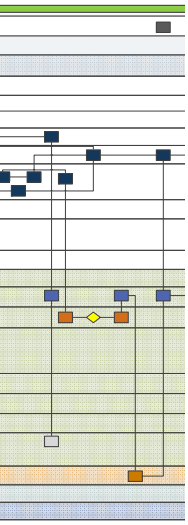
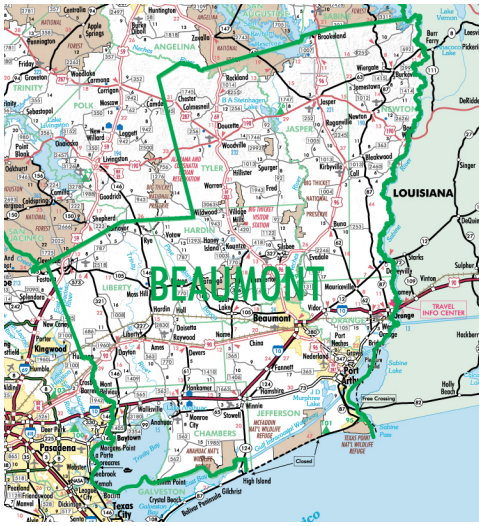
TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO)





BEAUMONT DISTRICT PROGRAM PLAN

APRIL 2021

Texas Department of Transportation

Document Control

Version	Date	Description of Change	Author
0.1	06/23/2020	Draft for Working Group review	DKS Associates Team
0.2	07/09/2020	Revised draft for Working Group and expanded stakeholder review	DKS Associates Team
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1.0	04/22/2021	Updated Figure 1	DKS Associates Team

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List of Acronyms

Acronym	Definition
AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AE	Area Engineer
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
BMT	Beaumont District
BP	Business Processes
CMM	Capability Maturity Model
CMF	Capability Maturity Framework
CO	Collaboration
ConOps	Concept of Operations
CRIS	Crash Records Information System
CU	Culture
DBE	Disadvantaged Business Enterprise
DD6	Jefferson County Drainage District 6
DDC	Disaster District Committee
DE	District Engineer
DMS	Dynamic Message Sign
DMV	Department of Motor Vehicles
DOT	Department of Transportation
DPS	Department of Public Safety
EA	Engineer Assistant
EOC	Emergency Operations Center
FAST	Fixing America's Surface Transportation
FHWA	Federal Highway Administration
FTE	Full Time Equivalent (referring to full-time staff position)
HCRS	Highway Condition Reporting System
H-GAC	Houston-Galveston Area Council
HOU	Houston District
HSIP	Highway Safety Improvement Program
HUB	Historically Underutilized Business
IT	Information Technology
ITS	Intelligent Transportation Systems
JOHRTS	Jefferson-Orange-Hardin Regional Transportation Study
LOS	Level of Service

Acronym	Definition
LOTTR	Level of Travel Time Reliability
MAP-21	Moving Ahead for Progress in the 21st Century Act
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan
N/A	Not Applicable
NHS	National Highway System
NPMRDS	National Performance Management Research Data Set
NWS	National Weather Service
O&M	Operations & Maintenance
OW	Organization and Workforce
PCMS	Portable Changeable Message Sign
PIO	Public Involvement Office
PM	Performance Measurement
PMIS	Pavement Management Information System
R.A.C.E.	Roadways, Attitudes and Community Empowerment
RIMS	Regional Incident Management System
SETRPC	South East Texas Regional Planning Commission
SHRP	Strategic Highway Research Program
SOP	Standard Operating Procedure
ST	Systems and Technology
STAN	Southeast Texas Alert Network
TBD	To Be Determined
TDM	Travel Demand Management
TIM	Traffic Incident Management
TIP	Transportation Improvement Program
TMC	Transportation Management Center
TMP	Traffic Management Plan
TMS	Traffic Management System
TP&D	Transportation Planning & Development
TRF	Traffic Division (Central Office)
TSMO	Transportation Systems Management & Operations
TTTR	Truck Travel Time Reliability Index
TTI	Texas A&M Transportation Institute
TxDOT	Texas Department of Transportation
US	United States
US DOT	United States Department of Transportation

Acronym	Definition
USGS	United States Geological Survey
UTP	Unified Transportation Program
VMT	Vehicle Miles Traveled

Executive Summary

The Beaumont District Transportation Systems and Management Operations (TSMO) Program Plan (TSMO Plan) documents the Beaumont District's strategic vision, goals, current TSMO processes, and recommended actions. The purpose of the plan is to implement data-driven decisions to make the transportation network safer, more efficient, and reliable over the next four years.

The TSMO Plan includes recommendations to improve workforce development, business practices, collaboration, culture, and performance management to support, streamline, and institutionalize TSMO projects and practices.

WHAT IS TSMO?

TSMO is "an integrated set of strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system." (United States Department of Transportation)

This Executive Summary highlights:

- TSMO benefits
- TSMO vision, mission, and goals
- Business case for TSMO
- Proposed early action items
- Plan update process

TSMO Benefits

TSMO provides agencies with the tools to manage and operate their existing transportation infrastructure more efficiently and effectively before making additional investments. It benefits every step of the project delivery life cycle.

TSMO BENEFITS

Provides the most cost-effective means to improve:

- *Safety*
- *Congestion*
- *Mobility and reliability*
- *Multimodal connectivity*
- *Emergency response*
- *Maintenance of overall system*
- *Optimization of existing infrastructure*
- *Customer service*

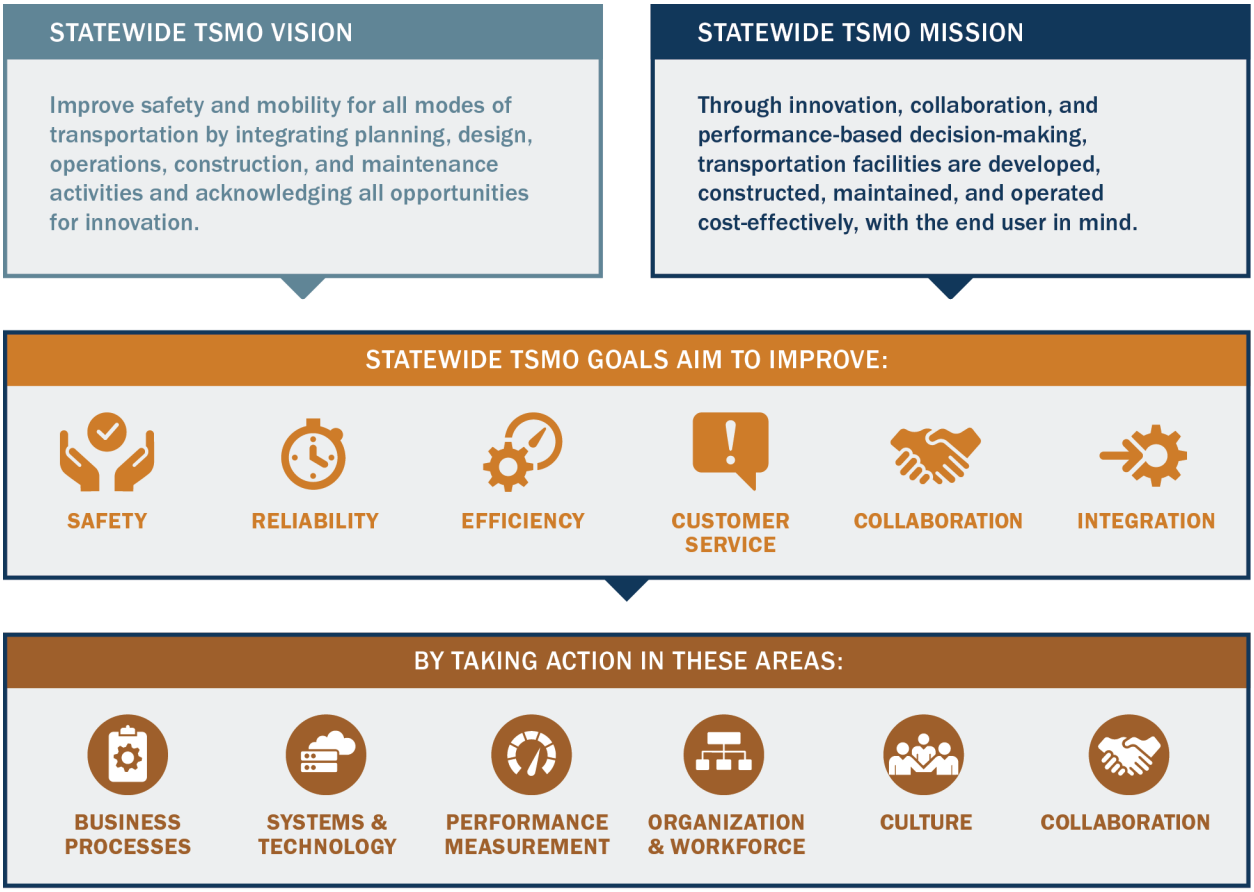
Mitigates the negative impacts on traffic from:

- TRAFFIC INCIDENTS
- WORK ZONES
- ADVERSE WEATHER CONDITIONS

Benefits many areas of the project life cycle:

TSMO Vision, Mission, and Goals

The district's TSMO vision, mission, and goals support those of TxDOT's statewide TSMO program. For each goal, targeted objectives, many of them measurable, are included in the main body of the report.



The Business Case for TSMO

The Beaumont District has successfully used TSMO strategies to mitigate the impacts of weather incidents and fast population growth in the region. The strategies in this TSMO plan are aimed at the current key influencers shown below.

Proposed Early Actions

Action items identified for implementation by the Beaumont District within the next 12 to 18 months:

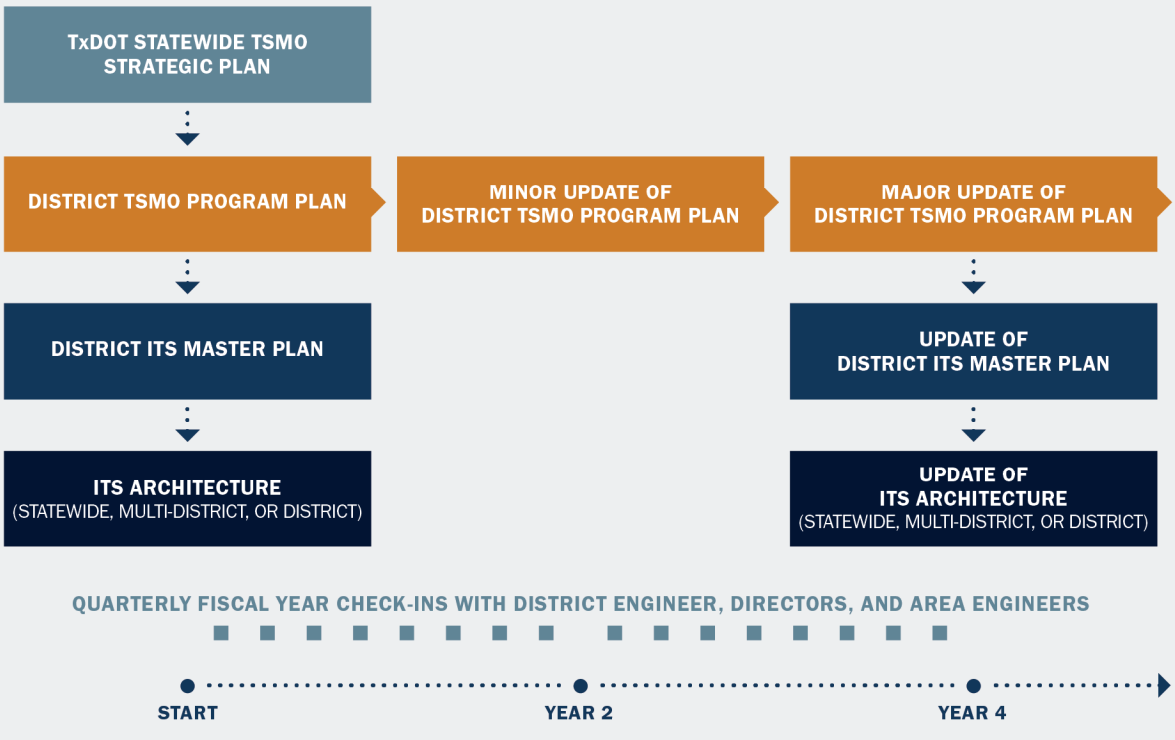
	Business Processes (BP)
BP-01	Establish TSMO Program Coordinator role and responsibilities to facilitate program implementation and TSMO integration into all aspects of project delivery process across the Beaumont District.
BP-02	Develop Intelligent Transportation System (ITS) Master Plan.
BP-03	Incorporate standalone ITS projects into TxDOT's 10-year Unified Transportation Program (UTP). Update list every year as part of the UTP's annual update cycle
	Systems and Technology (ST)
ST-01	Develop criteria for using Traffic Management Plan (TMP); Develop template for Beaumont District TMP
	Performance Measurement (PM)
PM-01	Develop and implement data-driven performance feedback loop for TSMO project elements (e.g., performance monitoring including metrics, data needs and frequency, and feedback to project development cycle).

PM-02	Overlay BMT's pavement monitoring system with crash data, drainage data, and weather data.
	Organization and Workforce (OW)
OW-02	Establish practices for information sharing on TSMO successes, (e.g., share work zone best practices) with public and private sector partners.
	Culture (CU)
CU-01	Develop checklist for regular ongoing stakeholder/partner outreach to keep stakeholders informed of Beaumont District projects and points of contact and vice versa.
	Collaboration (CO)
CO-01	Meet every quarter with representatives from the four core sections and the three Area Offices to review TSMO implementation status.
CO-02	Identify BMT Liaison(s) for Emergency Operations Centers (EOCs) so there are primary and backup points to contact and update the list annually in conjunction with hurricane evacuation manual update.
CO-03	Implement the Pathfinder Project developed by the Federal Highway Administration (FHWA) and the National Weather Service (NWS) to support emergency weather operations.
CO-04	Initiate scenario planning and after-action response with partners to prepare for all major emergency events (including weather, plant explosions, fire, etc.) to establish evacuation routes and technology redundancy.
CO-05	Develop process (such as a regular meeting/call) to partner with Ports and private industry to improve freight management.
CO-07	Collaborate with the Southeast Texas Alert Network (STAN) to consistently inform citizens about transportation mobility and safety impacts.
CO-08	Develop and maintain a contact list of emergency management and law enforcement personnel for internal use by the Beaumont District.
CO-09	Meet annually to discuss Highway Safety Improvement Program (HSIP) and to coordinate an approach among different sections within the district.
CO-10	Meet annually to discuss Road to Zero program and to coordinate an approach among different sections within the district.

Update Process

The Beaumont District plans to review TSMO action item implementation status on a quarterly basis with the district engineer, area engineers, and directors, and to update the entire plan on a four-year cycle.

BEAUMONT DISTRICT UPDATE PROCESS



Introduction

The Beaumont District Transportation System Management and Operations Plan (Beaumont TSMO Plan) prioritizes reliable strategies for operations and management of the existing transportation infrastructure to use it at its full potential. The Beaumont TSMO Plan supports the TxDOT TSMO Statewide Strategic Plan (TxDOT, 2018) by providing a district-level approach. TSMO strategies, including traffic management, traffic incident management, traveler information, work zone management, and freight management will help transportation engineers and planners to proactively manage the system in real time and improve system efficiency. As such, they are key tools to address increasing congestion and limited funding.

The Beaumont TSMO Plan includes recommendations to improve various process and institutional dimensions within the district:

- Business processes
- Systems and technology
- Performance measurement
- Culture
- Organization and workforce
- Collaboration (both internal and external)

These improvements will support, streamline, and institutionalize TSMO projects and practices across the district and with external stakeholders. Implementing the Beaumont TSMO Plan will improve project delivery processes by integrating mobility-focused solutions throughout planning, programming, design, construction, operations, and maintenance phases of project life cycles. By continuing collaboration with external stakeholders and implementing processes that support data-driven decisions, the movement of people and goods will be safer, more efficient, and more reliable.

Program Plan Format

Key components of the Beaumont TSMO Plan:

- An introduction to TSMO and a description of the Beaumont District boundaries and key stakeholders
- The business case for why TSMO is needed in the Beaumont District
- The TxDOT statewide mission, vision, goals, and objectives on which the Beaumont TSMO objectives were created, and which form the foundation of the action items in the implementation plan
- A discussion of the six dimensions of the capability maturity model (CMM) with discussion of the successes and challenges of function areas identified in each of the six dimensions
- A TSMO Implementation Plan, which includes a list of actions items with a description of priority, timeline, lead Beaumont District staff, resources, and partners (e.g., adjacent districts, Traffic Safety Division, external agencies); a maintenance plan is also included for continuous implementation and improvement between plan updates
- Recommendations for the development of a tactical plan for traffic management, which includes development of a traffic management center

Why Develop a TSMO Program Plan?

Traditionally in many transportation agencies, roadway capacity expansion has been the primary tool for managing transportation congestion and operations. However, capacity expansion cannot solely be relied upon to address the needs of the modern transportation system. Other fundamental issues that argue for TSMO-based solutions rather than capacity expansion are:

- **Induced travel demand**, which can overwhelm new capacity projects even before completion
- **Limited funding**, which often requires district to choose between maintaining the system or adding more capacity
- **Expanding capabilities of technology**, which can be leveraged to address future mobility needs, including connected and automated vehicles, traveler information, system maintenance, crash mitigation, and other safety improvements

TSMO PROGRAM BENEFITS

"TSMO programs incorporate skills and capabilities of project delivery with effective systems management, traffic operations, technological innovations, and other activities that improve travel safety and reliability, enhance traveler information and user experience, and maximize the agency's return on capital investments."
(FHWA, 2017)

Implementing a TSMO program plan encourages the Beaumont District and its partners to evaluate a broad range of options to solve safety, mobility and reliability challenges.

The Beaumont TSMO Plan supports district Traffic Management Systems (TMS) performance measures, a priority identified by TxDOT's Chief Engineer. Initial metrics identified include TMS asset operational uptime, incident clearance times, level of travel time reliability, and geographic coverage. The Chief Engineer's memos are included in the appendix of the TxDOT TSMO Statewide Strategic Plan (TxDOT, 2018).

TSMO will be integrated into existing plans, programs, and business processes as much as possible. Like the Beaumont District, each TxDOT district is developing a District TSMO Program Plan.

TSMO BENEFITS

Provides the most cost-effective means to improve:

- *Safety*
- *Congestion*
- *Mobility and reliability*
- *Multimodal connectivity*
- *Emergency response*
- *Maintenance of overall system*
- *Optimization of existing infrastructure*
- *Customer service*

Mitigates the negative impacts on traffic from:

- TRAFFIC INCIDENTS
- WORK ZONES
- ADVERSE WEATHER CONDITIONS

Benefits many areas of the project life cycle:

Current Beaumont District TSMO State of the Practice

The TxDOT Beaumont District is responsible for planning, programming, design, construction, operations and maintenance of transportation and other related projects within the district. Within each of these areas, the TxDOT Beaumont District is already applying TSMO tools at varying levels and consistency.

Current districtwide TSMO activities, and TSMO related transportation planning and development (TP&D), construction, operations, and maintenance activities are summarized in Table 1. Additional details and supporting documents are provided in the Beaumont District State of the Practice Report (TxDOT Beaumont District, 2020). The current TSMO activities were reviewed as part of the Capability Maturity Model, described later in this plan.

TABLE 1: BEAUMONT DISTRICT TSMO CURRENT STATE OF THE PRACTICE

Group	TSMO Activity
Districtwide	▪ Beaumont District developed R.A.C.E. to Zero safety plan, which supports statewide "Road to Zero" initiative to reduce fatalities on state highway by half by 2035 and to zero by 2050 (TxDOT Beaumont District, 2020) ▪ Junior Engineering Assistant (EA) staff rotation program provides cross-training between sections ▪ Robust traveler information program through the district's Public Information Office (PIO) using traditional and social media (@TxDOTBeaumont, DriveTexas.org, HoustonTranStar.org, etc.) ▪ Well-established inter-jurisdictional coordination (e.g., regular meetings with larger jurisdictions, Disaster District Committee for hurricane preparedness and response)
TP&D	▪ Beginning to include ITS technologies in project development phases (planning, programming, and design) ▪ Coordinate with the South East Texas Regional Planning Commission (SETRPC) to program projects in Hardin, Jefferson, and Orange counties and with the Houston-Galveston Area Council (H-GAC) in Liberty and Chambers counties
Construction	▪ Statewide tools used to determine use of law enforcement and posted speed limit reduction in construction zones ▪ Statewide decision tool used to identify Smart Work Zone applications ▪ Alternate procurement methods used (e.g., A + B, design-build, and lane rentals) to increase flexibility for including TSMO strategies in construction projects ▪ Use a three-year holiday schedule to avoid lane closures and to coordinate staff availability ▪ Use Contract Administration Best Practices Checklist for construction contract functionality, record keeping, and uniformity across the district
Operations	▪ Recent and programmed upgrades to traffic signal controllers within next four years ▪ Adaptive traffic signal system is being installed on US 90 in Dayton ▪ ITS Regional Architecture ▪ ITS devices in use include cameras, Bluetooth readers, dynamic message signs, and fog detectors

Group	TSMO Activity
Operations (continued)	▪ Currently expanding ITS infrastructure and supporting communications network with ongoing and upcoming construction projects, such as I-10 widening and the I-69 conversion project ▪ ITS Master Plan is currently under development to prioritize TMS investments ▪ Communications system includes cellular modems and fiber optic cable ▪ Houston District manages the Beaumont ITS infrastructure after hours at the Houston TranStar traffic management center (TMC); the Beaumont District has started developing plans for an unmanned TMC workstations to support TSMO during emergencies
Maintenance	▪ Manage pavement assets with Pavement Analyst, Pavement Management Information System, and infrared cameras on vans to assess and monitor pavement conditions ▪ Have plans to add asset inventories ▪ Maintenance crews assist law enforcement and local jurisdictions with traffic incident response when requested

Beaumont District Boundaries

The Beaumont District is shown in Figure 1, and includes eight counties. Figure 1 highlights the larger cities as well as the two ports within the district. Approximately half of the district falls within a Metropolitan Planning Organization (MPO) service area:

- South East Texas Regional Planning Commission: Serves Hardin, Jefferson, and Orange Counties and is located within the Beaumont District boundaries.
- Houston-Galveston Area Council: Liberty and Chambers Counties fall within the 13-county H-GAC service region that is primarily located in the Houston District.

The Beaumont District has three Area Offices and nine Maintenance Offices as listed in Table 2.

TABLE 2: OFFICES WITHIN THE BEAUMONT DISTRICT

District Office	Area Offices	Maintenance Offices		
Beaumont	Beaumont Jasper Liberty	Anahuac Beaumont Jasper	Kountze Liberty Newton	Orange Port Arthur Woodville

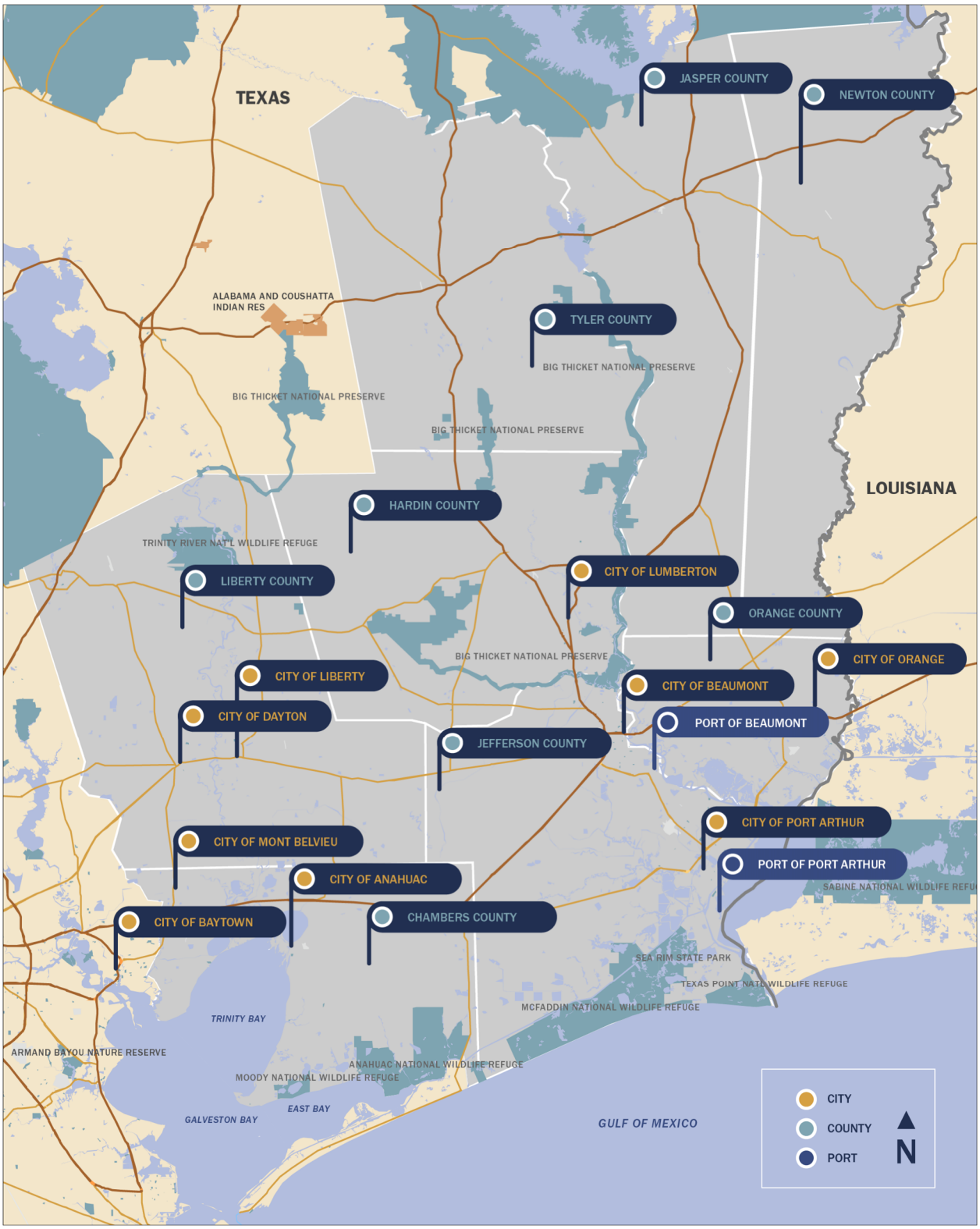


FIGURE 1: BEAUMONT DISTRICT AREA MAP

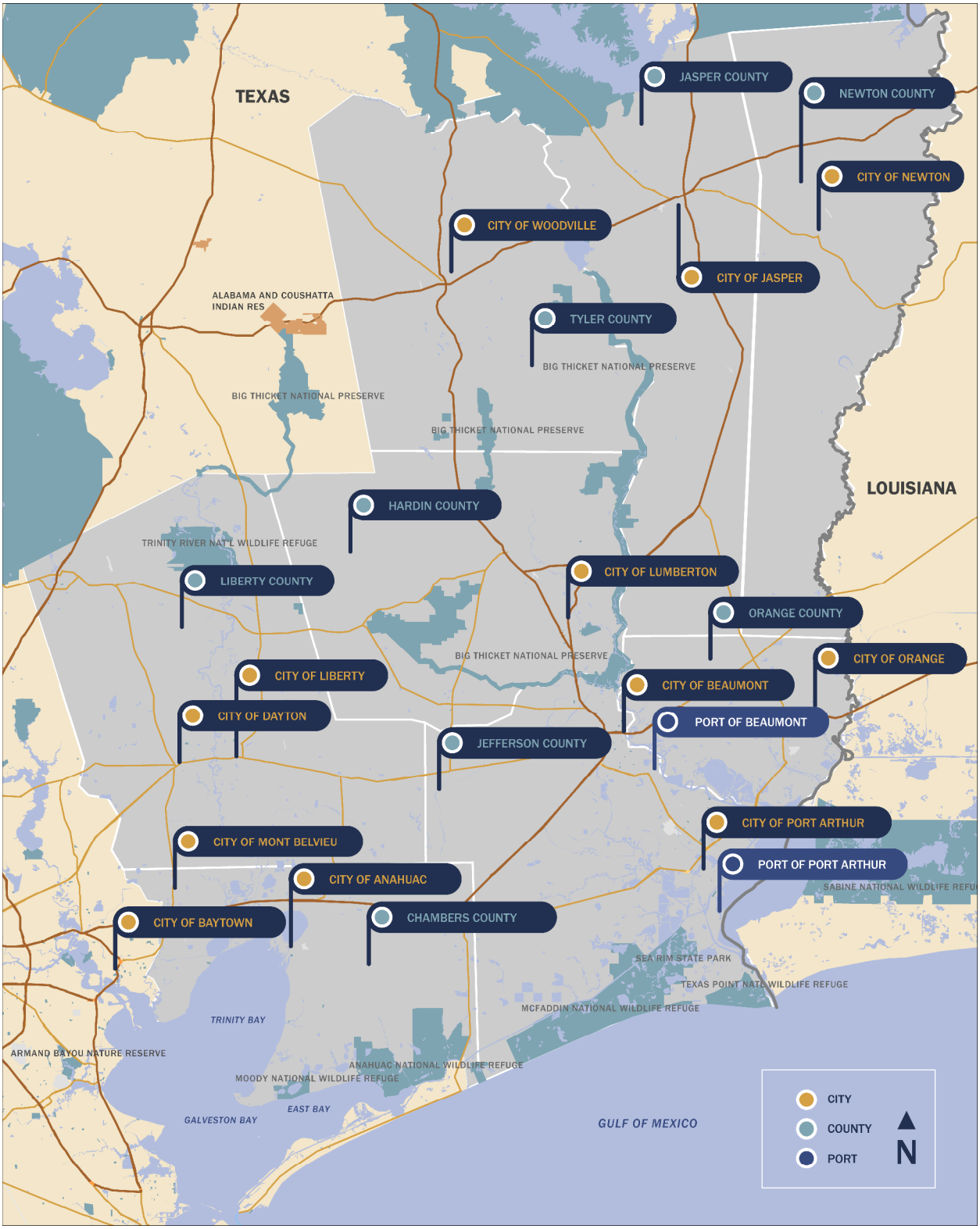


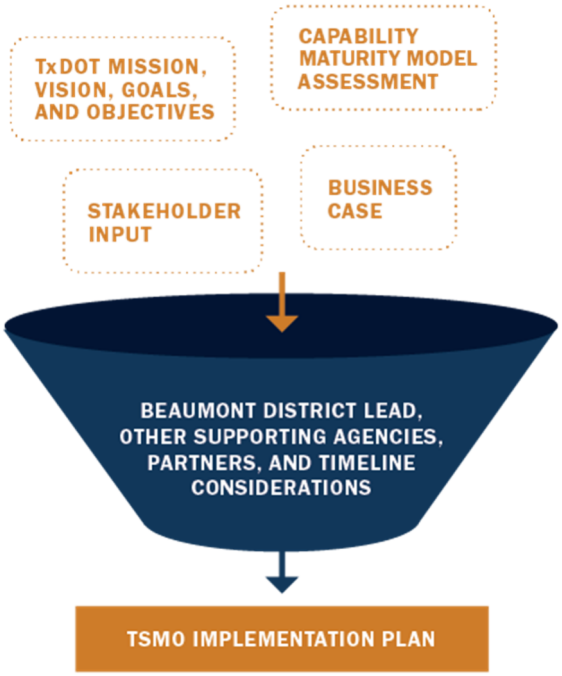
FIGURE 1: BEAUMONT DISTRICT AREA MAP

Stakeholder Involvement

Stakeholders from each practice area within the Beaumont District participated in a Working Group to develop the Beaumont TSMO Plan through a series of meetings, workshops and phone calls between October 2019 and September 2020.

The workshops included participation with numerous external stakeholders from area cities, counties, ports, and law enforcement agencies. The stakeholder outreach process is shown in Figure 2 and stakeholders are acknowledged in Appendix A.

The Beaumont TSMO Plan effort was led by the district's Operations section. The District Engineer (DE) participated throughout the development of this plan, which helped accelerate district leadership consensus.



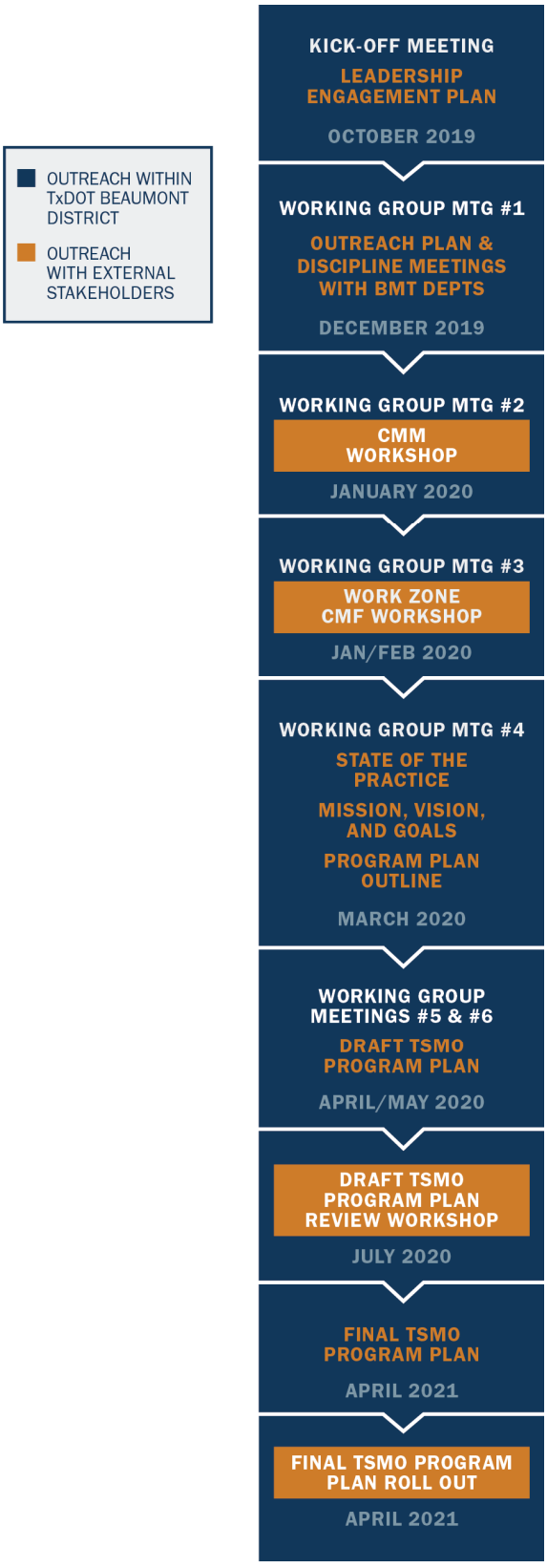


FIGURE 2: STAKEHOLDER OUTREACH PROCESS

How Can TSMO Improve Equity in the Beaumont District?

Equity refers to the distribution of "benefits and burdens" of the transportation system on vulnerable members of the community such as low-income residents, minorities, children, persons with disabilities, and older adults (US DOT, 2013). These community members may rely on public transportation for access to grocers, schools, medical facilities, and employment. Nationally, only 30 percent of urban jobs are accessible via a 90-minute ride via public transportation (Mobility Lab, 2019). Access to reliable transportation is critical to addressing poverty and unemployment. Applying TSMO ideas: pavement management system—overlay with demographics—make sure that disadvantaged communities are prioritized; checklist for incorporation of bicycles and pedestrians for new projects or improving safety of existing crosswalks (partnership opportunity); talking pedestrian signals; school zone safety – automate systems, remote flashers, etc.

Following are some excerpts:

- TSMO strategies can increase public awareness of suitable travel options. Through the use of transportation options marketing, travel demand management (TDM), and traveler information programs, travelers can make more informed decisions about their mode choice, travel time, and/or travel routes, leading to smarter, more efficient use of the transportation network (US DOT, 2012).
- TSMO strategies can provide greater social equity by increasing travel options for disadvantaged populations and communities. TSMO strategies that improve multimodal safety are strategies that promote social equity amongst all populations including senior citizens, children, and those with disabilities.
- TSMO strategies preserve existing communities by maximizing the efficient use of existing infrastructure. ITS and operations investments require minimal new rights of way or construction, thereby preserving existing transportation infrastructure while improving operations. TSMO may reduce the need for potentially costly and disruptive capital investments that may be out of character with communities they serve.

Maximizing the livability and sustainability benefits of TSMO strategies requires a balanced approach. Not all TMSO strategies support livability and sustainability outcomes equally. For example, traffic signals that prioritize vehicle traffic flow but do not consider the mobility and access needs of pedestrians, bicycles, and transit can actually work against livability and sustainability principles. In contrast, signal timing plans and roundabouts that support livability and sustainability objectives will provide improved mobility in a way that balances vehicular and bus traffic, pedestrians, and bicycle access, in order to support community vitality, safety, and the environment.

A balanced approach to TSMO provides a framework that helps practitioners consider trade-offs, better understand potential impacts on livability and sustainability, and avoid unintended results. Most importantly, this framework encourages practitioners to evaluate transportation system operations from a variety of perspectives and consider how the system can be optimized in multiple ways to achieve different performance measures and goals.

Business Case for TSMO in the Beaumont District

The business case for TSMO is built on providing TxDOT and its partners a robust set of strategies to maintain safety and reliability of the transportation system in the face of increased regional growth, severe weather, major construction projects, and limited resources and budget.

Figure 3 summarizes the business case for TSMO in the Beaumont District, highlighting the key influencers in the district, challenges and/or opportunities resulting from these influencers, and relevant TSMO strategies to address them. The paragraphs that follow provide additional discussion about the business case.

FIGURE 3: BEAUMONT DISTRICT BUSINESS CASE FOR TSMO — INFLUENCERS, CHALLENGES/OPPORTUNITIES, AND STRATEGIES

Managing Travel Reliability and Safety

In the Beaumont District, Interstate 10 (I-10) classifies as a primary highway freight system roadway, one of the most critical highway portions of the United States (US). In the Beaumont District, the highest change in traffic volume in the past five years has been on I-10 between US 90 and Phelan Boulevard and the highest truck volume was along I-10 between US 69 and Washington Boulevard. The highest number of crashes occurred on I-10 at North Pearl Street and most of the district's crashes are along I-10 and US 69.

The Beaumont District is committed to the formal Road to Zero goal adopted by the Texas Transportation Commission to achieve zero fatalities on roadways by 2050 and to cut fatalities in half by 2035. From 2015 to 2019, highways in the Beaumont District have experienced approximately 115 fatalities per year on average and approximately 400 incapacitating injury crashes per year on average. In spring 2020, the district

developed a Roadway Safety Plan, or R.A.C.E. to Zero, which is built on three principles: Roadways, Attitudes and Community Empowerment (R.A.C.E.). The plan is a data-driven safety program using the 4 E's (Engineering, Education, Enforcement, and Emergency Response) to move toward the Road to Zero goals. The plan also supports equity of the transportation system.

TSMO strategies improve safety by addressing congestion that is unpredictable. Strategies that reduce conflict points, provide information to travelers, and allow quicker incident response are becoming more widely available:

- Road weather information systems can reduce traveler delay and lower crash rates by seven to 83 percent.
- Overheight vehicle warning systems can decrease bridge strikes by up to 66 percent.
- Traffic incident management can decrease incident duration by 30 to 40 percent.
- Traffic signal optimization can decrease delay substantially (13 to 94 percent) while improving safety at a fraction of the cost of infrastructure capacity expansion.
- Smart work zone management results in improved safety to both traveling public and construction workers.

Supporting Effective Economic Activity and Freight Movement

Truck traffic represents a major contributor to the Average Annual Daily Traffic (AADT) for several designated truck routes. I-10's primary function is to facilitate long-distance travel and trade, with trucks on I-10 in Beaumont comprising 16 to 42 percent of the AADT. The Port of Beaumont is the fifth busiest port in the US. Serving as the primary lay berth for the fleet of the US Department of Transportation Maritime Administration, the port is a strategic military port within the National Port Readiness Network and is the busiest port for US military cargo. The port also serves as the headquarters for the US Army 842nd Transportation Battalion, which is responsible for all military maritime logistics in the Gulf of Mexico, the Pacific Northwest, and Alaska. On-site, the port provides 620,000 square feet of covered storage and 90 acres of open-air storage.

In October 2018, the US Commerce Department awarded the Port of Beaumont Navigation District a grant in the amount of $5 million to reconstruct three docks in support of the Port's Main Street Terminal 1 Dock Project. The improvement will support additional cargo that will increase economic activity and business growth within the region creating or retaining 15,750 jobs and generating $9.8 million in private investment. Currently, there is no direct connection from the Port to TxDOT on-system facilities, and Port ingress/egress for trucks impacts City of Beaumont streets.

Strategies to manage and operate the transportation system protect the supply chain and help meet just-in-time delivery schedules in a safe and timely manner:

- New transportation strategies make goods movements more predictable and efficient, translating into lower costs for goods and enhanced economic competitiveness.
- Real-time information about travel conditions, weather, and road work helps truck drivers and dispatchers to make informed, safe decisions about travel routes and schedules.
- TSMO freight strategies include advanced technologies that optimize freight movement scheduling and dynamic route guidance. These strategies use real-time information on traffic conditions on I-10, US 69/96, and US 90 to recommend optimal truck routes.

Improving the Ability of TxDOT to Plan, Respond, Collaborate, and Recover During Emergencies

Flooding was noted as a major concern and an on-going challenge due to the frequency of heavy rainfall events, including tropical storms and hurricanes. In addition to short-term flooding from heavy rainfall events, concerns also include emergency response, including evacuation, repatriation, and getting resources to help people in affected areas. The Beaumont District noted the need for more robust and reliable ITS communications. Currently, there are not enough cameras, flood gauges, or access for reliable remote assessment (roadway water depth measurement and verification) of flooding and operational issues. TSMO capabilities including improved monitoring of facilities, interoperable systems, enhanced field-to-center communication links and data sharing will help the Beaumont District with greater preparedness, situational awareness, and the ability to control the roadway system. Jefferson County Drainage District Number 6 (DD6) has started developing a flood warning system. The Beaumont District is coordinating with DD6.

Improving Traveler Information Related to Non-Recurring Delay

Many of the travel decisions, especially for freight and long-distance through travel, are made outside the regional boundaries. Consequently, travelers and truck traffic arriving in the Beaumont District may not be aware of work zones, lane closures, or weather-related capacity restrictions. TSMO strategies like predictive traveler information, especially for long-distance travel (e.g., the I-35 Work Zone Project), might be particularly useful in combination with statewide resources, as well as in coordinating with the neighboring Houston District. Widespread traveler information helps provide equity to travelers.

Making Data-Driven Decisions to Maximize TxDOT's Return on Investment and Value to Customers

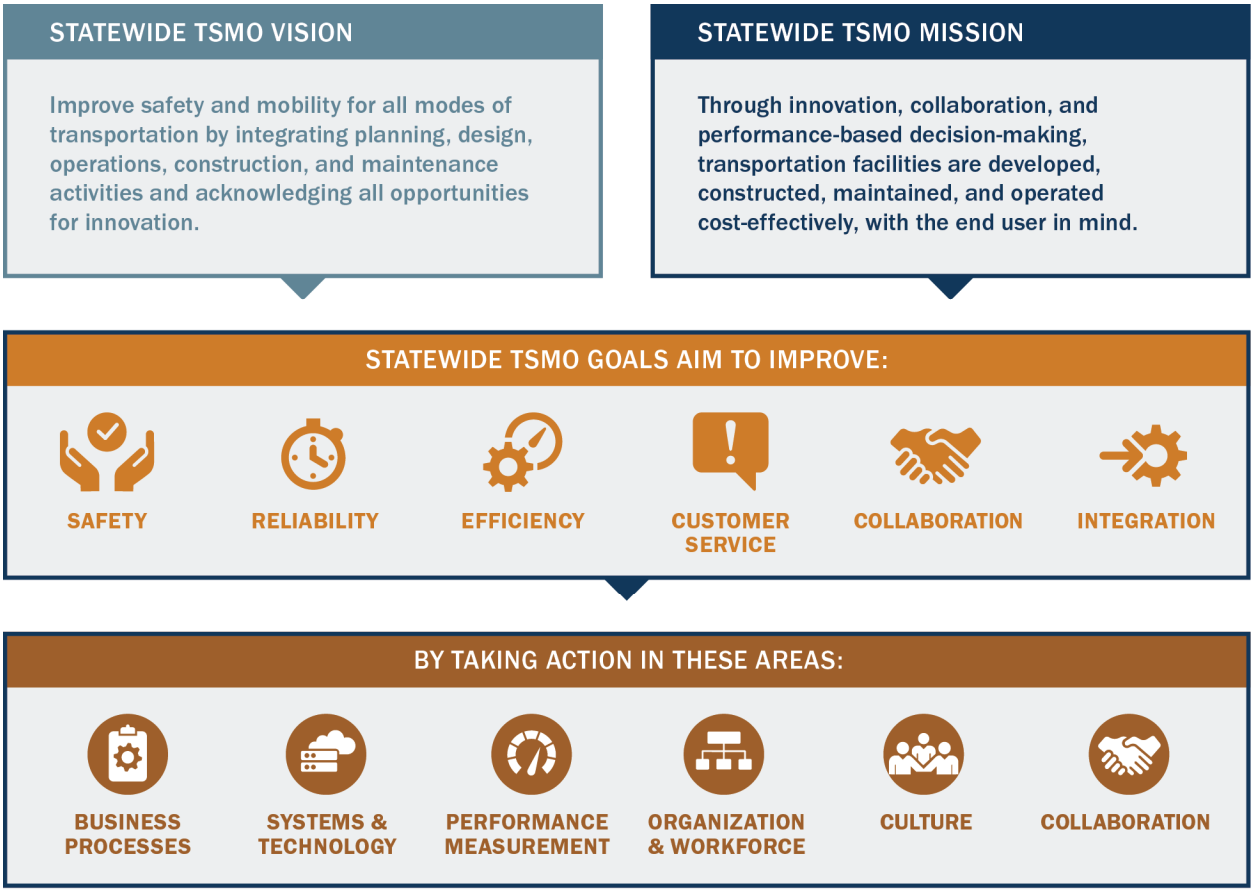
TSMO strategies are generally low-cost compared to capacity investments. More importantly, they are extremely cost-effective in terms of the impacts produced. By utilizing the data generated by TSMO and combining it with existing TxDOT resources, investments for both TSMO or for other transportation investments can be based on performance and cost-benefit analysis, including social costs. TSMO is a catalyst to establish and ensure the availability of reliable real-time data sources, expert staff, and clear performance measures to effectively collect, report, and share data and to monitor performance for the region.

Providing TSMO Leadership

Compared to large metropolitan districts, the region has less resources in terms of workforce, funding, and systems to devote to TSMO. Limited TSMO asset management tools and practices make it difficult to plan for system maintenance, technology upgrades, and replacement. This creates an onus on the district to integrate TSMO into transportation planning, programming, scoping, and engineering, with more collaboration between highway design and operations. The case to creatively address operations & maintenance (O&M) and information technology (IT) issues associated with TSMO assets (ITS infrastructure, back-office systems, traffic signal infrastructure, and priority treatments) through innovative contracting, workforce development, and resource sharing (with other districts) are critical to TSMO in the region.

TSMO Vision, Mission, Goals, and Objectives

The Beaumont District supports the statewide TSMO vision, mission, and goals and has developed district-specific objectives to support the statewide goals as described in this section.



Beaumont District TSMO Goals and Objectives

The Beaumont District supports each of the six statewide TSMO goals (safety, reliability, efficiency, customer service, collaboration, and integration) and has developed objectives for the district under each goal to support ongoing monitoring of the effectiveness of the TSMO program plan. Measurable objectives have been set where baseline data is available to track performance. Other objectives are aspirational and should be re-visited with future TSMO Plan updates once the district has established more performance metrics and data sources. The Beaumont District objectives are listed in Table 3 along with the corresponding statewide goals.

TABLE 3: STATEWIDE AND BEAUMONT DISTRICT TSMO GOALS AND OBJECTIVES

Goal	Strategic Statewide Objectives	Strategic Beaumont District Objectives
Safety 	Reduce crashes and fatalities through continuous improvement of traffic management systems and procedures.	▪ Reduce 5-year rolling average fatalities by half by 2035. ▪ Reduce fatalities to approach zero by 2050. ▪ Reduce severe injury crashes (both incapacitating and non-incapacitating). ▪ Reduce work zone crashes. ▪ Review fatality and serious injury crashes annually to determine countermeasure strategies.
Reliability 	Optimize travel times on transportation systems in critical corridors to ensure travelers are reaching their destinations in the amount of time they expected for the journey.	▪ Increase percent of person-miles traveled on the Interstate system that are reliable. ▪ Increase percent of person-miles traveled on the non-Interstate national highway system (NHS) that are reliable. ▪ Reduce delay caused by work zones or system maintenance. ▪ Reduce average incident clearance time on highways. ▪ Reduce the time to evacuate people in the region.
Efficiency 	Implement projects that optimize existing transportation system capacity and vehicular throughput.	▪ Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate. ▪ Maintain a program of evaluating 100 percent of signals for retiming every three years.
Customer Service 	Provide timely and accurate travel information to customers so they can make informed mobility decisions.	▪ Reduce time between incident/emergency verification and posting an alert to traveler information outlets (e.g., dynamic message sign (DMS), website, social media). ▪ Reduce the time between recovery from incident/emergency and removal of traveler alerts for that incident. ▪ Increase number of repeat visitors to Beaumont section of DriveTexas.org during major events (e.g., floods, hurricanes). ▪ Increase number of subscribers to Beaumont District social media platforms.
Collaboration 	Proactively manage and operate an integrated transportation system through multi-jurisdictional coordination, internal collaboration, and cooperation between various transportation disciplines and partner agencies.	▪ Meet once per fiscal year quarter with representatives from the four core sections and the three Area Offices to review TSMO implementation status. ▪ Hold after-action review meetings with attendance from the majority of the agencies involved in the response to an incident or adverse weather event. ▪ Increase the number of major capital projects reviewed for regional construction coordination to 100 percent in three years.

Goal	Strategic Statewide Objectives	Strategic Beaumont District Objectives
Integration	Prioritize TSMO as a core objective in the agency's planning, design, construction, operations, and maintenance activities.	▪ Increase incident detection capabilities on I-10 and US 69 to achieve 100 percent TMS coverage by 2030. ▪ Increase TMS coverage to 60 percent of major highway junctions by 2030. ▪ Maintain 90 percent TMS asset operational uptime annually. ▪ Expand network monitoring to 100 percent of traffic signals over the next five years. ▪ Increase number of ITS-related assets in use for incident and emergency detection/response. ▪ Conduct joint training exercises in the region.

Capability Maturity Model

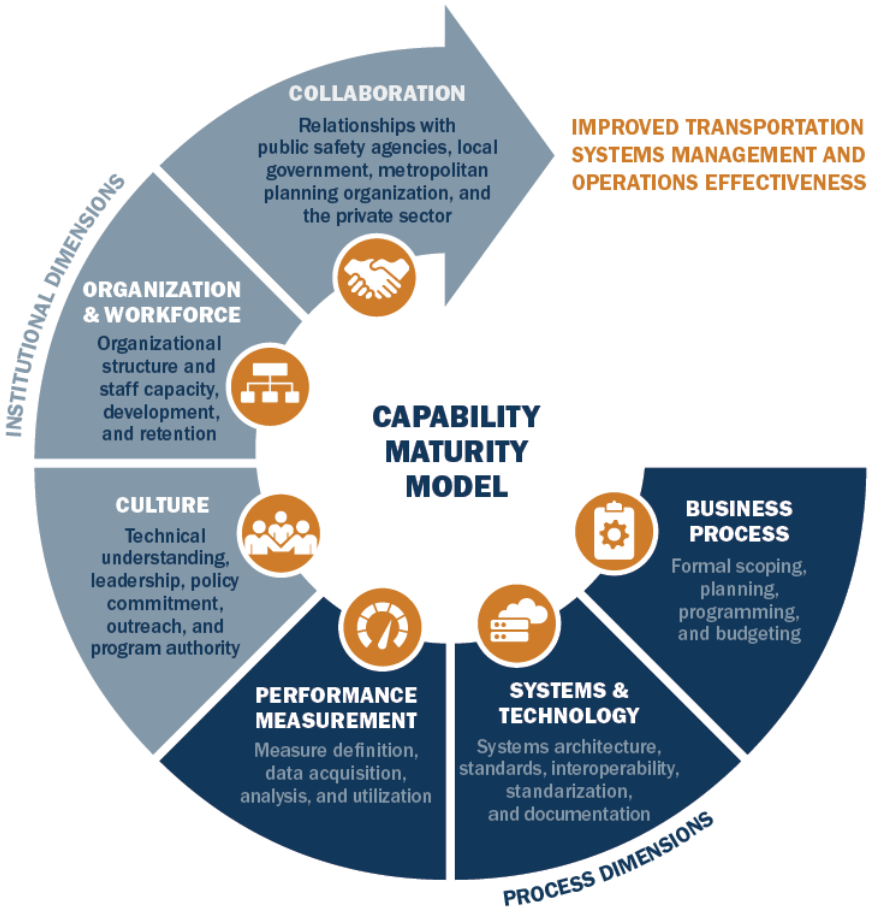
This section includes an introduction to the Capability Maturity Model (CMM) process and summarizes the assessment of how each of the six dimensions applies to the Beaumont District: 1) business processes, 2) systems and technology, 3) performance measurement, 4) organization and workforce, 5) culture, and 6) collaboration (FHWA, 2020).

Introduction to the CMM Process

Existing capabilities, gaps, and needs for TSMO in the Beaumont District were identified through a combination of interviews and workshops. Tools used to gather capabilities were the TSMO Capability Maturity Model and Frameworks. The CMM self-assessment framework, shown in Figure 4, is comprised of six dimensions of capability—three process-oriented dimensions and three institutional dimensions. The Capability Maturity Frameworks (CMFs) are based on the same dimensions but are focused on specific aspects of TSMO like work zone management.

The use of the capability maturity concepts provides an approach to review common barriers to adoption and success of TSMO and allows agencies to understand and identify actions for improvement of institutional issues that an agency faces on a continual and consistent basis. The process fosters an agency's ability to develop consensus around needed agency improvements; identify their immediate priorities for improvements; and identify concrete actions to continuously improve capabilities to plan, design, and implement TSMO.

Capability Maturity Model workshop at the Beaumont District Office



Source: Strategic Highway Research Program (SHRP2), American Association of State and Highway Officials (AASHTO), and Federal Highway Administration (FHWA-HOP-17-017)

FIGURE 4: CAPABILITY MATURITY DIMENSIONS

Consistent with the Strategic Highway Research Program 2 (SHRP2, 2017) guidance and other federal CMM and CMF guidance (AASHTO, 2014; FHWA, 2017), the capabilities for each dimension are described as a matrix that defines the process improvement areas and levels (from Level 1, ad-hoc, to Level 4, optimized level of capability). Table 4includes this matrix, which shows how each of the six dimensions is assessed for each level. Following a self-assessment process, specific actions are identified to increase capabilities across the desired process areas.

The capability assessment process, tool, and instructions were discussed with stakeholders during the workshop. The overall assessment of capability for the Beaumont District provided in Table 5 is based on the input provided during the CMM workshop. Stakeholders at the workshop rated themselves near a Level 2 for business processes and collaboration, noting that the rating for collaboration for planned events and emergency operations was higher. They rated themselves a Level 1 for systems and technology, performance measurement, organization and workforce, and culture.

TABLE 4: CMM ASSESSMENT CRITERIA

Dimension	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes	Processes related to TSMO activities ad hoc and un-integrated	Multi-year, statewide TSMO plan and program exists with deficiencies, evaluation, and strategies	Programming, budgeting, and project development processes for TSMO standardized and documented	Processes streamlined and subject to continuous improvement
Systems & Technology	Ad hoc approaches outside systematic systems engineering	Systems engineering employed and consistently used for ConOps, architecture, and systems development	Systems and technology standardized, documented, and trained statewide, and new technology incorporated	Systems and technology routinely upgraded and utilized to improve efficiency performance
Performance Measurement	No regular performance measurement related to TSMO	TSMO strategies measurement largely via outputs, with limited after-action analyses	Outcome measures identified and consistently used for TSMO strategies improvement	Mission-related outputs/ outcomes data is routinely utilized for management, reported internally and externally, and archived
Organization & Workforce	Fragmented roles based on legacy organization and available skills	Relationship among roles and units rationalized and core staff capacities identified	Top level management position and core staff for TSMO established in central office and districts	Professionalization and certification of operations core capacity positions, including performance incentives
Culture	Value of TSMO not widely understood beyond champions	Agency-wide appreciation of the value and role of TSMO	TSMO accepted as a formal core program	Explicit agency commitment to TSMO as key strategy to achieve full range of mobility, safety, and liveability/ sustainability objectives
Collaboration	Relationships on informal, infrequent, and personal basis	Regular collaboration at regional level	Collaborative interagency adjustment of roles/ responsibilities by formal interagency agreements	High level of operations coordination institutionalized among key players –public and private

Source: Strategic Highway Research Program (SHRP2), American Association of State and Highway Officials (AASHTO), and Federal Highway Administration (FHWA-HOP-17-017)

TABLE 5: BEAUMONT DISTRICT CAPABILITY MATURITY SELF-ASSESSMENT BY WORKSHOP STAKEHOLDERS

Dimension	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes				
Systems and Technology				
Performance Measurement				
Organization and Workforce				
Culture				
Collaboration				

Capability Maturity Frameworks

During the capability workshop series, the Beaumont TSMO Plan Working Group performed CMF reviews on six CMF Frameworks: Traffic Management, Road Weather Management, Work Zone Management, Traffic Signal Management, Traffic Incident Management, and Planned Special Events. A CMF review applies the same CMM dimensions of business processes, systems and technology, performance measurement, workforce and organization, culture, and collaboration to very specific transportation operations and management practices. The CMF review highlighted some targeted opportunities for the Beaumont District, summarized in Figure 5. These are included, with other action items, in the Beaumont District TSMO Implementation Plan.

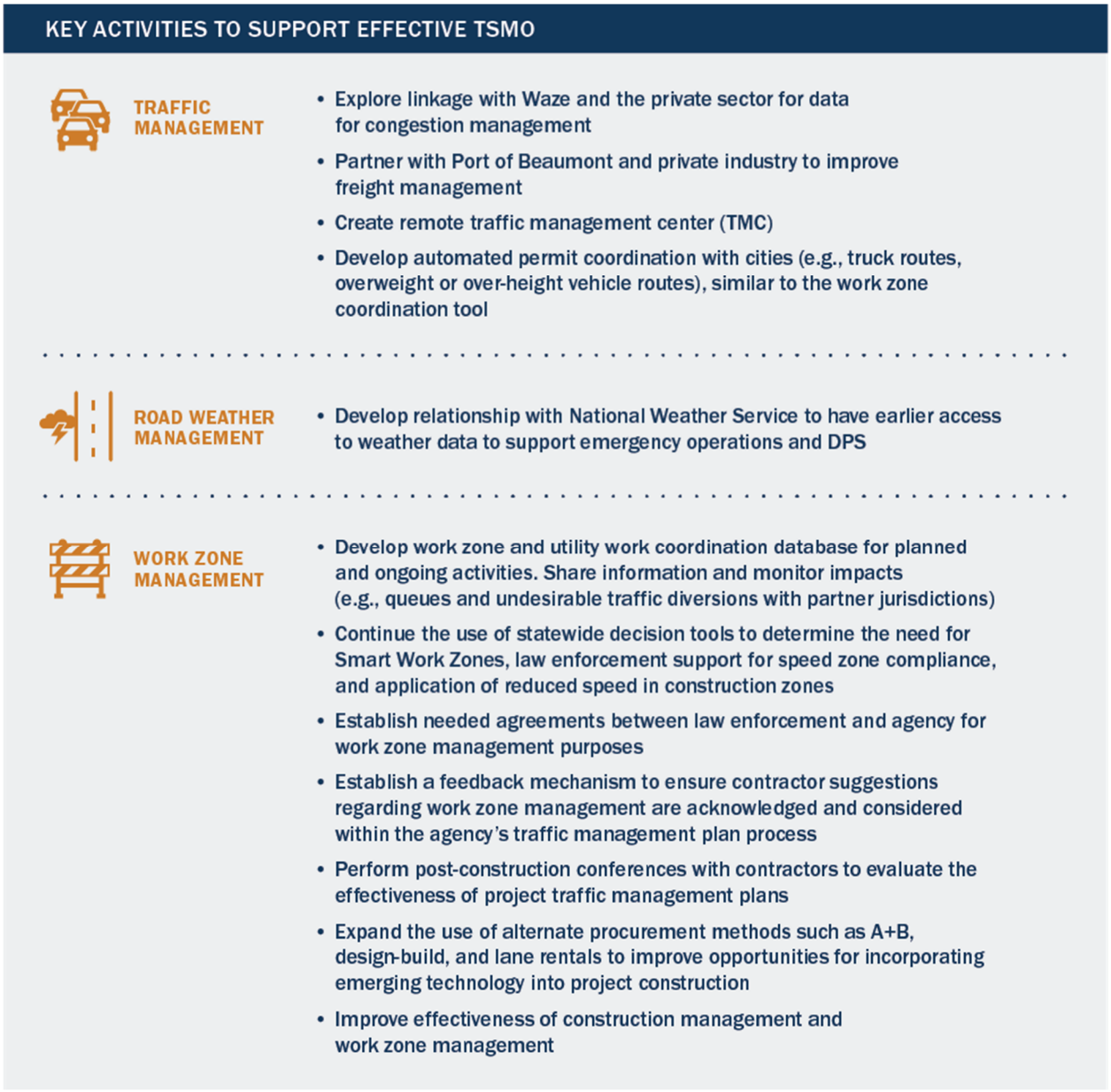


FIGURE 5: TARGETED OPPORTUNITIES IDENTIFIED BY THE CMF REVIEW

Table 6 includes the overall assessment. A detailed assessment report and survey are included in the CMF Assessment (TxDOT Beaumont District, 2020).

TABLE 6: CAPABILITY MATURITY FRAMEWORK ASSESSMENT BY WORKSHOP STAKEHOLDERS

Framework	Capability Level	Framework Description
Traffic Management	1 – 2	Ability to monitor and control traffic and the roadway network to coordinate traffic information
Traffic Signal Management	2	Planning, design, integration, maintenance, and proactive operation of a traffic signal system
Work Zone Management	2	Assessment of work zone impacts and implementing strategies to minimize or mitigate impacts
Traffic Incident Management	2	Planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents
Road Weather Management	2	Manage traffic flow and operations before and during adverse weather conditions
Planned Special Events	2	Advanced operations planning, stakeholder coordination, resource sharing, and public awareness of potential travel impacts

The following sections break down the district's existing capabilities and needs across the six dimensions.

Business Processes

This section describes the Beaumont District organization and incorporation of TSMO into the project delivery process.

Beaumont District Organization

The TSMO program at the Beaumont District is championed by the District Engineer. Directors of TP&D, Construction, and Transportation Operations, and Maintenance sections report to the District Engineer and conduct TSMO practices in their domain. As TSMO is related to all four sections across the district, the Directors practice TSMO to varying degrees. The three Area Offices in Beaumont, Liberty, and Jasper coordinate the TSMO process at the field level. The Area Engineer for each Area Office reports directly to the

District Engineer but also coordinates TSMO efforts with the Directors and support staff of the four core sections. The Safety and PIO sections report directly to the District Engineer and support all districtwide functions, including TSMO.

Figure 6 provides a high-level overview of the Beaumont District's organizational chart. Staff at the district may find the current detailed organizational chart with additional sub-sections, names of district leadership, and full-time equivalent (FTE) numbers at any time on TxDOT's Intranet.

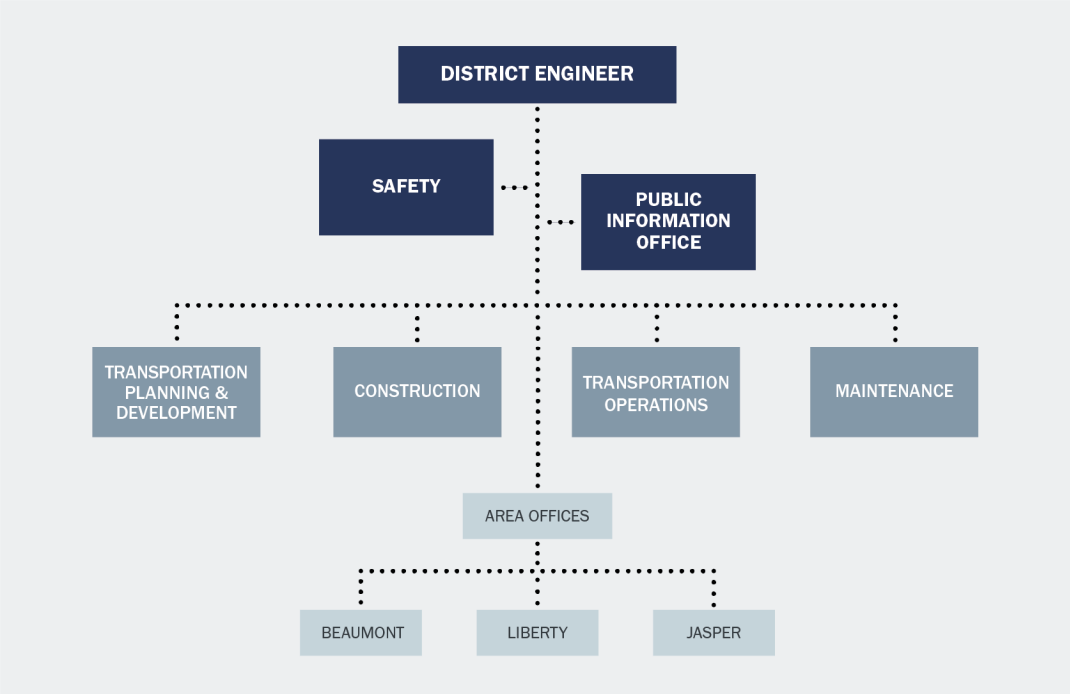


FIGURE 6: BEAUMONT DISTRICT ORGANIZATIONAL CHART

Project Delivery Process

The Beaumont District is responsible for planning, programming, design, construction, operations, and maintenance of projects within the district. Within each of these areas, the Beaumont District is already applying TSMO strategies at varying levels and consistency. At the CMM workshop, participants rated the business processes near a Level 2 and noted that while TxDOT does have a multi-year statewide TSMO plan, many of Beaumont District's processes related to TSMO activities are ad-hoc or not integrated. Beaumont District staff noted that their effectiveness has improved in the last year. For example, the district has implemented a pavement plan and a safety plan, and they conduct regular safety audits. Additionally, they noted that agency collaboration is improving.

The project development process at the TxDOT Beaumont District comprises six steps: Planning, Programming, Design, Construction, Operations, and Maintenance. While this process has typically been used to develop more traditional capital improvement projects, it also supports the development of projects that use TSMO strategies. Projects are identified through the planning process and prioritized projects progress through the process as funding and resources permit. Figure 7 illustrates that successes or challenges experienced in the process are communicated back to groups responsible for earlier stages so that practices are improved. Some performance metrics are also used to support the project development cycle. In the Beaumont District, this

feedback loop is functional, especially for larger projects, and is strongest between Design and Construction and between Construction and Maintenance.

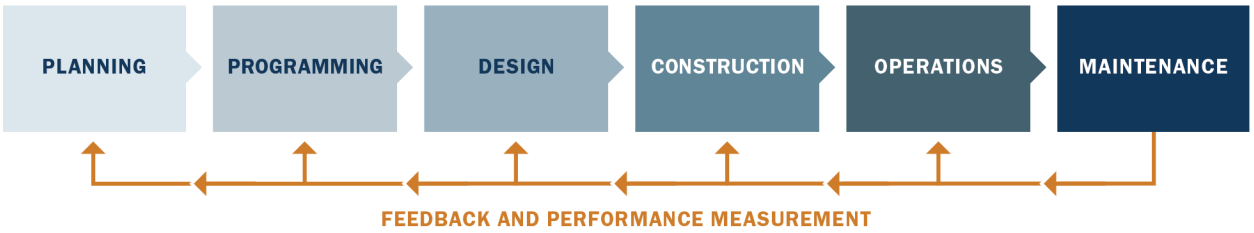


FIGURE 7: PROJECT DEVELOPMENT AND FEEDBACK LOOP

TABLE 7: REVISED PROJECT DELIVERY PROCESS

Project Delivery Step	Revised Process to Include TSMO
Planning	▪ Continue to consider TSMO strategies as part of the project planning process
Programming	▪ Unified Transportation Program (UTP)- include TMS infrastructure, as part of other capital projects or as stand-alone projects, that support TSMO strategies ▪ Highway Safety Improvement Program (HSIP) and R.A.C.E to Zero: Include TSMO strategies that improve safety in project calls
Design	▪ Add a section to discuss TSMO on the pre-design meeting agenda and document the process for consideration and incorporation of TSMO elements ▪ Continue to use statewide standards for traffic signal and ITS design decisions
Construction	▪ Continue to evaluate and use smart work zone strategies ▪ Share lessons learned with district Design staff
Operations	▪ Formalize agreement with the Houston District for after hours ITS operations and maintenance support ▪ Document process for reporting incidents to Houston TranStar ▪ Develop incident detour maps for I-10 and I-69 to identify traffic control strategies, roles, and responsibilities for major incidents that result in lane closures or full directional closures
Maintenance	▪ Formalize agreement with the Houston District for after hours ITS maintenance support ▪ Share lessons learned with district Design staff

Systems and Technology

This section describes the district's ITS Master Plan, ITS architecture, processes to vet innovative technologies, and the systems engineering analysis process.

Beaumont District ITS Master Plan and Architecture

The Beaumont District has started developing an ITS Master Plan and plans to pursue funding for implementation. This document will help the district decide where and how to implement TSMO strategies and feed into the planning and programming part of the project development process. The Beaumont District will track the implementation of the ITS Master Plan and update the plan as needed.

The Beaumont District noted a preference for a multi-district or statewide ITS architecture that the district provides input on but not one they maintain. Although the use of ITS is relatively new to the Beaumont District, the ITS regional architecture developed in 2005 is documented online (ConSysTec, 2003). The 2003 architecture was created in Turbo Architecture. Any updated district, multi-district, or statewide architecture would need to use the new Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) (US DOT, 2019).

ITS devices currently used by the Beaumont District include cameras, Bluetooth readers, dynamic message signs, and fog detectors. Initially, ITS devices were added as a change order to existing construction projects. Now, ITS devices that support TSMO strategies such as cameras, detection, and dynamic message signs are being included with projects during the district's planning and programming phases. Within the MPO boundaries, TP&D coordinates with the SETRPC, H-GAC, and local jurisdictions for project planning and funding (primarily Category 2 on-system).

The Beaumont District currently uses cellular modems (upgrading from 3G to 4G) for communications to traffic signals and ITS devices. Several upcoming design and construction projects include the installation of fiber optic cable. The district is currently developing a plan for how to complete their communications network, including a link back to the District Office.

Operations staff manage the district's ITS devices during the business hours and rely on the Houston TranStar TMS after hours to actively monitor cameras and detectors and to post messages on dynamic message signs. The Beaumont District has started developing plans for an unmanned TMC workstation(s) with access to Lonestar (TxDOT's statewide advanced traffic management system) and camera feeds to support TSMO during emergencies.

The Beaumont District has been updating traffic signal controllers and is expected to complete this effort districtwide in accordance with its four-year plan. Although traffic signal timing updates are done from time to time, the district is considering a three-year schedule. An adaptive traffic signal system is being installed on US 90 in Dayton. The district does not currently have a central traffic signal system for remote traffic signal management but the Traffic Division is working on procuring a statewide system.

The Beaumont District uses Pavement Analyst and Pavement Management Information System (PMIS) for pavement asset management. This includes the use of infrared cameras on vans to assess pavement conditions. They have plans to add asset inventories.

Systems Engineering Analysis Process

As applied to ITS, systems engineering assesses the value and functionality of a high-technology project, service, or system from inception to end of life and considers what the system requires operationally throughout its lifespan. The systems engineering approach defines project requirements before technology choices are made and the system is implemented.

Systems engineering results in better project cost and schedule adherence, ensures that stakeholder needs are met, reduces the risk of schedule and cost overruns, and increases the likelihood that the implementation will meet the user's needs. A detailed systems engineering process gives ITS program managers the information to identify life cycle costs for near-term and long-term budget preparation.

Systems engineering is an interdisciplinary approach to enable the realization of successful systems that:

- Focus on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem
- Integrate all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation
- Consider both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs

In 2002, the United States Department of Transportation (US DOT) established requirements for a systems engineering analysis for any ITS project that uses funds from the Highway Trust Fund (US DOT, 2002). Currently the systems engineering process is a mature process. US DOT policy specifies that the systems engineering process should include seven requirements:

1) Identification of portions of the regional ITS architecture being implemented
2) Identification of participating agencies' roles and responsibilities
3) Requirements definitions
4) Analysis of alternative system configurations and technology options to meet requirements
5) Procurement options
6) Identification of applicable ITS standards and testing procedures
7) Procedures and resources

Benefits of the systems engineering process:

- Improved stakeholder participation
- More adaptable, resilient systems
- Verified functionality and fewer defects
- Higher level of reuse from one project to the next
- Better documentation
- Cost efficiencies

The systems engineering process represented by the "V" (or "Vee") model shown in Figure 8 has been broadly adopted in the transportation industry (FHWA California Division, 2009). On the left wing of the V, the system definition progresses from a general user view of the system to a detailed specification of the system design. Here, the regional ITS architecture, feasibility studies, and concept exploration that support initial identification and scoping of an ITS project are based on regional needs. A gap follows the regional architecture step because the regional architecture is a broader product of the planning process that covers all ITS projects in the region. The system is then parsed into distinct subsystems, and the subsystems into components. As the

distinct subsystems are identified, the requirements for each subsystem requirements that are allocated to the system components and documented baselines are established.

The central core of the V shows the project definition, implementation, and verification processes. The system hardware and software are implemented here.

The right wing of the V shows the operations and maintenance, changes and upgrades, and ultimate retirement of the system. Here, the components of the system are integrated and verified in an iterative fashion. Ultimately, the completed system is validated to measure how well it meets the agency's needs.

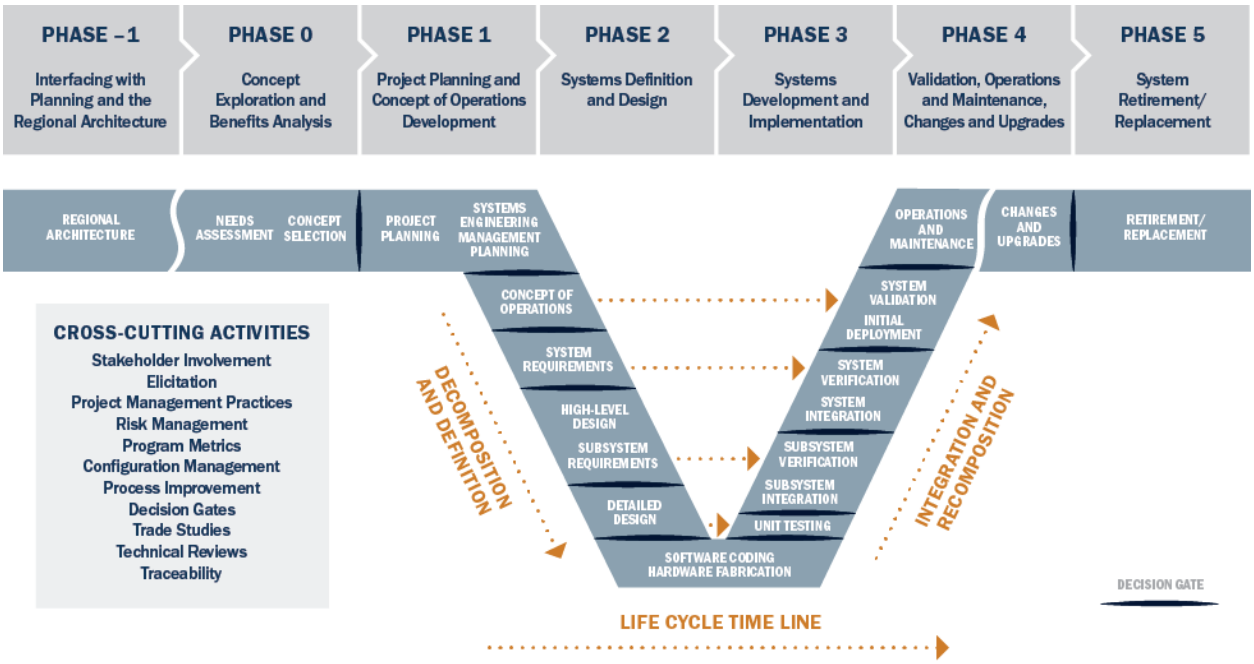


FIGURE 8: SYSTEMS ENGINEERING "V" DIAGRAM

The Beaumont District has identified a need to develop systems engineering documentation for:

- A TMC, which will support the district's growing ITS infrastructure and TSMO strategy implementation, most likely scaled to one or two workstations with continued support from Houston TranStar
- A real-time flood warning system, similar to one deployed by the Houston District, to support traffic management and emergency response due to heavy rainfall or hurricane events that cause flooding and/or evacuations

Processes to Vet Innovative Technologies

Although open to innovative technologies, the Beaumont District relies heavily on the Traffic Division and the metropolitan districts, particularly Houston, to vet innovative technologies first before considering them for use. Pilot projects and a thorough use of the systems engineering analysis process will be considered for any innovative technologies.

Performance Measurement

As the Beaumont District's TSMO Program develops, it is critical that performance-based tracking and reporting be used to assess whether TSMO strategies are successfully delivering the desired outcomes. TSMO-oriented performance measures are being applied at varying levels of capability within the Beaumont District in the following areas:

- **TxDOT Agency-Wide Performance Measures –** A small subset of TxDOT's statewide Performance Dashboard include TSMO-oriented performance measures.
- **Beaumont District-Wide Performance Measures –** The district is required to monitor and report on specific performance measures through the TMS program.
- **Regional Performance-Based Initiatives –** The SETRPC Jefferson-Orange-Hardin Regional Transportation Study (JOHRTS) 2045 Metropolitan Transportation Plan (MTP) includes several TSMO-related national performance measures.

This section provides an overview of national performance measurement, TxDOT agency-wide performance measures, Beaumont District performance measure capability, regional performance-based initiatives, and a performance measurement assessment.

National Performance Measurement

The Moving Ahead for Progress in the 21st Century (MAP-21) Act of 2012 established performance-based planning and management to improve the transparency and accountability of investment decisions for federal-aid highway programs. A performance-based approach ensures transportation investments are linked to agency goals and objectives through structured performance evaluation, monitoring, and reporting methods. MAP-21 requires state DOTs and MPOs to establish performance targets and track progress made toward seven national performance goals: safety, infrastructure condition, congestion reduction, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays. The Fixing America's Surface Transportation (FAST) Act of 2015 continues this approach and requires states to invest in projects that collectively make progress toward national goals (US DOT, 2015).

TxDOT Agency-Wide Performance Measures

TxDOT launched a Performance Dashboard in 2018 to quantitatively track statewide performance and targets relative to its core mission, goals, and objectives (TxDOT, 2018). The dashboard is grouped according to seven goal areas and includes 19 performance measures as summarized in Table 8. TxDOT's goals related to system performance and safety include TSMO-oriented performance measures (denoted in italics).

TABLE 8: TxDOT AGENCY-WIDE PERFORMANCE DASHBOARD GOALS, OBJECTIVES, AND PERFORMANCE MEASURES

TxDOT Goal	Objectives	Performance Measures (*Italics denote TSMO-oriented measures*)
Optimize System Performance	▪ Mitigate congestion ▪ Enhance connectivity and mobility ▪ Improve the reliability of our transportation system ▪ Facilitate the movement of freight and international trade ▪ Foster economic competitiveness through infrastructure improvements	▪ *Congestion and Reliability Indexes* o *Urban Congestion* o *Urban Reliability* o *Rural Reliability* o *Truck Reliability* ▪ Vehicle Miles Traveled (VMT) ▪ *Annual Delay per Person*
Deliver the Right Projects	▪ Use scenario-based forecasting, budgeting and resource-management practices to plan and program projects ▪ Align plans and programs with strategic goals ▪ Adhere to planned budgets and schedules ▪ Provide post-delivery project and program analysis	▪ Percent of Highway Infrastructure Contracts Completed on Time ▪ Percent of Highway Infrastructure Contracts Completed on Budget
Promote Safety	▪ Reduce crashes and fatalities by continuously improving guidelines and innovations along with increased targeted awareness and education ▪ Reduce employee incidents	▪ *Annual Fatalities & Fatality Rate* ▪ *Annual Serious Injuries & Serious Injury Rate* ▪ *Fatality Emphasis Areas involving:* o *Run off the road* o *Distracted driving* o *Driving under the influence* o *Intersections* o *Pedalcyclist* o *Pedestrian* ▪ Employee Injury Rate
Preserve Our Assets	▪ Maintain and preserve system infrastructure to achieve a state of good repair and avoid asset deterioration ▪ Procure, secure, and maintain equipment, technology, and buildings to achieve a state of good repair and prolong life cycle and utilization	▪ Percentage of Lane Miles in Good or Better Condition ▪ Bridge Condition Score
Focus on the Customer	▪ Be transparent, open, and forthright in agency communications ▪ Strengthen our key partnerships and relationships with a customer service focus	▪ Percentage of Customer Complaint Cases Closed on Time ▪ Customer Complaint Case Type (Top 5) ▪ Average TxTag Call Wait Time

TxDOT Goal	Objectives	Performance Measures (*Italics denote TSMO-oriented measures*)
	▪ Incorporate customer feedback and comments into agency practices, project development, and policies ▪ Emphasize customer service in all TxDOT operations	▪ Average TxTag Call Handle Time
Value our Employees	▪ Emphasize internal communications ▪ Support and facilitate the development of a successful and skilled workforce through recruitment, training and mentoring programs, succession planning, trust, and empowerment ▪ Encourage a healthy work environment through wellness programs and work-life balance	▪ Employee Engagement Score
Foster Stewardship	▪ Use fiscal resources responsibly ▪ Protect our natural resources ▪ Operate efficiently and manage risk	▪ Disadvantaged Business Enterprise (DBE) Attainment ▪ Historically Underutilized Business (HUB) Attainment ▪ Direct Transportation Funding

Beaumont District-Performance Measure Capability

This section describes the Beaumont District's performance measurement capability with regards to the TMS program and TxDOT's Road to Zero initiative. TxDOT division offices require districts to monitor and report on specific performance measures through the TMS program. Table 9 summarizes the performance measures mandated in Chief Engineer William Hale's memos along with the Beaumont District's current capabilities with regards to each measure. In the future, the District Engineer's performance for the Beaumont District may include an assessment of TMS asset operational uptime.

TABLE 9: BEAUMONT DISTRICT TMS PERFORMANCE MEASURE CAPABILITY

TMS Program Performance Measure	District Capability
Incident Clearance Time – Measures the time to clear incidents	The district does not currently measure incident clearance time, since first responder agencies receive these calls and respond to incidents. The district assists with clearing debris if requested. The district has access to detailed crash data, but capabilities to query and utilize the data for incident management purposes are still emerging in the region.
Travel Time Reliability – MAP-21 measure to assess the reliability of travel times on the Interstate or non-Interstate National Highway System	Travel time reliability is not currently measured at the Beaumont District. The Traffic Division is working on a statewide approach to help urban and rural districts measure travel time reliability.
TMS System Coverage – Measure the portion of Interstates and other key roadways adequately covered with ITS equipment and communications	This plan includes objectives to increase TMS coverage on I-10 and US 69 to 100 percent coverage by 2030 and to increase TMS coverage at major highway junctions to 60 percent coverage by 2030.
TMS Asset Operational Uptime – Measure the percent of time ITS equipment is operational	Beaumont District ITS device uptime is currently reported in the Houston performance management report.

TxDOT has adopted a statewide "Road to Zero" initiative to reduce fatalities on state highways by half by 2035 and to zero by 2050. The public messaging for this initiative is #EndTheStreakTX. The Texas A&M Transportation Institute (TTI) is developing a new safety-driven data tool to support safety analysis statewide. To support the "Road to Zero" initiative, the Beaumont District recently developed a District Safety Plan that includes TSMO strategies. The district noted that while they measure different parameters related to TSMO, performance measurement is not fully utilized and could be improved by pulling the data together to inform decisions on a systematic basis. Detailed crash data is available but capabilities to query and use the data is still emerging in the region.

Regional Performance-Based Initiatives

Consistent with FHWA planning rules, the SETRPC JOHRTS 2045 MTP recognizes the importance of linking goals, objectives, and investment priorities to stated performance objectives, and that establishing this link is critical to achieving statewide and national performance targets. As such, the JOHRTS 2045 MTP includes the following TSMO-related MAP-21 performance measures:

- **Safety:** Number and rate of fatalities, number and rate of serious injuries, number of combined non-motorized fatalities and non-motorized serious injuries
- **Travel Time Reliability:** Percent of person-miles on the Interstate system that are reliable, percent of person-miles on the non-Interstate NHS that are reliable, and truck travel time reliability index (TTTR).

The JOHRTS 2045 MTP reports on statewide baseline performance (but not specific to the three-county region) in each of these areas. The SETRPC adopted the TxDOT statewide two-year and four-year targets that represent expected performance at the end of calendar years 2019 and 2021, respectively.

The JOHRTS Fiscal Year 2021-2024 Transportation Improvement Program (TIP) planning process also incorporates performance measures into its project evaluation and selection process for the fiscally constrained project list:

- **Safety:** Ability to reduce potential crashes based on the Safety Improvement Index reduction factor for specific improvements
- **Emergency Response:** Ability to enhance the provision of emergency services
- **Intermodal Benefits:** Ability to improve the flow of intermodal transport along roadways in the most cost-effective and safety conscious manner
- **Mobility:** Ability to improve roadway level of service.

The fiscally constrained JOHRTS 2045 MTP recommends $14,829,416 of investments in safety projects and $626,388,355 of investments for travel time reliability improvements allocated to the TxDOT Beaumont District. The funded projects are expected to contribute toward achieving TxDOT's statewide safety and travel time reliability targets.

The Beaumont District intends to work toward adding district-level performance measures for safety, mobility, traveler information, and collaboration. Initially, the available data sources and data collection methods will be identified to develop the performance measures of interest to the Beaumont District. Additionally, the current performance measurement data can be used to create a data clearinghouse. The district can use the performance metrics to promote success stories to share among other TxDOT districts, as well as with the general public.

From a practical standpoint, the Beaumont District will require additional staffing capabilities to develop, collect, and monitor performance measures for TSMO. The district will also have to rely on statewide efforts at performance measure definition to ensure that its measures are consistent with statewide needs. This is particularly important for traffic incident management, MAP-21 reporting, and reliability and safety-related measures.

Performance Measurement AssessmentOverall, the CMM workshop participants rated their current performance measurement capabilities at a Level 1 maturity. The District noted that while they measure several parameters related to TSMO, there are opportunities to better utilize performance measures to inform decisions on a systematic basis.

Performance measurement is a critical activity to test and improve how TSMO is advancing progress toward state and district goals of safety, reliability, efficiency, customer service, collaboration, and integration. The implementation plan identifies performance measurement action items to formalize processes to access data and to develop metrics for asset uptime, incident clearance time, and evacuation-related congestion management. Suggested performance measures are provided over the next few pages in Table 10 and will advance performance measurement for the Beaumont District to a solid Level 2 by 2025.

TABLE 10: TSMO PLAN PERFORMANCE MEASURES

Goal / Performance Measure	Calculation	Data Required	Data Source	Update Frequency	Reference
Safety					
Number of fatalities	5-year rolling average $\frac{K_n+K_{n-1}+K_{n-2}+K_{n-3}+K_{n-4}}{5}$ where: K = number of fatalities N = year of calculation	▪ Total number of deaths in reportable motor vehicle traffic crashes each calendar year for the past five years on all public roads in the Beaumont District	TxDOT Crash Records Information System (CRIS)	Annually	(1)
Number of serious injuries	5-year rolling average $\frac{A_n+A_{n-1}+A_{n-2}+A_{n-3}+A_{n-4}}{5}$ where: A = number of incapacitating injuries N = year of calculation	▪ Total number of incapacitating injuries in reportable motor vehicle traffic crashes each calendar year for the past five years on all public roads in the Beaumont District	CRIS	Annually	(1)
Number of work zone crashes	5-year rolling average $\frac{C_n+C_{n-1}+C_{n-2}+C_{n-3}+C_{n-4}}{5}$ where: C = number of work zone crashes N = year of calculation	▪ Total number of work zone crashes each calendar year for the past five years on all public roads in the Beaumont District. ▪ Work zone crash defined using the following CRIS crash database table codes: Crash Road Construction Zone Flag ID = "Y", or Crash Road Construction Zone Worker Flag ID = "Y", or OTHR_FACTR = 49 or 50 or 51 or 52	CRIS	Annually	N/A

Goal / Performance Measure	Calculation	Data Required	Data Source	Update Frequency	Reference
Reliability					
Percent of person-miles traveled on the Interstate system that are reliable	▪ Determine 80th and 50th percentile travel times for all reporting segments. ▪ Calculate Level of Travel Time Reliability (LOTTR) as the ratio of longer travel times (80th percentile) to a normal travel time (50th percentile). LOTTR is calculated for each reporting segment of the Interstate system for each of four time periods for an entire year: AM peak 6am-10am weekdays; midday 10am-4pm weekdays; PM peak 4pm-8pm weekdays, and weekends 6am-8pm. ▪ Determine if reporting segment is included in measure calculation (reliable person miles). A segment is reliable if the LOTTR is less than 1.5 for *all four* time periods. If one or more time periods has a LOTTR of 1.5 or above, that segment is unreliable. ▪ Calculate person miles traveled that are reliable as Segment Length × Annual Traffic Volume × Average Vehicle Occupancy for all Interstate reporting segments with LOTTR < 1.50 for all four time periods. ▪ Calculate total person-miles of travel as Segment Length × Annual Traffic Volume × Average Vehicle Occupancy for all Interstate reporting segments. ▪ Calculate measure as the ratio of person-miles of travel that are reliable to total person-miles of travel.	▪ Reporting segment length ▪ Travel time on segment (all vehicles) in 15-minute intervals for the hours of 6 AM to 8 PM each day for an entire year. ▪ Highway type (Interstate NHS) ▪ AADT for each segment ▪ Average vehicle occupancy for all vehicles	FHWA's National Performance Management Research Data Set (NPMRDS) or TxDOT-approved equivalent	Biennially	(2)

Goal / Performance Measure	Calculation	Data Required	Data Source	Update Frequency	Reference
Percent of person-miles traveled on the non-Interstate NHS that are reliable	▪ Same as above, but the LOTTR ratio is calculated for each reporting segment of non-Interstate NHS.	▪ Reporting segment length ▪ Travel time on segment (all vehicles) in 15-minute intervals for the hours of 6 AM to 8 PM each day for an entire year. ▪ Highway type (non-Interstate NHS) ▪ AADT for each segment ▪ Average vehicle occupancy for all vehicles	FHWA's National Performance Management Research Data Set (NPMRDS) or TxDOT-approved equivalent	Biennially	(2)
Annual person hours of work zone delay	▪ Estimate average travel time per vehicle for each 15-minute interval on reporting segments impacted by work zones. ▪ Estimate free flow travel time per vehicle for each 15-minute interval on reporting segments ▪ Calculate delay as the difference between average travel time and free flow travel time for each 15-minute interval on reporting segments impacted by work zones. Convert to hours of delay. ▪ Calculate person-hours of work zone delay for each 15-minute interval on reporting segments as the Delay × 15-minute traffic volume × average vehicle occupancy. ▪ Calculate annual person-hours of work zone delay by summing across all reporting segments and 15-minute intervals impacted by work zones.	▪ Location and duration of work zones ▪ Length of reporting segments impacted by work zones ▪ Travel time or speeds on segment (all vehicles) in 15-minute intervals for the duration of the work zone ▪ Free-flow travel time or speeds in work zones ▪ 15-minute traffic volumes on reporting segments impacted by work zones ▪ Percent of total traffic for cars, buses, and trucks ▪ Average vehicle occupancy for cars, buses, and trucks	FHWA's National Performance Management Research Data Set (NPMRDS) or TxDOT-approved equivalent	Annually	N/A

Goal / Performance Measure	Calculation	Data Required	Data Source	Update Frequency	Reference
Average incident clearance time	▪ For each incident, calculate the time between first recordable awareness of the incident and the time the last responder leaves the scene. ▪ Calculate the average incident clearance time for all incidents of interest in the region for an entire year.	▪ Incident notification time and time last responder leaves the scene for each incident of interest in the region	Public safety/first responders (police, fire, medical), Beaumont District Area and Maintenance Offices, or Houston TranStar staff as part of their Regional Incident Management System (RIMS) database	Annually	(3)
Evacuation clearance time	▪ Evacuation clearance time is the time necessary for people to evacuate from the point when a mandatory evacuation order is issued until the last evacuee can leave the evacuation zone. ▪ The base evacuation time is the worst-case scenario with 100% of people in each zone evacuating at the same time. ▪ The operational evacuation time is based on information from the Regional Planning Councils and local Emergency Management offices that is specific to their region and county. It accounts for the behavior of residents, traffic patterns, roadway construction, etc.	▪ Base evacuation time for each evacuation zone ▪ Operational evacuation time	Regional planning councils Local emergency management offices	Annually (or following event occurrence)	None

Goal / Performance Measure	Calculation	Data Required	Data Source	Update Frequency	Reference
Efficiency					
Rate of growth in NHS facility miles experiencing recurring congestion	▪ Establish threshold for recurring congestion. Examples include speed < 45 mph, level of service (LOS) F, volume-to-capacity ratio > 1.0. ▪ Estimate average travel time per vehicle for each 15-minute interval on reporting segments during the AM and PM peak periods: AM peak 6am-10am weekdays; PM peak 4pm-8pm weekdays. ▪ Determine if reporting segment is included in measure calculation (experiencing recurring congestion). A segment is congested if travel conditions exceed the threshold for any length of time during the AM and PM peak periods. ▪ Calculate sum of NHS facility miles that experience recurring congestion during the AM and PM peak periods. ▪ Compare rate of growth in NHS facility miles experiencing recurring congestion to population growth rate between previous and current calendar year.	▪ Length of reporting segments ▪ Travel time or speeds on segment (all vehicles) in 15-minute intervals ▪ Urbanized area population	FHWA's National Performance Management Research Data Set (NPMRDS) or TxDOT-approved equivalent 5-year population estimates from American Community Survey (US Census Bureau)	Annually	N/A
Percent of traffic signals retimed	Divide the number of traffic signals retimed by the total number of traffic signals on TxDOT maintained roadways in the Beaumont District.	▪ Number of traffic signals on TxDOT maintained roadways retimed ▪ Total number of traffic signals on TxDOT maintained roadways in the Beaumont District	TxDOT Beaumont District Operations technicians	Annually	N/A

Goal / Performance Measure	Calculation	Data Required	Data Source	Update Frequency	Reference
Customer Service					
Time between incident/ emergency verification and posting an alert to traveler information outlets (e.g. DMS, website, social media)	▪ For each incident of interest, calculate the time between incident/emergency verification and the time an alert is posted to traveler information outlets (e.g., DMS, website, social media). ▪ Calculate the average alert post time for all incidents of interest in the region for an entire year.	▪ Incident verification time ▪ Time an alert is posted to traveler information outlets for each incident of interest in the region	First responders, TMC operations staff, or TranStar Regional Incident Management System (RIMS) database TxDOT Beaumont District Public Information Office	Annually	N/A
Time between recovery from incident/ emergency and removal of traveler alerts for that incident	▪ For each incident of interest, calculate the time between last responder leaving the scene and the time an alert is removed from traveler information outlets (e.g., DMS, website, social media). ▪ Calculate the average alert post removal time for all incidents of interest in the region for an entire year.	▪ Time last responder leaves the scene ▪ Time an alert is removed from traveler information outlets for each incident of interest in the region	First responders, TMC operations staff, or TranStar Regional Incident Management System (RIMS) database TxDOT Beaumont District Public Information Office	Annually	N/A
Repeat visitors to Beaumont section of DriveTexas.org	▪ Divide the number of return visitors to the Beaumont section of the DriveTexas.org website by the number of total unique visitors for a calendar year.	▪ Number of return visitors to Beaumont section of DriveTexas.org website ▪ Number of unique visitors to Beaumont section of DriveTexas.org website	TxDOT Travel Information Division TxDOT Beaumont District Public Information Office	Annually	N/A

Goal / Performance Measure	Calculation	Data Required	Data Source	Update Frequency	Reference
Number of subscribers to Beaumont District social media platforms	▪ Social media platforms or Hootsuite can provide the Beaumont PIO tools to automatically calculate social media metrics	▪ Number of subscribers across all district social media platforms	Twitter, Hootsuite, etc.	Monthly	N/A
Number of complaints received and resolved	▪ Use the statewide system TRACK to record the number of complaints received ▪ Calculate percentage of complaints that are resolved and closed within 10 days	▪ Number of complaints received ▪ Number of complaints resolved within 10 days	TRACK	Monthly	N/A
Collaboration					
Number of TSMO implementation status meetings	▪ Number of meetings with representatives from the four core sections (TP&D, Construction, Maintenance, and Transportation Operations) and the three Area Offices to review TSMO implementation status.	▪ Number and dates of TSMO implementation status meetings	TSMO Champion	Annually	N/A
Number of after-action review meetings	▪ Number of after-action review meetings with attendance from at least 90 percent of agencies involved in the response to a major incident/emergency or adverse weather event.	▪ Number, date, and percent of responder agencies represented at after-action review meetings	TSMO Champion	Annually	N/A
Percent of capital projects reviewed for regional construction coordination	▪ Percent of capital projects reviewed for regional construction coordination.	▪ Number of capital projects submitted for review ▪ Capital project anticipated and actual schedules ▪ Number of capital projects that included review for regional construction coordination	TSMO Champion	Annually	N/A

Goal / Performance Measure	Calculation	Data Required	Data Source	Update Frequency	Reference
Integration					
TMS system coverage	▪ Divide the number of Interstate centerline roadway miles equipped with ITS equipment and communications for incident and emergency detection/response by the total number of Interstate centerline roadway miles.	▪ Total centerline miles of I-10 and US 69 in the District ▪ Total centerline miles equipped with ITS-related assets for incident and emergency detection/response	TBD	Annually	N/A
Percent TMS asset operational uptime	▪ For each TMS asset of interest, divide the number of hours (or other time increment) the asset is operational by the total number of hours (or other time increment) in a calendar year. ▪ Calculate the average percent TMS asset operational uptime across all TMS assets.	▪ Number of hours (or other time increment) each TMS asset is operational	TBD	Annually	N/A
Percent traffic signals monitored through the network and equipped with automatic failure alerts	▪ Divide the number of traffic signals monitored through the network and equipped with automatic failure alerts by the total number of traffic signals.	▪ Number of traffic signals monitored through the network and equipped with automatic failure alerts ▪ Total number of traffic signals	TBD	Annually	N/A
Number of joint training exercises conducted	▪ Number of joint training exercises in the region that support shared implementation of TSMO strategies	▪ Number and dates of joint training exercises in the region	TSMO Champion	Annually	N/A

References:

(1) Safety Performance Measures Fact Sheet. https://safety.fhwa.dot.gov/hsip/spm/docs/safety_pm_fs.pdf

(2) Overview of Performance Measures: Travel Time Reliability (NHPP) and Annual Hours of Peak Hour Excessive Delay (CMAQ), September 2017. https://www.fhwa.dot.gov/tpm/workshop/az/reliability.pdf

FHWA Computation Procedure for Travel Time Based and Percent Non-Single Occupancy Vehicle (non-SOV) Travel Performance Measures. FHWA HIF-18-024. May 2018. https://www.fhwa.dot.gov/tpm/guidance/hif18024.pdf

(3) FHWA Traffic Incident Management Performance Measurement Presentation. https://ops.fhwa.dot.gov/publications/fhwahop10010/tim_pm_pres.ppt

Organization and Workforce

The existing organizational structure of the Beaumont District is comprised of members from TP&D, Construction, Transportation Operations, Maintenance, and Area Offices. Many of these district employees already perform TSMO activities; however, standardizing collaboration in all projects will promote TSMO, and defining the person responsible for ensuring this activity is carried out further enables the success of TSMO in the district. The Beaumont District has identified potential new staff positions for consideration.

Transportation Operations Analyst – Coordinate and review data, manage operations, and measure performance. It is possible that these responsibilities could be assigned to a traffic engineer or a safety engineer that the district is planning to hire.

TSMO Coordinator – Coordinate district progress toward mainstreaming TSMO including integrating TSMO into all stages of project development and delivery, funding requests, training, and interagency coordination.

The Beaumont District is challenged with retaining staff due to the competitive market and a younger generation of staff with different needs and expectations. Based on this, CMM workshop participants rated organization and workforce at a Level 1. Currently, TSMO activities are diffused across many positions within TxDOT. To promote retention, a career path for operations within TxDOT could be identified more broadly across TxDOT.

The Beaumont District implements a program that rotates junior staff into core discipline areas and Area Offices. This allows staff to cross-train and collaborate between sections, which is critical to successful TSMO practice and supports the implementation of TSMO across program areas. The district plans to focus on internal training to develop a TSMO-competent workforce that continues beyond individual champions and grows roots in the organization. Additionally, the district intends to evaluate its role as a training clearinghouse for capacity building and to share information and opportunities with stakeholder agencies. These planned actions will help move organization and workforce to a Level 2.

Culture

The Beaumont District has a strong relational culture, and it is important to supplement the personal communication with technology. The availability of funding to build capacity can affect prioritization of TSMO efforts, and it was noted that focusing on operations offices within each TxDOT district can help focus on effective operations within existing facilities. Given the statewide focus on TSMO, the Beaumont District expects to improve the culture in the context of TSMO from a Level 1 to a Level 2.

Collaboration

The workshop participants rated collaboration as a Level 2 and noted they are effective because of the strong long-standing relationships within the district and with external stakeholders. These relationships support coordinated construction traffic management planning, traffic control, and strategic assistance by law enforcement. The group identified the need for supplementing communication with data to improve situational awareness among agencies.

Examples of ongoing regional collaboration include:

- A Disaster District Committee (DDC) that oversees hurricane preparedness and response throughout the district involving many agencies
- Area Office coordination with local jurisdictions during the project development process
- Quarterly coordination meetings between the Beaumont District and the City of Beaumont

An example of ad-hoc or as needed collaboration and coordination includes:

- Beaumont District maintenance crews assist law enforcement agencies and local jurisdictions on a routine basis in responding to traffic incidents including helping protect a crash scene with temporary traffic control devices, clearing debris, and checking flood conditions during heavy rainfall events.

Many of the action items recommended in this plan require coordination among TSMO partners. Stakeholders identified the following opportunities as candidates for pursuing TSMO coordination, which will advance collaboration to a Level 3, and providing TSMO updates:

- Quarterly status updates by Beaumont District Public Information Officer
- SETRPC quarterly meeting with local cities, counties and TxDOT
- Houston-Galveston Area Council meetings
- I-10 East Planning and Environmental Linkages Study Planning Meetings

TSMO Implementation Plan

This section includes a prioritized implementation action plan for advancing TSMO in the Beaumont District over the next four years, a process for advancing statewide initiatives in the Beaumont District, and TSMO Performance Measures. Based on the discussions and action needs for the Beaumont District brought forward in the Working Group meetings, stakeholder meetings within the district, and then further discussed through the Capability Maturity Model (CMM) and Capability Maturity Framework (CMF) surveys and workshops, numerous action items were identified.

Beaumont District Four-Year TSMO Action Plan

Table 11 includes the following information as it relates to each of the TSMO strategy action items identified for implementation by the Beaumont District:

- **Action Number:** Provides a number for identification and tracking of the action. The initials stand for the related CMM dimension: business processes (BP), systems and technology (ST), performance measurement (PM), organization and workforce (OW), culture (CU) and collaboration (CO).
- **Action Description:** Provides a brief description of the action, which may include multiple steps.
- **Supports District TSMO Goals:** Identifies which of the TSMO goals the action supports. Some actions may not directly support a goal, but their implementation will help in achieving the goal. The six statewide TSMO goals supported by the district are described in Table 3: safety, reliability, efficiency, customer service, collaboration, and integration.
- **Priority or Review Cycle:** Classifies actions as high, medium, or low priority based on the time it will take to implement the action, the urgency of the action, whether other actions are dependent on the action being completed first, or available resources. Generally high priority actions will be implemented within the next fiscal year, medium priority actions will be completed in the next two to three fiscal years and low priority actions will be completed starting in the fourth fiscal year and re-evaluated in the next planning cycle. Priorities may shift as major events occur or staffing and funding resources change. A review cycle (e.g., annually) is shown for recurring action items.
- **TxDOT Beaumont District Lead:** Identifies the individual at the Beaumont District who will take ownership of the action and will oversee that implementation progresses as planned.
- **TxDOT Support:** Identifies specific TxDOT staff, sections, divisions, or adjacent districts to support the action.
- **Partners:** Identifies external stakeholders needed for coordination or resources for successful action implementation.
- **Resources:** Identifies staff, funding, and other tools needed to support the action.
- **Measures of Success:** Provides performance metrics that will help action tracking and reporting.

TABLE 11: BEAUMONT DISTRICT TSMO IMPLEMENTATION PLAN ACTIONS

ACTION NUMBER	ACTION DESCRIPTION	SUPPORTS BEAUMONT DISTRICT TSMO GOALS						PRIORITY OF REVIEW CYCLE	TxDOT BEAUMONT DISTRICT LEAD	TxDOT SUPPORT	PARTNERS	RESOURCES	MEASURES OF SUCCESS
		SAFETY	RELIABILITY	EFFICIENCY	CUSTOMER SERVICE	COLLABORATION	INTEGRATION						
BUSINESS PROCESSES (BP)													
BP-01	Establish TSMO Program Coordinator role and responsibilities to facilitate program implementation and TSMO integration into all aspects of project delivery process across the Beaumont District (TP&D, Construction, Transportation Operations, Maintenance, Safety, PIO, Area Offices). Develop a schedule associated with the roles and responsibilities.	✓	✓	✓	✓	✓	✓	High	Director of Transportation Operations, TSMO Coordinator	District Engineer		Staff hours	% complete until finalized
BP-02	Develop ITS Master Plan	✓	✓	✓	✓	✓	✓	High	Director of Transportation Operations	TP&D	External Stakeholders	Staff hours	% complete until finalized
BP-03	Incorporate stand-alone ITS projects into TxDOT's 10-year Unified Transportation Program (UTP). Update list every year as part of the UTP's annual update cycle.	✓	✓	✓	✓	✓	✓	Annually	Director of Transportation Operations	TSMO Coordinator, Director of TP&D		Staff hours	% complete until finalized each year
BP-04	1. Create workstation-based traffic management center (TMC)- develop systems engineering (plan for how to use TMC, roles and responsibilities, training for staff, etc.) 2. Develop formal agreement with Houston District outlining TMC roles and responsibilities where Houston TranStar is supporting traffic management in the Beaumont District (BMT)	✓	✓		✓	✓		Medium	ITS Analyst	Director of Transportation Operations, TSMO Coordinator, Houston District (HOU), Traffic Division (TRF)	Houston TranStar	Technology, location, staff hours for planning, implementation, management	Fully functioning TMC
BP-05	1. Update ITS Architecture- Work with TRF to determine if a statewide or regional multi-district architecture is most practical versus updating the multi-agency Beaumont ITS architecture from 2003 2. Perform a comparative evaluation on the ITS architecture used by the jurisdictions that fall within the BMT boundaries to support interoperability and to identify where resources could be shared 3. 3) Determine if a reginal architecture tailored to a specific system (i.e., flooding) would be more valuable than a broad architecture covering multiple systems	✓	✓	✓	✓	✓	✓	Medium	TSMO Coordinator	TRF, other districts	External stakeholders	Staff hours	% complete until finalized
BP-06	1. Continue to develop guidelines to establish construction schedules with sufficient detail to capture all activities. Take into account lessons learned and actual activity durations from a variety of district projects. 2. Revisit new guidelines after they have been tested on actual projects.							Medium	Director of TP&D	Director of Construction, Area Engineers	Contractors, Consultants	Staff hours for planning, implementation, management	% complete until finalized
BP-07	Update TSMO Implementation Table every 2 years per the recommended cycle established by TRF.	✓	✓	✓	✓	✓	✓	Every 2 years	TSMO Coordinator	BMT Directors/Area Engineers, TRF	External stakeholders	Staff hours, data collection and analysis	% complete until finalized
BP-08	Update the CMF survey and TSMO Program Plan every 4 years per the recommended cycle established by TRF.	✓	✓	✓	✓	✓	✓	Every 4 years	TSMO Coordinator	BMT Directors/Area Engineers, TRF	External stakeholders	Staff hours, data collection and analysis	% complete until finalized

ACTION NUMBER	ACTION DESCRIPTION	SUPPORTS BEAUMONT DISTRICT TSMO GOALS						PRIORITY OF REVIEW CYCLE	TxDOT BEAUMONT DISTRICT LEAD	TxDOT SUPPORT	PARTNERS	RESOURCES	MEASURES OF SUCCESS
		SAFETY	RELIABILITY	EFFICIENCY	CUSTOMER SERVICE	COLLABORATION	INTEGRATION						
SYSTEMS AND TECHNOLOGY (ST)													
ST-01	1. Develop criteria (e.g. construction budget, complexity) for when to use a Traffic Management Plan (TMP) for BMT work zones. 2. Develop template BMT TMP based on FHWA guidelines (https://ops.fhwa.dot.gov/wz/resources/tmp_factsheet.htm) or templates from other state DOTs. 3. Conduct a pilot to test TMP use on one or two different types of projects to evaluate effectiveness.	✓	✓		✓	✓	✓	Medium	TSMO Coordinator	Director of Construction, Area Engineers, TRF		Staff hours, data collection and analysis	% complete until finalized for each step
ST-02	Develop a virtual TMC concept for work zone monitoring and pilot it at one of the Area Offices for a construction project that includes a smart work zone application.	✓	✓		✓		✓	Medium	TSMO Coordinator, ITS Analyst	Area Engineers	TRF	Staff hours for planning, implementation, management	% complete until finalized
ST-03	Develop and implement lifecycle management plan to replace aging ITS equipment.						✓	Low	ITS Analyst	TSMO Coordinator, TRF		Staff hours, data collection and analysis	% complete until finalized
PERFORMANCE MEASUREMENT (PM)													
PM-01	Develop and implement data-driven performance feedback loop for TSMO project elements (i.e., performance monitoring including metrics, data needs and frequency, and feedback to project development cycle) 1. Identify performance measurement data sources. 2. Identify gaps in data needed to measure performance. 3. Create accessible regional maps-based data, procedures to access and maintain, and identify lead department.	✓	✓	✓	✓	✓	✓	High	Traffic Safety Engineer	BMT Directors/Area Engineers, TRF	SETPRC, Cities, County, Emergency Responders	Staff hours for planning, implementation, management; data collection and analysis	% complete until each step finalized
PM-02	Overlay BMT's pavement monitoring system with crash data, drainage data, and weather data	✓	✓	✓	✓	✓		High	Director of Maintenance	Traffic Safety Engineer, Director of Transportation Operations, Area Engineers	NWS, USGS, Drainage Districts	Staff hours, data collection and analysis	% complete until finalized
PM-03	1. Establish checklist and hold post-construction conferences with contractors to evaluate the effectiveness of work zone management. 2. Establish a feedback mechanism so that findings from conferences are considered and applied to future policies or projects.	✓	✓			✓	✓	Medium	Director of Construction	Area Engineers, Director of Transportation Operations, Director of TP&D, TSMO Coordinator	Contractors, Consultants	Staff hours for planning, implementation, management	% complete until finalized
ORGANIZATION AND WORKFORCE (OW)													
OW-01	1. Identify and create a clear career path for TSMO positions within TxDOT 2. Consider hiring a Transportation Operations Analyst and a TSMO Coordinator (this position could support the role described in BP-01); Evaluate need as more systems are implemented					✓	✓	Low	Director of Transportation Operations	District Engineer		Staff hours for planning, implementation, management	Have clearly defined TSMO positions and hire to fill those positions

ACTION NUMBER	ACTION DESCRIPTION	SUPPORTS BEAUMONT DISTRICT TSMO GOALS						PRIORITY OF REVIEW CYCLE	TxDOT BEAUMONT DISTRICT LEAD	TxDOT SUPPORT	PARTNERS	RESOURCES	MEASURES OF SUCCESS
		SAFETY	RELIABILITY	EFFICIENCY	CUSTOMER SERVICE	COLLABORATION	INTEGRATION						
OW-02	Establish practices for information sharing on TSMO successes (e.g., share work zone best practices) with public and private sector partners							High	Director of Transportation Operations	PIO	External stakeholders, Contractors, Consultants	Staff hours for planning, implementation, management	
OW-03	Develop and implement TSMO on-boarding for new BMT staff. Incorporate into existing on-boarding processes if possible.	✓	✓	✓	✓	✓	✓	Medium/Low	TSMO Coordinator	Director of Transportation Operations, District Engineer		Staff hours for planning, implementation, management	% complete until process finalized; % of new employees that have completed on-boarding
OW-04	Share TSMO training opportunities (through TRF or external sources) with BMT staff	✓	✓	✓	✓	✓	✓	Ongoing	TSMO Coordinator	BMT Directors/Area Engineers, District Engineer, TRF		Staff hours for planning, implementation, management	% of training opportunities shared with BMT staff
CULTURE (CU)													
CU-01	Develop checklist for regular ongoing stakeholder/partner outreach to keep stakeholders informed of BMT projects and points of contact and vice versa. Consider actions such as: 1. Develop formal process for initial meeting with new mayors, county judges, agency traffic engineers, etc. 2. Regular outreach (e.g., quarterly meeting/call/email) by Area Engineers, Directors, and DE with county and city officials 3. Periodic review of newsletter distribution list					✓	✓	High	PIO, TSMO Coordinator	District Engineer, BMT Directors/Area Engineers	External stakeholders	Staff hours for planning, implementation, management	% complete until checklist finalized; % complete each fiscal year
CU-02	Develop an action plan to establish a culture of TSMO within the district. Determine activities to promote TSMO and invite staff involvement across sections to increase knowledge, investment, and commitment. Ideas for incorporating culture: 1. Include TSMO coordinator in project meetings to provide TSMO updates, to listen, and to identify ways to include TSMO 2. Highlight TSMO activities, successes, benefits, and performance metrics in the district's monthly newsletter, emails, and/or district meetings 3. Post TSMO information on pin boards throughout district offices					✓	✓	Medium	TSMO Coordinator	PIO, BMT Directors/Area Engineers		Staff hours for planning, implementation, management	staff understanding of importance of TSMO, inclusion of TSMO throughout BMT processes
CU-03	Establish a regional work zone steering committee of key champions and core BMT TP&D, Construction and Area Office staff. Use this committee to share results of recent and ongoing innovative work zone management efforts.					✓	✓	Medium	Director of Construction	Directors of Construction and TP&D, Area Engineers, TSMO Coordinator		Staff hours for planning, implementation, management	% complete until finalized, ongoing status check that committee is meeting
COLLABORATION (CO)													
CO-01	Meet every quarter (as part of an existing district meeting or a separate meeting) with DE, Area Engineers (AEs), directors, and representatives from the TP&D, Construction, Operations, and Maintenance sections and the three Area Offices to review TSMO implementation status.					✓	✓	Quarterly	TSMO Coordinator	DE; Directors of TP&D, Construction, Operations, Maintenance; Area Engineers		Staff hours for planning, implementation, management	meeting held quarterly with ongoing status updates of this table

ACTION NUMBER	ACTION DESCRIPTION	SUPPORTS BEAUMONT DISTRICT TSMO GOALS						PRIORITY OF REVIEW CYCLE	TxDOT BEAUMONT DISTRICT LEAD	TxDOT SUPPORT	PARTNERS	RESOURCES	MEASURES OF SUCCESS
		SAFETY	RELIABILITY	EFFICIENCY	CUSTOMER SERVICE	COLLABORATION	INTEGRATION						
CO-02	Identify BMT Liaison(s) for Emergency Operations Centers (EOCs) so there are primary and backup points to contact and update the list annually. During major emergencies, multiple county EOCs are activated. Under a worst-case scenario, all eight county EOCs could be activated. Update the list yearly at the same time as the hurricane evacuation manual update.	✓	✓			✓	✓	Annually	Director of Transportation Operations	PIO	County EOCs	Staff hours for planning, implementation, management	% complete until finalized each fiscal year
CO-03	Implement the Pathfinder Project (FHWA-HOP-16-086 and Pathfinder online toolkit) developed by the Federal Highway Administration (FHWA) and the National Weather Service (NWS) to support emergency weather operations. 1. Identify partners 2. Determine qualifying collaboration events 3. Select communication mediums and set procedures 4. Establish point person at each participating entity 5. Synchronize forecast schedules 6. Establish definitions and create shared resources 7. Create shared Impact message for the public 8. Conduct post event review, archive data, and document operating procedures	✓	✓			✓	✓	High	TSMO Coordinator	PIO, TRF	NWS, DPS, emergency responders, Support from FHWA	Staff hours for planning, implementation, management	% of major events that have after-action meetings
CO-04**	Initiate scenario planning and after-action response with partners to prepare for all major emergency events including weather, plant explosions, fire to establish evacuation routes and technology redundancy.	✓	✓			✓	✓	High	TSMO Coordinator	Safety Officer	DPS	Staff hours for planning, implementation, management	% completion of plans; % of major events that have after-action meetings
CO-05	Develop process (such as a regular meeting/call) to partner with Ports and private industry to improve freight management. Considerations to get the ball rolling: 1. Review freight mobility issues for each state highway 2. Evaluate if set freight routes make sense and make adjustments 3. Review TSMO strategies that may address issues: targeted data feeds, routing, connected vehicle-to-infrastructure applications (e.g. truck signal priority, queue warning), etc. 4. Work with Port to identify dedicated freight route, perhaps with performance measurement feedback loop regarding pavement condition 5. Leverage efforts of Texas Connected Freight Corridors	✓	✓	✓		✓	✓	High	Director of Transportation Operations, Director of TP&D	Freight and International Trade Section, TRF	Port of Beaumont, Port of Port Arthur, freight groups, SETPRC; military	Staff hours for planning, implementation, management	% complete until finalized
CO-06	Develop automated permit coordination with cities (e.g., truck routes, overweight or over-height vehicle routes), similar to a work zone coordination tool to show what is happening where.				✓	✓		Medium	Permit Coordinator	Director of Construction, Director of Transportation Operations	Texas DMV, Cities, Counties, Port	Staff hours for planning, implementation, management	% of permits shared through automated tool
CO-07	Collaborate with the Southeast Texas Alert Network (STAN) to consistently inform citizens about transportation mobility and safety impacts. Start with initial contact, develop plan of action, and check-in periodically.	✓			✓	✓		Annually	PIO	TSMO Coordinator	STAN	Staff hours for planning, implementation, management	% complete until initial plan finalized; % complete each fiscal year after that
CO-08	Develop and maintain a contact list of emergency management and law enforcement personnel for internal use by the Beaumont District	✓	✓	✓	✓	✓	✓	Quarterly	Safety Coordinator	PIO, TSMO Coordinator	DPS, Local law enforcement, emergency management	Staff hours for planning, implementation, management	% complete until initial list finalized; % complete each quarter after that

ACTION NUMBER	ACTION DESCRIPTION	SUPPORTS BEAUMONT DISTRICT TSMO GOALS						PRIORITY OF REVIEW CYCLE	TxDOT BEAUMONT DISTRICT LEAD	TxDOT SUPPORT	PARTNERS	RESOURCES	MEASURES OF SUCCESS
		SAFETY	RELIABILITY	EFFICIENCY	CUSTOMER SERVICE	COLLABORATION	INTEGRATION						
CO-09	Meet annually to discuss Highway Safety Improvement Program (HSIP) and to coordinate an approach among different sections within the district	✓				✓		Annually	Traffic Safety Engineer	Directors of TP&D and Maintenance, Area Engineers		Staff hours for planning, implementation, management	% complete each fiscal year
CO-10	Meet annually to discuss Road to Zero program and to coordinate an approach among different sections within the district	✓				✓		Annually	Traffic Safety Engineer	Directors of TP&D and Maintenance, Area Engineers		Staff hours for planning, implementation, management	% complete each fiscal year

Advancing Statewide TSMO Actions in the Beaumont District

In addition to efforts led by the Beaumont District, part of the implementation plan includes working with the Traffic Division to roll out statewide initiatives at the district or working with other partners (TxDOT districts or external partners) who may be leading efforts. Table 12 includes an overview of other TxDOT initiatives and the Beaumont District's role. This list will continue to evolve as more statewide initiatives are rolled out and the Beaumont District continues to collaborate with other districts.

TABLE 12: IMPLEMENTATION OF TSMO STATEWIDE INITIATIVES AND COLLABORATION WITH OTHER PARTNERS

Initiative	Beaumont District Role
TxDOT ITS Design Manual- The development of a statewide manual is underway. The Traffic Division has been reaching out to the districts to gather existing practices, standards, and specs.	Provide existing documentation to TRF. Review draft manuals based on experience.
Third Party Data Integration- The Traffic Division is currently working with third party data providers to evaluate how to supplement TxDOT mobility data (e.g. volume, speed) to provide coverage where there are currently gaps.	Provide input on gaps on system coverage as requested by the Traffic Division.
Data Lake- TxDOT is collecting data from several sources (including Lonestar™ and CRIS) to create a repository of unstructured data and also working to develop a Data Mart, which is a structured data platform that can be brokered for specific user needs.	Coordinate with the Traffic Division and Information Technology Division to incorporate Beaumont District data sources
TSMO Training- The Traffic Division has provided and will continue to provide training opportunities for TSMO, including presentations and discussions at the annual Traffic Safety/Operations/Maintenance Conference and annual Short Course. Other webinars or in-person trainings may also be available. Approximately 30 TSMO training modules are currently under development.	Participate in available training opportunities. Share new knowledge with applicable Beaumont District staff.
Develop Methodology to Allocate ITS/Signals O&M Funding to Align with TSMO Goals	Provide input and guidance for help allocating more TMS O&M funding.
Develop Statewide Standard Operating Procedures (SOPs) to Improve Operational Interoperability	Consider using SOPs to cover any gaps.
Improve Procurement Processes to Support TSMO Program Objectives	Provide existing procurement processes. Apply new processes as applicable.
Develop Emergency Response Plan to Improve Preparedness, Response, and Recovery	Provide current capabilities and provide feedback on areas to improve within the Beaumont District.
Develop Enhanced Traffic Signal System Implementation Plans	Provide existing enhanced traffic signal implementation plans and work to expand existing program.
Strengthen Traffic Incident Management (TIM) Teams Collaboration with Stakeholders to Safely Reduce Incident Clearance Times	Work with the statewide TIM coordinator to develop a district TIM program if deemed applicable.

Initiative	Beaumont District Role
Highway Conditions Reporting System (HCRS)- Determine if there is an external interface for district partners (e.g. cities, counties) to enter planned and ongoing construction information into HCRS, which also populates the DriveTexas.org website.	If an external interface is or becomes available, provide outreach and training to stakeholders within the district.
Improve Department of Public Safety (DPS) access to Houston TranStar data (agency portal vs. public website).	Reach out to DPS contacts in the Beaumont District as needed by Houston District/Houston TranStar.
Flood Warning System: Jefferson County Drainage District Number 6 (DD6) has started developing a flood warning system	Beaumont District TSMO Coordinator: Work with DD6 to provide input on needs related to flood events on TxDOT roadways and identify how to integrate information from the system into district practices.

TSMO Implementation Plan Update Process

The Beaumont District TSMO Implementation Plan is intended to be a living document that is updated as progress on actions gets made or as things change, as illustrated in Figure 9.

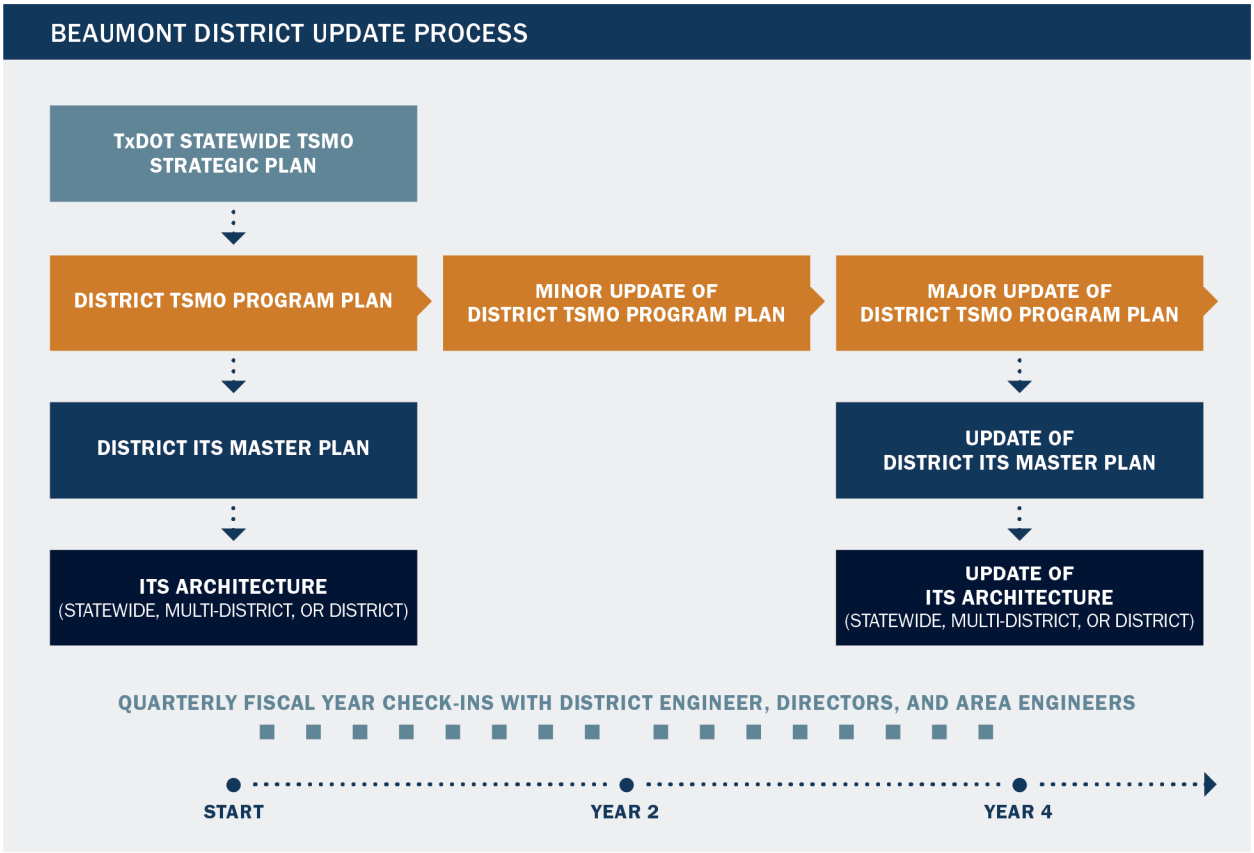


FIGURE 9: BEAUMONT DISTRICT TSMO PLAN UPDATE PROCESS

A key activity in maintaining the plan is the quarterly check-in of progress of the implementation plan. These meetings will keep the momentum going for implementation and allow section directors and staff to provide status updates on progress made on action items, discuss if any changes are needed to upcoming action items, and assign action items (to identified lead, alternate lead, identify an action committee, etc.). Part of this check-in will include an ongoing performance assessment using the objectives and measures used today or established in this plan. As the district continues to refine performance metrics and include new data sources, existing and aspirational objectives should be re-visited as part of the TSMO Plan update process.

Overall, the Beaumont District plans to update the TSMO Program Plan (including CMF surveys), ITS Master Plan, and ITS architecture on a four-year cycle with an interim minor update to the TSMO Program Plan every two years as shown in Figure 9. Leadership changes are underway at the district and so the exact format of quarterly check-ins is still being determined. Options being considered:

- TSMO status check-ins during standing district meetings (e.g., District Engineer staff meeting, Supervisor's meeting)
- Separate quarterly meeting with TSMO Coordinator, Directors, and Area Engineers
- Individual quarterly meetings between the TSMO Coordinator and each Director and Area Engineer

TSMO Tactical Plan Assessment

This TSMO Program Plan has established the Beaumont District's *strategic* elements — relating TSMO strategies to the district's mission, vision, goals, and objectives — and *programmatic* elements — organizational structure and business processes necessary to support TSMO implementation. This final section focuses on the *tactical* elements — the actions necessary to operationalize the services, programs, and priorities identified in the Implementation Plan.

A TSMO Tactical Plan should be developed for each of the Beaumont District prioritized services, activities, or projects to be advanced in the near-term. This section describes tactical plan criteria, tactical plan components, and recommended tactical plans.

Tactical Plan Criteria

Tactical criteria were developed by the TxDOT's Traffic Safety Division using qualitative descriptors with the intent that, as tactical plans advance to implementation, quantitative analyses will be performed (e.g., cost estimates, benefit-cost ratios, funding sources, detailed schedules). Criteria for tactical plans applied at the strategic plan level are as follows:

- Alignment with TxDOT's mission, vision, and goals (safety, reliability, efficiency, customer service, collaboration, and integration)
- TxDOT Beaumont District staff support (e.g., low, medium, high)
- Stakeholder partnerships (e.g., internal, external)
- Costs (e.g., low, medium, or high for initial and recurring costs)
- Return-on-investment (e.g., low, medium, high)

Tactical Plan Components

A TSMO Tactical Plan will be developed for each of the Beaumont District's prioritized services, activities, or projects, as identified in the next section on Recommended Tactical Plans. Each Tactical Plan will contain the following components:

1. A description of the prioritized service, activity, or project
2. An identification of the key enabling implementation guidelines and policies
3. An investment/financial plan
4. An annual action/deployment plan
5. An identification of the performance measures to be used to monitor and evaluate investments

These five tactical plan components are described more fully below.

Description of the Prioritized Service, Activity, or Project

Describe the initiative and how it supports the district's TSMO goals and objectives. Describe existing services such as devices and systems, staffing, priorities, and stakeholder coordination. Perform a gap analysis to review how emerging technologies, operating models, data acquisition and utilization, resources and staffing, and business process relate to the initiative. Describe the future of the initiative.

Supporting Implementation Policies and Guidelines

Identify the relevant TxDOT, district, or federal policies and guidelines needed for the specific service or strategy. Examples include standards and specifications for communications technologies, guidelines for selection or deployment of ITS devices, policies and guidance on public/private data sharing initiatives, decision-making guidelines for implementation, and service levels standards for devices.

Investment/Financial Plan

Effective planning for TSMO involves identifying the costs associated with deployment of services, which may include new infrastructure investments, technology purchases, staff time and resources, or other resources. Use benefit/cost or other criteria analysis methods to support project prioritization and funding requests. Identify current funding resources for the deployment and any potential funding sources that could be matched to the initiative or each action item or project.

Annual Action Plans

Drawing from funding resources and opportunities to integrate TSMO in other activities and projects, develop a set of specific actions for deployment, on an annualized timeframe. These annual plans should be developed in coordination with larger district or agency planning efforts and integrated in standard programs, which often have a four-year timeframe.

Tracking Progress: Performance Assessment

Finally, the TSMO Tactical Plan should address how performance analysis will be conducted to measure the effectiveness of tactics in meeting program objectives. Select from the metrics identified earlier in this Program Plan to be used to conduct on-going monitoring of system performance and project evaluation. Clearly identify how we will measure how well we are meeting the program's stated objectives. Also identify what data are currently available and what additional data is still needed. Finally, consider ways that data can be used to tell success stories to justify future TSMO investments and to promote a TSMO culture within the district.

Recommended Tactical Plans

A Traffic Management Tactical Plan is recommended for the Beaumont District along with systems engineering documentation for a Traffic Management Center (TMC) and a real-time flood warning system. Tactical planning for the flood warning system may be covered under Jefferson County Drainage District 6; however, there may be tactical planning elements that the Beaumont District may need to complete separately if they are not covered by the DD6 plan.

Tactical Plan Assessment

The recommended Traffic Management Tactical Plan is assessed against the strategic level tactical criteria as shown in the table below:

Traffic Management Tactical Plan Assessment					
Goal Alignment	**Safety:**	Yes	Resources	**District staff support:**	High
	Reliability:	Yes		**Partnerships:**	Internal & External
	Efficiency:	Yes		**Costs:**	Medium
	Customer Service:	Yes		**Return on Investment:**	High
	Collaboration:	Yes			
	Integration:	Yes			

Traffic Management Tactical Plan Assessment

Key Considerations:

- Operations and maintenance of ITS devices currently managed by Houston TranStar
- Operations and maintenance of ITS devices under construction, programmed, or included in the ITS Master Plan currently under development
- Supporting communications network
- Development of a TMC, including associated systems engineering, to support district traffic management
- Workforce organization to support this effort

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- TxDOT (2018) *Transportation Systems Management & Operations*

Beaumont District TSMO Program

TSMO Program Plan

APPENDIX

Appendix A: List of Stakeholders and Acknowledgements

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