NWA
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Planning
Commission

NORTHWEST ARKANSAS
REGIONAL TSMO PLAN / 2023

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REGIONAL TSMO PLAN

2023

Prepared for

Northwest Arkansas Regional Planning Commission

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NWA Regional Planning Commission

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EXECUTIVE SUMMARY

The Northwest Arkansas Regional Planning Commission (NWARPC) has developed a regional approach to Transportation Systems Management and Operations (TSMO). TSMO encompasses a range of operational strategies and applications that can optimize the performance of Northwest Arkansas's existing infrastructure and benefit travelers in the region. TSMO, which is defined in greater detail below, examines improvements from an integrated systems perspective, looking beyond a single strategy, project, or corridor.

This plan captures the Northwest Arkansas region's strategic approach to TSMO, based on regional outreach and a regional TSMO Capability Maturity Model (CMM) self-assessment. The region's strategic approach includes its TSMO mission, vision, goals and objectives. From this, the region identified specific TSMO strategies and actions to implement, and developed implementation plans for high-priority actions. The high-level strategic direction and actions are summarized in this Executive Summary. They are detailed, along with the outreach and research behind them, in the plan that follows.

The TSMO Plan is developed using a consensus-based approach with input from stakeholder agencies by undertaking the following tasks:

- Develop a business case for TSMO in Northwest Arkansas
- Review relevant plan documents
- Develop best practices report
- Conduct CMM assessment
- Develop TSMO Strategic Plan
- Develop TSMO Implementation Plan

NWARPC has also developed a regional Intelligent Transportation System (ITS) architecture plan. This ITS architecture plan provides a framework for implementing ITS projects, encourage interoperability and resource sharing among agencies, identify applicable standards to apply to projects, and allow for cohesive long-range planning among regional stakeholders. The ITS architecture allows stakeholders to 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 in the short-term.

What is TSMO

TSMO is a set of strategies that focus on operational improvements to maintain or restore performance of the existing transportation system before extra capacity is needed. It is a cross-discipline, collaborative, and integrated program of strategies and applications to improve existing and planned transportation infrastructure and multimodal systems through better integration, coordination and implementation of key operational strategies, innovation, and technology. TSMO strategies are often low-cost relative to capacity improvements, and frequently are high-impact actions that can be implemented more quickly, either on their own or in support of a traditional capacity-building project. Figure 1 shows the topic areas that fall under the TSMO umbrella and work together to improve the transportation system.

WHAT IS TSMO?

TSMO is “an integrated set of strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system.”

FIGURE 1. TSMO FOCUS AREAS

TSMO Vision, Mission, Goals and Objectives

The Northwest Arkansas TSMO strategic direction is materialized through the vision, mission, goals, and objectives presented in this section. The information in this section aligns with the NWARPC vision for the region as illustrated in current endeavors such as the 2045 Metropolitan Transportation Plan and the region's 2022 Congestion Management Process and through the discussions conducted with the region's stakeholders.

FIGURE 2. NWARPC TSMO VISION, MISSION AND GOALS

Vision

The Northwest Arkansas region collaboratively manages an integrated transportation system that provides safe, reliable, and efficient transportation options for the growing region.

Mission

Provide a safe, reliable, and efficient transportation network for the Northwest Arkansas region by leveraging stakeholder collaboration and innovative technology solutions.

Goals

- **Safety**
- **Reliability**
- **Efficiency**
- **Collaboration**
- **Integration**
- **Innovation**
- **Environmental Sustainability**

TSMO Prioritized Activities and Projects

This section prioritizes the activities, and projects to accomplish meeting the NWARPC TSMO mission, vision, goals, and objectives. This component establishes the foundation for subsequent TSMO deployment. Typically, this phase of TSMO program planning involves a focus of 3 to 5 years and is used by metropolitan planning organizations (MPO) to identify priorities to move forward as investments and programs within a transportation improvement program (TIP).

TABLE 1. NWARPC TSMO PRIORITIZED ACTIVITIES AND PROJECTS

#	Identified Activity/Project	Priority		
		High	Medium	Low
Strategy # 1: TSMO Planning				
1.1	Continue to maintain and update as needed the regional TSMO committee	x		
1.2	Demonstrate the value of TSMO to decision makers	x		
1.3	Integrate TSMO into local and regional planning	x		
1.4	Plan for and develop a regional Transportation Management Center (TMC)	x	x	
1.5	Incorporate freight into TSMO planning activities		x	
1.6	Develop processes for regional technology standards		x	
Strategy # 2: Data Management				
2.1	Develop a regional data governance framework	x		
2.2	Develop TSMO performance measures and track progress	x		
2.3	Develop a centralized data hub for regionwide use		x	
2.4	Develop data acquisition, management and sharing strategies		x	
2.5	Develop data-driven techniques to analyze TSMO strategies			x
Strategy # 3: Regional Coordination				
3.1	Maintain and update a regional multimodal network for the Northwest Arkansas region	x		
3.2	Develop Signal Corridor Management Strategies	x		
3.3	Improve and modernize the communications network architecture		x	
3.4	Explore improvements in traveler information		x	
Strategy # 4: Connected and Automated Vehicle and Innovative Technologies				
4.1	Conduct research projects to analyze the impacts of connected and automated vehicles to the Northwest Arkansas region	x		
4.2	Identify connected vehicle technologies to improve safety, mobility and reliability for travelers		x	
4.3	Develop a CAV Plan for the Region		x	
Strategy # 5: Managing Nonrecurring Congestion				
5.1	Improve regional coordination focusing on special events	x		
5.2	Develop strategies to improve parking in central business districts		x	
5.3	Implement smart work zone technologies		x	

TSMO Implementation Plan

The NWARPC Regional TSMO Implementation Plan provides a roadmap for deployment of strategies, action items, policies and practices to support a successful systems management and operations in the region. Implementing these TSMO strategies will lead to increased safety, reduced congestion, and improved system performance. Succesful implementaion will require ongoing interagency coordination for planning, funding and operating the improvements.

For each of the high priority action items, the TSMO Plan includes the following components:

- Strategy
- Action
- Description
- Goals Addressed
- Implementation Steps
- Timeframe
- Benefits

1. INTRODUCTION

The Northwest Arkansas Regional Planning Commission (NWARPC) has developed a regional approach to Transportation Systems Management and Operations (TSMO). TSMO encompasses a range of operational strategies and applications that can optimize the performance of Northwest Arkansas's existing infrastructure and benefit travelers in the region. TSMO, which is defined in greater detail later, examines improvements from an integrated systems perspective, looking beyond a single strategy, project, or corridor.

NWARPC has also developed a regional Intelligent Transportation System (ITS) architecture plan. This ITS architecture plan provides a framework for implementing ITS projects, encourage interoperability and resource sharing among agencies, identify applicable standards to apply to projects, and allow for cohesive long-range planning among regional stakeholders. The ITS architecture allows stakeholders to 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 in the short-term.

The Northwest Arkansas region's current TSMO-related strategies are limited, based on a self-assessment done by regional stakeholders as part of a Capability Maturity Model (CMM) assessment effort that is discussed within this plan (Chapter 4). TSMO-related strategies currently focus mainly on traffic signal and intersection operations within individual cities, in addition to some Arkansas Department of Transportation (ARDOT) efforts focused on transportation data collection and sharing. This CMM assessment identified the necessary steps to advance to the next level of TSMO maturity, specifically identifying three main focus areas: creating a regional TSMO network, making the TSMO business case to senior leaders, and identifying funding sources to advance TSMO locally.

This TSMO Plan builds a foundation and strategic direction for TSMO in the Northwest Arkansas region by identifying goals and objectives to advance TSMO activities — and their positive impacts on safety, efficiency, and reliability—as an integrated and comprehensive program. Additionally, the TSMO Plan also identifies strategies, prioritized action items and implementation steps that can be undertaken by NWARPC and stakeholders. The TSMO Plan is developed using a consensus-based approach with input from stakeholder agencies by undertaking the following tasks:

- Develop a business case for TSMO in Northwest Arkansas
- Review relevant plan documents
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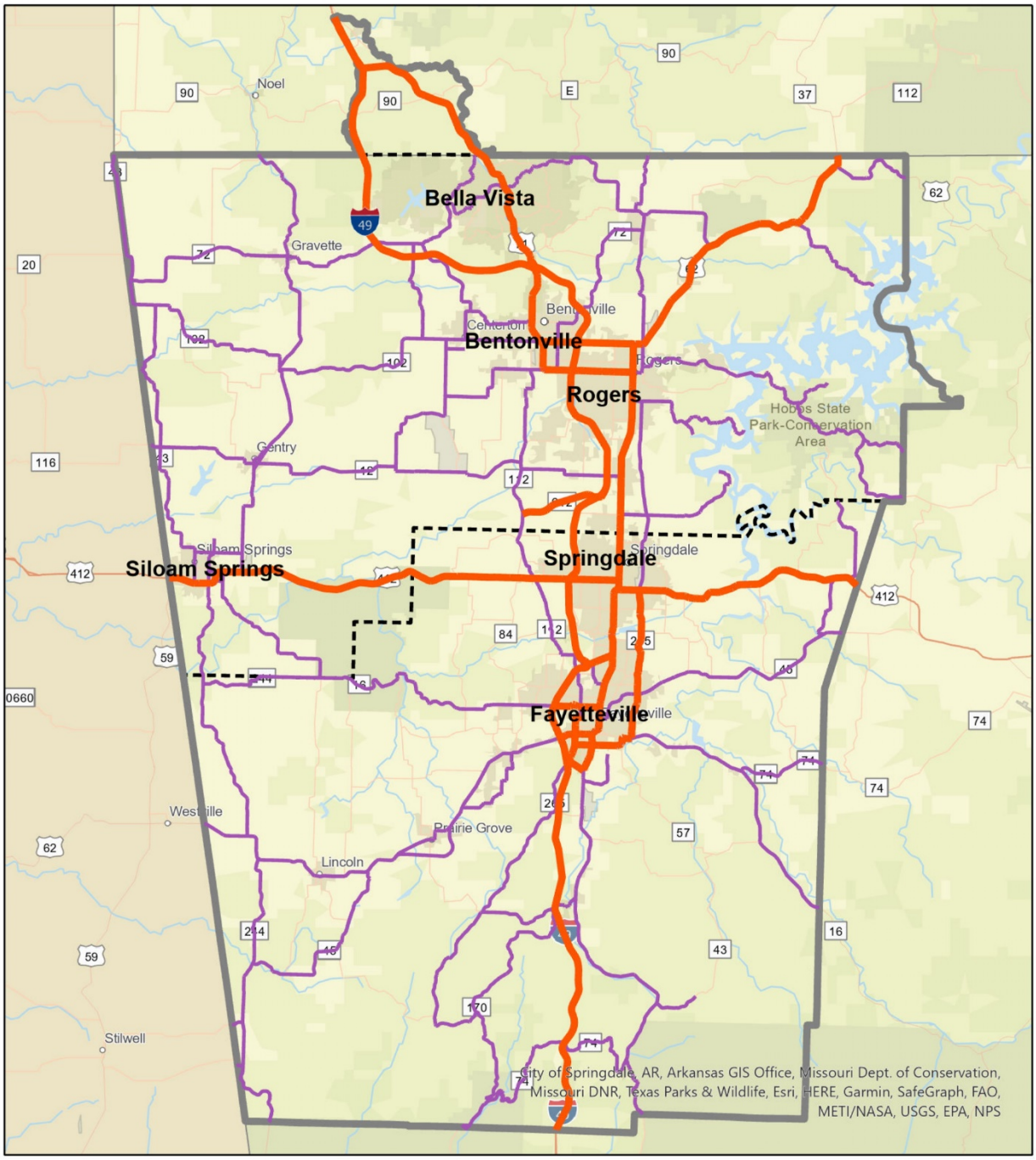
FIGURE 3. NORTHWEST ARKANSAS REGIONAL PLANNING COMMISSION BOUNDARIES



1.1 TSMO Overview

TSMO is a set of strategies that focus on operational improvements to maintain or restore performance of the existing transportation system before extra capacity is needed. It is a cross-discipline, collaborative, and integrated program of strategies and applications to improve existing and planned transportation infrastructure and multimodal systems through better integration, coordination and implementation of key operational strategies, innovation, and technology. TSMO strategies are often low-cost relative to capacity improvements, and frequently are high-impact actions that can be implemented more quickly, either on their own or in support of a traditional capacity-building project. Figure 4 shows the focus areas that fall under the TSMO umbrella and work together to improve the transportation system.

WHAT IS TSMO?

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

FIGURE 4. TSMO FOCUS AREAS

1.2 Business Case for TSMO

The Northwest Arkansas region faces a set of challenges that are directly related to the current state of the region's transportation system. Additionally, projected population and economic growth in the region will add more strain on the existing transportation system. This section summarizes the business case for investing in TSMO strategies as a part of the NWARPC TSMO Plan.

Safety Impacts

The 2045 NWARPC Metropolitan Transportation Plan goal for "Improve Safety" aligns with many TSMO strategies. TSMO planning identifies technologies that can be incorporated into infrastructure to improve the safety of road users for all modes of transportation, including walking, bicycling, transit and vehicular.

> NWARPC MTP GOAL: IMPROVE SAFETY
>
> Increase transportation safety for all modes of travel by providing safe and secure travel for all modes of transportation, including walking, bicycling, transit and vehicular.

The average annual fatalities in Northwest Arkansas between 2017 and 2021 was 43 (Arkansas Crash Analytics Tool (ACAT)). The annual safety cost per driver was $198 (TRIP, 2020).

Congestion Impacts

> NWARPC MTP GOAL: REDUCE CONGESTION AND IMPROVE RELIABILITY
>
> Maximize the capacity and reliability of existing facilities on regionally significant routes and minimize the need for new roadways.

The 2045 NWARPC Metropolitan Transportation Plan goal of "Reduce Congestion and Improve Reliability" aligns with many TSMO strategies. TSMO planning usually identifies strategies that are mostly focused on non-recurring congestion. The low-cost strategies are typically effective at improving travel time reliability.

The average annual hours lost in Northwest Arkansas region is 33 hours per driver and the annual cost of congestion per driver is $677 (TRIP, 2020). According to a 2012 study by the Texas A&M Transportation Institute for the region, the average delay was 32,200 hours per year, performing "far worse" than regions with similar size. The study also found that 40% of the traffic delay is caused by less than 10% of the region's roadway mileage (Traffic Congestion in Benton and Washington Counties, 2012).

The above statistics on safety and congestion highlight the current state of the region's transportation system and illustrates the fact that there's a margin for improvement when it comes to increasing roadway safety and reducing congestion on Northwest Arkansas's roads.

Demographic and Economic Impacts

The rapidly growing Northwest Arkansas region had a population of 530,000 in 2020. The forecasted population for the Northwest Arkansas region is nearly 1 million residents by 2045 (Arkansas Economic Development Institute, 2020). This population growth also reflects the economic growth in the region, with the region's gross domestic product (GDP) growth being 1.3 times higher than that of the nation (Northwest Arkansas Council State of the Region, 2021).

Northwest Arkansas is the home to several major trucking companies, as well as companies with large truck fleets. Pairing that with the region's economic growth, demand for trucking is forecasted to increase by 50 percent over the next 20 years (Arkansas State Freight Plan, 2020).

This demographic and economic growth reflects a projected increase in travel demand. Additionally, the Annual Average Daily Traffic (AADT) in the Northwest Arkansas region has been on a steady rise over the last several years. These various factors highlight the importance of an efficient transportation system that is able to cater to the needs of the region's residents and businesses.

Value of TSMO Strategies

TSMO solutions are often quicker to implement and have a relatively low cost compared to traditional capacity-building solutions. TSMO's holistic and multimodal perspective allows it to be applied in combination with traditional infrastructure and capacity-building projects, such as adding lanes while considering deeper shoulder depths for hard shoulder operations. It can enhance the effectiveness of these infrastructure projects, especially when it comes to managing non-recurring congestion. TSMO expands the traditional regional focus on capacity to also include efficient and reliable systems operations as an equal priority with other program- and project-level decision-making.

TSMO supports NWARPC's vision for the region. Part of NWARPC's vision, as stated in the 2045 Metropolitan Transportation Plan (MTP), is to develop and maintain a safe, reliable, and efficient transportation system for the movement of people and goods throughout the area (NWARPC Metropolitan Transportation Plan (MTP), 2021). Furthermore, TSMO supports the 2022 Congestion Management Process (CMP) objectives which revolve around maximizing the transportation systems' efficiency through focusing on management and operations. The CMP also encourages the use of ITS technologies to improve safety and reliability for the users of the transportation system. With a vision focused on safety and reliability, TSMO is a vital step to improve these two metrics. A comprehensive approach to TSMO will help improve foundational capabilities and coordinate strategies across the region to optimize how NWARPC improves safety and reliability of the region's transportation system. For example, the NWARPC encompasses all local governments in Benton and Washington Counties, as well as Huntsville and Hindsville in Madison County, the Beaver Water District, and the NWA Regional Airport (XNA). The benefits of a TSMO program include regional efficiency when it comes to transportation project implementation and improved collaboration across local governments in the region. The operational benefits of TSMO strategies include a reduction in crashes, improved reliability of the system, lower vehicle emissions and energy costs, and increased travel time reliability. In a region where there is a high forecasted population growth, having safe, reliable and efficient regional connectivity helps in adopting a proactive approach when it comes to managing an increased demand on the transportation network.

In addition to safety and reliability, NWARPC's 2045 MTP vision includes sustaining a high level of economic vitality in the region. Companies are constantly looking at the quality of a region's transportation system when deciding where to re-locate or expand. Regions with congested or poorly maintained roads may see businesses relocate to areas with a smoother, more efficient and more modern transportation system. Given Northwest Arkansas is already a home to companies with large freight activity, having an efficient transportation system will help sustain current and future regional economic activity and growth.

TSMO Success Stories

Other states around the country have implemented a TSMO culture into their organization. As part of their strategic planning efforts, they prioritize TSMO projects and programs as an alternative to capacity-building. Some success stories listed below:

- Ohio DOT developed the Traffic Operations Assessment Systems Tool (TOAST) to help inform project planning by using available transportation data. TOAST helped the Ohio DOT prioritize projects through systematically assessing operationally sensitive segments (ODOT, 2022).
- Washington State DOT employs queue warnings which are a traveler information strategy that uses real-time traffic detection and warning signs to variable message signs strategy and/or flashing lights to inform drivers of stopped or slow traffic ahead. The strategy benefits are realized through a reduction in primary and secondary collisions, reduction in the severity of collisions, shortening the duration of recurring freeway congestion, and a reduction in emissions and fuel consumption by decreasing stop-and-go traffic (WSDOT, 2022).
- According to the Pennsylvania DOT TSMO performance report, the Smart Work Zone systems which includes speed management, ramp metering and traveler information applications reduced congestion-related crashes by 22% from 2017 to 2019 (PennDOT, 2022).

2. REVIEW RELEVANT DOCUMENTS AND DEVELOP BEST PRACTICES REPORT

2.1 Relevant RPC Documents

A key first step in developing a Regional Transportation Systems Management and Operations (TSMO) Plan is reviewing existing plans and programs for connections and overlapping areas with TSMO. It is important that the TSMO Plan works in harmony with, complements, and builds on existing efforts. Similarly, it is important to avoid recreating the wheel or creating redundant pathways.

This document review seeks to review existing Northwest Arkansas Regional Planning Commission (NWARPC) documents relevant to TSMO, as well as key partner documents such as those from the Arkansas DOT (ARDOT). As a part of this effort, each plan is briefly summarized for context and key connections, areas of overlap, and other takeaways for this effort are identified. Detailed information from the following documents is available in Appendix A.

- 2007 Northwest Arkansas Regional ITS Architecture and Deployment Plan
- 2045 Metropolitan Transportation Plan
- 2021-2024 Transportation Improvement Plan
- 2020 Connect NWA (10-year Transit Development Plan)
- 2015 Bicycle and Pedestrian Master Plan
- ARDOT Strategic Plan (2017-2022)

2.2 Summary of TSMO Best Practices

The NWARPC TSMO Plan will reflect national and peer best practices in TSMO planning. To this end, the project team identified three peer agency case studies for regional TSMO planning. In identifying case studies, the team sought to find peers with (1) formalized, established TSMO plans/ITS architectures and plans and (2) relevance to the unique context and needs of NWARPC and Northwest Arkansas. This document captures those case studies along with national best practices and guidance to complement the peer findings and bring in a broader perspective. TSMO Plans from the following three peer agencies were reviewed:

- Wichita Area Metropolitan Planning Organization
- Atlanta Regional Commission
- TxDOT Atlanta District

As a note on selecting peers for this study: formal TSMO program planning is an emerging and forward-looking practice. To-date, primarily state Departments of Transportation (DOTs) have started formal TSMO programs, although increasingly regional agencies such as NWARPC are also launching formal TSMO programs. Still, many state DOTs and even more regional agencies do not have formal TSMO programs to assess for best practices (that is to say, many agencies implement TSMO strategies in an ad hoc or decentralized manner, instead of through a formal program). Further, most formal TSMO efforts are relatively young, with the oldest programs having approximately 5-7 years of experience in 2022. This limits, to some extent, the range of peers to select from and the available benefit/cost information. Nonetheless, there are significant, valuable insights and lessons learned from the peers in this study who have established and maintained a formal TSMO program.

Appendix B captures the key aspects of the identified peer TSMO plans and the agency/regional context in which they operate. It pulled out key takeaways for NWARPC to consider in the development of a Regional TSMO Plan.

3. CAPABILITY MATURITY MODEL ASSESSMENT

3.1 Introduction

The Northwest Arkansas Regional Planning Commission (NWARPC) held a Transportation Systems Management and Operations (TSMO) Capability Maturity Model (CMM) assessment workshop on May 3rd and 4th, 2022 with the TSMO Committee members. The workshop assessed the Northwest Arkansas region TSMO capabilities for the first time. The 2022 CMM assessment was held in-person over the course of two half-day sessions.

3.2 Objective

Research shows that moving beyond a collection of strategy applications to an effective TSMO program requires a set of deliberate change management actions to improve agency capabilities in six specific dimensions. A "capability maturity" approach utilized in the Workshop focused on the key dimensions that impact TSMO program effectiveness: business processes, systems and technology, performance measurement, agency culture, organization and workforce, and collaboration. Improving these capabilities are essential to TSMO and its performance impacts for the NWARPC and its partners in the region.

The objective of the assessment was to raise awareness and opportunities for developing a regional TSMO program. It focused on the broad set of strategic and programmatic approaches that will help build a foundation for TSMO as a regional program. The outcome of the workshop documented the priorities and potential actions to develop a regional TSMO program.

This assessment recognized that there are various stakeholders in the region whose involvement is necessary to advance TSMO, with the region's MPO and cities being the primary players.

3.3 Overview of CMM Assessment

At the facilitated self-assessment workshop, Committee members classified the TSMO capabilities into one of four levels of organizational maturity. This section provides details on the CMM assessment process.

Key Dimensions: Processes

Predictable and repeatable processes – both business and technical – within an organization are the key to effective, "surprise free" TSMO. Achieving predictability and repeatability requires planning for standardization and documentation of systems and technology, training and performance measurement. These features are also the tools required for continuous improvement – putting the program on a stepwise path to improved effectiveness. Many of these considerations have long been embodied in how regional transportation agencies do their other core business such as capital project development and maintenance. But the requirements of a high tech, real-time customer service activity like TSMO are different and need to be specifically accommodated with appropriate processes. Organizations that want their TSMO processes to be predictable and repeatable and tailored to the

incremental high-tech, low-cost nature of the improvements, must evolve through a series of stages of maturity from informal (at the lower end of the scale) to highly routinized and with continuous improvement embedded at the higher end. As each process develops in this way, its capability will improve.

There are three process dimensions considered in the workshops:

- **Business processes**, including formal scoping, planning, programming, and budgeting. TSMO is not typically integrated into the regional planning and programming processes, which focuses on allocating federal and state funds within the conventional construction and maintenance programs. Currently, TSMO investments tend to be ad hoc; without a clear and sustainable improvement program. Few state DOTs and Metropolitan Planning Organizations (MPO) even know what they spend on TSMO for capital or maintenance. Of the agencies that track the information, a few spend more than 2 percent of their total budgets on TSMO despite its potential to address more than half of the causes of delay and most of the causes of unreliability.

- **Systems and technology**, including systems architecture, interoperability, standardization, and documentation. State DOT and MPO technical staff – especially at the regional or district level – have a well-developed understanding of systems and technology issues, in part because of federal support but also because of professional interest in technology. Most agencies have developed systems architectures with extensive federal guidance. But agencies are struggling with standardization, documentation, upgrades, interoperability and integration, especially given the rapid rate of technology development. Relationships with IT agencies have sometimes proved problematic. In several states, private-sector systems and service providers are playing an increasing role in day-to-day operations and maintenance.

- **Performance measurement**, including measures definition, data acquisition, analysis, and utilization. Improving the effectiveness of any TSMO strategy depends on performance measurement. Some agencies measure their TSMO by the number of activities they perform, and some conduct post-event debriefings after major crashes or storms. Nevertheless, most agencies have limited knowledge of the effects of their routine TSMO activities in reducing delay, unreliability, and crashes. Even at the national level, information on the benefits of TSMO activities is fragmentary, which makes improving procedures and protocols difficult and hampers efforts to “make the business case” for increased investment. An increased focus on improvement in performance measurement is now taking place in response to the strong federal emphasis on performance measurement (MAP-21) often supported by the private sector’s growing involvement in supplying such measures as vehicle probe-based traffic information.

Key Dimensions: Institutional Arrangements

The “architecture” of the organization must be appropriate to promoting the alignment of understanding and objectives, authority and accountability, technical capacity and resources and roles and relationships, as needed for TSMO. The existing culture, organizational structure, and staff capabilities of most transportation agencies have been established to support the traditional core programs. It is not surprising that a new program focus – with its service and performance focus and its dependence on external partners – requires certain organizational adjustments.

The three Institutional dimensions to be considered are:

- **Culture**, including technical understanding, leadership, policy commitment, outreach, and program authority. In many agencies, senior executive recognition of the potential of TSMO is limited, as reflected by its absence in formal agency policy and programs. Most agencies have a legacy culture of public works with the related values, expertise, and well-established practices supporting a focus on capital improvements. In this context, real time operational management has not been a priority. Many of the more effective TSMO programs have resulted not from new policy but in response to external crisis, such as a major crash, a weather-related traffic disaster, or the challenges of accommodating a major event. Most of the more successful programs depend on middle management staff champions who apply extra energy and entrepreneurship to cobble together a coherent program.

- **Organization and staffing**, including organizational structure, staff capacity development, and retention. TSMO is not yet a top-level unit in an agency's organizational structure. Its key components are often fragmented into intelligent transportation systems, traffic engineering, and traffic operations units – at the third or fourth level of the management hierarchy and reporting to division managers in regional or central offices. As a result, deliberations by senior management about the agency's program, budget, and staffing do not typically include representation from TSMO, and accountability for operations services is rarely evident. TSMO is often understaffed, not only because of agency-wide constraints, but also because of the difficulty in finding and retaining qualified staff. TSMO is not yet widely established as a rewarding career track within agencies, with job specifications, competitive positions, and clear opportunities for advancement. In addition, outsourcing key responsibilities to private entities is a growing trend.

- **Collaboration**, including relationships with public safety agencies, local governments, MPOs, DOTs and the private sector. Many of the important TSMO strategies are beyond the span-of-control of transportation agencies alone. The divided jurisdictions and responsibilities for critical actions regarding incident traffic management, arterial traffic operations, ramp metering, and integrated corridors present special challenges. Several of the most important TSMO strategies require collaboration with law enforcement, emergency services, local governments, and private providers of services – such as towing and recovery or private information and service suppliers. At the regional level, collaboration is often informal and can be disrupted by staff turnover. Many agencies are working to transcend interagency differences in missions, resources, and tactical approaches through formal agreements. Some MPOs are using innovative approaches for public-public and public-private collaboration, including coalitions, cross subsidies, co-training, and incentive and disincentive contracting.

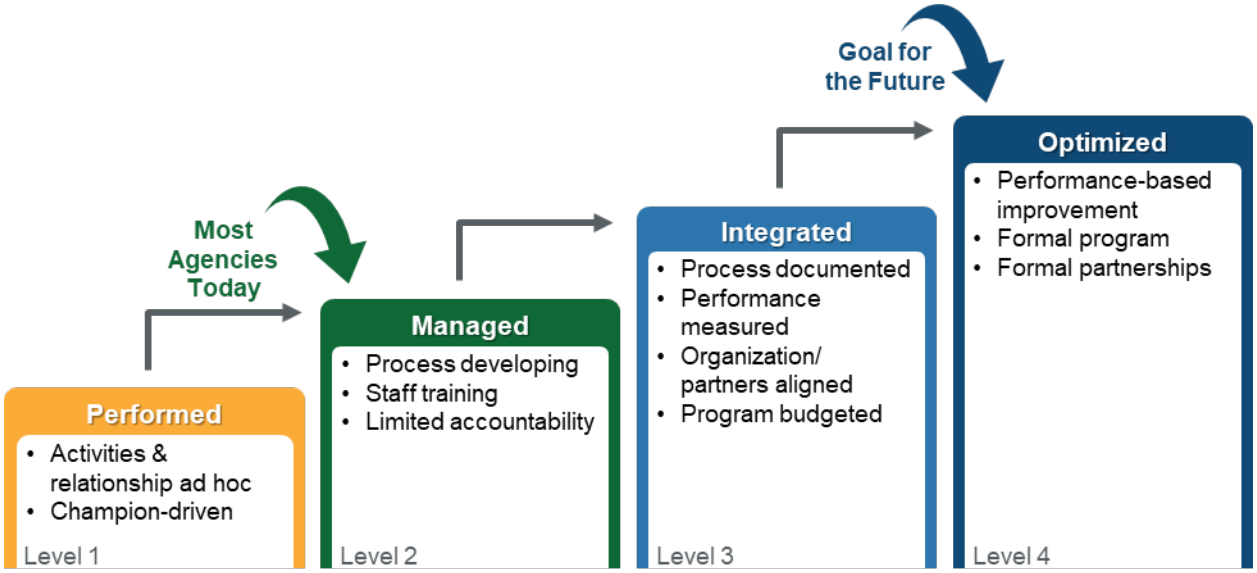
Capability Levels

Discrete levels (stages) of capability maturity for the various dimensions have been observed and defined from research and an analysis of various existing regional TSMO programs – and have been interpreted in terms of the capability maturity concept – ranging from ad hoc/start-up activities to an ideal level. The CMM levels are:

- **Level 1: Performed –** Activities and relationships largely ad hoc, informal and champion-driven – substantially outside the mainstream of other transportation activities.
- **Level 2: Managed –** Basic strategy applications understood but limited accountability and external alignment; processes and support requirements identified, key technology and core capacities under development.

- **Level 3: Integrated –** Standardized strategy applications implemented in priority contexts and managed for performance; technical and processes developed, documented, integrated and funded into the regional transportation agencies, partnerships aligned.
- **Level 4: Optimized –** TSMO as full, formal, sustainable region-wide program, established on the basis of continuous improvement with all partners.

The relationships among the levels are illustrated below.



3.4 Results

This report includes six tables (one for each CMM dimension) that provides a summary of the consensus strengths and weaknesses voiced by workshop participants regarding current TSMO levels of capability. After assessing the strengths and weaknesses participants voted on the level of maturity each dimension fit most closely. The group then brought forward suggested actions that would advance the region's TSMO capabilities for each dimension. The articulation of participants' views and comments during the workshops are documented as brief bulleted points as they were made by participants, without interpretation by the facilitation team. They can be used as the basis for understanding and advancing a TSMO implementation planning process.

Proceeding the six tables, the workshop team has highlighted an analysis of key trends and actions to help summarize across dimensions, for consideration by the NWARPC team.

The following table summarizes the Northwest Arkansas region self-assessed level in each CMM dimension.

	Level 1 – Performed	Level 2 – Managed	Level 3 - Integrated	Level 4 - Optimized
Business Processes	1.5			
Collaboration	1			
Culture	1			
Systems and Technology	1			
Performance Management	1			
Organization and Staffing	1			

3.5 Key Issues and Themes

Participants brought forward various trends and actions when discussing the dimensions of capability for TSMO. Often a similar action would benefit advancing capabilities in several dimensions. The below summary of recurring themes span the full six dimensions in synthesizing the entirety of inputs from the two work sessions, noting that more specific actions are detailed in the Dimension tables. These synthesized items were voiced in several stated actions that would advance the Northwest Arkansas region TSMO program development. Recurring themes and discussions included:

- Identifying a Regional Network where TSMO would be focused on. This network would focus on connecting the cities in the Northwest Arkansas region rather than focusing on the internal network in the cities themselves.
- The need to sell the TSMO case to the Upper Leadership where decisions are ultimately made in the region. This needs to focus on the benefits of TSMO on the region's transportation network.
- The need for additional Funding Sources to be able to develop a regional TSMO program. Cities within the region are currently working with constrained budgets.

Business Processes (Planning and Programming)

Strengths	Weaknesses
• Regional MPO (NWARPC) is working on several plans including TSMO and ITS plans. • Some cities conduct yearly traffic improvement planning / transportation studies. • Cities have an emphasis on planning for signal operations. • ArDOT's iDrive is being utilized by some of the agencies for traffic and camera information. • Cities are proactive about available funding opportunities for planning projects. • There are some form of joint planning between the cities and the University of Arkansas, law enforcement, and local businesses (e.g., Special Events). • There are traffic plans with detour information for work zones.	• Planning within cities is not directly involves with operations. • Planning is largely driven by political decisions and the publics' requests. • Planning funding opportunities are not sustainable, cities budget year by year. • Planning is mostly focused on signal / intersections operations. • Cities are more focused on maintenance.

	LEVEL 1 — PERFORMED	LEVEL 2 — MANAGED	LEVEL 3 — INTEGRATED	LEVEL 4 — OPTIMIZING
Level Criteria	Each jurisdiction doing its own thing according to individual priorities and capabilities	Consensus regional approach developed regarding TSM&O goals, deficiencies, B/C, networks, strategies and common priorities	Regional program integrated into jurisdictions' overall multimodal transportation plans with related staged program	TSM&O integrated into jurisdictions' multi-sectoral plans and programs, based on a formal, continuing planning processes
Consensus	1.5			

Actions to Advance to the Next Level

- Establishing regional TSMO goals with consensus from the leadership.
- Identify a larger government entity to lead the regions planning (e.g., ArDOT).
- Benchmark similar regions that implemented / planned for TSMO.
- Regional discussions on TSMO planning with the MPO, Cities, law enforcement, etc.
- Identify regional network that overlaps between jurisdictions which are critical for TSMO planning.
- Regional discussions to share the cities' current experiences and identify potential synergies.
- Identify additional funding opportunities to fund TSMO related efforts.

Systems and Technology

Strengths	Weaknesses
• Signals on some major corridors are coordinated. • Some cities are planning to utilize intersection cameras to collect intersection data. • Plans for signal controller consistency within cities. • Some cities utilize a specialized software to collect traffic, bicycle and pedestrian counts. • Battery backed up signals. • Some cities use long range Lidar detection to measure speeds in limited locations. • State DOT utilized some form changeable message boards, cameras, and weather condition measurement. • State DOT is currently working on a truck parking notification system. • Private companies in the region are utilizing emerging transportation technologies.	• Lack of consistency due to the presence of different transportation system vendors within the same city. • Ad-hoc coordination between IT and operations departments within agencies. • Absence of large-scale signal coordination • Lack of technology guiding standards and policies. • Absence of ramp metering • State DOT technology / data sources are isolated from the region's agencies' systems. • State DOT Message boards are not dynamic.

	LEVEL 1 — PERFORMED	LEVEL 2 — MANAGED	LEVEL 3 — INTEGRATED	LEVEL 4 — OPTIMIZING
Level Criteria	Ad hoc approaches to system implementation without consideration of systems engineering and appropriate procurement processes	Regional ConOps and architectures developed and documented with costs included; appropriate procurement process employed	Systems & technology standardized and integrated on a regional basis (including arterial focus) with other related processes	Architectures and technology routinely upgraded to improve performance; systems integration/interoperability maintained on continuing basis
Consensus	1			

Actions to Advance to the Next Level

- Development of regional standards and policies for transportation technologies / regional implementation of the ITS architecture plan.
- Real-time travel time measurement technologies on regional corridors.

Performance Measurement

Strengths	Weaknesses
• Traffic volumes, limited ped and bike count measurement. • Some cities utilize specialized software to measure speeds at intersections. • Master street plans drive limited congestion measurement efforts. • Level of service studies are conducted for specific corridors. • State DOT keeps record of lane clearance time on certain corridors. • State DOT keeps track of certain critical / federally required measures. • State DOT utilized Streetlight Inc. data. • State DOT shares AADT counts with the region's agencies. • Updated Congestion Management Plan which identified performance measures. • Collaboration with RITIS to generate regional performance measures.	• Absence of overall regional transportation system condition reporting. • Congestion measurement is not actively monitored. • Cities do not collect nor maintain traffic incident data. • Limited studies to measure performance improvement of transportation projects (before / after studies). • Absence of public facing performance measurement data. • Absence of standards for lane clearance times. • LOS studies are not frequent. • Limited tracking of citizen complaints within cities. • Streetlight data use is limited to internal state DOT planning; not shared with cities (limited access contract)

	LEVEL 1 — PERFORMED	LEVEL 2 — MANAGED	LEVEL 3 — INTEGRATED	LEVEL 4 — OPTIMIZING
Level Criteria	Some outputs measured and reported by some jurisdictions	Output data used directly for after-action debriefings and improvements; data easily available and dashboarded	Outcome measures identified (networks, modes, impacts) and routinely utilized for objective-based program improvements	Performance measures reported internally for utilization and externally for accountability and program justification
Consensus	1			

Actions to Advance to the Next Level

- Developing dashboards containing regional transportation system performance measures.
- Developing standards for measuring impacts of transportation projects (Before / After studies)
- Utilizing transportation models based on monthly / annual data.
- Integrating RITIS data to the current network.

Culture

Strengths	Weaknesses
• The regional MPO comprehends the importance of adopting proactive strategies materialized by TSMO. • Some cities have some understanding on causes of non-recurring congestion and the need to mitigate those.	• Lack of technical understanding among city level staff in importance of TSMO strategies. • Leadership oriented towards more tangible projects. • Abundance of individual opinions on what needs to be done regionally. • Providing alternate routes is the main approach to manage incidents.

	LEVEL 1 — PERFORMED	LEVEL 2 — MANAGED	LEVEL 3 — INTEGRATED	LEVEL 4 — OPTIMIZING
Level Criteria	Individual staff champions promote TSM&O – varying among jurisdictions	Jurisdictions' senior management understands TSM&O business case and educates decision makers/public	Jurisdictions' mission identifies TSM&O and benefits with formal program and achieves wide public visibility/understanding	Customer mobility service commitment accountability accepted as formal, top-level core program of all jurisdictions
Consensus	1			

Actions to Advance to the Next Level

- Selling the TSMO business case to the leadership.
- Educating city staff about the importance and the technical aspects of TSMO projects.

Organization and Staffing

Strengths	Weaknesses
• Some cities either have or are transitioning towards having engineering under the transportation department. • Staff pursue training and certification as needed. • Vendors provide technical equipment training for city staff.	• Planning is generally separate from the rest of the departments. • Different transportation visions within the different city departments • Qualified staff shortages and retention difficulties were existing pre-pandemic. • Limited regional training depending on cities' needs / requests. • Limited exploration of flexible work arrangements for city staff.

	LEVEL 1 — PERFORMED	LEVEL 2 — MANAGED	LEVEL 3 — INTEGRATED	LEVEL 4 — OPTIMIZING
Level Criteria	TSM&O added on to units within existing structure and staffing, dependent on technical champions	TSM&O-specific organizational concept developed within/among jurisdictions with core capacity needs identified; collaboration takes place	TSM&O managers have direct report to top management; job specs, certification and training for core positions	TSM&O senior managers at equivalent level with other jurisdiction services and staff professionalized
Consensus	1			

Actions to Advance to the Next Level

- Establish a regional TSMO leadership.
- Identifying regional TSMO workforce.
- Centralizing transportation disciplines under one department within Cities.
- Establish a dedicated City traffic engineer position focused on the technical aspects.
- Explore the feasibility of flexible work arrangements to attract qualified staff.
- Exploring additional training and certification opportunities for existing staff.

Collaboration

Strengths	Weaknesses
• Good attendance at regional meetings. • Some cities coordinate on special events planning. • Some discussions with freight companies to mitigate traffic. • Private companies are involved with some local projects. • Consultants might serve as liaisons for collaboration between cities and private companies.	• Operations personnel within cities are not formally involved in planning. • Minimal coordination with first responder agencies mainly driven by specific events (e.g., weather events). • Lack of effective communication between cities and the state DOT. • There's no formal communication policies and standards between cities and the State DOT on one end and private companies on the other. • Limited communication with freight companies. • Limited coordination with the University of Arkansas. • Absence of coordination between cities when it comes to towing.

	LEVEL 1 — PERFORMED	LEVEL 2 — MANAGED	LEVEL 3 — INTEGRATED	LEVEL 4 — OPTIMIZING
Level Criteria	Relationships ad hoc and on personal basis (public-public, public-private)	Objectives, strategies and performance measures aligned among organized key players (transportation and public service agencies) with after-action debriefing	Rationalization/sharing/ formalization of responsibilities among key players through co-training, formal agreements and incentives	High level of TSM&O coordination among owner/operators (state, local, private)
Consensus	1			

Actions to Advance to the Next Level

- Develop policies and standards that define communications triggers between cities themselves and with first responder agencies.
- Develop multi-disciplinary training programs to share best practices between the regional agencies.

4. TSMO STRATEGIC PLAN

The Northwest Arkansas TSMO strategic direction is materialized through the vision, mission, goals, and objectives presented in this section. The information in this section aligns with the NWARPC vision for the region as illustrated in current endeavors such as the 2045 Metropolitan Transportation Plan and the region's 2022 Congestion Management Process and through the discussions conducted with the region's stakeholders.

4.1 Vision

The Northwest Arkansas region collaboratively manages an integrated transportation system that provides safe, reliable, and efficient transportation options for the growing region.

4.2 Mission

Provide a safe, reliable, and efficient transportation network for the Northwest Arkansas region by leveraging stakeholder collaboration and innovative technology solutions.

4.3 Goals and Objectives

The TSMO goals and their associated objectives are intended to define a practical direction to attain the vision and support the mission defined in the previous sub-sections.

- **Safety**
  - Reduce crash frequency in the region.
  - Reduce crash severity in the region.
  - Minimize the motor vehicle crash-associated cost incurred by roadway users in the region.
  - Reduce bike/ped crashes in the region.
- **Reliability**
  - Improve the region's travel-time reliability.
  - Manage congestion more efficiently.
  - Enhance real-time traffic information in the region.
- **Efficiency**
  - Operate a coordinated regional transportation network.
  - Maintain the regional transportation network.
  - Provide seamless mobility to the transportation network users.

- **Collaboration**
  - Promote coordination between the various stakeholders in Northwest Arkansas, which includes, but is not limited to, ArDOT, MPO, Cities, and private sector companies.
  - Develop a communication framework for the region's stakeholders.
  - Encourage data and information sharing between the region's stakeholders.
- **Integration**
  - Incorporate TSMO strategies into the regional planning.
  - Focus on implementing strategies that directly improve transportation operations in the region.
  - Include TSMO in maintenance, construction, and design processes.
- **Innovation**
  - Leverage feasible technology solutions on the regional network.
  - Create an environment that attracts transportation innovators to the region.
- **Environmental Sustainability**
  - Reduce vehicle travel delay.
  - Increase use of transit, ridesharing, and non-motorized modes.
  - Reduce motor vehicle emissions that contribute to air quality issues and climate change.

4.4 TSMO Strategic Initiatives

The NWARPC TSMO strategic initiatives are developed based on the assessment of current conditions to develop recommendations for how the Northwest Arkansas region should move toward achieving the region's TSMO mission to "Provide a safe, reliable, and efficient transportation network for the Northwest Arkansas region through leveraging stakeholder collaboration and innovative technology solutions."

The TSMO Strategic Initiatives are broad regional areas of focus and will play a key role in advancing the Northwest Arkansas region's TSMO vision, mission and goals. This plan identifies five (5) strategic initiatives that build on the region's current strengths and take advantage of new and emerging opportunities.

- **Strategy # 1: TSMO Planning**
  - This strategy focuses on developing TSMO institutional structures, integration of TSMO into regional planning, programming, and project development.
- **Strategy # 2: Data Management**
  - This strategy focuses on enhancing data management, data collection, organization and integration of data collected from various sources, developing performance measures.
- **Strategy # 3: Regional Coordination**

  - This strategy focuses on improving coordination among regional agencies, integration of different systems to advance regional system performance.

- **Strategy # 4: Connected and Automated Vehicle Technologies**
  - This strategy focuses on utilizing connected and automated vehicle (CAV) and other innovative technologies.
- **Strategy # 5: Managing Nonrecurring Congestion**
  - This strategy focuses on implementing strategies for work zones, special events, parking, etc. to improve safety, mobility, and reliability.

Strategy # 1: TSMO Planning

This strategy focuses on developing TSMO institutional structures, integration of TSMO into regional planning, programming, and project development. This strategy will help achieve the Northwest Arkansas region's TSMO mission and vision.

Action Items:

- 1.1. Continue to maintain and update as needed the regional TSMO committee.
- 1.2. Demonstrate the value of TSMO to decision makers.
- 1.3. Integrate TSMO into local and regional planning.
- 1.4. Plan for and develop a regional Transportation Management Center.
- 1.5. Incorporate freight into TSMO planning activities.
- 1.6. Develop processes for regional technology standards.

Strategy # 2: Data Management

This strategy focuses on enhancing data management, data collection, organization and integration of data collected from various sources, developing performance measures.

Action Items:

- 2.1. Develop a regional data governance framework.
- 2.2. Develop TSMO performance measures and track progress.
- 2.3 Develop a centralized data hub for regionwide use.
- 2.4. Develop data acquisition, management and sharing strategies.
- 2.5. Develop data-driven techniques to analyze TSMO strategies.

Strategy # 3: Regional Coordination

This strategy focuses on improving coordination among regional agencies, integration of different systems to advance regional system performance.

Action Items:

- 3.1. Maintain and update a regional multimodal network for the Northwest Arkansas region.
- 3.2. Develop signal corridor management strategies.
- 3.3. Improve and modernize the communications network architecture.
- 3.4 Explore improvements in traveler information

Strategy # 4: Connected and Automated Vehicle and Innovative Technologies

This strategy focuses on utilizing connected and automated vehicle (CAV) and other innovative technologies.

Action Items:

- 4.1. Conduct research projects to analyze the impacts of connected and automated vehicles to the Northwest Arkansas region.
- 4.2. Identify connected vehicle technologies to improve safety, mobility and reliability for travelers.
- 4.3 Develop a CAV Plan for the Region.

Strategy # 5: Managing Nonrecurring Congestion

This strategy focuses on implementing strategies for work zones, special events, parking, etc. to improve safety, mobility, and reliability.

Action Items:

- 5.1. Improve regional coordination focusing on special events.
- 5.2. Develop strategies to improve parking in central business districts.
- 5.3. Implement smart work zone technologies.

5. TSMO IMPLEMENTATION PLAN

The NWARPC Regional TSMO Implementation Plan provides a roadmap for deployment of strategies, action items, policies and practices to support a successful systems management and operations in the region. Implementing these TSMO strategies will lead to increased safety, reduced congestion, and improved system performance. Succesful implementaion will require ongoing interagency coordination for planning, funding and operating the improvements.

This section provides a prioritized list of action items, detailed implementation steps for the high priority action items. This section also provides an overview of TSMO strategies with examples and references for additional information.

5.1 TSMO Prioritized Activities and Projects

This section prioritizes the activities, and projects to accomplish meeting the NWARPC TSMO mission, vision, goals, and objectives. Note that these are the actions described in Section 5.4: TSMO Strategic Initiatives. This component establishes the foundation for subsequent TSMO deployment. Typically, this phase of TSMO program planning involves a focus of 3 to 5 years, and is used by metropolitan planning organizations (MPO) to identify priorities to move forward as investments and programs within a transportation improvement program (TIP).

Implementation Policies and Guidelines/Considerations

The following are some examples of policies and guidelines that should be considered as the TSMO Plan is implemented:

- Inter-agency cooperation agreements / MOUs – As the Northwest Arkansas region implements the TSMO Plan, there will be a need for increased coordination. This would require development and/or enhancement of formal agreements between the agencies to support coordinated operations.
- Training – During the CMM workshop, training was identified as a key need for staff to stay engaged in traffic operations and management.
- Staffing and workforce development – Staff with specific skill sets would be required to support the TSMO Plan implementation.

TABLE 2. NWARPC TSMO PRIORITIZED ACTIVITIES AND PROJECTS

#	Identified Activity/Project	Priority		
		High	Medium	Low
Strategy # 1: TSMO Planning				
1.1	Continue to maintain and update as needed the regional TSMO committee	x		
1.2	Demonstrate the value of TSMO to decision makers	x		
1.3	Integrate TSMO into local and regional planning	x		
1.4	Plan for and develop a regional Transportation Management Center	x	x	
1.5	Incorporate freight into TSMO planning activities		x	
1.6	Develop processes for regional technology standards		x	
Strategy # 2: Data Management				
2.1	Develop a regional data governance framework	x		
2.2	Develop TSMO performance measures and track progress	x		
2.3	Develop a centralized data hub for regionwide use		x	
2.4	Develop data acquisition, management and sharing strategies		x	
2.5	Develop data-driven techniques to analyze TSMO strategies			x
Strategy # 3: Regional Coordination				
3.1	Maintain and update a regional multimodal network for the Northwest Arkansas region	x		
3.2	Develop Signal Corridor Management Strategies	x		
3.3	Improve and modernize the communications network architecture		x	
3.4	Explore improvements in traveler information		x	
Strategy # 4: Connected and Automated Vehicle and Innovative Technologies				
4.1	Conduct research projects to analyze the impacts of connected and automated vehicles to the Northwest Arkansas region	x		
4.2	Identify connected vehicle technologies to improve safety, mobility and reliability for travelers		x	
4.3	Develop a CAV Plan for the Region		x	
Strategy # 5: Managing Nonrecurring Congestion				
5.1	Improve regional coordination focusing on special events	x		
5.2	Develop strategies to improve parking in central business districts		x	
5.3	Implement smart work zone technologies		x	

5.2 TSMO Implementation Steps

This section describes detailed implementation steps for actions ranked high-priority, as shown in Section 5.4.

Strategy #1 TSMO Planning

Action 1.1 Improve collaboration among the TSMO committee

Description	Maintain the TSMO Committee roster and coordinate closely with the Committee members.
Goals Addressed	Collaboration
Implementation Steps	1. Maintain and update the roster of TSMO Committee. 2. Conduct periodic (quarterly or more frequent) meetings with the TSMO Committee and discuss the status of the TSMO strategies and implementation of action items. 3. Review existing practices in terms of line of communication, exchange of data, etc. and identify areas of improvement. 4. Develop operating procedures of the TSMO Committee which may include priorities and initiatives, key roles and responsibilities, communication protocol, etc. 4. Identify training needs and frequency of training.
Timeframe	Ongoing
Benefits	• Improved coordination between stakeholders in Northwest Arkansas region • Strengthen stakeholder relationships

Strategy #1 TSMO Planning

Action 1.2 Demonstrate the value of TSMO to decision makers

Description	Identify opportunities to draw attention to existing and new TSMO initiatives with the decision makers, and to tell the story about how TSMO matters to people.
Goals Addressed	Collaboration
Implementation Steps	1. Encourage evaluations and return-on-investment analysis to be completed for NWARPC-funded TSMO projects. 2. Provide examples and shared resources to local agencies and further encourage consistent TSMO project evaluations.
Timeframe	Ongoing
Benefits	• Advance TSMO awareness and education in the Northwest Arkansas region • Build the TSMO culture and mindset

Strategy #1 TSMO Planning

Action 1.3 Integrate TSMO into local and regional planning

Description	Align regional and local planning with TSMO strategies.
Goals Addressed	Collaboration
Implementation Steps	1. Identify opportunities to integrate TSMO considerations within existing guidelines and manuals used in planning. 2. Update relevant guidelines and manuals to reflect best practices.
Timeframe	Ongoing
Benefits	• Helps integrate TSMO strategies in planning and development approval processes • Incorporate national TSMO best practices into local and regional planning

Strategy #1 TSMO Planning

Action 1.4 Plan for and develop a regional Transportation Management Center (TMC)

Description	Develop a concept of operations for a potential regional TMC based out of Northwest Arkansas region.
Goals Addressed	Safety, Reliability, Collaboration, Integration
Implementation Steps	1. Complete a systems engineering analysis and concept of operations document to identify TMC needs, objectives, and functional requirements for successful implementation. 2. Identify what agency staff and how many would sit at the TMC, identify potential funding sources, and identify potential locations for the TMC that meet space and communications connectivity requirements, likely in Northwest Arkansas. 3. Follow up with partners at ArDOT and local agencies to determine interest in moving a regional TMC concept forward.
Timeframe	July 2023 – June 2024
Benefits	• Actively manage traffic and mitigate congestion during special events. • Improve safety within and near event locations. • Improve coordination and response during events.

Strategy #2 Data Management

Action 2.1 Develop a regional data governance framework

Description	Address challenges currently being faced in regard to inconsistent structures, formats, and semantics for data among organizations; inconsistent access to data; as well as challenges associated with data privacy.
Goals Addressed	Collaboration  Integration 
	Efficiency 
Implementation Steps	1. Develop data governance charter with organization roles/responsibilities. 2. Create a Data Stewardship Steering Committee and define stakeholder roles and responsibilities. 3. Develop a data dictionary to understand the structure and content of data available at agencies in Northwest Arkansas. 4. Establish data standards for data integration and sharing.
Timeframe	July 2024 – June 2025
Benefits	• Improve the quality of existing and new data. • Standardize data for easy and consistent sharing with stakeholders. • Maintain data security, privacy, and compliance. • Make better data-driven decisions.

Strategy #2 Data Management

Action 2.2 Develop TSMO performance measures and track progress

Description	Address challenges currently being faced in regard to inconsistent structures, formats, and semantics for data among organizations; inconsistent access to data; as well as challenges associated with data privacy.
Goals Addressed	Collaboration, Integration, Efficiency, Innovation
Implementation Steps	1. Evaluate existing performance metrics available at NWARPC and develop additional TSMO oriented performance metrics. 2. Identify data needs to develop the TSMO performance metrics and develop methodologies. 3. Develop tools and dashboards to generate performance reports.
Timeframe	July 2024 – June 2025
Benefits	• Effective and systematic process to measure and monitor TSMO advancement using available data. • Improve internal and federal reporting on performance.

Strategy #3 Regional Coordination

Action 3.2 Develop signal corridor management strategies

Description	Develop corridor management and performance measurement strategies in collaboration with ArDOT and local agencies to improve mobility along corridors in the Northwest Arkansas region.
Goals Addressed	Safety  Reliability 
	Collaboration 
Implementation Steps	1. Coordinate with local agencies and ArDOT to identify key signalized corridors within the Northwest Arkansas region. Identify any operational challenges and bottlenecks in the region. 2. Coordinate with local agencies to identify the deployment of technologies such as modems and interconnect equipment to establish coordinated signal systems. 3. Identify performance measures to track performance over time. Monitor corridor performance and update coordination patters as needed and share data with the local agencies. 4. Identify systems and technologies such as leading pedestrian interveals at key intersections along the region's corridors.
Timeframe	January 2024 – December 2025
Benefits	• Improved safety and reliability along key corridors within the region.

Strategy #4 Connected and Automated Vehicle and Innovative Technologies

Action 4.1 Conduct research projects to analyze the impacts of connected and automated vehicles to the Northwest Arkansas region

Description	Develop a clear understanding of the impact of deploying CAV technologies, as well as the data generated by the CAV.
Goals Addressed	Safety  Innovation 
	Collaboration 
Implementation Steps	1. Identify funding to conduct reseach into the impact of CAV technologies. 2. Identify and deploy CAV technologies in the region. 3. Develop CAV guidance documents.
Timeframe	January 2025 – December 2025
Benefits	• Establish NWARPC as a key agency exploring the CAV technologies • Help identify the potential impacts of CAV technologies to the region

Strategy #5 Managing Recurring Congestion

Action 5.1 Improve regional coordination focusing on special events

Description	Improve event coordination between event coordinators, ArDOT, NWARPC, emergency responders, and local agencies.
Goals Addressed	Safety  Innovation 
	Collaboration 
Implementation Steps	1. Define special event categories that impact traffic operations. 2. Review existing practices in terms of line of communication, exchange of data, event coordination procedures, community outreach, etc. 3. Formalize special events response by establishing standard operating procedures (SOP).
Timeframe	January 2024 – December 2025
Benefits	• Actively manage traffic and mitigate congestion during special events. • Improve safety within and near event locations. • Improve coordination and response during events.

5.3 TSMO Implementation Guide

The TSMO Implementation Guide section can ideally function as a standalone document that is updated frequently and serves two main functions. First, it will give planners and operators an introduction to TSMO and emerging transportation technologies. Second, it can be incorporated into project development and project selection as a reference for what type of solutions are appropriate, based on the type of transportation facility and the performance needs of a project area.

This section incorporates a scan or literature review of notable national and international examples of state-of-the-practice implementations to be used as case studies for the TSMO Committee to consider. Additional reference materials are provided in Appendix C.

Traffic Signal Management

FHWA defines traffic signal management as “organizing for the planning, maintenance, design, and operation of signalized intersections and traffic signal systems.”

Examples

- Uncoordinated Signal Timing: These type of signal timings are applied at a single intersection only and are not connected to nearby signals along the corridor.
- Coordinated Signal Timing: Coordinated signal timing synchronizes traffic movements and manages the progression speed of specific modes where uninterrupted flow is desired along a corridor. While traditionally applied to increase vehicular traffic flow and reduce peak-hour delay, coordinated signal timing can also be optimized for slower speeds, creating an uninterrupted flow for bicyclists or low vehicle progression speeds for a pedestrian-friendly downtown. Signals may also be timed to coordinate transit headways along routes where regular transit service is consistent and has low variability.
- Leading Pedestrian Interval: A Leading Pedestrian Interval (LPI) typically gives pedestrians a 3–7 second head start when entering an intersection with a corresponding green signal in the same direction of travel. LPIs enhance the visibility of pedestrians in the intersection and reinforce their right-of-way over turning vehicles, especially in locations with a history of conflict.

- Actuated Signal Timing: In general, fixed-time signals are the rule in urban areas for reasons of regularity, network organization, predictability, and reducing unnecessary delay. In certain, less-trafficked areas, actuated signals (push buttons, loop detectors) may be appropriate; however, these must be programmed to minimize delay, which will increase compliance. Actuated signals in general are not preferable because of the maintenance requirements and upkeep of the detection on the street.
  - » Actuated signals prioritize movement along the primary corridor and can present obstacles to cross traffic and pedestrians if timed to prioritize vehicle movements only.
  - » Where used, actuated signals should be timed to be as responsive to activation as possible, with delay kept to a minimum.

- Emergency Vehicle Preemption: EVP is done by adjusting traffic signals. This starts with communications between a receiving device on a traffic signal and an emitter on an approaching emergency vehicle. The goal is to ensure the emergency vehicle's safe passage through the intersection. Emergency vehicles with an emitter can request traffic signal preemption as they near an intersection.
- Transit Signal Priority (TSP): Transit signal priority deals with communication between a transit vehicle and traffic signals and the end result is to provide additional green time to the transit vehicle by prioritizing its movement.

References

- FHWA Traffic Signal Timing Manual – Second Edition
  - » http://www.trb.org/OperationsTrafficManagement/Blurbs/173121.aspx
- FHWA Traffic Signal Management Plan Guidebook
  - » https://ops.fhwa.dot.gov/publications/fhwahop15038/index.htm
- USDOT ITS Knowledge Resources
  - » https://www.itsbenefits.its.dot.gov/its/benecost.nsf/BenefitsHome

Work Zone Management

The safe and efficient flow of traffic through work zones is a major concern to transportation officials, industry, the public, businesses, and commercial motor carriers. The Work Zone Management deals with making work zones work better by providing transportation practitioners with high-quality products, tools, and information that can be of value in planning, designing, and implementing safer, more efficient, and less congested work zones.

Examples

- Variable Speed Limits: Selecting appropriate speed limits on roadways is important in maintaining a safe and efficient transportation network. Speed limits are established with an engineering study based on inputs like traffic volumes, operating speeds, roadway characteristics, and crash history. However, conditions on the roadway are susceptible to change in a short amount of time (e.g., congestion, crashes, weather). Drivers typically determine their operating speeds under normal weather conditions on a straight roadway section with good pavement quality and adequate sight distances. If ideal conditions do not exist and the roadway does not meet the driver's expectations, there is a greater chance that a driver error could result in a crash. Providing variable speeds limits (VSLs) capable of adapting to changing circumstances could reduce crash frequency and severity.

- Queue Warning System: A queue warning system uses detection components paired with variable or dynamic message signs, or static signing with interactive flashers. Crews deploy the detection devices upstream of the work zone at successive intervals where they anticipate queues. Each detection device communicates with its own set of sign components, either activating prepopulated messages such as “Stopped Traffic Ahead/Be Prepared to Stop” or “Speed Ahead 30 MPH/Prepare to Stop,” or activating flashers on the static signing that might read “Be Prepared to Stop When Flashing.”

Texas A&M Transportation Institute

References

- FHWA Work Zone Management Program
  - » https://ops.fhwa.dot.gov/wz/index.asp
- USDOT Work Zone Management Program
  - » https://collaboration.fhwa.dot.gov/wzmp/default.aspx
- USDOT Work Zone Data Initiative
  - » https://collaboration.fhwa.dot.gov/wzmp/wzdi/Forms/AllItems.aspx
- National Work Zone Safety Information Clearinghouse
  - » https://www.workzonesafety.org/swz/

Traveler Information

Traveler information systems provide real-time information so that users are better informed to make route, departure time and mode decisions.

Examples

- Transportation Management Center: The Transportation Management Center (TMC) is the hub or nerve center of most roadway management systems. It is the data about the roadway system that is collected and processed, fused with other operational and control data, synthesized to produce "information", and distributed to stakeholders such as the media, other agencies, and the traveling public. TMC staff uses the information to monitor the operation of the roadways and to initiate control strategies that affect changes in the operation of the freeway network. It is also where agencies can coordinate their responses to traffic situations and incidents.
- Social Media: Social media connects travelers instantly to traveler information and can be used to send information on various useful data such as weather alerts, road closures, travel times, and construction activity.

- Traveler Information Portals: These serve as a central hub for all traveler information and include helpful links to other agency related web services. The portals could contain information about weather, road, and bridges statuses, and also include information from closed circuit cameras and dynamic message signs.

References

- FHWA Real-Time Traveler Information Program
  - » https://ops.fhwa.dot.gov/travelinfo/about/aboutus.htm
- USDOT ITS Joing Program Office – Dynamic Mobility Applications Program
  - » https://www.its.dot.gov/research_archives/dma/bundle/enableATIS_plan.htm

Transportation Demand Management

Transportation demand management (TDM), or simply demand management, is defined as a set of strategies aimed at maximizing traveler choices. Traditionally, TDM has been narrowly defined as commuter ridesharing and its planning application restricted to air quality mitigation (conformity analysis), development mitigation (reducing trip generation rates and parking needs), or efforts to increase multi-modalism in transportation plans.

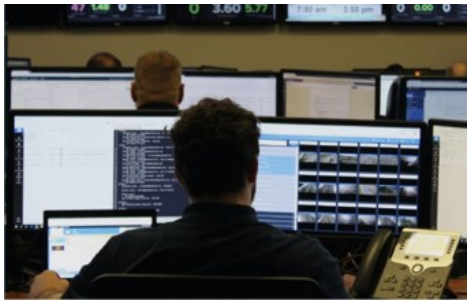
Examples

- Transportation Network Companies (TNCs): TNCs provide prearranged transportation services for compensation using an online-enabled application or platform (such as smart phone apps) to connect drivers using their personal vehicles with passengers.
- Rideshare Programs: Ride sharing is the practice of sharing rides or transportation, especially by commuters, typically in the form of carpooling and vanpooling. Some agencies and organizations have adopted formal definitions clarifying the number of people, types of vehicles, and operating characteristics that qualify as ride sharing. Shared ride programs generally include all forms of carpooling and vanpooling. These can be informal arrangements or formal arrangements made through ride-matching services. Ride-matching services take several forms, such as committed vanpool groups or dynamic ride sharing programs that support real-time ride sharing through short-term instant arrangements enabled by GPS and wireless service. Ride matching programs are often supported by a local public transportation agency.
- Transit Subsidies: Transit subsidies encourage users commute via mass transit.

References

- FHWA Active Transportation and Demand Management
  - » https://ops.fhwa.dot.gov/atdm/index.htm
- FHWA Priced Vehicle Sharing and Dynamic Ridesharing
  - » https://ops.fhwa.dot.gov/congestionpricing/strategies/not_involving_tolls/dynamic_sharing.htm

Integrated Corridor Management



The vision of Integrated Corridor Management (ICM) is that transportation networks will realize significant improvements in the efficient movement of people and goods through institutional collaboration and aggressive, proactive integration of existing infrastructure along major corridors. Through an ICM approach, transportation professionals manage the corridor as a multimodal system and make operational decisions for the benefit of the corridor as a whole.

Examples

- Transit Priority Treatments: One strategy to incorporate transit into ICM is transit priority or preferential treatments, which can enhance the efficiency of transit operations, reduce delays and congestion, and improve overall mobility and user satisfaction. Transit signal priority (TSP) and dedicated transit vehicle facilities are the most common preferential treatments for transit in an ICM environment.
- Reversible lanes: Reversible lanes allow agencies to switch the direction of traffic flow during certain times and conditions. They are typically used during peak commuting hours to add capacity in one direction. Reversible lanes help address traffic congestion by allowing agencies to switch the travel direction of one or more lanes when additional capacity is needed. Because they move capacity from one direction and give it to the other, they provide the most value for roads with highly directional congestion at certain times of day. Reversible lanes are typically operated on regular fixed schedules that reflect daily commuting patterns, but can also be activated for major events or incidents.
- Dynamic lane assignment: Dynamic lane assignment strategies repurpose road space based on current or expected demand conditions in order to improve the efficiency and safety of the transportation system. Dynamic lane assignment strategies include reversible lanes on highways and arterials, merge (or junction) control on highway ramps, and part-time highway shoulder use. Dynamic lane assignment is a category of managed lane strategies that involve reallocating road space in response to changes in demand in order to use existing infrastructure most efficiently. This approach can function as an alternative to constructing more roadway by providing additional capacity to certain kinds of traffic at certain times.
- Adaptive Ramp Metering: Ramp metering uses traffic control signals to meter the flow of vehicles entering a freeway or expressway. Restricting the flow of vehicles from on-ramps reduces the adverse effect of merging vehicles on mainline traffic. Ramp meters are installed on ramps and operate to reduce main line delay during peak periods of congestion. They can be implemented by time of day, using traffic sensors, or through central control. The operations depends on the efforts of transportation professionals to monitor operations and evaluate performance.

References

- FHWA Corridor Traffic Management
  - » https://ops.fhwa.dot.gov/program_areas/corridor_traffic_mgmt.htm
- FHWA Integrated Corridor Management, Managed Lanes, and Congestion Pricing
  - » https://ops.fhwa.dot.gov/publications/fhwahop16042/index.htm

- FHWA Planning for Transportation Systems Management and Operations Within Corridors: A Desk Reference
  - » https://ops.fhwa.dot.gov/publications/fhwahop16037/fhwahop16037.pdf

Event Management

Special events include sporting events, concerts, festivals, and conventions occurring at permanent multi-use venues (e.g., arenas, stadiums, racetracks, fairgrounds, amphitheaters, convention centers). They also include less frequent public events such as parades, fireworks displays, bicycle races, sporting games, motorcycle rallies, seasonal festivals, and milestone celebrations at temporary venues.

Planned special events can significantly impact travel safety, mobility, and travel time reliability across all surface transportation modes and roadway facilities. Managing travel for planned special events involves advanced operations planning, stakeholder coordination and partnerships, developing multi-agency transportation management plans, raising awareness of general public and event patrons of potential travel impacts, and coordinating agency services and resource sharing.

References

- FHWA Traffic Management for Planned Special Events
  - » https://ops.fhwa.dot.gov/eto_tim_pse/about/pse.htm
- FHWA Road Weather Management
  - » https://ops.fhwa.dot.gov/weather/

Freight Management

Freight management applications focus on the safe and efficient movement of goods throughout the transportation network, leveraging technology and collaboration to enhance safety and mobility for all.

Examples

- Truck Parking: Truck parking shortages are a safety concern. Commercial truck drivers need access to safe, secure, and accessible truck parking. With the projected growth of truck traffic, the demand for truck parking will continue to outpace the supply of public and private parking facilities and will only exacerbate the truck parking problems experienced in many regions. An inadequate supply of truck parking spaces can result in negative consequences. Tired truck drivers may continue to drive because they have difficulty finding a place to park for rest. Truck drivers may choose to park at unsafe locations, such as on the shoulder of the road, exit ramps, or vacant lots, if they are unable to locate official, available parking.
- Curb Management: Increasing use of curb space offers challenges in considering accessibility for all users, accommodating increased delivery access, and optimizing curb productivity. Curbside management can include considerations for pedestrians, micromobility, parking, and access to businesses.

References

- FHWA Freight Management and Operations

- https://ops.fhwa.dot.gov/freight/

- FHWA Truck Parking
  - https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/
- The National Coalition on Truck Parking
  - https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/workinggroups/index.htm
- FHWA Freight Transportation Improvements and the Economy
  - https://ops.fhwa.dot.gov/freight/freight_analysis/improve_econ/index.htm

Parking Management

Active parking management is the dynamic management of parking facilities in a region to optimize performance and utilization of those facilities while influencing travel behavior at various stages along the trip making process.

Examples

- Dynamic Overflow Transit Parking: This strategy dynamically utilizes overflow parking facilities in the vicinity of transit stations and/or park-and-ride facilities when the existing parking facilities are at or near capacity. The overflow parking are typically underutilized, such as large retail parking lots, and transit agencies could have agreements with these entities for occasional use of pre-designated, underutilized areas of the parking lots.
- Dynamic Parking Reservation: This strategy provides travelers the ability to utilize technology to reserve a parking space at a destination facility on demand to ensure availability. In an ATDM approach, the parking availability is continuously monitored and system users can reserve the parking space ahead of arriving at the parking location.
- Dynamic Wayfinding: This is the practice of providing real-time parking-related information to travelers associated with space availability and location so as to optimize the use of parking facilities and minimize the time spent searching for available parking. In an ATDM approach, the parking availability is continuously monitored and routing information to the parking space is provided to the user.
- Dynamically Priced Parking: This strategy involves parking fees that are dynamically varied based on demand and availability to influence trip timing choice and parking facility or location choice in an effort to more efficiently balance parking supply and demand, reduce the negative impacts of travelers searching for parking, or to reduce traffic impacts associated with peak period trip making. In an ATDM approach, the parking availability is continuously monitored and parking pricing is used as a means to influence travel and parking choices and dynamically manage the traffic demand.

References

- FHWA Active Parking Management
  - https://ops.fhwa.dot.gov/atdm/approaches/apm.htm
- FHWA Contemporary Approaches to Parking Pricing: A Primer
  - https://ops.fhwa.dot.gov/publications/fhwahop12026/index.htm#toc

APPENDIX A. SUMMARY OF RELEVANT RPC DOCUMENTS

This Appendix summarizes the following plans for context and key connections, areas of overlap, and other takeaways:

- 2007 Northwest Arkansas Regional ITS Architecture and Deployment Plan
- 2045 Metropolitan Transportation Plan
- 2021-2024 Transportation Improvement Plan
- 2020 Connect NWA (10-year Transit Development Plan)
- 2015 Bicycle and Pedestrian Master Plan
- ARDOT Strategic Plan (2017-2022)

A.1 2007 Northwest Arkansas Regional ITS Architecture and Deployment Plan

The 2007 Northwest Arkansas Regional ITS Architecture and Deployment Plan consists of an Executive Summary, a Regional ITS Architecture, a Regional ITS Deployment Plan and appendices to support the other three documents. The plan was developed by the Arkansas State Highway and Transportation Department (AHTD) – now the Arkansas Department of Transportation (ARDOT) – and the Northwest Arkansas Regional Planning Commission (NWRPC) to provide a regional framework for planning and implementing ITS projects, encourage interoperability and resource sharing among agencies, identify applicable standards to apply to projects, and allow for cohesive long-range planning among regional stakeholders within Benton and Washington Counties. The Regional ITS Architecture focuses on the functionality that ITS could provide in the region as well as how those functions would be operated by agencies in and around the Northwest Arkansas Region.

The Regional ITS Architecture was also developed to satisfy federal requirements for funding eligibility for ITS projects from the Federal Highway Administration (FHWA) or the Federal Transit administration (FTA). To be eligible, regions must demonstrate that the ITS projects conform to a Regional ITS Architecture.

The Northwest Arkansas Regional ITS Architecture and Deployment Plan was developed in a three-step process:

Step 1 Identify Needs and ITS Inventory – Existing and planned ITS elements were identified as well as additional unmet stakeholder needs in the areas of centers, vehicles, travelers, and field devices. The inventory of existing and planned ITS elements in the region and the assessment of additional needs was developed in the first workshop. A total of 36 needs were identified in seven market-package categories, as well as three more needs in a general category.

Step 2 Develop ITS Market Packages – A total of 52 market packages (services that ITS can provide to meet one or more needs in the region) were identified and prioritized as high, medium or low priority. Market packages were developed in seven major areas:

- Traffic Management
- Emergency Management

- Maintenance and Construction
- Public Transportation Management
- Commercial Vehicle Operations
- Traveler Information
- Archived Data Management

Step 3 Develop an ITS Deployment Plan – An ITS Deployment Plan was prepared to provide a blueprint for how the ITS services identified in the market packages would be implemented in the region and the roles and responsibilities of the stakeholder agencies.

Stakeholder Involvement

The Plan was developed over a two-year period with significant input from a stakeholder group representing 17 state, regional and local agencies as well as the FHWA Arkansas Division. Stakeholders included the following:

- Arkansas Highway Patrol
- Arkansas State Highway and Transportation Department
- Benton and Washington County
- Cities of Bentonville, Fayetteville, Lowell, Pea Ridge, Rogers, Siloam Springs and Springdale
- Federal Highway Administration Arkansas Division
- J. B. Hunt Transport Services, Inc.
- Northwest Arkansas Regional Airport
- Northwest Arkansas Regional Planning Commission
- Ozark Regional and Razorback Transit
- Western Arkansas Planning and Development District

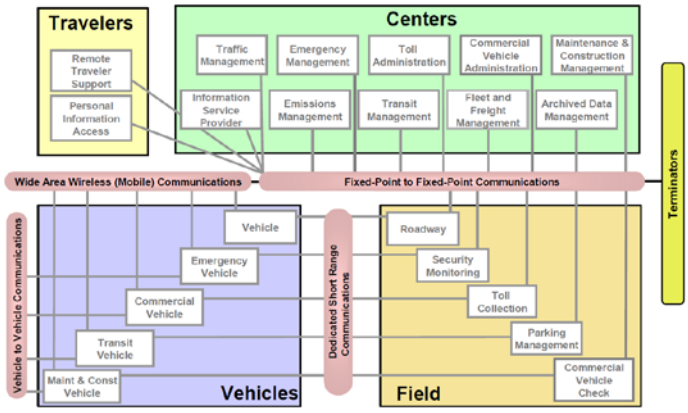
Stakeholder input was solicited through five workshops designed to generate a consensus on the direction and specific elements of the Plan:

- Kick-off Workshop;
- Regional ITS Architecture Development Workshop;
- Regional ITS Architecture Review Workshop;
- ITS Deployment Plan Workshop; and
- Comment Resolution Workshop.

Application of the National ITS Architecture

The study team used the National ITS Architecture to help structure the plan development process for Northwest Arkansas including identification of ITS subsystems and the interconnections illustrated in Figure 1.

FIGURE 5. NATIONAL ITS ARCHITECTURE PHYSICAL SUBSYSTEM INTERCONNECT DIAGRAM



Source: 2007 Northwest Arkansas Regional ITS Architecture and Deployment Plan

The study team identified subsystems for each of the Northwest Arkansas stakeholder agencies, described the elements of each subsystem and indicated whether it was existing or planned. From this, the study team developed a very detailed Northwest Arkansas Regional System Interconnect Diagram that identifies the connections between potential ITS elements being consider for the plan. This led to the identification of data flows between ITS elements and market packages, which is a critical step in the development of a connected, compatible and interoperable ITS system.

Functional Requirements

In considering the implementation requirements for the Northwest Arkansas Regional ITS Architecture and Deployment Plan, the study team identified functional requirements for each of the market packages describing the services that ITS needs to provide in the region and the architecture flows between the elements. The study team also developed a more detailed level of functional requirements that were described in terms of the functions that each element in the architecture will perform.

Identification of Standards

The study team also identified standards that would apply to the elements of the Northwest Arkansas Regional ITS Architecture and Deployment Plan. There are a number of organizations that participate in the development of ITS standards, including the following:

- AASHTO (American Association of State Highway and Transportation Officials)
- ASTM (American Society for Testing and Materials)
- IEEE (Institute of Electrical and Electronics Engineers)

- ITE (Institute of Transportation Engineers)
- ISO (International Organization for Standardization)
- SAE (Society of Automotive Engineers)

In all, 76 standards were identified for potential ITS elements identified in the Northwest Arkansas Regional ITS Architecture.

Operational Concepts

Operational Concepts were developed for the Northwest Arkansas ITS Architecture to define how ITS elements fit together, how information and data flows support the various element, and how the elements are operated and maintained. Another important part of the Operational Concepts is the identification of roles and responsibilities for the participating agencies in providing the ITS services. Roles and responsibilities were developed for the Northwest Arkansas stakeholders previously identified for all of the Market Packages. Almost 600 roles or responsibilities were identified.

Project Recommendations

One of the main products of the Northwest Arkansas Regional ITS Architecture and Deployment Plan was a phased list of recommended projects. As indicate in Table 1, 64 projects were identified in the seven market package categories. Each project was categorized by its recommended implementation time from: short-term, medium-term or long-term based on timing of the need, the priority of the project and funding availability. For each recommended project, the specific nature of the project and the responsible agency are identified. A rough estimate of probable cost is also provided along with an indication of whether funding is available.

TABLE 3. ITS PROJECT RECOMMENDATIONS FOR NORTHWEST ARKANSAS

Market Package Category	Short-Term Within 5 Years	Mid-Term 5 to 10 Years	Long-Term 10 to 20 Years	Total
Traffic Management	18	9	1	**28**
Emergency Management	6	2	0	**8**
Maintenance and Construction Management	6	1	0	**7**
Public Transportation Management	12	2	0	**14**
Commercial Vehicle Operations	0	1	0	**1**
Traveler Information	3	1	0	**4**
Archived Data Management	0	2	0	**2**
Total	**45**	**18**	**1**	**64**

Among the recommended projects, four were identified as “Projects of Statewide Significance.” These were projects that the study team felt were important to the region, but that would most likely be implemented on a statewide level rather than a regional level. These included:

- AHTD Statewide TMC
- Arkansas 511 Implementation
- DMS AMBER Alert Message Dissemination System
- CVISN Implementation

These projects were identified as the primary responsibility of AHTD Central Office Headquarters or the Arkansas State Police.

The Plan also acknowledges the importance of a robust and reliable communication system to support the recommended ITS projects. It recognizes that such a communication system will be costly and will require rigorous maintenance to ensure its reliability during major incidents, severe weather, or other emergencies – the same times that communication systems are often most stressed due to high call volumes and potential damage from severe weather events. The plan suggests cost sharing between stakeholder agencies whenever possible as a cost-effective way to deploy communications.

Funding

Because there was no dedicated source of funding for the project recommended in the Northwest Arkansas Regional ITS Architecture and Deployment Plan, the study team also provided a description of potential funding sources for which the project might be eligible. Categories of potential funding included the following:

- Federal-Aid Highways Programs (11 programs)
- USDOT Congestion Reduction Initiative Program
- AHTD Funding
- Northwest Arkansas Regional Planning Commission Funding

Maintaining the Regional ITS Deployment Plan

The Northwest Arkansas Regional ITS Architecture and Deployment Plan acknowledges the value of the Plan as a living document that needs to be updated regularly to reflect changes in the region and changes in ITS technology. While complete plan updates are scheduled to occur every five years, stakeholders agreed that it would be beneficial to review the projects identified in the ITS Deployment Plan once a year. The NWARPC Policy Committee and Technical Advisory Committee was designated to lead the annual project reviews. The purpose of the discussion would be to update the project status, remove projects that were completed, add project detail when available, and add new projects. Any corresponding changes to the Regional ITS Architecture would be documented and retained by NWARPC for inclusion during the next complete update as outlined in the Regional ITS Architecture.

A.2 2045 Metropolitan Transportation Plan

The 2045 Metropolitan Transportation Plan (MTP), approved in March 2020, is the 25-year regional transportation plan for Northwest Arkansas. It provides long-range, comprehensive direction on the region's transportation needs, goals, and strategies across all modes (including highways, transit, bicycle, and pedestrian). The MTP is designed to meet Federal requirements for Metropolitan Planning Organizations (MPOs), as NWARPC is the designated MPO for the Northwest Arkansas region.

The MTP provides high-level, strategic direction via a vision, goals, and objectives. The vision, below, is very closely aligned with the goals and benefits of advancing TSMO. Both focus on improving system safety, reliability, and efficiency. Both also promote a system-wide, multimodal, integrated approach. Finally, both seek to provide economic, quality of life, mobility, and sustainability benefits.

> **NWARPC MTP VISION STATEMENT**
>
> The Northwest Arkansas region will develop and maintain a safe, reliable, and efficient transportation system for the movement of people and goods throughout the area. The system will include a safe, secure, well-integrated and connected roadway, transit, freight, pedestrian and bicycle network. The system will enhance and sustain a high level of economic vitality, community livability and quality of life by providing movement of goods, choice, mobility, convenience and energy efficiency.

The MTP also identifies five goal areas – and aligns these goals across national, ARDOT, MoDOT, and NWARPC goals, as well as performance measures in the 2045 MTP. These goal areas are shown below, summarized in the table from page 2-2 of the MTP (Figure 1). The MTP then further identifies specific objectives under each goal area.

All five goal areas are relevant, however, "Safety and Security" and "Congestion Reduction and System Reliability" most closely align to TSMO. The specific objectives under these goal areas are shown below the summary table (Figures 2 and 3). These objectives especially – as well as the ones in the other goal areas – should be referenced while determining TSMO priorities and actions for NWARPC, to ensure alignment and avoid redundancy.

FIGURE 6. ALIGNMENT OF NORTHWEST ARKANSAS, STATEWIDE, AND NATIONAL GOALS IN THE MTP

2045 Metropolitan Transportation Plan - Framework - National, State, and Region

National Goal Area	National Goals	ArDOT Goals	MoDOT Goals	NWARPC 2045 MTP Goals		2045 MTP System Performance Measures
Infrastructure Condition - State of Good Repair	To maintain the highway infrastructure asset system in a state of good repair	Invest in the existing highway and bridges to maintain and preserve the existing system.	Take care of the transportation system and services we enjoy today	**Preserve and Maintain Infrastructure**	Maintain the existing and planned transportation system through ongoing maintenance, rehabilitation, reconstruction, and/or preservation.	Percentage of interstate pavements in good condition Percentage of interstate pavements in poor condition Percentage of non-interstate NHS pavements in good condition Percentage of non-interstate NHS pavements in poor condition Percent of NHS bridges by deck area classified as Good condition Percent of NHS bridges by deck area classified as Poor condition Pavement Condition on NHS Transit (PTASP) mean distance between major mechanical failure Transit (TAM) Plan transit bus/fleet age/condition
Safety and Security	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads	Improve statewide safety for all modes and all users and reduce system vulnerability and improve system resiliency to maintain essential travel during extreme events.	Keep all travelers safe, no matter the mode of transportation	**Improve Safety**	Increase transportation safety for all modes of travel	Number of fatalities Fatality rate per 100 million VMT Number of serious injuries Serious injury rate per 100 million VMT Number of non-motorized fatalities and serious injuries Transit (PTASP) Number of fatalities and injuries and rate per revenue miles traveled
Congestion Reduction and System Reliability	To achieve a significant reduction in congestion on the National Highway System. To improve the efficiency of the surface transportation system	Invest in the multimodal transportation system to improve mobility, connectivity, accessibility, and reliability for people and goods.	Improve reliability and reduce congestion on Missouri's transportation system	**Reduce Congestion Improve Reliability**	Maximize the capacity and reliability of existing facilities on regionally significant routes and minimize the need for new roadways.	Interstate Travel Time Reliability Measure: Percent of Reliable Person-Miles Traveled on the Interstate Non-Interstate Travel Time Reliability Measure: Percent of Reliable Person-Miles Traveled on the Non-Interstate NHS Freight Reliability Measure: Truck Travel Time Reliability Index
Freight Movement and Economic Vitality	To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development	Improve intermodal transportation system connectivity, efficiency, and mobility to support existing industries and strengthen national and regional economic competitiveness. Partner with Metropolitan Planning Organizations, Planning and Development Districts, local governments, and other responsible modal agencies to improve intermodal transportation system safety, accessibility, and connectivity.	Invest in projects that spur economic growth and create jobs	**Improve Regional Mobility**	Increase transportation mobility and accessibility for both persons and freight, thus promoting economic vitality in the region.	Miles of Complete Streets Miles of roadways with Access Management % population served by trails within 1/4 mile % population served by public transit within 1/4 mile Unlinked Trips per revenue mile (Transit, NTD) Unlinked Trips per Revenue hour (Transit, NTD)
Environmental Sustainability	To enhance the performance of the transportation system while protecting and enhancing the natural environment	Enhance the performance of the transportation system while avoiding, minimizing, and/or mitigating impacts to natural and cultural resources.	Give Missourians better transportation choices	**Protect the Environment**	To enhance the performance of the transportation system while protecting and enhancing the natural environment.	Number of Jurisdictions with drainage criteria manuals Number of jurisdictions with Karst BMP's Cave Springs Recharge Area

Source: 2045 MTP, page 2-2

FIGURE 7. MTP SAFETY AND SECURITY GOALS, OBJECTIVES, AND PERFORMANCE MEASURES

NATIONAL GOAL AREA	NATIONAL GOAL	ARDOT GOAL	MODOT GOAL
Safety and Security	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.	Improve statewide safety funding projects reducing fatal and serious injury crashes, reducing vulnerability (in magnitude of impact on the system due to events such as major traffic incidents, flooding, lane closures, bridge failures, and seismic activity), and improving resiliency of the system (the ability of the system to recover from these events).	Keep all travelers safe, no matter the mode of transportation.
MTP GOAL I: Increase transportation safety for all modes of travel by providing safe and secure travel for all modes of transportation, including walking, bicycling, transit and vehicular.			
OBJECTIVES			
1. Encourage improved traffic operations, access management and other strategies and measures to reduce the number and rate of crashes and improve system reliability.			
2. Encourage the use of intelligent transportation systems (ITS) that improve the emergency response to incidents and clearing of incidents to improve safety and system reliability.			
3. Implement strategies that help reduce fatality and serious injury crash rates for all modes.			
4. Promote and improve safety for pedestrians, bicyclists, and other non-motorized travelers through adherence to the Northwest Arkansas Regional Bicycle and Pedestrian Master Plan.			
5. Encourage transit agencies to implement safety performance targets and measures and safety management Systems.			
GOAL I: ACTUAL AND POTENTIAL 2045 MTP SYSTEM PERFORMANCE MEASURES			
Number of fatalities	Rate of fatalities per 100M VMT	Number of serious injuries	Number of serious injuries per 100M VMT	Number of non-motorized fatalities and serious injuries

Source: 2045 MTP, page 2-3

FIGURE 8. MTP CONGESTION REDUCTION AND SYSTEM RELIABILITY GOALS, OBJECTIVES, AND PERFORMANCE MEASURES

NATIONAL GOAL AREA	NATIONAL GOALS	ARDOT GOALS	MODOT GOALS
Congestion Reduction and System Reliability	To achieve a significant reduction in congestion on the National Highway System. To improve the efficiency of the surface transportation system.	Invest in the multimodal transportation system to improve mobility, connectivity, accessibility, and reliability for people and goods.	Improve reliability and reduce congestion on Missouri's transportation system.
MTP GOAL III: Maximize the capacity and reliability of existing road and transit facilities on regionally significant routes and minimize the need for new roadways.			
OBJECTIVE – Address congestion and system reliability and maximizing efficiency and effectiveness through Management and Operations.			
1. Align the Northwest Arkansas Congestion Management Process (CMP) closely with the MTP and use the CMP performance measures in project prioritization and funding that will maximize capacity and system reliability.			
2. Manage access to and from adjacent property in key corridors, thus improving vehicular and pedestrian safety and reliability.			
3. Safeguard transportation investments by promoting access management policies.			
4. Encourage use of management and operations such as ridesharing, transit service, and coordinated traffic signals and traffic operations.			
OBJECTIVE – Endeavor to reduce congestion by supporting alternative transportation modes.			
1. Provide adequate and steady funding to operate existing public transit systems and implement recommendations of Connect NWA Transit Development Plan.			
2. Provide improved pedestrian connectivity by providing sidewalks and/or trails to good, services, jobs, schools, and recreation activities and providing safe crossings of roadways.			
3. Continue development of the regional trail system for bicycles and pedestrians that provides a safe route of travel between home, work and services as an alternative means of transportation through use of the principals included in the Northwest Arkansas Regional Bicycle and Pedestrian Master Plan.			
4. Encourage and support bus rapid transit and commuter rail transportation alternatives with the understanding that financial feasibility will depend on population density, ridership, capital costs, and potential federal, state and local funding.			
OBJECTIVE – Encourage land development patterns that promote transportation efficiency.			
1. Support in-fill development and the concentration of new commercial and office space activity that enhance the utilization of alternative forms of transportation.			
2. Identify transit corridors that allow higher density mixed-use areas to be served by public transit.			
3. Encourage major facilities to locate along planned public transit lines and implement "transit friendly" strategies.			
4. Encourage transit stops/stations within convenient walking distance of major concentrations of employment.			
GOAL III. ACTUAL AND POTENTIAL 2045 MTP SYSTEM PERFORMANCE MEASURES			
Volume Delay per Mile on CMP	Congestion Index on CMP	Travel Time on CMP	

Source: 2045 MTP, page 2-5

A.3 2021-2024 Transportation Improvement Plan

The Transportation Improvement Plan (TIP) is a Federal requirement. The TIP documents all federally funded transportation project to be undertaken within the transportation study area (by implementing agencies) over five years. NWARPC develops the TIP collaboratively with ARDOT and MoDOT. The 2021-2024 TIP was approved December 2020.

The TIP references and syncs with the NWARPC MTP's five goal areas – Safety and Security, Infrastructure Condition, Congestion Reduction and System Reliability, Freight Movement and Economic Vitality, and Environmental Sustainability. As noted under the MTP section, these goals intersect significantly with TSMO, especially under Safety and Security and under Congestion Reduction and System Reliability. Similarly, the TIP references and syncs with several other NWARPC, ARDOT, and MoDOT planning documents, such as the NWARPC CMP and ARDOT Strategic Highway Safety Plan.

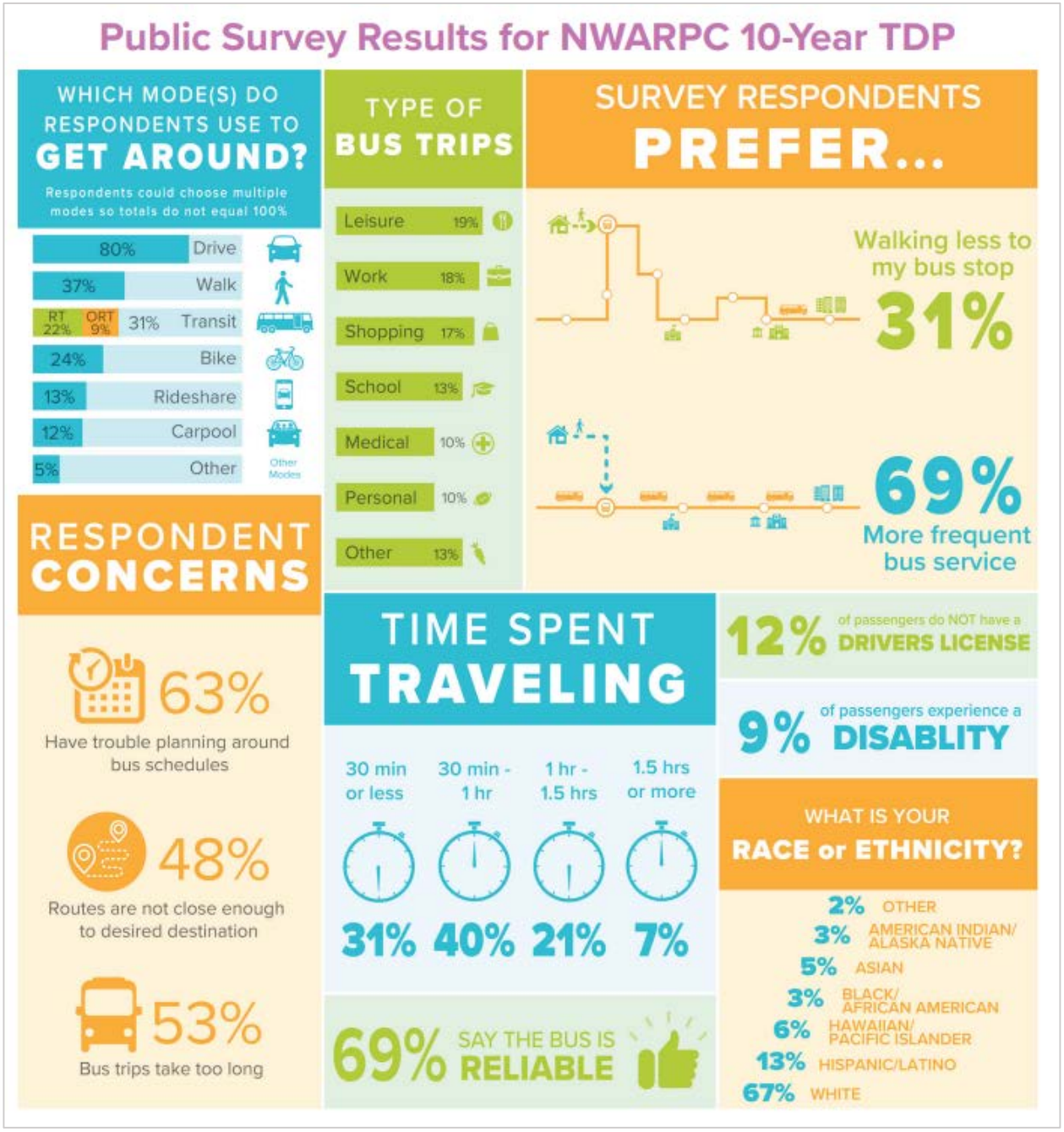
The TIP is important to reference for awareness of planned projects (listed in detail in the plan). Of equal importance, the TSMO program understand and work with the process behind developing the TIP. This will help identify opportunities to incorporate and leverage TSMO strategies in the TIP and related planning processes. This would be a key part of a larger efforts to integrate TSMO in project identification, prioritization, planning, and development.

A.4 2020 Connect NWA (10-year Transit Development Plan)

Connect Northwest Arkansas is the 10-Year Transit Development Plan (TDP) for the Northwest Arkansas region. It was adopted in 2020 and created a "Blueprint" for improving and expanding transit in the region.

Plan development included extensive stakeholder and public engagement, and the plan documents a wealth of knowledge on regional transit use and preferences. Part of the public survey, in particular, provide helpful insights and context for developing a multimodal TSMO program plan – with information on travel trends, preferences, and concerns.

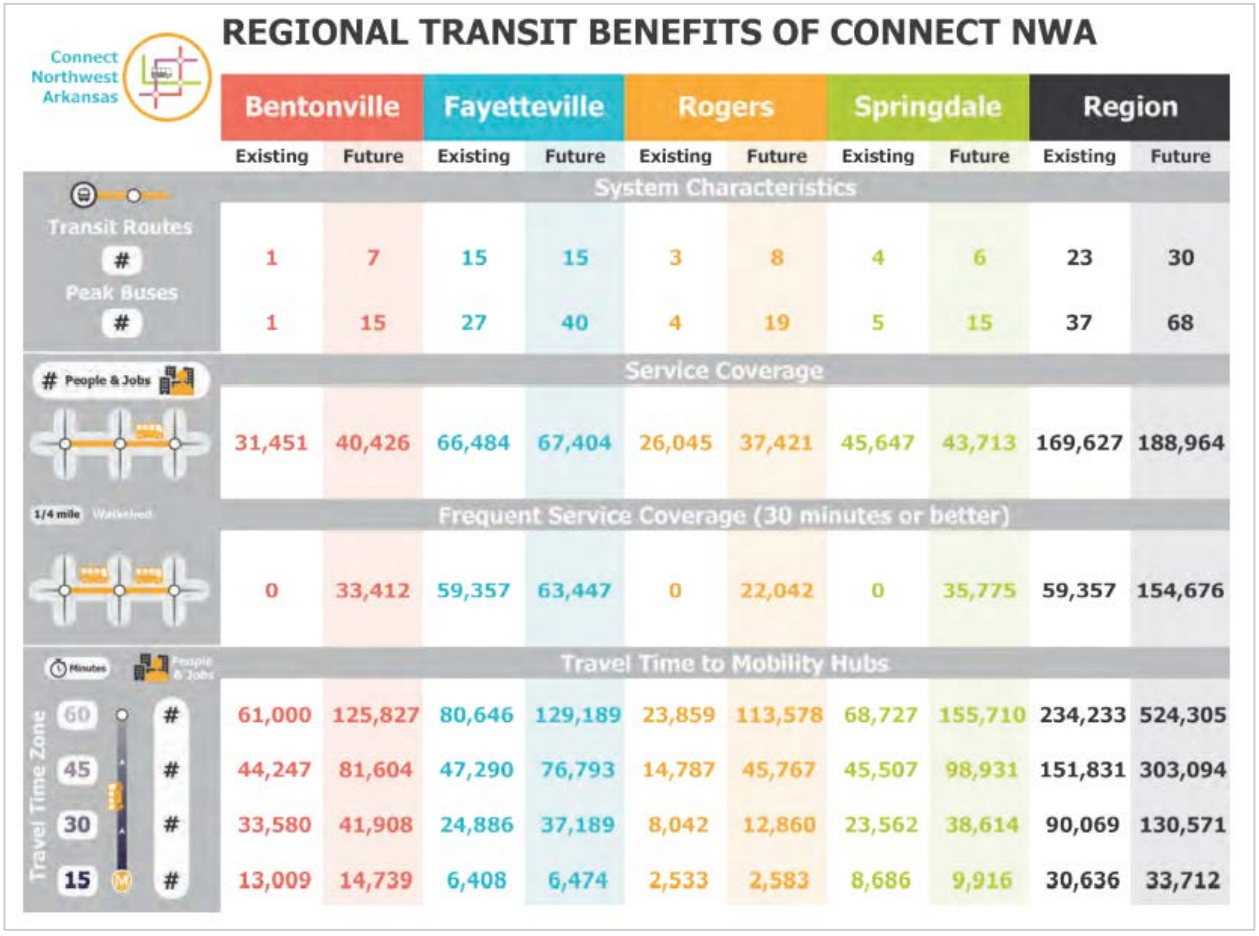
FIGURE 9. CONNECT NORTHWEST ARKANSAS PUBLIC SURVEY RESULTS



Source: Connect Northwest Arkansas, 2020, page 43

The plan proposes adding transit routes to the Bentonville, Rodgers, and Springdale areas. This proposal, and its expected benefits, are summarized in the figure below. Maps with alternative recommendations are provided in the plan. To optimize existing infrastructure and system performance via TSMO, it is important to coordinate plans with such existing transit plan so that the region can best leverage all modes.

FIGURE 10. PROPOSED NORTHWEST ARKANSAS TRANSIT EXPANSION AND BENEFITS



REGIONAL TRANSIT BENEFITS OF CONNECT NWA

Connect Northwest Arkansas

	Bentonville		Fayetteville		Rogers		Springdale		Region	
	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future
System Characteristics										
Transit Routes #	1	7	15	15	3	8	4	6	23	30
Peak Buses #	1	15	27	40	4	19	5	15	37	68
Service Coverage										
# People & Jobs	31,451	40,426	66,484	67,404	26,045	37,421	45,647	43,713	169,627	188,964
Frequent Service Coverage (30 minutes or better)										
1/4 mile Walkshed	0	33,412	59,357	63,447	0	22,042	0	35,775	59,357	154,676
Travel Time to Mobility Hubs										
Minutes / People & Jobs										
Travel Time Zone 60 #	61,000	125,827	80,646	129,189	23,859	113,578	68,727	155,710	234,233	524,305
45 #	44,247	81,604	47,290	76,793	14,787	45,767	45,507	98,931	151,831	303,094
30 #	33,580	41,908	24,886	37,189	8,042	12,860	23,562	38,614	90,069	130,571
15 #	13,009	14,739	6,408	6,474	2,533	2,583	8,686	9,916	30,636	33,712

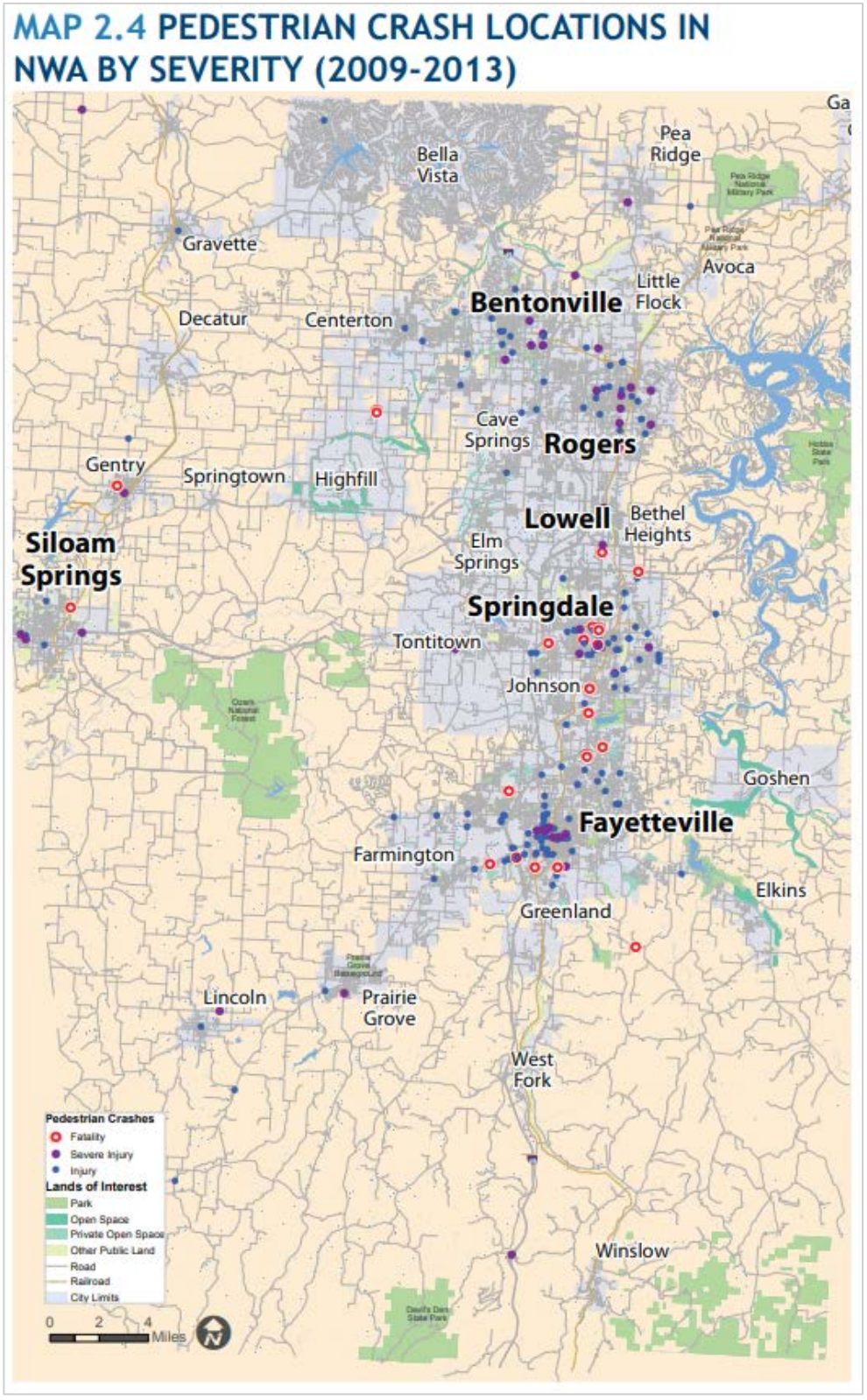
Source: Connect Northwest Arkansas, 2020, page 160

A.5 2015 Bicycle and Pedestrian Master Plan

The Northwest Arkansas Regional Bicycle and Pedestrian Plan was adopted in December 2015. It builds on previous bicycle and pedestrian initiatives to further Northwest Arkansas' network of bicycle and pedestrian facilities. The plan includes 25 individual community plans.

Many components of this plan connect to the region's TSMO work. The plan includes a bicycle and pedestrian safety analysis, along with crash data and maps on frequency and severity across jurisdictions, roadways, facility types, times, and contributing factors. The figure below is an example of such mapped data. This data is 6+ years old at this point, but coordinating with any staff involved in this effort could help integrate TSMO and bicycle/pedestrian efforts to improve safety in key locations.

FIGURE 11. PEDESTRIAN CRASH LOCATIONS IN NORTHWEST ARKANSAS BY SEVERITY (2009-2013)



Source: NWARPC 2015 Bicycle and Pedestrian Master Plan, page 2-19.

The plan also includes a number of programmatic and policy recommendations (Section 3) – some of which are similar to typical TSMO program plan strategies such as raising awareness and knowledge across the agency, or integrating bicycle/pedestrian better with planning and project development activities. These may be potential areas for collaboration between TSMO and bicycle/pedestrian efforts.

Finally the plan details an implementation plan and 20 recommendations for catalyst projects, many of which intersect with TSMO in terms of adding bicycle/pedestrian facilities to improve safety and mobility.

Similar to the Transit Development Plan (TDP), in order to optimize existing infrastructure and system performance via TSMO, it is important to coordinate plans with existing bicycle/pedestrian efforts so that the region can best leverage all modes. Given that this plan is about 6 years old, the TSMO plan may want to propose increasing/continuing collaboration between TSMO and bicycle/pedestrian staff to get updates on progress since 2015.

A.6 ARDOT Strategic Plan (2017-2022)

The ARDOT Strategic Plan provides strategic direction for all ARDOT activities across the state. Specifically, it documents ARDOT's mission, vision, core values, and strategic goals. The mission, vision, and core values provide high-level direction. For the strategic goals, ARDOT presents all five in more detail – each with specific objectives and strategies listed to meet the goal.

The advancement of TSMO supports every aspect of ARDOT's Strategic Plan – primarily by directly advancing the same goals through TSMO strategies and, sometimes, by indirectly supporting the same goals through improved system performance and collaboration.

It is important to note that the period of time covered by this Strategic Plan (2017-2022) is set to end next year (2022), which is when the bulk of the TSMO Plan development will take place. It is reasonable to expect that many of the same themes will carry forward beyond 2022, but nonetheless it is important context.

The following table maps how TSMO supports ARDOT's current strategic direction. Note that this table could be expanded in the to-be-developed TSMO Plan to show these connections with the more detailed Strategic Goals and Objectives. These connections are key messages for promoting the importance of TSMO for Arkansas (ARDOT, NWARPC, and partners).

TABLE 4. CONNECTIONS BETWEEN ARDOT STRATEGIC PLAN AND TSMO PLAN

ARDOT Strategic Plan		TSMO Connections/Benefits/Support
Element	***Full Description***	
Mission	Provide safe and efficient transportation solutions to support Arkansas' economy and enhance the quality of life for generations to come.	Improving safety and efficiency are key objectives and benefits of TSMO programs and many individual TSMO strategies.
Vision	Continue to preserve and improve Arkansas' transportation system emphasizing safety, efficiency, quality, trust, and stewardship with a public service focused workforce.	Same as above, with the addition that TSMO encourages collaboration within the agency, with partners, and with the public – with promotes trust and a public service focused mindset.
Core Values	Safety – Safety first in all we do. Public Service – Focus on the greater good. Teamwork – One vision through collaboration and communication. Quality – Deliver reliable transportation solutions. Integrity – Commitment to ethics and transparency. Efficiency – Achieve maximum benefit through fiscal responsibility.	Same as above in terms of safety, public service, teamwork (collaboration), and efficiency. In addition, by focusing on improving the *existing* transportation system with low-cost, high-benefit operational solution, TSMO improves the quality of ARDOT's transportation systems and services.

APPENDIX B. SUMMARY OF TSMO BEST PRACTICES

This Appenix summarizes the TSMO Plans from the following three peer agencies:

- Wichita Area Metropolitan Planning Organization
- Atlanta Regional Commission
- TxDOT Atlanta District

B.1 Wichita Area Metropolitan Planning Organization Regional TSMO Plan

Background

The Wichita Area Metropolitan Planning Organization (WAMPO) is the regional planning agency for the greater Wichita area, including three counties and 22 cities in South Central Kansas. The region is home to about 550,000, of which about 400,000 live in Wichita, and is growing at a relatively slower pace of 1% a year. The region's transportation challenges stem primarily from changes in transportation services, available technologies, and customer expectations – rather than growth and stress on the system .

WAMPO's Regional TSMO Plan , published in 2019, was developed in collaboration with WAMPO member agencies, the Kansas Department of Transportation (KDOT), and the Federal Highway Administration (FHWA). Like many agencies, WAMPO conducted an FHWA-sponsored CMM self-assessment workshop prior to launching a formal TSMO planning process.

WAMPO's Approach to TSMO

WAMPO's Regional TSMO Plan focuses on three components:

- The region's need and business case for TSMO.
- Organizing for TSMO, including setting up a TSMO Task Force to lead implementation.
- Ten TSMO Service Layers with action items, to focus TSMO advancement around these ten priority areas.

In general, WAMPO's Regional TSMO Plan is a concise and focused document at 20 pages in length. Each Service Layer contains a brief description of WAMPO's status and needs in that area followed by a listing of 2-9 action items.

Need and Business Case for TSMO

WAMPO's TSMO needs and business case are tailored to the greater Wichita region. The discussion utilizes a hypothetical story of a typical, local commuter traversing Wichita roadways for work and family obligations. Beyond this narrative, the discussion also highlights specific roadways, challenges, and existing projects to improve systems operations. This helps connect the need for and benefits of TSMO to a local audience. Finally, this section includes a short summary of existing plans and activities on which the TSMO plan seeks to build – such as related MPO plans, the regional ITS architecture, and the Wichita TMC (WICHway).

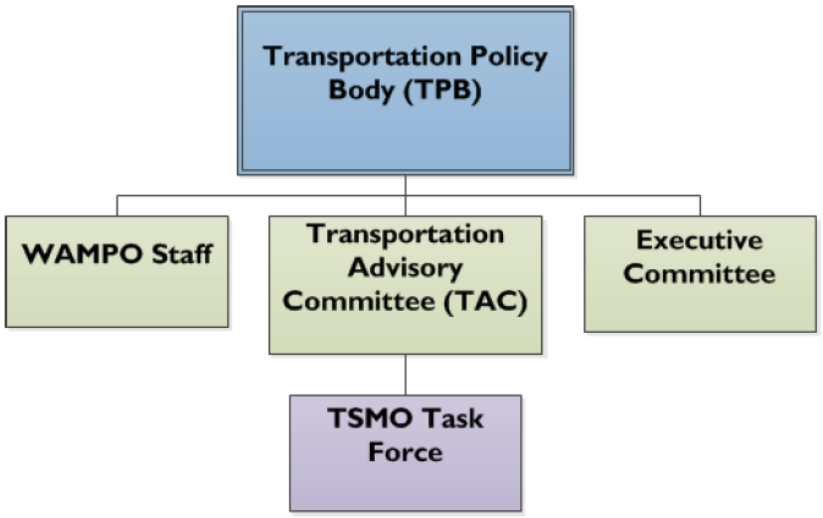
Organizing for TSMO

The "Organizing for TSMO" section establishes roles and responsibilities for advancing TSMO within WAMPO's existing organizational structure. WAMPO set up a TSMO Task Force as a sub-committee of the WAMPO Transportation Advisory Committee (TAC), which sets the technical programming for the region's Transportation Improvement Plan (TIP) and Long Range Transportation Plan (LRTP). Figure 1 below shows how the Task Force fits within WAMPO's existing structure. The Regional TSMO Plan also lists which roles and partner agencies should be included in the task force at a minimum.

The Regional TSMO Plan specifies that the TSMO Task Force will oversee and support the implementation of the plan's Service Layer actions. The Task Force will also identify future projects that should include TSMO strategies as well as standalone TSMO projects – as part of the Task Force's work with the larger TAC's planning responsibilities.

Integrating TSMO into planning processes is a key programmatic step in advancing TSMO at any agency. By setting up the TSMO Task Force within a planning committee, WAMPO is helping to facilitate this integration.

FIGURE 12. PROPOSED TSMO TASK FORCE RELATIONSHIP WITH WAMPO



Source: WAMPO Regional TSMO Plan, 2019

Ten TSMO Service Layers

The WAMPO Regional TSMO Plan specifies ten Service Layers to guide the advancement of TSMO activities in the region. The primary focus here is on Service Layers 1-7, with a secondary focus on 8-10. Note that these Service Layers span both programmatic areas (e.g. public communications, performance measurement) and tactical/applied areas (e.g. traffic incident management, work zone management)

WAMPO's TSMO Service Layers:

- TSMO Task Force

- Transportation Management Center (TMC)
  - » Freeway Management
  - » Active Arterial Management
- ITS & Communications
  - » ITS Architecture
  - » Deployment Plan
- Traffic Incident Management (TIM)
- Work Zone Management
- Public Communication
- Performance Measurement
- Connected and Automated Vehicles (CAV)
- Multimodal Transportation
- Training and Education

For each Service Layer, the plan provides a brief summary of the area followed by 2-9 action items to advance WAMPO's activities in that area. All action items across Service Layers are summarized in Figure 10 below. As noted above, the Regional TSMO Plan specifies that the TSMO Task Force will oversee and support the implementation of the plan's Service Layer actions.

FIGURE 13. SUMMARY OF WAMPO TSMO ACTION ITEMS ACROSS ITS 10 SERVICE LAYERS

REGIONAL TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS (TSMO) PLAN

A regional approach to reliable transportation systems

WORKPLAN

	IMMEDIATE PRIORITIES	NEAR TERM PRIORITIES	LONG-TERM PRIORITIES
TSMO Task Force	Formalize TSMO evaluation worksheet Identify future needs Develop TSMO Task Force Membership Launch pilot project (K-15 highway) Update architecture	Establish programming and funding Develop agreements for regional signal database Establish regional ITS standards Establish regional signal standards	
TMC	Update ATMS software Develop XML feed for incidents	Incorporate Google, WAZE, etc. for incidents Update Diversion Plan Guide	Implement Diversion Plan from TMC in field
ITS & Communications	Establish shared fiber agreements Design/implement new city network Launch ATMS software for signal control	Create Regional Fiber Plan Update Traffic Signal Controllers to incorporate ATSPM's	Create cross network agreements/firewalls
Traffic Incident Management	Engage WPD Traffic Unit Reach out to surrounding cities Establish Incident Review Committee Review Accident Reporting Form Engage stakeholders - KHP, Derby, Andover	Identify Regional Incident Commander Introduce salvage legislation for freeway system	Expand TIM training to all first responders throughout region Improve integration of systems (e.g. Dispatch and ATMS)
Work Zone Management	Implement Smart Work Zone Management Coordinate Maintenance, Cities and KDOT Training for TIM contractors	Determine regional targets for work zone performance measures	
Public Communications	Develop materials to tell TSMO story Publicize performance measures Publicize 'value of delay' Reach out to surrounding cities Conduct August operations meeting	Create one location for construction information Develop Performance measures for public perception	
Connected & Autonomous Vehicles		Develop CV/AV strategy	Incorporate into regional, statewide architecture
Multi-Modal Transportation	Develop Enforcement and Safety corridors Engage WAMPO freight connection	Interface WICHway into Freight Vehicle feed Engage transit	Budget, implement opportunity plan
Performance Measurement	Develop Performance Measures on arterials Deliver better data to stakeholders Align MAP-21 requirements to TSMO PM's Determine Work Zone performance measures Calculate opportunity costs for projects	Integrate ATSPM software/15% existing signals	Integrate ATSPM software in 100% regional signals
Training & Education	Work with CKITE, ITS Heartland, others Deliver 'Lunch and Learns' for field staff	Develop university partnerships	

Source: WAMPO Regional TSMO Plan, 2019

TSMO Strategies and Projects

Under each Service Layer, the WAMPO plan includes a number of TSMO strategies and projects that may be of interest to NWARPC as it develops its own TSMO plan and actions. TSMO strategies are generally tailored to the unique context and needs of each agency, however, NWARPC may want to consider a number of WAMPO's more regionally-focused actions in particular. These may spur ideas for analogous actions in the Northwest Arkansas region.

These select action items are taken directly from the WAMPO Regional TSMO Plan Service Layers. A full account of all action items in shown in Figure 10 as well as in the full WAMPO plan.

TSMO Task Force

- Formalize TSMO evaluation worksheet – The TSMO evaluation worksheet will be used to identify projects that should include TSMO components and could be used as an evaluation tool for all projects.

- Pilot collaboration projects – Identify cross jurisdictional projects that will allow agencies to develop better specifications and standard designs.
- Develop agreements for regional traffic signal database – by regionalizing all signals into a single database, corridor interoperability will be possible and ICM strategies can be better implemented.
- Establish regional ITS standards – These will support ICM and other strategies and to better align with state standards.
- Establish regional signal standards – For ICM and traffic signal database standardization projects, signal standardization is key to easing integration.

ITS & Communications

- Create Regional Fiber Plan – Identify the needs of all regional stakeholders and develop a project plan to build out as funding is available.

Work Zone Management

- Coordinate Maintenance – By coordinating maintenance and construction project, drivers will have more reliable alternate paths around work zones.
- TIM training for contractors – By understanding how TIM procedures work, construction work zone crashes may be alleviated and contractor towing more readily used.

Public Communications

- Publicize performance measures – As part of telling the story, use performance measures and targets to show the benefits. Enlist the public to help guide performance based management of the roadway.
- Publicize the Negative Value of Delay – Often delay savings or delay costs are overlooked when making decisions on construction phasing or lane clearance time. There is an opportunity cost to put ITS equipment and TSMO strategies in place but there is a cost associated to doing nothing as well.

Performance Measurement

- Align Federal requirements to TSMO performance measures – This will aid in duplicating and developing similar performance measures. Since the reporting has to be completed to meet federal requirements, aligning similar performance measures eases work load.
- Calculate opportunity costs for projects – Typically only project construction costs are reported; opportunity costs examine the cost of “not” doing the project as well. User delay costs would often justify project expenses.

Connected and Automated Vehicles (CAV)

- Develop CAV strategy in conjunction with KDOT – Exchange and storing of data is going to be a key feature of efficient CV and AV vehicles, as well as subsequent planning and engineering projects associated with the data collected. Developing a plan that will identify how this is going to be collected and stored (and infrastructure needed to do it) is key to the region’s development.

Multimodal Transportation

- Engage Transit – Develop transit-based TSMO strategies that are applicable to the region

Training and Education

- Work with local technical groups (CKITE, ITS Heartland, ASCE, etc.) to integrate TSMO into lunch and learn programs – By spreading the knowledge of TSMO decision making to other groups, better decisions and more meaningful performance will be achieved.
- Develop Lunch and Learn Program for Field Staff - By using vendor supplied lunch and learns, better educated field staff will be available, further optimizing operations.
- Develop University Partnerships – Using university programs and researchers to help solve problems, especially for data reduction and processing, is key to more efficiently developing meaningful performance measures.

Insights for NWARPC

TSMO Task Force

The WAMPO TSMO plan establishes some high-level responsibilities for advancing TSMO by defining a TSMO Task Force to be set up within WAMPO's existing organizational structure (WAMPO's Transportation Advisory Committee (TAC)). The TSMO Plan lists which roles and partner agencies should be included in the task force at a minimum. It also specifies that the TSMO Task Force will oversee and support the implementation of the plan's Service Layer actions as well as identify future projects that should include TSMO strategies as well as standalone TSMO projects. Integrating TSMO into planning processes is a key programmatic step in advancing TSMO at any agency. By setting up the TSMO Task Force within a planning committee, WAMPO is helping to facilitate this integration.

It can sometimes be tricky to define TSMO roles and responsibilities too specifically in an initial plan. Setting up a new structure such as a TSMO Task Force, along with some high-level guidelines, can be a great way to set up the agency for success in terms of staff ownership and implementation of the TSMO plan actions.

Service Layer Plans & Actions

Organizing TSMO program priorities and action items into Service Layers is an established best practice in TSMO planning. Some TSMO plans focus only on tactical areas/specific TSMO applications in their Service Layers, and cover programmatic areas in a separate TSMO Program Plan or section. Here, WAMPO includes both programmatic and tactical areas in its 10 Service Areas. There are pros and cons to each approach, but here the pros are that this streamlines the WAMPO TSMO plan and makes tracking actions across all Service Layers easier (using the summary matrix that prioritizes all actions across Service Layers).

WAMPO's Service Layers provide a good example of a comprehensive set of regional TSMO priorities and example action items. NWARPC may want to consider a number of WAMPO's more regionally-focused actions in particular. These may spur ideas for analogous actions in the Northwest Arkansas region.

Some TSMO plans further details action items such as these into action matrices that document a staff owner, support staff, timeline, resources, performance measures, and more. These action matrices are used by staff as an internal document to track the progress of TSMO plan implementation.

B.2 Atlanta Regional Commission TSMO Plan

Background

The Atlanta Regional Commission (ARC) is the regional planning and inter-government coordinating agency for the Atlanta region – including the City of Atlanta and 11 core surrounding counties. ARC is also the Atlanta region's MPOs, including Atlanta and parts of 20 surrounding counties . Atlanta has been a national leader in regional ITS and TSMO initiatives, dating back to investments to manage traffic during the 1996 Olympics. Atlanta is also one of the country's largest (ranked 9th) and fastest growing metropolitan areas. Transportation challenges and congestion have consistently been one of the area's top challenges. In complement to a smaller, slower-growing metropolitan area like Wichita, Atlanta provides an example of how a large, national leader addresses regional TSMO planning. As the case study shows, Atlanta's approach contains many similarities to smaller peers like Wichita, as well as a number of relevant, regional ideas and models for NWARPC to consider.

ARC's Approach to TSMO

ARC published the Atlanta Regional TSMO Strategic Plan in 2020, in partnership with its members, stakeholders, and statewide/regional transportation agencies including the Georgia DOT and the Metropolitan Atlanta Rapid Transit Authority (MARTA).

The process of developing the TSMO plan included a considerable information-collection and stakeholder outreach phase. ARC engaged stakeholders to first collaboratively develop a common vision and goals for TSMO in the region. This is especially important for an MPO, to increase buy-in and ownership from its members and stakeholders. This was followed by a series of research and engagement efforts to inventory ITS infrastructure in the region, research best practices, and assess the region's current technology. This information was used to update the regional ITS Architecture, as well as input to the TSMO plan. Much like NWARPC, ARC conducted its TSMO and ITS planning process in tandem. All together, ARC conducted four stakeholder workshops and two surveys to collect input on these items.

The plan is organized into six sections. The first four sections essentially document ARC's high-level strategy and framework for TSMO:

- Introduction
  - » Defines TSMO, the scope/purpose of the plan, plan development process, and essentially makes the business case for TSMO in the region (Section 1.3 "Why does the Atlanta region need TSMO?").
  - » ARC's business case is a strong example of tying the benefits of TSMO to specific regional needs – in this case, the Atlanta region's transportation and congestion challenges. ARC cites Atlanta's not-so-enviable INRIX Global Traffic Scorecard rankings and information from past regional surveys to drive the point home. The business case also highlights the cost-effectiveness of TSMO, drawing from national cost-benefit estimates.

- TSMO Vision and Goals
  - » Sets the high-level strategic direction for TSMO in the Atlanta region, to guide the rest of the plan, see Figure 11 below.
  - » As noted above, ARC held a workshop to develop its TSMO vision and goals with input member organizations and other stakeholders. Engagement in this or another form is critical to gaining regional buy-in and consensus. Outreach for vision and goal setting is done early in the planning process to steer the plan development.

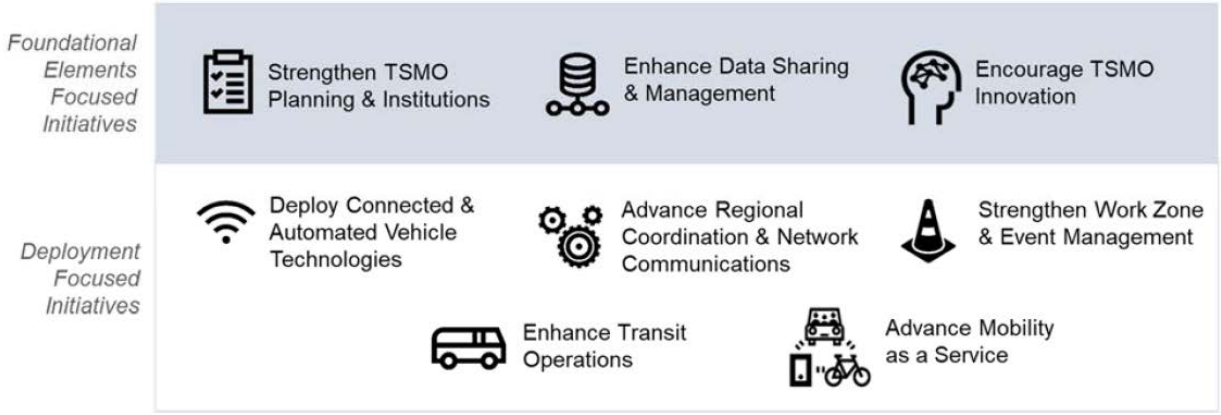
FIGURE 14. ATLANTA REGIONAL TSMO STRATEGIC PLAN – VISION AND GOALS

Source: ARC, Atlanta Regional TSMO Strategic Plan, 2020

- Regional Strengths and Opportunities
  - » ARC conducted a technological assessment of its current TSMO and ITS capabilities and technologies. The assessment focused on two questions:
    - – Assess the gap between the current state and the overarching TSMO vision [and goals].
    - – Compare the region's current state of the practice against national best practices.
  - » In the plan, this assessment is captured as specific strengths and opportunities under each of the five overarching goal areas (see Figure 3 above). This approach is similar to a Capability Maturity Model TSMO assessment, using ARC's identified TSMO goals in the place of the six dimensions.
- TSMO Strategic Plan Framework
  - » The strategic/foundation-setting sections of the ARC TSMO plan build to Section 4, which lays out a TSMO Strategic Plan Framework. This framework identifies eight TSMO strategic initiatives, around which ARC focuses its ensuing actions. These eight initiatives are summarized in Figure 4 below. As the plan notes, these initiatives span the programmatic ("Foundational) and tactical ("Deployment") aspects of advancing

TSMO, which some plans split into separate sections or efforts. Here, like in the Wichita plan, ARC gets the benefit of combining programmatic and tactical initiatives into one, concise account.

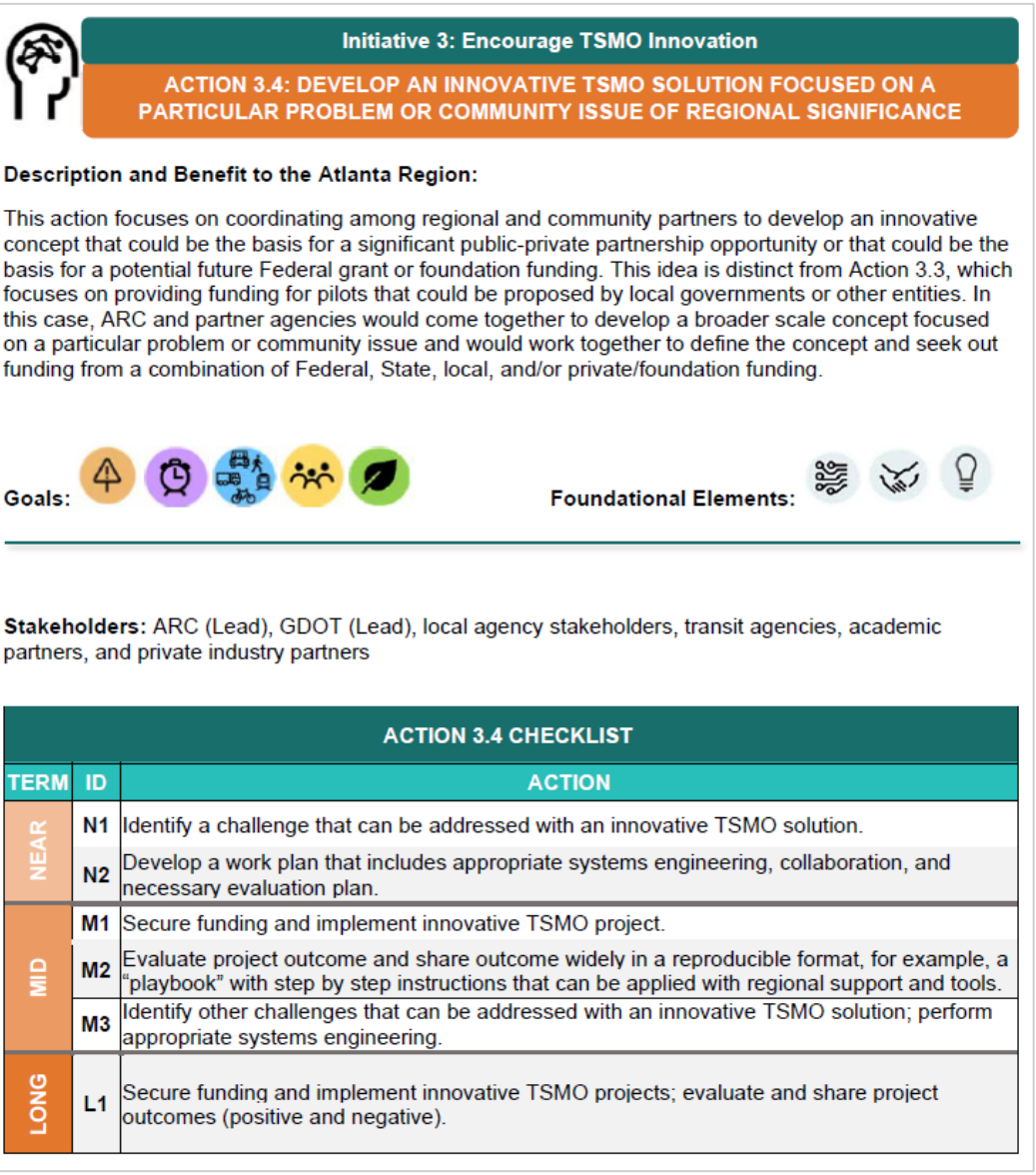
FIGURE 15. ATLANTA REGIONAL TSMO STRATEGIC PLAN – STRATEGIC INITIATIVES FOR ACTION



Source: ARC, Atlanta Regional TSMO Strategic Plan, 2020

The ARC plan then dives into specific actions to advance TSMO in the region (in Section 5 - TSMO Priority Actions). These are organized under the eight TSMO strategic initiatives. Each initiative has 3-6 priority actions under it, and each action is then further broken down into a handful of incremental steps to advance the actions in the near, medium, and long term. The plan also lists key stakeholders for each action, with a lead organization denoted. Figure 5 below shows an example of how each individual action is broken down in the plan – with a brief description highlighting the benefits to the region, a list of stakeholders with lead organization(s), and a "checklist" of incremental steps to advance the action. Note that the near-term steps are small and specific – providing a clear roadmap for advancing the action.

FIGURE 16. ATLANTA REGIONAL TSMO STRATEGIC PLAN – STRATEGIC INITIATIVES FOR ACTION



Initiative 3: Encourage TSMO Innovation

ACTION 3.4: DEVELOP AN INNOVATIVE TSMO SOLUTION FOCUSED ON A PARTICULAR PROBLEM OR COMMUNITY ISSUE OF REGIONAL SIGNIFICANCE

Description and Benefit to the Atlanta Region:

This action focuses on coordinating among regional and community partners to develop an innovative concept that could be the basis for a significant public-private partnership opportunity or that could be the basis for a potential future Federal grant or foundation funding. This idea is distinct from Action 3.3, which focuses on providing funding for pilots that could be proposed by local governments or other entities. In this case, ARC and partner agencies would come together to develop a broader scale concept focused on a particular problem or community issue and would work together to define the concept and seek out funding from a combination of Federal, State, local, and/or private/foundation funding.

Goals: **Foundational Elements:**

Stakeholders: ARC (Lead), GDOT (Lead), local agency stakeholders, transit agencies, academic partners, and private industry partners

ACTION 3.4 CHECKLIST

TERM	ID	ACTION
NEAR	N1	Identify a challenge that can be addressed with an innovative TSMO solution.
	N2	Develop a work plan that includes appropriate systems engineering, collaboration, and necessary evaluation plan.
MID	M1	Secure funding and implement innovative TSMO project.
	M2	Evaluate project outcome and share outcome widely in a reproducible format, for example, a "playbook" with step by step instructions that can be applied with regional support and tools.
	M3	Identify other challenges that can be addressed with an innovative TSMO solution; perform appropriate systems engineering.
LONG	L1	Secure funding and implement innovative TSMO projects; evaluate and share project outcomes (positive and negative).

Source: ARC, Atlanta Regional TSMO Strategic Plan, 2020

This approach is similar to the action matrix approach that some state DOT's have taken in their TSMO plans (e.g. Michigan DOT, Missouri DOT). With action matrices, the agency documents its actions along with sub-steps, leads, resources, timelines, priority, etc. in a tabular form. Both structures are effective ways of detailing out the same information and setting the agency/region up for success in implementation.

The Atlanta Regional TSMO Strategic Plan concludes with a brief (3 paragraph) section on next steps and implementation. As discussed, much of the roadmap for implementation is captured in the action breakdowns shown in Figure 5. This final section essentially emphasizes that the plan is a work-in-progress/"living document" and that the region should expect to use it as a framework to be adapted as their work progresses and situations change. For example, the plan specifically notes the COVID-19 pandemic as an instance where the region needs to

stay nimble and adaptable in its implementation of this plan. The plan encourages monitoring, collaboration, and communication to maintain this adaptability and continue moving forward.

TSMO Strategies and Projects

Under each of the eight TSMO initiatives, the ARC plan includes a number of TSMO actions that may be of interest to NWARPC as it develops its own TSMO plan and actions. A selection of these actions are provided below – focusing on actions that are regional in scope or otherwise may be of interest to Northwest Arkansas. This selection also illustrates the type and range of actions proposed in the ARC plan. Note that each of the actions below is broken down into incremental steps, per Figure 13.

Initiative 1: Strengthen TSMO Planning and Institutions

- 1.1 Establish and sustain a diverse regional TSMO committee.
- 1.3 Develop tools and guidance for local agencies and partners to advance TSMO strategies.
- 1.4 Integrate TSMO into local and regional planning and development processes.

Initiative 2: Enhance Data Sharing and Management

- 2.3 Improve/develop data curation and sharing strategies.

Initiative 3: Encourage TSMO Innovation

- 3.4 Develop an innovative TSMO solution focused on a particular problem or community issue of regional significance.

Initiative 4: Deploy Connected and Automated Vehicle Technologies

- 4.2 Leverage connected vehicle technologies to improve safety and mobility for all travelers.

Initiative 5: Advance Regional Coordination and Network Communications

- 5.1 Advance Integrated Corridor Management (ICM) systems
- 5.2 Develop better tools for communications among emergency responders and between event management tools and traveler information outlets.

Initiative 6: Strengthen Work Zone and Event Management

- 6.2 Implement smart work zone strategies.

Initiative 7: Enhance Transit Operations

- 7.1 Advance implementation of high capacity premium transit service strategies including transit signal priority.

Initiative 8: Advance Mobility as a Service

- 8.1 Promote and increase access to safe, affordable, and environmentally friendly mobility options.

In addition to the TSMO plan, ARC developed a companion TSMO Local Agency Deployment Guide . This guide contains a condensed version of the high-level TSMO strategic and framework material as the full TSMO plan. It then presents a “menu of options” of TSMO strategies along with descriptions, guidance, and resources to help local agency identify and implement TSMO strategies that meet their needs.

Insights for NWARPC

Consensus-building to Set TSMO Vision and Goals

The ARC case study exemplifies a best practice in TSMO planning and plan development – conducting partner and stakeholder engagement to set a vision and goals for the plan early in the planning process. This can be especially important for areas like TSMO where formal planning and programming has more recently emerged, and partners may not share a common understanding going into plan development. It can also be especially important and useful for regional organizations that work closely and frequently with a wide variety of partners, and with which they want to foster buy-in in the TSMO program. The ARC plan is additionally a good example of how to build a plan framework and actions on top of a common mission and set of goals (see below).

Organizing Actions around Focused Initiatives

The ARC plan builds its plan’s framework and actions on the common vision and goals it developed with its partners. It does so by assessing strengths and opportunities in each of its five goal areas, and then using these insights to develop eight specific initiatives that serve as the focal point for the plan’s actions. As noted in the “ARC’s Approach to TSMO” discussion, each one of these eight initiatives flows into a handful of actions, which in turn are broken down into incremental steps. The ARC plan demonstrates a logical flow from high-level strategy to detailed, incremental steps – making a strong case for why the recommended actions advance priority TSMO needs in the region. Centering the actions around eight initiatives also lends the plan focus and helps ARC detail how specific steps to advance (see below).

Detailing Actions into Incremental Steps

Each of ARC’s eight TSMO initiatives has 3-6 priority actions under it, and each action is then further broken down into a handful of incremental steps to advance the actions in the near, medium, and long term. The plan also lists key stakeholders for each action, with a lead organization denoted. Figure 5 above shows an example of how each individual action is broken down in the plan – with a brief description highlighting the benefits to the region, a list of stakeholders with lead organization(s), and a “checklist” of incremental steps to advance the action. The near-term steps are small and specific – providing a clear roadmap for advancing the action.

This approach is similar to the action matrix approach that some state DOT’s have taken in their TSMO plans (e.g. Michigan DOT, Missouri DOT). With action matrices, the agency documents its actions along with sub-steps, leads, resources, timelines, priority, etc. in a tabular form. Both structures are effective ways of detailing out the same information and setting the agency/region up for success in implementation.

B.3 Texas DOT Districts

Background

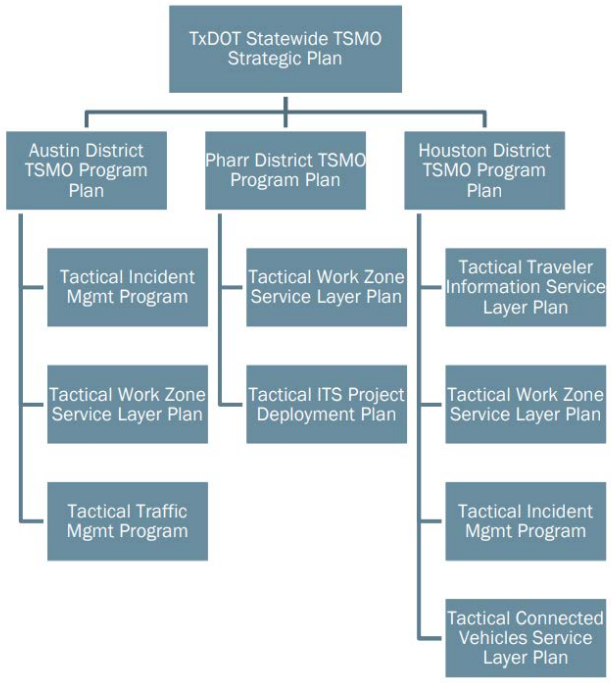
The Texas DOT (TxDOT) completed and published a TSMO Statewide Strategic Plan in 2018. This document sets the statewide vision, mission, and goals and objectives for TSMO. It also lays out TxDOT's approach for advancing TSMO in Texas, as a large state with a wide variety of contexts, needs, and levels of maturity.

Because of the size of the transportation network in Texas and because of TxDOT's decentralized structure focusing on the districts (of which there are 25), TxDOT chose to implement a three-pronged approach for the TSMO planning initiative: a statewide strategic plan, District program plans, and district tactical plans. The TSMO Statewide Strategic Plan provides overall guidance, and then each TxDOT District TSMO Program Plan develops tailored, local recommendations based on this statewide guidance. Depending on District needs, each District may further create TSMO Tactical Plan focused on detailed actions, processes, and protocols for advancing certain TSMO applications, such as Traffic Incident Management (TIM) or work zone management. This hierarchy of plans is illustrated in Figure 6 below, using three TxDOT Districts as examples.

To facilitate consistency across District TSMO plans, the TxDOT statewide plan provides a common Table of Contents (or an outline) for the districts to follow. Any modifications to this outline require approval from the statewide TSMO committee. Some key components include: District-specific goals and objectives tied to the statewide vision and mission, a Capability Maturity Model (CMM) assessment, and District-specific actions under each of the six dimensions assessed in the CMM (Business Processes, Systems and Technology, Performance Measurement, Organization and Workforce, Culture, and Collaboration).

The actions in both the statewide and the District TSMO plan are oriented around the six CMM dimensions. The statewide plan identifies a series of key actions in each dimension and lists Central Office and District Office responsibilities for advancing these actions. Most of the District responsibilities are high-level (develop TSMO program, updated ITS Architecture, monitor performance measures regularly) and provide a good framework on which the Districts can build out their TSMO program plans. It was TxDOT's intention that TSMO integrate operations and management strategies throughout the entire project delivery process through coordination and collaboration of stakeholders to address the end users' needs.

FIGURE 17. EXAMPLE ILLUSTRATING THE TXDOT HIERARCHY OF TSMO PLANS



Source: TxDOT TSMO Statewide Strategic Plan, 2018

The TxDOT District TSMO Program Plans that have been developed to-date are posted on the statewide TSMO webpage (https://www.txdot.gov/inside-txdot/division/traffic/tsmo.html) along with the TSMO Statewide Strategic Plan. Since the completion of the Statewide TSMO Strategic Plan and the pilot TSMO Program Plan for the Austin District, development of TSMO Program plans has begun for the remaining twenty-four districts. At the beginning of 2022, thirteen districts had completed and adopted TSMO Program Plans.

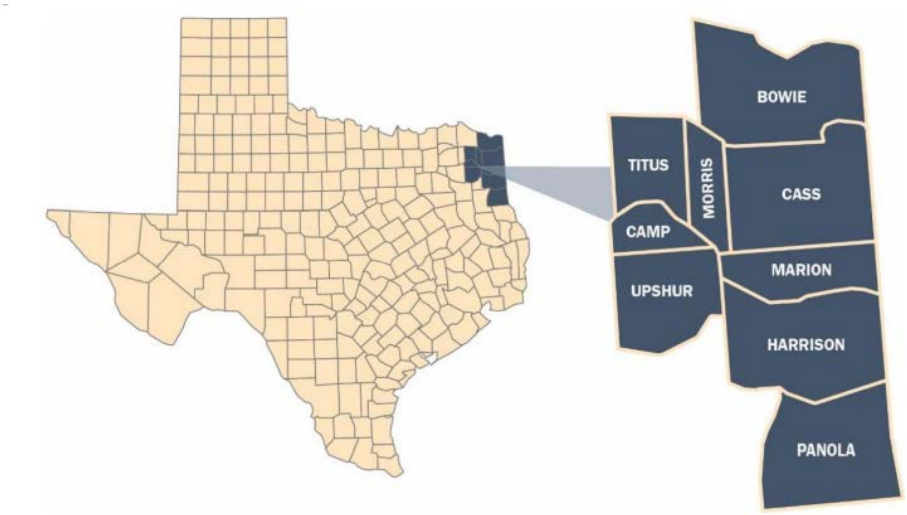
As part of the statewide TSMO initiative, TxDOT has supported development or updating ITS Master Plans and Regional ITS Architectures as companion documents to the TSMO Program Plan. Development or updating of these documents is underway in many of the districts but only five ITS Master Plans and only one Regional ITS Architecture have been created or updated. In December of 2021, TxDOT initiated a program to develop a Statewide ITS Architecture and potentially also multi-district Regional ITS Architectures. Several of the more rural districts have indicated in their TSMO program plans that they will participate in mutli-district Regional ITS Architectures rather than develop or update a stand-alone Regional ITS Architecture for their district.

TxDOT Atlanta District TSMO Program Plan

This peer review will focus on one such TxDOT District TSMO Program Plan – the Atlanta District TSMO Program Plan (published May 2021), as an example of the broader set of TxDOT District TSMO Plans that are District/regional in scope. TxDOT's approach to TSMO and its relevance to the current NWARPC effort can be illustrated by a review of the TSMO Program Plan developed by the TxDOT Atlanta District. The Atlanta District is similar in character and transportation needs to that of Northwest Arkansas. The Atlanta District is in the northeast corner of Texas and includes nine Texas counties: Bowie, Camp, Cass, Harrison, Marion, Morris, Panola, Titus and Upshur (see Figure 7). The district covers 5,341 square miles and had an estimated population of 330,000 in 2021.

There are 6,463 lanes miles of highway in the district. The district borders the states of Arkansas, Louisiana and Oklahoma and the district collaborates with those states' DOTs on major transportation issues.

FIGURE 18. MAP OF THE TXDOT ATLANTA DISTRICT



(Source: TxDOT Atlanta District TSMO Program Plan.)

The TxDOT Atlanta District published its TSMO Program Plan in May 2021 after outreach to staff and area stakeholders the previous year. This plan follows the statewide guidance for District TSMO plans. Its content essentially boils down to the following sections:

Introduction – What is TSMO? Why is it important?

Business Case for TSMO – The District's business case for TSMO, focusing on the funding, safety, and congestion benefits of advancing TSMO. The business case weaves in funding, safety, and congestion statistics from the District. It also highlights the value of mainstreaming TSMO (integrating TSMO throughout the agency and into regular processes).

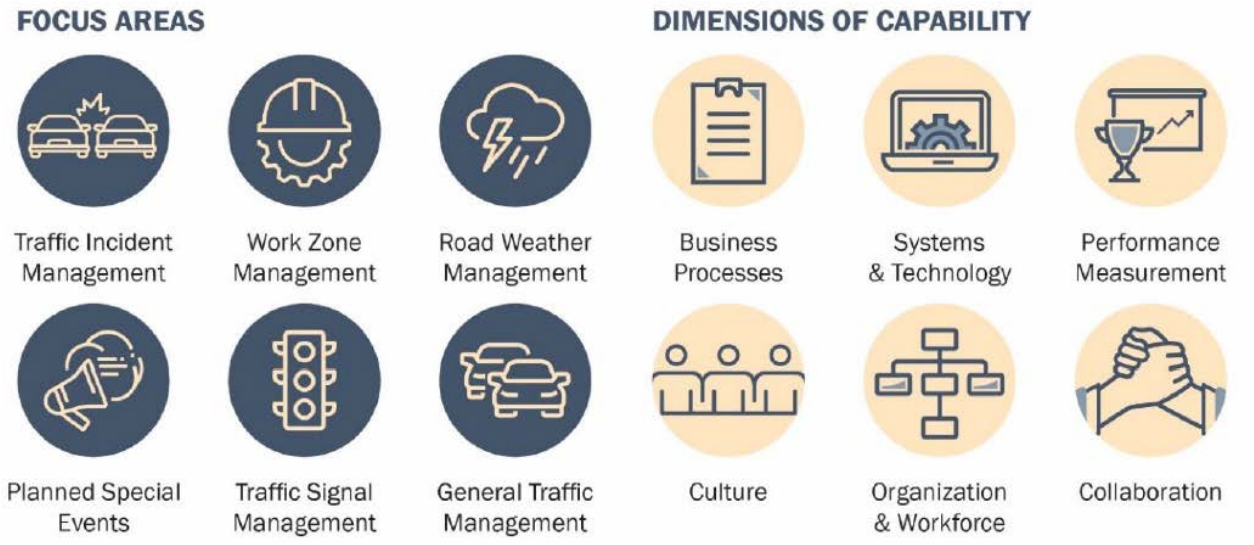
TSMO Vision, Mission, Goals and Objectives – Aligning the District's strategic direction for TSMO to the TxDOT Statewide strategy, see Figure 8 below.

FIGURE 19. ATLANTA DISTRICT TSMO VISION, MISSION, AND GOALS

Source: TxDOT Atlanta District TSMO Program Plan, 2021

CMM Assessments – The TxDOT District plans employed both an overall CMM TSMO self-assessment as well as six Capability Maturity Framework (CMF) self-assessments that focus on six TSMO application areas. These six CMF areas are shown in Figure 9 below (the blue icons under "Focus Areas"). Both the overall TSMO CMM and the CMFs use the six dimensions of capability (Figure 9, yellow icons) to evaluate TSMO overall and the six focus areas, respectively. The CMM dimensions and the CMF areas are further described below. This robust self-assessment process resulted in series of priority actions for the Atlanta District, spanning the programmatic and tactical areas of TSMO.

FIGURE 20. CMM AND CAPABILITY MATURITY FRAMEWORK (CMF) AREAS OF SELF-ASSESSMENT



Source: TxDOT Atlanta District TSMO Program Plan, 2021

The CMF areas, or TSMO tactical/application areas, on which the Atlanta District focused are:

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

The current status of each of these focus areas was self-assessed by the Atlanta District according to the Capability Maturity Model (CMM) methodology that FHWA has developed for TSMO. This methodology evaluates six ‘dimensions’ within the agency that help promote and inform goals set out by TSMO. These dimensions are:

- Business Process: includes formal scoping, planning, programming, and budgeting
- Systems & Technology: includes systems architecture, standards, interoperability, standardization, and documentation
- Performance Measurement: includes measurement definition, data acquisition, analysis, and utilization
- Culture: includes technical understanding, leadership, policy commitment, outreach, and program authority

- Organization & Workforce: includes organizational structure and staff capacity, development, and retention
- Collaboration: includes relationship with public safety agencies, local governments, metropolitan planning organizations, and the private sector

Actions – The bulk of the Atlanta District plan are actions, organized by the six CMM dimensions. For each dimension, 3-10 actions were identified via the self-assessments. For each action, the TSMO Program Plan contains a one-page, detailed breakdown of the action. These one-pagers are among the more detailed action breakdowns of contemporary statewide and regional TSMO plans – even when compared to other TxDOT District Plans. Each one-pager includes a summary of the action objective and need, a timeline, an organizational lead, supporting organizations, links to the District's goals, incremental "Implementation Steps", expected benefits, and – as available – a one paragraph peer case study. Figure 10 below shows an example of one such action one-pager from the Atlanta District's plan, for an action under the Collaboration dimension of the CMM.

It should be noted that these actions lean towards "programmatic" broad-reaching actions, as that is the focus of the District TSMO Program Plan and the CMM assessments. TxDOT has structured their TSMO program rollout to have Districts develop separate, more detailed Tactical Plans on focal areas for the District (that is, plans focused on the specifics of TSMO applications such as incident management or advanced signal technology) as needed. The TxDOT Atlanta District TSMO Program Plan identifies five potential future Tactical Plans:

- Districtwide Severe Crash Mitigation Strategy
- Regional TIM Program Development
- District Signal Technology Deployment and Management
- Regional TMC Concept Development
- Regional ITS Architecture Update

FIGURE 21. EXAMPLE OF DETAILED ACTION ONE-PAGER FROM TXDOT ATLANTA DISTRICT TSMO PROGRAM PLAN

CO-07: Develop Signal Corridor Management Strategies with Partner Agencies

SCHEDULE	2021	2022		2023		2024		2025		2026
	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1

Focus Area:
Traffic Signal Management

Action Item Lead:
District Traffic Engineer

Partners:
ATL Operations, Local Transportation Agencies, ArDOT, LADOTD

Goals Addressed:

Safety	✓
Reliability	✓
Efficiency	✓
Customer Service	
Collaboration	✓
Integration	

Objective: Develop corridor management and performance measurement strategies in collaboration with neighboring state and local partners to improve mobility along key signalized corridors.

Need: The TxDOT Atlanta District borders the states of Arkansas, Louisiana, and Oklahoma, and the city of Texarkana straddles the border of Texas and Arkansas. Due to the changes in jurisdiction along many major arterial corridors in the region, the District identified a need to improve cross-jurisdictional signal coordination. The District currently does not monitor or collect data to support signalized corridor performance measures, nor does it collaborate with neighboring TxDOT Districts or states to collaboratively update coordinated signal timings along corridors.

Implementation Step #1: Coordinate with local partners as well as neighboring TxDOT Districts and states to identify key signalized corridors within the region that cross jurisdictional boundaries, including ones that serve Texarkana and Longview. Discuss operational challenges and signal bottlenecks for these corridors.

Implementation Step #2: Continue and complete systemwide deployment of cellular modems at TxDOT Atlanta District traffic signal locations to establish communication and control of District signals (see Action Item ST-03).

Implementation Step #3: Identify corridor performance measures to track and set goals. Monitor signal corridor performance and update coordination patterns as needed, sharing this data with partners so that they can update timings accordingly for the signals that they maintain along the same corridor.

Expected Benefits: Better corridor signal coordination can eliminate unnecessary starting and stopping, decrease travel times, and prevent driver frustration. Minimizing these common issues can improve traffic flow and lead to reductions in congestion, rear-end collisions, waiting time, and fuel consumption.

Strategy and Best Practice
The Utah DOT (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.

Source: TxDOT Atlanta District TSMO Program Plan, 2021

Implementation Plan – The plan concludes with an implementation section that essentially compiles all actions across all CMM dimensions into a large matrix along with key implementation details such as action lead, support organizations, cost ($ to $$$), level of effort (1-4), timeline, and how the action relates to the plan's goals and other actions. This is a helpful reference tool for planning across actions and tracking progress.

TSMO Strategies and Projects

As a TSMO program plan, the actions in the Atlanta TSMO plan lean towards broad-reaching, programmatic actions that fall under the CMM dimensions. A full list of actions included in the plan is shown in Figure 11. The following select actions may be of particular interest to NWARPC as they consider priority TSMO actions for the Northwest Arkansas Region (selected for their broad applicability and/or regional focus).

Business Processes

These strategies focus on the agency's internal activities, including planning, programing and budgeting. They may also focus on the internal protocols that are followed for implementing projects. Examples of these strategies include:

- Establish Criteria for Conducting After-Action Incident Reviews: this allows for current gaps in protocol to be identified and best practices to be established in a way that will inform and improve future responses
- Use TxDOT's Smart Work Zone (SWZ) Decision Tool and Deployment Guidelines: this strategy encourages the use of ITS by implementing an existing tool that aids in decisions for what technology to deploy to establish SWZs in the area
- Develop and Maintain an Event Schedule: by formalizing a list of known events that would disrupt traffic patterns, potential incidents can be planned for and resolved in a more efficient manner when the time arrives

Systems & Technology

Action items laid out by the Atlanta District for this dimension largely involve ITS planning and deployment. ITS is used in many agencies but formalizing and mainstreaming ITS activities provides large system-wide benefits and promotes more technology integration in the future. Examples of these strategies include:

- Provide Closure Information Through Third-Party Apps: this would involve finding a "trusted provider" (e.g. Waze's Connected Citizens Program) that would allow for closure to be communicated on a widespread basis faster and more efficiently in order to avoid potential bottlenecks
- Continue Deploying and Maintaining ITS Devices Along Key Routes: this strategy leans heavily on the district's ITS Master Plan and ITS Architecture to inform how to maintain and expand ITS practices. Atlanta's current ITS activities include mainly CCTV and DMS, but this strategy recognizes the importance of referring to and updating these ITS documents as available technology expands.
- Develop a Multi-State TMC Concept of Operations: due being on the border between Texas and Arkansas, the Atlanta District wants to pursue sharing resources by creating a joint TMC for agencies in both states. They propose drafting a "Concept of Operations" as a document that can help procure funding

Performance Measurement

These strategies focus on not only collecting data, but also developing plans for what should be collected and how it should be used. By developing performance measures with specific intents, the data an agency receives will be most effective in tracking and promoting change over time. Examples of these strategies include:

- Monitor Towing Company Performance: by tracking metrics such as how long towing companies take to remove cars and clear debris after an incident, the agency will be better informed on what works and what doesn't whenever it's time to sign contracts with local towers
- Establish Traffic Signal Maintenance Performance Measures: by establishing data collection from signal activities, maintenance procedures can be better tracked and adjusted as needed

Culture

Culture within an agency can determine the success or failure of any TSMO policy, as a mindset of critiquing current and future activities is the best way to find room to implement TSMO plans. Technical understanding, leadership, outreach are all important elements of promoting TSMO within a culture. Examples of culture strategies include:

- Conduct Regular Work Zone Management Practice Reviews: assessing lessons learned in practices like WZM can help ensure that agency standards and procedures are as beneficial to the agency as they can be

Organization & Workforce

In addition to culture within an agency, it is also important to introduce action items that deal with agency organization on a more structural basis, such as staffing plans or forming internal committees. Examples of these strategies include:

- Establish Regional Multidisciplinary TIM Training: the Atlanta District proposes partnering with TxDOT's statewide TIM coordinator to set up trainings that would allow staff to become more informed on TIM practices, as well as how new technologies, strategies, and best practices can be utilized

Collaboration

This dimension focuses specifically on collaboration between partner agencies and other stakeholders, which is a key component to implementing TSMO on a regional basis. The more streamlined the collaboration between agencies is, the easier it will be to be successful in meeting goals that involve different parts of the community. Examples of these strategies are:

- Standardize Communicating Work Zone Information to Local Partners: alerting local partners about construction in their jurisdiction as early as possible will allow work zones to be set up as smoothly as possible as no one is caught off guard and can help collaborate where needed
- Develop Signal Corridor Management Strategies with Partner Agencies: the Atlanta District that due to the district bordering several states, it is important to formalize a plan that would improve coordination among signals in multiple jurisdictions. This involves opening communication and sharing data between parties

FIGURE 22. RECOMMENDED TSMO ACTIONS ACROSS CMM DIMENSIONS

Task Name
BUSINESS PROCESSES
BP-01: Formalize a Response Approach for Commercial Vehicle Incidents
BP-02: Establish Criteria for Conducting After-Action Incident Reviews
BP-03: Develop an Approach to Maintain ITS Functionality During Construction
BP-04: Establish Work Zone Accessibility Criteria for First Responders
BP-05: Use TxDOT's Smart Work Zone Decision Tool and Deployment Guidelines
BP-06: Conduct Post-Special Event Reviews as Needed
BP-07: Develop and Maintain an Events Schedule
BP-08: Formalize Active Management of Signal Battery Backup Units
BP-09: Integrate Existing Regional GIS Mapping Datasets
SYSTEMS & TECHNOLOGY
ST-01: Install Signage for Improved Incident Location Self-Identification
ST-02: Provide Closure Information Through Third-Party Apps
ST-03: Complete Cellular Modem Deployments to Signals
ST-04: Plan and Implement Surveillance Technology for Signals
ST-05: Continue Deploying and Maintaining ITS Devices along Key Routes
ST-06: Implement Route Choice Corridor Management Approaches
ST-07: Develop a Multi-State TMC Concept of Operations
PERFORMANCE MEASUREMENT
PM-01: Monitor Towing Company Performance
PM-02: Track TIM Performance in Partnership with Texas DPS
PM-03: Establish Traffic Signal Maintenance Performance Measures
PM-04: Develop Districtwide Traffic Operations Performance Measures
PM-05: Regularly Review Severe Crash Data and Develop Mitigation Strategy
CULTURE
CU-01: Develop Joint TIM Traffic Control Procedures with Law Enforcement
CU-02: Conduct Regular Work Zone Management Practice Reviews
CU-03: Continue Investments in Safe Driving Public Education
ORGANIZATION & WORKFORCE
OW-01: Establish Regional Multidisciplinary TIM Training
OW-02: Establish Staff Roles for Remote Signal Monitoring
OW-03: Enhance Camera Monitoring Capabilities and Staff Roles
COLLABORATION
CO-01: Formalize a Regional TIM Working Group
CO-02: Standardize TIM Communication Protocol
CO-03: Share Detailed Incident Information with Neighboring State DOTs
CO-04: Standardize Communicating Work Zone Information to Local Partners
CO-05: Establish Early Involvement of First Responders in the Construction Planning Process
CO-06: Formalize a Process for Sharing Work Zone Notices Between States
CO-07: Develop Signal Corridor Management Strategies with Partner Agencies
CO-08: Maintain a Formal List of Partner Contact Information
CO-09: Pursue Regional Traffic Camera Sharing Agreements
CO-10: Improve Collaboration with Local Agencies for Safety Funding Programs

Source: TxDOT Atlanta District TSMO Program Plan, 2021

Insights for NWARPC

The Atlanta District of TxDOT shares many similarities to the area overseen by the NWARPC. As such, there are many elements and lessons learned from the TSMO Program Plan that would be beneficial in guiding and informing a similar plan for the NWARPC.

Coordination between Regional and Statewide TSMO Plans

The TxDOT TSMO Statewide Strategic Plan and the TxDOT District TSMO Program Plans exemplify coordination and connection between statewide and regional strategies/actions. The statewide plan sets overall direction and strategy, and the district plan tailor this to their unique needs, while maintaining and clear connection and consistency between the two. This is seen especially in TxDOT's approach to setting mission, vision, goals, and objectives – as well as the overall consistent structure of the TSMO program plans. While the NWARPC and ARDOT plans are not part of as large of a planning efforts as TxDOT's statewide effort, there are valuable insights here and opportunities to set a model for the remainder of Arkansas:

- The Atlanta District and statewide plans are working towards a coordinated set of strategic goals that complement one another, helping leverage state and regional resources to meet shared goals.
- The statewide plan specifies expectations for statewide vs. District roles and responsibilities, helping both entities focus on their role in advancing TSMO. This allows the District to identify regional actions that leverage statewide efforts.
- TxDOT set a model for its District TSMO Program Plans, something that the NWARPC has the potential to be for other regional TSMO plans in Arkansas.

Breaking Concepts Down

The flow of Atlanta District's TSMO plan was such so that there was a clear flow from introducing the concepts involved in TSMO, to breaking down need within the district, to developing specific strategies and implementation steps. The one-page action sheets in the back half of the report do an excellent job at giving a holistic picture of a strategy that makes it seem manageable and achievable.

When developing a plan, one should keep the reader in mind to ensure that the ideas being laid out are easy to follow along with. A lot of TSMO concepts are high level and while it's important to communicate the ultimate goals and benefits that TSMO can bring, the context of the agency itself and its current practices must be the guide that helps ensure that any goals laid out are able to realistically be met.

Communication

The Atlanta District not only contains many individual localities, but also borders several other jurisdictions in and outside the state. This poses a unique set of problems where it's easy to not hear or be heard by those the district needs to work with. The TSMO Program Plan strongly emphasizes the need for clear and open communication between all its stakeholders.

As NWARPC contains many cities of significant size within close proximity to each other, it will be important to find opportunities within the TSMO program plan to institutionalize free communication and collaboration between agencies. Promoting these values will increase the efficiency of TSMO strategies across the entire region.

APPENDIX C. TSMO RESOURCES

National Operations Center of Excellence (NoCOE) Resources

The following table summarizes select TSMO resources available from the National Operations Center of Excellence (NOCoE). More TSMO resources can be found at the NOCoE website: https://transportationops.org/

Title	Date	Summary
Workforce Training Database https://transportationops.org/training	2022	This webpage within the NOCoE site provides a comprehensive and searchable database of TSMO industry trainings and courses.
NOCoE Case Studies https://www.transportationops.org/nocoe-case-studies	various	NOCoE Case Studies capture the strategies and practices currently being deployed to advance the TSMO industry. Case studies are developed in partnership with the authoring organization.

U.S. Department of Transportation / Federal Highway Administration Resources

The following table summarizes TSMO resources available from the U.S Department of Transportation (USDOT)/the Federal Highway Administration (FHWA). More TSMO resources can be found at the following USDOT/FHWA webpages:

- FHWA Office of Operations: https://ops.fhwa.dot.gov/
- FHWA Office of Operations "What is TSMO" website: https://ops.fhwa.dot.gov/tsmo/index.htm
- USDOT ITS Joint Program office (JPO): https://www.its.dot.gov/

Title	Date	Summary
Advancing TSMO: Making the Business Case for Institutional, Organizational, and Procedural Changes (FHWA-HOP-19-017) *Available at: https://ops.fhwa.dot.gov/publications/publications.htm; search by title or publication number (FHWA-HOP-19-017)*	January 2019	This primer provides guidance and a framework to help transportation agencies make an effective business case for the benefits of implementing institutional, organizational, and procedural changes to support and advance TSMO.
Communicating with Other Programs TSMO Factsheets https://ops.fhwa.dot.gov/plan4ops/focus_areas/integrating/tsmo_factsheets.htm	various	Fact Sheets were developed to explain how TSMO relates to asset management, construction, design, environment, human resources, maintenance, performance management, planning, and safety.
Transportation Systems Management and Operations in Smart Connected Communities (FHWA-HOP-19-004) *Available at:* *https://ops.fhwa.dot.gov/publications/fhwahop19004/fhwahop19004.pdf*	December 2018	This primer describes the key characteristics of smart, connected communities and how they can benefit from closer collaboration with TSMO and how TSMO can benefit from these collaborations.
Organizing for TSMO – 2020 Peer Exchange Report (FHWA-HOP-20-046) *Available at:*	December 2020	This report summarizes the findings of a peer exchange that brought together transportation agencies to discuss challenges, best practices, and lessons

https://ops.fhwa.dot.gov/publications/fhwahop20046/index.htm		learned related to advancing organizational capabilities for TSMO.
Model Transportation Systems Management and Operations Deployments in Corridors and Subareas Primer (FHWA-HOP-18-026) *Available at:* *https://ops.fhwa.dot.gov/publications/fhwahop18026/fhwahop18026.pdf*	February 2018	This primer showcases six illustrative packages of TSMO strategy deployments with varied geographic, social, and institutional contexts to serve as examples for advancing TSMO.
Mainstreaming TSMO: Examples of Integrating TSMO Across a Transportation (FHWA-HOP-21-041) Agency *Available at:* *https://ops.fhwa.dot.gov/publications/fhwahop21041/index.htm*	October 2017	The infographic provided in this resource presents examples of how TSMO can be integrated into various agency functions.
Planning for Transportation Systems Management and Operations within Subareas - A Desk Reference (FHWA-HOP-16-074) *Available at:* *https://ops.fhwa.dot.gov/publications/fhwahop16074/index.htm*	October 2016	This desk reference is designed to equip State, regional, and local transportation operations and planning professionals with the knowledge and tools necessary to effectively plan for and implement TSMO within a subarea context.

American Association of State Highway and Transportation Officials (AASHTO) Committee on Transportation System Operations (CTSO) Resources

Resources from the AASHTO CTSO can be found on the subcommittee's webpage:

- https://systemoperations.transportation.org/

Transportation research Board (TRB) National Cooperative Highway Research Program (NCHRP) Resources

The following table summarizes TSMO resources available from the Transportation Research Board (TRB) National Cooperative Highway Research Program (NCHRP). More TSMO resources can be found at the NCHRP webpage: http://www.trb.org/NCHRP/NCHRP.aspx.

Title	Date	Summary
Transportation Systems Management and Operations (TSMO) Workforce Guidebook (NCHRP 20-07 Task 408) *Available at:* *https://transportationops.org/sites/transops/files/TSMO%20Workforce%20Guidebook%20NCHRP.pdf*	March 2019	This report presents the results of research for training, hiring, developing, and retaining a workforce needed for a successful TSMO program.
Transportation Operations Manual NCHRP 03-126 *Available soon*	Not yet published Expected in 2023	The Transportation Operations Manual (TOM) will serve as an authoritative guide for transportation systems management and operations (TSMO). The manual takes a holistic view of the operation and management of the transportation system, both in urban and rural settings and for people and goods. The primary audiences will be staff at state, regional, and local transportation agencies.

		The manual describes a broad array of TSMO related subject areas and offers effective practices and guidance in each. The topics are generally covered in depth in other disparate documents and those documents are referenced widely in the manual.

Adapted from MDOT TSMO Implementation and Strategic Plan, 2023


NWA
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Planning
Commission