TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS (TSMO)

Statewide Strategic Plan Rollout
TxDOT Statewide TSMO Highlights

- **Mid’15:** Traffic Management Systems (TMS) State of the Practice Research
- **early’16:** TRF-Information Management Division (IMD) Partnership: District TMS Support
- **fall’16:** Statewide TSMO program Kick-off, Outreach Events and CMM Workshops
- **Apr’17:** Chief Engineer’s Memo: Statewide TMS Procedures
- **Apr’17:** TMS Metrics on Engineering Operations Dashboard
- **Aug’17:** Statewide TSMO Strategic Plan issued
- **Aug’17:** TSMO Website launched
- **late’17:** Information Technology Pilots in Districts Begin (IMD Support)
- **Feb’18:** TRF/Districts reach consensus: Consultants to develop remaining TSMO program plans
- **Jun’18:** Austin District TSMO Program Plan completed; first district-level TSMO program plan.
- **mid’18:** TMS Enterprise Work Group established (TRF, IMD, Districts)
- **Oct’18:** Statewide TSMO planning contracts executed with 4 consulting firms
- **2019 – ‘23:** TSMO program and tactical plans to be developed for the Metro, Urban and Rural districts.
- **2019 – ‘23:** Mainstream TSMO statewide into core agency processes, managed by TRF-TM.
Purpose of the Statewide TSMO Planning Initiative

- Develop a strategic plan to provide statewide vision, mission and goals for TSMO.

- Guidelines for TSMO program planning at the district and regional level.

- Mainstream TSMO in project planning, funding and development procedures.
“As TxDOT moves ahead with the goals of reducing congestion and enhancing safety, it is critical that Traffic Management Systems (TMS) be included on new roadway construction projects.” (Memo dated July 1, 2016)

“Each district will be expected to ensure (1) TMS is included in each project’s planning, development, design, construction, maintenance and operation, and (2) provide specific TMS projects where gaps exist between typical road and bridge projects… TRF will also provide Transportation Systems Management and Operations (TSM&O) guidance for the districts” (Memo dated April 7, 2017)
Leadership Objectives

- Traffic Management Systems (TMS) Status Reports
  - Districts report on current status of TMS completion, and identifies projects included in the Unified Transportation Program (UTP).
  - Serve as status update to TSMO Program Plan goals.
  - Reported to TxDOT administration every 6 months beginning October 2017.
  - Initially required for the metro districts and El Paso only.
  - Starting October 2018, required for all 25 districts – metro, urban and rural.
Leadership Objectives

- Four TMS performance metrics implemented in FY 2017, per Chief Engineer’s memo.
  
  - **TMS Asset Operational Uptime** - measure how Districts maintain their traffic management equipment, is the most critical metric to improve in the short-term
  
  - **Incident Clearance Times** - Measure mobility on our system, driven by District incident management processes in collaboration with regional partners
  
  - **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.
  
  - **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
WHAT ARE THE MAJOR CAUSES OF CONGESTION?

- Bottlenecks (Predictable Congestion) - 40%
- Traffic Incidents - 25%
- Bad Weather - 15%
- Work Zones - 10%
- Poor Signal Timing - 5%
- Special Events/Other

Transportation Planning Process

**Traditional Focus**
- Long term
- Capital investment
- Project orientation
- Capacity deficiencies
- Link improvements
- Environmental impacts
- Recurring congestion (from forecasts)

**Needed (In Addition)**
- Significant collaboration
- Consideration on non-recurring congestion & operations
- An objectives-driven approach
- Performance based focus on outcomes
- Network and region-wide applications
- Include on-going costs for operations & maintenance

Source: FHWA, SHRP2 Reliability resources
Providing Effective, Safe and Reliable Transportation

- Building the necessary infrastructure
- Keeping in a state of good repair (maintenance & reconstruction)
- Operating and managing the infrastructure on a day-to-day basis

Core attributes of planning process (LRTP, TIP); have been for decades

Operations should be integrated into the traditional planning & programming processes

“Mainstreaming”

New construction will continue to be important.
But we can’t build our way out of congestion!

Source: FHWA, SHRP2 Reliability resources
What is TSMO?

Federal Legislation (“MAP-21”) Definition:
“Integrated strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system.”

Source(s): 1.) MAP-21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), Title 23 U.S.C. Sec. 101. Definitions and declaration of policy, (30)
What is TSMO?

Operations Strategies:

- Work Zone Management
- Traffic Incident Management
- Service Patrols
- Special Event Management
- Road Weather Management
- Transit Management
- Freight Management

- Traffic Signal Coordination
- Traveler Information
- Ramp Management
- Managed Lanes
- Active Traffic Management
- Integrated Corridor Management
- Rural Emergency Response
What is TSMO?

- Also known as low-cost enhancements (LCEs)
- Small, low-cost projects that can be implemented quickly to improve operational safety or reduce congestion on the highway system.
- LCE projects generally target problem areas and allow traffic engineers to quickly respond to emerging roadway safety issues.

Minor Operational Enhancements:

- Channelization
- Delineation
- Low-cost safety enhancements
- Signage
- Striping
- Traffic calming

### Who performs TSMO?

<table>
<thead>
<tr>
<th>State DOTs</th>
<th>MPOs</th>
<th>Local DOTs / Roadway Authorities</th>
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</thead>
</table>
| - Corridor and freeway management strategies.  
- Develop processes and institutional arrangements that optimize TSMO throughout the state.  
- At the district level, collaborate with local agencies to plan and optimize traffic management strategies. | - Facilitate coordination and collaboration among various agencies (state and local), in the areas of planning, funding and traffic management.  
- Long-range planning to guide the identification, prioritization, and selection of investments, programs, and strategies for the region. | - Corridor and arterial management strategies.  
- Transit service coordination with corridor management strategies.  
- Provide input to traffic management and operations priorities for region.  
- Police, Fire, EMS coordination with traffic management strategies. |
Road to Zero

The Texas Transportation Commission adopted a formal goal to achieve zero deaths on our roadways by 2050 with a midway goal to cut fatalities in half by 2035.

November 7, 2000 is the last deathless day on Texas roadways.
Why TSMO?

- **TSMO strategies have safety benefits:**
  - **Safe, quick clearance of traffic incidents** on roadways reduces the occurrence of secondary incidents (incidents caused by the effects of the original incident). One study estimates that the chance of secondary incidents increases by 2.8 percent for each minute the initial incident continues to pose a hazard.
  - **Road weather management** promotes safety by providing timely, accurate, and relevant information about roadway impacts of weather on travelers and transportation agencies, allowing agencies and drivers to make safe decisions during inclement weather.
  - **Traveler information** before and within work zones and in advance of congested slowdowns and queues can alert drivers of upcoming hazards, enable drivers to re-route, and create safer driver behavior.
  - **Active traffic management** strategies such as dynamic speed limits and dynamic lane control on freeways can harmonize vehicle speeds when congestion is building and reduce erratic flow conditions that lead to crashes.

Why TSMO?

Congestion Problem Continues to Get Worse

- $160 billion of wasted time and fuel
- Including $28 billion of extra truck operating time and fuel
- An extra 6.9 billion hours of travel and 3.1 billion gallons of fuel consumed

The average urban commuter in 2014:

- Spent an extra 42 hours of travel time on roads than if the travel was done in low-volume conditions
- Used 19 extra gallons of fuel
- Which amounted to an average of $960 per commuter

National measures of the congestion problem for the 471 urban areas in 2014:

Source: 2015 Urban Mobility Scorecard, by Texas A&M Transportation Institute and INRIX
Why TSMO?

The Transportation Environment is Changing:

- Changes that may redefine the DOT’s roles and responsibilities (e.g. MAP-21, Connected Vehicles)
- Increased reliance on information and technology
- Increasing customer needs and expectations
- Growing emphasis on measuring performance
- Reduced financial resources
- Technology offers opportunities to better manage congestion and traffic incidents, thus reducing unexpected delay and improving safety.

Source: FHWA, SHRP2 Reliability resources

From 511SF website
“Planning for Operations” – a joint effort between planners & operators to merge operations into traditional planning and programming

- Develop and program operations strategies based on regional goals, objectives & performance measures
- Enhance the process so that operations investments are on par with construction & preservation funding.
- Help meet requirements of MAP 21 (i.e., “promote efficient operations”)

Source: FHWA, SHRP2 Reliability resources
**Institutional** – actions focused on growing an agency culture that values TSMO.

**Organizational** – actions that adjust structure of responsibilities to better support TSMO functions.

**Procedural** – actions that improve business processes to better incorporate TSMO, including adjustments in planning, programming and budgeting, systems engineering, and performance measurement.

Source(s): 1.) Advancing TSMO: Making the Business Case for Institutional, Organizational, and Procedural Changes, Available at: https://ops.fhwa.dot.gov/publications/fhwahop19017/index.htm
Statewide TSMO Strategic Plan

- Provides statewide vision, mission and goals for TSMO.
- Serves as a guideline and checklist for TSMO program planning at district level.
- Basis for best-practice sharing, common technology solutions, and performance measures.
- Describes how centralized support will be provided to the districts’ traffic management systems performance.
- Identifies specific and time-bound actions to mainstream TSMO into project development procedures.

Prepared by:
Statewide TSMO Vision:

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

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

- **Safety** - Reduce crashes and fatalities through continuous improvement of traffic management systems and procedures.

- **Reliability** - Optimize travel times on transportation systems in critical corridors to ensure travelers are reaching their destinations in the amount of time they expected for the journey.

- **Efficiency** - Implement projects that optimize existing transportation system capacity and alleviate congestion.

- **Customer Service** - Provide timely and accurate travel information to customers so they can make informed mobility decisions.

- **Collaboration** - Proactively manage and operate an integrated transportation system through multijurisdictional coordination, and cooperation between various transportation disciplines and partner agencies.

- **Integration** - Prioritize TSMO as a core objective in the agency's planning, design, construction, operations and maintenance activities.
TxDOT Statewide TSMO Planning Structure

Statewide Strategic Plan

District Program Plans

Tactical Plans examples

- Austin District TSMO Program Plan
- Pharr District TSMO Program Plan
- Houston District TSMO Program Plan

- Incident Mgmt Program Plan
- Work Zone Service Layer Plan
- ITS Project Deployment Plan
- Traveler Information Service Layer Plan
- Traffic Signal Coordination Plan
- Road Weather Management Plan
- Road Weather Management Plan
- CAV Infrastructure Deployment Plan
**TxDOT Statewide TSMO Strategic Plan Development Schedule**

1. **AUG 2016 - SEP 2016**
   - Literature search of existing TSMO guidance documents and state TSMO implementation plans
   - Develop TSMO State of the Practice

2. **OCT 2016 - JAN 2017**
   - Hold Capability Maturity Model (CMM) workshop at outreach events across the state of Texas

3. **FEB 2017 - AUG 2017**
   - Compile CMM results
   - Develop Statewide TSMO Strategic Plan
   - Create TSMO evaluation tool

4. **SEP 2017 - NOV 2017**
   - Roll-out events across the state of Texas
TSMO State of the Practice

- Gathered an understanding for TSMO capabilities at different state and local agencies
- Helped to identify where TxDOT can improve in TSMO and different strategies for engaging stakeholders
- Provided ideas for alternative ways to structure TxDOT’s statewide TSMO program
### Outreach Events: TSMO/CMM Workshop

<table>
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<tr>
<th>LOCATION</th>
<th>DATE &amp; TIME</th>
<th>NUMBER OF ATTENDEES</th>
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<tr>
<td>EL PASO</td>
<td>Tuesday, October 18(^{th}), 2016 - 8 am to 12 pm</td>
<td>13</td>
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<tr>
<td>DALLAS-FORT WORTH</td>
<td>Wednesday, November 2(^{nd}), 2016 - 1 pm to 5 pm</td>
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<tr>
<td>HOUSTON</td>
<td>Thursday, November 3(^{rd}), 2016 - 9 am to 12 pm</td>
<td>22</td>
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<td>SAN ANTONIO</td>
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<tr>
<td>ITS TEXAS (RICHARDSON)</td>
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<td>33</td>
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<tr>
<td>AUSTIN</td>
<td>Thursday, November 17(^{th}), 2016 - 8 am to 12 pm</td>
<td>22</td>
</tr>
<tr>
<td>WEBINAR</td>
<td>Thursday, January 26(^{th}), 2017 - 10 am to 12pm</td>
<td>110*</td>
</tr>
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*It is likely that more than 110 individuals attended the webinar as some attended among a group of individuals from a conference room at their respective locations.

The attendees at each outreach event were generally a collection of personnel from the various TxDOT districts’ Operations and Planning sections, Metropolitan Planning Organizations (MPO), and local transportation agencies.
How to Assess an Agency’s TSMO Capabilities?

**Capability Maturity Model (CMM)**

- Widely used in the Information Technology industry

- When applied to TSMO, it helps agencies identify strengths, weaknesses, and next steps to improvement

- 6 Capability Dimensions:
  - Business Processes, Culture, Systems & Technology, Organization & Staffing, Collaboration, and Performance Measurement
Capability Maturity Model (CMM)

- Business Processes
- Systems & Technology
- Performance Measures
- Culture
- Organization & Workforce
- Collaboration
Capability Maturity Model (CMM)

**Goal for the Future**

- **Optimized**
  - Performance-based improvement
  - Formal program
  - Formal partnerships

**Integrated**

- Processes documented
- Performance measured
- Organization/partners aligned
- Program budgeted

**Managed**

- Processes developing
- Staff training
- Organization/partners aligned
- Program budgeted

**Performed**

- Activities and relationships ad hoc
- Champion-driven

Source: Creating an Effective Program to Advance Transportation System Management and Operations, FHWA Jan 2012
Texas CMM Results, 2016 - 2017

Opportunity for improvement

- All TxDOT
- Cities
- County
- MPO/COG/Tollway Authority

CMM Level

- Business Processes
- Systems and Technology
- Performance Measurement
- Culture
- Organization and Workforce
- Collaboration

Opportunity for improvement
Capability Maturity Model (CMM) - Framework for Effective TSMO

Sources(s): -1.) US DOT, FHWA, -2.) AASHTO, -3) SHRP2 Solutions
Rollout Events: Statewide TSMO Strategic Plan

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<th>NUMBER OF ATTENDEES</th>
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<tr>
<td>TEXITE MEETING (SAN MARCOS)</td>
<td>Friday, September 8th, 2017 – 8:30 am to 9 am</td>
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<tr>
<td>AUSTIN</td>
<td>Monday, September 18th, 2017 – 9:30 am to 12 pm</td>
<td>21</td>
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<tr>
<td>DALLAS-FORT WORTH</td>
<td>Wednesday, November 1st, 2017 - 2 pm to 4:30 pm</td>
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<td>WEBINAR</td>
<td>Thursday, October 5th, 2017 - 10 am to 10:30 am</td>
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<tr>
<td>ITS TEXAS (HOUSTON)</td>
<td>Wednesday, November 8th, 2017 - 4 pm to 6 pm</td>
<td>14</td>
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<tr>
<td>EL PASO</td>
<td>Monday, December 11th, 2017 – 2:30 pm to 4:30 pm</td>
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<td>WEBINAR</td>
<td>Wednesday, December 6th, 2017 - 10 am to 12pm</td>
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<td>HOUSTON</td>
<td>Friday, January 26th, 2018 – 9 am to 11 am</td>
<td>34</td>
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*It is likely that more than 130 individuals attended the two webinars as some attended among a group of individuals from a conference room at their respective locations.

The attendees at each rollout event were generally a collection of personnel from the various TxDOT districts’ Operations and Planning sections, Metropolitan Planning Organizations (MPO), and local transportation agencies.
Summary

- Operations is a critical component for managing the transportation network on a daily basis.
  - Enhance mobility, reliability, safety, and environment
  - Provide a sustainable transportation network
  - Support a performance-based approach, focusing on outcomes
  - Achieve quick and cost-effective implementation

- To be successful, operations need to be “mainstreamed” into the regional planning and programming processes and documentation
Memo issued by Michael Chacon - Director, Traffic Safety Division

“...the Traffic Safety Division will lead efforts to further mainstream TSMO at the statewide level, collaborating with the districts as well as other divisions...

District TSMO Program Plans will define specific processes, institutional arrangements and projects that need implementation to support Traffic Management System (TMS) performance... early endorsement is needed from the senior leadership in the district, with participation from each of the districts’ core functional groups (planning, design, construction, operations, maintenance, etc.). It is also important to have participation from the external partner agencies (cities, first responders, toll authorities, Metropolitan Planning Organizations (MPOs), etc.)”

(Memo dated September 17, 2018)
Source(s):
- 1.) Organizational Context to TSMO Planning (FHWA Resource Center)
• TSMO is not new. Districts are already applying certain TSMO strategies and engage in certain aspects of TSMO planning.

• But the processes, performance measures, staffing and funding that sustain TSMO need to be better defined, and mainstreamed statewide.

• Rural areas also benefit from TSMO planning. While congestion is generally a minor concern, traffic safety, special events, and weather are often significant concerns.

• Interstate corridors running through rural districts connect major freight and urban population centers.
Some states have targeted their TSMO planning efforts toward strategic corridors instead of entire districts or regions.

Separate regions will have a slightly different approach to TSMO planning, based on size, staffing and transportation challenges being faced.

Local agencies, MPOs, and TxDOT should work together to determine the best approach for their respective regions. Collaboration is essential.

Facilitate a CMM self-assessment workshop to establish priority actions for the district/region to consider as part of its future TSMO program plan.
District TSMO Program Plans—Things to Consider

- Each district has appointed a TSMO Coordinator and TSMO Champion.

- Which local or regional agencies should be involved?

- Which existing plans or initiatives should be referenced in or combined with the TSMO Program Plan?... No need to “reinvent the wheel.”

- To be successful, early endorsement needed from senior leadership, with full participation from each of the core disciplines of the organization [e.g. planning, design, construction, operations and maintenance].
Statewide-use TSMO Planning Contracts

- Engineering consultant contracts to be used for TSMO planning.
- Four (4) consultants selected, each for 5 yr./$5M indefinite deliverable contracts; executed in early Oct ‘18.
- Statewide project management of the contracts to be done by Traffic Safety Division (TRF).
- Work authorizations (WA) executed through these contracts will be managed and funded by the district / division that requested the WA.
TSMO Consultants - District Assignments

Kimley-Horn
- WFS, ABL, WAC, FTW, BWD

Kimley-Horn
- DAL, PAR, TYL, ATL

ARCADIS
- SAT, PHR, LRD, AUS, CRP, SJT

DKS
- BRY, YKM, LFK, HOU, BMT

AECOM
- ELP, ODA, LBB, AMA, CHS

AECOM Traffic Safety Division
- (TRF)
Contract - Scope of Work

- **Program Planning**
  - Develop business case, vision, mission and goals for TSMO, taking input from internal and external stakeholders.
  - Analysis of business processes, institutional arrangements, as well as mobility and safety challenges.
  - Recommend process improvements, institutional arrangements, projects and services that will improve TSMO capabilities and achieve TSMO goals and objectives.

- **Tactical Planning**
  - Identification of funding, staffing and equipment needed to deploy projects and services (e.g. Traffic Incident Management, Integrated Corridor Management, Traveler Information, Safety Service Patrol, etc.).
  - Concept of operations (ConOps) for operations strategies, ITS architectures, ITS Master Plans, etc.

- **Program Development and Implementation**
  - Analysis, reporting, meetings, workshops and other actions to integrate ("mainstream") TSMO into core functions of the agency, such as planning, design, construction, maintenance and traffic operations.
  - Implement processes and institutional arrangements that will improve TSMO capabilities and achieve TSMO goals and objectives.

- **Preliminary Design**
  - Benefit-cost analysis, system requirements, schematics, device layout, cost of equipment, installation, and maintenance (i.e. detailed design framework).

- **Public Involvement**
  - Professional outreach, marketing, promotional materials as needed.

- **Project Management**
  - Project coordination, invoicing, status reports.
Program planning resources

National Operations Center of Excellence

- transportationops.org

- Partnership of AASHTO, ITE, and ITS America with support from the FHWA

- Offers a document library, peer exchanges, webinars, on-call assistance, assessments, and other TSMO support via the Operations Technical Services Program.

National Operations Center for Rural Road Safety

- ruralsafetycenter.org

FHWA Resource: What is TSMO?
https://ops.fhwa.dot.gov/plan4ops/focus_areas/tsmo/what_is_tsmo.htm
Through collaboration and leadership, we deliver a safe, reliable, and integrated transportation system that enables the movement of people and goods.

Michael Chacon, PE, Director, Traffic Safety Division (TRF)
George Villarreal, PE, Deputy Director, TRF
Joseph Hunt, Director, TRF Traffic Management Section

Marco Cameron, PE, Transportation Engineer
WFS, ABL, WAC, FTW, BWD

Barbara Russell, PE
TM Engineering Branch Supervisor
SAT, PHR, LRD, AUS, CRP, SJT

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TM Engineering Branch Supervisor
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Marco Cameron, PE, Transportation Engineer
DAL, PAR, TYL, ATL

Jianming Ma, PE, Transportation Engineer
BRY, YKM, LFK, HOU, BMT

David McDonald, Traffic Incident Management (TIM) Coordinator
Statewide

TxDOT Statewide TSMO Strategic Plan Rollout
July 12, 2019
Contact:

TxDOT – Traffic Safety Division

Marco Cameron, PE
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TxDOT TSMO Webpage:  
https://www.txdot.gov/inside-txdot/division/traffic/tsmo.html

Districts Webpage:  
http://www.txdot.gov/inside-txdot/district.html