

ODOT Transportation Systems Management & Operations Plan

Resource Alignment Brief

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Transportation Systems Management & Operations

PID: 97927

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Introduction

Historically, state departments of transportation (DOT), including Ohio DOT (ODOT), have focused efforts and resources primarily on construction and maintenance activities. Limited focus and resources have been placed on daily operational needs. The Federal Highway Administration (FHWA) has highlighted, through their Office of Operations, the Fixing America's Surface Transportation (FAST) Act, and Moving Ahead for Progress in the 21st Century (MAP-21) legislation, the need for state DOTs to strategize, implement, and evaluate the integration of systems management and operations into the agency. This requires an ongoing, iterative process that evaluates strengths, weaknesses, opportunities, and threats (SWOT) within the context of other agency plans and initiatives while taking into consideration relationships and interactions with stakeholders. As technology and demands on infrastructure change and funding and resources become more strained, ODOT must be positioned to meet these challenges and increase efficiency in the existing system through operational improvements.

To this end, ODOT developed a Transportation Systems Management and Operations (TSMO) Plan. ODOT's TSMO Plan will serve as a road map to guide the Department as it continues to integrate operations, asset management, and preservation into the organization. The TSMO Plan is the basis for statewide policy and process changes aimed at increasing the focus and execution of traffic operations to better meet future system needs.

This technical brief describes the proposed organization and resource alignment needed to support the functions of TSMO within ODOT. It was developed with input from ODOT leadership and seeks to enhance and facilitate implementation of the TSMO Program while preserving existing functional connections throughout ODOT. The recommendations contained in this brief represent a forecasted need at a given point in time. As the TSMO Program is implemented and technology evolves, it is expected that staffing and other resource needs will fluctuate. All "total future projected staff" numbers listed in this brief are to be considered as full-time equivalent recommendations and may be comprised of ODOT staff (existing and new) and consultant staff. All staffing adjustments are expected to occur over an extended period of time.

During staff interviews and workshops, a number of needs related to operations planning, funding, managing data, and measuring TSMO functions arose. While ODOT staff partially cover these areas, it is typically on an ad hoc basis. Resource commitments for these critical functions must be codified and secured over the long-term to support a robust TSMO Program.

The evolution of ODOT's Transportation Asset Management (TAM) program provides a blueprint for how communication and the ideals of TSMO can permeate through the Department at a fairly advanced pace. TAM has also created more cross-division and office collaboration and communication while avoiding drastic organizational changes. It is widely recognized that an organizational chart cannot force the level of communication, collaboration, and training needed for a departmental culture shift towards TSMO. It is the responsibility of ODOT's leaders to continue to facilitate this transition.

As the TSMO Program grows and matures within ODOT and TSMO is further embraced at the local level, there may be a need to revisit the proposed organization and alignment of resources incrementally to assure ODOT is always seen as Ohio's leader in TSMO. In this way, it will be able to provide thought leadership and technical guidance to its external partners as well as a high level of internal service.

Organization

TSMO Council

It is recommended that a TSMO Council be formed similar to the Technology Council. This leadership group should meet on a regular basis and include a cross section of ODOT offices (including the Districts) and functions. Consideration could also be given to including regional partners such as the MPOs and RPOs. The Council's purpose will be to collaborate on program policies and goals as well as provide recommendations to executive leadership regarding expenditures and organization. This group will share best practices and report on the progress of TSMO implementation including successes and challenges.

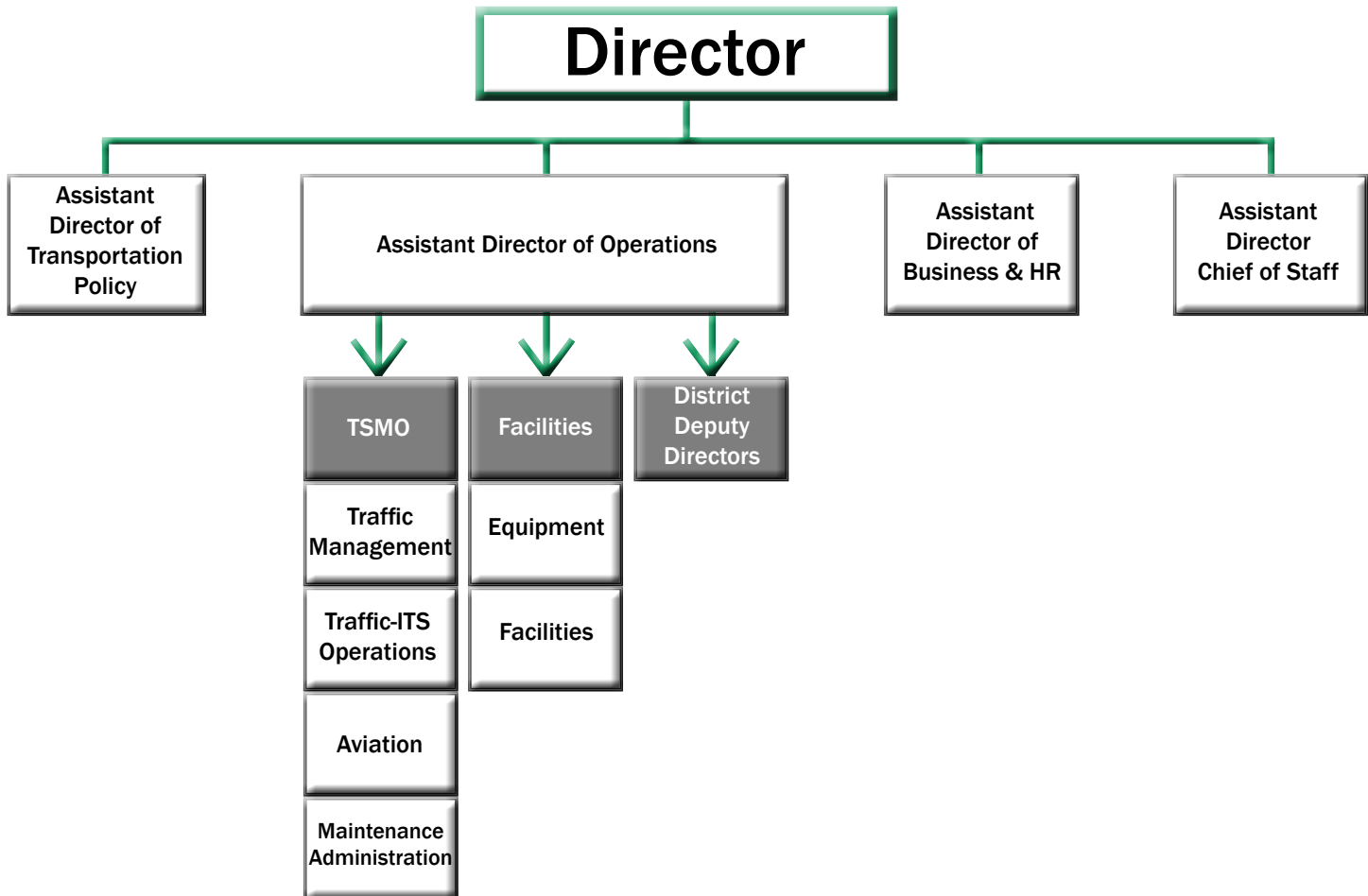


Figure 1: Department Level Recommendations

Division Level Recommendations

Currently, the majority of TSMO-related functions at Central Office are located in the Division of Operations' Office of Traffic Operations. At the District level, the functions are generally divided among the Highway Management and Capital Program Management areas.

ODOT's leadership wishes to incorporate TSMO as a cornerstone of how the Department will conduct business in the future. TSMO will be considered a peer, core practice alongside other areas such as Planning and Engineering, Highway Maintenance, and Construction. With TSMO elevated to this level, it will be reflected in all aspects of ODOT's culture and mindset. The shift in culture from design and construction to preservation, management, and maintenance is necessary to embrace the future of

transportation and also to recognize the Department's limited ability to continue to construct costly, large capacity-adding projects. Infrastructure funding cannot keep pace with capacity project needs. Shifting to a philosophy of preserving and managing infrastructure to its optimal capacity potential provides an alternative. This shift will require technology and strategies that a TSMO Program can offer.

As a reflection of TSMO's elevated status as a core organizational function and given that the core of the TSMO Program (TMC, ITS, Traffic Operations) resides in the current Division of Operations, it is recommended that the Division of Operations becomes the Division of TSMO. This elevates the status of TSMO and aligns it with other core departmental functions mentioned previously. This change



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is reflected in the structure of other state DOTs that have recently reorganized for TSMO, such as Colorado, where maintenance and TSMO are aligned under one Assistant Director, and Capital Program Management is aligned under a second Assistant Director similar to ODOT's structure. With the expected size of the future Division of TSMO, it would be too much for one office administrator to efficiently oversee. Raising key functions to a higher level will improve management, communication, and resource allocation. The downside to TSMO's division status is that its leader (Deputy Director), who will be key in establishing the new TSMO Program, would be at risk of being replaced during administration changes. **Figure 1** illustrates the proposed Division's arrangement.

Office Level Recommendations

As shown in **Figure 2**, the recommended offices to be located under the Division of TSMO include the Offices of Traffic Management, Traffic-ITS Operations, Aviation, and Maintenance Administration. This section focuses on the functional changes to the Offices of Traffic Management and Traffic-ITS Operations. No changes are being recommended to the Office of Aviation. The only recommended change to the Office of Maintenance Administration is the relocation of RWIS responsibilities to the Office of Traffic Management. This recommended structure splits the Office of Traffic Operations into two new offices: the Office of Traffic Management (real-time traffic management/control, data management and analysis) and the Office of Traffic-ITS Operations (Systems Development, Implementation, and Maintenance).

Currently, many TSMO-related functions are organized around individual staff who have assumed roles and responsibilities based on a past or present job function being similar in nature. This arrangement is most prevalent in the specialty design areas such as lighting or signing, where one employee may be responsible for everything associated with that area. In the future, distributing those roles and responsibilities across multiple employees would increase organizational efficiency. For example, the expert in lighting design does not also have to be the expert in maintenance, operations, and standards.

The proposed office structure in **Figure 2** represents a goal and can be implemented immediately or over time as opportunity presents itself.

Office of Traffic Management

The Office of Traffic Management is recommended to have three functional areas: the Traffic Management Center (TMC), Emergency Operations, and TSMO Analytics and Performance. **Figure 2** illustrates some of the functions that would fall under the Office of Traffic Management. The TMC includes all real-time command, control, and monitoring functions needed to manage traffic and is the foundation for the two other related functional areas.

Emergency Management relies heavily on the TMC for monitoring and coordination. This proposed alignment with the TMC allows for more efficient communication. While Emergency Operations will not be part of the TMC staff, space will be needed in the TMC for those staff to work alongside the TMC operators. In the future, it is recommended that Emergency Management be physically located in the new TMC.

The TMC is the command and operational control center for TSMO strategies. Its goal will be to provide reliable network mobility to Ohio's transportation system users. It will utilize the latest technology for surveillance and monitoring of the transportation system and be capable of real-time transportation demand management. The TMC will monitor, manage, and react to the real-time needs of the transportation system. It will lead ODOT's traffic incident management program to facilitate incident clearance and restoration of traffic flows, monitor the performance of various systems across the state, and provide real-time adjustments to maintain reliability of the transportation network.

The TMC is also expected to continue to grow as new TSMO functions are brought on line such as hard shoulder running, variable speed limits, ramp meters, advanced traffic signal systems management, truck parking information systems, and CV/AV. With each step in its growth, resources will be needed in the form of equipment, software, and personnel. The TMC currently has 15 employees, a number that could double in the future with the addition of the above functions as well as the functions listed in **Figure 2**. It should be noted that for every peak hour function that needs command and control capabilities such as variable speed limits or hard shoulder running, at a minimum two new operators (one for first shift and one for second shift) will be needed. Depending

Division of TSMO

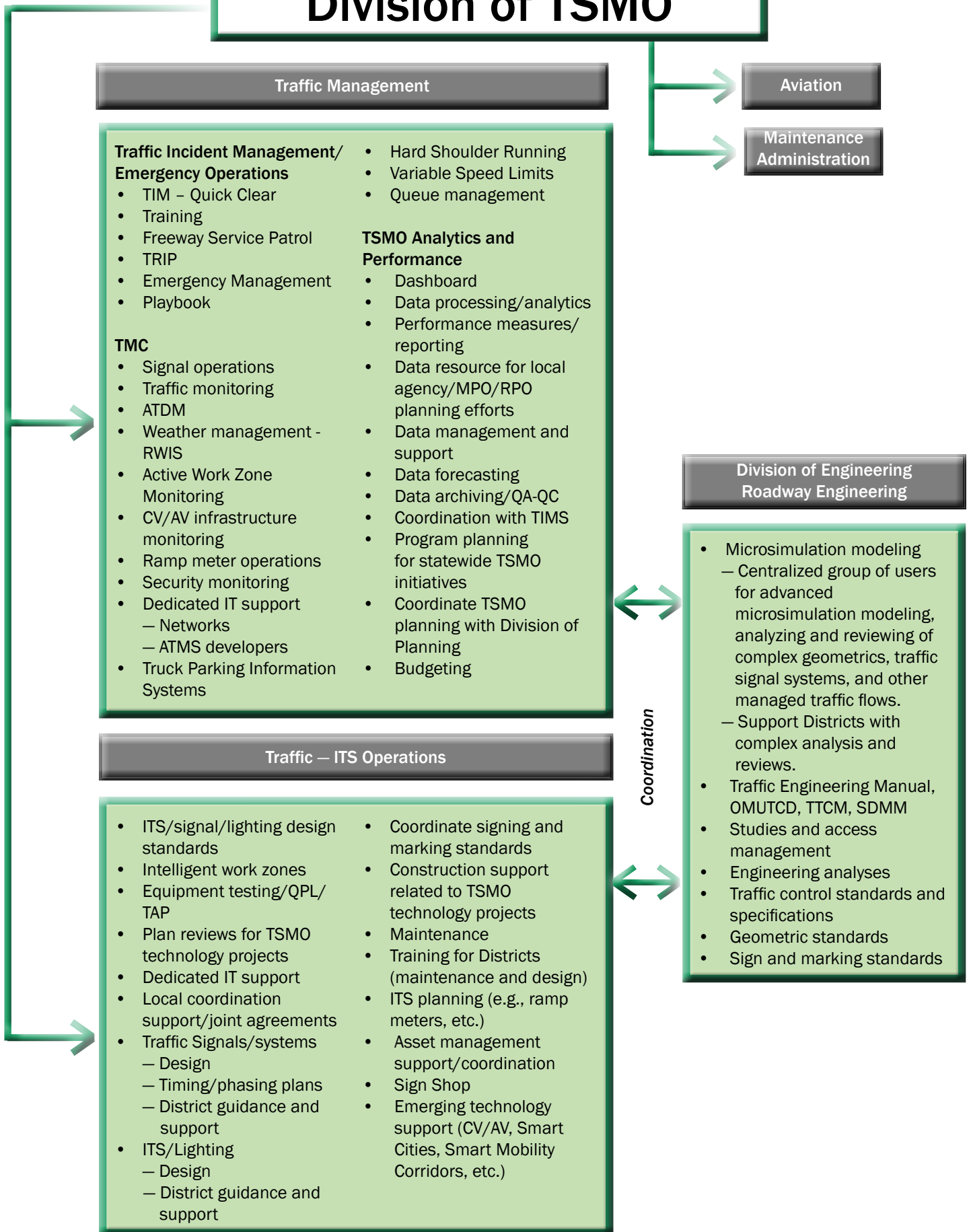


Figure 2: Division Level Recommendations

on the level of real-time management required, additional operators could be required. Other existing TSMO-related functions that are recommended for inclusion in the TMC, such as weather management, currently have staff that will be transferred to the TMC with those functions.

To manage the large amount of data that will be flowing through the TMC and the TSMO Program in general, the third recommended functional area of the Office of Traffic Management is TSMO Analytics and Performance. The TSMO Analytics and Performance area will organize a number of functions that must be expanded in the future to support a strong TSMO Program. This group will lead program planning and budgeting for statewide TSMO initiatives and work closely with the Districts and the Division of Planning on policy development, data sharing, standardization, funding, work planning, and any other planning initiatives. They will be responsible for developing a work plan for the Division of TSMO and leading any TSMO-related planning efforts on a statewide level.

Figure 2 on the following page shows the list of recommended functions for this section and includes functions that are currently performed on an ad hoc basis such as performance measurement and analytics. Other functions are new and will be needed to evolve a state-of-the-art TSMO Program. Data management will become a large function of the section. Real-time data flows from ITS systems and CV/AV will generate large quantities of data. Data will need to be reviewed, scrubbed, curated, and archived to be used for planning and analytical purposes. Efforts have already begun to collaborate with the Division of Planning on standardization and elimination of duplicate efforts related to data and analytics.

The TSMO Analytics and Performance area will be responsible for coordinating data collection efforts with ODOT's central repository staff to ensure adherence to IT governance. TSMO planners will process, analyze, manage, and QA-QC real-time and archived data for use in developing and reporting on TSMO-related performance measures. Other responsibilities for the section include maintaining the TSMO Dashboard, data forecasting, and providing data to local planning agencies (MPOs/RPOs) to support their efforts to include TSMO in long range transportation

plans and local project planning. This area will also oversee ODOT's integrated data exchange efforts.

For more details on these TSMO recommendations and functions, refer to the Policy Action Brief recommendations BP1, BP6, BP7, ST2, ST4, ST6, ST7, ST8, ST10, PM1, PM2, PM3, CU2, CO4, and CO5.

Office of Traffic-ITS Operations

The Office of Traffic-ITS Operations would have a wide range of functions related to systems development, implementation, and maintenance. A list of the Office of Traffic-ITS Operations' proposed functions can be found in **Figure 2**. This office will largely focus on ODOT's traffic signals and ITS systems and include all of the responsibilities currently performed by the Office of Traffic Operations that are not recommended for transfer to the Office of Traffic Management.

Other functions located in this office will be developing signals and ITS equipment trainings and guidance for District design and maintenance personnel, plan reviews, equipment testing, sign shop, construction support related to the installation of TSMO technology, and increased support for emerging technologies (CV/AV, Smart Cities, Smart Lighting, etc.).

For more details on these TSMO recommendations and functions, refer to the Policy Action Brief recommendations BP2, BP4, BP8, ST1, ST3, ST5, ST9, OS5, OS7, and CO3.

District Level Recommendations

The District workshop in November 2016 showed that, while all Districts have the same basic organization, current TSMO functions are distributed and organized differently in different Districts; furthermore, these functions span across District silos, such as Highway Maintenance, Construction, and Capital Program Management. Feedback at this workshop, specifically the desire to have someone who could coordinate all of these efforts, led to the recommendation of a new role, the District TSMO Coordinator.

The primary purpose of this District-level role is to provide efficient internal communication, statewide consistency, technical assistance, and stronger communications with

local agencies related to TSMO. For these Coordinators to be successful, leaders with advanced communication skills and a nuanced understanding of ODOT will be required. They will become conduits between Central Office and the Districts and ODOT and the locals for all TSMO-related issues.

The overriding rationale for the District TSMO Coordinator organizational strategy is to improve communication, consistency, and knowledge sharing between Central Office and the Districts. Other state DOTs have taken similar approaches to help identify and troubleshoot problems more quickly. Each District would have one TSMO point of contact. When District staff need TSMO-related assistance, they will know that their District TSMO Coordinator will be ready to support them regardless of the location or nature of a particular incident.

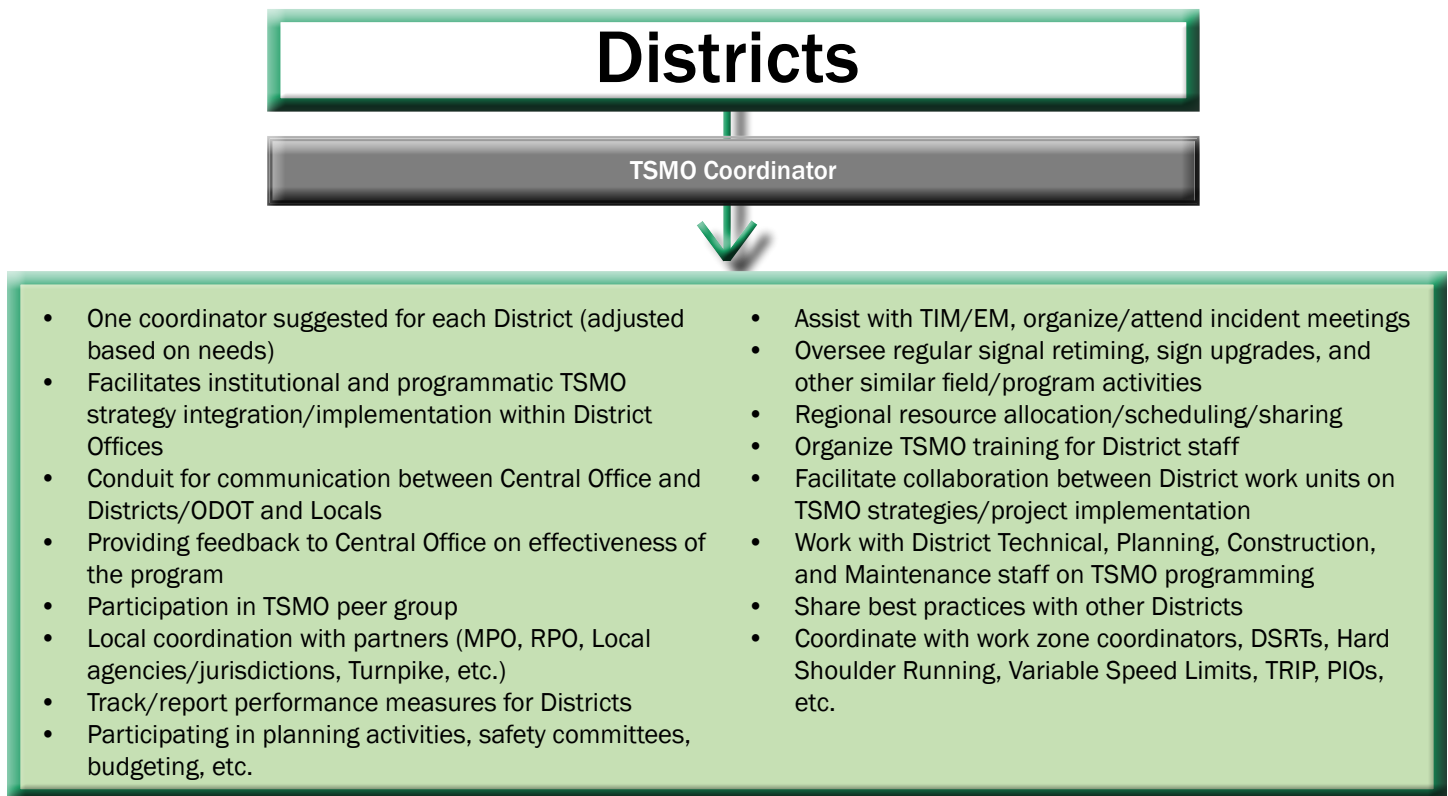


Figure 3: District Level Recommendations

Each District TSMO Coordinator will be based in a District office and foster strong local ties to assist with coordination. They will oversee performance measurement in the Districts as well as Traffic Incident Management and Emergency Management among other duties. **Figure 3** lists the District TSMO Coordinators' responsibilities. Coordinators will monitor program activities and project implementation, be involved with planning, safety, and budgeting, and maintain TSMO-related communication between Districts and District business units. District TSMO Coordinators will also participate in TSMO peer groups and other TSMO committees as needed. More information on the District TSMO Coordinator role can also be found in the Policy Action Brief's OS3 profile sheet.

With the introduction of the District TSMO Coordinators, no reorganization at the District level is necessary until such time when the program's size necessitates a more formal approach in the Districts. It is important that the Districts maintain flexibility with regard to how they integrate TSMO functions.

Resources Needed - Existing

The recommendations contained in this brief represent a forecasted need at a given point in time. As the TSMO Program is implemented and technology evolves, it is expected that staffing and other resource needs will fluctuate. All "total future projected staff" numbers listed in this brief are to be considered as full-time equivalent recommendations and may be comprised of ODOT staff (existing and new) and consultant staff. This determination will be made based on the specific needs that are being addressed. All staffing adjustments are expected to occur over an extended period of time.

As part of the planning process, the project team discussed roles and responsibilities with current staff in order to ascertain what resources may be needed now and in the future to support a TSMO Program.

Currently many of the new functions related to TSMO are added onto existing employees' duties on an ad hoc basis. Traffic Operations staff are at capacity and not able to take on additional duties without other responsibilities

being delayed. Many of the technical staff are unable to proactively respond to situations and lack the time and resources needed to plan properly for maintaining devices or advancing current technical systems.

As more ODOT staff become eligible for retirement or depart for other opportunities, their replacements tend to be less experienced. New inexperienced staff cannot be expected to have the institutional knowledge needed to assume the same workload as departing staff. This deficit in institutional knowledge requires additional shuffling of duties or multiple new staff to cover the roles and responsibilities of one retired senior employee.

The organizational chart in **Figure 2** attempts to correct and mitigate this concern by taking a functions-focused approach. It shows where those functions are best served rather than focusing on the people currently performing those functions. This approach acknowledges that in the future those duties will likely be split among different personnel, and will begin to highlight organizational needs within the department as the TSMO Program evolves.

Resources Needed for Existing Functions

The next two sections include resource recommendations based on current needs to maintain service levels and to incrementally move the TSMO Program forward. These recommendations will need to be revisited as the future organizational structure and specific functions of the TSMO Program are agreed upon and needs evolve.

There are deficiencies within existing TSMO functional areas. The following personnel and skills are needed to maintain TSMO functions that currently exist at ODOT.

Office of Traffic Management

Recommendations:

- Proposed staffing level plus 1 new administrator = 26.



Traffic Management Center

Recommendations:

- Add at least **1** additional operator for TMC third shift.
- Add **2** additional operators for hard shoulder running and variable speed limits management (1 for first shift AM peak and 1 for second shift PM peak).
- Move **1** Maintenance Operations employee to TMC to integrate weather management/RWIS.
- The above recommendations would bring the TMC staff count to **20**.

The TMC has 13 operators and two supervisors. The TMC runs 24/7 operations in three daily shifts. Currently there is only one employee on third shift. For safety and other service reasons, at least two staff should be present.

ODOT is also in the process of adding its first hard shoulder running and variable speed limit projects to the system. Additional personnel will be needed to manage these locations. This is a high priority as these operators will need to be hired and trained well in advance of the launch of each of these new projects.

Several internal transfers may be necessary to align employees and new functions. Relocating weather management into the TMC to better align that function with other real-time data gathering functions of the TMC would require moving one staff member from Maintenance Administration. Relocating work zone operations to Traffic Management would require moving at least one staff member from the Office of Roadway Engineering.

The relocation of existing functions and personnel in other areas of ODOT will be at the discretion of the Deputy Directors that oversee those areas.

Dedicated IT Resources

The TMC relies on constant communications with field systems and personnel. A number of computer software and platforms are used to provide existing TMC services. The systems are not fail-proof and require near constant maintenance, updating, and troubleshooting. With anticipated expanded coverage throughout the state plus introduction of new TMC functions (e.g., ATDM, Truck Parking Information, etc.), additional dedicated ITS services are required.

A committee has been formed to identify the immediate and future information technology needs of the TMC. The committee's recommendations for dedicated IT services will continue to evolve. The TMC currently needs dedicated personnel with the following skill sets:

- Software development
- Network support (troubleshooting)
- 24/7 availability to match round-the-clock operations of the TMC

Emergency Operations

Recommendations:

- Monitor needs after TSMO Coordinators are integrated.

In order for ODOT to remain a national leader in emergency management, staffing levels will need to be monitored and increased as the program and services continue to grow. The addition of the TSMO Coordinator at the District level could relieve some of the current staff pressures. However, at some point in the future, demand on the current staff will not be manageable. Additional resources will be needed to provide leadership and training to local first responders and incident commanders. Any new hires should bring an emergency management background with the ability to communicate with engineers and other technical personnel.

TSMO Analytics and Performance

Recommendations:

- **1** Planner.
- **1** Engineering analyst – existing staff position from Traffic Operations.
- At least **1** Data analyst/manager.

New functions included in the proposed TSMO Analytics and Performance area would require either internal transferring of staff or new hires. To perform its assigned functions (see **Figure 2**) the staff should include planners, data analysts/managers, and engineers. The proposed initial staff count would be three employees: planner, data analyst/manager, and engineering analyst.



Office of Traffic-ITS Operations

Recommendations:

- Continue to backfill vacated positions.
- Add **1** ITS maintenance person to free up senior staff to focus on emerging technologies.
- Explore traffic signal section needs – add **1** engineer to allow for separation of traffic signal engineering functions from maintenance functions.
- Fill **2** full time staff positions at the sign shop and eliminate equivalent temporary positions.
- Dedicated personnel for IT/network support.

Traffic-ITS Operations (currently Traffic Operations) is now in the process of backfilling vacated positions to match staffing levels from when the TSMO planning process began. Traffic Operations has also become more involved in new initiatives such as CV/AV and smart mobility corridors and is aware that managed lanes and ramp meter expansion are on the horizon.

It is recommended that Traffic Operations continue to backfill vacated positions with the most experienced personnel possible through internal transfers or new hires.

As CV/AV continues to grow, ODOT should dedicate a full-time technical position toward this initiative or add a position to backfill duties of the person who is now most involved in ODOT's current emerging technology initiatives. An ITS maintenance position could be added to allow senior staff currently splitting their time and efforts to focus more on emerging technologies and ODOT's involvement with researching and implementing those technologies.

Because Traffic-ITS Operations handles maintenance of devices as well as operations, a large amount of traffic signal engineers' time is spent handling device warranty work and maintenance work orders. This workload leaves less time for plan reviews, developing new timing plans, and other signal engineering work to move the program forward. There is one vacant position in this section, after the departure of a senior level traffic signal engineer.

It is recommended to analyze this workload challenge and, if needed, hire an engineer to focus on plan reviews, work orders, and device warranty work. This addition would

allow the traffic signal engineers to focus on planning and operating the existing traffic signal systems.

The sign shop currently has several vacant full-time positions and has covered this deficit with temporary workers, producing mixed results. The current full-time staff pride themselves on the level of ownership they take in their work. Replenishing full-time staff levels will enhance ownership and maintain a high caliber of work. IT resources are also critical to this office. Options for providing dedicated IT support should be explored for this office similar to what is being discussed for the TMC.

Resources Needed in the Future

Until the organizational structure of the TSMO Program is set, the amount of staff needed and skill sets required are difficult to project. The previous section recommended staffing levels for each proposed office to maintain existing functions and new staff functions that are already planned. As the program matures and grows, additional staff will be needed to monitor, manage, analyze, and operate the TSMO Program at ODOT. Data streams and sources will continue to increase and ODOT will need to be prepared to process large amounts of data.

To meet these needs ODOT must recruit employees with skill sets that are not aligned with those of traditional civil engineers. More positions related to Capital Program Management will need to be developed to meet these needs (see Policy Action Brief profile sheet OS1).

Over the next few years a large portion of ODOT's current staff will become eligible for retirement. These vacancies will provide ODOT an opportunity to hire TSMO-focused employees without expanding its overall workforce. However, these changes would require staff reductions in other areas of ODOT. Other state DOTs have worked with the private sector and university partners to provide additional capabilities, because contract staff do not count towards agency staffing caps.

On the following page is a projection of the potential future staff needs for key areas of the TSMO Program. These changes could be a combination of internal staff realignment, hiring new staff or contract employees.



Resources Needed - Future

Office of Traffic Management

Future Needs:

- **9** - 3 additional staff per TMC shift for normal activities, or more for first and second shift with a minimum of 3 for third shift.
- **6 or more** TMC staff for ATDM (3 for first shift; 3 for second shift), or more depending on how dynamic the systems are.
- **9** - 3 engineers and 6 technicians for traffic signal systems as systems become more widespread and advanced.
- **4** data analysts or managers for CV/AV and other emerging technology data.
- **2** Engineering/Planning analysts.
- **2** Supervisor positions.

The TMC is expected to be the largest source of growth and possibly expand rapidly in the near term as more functions are added to the TMC's sphere of influence. These functions include managed lanes, more signal systems, CV/AV, and truck parking information. ODOT is rapidly shifting from monitoring traffic to managing traffic. Additional staff are need to provide 24/7 traffic management. Below are some projected staff numbers as well as comparisons to other DOT TMCs.

Another area of growth will be the TSMO Analytics and Performance section as the need for data integration and management will continue to increase.

- Current staff projection for Office of Traffic Management: 26.
- Total future projected staff for Office of Traffic Management: 58.

TMC staffing numbers for other DOTs are provided below:

- Florida DOT District 7 (Tampa Bay area only) has 30 Operators.
- Iowa DOT has a staff of 18 for their statewide operation (no signal management).
- Wisconsin DOT has a staff of 25 for their statewide operation (no signal management).

Office of Traffic-ITS Operations

Future Needs:

- **8** new engineering/maintenance staff as needed to cover expanding network needs/design, standards development, plan reviews, maintenance of ITS/Signals/Lighting/RWIS, traffic signal timings, etc.
- **2** or more positions focused on integrating emerging technologies.
- **1** additional supervisor.

The projection for the Office of Traffic-ITS Operations is more difficult at this point in the planning process as its functions cover a large cross section of responsibilities. Existing Traffic Operations staff count (35) minus TMC staff (15), one analyst, and one supervisor (to align with the organization recommendations from the Resource Alignment section) results in a future staff count of 18.

Other needs in the Office of Traffic-ITS Operations could require an additional nine engineers/maintenance staff based on the above immediate needs discussion. These staff would be needed for technical support for new or expanding TSMO functions, including:

- Expansion of the ITS, Traffic Signals, and communications network (adding in more of the interstate, freeway, and 2 lane system in the future).
- More traffic signal engineering needs.
- Increased ITS maintenance needs.
- Plan reviews, etc.

In the future a new group focused on supporting the integration of emerging technologies could develop out of this office with staff dedicated to efforts like Smart Cities, Smart Mobility Corridors, CV/AV, and truck parking information systems.

- Current staff projection for Office of Traffic-ITS Operations: 29.
- Total future projected staff for Office of Traffic-ITS Operations: 40.