2ND TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO) SUMMIT

CASE STUDY 1: DEFINING THE TSMO WORKFORCE PIPELINE

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HIGHLIGHTS

- While the TSMO Industry continues to draw from traditional sources of workforce, to fully realize the benefits and meet future demands, workforce pipeline sources must be diversified.
- Many transportation agencies face challenges in building a pipeline specific to TSMO because of organizational structure limitations, dated hiring practices, and TSMO awareness throughout the agency.
- Best practices for developing the TSMO workforce pipeline include innovative partnerships, expanding depth and breadth of current development activities, and targeting a variety of diverse communities.

INTRODUCTION

A key challenge in building a robust TSMO workforce is the lack of clearly defined pipeline for recruiting workers. As noted in the *National Transportation Career Pathway Initiative Final Report* produced by the National Network for the Transportation Workforce, "The primary challenge for readiness of the transportation operations workforce is that transportation operations as a specific pathway through a specific discipline does not exist." This is due to the inherently interdisciplinary nature and complexity of TSMO work. To address limited candidate pools, a more comprehensive approach to raising awareness of TSMO opportunities and recruiting qualified workers that creates new rather than just draws from existing pipelines is needed.

CURRENT SOURCES FOR TSMO WORKERS

Potential candidates for TSMO jobs must be recruited from academic programs (at the technical, community college and university levels) as well as from incumbent workers in other fields. The TSMO workforce requires a wide range of personnel including engineers and planners, computer specialists and signal technicians, as well as TMC operators and traffic incident management staff. These workers must possess varied, but largely technical, knowledge and skills. And the fast-paced and often high-stress nature of TSMO roles means that communication, problem-solving, and decision-making are also critical competencies.

Typical Academic Pathways

At the university level, transportation agencies typically recruit from a limited number of disciplines, with the most prevalent being civil engineering and planning. Other disciplines that have students with TSMO-related competencies include electrical and computer engineering, computer science, information technology, and earth sciences (housing Geographic Information Systems programs), although recruitment from these disciplines is not widespread. Transportation agencies generally have established relationships with colleges and universities that allow for routine participation in career fairs for specific majors (like civil engineering and transportation planning). University internship programs with transportation agencies are another direct connection for recruiting students into TSMO roles.

Technician-level workers are frequently recruited from both technical and community colleges with programs that, while not TSMO-specific, train students in skillsets that are relevant for the TSMO workforce. These programs may lead to technical certifications or to associate degrees. Such programs include:

- Computer information technology
- Computer engineering technology

- Electrical engineering/electronics technology
- Equipment technology
- Commercial driver programs

Some DOTs have established partnerships with technical or community colleges to directly recruit students as they near completion of their program and also offer apprenticeship or internship options for these students.

Sources of Incumbent workers

Incumbent workers are typically recruited through a range of activities, including specifically created programs and partnerships targeting particular groups or through broad community career fairs and advertisements. Some of the key groups that are a source of workers include:

- Veterans
- Emergency management professionals
- Construction industry
- IT industry

Veterans are frequently sought out by transportation agencies because of the relevant training that many have obtained during military service, as the majority of military occupations are transportation, logistics, or technology related. Emergency management personnel are also a key group for TSMO recruitment. This is due to the fact that incident management requires a directly related skillset and these workers are accustomed to the type of fast-paced and stressful environment that they will encounter within TSMO. Both veterans and emergency management professionals also have experience with the integration of numerous stakeholders, policies, and communication requirements necessary within the TSMO realm. Other technicians may be recruited from construction or IT industries, as TSMO technician roles require skills that cross several disciplinary boundaries.

ADDITIONAL SOURCES OF TSMO WORKERS

New and innovative approaches to building the TSMO workforce pipeline are necessary to address current challenges. This includes seeking out additional sources of workers beyond those typically recruited to TSMO. Opportunities with the potential to create new avenues for attracting TSMO workers include:

- **Expanding academic pipelines.** Include other related engineering disciplines, computer science, information technology, data science, etc.

- **Creating strategic partnerships.** Recruit and train workers to enter paraprofessional TSMO tracks – this may include partnerships with community organizations that serve underemployed workers, organizations that seek to empower underserved populations (such as women from low-income communities), and high school career and technology education (CTE) programs.

- **Developing training and work experience programs for neurodiverse individuals**. The number of neurodiverse individuals is growing, with estimates that this group accounts for more than 2% of the US population. Neurodiverse workers may need accommodations in the workplace to support communication and learning differences but may in turn bring significant strengths to TSMO programs through higher-level skillsets in computer applications, mathematics, and technology and the ability to approach a problem from a different perspective.

- **Cross-training for DOT staff**. One way to improve awareness of TSMO functions and retention within DOTs is to develop cross-training options that allow staff in other areas of the organization to learn about TSMO and develop skills that support TSMO operations. This can create opportunities for staff who might not otherwise remain with the agency because they are not challenged in their current role or do not see a pathway for advancement.

- **Encore Careers.** People beginning a new vocation at a later age, typically after regular retirement from a prior career, provide another potential source of TSMO workers. Encore careers are typically motivated by social impact and a sense of personal fulfillment rather than economic factors. Based on research from the MetLife Foundation, approximately 25% of all encore careers are in government with an anticipated tenure of 11 years prior to full retirement.

BARRIERS TO INCREASING TSMO AWARENESS

Awareness of career opportunities within TSMO is crucial for attracting workers to the field. However, there are several barriers that limit exposure and recognition of TSMO career pathways. These include visibility of TSMO in academic programs, hiring practices that can restrict the ability to reach appropriate candidates, and organizational silos.

Visibility of TSMO

There are barriers to increasing visibility of TSMO across the board, whether through traditional or newly connected disciplinary areas. In civil engineering programs, a core challenge is the limited exposure that students have at the undergraduate level to transportation as a whole (and certainly to TSMO). Most Accreditation Board for Engineering and Technology (ABET)-accredited programs in the US require only one transportation class at the undergraduate level, and typically this course appears in the junior year of the program. This means students are immersed in other subdisciplines of civil engineering (such as structural, geotechnical, or water resources sub-disciplines) earlier in the program of study. This typically leads to students selecting concentrations (and thus electives) before they ever learn about transportation. Given that the transportation course must cover a wide range of topics to provide the introductory content and fundamentals of design that may appear on the Fundamentals of Engineering Exam, many of the courses do not include reference to TSMO at all. And, in a recent review of ABET-accredited civil engineering programs, it was determined that only 13% of all courses (including electives) offered at the undergraduate level included an operations focus, as the majority (54%) concentrated on design. Thus, if a student is to be made aware of TSMO, they would have to be swayed to pursue a transportation concentration once they finally take the transportation course, and then select electives that will introduce TSMO concepts.

Other disciplines have even more precarious connections to TSMO. Most relevant programs at the university level, such as computer science, information technology, or computer engineering, offer students no contextual link to transportation and TSMO. The same is true at the community and technical college levels, with the exception of programs where DOTs have established specific partnerships. In fact, similar professionals are needed not only in the traffic arena but also in transit and freight, and visibility across these areas of the transportation industry is also limited. Rarely do organizations (whether public or private) recognize the potential for recruitment across these boundaries. Similarly, the individuals employed in these areas typically do not understand the transferability of their knowledge, skills, and experience to TSMO.

Hiring Practices

Public sector transportation roles, particularly for engineering and management positions, have typically been dominated by recruitment of civil engineering and planning professionals. As technology has continued to evolve and become pervasive in DOT operations, the need for a wider range of skillsets has emerged. While the need to consider recruitment of students and professionals from an expanded set of disciplines is increasingly important in TSMO, this is often problematic for DOTs due to hiring limitations and lack of relationships in these disciplines. Many agencies face challenges because position descriptions are outdated and may restrict acceptable candidates to specific backgrounds (such as civil engineering or planning) that may no longer be the best (or only) option for new and evolving roles. When outdated position descriptions are used, this limits the ability of an agency to recruit the talent needed to enhance organizational capabilities. When agencies can recruit outside of traditional disciplinary boundaries, the key challenge is often identifying connections that will lead to recruitment partnerships, such as points of contact in diverse academic programs and professional organizations.

Organizational Silos

To develop a mature TSMO program within a DOT, there must be agency-wide awareness of and buy-in regarding the impact and importance of TSMO to the organizational mission. Without this, the potential for cross-training of existing staff and collaboration in recruitment efforts is limited. An effective internal and external communication strategy can elevate the status of TSMO and highlight the impact of the TSMO workforce in improving safety and congestion issues in our communities. When organizational silos exist and this type of communication does not occur, pipeline challenges are exacerbated.

BEST PRACTICES FOR BUILDING THE TSMO PIPELINE

Even with the significant challenges to developing the TSMO pipeline, there are many opportunities to overcome and address these issues. The following best practices can enhance recruitment potential across a wide range of TSMO roles:

- **Start building the pipeline early**. TSMO-related training can be designed for high school students and delivered through career and technical education (CTE) programs. Students can earn professional certifications along with course credit that can prepare them to enter the TSMO workforce immediately after high school graduation. Additionally, pre-apprenticeships, internship programs, and shadow days can be highly effective for building a pipeline of students. Transportation-focused STEM academies, such as the T-STEM Academy at East High School in Memphis, Tennessee, provide an excellent opportunity for DOTs to build pipeline partnerships and to highlight some of the technologies, innovations, and impact of TSMO that can attract students to transportation careers.

- **Expand partnerships between industry and academia**. The workforce challenges faced in TSMO make it especially important to develop industry-academia partnerships that allow industry to provide curricular guidance, mentoring, and career awareness to students and to establish relationships with faculty and administrators that support pipeline development efforts.

- **Cast the net much wider - beyond 'traditional' groups**. In order to attract qualified candidates that can strengthen TSMO capabilities for an organization, recruitment and hiring practices must be revisited so that job descriptions and stated candidate qualifications align with workforce needs. It is also essential to open the door to individuals with backgrounds or abilities that are

non-traditional or groups traditionally underrepresented within a DOT and to establish outreach efforts to reach them. Partner with relevant professional, technical, and student organizations (such as the Society of Women Engineers), Historically Black Colleges and Universities, Minority Serving Institutions (MSIs) or college programs serving students with varied abilities (such as neurodiverse populations) to reach a wide range of diverse groups.

- **Provide exceptional learning experiences to students**.
    - Programs like Transportation Technology Tournament that pair DOT and industry mentors with college students to work on a real-world challenge gives students an opportunity to engage in hands-on, problem-based learning. These types of experiences can be very effective in attracting students to TSMO.
    - Resources that can be integrated into existing courses, such as the ITSPCB Academic Case Studies, facilitate delivery of TSMO content in college classes. Practitioners can volunteer to lead these activities in classrooms, serve as guest speakers to contribute additional project examples, and provide related field-trip experiences.

- **Design pre-apprenticeship/apprenticeship and other training programs that account for participant needs**. In the case of underserved populations, this may include providing transportation or childcare options that support the participant in completing the training.

- **Elevate awareness of TSMO as a profession**. It is important for agencies to tell the story of transportation and TSMO both within and external to the agency to enhance pipeline opportunities.

- **Recruit from within**. Creating opportunities for agency cross-training and exposure along with pathways to advancement can improve retention and provide a new source of workers who might have otherwise left the DOT.

- **Create a culture of innovation**. As important as innovation is to developing organizational capability with regard to TSMO, it is equally important to developing a TSMO workforce. Building a strong workforce pipeline requires creativity, collaboration, and innovation to overcome barriers and achieve workforce goals.