



# Transportation Systems Management and Operations Program Plan

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TxDOT Brownwood District

December 20, 2023

Final TSMO Program Plan

Date	Version	Description
April 22, 2022	1.0	Draft Transportation Systems Management and Operations Program Plan – TxDOT Brownwood District Review
May 25, 2022	2.0	Revised Draft 1 TxDOT Brownwood District Transportation Systems Management and Operations Program Plan
October 21, 2022	2.1	Revised Draft 2 TxDOT Brownwood District Transportation Systems Management and Operations Program Plan
February 23, 2023	3.0	Revised Draft 3 TxDOT Brownwood District Transportation Systems Management and Operations Program Plan
December 20, 2023	4.0	Final TxDOT Brownwood District Transportation Systems Management and Operations Program Plan

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## List of Acronyms

AAR	After-Action Review (or After-Action Report)
AASHTO	American Association of State Highway and Transportation Officials
ATSPM	Automated Traffic Signal Performance Measures
BP	Business Processes (TSMO Capability Dimension)
CCTV	Closed-Circuit Television
CMF	Capability Maturity Framework
CMM	Capability Maturity Model
CO	Collaboration (TSMO Capability Dimension)
CRIS	Crash Records Information System
CU	Culture (TSMO Capability Dimension)
DMS	Dynamic Message Sign
DOT	Department of Transportation
DPS	Department of Public Safety
EMS	Emergency Medical Services
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
ICT	Incident Clearance Time
ITS	Intelligent Transportation Systems
OW	Organization and Workforce (TSMO Capability Dimension)
PIO	Public Information Office
PM	Performance Measurement (TSMO Capability Dimension)
PSE	Planned Special Events (TSMO Focus Area)
RCT	Roadway Clearance Time
RWM	Road Weather Management (TSMO Focus Area)
SOP	Standard Operating Procedure
ST	Systems and Technology (TSMO Capability Dimension)
SWZ	Smart Work Zone
TM	General Traffic Management (TSMO Focus Area)
TIM	Traffic Incident Management (TSMO Focus Area)
TMC	Traffic Management Center
TMS	Traffic Management Systems
TRF	Traffic Safety Division
TSM	Traffic Signal Management (TSMO Focus Area)
TSMO	Transportation Systems Management and Operations
TTI	Texas Transportation Institute
TxDOT	Texas Department of Transportation
UTP	Unified Transportation Program
WZM	Work Zone Management (TSMO Focus Area)

## Executive Summary

### What is a TSMO Program Plan?

Transportation Systems Management and Operations (TSMO) is an approach to improve mobility for all modes of transportation. TSMO uses integrated strategies that are designed to optimize the performance of existing infrastructure by preserving capacity and improving the security, safety, and reliability of the transportation system. The Texas Department of Transportation (TxDOT) Brownwood District has developed this TSMO Program Plan to identify TSMO action items that District staff can implement over the next five years to improve traffic operations.

Stakeholder engagement for this TSMO Program Plan effort began in July 2021 and included outreach to District staff and local agency partners in traffic engineering and emergency response. Engagement included both individual stakeholder meetings as well as a group workshop. Each phase of stakeholder engagement is summarized in the project timeline to the right. The plan was approved by the TxDOT Brownwood District and rolled out in May 2022. Additional comments and revisions were later made to the plan based on review by the TxDOT Traffic Safety Division.

To develop this plan, the TxDOT Brownwood District reviewed existing data and engaged with both internal and external stakeholders through a series of meetings and workshops to identify strengths and needs related to six TSMO **Focus Areas**. From these strengths and needs, the TxDOT Brownwood District identified a list of potential action items that could be implemented to build on existing strengths and address ongoing needs. These action items were grouped into six TSMO **Dimensions of Capability**.

These TSMO focus areas and dimensions of capability are shown on the next page alongside icons used throughout the report to identify related discussion of existing District activities, identified operational needs, and recommended TSMO strategies.

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)

### STAKEHOLDER INVOLVEMENT TIMELINE



## FOCUS AREAS



Traffic Incident Management



Work Zone Management



Road Weather Management



Planned Special Events



Traffic Signal Management



General Traffic Management

## DIMENSIONS OF CAPABILITY



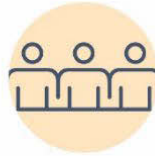
Business Processes



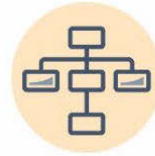
Systems & Technology



Performance Measurement



Culture



Organization & Workforce



Collaboration

### Why Invest in TSMO Actions?

















A review of congestion and safety impacts in the TxDOT Brownwood District revealed that congestion and crashes within the District's boundaries cost travelers more than \$541 million in 2020. TSMO actions have been proven to reduce congestion and crash rates at levels of investment far lower than would be required for capacity-building projects. Investing in low-cost TSMO actions that reduce these societal costs can provide a significant return on investment for the TxDOT Brownwood District. For example, a mere 1 percent reduction in congestion and safety impacts would result in a reduction of more than \$5 million in total societal costs. The **Business Case for TSMO** section of the TSMO Program Plan discusses this potential further.











## How Should the District Invest in TSMO?

Based upon the District’s guiding TSMO principles and existing needs identified by TxDOT and its partners, 22 action items to advance TSMO were identified for the TxDOT Brownwood District. A full list of recommended action items is in the **TSMO Implementation Plan** section of this TSMO Program Plan. Action items that were expected to provide some of the highest benefit-cost returns and met the greatest operations needs are summarized in the table below. These action items have been categorized as: Early Win Action Items, Low-Cost/High Impact Action Items, and High Cost/High Impact Action items.

Summary of Action Items with Expected Highest Benefit-Cost



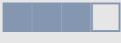
Action No.	Action Description	Report Page #	TSMO Focus Area	TSMO Capability Dimension
<b>Early Win Recommended Action Items</b>				
BP-03	<b>Use TxDOT’s Smart Work Zone Decision Tool and Deployment Guidance:</b> Adapt TxDOT’s existing SWZ guidance and deployment decision tool to determine which work zone ITS technologies to use for District construction projects.	41		
BP-07	<b>Develop TxDOT Brownwood District ITS Master Plan:</b> Develop an ITS Master Plan for the TxDOT Brownwood District to identify and prioritize ITS and communication infrastructure deployments throughout the District.	45		
ST-02	<b>Provide Work Zone Closure Information Through Third-Party Apps:</b> Partner with third-party navigation apps to provide accurate work zone closure information for travelers through the District.	48		
PM-02	<b>Monitor Towing Company Performance:</b> Partner with Texas DPS and local municipalities to monitor performance of tow companies and establish baseline performance that must be met.	57		
<b>Low Cost, High Impact Recommended Action Items</b>				
PM-01	<b>Improve TIM Data Collection:</b> Improve incident management-related data collection of roadway clearance time, incident clearance time, and secondary crash data.	56		
OW-01	<b>Establish Regional Multidisciplinary TIM Training:</b> Partner with TxDOT Statewide Traffic Incident Management Coordinators to provide TIM multidisciplinary trainings and Train-the-Trainer programs to TxDOT staff and interested parties.	60		
OW-02	<b>Improve Traffic Signal Technology Training:</b> Coordinate with TxDOT Traffic Safety Division to identify technologies that can address signal challenges within the District. Provide signal technology training opportunities for District signal technicians.	61		
CO-01	<b>Establish a Formal Regional TIM Team:</b> Establish a formalized TIM Team that meets regularly and includes all relevant jurisdictions and roles.	64		



Action No.	Action Description	Report Page #	TSMO Focus Area	TSMO Capability Dimension
<b>High Cost, High Impact Recommended Action Items</b>				
ST-01	<b>Deploy Work Zone Technology:</b> Deploy work zone technology throughout the District to support improved work zone monitoring, localized real-time traveler information, and end of queue warning.	47		
ST-04	<b>Prioritize and Deploy Signal Battery Backup Units:</b> Develop a deployment plan to prioritize and deploy traffic signal battery back-up units throughout the District.	50		
ST-05	<b>Plan and Implement Surveillance Technology for Signals:</b> Identify implementation priority for cameras and necessary software enhancement to allow remote surveillance of District traffic signals from a single software platform.	51		
ST-06	<b>Improve Communications Link to Signals in Rural Areas:</b> Upgrade communications capabilities at rural TxDOT traffic signal locations to improve ability to monitor and respond to conflicts, outages, and other signal issues.	52		

### Which TSMO Actions Would Benefit from Further Development?

Tactical plans provide a focused look at how to implement key action items. These plans can establish project details, develop and assign responsibilities, and include detailed cost and staffing estimates for specific TSMO initiatives. The TSMO Program Plan identifies several recommended Tactical Plans in the **TSMO Tactical Plan Assessment** section to support priority action items. Tactical plans recommended for the TxDOT Brownwood District are shown below.

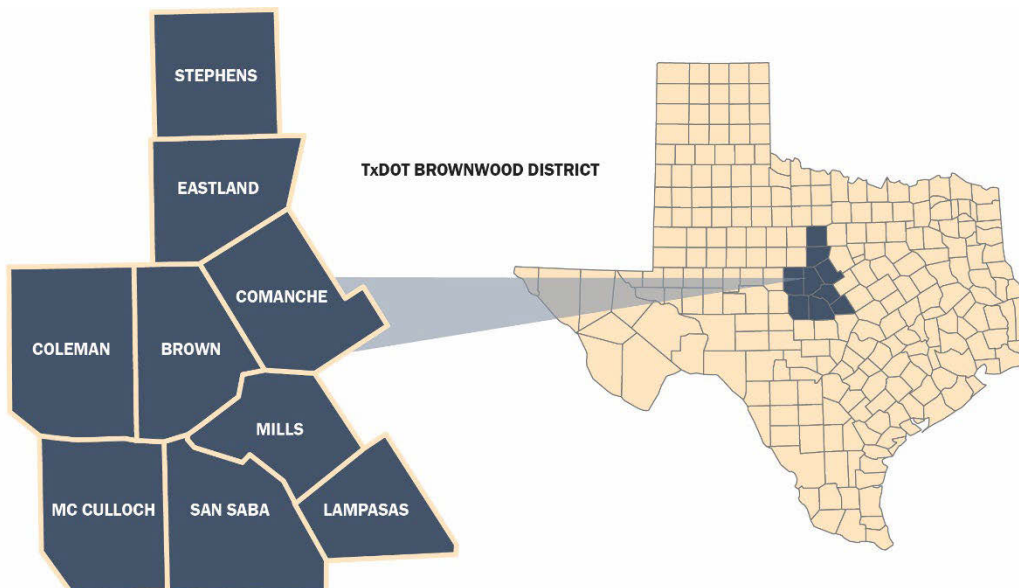
Potential Tactical Plan	Supports District TSMO Goals						Key Internal and External Partners	Expected Long-Term Program Costs	Expected Ongoing Program Level of Effort	TSMO Action Items Addressed
	Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration				
<b>TxDOT Brownwood District ITS Master Plan</b>	✓	✓	✓	✓	✓	✓	BWD Operations, BWD Area Engineers	\$\$\$		BP-03, BP-07, ST-01, ST-04, ST-05, ST-06, ST-07
<b>Traffic Signal System Upgrade Plan</b>	✓	✓	✓			✓	BWD Operations, BWD Maintenance, BWD Area Engineers, BWD Signal Shop	\$\$		BP-07, ST-04, ST-05, ST-06, ST-07, PM-03, OW-02
<b>Regional TIM Program Plan</b>	✓	✓	✓	✓	✓		TxDOT TRF, BWD Operations, BWD Maintenance, BWD Area Engineers, First Responders	\$\$		BP-01, BP-02, ST-07, ST-08, PM-01, PM-02, OW-01, CO-01

## Introduction

The Texas Department of Transportation (TxDOT) Brownwood District, shown in Figure 1, is developing and implementing a Transportation Systems Management and Operations (TSMO) program. TSMO is an approach to improve mobility for all modes of transportation using integrated strategies that are designed to optimize the performance of existing infrastructure by preserving capacity and improving the security, safety, and reliability of the transportation system.

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)

Figure 1: TxDOT Brownwood District Map

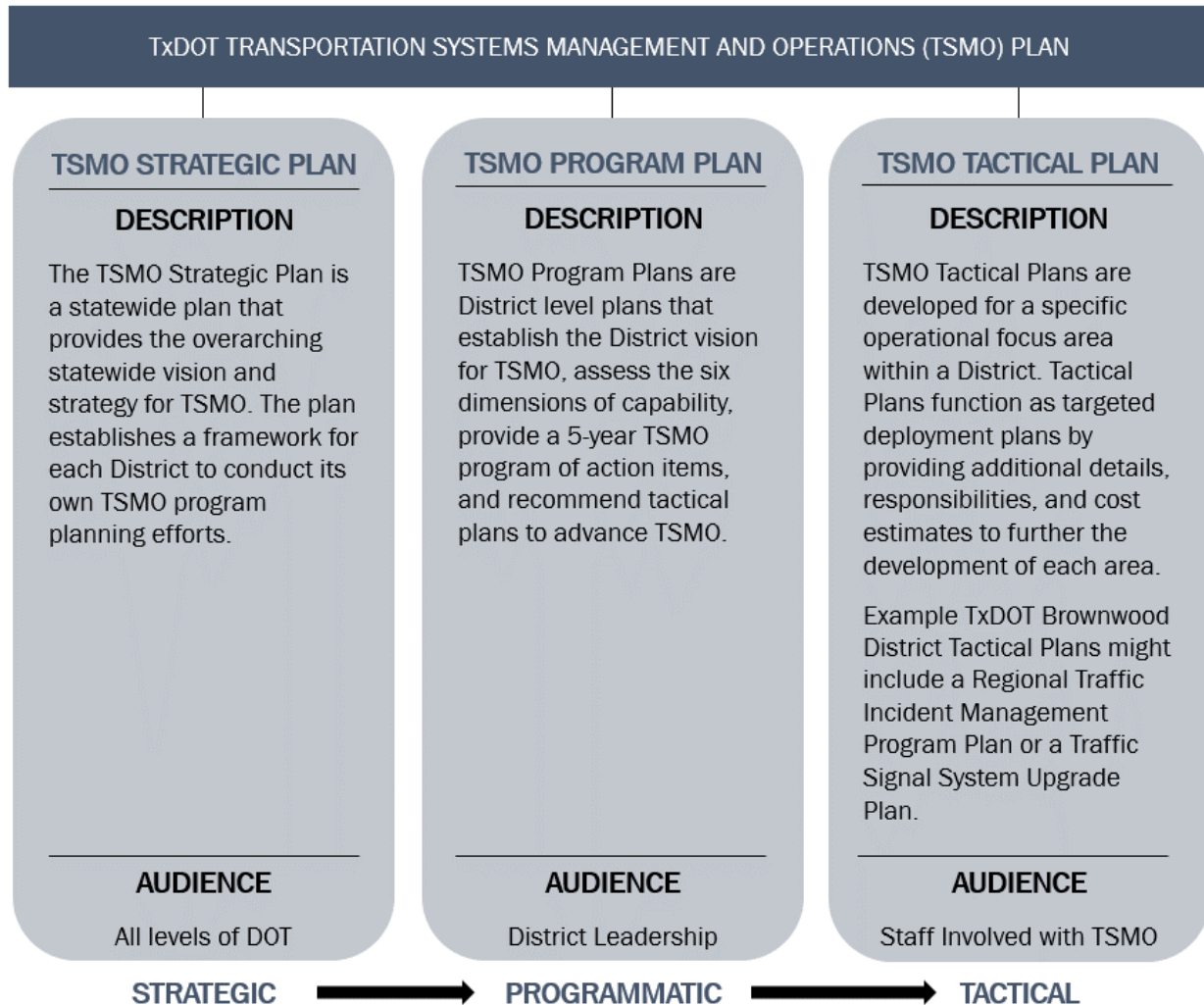


TSMO is defined specifically in federal legislation, including the Moving Ahead for Progress in the 21st Century Act (MAP-21), as well as the Fixing America’s Surface Transportation (FAST) Act. The TxDOT Traffic Safety Division (TRF) developed a Statewide TSMO Strategic Plan in 2018 that identifies statewide goals, objectives, and strategies for advancing TSMO in Texas.

In comparison to other state DOTs, TxDOT is largely decentralized. Each of TxDOT’s 25 districts has a unique set of operational challenges and constraints. As a result, each TxDOT district is developing its own TSMO Program Plan which will reference and conform to the Statewide TSMO Strategic Plan and related guidance that was finalized by TxDOT TRF in 2018. Even with consistency across each of the District TSMO Program Plans, the business case, roles and partnering approaches, and implementation strategies will be uniquely tailored to each district’s transportation challenges and needs.

The Federal Highway Administration (FHWA) generally recommends that state DOT TSMO planning elements include the three levels of planning: strategic, program, and tactical. This report corresponds to the second level of TSMO planning in this hierarchy. The three levels of TSMO plans and a brief description of each is shown in Figure 2 below.

Figure 2: TxDOT Transportation Systems Management and Operations Plan Hierarchy



The TxDOT Statewide TSMO Strategic Plan was completed in 2018 as the first component of the TxDOT TSMO planning initiative. TSMO activities have been taking place throughout the state on an ad-hoc basis for decades. The TxDOT Statewide TSMO Strategic Plan defines processes to conduct TSMO consistently across the state. It also identifies the roles and responsibilities of each TxDOT division and of individual TxDOT districts for implementation of a statewide TSMO program.

Following the development of this framework, the second component of the TxDOT TSMO planning initiative is to develop district-level TSMO program plans. The TxDOT Austin District was the first of the 25 TxDOT districts to develop a TSMO Program Plan, completing theirs in June 2018. Other TxDOT districts began development of their TSMO Program Plans between 2019 and 2021.

Figure 3: Brownwood District TSMO Structure



Each district’s TSMO Program Plan focuses on strategies that can be implemented within the next five years, after which the Program Plan should be updated to assess progress and to identify new focus areas and strategies. Potential TSMO Tactical Plans will be identified for the TxDOT Brownwood District as a part of this TSMO Program Plan. The structure of the TxDOT Brownwood District TSMO planning initiative is shown in Figure 3.

The development of the TxDOT Brownwood District TSMO Program Plan involved individual agency outreach meetings and group workshops with both internal TxDOT stakeholders and external local and regional agency partners such as city transportation staff, law enforcement, and emergency response officials. These partners were asked to provide initial input on regional operational challenges, to give feedback on existing regional capabilities to address those challenges, and to discuss strategies that the region could enact to improve those regional capabilities. The stakeholder engagement timeline for this effort is shown in Figure 4, and a detailed list of participants is included in Appendix A. Due to travel restrictions related to the COVID-19 pandemic, all outreach was conducted virtually.

**Program Plan Format**

In the **Business Case for TSMO** section, the TxDOT Brownwood District TSMO Program Plan estimates the potential benefit-cost ratio for adopting TSMO priorities throughout the District. This business case includes available metrics on congestion and safety and an assessment of existing societal costs related to delay and crashes within the District. This information is analyzed alongside available funding sources and some of the regional operational challenges that TxDOT Brownwood District staff and external partners identified. An explanation is provided as to how TSMO strategies might reduce these societal costs and address funding and operational challenges that the TxDOT Brownwood District has identified as a priority.

Figure 4: Brownwood District TSMO Stakeholder Engagement Timeline

**STAKEHOLDER INVOLVEMENT TIMELINE**

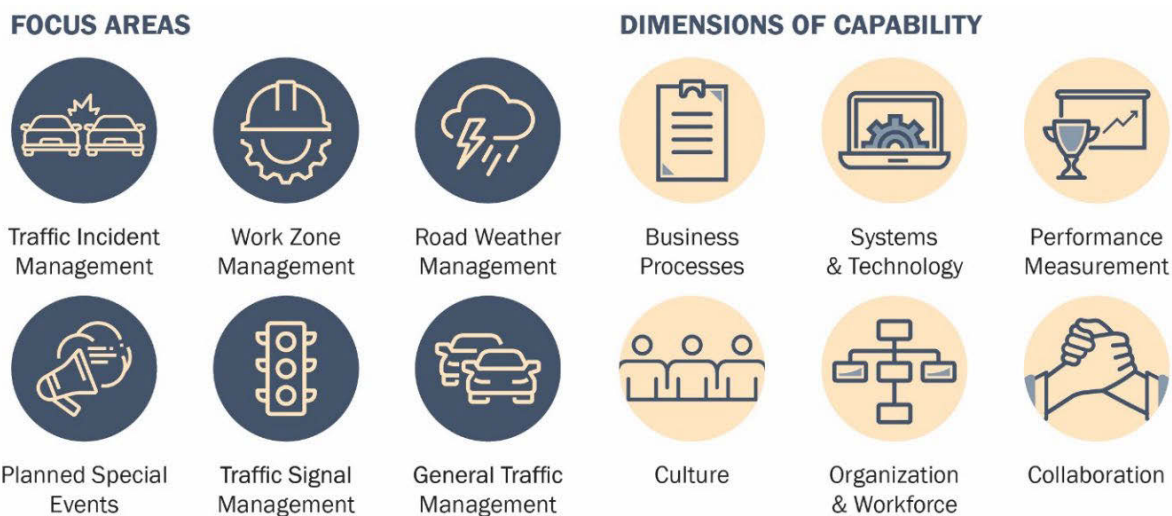


The **TSMO Vision, Mission, Goals, and Objectives** section introduces the Statewide TSMO Vision and Mission, both of which were developed as part of the 2018 TxDOT TSMO Strategic Plan. The section then lists the TSMO goals and objectives that the TxDOT Brownwood District selected as part of this program planning process.

The **Capability Maturity Model (CMM)** section provides an overview of the self-assessment process and the assessment results that TxDOT Brownwood District and partner agency stakeholders reported for six standard capability dimensions: Business Processes (BP), Systems and Technology (ST), Performance Measurement (PM), Culture (CU), Organization and Workforce (OW), and Collaboration (CO). The section describes how each of these results and related stakeholder feedback showed the TxDOT Brownwood District’s existing capabilities in responding to six of the most typical TSMO focus areas: Traffic Incident Management (TIM), Work Zone Management (WZM), Road Weather Management (RWM), Planned Special Events (PSE), Traffic Signal Management (TSM), and General Traffic Management (TM).

Descriptions of recommended TSMO action items and relevant case studies of best practices from other TxDOT districts and state DOTs are included in the CMM section, and the icons shown in Figure 5 are used to relate the recommended action items to each TSMO capability dimension and focus area. Each recommended TSMO action item is detailed on its own page, and each page includes discussion on the underlying need for the action item, a guide for how that action item could potentially be implemented, and the anticipated benefits of implementing the action.

Figure 5: TSMO Focus Areas and Dimensions of Capability

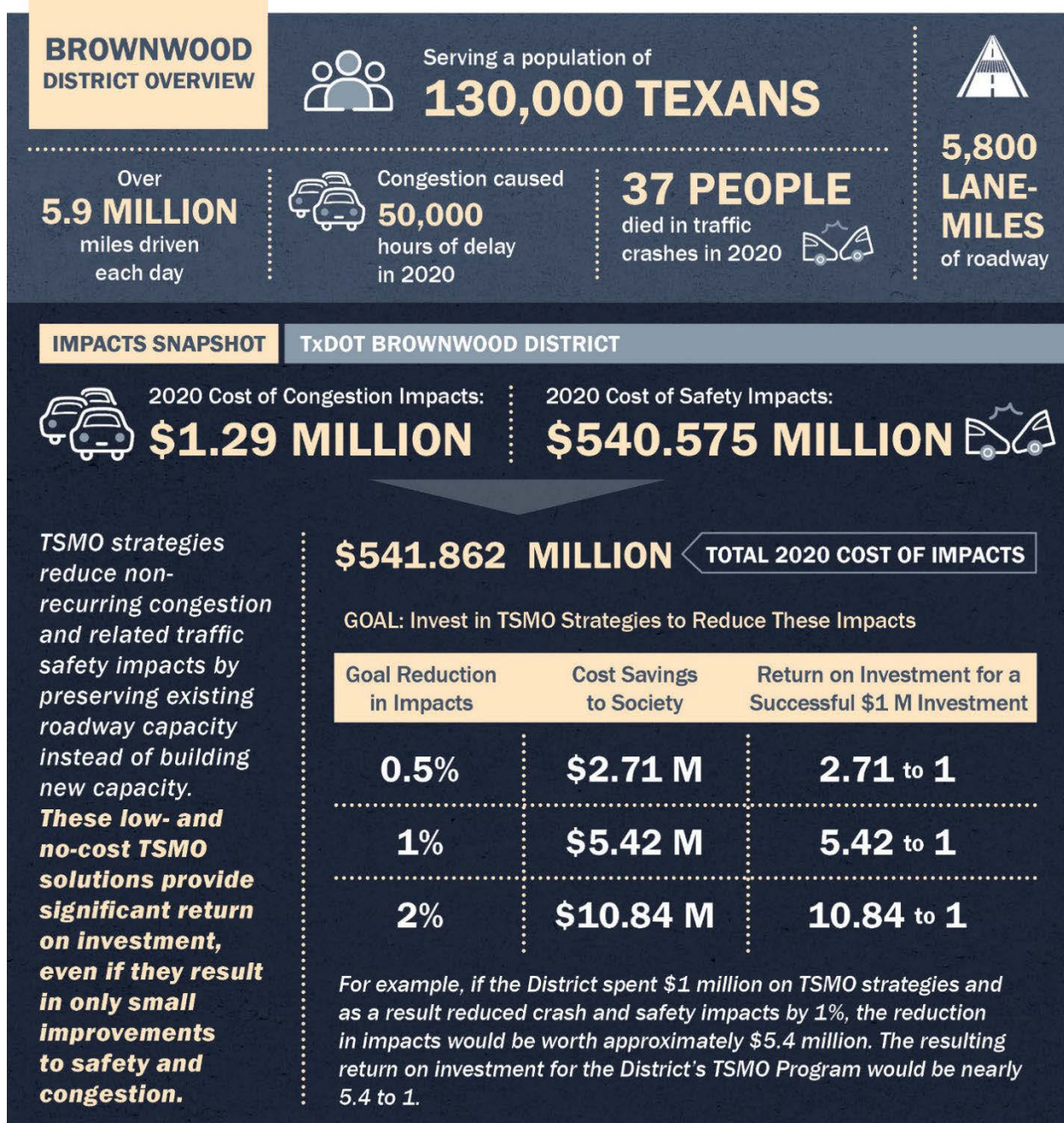


The **TSMO Implementation Plan** section shows all recommended TSMO action items for the TxDOT Brownwood District to undertake for the next five years in both a summary table and an implementation schedule. Finally, focus areas and related action items that would benefit from further planning or development prior to program implementation are summarized in the **TSMO Tactical Plan Needs Assessment** section.

## Business Case for TSMO

In 2020, congestion led to 50,000 hours of delay within the TxDOT Brownwood District, and 37 people lost their lives in traffic crashes with at least another 375 people sustaining injuries. All these negative outcomes led to more than \$541 million in costs to society. Figure 6 below summarizes the business case for investing in TSMO strategies in the District. As shown below, if the TxDOT Brownwood District and its partners invested \$1 million in TSMO strategies and as a result reduced these negative outcomes by just 1 percent, the investment would pay for itself more than five times over. More detailed discussion about congestion and safety impacts and how TSMO can address these impacts is included on subsequent pages.

Figure 6: TxDOT Brownwood District Overview and TSMO Impacts Snapshot



## **Congestion Impacts**

The 2050 Texas Transportation Plan goal **Optimize System Performance: Movement of People and Goods** can be addressed using TSMO strategies.

### **TxDOT Goal: Optimize System Performance - Movement of People and Goods**

Detailed objectives include:

- Reduce congestion through both traditional and alternative strategies
- Enable reliable travel times
- Increase travel options/connections
- Ensure freight can move efficiently
- Increase access to jobs, services, and activity centers
- Leverage transportation assets to support economic growth and vitality

TSMO planning identifies strategies beyond typical capacity enhancements that reduce congestion. Since TSMO strategies are mostly focused on non-recurring congestion, they are typically more effective at improving travel time reliability when compared to capacity enhancements.

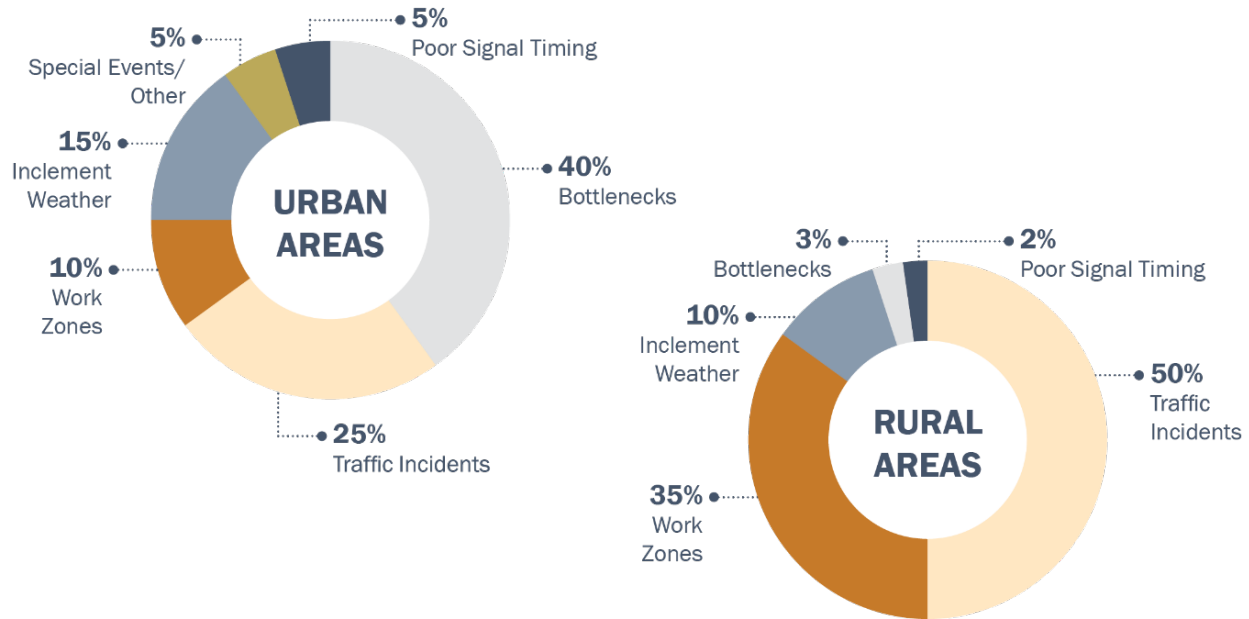
The Texas Demographic Center reports the population of the TxDOT Brownwood District increased by 0.4 percent between the 2010 and 2020 census.<sup>3</sup> Although some counties in the TxDOT Brownwood District have seen a decrease in population, Brown County, Lampasas County, and McCulloch County grew 2.1 percent, 6.9 percent, and 4.6 percent respectively, resulting in overall population growth in the District.

Many of the congestion impacts throughout the District occur due to events that limit roadway capacity, such as traffic incidents and planned construction closures. FHWA's breakdown of these congestion sources taken from nationwide data is shown in Figure 7 for both urban and rural areas.<sup>4</sup>

In 2020, the Texas A&M Transportation Institute (TTI) estimated an annual total delay of approximately 53,305 passenger-hours along major thoroughfares within the TxDOT Brownwood District. This total is inclusive of an estimated annual freight vehicle delay of 6,723 driver-hours along those same major thoroughfares. Using Texas-specific user cost values, this congestion resulted in a societal cost of \$1,286,629 within the TxDOT Brownwood District in 2020.<sup>5</sup> Based on traffic pattern observations, the TxDOT Brownwood District attributes the majority of delays to non-recurring congestion from events such as incidents, construction, and severe weather.

One interesting note related to the impacts of the COVID-19 pandemic was that the TxDOT Brownwood District, unlike much of Texas, saw an increase in congestion during the first year of the COVID-19 pandemic. In 2020, Texas saw a 9.8% drop in total daily vehicles miles of travel compared to 2019 per the TxDOT Transportation Planning and Programming Division Roadway Inventory Data. Texas also saw a drop in overall congestion in 2020 compared to 2019 per the 2020 TTI estimated annual total delay. However, in the Brownwood District, the 2020 TTI estimated annual total delay was higher than 2019.

Figure 7: Nationwide Causes of Congestion in Urban and Rural Areas (FHWA)



TSMO allows for the inclusion of operations strategies that result in the improved management of incidents, work zones, weather events, and planned special events, thereby reducing the congestion impacts and related societal costs of these interferences on the TxDOT Brownwood District transportation network.

### Safety Impacts

The 2050 Texas Transportation Plan goal to **Promote Safety** corresponds with many TSMO strategies.

#### TxDOT Goal: Promote Safety

Detailed objectives include:

- Work with stakeholders to identify and develop proven and data-driven strategies, countermeasures, and programs
- Reduce crashes and lessen crash severity by implementing engineering solutions
- Use education and outreach to promote safe driving, bicycling, and pedestrian activities
- Coordinate with first responders to improve incident response times

TSMO planning identifies technologies or systems that can be incorporated into existing or planned infrastructure to improve the safety of road users, whether they be drivers, cyclists, or pedestrians. In addition to the objectives outlined in the 2050 Texas Transportation Plan, the Texas Transportation Commission adopted a Road to Zero Goal in 2019. The goal is the elimination of all deaths on Texas roadways by 2050, with a midway goal of halving the number of deaths on Texas roadways by 2035. The implementation of TSMO strategies will be essential in reducing and eventually eliminating deaths on Texas roadways.



An evaluation of the three-year crash history (2019 – 2021) for the TxDOT Brownwood District revealed that the total number of crashes experienced within the District has increased every year from 2019 to 2021. From 2019 to 2020, the total number of crashes increased by approximately 1% (21 crashes.) 2021 saw further increases with the number of crashes increasing by an additional 17% (367 crashes.) This increase in crashes led to an \$144,125,000 increase in estimated societal costs. While an increase of 21 crashes between 2019 and 2020 is much less than the increase that occurred in 2021, crash rates were expected to be reduced along with the significant decrease in traffic volume due to the impacts of COVID-19 in 2020. With fewer vehicle miles traveled within the District, the crash rate will have increased during COVID-19 as the total number of crashes increased and the vehicle miles traveled decreased.

### **Societal Cost of Crashes**

TxDOT calculates the societal cost of crashes using the National Safety Council comprehensive injury cost values. These values were used to develop weighted fatal and suspected serious injury crash unit cost values (\$3,300,000 per crash for both fatal and suspected injury crashes) and suspected minor injury cost values (\$475,000 per crash.) TxDOT does not consider crashes with only possible injuries or no apparent injury in economic analysis, so those were not factored into the societal cost of crashes in this report.

Trends across the nation and state showed an overall decrease in the number of crashes in general, caused by the decrease in traffic volumes due to the COVID-19 pandemic. An increase in fatal crashes was seen nationwide and in other TxDOT districts, as a result of the lack of congestion and resulting faster speeds. However, the CRIS data for crashes within the TxDOT Brownwood District do not completely align with these trends seen elsewhere. The overall number of crashes continuously increased 18 percent from 2019 through the COVID-19 pandemic to 2021, while the number of fatal crashes decreased by fourteen percent during the three-year period. Although fatalities in the District were lower by 2021, severe injury crashes increased over 35 percent.

In 2019, there were 2,144 reported crashes in the TxDOT Brownwood District.<sup>6</sup> In those crashes, 40 people died and 124 people suffered an incapacitating injury. A summary of 2019 crashes in the TxDOT Brownwood District, including the count of certain crash types that could be targeted by TSMO strategies, is shown below in Table 1. Using Texas-specific user cost values, these crashes and associated damages resulted in a societal cost of \$524,450,000 within the TxDOT Brownwood District in 2019.<sup>7</sup>

Table 1: 2019 Summary of Crashes by Type Within the TxDOT Brownwood District

	Fatal (K)	Serious Injury (A)	Minor Injury (B)	Possible Injury (C)	No Injury (O)	Unknown Severity
<b>Total Crashes</b>	37	94	194	347	1417	55
<b>Total Persons Affected</b>	40	124	259	535	3645	55
Inclement Weather Crashes – Rain or Fog	3	8	23	52	208	4
Inclement Weather Crashes – Winter Weather	0	1	0	3	4	0
Work Zone Crashes	2	2	6	13	49	0
Intersection Crashes	3	21	51	111	405	6
Commercial Vehicle Crashes	8	14	25	30	176	2

In 2020, there were 2,165 reported crashes in the TxDOT Brownwood District.<sup>7</sup> In those crashes, 37 people died and 137 people suffered an incapacitating injury. A summary of 2020 crashes in the TxDOT Brownwood District, including the count of certain crash types that could be targeted by TSMO strategies, is shown in Table 2. Using Texas-specific user cost values, these crashes and associated damages resulted in a societal cost of \$540,575,000 within the TxDOT Brownwood District in 2020.<sup>8</sup>

Table 2: 2020 Summary of Crashes by Type Within the TxDOT Brownwood District

	Fatal (K)	Serious Injury (A)	Minor Injury (B)	Possible Injury (C)	No Injury (O)	Unknown Severity
<b>Total Crashes</b>	33	99	221	267	1474	71
<b>Total Persons Affected</b>	37	137	297	376	3704	71
Inclement Weather Crashes – Rain or Fog	5	7	21	27	11	0
Inclement Weather Crashes – Winter Weather	0	1	3	2	11	0
Work Zone Crashes	1	1	3	4	45	0
Intersection Crashes	4	21	68	83	395	7
Commercial Vehicle Crashes	3	12	18	19	181	2

In 2021, there were 2,532 reported crashes in the TxDOT Brownwood District.<sup>7</sup> In those crashes, 37 people died and 160 people suffered an incapacitating injury. A summary of 2021 crashes in the TxDOT Brownwood District, including the count of certain crash types that could be targeted by TSMO strategies, is shown below in

Table 3. Using Texas-specific user cost values, these crashes and associated damages resulted in a societal cost of \$668,575,000 within the TxDOT Brownwood District in 2021.<sup>8</sup>

Table 3: 2021 Summary of Crashes by Type Within the TxDOT Brownwood District

	Fatal (K)	Serious Injury (A)	Minor Injury (B)	Possible Injury (C)	No Injury (O)	Unknown Severity
<b>Total Crashes</b>	32	129	289	251	1764	67
<b>Total Persons Affected</b>	37	160	379	373	4534	67
Inclement Weather Crashes – Rain or Fog	6	10	23	20	255	4
Inclement Weather Crashes – Winter Weather	0	1	2	4	30	2
Work Zone Crashes	0	2	5	12	75	0
Intersection Crashes	7	30	88	80	432	3
Commercial Vehicle Crashes	8	8	28	27	252	3

The TxDOT Brownwood District CRIS data from 2019 through 2021 was used to analyze all of the major corridors including Interstates, State Highways, US Highways and Farm to Market to identify roads with the greatest number of crashes and fatalities. Over the three-year period from 2019 to 2020, Interstate 20 had the greatest number of crashes recorded in the District, with 764 crashes including 12 fatalities. The major corridor with the second highest number of crashes was SH 67 with 725 crashes and 8 fatalities. US 84 ranked fourth in the total number of crashes but was tied for highest number of fatalities along with Interstate 20 with a total of 12 fatalities.

Detailed results for crash data on major corridors over the three-year period from 2019 to 2021 within the TxDOT Brownwood District are shown in Table 4.

Table 4: 2019 – 2020 Crash Data for Major Corridors within the TxDOT Brownwood District

Corridor Name	3-yr Total Crashes	Total Corridor Crashes			3-yr Total Fatality Crashes	Total Corridor Fatalities		
		2019	2020	2021		2019	2020	2021
Interstate 20	764	232	224	308	12	5	4	3
US 67	725	193	251	281	8	3	2	3
US 183	452	160	119	173	5	1	1	3
US Highway 190	289	118	77	94	6	4	2	0
US Highway 84	250	66	83	101	12	4	4	4
US Highway 377	216	64	64	88	3	1	0	2
State Highway 6	200	69	63	68	3	1	1	1
State Highway 16	191	74	56	61	7	2	0	5
Farm to Market 2524	156	43	53	60	0	0	0	0
State Highway 180	152	49	51	52	1	0	1	0
State Highway 36	122	40	39	43	4	1	2	1
Farm to Market 580	109	39	31	39	0	0	0	0
State Highway 206	104	21	45	38	4	0	4	0
State Highway 279	97	29	29	39	1	0	0	1
US Highway 87	95	44	12	39	2	0	1	1
US Highway 281	90	25	41	24	4	1	1	2
State Highway 71	52	25	13	14	5	3	2	0

When TSMO activities are considered in project development, such as during planning for roadway reconstruction, solutions to improve safety for all modes of transportation can be identified and implemented. Furthermore, TSMO strategies aimed at reducing non-recurring sources of congestion and improving traveler information can improve driver expectancy and improve driver awareness of conditions that increase crash risks. Finally, TSMO strategies can help protect those who spend time working in the roadway, including TxDOT employees and contractors, public safety officers, and emergency responders.

### ***Funding Impacts***

The number of people living in Texas has increased by more than 15 percent in the last ten years. Adding transportation network capacity and optimizing the use of available funding have become increasingly challenging as the population of Texas continues to grow. As a result, TxDOT has emphasized transitioning transportation funding and resources from conventional capacity-adding methods to a focus on managing and operating the transportation network through investing in technology and Traffic Management Systems (TMS), as well as leveraging resources among regional partner agencies and the private sector.

The 2050 Texas Transportation Plan goal to **Deliver the Right Projects** corresponds closely with addressing funding challenges using TSMO strategies.

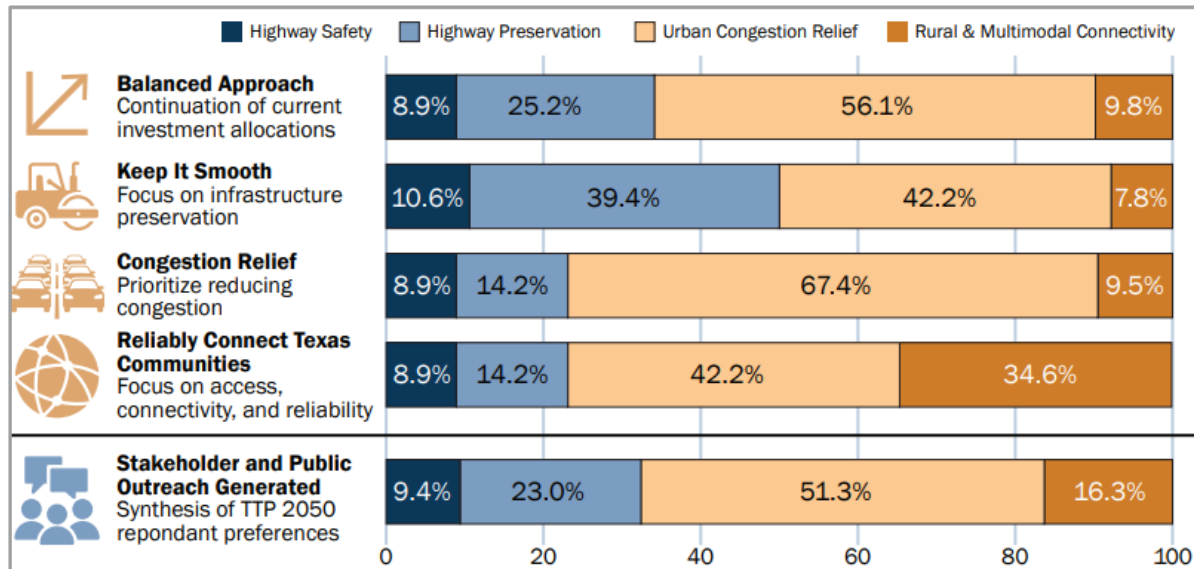
#### **TxDOT Goal: Deliver the Right Projects**

Detailed objectives include:

- Reduce user costs
- Identify and maintain reliable funding
- Improve analytic capabilities to maximize the value of investments
- Fairly distribute transportation benefits and costs
- Strategically deploy innovative technology to increase effectiveness and efficiency of the system
- Maintain sustainable funding

FHWA studies have shown that operational improvements to increase mobility without adding capacity typically have a higher benefit-cost ratio than infrastructure projects that build additional lane miles of capacity, especially when life-cycle costs are considered for both project types. With transportation demand growing, integrating TSMO into existing TxDOT Brownwood District processes will help TxDOT staff identify and prioritize cost-efficient operations and systems management methods to improve system reliability and safety, thus optimizing available capacity. TSMO will support projects that can bridge the gap between existing needs and available funding. Figure 8 shows several potential investment scenarios for TxDOT over the next 30 years.<sup>1</sup>

Figure 8: 2050 Texas Transportation Plan Potential Funding Scenarios

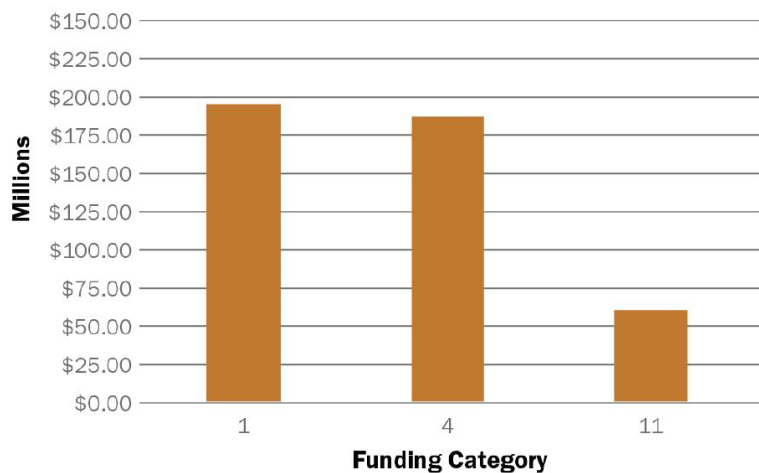


Source: 2050 Texas Transportation Plan

The Texas 2020 Unified Transportation Program (UTP) established a planning target of \$440,920,000 in project funding for the TxDOT Brownwood District over the next 10 years.<sup>2</sup> A breakdown by funding category of these planning targets over the next 10 years for the TxDOT Brownwood District from the UTP is shown in Figure 9.

Figure 9: TxDOT Brownwood District 10-Year Planning Targets by Category

### Brownwood District: 2020 Planning Targets by Category



## 12

### TxDOT FUNDING CATEGORIES

- 1 Preventive Maintenance and Rehabilitation
- 2 Metropolitan and Urban Area Corridor Projects
- 3 Non-Traditionally Funded Transportation Projects
- 4 Statewide Connectivity Corridor Projects
- 5 Congestion Mitigation and Air Quality Improvement
- 6 Structures Replacement and Rehabilitation
- 7 Metropolitan Mobility and Rehabilitation
- 8 Safety
- 9 Transportation Alternatives Program
- 10 Supplemental Transportation Projects
- 11 District Discretionary
- 12 Strategic Priority

Based on these planning targets, preventive maintenance and rehabilitation projects (Category 1) as well as Statewide Connectivity Corridor Projects (Category 4) are key investment areas that the TxDOT Brownwood District will focus on over the next 10 years. TSMO strategies can be applied to both investment areas, and especially to improvements focused on preventive maintenance and rehabilitation projects. Several of the key projects related to these investment areas are:

- Reconstructing and widening SH 6 in Comanche and Eastland Counties
- Reconstructing SH 206 in Coleman County
- Constructing passing lane along SH 6 for Super 2 highway in Comanche and Eastland Counties
- Constructing median along US 281 South to divide the lanes in Lampasas County
- Reconstructing US 377 in McCulloch County

Agencies that place importance on TSMO in long-range planning, project development, system completion, and system maintenance have a strong basis for devoting funding to these strategies because operations and management activities can improve congestion while minimizing or delaying the need for physical capacity improvements. Through TSMO planning, funding is reserved to include TMS in conventional construction, asset management techniques, upgrades to existing infrastructure, workforce resources, and other operational strategies.

### ***The Value of Mainstreaming TSMO***

The business case for TSMO is grounded in the fact that funding for the TxDOT Brownwood District to solve existing congestion challenges through capacity enhancements alone is not readily available. FHWA congestion research shows that most of the congestion that road users experience in the United States is not a result of capacity bottlenecks. Instead, most congestion occurs due to non-recurring shocks to the network such as traffic incidents, inclement weather, or work zones. In rural areas, nearly all congestion impacts come from these non-recurring sources.

TSMO strategies integrate TMS into the planning, design, and construction of District facilities. One group of strategies, the use of Intelligent Transportation Systems (ITS) deployments such as Closed-Circuit Television (CCTV) cameras or Dynamic Message Signs (DMS), has been used by TxDOT for decades. The use of ITS as well as other TMS and TSMO strategies allows for more nimble operation and maintenance of the facilities once they are constructed. Successful integration of TMS allows agencies who maintain the transportation network to respond more quickly and to better mitigate the adverse effects of many sources of non-recurring congestion, thereby reducing the amount of congestion and making roads safer.

Building necessary infrastructure and maintaining it have historically been the core goals of TxDOT's transportation project planning process, while operating and managing the performance of that infrastructure have traditionally not been as highly prioritized. TSMO justifies investment in technology and TMS infrastructure to facilitate the integration of management and operations into the transportation system. Promoting and formalizing TMS deployment and maintenance ensures operational asset uptime, which in turn enables regional transportation agencies to provide greater traveler information, traffic incident management, road weather management, safer work zones, and more.

TSMO planning fosters the cultural shift required to prioritize the dedicated funding of operational improvements and TMS. It also establishes a framework for performance measurement and continuous improvement to enhance safety and mobility throughout the District. Ultimately, this brings the District closer to achieving the TxDOT mission statement: "Through collaboration and leadership, we deliver a safe, reliable, and integrated transportation system that enables the movement of people and goods."

## TSMO Vision, Mission, Goals, and Objectives

The TxDOT Brownwood District TSMO Program vision, mission, goals, and objectives were based on similar items developed for the statewide TxDOT TSMO Strategic Plan. District project leadership chose to adopt the statewide vision, mission, goals, and objectives.

### Statewide TSMO Vision

Improve safety and mobility for all modes of transportation by integrating planning, design, operations, construction, and maintenance activities and acknowledging all opportunities for innovation.

### Statewide TSMO Mission

Through innovation, collaboration, and performance-based decision-making, transportation facilities are developed, constructed, maintained, and operated cost-effectively, with the end user in mind.

### Brownwood District TSMO Goals and Objectives

The goals and objectives for the TxDOT Brownwood District TSMO Program Plan are identified below, in *Table 5*. District project leadership chose to adopt the TxDOT statewide TSMO goals and objectives.

Table 5: TxDOT Brownwood District TSMO Program Plan Goals and Objectives

TxDOT Statewide TSMO Goals	TxDOT Statewide TSMO Strategic Objectives
Safety	Reduce crashes and fatalities through continuous improvement of traffic management systems and procedures.
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.
Efficiency	Implement projects that optimize existing transportation system capacity and vehicular throughput.
Customer Service	Provide timely and accurate travel information to customers so they can make informed mobility decisions.
Collaboration	Proactively manage and operate an integrated transportation system through multi-jurisdictional coordination, internal collaboration, and cooperation between various transportation disciplines and partner agencies.
Integration	Prioritize TSMO as a core objective in the agency's planning, design, construction, operations, and maintenance activities.



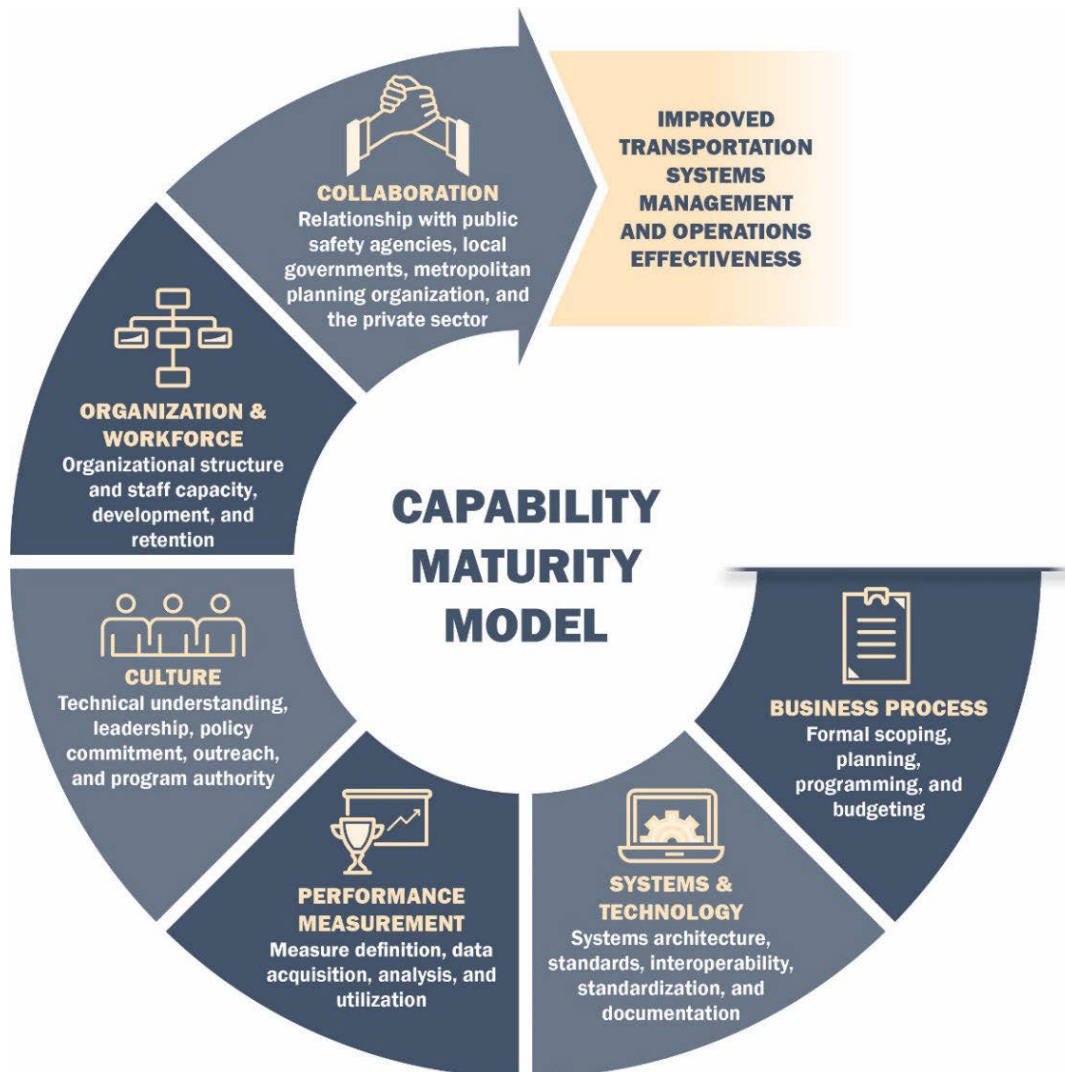
## Capability Maturity Model

A Capability Maturity Model (CMM) is a systematic methodology in which a program or organization is evaluated to determine a level of achievement for specific attributes. The American Association of State Highway Transportation Officials (AASHTO) adapted the CMM approach, originally developed for the information technology industry, so that it could be used to gauge a transportation agency's capabilities in addressing various operational challenges related to TSMO. The CMM is a self-assessment and relies on direct input from internal and external stakeholders to assess the strengths and weaknesses across a range of different program perspectives.

### Dimensions of TSMO Capability

The CMM is based on the concept that there are six core areas, referred to as 'dimensions' that are critical for improving program efficiency and effectiveness. These dimensions, as well as processes and activities within TxDOT that correspond to each one, are shown in Figure 10.

Figure 10: CMM Dimensions of TSMO Capability (adapted from AASHTO)



## ***TSMO Focus Areas***

The AASHTO CMM assessed the TxDOT Brownwood District's capabilities across the six dimensions of capability shown in Figure 10 for six different focus areas (often referred to as Capability Maturity Framework, or CMF). These focus areas are:

- **Traffic Incident Management (TIM):** The institutional capability to detect, respond to, and clear traffic incidents so that normal operations can be restored safely and quickly.
- **Work Zone Management (WZM):** The institutional capability to assess and mitigate work zone impacts.
- **Road Weather Management (RWM):** The institutional capability to respond to adverse weather conditions through both maintenance and operations activities.
- **Planned Special Events (PSE):** The institutional capability to manage traffic impacts generated by events at permanent event venues, temporary venues, or ones that occur on the road network itself.
- **Traffic Signal Management (TSM):** The institutional capability to effectively design, operate, and maintain traffic signals.
- **General Traffic Management (TM):** The institutional capability to manage the movement of traffic on roadways within a region, including through corridor management.

## ***Introduction to the CMM Process***

Each of the TSMO capabilities evaluated in the CMM assessment are classified as one of four levels of organizational maturity by stakeholders through a facilitated self-assessment process. As shown in Figure 11, the base level, or Level 1, is the Performed level. The top level, or Level 4, is the Optimized level. It is important to note that the levels are not grades, they merely reflect where the organization currently stands within a particular TSMO capability.

Level 1, Performed, means the TSMO capability is completed on an ad-hoc basis, usually by one or two individual champions.

Level 2, Managed, may involve more individuals on a team performing the activity and beginning to integrate into other processes; however, there is little accountability for achieving performance measures.

At Level 3, Integrated, the program dimension is part of a more formalized process, there are established performance measures and activities are structured to work toward performance objectives. At this stage, processes are more clearly defined and there is some recognized, organizational support for the activities, including budgets.

When an organization has achieved Level 4, Optimized, the capability is largely institutionalized and formalized, with strong collaboration and recognition of roles and responsibilities by agency staff and partners. At this level, there is also a more formal commitment to performance-based improvements.

Figure 11: CMM Levels of Maturity



Each of the capabilities were evaluated for the TxDOT Brownwood District during five stakeholder meetings: four Individual Stakeholder Interviews held throughout August and September 2021 and one Stakeholder Outreach Workshop with both TxDOT and partner agency staff held in October 2021. These meetings were conducted virtually via Microsoft Teams. The Individual Stakeholder Interviews were each focused on capabilities in the major cities within the TxDOT Brownwood District, while the Stakeholder Outreach Workshop discussed the capabilities throughout the District overall. Figure 12 shows where the TxDOT Brownwood District ranked itself for each of the TSMO capabilities. Based on the overall CMM assessment results, the District currently sees itself operating at Level 2 in all CMM capability dimensions except Performance Measurement, for which the District ranked itself as operating at Level 1.

Figure 12: TxDOT Brownwood District CMM Assessment

TSMO Capability Dimensions	Overall Capabilities			
	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes		●		
Systems & Technology		●		
Performance Measurement	●			
Culture		●		
Organization & Workforce		●		
Collaboration		●		

Following the completion of the CMM assessment, District leadership met on January 13, 2022 to discuss the assessment results and review a list of potential action items to be recommended in the TxDOT Brownwood District TSMO Program Plan. The District leadership selected action items that would allow the TxDOT Brownwood District to advance one level in the CMM assessment for each capability dimension with respect to the six TSMO focus areas.

Input from all of the stakeholder and District leadership meetings is presented in this section, organized by focus area. Case study examples from other TxDOT districts and other transportation agencies across the United States are included to provide examples of successful TSMO-related deployments elsewhere that could be similarly implemented within the TxDOT Brownwood District.



### Traffic Incident Management District Assessment

Traffic Incident Management (TIM) involves the TxDOT Brownwood District and partner agency response to traffic incidents. When TIM is conducted effectively, it can reduce congestion, improve travel time reliability, and increase safety. The TxDOT Brownwood District generally performs TIM activities on an ad hoc basis. At the time this report was developed, no formal TIM program existed in the TxDOT Brownwood District, funding was not allocated for TIM activities, and there were no formalized process for considering TIM during planning efforts for construction work zones. Figure 13 shows where the District ranked itself for each of the TSMO capabilities regarding TIM.

Figure 13: TxDOT Brownwood District CMM Assessment for Traffic Incident Management

Focus Area: Traffic Incident Management				
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes	●			
Systems & Technology		●		
Performance Measurement	●			
Culture	●			
Organization & Workforce	●			
Collaboration	●			

While the TxDOT Brownwood District does not currently conduct after-action reviews (AARs) for traffic incidents on a regular basis, stakeholders and District staff identified that the creation of a formalized TIM Team would be beneficial. The City of Lampasas currently meets with TxDOT Brownwood District staff once a year to discuss

major issues, but the meeting does not include other cities or counties. A TIM Team could meet consistently and include all of the TxDOT Brownwood District's partner agencies to discuss TIM-related regional priorities, assist with coordination among local agencies during traffic incidents, and conduct AARs, which would improve incident response and overall traffic operations.

District staff and stakeholders emphasized the need for better coordination among responders during an incident to identify which units should respond based on proximity to the incident and needed response services. TxDOT and first responder staff generally live and work at locations dispersed across the District, therefore responders from stakeholder agencies are often not nearby when a traffic incident occurs. Stakeholders noted that although it may take TxDOT staff a while to arrive at an incident, they usually have all of the appropriate equipment to clear the scene. This helps the District achieve its goal of keeping the length of closures due to traffic incidents to under two hours because the MUTCD requirements for traffic control become stricter and more extensive if the closure exceeds that two-hour threshold. Within the TxDOT Brownwood District, a rotation list for wrecker services is used along I-20, but the companies tend to know when they are next on the list and do not respond or clear an incident as fast, making the two-hour goal a concern for the District.

The TxDOT Brownwood District currently does not collect any TIM-related performance measures, such as roadway clearance time (RCT), incident clearance time (ICT), and secondary crash data. The District also currently does not log any incident data in Lonestar, nor does it track timestamps for TIM-related activities. The Brownwood Emergency Operations Center (EOC) maintains an internal email group that is used to disseminate incident updates during winter storms or flooding to report county-specific events that occur. For an incident on I-20 that results in Texas Department of Public Safety (DPS) closing the interstate, the Brownwood EOC group will typically get an email from someone local sharing that the interstate is closed and a follow-up email when it reopens. District staff noted that most of the time there is a good assessment of incident duration as part of the initial scene size-up, but this is not always conveyed to the Brownwood EOC email group.

Other existing capabilities for TIM related performance measurement are limited to observation via camera feeds along I-20 and on scene data collection by local public safety agencies. Other TxDOT districts often use a traffic management center (TMC) to watch camera feeds to detect, verify, and monitor traffic incidents, but the TxDOT Brownwood District does not currently have a TMC and its existing infrastructure has limited camera coverage. However, the TxDOT Brownwood District is working with the TxDOT TRF to identify gaps in CCTV camera and DMS coverage to improve its capability to detect traffic incidents, monitor traffic conditions, and track TIM performance measures. The District currently only has cameras deployed along I-20, east of the City of Eastland. The District also only has two permanent DMS units deployed, one on I-20 and one on the other side of the District boundary in Palo Pinto County for westbound travelers entering the TxDOT Brownwood District on I-20.

The TxDOT Brownwood District has self-identified a need for coordination district-wide in response to incidents, potentially through increased CCTV camera coverage and sharing video feeds with first responders. Additional cameras would allow TxDOT Brownwood District staff to detect, verify, and notify first responders of traffic incidents faster, reducing incident verification time, as well as improving TIM data collection capabilities.

Additional DMS would allow TxDOT Brownwood District staff to post travel information regarding incidents to warn drivers of potential congestion or hazards.

The TxDOT Brownwood District noted that TIM personnel know who to contact and there is a good line of communication between TxDOT and cities, particularly the City of Brownwood. Personal relationships are currently the foundation of this currently strong line of communication. There is a need for multidisciplinary training to encourage consistent compliance with statewide laws and quick-clearance goals, and to increase regional knowledge of TIM-related strategies and best practices. This training could also improve coordination and communication during traffic incidents.



### Work Zone Management District Assessment

Work Zone Management (WZM) involves the TxDOT Brownwood District and partner agency management of traffic before, during, and after planned construction events. Effective WZM can reduce congestion, improve travel time reliability, and increase safety. Figure 14 shows where the District ranked itself for each of the TSMO capabilities regarding WZM.

Figure 14: TxDOT Brownwood District CMM Assessment for Work Zone Management

Focus Area: Work Zone Management				
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes			●	
Systems & Technology			●	
Performance Measurement	●			
Culture		●		
Organization & Workforce	●			
Collaboration			●	

Currently, the TxDOT Brownwood District coordinates construction projects internally and involves all external stakeholders in the planning phase of major projects. While pre-construction meetings are extended to local municipalities when large projects are planned, external stakeholders are not regularly included in discussions about more granular project details, such as routine maintenance or striping work. There is also room for improvement for internal information dissemination, as work zone information is not consistently received by local agencies. Specifically, project updates and construction schedule changes are not always shared with partners in a timely manner. The City of Lampasas noted that recently many Lampasas residents have called

the City inquiring about major road construction along US 281, and to provide answers city staff must call TxDOT to find out work zone information.

The District generally communicates well with the public by disseminating information regarding closures through the Public Information Office (PIO), which shares work zone information with the newspaper and media. Stakeholders pointed out that not all travelers utilize these information platforms and therefore there is opportunity for coordination with third-party applications to distribute updated traveler information related to work zones directly to travelers in the area.

The TxDOT Brownwood District does not collect work zone management performance measurement data and does not deploy or maintain smart work zone (SWZ) devices for major construction projects. There is limited knowledge within the District of what technologies are most essential for work zone safety and of how to budget for the inclusion of this technology and procure it for road construction projects. Detour routes are not currently planned for work zones, and timings at traffic signals along any detour routes planned on an ad hoc basis currently must be changed manually due to lack of remote control of traffic signal operations. Additionally, District staffing is currently limited, and employees are not available to consistently monitor, operate, or maintain SWZ devices.

The City of Brownwood conducts quarterly infrastructure meetings and invites TxDOT Brownwood District staff, who generally attend one meeting per year. The meetings discuss upcoming construction projects and identify which work zone management strategies are working and which are not. Due to the region's growth and many future roadway widening projects, District staff self-identified the need to continue attending the City of Brownwood infrastructure meetings to maintain regional knowledge of lessons learned, best practices, and other work zone guidance from across the TxDOT Brownwood District and state.



### **Road Weather Management District Assessment**

Road Weather Management (RWM) involves the TxDOT Brownwood District and partner agency response to anticipated major weather events. While the TxDOT Brownwood District recognized the importance of RWM, they generally rated themselves higher in this focus area and action items to improve RWM performance were not identified. Figure 15 shows where the District ranked itself for each of the TSMO capabilities regarding RWM.

Eastland County holds a meeting every fall before the winter weather season to discuss winter weather preparation, maintenance activities, and emergency response actions. This meeting includes staff from the TxDOT Brownwood District, TxDOT Abilene District, Eastland County officials, and local law enforcement.

RWM is handled by existing TxDOT staff who are assigned roles and responsibilities for when storms or winter weather occur. Roadway conditions and operations are monitored by District staff patrolling the region to see if additional winter maintenance is needed. Because current camera coverage is minimal, existing only on I-20, there is a need to increase the District's capability to observe road weather conditions remotely, as well as general traffic operations. The City of Brownwood has flood and ice detection on some of its bridges, but TxDOT staff manually close flooded roads by placing signage and barricades if the City alerts them. This poses a

safety risk for District staff as they travel in inclement weather, as well as the traveling public that began driving prior to the closure being set up.

For roads not maintained by a local agency, the TxDOT Brownwood District typically keeps roads open until DPS makes the decision to close them. The decision varies depending on each unique weather event and its impacts, so road closures and the dissemination of information is handled on an ad hoc basis. In regard to low water crossings, District staff mentioned that the majority of the locations where flooding is an issue are low volume farm-to-market roads where the local public already knows when they will need to find an alternate route, depending on the weather. Therefore, the deployment of flood detection, warning, and closure devices were not seen as necessary for the District at this time.

Figure 15: TxDOT Brownwood District CMM Assessment for Road Weather Management

Focus Area: Road Weather Management				
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes		●		
Systems & Technology		●		
Performance Measurement	●			
Culture			●	
Organization & Workforce				●
Collaboration		●		

In the TxDOT Brownwood District, communication of road closures and detours due to severe weather events currently occurs by TxDOT updating road conditions and closure information on DriveTexas.org. Cities and other stakeholder agencies generally do not receive direct communication from the District and are encouraged to go to DriveTexas.org for road conditions. If TxDOT is planning to close a road that will send traffic onto city streets, they will notify the city in advance. The media and the public are provided information via social media and other existing communication channels established by the District.



### Planned Special Events District Assessment


Planned Special Event (PSE) management involves the TxDOT Brownwood District and partner agency response to preplanned special events, like local holiday events or major sporting events. The TxDOT Brownwood District generally is not centrally involved in special event operations and



instead holds more of a general role of approver of event traffic plans. Figure 16 shows where the District ranked itself for each of the TSMO capabilities regarding PSE management.

The TxDOT Brownwood District does not currently have the ability to remotely manage signal operations and as a result no advanced troubleshooting is conducted before crews arrive on site to address a reported traffic signal issue. District staff noted that there have been instances in the past where issues are called in and a signal technician cannot visualize the problem from the information called in until they arrive on scene. This often results in more downtime since the technicians are not able to monitor signals in real-time and may have to drive over an hour to evaluate the signal in person. Therefore, the District has self-identified the need for the deployment of modern signal controller and communications technology to support signal operations, but funding is a constraint. District traffic signals in rural areas often malfunction or experience outages, typically caused by inclement weather. Improved communications capabilities and signal battery back-up systems would improve the District’s ability to restore signal operations efficiently.

Figure 16: TxDOT Brownwood District CMM Assessment for Planned Special Events

Focus Area: Planned Special Events				
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes				
Systems & Technology				
Performance Measurement				
Culture				
Organization & Workforce				
Collaboration				

The TxDOT Brownwood District does not have regularly occurring large special events and the events that do occur generally have short durations. Therefore, the TxDOT Brownwood District does not have designated personnel with formal PSE job functions for events within the District. PSE operation roles and responsibilities are mutually understood by TxDOT and local stakeholder agencies. Regularly occurring special events are typically handled at the local level, with the city or event planner responsible for managing the detour route. TxDOT provides general assistance and oversight through event permitting and traffic control guidance on an ad hoc basis. There is minimal to no formal budgeting for PSE-related traffic planning and no PSE data is captured or shared.

The TxDOT Brownwood District has self-identified the future need for improved traveler information about PSE delays and related detour routing once the growth in the region increases the size and impact of PSEs. Similar to WZM information dissemination efforts, this provides an opportunity for coordination with third-party web-based applications to distribute accurate event-related traveler information directly to travelers in the area.

No other needs were specifically identified by stakeholders or the District for PSE management. There are some basic and low effort exercises that the District could consider to anticipate and prepare for future planned special event activities, should they arise. For example, maintaining a District special events calendar or conducting planning meetings or AARs focused on traffic operations surrounding special events can improve District readiness.



### Traffic Signal Management District Assessment

Traffic Signal Management (TSM) involves the TxDOT Brownwood District management of its traffic signal system. Figure 17 shows where the District ranked itself for each of the TSMO capabilities regarding TSM.

Figure 17: TxDOT Brownwood District CMM Assessment for Traffic Signal Management

Focus Area: Traffic Signal Management				
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes		●		
Systems & Technology			●	
Performance Measurement	●			
Culture		●		
Organization & Workforce		●		
Collaboration		●		

Since communication technology on traffic signals is not deployed throughout the region, there is not a method for collecting traffic signal data or tracking this data remotely. No TSM data is captured, and no signal-related performance measures have been standardized in the District.

The TxDOT Brownwood District self-identified the need to improve knowledge of available new and emerging traffic signal technologies that can address the District’s current operational challenges. District staff expressed interest in reviewing statewide and nationwide traffic signal lessons learned, best practices, and

standards to identify strategies that could be beneficial for the TxDOT Brownwood District. The District is currently facing challenges regarding signal technician turnover, resulting in a single technician with about a year of experience currently being responsible for managing the District’s 65 traffic signals. District staff are actively searching for additional signal training opportunities to increase the technician’s experience, as well as improve the training process for future TxDOT Brownwood District signal technicians.



**General Traffic Management District Assessment**

General Traffic Management involves the TxDOT Brownwood District management of traffic conditions throughout the region. The TxDOT Brownwood District generally conducts internal traffic management planning and programming to meet agency goals and objectives on an ad hoc basis. Figure 18 shows where the District ranked itself for each of the TSMO capabilities regarding general TM.

Figure 18: TxDOT Brownwood District CMM Assessment for General Traffic Management

Focus Area: General Traffic Management				
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized
Business Processes	●			
Systems & Technology		●		
Performance Measurement	●			
Culture	●			
Organization & Workforce	●			
Collaboration		●		

Currently, the District only has CCTV cameras on I-20, east of the City of Eastland, and two DMS units. District staff are working with TxDOT TRF to identify gaps in CCTV camera and DMS coverage along I-20 and develop a deployment plan to meet the spacing requirements TxDOT TRF has recently established. District staff are hopeful that some ITS devices will be deployed along the west end of I-20 within the TxDOT Brownwood District by the end of 2022.

The TxDOT Brownwood District has identified the need to expand deployment of CCTV cameras and communication connections to allow for improved visual coverage and active and passive management capabilities throughout the District on routes other than I-20. The District also wants to implement additional DMS throughout the region to improve dissemination of real-time traveler information for drivers traveling

towards Killeen, Temple, and other larger cities; provide work zone updates; and encourage diversion of traffic to other routes as needed. The eastern end of Lampasas, along US 190, near Copperas Cove was identified as the TxDOT Brownwood District's fastest growing area which would likely benefit from ITS devices.

The TxDOT Brownwood District currently does not collect or track general traffic management data along roadways in the District such as travel time reliability and most local agencies do not have the resources to easily measure transportation network performance. Cities in the region do not have cameras; therefore, video sharing among TxDOT and local agencies could be beneficial for responding to traffic incidents, monitoring work zones, allowing for more oversight of special events, detecting poor road weather conditions, and other general traffic management activities.

The TxDOT Brownwood District noted collaboration and communication as strengths. There is currently good coordination among agencies, as most chains of communication are founded on strong personal relationships and connections. However, District staff and local partner agency staff discussed issues regarding collaboration and communication related to freight management. Oversize and over-height vehicles are an issue when they are routed around a work zone or incident, or simply get lost, and drive through towns that may not have adequate facilities to support these vehicles. These large, heavy vehicles create a safety concern for other travelers because roadways, traffic signals, and signage can be damaged when oversize and over-height vehicles cannot complete turns or fit under infrastructure.

## TSMO Implementation Plan

This section summarizes the 22 recommended action items for advancing TSMO in the TxDOT Brownwood District over the next five years. Its contents are based on the existing strengths and needs that the Brownwood District and regional stakeholders identified over the course of the TSMO Plan's development. The Implementation Plan is shown in Table 6 through Table 10, and in the schedule on the following pages shown in Figure 19. Action items in Table 6 through Table 10 are organized by TSMO capability dimension, and these same action items are shown in Appendix B organized by TSMO focus area. Table 6 through Table 10 and Appendix B include the following information for each recommended action item:

- **Action Number:** An identifier for each recommended action item, organized by CMM capability dimension: Business Processes (BP), Systems & Technology (ST), Performance Measurement (PM), Culture (CU), Organization & Workforce (OW), and Collaboration (CO).
- **Action Description:** Provides a brief description of the action, which may include multiple steps.
- **Program Plan Page Number:** A reference to TSMO Program Plan page number with more detailed discussion contained in the Action Item Sheets located in the CMM section of the report.
- **Action Lead:** Identifies the individual at the TxDOT Brownwood District who will take ownership of the action and will oversee that implementation progresses as planned.
- **Supports District TSMO Goals:** Identifies which of the District's TSMO goals the action item supports: Safety, Reliability, Efficiency, Customer Service, Collaboration, or Integration.
- **Partners:** Identifies TxDOT staff and external stakeholders that will contribute to implementation of the recommended action item.
- **Cost:** Provides a semi-quantitative opinion of the level of fiscal resources that TxDOT would need to commit to implement the recommended action item.
- **Effort:** Provides a semi-quantitative opinion of the level of effort that TxDOT would need to dedicate to implement the recommended action item.
- **TSMO Focus Area:** Indicates which of the six TSMO focus areas the action item addresses: Traffic Incident Management (TIM), Work Zone Management (WZM), Road Weather Management (RWM), Planned Special Events (PSE), Traffic Signal Management (TSM), and General Traffic Management (TM).
- **Related Action Items:** Lists the Action Numbers of related action items that could be implemented either concurrently or subsequently if the District chose to focus on specific program areas or further developing relationships with specific stakeholders.

Separately, the implementation plan schedule provides a year-by-year roadmap for implementing each recommended action item. All action items are shown with recommended timeframes at a half-year level of detail for the next five years, beginning with the second half of 2022.

The TxDOT Brownwood District TSMO Program Plan is an unconstrained planning document focused on near-term implementation priorities. While all action items listed could potentially be implemented within the next five years, no funding is currently allocated for any of these action items unless otherwise specifically stated in this plan. Action items will be implemented as District resources permit.

Table 6: TxDOT Brownwood District TSMO Implementation Plan for Business Processes


Action No.	 Business Processes (BP) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Focus Area	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
BP-01	<b>Implement TIM Response Measures for Major Construction:</b> Develop process and procedures for incident management within construction work zones prior to letting of all major construction contracts.	39	District Director of Construction	✓		✓		✓	✓	BWD Construction, BWD Operations, BWD Area Engineers, Contractors, Texas DPS, Local Public Safety Agencies	\$			ST-01, ST-02, CO-01
BP-02	<b>Conduct After-Action Reviews for Major Incidents:</b> Establish criteria for determining which incidents require after-action reviews and conduct reviews as needed.	40	District Director of Operations	✓	✓	✓		✓	✓	TxDOT Traffic Safety Division, BWD Operations, BWD Area Offices, BWD Maintenance, Texas DPS, Local Public Safety Agencies	\$			PM-01, PM-02, OW-03, CO-01
BP-03	<b>Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidance:</b> Adapt TxDOT's existing SWZ guidance and deployment decision tool to determine which work zone ITS technologies to use for District construction projects.	41	District Director of Construction	✓	✓		✓		✓	TxDOT Traffic Safety Division, BWD Construction, BWD Operations	\$			ST-01, OW-03
BP-04	<b>Standardize Advanced Notification of Planned Lane Closure Events:</b> Standardize a District process for communicating construction impacts to local transportation, transit, and public safety partners, as well as the public.	42	District Public Information Officer	✓			✓	✓	✓	BWD Area Engineers, BWD Construction, BWD Public Information Office, Local Transportation Agencies, Transit Agencies, Texas DPS	\$			ST-02
BP-05	<b>Develop Method for Evaluating Corridor Signal Timings:</b> Develop a proactive method for evaluating and retiming signals along corridors to improve safety and efficiency on the system.	43	District Director of Operations	✓	✓	✓			✓	BWD Operations, BWD Signal Shop, BWD Maintenance	\$			ST-05, PM-03
BP-06	<b>Establish Notification Process to Cities for Over Height/Oversize Vehicles Permits:</b> Establish a process within TxDOT permitting to notify local agencies when over-height/oversize vehicles will be traveling through their jurisdictions so they can plan for and monitor these movements.	44	District Director of Operations	✓					✓	Texas Department of Motor Vehicles, BWD Operations, BWD Maintenance, Local Transportation Agencies	\$			
BP-07	<b>Develop TxDOT Brownwood District ITS Master Plan:</b> Develop an ITS Master Plan for the TxDOT Brownwood District to identify and prioritize ITS and communication infrastructure deployments throughout the District.	45	District Director of Transportation Planning & Development	✓	✓	✓	✓	✓	✓	BWD Operations, BWD Area Engineers	\$\$			ST-04, ST-05, ST-06, ST-07, PM-03

Table 7: TxDOT Brownwood District TSMO Implementation Plan for Systems & Technology

Action No.	 Systems & Technology (ST) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Focus Area	Related Action Items	
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration						
ST-01	<b>Deploy Work Zone Technology:</b> Deploy work zone technology throughout the District to support improved work zone monitoring, localized real-time traveler information, and end of queue warning.	47	District Director of Construction	✓		✓	✓	✓	✓	BWD Construction, BWD Operations, BWD Area Engineers, TxDOT Construction Division, Contractors	\$\$	<div style="width: 25%;"></div>		BP-01, BP-03, ST-02	
ST-02	<b>Provide Work Zone Closure Information Through Third-Party Apps:</b> Partner with third-party navigation apps to provide accurate work zone closure information for travelers through the District.	48	District Public Information Officer		✓		✓	✓	✓	BWD Public Information Office, BWD Operations, BWD Construction, Private Third-Party Providers	\$	<div style="width: 25%;"></div>		BP-01, BP-04, ST-01, ST-03	
ST-03	<b>Share Event-Related Road Impacts with Third-Party Apps:</b> Partner with third-party navigation apps to provide accurate special event-related closure and routing information for travelers through the District.	49	District Public Information Officer		✓		✓	✓	✓	BWD Operations, BWD Public Information Office, Event Organizers, Private Third-Party Providers	\$	<div style="width: 25%;"></div>		ST-02	
ST-04	<b>Prioritize and Deploy Signal Battery Backup Units:</b> Develop a deployment plan to prioritize and deploy traffic signal battery backup units throughout the District.	50	District Director of Operations	✓	✓	✓			✓	BWD Operations, BWD Maintenance	\$\$	<div style="width: 25%;"></div>		BP-07, ST-05, ST-06	
ST-05	<b>Plan and Implement Surveillance Technology for Signals:</b> Identify implementation priority for cameras and necessary software enhancement to allow remote surveillance of District traffic signals from a single software platform.	51	District Director of Operations	✓	✓	✓			✓	✓	BWD Operations, BWD Maintenance	\$\$\$	<div style="width: 25%;"></div>		BP-05, BP-07, ST-04, PM-03
ST-06	<b>Improve Communications Link to Signals in Rural Areas:</b> Upgrade communications capabilities at rural TxDOT traffic signal locations to improve ability to monitor and respond to conflicts, outages, and other signal issues.	52	District Director of Operations	✓	✓	✓			✓	BWD Operations, BWD Maintenance	\$\$	<div style="width: 25%;"></div>		BP-07, ST-04, PM-03	
ST-07	<b>Implement ITS Field Devices Identified in ITS Master Plan:</b> Deploy ITS infrastructure identified in the District ITS Master Plan to support improved traffic management and operations in the District.	53	District Director of Operations	✓	✓	✓	✓		✓	BWD Transportation Planning & Development, BWD Operations, BWD Construction, Local Transportation Agencies	\$\$	<div style="width: 25%;"></div>		BP-07, OW-02	
ST-08	<b>Improve Regional Video Sharing Capabilities:</b> Use cloud-based technology platforms for sharing access to CCTV camera video feeds.	54	District Director of Operations			✓		✓	✓	TxDOT Traffic Safety Division, BWD Operations, Local Transportation Agencies	\$\$\$	<div style="width: 25%;"></div>		PM-01, CO-01	

Table 8: TxDOT Brownwood District TSMO Implementation Plan for Performance Measurement





Action No.	 Performance Measurement (PM) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Focus Area	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
PM-01	<b>Improve TIM Data Collection:</b> Improve incident management-related data collection of roadway clearance time, incident clearance time, and secondary crash data. <i>Note: This action item would be done in coordination with TxDOT TRF and their efforts to improve TIM data within CRIS on a statewide basis.</i>	56	District Director of Operations	✓	✓	✓		✓	✓	TxDOT Traffic Safety Division, BWD Operations, Texas DPS, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		BP-02, ST-08, PM-02, OW-01, CO-01
PM-02	<b>Monitor Towing Company Performance:</b> Partner with Texas DPS and local municipalities to monitor performance of tow companies and establish baseline performance that must be met.	57	District Director of Operations	✓	✓			✓		BWD Operations, Texas DPS, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		BP-02, PM-01, OW-01, CO-01
PM-03	<b>Develop and Implement Automated Traffic Signal Performance Measures:</b> Develop a formal program and implement necessary technology and software to support Automated Traffic Signal Performance Measures operations on key District corridors.	58	District Director of Operations		✓	✓		✓		BWD Operations, BWD Maintenance	\$\$\$	<div style="width: 25%;"></div>		BP-05, BP-07, ST-05, ST-06, OW-02

Table 9: TxDOT Brownwood District TSMO Implementation Plan for Organization & Workforce





Action No.	 Organization & Workforce (OW) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Focus Area	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
OW-01	<b>Establish Regional Multidisciplinary TIM Training:</b> Partner with TxDOT Statewide Traffic Incident Management Coordinator to provide TIM multidisciplinary trainings and Train the Trainer programs to TxDOT staff and interested parties.	60	District Director of Operations	✓	✓		✓	✓	✓	TxDOT Traffic Safety Division (Statewide TIM Coordinator), BWD Operations, BWD Maintenance, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		PM-01, PM-02, CO-01, OW-03
OW-02	<b>Improve Traffic Signal Technology Training:</b> Coordinate with TxDOT Traffic Safety Division to identify technologies that can address signal challenges within the District. Provide signal technology training opportunities for District signal technicians.	61	District Director of Operations	✓	✓		✓	✓	✓	TxDOT Traffic Safety Division, BWD Area Engineers, BWD Operations, BWD Signal Shop, Local Transportation Agencies	\$	<div style="width: 25%;"></div>		ST-07, PM-03
OW-03	<b>Provide Traffic Control Training:</b> Develop and deliver traffic control training for local agencies to support adherence to TxDOT traffic control plan standards.	62	District Director of Operations	✓	✓		✓	✓	✓	TxDOT Traffic Safety Division, BWD Area Engineers, BWD Operations, BWD Signal Shop, Local Transportation Agencies	\$	<div style="width: 25%;"></div>		BP-03, OW-01



Table 10: TxDOT Brownwood District TSMO Implementation Plan for Collaboration

Action No.	 Collaboration (CO) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Focus Area	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
CO-01	<b>Establish a Formal Regional TIM Team:</b> Establish a formalized TIM Team that meets regularly and includes all relevant jurisdictions and roles.	64	District Director of Operations	✓	✓	✓	✓	✓	✓	TxDOT Traffic Safety Division (Statewide TIM Coordinator), BWD Operations, BWD Area Engineers, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies	\$			BP-01, BP-02, ST-08, PM-01, PM-02, OW-01

Figure 19: TxDOT Brownwood District TSMO Implementation Schedule


Task Name	2022	2023		2024		2025		2026		2027
	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1
<b>BUSINESS PROCESSES</b>										
BP-01: Implement TIM Response Measures for Major Construction										
BP-02: Conduct After-Action Reviews for Major Incidents										Ongoing
BP-03: Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidance										
BP-04: Standardize Advanced Notification of Planned Lane Closures Events										
BP-05: Develop Method for Evaluating Corridor Signal Timings										
BP-06: Establish Notification Process to Cities for Over Height/Oversize Vehicles Permits										
BP-07: Develop TxDOT Brownwood District ITS Master Plan										
<b>SYSTEMS &amp; TECHNOLOGY</b>										
ST-01: Deploy Work Zone Technology										Ongoing
ST-02: Provide Work Zone Closure Information Through Third-Party Apps										Ongoing
ST-03: Share Event-Related Road Impacts with Third-Party Apps										Ongoing
ST-04: Prioritize and Deploy Signal Battery Backup Units										
ST-05: Plan and Implement Surveillance Technology for Signals										
ST-06: Improve Communications Link to Signals in Rural Areas										
ST-07: Implement ITS Field Devices Identified in ITS Master Plan										Ongoing
ST-08: Improve Regional Video Sharing Capabilities										
<b>PERFORMANCE MEASUREMENT</b>										
PM-01: Improve TIM Data Collection										
PM-02: Monitor Towing Company Performance										Ongoing
PM-03: Develop and Implement Automated Traffic Signal Performance Measures										
<b>ORGANIZATION &amp; WORKFORCE</b>										
OW-01: Establish Regional Multidisciplinary TIM Training										Ongoing
OW-02: Improve Traffic Signal Technology Training										Ongoing
OW-03: Provide Traffic Control Training										Ongoing
<b>COLLABORATION</b>										
CO-01: Establish a Formal Regional TIM Team										



### Business Processes

Within the CMM, business processes refer to an agency’s internal activities and tasks that allow it to meet its TSMO goals. Considerations include how an agency plans, programs, and budgets for TSMO projects. Business processes may also refer to how an agency follows its internal protocol to implement specific TSMO projects. Table 11 shows the recommended Business Processes action items for the TxDOT Brownwood District.

Table 11: TxDOT Brownwood District TSMO Recommended Action Items - Business Processes

CMM Capability Dimension	Action Item Number	Action Item Description
Business Processes 	BP-01	Implement TIM Response Measures for Major Construction
	BP-02	Conduct After-Action Reviews for Major Incidents
	BP-03	Use TxDOT’s Smart Work Zone Decision Tool and Deployment Guidance
	BP-04	Standardize Advanced Notification of Planned Lane Closure Events
	BP-05	Develop Method for Evaluating Corridor Signal Timings
	BP-06	Establish Notification Process to Cities for Over Height/Oversize Vehicles Permits
	BP-07	Develop TxDOT Brownwood District ITS Master Plan



## BP-01: Implement TIM Response Measures for Major Construction

### Focus Area:

Traffic Incident Management



### Action Item Lead:

District Director of Construction

### Partners:

BWD Construction, BWD Operations, BWD Area Engineers, First Responders, Contractors, Local Public Safety Agencies

### Goals Addressed:

Safety	✓
Reliability	
Efficiency	✓
Customer Service	
Collaboration	✓
Integration	✓

**Objective:** Develop a process and procedures for incident management within construction work zones prior to letting of all major construction contracts.

**Need:** The TxDOT Brownwood District typically does not consider TIM during planning efforts for work zones. First responders are often unaware of project schedule changes and work zone updates, making it more difficult for them to access an incident and therefore increasing response times. First responders should be included in construction planning and in coordination meetings throughout the construction process to ensure they have accessibility to incidents within the construction area and receive updated work zone information.

**Implementation Step #1:** Develop criteria for determining when TIM response measures should be implemented within work zones as part of work zone design and operations. Factors to consider might include distance between entry points on a freeway, shoulder width, or ease of access from frontage roads.

**Implementation Step #2:** Develop a list of standard strategies to support TIM in work zones, such as use of movable barriers, emergency pull-off areas, or staged towing services. Identify when each of these strategies might be warranted based upon the work zone design factors listed above and anticipated traffic volumes.

**Implementation Step #3:** Incorporate the decision process into the District's existing project specification development and letting processes.

**Expected Benefits:** Maintaining first responder accessibility to roadways during major construction allows incident clearance to happen as fast as possible by reducing public safety agency response times. TIM protocols for work zones might also involve resource sharing discussions, such as providing first responders access to TxDOT camera feeds or identifying locally relevant resources or other assistance that TxDOT maintenance sections or contractors could provide to assist with traffic control in an incident influence area.

### Strategy and Best Practice

The Colorado Department of Transportation (CDOT) published Guidelines for Developing Traffic Incident Management Plans (TIMP) for Work Zones. This document outlines existing CDOT TIMPs and best practices from other states. The considerations for developing TIMPs for work zones and key components include each response agency's roles and responsibilities. Program implementation and management strategies are also provided.





## BP-02: Conduct After-Action Reviews for Major Incidents

### Focus Area:

Traffic Incident Management



### Action Item Lead:

District Director of Operations

### Partners:

TxDOT Traffic Safety Division, BWD Operations, BWD Area Offices, BWD Maintenance, Texas DPS, Local Public Safety Agencies

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	✓
Integration	✓

**Objective:** Establish criteria for determining which incidents require after-action reviews and conduct reviews as needed.

**Need:** The TxDOT Brownwood District currently does not perform after-action reviews (AARs) on a regular basis or for major incidents in general. District staff meet with the City of Lampasas once a year to discuss major TIM related issues. The District does not meet with other cities or counties nor does it have a standard protocol for conducting AARs following major traffic incidents. The TxDOT Brownwood District agreed that the creation of a formalized TIM Team would be beneficial and members of the team could conduct AARs when needed.

**Implementation Step #1:** Establish formal thresholds that determine when an AAR for a traffic incident is warranted. For example, if a crash takes a certain amount of time or longer to be cleared or if a crash involves more than a specified number of vehicles, then a review could be required.

**Implementation Step #2:** Develop a review meeting format based upon existing statewide guidance. TxDOT has an After-Action Report form for TIM, included in Appendix C, to outline details such as what agencies were involved, what resources were needed, what went well, training needs, and lessons learned.

**Implementation Step #3:** Conduct AARs with all agencies that were involved in the response. The Statewide After-Action Report form includes a checklist to ensure that every piece of information about the incident is recorded and analyzed.

**Expected Benefits:** Identifying what worked well and what needs to be improved during incident response and clearance is essential in minimizing TIM delays, which in turn can reduce other incident issues, such as the occurrence of secondary crashes. Without AARs, responders do not have an ability to collaboratively revisit past incidents that provided challenges in scene management.

### Strategy and Best Practice

Virginia's Department of Transportation's (VDOT) Operations Division produced an instructional and informational memorandum (IIM) to establish a standard operating procedure for AARs. The document outlines criteria for when an AAR should be conducted and the process in which it should be done. This IIM includes a facilitator's guide, AAR report contents, and various input forms for those involved in the incident and review process.



## BP-03: Use TxDOT’s Smart Work Zone Decision Tool and Deployment Guidance

### Focus Area:

Work Zone Management



### Action Item Lead:

District Director of Construction

### Partners:

TxDOT Traffic Safety Division, BWD  
Construction, BWD  
Operations

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	
Integration	✓

**Objective:** Adapt TxDOT’s existing SWZ guidance and deployment decision tool to determine which work zone ITS technologies to use for District construction projects.

**Need:** Work zone ITS is not consistently being used throughout the TxDOT Brownwood District. A decision tool is needed to aid in the standardization of SWZ systems deployment. TxDOT TRF developed SWZ Guidelines and a SWZ System Go/No-Go Decision Tool to aid work zone ITS device selection for construction projects statewide. The TxDOT Brownwood District is not yet utilizing these resources and there is limited knowledge within the District of what technologies are most essential for work zone safety and of how to budget for the inclusion of this technology and procure it for road construction projects.

**Implementation Guidance:** Review available work zone ITS technologies specified in the TxDOT’s SWZ Guidelines. Utilize the existing SWZ System Go/No-Go Decision Tool to select appropriate SWZ ITS devices for upcoming projects. Incorporate work zone ITS into construction contracts when the Statewide Decision Tree for SWZ Systems warrants them. Add SWZ System criteria and strategies to the project spec development and letting process. The District should explore what additional standard operating procedures (SOPs) and staff roles might be necessary to monitor SWZ devices once they are deployed at construction sites to ensure the devices are deployed properly, that they maintain function throughout the construction project, and that they collect data that allows for evaluation of the work zone’s performance measures.

**Expected Benefits:** A decision tool for when to deploy certain work zone ITS technologies can improve the safety of a work zone for motorists and construction workers while controlling construction costs. Providing drivers with more warning about an upcoming work zone allows them to make more informed decisions and prepare for potential hazards on the road ahead. Standardizing the use of work zone ITS devices can also better establish driver expectations for work zones, further increasing safety.

**Resources:** SWZ Guidelines and the System Go/No-Go Decision Tool are both available for download at:

<https://www.txdot.gov/inside-txdot/division/traffic/smart-work-zones.html>



## BP-04: Standardize Advanced Notification of Planned Lane Closure Events

### Focus Area:

Work Zone Management



### Action Item Lead:

District Public Information Officer

### Partners:

BWD Area Engineers, BWD Construction, BWD Public Information Office, Local Transportation Agencies, Transit Agencies, Texas DPS

### Goals Addressed:

Safety	✓
Reliability	
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Standardize a District process for communicating construction impacts to local transportation, transit, and public safety partners, as well as the public.

**Need:** Currently, the TxDOT Brownwood District coordinates construction projects internally and involves all external stakeholders in the planning phase of major projects. While pre-construction meetings are extended to local municipalities when large projects are planned, external stakeholders are not regularly included in discussions about more granular project details, such as routine maintenance or striping work. Project updates and construction schedule changes are also not always shared with local partner agencies or the public. The City of Lampasas has recently received numerous calls from its residents inquiring about construction along US 281, which the City is unable to provide answers about without contacting TxDOT for more information.

**Implementation Step #1:** Identify key contacts for TxDOT Brownwood District staff, counterparts from local transportation agencies, transit, and other local partner agency staff that should receive construction information updates.

**Implementation Step #2:** Establish protocol for when and how to notify the appropriate contacts of updates related to construction activities, schedules, and anticipated impacts. Notification of these partners should occur via regular Public Information Office (PIO) updates as well as direct outreach from local area engineers.

**Implementation Step #3:** Coordinate with local partners and third-party apps (see Action Item ST-03) to disseminate updated work zone information to the public.

**Expected Benefits:** Improving construction information dissemination can help the District maintain good working relations with its local partners and the public. A formal process for sharing work zone information between agencies would create a more cohesive and coordinated traveler information system throughout the region. Sharing information regarding upcoming projects could also help avoid concurrent closures and support work zone ITS use.

### Strategy and Best Practice

The Greater Houston region uses TranStar, a multimodal transportation and emergency management center to operate and maintain roads in the region. Engineers and planners from different agencies can share project information with *Roadworks*, TranStar’s web-based construction management system.



## BP-05: Develop Method for Evaluating Corridor Signal Timings

### Focus Area:

Traffic Signal Management



### Action Item Lead:

District Signal Shop Manager

### Partners:

BWD Operations,  
BWD Signal Shop,  
BWD Maintenance

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	
Integration	✓

**Objective:** Develop a proactive method for evaluating and retiming signals along corridors to improve safety and efficiency on the system.

**Need:** The TxDOT Brownwood District currently retimes signals on an as needed or requested basis. There is no current traffic signal data collection, signal performance measures, or signal program in place to evaluate and, if needed, update signal timings in an organized or scheduled manner. Stakeholders and District staff noted that there are seasonal side street detection issues. Inclement weather conditions or sunlight limit visibility or create glare that prevents the detection systems from functioning properly, causing delays and timing issues on the minor streets. Uncoordinated signals can lead to driver frustration and unsafe driver behavior along signalized corridors, such as US 84 through Brownwood or US 183 through Lampasas. Sudden braking when a platoon approaches an intersection as the light turns yellow is another crash risk. Traffic patterns may also change with time, which would require signal timings to be revisited to increase throughput.

**Implementation Step #1:** Consistently inventory all signals and their signal timings and identify corridors with coordination issues. This should generally be done at least every five years.

**Implementation Step #2:** Prioritize signals to retime by analyzing traffic signal performance measure data, if available, or conduct a field review to observe signal performance. Look at intersection and corridor safety issues, such as crash data.

**Implementation Step #3:** As the implementation of signal performance measurement technology expands throughout the District (see Action Item PM-03), develop performance measures to track and set goals, and to inform when changes to signal operations may be needed.

**Expected Benefits:** Better corridor signal coordination can eliminate unnecessary starting and stopping and can decrease travel times. Minimizing these common issues can improve traffic flow and lead to reductions in congestion, rear-end collisions, waiting time, and fuel consumption. Signal coordination improves the safety of a corridor by reducing driver frustration and therefore unsafe driver behavior such as red light running, aggressive left turning, right turn on red issues, and hard braking.





## BP-06: Establish Notification Process to Cities for Over Height/Oversize Vehicles Permits

### Focus Area:

General Traffic Management



### Action Item Lead:

District Director of Operations

### Partners:

Texas Department of Motor Vehicles, BWD Operations, BWD Maintenance, Local Transportation Agencies

### Goals Addressed:

Safety	✓
Reliability	
Efficiency	
Customer Service	
Collaboration	✓
Integration	

**Objective:** Establish a process within TxDOT permitting to notify local agencies when over-height/oversize vehicles will be traveling through their jurisdictions so they can plan for and monitor these movements.

**Need:** Within the TxDOT Brownwood District, collaboration and communication among agencies are currently seen as strengths, as most chains of communication are founded on strong personal relationships and connections. However, District and local partner agency staff discussed issues regarding freight management and the advanced notification of oversize and over-height vehicles traveling through the region. Oversize and over-height vehicles are an issue when they are routed around a work zone or incident, or simply get lost, and drive through towns that may not have adequate facilities to support these vehicles. These large, heavy vehicles create a safety concern for other travelers because roadways, traffic signals, and signage can be damaged when oversize and over-height vehicles cannot complete turns or fit under infrastructure.

**Implementation Guidance:** The TxDOT Brownwood District should establish a communication link with the Texas Department of Motor Vehicles, Motor Carrier Division to request that oversize vehicle permit and routing information be shared with the action item lead as permits are approved. TxDOT should regularly review approved routes and share permit details with local agencies whose jurisdictions would include some part of the oversize vehicle route in question.

**Expected Benefits:** If the District and its cities are alerted when over-height and oversized vehicles are traveling through their jurisdiction, they can plan for traffic impacts and better mitigate infrastructure risks along the vehicle's planned route. The cities would also know in advance when and why the connection to a traffic signal may be lost if the permit involves temporary removal of overhead equipment such as signal mast arms. Cities may also be able to provide valuable information to TxDOT if a planned oversize vehicle route conflicts with construction activities or another planned event with potential traffic impacts.



## BP-07: Develop TxDOT Brownwood District ITS Master Plan

### Focus Area:

General Traffic Management



### Action Item Lead:

District Director of Transportation Planning & Development

### Partners:

BWD Operations, BWD Area Engineers

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Develop an ITS Master Plan for the TxDOT Brownwood District to identify and prioritize ITS and communication infrastructure deployments throughout the District.

**Need:** The TxDOT Brownwood District only has CCTV cameras on I-20, east of the City of Eastland, and one DMS unit. District staff recently completed a gap study with TxDOT TRF to identify gaps in CCTV camera and DMS coverage along I-20 and develop a deployment plan to meet the spacing requirements TxDOT TRF has recently established. The TxDOT Brownwood District self-identified the need to improve knowledge of available new and emerging traffic signal technologies that can address the District’s current operational challenges, as well as increase communications capabilities and deployment of battery back-up units. A formal ITS Master Plan could identify and prioritize ITS device needs throughout the region.

**Implementation Guide:** Develop an ITS Master Plan for the TxDOT Brownwood District. The plan should include a review of the regional ITS architecture to demonstrate conformance, a data review to identify crash hotspots and critical infrastructure locations, a prioritized list of ITS device locations for the District’s road network, cost estimates for device installation, asset management and design life considerations, and consideration for how recommended devices will be integrated into the existing system.

**Expected Benefits:** A District ITS Master Plan establishes a justification for additional ITS device deployments and provides cost and prioritization information to District decision makers so that the District can incorporate ITS device recommendations into its project development and budgeting processes. The document also includes information that can support project applications that require federal funding. ITS Master Plans represent an initial step in the systems engineering process and can guide subsequent stages of ITS project design, including device design and testing as well as Traffic Management Systems (TMS) verification.

### Strategy and Best Practice

MetroPlan Orlando created an ITS Master Plan to evaluate the Central Florida Region’s information, communication, and technology systems. MetroPlan Orlando and the Florida Department of Transportation (FDOT) reviewed the existing ITS architecture in three counties to determine its future needs. New ITS projects are now scored based on the goals and objectives of the ITS Master Plan as well as local needs to prioritize implementation.






### Systems & Technology

Systems and technology refer to an agency’s systems engineering, regional architectures, and procurement processes that allow the agency to increase the value and functionality of a high-technology project, service, or system. Considerations include how an agency integrates ITS components regionally so that TSMO projects and services are deployed in an organized manner. Table 12 shows the recommended Systems and Technology action items for the TxDOT Brownwood District.

Table 12: TxDOT Brownwood District TSMO Recommended Action Items – Systems & Technology

CMM Capability Dimension	Action Item Number	Action Item Description
Systems & Technology 	ST-01	<b>Deploy Work Zone Technology</b>
	ST-02	<b>Provide Work Zone Closure Information Through Third-Party Apps</b>
	ST-03	<b>Share Event-Related Road Impacts with Third-Party Apps</b>
	ST-04	<b>Prioritize and Deploy Signal Battery Backup Units</b>
	ST-05	<b>Plan and Implement Surveillance Technology for Signals</b>
	ST-06	<b>Improve Communications Link to Signals in Rural Areas</b>
	ST-07	<b>Implement ITS Field Devices Identified in ITS Master Plan</b>
	ST-08	<b>Improve Regional Video Sharing Capabilities</b>



## ST-01: Deploy Work Zone Technology

### Focus Area:

Work Zone Management



### Action Item Lead:

District Director of Construction

### Partners:

BWD Construction, BWD Operations, BWD Area Engineers, TxDOT Construction Division, Contractors

### Goals Addressed:

Safety	✓
Reliability	
Efficiency	✓
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Deploy work zone technology throughout the District to support improved work zone monitoring, localized real-time traveler information, and end of queue warning.

**Need:** The TxDOT Brownwood District currently does not deploy work zone technologies for major construction projects, nor does it utilize the TxDOT SWZ Guidelines or SWZ System Go/No-Go Decision Tool to identify applicable work zone ITS. The District has minimal equipment available to assist with WZM and staffing limitations inhibit the ability to monitor equipment if deployed. As plans for major construction along US 190 and US 183 develop, it is important to implement work zone ITS technology to assist with work zone safety and operations.

**Implementation Step #1:** Identify planned construction projects scheduled in the next five years. Review work zone ITS technologies, such as those included in the TxDOT SWZ Guidelines and utilize the existing SWZ System Go/No-Go Decision Tool (see Action Item BP-03) to select the appropriate work zone ITS devices for upcoming projects. Determine how much additional funding would need to be budgeted as part of projects to include these devices.

**Implementation Step #2:** Incorporate work zone ITS into construction contracts when the Statewide Decision Tree for SWZ Systems warrants them. Incorporate WZM specifications into the project specification development and letting process.

**Implementation Step #3:** Track instances of work zone ITS deployments on construction projects to monitor frequency of usage and related traffic operations impacts. Continuously identify existing WZM strengths and weaknesses, investigate new technologies, and maintain guidelines that specify use of best practice technologies and strategies.

**Expected Benefits:** Consistent deployment of certain work zone ITS technologies can increase the traffic flow and safety within a work zone for motorists and construction workers by improving driver expectation and providing advance warning of the work zone area or potential vehicle queues. Work zone ITS can be implemented to manage the traffic impacts work zones have on the roadway. Queue detection and Bluetooth detection technologies, for example, can provide real-time work zone traveler information to help drivers make routing decisions. This data can also be used to adjust lane closures or provide information for planning how similar work zones should be managed in the future.



## ST-02: Provide Work Zone Closure Information Through Third-Party Apps

### Focus Area:

Work Zone Management



### Action Item Lead:

District Public Information Officer

### Partners:

BWD Public Information Office, BWD Operations, BWD Construction, Private Third-Party Providers

### Goals Addressed:

Safety	
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Partner with third-party navigation apps to provide accurate work zone closure information for travelers through the District.

**Need:** The City of Lampasas has recently received numerous calls from its residents inquiring about construction along US 281, which the City is unable to provide answers about without contacting TxDOT for more information. The TxDOT Brownwood District generally communicates well with the public by disseminating information regarding closures through the Public Information Office (PIO), which shares work zone information with the newspaper and media. However, last minute construction schedule changes and minor maintenance project details are often not readily available for the traveling public. Stakeholders noted that not all travelers utilize the existing information platforms and therefore there is opportunity for coordination with third-party applications to distribute updated traveler information related to work zones directly to travelers in the area.

**Implementation Step #1:** Establish “trusted provider” status with third-party navigation applications (such as Waze, through their Waze for Cities Program).

**Implementation Step #2:** Update staff roles to designate responsibility for sharing details about construction events that impact travel lanes with partner third-party apps.

**Expected Benefits:** Establishing these partnerships with third-party navigation app vendors will increase the reach of traveler-focused work zone closure messaging beyond the existing methods available internally to TxDOT districts. With a larger number of travelers either aware of or actively routed around areas impacted by work zones, fewer vehicles pass through those work zones. As a result, congestion and traffic incident risks related to end-of-queue crashes are both reduced.

### Strategy and Best Practice

The Port Authority of New York and New Jersey uses crowdsourced incident and congestion data via the Waze Connected Citizens Program (now known as Waze for Cities) to push out information such as road closures, detour routes, and preferred routes to influence traffic behavior. Crowdsourced data can help manage traffic through construction sites in real time by providing awareness of new incidents and congested spots. This allows for quicker dispatch of field units to incident scenes and for better congestion mitigation.





## ST-03: Share Event-Related Road Impacts with Third-Party Apps

### Focus Area:

Planned Special Events



### Action Item Lead:

District Public Information Officer

### Partners:

BWD Operations, BWD Public Information Offices, Event Organizers, Private Third-Party Providers

### Goals Addressed:

Safety	
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Partner with third-party navigation apps to provide accurate special event-related closure and routing information for travelers through the District.

**Need:** The TxDOT Brownwood District does not have regularly occurring large special events and the events that do occur generally have short durations. Although there are no designated TxDOT Brownwood District staff with formal PSE job functions for events within the District and the city staff or event planner is generally responsible for managing the detour route, the District self-identified the future need to improve traveler information about PSE delays and related detour routing.

Each year more travelers rely on third-party navigation apps to route them while travelling. Third-party navigation apps such as Waze maintain “trusted provider” programs available to public transportation agencies that permit those agencies to share events with traffic impacts, which apps then integrate into their platforms so that users are informed of those events or are routed around them.

**Implementation Guide:** If event organizers plan events in the future that impact traffic operations, the TxDOT Brownwood District operations staff should identify which event generators in the District are not sharing road closure impacts with third-party apps and should encourage those event generators to establish information-sharing relationships. Staff should prioritize which event organizers to engage with first, considering factors such as event frequency and measured congestion or safety impacts from past events. The District may also consider incorporating a third-party data reporting requirement for event organizers as part of its special events traffic control plan approval processes.

**Expected Benefits:** Establishing more partnerships between event organizers and third-party navigation app vendors will increase the frequency with which traveler-focused special event closure messaging appears on third-party navigation apps. With a larger number of travelers either aware of or actively routed around areas impacted by special events, more of the existing roadway capacity in the event impact area is available for event-related ingress and egress.



## ST-04: Prioritize and Deploy Signal Battery Backup Units

### Focus Area:

Traffic Signal Management



### Action Item Lead:

District Traffic Engineer

### Partners:

BWD Operations, BWD Maintenance

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	
Integration	✓

**Objective:** Develop a deployment plan to prioritize and deploy traffic signal battery back-up units throughout the District.

**Need:** The TxDOT Brownwood District traffic signals in rural areas often malfunction or experience outages, typically caused by inclement weather. In the past, traffic signal power outages have also occurred as the result of a heavy vehicle crashing into a power pole. A truck recently struck a power pole and caused a signal that relied on the impacted power source to be out of operation for four hours. District staff identified the improvement of communications capabilities and increased deployment of signal battery back-up systems as a high priority.

**Implementation Step #1:** Complete an inventory of existing traffic signal battery backup systems and conduct testing to verify the working condition of each battery bank. Identify signals and areas within the District that do not currently have a battery backup system installed.

**Implementation Step #2:** Prioritize signals for new battery backup system deployment, taking intersection volumes, corridor, and location into consideration. Track the status of all deployed systems Districtwide in a single database.

**Implementation Step #3:** Develop an implementation and maintenance plan that includes routine device testing and an asset management schedule based on battery backup system lifespans, possibly as part of a District ITS Master Plan (see Action Item BP-07). Incorporate costs of new system deployment and end-of-life system replacement into the District’s budgeting process.

**Implementation Step #4:** Educate the public on how to navigate a signal whose power source has been interrupted, whether the signal is completely dark or flashing red.

**Expected Benefits:** Traffic signal battery backup systems prevent traffic signals from going dark during short- and medium-term power outages. This reduces the pressure for the District’s single signal technician to respond immediately to signals that are out and gives the technician time to prioritize signal issues throughout the region. Establishing a deployment and asset management plan that includes routine testing will decrease the chances that a signal will completely lose power, which in turn will reduce the likelihood of drivers passing through the signalized intersection without stopping.



## ST-05: Plan and Implement Surveillance Technology for Signals

### Focus Area:

Traffic Signal Management



### Action Item Lead:

District Traffic Engineer

### Partners:

BWD Operations,  
BWD Maintenance

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	✓
Integration	✓

**Objective:** Identify implementation priority for cameras and necessary software enhancement to allow remote surveillance of District traffic signals from a single software platform.

**Need:** The TxDOT Brownwood District does not currently have the ability to remotely view traffic signal operations and therefore cannot verify or troubleshoot reported issues without travelling to the signal. This often results in more downtime since the technicians are not able to monitor signals in real-time and may have to drive over an hour to evaluate a rural signal in person. Therefore, the District has self-identified the need for the deployment of new signal technologies to support remote signal operations and troubleshooting, although funding is a constraint.

**Implementation Step #1:** Upgrade signals along priority routes to adjust timings remotely and improve communications links to signals in rural areas for simple troubleshooting purposes (see Action Item ST-06).

**Implementation Step #2:** Identify signalized intersections with operational challenges and ones at crash hotspots to determine priority signal locations for initial camera deployments, possibly as part of a District ITS Master Plan (see Action Item BP-07). Install cameras at these locations as funding allows.

**Implementation Step #3:** Determine the type of camera to use and adopt a user-friendly software to allow for surveillance of signal cameras from a single interface.

**Expected Benefits:** Improving camera coverage at signalized intersections throughout the region enhances the District’s ability to monitor traffic actively and passively along key corridors and more easily detect issues, particularly those related to signal performance. This allows the District’s only signal technician to efficiently troubleshoot and prioritize signal issues throughout the region. The benefits of increasing video surveillance at signal locations can be enhanced further by improving operations staff accessibility to camera feeds. Adopting a single platform that provides access to all cameras within the District makes it easier to pull up real-time feeds and detect issues anywhere cameras are deployed. With a user-friendly interface and camera selection based on location, staff can quickly and easily track congestion and incidents along corridors.





## ST-06: Improve Communications Link to Signals in Rural Areas

### Focus Area:

Traffic Signal Management



### Action Item Lead:

District  
Transportation  
Engineering  
Supervisor

### Partners:

BWD Operations,  
BWD Maintenance

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	
Integration	✓

**Objective:** Upgrade communications capabilities at rural TxDOT traffic signal locations to improve ability to monitor and respond to conflicts, outages, and other signal issues.

**Need:** The TxDOT Brownwood District does not currently have the capability to remotely manage signal operations, making it difficult for District staff to quickly detect, verify, and address traffic signal issues. When signal issues are reported, the District’s only signal technician must evaluate the traffic signal in person, resulting in long response times as the technician may have to drive over an hour to the signal. This increases the downtime of malfunctioning signals, which increases the delays and congestion at the intersection and along adjacent corridors, as well as hinders the signal technician’s ability to tend to other traffic signal issues. The District has self-identified the need for the deployment of modern signal controller and communications technology to support signal operations.

**Implementation Step #1:** Inventory all signals in the TxDOT Brownwood District to identify which ones need a signal cell modem. Plan and Implement surveillance technologies for signals and CCTV cameras (see Action Items ST-05 and ST-07).

**Implementation Step #2:** Prioritize signals based on existing conditions, such as intersection location, traffic volume, history of inclement weather impacts, and malfunction frequency.

**Implementation Step #3:** Verify that communications are operable to signals Districtwide once deployment is complete and address communications malfunctions as needed. Educate the public on how to navigate a signal whose power source has been interrupted, whether the signal is completely dark or flashing red.

**Expected Benefits:** Completing systemwide traffic signal modem deployment is essential for managing the entire District’s signal system. Remote control of traffic signals could improve troubleshooting response times and reduce the time wasted when signal technicians must travel to a rural signal for a simple issue. Once communication and monitoring capabilities are established at all signals, a signal status dashboard with automated notifications of malfunctions can be established to provide quick detection of and response to signals that lose power or malfunction.



## ST-07: Implement ITS Field Devices Identified in ITS Master Plan

### Focus Area:

General Traffic Management



### Action Item Lead:

District Traffic Engineer

### Partners:

BWD Transportation Planning & Development, BWD Operations, BWD Construction, Local Transportation Agencies

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	✓
Collaboration	
Integration	✓

**Objective:** Deploy ITS infrastructure identified in the District ITS Master Plan to support improved traffic management and operations in the District.

**Need:** The TxDOT Brownwood District currently only has cameras deployed along I-20, east of the City of Eastland, and one permanent DMS unit. The District has identified the need to expand deployment of CCTV cameras, DMS, and communication connections to allow for improved visual coverage and real-time traveler information dissemination throughout the District on routes other than I-20. The District wants to implement additional DMS to improve traveler information for drivers traveling towards Killeen, Temple, and other larger cities beyond the District boundary; provide work zone updates; and encourage diversion of traffic to other routes as needed. The eastern end of Lampasas, along US 190, near Copperas Cove was identified as the TxDOT Brownwood District’s fastest growing area which would likely benefit from ITS devices. District staff also expressed interest in investigating new and emerging traffic signal technologies that can address the District’s current operational challenges, as well as implementing communications links, signal surveillance, and battery backup units.

**Implementation Guide:** TxDOT Brownwood District staff should seek to incorporate ITS device deployment recommendations from the future TxDOT Brownwood District ITS Master Plan (see Action Item BP-07). Beyond that, staff should review upcoming major construction projects for which design is underway to identify opportunities for deploying additional ITS devices as part of project construction efforts, particularly traffic signal technologies. For projects in the planning phase, TxDOT Brownwood District staff should review design summary reports prepared for those improvements to identify whether ITS device use has already been identified or could be added either during construction or as part of the built project design.

**Expected Benefits:** Expanding the District’s ITS device deployments will allow for District staff to disseminate traveler information that will reach a greater number of travelers at a greater number of locations, in the case of DMS. Furthermore, by increasing CCTV camera coverage along key routes, District staff will have an improved ability to detect issues on the road that could impact traffic operations. ITS device deployments could also improve the District’s ability to monitor signal operations and to collect general traffic operations performance data.



## ST-08: Improve Regional Video Sharing Capabilities

### Focus Area:

General Traffic Management



### Action Item Lead:

District Director of Operations

### Partners:

TxDOT Traffic Safety Division, BWD Operations, Local Transportation Agencies

### Goals Addressed:

Safety	
Reliability	
Efficiency	✓
Customer Service	
Collaboration	✓
Integration	✓

**Objective:** Use cloud-based technology platforms for sharing access to CCTV camera video feeds.

**Need:** The cities within the TxDOT Brownwood District do not currently have cameras. The District itself has identified the need to expand deployment of CCTV cameras and communication connections. As these technologies are deployed, video sharing agreements among TxDOT and local agencies may be considered. This could be beneficial for responding to traffic incidents, monitoring work zones, and other traffic management activities that benefit from coordination among multiple agencies. There is currently good coordination among agencies, as most chains of communication are founded on strong personal relationships and connections, but existing coordination could be bolstered with increased sharing of visual traffic feeds.

**Implementation Guidance:** TxDOT Brownwood District staff should coordinate with TxDOT TRF to improve CCTV camera video sharing capabilities and develop a user-friendly software or platform to permit access to camera feeds by external traffic operations partners. Consider investing in cloud-based communications interoperability software to make partner agency camera feeds and radio communications available in real time to staff and at regional emergency operations centers (EOCs) while they are activated. The solution chosen to support this interoperability should offer security features such as end-to-end data encryption to meet privacy requirements of partners in public safety that may be sharing information through these efforts.


**Expected Benefits:** Allowing camera feeds to be shared regionally among partners allows for any partners responding to an event impacting traffic operations to view real-time conditions, which assists with decision making. For example, maintaining a platform to share real-time camera feeds throughout the region can allow emergency dispatchers to verify a traffic incident and to relay incident-specific information to responders when requesting specific equipment for response, such as a heavy wrecker tow truck for clearing a commercial vehicle traffic incident.



### Performance Measurement

TSMO programs are tracked by agencies through performance measures to track progress and assess benefits of implemented projects and processes. Well-defined performance measures help an agency make informed decisions and prioritize projects effectively. Performance measures drive the success of TSMO programs by allowing agencies to realize and quantify improvements in the short-term through the effective use of TSMO strategies. Table 13 shows the recommended Performance Measurement action items for the TxDOT Brownwood District.

Table 13: TxDOT Brownwood District TSMO Recommended Action Items – Performance Measurement

CMM Capability Dimension	Action Item Number	Action Item Description
Performance Measurement 	PM-01	<b>Improve TIM Data Collection</b>
	PM-02	<b>Monitor Towing Company Performance</b>
	PM-03	<b>Develop and Implement Automated Traffic Signal Performance Measures</b>



## PM-01: Improve TIM Data Collection

### Focus Area:

Traffic Incident Management



### Action Item Lead:

District Director of Operations

### Partners:

TxDOT Traffic Safety Division, BWD Operations, Texas DPS, Local Public Safety Agencies

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	✓
Integration	✓

**Objective:** Improve incident management-related data collection of roadway clearance time, incident clearance time, and secondary crash data. *Note: This action item would be done in coordination with TxDOT TRF and their efforts to improve TIM data within CRIS on a statewide basis.*

**Need:** The TxDOT Brownwood District currently does not collect any TIM-related performance measures, such as RCT, ICT, and secondary crash data. Other TxDOT districts often use a TMC to watch camera feeds to detect, verify, and monitor traffic incidents, but the TxDOT Brownwood District does not have a TMC and its existing infrastructure has limited camera coverage. However, the TxDOT Brownwood District recently worked with TxDOT TRF to identify gaps in camera coverage to improve its capability to detect traffic incidents, monitor traffic conditions, and track TIM performance measures. The District could also work with TxDOT TRF on TIM-related data collection because TxDOT TRF is currently working on improving TIM data collection within TxDOT's Crash Records Information System (CRIS) on a statewide basis.

**Implementation Step #1:** Encourage traffic operators and law enforcement partners to prioritize TIM data collection. Identify additional data sources to use as proxies for when cameras cannot be used to track incident details firsthand. CRIS could be considered for tracking RCT, ICT, and Secondary Crashes (once this data begins to be reported by law enforcement agencies statewide), while INRIX could be considered for measuring Time to Return to Normal Flow.

**Implementation Step #2:** Establish a process for regularly collecting TIM data from CRIS, which will soon include RCT, ICT, and Secondary Crashes for all responders.

**Implementation Step #3:** Add TIM data to the Statewide TxDOT Safety and Operations Dashboard and regularly assess TIM performance to set program performance targets.

**Expected Benefits:** TIM data is important for AARs to identify what worked well and what can be improved. This data can also be used to monitor responder performance and to convey TIM performance expectations. Aggregate data can also be used to identify problem spots where incident response and clearance times are generally longer.



## PM-02: Monitor Towing Company Performance

### Focus Area:

Traffic Incident Management



### Action Item Lead:

District Director of Operations

### Partners:

BWD Operations, Texas DPS, Local Public Safety Agencies

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	
Customer Service	
Collaboration	✓
Integration	

**Objective:** Partner with Texas DPS and local municipalities to monitor performance of tow companies and establish baseline performance that must be met.

**Need:** Within the TxDOT Brownwood District, a rotation list for wrecker services is used along I-20. However, the tow companies tend to know when they are next on the list and do not respond or clear an incident as fast and are not penalized for substandard performance. Long cleanups result in longer delays, more congestion, and a higher risk of secondary crashes. There is a need to improve the response of companies on the wrecker services rotation list and compliance with statewide laws and quick-clearance goals by establishing and enforcing performance requirements.

**Implementation Step #1:** Identify performance measures to track, such as incident response and clearance times. Set goals for the identified performance measures that are specific to the tow company operator's performance.

**Implementation Step #2:** Invite towing companies and representatives from agencies who maintain their contracts to incident AARs (see Action Item BP-02) when warranted and include discussion of tow company performance as part of the review.

**Implementation Step #3:** Encourage agencies that maintain the towing contracts to incorporate penalties for substandard performance into contracts.

**Expected Benefits:** Monitoring tow company performance and possibly introducing performance-based incentive or disincentive language into existing locally maintained towing contracts and rotation lists can encourage faster incident cleanups. Establishing performance expectations or baselines that must be met can provide agencies with tools to ensure that only qualified and compliant towing providers remain on rotation lists. It is essential to quickly clear an incident to reduce delays, congestion, and driver frustration. A shorter ICT also means responder and motorist safety is improved because on-scene personnel are not exposed to moving traffic and drivers do not have to navigate around potential obstacles for as long, which reduces the likelihood that secondary crashes occur.



## PM-03: Develop and Implement Automated Traffic Signal Performance Measures

### Focus Area:

Traffic Signal Management



### Action Item Lead:

District Director of Operations

### Partners:

BWD Operations,  
BWD Maintenance

### Goals Addressed:

Safety	
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	
Integration	✓

**Objective:** Develop a formal program and implement necessary technology and software to support Automated Traffic Signal Performance Measures operations on key District corridors.

**Need:** Due to the TxDOT Brownwood District not having communication technology deployed on all of its traffic signals, there is not a method for collecting or tracking traffic signal data remotely. There are seasonal side street detection issues, as the weather or sun limit visibility or create glare that prevents the detection from functioning properly. The District identified the need to explore the implementation of Automated Traffic Signal Performance Measures (ATSPM) to set goals and track signal performance in order to address operations challenges, as well as identify reoccurring issues and prioritize implementation locations at District signals.

**Implementation Step #1:** Formalize the District's ATSPM program objectives by selecting performance measures to focus on, determining how ATSPM data will be managed and analyzed by District staff, and establishing criteria for prioritizing which signals and corridors would benefit most from the deployment of ATSPM technology.

**Implementation Step #2:** Inventory existing TxDOT traffic signal equipment. When the statewide ATSPM guidelines are available, it will be necessary to identify whether each TxDOT signal has equipment compatible with the proposed ATSPM system. Newer traffic signal locations are more likely to already be compatible but not all equipment may support ATSPM systems. These locations with newer equipment may be more budget friendly for ATSPM upgrades.

**Implementation Step #3:** Prioritize deployment locations for ATSPM technology and establish a budget item to support annual device procurement and installation. Upgrades at individual high-priority intersections can be the more cost-effective option for implementing ATSPM, but linear deployments along a major signalized corridor would likely provide the greatest overall benefit.

**Expected Benefits:** ATSPM analysis allows for more effective signal timing plans, and the data can help the District in reducing delay, reducing conflicting movements, supporting proactive maintenance activities, or pursuing other goals related to signal operations. Ultimately ATSPM deployments will provide relief to departments who experience staffing shortages, allow for remote system diagnostics and analytics, and improve road user experience at signals.



### Culture


TSMO culture within an agency is dependent on engaged staff who adhere and implement TSMO goals. Staff can positively improve TSMO culture by critically analyzing daily activities to adhere to and meet program objectives. Considerations involved in creating a TSMO culture include a technical understanding, strong leadership, outreach, and buy-in of program authority. Specific TSMO action items for improving the culture of operations were not identified in the Brownwood District at this time.



### Organization & Workforce

The Organization & Workforce component of TSMO planning addresses how the program will be delivered through institutional and organizational changes. There are many ways to structure TSMO programs and not all agencies will require major changes to existing organization and staffing. Agencies are encouraged to evaluate each possible solution and select the organizational structure that will work best with the desired outcomes for their TSMO program. Considerations involved in determining organizational structure include program status, workforce capability, staff development and recruitment, and staff retention. Table 14 shows the recommended Organization & Workforce action items for the TxDOT Brownwood District.

Table 14: TxDOT Brownwood District TSMO Recommended Action Items – Organization & Workforce

CMM Capability Dimension	Action Item Number	Action Item Description
Organization & Workforce 	OW-01	<b>Establish Regional Multidisciplinary TIM Training</b>
	OW-02	<b>Improve Traffic Signal Technology Training</b>
	OW-03	<b>Provide Traffic Control Training</b>





## OW-01: Establish Regional Multidisciplinary TIM Training

### Focus Area:

Traffic Incident Management



### Action Item Lead:

District Director of Operations

### Partners:

TxDOT Traffic Safety Division (Statewide TIM Coordinators), BWD Operations, BWD Maintenance, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Partner with TxDOT Statewide Traffic Incident Management Coordinators to provide TIM multidisciplinary trainings and Train the Trainer programs to TxDOT staff and interested parties.

**Need:** Multidisciplinary TIM training is a core component of a successful TIM program and TIM activities. TxDOT TRF has been partnering with TxDOT districts and TIM working groups across Texas to conduct training. Training typically involves representatives from TxDOT, police, fire, emergency management services (EMS), local city transportation staff, and wrecker companies.

**Implementation Step #1:** Develop a TIM training program by adapting statewide TIM training material and Strategic Highway Research Program 2 (SHRP2) trainings to focus on local TIM needs. Identify who will lead the trainings and outline which agencies should be involved. Meet individually with identified agencies to encourage participation and identify barriers to participation.

**Implementation Step #2:** Coordinate with TxDOT TRF to adapt the existing Train the Trainer program to fit the TxDOT Brownwood District’s needs. Provide Train the Trainer sessions to interested personnel to initiate the multidisciplinary trainings.

**Implementation Step #3:** Offer regional TIM training opportunities at least once per year. Continuously update trainings to incorporate new technologies, strategies, lessons learned, and best practices.

**Expected Benefits:** Benefits of multidisciplinary TIM training include a better understanding of each agency’s roles and capabilities when responding to incidents, the ability to discuss response strategies using tabletop exercises that resemble real life situations, and the establishment of a baseline competency regarding incident management in the region. Train the Trainer courses would build the region’s capacity for conducting its own TIM training as needed.

### Strategy and Best Practice

In the Dallas-Fort Worth Region, the North-Central Texas Council of Governments provides a free TIM training course. The multidisciplinary course supports a coordinated response to traffic incidents that builds partnerships, enhances safety for emergency personnel, reduces secondary crashes, and increases reliability by shortening response and clearance times.





## OW-02: Improve Traffic Signal Technology Training

### Focus Area:

Traffic Signal Management



### Action Item Lead:

District Traffic Engineer

### Partners:

TxDOT Traffic Safety Division, BWD Area Engineers, BWD Operations, BWD Signal Shop, Local Transportation Agencies

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Coordinate with TxDOT Traffic Safety Division to identify technologies that can address signal challenges within the District. Provide signal technology training opportunities for District signal technicians.

**Need:** The TxDOT Brownwood District is currently facing challenges regarding signal technician turnover, resulting in a single technician with about a year of experience currently being responsible for managing the District’s 65 traffic signals. District staff are actively searching for additional signal training opportunities to increase the technician’s experience, as well as improve the training process for future TxDOT Brownwood District signal technicians. District staff expressed interest in reviewing statewide and nationwide traffic signal lessons learned, best practices, and standards to identify training strategies that could be beneficial for the TxDOT Brownwood District.

**Implementation Step #1:** Determine District signal technician training needs based on common traffic signal operations and maintenance issues staff face.

**Implementation Step #2:** Develop a signal technician training program by adapting available internal statewide TxDOT trainings to focus on needs in the TxDOT Brownwood District. Identify who will lead the trainings and outline which agencies should be involved.

**Implementation Step #3:** Offer regional signal technician training opportunities at least once per year. Continuously update trainings to incorporate new technologies, strategies, lessons learned, and best practices.

**Expected Benefits:** Providing District signal technicians with sufficient training could improve the District’s capabilities and therefore overall signalized corridor operations. Training provides signal technicians with tools to improve their familiarity with the various signal controller technologies that are deployed at traffic signal locations throughout the District, to diagnose and troubleshoot signal problems more efficiently, and to safely stage a work area while addressing issues in the field. A more cohesive and up-to-date training program could improve the efficiency of operations and maintenance along key corridors in the District.



## OW-03: Provide Traffic Control Training

### Focus Area:

Traffic Signal Management



### Action Item Lead:

District Traffic Engineer

### Partners:

TxDOT Traffic Safety Division, BWD Area Engineers, BWD Operations, BWD Signal Shop, Local Transportation Agencies

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Develop and deliver traffic control training for local agencies to support adherence to TxDOT traffic control plan standards.

**Need:** The cities within the TxDOT Brownwood District are required to abide by TxDOT traffic control standards for events such as traffic incidents, work zones, and planned special events. Stakeholders noted that TxDOT staff are quick to review and provide response to traffic control plans when they are submitted for planned special events. However, the local agencies struggle with the initial development of the plans as well as their implementation due to limited knowledge of the statewide guidelines. There is a need for improved traffic control trainings for the region's municipal agency partners to solidify the understanding of statewide and nationwide standards and ensure proper traffic control deployment.

**Implementation Step #1:** Review TxDOT and national traffic control guidelines and standards. Determine local traffic control training needs based on common traffic control plan and deployment issues District and partner agency staff face.

**Implementation Step #2:** Develop a training program by adapting available internal TxDOT Brownwood District trainings to focus on local needs. Identify who will lead the trainings and outline which agencies should be involved, including likely many of the same agencies that attend the multidisciplinary traffic incident management trainings (see Action Item OW-01).

**Implementation Step #3:** Offer regional traffic control training opportunities at least once per year. Continuously update trainings to incorporate new standards and guidelines, strategies, lessons learned, and best practices.

**Expected Benefits:** Providing traffic control training to partner agencies could make local agency traffic management activities more efficient and effective, and create uniform traffic control operations in locations where corridors are managed by different agencies. Training provides partner agency staff with tools to improve their familiarity with the standards, procedures and improves safety of traffic incident responders, traffic control personnel, and drivers. A more cohesive and up-to-date training program could improve the efficiency of general operations, maintenance projects, and event activities along key corridors in the District.



### Collaboration

The TSMO collaboration component is vital to emphasize the importance of partner agencies and stakeholders working together to meet regional transportation goals. Collaboration should take place in every aspect of TSMO programming; from early in developing TSMO strategic elements such as vision, mission, goals, and objectives to throughout implementation of projects, programs, and services. Considerations should include partnerships among different levels of government like public safety agencies, both internal agency and external stakeholder collaboration, and partnerships with the private sector. Table 15 shows the recommended Collaboration action items for the TxDOT Brownwood District.

Table 15: TxDOT Brownwood District TSMO Recommended Action Items - Collaboration

CMM Capability Dimension	Action Item Number	Action Item Description
Collaboration 	CO-01	<b>Establish a Formal Regional TIM Team</b>



## CO-01: Establish a Formal TIM Team

### Focus Area:

Traffic Incident Management



### Action Item Lead:

District Director of Operations

### Partners:

TxDOT Traffic Safety Division (Statewide TIM Coordinator), BWD Operations, BWD Area Engineers, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies

### Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	✓
Collaboration	✓
Integration	✓

**Objective:** Establish a formalized TIM Team that meets regularly and includes all relevant jurisdictions and roles.

**Need:** The TxDOT Brownwood District does not currently have a regional TIM working group, or “TIM Team”, that meets regularly to discuss TIM-related regional priorities, training opportunities, best practices, and incident AARs. Stakeholders and District staff identified that the creation of a formalized TIM Team would improve incident response and overall traffic operations.

**Implementation Step #1:** Identify local partners at the county level, such as local sheriff, police, and fire departments, to involve in TIM Team outreach. Conduct outreach to share the District’s goals for quick clearance of incidents, existing state laws supporting these goals, and upcoming training opportunities.

**Implementation Step #2:** Gauge interest for organizing and hosting regularly scheduled regional TIM Team meetings with TxDOT staff and responders. Items to consider when organizing these meetings include the frequency, location, agendas, and attendee list for TIM Team meetings.

**Implementation Step #3:** Conduct regularly scheduled regional TIM Team meetings, with support from the TxDOT TRF Statewide TIM Coordinator.

**Expected Benefits:** TIM Teams consisting of stakeholders from throughout the region can meet on a regular basis to discuss current initiatives and challenges related to TIM. These working groups can conduct AARs of high-impact incidents and can feature guest presenters to showcase new technology or resources that incident managers could potentially incorporate into their TIM procedures. Conducting these activities with all stakeholders can improve TIM practices among agencies throughout the region, allowing for the entire region to improve in terms of TIM performance.

### Strategy and Best Practice

The Austin-Area Incident Management for Highways (AIMHigh) Team in Austin, TX meet every other month to discuss TIM challenges and accomplishments. Meetings are facilitated by a contractor who encourages participation from first responders and other partners in the region. The team includes representatives from federal, state, and local transportation agencies; state and local law enforcement agencies; fire and rescue agencies; EMS; the local towing association; and the regional MPO.



## **TSMO Tactical Plan Assessment**

TSMO Tactical Plans allow the TxDOT Brownwood District to establish greater detail in how to act upon some of the high priority recommended action items included in the TSMO Program Plan. Tactical Plans can establish project details, assign responsibilities, and include cost and staff estimates for specific initiatives. Often, Tactical Plans establish further direction regarding a specific TSMO capability dimension (for example, performance measurement), focus area (for example, TIM), or a service within the scope of a TSMO focus area (for example, winter road management, within the RWM focus area).

### ***Tactical Plan Criteria***

Based on the transportation challenges in the region, and priorities identified by regional stakeholders, several Tactical Plans are recommended for the TxDOT Brownwood District. Plans are displayed according to the following criteria:

- Alignment with the TxDOT Brownwood District TSMO Goals: Safety, Reliability, Efficiency, Customer Service, Collaboration, and Integration
- Stakeholder partnerships required for successful implementation
- Level of anticipated initial and ongoing costs anticipated for successful implementation
- Level of District staff support anticipated for successful implementation
- Expected return on investment anticipated, pending successful implementation
- Action items from this TSMO Program Plan within the Tactical Plan's scope

### ***Tactical Plan Components***

The following components are typically included in TSMO Tactical Plans:

- A detailed account of existing activities within the District and region, including who is responsible, a schedule of when and how the activities are executed, and other considerations
- Recommendations for new activities, or changes to existing activities that would support the aim of the Tactical Plan
- A description of how the recommended activities will be integrated with existing business processes
- A detailed schedule for up-front and ongoing recommended activities
- Up-front and ongoing cost estimates for implementation of recommended activities
- Performance measures that would allow for tracking the progress of recommended activities

### ***Recommended Tactical Plans***

Recommended TSMO Tactical Plans are included on the next page in Table 16.

Table 16: TxDOT Brownwood District Potential TSMO Tactical Plans

Potential Tactical Plan	Supports District TSMO Goals						Key Internal and External Partners	Expected Long-Term Program Costs	Expected Ongoing Program Level of Effort	TSMO Action Items Addressed
	Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration				
TxDOT Brownwood District ITS Master Plan	✓	✓	✓	✓	✓	✓	BWD Operations, BWD Area Engineers	\$\$\$		BP-03, BP-07, ST-01, ST-04, ST-05, ST-06, ST-07
Traffic Signal System Upgrade Plan	✓	✓	✓			✓	BWD Operations, BWD Maintenance, BWD Area Engineers, BWD Signal Shop	\$\$		BP-07, ST-04, ST-05, ST-06, ST-07, PM-03, OW-02
Regional TIM Program Plan	✓	✓	✓	✓	✓		TxDOT TRF, BWD Operations, BWD Maintenance, BWD Area Engineers, First Responders	\$\$		BP-01, BP-02, ST-07, ST-08, PM-01, PM-02, OW-01, CO-01

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7. U.S. Department of Transportation Federal Highway Administration. (2018). *Crash Costs for Highway Safety Analysis (Report No. FHWA-SA-17-071)*, 85. Retrieved from <https://safety.fhwa.dot.gov/hsip/docs/fhwasa17071.pdf>



## Appendix A – Stakeholder Participation Database

Appendix A – Stakeholder Participation Database

TxDOT Brownwood District TSMO Program Plan Participating Stakeholders <sup>1</sup>						
Organization	Name	Title	Meeting or Workshop Attendees			
			TxDOT Brownwood District Leadership Meeting	External Partner Leadership Meeting	Stakeholder Outreach Workshop	Action Item Review Meeting
Central Texas Rural Transit District	Rhonda Kelton	Mobility and Transit Manager			X	
City of Breckenridge	Houston Satterwhite	Public Works Director		X		
City of Brownwood	Kevin Scalley	Public Works Coordinator		X		
City of Lampasas	Carlos Garcia	Public Works - Street Superintendent		X		
City of Lampasas Texas Police	Jody Cummings	Assistant Chief of Police			X	
Hill Country Transit District	Tony Austin	Director of Rural Operations			X	
KTMPO	Kendra Coufal	Planning Services Manager				
KTMPO	James McGill	Senior Planner		X	X	
TxDOT BWD District	Chris Graf	Director of Construction	X			
TxDOT BWD District	Eric Lykins	Director of Operations & Maintenance	X		X	X
TxDOT BWD District	Elias Rmeili	District Engineer	X			
TxDOT BWD District	Jason Scantling	Director of Transportation Planning & Development	X			
TxDOT BWD District	Blake Stenbridge	District Maintenance				X
TxDOT BWD District	Julie Swenson	District Operations			X	X
TxDOT BWD District	Lisa Tipton	Public Information Officer	X			

<sup>1</sup>Organization and title listed for each stakeholder reflects their organization and title at the time they participated in the TxDOT Brownwood District TSMO Program Plan.


## **Appendix B – Action Items Organized by TSMO Focus Area**

Appendix B – Action Items Organized by TSMO Focus Area

Action No.	 Traffic Incident Management (TIM) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Capability Dimension	Related Action Items	
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration						
BP-01	<b>Implement TIM Response Measures for Major Construction:</b> Develop process and procedures for incident management within construction work zones prior to letting of all major construction contracts.	39	District Director of Construction	✓		✓			✓	✓	BWD Construction, BWD Operations, BWD Area Engineers, First Responders, Contractors, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		ST-01, ST-02, CO-01
BP-02	<b>Conduct After-Action Reviews for Major Incidents:</b> Establish criteria for determining which incidents require after-action reviews and conduct reviews as needed.	40	District Director of Operations	✓	✓	✓			✓	✓	TxDOT Traffic Safety Division, BWD Operations, BWD Area Offices, BWD Maintenance, Texas DPS, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		PM-01, PM-02, OW-03, CO-01
PM-01	<b>Improve TIM Data Collection:</b> Improve incident management-related data collection of roadway clearance time, incident clearance time, and secondary crash data. <i>Note: This action item would be done in coordination with TxDOT TRF and their efforts to improve TIM data within CRIS on a statewide basis.</i>	56	District Director of Operations	✓	✓	✓			✓	✓	TxDOT Traffic Safety Division, BWD Operations, Texas DPS, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		BP-02, ST-08, PM-02, OW-01, CO-01
PM-02	<b>Monitor Towing Company Performance:</b> Partner with Texas DPS and local municipalities to monitor performance of tow companies and establish baseline performance that must be met.	57	District Director of Operations	✓	✓				✓		BWD Operations, Texas DPS, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		BP-02, PM-01, OW-01, CO-01
OW-01	<b>Establish Regional Multidisciplinary TIM Training:</b> Partner with TxDOT Statewide Traffic Incident Management Coordinator to provide TIM multidisciplinary trainings and Train the Trainer programs to TxDOT staff and interested parties.	60	District Director of Operations	✓	✓				✓	✓	TxDOT Traffic Safety Division (Statewide TIM Coordinator), BWD Operations, BWD Maintenance, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		PM-01, PM-02, CO-01, OW-03
CO-01	<b>Establish a Formal Regional TIM Team:</b> Establish a formalized TIM Team that meets regularly and includes all relevant jurisdictions and roles.	64	District Director of Operations	✓	✓	✓	✓	✓	✓	✓	TxDOT Traffic Safety Division (Statewide TIM Coordinator), BWD Operations, BWD Area Engineers, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies	\$	<div style="width: 25%;"></div>		BP-01, BP-02, ST-08, PM-01, PM-02, OW-01

Table continued on next page.

Action No.	 Work Zone Management (WZM) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Capability Dimension	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
BP-03	<b>Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidance:</b> Adapt TxDOT's existing SWZ guidance and deployment decision tool to determine which work zone ITS technologies to use for District construction projects.	41	District Director of Construction	✓	✓		✓		✓	TxDOT Traffic Safety Division, BWD Construction, BWD Operations	\$	<div style="width: 25%;"><div></div></div>		ST-01, OW-03
BP-04	<b>Standardize Advanced Notification of Planned Lane Closure Events:</b> Standardize a District process for communicating construction impacts to local transportation, transit, and public safety partners, as well as the public.	42	District Public Information Officer	✓			✓	✓	✓	BWD Area Engineers, BWD Construction, BWD Public Information Office, Local Transportation Agencies, Transit Agencies, Texas DPS	\$	<div style="width: 25%;"><div></div></div>		ST-02
ST-01	<b>Deploy Work Zone Technology:</b> Deploy work zone technology throughout the District to support improved work zone monitoring, localized real-time traveler information, and end of queue warning.	47	District Director of Construction	✓		✓	✓	✓	✓	BWD Construction, BWD Operations, BWD Area Engineers, TxDOT Construction Division, Contractors	\$\$	<div style="width: 25%;"><div></div></div>		BP-01, BP-03, ST-02
ST-02	<b>Provide Work Zone Closure Information Through Third-Party Apps:</b> Partner with third-party navigation apps to provide accurate work zone closure information for travelers through the District.	48	District Public Information Officer		✓		✓	✓	✓	BWD Public Information Office, BWD Operations, BWD Construction, Private Third-Party Providers	\$	<div style="width: 25%;"><div></div></div>		BP-01, BP-04, ST-01, ST-03

Action No.	 Road Weather Management (RWM) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Capability Dimension	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
N/A	<i>Note: The Brownwood District generally rated themselves highest in the Road Weather Management focus area. Specific action items to improve Road Weather Management were not identified at this time. However, there are recommended action items that have been included in the General Traffic Management focus area that can support improved Road Weather Management, such as the deployment of additional ITS devices and regional video sharing.</i>													

Action No.	 Planned Special Events (PSE) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Capability Dimension	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
ST-03	<b>Share Event-Related Road Impacts with Third-Party Apps:</b> Partner with third-party navigation apps to provide accurate special event-related closure and routing information for travelers through the District.	49	District Public Information Officer		✓		✓	✓	✓	BWD Operations, BWD Public Information Offices, Event Organizers, Private Third-Party Providers	\$	<div style="width: 25%;"><div></div></div>		ST-02

Table continued on next page.







Action No.	 Traffic Signal Management (TSM) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Capability Dimension	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
BP-05	<b>Develop Method for Evaluating Corridor Signal Timings:</b> Develop a proactive method for evaluating and retiming signals along corridors to improve safety and efficiency on the system.	43	District Director of Operations	✓	✓	✓			✓	BWD Operations, BWD Signal Shop, BWD Maintenance	\$			ST-05, PM-03
ST-04	<b>Prioritize and Deploy Signal Battery Backup Units:</b> Develop a deployment plan to prioritize and deploy traffic signal battery back-up units throughout the District.	50	District Director of Operations	✓	✓	✓			✓	BWD Operations, BWD Maintenance	\$\$			BP-07, ST-05, ST-06
ST-05	<b>Plan and Implement Surveillance Technology for Signals:</b> Identify implementation priority for cameras and necessary software enhancement to allow remote surveillance of District traffic signals from a single software platform.	51	District Director of Operations	✓	✓	✓		✓	✓	BWD Operations, BWD Maintenance	\$\$\$			BP-05, BP-07, ST-04, PM-03
ST-06	<b>Improve Communications Link to Signals in Rural Areas:</b> Upgrade communications capabilities at rural TxDOT traffic signal locations to improve ability to monitor and respond to conflicts, outages, and other signal issues.	52	District Director of Operations	✓	✓	✓			✓	BWD Operations, BWD Maintenance	\$\$			BP-07, ST-04, PM-03
OW-02	<b>Improve Traffic Signal Technology Training:</b> Coordinate with TxDOT Traffic Safety Division to identify technologies that can address signal challenges within the District. Provide signal technology training opportunities for District signal technicians.	61	District Director of Operations	✓	✓		✓	✓	✓	TxDOT Traffic Safety Division, BWD Area Engineers, BWD Operations, BWD Signal Shop, Local Transportation Agencies	\$			ST-07, PM-03
OW-03	<b>Provide Traffic Control Training:</b> Develop and deliver traffic control training for local agencies to support adherence to TxDOT traffic control plan standards.	62	District Director of Operations	✓	✓		✓	✓	✓	TxDOT Traffic Safety Division, BWD Area Engineers, BWD Operations, BWD Signal Shop, Local Transportation Agencies	\$			BP-03, OW-01

Table continued on next page.

Action No.	 General Traffic Management (TM) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals						Partners	Cost	Effort	TSMO Capability Dimension	Related Action Items
				Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration					
BP-06	<b>Establish Notification Process to Cities for Over Height/Oversize Vehicles Permits:</b> Establish a process within TxDOT permitting to notify local agencies when over-height/oversize vehicles will be traveling through their jurisdictions so they can plan for and monitor these movements.	44	District Director of Operations	✓					✓	Texas Department of Motor Vehicles, BWD Operations, BWD Maintenance, Local Transportation Agencies	\$	<div style="width: 25%;"><div style="background-color: #4a7ebb; height: 10px;"></div></div>		
BP-07	<b>Develop TxDOT Brownwood District ITS Master Plan:</b> Develop an ITS Master Plan for the TxDOT Brownwood District to identify and prioritize ITS and communication infrastructure deployments throughout the District.	45	District Director of Transportation Planning & Development	✓	✓	✓	✓	✓	✓	BWD Operations, BWD Area Engineers	\$\$	<div style="width: 30%;"><div style="background-color: #4a7ebb; height: 10px;"></div></div>		ST-04, ST-05, ST-06, ST-07, PM-03
ST-07	<b>Implement ITS Field Devices Identified in ITS Master Plan:</b> Deploy ITS infrastructure identified in the District ITS Master Plan to support improved traffic management and operations in the District.	53	District Director of Operations	✓	✓	✓	✓		✓	BWD Transportation Planning & Development, BWD Operations, BWD Construction, Local Transportation Agencies	\$\$	<div style="width: 30%;"><div style="background-color: #4a7ebb; height: 10px;"></div></div>		BP-07, OW-02
ST-08	<b>Improve Regional Video Sharing Capabilities:</b> Use cloud-based technology platforms for sharing access to CCTV camera video feeds.	54	District Director of Operations			✓			✓	TxDOT Traffic Safety Division, BWD Operations, Local Transportation Agencies	\$\$\$	<div style="width: 30%;"><div style="background-color: #4a7ebb; height: 10px;"></div></div>		PM-01, CO-01

## **Appendix C – TxDOT Incident After-Action Report Form**

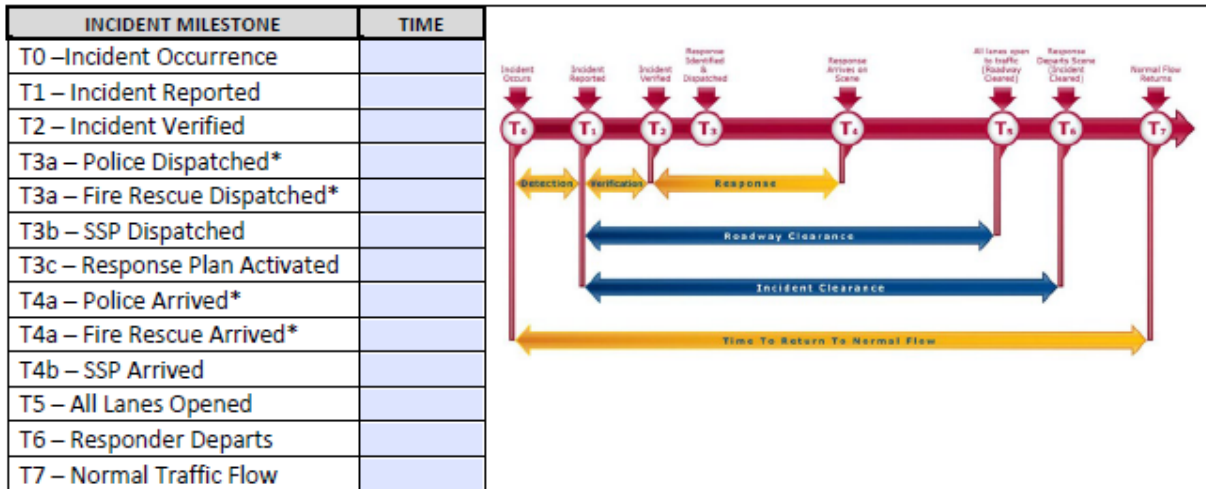




## AFTER ACTION REPORT TEXAS DEPT. OF TRANSPORTATION Traffic Incident Management Teams

INCIDENT INFORMATION					
District: <input type="text" value="Lonestar#"/>	Level: <input type="text" value="Select Level"/>	Conditions: <input type="text" value="Select Condition"/>			
Select Day: <input type="text"/>	Date: <input type="text"/>	Time: (HR:MN) <input type="text"/>	Incident Type: <input type="checkbox"/> Traffic Crash		
Location: <input type="text"/>			<input type="checkbox"/> HAZMAT <input type="checkbox"/> Oil Spill		
CMV: <input type="checkbox"/> Yes <input type="checkbox"/> No	Construction Zone: <input type="checkbox"/> Yes <input type="checkbox"/> No		PD/FD CAD#: <input type="text"/>		
Secondary Crash: <input type="checkbox"/> Yes <input type="checkbox"/> No					

### INCIDENT TIMELINE



\*Note: CAD data will be utilized for these times; if no times are available Lonestar data will be utilized.

NOTIFICATIONS			
TYPE	TIME	TYPE	TIME
TMC EMAIL ALERT		Medical Examiner	
SSP/HERO		News Media	
DOT		Other <input type="text"/>	
Wrecker			
Police			
Fire Rescue			

### INCIDENT SUMMARY:

1

Reviewed by: <input type="text"/>
Position: <input type="text"/>
Date: <input type="text"/>



**AFTER ACTION REPORT  
TEXAS DEPT. OF TRANSPORTATION  
Traffic Incident Management Teams**

**AAR MEETING LOCATION AND MODERATOR:**

**MEETING NOTES/QUESTIONS/COMMENTS:**

**RESOURCES NEEDED:**



**AFTER ACTION REPORT  
TEXAS DEPT. OF TRANSPORTATION  
Traffic Incident Management Teams**

**ISSUES:**

**WHAT WENT WELL?**

**TRAINING NEEDS?**



**AFTER ACTION REPORT  
TEXAS DEPT. OF TRANSPORTATION  
Traffic Incident Management Teams**

**ACTION ITEMS/LESSONS LEARNED/RECOMMENDATIONS:**

A large, empty rectangular box with a light blue gradient background, intended for entering action items, lessons learned, or recommendations.



**AFTER ACTION REPORT**  
**TEXAS DEPT. OF TRANSPORTATION**  
**Traffic Incident Management Teams**

<b>AAR SIGN IN SHEET (please print clearly)</b>				
<b>Name</b>	<b>Title</b>	<b>Agency</b>	<b>Phone</b>	<b>Email Address</b>



**AFTER ACTION REPORT**  
**TEXAS DEPT. OF TRANSPORTATION**  
**Traffic Incident Management Teams**

<b>AAR SIGN IN SHEET (please print clearly)</b>				
<b>Name</b>	<b>Title</b>	<b>Agency</b>	<b>Phone</b>	<b>Email Address</b>



## Texas Department of Transportation Traffic Incident Management After-Action Review Report (a.k.a., Post Incident Analysis) Best Practices

After Action Reports – a document capturing an incident timeline, responding agencies, communications, issues, lessons learned and action items to improve future incident response and clearance. The AAR is created following a meeting of all involved first responders and agencies where a pro-active, non-confrontational approach is taken and usually includes scene documentation/photos, agency CAD reports and a tabletop review. AAR meetings are usually conducted by a lead agency representative that facilitates the time and location, agenda, audio-visuals, distributes meeting minutes and follows up on any action items. AAR reports can be captured on a shared file system or database categorizing incident types, clearance methods and other related items to allow for historical access and benefit.

### AAR Basics:

- Assign an AAR Coordinator and alternate to manage meetings - AAR facilitators should have a background in traffic incident management, understand the incident command system, each agency's responsibilities, incident timelines and be skilled in general meeting conduct and have professional writing skills.
- Develop AAR Meeting Activation Requirements - Develop an agreed upon AAR activation plan based on incident severity, location and impact. For less severe impacting incidents, some agencies have "mini AARs" with selected agencies; sometimes at their station to resolve a particular matter but following basic AAR guideline principles.

*It is important to understand what issues affected the decision making process from the actual first responders.*

**ACTIVATION RECOMMENDATION:** Incidents involving first responder, hazmat or limited access highway blocked over 4 hours.

- Set timeline to schedule AAR meetings following the incident. Options: 1) immediately after the incident; 2) within 48-72 hours and no more than two weeks after the incident.
- Get the actual participants to take part in the AAR meeting, since other agency representative may not be able to relay the decision making process based on the information available in an agency report.
- Determine whether fire/police may have already scheduled an AAR meeting and ask to be included.
- Some agencies facilitate AAR meetings with the use of conference calls in concert or as alternative but face-to-face meetings are most effective.
- It is crucial to capture the action items and lessons learned to report at the next TIM meeting to show results and progress. At the same time, organizers can educate TIM team members about the overall AAR meeting benefits and set their expectations for the next incident.
- Have agencies send Computer Aided Dispatch (CAD) or crash reports ahead of time to the AAR coordination, so that he or she can compile and compare timelines and details; then use information as discussion points at the AAR meeting.
- The person running the AAR meeting should take the approach to follow the agenda but really try to engage participants – interviewing first responders about what they saw and what happened.
- AAR coordinator should be careful not to allow finger pointing by turning a negative into improving operations in the future.  
Prepare an AAR standard operating procedure document, update as needed and train AAR coordinators on the procedure.

*Some agency representatives have been reluctant to attend AARs because they felt they will be blamed. AAR coordinators have been able to change this perspective by showing that AAR meetings are an opportunity to realize future benefits and understanding each agency's needs and objectives at crashes.*



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Best Practices**

**AAR MEETING PLAN CHECKLIST**

- Prepare incident summary (location, times, agencies involved, incident description, incident impact). Contact any or all of the following agencies by phone and/or email:
  - Law enforcement (primary, backup)
  - Fire rescue (primary, backup)
  - Maintenance (DOT, county, municipal)
  - Wrecker companies
  - Environmental
  - HAZMAT Vendor
  - Medical Examiner
  - Other (NTSB, airport, emergency operations center, etc.)
- Obtain agency data reports before AAR meeting (incident reports, CAD, photographs)
- Select meeting time/location
- Send email meeting invite to all first responders that were at scene. Include appropriate related transportation officials and supervisors.
- Prepare meeting materials:
  - Agenda template:
    - Incident brief description of date, time, location, weather/roadway conditions, etc.
    - Purpose of AAR
    - Synopsis of Event
    - List of involved agencies
    - Agency report reviews
    - Questions/Comments (issues, problems, successes and general comments)
    - Slides (include agenda, incident description, aerial photo/map, incident photographs)
    - Handouts
    - Sign in sheet (name, agency, email, phone)
- Reconfirm meeting room availability
- Send meeting reminder one day prior

**CONDUCTING AN AFTER ACTION REPORT MEETING:**

- Assign meeting note taker
- Distribute printed copies of agenda
- Confirm all have signed in
- Conduct self-introductions
- Describe purpose and goals of AAR
- Review slides with incident summary description
- Begin agency report/interview of participants. Ask each agency/company representative if they have anything to add about their response and involvement in the incident.
- Review each question/comment in depth, encouraging discussion from all of the participants.
- Take notes of key points, questions and action items for final report





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**AAR TIMELINE**

Upon determination of an AAR:

TASK	TIMELINE*
Contact first responders	Within 1-2 days of incident
Reserve AAR meeting room	Within 1-2 days of incident
Invite first responders	Within 1-2 days of incident
Request agency reports be sent prior to meeting	Within 1-2 days of incident
Prepare AAR agenda	Within 3-4 days of incident
Prepare meeting materials	Within 3-4 days of incident
Conduct AAR meeting	Within 3-14 days of incident
Complete Final AAR	Within 3 weeks of incident
Distribute Final AAR	Within 4 weeks of incident

\*Timeline compressed if AAR immediately after incident

**AAR FINAL REPORT** - A final AAR will be compiled for the lead agency and distributed to all first responders. The report should include the following elements:

- Incident Summary
- Location of AAR Meeting
- Meeting Notes
- Resources Needed
- Issues
- Lessons Learned
- Training Needs Identified
- Action Items/Recommendation
- Sign In Sheet