Organizing for TSMO

Case Study 11: Metropolitan Planning Organization Examples

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16. Abstract Given the varying stages of TSMO adoption and advancement, the Federal Highway Administration identified the need for case studies to provide examples of common challenges and best practices for transportation agencies to learn from each other. This is one of 12 case studies developed to support organizing for TSMO. This case study focuses on how metropolitan planning organizations are using and advancing TSMO capabilities in their agencies. Three agencies that worked to advance TSMO in their regions were interviewed: North Central Texas Council of Governments (NCTCOG), Maricopa Association of Governments (MAG), and Atlanta Regional Commission (ARC). Each agency provided information on the processes they developed to advance TSMO capabilities and maturity.			
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List of Abbreviations and Acronyms

AASHTO .....American Association of State Highway and Transportation Officials
ARC ..... Atlanta Regional Commission
CMM..... Capability Maturity Model
CMP ..... Congestion Management Process
DPS .....Department of Public Safety
FHWA.....Federal Highway Administration
ITS..... Intelligent Transportation Systems
MAG ..... Maricopa Association of Governments
MPO.....Metropolitan Planning Organization
NCTCOG ..... North Central Texas Council of Governments
SHRP2..... Strategic Highway Research Program 2
TIP.....Transportation Improvement Program
TMC ..... Traffic Management Center
TRB.....Transportation Research Board
TSMO ..... Transportation Systems Management and Operations

EXECUTIVE SUMMARY

Transportation systems management and operations (TSMO) provides tools for transportation managers to address safety, system performance, and reliability. 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.[1]" Through participation in the second Strategic Highway Research Program (SHRP2) workshops, transportation agencies are working to better support TSMO programs. Deploying intelligent transportation systems (ITS), hiring internal information technology staff, and using performance measures for data-driven decisions are just a few examples of the many activities a TSMO program can support.

Given the varying stages of TSMO adoption and advancement, the Federal Highway Administration identified the need for case studies to provide examples of common challenges and best practices for transportation agencies to learn from each other. This is one of 12 case studies developed to support organizing for TSMO. This case study focuses on how metropolitan planning organizations are using and advancing TSMO capabilities in their agencies.

Three agencies that worked to advance TSMO in their regions were interviewed: North Central Texas Council of Governments (NCTCOG), Maricopa Association of Governments (MAG), and Atlanta Regional Commission (ARC). Each agency provided information on the processes they developed to advance TSMO capabilities and maturity. Some of the best practices identified include:

- NCTCOG's established TSMO policies to improve regional TSMO culture and project selection criteria.
- NCTCOG's use of before and after studies such as identifying performance values for signalized intersections and pilot mobility projects.
- MAG's dedication to collaboration through stakeholder meetings and frequent internal communications.
- MAG's unique approach to TSMO planning using available funding mechanisms.
- ARC's incorporation of TSMO into thoroughfare planning through the establishment of process-based selection criteria and desired performance measures.

[1] Source: https://ops.fhwa.dot.gov/tsmo/index.htm

CHAPTER 1 – INTRODUCTION

Historically, transportation agencies have managed congestion primarily by funding major capital projects that focused on adding capacity to address physical constraints such as bottlenecks. Operational improvements were typically an afterthought and considered after the new infrastructure was already added to the system. Given the changing transportation landscape that includes increased customer expectations, a better understanding of the sources of congestion, and constraints in resources, alternative approaches were needed. Transportation systems management and operations (TSMO) provides such an approach to overcome these challenges and address a broader range of congestion issues to improve overall system performance. With agencies needing to stretch transportation funding further and demand for reliable travel increasing, TSMO activities can help agencies maximize the use of available capacity and implement solutions with a high benefit-cost ratio. This approach supports agencies' abilities to address changing system demands and be flexible for a wide range of conditions.

Effective TSMO efforts require full integration within a transportation agency and should be supported by partner agencies. This can be achieved by identifying opportunities for improving processes, instituting data-driven decision-making, establishing proactive collaboration, and developing actionable activities to develop processes that optimize performance.

Through the second Strategic Highway Research Program (SHRP2), a national partnership between the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board, (TRB), a self-assessment framework was developed based on a model from the software industry. The SHRP2 program developed a framework for agencies to assess their critical processes and institutional arrangements through a capability maturity model (CMM). CMM uses six dimensions of capability to allow agencies to self-assess their implementation of TSMO principles [1]:

1. Business processes – planning, programming, and budgeting.
2. Systems and technology – systems engineering, systems architecture standards, interoperability, and standardization.
3. Performance measurement – measures definition, data acquisition, and utilization.
4. Culture – technical understanding, leadership, outreach, and program authority.
5. Organization and workforce – programmatic status, organizational structure, staff development, recruitment, and retention.
6. Collaboration – relationships with public safety agencies, local governments, metropolitan planning organizations (MPO), and the private sector.

Within each capability dimension, there are four levels of maturity (performed, managed, integrated, and optimized), as shown in Figure 1. An agency uses the CMM self-assessment to

[1] FHWA, Office of Operations, "Organizing for Reliability – Capability Maturity Model Assessment and Implementation Plans Executive Summary," May 2015. https://ops.fhwa.dot.gov/docs/cmmexesum/sec1.htm

identify their level of maturity in each dimension, to determine their strengths and weaknesses, and to determine actions they can take to improve their capabilities.

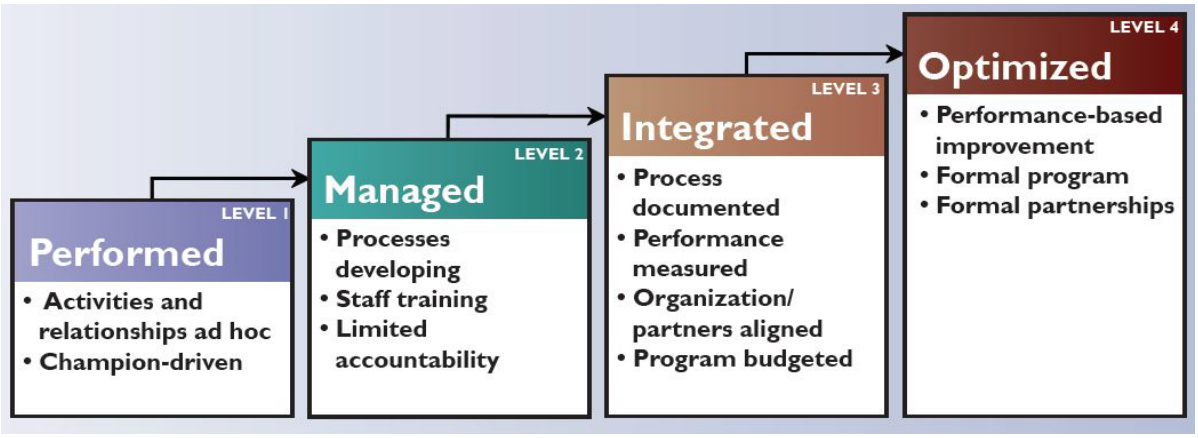

Figure 1. Chart. Four Levels of Maturity
Source: Creating an Effective Program to Advance Transportation System Management and Operations, FHWA Jan 2012

Purpose of Case Studies

In the first 10 years of implementation of the TSMO CMM, more than 50 States and regions used the tool to assess and improve their TSMO capabilities. With the many benefits experienced by these agencies, FHWA developed a series of case studies to showcase leading practices to assist other transportation professionals in advancing and mainstreaming TSMO into their agencies. The purposes of the case studies are to:

- Communicate the value of changing the culture and standard practices towards TSMO to stakeholders and decision-makers.
- Provide examples of best practices and lessons learned by other State and local agencies during their adoption, implementation, and mainstreaming of TSMO.

These case studies support transportation agencies by showing a wide range of challenges, opportunities, and results to provide proof for the potential benefits of implementing TSMO. Each case study was identified to address challenges faced by TSMO professionals when implementing new or expanding existing practices in the agency and to provide lessons learned.

Identified Topics of Importance

This case study provides a holistic perspective of successful TSMO programs at MPOs. Highlighting all aspects of specific MPOs is important because MPOs play a critical role in regional planning. Agencies highlighted for this case study addressed those challenges through integrating TSMO-based planning with existing planning processes.

Interviews

Agencies were selected for each case study based on prior research indicating that the agency was excelling in particular TSMO capabilities. Care was taken to include a diversity of

geographical locations and agency types (departments of transportation, cities, and MPOs) to develop case studies that other agencies could easily relate to and learn from. Interviews were conducted with selected agencies to collect information on the topic for each case study.

Description of Metropolitan Planning Organizations

MPOs support planning activities for regions of metropolitan areas including development of transportation improvement programs to be included in statewide efforts. This affords a strong understanding of long-range plans for specific regions that can help provide guidance and direction for a TSMO program. Each agency will have a unique approach to TSMO; however, in general, MPOs can play a leading role in the following capacities:

- **Strategic Direction** – With experience developing long-range plans, MPOs understand the goals of specific regions, which can provide valuable insight for the strategic direction of a TSMO program. MPOs can help ensure that TSMO program objectives are consistent with existing objectives for both the MPO and other local jurisdictions.
- **Safety and Mobility Strategies** – MPOs can plan for safety and mobility strategies for a region and incorporate strategies into planning documents and programs. This will help ensure that strategies are implemented.
- **Funding** – MPOs can guide funding decisions for strategies and programs to improve TSMO capabilities. With knowledge of long-term investment plans, MPOs can help identify funding priorities and provide input on where TSMO activities could support existing plans to improve funding potential.
- **Collaboration with Stakeholders** – The regional focus of MPOs results in a close relationship with local agencies and multimodal agencies. MPOs can facilitate communication and collaboration with stakeholders to ensure that everyone is working towards the same goals. They can also use the long-range planning activities to share information and provide education on TSMO program objectives.

CHAPTER 2 – BEST PRACTICE EXAMPLES

The North Central Texas Council of Governments (NCTCOG), Maricopa Association of Governments (MAG), and the Atlanta Regional Commission (ARC) participated in the second Strategic Highway Research Program (SHRP2) workshops to complete capability maturity model (CMM) assessments. The workshop assessments helped guide them to implement transportation systems management and operations (TSMO) in their agencies. This section highlights several successful initiatives each agency accomplished.

North Central Texas Council of Governments (NCTCOG)

NCTCOG works with the Regional Transportation Council to make up the metropolitan planning organization (MPO) for the greater Dallas-Fort Worth region. Areas served include Dallas-Fort Worth-Arlington, Denton-Lewisville, and McKinney urbanized areas and surroundings. NCTCOG works closely with regional, State, and federal partners to plan and recommend transportation projects that will improve mobility and encourage more efficient land use. Major products produced by NCTCOG include a long-range Metropolitan Transportation Plan, a shorter-term Transportation Improvement Program (TIP), a Congestion Management Process (CMP), and a Unified Planning Work Program.[1]

Incorporating TSMO into the Planning Process

Over the past few years, NCTCOG has focused largely on incorporating TSMO and transportation demand management into existing planning processes. The 2013 update to NCTCOG's CMP seeks a management solution to increased transportation challenges by integrating a TSMO approach into planning activities. NCTCOG collaborated with stakeholders to identify strategic business processes such as regional transportation objectives. They developed a programmatic process to evaluate facilities that either lack coverage or have deficiencies based on desired performance values. The MPO, along with regional partner agencies, developed a list of TSMO strategies that could be implemented to address facility deficiencies. Each identified strategy is associated with a type of project and is listed in table format to be used as a resource for future transportation projects. Figure 2 provides an excerpt from this table. Compliance with CMP goals and objectives is a prerequisite for projects funded through the TIP.

[1] https://www.nctcog.org/trans/about , 9/18/2018.

TDM and TSMO Strategies	Associated Projects	Alternative Roadway Infrastructure (Services)	Modal Options (Services)	System Demand (Recurring)	System Reliability (Non-Recurring)
Commuter Transportation Options	Bicycle Sharing/Leasing Services	✗	✓	✓	✓
	Bike/Transit System Integration	✗	✓	✓	✓
	Carsharing/Ride Leasing/Station Car	✗	✓	✓	✓
	Commute Trip Reduction Programs (Aggressive marketing of biking, walking, transit, ridesharing, alternative work schedules, telecommuting, Transportation Management Associations (TMA), etc.)	✗	✓	✓	✓
	Park-and-Ride Facilities	✗	✓	✓	✓
	Ridesharing and Ridematching Services – Carpooling and Vanpooling	✗	✓	✓	✓
	Shuttle and Taxi Services	✗	✓	✓	✗
	Transit	✗	✓	✓	✓

Figure 2. Chart. Excerpt from NCTCOG's CMP Appendix A

Source: https://www.nctcog.org/nctcg/media/Transportation/DocsMaps/Manage/CMP/CMP-2013-Appendix-A-TDM-and-TSMO-Strategies.pdf

A similar process is followed for long-range planning efforts. Operational efficiency is a key element of the region's "Mobility 2045" planning document. This long-range plan notes that TSMO strategies are critical to addressing the growing transportation demand of the region. TSMO policies have been established to ensure management and operations are considered on every project. The plan provides strategic and programmatic business processes such as goals, implementation measures, and performance values for regional operations and management programs such as the Employer Trip Reduction Program, Regional Vanpool Program, and Park and Ride facilities.

Including TSMO in the planning process has helped the agency use resources more efficiently. Through TSMO activities, they can identify if transportation challenges will be mitigated through less traditional and less costly mobility improvements. The MPO worked closely with regional partners to integrate TSMO into their planning process. They noted that stakeholder collaboration was critical to their success.

Using Performance Measures to Identify Success

Defining and utilizing performance measures is a key component of NCTCOG's TSMO initiative. Planning documents such as the CMP, Transportation Improvement Program, and the long-range transportation plan all use performance measures to assist with project prioritization. Performance measures for project prioritization refer to both traffic and operational asset

conditions. The MPO looks at existing operational assets such as signal controllers and intelligent transportation systems (ITS) devices and evaluates life expectancy and interoperability. Considering both traffic and operational asset performance measures enables the agency to optimize project prioritization by evaluating the impact of implementation against desired facility performance.

Additionally, NCTCOG implemented performance measures based on before and after studies on projects. An analysis was completed to evaluate performance metrics of travel time, number of stops, and emission output before and after retiming of over 1,000 traffic signals as part of an effort to maximize capacity in the Traffic Signal Retiming Program of 2016. The agency noted improvements in all categories through this operational approach.[2] NCTCOG also conducts before and after studies when implementing pilot projects. For example, a pilot project allowing peak-period use of shoulder lanes on a State highway in the region was implemented with studies to explore potential improvements to corridor speeds, congestion, and safety. These performance-based before and after studies enable the agency to identify mobility solutions that work for the region. The studies also help to make the business case for TSMO to local policy makers.

NCTCOG's next step in progressing performance measures is to research the current state of performance measure usage in the region. The agency plans to conduct outreach to determine what metrics stakeholders currently track. The MPO plans to collaborate with their partner agencies to develop a regional performance measure standard through identifying opportunities for tracking additional metrics using assets currently deployed.

Maricopa Association of Governments (MAG)

MAG serves as the Maricopa County regional air quality planning agency and MPO for transportation. This includes the Phoenix area and the neighboring urbanized area in Pinal County, containing the Town of Florence and City of Maricopa. MAG provides regional planning and policy decisions in areas of transportation, air quality, water quality, and human services. MAG was formed in 1967 when local elected officials recognized the need for long range planning and policy development on a regional scale. They realized that many issues such as transportation and air quality affected residents beyond the borders of their individual jurisdictions.[3]

Using Collaboration as a Tool

During development of MAG's Systems Management and Operations Plan, the MPO undertook an 18-month study with regional partners. They held working group meetings every month over the duration of development that included local agency staff representing the MAG ITS Committee and Technical Advisory Group members. This collaboration enabled the agency to create a plan that identified TSMO strategies to address the needs of the entire region.

[2] https://resources.nctcog.org/trans/tsm/
[3] http://azmag.gov/About-Us/About-MAG

MAG frequently collaborates with many local agencies. Because of this ongoing collaboration, the MPO is very familiar with challenges that every regional stakeholder experiences and can provide recommendations to help optimize transportation operations, such as providing fiber backbones for regional ITS use, training for ITS applications, deploying projects and programs, and making other recommendations for improvement.

In particular, a pilot project between MAG, the Arizona Department of Transportation, the Department of Public Safety (DPS), and other local partners aimed to improve both safety and mobility in the region using a collaborative TSMO strategy. DPS staff were co-located in a regional traffic management center and utilized traffic incident management concepts to improve conditions on the regional transportation network. The results from the pilot found that response time, roadway clearance time, incident clearance time, and incident duration all improved with a benefit cost ratio of 258:1.

MAG's continual collaboration in plan development and projects has helped the agency make the business case for TSMO to regional policy boards. The success of the co-location pilot project mobilized an improved cultural shift towards using more management and operations strategies on the transportation network.

Investing in TSMO

MAG's Systems Management and Operations Plan was released in 2018. Their approach to developing strategic and tactical business processes for this plan is uniquely driven by financial considerations. For strategic business processes, TSMO objectives are presented as four key investment priorities, as shown in Figure 3.

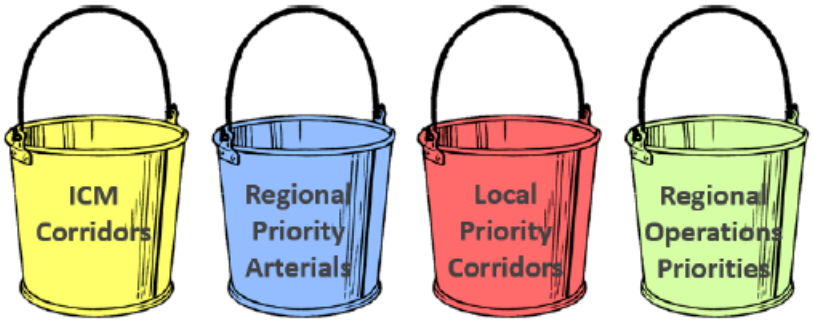

Figure 3. Illustration. MAG Key Investment Priorities
Source: MAG Systems Management and Operations Plan, July 2018.

Tactical strategies were developed for each of the key investment priorities as follows:

Integrated Corridor Management Corridors

- Ramp metering.
- Real-time closed-circuit television monitoring at intersections with arterials.
- Actuated detection for vehicles and pedestrians to support operations and real-time collection of data, including turning movements.

- Static detour wayfinding.
- Wrong-way detection.
- Documented Integrated Corridor Management Plans to include detour routes, preset signal timing plan scenarios, agency coordination, and notification processes.
- Upgrade and replace freeway management systems equipment.

Regional Priority Arterials

- Real-time visual monitoring of intersections.
- Additional detection for real-time data collection and archiving.
- Remote management of traffic operations at intersections.
- Regional asset upgrade/replace program.

Local Priority Corridors

- Invest in local priority ITS projects.

Regional Operations Priorities

- Traffic signal optimization program.
- Incident response and management.
- Freeway service patrol.
- Update Regional Archived Data Service server and data management program.
- Track performance measures of system operations using real-time and historical data.
- Acquire real-time arterial traffic data via private sector or develop a system.
- Regional connected and autonomous vehicle guide.
- Integrate transit data and systems to facilitate real-time coordination between operations agencies.
- Equipment support for after-hours traffic management center (TMC) response.
- After-hours traffic operations – 3-year pilot project.
- After-hours traffic operations – 2-year support.
- Regional qualified vendors list.

Funding constraints for transportation improvements are common throughout the industry. MAG overcomes this challenge by planning for TSMO. When developing priority strategies, MAG also determined the cost of each strategy and where the funds would come from. With this data, the strategies were divided into three phases that will be implemented over several consecutive fiscal years.

Funding constraints in the region are not just limited to facilities or assets. Another common funding challenge is availability of staff. MAG recognized the benefit that additional TMC staff have on the transportation system and is currently using systems and technology to pilot virtual TMCs in the region as part of their regional operations priorities. The after-hours traffic operations pilot project will provide constant TMC surveillance without the cost incurred to staff the TMC at all times.

Using CMM dimensions, such as business processes and systems and technology, MAG has set the stage to fully implement and fund TSMO strategies in the region. The MPO noted that implementation of any TSMO strategy requires frequent stakeholder collaboration. The input and assistance provided by partner agencies was extremely valuable during MAG's TSMO plan development.

Atlanta Regional Commission (ARC)

ARC is the regional planning and intergovernmental coordination agency for the 20-county Atlanta region. "Some counties are considered within all elements of ARC's work, while others are only involved in one aspect." Further, "ARC coordinates planning efforts across the Region in many areas such as aging, community services, environmental planning, governmental services, job training, land use, and public facilities as well as transportation planning.[4]" Since 1947, ARC and its predecessor agencies have helped focus the region's leadership, attention, and resources on critical issues. The agency serves as a regional facilitator, bringing diverse stakeholders to the table to address the most important issues facing metro Atlanta.[5]

Addressing Thoroughfare Challenges with TSMO

In 2011, ARC developed their Strategic Regional Thoroughfare Plan and identified strategic arterial corridors for improvements using a performance-based selection process. Both a quantitative and qualitative analysis was used to identify the thoroughfare (road network). This network excludes freeways and any limited access facilities to spotlight the most significant arterials and collectors. Furthermore, the Regional Thoroughfare Network is identified as the CMP-monitoring network (in addition to the instrumented freeway network, supported by the NAVIGaTOR freeway ATMS). Quantitatively, the MPO used systems and technology concepts to efficiently use data. ARC uses data in many aspects of TSMO planning. In developing the Strategic Regional Thoroughfare Plan, data collected on regional roadways was used for corridor identification and prioritization. Travel time and speed data was collected from the roadway network and ARC used this data to develop a linear reference system that enabled the agency to also gather crash data and traffic volumes. Qualitatively, the MPO identified which corridors needed improved pedestrian access, transit options, and other multi-modal components.

Once critical corridors were identified, each thoroughfare was classified on land use, multi-modal capabilities, freight considerations, and traffic conditions, both current and forecasted. The classification process allowed ARC to develop congestion management and desirable adjacent land use strategies for different thoroughfares. For example, some corridors are affected by both mobility and accessibility challenges. Needs, priority, and strategies were established once corridors were classified. This list of prioritized corridors is the backbone of the thoroughfare plan and influences planning decisions in the region.

Through development of the selection process, the MPO discovered the importance of using quantitative, qualitative, and transparent criteria when applying TSMO processes to program

[4] http://documents.atlantaregional.com/The-Atlanta-Region-s-Plan/rtp/introduction.pdf
[5] https://atlantaregional.org/about-arc/

development. As the MPO moves towards implementation of the plan, they noted that identifying funding sources early in development would mitigate some of the challenges they currently face.

CHAPTER 3 – SUMMARY

Metropolitan planning organizations (MPO) can help ensure that the objectives of local transportation systems management and operations (TSMO) programs are consistent with existing regional objectives. In many cases, the MPO will lead the effort to develop a TSMO plan for the region. MPOs highlighted in this case study have taken varying approaches to implement TSMO in regional planning initiatives. Lessons learned while developing TSMO plans for their regions include:

- Integration of TSMO into the planning process enables agencies to use resources more efficiently. Through TSMO activities, they can identify if transportation challenges might be mitigated through innovative and less costly mobility improvements.
- Aligning TSMO objectives with regional transportation objectives enhances the overall planning process by looking at transportation challenges holistically.
- Considering funding early in TSMO program planning is critical to ensure that regional TSMO goals can be met. TSMO plans must have financial backing to promote overall program strategies and objectives.
- Collaboration with stakeholders ensures that the needs of all local partners are considered during TSMO program development. Frequent communication and collaboration with stakeholders facilitates improved TSMO culture in the region.

MPOs can play a critical role in developing and implementing TSMO programs across regions through revising existing planning processes and documentation. The lessons learned in this case study can be used by other planning organizations to advance TSMO in other regions.

REFERENCES

Information for use in this case study was gathered from sources noted throughout the report together with the following web sites:

- FHWA's What is Transportation Systems Management and Operations (TSMO)?
  - https://ops.fhwa.dot.gov/tsmo/
- AASHTO's TSMO Guidance
  - http://www.aashtotsmoguidance.org/
- FHWA's Organizing and Planning for Operations
  - https://ops.fhwa.dot.gov/plan4ops/
- FHWA's Organizing for Operations Resources
  - https://ops.fhwa.dot.gov/plan4ops/focus_areas/organizing_for_op.htm
- FHWA's Organizing for Reliability – Capability Maturity Model Assessment and Implementation Plans
  - https://ops.fhwa.dot.gov/docs/cmmexesum/sec1.htm
- FHWA's Creating an Effective Program to Advance Transportation Systems Management and Operations, Primer
  - https://ops.fhwa.dot.gov/publications/fhwahop12003/index.htm
- North Central Texas Council of Governments
  - https://www.nctcog.org/
- Maricopa Association of Governments
  - http://azmag.gov/
- Atlanta Regional Commission
  - https://atlantaregional.org/

Table 1. Interview Participants and Agencies

Agency	North Central Texas Council of Governments (NCTCOG)	Maricopa Association of Governments (MAG)	Atlanta Regional Commission (ARC)
Agency Representative Name:	Natalie Bettger	Sarath Joshua	Kofi Wakhisi
Agency Representative Title:	Senior Program Manager, Congestion Management and System Operation	Senior Program Manager – Intelligent Transportation Systems and Safety	Transportation Access and Mobility Group
Agency Representative Email:	nbettger@nctcog.org	N/A	kwakhisi@atlantaregional.org
Interview Date:	July 19, 2018	July 27, 2018	July 31, 2018

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