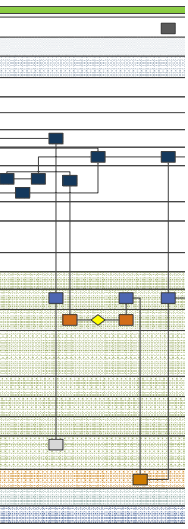
TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO)



ABILENE DISTRICT PROGRAM PLAN

July 2022

Texas Department of Transportation

Document Control

Date	Version	Description
July 1, 2022	1.0	Draft Transportation Systems Management and Operations Program Plan – TxDOT Abilene District Review
July 27, 2022	2.0	Final Transportation Systems Management and Operations Program Plan

Table of Contents

List of Tables

List of Figures

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)
PCMS	Portable Changeable Message Signs
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 Plan
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.

> **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)

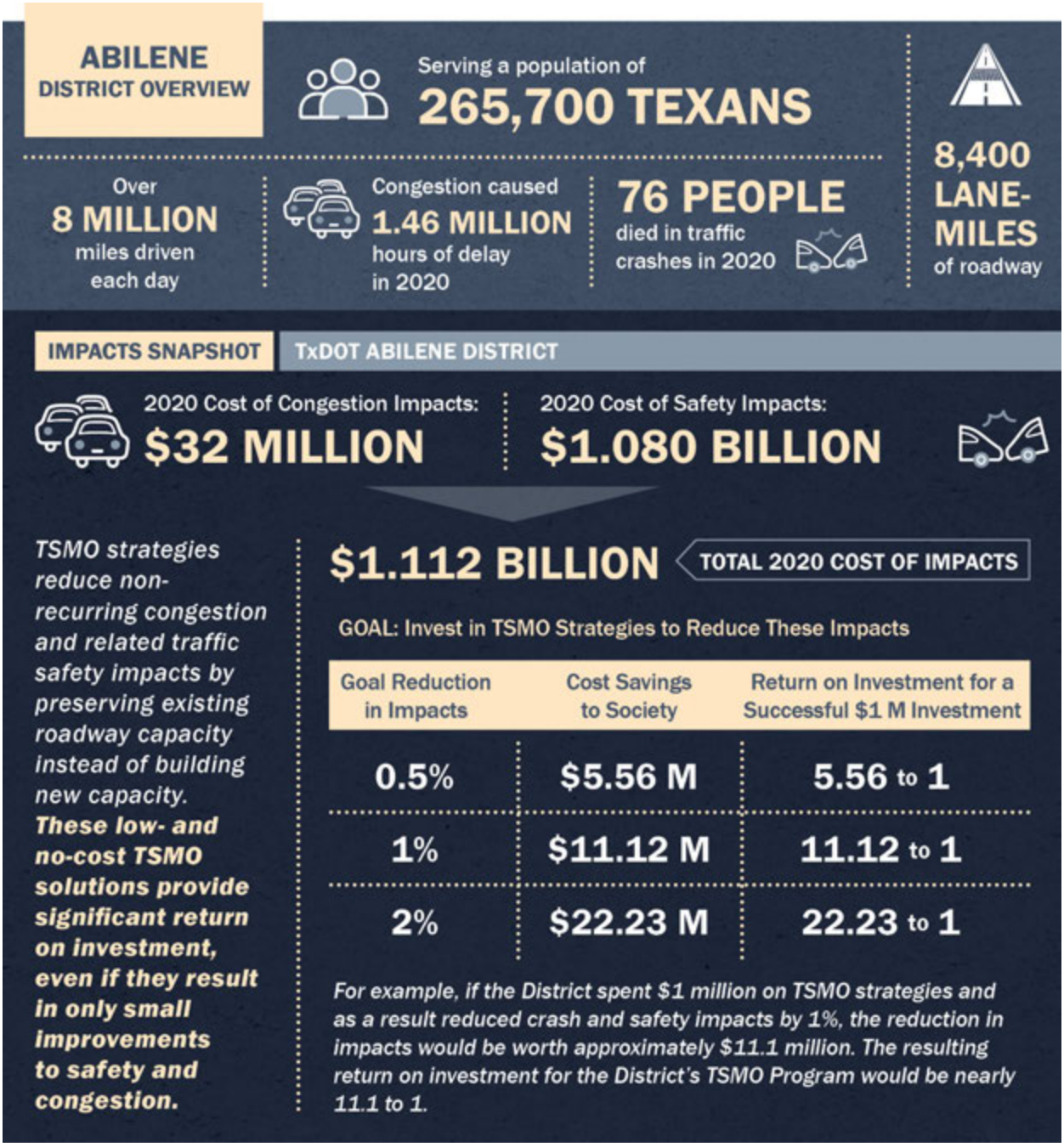
The Texas Department of Transportation (TxDOT) Abilene District has developed this TSMO Program Plan to identify TSMO action items that District staff can implement over the next five years to improve traffic operations.

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. Each phase of stakeholder engagement is summarized in the timeline to the left.

To develop this plan, the TxDOT Abilene 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 Abilene 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 below, with these icons used throughout the report to identify related discussion.

Why Invest in TSMO Actions?

A review of congestion and safety impacts in the TxDOT Abilene District revealed that traffic and crashes within the District's boundaries cost travelers more than $1.1 billion 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. The overview below shows how investing in TSMO actions to reduce these societal costs can provide a significant return on investment for the TxDOT Abilene District. More detail is provided in the **Business Case for TSMO** section of this TSMO Program Plan.



How Should the District Invest in TSMO?

Based upon the District's guiding TSMO principles and existing needs identified by TxDOT and its partners, 25 action items to advance TSMO were identified for the TxDOT Abilene 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
Early Win Recommended Action Items				
BP 02	**Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidance:** Adapt TxDOT's existing Smart Work Zone guidance and deployment decision tool when determining which work zone ITS technologies to use for District construction projects.	40		
BP 07	**Establish Standard Protocol for Use of DMS:** Develop protocol for when to post and what messages to post on DMS for disseminating information to the traveling public. Develop standard message templates to use for creating messages for various scenarios.			
OW 01	**Establish Regional Multidisciplinary TIM Training:** Partner with the TxDOT Statewide Traffic Incident Management Coordinator to provide TIM multidisciplinary trainings and Train the Trainer programs to TxDOT staff and interested parties.	65		
OW 02	**Develop Standard Operating Procedures for District ITS Device Use:** Develop a set of standard operating procedures for the operation of ITS devices identified in Phase 1 of the District ITS			
Low Cost, High Impact Recommended Action Items				
ST 01	**Improve Regional Video Sharing Capabilities:** Use cloud-based technology platforms for sharing access to CCTV camera video feeds with City of Abilene Engineering, City of Abilene Police, City of Abilene Fire, and DPS.	47		
PM 01	**Improve TIM Data Collection:** Improve incident management-related data collection of roadway clearance time, incident clearance time, and secondary crash data.			
CU 02	**Increase Awareness of Information Available on DriveTexas.org:** Increase public awareness of DriveTexas.org to increase dissemination of WZM, RWM, and PSE information.	63		
CO 01	**Establish a Formal Regional TIM Team:** Establish a formalized TIM Team that meets regularly and includes all relevant jurisdictions and roles. Participants to include TxDOT, DPS, and municipal public safety and traffic representatives.			

Action No.	Action Description	Report Page #	TSMO Focus Area	TSMO Capability Dimension
High Cost, High Impact Recommended Action Items				
ST 02	**Deploy Work Zone Technology:** Deploy work zone technology throughout the District to support improved work zone monitoring, localized real-time traveler information, and end of queue warning.	48		
ST 05	**Deploy Flood Detection, Warning, and Closure Devices:** Implement technology for flood detection, warning, and automated road closure in areas that frequently flood.	51		
ST 07	**Plan and Implement Surveillance Technology for Signals:** Identify implementation priority for cameras and necessary software enhancement to allow remote surveillance of District traffic signals from a single software platform.	53		
ST 09	**Implement ITS Field Devices Identified in the ITS Master Plan Phase 1:** Deploy ITS infrastructure identified in Phase 1 of the TxDOT Abilene District ITS Master Plan to support improved traffic management and operations in the District.	55		

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 Abilene District are shown below.

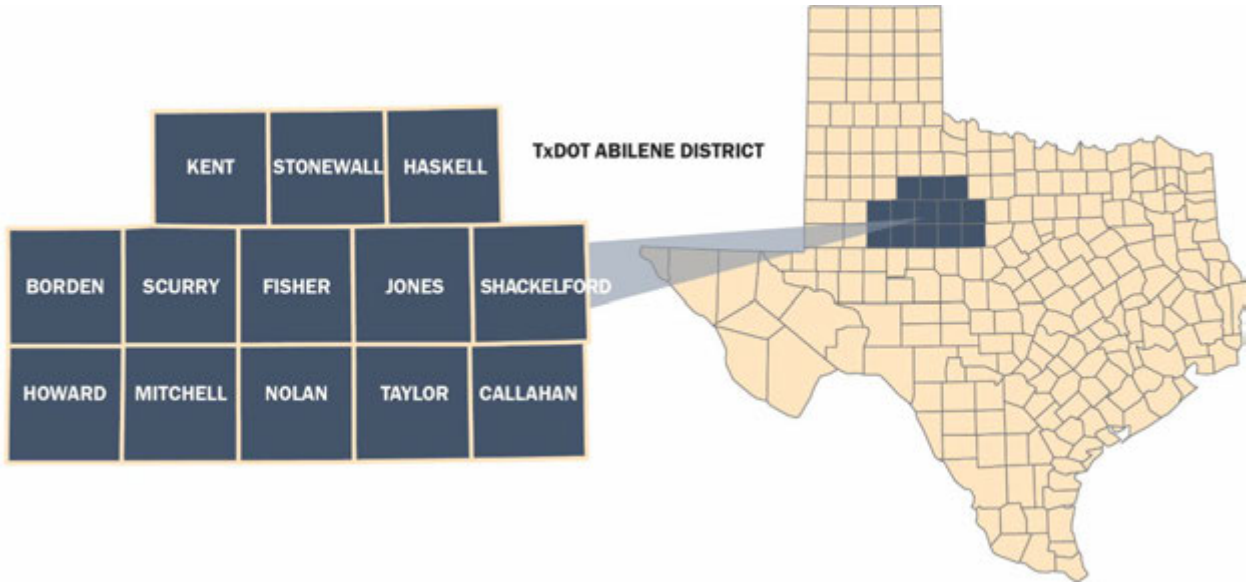
Potential Tactical Plan	Supports District TSMO Goals						Key Internal and External Partners	Expected Long Term Program Costs	Expected Ongoing Program Level of Effort	TSMO Action Items Addressed
	Safety	Reliability	Efficiency	Customer Service	Collaboration	Integration				
ITS Concept of Operations Plan	✓	✓	✓	✓	✓	✓	ABL Operations, ABL Maintenance, ABL Area Engineers	$		BP-02, BP-07, ST-01, ST-03, ST-05, ST-09, OW-02
Regional TIM Program Plan	✓	✓	✓		✓	✓	TxDOT TRF, ABL Operations, ABL Maintenance, ABL Area Engineers, First Responders	$$		BP-01, ST-01, PM-01, OW-01, CO-01
Work Zone Technology Deployment Plan		✓		✓		✓	ABL Operations, ABL Area Engineers, ABL Construction	$$		BP-02, BP-03, ST-02, ST-03, CU-01
Traffic Signal System Upgrade Plan	✓	✓	✓			✓	ABL Operations, ABL Maintenance, ABL Area Engineers, ABL Signal Shop	$$$		BP-05, ST-07, ST-08, PM-02

Introduction

The Texas Department of Transportation (TxDOT) Abilene 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 Abilene District Map



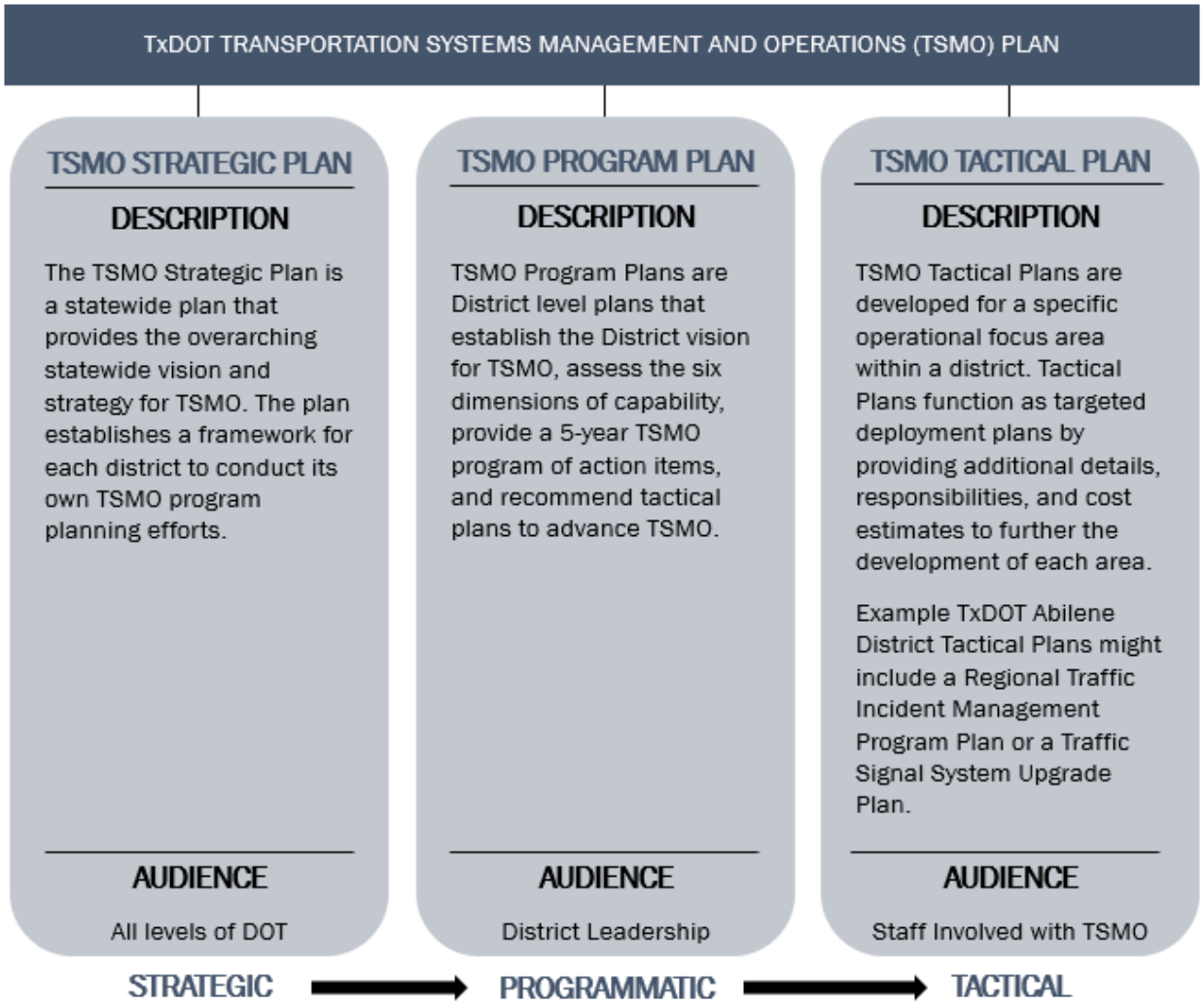
TSMO is defined specifically in federal legislation, including the Moving Ahead for Progress in the 21st Century Act (MAP-21), as well as the Fixing America's Surface Transportation (FAST) Act. The TxDOT Traffic Safety Division (TRF) developed a Statewide TSMO Strategic Plan in 2018 that identifies statewide 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: Abilene 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 Abilene District as a part of this TSMO Program Plan. The structure of the TxDOT Abilene District TSMO planning initiative is shown in Figure 3.

Figure 4: Abilene District TSMO Stakeholder Engagement Timeline

The development of the TxDOT Abilene 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, members from the region's metropolitan planning organization (MPO), and transit 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.

Program Plan Format

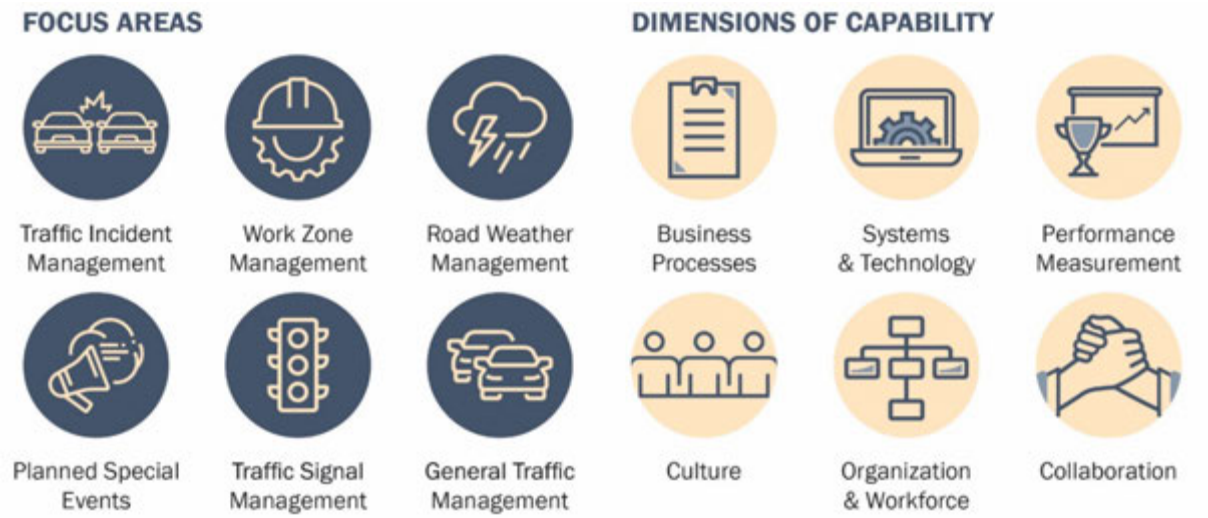
In the **Business Case for TSMO** section, the TxDOT Abilene District TSMO Program Plan estimates the potential benefit-cost ratio for adopting TSMO priorities throughout the District. This business case includes available metrics on congestion and safety and an assessment of existing societal costs 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 Abilene 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 Abilene District has identified as a priority.

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 Abilene 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 Abilene 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 Abilene 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

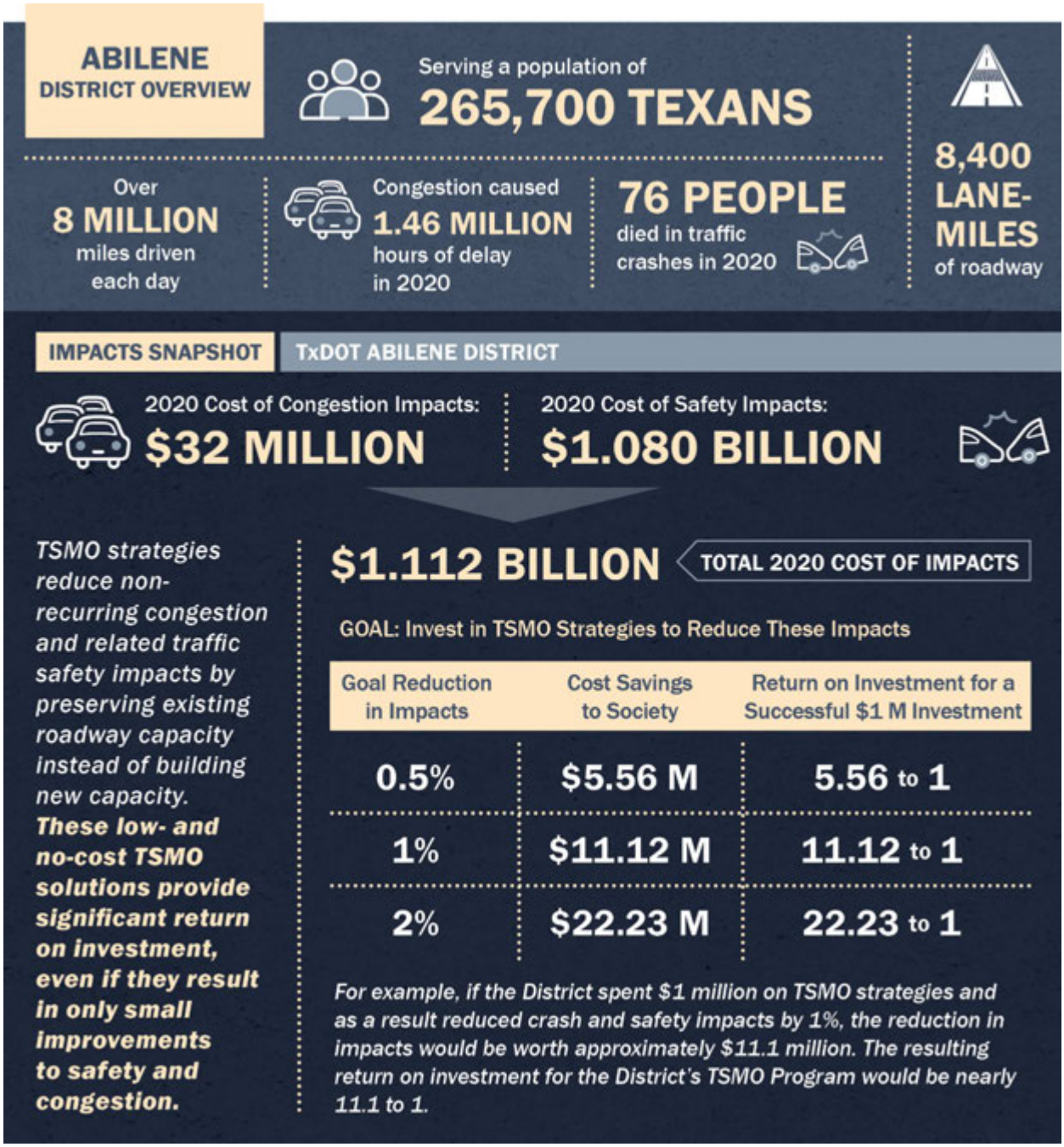


The **TSMO Implementation Plan** section shows all recommended TSMO action items for the TxDOT Abilene District to undertake for the next five years in both a summary table and an implementation schedule. Finally, focus areas and related action items that would benefit from further planning or development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

Business Case for TSMO

Figure 6 below summarizes the business case for investing in TSMO strategies in the TxDOT Abilene District. More detailed analysis of funding sources, congestion impacts, and safety impacts is provided on the pages that follow in this section.

Figure 6: TxDOT Abilene District Overview and TSMO Impacts Snapshot



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.

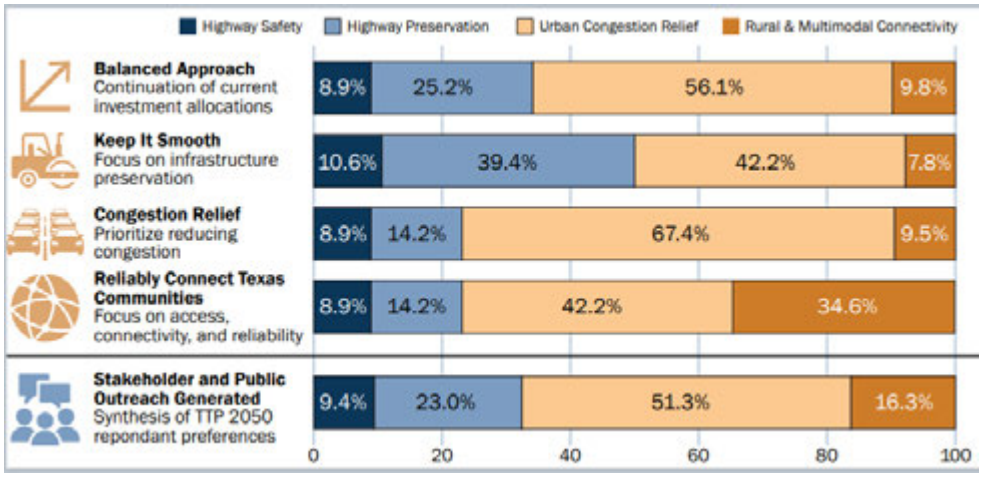
TxDOT Goal: Deliver the Right Projects

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

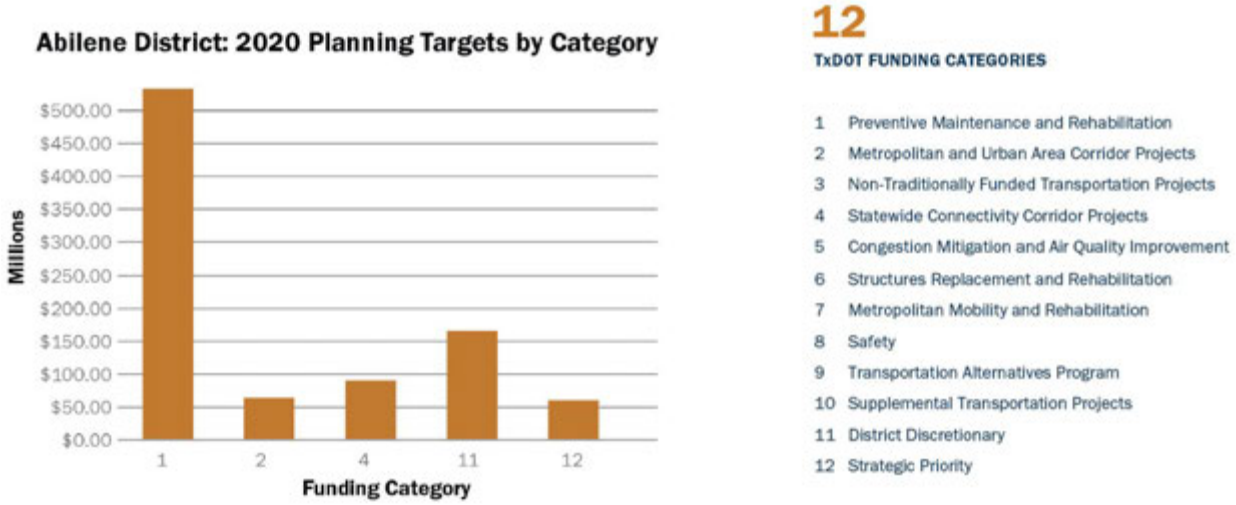
FHWA studies have shown that operational improvements to increase mobility without adding capacity typically have a higher benefit-cost ratio than infrastructure projects that build additional lane miles of capacity, especially when life-cycle costs are considered for both project types. With transportation demand growing, integrating TSMO into existing TxDOT Abilene 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 7 shows several potential investment scenarios for TxDOT over the next 30 years.[1]

Figure 7: 2050 Texas Transportation Plan Potential Funding Scenarios



The Texas 2020 Unified Transportation Program (UTP) established a planning target of $871,750,000 in project funding for the TxDOT Abilene District over the next 10 years.[2] The UTP also established a planning target of an additional $64,710,000 in project funding for the Abilene Metropolitan Planning Organization (MPO) over the next 10 years. Planning targets from the UTP for the TxDOT Abilene District are shown in Figure 8. Note that MPO target funding amounts are not included in this figure.

Figure 8: TxDOT Abilene District 10-Year Planning Targets by Category



Based on these planning targets, preventive maintenance and rehabilitation projects (Category 1), is the key investment area that the TxDOT Abilene District will prioritize over the next 10 years. The TxDOT Abilene District will also focus on metropolitan and urban area corridor projects (Category 2) and statewide connectivity corridor projects (Category 4). TSMO strategies can be applied to all investment areas, and especially to improvements that include preventive maintenance and rehabilitation projects. Several of the key projects related to these investment areas are:

- Improving the I-20/US 84 Interchange in Nolan County
- Constructing a US 83/FM 3034 Overpass in Jones County
- Constructing Super 2 along US 83 in Taylor County
- Widening I-20 to six lanes in Taylor County
- Constructing a US 83/US 84 Interchange in Taylor 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 TSMO program considerations in conventional construction, asset management techniques, upgrades to existing infrastructure, workforce resources, and other operational strategies.

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:

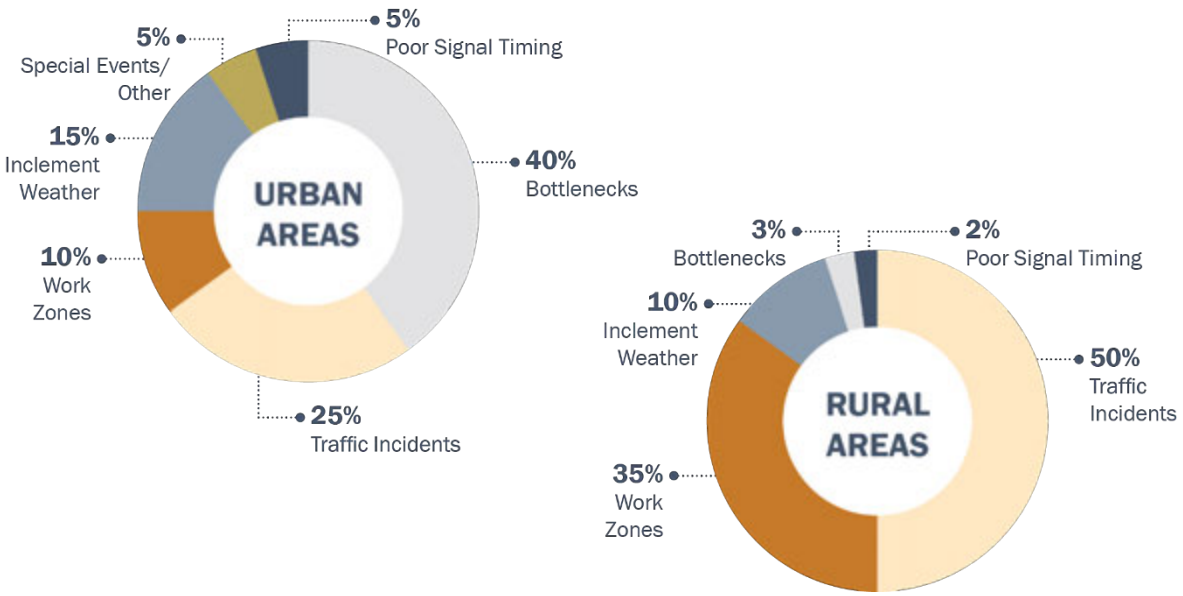
- Reduce congestion through both traditional and alternative strategies
- Enable reliable travel times
- Increase travel options/connections
- Ensure freight can move efficiently
- Increase access to jobs, services, and activity centers
- Leverage transportation assets to support economic growth and 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 Abilene District increased by 6.3 percent between the 2010 and 2020 census.[3] TDC projects that the population will continue to increase by approximately 12.4 percent over the next 20 years.[3] As annual vehicle miles traveled (VMT) continue to increase, congestion will worsen unless innovative, proactive actions are taken.

Many of the congestion impacts in other areas 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 9 for both urban and rural areas.[4]

Figure 9: Nationwide Causes of Congestion in Urban and Rural Areas (FHWA)



In 2020, the Texas Transportation Institute (TTI) estimated an annual total delay of approximately 1,456,437 passenger-hours along major thoroughfares within the Abilene District. This total is inclusive of an estimated annual freight vehicle delay of 73,966 driver-hours along those same major thoroughfares. Using Texas-specific user cost values, this congestion resulted in a societal cost of $31,998,708 within the TxDOT Abilene District in 2020.[5] It is likely that a majority of these impacts resulted from capacity-limiting events, rather than bottlenecks.

In 2020, Texas saw a 9.8 percent drop in total daily VMT compared to 2019 per the TxDOT Transportation Planning and Programming Division Roadway Inventory Data. Although there was a statewide drop in miles traveled and in many areas of the state there was also a drop in congestion, in the TxDOT Abilene District the 2020 TTI estimated annual total delay was higher than annual total delay from the 2019 dataset.

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 disruptions on the TxDOT Abilene 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 Abilene District revealed that the number of crashes experienced within the District follows the trends experienced nationwide. The total number of crashes in the District decreased by 568 between 2019 and 2020. This change matches the national trend of crash rates being reduced along with the significant decrease in traffic volume due to the impacts of COVID-19 in 2020. As traffic patterns began to return to normal in 2021, the crash rates rose as well, increasing by 11 percent or by 600 crashes from 2020 to 2021, ultimately exceeding the number of crashes in 2019 by 32. The increase in crashes between 2020 and 2021 lead to a $354,600,000 increase in estimated societal costs, year-over-year.

Crash 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 from the lack of congestion and therefore faster speeds. While the overall number of crashes increased as traffic volumes began to return to normal in 2021, the number of fatal crashes per year increased by 10 from 2019 to 2021.

In 2019, there were 6,068 reported crashes in the TxDOT Abilene District.[6] In those crashes, 66 people died and 268 people suffered an incapacitating injury. A summary of 2019 crashes in the TxDOT Abilene 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 $1,223,200,000 within the TxDOT Abilene District in 2019.[7]

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

	Fatal (K)	Serious Injury (A)	Minor Injury (B)	Possible Injury (C)	No Injury (O)	Unknown Severity
Total Crashes	60	203	748	918	3942	197
Total Persons Affected	66	268	1026	1530	11443	197
Inclement Weather Crashes Rain or Fog	4	13	57	63	398	10
Inclement Weather Crashes Winter Weather	0	5	4	7	32	3
Work Zone Crashes	2	10	25	32	156	0
Intersection Crashes	10	64	260	344	1108	0
Commercial Vehicle Crashes	21	32	86	68	491	0

In 2020, there were 5,500 reported crashes in the TxDOT Abilene District.[7] In those crashes, 76 people died and 198 people suffered an incapacitating injury. A summary of 2020 crashes in the TxDOT Abilene 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 $1,079,650,000 within the TxDOT Abilene District in 2020.[8]

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

	Fatal (K)	Serious Injury (A)	Minor Injury (B)	Possible Injury (C)	No Injury (O)	Unknown Severity
Total Crashes	64	165	682	773	3644	172
Total Persons Affected	76	198	909	1299	9787	172
Inclement Weather Crashes Rain or Fog	5					
Inclement Weather Crashes Winter Weather	1	4	7	9	178	2
Work Zone Crashes	1	1	25	23	138	0
Intersection Crashes	16	48	263	315	1067	0
Commercial Vehicle Crashes	15					

In 2021, there were 6,100 reported crashes in the TxDOT Abilene District.[7] In those crashes, 76 people died and 300 people suffered an incapacitating injury. A summary of 2021 crashes in the TxDOT Abilene 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 $1,434,250,000 within the TxDOT Abilene District in 2021.[8]

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

	Fatal (K)	Serious Injury (A)	Minor Injury (B)	Possible Injury (C)	No Injury (O)	Unknown Severity
Total Crashes	70	244	838	851	3939	158
Total Persons Affected	76	300	1157	1475	11275	158
Inclement Weather Crashes Rain or Fog	3	14	53	51	306	10
Inclement Weather Crashes Winter Weather	0	5	13	14	104	2
Work Zone Crashes	6	14	34	29	200	2
Intersection Crashes	15	60	329	355	1145	14
Commercial Vehicle Crashes	25	37	78	56	517	3

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.

The Value of Mainstreaming TSMO

The business case for TSMO is grounded in the fact that funding for the TxDOT Abilene 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 better 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 statewide goals of optimizing system performance and promoting safety.

TSMO Vision, Mission, Goals, and Objectives

The TxDOT Abilene 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.

Abilene District TSMO Goals and Objectives

The goals and objectives for the TxDOT Abilene District TSMO Program Plan are identified below, in Table 4. District project leadership chose to adopt the TxDOT statewide TSMO goals and objectives.

Table 4: TxDOT Abilene 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.

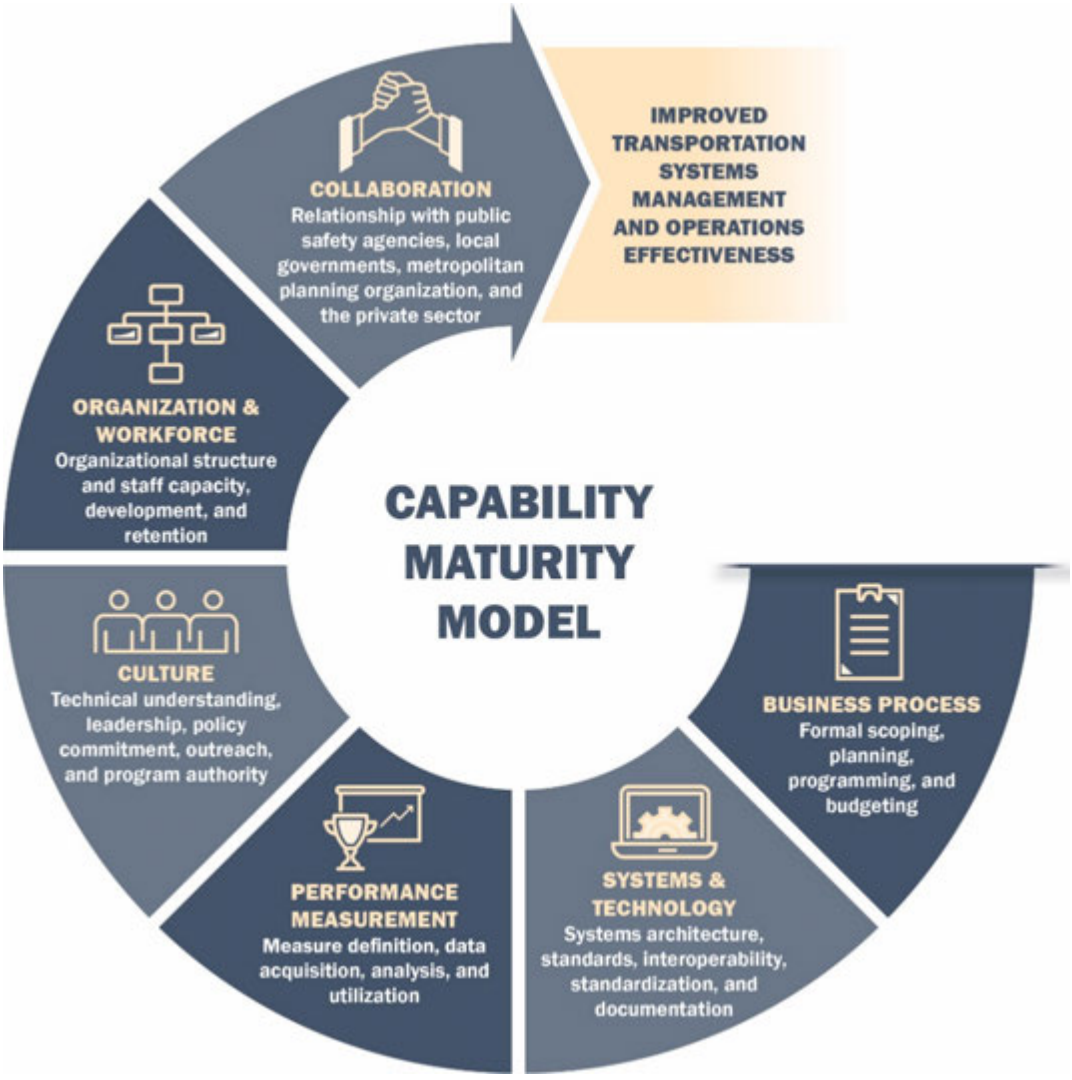
Capability Maturity Model

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 Abilene 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, and there are established performance measures and activities which 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 Abilene District during four stakeholder meetings: one internal meeting with only TxDOT staff held in September 2021, two stakeholder outreach workshops with both TxDOT and partner agency staff held in December 2021 and March 2022, and one individual stakeholder interview with the City of Abilene held in January 2022. The September internal TxDOT meeting and the interview with the City of Abilene were conducted virtually via Microsoft Teams. The two stakeholder outreach workshops were held in person in the training room at the TxDOT Abilene District office. The interview with the City of Abilene focused on capabilities in the major city within the TxDOT Abilene District, while the stakeholder outreach workshops discussed the capabilities throughout the District overall. Figure 12 shows where the TxDOT Abilene 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.

Figure 12: TxDOT Abilene District CMM Assessment

Overall Capabilities				
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		●		

District stakeholders met for the Stakeholder Action Item Workshop on March 23, 2022 to walk through four different scenarios to determine the District's current processes for addressing specific events that impact traffic conditions and operations. Through those exercises, workshop attendees identified action items that would allow the TxDOT Abilene District to advance one level in the CMM assessment for each capability dimension within a given TSMO focus area.

The four scenarios discussed during the Stakeholder Action Item Workshop were designed to walk attendees through how the TxDOT Abilene District currently prepares for an event, how District staff respond and manage traffic during the event, and what the District does once the event is over. The first three scenarios covered specific TSMO focus areas, while the last scenario outlined daily District operations when no major event with significant traffic impacts occurs, to identify general traffic management action items and traffic signal related action items that could support the other focus areas as well.

The first scenario discussed was a major multi-vehicle traffic incident on I-20 at Old Anson Road, identified as a suspected serious injury crash which caused traffic to be diverted onto the frontage roads and caused queues on I-20 to form beyond the US 277 interchange. Talking through this scenario helped identify action items to support the TIM focus area. The second scenario involved a major construction project along I-20 at East Ambler Avenue which required overnight full-freeway closures on the weekend. This scenario's discussion assisted with identifying action items to support the WZM focus area.

The third scenario covered both a recent severe weather event and a recent winter weather event. The severe weather event was a storm that brought heavy rainfall, light hail, and heavy winds and caused flooding in Taylor County in the fall of 2021. The winter weather event was a storm that occurred in February 2022 which resulted in ice and snow accumulating on roadways throughout the TxDOT Abilene District.

Input from all the stakeholder and District staff meetings and workshops 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 Abilene District.

Traffic Incident Management District Assessment

Traffic Incident Management (TIM) involves the TxDOT Abilene 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 Abilene District generally performs TIM activities on an ad hoc basis. As of April 2022, no formal TIM program exists, funding is not allocated for TIM activities, and there is no formalized process for conducting after-action reviews for traffic incidents with partner agencies. Figure 13 shows where the District ranked itself for each of the TSMO capabilities regarding TIM.

The TxDOT Abilene District typically receives notification of traffic incidents from the Texas Department of Public Safety (DPS) or the local police department. DPS usually has control of the traffic incident scene when

TxDOT staff show up. TxDOT often provides traffic control for incidents while law enforcement investigates the crash and provides assistance with debris clearance. For more major incidents, TxDOT occasionally moves the incident onto the shoulder in order to open main lanes faster, then works on clearing the incident and cleaning up debris from the shoulder.

Figure 13: TxDOT Abilene 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		●		

The TxDOT Abilene District staff have a rotating 24-hour on-call list for responding to traffic incidents. When TxDOT is notified of an incident, the designated on-call TxDOT staff goes straight to the incident to identify what traffic control and response equipment is needed. The on-call staff drive a TxDOT truck with a message board home so they can go directly to any incident that occurs after-hours and set up basic traffic control.

The District does not have incident response equipment stationed at locations that frequently experience crashes. However, the TxDOT Abilene District is broken into 13 counties that each have a trailer ready with traffic control and incident response equipment, such as DMS, truck mounted attenuators (TMAs), and cones at the county offices. These trailers are located in the maintenance section yards of each county, which have good access to highway facilities.

The TxDOT Abilene District currently does not collect any TIM-related performance measures, such as roadway clearance time, incident clearance time, 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. TxDOT staff noted that TxDOT typically only receives notification of a traffic incident if assistance with traffic control or debris clearance is needed. Therefore, it is difficult for staff to determine locations that frequently experience crashes and what the causes of incidents are. The District self-identified the need to be able to track incident information and

crash hotspots to identify common incident types and profiles. This may be improved with more consistent notification of traffic incidents, as well as the addition of CCTV cameras to monitor incidents.

Other TxDOT districts often use CCTV cameras or a traffic management center (TMC) to watch camera feeds to detect, verify, and monitor traffic incidents, but the TxDOT Abilene District does not currently have a TMC and its existing infrastructure does not include CCTV cameras. In 2021, the TxDOT Abilene District completed an ITS Master Plan that identified priority ITS devices, such as CCTV cameras and DMS units, and potential locations for device implementation. CCTV cameras would allow TxDOT Abilene District staff to detect, verify, and notify first responders of traffic incidents faster, reducing response times, as well as improving TIM data collection capabilities.

The TxDOT Abilene District currently conducts after-action reviews informally and internally after major traffic incidents. There is not a formal agenda for these reviews, but TxDOT staff discuss what worked well and what needs improvement regarding TxDOT's response. While the TxDOT Abilene District does not conduct after-action reviews on a regular basis and funding is currently limited, stakeholders and District staff identified that the creation of a formalized TIM Team would be beneficial. A TIM Team could meet consistently and include all of the TxDOT Abilene District's partner agencies to discuss TIM-related regional priorities, assist with coordination among local agencies during traffic incidents, and conduct after-action reviews, which would improve incident response and overall traffic operations.

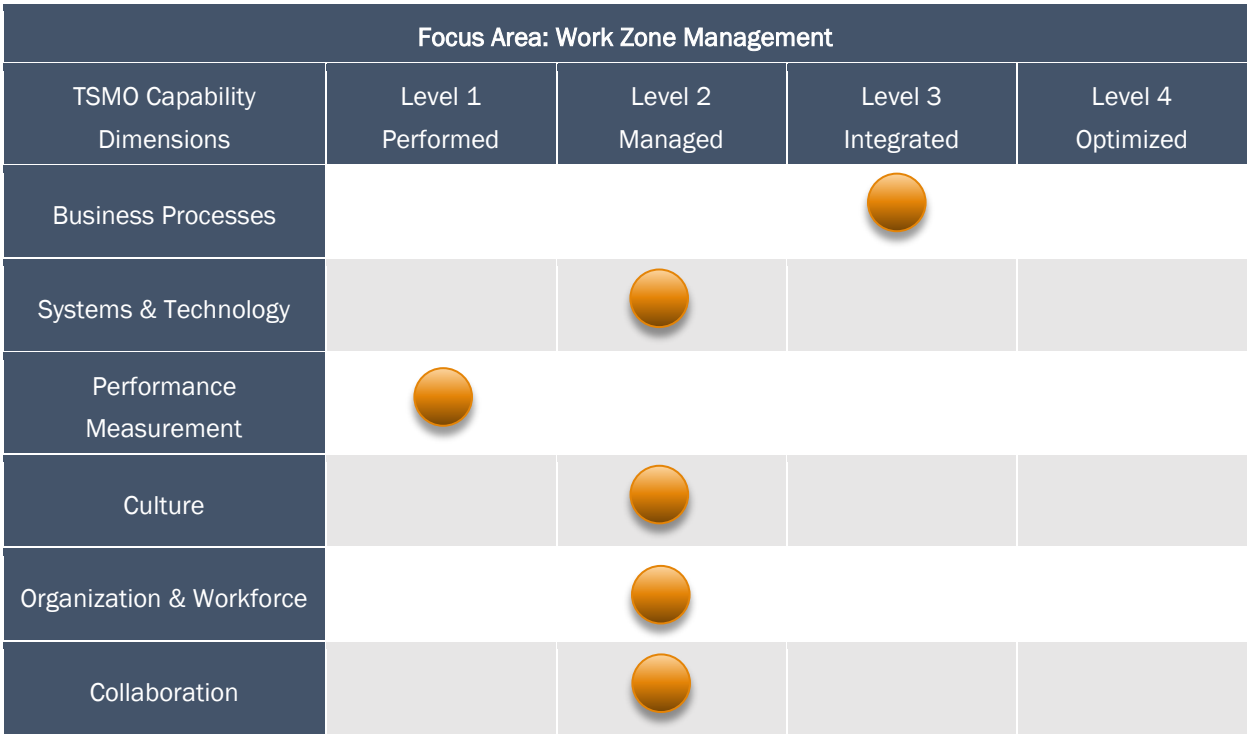
The City of Abilene also currently has very minimal camera coverage. 20 CCTV cameras are currently deployed at intersections and connect back to the City. These cameras do not record video but do allow City staff the ability to monitor traffic signals and traffic conditions in real time. City cameras are monitored on an as-needed basis during business hours. At this time, the City is working on internal camera sharing agreements, but is not opposed to sharing camera access with TxDOT. TxDOT staff noted that they would like to provide the City with access to the TxDOT Abilene District's camera feeds, once the first phase of the ITS Master Plan deployment is completed.

The TxDOT Abilene District has provided incident response training to first responders, tow truck companies, and heavy wrecker companies in the past. However, there is a need for regular multidisciplinary trainings to maintain 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. The District's Traffic Safety Specialist held a TIM responder training in May 2022 for all TIM disciplines, including communications, emergency management, law enforcement, towing companies, and public works. The Traffic Safety Specialist is currently working on establishing the training as reoccurring and held a second TIM responder training In June 2022.

Work Zone Management District Assessment

Work Zone Management (WZM) involves the TxDOT Abilene 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 Abilene District CMM Assessment for Work Zone Management



Currently, the TxDOT Abilene District coordinates construction projects internally and involves external stakeholders in the planning phase of major projects on an ad hoc basis. While pre-construction meeting invitations are extended to local municipalities when large projects are planned, external stakeholders are not regularly included in discussions about more granular TxDOT project details, such as routine maintenance or striping work. First responders are not usually involved in the preconstruction meetings and do not receive direct project updates, but they do receive the Public Information Office (PIO) press releases before major projects start. The District self-identified the need to improve outreach to contractors and affected businesses earlier in its work zone and construction planning process.

The District PIO communicates with the public by disseminating information regarding closures via newspapers, social media, such as Twitter and Facebook, and DriveTexas.org. The PIO also provides information regarding more granular project details and last-minute maintenance projects via updates on social media and DriveTexas.org. District staff and stakeholders pointed out that not all travelers utilize these information platforms, particularly DriveTexas.org. District staff expressed concern about the accuracy of the information provided on third-party applications due to a recent falsely reported closure that caused significant congestion and safety issues. However, because the public tends to rely on third-party applications for route selection and travel updates, there is opportunity for coordination with third-party applications to distribute real-time traveler information related to work zones directly to travelers in the area and a need to ensure the third-party applications are providing the correct information. The District also self-identified the need to increase awareness of DriveTexas.org and the information it has to offer travelers.

The TxDOT Abilene District does not collect WZM performance measurement data and does not consistently deploy Smart Work Zone (SWZ) technologies that help with WZM. The only SWZ devices the district currently deploys are queue detection and warning systems. Due to the high cost of device deployment, queue detection is only considered for major construction projects along tier 1 facilities, such as I-20 and US 84. District staff and stakeholders noted that queues often back up past the SWZ units. Construction contracts include contingency funds to hire law enforcement to assist with managing and drawing driver attention to these queues. However, when law enforcement is used drivers will slow down when they see an officer, speed back up once they have passed the officer, and slow down again when they arrive at the queue warning sign or start of the work zone. This results in the formation of two queues, one at the positioned officer and one at the work zone, creating unsafe driving conditions.

The City of Abilene, the Abilene MPO, and TxDOT Abilene District currently meet on a regular basis to talk about current and upcoming construction projects. The TxDOT Abilene District is working on establishing quarterly meetings with partner agencies to discuss and coordinate upcoming roadway construction projects. These meetings do not typically review recent projects and work zone successes and challenges to establish regional knowledge of lessons learned, best practices, and other work zone guidance from across the TxDOT Abilene District and state.

Road Weather Management District Assessment

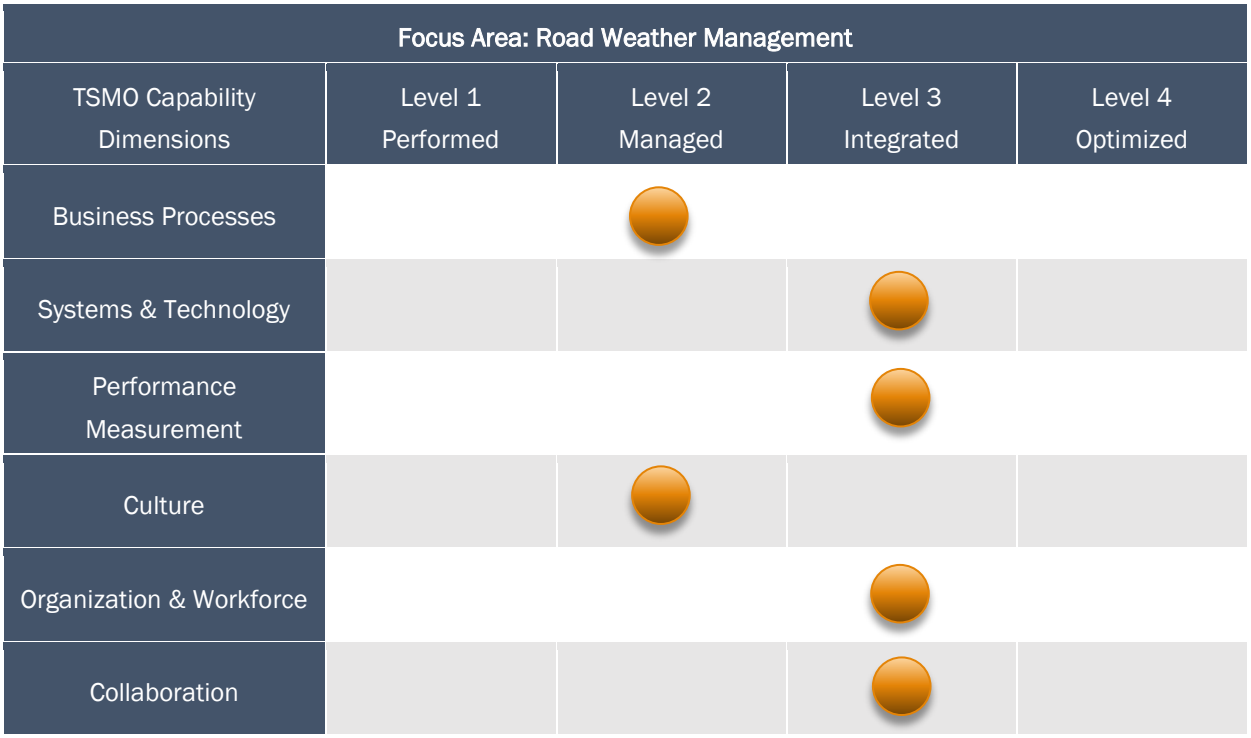
Road Weather Management (RWM) involves the TxDOT Abilene District and partner agency response to anticipated major weather events. The existing TxDOT staff who respond to winter weather events are the same as those that respond to summer weather issues, such as flooding. The District does not currently have funding allocated specifically for weather-related maintenance activities nor does it collect weather-related data. However, a few of the TxDOT maintenance supervisor trucks have ice detection and road surface sensors, which are being tested on the District's snowplows. Figure 15 shows where the District ranked itself for each of the TSMO capabilities regarding RWM.

If a severe weather event is predicted to occur within the TxDOT Abilene District, a systemwide alert is sent out via email and text. The National Weather Service (NWS) provides general broadcast information directly to the City of Abilene and TxDOT. Dyess Air Force Base also disseminates weather conditions information to the local agencies in the area, aiding in advanced notification of potential severe weather events. However, the TxDOT Abilene District's weather is very localized, varying greatly depending where one is in the District. Therefore, the City of Abilene and TxDOT rely more on their staff in the field to report local weather conditions back to the offices.

In the TxDOT Abilene District, communication of road conditions, road winter weather pretreatment activities, and closures and detours due to severe weather events currently occurs by the District's maintenance staff reporting water on the road or where the road surface is slick due to ice to the PIO, who relays the information to the public via press releases, social media platforms, and other existing communication channels, such as DriveTexas.org. The District also occasionally provides updates on severe weather events along roads via portable DMS units deployed by TxDOT staff that can be controlled remotely. The District self-identified the

need to increase awareness of DriveTexas.org and the information it has to offer because DriveTexas.org is not widely used by the public for traveler information.

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



Like work zone information dissemination efforts, severe weather events provide an opportunity for coordination with third-party applications to distribute real-time weather-related traveler information directly to travelers within the TxDOT Abilene District. District staff noted that during a recent ice storm, TxDOT worked hard to get I-20 open and succeeded at about 10 pm, but third-party applications were indicating that the road was going to be closed until 8 am the next day. Although the roadway was cleared, vehicles pulled over to park at a rest area ahead of the nonexistent closure location instead of continuing to use the road. This resulted in the rest area filling up, vehicles parking along the shoulders, and eventually blocking the main lanes. Trucks that had parked on an uphill grade then had issues getting going again. TxDOT staff are now concerned about commercial vehicle drivers and the public relying on these third-party mapping applications. Because the public does tend to rely on this source of information, there is a need for TxDOT to ensure the third-party applications are providing accurate information.

The TxDOT Abilene District handles weather-related road closures on an ad hoc basis. Currently, maintenance staff must go out to assess the need for traffic control and manually close flooded or icy roads by placing signage and barricades. 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. Within the City of Abilene, there are a few low points that flood consistently where permanent road closure gates have been installed. However, District staff and stakeholders agreed that flood detection and warning systems or automated closure devices may be beneficial because staff receive reports of flooding, but by the time maintenance arrives, the water is

often already gone. Staff also expressed frustration with constantly driving back and forth to place and remove barricades or open and close gates as water levels frequently fluctuate.

District staff identified the spillway from Fort Phantom on FM 1082 as a priority location that consistently experiences flooding. Travelers are usually unaware of the flooding until they reach the spillway and then must backtrack several miles to find a detour. Stakeholders mentioned that the majority of the locations where flooding, fog, or dust is an issue are rural roads where the local public already knows when they will need to find an alternate route, depending on the weather. Local residents also know that during heavy rains many roads temporarily flood because the water runs across the road as it flows into creeks since the area is flat.

Planned Special Events District Assessment

Planned Special Event (PSE) management involves the TxDOT Abilene District and partner agency response to preplanned special events, like local holiday events or major sporting events. Regularly occurring special events are typically handled at the local level, with the city or event planner responsible for managing the detour route. The TxDOT Abilene District typically is not centrally involved in special event operations. 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. Figure 16 shows where the District ranked itself for each of the TSMO capabilities regarding PSE management.

Figure 16: TxDOT Abilene 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 Abilene District does not have regularly occurring large special events, and the events that do occur generally have short durations. TxDOT staff identified a few bicycle races, a clothing and food drive, rodeos,

and college sporting events as the major special events in the District. However, stakeholders agreed that the colleges in the area are small enough that their planned special events do not cause traffic concerns. Therefore, the TxDOT Abilene 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.

The TxDOT Abilene District has identified a 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 work zone and road weather information dissemination efforts, this provides an opportunity for coordination with third-party 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 PSE activities, should they arise. For example, maintaining a District special events calendar or conducting planning meetings or after-action reviews focused on traffic operations surrounding special events can improve District readiness.

Traffic Signal Management District Assessment

Traffic Signal Management (TSM) involves the TxDOT Abilene District management of its traffic signal system. Since communication technology on traffic signals is not yet deployed consistently throughout the region and camera coverage is minimal, 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. Figure 17 shows where the District ranked itself for each of the TSMO capabilities regarding TSM.

The TxDOT Abilene District manages a little over 60 traffic signals, including all signals within the District boundary that are not within the City of Abilene. Therefore, District staff meet on a quarterly basis with the City of Abilene to discuss a variety of topics, including traffic signal coordination. TxDOT Abilene District staff also have good working relations with the City of Abilene during the design phase of new traffic signals to confirm that the City's new signals follow TxDOT guidelines and include the correct TxDOT specifications in the construction plans, as well as to ensure TxDOT is incorporating the City's preferred signal technologies and equipment. This collaboration establishes consistency between the two agencies' traffic signal systems and eases the transition when signals built by TxDOT within city limits are taken over by the City of Abilene.

The majority of the TxDOT Abilene District's traffic signals have cell modems for communication. At the time the State of the Practice report was developed, no signals had CCTV cameras installed although there are plans to add CCTV cameras to six signalized intersections in the next year. The current lack of CCTV camera coverage of TxDOT traffic signals limits signal technicians' ability to troubleshoot in advance of crews arriving on site to address a reported traffic signal issue. 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 visually monitor signals in real-time. The District is installing video detection in all of its new traffic signals, however staff noted that the video detection

is not as helpful as CCTV cameras for viewing traffic conditions at intersections and along heavy volume corridors. Therefore, the TxDOT Abilene District self-identified the need to prioritize the identification of key locations for the deployment of additional CCTV cameras and to follow through with the deployments.

Figure 17: TxDOT Abilene 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		●		

The TxDOT Abilene District currently considers deploying battery backup units when new or replacement TxDOT traffic signals are installed. The need for battery backup units and deployment prioritization is based on factors such as the impact a signal's outage would have on systemwide traffic operations and the history of power reliability at the location. The City of Abilene is working on deploying battery backup units at all of its traffic signal locations, new and existing. The TxDOT Abilene District and City of Abilene TSM capabilities also differ in that the City of Abilene has emergency preemption technology deployed at some of the City maintained traffic signals and the TxDOT Abilene District does not have any deployed at its signals. However, District staff noted that it has not received a formal request from emergency responders to implement emergency preemption at TxDOT traffic signals and therefore does not have plans to do so in the foreseeable future.

General Traffic Management District Assessment

General Traffic Management involves the TxDOT Abilene District management of traffic conditions throughout the region. The TxDOT Abilene 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 Abilene 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 TxDOT Abilene District has six DMS units; two deployed along I-20 to the east and west of the City of Abilene, one on US 83/US 277 north of the City of Abilene, two on US 83/US 84 south of the City of Abilene, and one on US 84 south of the City of Snyder. In 2021, the District completed an ITS Master Plan that identified priority locations for ITS devices, including CCTV cameras and DMS units along key corridors throughout the District. Because the TxDOT Abilene District will not have a 24-hour TMC for the foreseeable future, District staff noted the need for developing a plan for operating and monitoring ITS devices once Phase 1 of the ITS Master Plan is deployed.

CCTV cameras will allow TxDOT Abilene District staff to detect, verify, and notify first responders of traffic incidents faster, reducing response times and improving TIM data collection capabilities. CCTV cameras will also enable District signal technicians to remotely visualize traffic signals in real time to troubleshoot reported issues, as well as provide District staff with the ability to monitor work zones, road weather conditions, and overall traffic conditions.

The District wants to make the most of its existing DMS units, as well as the additional DMS recommended in the ITS Master Plan. DMS allow TxDOT Abilene District staff to post traveler information regarding traffic

incidents, work zones, road weather conditions, and special events to warn drivers of potential congestion or hazards. District staff expressed interest in improving the process for updating DMS to provide more useful information to travelers, by creating template messages to fill out or a list of standard messages to post.

The TxDOT Abilene District currently does not collect or track general traffic management data such as travel time reliability along roadways in the District, and most local agencies do not have the resources to easily measure transportation network performance. Cities in the region have little to no traffic camera coverage; 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.

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. District staff and the City of Abilene expressed interest in receiving notification when these oversize and over-height vehicles are coming through the District and City in advance so staff can plan accordingly and ensure the large vehicles take the best route.

The TxDOT Abilene District and its stakeholders emphasized the need to increase the public's awareness of DriveTexas.org. The traveling public currently relies on third-party applications for traveler information instead of utilizing DriveTexas.org. However, as discussed in previous focus areas, the District recently had issues with third-party applications disseminating incorrect closure information during a severe winter weather event which resulted in significant congestion and major safety concerns. District staff noted that the use of DriveTexas.org is a statewide issue and requires more advertisement throughout the state.

TSMO Implementation Plan

This section summarizes the 25 recommended action items for advancing TSMO in the TxDOT Abilene District over the next five years. Its contents are based on the existing strengths and needs that the Abilene District and regional stakeholders identified over the course of the TSMO Plan's development. The Implementation Plan is shown in Table 5 through Table 10, and in the schedule on the following pages shown in Figure 19. Action items in Table 5 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 5 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 Abilene 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 Abilene 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 5: TxDOT Abilene 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					Integration					
BP 01	**Conduct Multi-Agency After-Action Reviews for Major Incidents**: Establish criteria for determining which incidents require after-action reviews and conduct reviews with partner agencies as needed.	39	District Director of Operations		✓	✓		✓	✓	TxDOT Statewide TIM Coordinator, ABL Area Engineers, ABL Operations, Local Transportation Agencies, Local Public Safety Agencies	$			ST-01, PM-01, OW-01, CO-01
BP 02	**Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidance:** Adapt TxDOT's existing Smart Work Zone guidance and deployment decision tool when determining which work zone ITS technologies to use for District construction projects.	40	District Director of Construction		✓		✓	✓		TxDOT Traffic Safety Division, ABL Construction, ABL Operations, ABL Area Engineers	$			BP-03, BP-07, ST-02, ST-03, ST-09, CU-01, OW-02
BP 03	**Develop Standard Contract Language for Smart Work Zone Equipment:** Develop standard contract language for the use of Smart Work Zone equipment and enforcement of contract language. The language should be developed in accordance with the TxDOT Smart Work Zone			✓	✓		✓		✓		$			
BP 04	**Develop Alternate Route Plans for Diverting Traffic During Flooding:** Develop guidelines for managing traffic during flood events on state routes where flooding occurs most frequently.	42	District Director of Operations	✓	✓	✓	✓			ABL Operations, ABL Maintenance, ABL Area Engineers, Local Transportation Agencies	$			BP-05, BP-07, ST-05, ST-08, CU-02
BP 05	**Develop Method for Evaluating Corridor Signal Timings:** Develop a proactive method for evaluating and retiming signals along corridors to	43	District Signal Shop Manager	✓	✓	✓			✓	ABL Operations, ABL Signal Shop, ABL Maintenance	$			BP-04, ST-07, PM-02
BP 06	**Develop a System for Accessing TxDMV Issued Over-Height/Oversize Permits:** Develop a system that allows TxDOT and local agencies access to over-height/oversize vehicle permits that have been issued by the TxDMV. *Note: This action item would be led by the TxDMV, but could be developed with support from TxDOT TRF.*	44	TxDMV		✓	✓		✓		TxDOT Traffic Safety Division, ABL Operations, ABL Maintenance, Local Transportation Agencies	$			ST-11
BP 07	**Establish Standard Protocol for Use of DMS:** Develop protocol for when to post and what messages to post on DMS for disseminating information to the traveling public. Develop standard message			✓	✓	✓	✓				$			

Table 6: TxDOT Abilene 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					Integration					
ST 01	**Improve Regional Video Sharing Capabilities:** Use cloud-based technology platforms for sharing access to CCTV camera video feeds with City of Abilene Engineering, City of Abilene Police, City of	47	District Director of Operations		✓		✓	✓		ABL Operations, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies	$			BP-01, ST-09, ST-10, PM-01, OW-02, CO-01
ST 02	**Deploy Work Zone Technology:** Deploy work zone technology throughout the District to support improved work zone monitoring, localized real-time traveler information, and end of queue warning.	48	District Director of Construction	✓		✓	✓	✓	✓	ABL Construction, ABL Operations, ABL Area Engineers, TxDOT Construction Division, Contractors	$$			BP-02, BP-03, BP-07, ST-03, ST-09, ST-10, OW-02
ST 03	**Integrate Smart Work Zone System with Permanent DMS:** Integrate Smart Work Zone System information, including queue detection			✓	✓	✓		✓	✓		$			
ST 04	**Provide Work Zone Closure Information Through Third-Party Apps:** Partner with third-party navigation apps to ensure accurate, TxDOT District approved, work zone closure information is displayed for travelers.	50	District Public Information Officer		✓		✓	✓	✓	Private Third-Party Providers, ABL Public Information Office, ABL Operations, ABL Construction	$			ST-06, CU-02
ST 05	**Deploy Flood Detection, Warning, and Closure Devices:** Implement technology for flood detection, warning, and automated road	51	District Director of Operations	✓			✓		✓	ABL Operations, ABL Maintenance, ABL Area Engineers	$$			BP-04, ST-09, ST-10, OW-02
ST 06	**Share Event-Related Road Impacts with Third-Party Apps:** Partner with third-party navigation apps to provide accurate, TxDOT District approved, special event-related closure and routing information for travelers.	52	District Public Information Officer		✓		✓	✓	✓	Private Third-Party Providers, ABL Public Information Office, ABL Operations, Event Organizers	$			ST-04, CU-02
ST 07	**Plan and Implement Surveillance Technology for Signals:** Identify implementation priority for cameras and necessary software enhancement to allow remote surveillance of District traffic signals			✓	✓	✓		✓	✓		$$$			
ST 08	**Improve Communications Link to Signals:** Upgrade communications capabilities at TxDOT traffic signal locations to improve ability to monitor and respond to conflicts, outages, and other signal issues.	54	District Traffic Engineer	✓	✓	✓			✓	ABL Operations, ABL Maintenance, ABL Area Engineers	$$			BP-04, ST-07, ST-09, OW-02
ST 09	**Implement ITS Field Devices Identified in the ITS Master Plan Phase 1:** Deploy ITS infrastructure identified in Phase 1 of the TxDOT Abilene District ITS Master Plan to support improved traffic management and operations in the District.			✓	✓	✓	✓		✓		$$			

(Table continued on next page.)

Action No.	Systems & Technology (ST) Action Item Descriptions *(Continued)*	Program Plan Page #	Action Lead	Supports District TSMO Goals: Safety					Integration	Partners	Cost	Effort	TSMO Focus Area	Related Action Items
ST 10	**Implement ITS Field Devices Identified in the ITS Master Plan Phase 2:** Once Phase 1 of the TxDOT Abilene District ITS Master Plan is complete and operational, prioritize and deploy ITS infrastructure identified in Phase 2 to further support improved traffic management and operations in the District.	56	District Traffic Engineer	✓	✓	✓	✓		✓	ABL Area Engineers, ABL Transportation Planning & Development, ABL Operations, ABL Construction, Local Transportation Agencies	$$			ST-01, ST-02, ST-03, ST-05, ST-07, ST-09, ST-11
ST 11	**Implement Dynamic Truck Parking Signage:** Implement truck parking availability signage with dynamic information in advance of						✓		✓		$$			

Table 7: TxDOT Abilene District TSMO Implementation Plan for Performance Measurement

Action No.	Performance Measurement (PM) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals: Safety					Integration	Partners	Cost	Effort	TSMO Focus Area	Related Action Items
PM 01	**Improve TIM Data Collection:** 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 TRF and their efforts to improve TIM data within CRIS on a statewide basis.*	59	District Director of Operations	✓	✓			✓	✓	TxDOT Traffic Safety Division, ABL Operations, Texas DPS, Local Public Safety Agencies, Local Law Enforcement	$			BP-01, ST-01, ST-09, OW-01, CO-01
PM 02	**Develop and Implement Automated Traffic Signal Performance Measures:** Develop a formal program and implement necessary technology and software to support Automated Traffic Signal Performance Measures operations on key District corridors.				✓	✓			✓		$$$			

Table 8: TxDOT Abilene District TSMO Implementation Plan for Culture

Action No.	Culture (CU) Action Item Descriptions	Program Plan Page #	Action Lead	Supports District TSMO Goals: Safety					Integration	Partners	Cost	Effort	TSMO Focus Area	Related Action Items
CU 01	**Increase Public Outreach for Work Zone Safety:** Increase public outreach and education to promote reduced speeds and improve safety in work zones.	62	District Public Information Officer	✓					✓	TxDOT Traffic Safety Division, ABL Public Information Office, Texas DPS, Local Public Safety Agencies	$			BP-02, CU-02
CU 02	**Increase Awareness of Information Available on DriveTexas.org:** Increase public awareness of DriveTexas.org to increase dissemination of WZM, RWM, and PSE information.				✓		✓		✓		$			

Table 9: TxDOT Abilene 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					Integration					
OW 01	**Establish Regional Multidisciplinary TIM Training:** Partner with the TxDOT Statewide Traffic Incident Management Coordinator to provide TIM multidisciplinary trainings and Train the Trainer programs to TxDOT staff and interested parties.	65	District Traffic Safety Specialist	✓	✓		✓	✓	✓	TxDOT Statewide TIM Coordinator, ABL Maintenance, ABL Operations, Texas DPS, Local Transportation Agencies, Local Public Safety Agencies	$			BP-01, PM-01, CO-01
OW 02	**Develop Standard Operating Procedures for District ITS Device Use:** Develop a set of standard operating procedures for the operation of ITS devices identified in Phase 1 of the District ITS					✓			✓		$			

Table 10: TxDOT Abilene 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					Integration					
CO 01	Team that meets regularly and includes all relevant jurisdictions and roles. Participants to include TxDOT, DPS, and municipal public safety and traffic representatives.	68	District Traffic Safety Specialist	✓	✓	✓	✓	✓	✓	Area Engineers, ABL Operations, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies	$			BP-01, ST-01, PM-01, OW-01

Figure 19: TxDOT Abilene District TSMO Implementation Schedule

Task Name	2022	2023		2024		2025		2026		2027
	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1
BUSINESS PROCESSES										
BP-01: Conduct Multi-Agency After-Action Reviews for Major Incidents										*Ongoing*
BP-02: Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidance										
BP-03: Develop Standard Contract Language for Smart Work Zone Equipment										
BP-04: Develop Alternate Route Plans for Diverting Traffic During Flooding										
BP-05: Develop Method for Evaluating Corridor Signal Timings										
BP-06: Develop a System for Accessing TxDMV Issued Over-Height/Oversize Permits										
BP-07: Establish Standard Protocol for Use of DMS										
SYSTEMS & TECHNOLOGY										
ST-01: Improve Regional Data and Video Sharing Capabilities										
ST-02: Deploy Work Zone Technology										
ST-03: Integrate Smart Work Zone System with Permanent DMS										
ST-04: Provide Work Zone Closure Information Through Third-Party Apps										*Ongoing*
ST-05: Deploy Flood Detection, Warning, and Closure Devices										
ST-06: Share Event-Related Road Impacts with Third-Party Apps										*Ongoing*
ST-07: Plan and Implement Surveillance Technology for Signals										
ST-08: Improve Communications Link to Signals										
ST-09: Implement ITS Field Devices Identified in the ITS Master Plan Phase 1										
ST-10: Implement ITS Field Devices Identified in the ITS Master Plan Phase 2										*Ongoing*
ST-11: Implement Dynamic Truck Parking Signage										
PERFORMANCE MEASUREMENT										
PM-01: Improve TIM Data Collection										
PM-02: Develop and Implement Automated Traffic Signal Performance Measures										
CULTURE										
CU-01: Increase Public Outreach for Work Zone Safety										
CU-02: Increase Awareness of Information Available on DriveTexas.org										
ORGANIZATION & WORKFORCE										
OW-01: Establish Regional Multidisciplinary TIM Training										*Ongoing*
OW-02: Develop Standard Operating Procedures for District ITS Device Use										
COLLABORATION										
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 Abilene District.

Table 11: TxDOT Abilene District TSMO Recommended Action Items – Business Processes

CMM Capability Dimension	Action Item Number	Action Item Description
Business Processes	BP-01	**Conduct Multi-Agency After-Action Reviews for Major Incidents**
	BP-02	**Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidance**
	BP-03	
	BP-04	**Develop Alternate Route Plans for Diverting Traffic During Flooding**
	BP-05	
	BP-06	**Develop a System for Accessing TxDMV Issued Over-Height/Oversize Permits**
	BP-07	**Establish Standard Protocol for Use of DMS**

BP-01: Conduct Multi-Agency After-Action Reviews for Major Incidents

Focus Area:
Traffic Incident Management

Action Item Lead:
District Director of Operations

Partners:
TxDOT Statewide TIM Coordinator, ABL Area Engineers, ABL Operations, Local Transportation Agencies, 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 with partner agencies as needed.

Need: The TxDOT Abilene District currently does not conduct after-action reviews (AARs) on a regular basis. When the District conducts internal AARs for major traffic incidents, they do not follow a formal agenda and focus on what worked well and what needs improvement in TxDOT's response. Stakeholders and District staff identified that the creation of a formalized TIM Team to assist with coordination among agencies and conduct AARs could improve incident response and overall traffic operations. Collaboration can be a challenge, but establishing a process for consistently conducting AARs can address many of the difficulties by structuring procedures following traffic incidents and identifying areas of improvement when the TIM process did not go as planned.

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 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 opportunity to collaboratively revisit incidents that provided challenges in scene management.

Resources: The TxDOT After Action Report is included in Appendix C.

BP-02: 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, ABL Construction, ABL Operations, ABL Area Engineers

Goals Addressed:

Safety	
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	

Objective: Adapt TxDOT's existing Smart Work Zone guidance and deployment decision tool when determining which work zone ITS technologies to use for District construction projects.

Need: The only Smart Work Zone (SWZ) technologies that the TxDOT Abilene District currently deploys are queue detection and warning systems. Due to the high cost of device deployment, queue detection is only considered for major construction projects along tier 1 facilities. Because queues often back up past the SWZ units, construction contracts typically include contingency funds to hire law enforcement to assist with managing and drawing driver attention to these queues. However, when law enforcement is used drivers will slow down when they see an officer, speed back up once they have passed the officer, and slow down again when they arrive at the queue warning sign or start of the work zone. This behavior often results in two separate queues, creating unsafe driving conditions.

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 specification development and letting process (see Action Item BP-03). 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 remain functional 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-03: Develop Standard Contract Language for Smart Work Zone Equipment

Focus Area:
Work Zone Management

Action Item Lead:
District Director of Construction

Partners:
ABL Construction, ABL Operations, ABL Area Engineers, Contractors

Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	
Integration	✓

Objective: Develop standard contract language for the use of Smart Work Zone (SWZ) equipment and enforcement of contract language. The language should be developed in accordance with the TxDOT Smart Work Zone Guidelines.

Need: Roadways under construction are challenging environments to navigate for all modes of transportation. SWZ technologies can leverage information to improve safety and mobility in construction work zones by providing real-time information and warnings to the traveling public. When the TxDOT Abilene District deploys queue detection and warning systems, issues arise as queues frequently back up past the SWZ units. Construction contracts do not include language to ensure SWZ units are deployed correctly or effectively. As a result, there is no mechanism in place to ensure active monitoring of the work zone, accurate data collection, or SWZ device functionality for the duration of the construction.

Implementation Step #1: Review the Statewide SWZ Guidelines and SWZ System Go/No-Go Decision Tool (see Action Item BP-02) to identify the appropriate SWZ ITS devices to deploy. Determine the procedures and performance measures necessary to ensure each deployed ITS device is deployed correctly, and functions properly and effectively.

Implementation Step #2: Establish a method of enforcement. The contract may include incentives/disincentives for maintaining ITS functionality during construction, but enforcing these will generally require TxDOT staff to check the equipment either remotely via camera or via work zone drive-throughs.

Implementation Step #3: Coordinate with TxDOT TRF to adopt contract language that incentivizes or disincentivizes contractors depending upon whether they deploy work zone ITS correctly, based on existing construction contracts in other Districts that include similar provisions.

Expected Benefits: Developing contract language that promotes the use of SWZ technologies and establishes the requirement of ensuring proper SWZ unit function during construction can increase traffic flow and can improves safety within work zones for both motorists and construction workers. Consistent device deployment can improve driver expectation and provide advance warning of the work zone area or potential vehicle queues.

BP-04: Develop Alternate Route Plans for Diverting Traffic During Flooding

Focus Area:
Road Weather Management

Action Item Lead:
District Director of Operations

Partners:
ABL Operations, ABL Maintenance, ABL Area Engineers, Local Transportation Agencies

Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	✓
Collaboration	
Integration	

Objective: Develop guidelines for managing traffic on state routes where flooding frequently occurs.

Need: During severe weather events, the TxDOT Abilene District maintenance staff must go out to assess the need for traffic control and manually close flooded or icy roads by placing signage and barricades. This poses a safety risk for District staff as they travel in inclement weather and for the traveling public that began driving prior to the closure being set up. The TxDOT Abilene District staff noted occasional issues with responding to traffic incidents and redirecting traffic when flooding occurs on state routes and frontage roads. Responders are unable to access the incident as queues form upstream, blocking the travel lanes. To relieve congestion on state route main lanes, frontage roads are typically used as detour routes. However, this may not be an option if the frontage roads are flooded.

Implementation Step #1: Review FEMA flood maps and District Maintenance Department logs corresponding with historical severe weather events to identify District maintained roadways subject to flooding. Attempt to identify the catalog the frequency and severity of flooding at each location.

Implementation Step #2: Determine and prioritize highest risk locations, including locations routinely impassable, highest trafficked, or remotely isolated which pose the greatest demand on the District's maintenance staff resources and greatest risk to road users. Determine the need for permanent road weather information systems (see Action Item ST-05).

Implementation Step #3: Evaluate detour routes for each location. Potential routes should focus on directness while avoiding any additional potential flooding locations.

Expected Benefits: By identifying and prioritizing historically flood-prone locations, the TxDOT Abilene District can proactively stage or deploy portable warning signs and barricades at critical locations ahead of severe weather events. The pre-deployment of equipment reduces the danger to District personnel caused by needing to deploy during a severe weather event and minimize the risk of travelers encountering poor road conditions before maintenance closes the road. Establishing dedicated detour routes around areas that consistently flood can increase traffic flow and improve responder access to traffic incidents during flooding by reducing congestion upstream of the incident.

BP-05: Develop Method for Evaluating Corridor Signal Timings

Focus Area:
Traffic Signal Management

Action Item Lead:
District Signal Shop Manager

Partners:
ABL Operations, ABL Signal Shop, ABL 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 Abilene 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. Uncoordinated signals can lead to driver frustration and unsafe driver behavior along signalized corridors. 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 reevaluated and potentially retimed to increase throughput. Adjusting traffic signal timings for changing traffic patterns and volumes reduces stops, delays, and travel times along a corridor.

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. Review crash data to identify intersection and corridor safety issues, for example angle crashes might suggest issues with left turns, or rear end crashes might suggest issues with corridor progression.

Implementation Step #3: As the implementation of signal performance measurement technology expands throughout the District (see Action Item PM-02), develop performance measures to track and set goals, and to inform when changes to signal operations may be needed.

Expected Benefits: Signal retiming is a cost-effective way to improve traffic flow along a corridor. 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: Develop a System for Accessing TxDMV Issued Over-Height/Oversize Permits

Focus Area:
General Traffic Management

Action Item Lead:
TxDMV

Partners:
TxDOT Traffic Safety Division, ABL Operations, ABL Maintenance, Local Transportation Agencies

Goals Addressed:

Safety	
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	✓
Integration	

Objective: Develop a system that allows TxDOT and local agencies access to over-height/oversize vehicle permits that have been issued by the TxDMV. *Note: This action item would be led by the TxDMV, but could be developed with support from TxDOT TRF.*

Need: Within the TxDOT Abilene District, collaboration and communication among agencies are currently seen as strengths. However, District and local partner agency staff discussed issues regarding freight management and the advanced notification of over-height and oversize vehicles traveling through the region. Over-height and oversize vehicles are an issue when they are routed around a work zone or incident, or simply get lost, and drive on local roads that may not have adequate facilities to support these vehicles. Over-height and oversize vehicles are also more likely to impact traffic than normal vehicles even when adhering to their permitted route. For example, over-height vehicles may require traffic signals to be raised and oversize vehicles may be stuck when trying to make a turn. These types of vehicles may create a safety concern for other travelers because roadways, traffic signals, and signage can be damaged when over-height and oversize vehicles cannot complete turns or fit under infrastructure.

Implementation Guidance: The TxDOT TRF should coordinate with the TxDMV Motor Carrier Division to request that over-height and oversize vehicle permit and routing information be shared as permits are approved.

Expected Benefits: If the TxDOT Abilene District and its local partner agency staff 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. TxDOT and 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 TxDMV if a planned oversize vehicle route conflicts with construction activities or another planned event with potential traffic impacts.

BP-07: Establish Standard Protocol for Use of DMS

Focus Area:
General Traffic Management

Action Item Lead:
District Public Information Officer

Partners:
TxDOT Traffic Safety Division, ABL Operations, ABL Maintenance, ABL Public Information Office

Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	✓
Collaboration	
Integration	

Objective: Develop protocol for when to post and what messages to post on DMS for disseminating information to the traveling public. Develop standard message templates to use for creating messages for various scenarios.

Need: The TxDOT Abilene District only has six existing DMS units, five of which are deployed at the outskirts of the City of Abilene to provide traveler information for drivers approaching the city. District staff are enthusiastic about the deployment of additional DMS units recommended in the District's ITS Master Plan and emphasized the need to identify current TxDOT DMS message guidance and best practices to ensure the District makes the most the new DMS as they are deployed, as well as the existing units already in the field. DMS allow TxDOT Abilene District staff to post traveler information regarding traffic incidents, work zones, road weather conditions, and special events to notify drivers of road closures, travel times, and potential congestion or hazards.

Implementation Guide: Review existing TxDOT DMS message guidance in TxDOT's *Dynamic Message Sign Message Design and Display Manual*. Coordinate with TxDOT TRF to identify possible updates to the manual and determine statewide best practices. Develop a default list of template messages for various traffic conditions that frequently occur within the TxDOT Abilene District and criteria for when to implement each message. The District should explore what additional standard operating procedures (SOPs) and staff roles might be necessary to operate and monitor DMS units, as well as other ITS devices implemented from the ITS Master Plan (see Action Item ST-09 and Action Item OW-02).

Expected Benefits: The development of template or standard messages to post on DMS units and criteria for when to post them streamlines the traveler information dissemination process. When traffic conditions change, TxDOT staff can quickly determine the appropriate message to effectively relay real-time information to motorists, allowing drivers to make informed route choices and prepare for potential hazards on the road ahead.

Resources: Review TxDOT's *Dynamic Message Sign Message Design and Display Manual* available at:
https://static.tti.tamu.edu/tti.tamu.edu/documents/0-4023-P3.pdf

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 Abilene District.

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

CMM Capability Dimension	Action Item Number	Action Item Description
Systems & Technology	ST-01	**Improve Regional Video Sharing Capabilities**
	ST-02	**Deploy Work Zone Technology**
	ST-03	
	ST-04	**Provide Work Zone Closure Information Through Third-Party Apps**
	ST-05	
	ST-06	**Share Event-Related Road Impacts with Third-Party Apps**
	ST-07	
	ST-08	**Improve Communications Link to Signals**
	ST-09	
	ST-10	**Implement ITS Field Devices Identified in the ITS Master Plan Phase 2**
	ST-11	

ST-01: Improve Regional Video Sharing Capabilities

Focus Area:
Traffic Incident Management

Action Item Lead:
District Director of Operations

Partners:
ABL Operations, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies

Goals Addressed:

Safety	
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	

Objective: Use cloud-based technology platforms for sharing access to CCTV camera video feeds with City of Abilene Engineering, City of Abilene Police, City of Abilene Fire, and DPS.

Need: The TxDOT Abilene District has cameras that do not have pan-tilt-zoom capabilities deployed at some traffic signals primarily for detection purposes, but does not currently have any CCTV cameras deployed. However, the District's recently completed ITS Master Plan includes CCTV camera deployments in Phase 1 and Phase 2 of the plan. The City of Abilene currently has 20 CCTV cameras at intersections operated and maintained by the City. As TxDOT installs CCTV cameras identified in the ITS Master Plan, video sharing agreements among TxDOT and other local agencies such as the City of Abilene would be beneficial for responding to traffic incidents, monitoring work zones, and other traffic management activities.

Implementation Guidance: TxDOT Abilene District staff should coordinate with TxDOT TRF to improve CCTV camera video sharing capabilities and develop or procure a user-friendly software 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 at the future TxDOT Abilene District TMC and to staff at regional emergency operations centers 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 all agencies involved in incident management 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. A camera sharing agreement between the TxDOT Abilene District and the cities within the District that have existing CCTV cameras would enable TxDOT to monitor traffic operations while the District implements its ITS Master Plan and increases camera coverage.

ST-02: Deploy Work Zone Technology

Focus Area:
Work Zone Management

Action Item Lead:
District Director of Construction

Partners:
ABL Construction, ABL Operations, ABL 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 Abilene District does not consistently deploy Smart Work Zone (SWZ) technologies, nor does it utilize the TxDOT SWZ Guidelines or SWZ System Go/No-Go Decision Tool to identify applicable work zone ITS. The only SWZ devices the District currently deploys are queue detection and warning systems which are only considered for major construction projects along tier 1 facilities, such as I-20 and US 84, due to the high cost of device deployment.

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-02) to select the appropriate SWZ 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 (see Action Item BP-03). 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 SWZ 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-03: Integrate Smart Work Zone System with Permanent DMS

Focus Area:
Work Zone Management

Action Item Lead:
District Director of Operations

Partners:
ABL Construction, ABL Operations, ABL Area Engineers, TxDOT Construction Division, Contractors

Goals Addressed:

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

Objective: Integrate Smart Work Zone System information, including queue detection and work zone travel time, into Lonestar to allow real-time work zone related information to be displayed on permanent DMS.

Need: The TxDOT Abilene District wants to make the most of its existing DMS units and the additional DMS recommended in the ITS Master Plan, as well as portable changeable message signs (PCMS) temporarily deployed to disseminate work zone information (see Action Item ST-02). To ensure the PCMS provide accurate real-time information, the District staff identified the need to integrate the two systems. If PCMS units and permanent DMS units do not display consistent messages, drivers may get confused and make route choices based on inaccurate information.

Implementation Step #1: Review the TxDOT Abilene District's ITS Master Plan to identify locations of DMS units recommended in Phase 1. Identify upcoming construction projects and determine the locations of PCMS units that will be deployed for work zone and traveler information. Compare locations of permanent DMS and PCMS deployments.

Implementation Step #2: Verify that the PCMS units will be fully compatible with District software and linked to Lonestar to allow staff to remotely update the displayed work zone information.

Implementation Step #3: Develop standard operating procedures (SOPs) for the operation of the PCMS units for work zones in coordination with the SOPs for Phase 1 ITS devices (see Action Item OW-02).

Expected Benefits: Expanding the TxDOT Abilene District's PCMS and permanent DMS unit deployments and simplifying the process for posting messages on both types of DMS units will allow for District staff to increase the distribution of real-time travel information. When traffic conditions change, TxDOT staff can quickly determine the appropriate message to effectively relay real-time information to motorists, allowing drivers to make informed route choices and prepare for potential hazards on the road ahead.

ST-04: Provide Work Zone Closure Information Through Third-Party Apps

Focus Area:
Work Zone Management

Action Item Lead:
District Public Information Officer

Partners:
Private Third Party Providers, ABL Public Information Office, ABL Operations, ABL Construction

Goals Addressed:

Safety	
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	✓

Objective: Partner with third-party navigation apps to ensure accurate, TxDOT District approved, work zone closure information is displayed for travelers.

Need: The TxDOT Abilene District generally communicates well with the public by disseminating information regarding closures through the PIO, which shares work zone closures with the public via newspapers, social media, and DriveTexas.org. Although District staff expressed concern about the accuracy of the third-party information, drivers increasingly rely on third-party applications to assist with navigation.

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.

Implementation Step #3: Develop a process for TxDOT staff to approve closure information submitted to the third-party navigation application by personnel outside of TxDOT when the closure is identified as being on a TxDOT roadway.

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. These partnerships will also ensure accurate traveler information is provided to the public via third-party navigation applications. With a larger number of drivers 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-05: Deploy Flood Detection, Warning, and Closure Devices

Focus Area:
Road Weather Management

Action Item Lead:
District Director of Operations

Partners:
ABL Operations, ABL Maintenance, ABL Area Engineer

Goals Addressed:

Safety	✓
Reliability	
Efficiency	
Customer Service	✓
Collaboration	
Integration	✓

Objective: Implement technology for flood detection, warning, and automated road closure in areas that frequently flood.

Need: The TxDOT Abilene District handles weather-related road closures on an ad hoc basis. Current procedures for inclement weather involve maintenance staff going out to assess the need for traffic control and manually closing flooded or icy roads by placing signage and barricades. 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. The City of Abilene installed permanent road closure gates where there are a few low points that flood consistently, but these gates must be closed manually. District staff and stakeholders agreed that flood detection and warning systems or automated closure devices may be beneficial to reduce the demand on maintenance staff, resources, and time spent driving out to deploy equipment and back to remove it.

Implementation Step #1: Review FEMA flood maps, crash data, and District Maintenance Department logs corresponding with historical severe weather events to identify District maintained roadways subject to flooding.

Implementation Step #2: Prioritize locations for device implementation based on flooding event frequency, flood water depth, crashes, and traffic volume data.

Implementation Step #3: Business plan, budget for, and begin to deploy field devices based on the prioritized list of locations where devices are recommended. Identify alternative routes for roadways that consistently flood (see Action Item BP-04).

Expected Benefits: Permanently deployed road weather information systems, such as flood detection, warning, and automated road closure systems, offer a safer and more immediate response during flooding for road users and TxDOT Abilene District maintenance staff. As soon as a road is determined to be flooded by the system, the gates close to prevent vehicles from entering hazardous driving conditions. Once the water has cleared the road, the gates open to allow traffic safely through again. Automated closure systems minimize the need to dispatch TxDOT maintenance staff during severe weather events, reducing the risk to maintenance personnel and making them available for other priority tasks during severe weather events.

ST-06: Share Event-Related Road Impacts with Third-Party Apps

Focus Area:
Planned Special Events

Action Item Lead:
District Public Information Officer

Partners:
Private Third Party Providers, ABL Public Information Office, ABL Operations, Event Organizers

Goals Addressed:

Safety	
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	✓
Integration	✓

Objective: Partner with third-party navigation apps to provide accurate, TxDOT District approved, special event-related closure and routing information for travelers.

Need: The TxDOT Abilene District does not have regularly occurring large special events and the events that do occur generally have short durations. There are no designated TxDOT Abilene District staff with formal PSE job functions for events within the District. City staff, law enforcement, or event planners are generally responsible for managing the detour route. Stakeholders noted that during recent special events, they were unaware of the road closures or resulting congestion. The District and its stakeholders agreed that there may be a future need to improve traveler information about PSE delays and related detour routing as the growth in the region continues. Similar to work zone and road weather information dissemination efforts, this provides an opportunity for coordination with third-party applications to distribute accurate event-related traveler information.

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 Abilene 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 drivers 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-07: Plan and Implement Surveillance Technology for Signals

Focus Area:
Traffic Signal Management

Action Item Lead:
District Traffic Engineer

Partners:
ABL Operations, ABL Maintenance, ABL Area Engineers

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 majority of the TxDOT Abilene District's traffic signals utilize cell modems communication, and a few have traffic signal cameras primarily used for detection as they do not have pan-tilt-zoom capabilities. The lack of CCTV camera coverage limits signal technicians' ability to troubleshoot reported issues in advance of crews arriving on site. The District installs video detection at its new traffic signals, however staff noted that the video detection is not as helpful as CCTV cameras for viewing traffic signals or traffic conditions. Therefore, the TxDOT Abilene District self-identified the need to prioritize the identification of key locations for the deployment of additional CCTV cameras to monitor traffic signals.

Implementation Step #1: Upgrade signals along priority routes with technology that allows staff to quickly adjust timings in response to events remotely and improve communications links to TxDOT traffic signals for simple troubleshooting purposes (see Action Item ST-08).

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 the District's ITS Master Plan implementation (see Action Item ST-09). Install cameras at these locations as funding allows.

Implementation Step #3: Adopt user-friendly software to allow for surveillance of deployed signal cameras from a single interface, as opposed to individual surveillance via separate IP addresses.

Expected Benefits: Improving camera coverage at signalized intersections throughout the region enhances the District's ability to monitor traffic along key corridors and more easily detect issues, particularly those related to signal performance. This allows the District's signal technicians 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 identify issues anywhere cameras are deployed.

ST-08: Improve Communications Link to Signals

Focus Area:
Traffic Signal Management

Action Item Lead:
District Traffic Engineer

Partners:
ABL Operations, ABL Maintenance, ABL Area Engineers

Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	
Integration	✓

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

Need: Since communication technology on traffic signals is not yet deployed consistently throughout the TxDOT Abilene District, the District does not have full capabilities for detecting, verifying, and addressing traffic signal issues. When signal issues are reported, the District's signal technicians 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 modern signal controllers and communications technology to support signal operations.

Implementation Step #1: Inventory all signals in the TxDOT Abilene 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 for communications system deployments 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.

Implementation Step #4: Establish a signal status dashboard with automated notifications of malfunctions to provide quick detection of and response to signals that lose power or malfunction.

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.

ST-09: Implement ITS Field Devices Identified in the ITS Master Plan Phase 1

Focus Area:
General Traffic Management

Action Item Lead:
District Traffic Engineer

Partners:
ABL Area Engineers, ABL Transportation Planning & Development, ABL Operations, ABL Construction, Local Transportation Agencies

Goals Addressed:

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

Objective: Deploy ITS infrastructure identified in Phase 1 of the TxDOT Abilene District ITS Master Plan to support improved traffic management and operations in the District.

Need: Currently, the TxDOT Abilene District has no existing CCTV cameras and only has six DMS units: five deployed along I-20, US 83, and US 84 for drivers approaching the City of Abilene, and one located outside of the City of Snyder. In 2021, the District completed an ITS Master Plan that identified priority locations for ITS devices, including CCTV cameras and DMS units along key corridors such as I-20, US 83, US 84, US 87, US 180, and US 277. Because the TxDOT Abilene District's TMC will not be implemented for the foreseeable future, District staff noted the need for developing a plan to operate and monitor ITS devices as Phase 1 of the ITS Master Plan is deployed.

Implementation Step #1: Review the TxDOT Abilene District's ITS Master Plan to identify, prioritize, and budget for the ITS devices recommended in Phase 1. Identify opportunities for incorporating Phase 1 ITS devices into current and upcoming construction projects.

Implementation Step #2: Verify that ITS device deployments will be fully compatible and meet all agency needs once operational. Develop standard operating procedures (SOPs) for the operation of the Phase 1 ITS devices (see Action Item OW-02).

Implementation Step #3: As ITS device deployment continues and transitions to Phase 2 of the ITS Master Plan (see Action Item ST-10), establish a maintenance and end-of-life replacement schedule for deployed devices.

Expected Benefits: Expanding the TxDOT Abilene District's ITS device deployments will allow for District staff to monitor traffic and road conditions, as well as increase the distribution of travel information. The deployment of CCTV cameras along key routes enables the district to detect, verify, and respond to traffic incidents and traffic signal issues more efficiently. Additional DMS units improve the District's ability to provide real-time traveler information and alerts along more key corridors, thereby reaching a greater number of drivers. ITS device deployments could also enhance the District's abilities to monitor overall traffic and signal operations and to collect traffic operations performance data.

ST-10: Implement ITS Field Devices Identified in the ITS Master Plan Phase 2

Focus Area:
General Traffic Management

Action Item Lead:
District Traffic Engineer

Partners:
ABL Area Engineers, ABL Transportation Planning & Development, ABL Operations, ABL Construction, Local Transportation Agencies

Goals Addressed:

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

Objective: Once Phase 1 of the TxDOT Abilene District ITS Master Plan is complete and operational, prioritize and deploy ITS infrastructure identified in Phase 2 to further support improved traffic management and operations in the District.

Need: Phase 2 of the TxDOT Abilene District's recently completed ITS Master Plan identifies recommended ITS devices and deployment locations which are considered lower priority than those recommended for deployment in Phase 1. ITS devices identified in Phase 2 enhance the District's capabilities of monitoring traffic conditions and serves areas that are not within the coverage of the existing ITS network or the network proposed in the ITS Master Plan's Phase 1.

Implementation Step #1: As the implementation of Phase 1 of the ITS Master Plan is completed (see Action Item ST-09), review and update the TxDOT Abilene District's ITS Master Plan to reflect then-current state of ITS deployments.

Implementation Step #2: Identify, prioritize, and budget for the ITS devices recommended in Phase 2, as well as maintenance and replacement costs for ITS devices deployed in Phase 1. Identify opportunities for incorporating Phase 2 ITS devices into current and upcoming construction projects.

Implementation Step #3: Verify that ITS device deployments will fill in coverage gaps remaining after Phase 1 ITS devices are deployed, be compatible with the Phase 1 ITS devices, and meet all agency needs once operational. Develop standard operating procedures (SOPs) for the operation of the Phase 2 ITS devices and establish a maintenance and end-of-life replacement schedule for devices.

Implementation Step #4: As the deployment of the Phase 2 ITS devices from the ITS Master Plan comes to an end or funding becomes available, consider identifying additional ITS devices and locations to further enhance the TxDOT Abilene District's traffic management capabilities.

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-11: Implement Dynamic Truck Parking Signage

Focus Area:
General Traffic Management

Action Item Lead:
District Traffic Engineer

Partners:
ABL Area Engineers, ABL Operations, Local Transportation Agencies

Goals Addressed:

Safety	
Reliability	
Efficiency	
Customer Service	✓
Collaboration	
Integration	✓

Objective: Implement truck parking availability signage with dynamic information in advance of designated truck parking areas.

Need: TxDOT Abilene District does not currently have truck parking signage to inform truck drivers of upcoming available parking spots at legal, designated truck parking locations. District staff and partner agency staff expressed interest in deploying dynamic truck parking availability signage to reduce trucks the frequency of trucks parking along freeways and frontage roads in TxDOT right of way, as well as on exit ramps. This illegal parking is a safety concern as the trucks can restrict sight distance, block the road shoulder, and potentially stick out into a travel lane, and are an unexpected obstacle along ramps for motorists to navigate around.

Implementation Step #1: Inventory existing truck parking and rest area facilities, including the number of parking spaces, their utilization, and how many additional spaces may be needed.

Implementation Step #2: Identify what technology would be needed to implement dynamic truck parking signage, such as sensors or detectors to determine parking space availability and DMS to show space availability information in real-time. Determine where to install the dynamic truck parking signage to give truck drivers advance notification and discourage parking along the roadway.

Implementation Step #3: Install dynamic truck parking technology and coordinate with law enforcement to better enforce truck parking restrictions.

Expected Benefits: Providing truck drivers with advance available truck parking information would increase the utilization of designated truck parking and reduce the illegal parking of trucks along roadways and ramps. This would improve the safety of motorists and truck drivers by removing the potential for conflict due to the truck sticking into a travel lane or limiting sight distance.

Strategy and Best Practice

The Kansas Department of Transportation (KDOT) is leading a regional project to develop and implement Truck Parking Information Management Systems (TPIMS) in coordination with the Mid-America Association of State Transportation Officials (MAASTO). In-ground sensors and cameras determine the occupancy status of each parking space and count vehicles entering and exiting the facility. To maximize the utilization and efficiency of truck parking areas, TPRMS disseminate real-time truck parking information via apps, websites, DMS, etc.

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 that result from the effective use of TSMO strategies. Table 13 shows the recommended Performance Measurement action items for the TxDOT Abilene District.

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

CMM Capability Dimension	Action Item Number	Action Item Description
Performance Measurement 	PM-01	**Improve TIM Data Collection**
	PM-02	

PM-01: Improve TIM Data Collection

Focus Area:
Traffic Incident Management

Action Item Lead:
District Director of Operations

Partners:
TxDOT Traffic Safety Division, ABL Operations, Texas DPS, Local Public Safety Agencies, Local Law Enforcement

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 TRF and their efforts to improve TIM data within CRIS on a statewide basis.*

Need: Currently, the TxDOT Abilene District does not collect any TIM-related performance measures, such as roadway clearance time, incident clearance time, and secondary crash data. The District also does not log incident data in Lonestar, nor does it track timestamps for TIM-related activities. Other TxDOT districts often use a traffic management center (TMC) to watch camera feeds to detect, verify, and monitor traffic incidents, but the TxDOT Abilene District does not currently have a TMC and its existing infrastructure has limited camera coverage. However, the TxDOT Abilene District completed an ITS Master Plan in 2021 that identified priority ITS devices, including CCTV cameras and DMS units, to improve its capability to detect traffic incidents, monitor traffic conditions, and track TIM performance measures.

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 Roadway Clearance Time (RCT), Incident Clearance Time (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 during the management of an incident. 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: Develop and Implement Automated Traffic Signal Performance Measures

Focus Area:
Traffic Signal Management

Action Item Lead:
District Director of Operations

Partners:
ABL Operations, ABL Area Engineers

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: The TxDOT Abilene District currently has cell modems for communication deployed on a majority of the District's traffic signals. Due to the 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. The District has 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 operational challenges and identify reoccurring issues 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 identifying 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 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.

Culture

TSMO culture within an agency is dependent on engaged staff who adhere to and implement TSMO goals. Staff can positively improve TSMO culture by critically analyzing daily activities to meet program objectives. Considerations involved in creating a TSMO culture include a technical understanding, strong leadership, outreach, and buy-in of program authority. Table 14 shows the recommended Culture action items for the TxDOT Abilene District.

Table 14: TxDOT Abilene District TSMO Recommended Action Items – Culture

CMM Capability Dimension	Action Item Number	Action Item Description
Culture 	CU-01	**Increase Public Outreach for Work Zone Safety**
	CU-02	

CU-01: Increase Public Outreach for Work Zone Safety

Focus Area:
Work Zone Management

Action Item Lead:
District Public Information Officer

Partners:
TxDOT Traffic Safety Division, ABL Public Information Office, Texas DPS, Local Public Safety Agencies

Goals Addressed:

Safety	✓
Reliability	
Efficiency	
Customer Service	
Collaboration	
Integration	✓

Objective: Increase public outreach and education to promote reduced speeds and improve safety in work zones.

Need: TxDOT Abilene District's construction contracts typically include contingency funds to hire law enforcement to assist with managing and drawing driver attention to queues caused by work zones. However, drivers will slow down when they see an officer, speed back up once they have passed the officer, and slow down again when they arrive at the queue warning sign or start of the work zone. This behavior results in two distinct queues, creating unsafe driving conditions as well as unsafe working conditions for the construction crew. Therefore, District staff and stakeholders identified the need to better inform the public of safe driving practices through work zones. The TxDOT Abilene District PIO currently disseminates work zone information with the public by publishing closure details via newspapers, social media, such as Twitter and Facebook, and DriveTexas.org. These existing information outlets present an opportunity to increase public outreach and educate the public regarding work zone safety.

Implementation Step #1: Coordinate with the TxDOT TRF and TxDOT Abilene District PIO to develop standard safety messages that can be distributed to the public via various outlets. Potential messaging could promote tips for driving through work zones, emphasize reduced work zone speed limits, warn drivers of upcoming queues, or alert drivers of potential work zone hazards such as construction personnel or slow moving equipment.

Implementation Step #2: Develop contract wording and provisions for the inclusion of speed monitoring technology such as speed feedback trailers to raise speed awareness through work zones.

Implementation Step #3: Create a budget item for disseminating work zone information to the public through currently used media platforms such as newspapers, social media, and DriveTexas.org. Set goals for the frequency messages are posted, advance notification of upcoming construction, etc.

Expected Benefits: Driver inattention and speeding are among the leading causes of work zone crashes. Public awareness of the impact of speed, along with devices to bring attention to those who are speeding within a work zone, will promote a safer work environment for construction workers and increase safety of the traveling public.

CU-02: Increase Awareness of Information Available on DriveTexas.org

Focus Area:
General Traffic Management

Action Item Lead:
District Public Information Officer

Partners:
TxDOT Traffic Safety Division, ABL Public Information Office, Local Transportation Agencies

Goals Addressed:

Safety	
Reliability	✓
Efficiency	
Customer Service	✓
Collaboration	
Integration	✓

Objective: Increase public awareness of DriveTexas.org to increase dissemination of WZM, RWM, and PSE information.

Need: The TxDOT Abilene District PIO and maintenance staff consistently utilize DriveTexas.org to disseminate road condition and closure details related to work zones, weather, special events, and maintenance activities. However, the traveling public currently relies on third-party applications for real-time traveler information instead of DriveTexas.org. The District has had issues with third-party applications providing incorrect closure information, such as during a recent severe winter weather event which resulted in significant congestion and major safety concerns. The TxDOT Abilene District and its stakeholders emphasized the need to increase the public's awareness of DriveTexas.org and noted that the use of DriveTexas.org is a statewide issue that requires more advertisement throughout the state.

Implementation Step #1: Coordinate with the TxDOT TRF and PIOs in other districts to develop standard messages promoting DriveTexas.org for use on traveler information platforms including newspapers, TxDOT social media accounts, and DMS boards. Capitalize on opportunities when road users will be seeking information, such as weather events and holidays, to promote DriveTexas.org.

Implementation Step #2: Partner with third-party navigation apps to establish effective communication and ensure accurate traveler information (see Action Item ST-04 and Action Item ST-06).

Expected Benefits: Developing awareness of DriveTexas.org among road users will improve the dissemination of accurate real-time traveler information throughout the state. Establishing partnerships with third-party navigation app vendors will increase the reach of traveler-focused closure messaging beyond the existing methods available internally to TxDOT districts. With accurate closure details, drivers are able to anticipate driving conditions better and identify more suitable detours or alternative routes. With a larger number of drivers either aware of or actively routed around areas impacted by closures or poor driving conditions, fewer vehicles pass through those areas. As a result, congestion and traffic incident risks are both reduced.

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 15 shows the recommended Organization & Workforce action items for the TxDOT Abilene District.

Table 15: TxDOT Abilene District TSMO Recommended Action Items – Organization & Workforce

CMM Capability Dimension	Action Item Number	Action Item Description
Organization & Workforce 	OW-01	**Establish Regional Multidisciplinary TIM Training**
	OW-02	

OW-01: Establish Regional Multidisciplinary TIM Training

Focus Area:
Traffic Incident Management

Action Item Lead:
District Traffic Safety Specialist

Partners:
TxDOT Statewide TIM Coordinator, ABL Maintenance, ABL Operations, Texas DPS, Local Transportation Agencies, Local Public Safety Agencies

Goals Addressed:

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

Objective: Partner with the TxDOT Statewide Traffic Incident Management Coordinator 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 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. The District's Traffic Safety Specialist held a TIM responder training in May 2022 for all TIM disciplines and is currently working on establishing the training as a reoccurring event.

Implementation Step #1: Coordinate with TxDOT TRF to adapt the new Safety Specialist's TIM responder training to ensure it incorporates statewide TIM training material and Strategic Highway Research Program 2 (SHRP2) information. Identify which agencies should be involved and meet individually with agencies to encourage participation and identify barriers to participation.

Implementation Step #2: Coordinate with TxDOT TRF to adapt the existing Train the Trainer program and establish a training leader. Provide Train the Trainer sessions to interested personnel to initiate multidisciplinary training.

Implementation Step #3: Offer regional TIM training at least once per year. Update training materials as needed 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: Develop Standard Operating Procedures for District ITS Device Use

Focus Area:
General Traffic Management

Action Item Lead:
District Director of Operations

Partners:
ABL Operations, ABL Area Engineers, ABL Maintenance

Goals Addressed:

Safety	
Reliability	
Efficiency	✓
Customer Service	
Collaboration	
Integration	✓

Objective: Develop a set of standard operating procedures for the operation of ITS devices identified in Phase 1 of the District ITS Master Plan.

Need: The TxDOT Abilene District recently completed an ITS Master Plan that identified priority locations for ITS devices, including CCTV cameras and DMS units along key corridors such as I-20, US 83, US 84, US 87, US 180, and US 277. District staff are excited about the deployment of additional CCTV and DMS recommended in the District's ITS Master Plan, but some expressed concern regarding limited staff availability to operate and monitor the devices. The District also self-identified the need to increase knowledge of regional best practices to ensure the District is making the most of its existing and new ITS devices by creating standard operating procedures (SOPs).

Implementation Guide: Coordinate with TxDOT TRF to identify statewide best practices for operating and monitoring the various types of ITS devices recommended in the District's ITS Master Plan (see Action Item ST-09). The District should evaluate existing staff capabilities and determine what additional staff roles might be necessary to operate and monitor ITS devices most effectively. SOPs should be developed so that they can be consistently applied to ITS devices throughout the TxDOT Abilene District.

Expected Benefits: Expanding the TxDOT Abilene District's ITS device deployments will allow for District staff to better monitor traffic and road conditions, as well as increase the distribution of travel information. ITS device deployments could also enhance the District's ability to monitor traffic signal operations and enable the District to collect more traffic operations performance data. However, guidance on how to best utilize these ITS devices is necessary to ensure the system is effective, efficient, and cohesive throughout the TxDOT Abilene District and state.

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 16 shows the recommended Collaboration action items for the TxDOT Abilene District.

Table 16: TxDOT Abilene District TSMO Recommended Action Items – Collaboration

CMM Capability Dimension	Action Item Number	Action Item Description
Collaboration 	CO-01	**Establish a Formal Regional TIM Team**

CO-01: Establish a Formal TIM Team

Focus Area:
Traffic Incident Management

Action Item Lead:
District Traffic Safety Specialist

Partners:
TxDOT Statewide TIM Coordinator, ABL Area Engineers, ABL Operations, 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. Participants to include TxDOT, DPS, and municipal public safety and traffic representatives.

Need: The TxDOT Abilene 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 (see Action Item BP-01). District staff and other stakeholders identified the creation of a formalized TIM Team as a strategy that would increase communication and coordination between agencies, as well as 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 desired meeting frequency, meeting location, typical agenda items, and attendee invitation lists.

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

Expected Benefits: TIM working groups consisting of stakeholders from throughout the region can meet on a regular basis to discuss current initiatives and challenges related to TIM, conduct AARs of high-impact incidents, and showcase new technology or resources that support effective TIM. 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, Texas meets 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 Abilene 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 Abilene District. Plans are displayed according to the following criteria:

- Alignment with the TxDOT Abilene 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
- 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 implementation 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

Recommend TSMO Tactical Plans are included on the next page in Table 17.

Table 17: TxDOT Abilene 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					Integration				
ITS Concept of Operations Plan	✓	✓	✓	✓	✓	✓	ABL Operations, ABL Maintenance, ABL Area Engineers	$		BP-02, BP-07, ST-01, ST-03, ST-05, ST-09, OW-02
Regional TIM Program Plan	✓	✓	✓		✓	✓	TxDOT TRF, ABL Operations, ABL Maintenance, ABL Area Engineers, First Responders	$$		BP-01, ST-01, PM-01, OW-01, CO-01
Work Zone Technology Deployment Plan		✓		✓		✓	ABL Operations, ABL Area Engineers, ABL Construction	$$		BP-02, BP-03, ST-02, ST-03, CU-01
Traffic Signal System Upgrade Plan	✓	✓	✓			✓	ABL Operations, ABL Maintenance, ABL Area Engineers, ABL Signal Shop	$$$		BP-05, ST-07, ST-08, PM-02

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Appendix A – Stakeholder Involvement Database

Appendix A – Stakeholder Involvement Database

TxDOT Abilene District TSMO Program Plan Stakeholder Database				
Organization	**Name**	**Position/Role**	**Stakeholder Outreach Workshop Participant**	**Action Item Workshop Participant**
Abilene CityLink	Lauren Stevens	Assistant General Manager	X	
Abilene MPO	Benjamin LaBorde	Transportation Planner		X
Abilene MPO	E'Lisa Smetana	Executive Director	X	X
Central Texas Rural Transit District (CTRTD) - City and Rural Rides (CARR)	Rhonda Kelton	Mobility & Transit Manager	X	
City of Abilene	Max Johnson	Director of Public Works		X
City of Abilene	Scott Chandler	City Engineer		X
City of Snyder	Eli Torres	Public Works Director	X	
TxDOT Abilene District	Bryce Turentine	District Traffic Engineer	X	X
TxDOT Abilene District	Glenn Allbritton	District Engineer	X	X
TxDOT Abilene District	Jill Christie	Traffic Safety Specialist		X
TxDOT Abilene District	LaRissa Halford	General	X	
TxDOT Abilene District	Maxie Allen	Snyder Area Engineer	X	
TxDOT Abilene District	Ryan Carrigan	Transportation Maintenance Specialist		X
TxDOT Abilene District	Will Brazzil	Engineering Assistant	X	X
TxDOT Abilene District	Casey McGee	Director of Construction	X	
TxDOT Abilene District	Michael Haithcock	Director of TP&D		X
TxDOT Abilene District	Paul Norman	Abilene Area Engineer	X	X
TxDOT Abilene District	Ryan Sayles	Big Spring Area Engineer	X	X
TxDOT Abilene District	Stewart Chapman	Snyder Area Engineer		X
TxDOT Abilene District	Tanya Brown	District PIO	X	X
TxDOT Traffic Safety Division	David McDonald	Statewide Traffic Incident Management Coordinator	X	

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					Integration					
BP 01	**Conduct Multi-Agency After-Action Reviews for Major Incidents:** Establish criteria for determining which incidents require after-action reviews and conduct reviews with partner agencies as	39	District Director of Operations		✓	✓		✓	✓	TxDOT Statewide TIM Coordinator, ABL Area Engineers, ABL Operations, Local Transportation Agencies, Local Public Safety Agencies	$			ST-01, PM-01, OW-01, CO-01
ST 01	**Improve Regional Video Sharing Capabilities:** Use cloud-based technology platforms for sharing access to CCTV camera video feeds with City of Abilene Engineering, City of Abilene Police, City of Abilene Fire, and DPS.	47	District Director of Operations		✓		✓	✓		ABL Operations, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies	$			BP-01, ST-09, ST-10, PM-01, OW-02, CO-01
PM 01	**Improve TIM Data Collection:** Improve incident management-related data collection of roadway clearance time, incident clearance time, and secondary crash data. Note: This action	59	District Director of Operations	✓	✓			✓	✓	TxDOT Traffic Safety Division, ABL Operations, Texas DPS, Local Public Safety Agencies, Local Law Enforcement	$			BP-01, ST-01, ST-09, OW-01, CO-01
OW 01	**Establish Regional Multidisciplinary TIM Training:** Partner with the TxDOT Statewide Traffic Incident Management Coordinator to provide TIM multidisciplinary trainings and Train the Trainer programs to TxDOT staff and interested parties.	65	District Traffic Safety Specialist	✓	✓		✓	✓	✓	TxDOT Statewide TIM Coordinator, ABL Maintenance, ABL Operations, Texas DPS, Local Transportation Agencies, Local Public Safety Agencies	$			BP-01, PM-01, CO-01
CO 01	**Establish a Formal Regional TIM Team:** Establish a formalized TIM Team that meets regularly and includes all relevant jurisdictions and roles. Participants to include TxDOT, DPS, and			✓	✓	✓	✓	✓	✓	Area Engineers, ABL Operations, Local Transportation Agencies, Texas DPS, Local Public Safety Agencies	$			

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					Integration					
BP 02	**Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidance:** Adapt TxDOT's existing Smart Work Zone guidance and deployment decision tool when determining which work zone ITS technologies to use for District construction projects.	40	District Director of Construction		✓		✓	✓		TxDOT Traffic Safety Division, ABL Construction, ABL Operations	$			BP-03, BP-07, ST-02, ST-03, ST-09, CU-01, OW-02
BP 03	**Develop Standard Contract Language for Smart Work Zone Equipment:** Develop standard contract language for the use of Smart Work Zone equipment and enforcement of contract language. The language should be developed in accordance	41	District Director of Construction	✓	✓		✓		✓	ABL Construction, ABL Operations, ABL Area Engineers, Contractors	$			BP-02, ST-02, ST-03, ST-09, OW-02
ST 02	**Deploy Work Zone Technology:** Deploy work zone technology throughout the District to support improved work zone monitoring, localized real-time traveler information, and end of queue warning.	48	District Director of Construction	✓		✓	✓	✓	✓	ABL Construction, ABL Operations, ABL Area Engineers, TxDOT Construction Division, Contractors	$$			BP-02, BP-03, BP-07, ST-03, ST-09, ST-10, OW-02
ST 03	**Integrate Smart Work Zone System with Permanent DMS:** Integrate Smart Work Zone System information, including queue detection and work zone travel time, into Lonestar to allow real-time work zone related information to be displayed			✓	✓	✓		✓	✓		$			
ST 04	**Provide Work Zone Closure Information Through Third-Party Apps:** Partner with third-party navigation apps to ensure accurate, TxDOT District approved, work zone closure information is displayed for travelers.	50	District Public Information Officer		✓		✓	✓	✓	Private Third-Party Providers, ABL Public Information Office, ABL Operations, ABL Construction	$			ST-06, CU-02
CU 01	**Increase Public Outreach for Work Zone Safety:** Increase public outreach and education to promote reduced speeds and	62	District Public Information Officer	✓					✓	TxDOT Traffic Safety Division, ABL Public Information Office, Texas DPS, Local Public Safety Agencies	$			BP-02, CU-02

Table continued on next page.

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					
BP 04	**Develop Alternate Route Plans for Diverting Traffic During Flooding:** Develop guidelines for managing traffic on state routes where flooding frequently occurs.	42	District Director of Operations	✓	✓	✓	✓			ABL Operations, ABL Maintenance, ABL Area Engineers, Local Transportation Agencies	$			BP-05, BP-07, ST-05, ST-08, CU-02
ST 05	**Deploy Flood Detection, Warning, and Closure Devices:** Implement technology for flood detection, warning, and automated road closure in areas that frequently flood.	51	District Director of Operations	✓			✓		✓	ABL Operations, ABL Maintenance, ABL Area Engineers	$$			BP-04, ST-09, ST-10, OW-02

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 06	**Share Event-Related Road Impacts with Third-Party Apps:** Partner with third-party navigation apps to provide accurate, TxDOT District approved, special event-related closure and routing information for travelers.	52	District Public Information Officer		✓		✓	✓	✓	Private Third-Party Providers, ABL Public Information Office, ABL Operations, Event Organizers	$			ST-04, CU-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					Integration					
BP 05	**Develop Method for Evaluating Corridor Signal Timings:** Develop a proactive method for evaluating and retiming signals along corridors to improve safety and efficiency on the system.	43	District Signal Shop Manager	✓	✓	✓			✓	ABL Operations, ABL Signal Shop, ABL Maintenance	$			BP-04, ST-07, PM-02
ST 07	**Plan and Implement Surveillance Technology for Signals:** Identify implementation priority for cameras and necessary			✓	✓	✓		✓	✓		$$$			
ST 08	**Improve Communications Link to Signals:** Upgrade communications capabilities at TxDOT traffic signal locations to improve ability to monitor and respond to conflicts, outages, and other signal issues.	54	District Traffic Engineer	✓	✓	✓			✓	ABL Operations, ABL Maintenance, ABL Area Engineers	$$			BP-04, ST-07, ST-09, OW-02
PM 02	**Develop and Implement Automated Traffic Signal Performance Measures:** Develop a formal program and implement necessary technology and software to support Automated Traffic Signal Performance Measures operations on key District				✓	✓			✓		$$$			

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					Integration					
BP 06	**Develop a System for Accessing TxDMV Issued Over-Height/Oversize Permits:** Develop a system that allows TxDOT and local agencies access to over-height/oversize vehicle permits that have been issued by the TxDMV. *Note: This action item would be led by the TxDMV, but could be developed with support from TxDOT TRF.*	44	TxDMV		✓	✓		✓		TxDOT Traffic Safety Division, ABL Operations, ABL Maintenance, Local Transportation Agencies	$			ST-11
BP 07	**Establish Standard Protocol for Use of DMS:** Develop protocol for when to post and what messages to post on DMS for disseminating information to the traveling public. Develop standard message templates to use for creating messages for various scenarios.	45	District Public Information Officer	✓	✓	✓	✓			TxDOT Traffic Safety Division, ABL Operations, ABL Maintenance, ABL Public Information Office	$			BP-02, BP-04, ST-02, ST-03, ST-09, OW-02
ST 09	**Implement ITS Field Devices Identified in the ITS Master Plan Phase 1:** Deploy ITS infrastructure identified in Phase 1 of the TxDOT Abilene District ITS Master Plan to support improved	55	District Traffic Engineer	✓	✓	✓	✓		✓	ABL Area Engineers, ABL Transportation Planning & Development, ABL Operations, ABL Construction, Local Transportation Agencies	$$			BP-02, BP-03, BP-07, ST-01, ST-02, ST-03, ST-05, ST-07, ST-08, ST-10, PM-01, PM-02, OW-02
ST 10	**Implement ITS Field Devices Identified in the ITS Master Plan Phase 2:** Once Phase 1 of the TxDOT Abilene District ITS Master Plan is complete and operational, prioritize and deploy ITS infrastructure identified in Phase 2 to further support improved traffic management and operations in the District.	56	District Traffic Engineer	✓	✓	✓	✓		✓	ABL Area Engineers, ABL Transportation Planning & Development, ABL Operations, ABL Construction, Local Transportation Agencies	$$			ST-01, ST-02, ST-03, ST-05, ST-07, ST-09, ST-11
ST 11	**Implement Dynamic Truck Parking Signage:** Implement truck parking availability signage with dynamic information in	57	District Traffic Engineer				✓		✓	ABL Area Engineers, ABL Operations, Local Transportation Agencies	$$			BP-07, ST-10, OW-02
CU 02	**Increase Awareness of Information Available on DriveTexas.org:** Increase public awareness of DriveTexas.org to increase dissemination of WZM, RWM, and PSE information.	63	District Public Information Officer		✓		✓		✓	TxDOT Traffic Safety Division, ABL Public Information Office, Local Transportation Agencies	$			BP-04, ST-04, ST-06, CU-01
OW 02	**Develop Standard Operating Procedures for District ITS Device Use:** Develop a set of standard operating procedures for the operation of ITS devices identified in Phase 1 of the District ITS	66	District Director of Operations			✓			✓	ABL Operations, ABL Area Engineers, ABL Maintenance	$			BP-02, BP-03, BP-07, ST-01, ST-02, ST-03, ST-05, ST-07, ST-08, ST-09, ST-11

Appendix C – TxDOT Incident After-Action Report Form

AFTER ACTION REPORT

TEXAS DEPT. OF TRANSPORTATION

Traffic Incident Management Teams

INCIDENT INFORMATION					
Distri Lonestar#		Level: Select Level		Conditions: Select Condition	
Select Day	Date:	Time:(HR:MN)		Incident Type:	☐ Traffic Crash
Location:				☐ HAZMAT	☐ Oil Spill
CMV: ☐ Yes ☐ No		Construction Zone: ☐ Yes ☐ No		PD/FD CAD#	
		Secondary Crash: ☐ Yes ☐ No			

INCIDENT TIMELINE

INCIDENT MILESTONE	TIME
T0 –Incident Occurrence	
T1 – Incident Reported	
T2 – Incident Verified	
T3a – Police Dispatched*	
T3a – Fire Rescue Dispatched*	
T3b – SSP Dispatched	
T3c – Response Plan Activated	
T4a – Police Arrived*	
T4a – Fire Rescue Arrived*	
T4b – SSP Arrived	
T5 – All Lanes Opened	
T6 – Responder Departs	
T7 – Normal Traffic Flow	

*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	
Wrecker			
Police			
Fire Rescue			

INCIDENT SUMMARY:

1

Reviewed by:
Position:
Date:

TxDOT After Action Report Template v6 2019-04-04

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?

3

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

ACTION ITEMS/LESSONS LEARNED/RECOMMENDATIONS:

4

AFTER ACTION REPORT

TEXAS DEPT. OF TRANSPORTATION

Traffic Incident Management Teams

AAR SIGN IN SHEET (please print clearly)				
Name	Title	Agency	Phone	Email Address

AFTER ACTION REPORT

TEXAS DEPT. OF TRANSPORTATION

Traffic Incident Management Teams

AAR SIGN IN SHEET (please print clearly)				
Name	**Title**	**Agency**	**Phone**	**Email Address**

6

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 filed 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 agencies 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 incident, 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 ARR 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.

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 <u>AAR meetings are an opportunity to realize future benefits and understanding each agencies needs and objectives at crashes</u>.

- 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.

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

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

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

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