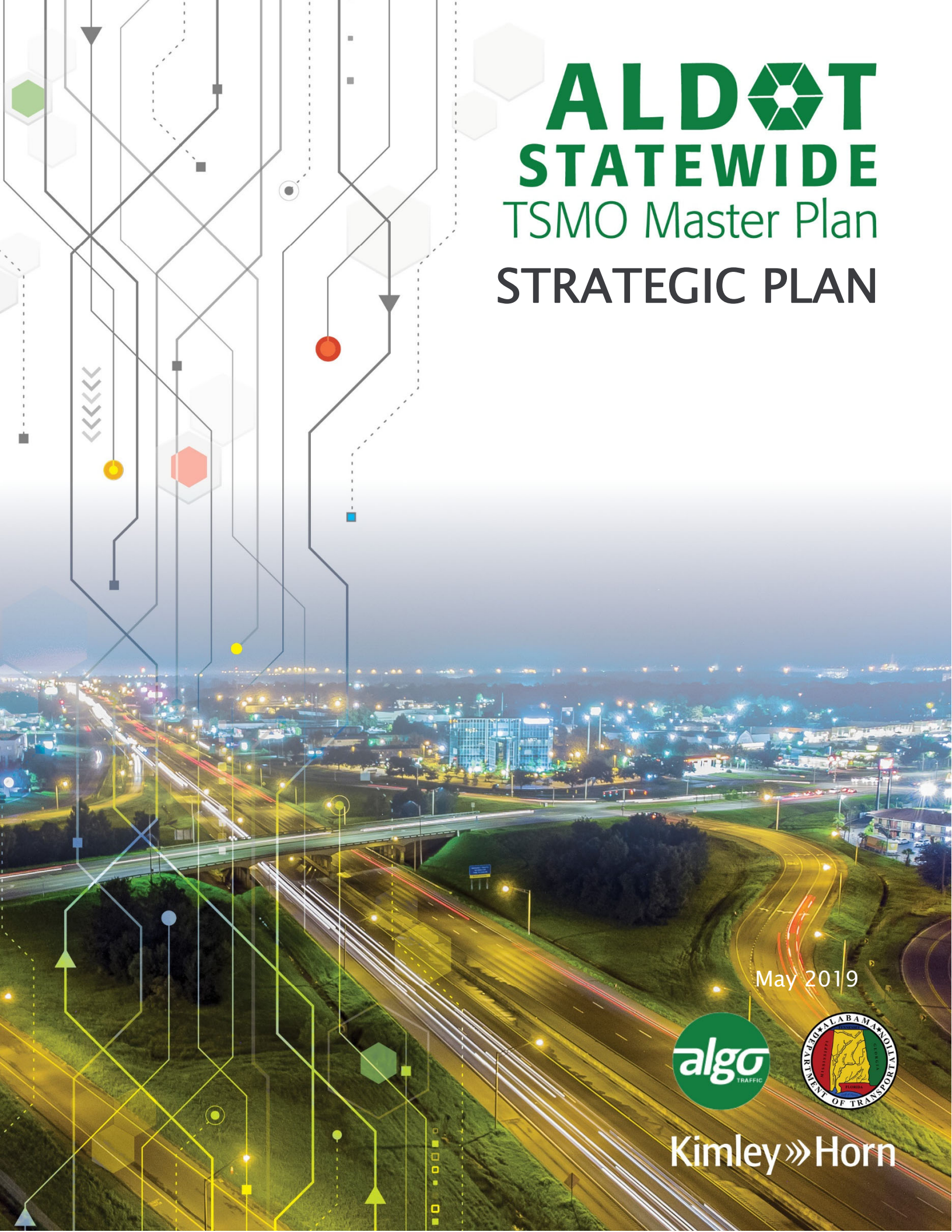
ALDOT STATEWIDE TSMO Master Plan

STRATEGIC PLAN



May 2019

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May 22, 2019

To whom it may concern:

The enclosed State TSM&O Strategic Plan and accompanying TSM&O Program Plan address the challenges associated with operating the State Highway System in Alabama. These documents illustrate the business case for TSM&O; the return on investing in operations; and the balance between conventional programs and TSM&O. The outlined strategies focus on the performance improvements that can be realized to mobility, safety, and commerce by maximizing existing highway infrastructure. TSM&O provides a data driven, performance based solution to operate a reliable transportation system.

Congestion is categorized into Recurring (40%) and Non-Recurring (60%) categories nationally. Recurring congestion typically is attributed to bottlenecks or poor traffic signal operations, while Non-Recurring congestion is typically associated with work zones, crashes, adverse weather, or special events. This program provides nine service layers to address these challenges and provide a customer centric focus to investing in the transportation system.

All DOT programs require dedicated resources to accomplish their mission. This program outlines and provides tools to establish the monetary and personnel resources needed to realize the full benefit of TSM&O. Lastly, this program compares how other states are realizing the benefits of TSM&O and setting the stage for the future of the transportation industry.

Sincerely,

Kerry C. NeSmith
Deputy State Maintenance Engineer

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1 INTRODUCTION

The Alabama Department of Transportation (ALDOT) is responsible for the management and operations of the extensive transportation system throughout the state. This includes approximately 10,900 miles of roadways, ports, freight routes, bicycle and pedestrian routes, and support to transit. ALDOT has a stated commitment as follows:

> *To provide a safe, efficient, environmentally sound intermodal transportation system for all users, especially the taxpayers of Alabama. To also facilitate economic and social development and prosperity through the efficient movement of people and goods and to facilitate intermodal connections within Alabama. ALDOT must also demand excellence in transportation and be involved in promoting adequate funding to promote and maintain Alabama's transportation infrastructure. – ALDOT Mission Statement*

This commitment to excellence has led ALDOT to the creation of a Statewide Transportation Systems Management and Operations (TSMO) Master Plan which will establish the strategies and programmatic fundamentals necessary to further develop and provide direction to the Statewide TSMO Program. The Statewide TSMO Master Plan is organized in three parts: the Strategic Plan, the Program Plan, and the Service Layer Brochures. This document is the Strategic Plan and focuses on the high-level purpose and need for TSMO as well as the vision, goals, and objectives developed through this planning process. Additional information about the assembly of the Master Plan is provided at the end of this document.

2 TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS OVERVIEW

The Moving Ahead for Progress in the 21st Century (MAP-21) Act was the first federal initiative that recognized the importance of TSMO with an enhanced definition that includes innovative strategies and coordination especially at a regional scale:

> *"Integrated strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system." (23 U.S.C. S 101(a)(30))*

The Fixing America's Surface Transportation (FAST) Act was later signed into law in December 2015 and further supports and recognizes the importance of TSMO initiatives. The FAST Act promotes an efficient and performance-based program designed to address the safety, mobility, and reliability challenges facing transportation systems and agencies across the nation. Some examples of potential outcomes of TSMO strategy implementation include: improved safety for the traveling public and first responders, full realization of the capacity of existing transportation infrastructure, increased

TSMO strategies focus on optimizing the existing transportation network to improve capacity, security, safety, and reliability.

travel time reliability for freight and motorists, improved information access for the public to assist in mobility choices, and agency readiness for adoption of innovative technology.

This legislation is supported and integrated within the transportation community through national agencies such as the American Association of State Highway and Transportation Officials (AASHTO), the U.S. Department of Transportation Federal Highway Administration (FHWA), the Institue of Transporation Engineers (ITE), and the Intelligent Transporation Society of America (ITSA). In addition, AASHTO, ITE, and ITSA, with support from FHWA, have established the National Operations Center of Excellence (NOCoE) which offers resources to serve and promote the TSMO community. Together, these leading agencies encourage and guide states in using TSMO deployment strategies, practices, and programmatic approaches to optimize the efficiency of transportation networks. Examples of available resources that are available include:

- Technical case studies and lessons learned
- Training and capacity building resources
- Best practice materials
- Peer exchanges
- Web-based TSMO evaluation guidance tool (AASHTO, http://www.aashtotsmoguidance.org/)
- *Business Case Primer: Communicating the Value of Transportation Systems Management and Operations* (TRB SHRP2 Program)

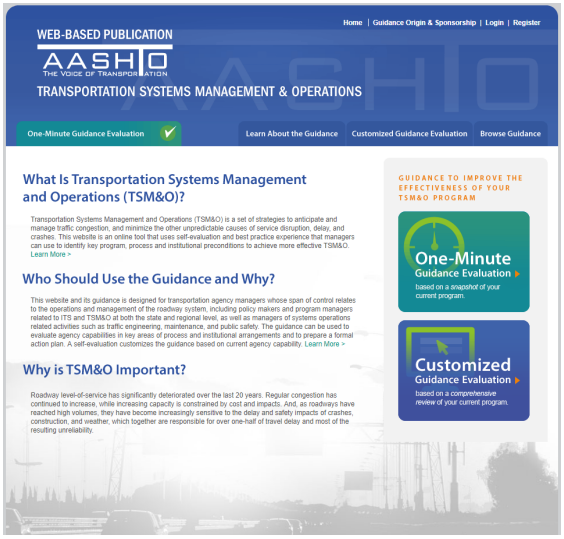

Figure 1: AASHTO TSMO Guidance (AASHTO, 2018)

The national transportation community recognizes the heightened need for a TSMO approach because of the continued increase in congestion and decreased space and funding for additional capacity. TSMO strategies leverage enhanced organizational techniques and performance measurement to promote program accountability throughout the transportation network. Examples of TSMO strategies used to improve safety, reduce congestion, and increase reliability include:

- Intelligent Transportation Systems (ITS) and Communications
- Advanced Traffic Signal Systems
- Traffic Management Centers (TMC)
- Real-time Traveler Information
- Traffic Incident Management (TIM)
- Emergency Transportation Operations
- Work Zone Management (WZM)
- Asset Management
- Road Weather Management
- Management and Operations Software Systems, including Decision Support Systems
- Performance Measures
- Special Event Management
- Emergency Management
- Connected/Automated Vehicles (CAV)
- Collaborative Business Practices
- Smart Cities

These strategies allow for more efficient, effective management and operations of transportation networks—this approach requires a cultural shift within most departments where the standard practice has been to plan, design, and construct roadways with only general maintenance requirements upon completion. A TSMO approach requires continued management and operations following implementation including improved communication, collaboration, and efficient use of resources among transportation partners. While TSMO strategies can address all modes of transportation, the focus for this plan has primarily been on vehicular and freight movements because the relative volume of these movements compared to that of pedestrian movements seemingly corresponds to a higher potential for positive impact. However, a mindset of actively seeking optimized efficiency in all modes of transportation is critical to the long-term success of the Department, and ALDOT is committed to integrating TSMO programming and practices as a way to increase safety, mobility, and reliability with efficacy and efficiency.

3 THE BUSINESS CASE FOR TSMO

Alabama has more than 102,000 miles of roadway in the state as identified by FHWA Highway Statistics and ALDOT's Highway Performance Monitoring System (HPMS) (Table 1); out of which 10,900 centerline roadway miles are maintained by the State (FHWA, 2018) (ALDOT, 2017).

	ROADWAY FUNCTIONAL CLASSIFICATION		
FUNCTIONAL CLASSIFICATION	All Roads (Miles)	ALDOT Maintained Network (Miles)	Percent of All Miles on ALDOT Network
Interstate	1,000.74	1,000.74	100%
Principal Arterial-Other Freeways and Expressways	30.15	30.15	100.0%
Principal Arterial-Other	3,319.37	3,177.98	95.7%
Minor Arterial	6,334.47	4,613.78	72.84%
Major Collector	15,855.20	2,048.15	12.92%
Minor Collector	6,820.44	31.64	0.46%
Local	68,657.20	1.01	0.0%
TOTAL	102,016.97	10,902.64	10.69%

Table 1: Alabama Public Roadway Functional Classification (FHWA, 2018)

While roadways maintained by ALDOT consist of only 10% of the total centerline miles in Alabama, the state-maintained roads carry significantly more traffic and freight than local roads and represent the critical connections between communities—what happens on these roads substantially impacts the quality of life for Alabamians throughout the state.

3.1 SAFETY AND MOBILITY CONCERNS

Safety and mobility are independently necessary concerns within any transportation system, however, the inherent relationship between safety and mobility places added importance and complexity to isolating and solving these concerns. Alabamians experience a variety of safety and mobility challenges every day—from an increased commute time due to a fender bender; to a road closure due to an overturned tractor trailer; to a traffic fatality.

3.1.1 Safety

Source: The Anniston Star

Traffic incidents such as stalled vehicles, major and minor crashes, and spilled freight loads account for one-fourth of all delays on the highway system in Alabama (ALDOT, 2018). Each minute a lane is blocked can lead to four minutes of delay which can mean a 30-minute lane blockage resulting in a potential two-hour distribution in traffic (FHWA, 2010) (SHRP 2, 2014). Importantly, for each minute that a primary incident continues, the likelihood of a secondary crash increases by 2.8% (FHWA, 2010). The United States Department of Transportation (USDOT) estimates that secondary crashes represent more than 20% of all crashes on freeways and 18% of fatalities on interstates (FHWA, 2010). Fewer incidents and quicker clearance of incidents help to reduce congestion, allowing the transportation system to operate more safely and efficiently.

There were 157,094 people involved in crashes in 2017 in Alabama with 15,003 non-capacitating injuries and 119,470 people involved in property damage only crashes as illustrated in Figure 2. In 2017, crashes in Alabama resulted in 860 fatalities and 6,413 incapacitating injuries (ADVANCE, 2018).

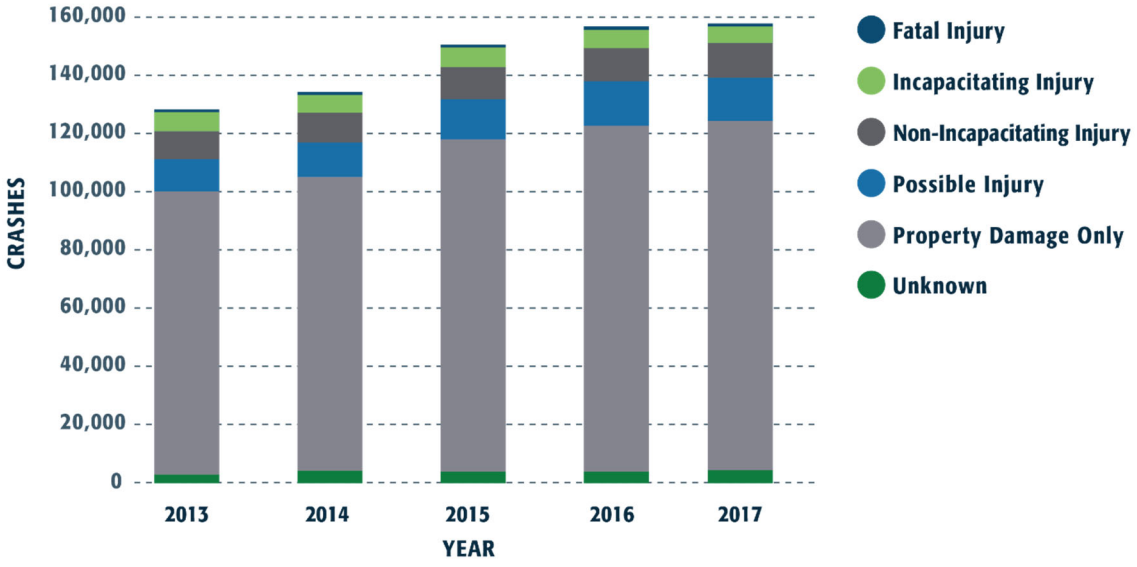

Figure 2: Alabama Crash Severity, 2013 – 2017 (ADVANCE, 2018)

In 2016, Alabama had double the national average for traffic fatalities. Alabama had 22.28 traffic fatality deaths per 100,000 population while there were 11.69 deaths per 100,000 population nationally. Alabama ranks second highest in the nation traffic fatalities per capita. Roads and highways in Alabama had a fatality rate of 1.56 fatalities per 100 million vehicle miles traveled (VMT) versus a national average of 1.19 in 2016 (BTS, 2016) (FHWA, 2018) (NHTSA, 2016). This trend is consistent, as shown in Figure 3 below.

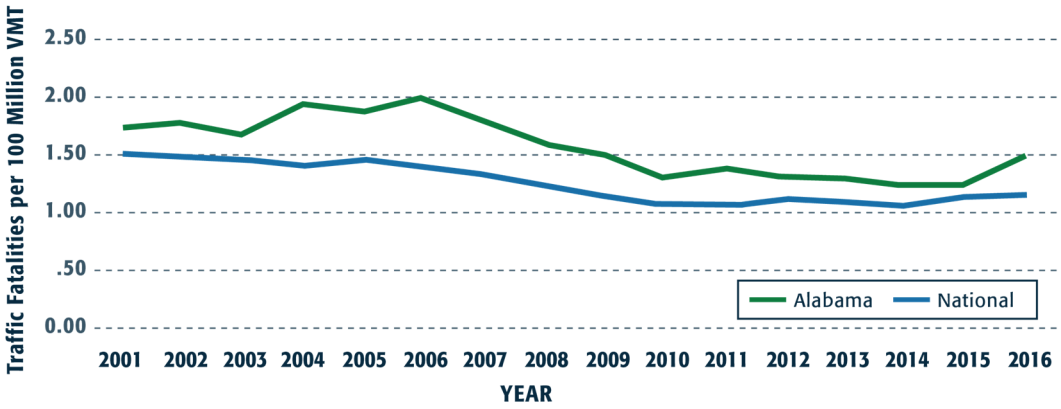

Figure 3: Alabama and National Traffic Fatalities per 100 Million VMT (2001 – 2016) (ADVANCE, 2018) (FHWA, 2018)

Crashes on Alabama roadways resulted in 860 fatalities in 2017—Alabama ranked second highest nationally for traffic fatalities per capita in 2016. Alabamians have a serious challenge.

3.1.2 Mobility and Reliability

Alabama's mobility challenges impact freight movement, commuting workers, the delivery of goods and services, and the general public. Congestion is impacted by both recurring and non-recurring events. Recurring congestion accounts for more than half of congestion nationally and typically occurs during peak travel periods due to demand exceeding capacity (FHWA, 2017). Non-recurring events account for the remaining contributors to congestion and include disruptions such as severe weather, traffic incidents, and work zones. Nationally, the three main causes of non-recurring congestion are traffic incidents (25% of total congestion), work zones (10% of total congestion), and weather (15% of total congestion) as illustrated in Figure 4 (FHWA, 2017).

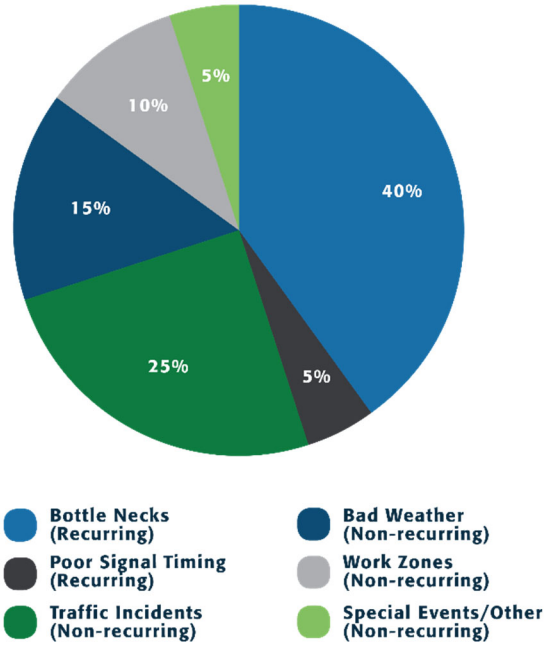

Figure 4: National Sources of Congestion *(FHWA, 2017)*

Congestion continues to increase annually as the increase in vehicle miles traveled (VMT) outpaces the growth of public road mileage (TTI, 2015). VMT in Alabama is increasing at a greater rate than public road mileage length for the state. Travel demand is outstripping the supply despite a focus on increasing capacity through infrastructure projects. In Alabama over the last sixteen years, VMT has grown 23% while public road mileage has only grown by 8%.

Birmingham, Huntsville, Mobile, and Montgomery commuters spend an average of 34, 23, 30, and 24 hours per year, stuck in traffic.

Congestion on roadways costs commuters, freight drivers, service providers, and the public time and money. In 2014, congestion cost Americans $160 billion (TTI, 2015). Studies indicate that drivers in the urban areas of Birmingham, Huntsville, Mobile, and Montgomery spend 34, 23, 30, and 24 hours per year, stuck in traffic, respectively (TTI, 2015). Nationally, congestion caused an extra 6.9 billion hours of travel in 2014 which resulted in a cost of $960 to the average commuter in 2014 (TTI, 2015).

Likewise, congestion is a significant problem for freight industry nationally and specifically, Alabama. The value of freight flow in Alabama was 386.6 billion in 2013 with 531.5 million tons of freight flow and 189.9 billion miles of freight flow (BTS, 2015). Alabama has two major water ports, Guntersville and Mobile, which includes ports ranked in the top 150 ports by tonnage in 2013 and has nine major airports (BTS, 2015). National truck operations experienced 18% (or $28 billion cost) of the congestion delay in 2014 (TTI, 2015). Not surprisingly, a goal of the 2017 Alabama Statewide Freight Plan is to reduce congestion and improve reliability on the National Multimodal Freight Network (NMFN) to improve safety and economic competitiveness (ALDOT, 2017).

In addition to the financial costs related to mobility concerns, research has shown a direct correlation between physical and mental wellbeing and congestion. Higher commute times have been linked to decreased energy, increased stress, and higher illness-related work absence. And those that experience congested driving have increased stress and frustration. Simply stated, safety and mobility have significant financial and wellness costs to the citizens of Alabama.

Congestion on roadways creates significant costs to commuters, freight drivers, service providers, and the public in the form of time, money, and wellness deterioration—Alabamians have a serious challenge.

3.1.3 Transportation Funding

As noted in ALDOT's 2017 Statewide Transportation Plan, annual revenues for transportation improvements averaged approximately $1.5 billion. In Alabama, roughly one-third of transportation revenues ($490 million) come from state sources, with the remaining two-thirds from Federal Aid, highway bonds, and other sources; gas excise and motor fuel taxes generate 70% ($341 million) of state revenues.

The Gas Excise and Motor Fuel tax makes up a considerable amount of the state's portion of transportation funds; however, Alabama is among the lowest in state gas taxes for both conventional and diesel fuels. As of July 2018, Alabama's gas tax was 20.91 cents per gallon, compared to the national average of 30.54 cents. The State has not increased the gas tax since 1992, with the most recent referendum this year not passing. However, this issue has gained momentum and is being considered during the 2019 legislative session. (Note: as of 3/12/2019, the State of Alabama legislature passed an increase in the gas tax by 10 cents per gallon by 2021).

There has been a steady decline in Motor Fuel Tax Revenues over the last two decades, made more dramatic if adjusting for inflation. While there has been a decline in revenues to support transportation infrastructure, there also have been dramatic increases in the use of this infrastructure. For example, between 1990 and 2015, the usage of Alabama's roads increased by more than 25 billion VMTs.

Low tax revenue on gas is only one part of the funding issue. Cars also are rapidly becoming more fuel efficient, decreasing the need for fuel. Beyond stagnant gas taxes in Alabama, the decreased dependence on motor fuels due to increased fuel efficiencies has decreased revenues despite increasing costs and congestion. So, at the same time we're witnessing greater usage of infrastructure while the gas tax has not increased, vehicles are becoming more efficient at how they use fuel, furthering the gap between revenue and need.

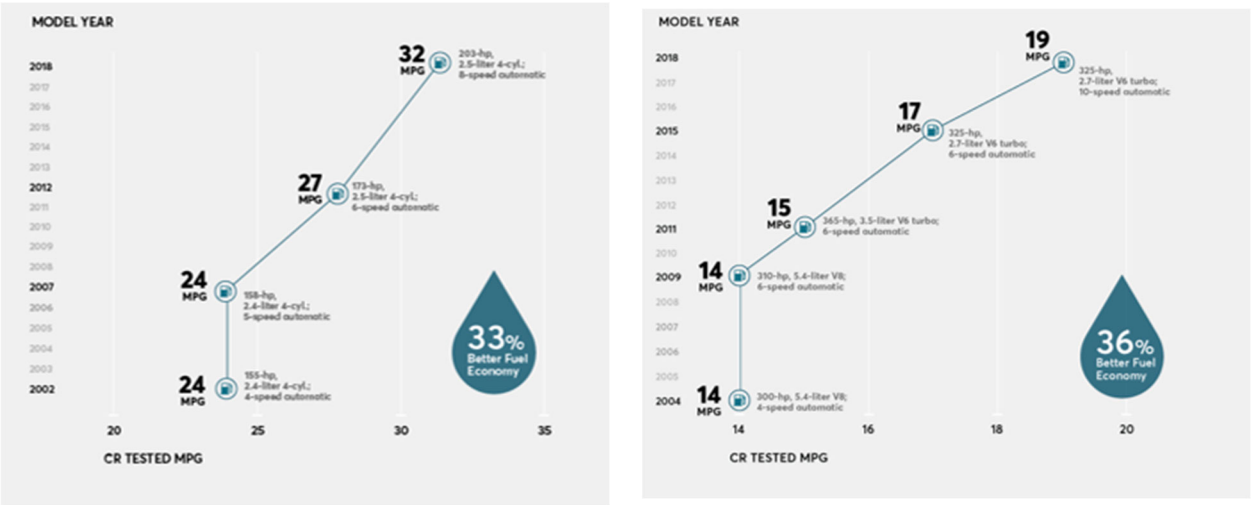

Figure 5: Toyota Camry (left) and Ford F-150 Fuel Efficiency (Plungis, 2018)

Many predictions forecast an imminent change in how DOTs approach funding transportation infrastructure improvements, with a total move away from gas taxes in as soon as a decade. A major focus in the transportation funding world now is collaboration and funding partnerships, which are some of the core components of TSMO strategies.

Alabama is dependent upon the gas tax for transportation funding. Alabama has not increased the gas tax since 1992. Vehicles are rapidly becoming more fuel efficient. Alabamians have a serious challenge.

3.2 OPPORTUNITY FOR IMPROVEMENT

Transportation agencies have historically focused on increasing roadway capacity through capital projects and ongoing infrastructure maintenance. The mindset has been to build our way out of congestion; to construct additional roads or lanes to accommodate growth. This approach is becoming more difficult as space becomes limited in the most congested areas and costs rise as funding decreases. With limited money to continue to build and maintain infrastructure, DOTs are turning to TSMO strategies to do more with less.

A TSMO approach has demonstrated fruitful return on investment (ROI) via a range of different strategies. TSMO investments offer DOTs the opportunity to realize better returns on investments than traditional roadway investment methods, such as adding more lanes. Some of the most beneficial strategies include coordinating our traffic signals and providing real-time traffic information. Table 2 provides some examples of benefit-to-cost ratios that have been demonstrated TSMO strategies.

TSMO Strategy	Benefit-to-Cost Ratio and Other Metrics
Traffic Incident Management	Incident duration reduced 30-40%
Safety Service Patrols	2:1 to 42:1
Surveillance/Detection	6:1
Traveler Information/Dynamic Message Signs	3% decreases in crashes
Road Weather Information Systems	2:1 to 10:1
Work Zone Management Systems	2:1 to 42:1
Ramp Metering Systems	15:1; up to 15% reduction in delay
Traffic Signal Optimization/Retiming	17:1 to 62:1; up to 2-3% reduction in delay
Traffic Adaptive Signal Control	Improved travel time 6-11%
Electronic Toll Systems	2:1 to 3:1
Commercial Vehicle Information Systems	3:1 to 5:1
Bus Rapid Transit	2:1 to 10:1
Transit Signal Priority	Improved travel time 2-16%
Parking Management Systems	Increase in transit mode share up to 6%
Transit Automated Vehicle Locator/Computer-aided Dispatch	AVL improves on-time bus performance 9-58% CAD improves on-time bus performance up to 9%
High Occupancy Toll Facilities	59% would pay $2 to save 20 minutes

Table 3: Impacts of Current TSMO Best Practices (US Department of Transportation, Intelligent Transportation Systems Joint Program Office, 2009)

The transportation industry has taken note of these returns; comprehensive TSMO programs are being initiated and expanded in transportation agencies throughout the nation to address increasing safety and congestion concerns in a time when financial resources continue to shrink. **TSMO programs provide significant benefits in safety and mobility of the transportation system**. The mission of DOTs is shifting from traditional capacity expansion through capital roadway widening or new location projects and infrastructure maintenance to increasing the efficiency and capacity of existing infrastructure through a focus on optimized operations. This new focus can be accomplished with a TSMO program that enables targeted use of innovative technology, agency collaboration across disciplines and jurisdictional boundaries, and focused solutions to congestions causes.

The Alabama TSMO program works to optimize the use of existing facilities, maximize performance of the system, target solutions to congestion causes, and complement capacity projects. These innovative and technology-based approaches are essential in a time when national VMT continue to increase annually resulting in higher demand, while lane miles of the nation's surface transportation system expand at a lower rate due to limited funds and geographic constraints. The Alabama Statewide TSMO Master Plan will accelerate the TSMO program, processes, and deployments.

Alabamians have a serious challenge —TSMO is a critical part of the solution.

4 TSMO MASTER PLAN DEVELOPMENT

The Alabama Department of Transportation has invested significant time, effort, and resources into developing a TSMO program and recognizes the benefits of pursuing strategies and processes supported by a TSMO approach. ALDOT completed a capability maturity model (CMM) assessment in 2018 which identified the key areas for growth. In addition, TSMO regional plans were developed which focus on region-specific TSMO recommendations and ITS project deployment recommendations.

The ALDOT Statewide TSMO Master Plan builds upon the CMM assessment and regional TSMO plans, as well as established ALDOT multi-modal plans and current initiatives, to consider and create a coordinated effort statewide to enhance transportation systems management and operations. The Plan recommends a TSMO program that supports the goals and core values of ALDOT and reflects the Alabama TSMO Program's priorities as articulated in workshops, interviews, and project management team meetings with ALDOT staff and partner organizations.

4.1 CAPABILITY MATURITY MODEL ASSESSMENT

The CMM Assessment promotes a process-driven approach to assessing and improving TSMO programs and focuses on the role of agencies and other institutions to improve the business processes and management of programs and projects. The CMM Assessment framework allows for a common understanding and improvement of institutional issues that an agency faces on a continual and consistent basis and promotes the adoption and success of TSMO programs. The CMM Assessment is a methodology developed by FHWA to assist agencies in the self-evaluation of effectiveness in six key areas:

- **Business Processes -** formal scoping, planning, programming, and budgeting
- **Collaboration -** working relationships with public and private sector agencies
- **Culture -** technical understanding, leadership, outreach, and program legal authority
- **Organization/Staffing –** programmatic status, organizational structure, and staff development, recruitment, and retention
- **Systems Technology -** use of systems engineering, architecture standards, interoperability, and standardization
- **Performance Measures -** use of performance measures including measure definition, data acquisition, and utilization (benchmarking and dashboards)

Following self-evaluation these six key areas are classified under four capability levels to determine agency strengths and weaknesses and specific actions are identified to increase capability levels across the key areas. The four capability levels range from informal activities (Level 1) to formal institutional programs (Level 4). FHWA depicts the four capability levels as shown in Figure 6.

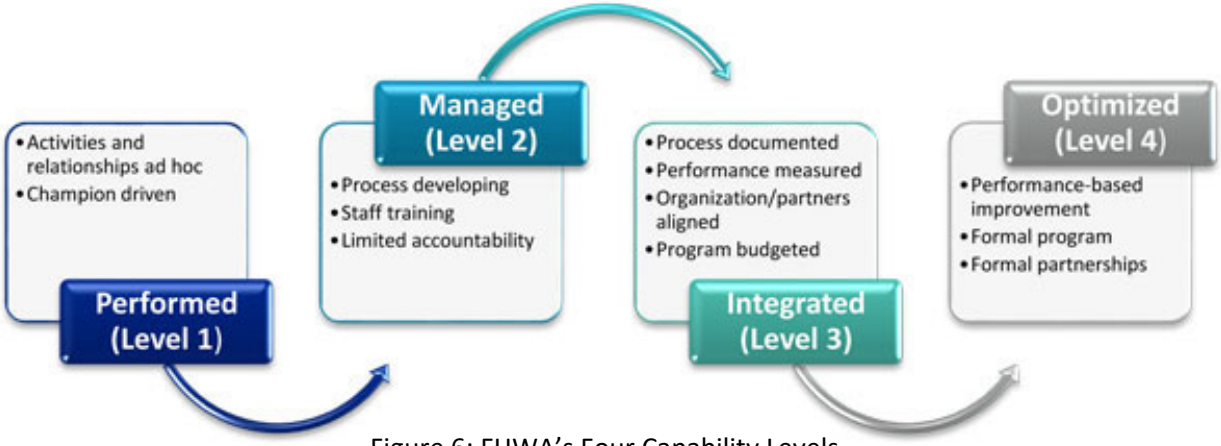

Figure 6: FHWA's Four Capability Levels
(FHWA, Capability Maturity Frameworks Overview, 2017)

By conducting and using a CMM Assessment, agencies can: develop consensus around needed agency improvements; identify their immediate priorities for improvements; and identify concrete actions to continuously improve capabilities to plan, design, implement TSMO (FHWA, Capability Maturity Frameworks Overview, 2017). ALDOT completed a CMM Assessment at the January 2018 TSMO Roundtable meeting to determine the current capability maturity levels for the six key areas. Capability levels were assessed for each region and at the statewide level. **Error! Reference source not found.** summarizes the results of the region, statewide, and averaged CMM Assessment. Lower capability levels in a CMM Assessment should not be interpreted as negative, instead the assessment should be used as a tool to identify where an agency should focus resources based on the agency vision, goals, and objectives.

Table 3 illustrates the capability maturity levels for the statewide CMM Assessment highlighted on the AASHTO CMM Assessment matrix.

	CAPABILITY LEVEL CRITERIA					
DIMENSIONS	NORTH REGION	WEST CENTRAL REGION	EAST CENTRAL REGION	SOUTHEAST REGION	SOUTHWEST REGION	STATEWIDE
Business Processes	1.5	2	2	1.5	2	2
Systems and Technology	1.5	1	1.5	2	2	2
Performance Measurement	1	1.5	2	2	2	1.5
Culture	2	2	2	1.5	2	2
Organization / Workforce Development	1	2	2	1.5	2	1.5
Collaboration	1	2.5	2	1.5	1.5	2

Table 3: January 2018 CMM Self-Assessment

	CAPABILITY LEVEL CRITERIA			
DIMENSIONS	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Business Processes	Processes related to TSMO activities ad hoc and un-integrated	Multiyear statewide TSMO plan and program exists with deficiencies, evaluation, and strategies	Programming, Budgeting, and project development processes for TSMO standardized and documented	Processes streamlined and subject to continuous improvement
Systems and Technology	Ad hoc approaches outside systematic systems engineering	Systems engineering employed and consistently used for ConOps, architecture and systems development	Systems and technology standardized, documented and trained statewide, and new technology incorporated	Systems and technology routinely upgraded and utilized to improve efficiency performance
Performance Measurement	No regular performance measurement related to TSMO	TSMO strategies measurement largely via outputs, with limited after-action analyses	Outcome measures identified and consistently used for TSMO strategies improvement	Mission-related outputs/outcomes data routinely utilized for management, reported internally and externally, and archived
Culture	Value of TSMO not widely understood beyond champions	Agency-wide appreciation of the value and role of TSMO	TSMO accepted as a formal core program	Explicit agency commitment to TSMO as key strategy to achieve full range of mobility, safety and livability / sustainability objectives
Organization / Workforce Development	Fragmented roles based on legacy organization and available skills	Relationship among roles and units rationalized and core staff capacities identified	Top level management position and core staff for TSMO established in central office and districts	Professionalization and certification of operations core capacity positions including performance incentives
Collaboration	Relationships on informal, infrequent and personal basis	Regular collaboration at regional level	Collaborative interagency adjustment of roles/ responsibilities by formal interagency agreements	High level of operations coordination institutionalized among key players –public and private

Table 4: Alabama Statewide TSMO Capability Maturity by Key Area (AASHTO, 2018)

As seen in Tables 3 and 4, ALDOT has self-assessed their dimensional capability levels as 2 except for Performance Measurement and Organization/Workforce Development which is assessed as 1.5. This assessment identifies opportunities for advancing capabilities within all of the six dimensions, particularly those assessed slightly lower. Key dimensions that were identified as areas needing immediate focus include: **Business Processes**, **Performance Measurement**, and **Organization/Workforce Development**.

4.2 TSMO SURVEY

As part of the Alabama Statewide TSMO Master Plan development process, a survey was distributed to ALDOT staff and partner agencies, such as metropolitan and rural planning organizations (MPO and RPO). The survey was focused on statewide transportation priorities, existing conditions, challenges, and opportunities. The CMM assessment mentioned above and the information captured from the survey served as the first step in developing the Plan's vision, goals, and objectives, as well as, service layer recommendations. The most significant needs identified by the survey respondents were:

- **Limited fiscal resources** – demand for transportation services exceeding available funds
- **Aging infrastructure** – maintaining and replacing aging infrastructure
- **Collaboration** – Internal collaboration across regions and jurisdictions and collaboration with external partners
- **Changing technology** – staying current with advances in technology including adequate funding and training
- **Staffing** – hiring and retaining staff with TSMO skill sets
- **Culture** – marketing the benefits of TSMO to the public and decision-makers

Survey respondents were asked to rank the six dimensions of the CMM from most to least critical, considering which areas could be improved to make their job more efficient and effective. As illustrated in Figure 7, the respondents identified culture, organization/workforce development, and collaboration as their top three priorities. This was not fully consistent with the focus areas identified during the CMM assessment described above. However, having an understanding of where the larger stakeholder group felt focus is needed, provided additional guidance during the development of this plan.

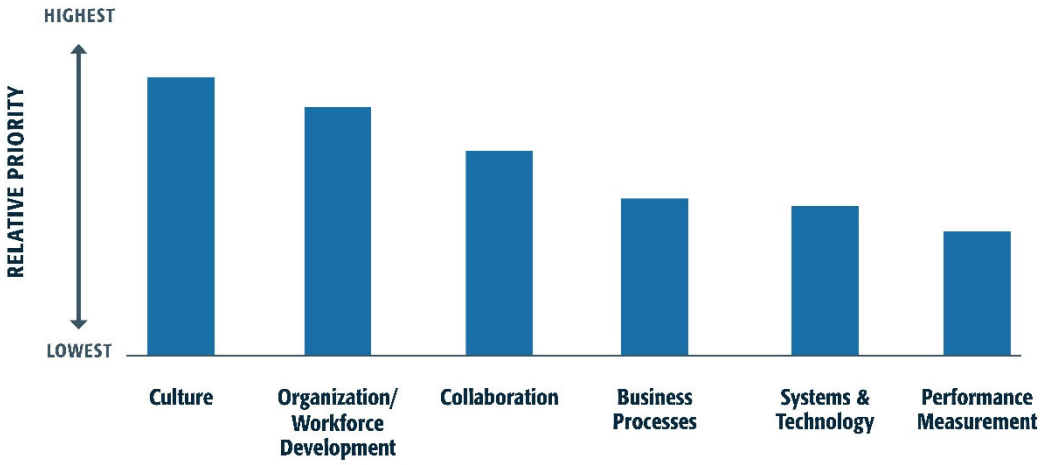

Figure 7: Priority CMM Areas

As seen in Figure 8, survey respondents indicated the TSMO strategies that they foresaw the greatest need for within Alabama and would expect to provide the best value if deployed. The results that received the highest rankings include incident management (86%), traffic signal systems (73%), and traveler information (68%); followed by ITS infrastructure (55%), work zone management (55%), and safety service patrol (50%).

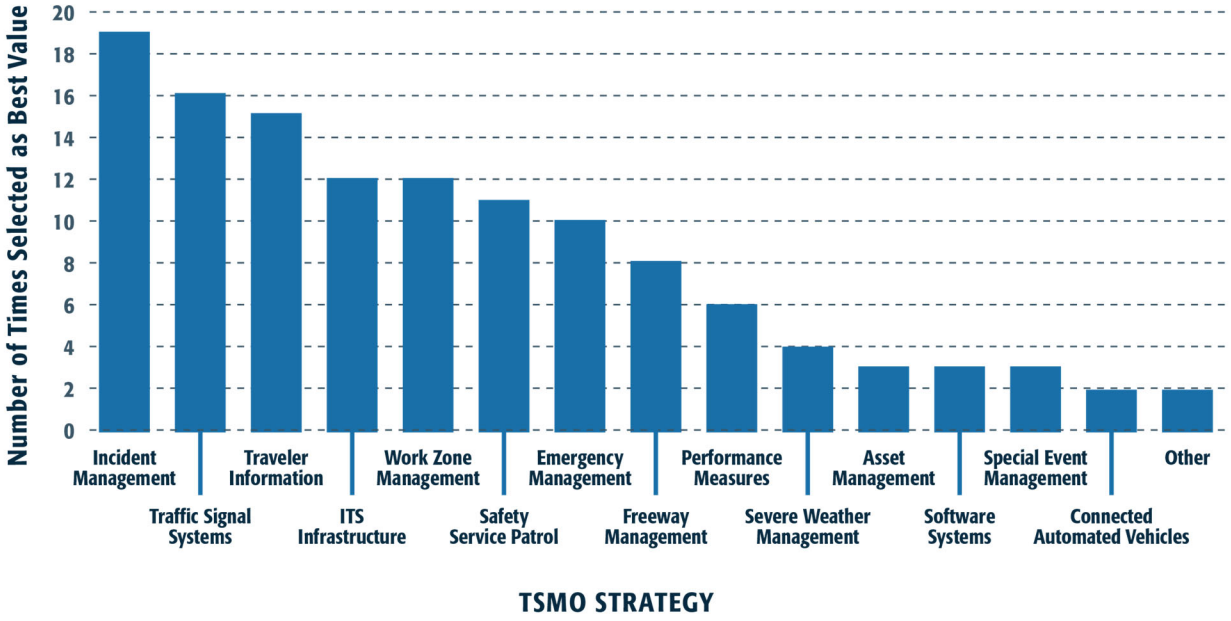

Figure 8: TSMO Strategies Expected to Provide Best Value in Alabama

Results from the survey and information gathered from stakeholder interviews and the statewide TSMO workshop provided both technical input and personal experiences which informed the development of the Plan.

4.3 TSMO WORKSHOPS

Workshops are used to reach larger groups of stakeholders and solicit feedback to guide development of a plan. Several workshops were held to guide this Plan. A Statewide TSMO Kickoff Workshop was held on June 25, 2018 and was widely attended by internal and external stakeholders. The primary focus of the workshop was to provide a background and understanding of what is meant by TSMO and how it can be beneficial throughout the state. In addition, this Plan and process for development was discussed. Participants were asked to

complete the survey cited in the previous section and were requested to provide feedback through discussions.

The following day after the Statewide TSMO Kickoff Workshop, June 26, 2018, a Statewide TSMO Vision Workshop was held with a subset of core stakeholders representing each of the ALDOT Regions. This was a half-day work session that focused on the existing conditions and needs; vision and goals from a statewide perspective. The group discussed what systems were working and what systems were in greatest need of improvement as well as the existing ALDOT culture and significant need for collaboration throughout departments. The need and vision for collaboration was a main theme heard throughout both workshops and survey results and was therefore, a significant focus area for this plan.

The need for **COLLABORATION** was consistently identified by stakeholder groups.

Regional workshops were held in each region to discuss the statewide TSMO program vision, goals, and objectives as well as solicit feedback about challenges and opportunities. This was a way to reach a broader stakeholder group then could be accomplished in a consolidated statewide workshop. In addition, this served as an opportunity reach stakeholders who may be less familiar with the TSMO program, but able to benefit from the strategies and collaboration.

The Statewide TSMO Vision Refinement, Needs, and Recommendations Workshop was held on September 13, 2018. Representatives from each region came together for a full day work session focused on defining the TSMO program vision, further refining needs, and beginning to develop TSMO recommendations. The workshop began with representatives from each region presenting a summary of their respective regional workshops to share ideas and illuminate common themes. Considering feedback from the regional workshops as well as regional TSMO plans, previous project team workshops, and various discussions, the recurring TSMO high-level needs were identified within the following areas:

- Collaboration and Coordination
- Culture of TSMO
- TSMO Program Structure
- Dedicated Funding
- Project Prioritization Methodology
- Partner MOUs/Sharing Agreements
- Statewide Consistency
- Communication Infrastructure
- Signal Timing and Coordination
- Traffic Incident Management
- Emergency Preparedness
- Work Zone Management
- Truck/Freight Parking
- Performance Measures
- Asset Management

TSMO workshop participants broke out into three groups to participate in breakout discussions on three topic areas: Strategic Visioning/Policy, Staffing/Technology, and Funding/Programming. After everyone rotated through each topic area, the group met to recap the discussion. The following summarizes the major themes in each topic area from the recommendation breakouts:

- **Strategic Visioning/Policy –** Recommendations were structured around the six areas of the CMM which include, business processes, collaboration, culture, organization/staffing, systems technology, and performance measures. Specifically, the break out groups consistently identified the need for better collaboration between interagency departments and more education and outreach to gain support for TSMO strategies.
- **Staffing/Technology –** The break out groups recommended methods to improve recruitment and retention of staff, continuing education and staff training, statewide ITS guidance and tools, protocols for data usage and maintenance, and a statewide approach for fiber deployment among other recommendations.
- **Funding/Programming –** Each breakout group identified the need to bolster TSMO programming and funding to further integrate and support the vision of the department. Specifically, the need for a dedicated funding budget was identified such that program needs could be managed and addressed according to priority rather than as opportunities arise.

The Statewide TSMO Program Recommendations Workshop was held on January 9, 2019 in conjunction with a Statewide TSMO Roundtable meeting and the draft high-level recommendations were introduced. The stakeholder committee provided feedback for inclusion and refinement. A second Statewide TSMO Program Recommendations Workshop was held February 11, 2019 in conjunction with a Statewide TSMO Roundtable meeting and focused on the refined programmatic recommendations, implementation plan, and program cycle. In addition, the Statewide TSMO Master Plan Presentation was given on May 15, 2019 and provided a high-level overview of the plan and critical recommendations.

5 TSMO MASTER PLAN OVERVIEW

A primary intent of the Alabama Statewide TSMO Master Plan is to facilitate and advance transportation systems management and operations as a way to achieve the core mission of ALDOT and to mature the TSMO capabilities of the agency. The FHWA provides guidance and resources to support TSMO program planning and states that a TSMO program plan should address the following elements:

- Strategic – states the business case for TSMO, vision, goals, and performance objectives
- Programmatic – considers leadership and organizational structure, staffing / workforce needs, business processes
- Tactical – recommends more specific TSMO projects and services, implementation policies

(Grant, 2017)

Alabama's TSMO plan follows this model framework – strategic, programmatic, and tactical – and utilizes three levels of TSMO planning documents, as shown in Figure 9, each with varying degrees of detail provided for different audiences. This approach is consistent with other State TSMO plans, such as the Iowa Transportation Systems Management and Operations Plan which is provided as an example and the basis for FHWA's Primer for Program Planning (Grant, 2017).

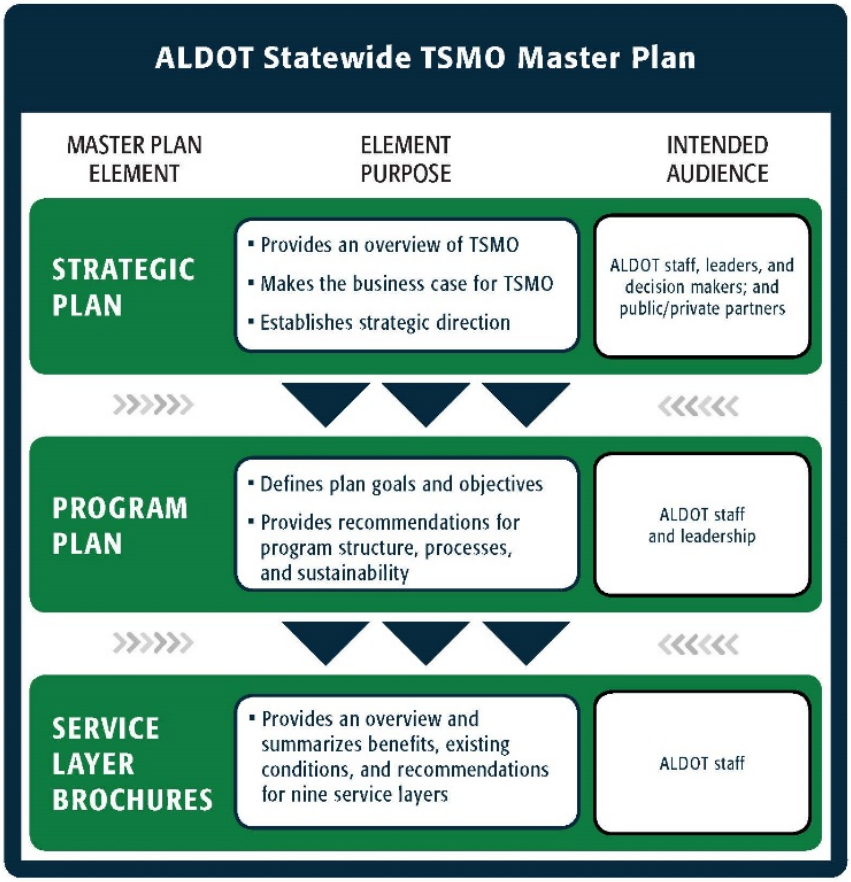

Figure 9: ALDOT Statewide TSMO Master Plan – Document Framework

The three parts of the TSMO Master Plan are: Strategic Plan, Program Plan, and Service Layer Brochures.

Strategic Plan – Provides a high-level summary and states the business case for TSMO. Outlines the vision, goals, and high-level objectives of the Plan. Summarizes Plan development and structure.

Program Plan – Complements the Strategic Plan and provides greater detail on the structure for ALDOT's comprehensive TSMO program. The Program Plan also provides a framework for TSMO integration into the culture, leadership, and business processes of the ALDOT organization. The Program Plan includes:

- TSMO Overview – Provides a general overview of TSMO and describes the purpose of the Plan.
- Vision, Goals, and Objectives – Provides detailed information on the ALDOT TSMO program vision, strategic goals, and objectives.
- Program Structure – Outlines specific programmatic objectives of the TSMO Program which support the integration with other traditional departments and practices. Recommends leadership and organization structural changes to increase TSMO capabilities, promote TSMO champions in leadership, and consider future organizational culture.
- Programmatic Processes – Provides recommended project development and evaluation methodologies to consistently and objectively allocate resources in a fiscally responsible, data driven manner; encouraging the most efficient and effective use of funds. Identifies best systems engineering practices to optimize project development, deployment, and operations.
- Program Sustainability – Recommends methods of consistent collaboration that will build relationships and encourage further integration and optimization. Outlines methods of communications, marketing, and outreach to encourage a TSMO culture. Recommends performance management processes built upon consistent data sets to effectively guide systems management and operations more effectively as systems increase in complexity.

Service Layer Brochures – Designed as nine brochures, one for each service layer considered, which describe the benefits of each service layer, existing conditions in Alabama, and summarize existing project recommendations for each of the nine service layers which are grounded in the strategic goals and objectives of the ALDOT Statewide TSMO Master Plan.

Table 5 provides a description for each service layer and examples of activities, programs, and solutions associated with each service layer.

SERVICE LAYER	DESCRIPTION	EXAMPLES
ITS AND COMMUNICATIONS	A systematic and encompassing program that combines advanced communications-based information and electronic technologies to deliver a safe, reliable, and sustainable transportation environment	Fixed and mobile traffic detectors, non-enforcement traffic cameras, fiber-optic communications infrastructure
TRAFFIC SIGNAL MANAGEMENT	Proactive operation, planning, and maintenance of traffic signal systems to deliver targeted solutions that improve efficiency, safety, and reliability of signalized intersection operations	Incident management signal adjustments, traffic signal emergency response plan, preventative maintenance, traffic signal coordination
TRAFFIC MANAGEMENT CENTERS	Serves as the nerve center of DOT roadway management where data is collected, processed, and analyzed to aid in monitoring and implementing control strategies which improve the safety and efficiency of the roadway network	State TMC; Regional TMCs (RTMC) – Birmingham, Huntsville, Mobile, Montgomery, and Tuscaloosa; local agency TMCs
TRAVELER INFORMATION	A range of ALDOT and partner agency managed technology solutions that provide traveler information and mobility choices to the public	511, Dynamic Messaging Signs (DMS), ALGO, social media
TRAFFIC INCIDENT MANAGEMENT	Systematic and coordinated program process to detect, respond to, and clear traffic incidents safely and efficiently	Alabama Service Assistance Patrol (ASAP) program integration with TMCs, TIM training program, towing services, coordination with partner public safety agencies
EMERGENCY TRANSPORTATION OPERATIONS	Coordination of response to non-recurring large-scale events (e.g. flooding, hurricanes) that interrupt or overwhelm transportation operations to improve public/first responder safety and transportation network efficiency	TMC/EOC (Emergency Operations Center) coordination, ITS integrating into response plans, partnerships with public safety agencies
WORK ZONE MANAGEMENT	Planned and coordinated process to manage traffic during roadway construction zones to improve worker and motorist safety and minimize traffic delay	Work zone ITS technology for dynamic management (dynamic queuing, variable speed limits, dynamic lane merge, entering/existing construction vehicle notification) and work zone traffic signal adjustments
ACTIVE TRANSPORTATION AND DEMAND MANAGEMENT	Advanced technical solutions and innovative strategies to increase safety and efficiency to maximize the capacity of the existing roadway network	Adaptive ramp metering, traffic responsive or adaptive signal control, dynamic speed limits, adaptive traffic signal control
EMERGING TECHNOLOGIES	Innovative technology solutions are transforming the transportation environment and way of life. Connected and automated vehicles are an emerging generation of vehicles and have the potential to provide significant safety and mobility benefits	Efficient platooning using intelligent speed adaptation (variable cruise control), event and traffic incident notifications and re-routing, and eco-driving

Table 5: Alabama Statewide TSMO Master Plan Service Layers

5.1 TSMO VISION, GOALS, AND OBJECTIVES

The information and guidance provided by the survey, workshops, and stakeholder discussions steered the development of the ALDOT TSMO vision. The ALDOT Statewide TSMO vision defines the future of TSMO in Alabama:

> ***Manage and operate a safe, reliable, optimized transportation system for all users through the collaborative efforts of stakeholders, technology-based solutions, and innovative strategies.***

This vision has been used to guide the development of objectives for the TSMO program. In addition, review of regional TSMO plans, statewide transportation plans, and information gathered through extensive engagement with ALDOT leadership and stakeholders through a survey, strategic interviews, and workshops were used to develop the TSMO strategic goals and objectives. The goals and objectives are illustrated in Table 6 and have been broken into three categories: move, manage, and motivate.

	GOAL	OBJECTIVE
MOVE	SAFETY	Reduce the number of overall crashes (including secondary) as well as severity
		Reduce work zone-related crashes
		Increase the resiliency of the transportation system to extreme weather events
		Enhance and expand TIM program
		Increase safety of freight corridors
	MOBILITY	Improve travel time reliability
		Provide timely information and mobility choices to the public
		Reduce congestion and bottlenecks
		Work with partners to actively manage traffic during large-scale special events
		Enhance freight route mobility
MANAGE	ACCOUNTABILITY	Demonstrate fiscal responsibility
		Increase sustainability and minimize environmental impacts
		Integrate TSMO solutions into ALDOT policies, plans, and procedures
		Create and implement project prioritization methodology based on data-driven decisions
		Develop performance measures to make the TSMO business case
MOTIVATE	COLLABORATION	Develop system standards to promote data sharing, coordination, and integration
		Elevate TSMO through leadership buy-in of the benefits and innovative technology
		Identify where to engage with conventional silos to promote collaboration
		Create a forward-thinking environment with continuous quality improvement practices
		Establish formal career paths to encourage retention and develop workforce
		Increase efficiency by seeking internal and external partnership opportunities
		Realize opportunities with P3 (public-private partnerships)
	INNOVATION	Provide training and foster growth and sharing of knowledge
		Seek strategic pilot project deployment opportunities
		Integrate consideration of innovative solutions for all modes

Table 6: Alabama TSMO Master Plan Strategic Goals and Objectives

The goals provide the direction and priorities for the Statewide TSMO program and the development of the Statewide Master Plan, the objectives define strategies to attain the identified goals. The Program Plan of the ALDOT Statewide TSMO Master Plan is the primary instrument to guide implementation the objectives and to achieve the outlined goals. The Program Plan outlines the proposed program activities, policies, and procedures recommended to work towards achieving the ALDOT TSMO vision.

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