TSMO Workforce Development: Preparing the Next Generation

TSITE Winter Meeting
February 25, 2021

Stephanie S. Ivey
Director, Southeast Transportation Workforce Center
Agenda

• Recently completed research/resources

• TSMO workforce of the future

• What’s up next for SETWC (and how to get involved!)
What type of experience do you have with TSMO?

- No experience with TSMO: 4
- State or local agency (TSMO functions within agency): 8
- Consultant supporting state/local agency with TSMO functions: 6
Recent Research

• FHWA National Transportation Career Pathways Initiative (NTCPI)

• Empowering the New Mobility Workforce: Educating, Training, and Inspiring Future Transportation Professionals – Ed. Tyler Reeb, Elsevier 2019

• SETWC Playbooks:
  • Women in Transportation
  • T-STEM Academy

• TSMO Workforce Guidebook (transportationops.org)
National Transportation Career Pathways Initiative - NTCPI

• Priority occupation analysis

• Development of resources:
  • Competency models
  • Discipline model
  • Sample KSAs and job descriptions
  • Career pathway models
  • Programs of study
  • Experiential learning resources

https://www.nntw.org/workforce-initiatives/ntcpi/
NTCPI - Transportation Operations Career Clusters

**Operations Management**
- Project & Program Mgr¹
- Computer & Information Systems Manager
- Traffic Incident Manager
- Operations Planner

**Systems/Operations Engineering**
- Civil (Traffic) Engineer
- Civil (Transit) Engineer
- Industrial Engineer²

**Operations Research & Data Science**
- Operations Research Analyst/Industrial Eng.²
- Data Science Analyst/Logistician

**Operations Technology**
- Traffic Signal Technicians
- Diesel Mechanics
- Commercial Drivers
Transportation Operations

Knowledge of Microsoft Office Programs
General Computer Skills
Ability to pass a drug screening or background check
Ability to collect, enter, or analyze data
Possess a good attitude/work ethic
Time and Task Management Skills
Process professional judgement
Analytical, Mathematical, or Problem-solving Skills
Ability to work well independently
Ability to work well on a team
INTERPERS. SKILLS
Ability to follow/ interpret instructions
Ability to read/ interpret diagrams, schematics, blueprints, etc.
Technical Communication/Report Development Skills
Communication Skills, Written and Verbal
MANAG. SUPERVIS. EXPERIENCE AND LEADERSHIP
Management/Supervisory Experience and Leadership Skills
Manual Labor/ Physical/Requirements and Constraints
Management of Labor, Tools, or Materials
Operation of Relevant Equipment/ Machinery
Operational Hazards and Safety Precautions
MULTCD
Traffic Control Devices
Electrical Trade
Traffic/ Traffic Engineering/ Operations

Figure 1.3.1. Most Sought-After Competencies for Traffic Signal/ITS Technicians

Figure 1.3.3. Competency Pyramid for Traffic Operations
**Job Description: Traffic Engineer (Traffic Operations)**

**Alternative Job Titles**
Entry Level Engineer, Traffic Operations Engineer, Traffic Operations Program/Project Manager, Traffic Engineer, Traffic Program/Project Manager, Advanced Traffic Operations/PM Engineer

**Job Description**
A traffic engineer will execute traffic signal, traffic operations, and intelligent transportation system design projects using civil engineering principles. A traffic engineer may work on traffic warrant and parking studies, transportation planning/analysis, traffic event management studies, and traffic signal/runway design projects. Other design projects may include integration of connected and automated vehicle infrastructure, roundabouts, pavement markings, temporary and permanent traffic control devices, and signal system design. A traffic engineer must be able to prepare and propose signals, delineation, road signs, and pavement markings. A traffic engineer should execute traffic engineering functions and activities to ensure efficient and safe traffic operations. An engineer with project management duties will manage project scope, schedule, and budget and assume a role to bring a project to completion. Other responsibilities may include:
- Use of engineering software and equipment to perform engineering tasks.
- Collection and preparation of data for evaluation and engineering reports.
- Coordination of projects from planning through final design.
- Design or management of transportation facilities operations.
- Management of staff and technical resources for day-to-day engineering projects.
- Coordination of project tasks across a variety of stakeholders.

**Knowledge Requirements**
- Transportation/Traffic Engineering/Operations
- Local Agency Procedures/Standard Design Principles
- Project Management Practices
- NITC
- ITS Technology/Operations
- Highway Capacity Manual
- AASHTO A Policy on Geometric Design of Highways and Streets
- Transportation Engineering Handbook: First Edition

**Required Skills & Abilities**
- Communication Skills, Written and Verbal
- Management/Supervisory Experience and Leadership Skills
- Interpersonal Skills
- Time and Task Management Skills
- Technical Communications/Report Development Skills
- Analytical, Mathematical, or Problem-solving Skills
- Ability to be innovative or creative
- Presentation Skills
- Basic Computer Skills
- Proficient with Microsoft Office Applications
- Ability to work well in a team
- Organizational Skills/Attention to Detail
- Ability to work independently
- Good judgment
- Ability to work in fast-paced or stressful environment

**Typical Salary**
- $24,000 - $34,000

**Education & Work Experience**
- Master’s degree preferred; bachelor’s degree required.
- Relevant coursework in civil engineering with traffic or transportation emphasis sometimes preferred.
- ET/PE License commonly required; PE/PE sometimes preferred.

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**Career Pathway: Traffic Engineering (Traffic Operations)**

**Master’s Degree**
- Preferred: Master’s Degree in Civil Engineering or related field
- 4-10 years of experience in management of traffic engineering projects and/or supervision experience.

**Bachelor’s Degree**
- Sometimes Preferred: Bachelor’s Degree in Civil Engineering
- 3-5 years of experience in transportation or traffic engineering.

**Entry Level Engineer**
- 1-3 years of experience in traffic engineering

**Salary**
- $24,000 - $31,000

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**Career Ladder**

**Senior Traffic Engineer/PM**
- Advanced Traffic Operations Project Manager
- Advanced Traffic Operations Engineer
- Salary: $85,000 - $120,000

**Traffic Operations Engineer**
- Associate Traffic Engineer
- Traffic Operations Design Engineer
- Traffic Project Engineer
- Salary: $67,000 - $128,000

**Traffic Operations Program Manager**
- Transportation Project Manager
- Salary: $55,000 - $134,000

**Traffic Engineer Project Manager**
- Salary: $55,000 - $96,000

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**Program of Study**
- Master of Science in Civil Engineering
- Master of Science in Transportation

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**UM**
- University of Michigan
Transportation Playbooks

Transportation-STEM Academy (T-STEM): A playbook for developing transformational educational experiences through industry-academia partnerships

Women in Transportation Playbook: Inspire, Engage and Empower

www.memphis.edu/setwc
TSMO Workforce Guidebook

Goal: Assist transportation agencies in advancing TSMO maturity through workforce development.

- **GET GUIDANCE:** People at transportation agencies looking to begin or advance a TSMO program
- **GET ADVICE:** People involved in recruiting, hiring, or training in the transportation operations field
- **UNDERSTAND CHANGING ROLES:** Consultants working with TSMO programs
- **KNOW HOW TO PREPARE TOMORROW’S WORKFORCE:** Educators at the undergraduate and graduate levels

NOT ONE SIZE FITS ALL
TSMO Workforce Guidebook

- Recruiting a TSMO Workforce
- Developing a TSMO Workforce
- Model TSMO Position Descriptions
- TSMO Workforce Retention

NOCoE Website

https://transportationops.org/workforce
TSMO Workforce Guidebook

- 19 different positions descriptions created
  - Pick and choose
  - “starter list”
- Some exist, but not widespread or can be expected to exist in future
- Developed to include:
  - When position might be needed – “Triggers”
  - How it relates to Capability Maturity Model (CMM) improvement
  - Knowledge, Skills Abilities for position
- Positions descriptions designed as starting point – Modify to fit agency needs
## TSMO Workforce Guidebook

<table>
<thead>
<tr>
<th>Position (Program Manager)</th>
<th>Position (Specialist)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Data Scientist/Statistician</td>
<td>Cyber Security Engineer</td>
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<tr>
<td>TSMO Manager/Chief/Bureau Director</td>
<td>Transportation Data Ethicist</td>
</tr>
<tr>
<td>TSMO Program Manager</td>
<td>Surface Weather Specialist</td>
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<tr>
<td>Computer Engineer</td>
<td>Systems Engineer</td>
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<tr>
<td>Artificial Intelligence Scientist</td>
<td>TSMO Modeling Specialist</td>
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<tr>
<td>Telecommunications Engineer</td>
<td>Emerging Technologies Industry Liaison</td>
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<tr>
<td>Data Management Specialist</td>
<td>Transportation Systems Performance Manager</td>
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<tr>
<td>Visualization Specialist</td>
<td>Integrated Corridor Management Manager</td>
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<tr>
<td>Connected and Automated Vehicles (CAV) Program Manager</td>
<td>Transportation Management Center Manager</td>
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<tr>
<td>Traffic Incident Management (TIM) Program Manager</td>
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</tbody>
</table>
TSMO Workforce Guidebook

- Management
  - Collaboration
  - Organization/Staffing
  - Culture

- Operations
  - Business Processes
  - Systems and Technology
  - Performance Management

- The more the radial graphs are filled out the higher potential to improve CMM category
Integrated Corridor Management Manager
Typical TSMO Program CMM Level: 2-3

Area of Improvement
- Collaboration
- Business Processes
- Organization/Staffing
- Systems and Technology
- Culture
- Performance Measurement

Legend
- Management (Blue)
- Operations (Green)

Area of Improvement: Management (Blue) Operations (Green)
## TSMO Workforce Guidebooks

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Abilities</th>
</tr>
</thead>
</table>
| • Knowledge of Transportation, Traffic Engineering, Operations  
• Knowledge of Project Management Practices  
• Knowledge of Local Agency Procedures, Standard Design Principles  
• Knowledge of ITS Technology, Operations | • Managerial/Supervisory Experience and Leadership Skills  
• Communication Skills, Written/Verbal  
• Technical Communication and Report Development  
• Interpersonal Skills  
• Time and Task Management Skills  
• Analytical, Mathematical, or Problem-solving Skills | • Ability to be Innovative or Creative  
• Ability to Work Well on a Team  
• Possess Professional Judgment  
• Ability to Collect, Enter, or Analyze Data |

*Integrated Corridor Management Manager KSAs*
# TSMO Workforce Guidebook

<table>
<thead>
<tr>
<th>Desired Information</th>
<th>Guidebook Section</th>
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<tbody>
<tr>
<td>• An understanding of the evolving skillsets and backgrounds needed for successful</td>
<td>Chapter 2. Recruiting a TSMO Workforce</td>
</tr>
<tr>
<td>and innovative approaches to TSMO.</td>
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<tr>
<td>• Understanding when an agency is ready to hire TSMO personnel.</td>
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<tr>
<td>• Recommendations and best practices for hiring TSMO positions.</td>
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</tr>
<tr>
<td>• A description of 19 TSMO-related positions and the knowledge, skills, and abilities</td>
<td>Chapter 3. Model TSMO Position Descriptions</td>
</tr>
<tr>
<td>required by each position.</td>
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<tr>
<td>• Information on when, where, and how to recruit for each of the TSMO-related 19</td>
<td></td>
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<tr>
<td>positions.</td>
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<tr>
<td>• Crafting a professional development plan for the TSMO workforce.</td>
<td>Chapter 4. Developing a TSMO Workforce</td>
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<tr>
<td>• Information on TSMO-related educational programs at the undergraduate and graduate</td>
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<td>level.</td>
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<tr>
<td>• Information on TSMO-related professional development courses.</td>
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<tr>
<td>• Areas of investment to strengthen a TSMO workforce.</td>
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<tr>
<td>• Recommendations and best practices for TSMO workforce retention through</td>
<td>Chapter 5. TSMO Workforce Retention</td>
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<tr>
<td>improvements to training and professional development, human resource benefits,</td>
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<td>and workplace culture.</td>
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<tr>
<td>• List of TSMO-related educational programs at the undergraduate and graduate</td>
<td>Appendices</td>
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<td>level.</td>
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<tr>
<td>• List of TSMO-related professional development courses and training programs.</td>
<td></td>
</tr>
<tr>
<td>• Example TSMO-related position descriptions.</td>
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TSMO Workforce of the Future

• Rapid evolution of technology transforming system operations and how work is done
• Increased emphasis on interconnected mobility – and emerging markets/modes
• Transform data into information – and other data considerations
• Complexity of problems blurs lines between disciplines
• Lifelong learning is essential
TSMO Workforce of the Future

- Evolution of positions – and emerging roles
- Complication of career pathway models
- Limited awareness
- Competition from other industry segments

The workforce of the future must possess more interdisciplinary skills that cross over traditional boundaries of academic preparation.
Which of the following do you see as the biggest challenge for developing a robust TSMO workforce?

- Rapid evolution of technology: 2
- Complicated career pathways: 1
- Limited awareness/visibility of TSMO: 13
- Competition from other industry segments: 1
TSMO Workforce of the Future

• Evolution of positions – and emerging roles
• Complication of career pathway models
• Limited awareness
• Competition from other industry segments

The workforce of the future must possess more interdisciplinary skills that cross over traditional boundaries of academic preparation.
Transportation Workforce of the Future

• Must reach students EARLY
• Elevate awareness of (and respect for) all transportation jobs – STEM for all
• Strong partnerships between academia and industry
• Diversity matters! Recruitment and retention efforts must evolve to attract diverse workers
• Continuous training requirements
Intelligent Transportation Systems – Professional Capacity Building (ITSPCB)

• Focused on ITS academic pipeline
  • K-12
  • Technical and community colleges
  • Universities
• Comprehensive and collaborative effort by NNTW
• Develop enhanced resources linking real world practice to academic content

www pcb its dot gov
Intelligent Transportation Systems – Professional Capacity Building (ITSPCB)

• Develop and manage Academic Communities of Practice
  • All academic levels
  • Focus on diversity
  • Connect to professional associations and employers

• Develop and manage K-12 national advisory group for
  • STEM for All (transportation centered)
  • Develop resource tool kit for teachers
Intelligent Transportation Systems – Professional Capacity Building (ITSPCB)

- Enhance ITS Case Studies
  - Revise existing
    - Adaptive Signal Control
    - Civil Design Considerations for ITS Implementations
    - Concepts of Operations
    - National ITS Architecture
    - Travel Time Based Performance Measures
  - Create new
    - Dynamic Message Signs
    - Safety Applications of ITS
    - ITS in Bus Rapid Transit
    - Planning for ITS
    - Capstone course concept
  - National advisory groups
Intelligent Transportation Systems – Professional Capacity Building (ITSPCB)

• ITS Career Path Profiles
  • Minimum of 60
  • Diverse career pathways
  • Virtual speaker series

• ITS Project Profiles
  • Minimum of 20
  • National coverage
  • Profile videos

• ITS Speakers Bureau

• Coordination across national projects/organizations
Opportunities for Engagement!

• Submit an ITS project profile
• Submit an ITS career profile
• Work with SETWC to create an ITS project video
• Join (one of the many!) advisory groups
• Provide a speaker for K-12 or college students (or both!)
• And more!
Why is this important?

- Full pipeline approach
- Don’t reinvent the wheel
- Engage in collaboration
- Change the conversation
  - Students
  - Industry and academia
  - Organizational

Awareness

Exposure and Experience

Identity
So, who wants to get involved?

I am so excited about getting involved that I can’t figure out how to respond...

- Me!
- Me! (and all of my coworkers)
- Me! (and all of my coworkers and everyone else I know!)
Questions?

Stephanie S. Ivey
ssalyers@memphis.edu

Additional Resources:
memphis.edu/setwc
nntw.org
transportationops.org