction Management for the H-GAC ITS Architecture	HCTRA	Control and monitor traffic within construction areas by providing real-time information and dynamic traffic management strategies.
Maintenance and Construction Management for the H-GAC ITS Architecture	Local Agencies	Operation of systems to monitor and manage roadside maintenance.
Maintenance and Construction Management for the H-GAC ITS Architecture	Local Agencies	Control and monitor traffic within construction areas by providing real-time information and dynamic traffic management strategies.
Maintenance and Construction Management for the H-GAC ITS Architecture	TxDOT Beaumont District	Control and monitor traffic within construction areas by providing real-time information and dynamic traffic management strategies.
Maintenance and Construction Management for the H-GAC ITS Architecture	TxDOT Beaumont District	Operation of systems to monitor and manage roadside maintenance.
Maintenance and Construction Management for the H-GAC ITS Architecture	TxDOT Houston District	Operation of systems to monitor and manage roadside maintenance.
Maintenance and Construction Management for the H-GAC ITS Architecture	TxDOT Houston District	Control and monitor traffic within construction areas by providing real-time information and dynamic traffic management strategies.
Parking Management for the H-GAC ITS Architecture	City of Galveston	The operation and management of parking sensors.
Parking Management for the H-GAC ITS Architecture	City of Galveston	Provide parking information to drivers.

RR Area Name	Stakeholder	RR Description
Parking Management for the H-GAC ITS Architecture	City of Houston	The operation and management of parking sensors.
Parking Management for the H-GAC ITS Architecture	City of Houston	Provide parking information to drivers.
Parking Management for the H-GAC ITS Architecture	Fort Bend County	Manage Park and Ride systems that allow commuters to park their vehicles in parking lots to access public transportation.
Parking Management for the H-GAC ITS Architecture	Harris County Transit	Manage Park and Ride systems that allow commuters to park their vehicles in parking lots to access public transportation.
Parking Management for the H-GAC ITS Architecture	Houston METRO	Manage Park and Ride systems that allow commuters to park their vehicles in parking lots to access public transportation.
Parking Management for the H-GAC ITS Architecture	The Woodlands Regional Transit Authority	Manage Park and Ride systems that allow commuters to park their vehicles in parking lots to access public transportation.
Traffic Signal Management for H-GAC ITS Architecture	City of Houston	Operate and maintain traffic signal systems.
Traffic Signal Management for H-GAC ITS Architecture	City of Houston	Provide traffic signal preemption for emergency vehicles.
Traffic Signal Management for H-GAC ITS Architecture	City of Houston	Provide traffic signal priority for transit vehicles.
Traffic Signal Management for H-GAC ITS Architecture	Harris County	Provide traffic signal priority for transit vehicles.
Traffic Signal Management for H-GAC ITS Architecture	Harris County	Operate and maintain traffic signal systems.

RR Area Name	Stakeholder	RR Description
Traffic Signal Management for H-GAC ITS Architecture	Harris County	Provide traffic signal preemption for emergency vehicles.
Traffic Signal Management for H-GAC ITS Architecture	Local Agencies	Provide traffic signal priority for transit vehicles.
Traffic Signal Management for H-GAC ITS Architecture	Local Agencies	Operate and maintain traffic signal systems.
Traffic Signal Management for H-GAC ITS Architecture	Local Agencies	Provide traffic signal preemption for emergency vehicles.
Traffic Signal Management for H-GAC ITS Architecture	TxDOT Beaumont District	Provide traffic signal priority for transit vehicles.
Traffic Signal Management for H-GAC ITS Architecture	TxDOT Beaumont District	Operate and maintain traffic signal systems.
Traffic Signal Management for H-GAC ITS Architecture	TxDOT Beaumont District	Provide traffic signal preemption for emergency vehicles.
Traffic Signal Management for H-GAC ITS Architecture	TxDOT Houston District	Provide traffic signal priority for transit vehicles.
Traffic Signal Management for H-GAC ITS Architecture	TxDOT Houston District	Operate and maintain traffic signal systems.
Traffic Signal Management for H-GAC ITS Architecture	TxDOT Houston District	Provide traffic signal preemption for emergency vehicles.
Transit Services for H-GAC ITS Architecture	Fort Bend County	Collect and store transit passenger origin-destination data.
Transit Services for H-GAC ITS Architecture	Fort Bend County	Coordinate with local agency staff on transit signal priority deployments.

RR Area Name	Stakeholder	RR Description
Transit Services for H-GAC ITS Architecture	Fort Bend County	Operate on-board systems to provide next stop annunciation.
Transit Services for H-GAC ITS Architecture	Fort Bend County	Provide transit passenger electronic fare payment on fixed route transit vehicles.
Transit Services for H-GAC ITS Architecture	Fort Bend County	Provide transit traveler information to the agency website, local private sector traveler information services, and the Tennessee 511 system.
Transit Services for H-GAC ITS Architecture	Harris County Transit	Provide transit traveler information to the agency website, local private sector traveler information services, and the Tennessee 511 system.
Transit Services for H-GAC ITS Architecture	Harris County Transit	Provide transit passenger electronic fare payment on fixed route transit vehicles.
Transit Services for H-GAC ITS Architecture	Harris County Transit	Operate on-board systems to provide next stop annunciation.
Transit Services for H-GAC ITS Architecture	Harris County Transit	Collect and store transit passenger origin-destination data.
Transit Services for H-GAC ITS Architecture	Harris County Transit	Coordinate with local agency staff on transit signal priority deployments.
Transit Services for H-GAC ITS Architecture	Houston METRO	Provide transit traveler information to the agency website, local private sector traveler information services, and the Tennessee 511 system.
Transit Services for H-GAC ITS Architecture	Houston METRO	Provide transit security on transit vehicles and at transit terminals through silent alarms and surveillance systems.
Transit Services for H-GAC ITS Architecture	Houston METRO	Provide transit passenger electronic fare payment on fixed route transit vehicles.

RR Area Name	Stakeholder	RR Description
Transit Services for H-GAC ITS Architecture	Houston METRO	Operates fixed route and paratransit services from central dispatch facilities responsible for tracking their location and status.
Transit Services for H-GAC ITS Architecture	Houston METRO	Coordinate with local agency staff on transit signal priority deployments.
Transit Services for H-GAC ITS Architecture	Houston METRO	Operate on-board systems to provide next stop annunciation.
Transit Services for H-GAC ITS Architecture	Houston METRO	Collect and store transit passenger origin-destination data.
Transit Services for H-GAC ITS Architecture	The Woodlands Regional Transit Authority	Collect and store transit passenger origin-destination data.
Transit Services for H-GAC ITS Architecture	The Woodlands Regional Transit Authority	Coordinate with local agency staff on transit signal priority deployments.
Transit Services for H-GAC ITS Architecture	The Woodlands Regional Transit Authority	Provide transit passenger electronic fare payment on fixed route transit vehicles.
Transit Services for H-GAC ITS Architecture	The Woodlands Regional Transit Authority	Provide transit traveler information to the agency website, local private sector traveler information services, and the Tennessee 511 system.
Traveler Information for H-GAC ITS Architecture	Local Agencies	Collect and distribute traveler information including incident information and maintenance and construction closure information.
Traveler Information for H-GAC ITS Architecture	Local Agencies	Collect, process, store, and broadcast traffic, transit, maintenance and construction, event and weather information, and evacuation information to travelers via traveler websites and 511 systems.

RR Area Name	Stakeholder	RR Description
Traveler Information for H-GAC ITS Architecture	TxDOT Beaumont District	Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
Traveler Information for H-GAC ITS Architecture	TxDOT Beaumont District	Collect and distribute traveler information including incident information and maintenance and construction closure information.
Traveler Information for H-GAC ITS Architecture	TxDOT Beaumont District	Collect, process, store, and broadcast traffic, transit, maintenance and construction, event and weather information, and evacuation information to travelers via traveler websites and 511 systems.
Traveler Information for H-GAC ITS Architecture	TxDOT Houston District	Operate DMS for the distribution of traffic information and roadway conditions to travelers on the roadway.
Traveler Information for H-GAC ITS Architecture	TxDOT Houston District	Collect and distribute traveler information including incident information and maintenance and construction closure information.
Traveler Information for H-GAC ITS Architecture	TxDOT Houston District	Collect, process, store, and broadcast traffic, transit, maintenance and construction, event and weather information, and evacuation information to travelers via traveler websites and 511 systems.

H-GAC ITS Architecture Plan

ITS Architecture Maintenance Form

Please complete the following form to document changes to the 2025 Houston-Galveston Area Council (H-GAC) ITS Architecture Plan. Forms should be submitted to H-GAC for review and acceptance. All accepted changes will be kept on file by H-GAC. Changes will be incorporated into the H-GAC ITS Architecture Plan during the next scheduled update.

Contact Information

Agency	
Agency Contact Person	
Street Address	
City	
State, Zip Code	
Telephone	
E-Mail	

Change Information

Please indicate the type of change to the ITS Architecture Plan:

- ☐ Administrative Change – Basic changes that do not affect the structure of the ITS service packages in the ITS Architecture Plan.
  Examples Include: Changes to stakeholder or element name, element status, or data flow status.
- ☐ Functional Change – Single Agency: Structural changes to the ITS service packages that impact only one agency in the ITS Architecture Plan.
  Examples Include: Addition of a new ITS service package or changes to data flow connections of an existing ITS service package. The addition or changes would only impact a single agency.
- ☐ Functional Change – Multiple Agencies: Structural changes to the ITS service packages that have the potential to impact multiple agencies in the ITS Architecture Plan.
  Examples Include: Addition of a new ITS service package or changes to data flow connections of an existing ITS service package. The addition or changes would impact multiple agencies and require coordination between the agencies.
- ☐ Project Change – Addition, modification, or removal of a project in the ITS Architecture Plan.
- ☐ Other: _____
  _____

Submittal

Please submit ITS Architecture Maintenance Documentation form to:

Houston-Galveston Area Council
3555 Timmons Lane
Houston, TX 77027
E-mail: stephen.keen@h-gac.com

Form Submittal Date: _____

H-GAC ITS Architecture Maintenance Form

H-GAC ITS Architecture Plan

ITS Architecture Maintenance Form

Question 1 Describe the requested change to the ITS Architecture Plan.	
Question 2 Are any of the ITS Architecture Plan ITS service packages impacted by the proposed change?	☐ Yes: Please complete Questions 2A and 2B ☐ No: Please proceed to Question 3 ☐ Unknown: Please coordinate with H-GAC to determine impacts of the change to the ITS Architecture Plan
Question 2A List all ITS service packages impacted by the proposed change.	
Question 2B Include a copy of the ITS service packages diagrams for all ITS service packages impacted by the proposed change. Mark any proposed modifications to the ITS service packages requested. Add any additional notes on proposed changes in this section.	
Question 3 Does the proposed change impact any stakeholder agencies other than the agency completing this form?	☐ Yes: Please complete Questions 3A and 3B ☐ No: Form is complete ☐ Unknown: Please coordinate with H-GAC to determine impacts of change to other agencies in the ITS Architecture Plan
Question 3A Identify the stakeholder agencies impacted by the change and a contact person for each agency.	
Question 3B Describe the coordination that has occurred with the stakeholder agencies and the results of the coordination?	