NORTH/WEST PASSAGE

Table of Contents

1. INTRODUCTION

The North/West Passage (NWP) pooled fund program focuses on cross-border intelligent transportation systems (ITS) coordination along the I-90 and I-94 corridors through the states of Washington, Idaho, Montana, Wyoming, North Dakota, South Dakota, and Minnesota, as illustrated in Figure 1.
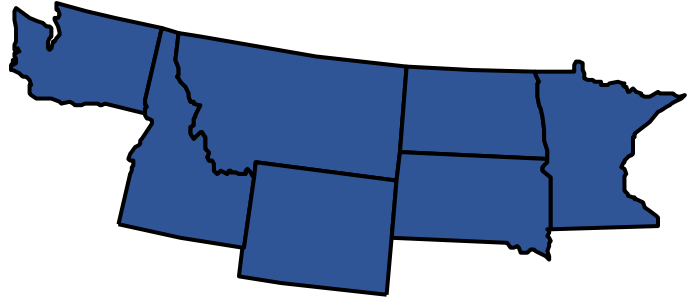
State departments of transportation are experiencing changes in workforce needs

Figure 1: North/West Passage Members

resulting from the impacts of new and evolving technologies, staff turnover, and retirements and have a need to grow and develop the maintenance and operations workforce. With increasing systems and technology there are challenges in training staff. Many personnel systems were established with an engineering layer but do not include a technical layer. In some situations, degree requirements and licensing for job positions eliminates job applicants.

This report documents workforce practices from NWP member states gathered through phone interviews and information shared during a peer exchange webinar.

This report is not meant to be comprehensive, but rather highlight the challenges, solutions, and practices to assist NWP members as they address their workforce needs and practices. The states that were interviewed and/or participated in the peer exchange include:

- Washington State Department of Transportation DOT (WSDOT)
- Idaho Transportation Department (ITD)
- Montana Department of Transportation (MDT)
- Wyoming Department of Transportation (WYDOT)
- North Dakota Department of Transportation (NDDOT)
- South Dakota Department of Transportation (SDDOT)
- Minnesota Department of Transportation (MnDOT)

The sections of this report include:

- 2. Project Approach – Describes the project tasks taken to complete this project.
- 3. Workforce Resources – Identifies and summarizes additional key workforce resources discovered through an online search and a Transportation Research International Documentation (TRID) database search.
- 4. North/West Passage Workforce Practices – Highlights the current workforce practices, challenges, and successes from the seven NWP states.
- 5. Summary – Overall summary from the key findings discovered during the interviews and the peer exchange including what has worked well and the greatest constraints for each NWP state.
- 6. Next Steps – Describes potential next steps to consider to moved related efforts forward.

2. PROJECT APPROACH

Four tasks were completed for this project to provide NWP member agencies with an understanding of the challenges, solutions, and practices as state DOTs address changing workforce needs.

The first task focused on creating interview questions to guide discussions on how the NWP states are addressing the challenges, needs, and current practices of changing workforce needs.

The interviews conducted in 2020 focused on gathering the following workforce information:
- Current practices for hiring/maintaining maintenance and operations staff including assigning tasks and training staff.
- Challenges with hiring, maintaining, and replacing staff.
- Existing workforce needs within the agency.

In addition to information on agency workforce needs, interviews explored the following:
- What has worked well/not worked well for hiring and maintaining staff?
- What information would agencies like to learn from other states on workforce practices?

In addition to performing interviews, as part of the second task NWP documented key workforce resources and coordinated with the National Operations Center of Excellence (NOCoE) that has developed a collection of transportation systems management and operations (TSMO) workforce resources. NOCoE reviewed the interview guide developed for this project to ensure there was not any duplication of efforts. This also provided an opportunity to share relevant information between the NWP states and NOCoE.

For the third task, NWP planned and facilitated a peer exchange held on July 31, 2020 to allow NWP members to share their experiences and learn about other experiences. The NOCoE also participated in the peer exchange for this project to highlight their efforts.

The final project task produced this document to present a summary of the challenges, solutions, and practices gathered from the interviews, summary of resources, the peer exchange, and next steps.

3. WORKFORCE RESOURCES

A few key workforce resources found through an online search and by searching the TRID database are highlighted below. This is not an exhaustive list since the availability of resources is continually changing. However, the resources provide examples of what has already been done in the area of transportation workforce needs.

- **National Operations Center of Excellence (NOCoE)**

  The NOCoE has identified workforce development as an important initiative to help address the needs of the Transportation Systems Management and Operations (TSMO) community. The NOCoE Collection of TSMO Workforce Resources includes resources for student education, workforce training, industry assessments, and human resources as well as events, contests, and success stories.

- **National Cooperative Highway Research Program (NCHRP)**

  NCHRP completed a project on TSMO workforce that provided a guidebook specifically for TSMO positions that were identified through the project. The TSMO Workforce Guidebook (March 2019) focuses on workforce development practices for a robust TSMO program including specific job positions, recommendations for hiring, and information on training and professional development.

- **Regional Operations Leadership Forum (ROLF)**

  The American Association of State Highway and Transportation Officials (AASHTO) has been conducting ROLF workshops that include a variety of subjects (e.g. business processes, multimodal coordination, emerging technologies) including a subject on workforce for attendees. Attendees are provided a description of workforce including why it is important, what TSMO benefits workforce provides, and examples of workforce leadership actions (e.g. identify organization changes to accommodate TSMO and creating an organization and staffing structure for TSMO). The ROLF workshops discuss the challenges of retaining staff and writing solid job descriptions. The ROLF program recommends that DOTs integrate TSMO into the overall agency structure and clarify reporting relationships by developing a TSMO-focused staff training program.

- **National Network for the Transportation Workforce (NNTW)**

  To provide a more strategic and efficient approach to transportation workforce development, FHWA established five Regional Transportation Workforce Centers as the National Network for the Transportation Workforce (NNTW). The Centers work together to facilitate national partnerships with key public and private organizations throughout the transportation, education, labor, and workforce investment communities to identify and promote effective transportation workforce activities and programs.

  Each of the five centers is dedicated to the development of the transportation workforce; has been assigned one of the five disciplinary focuses (safety, planning, engineering, environment, operations) specified by the National Transportation Career Pathways Initiative (NTCPI); and works collaboratively with leaders from transportation, education, and workforce development

to establish a body of research that challenges traditional approaches to job classification, occupational forecasting, and career pathway development.

To begin development of a forward-thinking, technological workforce, the NNTW initiated a project to establish discipline-focused career pathways for deployment at post-secondary education and training institutions nationwide. The final report (National Transportation Career Pathways Initiative (February 2019)), includes workforce characterizations, career pathway design and implementation, references, and documentation for each of the five disciplinary components: Transportation Planning, Transportation Operations, Transportation Environment, Transportation Engineering, and Transportation Safety.

- **Transportation Research Board: TR News, Number 323**

  TRB in their September-October 2019 issue of TR News focuses a number of articles on the *Transportation Workforce of the Future*. Key articles included in this issue include:
  - *Help Wanted: People, Organizations, Jobs, and Businesses for Tomorrow's Transportation* by Andrew C. Lemer – Describes how practitioners and educators are assessing changing demographics and technology to estimate transportation workforce needs and developing practical strategies and tactics for meeting those needs.
  - *View from the Top: The Future Multimodal Workforce* by Candace Blair Cronin and Lawrence D. Goldstein – Identifies common workforce challenges, important variations in workforce issues among transportation modes, and emerging perspectives on the value of building an integrated, strategic approach to workforce development.
  - *Silver Lining for the Transportation Workforce: Research Points a Way Forward* by Candace Blair Cronin and Lawrence D. Goldstein – Discusses rigorous research and action planning that is being conducted in each mode to mitigate the impact of workforce gaps.
  - *How to Win the War for Talent* by Charlene McArthur – Examines workplace culture, flexibility, and other expectations of new workers and job seekers; explores what drives those expectations; and presents best-practice, experience-based strategies to improve attraction and retention.
  - *Building a Business Case for Increasing Diversity in the Transportation Workforce* by Stephanie Ivey, Meredith Powers, and Adriana Clark – Explains why the impacts of changing demographics, technology, and user needs make it crucial to attract a highly skilled and diverse workforce.
  - *The Future Is Now: Transportation Agencies and Their Capabilities* by Frances Harrison and Hyun-A Park – Presents an NCHRP project on ensuring essential capabilities for transportation agencies of the future including identifying and describing emerging issues and trends, engaging senior agency leadership in discussion, and providing guidance on strategies to understand and meet upcoming challenges.
  - *Job Openings for Transportation System Management and Operations: Delivering TSMO Services* by Todd Szymkowski and Stephanie Ivey – Outlines an NCHRP project that provides DOTs and other transportation agencies with usable materials for revamping TSMO hiring and knowledge development, as well as lessons to meet other workforce needs associated with new technologies.

> o *Maintenance Peer Exchange Supports Workforce Development Efforts* by Kathryn Zimmerman – Discusses findings from a peer exchange.
>
> o *Maintaining the System: Defining Routes for Advancement for the Highway Maintenance Workforce* by Teresa Adams, Maria Hart, and Kerri Phillips – Describes a vision to better understand and address the need for workers developed by the Midwest Transportation Workforce Center.
>
> o *Supporting Workforce Continuity: Minnesota Department of Transportation's Knowledge Books* by Nancy Daubenberger – Provides information about the Minnesota Department of Transportation's concept of developing continuity books to share knowledge about documented processes and information resources within the agency, along with "just in time" training videos.

- **Individual Papers and Presentations**

Transportation Maintenance Operations Workforce Development: Challenges, Opportunities, and Solutions was presented at the International Conference on Transportation and Development 2018 and is available through the ASCE library. This paper explores innovative training and career development strategies to build and sustain highly effective maintenance operations workforces as a response to the major changes faced by the surface transportation maintenance operations workforce as experienced employees retire in large numbers and younger employees replace them.

The Evolving Surface Transportation Operations and Maintenance Workforce: Challenges and Opportunities is a pdf of PowerPoint slides presented during a Transportation Research Board (TRB) webinar on August 18, 2016. Five presenters across the United States discussed the evolving transportation workforce in terms of millennials, creating opportunities for women, language diversity challenges, veterans, and the needs of the TSMO community.

focuses on producing high-quality transportation professionals from underrepresented groups. The program was able to track former graduates as part of its goal to monitor their education and careers beyond the program.

A Guide for the Development of Career Pathways in Transportation, prepared for the U.S. Department of Education Office of Career, Technical, and Adult Education and the U.S. Department of Transportation, outlines steps transportation industry stakeholders can take to develop or expand career pathways to focus on the skills, competencies, and credentials needed for high-demand jobs in the transportation industry and its subsectors. Agencies worked together to identify six key elements (1. Build Cross-Agency Partnerships and Clarify Roles, 2. Identify Sector or Industry and Engage Employers, 3. Design Education and Training Programs, 4. Identify Funding Needs and Sources, 5. Align Policies and Programs, 6. Measure System Change and Performance) states and local agencies can take to develop and implement career pathways systems.

The *Transportation System Management and Operations (TSMO) Workforce Guidebook* was updated in March 2019 and outlines information in three areas considered critical to a healthy TSMO workforce: recruitment, professional development, and retention. The guidebook focuses on emerging TSMO positions and describes the overarching process of developing a workforce at

the professional and management levels of an organization. Technician and para-professional positions that support the advancement of TSMO are not included within the scope of this guidebook.

Nextgen Transportation System Workers: Building the Education, Training and Career Path Infrastructure, a presentation to the U.S. Conference of Mayors Workforce Development Board shows how cities and regions are reshaping and addressing mobility and building the workforce to support it. The presentation provides examples from three individual cities as well as common strategies and pitfalls, critical job competencies, and workforce readiness challenges.

In an effort to entice future workers to consider the education and training necessary to enter transportation areas with anticipated needs, *"I See Myself in that Career": Exploring Methods to Attract the Next Generation Transportation Workforce* presents in-depth career profiles of workers and showcases individuals from diverse backgrounds and interests who are engaged in work critical to the future of transportation systems and infrastructure.

- **Upcoming Projects**

    The *Research Roadmap for Knowledge Management* is an anticipated NCHRP project (*NCHRP 23*) that is charged with developing a research roadmap for knowledge management by identifying and prioritizing the knowledge management research needs of state DOTs and documenting knowledge management practices based on 10 years of research. The project will define a strategic approach to knowledge management research and develop the information and tools needed to expedite the integration of knowledge management into state DOTs.

4. NORTH/WEST PASSAGE WORKFORCE PRACTICES

This section includes operations and maintenance workforce practices of the North/West Passage members that were documented during phone interviews and during a peer exchange webinar that was held on July 31, 2020. The information was categorized as follows:

- Staffing and Assignments
- Recruiting and Hiring
- Succession Planning and Staff Turnover
- Career Development
- Training and Certification
- Contracting to Fill Gaps

For each category, NWP states provided examples of current practices, challenges or needs related to that practice, and what has worked well.

It is important to note that there may be a difference in states' workforce needs before, during, and after the COVID-19 Pandemic. NDDOT, SDDOT, MnDOT, and ITD interviews were all conducted prior to the start of the March 2020 COVID-19 Pandemic. MDT, WSDOT, and WYDOT information was gathered a few months after the COVID-19 Pandemic started.

For example, before COVID-19 MDT had issues with losing employees to the oil fields. Since COVID-19, MDT has not had a problem hiring or retaining workers that would have been enticed by the oil fields. Hiring issues are specific to each area and COVID-19 has changed the employee outlook. Many applicants now see MDT positions with job security and decent pay; however, 3-5 years ago when the oil fields were booming, MDT could not keep drivers or mechanics.

Staffing and Assignments

Current staffing and assignment practices followed by North/West Passage members are shown in Table 1 below. This table includes information such as how Full Time Employee (FTE) staffing levels were initially determined and how FTEs have changed in recent years, the TSMO positions that exist and how these positions are used, the practices that are in place for specialized positions such as IT and Maintenance positions, opportunities with new positions and job vacancies, and ways DOTs have found to coordinate with districts and other departments in their state.

Table 1: Staffing and Assignments – Current Practices, Challenges/Needs, and What has worked well?

Current Practices	Challenges/Needs	What has worked well?
FULL TIME EMPLOYEE (FTE)		
• **ITD** and **SDDOT** state legislatures determine the maximum number of FTEs. • In the last 4 years, **NDDOT** has downsized, losing 30-40 positions. • There are approximately 980 employees within **NDDOT**. Thirty percent (30%) of the employees are eligible for retirement. • **MnDOT** developed an ITS Statewide Plan which helps address the staffing gap MnDOT was previously experiencing. • **MDT** has reduced 70 FTE in maintenance but last year gained FTEs to staff a new Transportation Management Center (TMC) anticipated to open in Fall 2020. • **WSDOT** has implemented temporary mandatory furloughing for employees in lieu of permanent staff reduction (7 days/56 hours per employee over several months) to help relieve COVID-related budget constraints.	• **SDDOT** finds it challenging to justify hiring additional FTE to management. If a new project is assigned, typically it is assumed someone will take it on within their existing job responsibilities. • **NDDOT** is short staffed and not equipped to handle needs 24/7 with their available resources. • **NDDOT** anticipates an employee shortfall within the next 5 years. • **MDT** has had difficulty establishing new positions, although creation of the TMC has enabled adding a few new positions. • Post COVID-19, **WSDOT** may revisit how work is delivered as there may be more opportunities WSDOT can take advantage of with knowledge about and experience with remote employees.	• **ITD** turned back FTE positions, decreasing from 1800 to 1600 employees. The funding difference was used to increase pay for employees within their career path program which provides staff the opportunity to advance levels without moving positions. • **MnDOT**'s ITS Statewide Plan documented and explained why additional staff was needed and more capital was necessary to meet connected and automated vehicle (CAV) needs. This helped decision-makers understand that there is an operations and maintenance component to adding new devices or building new systems. • **WYDOT** implementation of virtual TMC operations during COVID-19 was successful enough to promote institutionalizing it.

Current Practices	Challenges/Needs	What has worked well?
TSMO POSITIONS		
• There are two TSMO positions at **NDDOT**. Currently these positions have not moved beyond traditional construction and maintenance staffing, but they plan to transition positions in the future. • **SDDOT** developed a TSMO plan in 2016 which includes a section on organization and staffing. However, currently TSMO is absorbed into existing positions. • TSMO has been practiced for a long time at **MnDOT**. However, MnDOT recently hired in early 2020 a TSMO manager to centralize and coordinate TSMO within the DOT. • Currently, **WSDOT** is less geared toward strictly TSMO positions, however, they offer 5-6 TSMO classes free to any interested WSDOT employee to encourage TSMO knowledge.	• Need to continue to transition towards TSMO organization and staffing positions (**SDDOT, NDDOT**). • FTEs are typically static in terms of **MDT**'s ability to hire so when a position is vacant, MDT has an opportunity to look at TSMO/technology needs. • **WSDOT** has more latitude to write a position description to a specific level or pay scale in management positions, but in non-management job classifications union position descriptions require extra review.	• Hiring a manager to centralize and coordinate TSMO within **MnDOT**. • **WSDOT** offers TSMO courses to better integrate TSMO knowledge throughout the workforce.
INFORMATION TECHNOLOGY (IT) POSITIONS		
• IT staff are centralized at **NDDOT, SDOT,** and **MnDOT.** • **MDT** has its own IT shop for application development and network maintenance of all equipment/hardware. • **WSDOT** maintains a IT/ITS staff at all levels and regions (centralized general IT support in addition to Headquarters/statewide functions and dedicated staff in some TMCs)	• There is a need for IT staff with focused ITS and operations experience to work closely within the operations and maintenance staff (**SDDOT, NDDOT**). • At times **MDT** finds it harder to recruit IT development staff. • When updating positions, **WSDOT** needs to separate and differentiate the IT component to reflect the special knowledge required for the position.	• Even though IT staff is centralized at MnDOT, some IT staff are embedded into select **MnDOT** areas (e.g. Regional Transportation Management Center) to provide their specific expertise and understanding.

Current Practices	Challenges/Needs	What has worked well?
MAINTENANCE POSITIONS		
• Employees may be cross trained for winter maintenance and then summer construction at **ITD** and **MnDOT**. • **NDDOT** Equipment Operators assist Transportation Technicians. • **MnDOT** hires seasonal drivers for snow and ice. • **WSDOT** cross trains some maintenance workers to provide incident response support.		• **NDDOT** Equipment Operators check on an ITS device and report back or may clean a camera lens to reduce the number of trips by a Transportation Technician.
NEW POSITIONS		
• If a new position does not fit into a current job classification at **ITD**, a process to reclassify an existing position begins by defining the function, activities, and responsibilities of the position. The description is sent to Human Resources to review and get approval, then can be announced, and process applications.	• The reclassification process for a new position at **ITD** takes some time to process. • **SDDOT** does not have a lot of latitude to hire or recreate a new position.	• As **MDT** writes job descriptions for new positions of TMC operators and lead workers they are incorporating GIS, AVL, and other needs.
JOB VACANCIES		
• Vacancies are evaluated at **ITD** to identify the function and determine whether there is a need. Responsibilities from the vacancy may be shared with other staff and the position may be moved into a different area if there is a greater need. **MDT** does not have an opportunity to add new positions very often, so they try to incorporate new duties into vacant positions.	• **MDT** finds rewriting position descriptions for vacant FTE positions a challenging process. Currently MDT has only one vacant position where the job description was rewritten to reflect technology needs.	• Evaluating **MDT** vacant positions to incorporate new responsibilities where there is a need has been helpful**.**

Current Practices	Challenges/Needs	What has worked well?
COORDINATION		
• **ITD** districts coordinate to help each other in some areas (e.g. design, environmental documents, winter operation). • Each **NDDOT** district has 1 IT Radio Technician and they share information between districts. • **MnDOT** has a centralized shared service statewide for district support with ITS, design, signals, right-of-way, etc. projects. Districts utilize the service based on workload or a project that require more specialized expertise. • **MDT** IT staff may consult state IT staff who manage and control the network to address an issue that is beyond the scope of MDT responsibility or where a coordinated effort would be more efficient. • **WSDOT** Headquarters offers limited support for regional operations and maintenance functions. Region staff coordinate with other regions to address similar issues.	• **WSDOT** has only two dedicated CAT/CAV staff and relies on interdivisional cooperation to address CAV needs.	• **MnDOT's** statewide centralized shared service allows employees to stay busy, gain opportunities for growth, and provides a variety in job tasks.

Recruiting and Hiring

Table 2 shows examples of the recruiting and hiring practices followed by North/West Passage states. Information contained in this table addresses how states post positions or determine eligibility and where DOTs typically recruit for positions.

Table 2: Recruiting and Hiring – Current Practices, Challenges/Needs, and What has worked well?

Current Practices	Challenges/Needs	What has worked well?
HIRING PROCESS		

• **ITD** works with the Human Resources section to post vacancies online including a description of activities, required skills, and salary. They follow a standard agency process where the Human Resources section receives and works with the hiring manager on the applications.
• Current process at **NDDOT** is to identify the position (e.g. engineer, field technician, equipment operator) and then obtain approval to hire.
• **NDDOT** and **MnDOT** allow positions to be posted with an underfilling option to avoid excluding applicants that don't meet all requirements but could be trained.
• **MDT** equipment operator needs may be met differently between districts, but MDT tries to keep position responsibilities as consistent as possible due to required tests/exams and reporting software. They do however have some flexibility for different division requirements, especially at lower levels.
• **WSDOT**'s hiring and employee retainment is decentralized so though Headquarters provides oversight and guidance, decisions on the organizational structure and responsibilities
	• Often there are few responses or qualified applicants to job postings at **ITD** and **MDT**.
	• **ITD** and **MnDOT** need a longer time to complete the hiring process than the private sector.
	• Lower compensation than private sector jobs may result in smaller applicant pools. Although other benefits are provided it may not be direct cash (**ITD, MDT, SDDOT, NDDOT, MnDOT**).
	• Though different areas of **MDT** have had various hiring challenges, MDT has had many recent applicants for building maintenance positions and believes the changing economy may have affected their applicant pool.
	• Positions hard to fill:
	   o Construction Technician and Equipment Operator positions at **NDDOT**.
	   o **SDDOT** struggles with finding individuals wanting to move to Pierre for a job.
		• **MDT, NDDOT,** and **MnDOT** are able to relax some initial job requirements and train staff after they are hired.
		• **WSDOT** has struggled with pay and competition in urban areas. To overcome this, WSDOT is more aggressively hiring interns from universities directly into Engineering 2 positions.

Current Practices	Challenges/Needs	What has worked well?
within individual positions are up to individual regions. • **WSDOT** is challenged to find electrical technicians. Though hiring of electrical engineers has been limited, WSDOT may need to explore this more as a result of CAV and IT Support positions that require more specific knowledge. • **WSDOT** has had to freeze dozens of open positions due to economic/revenue uncertainties.	○ **MnDOT** struggles with hiring non-engineering related positions and maintenance staff to work evenings and weekends. ○ **MDT** finds that Communications positions are very technical so basic requirements must be met to fill positions. • **WSDOT** struggles to hire TMC Operators due to their pay scale.	
RECRUITING		
• **NDDOT, SDDOT, MDT,** and **MnDOT** actively recruit at career fairs at colleges and universities. • **NDDOT** has an internship program to recruit to fill positions. • **MnDOT** has a visible presence at high school STEM days and has started a high school intern program (Phoenix Internship Program). • In anticipation of increased CAV needs, **MnDOT** is working with the University of Minnesota to develop a curriculum to cross train civil engineering, mechanical engineering, electrical engineering, and computer science students. MnDOT expects similar needs will occur at the technician level. • For mechanics, **MDT** looks at recent tech school grads because they often have knowledge and experience with technology and are comfortable with the computer world. • **WSDOT** uses University of Washington students as interns in the nearby region TMC.	• Internship positions are fewer at **NDDOT** due to budget constraints. • **MnDOT** acknowledges that they need to learn to recruit better through social media, especially when targeting younger workers • Anyone can subscribe for information on job postings in **NDDOT**, but the information is not actively pushed out. • **WSDOT** encountered challenges to recruit IT positions because a lot of the necessary knowledge is unique to WSDOT. • Prior to COVID-19, **WSDOT**'s recruitment for IT application developers was underwhelming.	• Recruiting at career fairs at colleges and universities (**NDDOT, SDDOT, and MnDOT**). • Internship programs assist in filling positions at **NDDOT**. • **MnDOT's** involvement in high schools encourage students to pursue fields in the transportation field. • **MnDOT's** involvement with developing a curriculum for cross training engineering students with the anticipation of increased CAV needs will encourage students to pursue CAV related positions. • During the COVID-19 Pandemic, **WSDOT** targeted colleges and universities for entry level civil engineering graduates. WSDOT is also trying to utilize internships to identify programs that align with the agency and have a diverse population.

Succession Planning and Staff Turnover

North/West Passage states address knowledge transfer by double filling positions, temporarily rehiring former employees, creating documentation for position responsibilities, or cross training other staff. DOTs also identified the types of position and timeframes that experience the most staff turnover. Table 3 identifies specific examples that were provided by individual North/West Passage states during interviews and the peer exchange.

Table 3: Succession Planning and Staff Turnover – Current Practices, Challenges/Needs, and What has worked well?

Current Practices	Challenges/Needs	What has worked well?
KNOWLEDGE TRANSFER		
• **ITD** and **NDDOT** can double fill a position to allow an employee to work closely with a retiree to be successful in the position. • **NDDOT** and **MnDOT** have also been able to hire back retired staff to assist with job transition. • Common pattern in **NDDOT** is retirement, gap, hire. • Knowledge is transferred at **ITD** through desk manuals, training, and support from other staff. • When an employee leaves **ITD**, they are invited to participate in an exit interview to share about their experience at ITD and offer any recommendations. Employees who were part of leadership may submit a video about their experiences (A Visual Approach to Knowledge-Sharing for new ITD recruits). • **NDDOT** developed a formal succession plan years ago; however, it is not often used. • **SDDOT** shares responsibilities to avoid only one person with knowledge of project efforts. • **MDT** has experienced little overlap in filling positions due to retirements but has adopted an informal agreement to allow employees who	• Transferring knowledge to address job changes and retirements is an area **MnDOT** feels they have an opportunity to improve. A lot of institutional knowledge resides in an employee's head so getting it out to document it has been challenging. • Due to budget constraints, **NDDOT** is unable to hire back retired staff to assist with transition. • **WSDOT** is at risk of a large knowledge base retiring at all levels of the organization, resulting in a great loss of institutional knowledge. Though WSDOT is allowed to double fill at all levels, this poses a budget challenge and WSDOT is unsure how they will be able to make the transition from so many retirements to accommodate double FTEs for these positions.	• Double filling a position to assist with knowledge transfer when an employee is retiring (**NDDOT** and **ITD**). • **SDDOT** shares responsibilities to avoid only one person with knowledge of project efforts. • **MDT** allows employees who have moved to another area within the department to return to train a new hire.

Current Practices	Challenges/Needs	What has worked well?
change positions within the department to return to train their successor. • In lieu of a lot of transition planning, **MDT** uses cross training to ensure knowledgeable employees are available to perform the required services.		
TURNOVER		
• **NDDOT** finds more turnover in entry level positions. • Some engineering and technical staff have tended to work at MnDOT for around 7 years but then they often move on to a private company or out of the transportation industry. Outstate **MnDOT** also struggles to retain staff. MnDOT can't compete against private companies. • **MnDOT** experiences high turnover and has trouble keeping licensed electricians because they compete with private industry, consultants, and contractors for employees. Currently, MnDOT is experiencing a fast turnover for electricians so they are trying to hire internally. Though there are some employees that can fill the electrician positions, they are short candidates. • **MDT**'s workforce is aging so they are looking at different options for future leadership. • **WSDOT**'s potential to lose employees in high-paying urban areas has led to a refocus on being an employer of choice – providing flexible schedules, work/life balance, and other fringe benefits to reduce agency turnover.	• **NDDOT** has struggled some to maintain staff salary benefits due to budget shortfalls. Staff leave for higher paying jobs with better benefits. • **MDT** has been their own worst enemy with turnover since they lose more staff to other areas within the department than outside the department because they cannot promote within a position. • **MDT** finds that younger employees are looking for short term gain and are quicker to go to private industry for more money whereas older employees often want stability with decent pay and to know that the job will be there. • **WSDOT**'s rural areas and suburbs have less competition for employees leaving the DOT but cross training has created competition for employees to move to other DOT opportunities within the smaller regions. • **WSDOT** needs to find non-monetary incentives to retain employees. To address this WSDOT is looking into mid-level mentoring, non-typical work opportunities, and career path review as potential opportunities.	• **WSDOT**'s western regions allow employees to transfer up in pay or classification to retain employees. In WSDOT's smaller regions, employees must move out to reach higher levels. However, geographic boundaries may be less important for traffic management after WSDOT's experiences with COVID-19 (i.e. how, where, and by whom work is performed)

Career Development

Table 4 includes career development opportunities that are provided by NWP states. These opportunities include rotation programs, established career paths, leadership programs, and mentoring programs.

Table 4: Career Development – Current Practices, Challenges/Needs, and What has worked well?

Current Practices	Challenges/Needs	What has worked well?
ROTATION PROGRAM		
• In the past **ITD** supported an engineer-in-training program where engineers rotated between units (construction, design, materials, environmental, etc.) to get a broad perspective, but ITD transitioned to the career path program. • **NDDOT** provides a rotational program for new staff that provide the opportunity to move to different positions to provide an understanding of the department. • **MDT** offers rotations in some entry level positions. • There are not any formal or informal rotation programs at **SDDOT** for staff to move and learn from various offices.	• Some **ITD** districts continue to rotate their staff but there is not a specific process and it is not consistent among districts	• Rotation programs at **NDDOT** allow new staff to move between offices to receive a broad perspective.
CAREER PATH, LEADERSHIP, AND MENTORING PROGRAMS		
Career Path • **ITD** offers a career path that was established 5 years ago. The program provides some staff classification the opportunity to advance from one level to another without moving positions. Compensation increases as the levels increase. With additional skills and training, employees can progress to the next level. It typically takes approximately 2 years to move a level.	• **MnDOT** struggles with employees not being able to move beyond their job classification for years. • **MDT** finds that career ladders are more difficult within Maintenance because there are not as many places to go. • Once a **WSDOT** employee reaches the top of a technical position they can only move into management to continue growth and pay opportunities.	• **SDDOT** and **ITD** are able to advance staff from one level to another without moving positions. • At **MnDOT** each employee has an independent development plan to keep employees engages about their job. • Cross training **MDT** employees and establishing a career ladder to build expertise.

Current Practices	Challenges/Needs	What has worked well?
• **MDT** implemented career ladders to facilitate cross training and promote employees as they demonstrated skills. • **SDDOT** is also able to advance staff (promotions) without changing jobs. • **MnDOT** keeps employees engaged in their jobs by asking all employees to have an independent development plan that is reviewed annually. • Technician and operator positions have been a huge asset to **WSDOT**, but employees need to have a clear career path defined. • In the past, **WSDOT** has had a fellowship program to assist employees with earning a master's degree, but the program is no longer available. Currently, WSDOT is only able to assist employees with one class per semester. ***Leadership/Mentoring Programs*** • **ITD** offers a leadership program to any interested employee, and it involves from video training, group partition, and self exercises on their own time to develop leadership skills by learning more about themselves and their style. • **NDDOT, SDDOT,** and **MnDOT** also offer an internal leadership training program. • **NDDOT** previously offered a mentoring program that provided job shadowing. • **MDT** offers leadership development courses. In past they have also had a maintenance mentoring program that they are bringing back.		• **MDT** includes the Maintenance Technician career ladder within the contract. • **WSDOT** encourages employees to gain expertise outside the classroom by expanding conference attendance opportunities to younger employees. • **WSDOT**'s Northwest Region has been intentional about recruiting by developing an early mentorship program for Interns and Engineering 1 employees. Other regions are also trying to be more intentional.

Training and Certification

NWP states identified their current certification and training practices for engineers and maintenance workers in Table 5 including both formal and informal training opportunities provided inhouse, online, and externally.

Table 5: Training and Certification – Current Practices, Challenges/Needs, and What has worked well?

Current Practices	Challenges/Needs	What has worked well?
CERTIFICATION		
Commercial Driver's License (CDL) • **ITD** and **SDDOT** require that maintenance/snowplow operator applicants have a CDL. *Other Certifications* • **MDT** requires welding certifications. If a new hire does not come in with the certification, MDT typically will work with them to obtain the required training. *PE or EIT* • Engineers must maintain their EIT certification or PE license at **ITD**. • Engineers at **SDDOT** are not required to have a PE for most positions. However, 60 to 70 percent hold a PE. Job classification is based on what you do.	• **ITD** has assisted employees with their CDL certification, but due to a new federal regulation, ITD will no longer be able to. • **MnDOT** needs to be able to pay more after certifying employees. • Though **WSDOT** supports employees pursuing the Professional Traffic Operations Engineer (PTOE) certification, WSDOT cannot pay for taking the certification.	• **NDDOT** and **MnDOT** are able to relax some initial job requirements and certify after they are hired. • Job classification for engineers at **SDDOT** is based on what you do, not on your license.
TRAINING		
Maintenance • **ITD** requires staff training on some equipment such as snowplows, loaders, backhoes. • **NDDOT** IT staff and equipment operators are trained by the device vendor, which also assists in	• In some instances, maintenance personal / operators trained by **ITD** move to a county position since the counties tend to have a higher pay. • Training is often required for Radio Technician positions at **NDDOT** because they typically do not have ITS experience.	• Vendors provide training on equipment and devices which assist staff with performing maintenance when needed at **NDDOT**. • At **MnDOT** staff are able to advance with increased training and knowledge.

Current Practices	Challenges/Needs	What has worked well?
knowledge for maintenance is needed on the device. • **MnDOT** offers training opportunities including courses tailored for younger or older employees, field operators, safety, etc. However, a lot of technical training is on the job training. If an employee is interested in a class, they are typically encouraged to attend. • **MnDOT** and **MDT** maintain a train the trainer environment and cross train employees. • **MnDOT** employees who have become respected topic experts are eligible for lead worker positions. • **MDT** hosts a Maintenance Academy once a year to provide equipment training to their employees. • **MDT** relies on program managers to serve as liaison to trainers from other geographic areas. • **MDT** shop superintendents provide just-in-time training to employees. If an employee has a need, MDT will train them. This method will likely also be used for fleet management. *Transportation Learning Network (TLN)* • **SDDOT, WYDOT, MDT,** and **NDDOT** participate in the Transportation Learning Network (TLN) which provides online training on a variety of topics.	• Often equipment operators in **NDDOT** are trained and then leave to work in the oil fields because they can make more money. • **MnDOT** needs to be able to pay more after training employees. • Before the COVID-19 Pandemic, **WSDOT** organized a group for technical training. With budget restrictions post COVID-19, WSDOT is working to avoid cutting technical training.	• **SDDOT, WYDOT, MDT,** and **NDDOT** participate in the TLN which provides online training on a variety of topics. • **NDDOT** has found the newer workforce to be more trainable and tech savvy. They are resourceful, require less computer training, and come in with phones and use them for work. • **MDT** emphasizes documenting training and creating training manuals. • **MDT** believes employees often learn the most by simply performing tasks on the job and not necessarily being trained. This allows them to tailor their work strategy to meet the current needs. Certain positions such as mechanics, however, should know the basics before being turned loose in the shop. • **WSDOT** has established a relationship with a group of universities to develop a core training program to develop and deliver classes in person or via internet. • **WSDOT** provides training through consultants to develop subject matter experts if there is a need.

Current Practices	Challenges/Needs	What has worked well?
Other • **NDDOT** CAV positions are trained internally as part of North Dakota's Strategies and Innovation needs. • **SDDOT** and **WSDOT** have a formal Traffic Incident Management (TIM) training program. • **SDDOT** is considering a TSMO training group to assist in defining what knowledge is needed for a position and then match training to the need. • Most **MDT** training is completed inhouse and supported by a full-time trainer. • For approximately the last 3 years, **WSDOT** training has become more divisionally resourced. For technical training, WSDOT coordinates among divisions.		

Contracting to Fill Gaps

NWP states may outsource work to fill gaps in expertise or staff workload. Specific examples of their contracting practices, challenges, and successes are shown in Table 6.

Table 6: Contracting to Fill Gaps – Current Practices, Challenges/Needs, and What has worked well?

Current Practices	Challenges/Needs	What has worked well?
OUTSOURCING WORK		
• At **ITD** and **MDT** most work is completed in-house. However, some work may be outsourced. • **ITD** design projects are outsourced based on workload. Maintenance of ITS devices are also outsourced. Repairing assets (e.g. guardrail, fences) are sometimes outsourced due to resources availability. • At **ITD** Some areas (such as paving) are entirely outsourced with ITD doing mostly potholes repairs. • **MDT** does not usually contract as a result of a knowledge gap. When specific tasks are required, vendors may be able to produce a plan or document faster so MDT will consider outsourcing that portion. • **MDT** may contract out for more specialized or technical training such as transmissions or hydraulic controls. • Maintenance of DMS is part of a vendor contract for **NDDOT**. • Each district within **NDDOT** has a maintenance budget assigned to ITS	• **ITD, MDT, NDDOT, SDDOT,** and **MnDOT** contract out work based on workload of their staff. • **MDT** sends equipment to the shop for repair and maintenance. As technology increases MDT may not have the tools or diagnostics for vehicles and equipment or aging employees may not have the necessary expertise. Without contracting out in these situations they may not have enough FTEs to complete the necessary equipment repairs and maintenance. • There has been an increase in outsourcing design work at **SDDOT**, due to the cap on FTE.	• **ITD, MDT, NDDOT, SDDOT,** and **MnDOT** contract out work based on workload of their staff and if a project requires technical expertise.

devices. ITS maintenance is not contracted out. • Research focused projects at **SDDOT** are contracted to universities or consultants. Operational related projects are contracted to consultants or vendors. • **MnDOT** establishes contracts with consultants based on employee workloads or if the project requires a technical expertise that MnDOT employees do not have. • **WSDOT** does most of its work in-house. However, contract and consulting positions do exist, particularly in the training area.		

5. SUMMARY

This section includes a summary of overall what has worked well and the greatest constraints with workforce practices within the North/West Passage member states.

What has worked well

- **ITD** established a career path for Maintenance Staff and Engineering 5 years ago. The program helps to maintain staff by providing an opportunity for staff to advance from one level to another without moving positions. Compensation increases as the levels increase and additional skills and training enable employees to progress to the next level. It typically takes approximately 2 years to move a level.
- **MDT** uses cross training to ensure knowledgeable employees are available to perform the required services and has implemented career ladders to facilitate cross training.
- **NDDOT** retains an experienced workforce by offering a variety of work tasks in the area of operations.
- **SDDOT** allows staff to advance through promotions without changing jobs.
- **MnDOT** had no good way to identify and quantify the gap between the number of staff and the number of devices they were required to manage as the number of devices increased each year. A planning effort, the ITS Statewide Plan, helped address the staffing gap MnDOT was experiencing. Using this plan, MnDOT was able to document and explain why they needed more staff and more capital to meet CAV needs. This helped decision-makers understand that there is an operations and maintenance component to adding new devices or building new systems.
- **WSDOT** has established a relationship with a group of universities to develop a core training program to develop and deliver classes in person or via internet.

Greatest Constraints

- **ITD** is constrained by their resources. Some operations work must be outsourced (e.g. mowing, replacing fences, or support infrastructure) to allow employees more time to dedicate to other work. There are also challenges on installing and maintaining software for road equipment.
- There are not a lot of places in maintenance for employees to advance to so **MDT** has been losing employees to private industry since they cannot promote within a position.
- Budget is one of **NDDOT**'s greatest constraints with staff positions. NDDOT is struggling with how to cut the budget, downsize government, and still be effective. How do they do more with less and take advantage of technology, including training employees to get them up to speed on new and changing technology?
- To retain staff, **MnDOT** needs to be able to pay more after training and certifying employees.
- In the next 5 years, many **WSDOT** employees are eligible for retirement. This places a huge burden on the agency and creates constraints on resources since WSDOT is at risk of losing vast institutional knowledge from these retirements.

6. NEXT STEPS

Based on the review of information gathered throughout the duration of this project, the following were identified as next steps to consider to move related workforce efforts forward.

- The NOCoE has identified workforce development as an important initiative to help address the needs of the TSMO community. The NOCoE Collection of TSMO Workforce Resources includes resources for student education, workforce training, industry assessments, and human resources as well as events, contests, and success stories. To continue to enhance the workforce resources NWP members should consider sending related materials (e.g. TMSO job descriptions) as well as sending this report.
- NWP members meet monthly on a variety of topics, to continue the discussion of workforce needs an agenda item once a year should be considered. This would also provide an opportunity to share related resources (e.g. career ladder documents).
- To continue the development of specific workforce resource gaps, existing resources with NWP member states and connections with other professional development platforms should be considered (e.g. Consortium for Innovative Transportation Education) to provide and enhance learning modules for mutually beneficial topics related to maintenance and operations, rural ITS implementation, workforce capacity, and other TSMO-related subjects.

References

Bergner, Dave. (2018, July 11). *Transportation Maintenance Operations Workforce Development: Challenges, Opportunities, and Solutions.* Available from https://doi.org/10.1061/9780784481547.002

Ciagett, Mary Gardner, Xinge Wang, and Patricia Greenfield. (2015, December) *A Guide for the Development of Career Pathways in Transportation.* Retrieved from https://s3.amazonaws.com/PCRN/docs/A-Guide-for-the-Development-of-Career-Pathways-in-Transportation.pdf

Kommalapati, Raghava, Radhakrishnan Ramalingam, and William Stockton. (2012, July 31). *Transportation Workforce Development: Sustaining and Expanding High School Outreach Programs and Multiagency Partnerships.* Retrieved from https://rosap.ntl.bts.gov/view/dot/24785

McFadden, Marissa, Hannah Ulman, and Glenn McRae. (2019, December). "*I See Myself in that Career": Exploring Methods to Attract the Next Generation Transportation Workforce.* Retrieved from https://escholarship.org/uc/item/82r0k1ch

McRae, Glenn. (2019, January 24). *Nextgen Transportation System Workers: Building the Education, Training and Career Path Infrastructure.* Presentation to the U.S. Conference of Mayors, Workforce Development Board. Retrieved from http://netwc.net/wp-content/uploads/2019/07/01242019_NNTW_USCMWDC_Presentation.pdf

Szymkowski, Todd, Stephanie Ivey, Alexandra Lopez, Pat Noyes, Nicholas Kehoe, and Carrie Redden. (2019, March). *Transportation System Management and Operations (TSMO) Workforce Guidebook.* Retrieved from https://transops.s3.amazonaws.com/uploaded_files/Task%206%20Deliverable%20Guidebook%20FINAL%2020190307.pdf

The Evolving Surface Transportation Operations and Maintenance Workforce: Challenges and Opportunities. (2016, August). Presentation prepared for Transportation Research Board. Retrieved from http://onlinepubs.trb.org/onlinepubs/webinars/160818.pdf

Transportation Workforce of the Future. (2019, September – October). TR News. Number 323. Retrieved from http://onlinepubs.trb.org/onlinepubs/trnews/trnews323.pdf