Transportation Systems Management and Operations Program Plan - State of the Practice Report

TxDOT Dallas and Fort Worth Districts

July 16, 2021

Final Report

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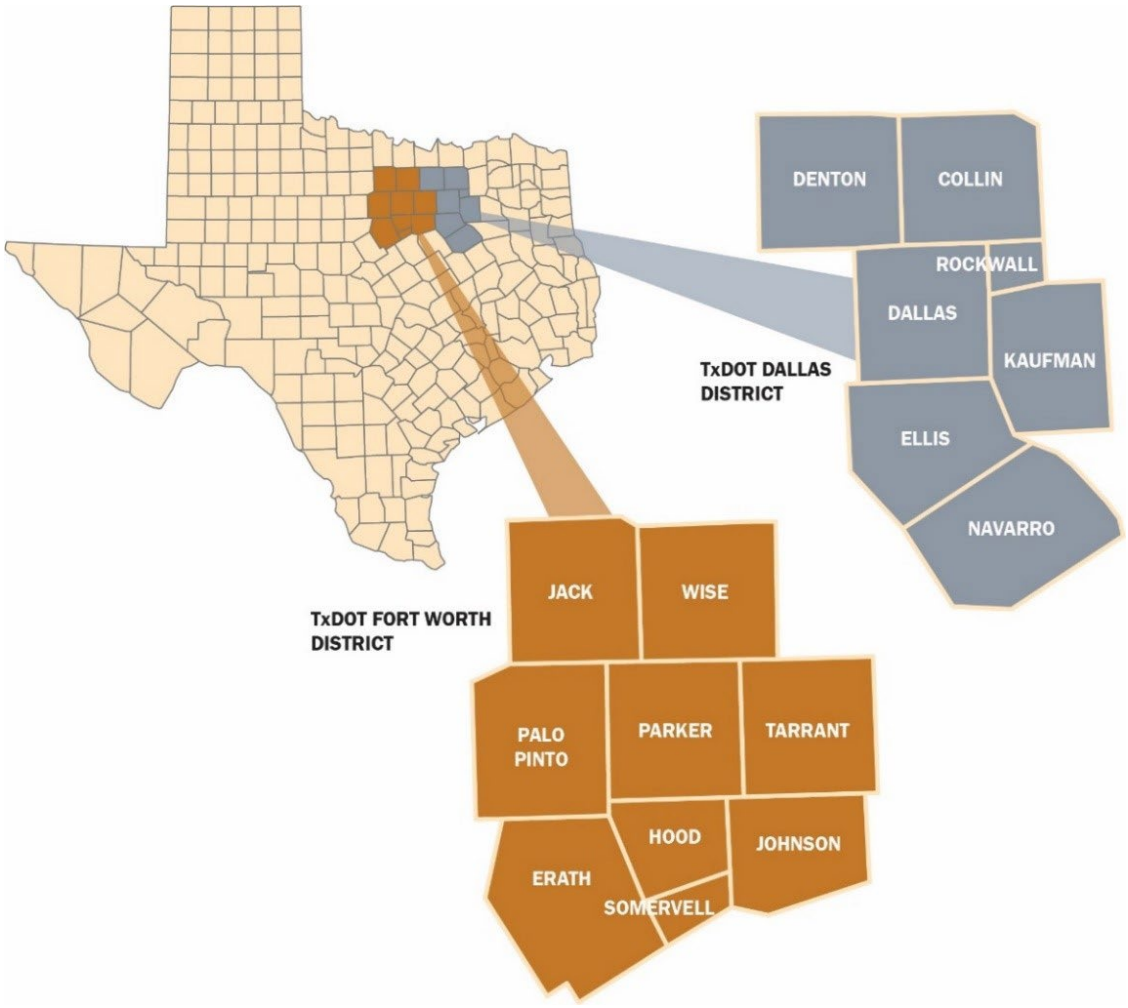
Introduction

The TxDOT Dallas and Fort Worth Districts, shown in Figure 1, are developing and implementing a Transportation Systems Management and Operations (TSMO) Program Plan. 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 safety, security, and reliability of the transportation system.

Figure 1: Map of TxDOT Dallas and Fort Worth Districts



This State of the Practice Report summarizes the TxDOT Dallas and Fort Worth Districts self-assessment of existing TSMO capabilities, strategies, and activities within the region. The Districts used the Capability Maturity Model (CMM) to perform a self-assessment of their current transportation operations. Additional, stakeholder workshops were held internally with TxDOT staff and jointly with TxDOT staff and their regional partners in the DFW area. Existing TSMO capabilities within the TxDOT Dallas and Fort Worth Districts. Based on the CMM self-assessments and workshops, a series of action-items were recommended for the Dallas and Fort Worth Districts to advance TSMO forward in the region.

The TxDOT and Fort Worth TSMO State of the Practice includes the following sections that provide an overview of the input gathered through the CMM process:

- Summary of the CMM process, TSMO areas of focus, and stakeholder workshops;
- TxDOT Dallas and Fort Worth District Assessment based on the CMM dimensions which include Business Processes, Systems and Technology, Performance Measurement, Culture, Organization and Workforce, and Collaboration;
- TxDOT Dallas and Fort Worth District Assessment based on TSMO focus areas for the Districts which include Traffic Incident Management, Work Zone Management, Road Weather Management, Planned Special Events, Traffic Signal Management, and General Traffic Management;
- Best practice examples from around Texas and the United States for each of the TSMO focus areas;
- Summary of recommended action items for the TxDOT Dallas and Fort Worth Districts to advance TSMO in the region; and
- Next steps.

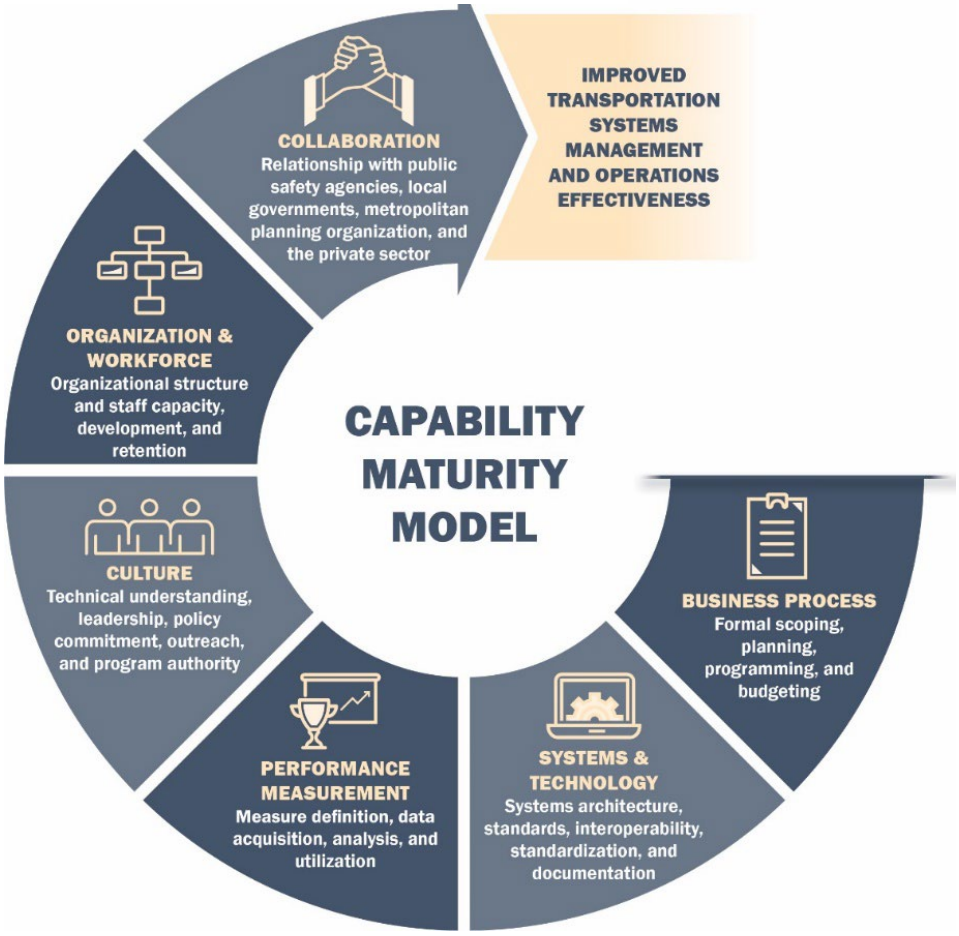
Capability Maturity Model (CMM)

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.

CMM Dimensions

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 include Business Processes, Systems and Technology, Performance Measurement, Culture, Organization and Workforce, and Collaboration. Additional information on each dimension is included in Figure 2.

Figure 2: CMM Dimensions of TSMO Capability (Adapted from AASHTO)



TxDOT Dallas and Fort Worth have many activities that relate to the six CMM dimensions of TxDOT. A summary of the key areas is included in Table 1.

Table 1: CMM Dimensions of TSMO Capability (Adapted from AASHTO)

CMM Dimension	Typical Related TxDOT Activities	
Business Processes	• Project Scoping • Planning	• Programming • Budgeting
Systems and Technology	• Systems Engineering • ITS Architectures	• Technology Interoperability • System Standardization
Performance Measurement	• Defined Measures and Targets • Performance Reporting • Data Acquisition	• Data Use • Informing Operations Decisions
Culture	• Technical Understanding • Leadership • Support for Improving Processes	• Outreach • Program Legal Authority
Organization and Workforce	• TSMO Program Status • Organizational Structure	• Training and Staff Development • Recruitment and Retention

Collaboration	• Relationships with:
	  ○ Local Governments
	  ○ Metropolitan Planning Organization
	  ○ Transit Authorities
	  ○ Toll Authorities
		• Relationships with:
		  ○ Public Safety Agencies
		  ○ Other State Agencies
		  ○ Private Sector Providers

TSMO Focus Areas

The AASHTO CMM assessed the TxDOT Dallas and Fort Worth capabilities across the six dimensions listed in Table 1 for six different focus areas (often referred to as Capability Maturity Frameworks, or CMFs). These focus areas are:

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

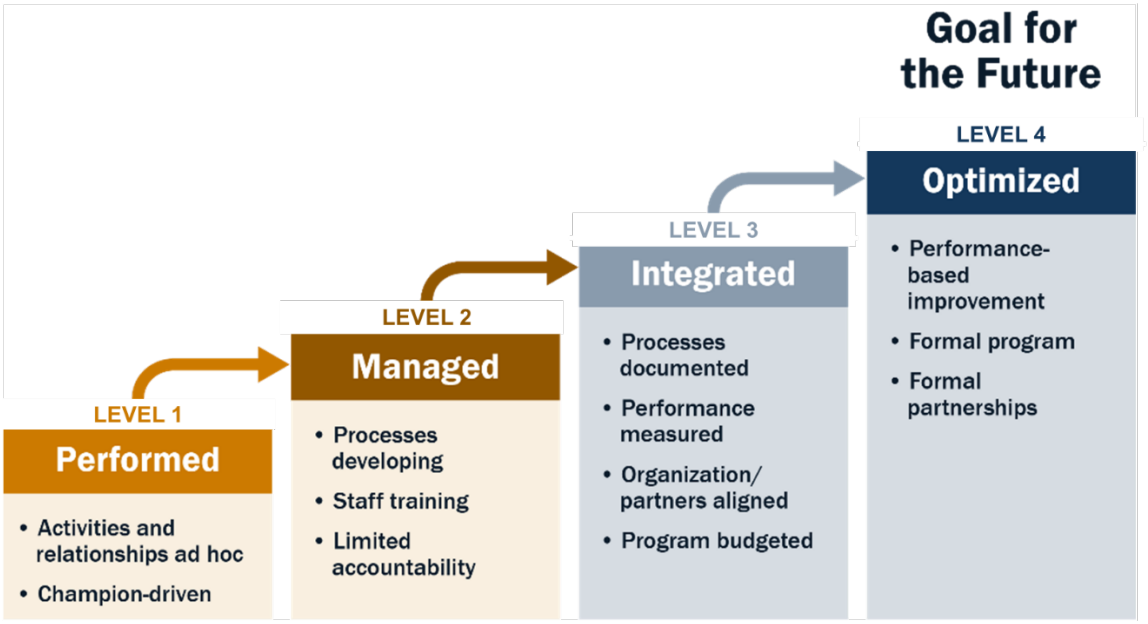
The CMM Process

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. 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.

As shown in Figure 3, Level 1, Performed, means the TSMO capability is completed on an ad-hoc basis, usually by one or two individual champions. Level 2, Managed, may involve more individuals on a team performing the activity and beginning to integrate into other processes; however, there is little accountability for achieving performance measures.

At Level 3, Integrated, the program dimension is part of a more formalized process, there are established performance measures, and activities are structured to work toward those 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 for performance-based improvements.

Figure 3: CMM Levels of Maturity



Each of the capabilities were evaluated through a self-assessment survey that the Dallas and Fort Worth Districts completed independently to evaluate the current state of operations within their respective Districts. Additionally, the capabilities were also evaluated for the TxDOT Dallas and Fort Worth Districts at three CMM

workshop held with both TxDOT and partner agency staff in August 2020 via virtual webinar. The three CMM workshops conducted were:

- CMM Workshop 1: Focus Area – Traffic incident Management
- CMM Workshop 2: Focus Area – Traffic Signal and General Traffic Management
- CMM Workshop 3: Focus Area – Work Zone Management, Planned Special Events, and Road Weather Management

Capability responses were refined later through individual interviews with TxDOT staff.

Table 2 shows where the TxDOT Dallas and Fort Worth Districts ranked themselves for each of the TSMO capability dimensions. Based on the CMM assessment, the District currently sees itself operating at an average of CMM Level 2 (Managed) in all CMM capability dimensions. Most of the dimensions on the scale of 1-4 (Performed to Optimized), are between CMM Level 2 (Managed) and CMM Level 3 (Integrated.)

Table 2: TxDOT Dallas and Fort Worth District CMM Assessment

Overall Capabilities					
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized	Region Score
Business Processes					2.6
Systems & Technology					2.6
Performance Measurement					2.2
Culture					2.5
Organization & Workforce					2.5
Collaboration					2.6

Dallas District Fort Worth District

District Assessment by Capability Dimensions

This section provides an overview of the TxDOT Dallas and Fort Worth Districts current state of the practice with respect to the six TSMO capability dimensions from the CMM: Business Processes, Systems and Technology, Performance Measurement, Culture, Organization and Workforce, and Collaboration.

Business Processes

Business processes that support TSMO can vary from strategic items, like the development agency-wide goals and objectives that focus on operations, to day-to-day items that focus on the formalization of ad hoc District activities and the development of documents such as ITS Master Plans and project prioritization and implementation documents.

Revised Project Delivery Process

Both Districts use TxDOT's Design Summary Reports (DSRs) to scope projects and guide the project delivery process. The Design Summary Report (DSR) is meant to be a dynamic document throughout the project delivery timeline; it contains the record of project development and design. The DSR's purpose is to ensure that the project team does not overlook potentially critical issues, including traffic operations issues, during project planning and design. Traffic operations staff from both Districts noted that the "Proposed Traffic Operations Elements" section in the DSR form could be built out to compel Districts to complete a more thorough analysis of how best to incorporate traffic operations elements into projects. The section is currently only a half-page long and asks five questions about traffic operations. This lack of detail has often led to potentially beneficial operations strategies being left off the DSR, making them more difficult to incorporate into projects later in the delivery process.

Beyond the DSR, the Fort Worth District conducts design concept meetings for specific projects during the planning phase, and these meetings include traffic operations staff. As a part of those meetings, TxDOT staff discuss whether ITS elements or traffic signals will be built or impacted as a part of the planned project. While the inclusion of traffic staff in these meetings regularly occurs, the Transportation Planning & Development (TP&D) group within the District is currently completing a design manual that will specifically state that traffic staff need to be included, thereby formalizing the Operations group's involvement in the early stages of project design.

The Dallas District has had challenges with including ITS elements in project design in the past, but these challenges have become less common over the past few years. According to District Operations staff, the current TP&D Director for the District has prioritized the consideration of ITS devices early in the project development process. The District will also conduct regular checks during the design phase to identify opportunities for signal or ITS device installation, but sometimes these opportunities are discovered too late in the project development process to include in the final project design.

Planning for TSMO

Effective planning for TSMO involves early identification and assessment of costs associated with deployment of technologies and services, which often includes infrastructure investments, technology purchases, staff time, and other resources. The Fort Worth District has developed an ITS Master Plan, which was most recently updated in 2018. The City of Dallas also has an ITS Master Plan. Both of these agencies use the plan to guide decision making related to the rollout of additional ITS field devices throughout the region. While the Dallas District does not have a current ITS Master Plan, agency staff maintain an internal list of ITS deployment projects to implement if funding is identified.

The North Central Texas Council of Governments (NCTCOG) will occasionally identify funding that supports the deployment of ITS throughout the region and will ask its member agencies, including both TxDOT Districts, to submit project proposals. NCTCOG completed an ITS Strategic Deployment Plan for the region in 2016 and is beginning to complete an update to that plan, which will provide a cross-jurisdictional snapshot of existing and recommended ITS deployments. Both Districts have submitted priority project lists to NCTCOG to support the completion of the current plan update.

Programming, Budgeting, and Funding

TxDOT's Chief Engineer has directed each District to include TSMO considerations and Traffic Management Systems (TMS) in all project planning, development, design, construction, maintenance, and operation. While statewide TSMO program planning does occur, a greater amount of planning and budgeting takes place at the District or corridor level. The responsibility in many aspects falls on each District to incorporate TSMO into their roadway and bridge project programming, budgeting, and funding.

Both the TxDOT Dallas and Fort Worth Districts noted that it is difficult to obtain funding for ITS device implementation and other TSMO strategies that support roadway projects in instances when these items are not scoped early in the project development process. As a result, operations staff in both Districts have sought greater involvement early in the project development process. If these elements are scoped early on, staff from both Districts said that it is uncommon for TSMO or ITS elements to be removed later on due to budget constraints. The Dallas District noted that at times, budget constraints may lead to a redesign of ITS elements on a project to reduce the number of devices that are deployed or to utilize less expensive communications technology, for example by utilizing wireless radio or cellular communication instead of installing a fiber optic cable backbone to connect deployed ITS devices back to the traffic management center (TMC).

Both Districts have an annual ITS device maintenance budget, and these budgets include line items for the replacement of ITS devices. Generally, though, these budgets are devised each year from historical averages and do not consider life-cycle projections of currently deployed ITS devices and component parts that tend to fail and require replacement after a set amount of time. As a result, repairs are often made in response to a component failing rather than preventatively, which results in a lower overall ITS asset uptime for the two Districts.

Continuous Improvement

Continuous Improvement can be reflected in incremental changes within the TxDOT Dallas and Fort Worth Districts to incorporate TSMO practices into its business processes and organizational culture. Continuous improvement can be fostered by sharing information related to data collection and development of performance metrics. Improving communication and increasing the frequency of coordination with internal and external stakeholders is one way to support continuous improvement with respect to TSMO priorities throughout the region.

Systems and Technology

The systems and technology component of TSMO includes systems engineering, regional architecture, and ITS procurement processes.

Systems Engineering Analysis Process

In relation to ITS, systems engineering assesses value, functionality and life cycle of technologies incorporated into roadway and bridge projects. FHWA realized the benefit of using a systems engineering analysis (SEA) on ITS projects and, since 2001, requires that a SEA be performed on all federally funded projects that involve ITS. States maintain flexibility in the extent of how they conduct SEA based on the project scope and scale of the project. USDOT policy specifies that the systems engineering process should include seven requirements:

- Identification of portions of the regional ITS architecture being implemented
- Identification of participating agencies' roles and responsibilities
- Requirements definitions
- Analysis of alternative system configurations and technology options to meet requirements
- Procurement options
- Identification of applicable ITS standards and testing procedures
- Procedures and resources.

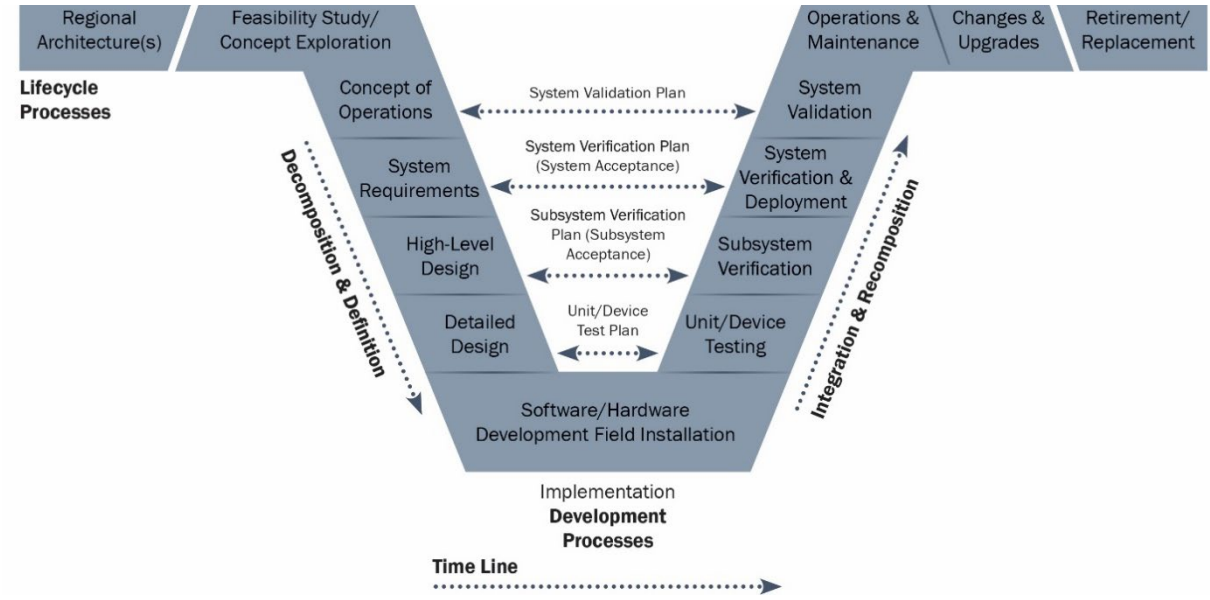
The primary benefit of doing systems engineering is that it will reduce the risk of schedule and cost overruns and will provide a system of higher integrity. Other benefits include:

- Better system documentation
- Higher level of stakeholder participation
- System functionality that meets stakeholders' expectation
- Potential for shorter project cycles
- Systems that can evolve with a minimum of redesign and cost
- Higher level of system reuse
- More predictable outcomes from projects

The systems engineering process represented by the "V" model shown in has been broadly adopted in the transportation industry. The left wing shows the regional ITS architecture, feasibility studies, and concept exploration that support initial identification and scoping of an ITS project based on regional needs. A gap follows the regional architecture(s) step because the regional architecture is a broader product of the planning

process that covers all ITS projects in the region. The following steps in the "V" are for a specific ITS project. The central core of the "V" shows the project definition, implementation, and verification processes. The right wing shows the operations and maintenance, changes and upgrades, and ultimate retirement of the system. The wings are a key addition to the model since it is important to consider the entire life cycle during project development.

Figure 4: Systems Engineering "V" Diagram



Similarly, a System Verification Plan is developed with the System Requirements so that the engineers consider how to verify each requirement as the requirements are written. The connections between the left and right are indicated by the arrows that cross the "V", showing how plans developed on the left drive the process on the right. The system hardware and software are implemented at the bottom of the V, and the components of the system are then integrated and verified in iterative fashion on the right. Ultimately, the completed system is validated to measure how well it meets the agency's needs.

The TxDOT Dallas and Fort Worth Districts do not currently have processes in place to prepare a formal systems engineering analysis for new projects involving ITS. Rather, both Districts typically rely on previous ITS project experience and lessons learned to guide the design and implementation of planned ITS improvements. The Fort Worth District, for example, prepares an after-action report once an ITS project is fully deployed and its elements are tested with the purpose of documenting successes and challenges with the project deployment.

Regional ITS Architecture

A regional ITS architecture is a framework that an agency maintains to improve the likelihood that ITS projects implemented throughout a region are integrated with one another in such a way that permits the region's stakeholders to obtain all desired functionality from the projects that are implemented. The framework allows for organized implementation of ITS projects, encourages resource sharing and interoperability among

agencies, identifies relevant industry standards that apply to ITS elements and projects, and allows for cohesive long-range planning among regional stakeholders.

A regional ITS architecture is needed to satisfy the ITS conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) bill passed in 2005 and the Moving Ahead for Progress in the 21st Century (MAP-21) bill passed in 2012. Since 2005, FHWA has required that any ITS projects show conformance with the regional ITS architecture in order to be eligible for federal funding. To show this conformance, it is important that any region deploying ITS have an updated regional ITS architecture in place.

Through the architecture's development, stakeholders can plan for what they want their system to look like in the long-term and then break out the system into smaller pieces that can be implemented as funding permits. Because those long-term visions change over time, the regional ITS architecture is a living document that should be periodically updated to accurately reflect current ITS needs and plans as ITS projects and processes are implemented and improved.

NCTCOG maintains a regional ITS architecture whose geographic scope encompasses both the Dallas and Fort Worth Districts. Both Districts, as well as NCTCOG's other municipal and county stakeholders, will communicate updates regarding newly planned or existing ITS elements or capabilities to NCTCOG staff so that the regional ITS architecture can be updated accordingly. As a result, neither District maintains its own ITS architecture. NCTCOG's regional ITS architecture was most recently updated in January 2020 and can be found online at this link: https://www.nctcog.org/trans/manage/its/nct-regional-its-architecture.

Existing and Planned Tools to Support ITS

Both the TxDOT Dallas and Fort Worth Districts use a bevy of tools to operate, monitor, and maintain their ITS assets deployed in the region. Several main tools used by the Districts are listed below:

- Lonestar: Lonestar is the advanced traffic management system (ATMS) used by TxDOT staff in both Districts to monitor and control TxDOT's deployed ITS devices, including CCTV cameras and DMS units. Lonestar also integrates probe-based data sources to provide travel time link estimates within the software and provides tools for operators to log incidents and manage service requests.
- Skyline Network Monitoring Tool: The Skyline Network Monitoring Tool regularly tracks and reports on the status of ITS assets owned and maintained by either TxDOT District. The Districts use this tool to track and monitor ITS asset uptime and to identify communication or power service issues to individual ITS devices deployed in the field.
- TxDOTNOW Portal: The TxDOTNOW Portal is the service portal that both Districts use to assign maintenance and service tickets for ITS devices (as well as other TxDOT property) to maintenance technicians so that these devices can be repaired efficiently and brought back online.
- Tableau: Tableau is a data visualization software platform available to staff in both Districts. Tableau links to TxDOT's data lake and allows users to quickly pull and visualize data through dashboards and

other visual tools. Operations staff in the TxDOT Dallas and Fort Worth District have access to dashboards that can show ITS and TSMO data, including for example ITS asset uptime and incident clearance time, for customizable areas and timeframes.

Staff from the Dallas District noted that while the TxDOTNOW system includes some asset management capabilities, there is a need within the District for a more detailed asset inventory, specifically with information such as device age and time before end of design life for ITS devices and their component parts. TxDOT Fort Worth District staff also indicated a need for this type of tool, indicating that while both Districts informally maintain some asset management information for their ITS device deployments internally, this information often contains critical gaps due to the lack of a formal system to track the data. Specifically, the Fort Worth District identified the need for a better way to track when new ITS devices and components go into service and how this information might affect year-to-year fluctuations in the District's maintenance and construction budgets.

Performance Measurement

The success of any TSMO program is tracked through performance measures that are used to track progress towards goals and evaluate if implemented action items are beneficial.

Agency Performance-Based Initiatives

The Texas Transportation Commission adopted a formal road to zero goal to achieve zero deaths on Texas roadways by 2050, with a midway goal to reduce fatalities in half by 2035. TxDOT is developing interim goals to show fatality reductions before 2035 and has made significant investment in safety since the road to zero goal was adopted.

November 7, 2020 Texas marked 20 years with a daily death every day on Texas roadways. TxDOT will continue to look for ways to improve safety on Texas roads and end the streak of fatalities. The public messaging for this initiative is #EndTheStreakTX.

District-Wide (or Project Specific) Performance Measures

Both Districts access performance data via Tableau data dashboards. Examples of these dashboards include ones that provide performance summaries for:

- Safety service patrols operating in the region
- The DalTrans and TransVISION regional TMCs
- Regional incident management and response
- Travel time reliability on key routes
- ITS asset uptime
- Districtwide safety data from Texas' Crash Records Information System (CRIS) database

District operations staff have access to these dashboards to check in on performance as needed or desired. The Fort Worth Director of Operations shares a summary report for these metrics with her staff each month for the purpose of generating discussion on areas of strength and areas for improvement. The Dallas District has used the information to support its tracking and reporting on TMS Status Report performance measures like ITS asset uptime. The prompt resolution of issues through tracking asset uptime in this way has led to high performance on the status report, which in turn has helped the District secure additional funding and consideration for ITS deployments.

TMS Status Report Required Performance Measures

The TxDOT Dallas and Fort Worth Districts track four TMS performance metrics since FY 2017, as required per the TxDOT Chief Engineer.

1. TMS Asset Operational Uptime – Measure how Districts maintain their traffic management equipment, the most critical metric to improve in the short-term.
2. Incident Clearance Times – Measure mobility on our system, driven by District incident management processes in collaboration with regional partners.
3. Level of Travel Time Reliability – An FHWA MAP-21 recommendation, to measure impact on the public from traffic management strategies applied to on-system roads e.g. work zone management, DMS, etc.
4. TMS System Coverage – Measure and understand what portion of on-system roadways are adequately covered with ITS equipment and communications, or where coverage needs to be expanded.

Both Districts report these metrics each month to identify the benefits of implemented projects and serve as an update to TSMO Program Plan goals. Performance metrics are also leveraged to identify TSMO projects and to incorporate ITS into programmed roadway and bridge projects.

Culture

The statewide TSMO program aims to improve mobility and safety through coordinated mobility strategies that are supported by well-defined institutional arrangements, operating procedures, and regional partnerships. At the District level, TSMO Coordinators and Champions aim to influence and nurture a culture which recognizes traffic management systems as a core priority, supported by dedicated programs and funding. Decisions are often determined by an organization based on its culture, which is made up of the organization's values and beliefs.

Engagement Opportunities

Providing TSMO-related engagement opportunities at all organizational levels, from District leadership to summer interns, is a key component of creating a strong TSMO culture within an organization. Developing engaged employees and collaborative agency processes can strengthen institutional TSMO knowledge and procedures. Dallas and Fort Worth District Leadership, with the resources and support from TxDOT statewide divisions, are the key drivers for providing engagement opportunities.

Currently, the traffic operations leadership is focused on improving the ITS, illumination, and signal infrastructure within the District on all projects. Both Districts have designated TSMO Champions, who are members of the District's leadership team that advocate for the implementation of TSMO programs and the accompanying dedication of funding and resources. Similarly, both Districts have designated TSMO Coordinators who are involved in day-to-day operations programs within the District. The TSMO Coordinators are tasked with organizing activities and serving as a point-of-contact to improve understanding of TSMO and its importance among staff in the District's Operations group, as well as the other teams operating within the District.

In addition to these formal roles in each District that supports a TSMO culture, TSMO Champions and Coordinators in the two Districts have been proactive in working with other partners and "bridging silos" to bring operations improvements to construction. For example, the Fort Worth TSMO team has worked with TP&D to become more included in the District's systemic safety projects to identify whether TSMO strategies can enhance other physical safety countermeasure deployments that have already been targeted for implementation. The Fort Worth District's TSMO team has also partnered with TxDOT's Traffic Safety Division and Information Technology Division to obtain cellular modems through a statewide initiative. As a result, the District is now deploying these modems to approximately 500 signals throughout the region. Once complete, the Fort Worth District will have remote surveillance and status monitoring capabilities for its entire signal system.

Organization & Workforce

Organization & Workforce refers to each District's programmatic elements like organizational structure, staffing and workforce needs, recruitment and retention, and training opportunities needed to support TSMO and to create key TSMO roles.

Revise Organization Structure to Accommodate TSMO

Revisions to organizational structure to accommodate TSMO are specific to the organization implementing TSMO processes and practices. Reorganization can be difficult depending on the institutional practices and is most effective when existing staff is engaged and supportive of TSMO goals. A specific organizational approach to accommodate TSMO could be implemented by a District TSMO Steering Committee chaired by the District TSMO Champion or TSMO Coordinator. The TSMO Steering Committee should include staff from Transportation Planning and Development, Construction and Operations departments.

Beyond any formal reorganization, the Dallas and Fort Worth Districts have already taken some initial steps to accommodate the development of a TSMO focus within its staff. The Dallas District has found that one consequence of staff moving between positions within the District, which has occurred often over the last decade, has been that different groups within the organization have been working together more closely with each other and with area offices. District staff said that people throughout the District now have a better idea than they did 10 years ago of who to call to ask for guidance when they anticipate an effort might have large traffic operations impacts.

Key TSMO Roles

This section describes the two key TSMO roles in each District's TSMO Program.

TSMO Champion – A TSMO Champion supports TSMO outreach activities has helped to enhance their TSMO culture. This champion continually advocates for TSMO in the agency and facilitates discussion for future improvement. The position is held by someone currently at the leadership or administrative level within TxDOT.

TSMO Coordinator - The TSMO Coordinator facilitates and is involved with day-to-day operations, traffic, and technology elements. TSMO Coordinator is the point of contact for TSMO questions and activities.

However, success in TSMO cannot be dependent on just one champion and one coordinator. All roles within the agency have a responsibility to drive TSMO practices. Other key contributors may be traffic engineers, traffic signal engineers, freeway operations engineers, arterial operations engineers, ITS design engineers, ITS planners, and transportation planners.

Staffing for TSMO Activities

In order to support operations, it is important for the TxDOT Dallas and Fort Worth Districts to recruit and retain staff, revise position responsibilities to accommodate TSMO activities, and provide growth opportunities. Both Districts have noted difficulties in hiring and retaining qualified staff to support design and maintenance of ITS devices, with hiring qualified construction inspectors of ITS and signal systems, and with hiring and retaining maintenance technicians for traffic signal systems. Staff from the Dallas District said that they aim to hire the most qualified candidate and typically resort to on-the-job training to build the needed skills for the job.

As of late 2020, the Fort Worth District had three full time equivalent job openings in their operations group. Candidates have generally not possessed the desired specialized experience in ITS and operations, and qualified applicants have at times spent a short amount of time with the District before moving on to work at another agency. Specifically, many applicants for engineering positions have not possessed sufficient experience with drafting software, which has led to missed errors in plan sets under review.

Training Plan

The Dallas and Fort Worth Districts have multiple opportunities for training both internally and through state-wide resources. For training on new technologies, the both Districts take advantage of free training and support offered from equipment vendors.

Both Districts noted room for growth among staff in working with ITS devices, both in terms of design at the engineering level and maintenance at the technician level. Each District is attempting to further build these skills among staff through a combination of internal and external training. In the Fort Worth District, for example, staff have been working to develop internal training opportunities geared toward ITS device design, signal cabinet troubleshooting, and signal and ITS device maintenance and upkeep. The Districts also noted that there exists a need for more widely available statewide training opportunities for staff in the areas of ITS design and overhead sign board design.

Collaboration

The Collaboration dimension describes how the TxDOT Dallas and Fort Worth Districts proactively manage and operate an integrated transportation system through multijurisdictional coordination and cooperation between various transportation disciplines and partner agencies.

Internal Partnerships

TSMO activities within the Dallas and Fort Worth Districts will often require internal collaboration among staff. The two Districts actively collaborate, with the Directors of Operations involving directors from other groups within the District in TSMO-related challenges when applicable. Operations staff often provide their expertise to area engineers and their teams as they carry out construction and maintenance efforts.

Within TxDOT, both Districts also regularly partner with subject matter experts in the TxDOT Traffic Safety Division or Information Technology Division to learn about new methods or technologies that could address TSMO goals and objectives. For example, both Districts are currently working with the TxDOT Traffic Safety Division to build expertise in the use of INRIX and Streetlight probe data tools that have been made available across the state. TMC staff in both Districts will also regularly partner with statewide experts to learn about new functionality available to tools already in use, such as the Lonestar advanced traffic management system.

External Partnerships

External partnerships with metropolitan planning organizations, local agencies, and incident responders improve many aspects of the Dallas-Fort Worth region's TSMO program. Traffic incident management is an example of a program that benefits from enhanced collaboration between organizations, and the region champions this spirit of collaboration through regularly held multidisciplinary incident management training sessions that are led by NCTCOG. The Dallas and Fort Worth Districts also each lead multidisciplinary traffic incident management working groups that meet regularly to share best practices and discuss ways to improve.

Transportation agencies throughout the region coordinate with one another through working groups and forums that support other specific initiatives, as well. Both Districts and cities partner with NCTCOG to support its regional traffic signal retiming program. District representatives also participate in activities of the NCTCOG regional ITS stakeholder committee and regional safety committee.

Both Districts also currently maintain numerous agreements that allow for the sharing of data and assets to support regional traffic management. These include fiber sharing agreements with partner cities in both Districts and with the North Texas Tollway Authority; video feed sharing agreements with cities, counties, public safety officials, and local news media; and traffic signal data sharing agreements with partner cities and NCTCOG. As a part of the video sharing agreements, certain cities have access to a virtual Lonestar module that allows these cities to control TxDOT's CCTV cameras to support local traffic management needs. While some of these written agreements have lapsed or expired, involved agencies have typically continued supporting one another via an informal agreement until a new written agreement is executed.

Adjacent Districts

Both the TxDOT Dallas District TMC (DalTrans) and Fort Worth TMC (TransVISION) support other TxDOT Districts throughout the state with after-hours monitoring and operation of ITS field devices. DalTrans provides after-hours support to the Atlanta District, Bryan District, Paris District, and Tyler District. TransVISION provides after-hours support to the Abilene District, Amarillo District, Brownwood District, and Waco District. TransVISION has also supported the Wichita Falls District, but these responsibilities are currently transitioning over to DalTrans.

The two Districts are also able to collaborate with subject matter experts in other Districts through both formal and informal means. Formal collaboration opportunities occur during events such as TxDOT's Short Course program, held each fall with attendees from across the state. Informal partnerships also arise when staff in multiple Districts must confront similar challenges. For example, the Fort Worth District is currently collaborating with staff in the El Paso, Lubbock, and San Antonio Districts to develop potential solutions to address TSMO-related challenges.

Public-Private Partnerships

Public-private partnerships involve collaboration between a government agency and the private-sector. These partnerships can help the agency finance, build, operate, and maintain projects that work towards completing TSMO objectives. One of the most common partnerships currently occurring within the region is the occurrence of data sharing agreements with third-party providers. For example, several agencies within the Dallas and Fort Worth District boundaries have partnered with navigation applications to push out to the public planned event and construction closures that will impact the road network.

Similarly, agencies have sought agreements with probe-based data providers to access real-time traffic operations data that can aid in agency decision making. While many agencies currently have their own agreements and are already using this data, the TxDOT Traffic Safety Division recently executed an agreement with INRIX and Streetlight to provide probe-based traffic operation and origin-destination data to all TxDOT Districts. Both the Dallas and Fort Worth Districts have some experience with using this data and have been working with the TxDOT Traffic Safety Division to expand the institutional understanding of how probe-based data can be used.

District Assessment by TSMO Focus Areas

Through outreach and CMM workshops and stakeholder interviews held virtually during the latter part of 2020, the TxDOT Dallas and Fort Worth Districts identified regional needs and assessed their CMM capabilities for not only the six dimensions of TSMO (Business Processes, Systems and Technology, Performance Measurement, Culture, Organization and Workforce, and Collaboration), but also for the each of the six TSMO focus areas:

- Traffic Incident Management
- Work Zone Management
- Road Weather Management
- Planned Speciate Events
- Traffic Signal Management
- General Traffic Management

Following completion of the CMM assessment survey and workshops, the TxDOT Dallas and Fort Worth District TSMO leadership selected three of the TSMO focus areas as the subject of Capability Maturity Framework (CMF) workshops. These workshops provided an opportunity for interested stakeholders to meet and identify action items that would allow the TxDOT Dallas and Fort Worth Districts to advance TSMO for each CMM capability dimension within a given TSMO focus area. The focus areas that the Districts chose for CMF workshops were Traffic Incident Management, Traffic Signal Management, and General Traffic Management with a focus on TxDOT TMC operations. The CMF workshops were then conducted October 2020 as noted below:

- CMF Workshop 1: Focus Area – Fort Worth Traffic Signal Management (this workshop was conducted with the TxDOT Fort Worth District and partner agencies located within the TxDOT Fort Worth District)
- CMF Workshop 2: Focus Area – Dallas Traffic Signal Management (this workshop was conducted with the TxDOT Dallas District and partner agencies located within the TxDOT Dallas District)
- CMF Workshop 3: Focus Area – General Traffic Management (this workshop was conducted with TxDOT staff only from the TxDOT Dallas and Fort Worth Districts)
- CMF Workshop 4: Focus Area – Traffic Incident Management (this workshop was conducted as a Region)

Input from both the CMM and the CMF workshops, as well as from individual stakeholder discussions, is presented in this subsection, organized by TSMO focus area. Action items to advance TSMO forward in each of the TSMO focus areas are provided. Case study examples from other TxDOT Districts and other transportation agencies across the United States are also included to provide examples of successful TSMO-related deployments that correspond to some of the recommended action items.

Traffic Incident Management Assessment

Traffic incident management (TIM) is the institutional capability to detect, respond to, and clear traffic incidents so that normal operations may be restored safely and quickly. The regional focus on TIM can improve safety, increase travel time reliability, and reduce congestion. The TxDOT Dallas and Fort Worth Districts generally perform TIM response activities in coordination with other regional partners. A formal TIM program exists within the Districts, with funding allocated for TIM training by NCTCOG. TIM performance data including road clearance time, incident clearance time, and secondary crashes is collected and logged in the TxDOT Lonestar system, and summaries of this data are available to decision makers. The TxDOT Dallas and Fort Worth Districts generally incorporate TIM considerations in construction and work zone planning efforts.

Table 3: CMM Assessment for Traffic Incident Management

Traffic Incident Management					
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized	Region Score
Business Processes					3.7
Systems & Technology					3.5
Performance Measurement					2.7
Culture					3.3
Organization & Workforce					3.8
Collaboration					3.3

Dallas District Fort Worth District Both Districts

The TxDOT Fort Worth District has a formalized process for responding to incidents, including documented TIM guidelines and a multidisciplinary TIM program that has been developed. There are four separate TIM task force groups that currently meet every other month within the Fort Worth District. The TxDOT Dallas District does not have a TIM groups that meet on a regular basis but has expressed interest in forming such groups.

Stakeholders in both Districts promote the existing statewide Authority Removal Law, Driver Removal Law, and Move Over Law. Stakeholders in both Districts also operate several Safety Service Patrol programs for both incident response and motorist assistance services.

The safety patrol programs are branded in the region as Mobility Assistance Patrol, Courtesy Patrol, or Roadside Assistance Patrol. The Mobility Assistance Patrol, led by NCTCOG, is a program put in place to improve roadway safety and reduce congestion on regional highways, toll roads, and managed lane facilities within the Dallas-Fort Worth region. The program provides free assistance to stalled and stranded motorists by assisting with flat tires and providing small quantities of gasoline to keep motorists moving. The overall goal is for the patrol service to quickly get vehicles operating or else to promptly remove disabled vehicles from the roadway completely. Courtesy Patrol are funded by TxDOT and NCTCOG and operated by the Tarrant County Sherriff's Office in Tarrant County and the Dallas County Sherriff's Office in Dallas County, with the mission for trained first responders to patrol the freeway system and assist stranded motorists in a safe and efficient manner to alleviate traffic congestion. The Courtesy Patrol works closely with law enforcement and local fire departments to assist with clearing incidents that occur on the freeway system. There are two types of Roadside Assistance Patrol programs in the Dallas-Fort Worth Districts, one through NTTA and the other through TEXpress. The programs serve the same goal of helping stranded motorists on their respective toll road facilities.

The Districts have policies in place to effectively respond to incidents that involve hazardous materials, commercial vehicles, and fatalities. Some law enforcement agencies have expedited crash investigation policies in place. The Districts also have procedures in place for early notification and timely response of incident resources such as contracts to support Hazmat cleanup. Although the Districts scored themselves lower in the performance measurement dimension of the CMM Self-Assessment, both are actively tracking and reporting key TIM metrics in Lonestar as well as other general traffic management metrics such as travel time reliability and congestion/delay.

Implementing standardized corridor messaging could be useful for traffic incident management, construction management, and special event management. In addition, streamlining video sharing processes through a developed written procedure would improve the ability for local police, fire, and city transportation departments to effectively respond to incidents. Lastly, improved communication among TIM and traffic groups throughout the Districts has been mentioned as a goal throughout the CMM and CMF workshops. During- and after-action collaboration and business processes were identified as current weaknesses, and communication on scene within the incident command structure is an ongoing challenge in the region.

Participants in the CMM and CMF workshops commented that performance measures need to be tracked and reported across agencies by other agencies in addition to TxDOT. Suggested measures to begin recording by other agencies in the region included roadway clearance time, incident response time, number of secondary crashes, and traveler delay associated with traffic incidents. The Districts further felt that TIM performance should be measured both on and off the TxDOT highway system.

Based on the CMM and CMF assessments, TIM in the TxDOT Dallas and Fort Worth Districts would benefit from the following action items.

- Develop process and procedures for incident management within construction work zones prior to letting of all major construction contracts.
- Establish documented standard communication protocol for timely public safety information sharing with TxDOT.
- Develop regional courtesy/service patrol plan for expansion; considering network coverage, hours of operation, and baseline of services provided.
- Improve TIM related data collection and reporting, with a focus on incident response time, roadway clearance time, incident clearance time, secondary crash data and time to return to normal flow.
- Develop regional TIM database in partnership with NCTCOG and local agencies to track TIM quick clearance performance on routes throughout the DFW Region.
- Continue partnering with NCTCOG and other agencies to identify agencies that have not been involved with training and provide recurring regional TIM training in a multidisciplinary setting.
- Establish a dedicated TIM coordinator position in the Dallas District to support TIM activities throughout this District.
- Conduct quarterly meetings between TxDOT Dallas and TxDOT Fort Worth Districts.
- Establish a formalized TIM Team that meets regularly, includes all relevant jurisdictions and roles, and provides a forum on after-action reviews of major incidents.
- Establish criteria for determining which incidents require after-action reviews and conduct reviews as needed.

Traffic Incident Management State of the Practice

Below are examples of existing programs in place around Texas and the United Sates focused on improving TIM:

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

Strategy and Best Practice

The Colorado Department of Transportation (CDOT) published Guidelines for Developing Traffic Incident Management Plans (TIMP) for Work Zones. This document outlines existing CDOT TIMPs and best practice examples from TIMPs in other states. The considerations for developing TIMPs for work zones and key components include detailed lists of response agencies and their roles and responsibilities. Program implementation and management strategies are also provided in these guidelines.

http://hermes.cde.state.co.us/drupal/islandora/object/co:5185

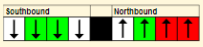
Action Item: *Develop regional courtesy/service patrol plan for expansion; considering network coverage, hours of operation, and baseline of services provided.*

Strategy and Best Practice

The Pennsylvania Turnpike Commission partnered with State Farm to patrol and provide first responder services along the Pennsylvania Turnpike, 24 hours a day, 365 days a year. The State Farm Safety Patrol responds to incidents, initializes spill control and clean ups, communicates with the Turnpike Operations Center to assist motorists and maintain traffic flow.

https://www.paturnpike.com/travel/state_farm_safety_patrol.aspx

Action Item: *Improve TIM related data collection and reporting, with a focus on incident response time, roadway clearance time, incident clearance time, secondary crash data and time to return to normal flow.*

Frederick County: I-270 NORTH PAST DOCTOR PERRY RD	
Type	Incident (Collision)
Location	Frederick County [I-270 NORTH PAST DOCTOR PERRY RD]
Direction	North
Details	1 Vehicle Involved All Southbound Lanes Open 1 of 2 Northbound Shoulders Closed 1 of 2 Northbound Traffic Lanes Closed Created: 01/27/2021 2:42 AM by TOC7
Lane Configuration Data	

Strategy and Best Practice (1 of 2)

Maryland Department of Transportation has a program called Coordinated Highways Action Response Team (CHART). CHART staff maintain a database that tracks each traffic incident; cataloging the location, lane closures, and the number of vehicles involved. Through performance measurement and related resulting action items, CHART achieved a reduction of 13% to 41% in incident duration for each incident evaluation period, demonstrating the value of tracking performance and its emphasis resulting in significant percentage reductions in incident clearance time.

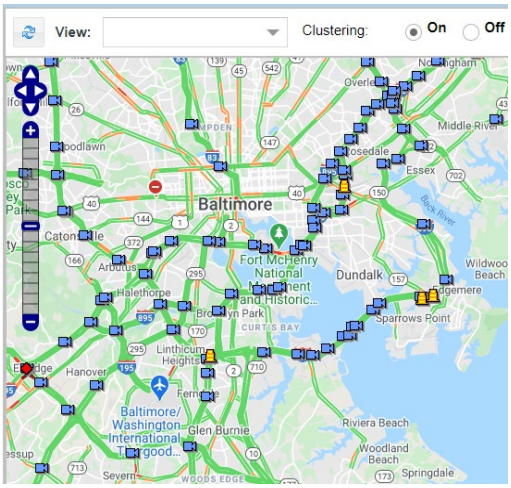
https://chart.maryland.gov/about/overview.asp

Strategy and Best Practice (2 of 2)

The Texas Department of Public Safety (DPS) logs incident clearance time, roadway clearance time, and secondary crash information as part of the agency's existing processes for submitting records to the Texas Crash Record Information System (CRIS). Agencies can add up to five additional CRIS data reporting fields at no charge, and Texas DPS chose to begin reporting this data. In separate efforts, TMCs across the state of Texas use Lonestar to enter timestamp and log data for incidents verified via CCTV.

https://cris.dot.state.tx.us/public/Query/app/welcome

Action Item: *Develop regional TIM database in partnership with NCTCOG and local agencies to track TIM quick clearance performance on routes throughout the DFW Region.*



Strategy and Best Practice

Maryland Department of Transportation has a program called Coordinated Highways Action Response Team (CHART). CHART staff maintain a database that tracks each traffic incident; cataloging the location, lane closures, and the number of vehicles involved. The program is directed by the CHART Board, consisting of senior technical and operational personnel from the Maryland State Highway Administration, Maryland Transportation Authority, Maryland State Police, Federal Highway Administration, University of Maryland Center for Advanced Transportation Technology and various local governments.

https://chart.maryland.gov/about/overview.asp

Action Item: *Continue partnering with NCTCOG and other agencies to identify agencies that have not been involved with training and provide recurring regional TIM training in a multidisciplinary setting.*

Strategy and Best Practice

In the Dallas-Fort Worth Region, the North-Central Texas Council of Governments (NCTCOG) provides a free Traffic Incident Management (TIM) training course. The multi-disciplinary course supports a common, coordinated response to traffic incidents that builds partnerships, enhances safety for emergency personnel, reduces secondary crashes, increases reliability, and improves air quality in the Dallas-Fort Worth region by shortening response and clearance times. Specific courses have been designed for first responders, traffic managers, and executive level policy makers.

https://www.nctcog.org/trans/quality/safety/transportation-safety/traffic-incident-management/tim-training-program

Action Item: *Conduct quarterly meeting between TxDOT Dallas and TxDOT Fort Worth Districts.*

Strategy and Best Practice

In 1998, California's Caltrans and Oregon's DOT formed a partnership called the California Oregon Advanced Transportation Systems (COATS). COATS has completed several regional projects, including the creation of an ITS Architecture Plan and Strategic Deployment Plan, the implementation of several road weather technologies, and an evaluation of the implemented technologies for long-term effectiveness. The two states also share a road information website which shows DMS, CCTV, construction, incidents, and more for both jurisdictions. COATS has expanded to now include agencies from Nevada, Utah and Washington and meets quarterly to address ITS issues and concerns.

http://www.westernstates.org/Projects/COATS /Documents/COATS_Factsheet_March_2020.pdf

Action Item: *Establish a formalized TIM Team that meets regularly, includes all relevant jurisdictions and roles, and provides a forum on after-action reviews of major incidents.*

Strategy and Best Practice

The Wisconsin Department of Transportation (WisDOT) developed the Traffic Incident Management Enhancement (TIME) program. TIME is a multi-agency, multi-discipline program with the purpose of improving responder safety, incident clearance, and communications. Regional team meetings cover regional issues, planned work, and review past activities. This program also uses footage from incident responses for future trainings.

https://wisconsindot.gov/Pages/about-wisdot/who-we-are/dtsd/bto/stoc/time.aspx

Action Item: *Establish Criteria for determining which incidents require after-action reviews and conduct reviews as needed.*

Strategy and Best Practice

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

http://www.vastim.org/documents/final_after_action_review_policy_-_signed_version.pdf

Work Zone Management District Assessment

Work Zone Management (WZM) involves the TxDOT Dallas and Fort Worth Districts and partner agency management before, during, and after planned construction events, which when done effectively can improve safety, reduce congestion, and increase travel time reliability. Table 4 shows that the TxDOT Dallas District consistently scored themselves as performing WZM at an integrated or optimized level. The TxDOT Fort Worth general rated themselves slightly lower as performing WZM at an integrated level. Both Districts regularly coordinate multiple projects along key corridors, inform partner agencies of road work plans, seek to apply established and existing technologies to support safety and mobility in work zones, and consider innovative technology to further improve work zone operations.

Table 4: CMM Assessment for Work Zone Management

Work Zone Management					
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized	Region Score
Business Processes					3.1
Systems & Technology					2.5
Performance Measurement					2.6
Culture					2.5
Organization & Workforce					2.6
Collaboration					2.5

The TxDOT Dallas and Fort Worth Districts acknowledge the benefits of effective WZM and train staff to improve understanding of the importance of WZM. The Districts will often use innovative contracting methods to incentivize WZM practices among contractors and will conduct regular check-ins to identify strengths and areas of improvement in WZM. The process to ensure consideration and use of innovative technologies and strategies for improving WZM on projects occur across the agencies, but both Districts felt innovative strategies should be considered earlier in WZM planning process.

In general, the Districts agree that the collaboration, communication, and business processes were strengths in terms of WZM. Work zone training and implementation is done well, especially on larger projects, and most of those larger projects include ITS technology deployments to support WZM. Coordination with partnering

agencies early in considering WZM, especially related to traffic incidents within work zones, was identified as an area for improvement; currently the collaboration occurs largely in later phases of construction. Establishing a mobility coordinator role on a wider range of construction projects or as a standing role could help the Districts with WZM. The Districts agreed on the importance of increasing coordination on parallel arterials during construction to ensure there are alternate routes for travelers.

Based on the CMM and CMF assessments, WZM in the TxDOT Dallas and Fort Worth Districts would benefit from the following action items.

- Conduct post-construction event reviews to determine level of delay, evaluate safety, and determine potential areas of improvement.
- Establish procedures for collecting work zone road user cost data occurring at significant projects and compare to predictions made during project development.
- Standardize an approach or decision tool for when to deploy certain work zone ITS technologies based on anticipated construction impacts. Expand deployment of work zone technology throughout both districts to support improved work zone monitoring, localized real-time traveler information, end of queue warning, and worker safety.
- Develop automated construction and special events notification application that uniformly provides information to HCRS, DriveTexas.org, and 511DFW which can be used by TxDOT and partner agencies to track existing and planned road closures due to construction and planned special events.
- Partner with third-party navigation apps to expand and provide accurate information for travelers related to work zone closures.
- Measure and report travel time delay in work zones.
- Establish a dashboard of key work zone performance measures that can be continually updated and viewed by agency personnel, other agencies, and the public.
- Prioritize communication with local agencies regarding both initial construction notices and subsequent construction plan or schedule changes.
- Establish district-level work zone coordinator responsibilities for coordination of construction closures to avoid conflicts and ensure communication to impacted stakeholders.
- Establish regular training sessions for TxDOT, education on WZM technologies, how and when each are most effective, installation procedures, and planning for budgets and contracts.

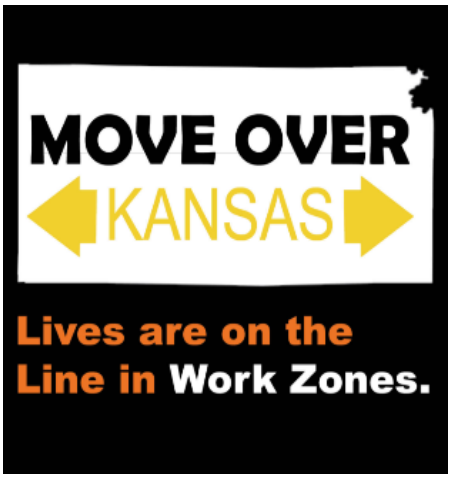
Work Zone Management State of the Practice

Below are examples of existing programs in place around Texas and the United Sates focused on improving work zone management.

Action Item: *Conduct post construction event reviews to determine level of delay, evaluate safety, and determine potential areas of improvement.*

Strategy and Best Practice

The Kansas Department of Transportation (KDOT) has implemented into their processes a Work Zone Review Team responsible for performing an onsite scan of project work zones throughout the state. As they scan the work zones, participants list positive and negative aspects of the operation. The review team analyzes all work zone collision data in the state for each year and documents the contributing circumstances. KDOT also has a Traffic Control Review Team that randomly selects construction and maintenance work areas on the State Highway System to determine if improvements are needed for the agency's traffic control procedures.



https://www.ksdot.org/Assets/wwwksdotorg/PDF_Files/KANSAS%20WORK%20ZONE%20SAFETY%20AND%20MOBILITY%20POLICY%20MASTER.pdf

Action Item: *Expand deployment work zone technology throughout both Districts to support improved work zone monitoring, localized real-time traveler information, end of queue warning, and worker safety.*

Strategy and Best Practice

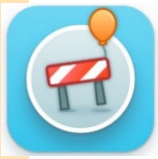
Maryland State Highway Administration deployed sport-utility vehicles with Automated Speed Enforcement (ASE) in work zones. Maryland ASE systems use lidar to measure speeds, which ensures that the measurement is of a particular vehicle. The fine for speeding is $40 and is considered a civil infraction. The use of ASE systems reduced the number of motorists driving at least 10 mph over the speed limit by 54%. The ASE Systems also reduced speed disparity between vehicles, resulting in more uniform flow through the work zone.

http://safezones.maryland.gov

Action Item: *Develop automated construction and special events notification application that uniformly provides information to HCRS, DriveTexas.org, and 511DFW which can be used by TxDOT and partner agencies to track existing and planned road closures due to construction and planned special events.*

Strategy and Best Practice

Maryland's Road Closure Reporter (MRCR) is a web-based system and application that local road jurisdictions use to capture road closure events. Maryland DOT State Highway Administration (SHA) hosts and administers the application. MRCR has bidirectional data sharing and tracks advanced closure attributes such as partial closures, specific times of day, reason for closure, and lanes blocked. Representatives from local agencies enter data through a desktop or smartphone which gets disseminated to the public through Waze. The MRCR team emails local agencies after creating, editing or ending a road closure, providing information about the closure and a link to view the closure in the MRCR public-facing demonstration application. Archived data is openly available.



http://dot.state.mn.us/research/TRS/2020/TRS2001.pdf

Action Item: *Partner with third-party navigation apps to expand and provide accurate information for travelers related to work zone closures.*

Strategy and Best Practice

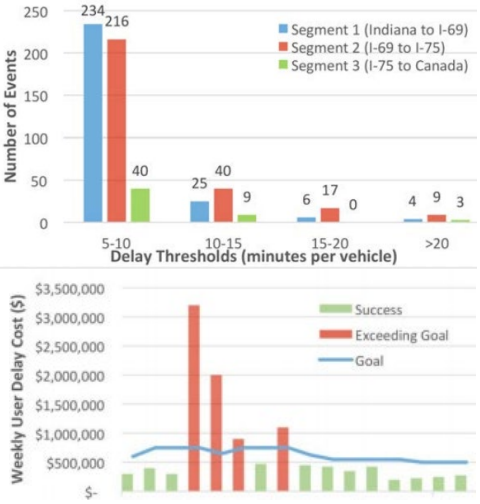
The Port Authority of New York and New Jersey uses crowdsourced incident and congestion data from via Waze Connected Citizens Program to detect hazards and traffic events. Additionally, they push out information such as road closures, detour routes, and preferred routes to through Waze to influence traffic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

https://ops.fhwa.dot.gov/publications/fhwahop18084/ch2.htm

Action Item: *Measure and report travel time delay in work zones.*

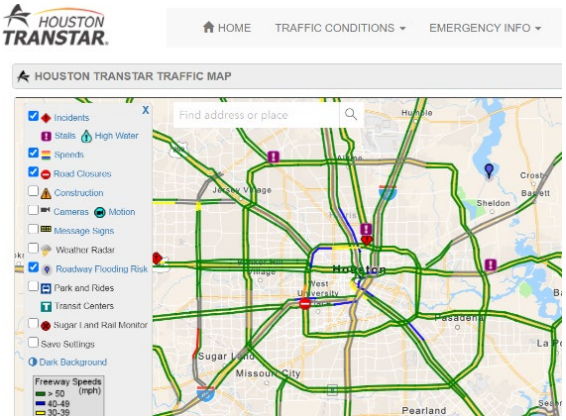
Strategy and Best Practice

The Michigan Department of Transportation (MDOT) originally used stopwatches and later screenshots of Google Traffic to calculate travel delay by hand. MDOT began using the Regional Integrated Transportation Information System (RITIS) in 2013, which utilizes probe data. RITIS provides a faster, more accurate measure of delay and its attributor, such as a work zone, incident, or weather. This data is used to estimate user delay cost, which is analyzed to determine work zone modifications during construction and can be applied to future projects.



https://www.workzonesafety.org/files/documents/SWZ/MI_PC_case_study.pdf

Action Item: *Prioritize communication with local agencies regarding both initial construction notices and subsequent construction plan or schedule changes.*



Strategy and Best Practice

Houston, Texas uses Tran Star, a multimodal transportation and emergency management center to plan, design, operate, and maintain the roads in the Greater Houston region. Engineers and planners from different agencies can share project information with *Roadworks*, TranStar's web-based construction management system. The public also has access to projects, maps, real-time traffic data, closures, and other information posted on the website.

https://traffic.houstontranstar.org/construction/

Action Item: *Establish work zone coordinator position that is responsible for coordination of construction closures to avoid conflicts and ensure communication to impacted stakeholders.*

Strategy and Best Practice

The Northern Virginia District of the Virginia Department of Transportation (VDOT) has a lane closure coordinator. This position was created to serve as a single point of contact for the compilation and dissemination of information related to planned lane closures. The coordinator is responsible for preventing multiple maintenance, construction, or utility work lane closures on neighboring roadways and to avoid conflicts in operations, reducing traffic delay and congestion.

https://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=52&from=crossref&Category_ID=2&subCat1=&subCat2=

Action Item: *Establish regular training sessions for TxDOT, education on WZM technologies, how and when each are most effective, installation procedures, and planning for budgets and contracts.*

Strategy and Best Practice

The Virginia Department of Transportation (VDOT) has three training courses for Work Zone Traffic Control (WZTC). For installing temporary traffic control devices there is a one-day Basic WZTC course. There is a two-day Intermediate WZTC course for inspectors and contractor superintendents. Another two-day Advanced WZTC course was implemented for the design of traffic control plans. VDOT requires that every design team must have a member who has completed the Advanced course. Every installation crew must have at least one Basic WZTC trained member and a supervisor who has completed the Intermediate course.

http://www.virginiadot.org/business/resources/NOVA_FairfaxPermits/Work_Zone_Traffic_Contr_Training_Options_May_09.pdf

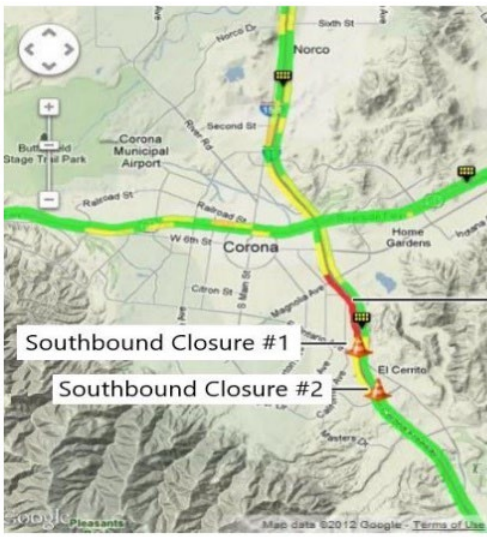
Action Item: *Establish a dashboard of key WZM performance measures that can be continually updated and viewed by agency personnel, other agencies, and the public.*

Strategy and Best Practice

The California Department of Transportation (Caltrans) uses its Performance Measurement System (PeMS) as the key platform for monitoring and managing work zone performance. PeMS is a comprehensive roadway performance monitoring system consisting of roadway sensors for data collection, a web-based data warehouse, and a data analytics suite. Caltrans planners and engineers use PeMS to proactively manage work zone impacts across all project stages. Similarly, the TxDOT Waco and TxDOT Austin Districts use SWZ units equipped with sensors that send data back to TMC operators who can monitor performance in real time as needed. In the Waco District, this data is also shown on a public-facing website along with updated closure information.

https://ops.fhwa.dot.gov/publications/fhwahop19054/index.htm

https://waco4bmap.org/#map



PeMS Lane Closure Delay Map
Source: PeMS

Road Weather Management District Assessment

Road weather management (RWM) involves the TxDOT Dallas and Fort Worth Districts' and partner agency response to anticipated major weather events. The TxDOT Dallas and Fort Worth Districts have developed a formal process to share resources throughout the region during weather events. The TxDOT Dallas and Fort Worth Districts utilize data from the National Weather Service to aid in forecasting and resource planning, and both Districts share road weather updates with the public via the Internet and via DMS or PCMS messages. Both Districts generally rated themselves as performing RWM at a managed or integrated level.

Table 5: CMM Assessment for Road Weather Management

Road Weather Management					
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized	Region Score
Business Processes					1.8
Systems & Technology					2.5
Performance Measurement					1.5
Culture					2.6
Organization & Workforce					2.3
Collaboration					2.5

Dallas District Fort Worth District

The TxDOT Dallas District has an established line of communication with the National Weather Service (NWS) to receive advance warnings of major weather events. The Fort Worth District currently does not actively coordinate with the NWS but does utilizes the data on the NWS website to provide road weather information to the public. The Districts communicate effectively among their Area Offices and Maintenance Sections during road weather response. After each major weather event, the Districts may conduct an after-action review with a focus on strategic planning for an improved response in future events. In general, collaboration, communication, and business processes were seen as strengths, and performance measurement was seen as a weakness for both the Dallas and Fort Worth Districts.

For winter weather events and planning, the Dallas District spends considerable effort to pre-stage equipment and supplies to respond more effectively to adverse weather conditions. This tends to be effective and allow for a quick response by their maintenance sections when winter weather arrives. Both Districts share equipment as needed with local agencies during flooding and other weather events, but participants within the CMM and CMF workshops noted that TxDOT could improve preparedness by ensuring that the equipment is ready to use in advance. Although the local agencies commented that they can communicate with the Districts and their contractors when an issue arises, communication with transit agencies was identified as an area for improvement.

Based on the CMM and CMF assessments, road weather management in the TxDOT Dallas and Fort Worth Districts would benefit from the following action items.

- Conduct after action-reviews to improve emergency weather event response times and lines of communication.
- Implement technology for closing roads or warning drivers in areas that frequently flood.
- Develop online dashboards that provide summary statistics of response for weather events.
- Develop and provide training for operation, maintenance, and asset management of road weather management equipment.
- Improve communication with local stakeholders regarding TxDOT weather-related road closures and ice prevention operations.

Road Weather Management State of the Practice

Below are examples of existing programs in place around Texas and the United Sates focused on improving road weather management:

Action Item: *Conduct after action reviews to improve emergency weather event response times and lines of communication.*

Strategy and Best Practice

The Utah Department of Transportation (UDOT) has started the Traveler Information (TI) Weather program, which consists of three contracted meteorologists located in UDOT's Traffic Operations Center (TOC). TI meteorologists fully cover hazardous weather events and work alongside the TOC's maintenance and operations weather forecasters, but serve public motorists specifically. Their responsibilities also include compiling road weather data from weather events for after action event reviews.

https://ops.fhwa.dot.gov/weather/best_practices/casestudies/026.pdf

Action Item: *Implement technology for closing roads or warning drivers in areas that frequently flood.*

Strategy and Best Practice

The TxDOT San Antonio District installed 26 High Water Detection Systems (HWDS). The district installed one system in the San Antonio metro area, while the other units have been installed in the rural areas surrounding San Antonio, which are subject to flash flooding due to the region's topography. The unit cost is typically $75,000. The water level is transmitted to a cabinet near the stream crossing which activates flashers on warning signs. The device also transmits system status and water elevation to the central software application at the traffic operations center.

https://ops.fhwa.dot.gov/publications/fhwahop12046/rwm25_texas1.htm

Action Item: *Develop online dashboards that provide summary statistics of response for weather events.*

Strategy and Best Practice (1 of 2)

Michigan Department of Transportation (MDOT) started installing automatic vehicle location (AVL) devices on its winter road maintenance equipment in 2013. These systems report where each truck is and gather data from other sensors. MDOT feeds that information, plus additional pavement and weather data and forecasts, into its maintenance decision support system (MDSS). The snowplow tracker is also provided on a website, called MiDrive, for the general public which shows where the tow trucks are and when each road had been plowed.

https://www.michigan.gov/mdot/0,4616,7-151-9620-399362--,00.html

Strategy and Best Practice (2 of 2)

The Iowa Department of Transportation (Iowa DOT) developed a website, Weatherview, to provide real-time road weather information for the traveling public. The interface displays a map of Iowa with various overlays containing temperature, wind, and visibility data, as well as general traffic flow information. Camera images, maintenance crews, and snowplow truck GPS locations can be monitored and managed by state personnel via Weatherview. Certain weather events can trigger E-mail and text alerts, providing another way to reach travelers with important information.

https://weatherview.iowadot.gov/

Action Item: *Develop and provide training for operation, maintenance, and asset management of road weather management equipment.*

Strategy and Best Practice

The Minnesota Department of Transportation (MnDOT) is the lead agency for Clear Roads, a program for researching weather maintenance materials, equipment, and methods for highway maintenance crews. Clear Roads provides hands-on and online webinar training for operating and supervising various road weather management equipment.

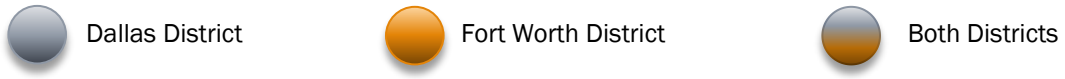
https://clearroads.org/training-resources/#

Planned Special Event District Assessment

Planned special events (PSE) involve the TxDOT Dallas and Fort Worth District and partner agency response to preplanned special events, like major sports events and local holiday events. The TxDOT Dallas and Fort Worth generally collaborate with external partners for PSE activities. For local events, TxDOT generally is not centrally involved in event operations and instead holds more of a general role of approver of event traffic control plans. The TxDOT Dallas and Fort Worth regularly task specific agency staff with formal PSE job functions for events occurring within the District and assess needs for planned events, but minimal budgeting is allocated to PSE planning. Not all operational entities consider or account for PSEs within their budgets.

Table 6: CMM Assessment for Planned Special Events

Planned Special Events					
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized	Region Score
Business Processes					2.3
Systems & Technology					2.1
Performance Measurement					2.3
Culture					2.8
Organization & Workforce					2.0
Collaboration					2.8



The Districts have a formal process in place on larger projects with mobility coordinators to document and assess traffic management needs for planned special events. Measurements of performance currently are strictly qualitative and not documented. PSE performance measures are considered for improving operations, but this is done inconsistently and not by all entities. The Districts support participation in PSE planning and operations, but current involvement is for approval purposes only.

The Districts consider special event planning and implementation as a strength. The DFW area frequently has large special events, especially at professional sports facilities in Arlington. Local agencies coordinate well with District TMC staff, and preparedness for special events is built into roadway project design. The Districts do a good job of communicating with the public through the media and Waze for larger planned special events.

Based on the CMM and CMF assessments, planned special events in the TxDOT Dallas and Fort Worth Districts would benefit from the following action items.

- Conduct post-planned special event reviews to determine level of delay, evaluate safety, and determine potential areas of improvement.
- Develop automated construction and special events notification application that uniformly provides information to HCRS, DriveTexas.org, and 511DFW which can be used by TxDOT and partner agencies to track existing and planned road closures due to construction and planned special events.
- Partner with third-party navigation apps to expand and provide accurate information for travelers related to planned special events.
- Measure and report travel time delay and other impacts of planned special events.
- Add discussion on planned special events and invite planned special event managers to the regional Traffic Management Team (TMT) meetings.

Planned Special Event State of the Practice

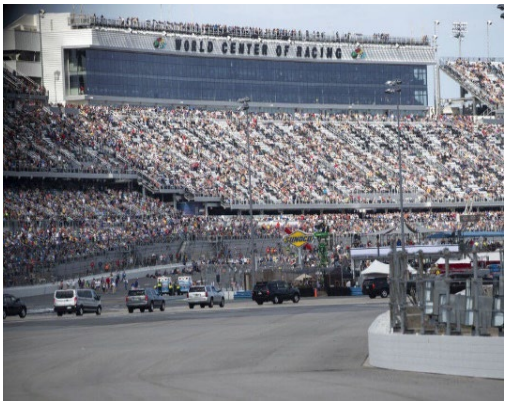
Below are examples of existing programs in place around Texas and the United Sates focused on improving planned special events:

Action Item: *Conduct post-planned special event reviews to determine level of delay, evaluate safety, and determine potential areas of improvement.*

Strategy and Best Practice

The FHWA published the Managing Travel for Planned Special Events Handbook in 2003 which regularly is updated on their website. Chapter 10 of the handbook outlines Post-Event Activities and provides a great resource on the importance of a post-event report and the key components. A post event report should include an Operational Cost Analysis, Qualitative Evaluation and Quantitative Evaluation. Daytona Beach, FL follows this format for the Daytona 500 race week events.

https://ops.fhwa.dot.gov/publications/fhwaop04010/chapter10.htm



Action Items: *Develop automated construction and special events notification application that uniformly provides information to HCRS, DriveTexas.org, and 511DFW which can be used by TxDOT and partner agencies to track existing and planned road closures due to construction and planned special events.* **AND** *Partner with third-party navigation apps to expand and provide accurate information for travelers related to planned special events.*

Strategy and Best Practice

As discussed in the Work Zone Management section earlier in this report, Maryland DOT State Highway Administration (SHA) runs the Maryland Road Closure Reporter (MRCR), a web-based system and application that local road jurisdictions use to capture road closure events. MRCR has bidirectional data sharing and tracks advanced closure attributes such as partial closures, specific times of day, reason for closure (such as special events), and lanes blocked. Representatives from local agencies enter data through a desktop or smartphone which gets disseminated to the public through Waze. The MRCR team emails local agencies after creating, editing or ending a road closure, providing information about the closure and a link to view the closure in the MRCR public-facing demonstration application.

http://dot.state.mn.us/research/TRS/2020/TRS2001.pdf

Action item: *Add discussion on planned special events and invite planned special event managers to the regional Traffic Management Team (TMT) meetings.*

Strategy and Best Practice

The City of Austin has created the program ACE (Austin Center for Events), which manages permitting and planning for hundreds of planned special events each year. ACE is an interdepartmental team consisting of representatives from multiple city departments, including Austin Police, Austin Fire, Austin-Travis County Emergency Medical Services, Austin Transportation, Austin Water Utility, Economic Development Department's Music & Entertainment Division, Parks and Recreation, Austin Public Health, Code Compliance, and Austin Resource Recovery.

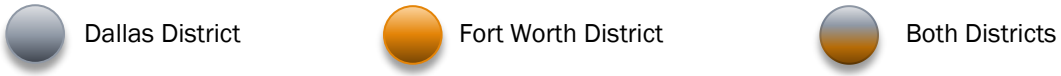
https://www.austintexas.gov/ace

Traffic Signal Management District Assessment

Traffic signal management (TSM) involves the TxDOT Dallas and Fort Worth District management of its traffic signal system. The TxDOT Dallas and Fort Worth Districts generally incorporate TSM activities into everyday District operations. The District links signal system planning with other TxDOT project planning efforts, allows a good deal of flexibility in signal technology procurement, and uses complex operational concepts when they are deemed beneficial to intersection operations. Currently, some TSM data is captured by the Districts and some partner agencies, but few performance measures have been identified.

Table 7: CMM Assessment for Traffic Signal Management

Traffic Signal Management					
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized	Region Score
Business Processes					2.4
Systems & Technology					2.5
Performance Measurement					1.5
Culture					2.0
Organization & Workforce					2.4
Collaboration					2.3



The TxDOT Dallas and Fort Worth Districts link traffic signal management goals to other TxDOT planning, design, operation, and maintenance goals and objectives. The Districts maintain signal systems along major corridors in a state of good repair. The Districts also actively maintain an inventory of deployed signal equipment and traffic signal timing settings. Both Districts follow MUCTD guidelines and standards to ensure consistency, using standard design sheets and hardware specifications. There is limited use of ITS devices and remote communications in existing field deployments throughout the Districts. The Districts collect output-oriented performance measures specific to maintenance activities (e.g. response times, outage times of emergency repairs). However, these performance measures are not currently used to actively monitor performance of the traffic signal systems or to identify the need for operational improvements.

During the CMM and CMF workshops, the Districts considered coordination between the regional partners on traffic signal management as both a strength and a weakness, with some partners noting very strong coordination and others noting improvements were needed. Within the Districts, there is a signal retiming program managed by NCTCOG that exists to coordinate signal operations between agencies along cross-jurisdictional corridors, and a general willingness to collaborate with regards to traffic signal management. The Districts noted that long-term planning for signal projects could be helpful: for example, signal considerations should be incorporated at the earliest possible phase in the project planning process.

Based on the CMM and CMF assessments, traffic signal management in the TxDOT Dallas and Fort Worth Districts would benefit from the following action items.

- Improve local agency institutional knowledge of agreements involving municipal maintenance, signal maintenance, and illumination.
- Pursue resource sharing agreements for ITS architecture such as CCTV cameras, conduit, fiber, etc.
- Implement technology at signalized intersections to support Advanced Traffic Signal Performance Measures.
- Establish special timing plans for alternate routes for special events and construction activities.
- Develop a formal process for the implementation of Advanced Traffic Signal Performance Measures.
- Develop and implement a formal training program to improve capability and staff development of TxDOT traffic signal staff and local partners.
- Conduct quarterly signal technician forums for TxDOT and partner agencies to improve collaboration, share best practices, and establish a regional competency regarding signal maintenance and operations.
- TxDOT and partner agencies to provide active assistance to NCTCOG in the development of incident and corridor timing plans.
- Create list service/email exchange for notification of implementation of incident-based traffic signal timing plans.

Traffic Signal Management State of the Practice

Below are examples of existing programs in place around Texas and the United Sates focused on improving traffic signal management:

Action Item: *Develop and implement a formal training program to improve capability and staff development of TxDOT traffic signal staff.*

Strategy and Best Practice

The Los Angeles Department of Transportation delivers a training program developed by the Los Angeles County Metropolitan Transportation Authority (Metro). This training allows local agency staff and partners to better understand the design and maintenance of signal systems. The training produces regional consistency in quality of work and educates staff on new and updated technological capabilities.

https://ops.fhwa.dot.gov/publications/fhwahop09007/fhwahop09007.pdf

Action Item: *Conduct quarterly signal technician forums for TxDOT and partner agencies to improve collaboration, share best practices, and establish a regional competency regarding signal maintenance and operations.*

Strategy and Best Practice

The San Francisco Bay Area's Metropolitan Transportation Commission (MTC) developed the Arterial Operations Program to provide technical and financial assistance for traffic signal projects. The Arterial Operations Committee (AOC) holds bi-monthly meetings for local traffic engineers and signal technicians to discuss regional issues, lessons learned from past projects, and training opportunities. The Technology Transfer Program allows experts and local engineers to present new and improved technologies at AOC meetings.

https://mtc.ca.gov/our-work/operate-coordinate/arterial-operations/technology-transfer-program

http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp20-68a_07-04.pdf

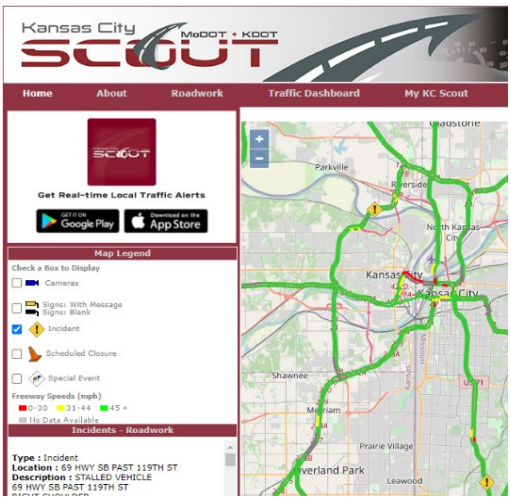
Action Item: *Establish special timing plans for alternate routes for special events and construction activities.*

Strategy and Best Practice

The Utah Department of Transportation (UDOT) developed a Traffic Signal Management Plan (TSMP) to provide framework for the maintenance, design and operation of the traffic signal system. This plan includes incident management signal adjustments and special event support guidance to improve the coordination and compatibility of signals across jurisdictional boundaries during incidents, special events, and adverse weather.

https://www.udot.utah.gov/main_old/uconowner.gf?n=29256708738824069

Action Item: *TxDOT and partner agencies to provide active assistance to NCTCOG in the development of incident and corridor timing plans.*



Strategy and Best Practice

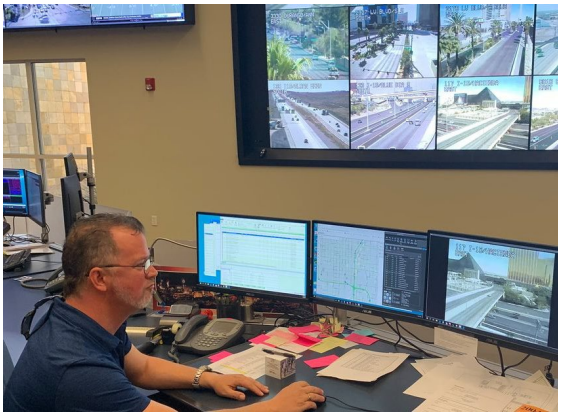
Kansas City Scout (KC Scout) Advanced Traffic Management System (ATMS) is operated by both the Missouri Department of Transportation (Moot) and the Kansas Department of Transportation (KDOT). Closed Circuit Televisions (CCTV), Dynamic Message Signs (DMS), and Vehicle Detection Stations (VDS) are used to manage traffic on freeways that cross the state border. KC Scout staff monitor weather, traffic incidents, special event impacts, etc. ATMS data is used to update DMS messages and report real-time travel information to increase coordination across jurisdictional boundaries.

https://tti.tamu.edu/researcher/the-i35-expansion-project/

Action Item: *Develop institutional agreements for implementing traffic signal timing strategies during special events and incident conditions.*

Strategy and Best Practice

The Freeway and Arterial System of Transportation (FAST) in Las Vegas is a freeway management system and Regional Traffic Signal Operations Program (RTSOP). All traffic signals in the region operate on a time-of-day pattern. Operators are responsible for making real-time adjustments to traffic signals during an incident or call special timing plans. FAST staff also develop the coordination timing plans for the major corridors in the area.



http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp20-68a_07-04.pdf

General Traffic Management District Assessment

General Traffic Management (TM) involves the TxDOT Dallas and Fort Worth District management of road traffic conditions throughout the region. The TxDOT Dallas and Fort Worth Districts generally perform TM activities through ongoing supervision of deployed ITS devices from the District Offices and TMCs. The TxDOT Dallas and Fort Worth Districts consider TM strategies in construction and maintenance planning, and both Districts include provisions for TM in these department budgets. TM coordination occurs regionally between TxDOT, NCTCOG, and local transportation agencies. The region's TM efforts are tied to mutually agreed-upon operational objectives.

Table 8: CMM Assessment for General Traffic Management

Traffic Management					
TSMO Capability Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimized	Region Score
Business Processes					2.3
Systems & Technology					2.2
Performance Measurement					2.5
Culture					2.0
Organization & Workforce					1.8
Collaboration					2.1

Dallas District Fort Worth District Both Districts

The TxDOT Dallas and Fort Worth Districts are starting to move toward consistent support of traffic management projects. Both Districts agree that TxDOT's current traffic management strategies address multimodal considerations on an ad hoc basis for specific events or projects, as opposed to through a formalized process to consider these impacts. The Districts' traffic management strategies are responsive during peak travel periods based on current conditions. The Districts have started to incorporate performance measures into the traffic management system and use Lonestar to track performance. The Dallas District supports performance measures in decision-making for current and future investment decisions. Both districts have developed protocols, procedures, and guidelines for training and professional capacity building (PCB), with development of internal training and guides for TMC staff. The Dallas District has limited training for new and experienced operators within the area, but completion of this training is not currently a requirement for

staff. The Districts' most common arrangement for sharing traffic management data and information in the region is via manual efforts for specific traffic management needs. Currently, TxDOT shares traffic management data with NTTA and with NCTCOG.

The TxDOT Dallas and Fort Worth Districts have expressed interest in improving collaboration with partner agencies regarding traffic management. Currently, the TxDOT Dallas and Fort Worth Districts have mentioned a need to better coordinate operations along corridors that cross both districts, such as coordination along I-30.

The local agencies reported that accessing TxDOT's infrastructure, such as fiber and cameras systems, is not a user-friendly process. The Fort Worth Districts agreed that standard procedures could assist with improving ease of partner agency access to TxDOT ITS assets, in addition to having a central cloud-based platform for the region for sharing camera feeds and other TM data.

Based on the CMM and CMF assessments, general traffic management in the TxDOT Dallas and Fort Worth Districts would benefit from the following action items.

- Revise the TxDOT Design Summary Report form to increase focus on TSMO related strategies including Smart Work Zones during construction, and traffic signal and ITS post construction.
- Support NCTCOG agreements for sharing collected traffic data among local agencies.
- Develop a multiyear TMS maintenance plan that includes replacement cycles, preventative maintenance, warranties, and procurement cycles.
- Develop an ITS Master Plan for the TxDOT Dallas District to identify and prioritize ITS and communication infrastructure deployments throughout the District.
- Establish a process for TxDOT Permitting to notify local agencies when over height/oversize vehicles will be traveling through their jurisdictions so they can plan for and monitor these movements.
- Use cloud-based technology platforms to overcome individual agency difference for data sharing such as CCTV camera video feeds and automated traffic signal performance measures (ATSPMs).
- Support TxDOT Connected Freight Corridor on I-30.
- Establish standard operating procedures to ensure consistency in how District Traffic Management System (TMS) performance measures are collected.
- Develop implementation plan to maximize the region's utility of available probe-based INRIX and Streetlight data.
- Create a clearly defined and consistently applied process for career advancement for traffic management staff.
- Create a formal certification and/or training program for all traffic management operators.
- Conduct traffic management team meetings between the TxDOT Dallas District and cities on a regular basis similar to the TxDOT Fort Worth meetings.
- Establish camera sharing agreement between TxDOT Fort Worth District, the City of Fort Worth, and the TransVISION TMC.

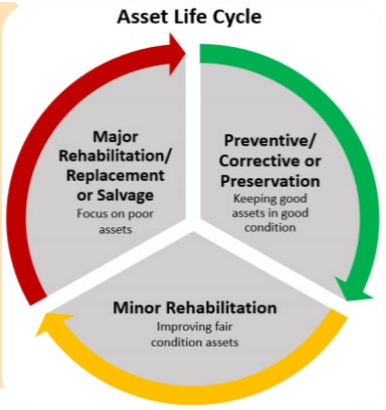
General Traffic Management State of the Practice

Below are examples of existing programs in place around Texas and the United Sates focused on improving general traffic management:

Action Item: *Develop a multi-year TMS maintenance plan that includes replacement cycles, preventative maintenance, warranties, and procurement cycles.*

Strategy and Best Practice

The California Streets and Highway Code requires a 10-Year State Highway Operation and Protection Program (SHOPP) Plan and a 5-Year Maintenance Plan. The California Department of Transportation (Caltrans) developed the State Highway System Management Plan (SHSMP) to fulfill these requirements. The SHSMP assesses the current and future needs, funding, and performance measures of the State Highway System and provides a variety of rehabilitation and life-cycle planning strategies.



https://dot.ca.gov/-/media/dot-media/programs/asset-management/documents/f0019647-shsmp-a11y.pdf

Action Item: *Develop an ITS Master Plan for the TxDOT Dallas District and priority ITS and communication infrastructure deployments throughout the District.*

Strategy and Best Practice

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

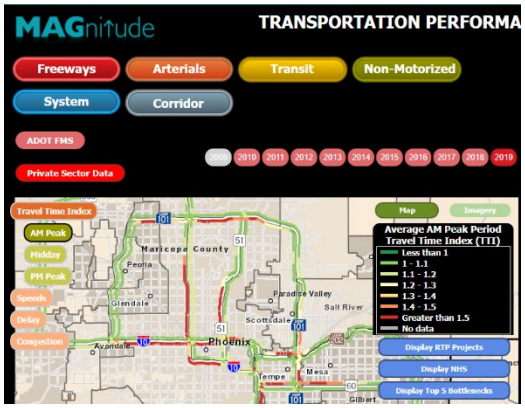
https://metroplanorlando.org/wp-content/uploads/MetroPlan_ITS-Master-Plan_Final.pdf

Action Item: *Establish standard operating procedures to ensure consistency in how District Traffic Management System (TMS) performance measures are collected.*

Strategy and Best Practice

The Maricopa Association of Governments (MAG) focuses on regional coordination to address regional planning concerns, such as safe and smart travel, in the greater Phoenix region. MAG developed a process to develop transportation operation goals and initiatives, and determined what performance measures can be used to achieve them. MAG provides historical performance measurement data and real-time dashboard.

https://www.fhwa.dot.gov/publications/research/operations/12054/12054.pdf
http://performance.azmag.gov/



Action Item: *Create a formal certification and/or training program for all traffic management operators.*

Strategy and Best Practice

The New Jersey Department of Transportation (NJDOT) developed a TMC Operator Training Course, outlined in the NJDOT Transportation Systems Management (TSM) Design Procedures Manual. The course consists of 9 modules of varying lengths that cover topics, including what a TMC is, general incident management, general traffic management, and an introduction to software systems and technologies. This course familiarizes operators with TMC resources and the steps involved in managing incidents and traffic.

https://www.nj.gov/transportation/eng/elec/ITS/pdf/TSMProceduresManual.pdf

CMM Summary of Action Items

A summary of all the recommended action items to advance TSMO forward in the TxDOT Dallas and Fort Worth Districts is provided in Table 9. The action items are grouped by the TSMO focus areas of Traffic Incident Management, Work Zone Management, Road Weather Management, Planned Special Events, Traffic Signal Management, and General Traffic Management.

The agency that will be leading the implementation of the action items is also identified in Table 9. A majority of the action items will be implemented by both the Dallas and Fort Worth Districts, although there are a few action items that pertain to only one of the Districts. The TxDOT Traffic Safety Division (TRF) has been identified as the lead agency for implementation on a small number of action items. In some cases, both the Districts and TRF have been identified as the lead agencies indicating a collaborative effort between the Districts and TRF will be needed for implementation.

The recommended action items were reviewed by TSMO staff from the TxDOT Dallas and Fort Worth Districts to refine the list and focus on actions that the Districts believed would provide real-world benefits and advance TSMO forward.

Table 9: Summary of Recommended Action Items

TSMO Focus Area	CMM Capability Dimension	Action Item Description	District or Division
Traffic Incident Management	**Business Processes**	**Implement TIM Response Measures for Major Construction:** Develop process and procedures for incident management within construction work zones prior to letting of all major construction contracts.	**DAL FTW**
	Systems & Technology	**Establish Standardized Radio Communications for TIM Response Dispatch Information:** Establish documented standard communication protocol for timely public safety information sharing with TxDOT.	**DAL FTW**
		Develop Plan for Regional Courtesy/Service Patrol Program Expansion: Develop regional courtesy/service patrol plan for expansion; considering network coverage, hours of operation, and baseline of services provided.	**DAL FTW**
	Performance Measurement	**Improve TIM Performance Collection and Reporting:** Improve TIM related data collection and reporting, with a focus on incident response time, roadway clearance time, incident clearance time, secondary crash data and time to return to normal flow.	**DAL FTW TRF**
		Develop Regional TIM Database: Develop regional TIM database in partnership with NCTCOG and local agencies to track TIM quick clearance performance on routes throughout the DFW Region.	**DAL FTW**
	Organization & Workforce	**Provide Recurring Regional TIM Training:** Continue partnering with NCTCOG and other agencies to identify agencies that have not been involved with training and provide recurring regional TIM training in a multidisciplinary setting.	**DAL FTW TRF**
		Establish Dedicated TIM Coordinator Position: Establish a dedicated TIM coordinator position in the Dallas District to support TIM activities throughout this District.	**DAL**
	Collaboration	**Conduct Quarterly TxDOT District TIM Meetings:** Conduct quarterly meeting between TxDOT Dallas and TxDOT Fort Worth Districts.	**DAL FTW**
		Establish a Formal Regional TIM Team in the Dallas District: Establish a formalized TIM Team that meets regularly, includes all relevant jurisdictions and roles, and provides a forum on after-action reviews of major incidents.	**DAL**
		Conduct After-Action Reviews for Major Incidents: Establish criteria for determining which incidents require after-action reviews and conduct reviews as needed.	**DAL FTW**

TSMO Focus Area	CMM Capability Dimension	Action Item Description	District or Division
Work Zone Management	Business Processes	**Utilize a Work Zone ITS Deployment Decision Tools:** Standardize an approach or decision tool for when to deploy certain work zone ITS technologies based on anticipated construction impacts.	DAL FTW
		Conduct Post-Construction Event Reviews: Conduct post-construction event reviews to determine level of delay, evaluate safety, and determine potential areas of improvement.	DAL FTW
		Establish Procedures for Collecting and Analyzing Work Zone Road User Cost Data: Establish procedures for collecting work zone road user cost data occurring at significant projects and compare to predictions made during project development.	DAL FTW
	Systems & Technology	**Expand Work Zone Technology Deployments:** Expand deployment of work zone technology throughout both Districts to support improved work zone monitoring, localized real-time traveler information, end of queue warning, and worker safety.	DAL FTW
		Develop Automated Construction and Special Events Notification Application: Develop automated construction and special events notification application that uniformly provides information to HCRS, DriveTexas.org, and 511DFW which can be used by TxDOT and partner agencies to track existing and planned road closures due to construction and planned special events.	DAL FTW
		Provide Work Zone Closure Information Through Third-Party Apps: Partner with third-party navigation apps to expand and provide accurate information for travelers related to work zone closures.	DAL FTW
	Performance Measurement	**Measure Work Zone Travel Time Delay:** Measure and report travel time delay in work zones.	DAL FTW
		Establish a Work Zone Management Dashboard: Establish a dashboard of key work zone performance measures that can be continually updated and viewed by agency personnel, other agencies, and the public.	DAL FTW
	Culture	**Prioritize Communicating Work Zone Information to Local Partners:** Prioritize communication with local agencies regarding both initial construction notices and subsequent construction plan or schedule changes.	DAL FTW
	Organization & Workforce	**Establish Work Zone Coordinator Responsibilities:** Establish regional-level work zone coordinator responsibilities for coordination of construction closures to avoid conflicts and ensure communication to impacted stakeholders. (Note that this position may not be staffed at TxDOT.)	DAL FTW
		Establish Regular Training for Work Zone Technologies: Establish regular training sessions for TxDOT, education on work zone technologies, how and when each are most effective, installation procedures, and planning for budgets and contracts.	DAL FTW TRF

TSMO Focus Area	CMM Capability Dimension	Action Item Description	District or Division
Road Weather Management	**Business Processes**	**Conduct After Action Reviews for Weather Events:** Conduct after action reviews to improve emergency weather event response times and lines of communication.	**DAL FTW**
	Systems & Technology	**Deploy Flood Warning and Closure Devices:** Implement technology for closing roads or warning drivers in areas that frequently flood.	**FTW**
	Performance Measurement	**Develop Online Weather Event Dashboards:** Develop online dashboards that provide summary statistics of response for weather events.	**DAL FTW**
	Organization & Workforce	**Manage Road Weather Equipment:** Develop and provide training for operation, maintenance, and asset management of road weather management equipment.	**DAL FTW**
	Collaboration	**Improve Communication of Road Weather Impacts and Response with Local Partners:** Improve communication with local stakeholders regarding TxDOT weather-related road closures and ice prevention operations.	**DAL FTW**

TSMO Focus Area	CMM Capability Dimension	Action Item Description	District or Division
Planned Special Events	**Business Processes**	**Conduct Post-Planned Special Event Reviews:** Conduct post-planned special event reviews to determine level of delay, evaluate safety, and determine potential areas of improvement.	**DAL FTW**
	Systems & Technology	**Develop Automated Construction and Special Events Notification Application:** Develop automated construction and special events notification application that uniformly provides information to HCRS, DriveTexas.org, and 511DFW which can be used by TxDOT and partner agencies to track existing and planned road closures due to construction and planned special events.	**DAL FTW**
		Expand Planned Special Event Closure Information Through Third-Party Apps: Partner with third-party navigation apps to expand and provide accurate information for travelers related to planned special events.	**DAL FTW**
	Performance Measurement	**Measure Planned Special Event Impacts:** Measure and report travel time delay and other impacts of planned special events.	**DAL FTW**
	Collaboration	**Include Planned Special Events in Traffic Management Team Meetings:** Add discussion on planned special events and invite planned special event managers to the regional Traffic Management Team (TMT) meetings.	**DAL FTW**

TSMO Focus Area	CMM Capability Dimension	Action Item Description	District or Division
Traffic Signal Management	Business Processes	**Improve Local Partner Knowledge of Existing Agreements:** Improve local agency institutional knowledge of agreements involving municipal maintenance, signal maintenance, and illumination.	FTW
		Establish Regional Resource Sharing Agreements: Pursue resource sharing agreements for ITS architecture such as CCTV cameras, conduit, fiber, etc.	DAL FTW
	Systems & Technology	**Implement Technology to Support Advanced Traffic Signal Performance Measures:** Implement technology at signalized intersections to support Advanced Traffic Signal Performance Measures.	DAL FTW
		Establish Special Timing Plans: Establish special timing plans for alternate routes for planned special events and construction.	DAL FTW
	Performance Measurement	**Implement Advanced Traffic Signal Performance Measures:** Develop a formal process for the implementation of Advanced Traffic Signal Performance Measures.	DAL FTW
	Organization & Workforce	**Develop a Traffic Signal Training and Staff Development Program:** Develop and implement a formal training program to improve capability and staff development of TxDOT traffic signal staff and local partners.	DAL FTW TRF
	Collaboration	**Conduct Quarterly Signal Technician Forums:** Conduct quarterly signal technician forums for TxDOT and partner agencies to improve collaboration, share best practices, and establish a regional competency regarding signal maintenance and operations.	DAL FTW TRF
		Improve Signal Timing Coordination Across Jurisdictional Boundaries: TxDOT and partner agencies to provide active assistance to NCTCOG in the development of incident and corridor timing plans.	DAL FTW
		Create Contact List for Special Signal Timing Notifications: Create list service/email exchange for notification of implementation of incident-based traffic signal timing plans.	DAL FTW

TSMO Focus Area	CMM Capability Dimension	Action Item Description	District or Division
General Traffic Management	Business Processes	**Revise TxDOT Design Summary Report to Increase Emphasis on Operations:** Revise the TxDOT Design Summary Report form to increase focus on TSMO related strategies including Smart Work Zones during construction, and traffic signal and ITS post construction.	TRF
		Support Regional Traffic Data Sharing Agreements: Support NCTCOG agreements for sharing collected traffic data among local agencies.	DAL FTW
		Develop a Multi-Year TMS Maintenance Plan: Develop a multi-year TMS maintenance plan that includes replacement cycles, preventative maintenance, warranties and procurement cycles.	DAL FTW
		Develop TxDOT Dallas ITS Master Plan: Develop an ITS Master Plan for the TxDOT Dallas District to identify and prioritize ITS and communication infrastructure deployments throughout the District.	DAL
		Establish Notification Process to Cities for Over Height/Oversize Vehicles Permits: Establish a process for TxDOT Permitting to notify local agencies when over height/oversize vehicles will be traveling through their jurisdictions so they can plan for and monitor these movements.	TRF
	Systems & Technology	**Improve Regional Data and Video Sharing Capabilities:** Use cloud-based technology platforms to overcome individual agency difference for data sharing such as CCTV camera video feeds and automated traffic signal performance measures (ATSPMs).	DAL FTW TRF
		Support Connected/Smart Corridor Design: Support TxDOT Connected Freight Corridor on I-30.	DAL FTW
	Performance Measurement	**Establish Standard Operating Procedures for District Traffic Management Systems Performance Measures:** Establish standard operating procedures to ensure consistency in how District Traffic Management System (TMS) performance measures are collected.	TRF
		Develop Implementation Plan for Regional Data Usage: Develop implementation plan to maximize the region's utility of available probe-based INRIX and Streetlight data.	TRF
	Organization & Workforce	**Establish Career Advancement Process for Traffic Management Staff:** Create a clearly defined and consistently applied process for career advancement for traffic management staff.	DAL FTW
		Develop Training Program for Traffic Management Operators: Create a formal certification and/or training program for all traffic management operators.	DAL FTW
	Collaboration	**Conduct Traffic Management Team Meetings with Cities:** Conduct traffic management team meetings between the TxDOT Dallas District and cities on a regular basis similar to the TxDOT Fort Worth meetings.	DAL

Next Steps

The recommended action items shown that have been identified for the TxDOT Dallas and Fort Worth Districts will be described in greater detail as part of the TxDOT Dallas and Fort Worth District TSMO Program Plan. The program plan will feature a TSMO implementation plan, including descriptions of sub-actions for each action item, implementation timeframe, level of cost and effort required for implementation, agency or staff member responsible for implementation, as well as any dependencies to other included recommendations. All recommendations included in the TSMO Program Plan will be targeted for implementation over the next five years, with the goal of improving safety, reducing congestion, and increasing travel reliability of transportation network in the TxDOT Dallas and Fort Worth Districts. Once finalized, the TSMO Program Plan will be shared with stakeholders and key regional priorities will be discussed at a TSMO Program Plan "roll-out" event.