



The National Operations Center of Excellence

A Longstanding Commitment to Workforce Development

The National Operations Center of Excellence's Longstanding Commitment to Workforce Development

- Introduction: About NOCoE
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Introduction: About NOCoE and why it was Formed

1

Over the last decade, TSMO has become widely recognized for its integral and essential role within the transportation ecosystem.

2

TSMO did not have a centralized home for collecting and disseminating best practice information and identifying research needs and capabilities.

3

The National Operations Center of Excellence (NOCoE) was developed to meet this need.

NOCoE is guided by the leadership of AASHTO, ITE, ITS America and FHWA.





Vision

NOCoE's exceptional services to the transportation systems management and operations community saves lives, improves travel times, and enhances economic vitality.

Mission

NOCoE provides centralized services to support the transportation industry through workforce readiness, deployment of technology and practices, and mainstreaming of TSMO solutions through education, networking, communication, and knowledge transfer.

Act One, Scene 1:

NOCoE's First Summit on WFD: June 22–23, 2016

- The goal of the Summit was to identify viable actions that NOCoE can either influence and encourage the development of additional resources for TSMO workforce development.
- In preparation for the summit, NOCoE produced three white papers focused on the current workforce environment for the TSMO community prepared in advance of the summit.
- The white papers provided context and discussion starting points by focusing on the institutional context for TSMO in transportation agencies, professional capacity building needs vs. available resources, recruitment, retention, and career development.

NOCoE's First WFD Summit: Day 1

- The first day of the Summit focused on discussion and review of the white papers and their suggested focus for TSMO workforce development.
- Discussions were held within breakout groups where participants developed responses and suggestions to pre-identified actions identified in the white papers followed by a discussion of the findings of each breakout.

NOCoE's First WFD Summit: Day 2


The second day identified eight priorities:

1. Convene a forum of DOTs, private sector and educators to discuss pre-employment education needs/solutions .
2. Create a repository of existing TSMO-related course materials across all educational institutions—universities and community colleges.
3. Conduct an updated systematic exploration of knowledge, skills and abilities (KSA) needs vs. training materials gaps for TSMO entity-related functions and positions.
4. Develop a repository of existing position descriptions (PD) for similar positions/functions, and create model position descriptions.
5. Develop model TSMO training program for new hires, promotions, and transfers— including a review of current best practice for organization policies, practices, and content.
6. Develop a strategy to elevate TSMO visibility as a core transportation function.
7. Document current best recruitment practice in public and private entities, including targeting of non-traditional disciplines and recruitment sources, and the use of recruitment “sweeteners”.
8. Document current best practices in mentoring, succession planning, cross training, special assignments and individual career planning for public and private entities.

Act One, Scene 2:

Summit-inspired Workforce Development Resources










National Operations Center of Excellence

Delivering resources to save time, lives, and money

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Search ... 

Workforce Overview

Student Education

K-12 Students

Community Colleges

University Education

Workforce Training

TSMO Training Database

TSMO Paraprofessional Workforce White Paper

Career Pathways

Industry Assessments

HR Resources

Model TSMO Position Descriptions

NOCoE Case Study: Defining the TSMO Workforce Pipeline

TSMO Workforce Development

Traffic Incident Management

Your Collection of TSMO Workforce Resources

As agencies and organizations adopt a transportation systems management & operations (TSMO) focus, the industry has identified the urgent need to develop and grow the TSMO workforce. Growing and developing the TSMO workforce requires a variety of approaches and strategies, from educating students on TSMO careers to increasing the skills of the current workforce.

This series of webpages captures the growing number of resources available across the industry, from U.S. DOT and the National Network for the Transportation Workforce to formalized training programs. Additionally, there are number of resources to help TSMO agencies take a broader approach in organizing and developing their TSMO personnel. Lastly, ongoing industry research and activities will continue to define the knowledge, skills, and abilities for the TSMO workforce and better define the needs for a successful TSMO workforce. We've outlined a few of these activities and will continue to capture those resources as they are developed.

We've organized the resources into the following categories (corresponding to the menu on the left):

- [Student Education](#)
- [Workforce Training](#)
- [Industry Assessments](#)
- [HR Resources](#)
- [Events, Contests, and Success Stories](#)

TSMO Guidebook Overview

The intent of this guidebook is to provide practitioners with a tool to understand what is needed and how to develop a strong Transportation Systems Management and Operations (TSMO) workforce. While a basic understanding of TSMO is beneficial to the reader, this guidebook focuses on workforce development practices rather than the specific details of TSMO, so readers without a background in TSMO will find the information within useful. This guidebook goes into detail on the hiring and workforce development practices recommended through literature and currently in place within existing and successful TSMO programs. It clearly identifies specific job positions required for a robust TSMO program, the knowledge, skills, and abilities required for those job positions, and recommendations tailored to hiring each position. Information on training and professional development is presented, including specifics on training providers and courses.

Project No. 20-07/Task 408

**TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS
(TSMO) WORKFORCE GUIDEBOOK
FINAL GUIDEBOOK**

Prepared for
National Cooperative Highway Research Program (NCHRP) Project 20-07
Transportation Research Board
of
The National Academies of Sciences, Engineering and Medicine

**TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES OF SCIENCES,
ENGINEERING AND MEDICINE
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Original Submittal November 2018

Updated March 2019

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Model Position Descriptions



TSMO Paraprofessional Workforce White Paper

Career Pathways

Industry Assessments

HR Resources

- Model TSMO Position Descriptions
- NOCoE Case Study: Defining the TSMO Workforce Pipeline
- White Paper: Assessing Pipeline Trends for Target Groups - Military
- Technical Memo: Workforce Trends and Practices Applicable to TSMO
- White Paper: Attracting Non-Traditional Workers Into the TSMO Workforce

Resources from Other Industries

Webinar Series

technology makes its way into the transportation industry. While many of the position descriptions build on more specialized civil engineering skills, others recognize the need to broadly expand and diversify the training and education needed for future positions.

The 19 positions descriptions are provided via the links below. Each example position description is organized in a table format and includes the components shown in the figure below.

• Traffic Data Scientist/Statistician	• Cyber Security Engineer
• TSMO Manager/Chief/Bureau Director	• Transportation Data Ethicist
• TSMO Program Manager	• Surface Weather Specialist
• Computer Engineer	• Systems Engineer
• Artificial Intelligence Scientist	• TSMO Modeling Specialist
• Telecommunications Engineer	• Emerging Technologies Industry Liaison
• Data Management Specialist	• Transportation Systems Performance Manager
• Visualization Specialist	• Integrated Corridor Management Manager
• Connected and Automated Vehicles (CAV) Program Manager	• Transportation Management Center Manager
• Traffic Incident Management (TIM) Program Manager	

Position Description Components

Career Pathways



Workforce Training

TSMO Training Database

TSMO Paraprofessional Workforce White Paper

Career Pathways

Industry Assessments

HR Resources

Model TSMO Position Descriptions

NOCoE Case Study: Defining the TSMO Workforce Pipeline

White Paper: Assessing Pipeline Trends for Target

1st NOCoE TSMO Workforce Summit

2nd TSMO Workforce Summit

Transportation Technology Tournament

NOCoE Fellowship

NOCoE ePortfolio Contest

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We want to capture and incorporate your resources. Please [email Adam Hopps](#) to share anything you feel will help the industry towards developing a TSMO workforce.

illustrates the need for a basic level of TSMO understanding for all new and existing staff within the DOT, with more in-depth, focused training for those working within the TSMO field.

Sample Workforce Development Plan

Basic Training	Advanced Training
New DOT Employee Orientation <i>Duration:</i> 1.5 hours <i>Format:</i> Webinar logged in DOT Knowledge Management System (KMS) <i>Description:</i> Provide a brief overview of TSMO at a very high level	New TSMO Employee Orientation <i>Duration:</i> 24 hours <i>Format:</i> ½ Immersion and ½ self-guided tutorial <i>Description:</i> Immersion training including visits to TMC, Statewide Emergency Operations Center (EOC), Maintenance Garage, Safety Service Patrol ride along, Snow Removal ride along (as weather permits) and university partner.
Co-Op/Intern Experience <i>Duration:</i> 8 hours	

Intermission: A New NOCoE Strategic Plan and its Strategic Goals (2020)

Strategic Goal #1: Attract, develop, sustain, and expand the TSMO workforce

Strategic Goal #2: Accelerate deployment of current and emerging TSMO practices (technology and strategies)

Strategic Goal #3: Mainstream TSMO as a core function of providing transportation system solutions for all

Act Two, Scene 1:

The Second NOCoE Workforce Development Summit

- The Summit was held virtually on September 20 and 23, 2021
- Participation included a broad range of over fifty state DOT, city, county, planning organization, academic, association and industry representatives.
- Transportation agency participants were a blend of TSMO practitioners and human resource (HR) professionals.

The Summit's Methodology



Major Themes

- Diversity, Equity, and Inclusion is Essential to a Strong TSMO Workforce
- Pre-Employment Education
- The TSMO Guidebook is Being Used and Remains Relevant

Summit Action Items

Increase awareness of TSMO workforce issues and resources

1. Provide ongoing **awareness** of TSMO workforce issues and **resources**.
7. Perform research on **non-traditional workforce**.
9. Develop guidance on **succession planning, retention, and young workers**.

Strengthening pipelines

2. Develop resources highlighting TSMO as a **career of choice**.
6. Strengthen **pipelines** (military, tech, colleges, 1st responders, HBCU, etc.)
8. Increase TSMO **apprenticeship** and co-op opportunities.

Leveraging / strengthening existing trainings and programs

4. Leverage **existing programs** with additional funding and promotion.
5. Develop **best practices for TSMO technical training**.
11. Leverage **existing technical education** programs to include TSMO.

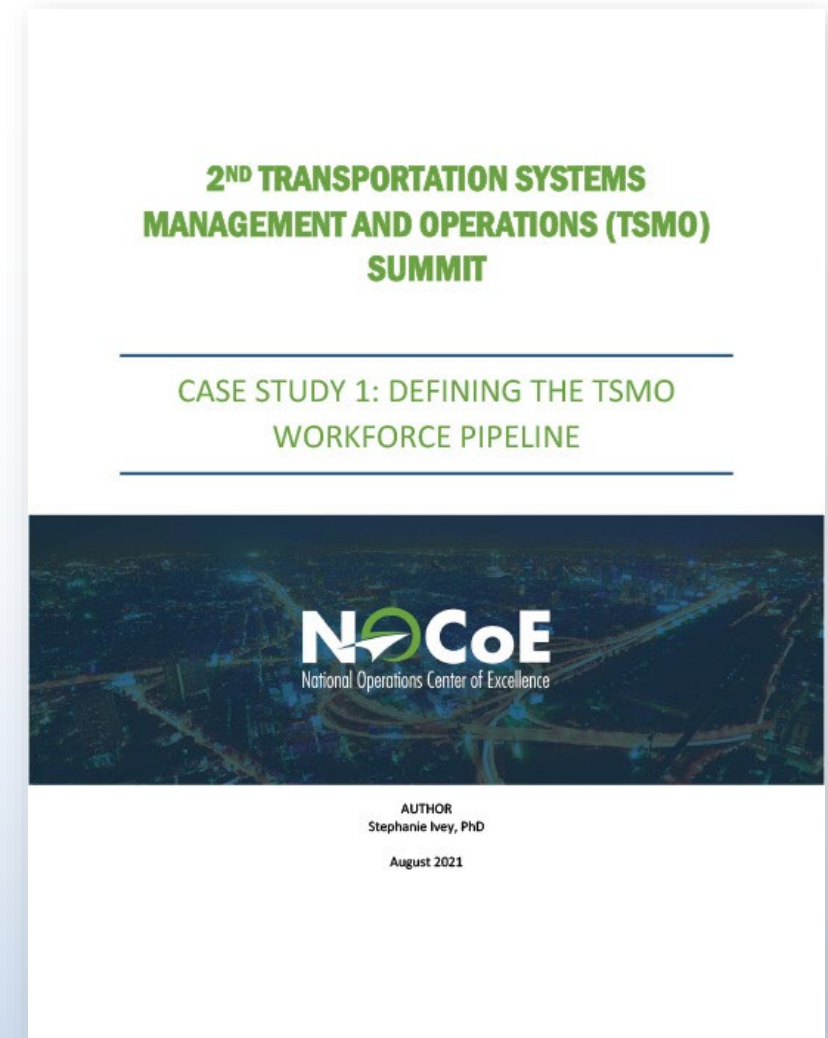
Address university programs

3. Develop **business case for academia** to focus more on TSMO
10. Create a new **university program** for TSMO.

Case Study: Defining TSMO Workforce Pipeline

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.



Case Study: Developing the TSMO Paraprofessional Workforce

Highlights:

- A consensus definition of a TSMO Paraprofessional was developed in a 2019 National Operations Center of Excellence

(NOCoE) White Paper building on previous work by the American Society of Civil Engineers (ASCE).

- There are many workforce activities underway across national, state, and local agencies attempting to define the workforce

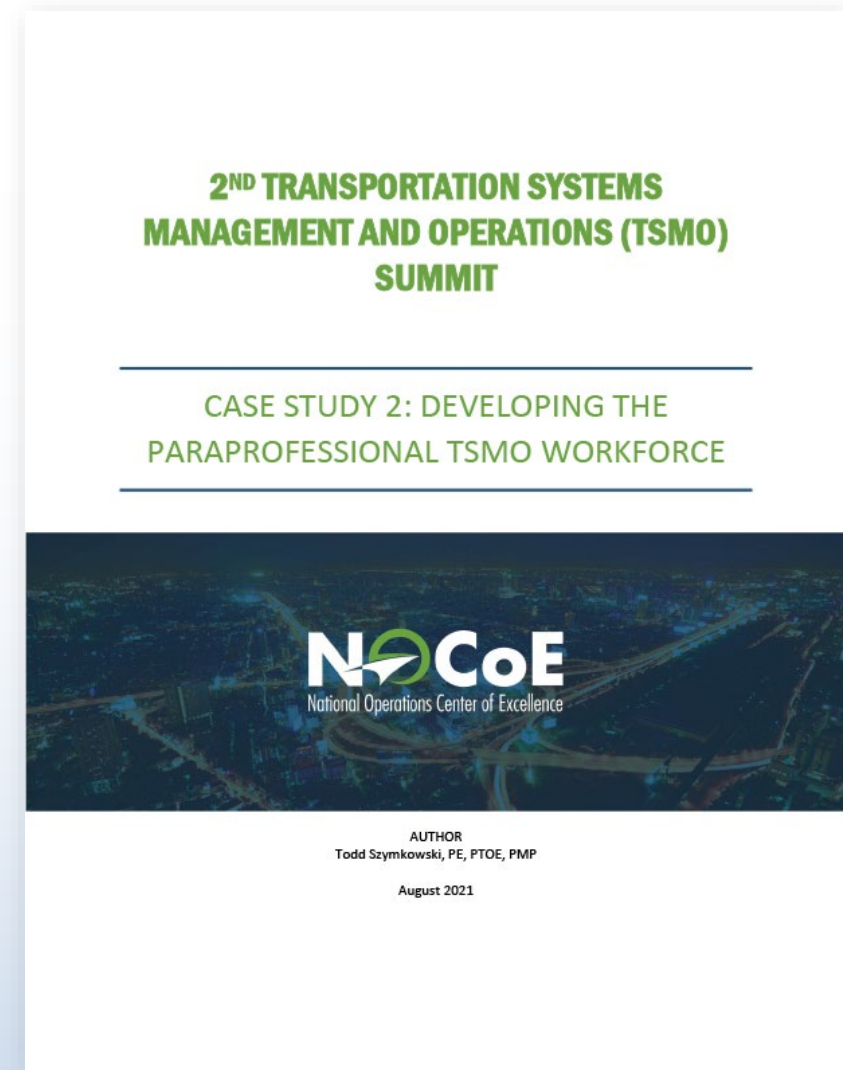
needs of the future related to transportation technology.

- There is a tradeoff of working for a public sector and private sector agency. On one hand, financial compensation tends to be

higher in the private sector, while the public sector offers more stability and a broader range of fringe benefits.

- As an initial estimate and subject to further refinement, it is estimated there are approximately 10,000 – 13,000 TSMO

paraprofessionals across the US supporting TMCs, maintaining operational technologies, and providing critical traffic incident



Case Study: Best Practices in Workforce Development from Similar Industries

Highlights:

- The TSMO community can leverage and adapt noteworthy workforce development practices from other industries with similar challenges.
- Water, Information Technology, Accounting, and Trucking Industries were scanned for lessons learned that the TSMO community could adapt.
- Advancing diversity, equity and inclusion strategies can bring

2ND TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO) SUMMIT

CASE STUDY 3: BEST PRACTICES IN WORKFORCE DEVELOPMENT FROM SIMILAR INDUSTRIES



AUTHOR
Pat Noyes

August 2021

White Paper: Assessing Pipeline Trends for Target Groups – Military

Key learnings from this paper are:

- With nearly 200,000 military personnel transitioning to civilian lives each year through either separations or retirements,

and more than eight million veterans currently part of the civilian workforce, this is a significant talent pool for consideration

for transportation systems management and operations (TSMO) roles.

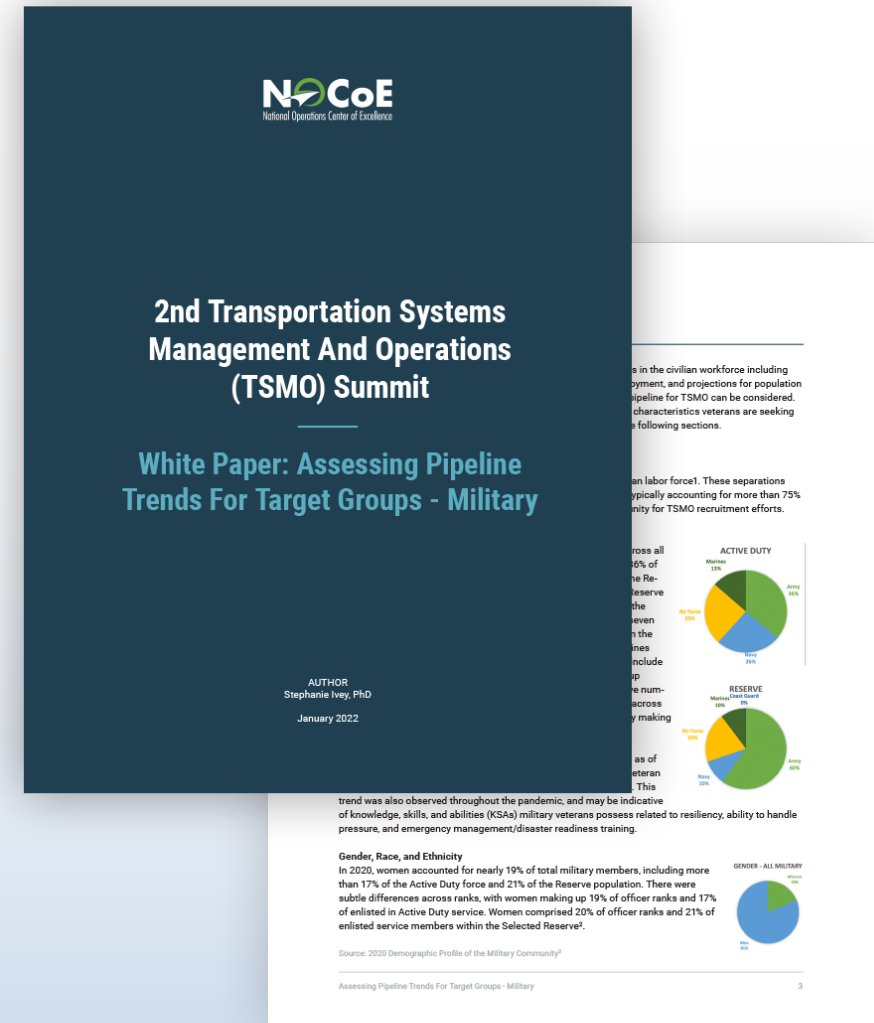
- The majority of military roles are related to STEM, transportation, and logistics across both paraprofessional and

professional categories. The added value of extensive experience in high pressure environments that require teamwork and

attention to safety makes this population particularly relevant for TSMO roles.

- In order to capitalize on the veteran talent pipeline for TSMO, organizations must be intentional in organizational

readiness, outreach, communication, and inclusive practice efforts.



Technical Memo: Workforce Trends and Practices Applicable to TSMO

Highlights:

- The pandemic has had a tremendous impact on the ways we work. The value of schedule flexibility, remote/hybrid work,

technology use, social purpose, work-life balance, pay, and benefits have shifted especially with many industries facing

worker shortages.

- This memo includes a deeper investigation into the industries scanned as build up to the September 2021 2nd TSMO

Workforce Development Summit. An outcome of the summit was a request to better understand best practices that could

be brought into the TSMO industry including Diversity, Equity, and Inclusion (DEI) strategies.

- Recommendations based on successes from other industries include formal mentoring, broader use of DEI initiatives,

amplifying and promoting social purpose, adopting modern workplace technology, and expanding the pool of candidates



2nd Transportation Systems Management And Operations (TSMO) Summit

Technical Memorandum: Workforce Trends And Practices Applicable To TSMO

AUTHOR
Pat Noyes

January 2022

White Paper: Attracting Non-Traditional Workers Into the TSMO Workforce

Key learnings from this paper are:

- There are many categories of non-traditional workers that could be attracted to the transportation systems management

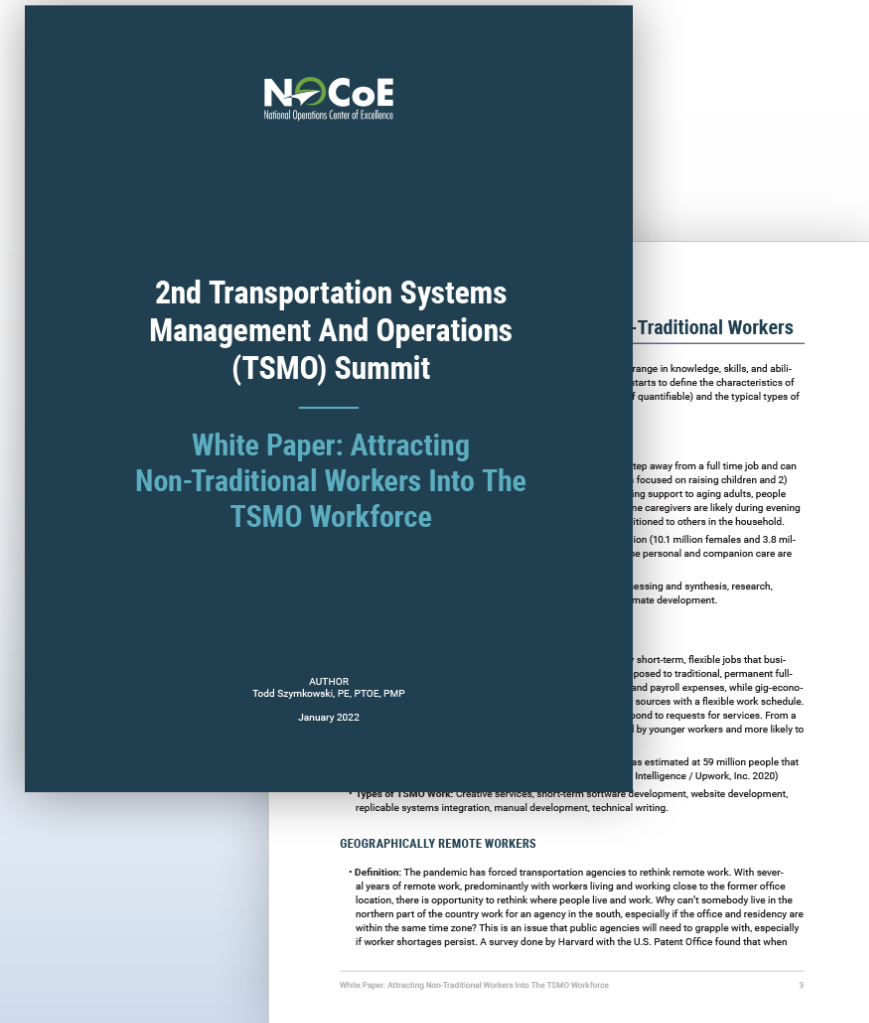
and operations (TSMO) industry.

- Transportation organizations could benefit from hiring non-traditional workers through higher retention rates.

- There are several examples of how transportation and non-transportation organizations are changing the culture of work

and trying to attract non-traditional workers.

- A variety of strategies are provided as "starter" ideas for piloting methods for attracting non-traditional workers.



Act Two, Scene 2: Workforce Development Peer Exchange

- Tuesday, May 24th and Thursday, May 26th
- Approximately 75 total attendees
- Participants from: city, county, state DOT, consulting firms, universities, research centers, FHWA
- Success stories submitted prior to the Peer Exchange

NOCoE Workforce Development Peer Exchange

Tuesday, May 24th and Thursday, May 26th

The National Operations Center of Excellence is pleased to announce its upcoming Peer Exchange on Workforce Development. The Peer Exchange will take place virtually on **Tuesday, May 24th and Thursday, May 26th.**

This Peer Exchange follows last autumn's highly successful NOCoE TSMO Workforce Summit that brought together TSMO leaders from around the country representing the public and private sector, universities, and community colleges. The Summit proceedings capture the prioritization of actions to address TSMO's workforce needs and a first round of products coming out of the Summit are available on NOCoE's Workforce Development portal.

Workforce Development Peer Exchange

– Agenda

- The NOCoE Workforce Development Initiative
- Background, 2021 NOCoE WFD Summit Highlights, and the Focus, Approach, and Hoped-for Outcomes of this Peer Exchange
- Workforce Development Guidebook and Web Tool
- Plenary 1: Workforce Trends and Practices
- Plenary 2: Michigan DOT's Transportation Diversity Recruitment Program
- Plenary 3: Workforce Initiatives in Arizona
- Breakouts

The Peer Exchange Breakouts



Small groups of participants engaging in facilitated dialogue/sharing of success stories



Four concurrent sets of breakouts voted on by the Peer Exchange registrants: recruitment, retention, DEI, training

What are the top 2 or 3 characteristics of your organization that make people stay?

Example:
1. Flexibility?
2. Pay?

Stability.
Challenge.
Ownership.

Advancement
opportunities;
mentorship
program

Transparency

Remote work
flexibility including
location (no need
to live close to
official reporting
location)

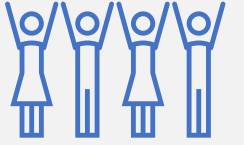
Tuition
remission
(employee
and
dependents)

Professional
development
(training)

Non-profit
status
(public
service)

Engagement
and
accessibility

Recruitment – Success Stories



Professionals

- Graduate rotational programs
- Strong university partnerships for co-ops/interns
- **Flexibility with remote work (and out-of-state/out-of-country allowances)**
- Mentoring
- Employee recruiting campaigns/recruiting from within
- Pet insurance

Paraprofessionals

- **Military, law enforcement, emergency management pipelines**
- Standardizing/formalizing training programs and focusing on skills demonstration
- Apprenticeship programs and 'growing your own' talent

Recruitment – Challenges



Professionals

- Departments becoming 'top heavy' or 'bottom heavy'
- **Salaries**
- Awareness

Paraprofessionals

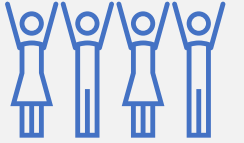
- Finding candidate pools
- Military pipelines
- **Pay scales**

Recruitment - Ideas



- Importance of consistency; including TSMO in onboarding
- Quality of life
- **Communicating impacts**
- Diversity of projects and opportunities within DOT
- Value-based metrics for hiring to match culture
- Benefits and stability (particularly for mid-late career transitions)
- Leveraging remote work options (particularly as Amazon, Google, etc. are requiring return to office)

Retention – Success Stories



- Flexible schedule and working from home (no need to live close to official reporting location)
- Compensation strategies
- Improved performance review process to be more efficient – outcomes inform merit pay increases, promotions, performance improvement plans
- Mentoring and opportunity to work on different roles
- Tours to TMCs and organization tours to keep new employees engaged
- **Being the "owner" and "making a difference"**
- Tuition remission (employee and dependents)

Retention - Challenges



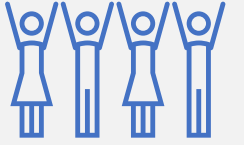
- Competition
- Pay rates
- Equitable pay
- **Ceiling for technical employees that don't want to be a manager**
- Not having adequate resources
- Retention of younger professionals is an issue
- Older generations: seeking retirement earlier
- The layers of approval
- Lack of transparency
- Not feeling part of a team
- Lack of personal connection
- Excessive workload
- Lack of engagement
- **Lack of career path or growth opportunities**
- People want to know their work is valued

Retention - Ideas



- Compensation strategies
- Succession planning
- Mentoring
- How to create a positive culture
- More communication between administrative office and technical staff
- Employees want to be heard
- What are the best channels for HR to advertise jobs?
- **Close coordination between TSMO and HR**

Diversity, Equity, and Inclusion – Success Stories



- **Include DEI in agency strategic planning – make DEI a core value**
- Organizational commitment in new positions focused on DEI – e.g. Chief Culture, Equity and Inclusion Officer
- Internship program for underrepresented groups
- High school summer camps for diverse students
- Formal hiring equity guidelines
- Employee newsletter includes profiles on women, minority, and other employees
- Celebrate and highlight cultural events
- Collecting data on recruitment and retention across diverse groups
- 504(e) federal workforce development funding used for DEI training

Diversity, Equity, and Inclusion - Challenges



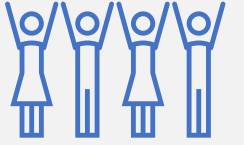
- Remote work can make inclusion more difficult
- Historically less diverse states or regions make it difficult to attract diversity
- Lack of understanding of what DEI means and why it is important
- **Barriers and inherent biases in hiring practice**
- Need data to analyze and assess agency inequities – gender, race, age, other
- Employee representation groups/unions that negotiate salaries add complexity to salary and benefit equity discussions

Diversity, Equity, and Inclusion - Ideas



- Build talking points and business case for the benefits of diversity
- **Review hiring practices for implicit biases (blind auditions, skills-based hiring)**
- Establish diverse hiring panels
- Recruit from underserved or underrepresented populations
- **Review HR policies for implicit bias – pay, benefits, hiring, etc.**
- It is not just about the numbers, we must support the success of all employees
- Leadership training and development for underrepresented employee groups

Training – Success Stories



- Partnerships with universities
- **Support for employees to pursue certifications**
- Use 504(e) funds to support training and workforce development activities
- Development of Operations Academy training
- High School Internship Program
- Certified Public Manager (CPM) certification and other leadership training leads to upward mobility
- On-demand online training for data analyst technicians
- Fiber optics training, approved for certification by the Fiber Optics Association and US Dept. of Labor
- Autonomous cybersecurity and network classes
- Expansion of training and certification of Safety Service Patrol program
- Training program for TMC operators
- ITS Technician Training Program

Training - Challenges



- Need to define how transportation agencies offer reimbursement for pursuit of next degree and how much time employees need to stay at the organization before having to repay the investment
- Retirements and the growing compensation gap seem to be the two most significant issues related to sustaining public sector workforce
- **Need to establish career paths for all positions: allow existing employees to understand how they can advance through the organization**
- Very limited awareness of TSMO shared across most transportation agencies

Training - Ideas



- Growth in apprenticeships including at professional levels
- Systematically capture Institutional knowledge as people retire
- TMC Pooled Fund Study has several upcoming workforce related projects starting
- Connect with Young Professionals of Transportation (YPT) local chapters to enhance formal and informal mentoring
- **Increased academic connections at 2-year, 4-year and advanced degree levels**
- Connect with LTAPs to increase National Highway Institute Training
- Leverage FHWA Resource Centers for technical transfer

Act Three:

The ITS/TSMO Community in Action

- What is Next? You are!
- What are your Workforce challenges?
- What steps are you taking to address them?
- Are you aware of the resources that NOCoE, FHWA, the ITS JPO, and other organizations making available? Are they useful?
- Share your experiences with NOCoE!