

# **TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO) PARAPROFESSIONAL WORKFORCE DEVELOPMENT**

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WHITE PAPER

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**AUTHORS:**  
Alexandra Lopez, Gannett Fleming & Todd Szymkowski, Gannett Fleming

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## SUMMARY

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Technology, improved data integration, and actively managing transportation systems has led the way to the concept of Transportation Systems Management and Operations (TSMO), which represents a set of integrated strategies developed to manage, maintain, and improve the performance of existing transportation systems using a strategic and systematic approach. Many state departments of transportation and other transportation organizations are already implementing TSMO programs and strategies at various levels. They have learned that successful deployment and use of TSMO strategies requires a diverse, skilled workforce capable of meeting changing organizational needs and rapidly evolving technology. Ongoing efforts are actively addressing workforce needs in the professional and management levels of transportation organizations. The next logical step is to look at position outside professional and management levels. This white paper identifies a wide range of critical support positions, referred to as TSMO paraprofessionals, and defines how each may need to evolve to meet rapidly changing organizational needs. The document also discusses a variety of issues transportations agencies will likely face and potential paths forward for them to be better prepared to recruit, retain and develop a TSMO paraprofessional workforce.

## INTRODUCTION

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In the past, departments of transportation (DOTs) focused on building roads to address the need to carry an increasing number of people and goods. However, new technology and data applications have enabled organizations to better operate and manage existing transportation systems to maximize available capacity. Collectively, improved data integration, technology, and actively managing transportation systems has led the way to the concept of Transportation Systems Management and Operations (TSMO). TSMO represents a set of integrated strategies developed to manage, maintain, and improve the performance of existing transportation systems using a strategic and systematic approach. Many state DOTs and other transportation organizations are already implementing TSMO programs at various levels and have learned that the successful deployment and use of TSMO strategies requires a diverse, skilled workforce capable of meeting changing organizational needs and rapidly evolving technology.

Efforts are underway to actively address the workforce needs of these emerging TSMO programs, including the National Cooperative Highway Research Program (NCHRP) Project 20-07/Task 408, *TSMO Workforce: Skills, Positions, Recruitment, Retention, and Career Development* project, completed in March 2019<sup>1</sup>. A logical next step for TSMO workforce development is to focus on positions within agency TSMO programs that do not require a four-year bachelor's degree but have significant impact to the organization's success<sup>2</sup>. The individuals filling these positions, which will be addressed in this paper as paraprofessionals, are important to the TSMO profession and should be properly recognized and understood by employers of the TSMO community.

The purpose of this white paper is to identify the most critical paraprofessional positions (defined further in the next section) in the TSMO workforce, define how these positions may evolve to meet rapidly-changing needs to maintain a successful TSMO program, and guide transportation organizations on potential paths to be better prepared to recruit, retain and develop a rapidly evolving workforce.

### ORIGINS OF NCHRP PROJECT 20-07/TASK 408

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The project was the result of a Workforce Summit held in 2016 by the National Operations Center of Excellence.

A strong recommendation came out of the summit to initiate a project to address the knowledge, skills, and abilities required for emerging TSMO positions at the professional and management levels of an organization.

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<sup>1</sup> More information about this effort can be found at <https://transportationops.org/workforce>.

<sup>2</sup> The percentage of equivalent full-time employees that work in the Florida Department of Transportation District 6 traffic management center operating and managing the TSMO program that require a four-year degree or equivalent experience is 42%, while 58% are categorized as paraprofessional. This demonstrates just how impactful support staff are to the industry.

## PARAPROFESSIONAL POSITIONS IN THE TSMO WORKFORCE

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In 2008, the American Society of Civil Engineers (ASCE) formed a task committee titled the Paraprofessional Exploratory Task Committee (PETC), whose main purpose was to explore paraprofessionals in civil engineering. The PETC established the following generic definition of a paraprofessional<sup>3</sup>:

- Paraprofessional – An individual supporting a professional in fields such as education, engineering, healthcare, and law. A paraprofessional may be required to demonstrate knowledge and skills through certification, education, and/or experience. Paraprofessionals are normally under the responsible charge of a licensed professional and may be assigned levels of responsibility commensurate with their knowledge and skills.

The PETC developed additional key position definitions related to civil engineering:

- Engineering Professional – An engineering professional is a position that encompasses responsible charge of engineering work and, therefore, must be held by an individual licensed to practice engineering. An engineering professional can comprehend and apply advanced knowledge of widely applied engineering principles in the solution of complex problems.
- Engineering Paraprofessional – An engineering paraprofessional is a position supporting an engineering professional. An engineering paraprofessional works under the responsible charge of an engineering professional but may exert a high level of judgment in the performance of their work. Engineering paraprofessionals can comprehend and apply knowledge of engineering principles in the solution of broadly defined problems.

As it relates to TSMO, there is no prior research establishing the definition of a TSMO paraprofessional. This, in part, has to do with the relatively recent emergence of a range of transportation technologies to help manage operations as well as the consequent provision of more and better data that needs to be made sense of. Paraprofessionals are key to the application of technologies and their effectiveness. With so many now in place in the TSMO workforce, the following definition is proposed.

### TSMO PARAPROFESSIONAL DEFINITION

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A TSMO paraprofessional is a position supporting the management and operations of transportation infrastructure. A TSMO paraprofessional may exert a high level of judgment in the performance of their work. TSMO paraprofessionals can comprehend and apply knowledge of basic engineering principles in the solution of broadly defined TSMO problems at a cursory level. TSMO paraprofessionals provide traffic management center operations services and a variety TSMO field services.

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<sup>3</sup> Paraprofessional Exploratory Task Committee (PETC), *Paraprofessional in Civil Engineering* (American Society of Civil Engineers [ASCE], 2009).

Current TSMO paraprofessional positions categorized by service type are defined below.

### Traffic Management Center Operations Services

Traffic management centers (TMCs) have traditionally served as the real-time interface between motorists and transportation agencies. TMC staff use travel condition information to select strategies that improve mobility and safety in a region. Over time, TMCs have evolved, and their mission has broadened to encompass a variety of goals and management approaches. For example, TMCs are now considering strategies in light of the environmental and economic impacts of congestion. A direct result of this is the deployment of congestion pricing strategies such as tolled managed lanes. TMCs have now become hubs for TSMO programs. Activities at a TMC include visual inspection of roadways through cameras, communication with responders in the field via radio, communication and coordination with other agencies, receiving phone calls from citizens, and monitoring sensors that collect traffic volumes, speeds, travel times, integration of information technology (IT) services, etc. TMC outputs include posting messages on dynamic message signs (DMSs), adjusting ramp metering systems, implementing traffic signal timing plans, updating a 511 website, or dispatching a safety service patrol vehicle. The TMC role is critical to the transportation network performance and when a TMC is successful, it can have a meaningful impact on the quality of life in the region<sup>4</sup>.

#### TMC OPERATIONS SERVICES PARAPROFESSIONALS

- TMC Operators
- TMC Operations Supervisors (non-degreed)

### TSMO Field Operations

TMCs' operations staff constantly interact with field devices and field personnel. Interaction with field personnel can either be with individuals dedicated to the support of a TMC's day-to-day operations or with personnel that sporadically collaborates with the TMC to support their own activities, such as construction project personnel. Regardless of the interaction type, proper communication and coordination with field personnel plays an important part in the operation and maintenance of the transportation infrastructure. Equally important is the interaction with field devices, which are critical to the services offered by TMCs.

An important day-to-day interaction is the constant communication between TMC operators and safety service patrols. Safety service patrols are considered an integral traffic incident management component. They greatly complement the efforts of regional TMCs in detecting, confirming, clearing and providing temporary traffic control for incidents that reduce roadway capacity. From a public perspective, they serve as the front-line representative of the agency who operates the patrols, providing face-to-face contact when an individual traveler may most need assistance. Safety service patrols are sometimes

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<sup>4</sup> E. Robinson, D. Barragan, D. Dembowski, T. Szymkowski, S. Miller, G. Golembiewski and S. Ferezan, *Human Factors Guidelines for Transportation Management Centers* (Research, Development, and Technology Turner-Fairbank Highway Research Center, McLean, 2018).

supported by roadway maintenance personnel, especially for long term maintenance of traffic (MOT) required for incidents that will impact the transportation network for an extended period. In rural areas, roadway maintenance personnel may play an even more important role for traffic and event management due to the lack of resources. They are also heavily involved in special events affecting traffic such as hurricane evacuations, recovery after winter storms, major sporting or cultural events, etc.

Another daily interaction between TMC staff and field personnel is the dispatching of intelligent transportation system (ITS) maintenance technicians to remedy ITS device failures, communication and power disruptions, etc., collectively known as operational technology or OT. OT services encompass the hardware and software that detects or causes a change through the direct monitoring and/or control of physical devices, processes and events. The term has become established to demonstrate the technological and functional differences between traditional IT systems and the industrial control systems environment, or the often called "IT" in the non-carpeted areas<sup>5</sup>.

A more sporadic TMC interaction is with other roadway incident support staff when incidents include commercial motor vehicles or other large vehicles, as well as major spills, where specialized equipment is needed to clear the road.

As previously mentioned, a sporadic area of interaction TMC staff must handle includes construction projects. Infrastructure improvements are still a major element in keeping up with regional travel demands. An essential part for TSMO is the ITS infrastructure or connected field devices that need to be installed, integrated, and tested according to set standards. ITS construction and engineering inspection (CEI) staff play a vital role in ensuring equipment is correctly deployed in a way that minimizes impacts on the traveling public.

For a TSMO program to be successful, there are several support services that need to be tapped into, such as procurement, financial, and public information services. Since these positions are under professions outside of the TSMO field, they will not be part of this discussion. However, further study should be conducted on these support services to identify gaps in knowledge, skills and abilities to further support the mainstreaming of TSMO practices.

## **TSMO FIELD OPERATIONS PARAPROFESSIONALS**

- Safety Service Patrol Staff
- OT / ITS Maintenance Staff
- Roadway Maintenance Staff
- Major Roadway Traffic Incident Support Staff

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<sup>5</sup> Derek Harp, Bengt Gregory-Brown, *IT/OT Convergence Bridging the Divide* (NexDefense).

## CONNECTING WITH THE NCHRP 20-7(408) RESEARCH PROJECT

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In June 2016, the National Operations Center of Excellence (NOCOe) convened a two-day TSMO Workforce Development Summit to discuss a variety of issues. The discussion identified a range of gaps in practice to necessitate further investigation through the NCHRP. As a result, the NCHRP Project 20-07/Task 408, TSMO Workforce: Skills, Positions, Recruitment, Retention, and Career Development project was requested by the American Association of State Highway and Transportation Officials (AASHTO) and completed in March 2019.

The resulting TSMO Workforce Guidebook encompasses:

- Results of research for training, hiring, developing, and retaining a workforce needed for a successful TSMO program at the professional and management levels of transportation organizations, which was defined as positions requiring a bachelor's degree or above.
- Stakeholder interview and literature review summaries used to identify issues, needs, and best practices for a TSMO workforce.
- A scan of existing professional education and training programs detailing more than 1,500 existing TSMO-related training programs and educational courses.
- Nineteen model position descriptions for TSMO-related positions developed using a combination of the literature review and stakeholder interviews.
- Knowledge, skills, and abilities (KSAs) for each of the position descriptions to help practitioners understand what is needed to attract and retain emerging TSMO positions.
- A strategic management framework developed for identifying new positions, recruiting, and retaining TSMO staff. This framework incorporates position descriptions, KSAs, triggers for hiring new positions, and recruitment and development best practices.

### TSMO WORKFORCE DEVELOPMENT SUMMIT

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The National Operations Center of Excellence identified workforce development as one of the focus areas that provides value to the TSMO community and hosted a two-day summit on TSMO workforce development on June 22–23, 2016. The goal of the 2016 summit was to identify viable actions that NOCOe can either influence or encourage, including the development of additional resources for TSMO workforce development. Topics discussed included general background and context regarding TSMO as a program activity, associated staffing within transportation agencies and the private sector, as well as TSMO workforce competencies, education, training, recruitment, retention, and career development.

Since the focus of this research was on emerging TSMO positions at the professional and management levels of an organization, a need for additional work to address technician and paraprofessional level positions to support the advancement of TSMO was identified.

The information shown in Table 1 suggests which portions of the NCHRP 20-7(408) Research Project can be leveraged and applied to the TSMO paraprofessional workforce.

*Table 1: Applicable Portions of the NCHRP 20-7(408) Research Project to TSMO Paraprofessionals*

Major Activity	How to Apply to TSMO Paraprofessionals
Capability Maturity Model (CMM) Framework	<ul style="list-style-type: none"> <li>• Use the CMM framework to help identify when agencies are ready to develop or hire these new TSMO paraprofessional positions.</li> </ul>
Strategic Management Framework for Recruiting, Developing, and Retaining TSMO-related Staff	<ul style="list-style-type: none"> <li>• Develop a recruitment plan to include as part of a retention framework for TSMO paraprofessionals.</li> <li>• Identify specific training gaps, opportunities and areas of investment to strengthen the TSMO paraprofessional workforce.</li> <li>• Develop training guidelines for paraprofessionals.</li> <li>• Gather best practices in TSMO paraprofessional workforce recruitment, hiring, retention and transfer knowledge to human resource departments and transportation leadership.</li> </ul>
Development of Job Position Descriptions	<ul style="list-style-type: none"> <li>• Develop specific emerging TSMO paraprofessional position descriptions.</li> </ul>
Identification of Required Knowledge, Skills, and Abilities	<ul style="list-style-type: none"> <li>• Develop appropriate knowledge, skills, and abilities for each emerging TSMO paraprofessional position.</li> </ul>
Scan of Existing Professional Education and Training Programs	<ul style="list-style-type: none"> <li>• Conduct a scan of colleges and technical school courses related to TSMO paraprofessionals working closely with organizations such as the American Technical Education Association, Association for Career and Technical Education and the American Association of Community Colleges.</li> <li>• Conduct a scan of trainings available for TSMO paraprofessionals outside of the formal college/technical school setting.</li> </ul>

## EVOLVING PARAPROFESSIONALS IN THE TSMO WORKFORCE

The transportation industry is recognizing the need to be flexible and responsive to changing needs in order to remain competitive and build a robust TSMO workforce. Transportation organizations have traditionally focused on hiring civil engineers and civil engineering technicians, but now see a need to expand hiring practices and diversify recruiting strategies to reflect the evolving skillsets and backgrounds needed for successful and innovative approaches to TSMO. Tables 2 and 3 present a description of traditional TSMO paraprofessional positions and include suggestions for future incremental evolution.

*Table 2: Evolution of Existing TSMO Paraprofessional Positions – TMC Operations*

TSMO Paraprofessional Position	General Summary of Position	Future Roles and Responsibilities
TMC Operators	Responsible for monitoring roadways, including detecting, confirming, updating, and responding to scheduled and unscheduled traffic events and congestion with ITS devices such as cameras, detectors, etc. Operators act like 911 dispatchers within a call center environment dispatching safety service patrols via a two-way radio system to assist motorists, respond to events and other activities that require timely and efficient responses. Operators may also react to incidents by making minor signal timing changes under the supervision of a traffic engineer.	<ul style="list-style-type: none"> <li>• Use new data sources such as connected vehicles and the internet of things (IoT).</li> <li>• Dispatch safety service patrols via automated routing services available in vehicles.</li> <li>• Operate connected traffic signals.</li> <li>• Operate integrated corridor management techniques.</li> <li>• Virtual and augmented reality work settings.</li> <li>• Disseminate traveler information to connected vehicles.</li> <li>• Integrate artificial intelligence in daily operations.</li> <li>• Coordinate with drone pilots for improved situational awareness.</li> </ul>
TMC Operations Supervisors	Responsible for supervising operators, monitoring and reporting on adherence to Standard Operating Guidelines (SOGs), monitoring traffic events to assign events and effectively manage traffic.	<ul style="list-style-type: none"> <li>• Virtual and augmented reality work settings.</li> <li>• Operation of connected traffic signals.</li> <li>• Operate integrated corridor management techniques.</li> <li>• Integrate artificial intelligence into daily operations.</li> <li>• Assess transportation network performance using new sources of data and advanced analytics.</li> </ul>
IT Support Staff	Responsible for providing all necessary repair and maintenance services to the IT infrastructure to ensure it is operational and functional 24 hours a day, 7 days a week and 365 days a year.	<ul style="list-style-type: none"> <li>• Routinely use cloud computing and storage.</li> <li>• Awareness and use of artificial intelligence, machine learning computing capabilities.</li> <li>• Handling of new data sources such as connected vehicles.</li> <li>• Virtual and augmented reality work settings.</li> <li>• More sophisticated cybersecurity techniques.</li> </ul>

Table 3: Evolution of Existing TSMO Paraprofessional Positions – TMC Field Operations

TSMO Paraprofessional Position	General Summary of Position	Future Roles and Responsibilities
Safety Service Patrol	Responsible for providing motorist assistance services including patrolling the designated roadways, changing flat tires, jump-starting batteries, removing minor non-hazardous spills and debris from the highway.	<ul style="list-style-type: none"> <li>• Provide roadside assistance to automated, connected, electric and shared-use vehicles, which may not have a driver operating the vehicle.</li> <li>• Use of automated and connected fleet vehicles.</li> <li>• Use of tethered drones to provide additional situational awareness to TMC staff and emergency responders.</li> </ul>
Roadway Maintenance Staff	Perform manual labor in the maintenance of highways, bridges and other highway facilities while using a variety of hand, pneumatic, and electrical tools. Coordinate, participate, and direct the maintenance activity and/or the assembly and erection of highway signs. Perform long term traffic control, structure maintenance for signs/DMS, etc. Assist in snow clearance and in rural area traffic incident management.	<ul style="list-style-type: none"> <li>• Signing and pavement markings upkeep requirements will be more stringent to support automated, connected, electric and shared-use vehicles.</li> <li>• Provide roadside assistance to automated, connected, electric and shared-use vehicles, which may not have a driver operating the vehicle.</li> <li>• Use automated and connected fleet vehicles.</li> </ul>
Major Roadway Incident Support Staff	Perform major incident clearance utilizing a variety of hand, pneumatic, and electrical tools. Deal with hazardous spill clean up, and long-term MOT, as well as safely clearing major highway incidents and truck crashes.	<ul style="list-style-type: none"> <li>• Use of automated and connected vehicles in the fleet.</li> <li>• Use of new devices to be introduced to infrastructure, such as sensors, charging stations, etc.</li> <li>• Provide roadside assistance to automated, connected, electric and shared-use vehicles, which may not have a driver operating the vehicle.</li> </ul>
OT / ITS Maintenance Staff	Responsible for providing all necessary repair and maintenance services to the ITS field infrastructure to ensure it is operational and functional 24 hours a day, 7 days a week and 365 days a year.	<ul style="list-style-type: none"> <li>• Maintenance of new devices to be introduced to ITS environment.</li> <li>• Maintenance of fewer field devices, such as dynamic message signs.</li> <li>• Higher reliability and availability requirements.</li> <li>• Networking using new telecommunications advancements such as artificial intelligence.</li> </ul>
ITS CEI Support Staff	Responsibilities include monitoring on-site construction activities; inspecting materials in accordance with scope of services, plans, specifications and special provisions; maintaining detailed accurate records of daily operations and significant events; preparing inspection reports; and testing.	<ul style="list-style-type: none"> <li>• Construction and inspection of new devices to be introduced to ITS environment.</li> <li>• Broader use of civil information modeling (CIM) for integrated enterprise asset management.</li> <li>• Fewer field devices, such as DMSs.</li> <li>• Networking using new telecommunications advancements.</li> </ul>

## KEY FACTORS SHAPING THE TSMO PARAPROFESSIONAL WORKFORCE

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Public and private transportation organizations require paraprofessionals to work with professionals to plan, design, build, operate and maintain the transportation system. As DOTs move toward utilizing TSMO strategies to better manage demand and capacity, highly specialized paraprofessionals are required to work in tandem with TSMO professionals. With technology changing rapidly and impacting the transportation field, it is important to understand key factors shaping and influencing the TSMO paraprofessional workforce. The following sections highlight a wide range of issues to consider within the context of TSMO paraprofessional workforce development.

### An Agile and Diversified<sup>6</sup> Workforce

The emergence of new technologies, ranging from advancements in edge computing, artificial intelligence; unmanned aerial systems (UAS) in surface transportation management; and automated, connected, electric, and shared (ACES) vehicles, is and will continue to be a disruptor in the TSMO community, calling for new ways of doing business. This reordering demands a more agile and diversified workforce that can adapt to rapid changes in technology to make roads safer and less congested. Employers are challenged with how to hire the supporting workforce and maintain the skills and training needed to remain relevant without compromising sound business practices and services provided to the public.

### Privatization of Public Services

Another consideration is the nature of how paraprofessionals are employed. The first TMCs were operated by staff of the owning agency. Today, many DOTs providing TSMO services such as traffic management, incident management, traveler information, etc. are supported by specialty service contracts for TMC operations staff, safety service patrols, ITS maintenance services, etc. This translates to various segments of the TSMO paraprofessional workforce being hired by private entities under public agency contracts<sup>7</sup>. Privatization of TSMO services varies significantly by agency. Privatization of TSMO public services can be attributed to several contributing factors. For one, the successful operation of a TMC and associated systems often requires specialized services outside those normally found in a transportation agency, such as software engineers, IT technicians, database specialists, etc. Public agencies face challenges in hiring and attracting these specialized positions and thus look to the private sector to help fill in gaps.

Another contributing factor can be the economic downturn of the late 2000's. When the economy first began unraveling during the Great Recession of the late 2000's, state and other transportation agencies began to retrench on services, implemented hiring freezes and left vacancies unfilled. The economy since then has recovered, and the public sector has increased investments in the community. However, many limitations on public sector hiring remain. Today, many public agencies continue to operate with staffing well below pre-recession levels while handling larger budgets. The privatization of the TSMO workforce may continue as public agencies are asked to attain the most out of their finances and as new technologies continue to be introduced into the services provided by TMCs. Thus, the role played by private organizations will be vital to the success of most TSMO programs.

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<sup>6</sup> Diversified in terms of knowledge, skills and abilities.

<sup>7</sup> Booz Allen Hamilton; Kimley Horn, *Transportation Management Center Business Planning*, (Federal Highway Administration, Washington DC, 2005).

## Labor Unions

Another factor shaping the TSMO paraprofessional workforce is the role played by labor unions and the collective bargaining process. According to the United States Bureau of Labor Statistics (BLS), a little over a tenth of wage and salary workers in the United States belonged to unions in 2018. Many more are influenced by the results of collective bargaining. The BLS also reports that now more public sector workers belong to a union than do private sector workers and a significant number of individuals are part of labor unions within the architecture and engineering industry. Thus, consideration must be given to labor unions and their influence in the industry. Labor unions have both pros and cons. Some of the positive impacts include higher wages and benefits, better worker protections, and better political organization. Some of the negative impacts include the fees and dues some of the unions require, unions may discourage individuality and add hurdles to promotion and termination of workers, as well as drive up costs.

Generally, maintenance, administrative, and technical positions would be more likely to be associated with the collective bargaining process and union membership. For example, in New York State, the DOT collective bargaining process extends through senior level engineering and technical positions, so it is important to be aware of the processes in each situation, and plan accordingly.

## Retention

Retaining a well-trained employee is critical to the long-term success of an agency's TSMO program. Retention challenges faced by both private and public organizations include inadequate compensation levels, lack of ongoing support and direction, and lack of a team culture in which paraprofessionals feel valued. Workforce development challenges in cases where the public agency is contracting services from the private entity may entail the need to balance tensions between the requirements of business profitability and the public agency culture of providing a service to the traveling public. Also, whether the employer of the paraprofessional is public or private, both face the ongoing challenge of achieving a balance between the perspectives and skills of supervisors versus job coaches or trainers and meeting substantial workforce development needs with limited training and support resources.

## Training and Career Development

Training and career development are often made successful through a healthy compliment of certifications and education opportunities. Certifications from reputable and industry accepted organizations make it possible for human resources (HR) departments to require and incentivize the certifications for career advancements and higher pay. However, a lack of directly related certification programs for TSMO paraprofessionals translate into poor definition of roles, responsibilities, salary scales, and career paths for these individuals. Currently, only one industry association certification for TMC operators exists through the International Municipal Signal Association (IMSA) and was developed and released in 2016<sup>8</sup>.

The good news is that effective collaboration amongst the infrastructure owner, operator, private service providers, and academic institutions invested in the transportation field, can navigate the minefield described above. Most of the training a TSMO paraprofessional goes through is either on-the-job training or semi-formal training put together by employers. For example, the Florida Department of

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<sup>8</sup> IMSA – Transportation Center System Specialist Level I and II.  
[https://www.imsasafety.org/IMSA/Certification/IMSA/Certification/Certification\\_Overview.aspx?hkey=4c8430a2-441e-4d1f-bce7-ac908cfeeb76#tcss1](https://www.imsasafety.org/IMSA/Certification/IMSA/Certification/Certification_Overview.aspx?hkey=4c8430a2-441e-4d1f-bce7-ac908cfeeb76#tcss1)

Transportation District 6 TMC has built into the TMC operation contract requirements the development of a training curriculum and certification program for TMC control room staff including an annual update of the material. Another example of this collaboration is the Washtenaw Community College in Southeast Michigan. They were able to create training modules that merged the advancement of the private and automotive industries with the needs of the public sector through modular courses in ITS, sensor hands-on applications and middle skill engineering.

Community colleges and two-year technical trade colleges are often the workforce pipeline for TSMO paraprofessionals. While these colleges would not serve all TSMO paraprofessionals, they provide an opportunity to build a future workforce that is interested and properly skilled for their future roles. This requires an intentional set of partnerships that co-own the vision and mission of safety and mobility, buy into the performance metrics needed to help direct and monitor progress, and embrace all involved as partners and co-workers to get the job done.

## CONCLUSIONS

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A robust and effective TSMO program requires expertise in a wide range of technologies, applications, and analysis that requires the need for evolving positions, both professional and paraprofessional, as well as new ways of attracting and managing the workforce. Agencies must identify emerging needs in new areas through strategic and programmatic TSMO planning with an understanding of current and targeted levels of TSMO maturity.

This white paper has been developed to assist transportation agencies in moving into a culture of systems management and operations through focused recruiting, developing, and retaining of paraprofessionals. The following provides a roadmap on efforts NOCoE and other partners should take to advance activities to strengthen the overall understanding of how the TSMO community can sustain its paraprofessional workforce:

- 1) Conduct a market study. Include identifying market size and current workforce, performing market predictions and overlapping analysis of KSAs in the market that are also in demand in other industries.
- 2) Conduct a robust CMM evaluation to determine how the evolving TSMO paraprofessional positions affect organizations.
- 3) Develop a strategic management framework for recruiting, developing, and retaining that is tailored to TSMO paraprofessional staff.
- 4) Develop evolving and emerging TSMO paraprofessional job position descriptions, as well as corresponding knowledge, skills, and abilities.
- 5) Conduct a national survey to determine challenges, opportunities and best practices for recruiting and retaining an adequate TSMO paraprofessional workforce.
- 6) Conduct a scan of college and technical school courses related to TSMO paraprofessionals, as well as training available for TSMO paraprofessionals outside the formal college/technical school setting. Create a repository of information that can be accessed by those involved with supervising TSMO paraprofessionals.