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Transportation Workforce Planning and Development Strategies

A Synthesis of Highway Practice

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Research sponsored by the American Association of State Highway and Transportation Officials in cooperation with the Federal Highway Administration

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TRANSPORTATION RESEARCH BOARD
2019
Systematic, well-designed, and implementable research is the most effective way to solve many problems facing state departments of transportation (DOTs) administrators and engineers. Often, highway problems are of local or regional interest and can best be studied by state DOTs individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation results in increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

Recognizing this need, the leadership of the American Association of State Highway and Transportation Officials (AASHTO) in 1962 initiated an objective national highway research program using modern scientific techniques—the National Cooperative Highway Research Program (NCHRP). NCHRP is supported on a continuing basis by funds from participating member states of AASHTO and receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine was requested by AASHTO to administer the research program because of TRB’s recognized objectivity and understanding of modern research practices. TRB is uniquely suited for this purpose for many reasons: TRB maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; TRB possesses avenues of communications and cooperation with federal, state, and local governmental agencies, universities, and industry; TRB’s relationship to the National Academies is an insurance of objectivity; and TRB maintains a full-time staff of specialists in highway transportation matters to bring the findings of research directly to those in a position to use them.

The program is developed on the basis of research needs identified by chief administrators and other staff of the highway and transportation departments, by committees of AASHTO, and by the Federal Highway Administration. Topics of the highest merit are selected by the AASHTO Special Committee on Research and Innovation (R&I), and each year R&I’s recommendations are proposed to the AASHTO Board of Directors and the National Academies. Research projects to address these topics are defined by NCHRP, and qualified research agencies are selected from submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Academies and TRB.

The needs for highway research are many, and NCHRP can make significant contributions to solving highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement, rather than to substitute for or duplicate, other highway research programs.
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The National Academy of Sciences was established in 1863 by an Act of Congress, signed by President Lincoln, as a private, non-governmental institution to advise the nation on issues related to science and technology. Members are elected by their peers for outstanding contributions to research. Dr. Marcia McNutt is president.

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The three Academies work together as the National Academies of Sciences, Engineering, and Medicine to provide independent, objective analysis and advice to the nation and conduct other activities to solve complex problems and inform public policy decisions. The National Academies also encourage education and research, recognize outstanding contributions to knowledge, and increase public understanding in matters of science, engineering, and medicine.

Learn more about the National Academies of Sciences, Engineering, and Medicine at www.national-academies.org.

The Transportation Research Board is one of seven major programs of the National Academies of Sciences, Engineering, and Medicine. The mission of the Transportation Research Board is to increase the benefits that transportation contributes to society by providing leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal. The Board’s varied committees, task forces, and panels annually engage about 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

Learn more about the Transportation Research Board at www.TRB.org.
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ABOUT THE NCHRP SYNTHESIS PROGRAM

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-05, “Synthesis of Information Related to Highway Problems,” searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, Synthesis of Highway Practice.

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

FOREWORD

By Mariela Garcia-Colberg
Staff Officer
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Given workforce shortfalls, state Departments of Transportation (DOTs) need to spend time analyzing and planning for the future of their own transportation workforce. This synthesis identifies the current state of practice associated with the implementation of surface transportation workforce planning and development strategies by state DOTs. A special effort was made to identify strategies used by state DOTs to help build career pathways in surface transportation for young adults, second career professionals, veterans, and encore careerists. The study, prepared by Robert Puentes and his team from Eno Center for Transportation, captures the current practice among state DOTs and associated local and tribal technical assistance programs (LTAPs/TTAPs).

The study presents a literature review and the results of a survey of both state DOTs that manage research programs and LTAPs. Forty-five completed responses were received from the 50 state DOTs in the survey sample, a response rate of 90%. Case examples of five state DOTs are provided; these present an in-depth analysis of the processes and considerations, challenges, lessons learned, and keys to success of some of the strategies.

This synthesis report will be of interest to administrators and others concerned with the challenges and opportunities facing the transportation industry and its changing workforce.

The members of the topic panel are acknowledged on page iv. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.
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A-1 Appendix A Survey Instrument and Raw Data

Note: Photographs, figures, and tables in this report may have been converted from color to grayscale for printing. The electronic version of the report (posted on the web at www.trb.org) retains the color versions.
The Transportation Research Board’s (TRB’s) National Cooperative Highway Research Program (NCHRP) commissioned this project to synthesize the current state of practice associated with the implementation of transportation workforce planning and development strategies at state departments of transportation (DOTs) and associated local and tribal technical assistance programs (LTAPs/TTAPs). The project identifies challenges, opportunities, and lessons learned through a literature review and a survey of state DOTs and LTAPs. It includes five selected case examples of current practice.

The synthesis addresses all modes of surface transportation. It focuses especially on young adults, second career professionals, veterans, and encore careerists. The scope of this research encompasses training, skills building, and forecasting only to a limited extent. The report focuses on workforce development under the umbrella of workforce planning. Many of the macro-level elements that relate to workforce planning and development fall beyond the scope of this synthesis research and merit further examination and study. The literature review and case examples in this report touch on some of these topics, but a full analysis of the state of the transportation workforce pipeline, recruitment, workforce demographics, and workforce forecasting requires additional consideration.

The literature highlights effective workforce programs across state transportation agencies, but also demonstrates the numerous challenges and opportunities and the diverse approaches to addressing them. There is a host of connected activities spanning workforce planning, workforce development, succession planning, and forecasting, which are closely related, but distinct, topics. However, these terms are often conflated in the literature. As industry needs shift and technologies evolve, transportation employers increasingly will need to focus on recruiting, developing, and retaining skilled workers.

The research team developed the survey portion of this project in parallel to and following the literature review. To collect standard, comparable, significant data, a concise online survey was designed for training department officials at the state DOTs and the LTAP Center Directors in each state. The survey encouraged respondents to answer questions about agency background and context, the broader workforce development and planning environment, specific types of programs, funding, and social factors. We achieved a 62% response rate from 45 out of 50 agencies.

The survey found there is a consistent lack of employees to implement full training programs. Many state DOTs have only a handful of employees, and the typical LTAP operates with a small staff, sometimes augmented by grant-funded staff. There is little correlation between the size of the state and the number of people tasked with training and workforce development. The survey also found that training and human resources/workforce planning
functions are often located in different organizational units of the state; this is even more pronounced when the LTAP is not located within the state DOT.

Overall, the survey shows that state DOTs and LTAPs are focused on traditional roadway engineering, safety, and equipment technical instruction. Topics also relevant to the modern state DOT—such as planning, environmental/cultural protection, and multimodalism—are found in some state DOT/LTAP training catalogs, but they are not universal. Furthermore, many respondents suggest managerial and leadership training is not being adequately addressed. Given the small staff size and divided portfolios of duties, there is a consistent recognition that workforce development is a serious challenge across the nation for the transportation industry.

Given that the organizational structure and program offerings of state DOTs and LTAPs vary considerably, case examples were selected to profile a cross-section of organizational types encountered in the survey. Overall, we aimed for a variety in size, geography, population, and state DOT and LTAP arrangement and programming. In addition, we ensured that the states had elements that would be interesting, useful, and transferable for others. All of the selected case examples submitted thorough responses to the survey and agreed to serve as detailed cases.

The first two case examples—Ohio and Alaska—are DOTs that directly operate an LTAP. The second two—Montana and New York—are standalone LTAPs, both at universities. The final case example—Michigan—covers a DOT (without an LTAP) with an active workforce development program. The intent of each case example was to present a snapshot of the organization or functional unit, highlighting its activities related to the workforce in that state. For example:

- **The Ohio Office of Local Programs/LTAP** Center uses a sophisticated training evaluation model for post-course evaluation, and conducts a return on investment analysis for select courses. The Ohio LTAP also operates technical assistance programs that are not courses. These programs provide help to practitioners, facilitate peer-to-peer information exchange, and take on tasks that are not in the portfolio elsewhere in the Ohio Department of Transportation (ODOT).

- **One of the notable practices at the Alaska DOT Office of Research, Development, and Technology Transfer** is a nationally recognized leadership development program that focuses on cross-discipline, peer-to-peer knowledge exchanges. Trainers have recognized that by breaking down silos within the agency, staff can learn from each other and easily transfer skills across disciplines.

- **Montana’s LTAP** participates in collaborative partnerships, such as the multiagency North and South Dakota Regional Local Roads Conference. It is also collaborating with Colorado to assist in developing the first-in-the-nation 2-year Associate of Applied Science (AAS) in Highway Maintenance Management degree program.

- **New York’s LTAP**, housed at Cornell University, emphasizes partnerships with professional associations and allied higher education institutions to help foster collaboration and disseminate training opportunities. Partners include the state universities and professional trade groups, several of whom particulate in the LTAP’s 3-day self-supporting Highway School program that is intended for town road superintendents.

- **To address workforce pipeline challenges and plan for future needs, the Michigan DOT Performance Excellence Section** implements internships and co-op programs, including ones that encourage veterans and students at Historically Black Colleges and Universities to learn as interns. Funding for employee workforce development and planning originates from scattered sources and is provided beyond the required match by the state to support the program appropriately.
Together, the literature review, survey, and case examples revealed several related findings:

- **There is no standard definition or understanding about workforce development.** State DOTs and LTAPs frame their characterizations of workforce development in a wide variety of ways, though the recurring theme across all respondents was a focus on training and skills. As a result, there is no clear consensus about how to handle many workforce challenges.

- **Institutional structures differ from state to state.** Relatedly, states’ approaches to workforce planning and development at state DOTs and LTAPs also vary. In fewer than one-third of the states, the state DOTs and LTAPs are closely coordinated and always work collaboratively and share resources and communication outlets.

- **There is a range of funding options.** The Federal Highway Administration (FHWA) provides $150,000 each year to LTAPs. State and local resources must match this, although this “flat” amount does not vary based on state size or complexity.

- **Practice is clearly changing to address new challenges facing the industry.** Although the transportation sector is facing many of the same opportunities and challenges as the larger U.S. workforce in general, some concerns, such as salary and benefits, appear more pronounced in the transportation sector.

- **The primary focus remains on traditional highway/roadway planning and programming.** This is understandable given the original mission of state DOTs and LTAPs, but with the changing nature of the workforce, replenishment may depend on a broader perspective. The skills required in transportation departments today and in the future go beyond the traditional construction, maintenance, and operation missions of agencies.

Future research may focus on developing a national perspective for transportation workforce planning and development. This approach could address standardization and benchmarking in order for states to learn from each other through case examples of practice as well as peer-to-peer learning. Greater attention may also be needed to determine the distinctions among workforce development, workforce planning, and succession planning.

Other potential areas of research that could be addressed include the following:

- **Advancing a clear definition for transportation workforce development.** A common definition and characterization would help to clarify both the traditional needs inherent in workforce development as well as future trends.

- **Understanding how to improve workplace and job quality.** The survey found that the most commonly identified non-personal reason for employees to leave was compensation, including both salary and benefits. Therefore, many states’ competitive propositions may lie in a better balance between work and personal life or flexible work arrangements.

- **Developing options for new multimodal coursework.** States may wish to consider expanding their portfolios of course offerings and focus on multimodalism, planning, and managerial and leadership “soft skills.”

This synthesis shows activity, interest, and need for continued transportation workforce strategies. Many states, LTAPs, universities, and private partners providing leadership and training are keenly aware of the broader U.S. workforce in general and have developed a robust and diverse set of professional and training practices.
CHAPTER 1

Introduction

Estimates indicate that more than 14 million jobs—about 11% of civilian jobs in the United States—are related to infrastructure (Kane and Puentes 2014). This workforce pipeline includes a multitude of transportation occupations, from bus and truck drivers to autoworkers and engineers, in both motorized and non-motorized modes. Due to industry growth, transportation also has the potential to be a major U.S. job creator with projections to add 417,000 net jobs from 2012 to 2022. An additional 4.2 million workers will need to be hired to fill vacancies created by separations (occupational transfers, retirements, and other exits) (U.S. Departments of Education, Transportation, and Labor 2015).

Certain transportation sectors are already facing critical workforce shortfalls. For example, according to the Transportation Learning Center, 54.5% of people in the current workforce within the six largest transportation sectors are 45 years or older, 8.7% higher than the national average (U.S. Departments of Education, Transportation, and Labor 2015). Much is written about the shortage of drivers in the trucking and logistics sectors, but similar challenges exist in public transit and construction (Braden 2017). For their part, federal and state transportation workforce shortages are widely considered a problem, presenting “a present and growing need” for workers (Martin and Dudley 2017). Although jobs in transportation are available for people with various levels of education, traditional training pipelines frequently are not designed to steer graduates toward the transportation sector. Furthermore, the types of jobs and skills needed are evolving. With increased automation and changes in the role of technology, jobs in the transportation sector are likely to change. Workforce strategies are needed to meet critical staffing needs and develop the current workforce.

The TRB’s NCHRP has commissioned this project to synthesize the current state of practice associated with the implementation of transportation workforce strategies at state DOTs and associated LTAPs. The project investigates the current state of practice and identifies challenges, opportunities, and lessons learned through a literature review and a survey of state DOTs and the LTAPs. It includes five selected case examples of current practice.

The synthesis addresses all modes of surface transportation and focuses especially on young adults, second career professionals, veterans, and encore careerists. State DOTs spend much of their time and money on highway engineering, project delivery, and operating the system, which is reflected in the comments and case examples. However, state DOTs have the authority and status to influence modes and expertise sectors spanning from aviation to active transportation (i.e., bicycling and walking), and long-range planning to environmental protection.

The scope of this research only encompasses training, skills building, and planning to a limited extent. Many of the macro-level elements that relate to workforce development and planning fall beyond the scope of this synthesis research and merit further examination and study. Variables such as geo- and sociodemographics are important to understand to match people
and jobs, evaluate equity, and to understand potential shifts, needs, and opportunities in the current and future workforces. Additional workforce development topics that fall out of scope, but play an important role in understanding the transportation workforce overall, include aspects of training and awareness through the pipeline all the way back to K-12 education, and agency recruitment strategies and practices.

Workforce forecasting relates to the development and planning topics both included and beyond the scope of this study, and is another important topic for investigation. The literature review and case examples in this report touch on some of these topics, but a full analysis of the state of the transportation workforce pipeline, recruitment, workforce demographics, and workforce forecasting requires additional future work.
This chapter summarizes and presents a literature-based review of transportation workforce planning and development programs. Overall, this information demonstrates the existing workforce programs in transportation, but also suggests that there is no clear consensus about how to handle many workforce challenges.

This chapter is organized to help the reader understand the scope of how workforce planning and development is defined in the transportation industry. It also describes the challenges and trends facing the transportation workforce, particularly among state transportation agencies. The literature review addressed the following questions:

- **Definition and understanding.** What do we mean by workforce planning and development?
- **Macro concerns and issues.** What are the opportunities and challenges facing the transportation workforce?
- **State of the practice.** How are workforce planning and development programs addressing the transportation workforce’s future needs?

The literature was collected through an Internet search of workforce planning and development definitions across all industries in the United States and practices specific to the transportation industry. The research team used the Transport Research International Documentation database as well as other trade and academic resources to find previous studies and syntheses on transportation workforce planning and development. In addition, the synthesis panel provided recommendations on relevant previous studies. In this way, the literature we reviewed was obtained from a mix of traditional peer-review journals and publications as well as documents such as federal and state agency reports, internal guidebooks, and others.

### 2.1 Defining and Understanding Workforce Planning and Development

The transportation workforce faces an uphill battle in the coming years due to the impending retirement of the Baby Boom generation—generally defined as people born between 1946 and 1964—and separations from the industry for other reasons, including employees leaving to work in the private sector. At the same time, there is a shortage of job seekers possessing the skills needed to fill current and upcoming available roles. This confluence of conditions will challenge the transportation industry’s ability to maintain a robust and flexible workforce that represents the nation’s demographic makeup.

The transportation industry is not alone in facing the challenge of preparing for drastic shifts in its workforce. Workforce planning has been described by the U.S. Office of Personnel Management as “a systematic process for identifying and addressing the gaps between the workforce...
of today and the human capital needs of tomorrow” (Office of Personnel Management n.d.). The Workforce Innovation and Opportunity Act of 2014 was enacted to “help job seekers access employment, education, training, and support services to succeed in the labor market and to match employers with the skilled workers they need to compete in the global economy” (Employment and Training Administration n.d.).

Workforce planning and development are related but distinct components of an industry’s efforts to predict, respond to, and manage workforce needs. Planning refers to the strategic steps taken by an organization to plan for impending changes to the entire workforce. In the report, Guide to Workforce Planning, the U.S. Department of Transportation (U.S. DOT) lists strategic alignment, obtaining a profile of both the current and future workforce, performing gap analyses, and making recommendations as typical elements constituting a workforce plan (U.S. DOT 2008).

The U.S. DOT report distinguishes workforce planning from succession plans, which allow organizations to plan for organizational changes regarding specific positions and talent pools. Succession plans incorporate inventories of key positions and talent, and recommendations for a path forward (U.S. DOT 2008). In this sense, succession planning encompasses workforce development initiatives, which are strategies aimed at developing competencies and skills for specific positions and individuals. Figure 1 offers a general framework depicting the distinctions between these workforce concepts.

The scope of this report is to evaluate workforce planning and development initiatives broadly. Where we mean to isolate one or the other in the following discussion, we will refer to it specifically as “workforce planning” or “workforce development.”

Workforce plans were described in Alan Schweyer’s book Talent Management Systems: Best Practices in Technology Solutions for Recruitment, Retention, and Workforce Planning as instruments that “map available and potential talent to broad and precise business objectives” (Schweyer 2004, p. 22). These tools vary from organization to organization, and are composed of skill and position recruitment forecasting, training, redeployment, developmental assignments, succession plans and promotions, and position elimination.

In the book Transforming U.S. Workforce Development Policies for the 21st Century, thought leaders and practitioners spanning a variety of fields explore how workforce development efforts can be revised to mirror national economic and social trends. The book covers topics such as the strengths and limitations in current U.S. workforce policies like post-secondary education.

Figure 1. Workforce planning and development framework.
and reemployment programs, possible strategies to reform workforce development like improving career information and delivering online training and education, and improving workforce programs through systematic data collection and analysis (Van Horn et al. 2015).

Despite the need for workforce planning and development efforts, a report by the John J. Heldrich Center for Workforce Development, *The State of the U.S. Workforce System: A Time for Incremental Realignment or Serious Reform?*, indicates that funding for workforce planning and development initiatives was hit during the 2008 Great Recession and has yet to rebound due to budget deficits and discretionary spending constraints (Krepcio and Martin 2012). Prioritizing the funding of workforce planning and development initiatives will help agencies to attract and retain capable workers.

This report focuses on efforts at the state level, and thus evaluates workforce planning and development practices housed at state DOTs and LTAPs/TTAPs. The two entities are closely linked, but do have different roles in supporting each state’s transportation workforce. State DOTs build, maintain, and operate state transportation systems across all modes. LTAPs/TTAPs provide information and training aimed at building capacity of local, state, and private transportation providers. The LTAP Centers (present in all 50 states, Puerto Rico, and tribal regions) are generally on university and technical college campuses. Through training programs, an information clearinghouse, technology updates and assistance, and newsletters, these centers provide transportation providers with in-person and online training services, technology transfer services, resources to enhance safety, and environmental, congestion, and capacity solutions (FHWA 2018a).

In the compendium for a 2009 summit on transportation workforce planning and development, *21st Century Workforce Development Summit*, Wittwer et al. declared that as the transportation industry looks to keep pace with societal, economic, and technological changes, its workforce must be equipped with a broader set of skills and new partnerships must form across transportation agencies, educators, and the private sector to help develop those skills (Wittwer et al. 2009). These two concentrations—skill capture and development, and partnership formation—will frame our discussion of priorities that transportation agencies emphasize in determining their future workforce needs.

### 2.1.1 Skill Capture and Development

To attract and prepare a new cohort of workers, the transportation industry’s workforce planning and development initiatives will need to ensure that employees keep pace with larger shifts in the economy as a whole and the transportation industry. New technologies, shifts in work–life balance priorities, demands for accountability, data availability and analysis, the rise in labor outsourcing, and the growth in financing options will require that employees be trained in critical skills like communications, management, teamwork, and leadership in addition to quantitative and technical skills (Wittwer et al. 2009).

For maximum efficacy, skills training can happen along the educational pipeline, from primary education to on-the-job training. The decline in younger generations choosing to enter into technical skill-based fields may be due in part to the lack of exposure to science, technology, engineering, and math (STEM) disciplines during primary and secondary education (Grossman et al. 2015). In the K-12 years, the transportation industry can work with educators to promote an awareness of the field to current students and to provide STEM training. Figure 2 shows a model of engagement for the future transportation workforce at various stages in education and employment.

The Council of University Transportation Centers conducted a National Transportation Workforce Summit in 2012. The report published after the summit, *National Transportation
Workforce Summit: Summary of Results, stated that the transportation sector’s challenge in attracting a skilled workforce during primary education stems from the absence of transportation-related career awareness in primary curriculum, which leads many students to pursue other fields in college (Council of University Transportation Centers 2014). In part, this is because U.S. students do not have access to a diverse enough array of science, technology, engineering, and mathematics courses prior to college and thus, are less proficient in these fields; for example, only 16% of high school seniors in the United States are proficient in math and interested in a STEM career (U.S. Department of Education n.d.).

There are opportunities to integrate transportation into education beyond the primary and secondary education levels by developing community college and university programs aimed at training skilled individuals for the transportation workforce through credit and non-credit programs, degrees, certificates, and continuing education programs, as described in a 2003 TRB Special Report, Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies (Committee on Future Surface Transportation Agency Human Resource Needs 2003). Fellowship programs and grants can lower the financial barriers to pursuing an education, and internship programs can provide on-the-job experience to current college students.

Among those students who do pursue STEM degrees for their post-secondary education, many lose interest before completing the degree (Malcom and Feder 2016). A 2017 survey by the Pew Research Center further explored this topic; in response to one survey question asking why more young people do not pursue STEM degrees, half of U.S. adults indicated that the difficulty of STEM subjects is an inhibiting factor. While slightly less than half of those with some college education or less indicated subject difficulty as the main reason young people do not pursue STEM degrees, the same respondents were more inclined to say that STEM subjects were not useful for their careers (Kennedy et al. 2018).

STEM training has been criticized for failing to prepare students properly for the workforce. In some cases, students acquire the technical skills required of jobs, but lack the broader “employability skills”: attitudes, behaviors, and motivation required to succeed in the workplace.
Transportation Workforce Planning and Development Strategies

(Committee on Improving Higher Education’s Responsiveness to STEM Workforce Needs et al. 2016). Additionally, introductory transportation courses often focus on traditional transportation engineering concepts at the expense of exposing students to the multimodal applicability of STEM skills. This may turn away those engineering students who have expressed interest in the non-technical aspects of transportation careers, including providing benefits to society and the environment (Hernandez and Ritchie 2015).

An NCHRP report, *In-Service Training Needs for State DOTs*, noted that transportation agencies increasingly require skills other than those associated with the traditional construction, maintenance, and operation missions of agencies (Tom Warne and Associates 2005). Today, many transportation employees are required to undertake project and program management tasks that require financial and administrative skills, and public and stakeholder relations tasks that require public outreach and consensus building skills. Additionally, leadership skills can be taught to prepare workers for senior management positions.

On-the-job training for those already in the transportation industry is an important tool for helping employees to renew and expand their existing skills in order to retain a skilled workforce and keep pace with industry advancements. *National Transportation Workforce Summit: Summary of Results* described how transportation agencies and employers can provide training aimed at keeping pace with the newest technologies in the industry and at helping workers advance in their careers by helping them to acquire additional skills through in-person and web-based trainings (Council of University Transportation Centers 2014).

### 2.1.2 Forming New Partnerships to Develop Necessary Skills

According to *National Transportation Workforce Summit: Summary of Results*, the following stakeholders are involved in transportation workforce planning and development efforts (Council of University Transportation Centers 2014):

- **Industry and labor** (i.e., employers across all transportation modes; trade and professional organizations; labor organizations; and state workforce organizations)
- **Government officials** (i.e., local, state, and federal personnel in Transportation, Labor, and Education departments)
- **Education partners** (i.e., researchers; accrediting and member organizations; universities, community colleges, and technical colleges; LTAP; public K-12 institutions; high school career and technical education centers)

Transportation workforce planning and development historically has been fragmented among transportation agencies, academic institutions, organized labor, and the private sector. Furthermore, there has been little coordination among the various entities (Glitman 2010). Partnerships among them can lead to better efficiency in training, resulting from a reduction in effort duplication, a wider breadth in experience for the trainees, improved understanding of organizational constraints, and more communication regarding desired outcomes (Wittwer et al. 2009). The case examples described later in this synthesis include examples of different models for collaborations among universities, state DOTs, LTAPs and outside contractors.

One of the main takeaways discussed in *Region V Transportation Workforce Assessment and Summit*, the report from the 2015 Midwest Transportation Workforce Summit that convened transportation, education, labor, and economic stakeholders, was that stronger commitments to regional industry-sector partnerships would help to deliver tangible outcomes aimed at addressing workforce challenges (Adams and Hart 2017). In particular, the report authors highlighted partnerships with outside educational partners, stating that: “Transportation agencies that work with educational partners to identify career pathways into and within the organization will retain their workforce longer.” The report includes specific examples, as well as a summit
participant survey with results showing positive correlations between self-reported partnership establishment and self-reported participation and value in experiences (Adams and Hart 2017).

Increasingly, partnerships between the public and private sectors also play a role in the procurement, delivery, and maintenance of transportation services. A report by TransitCenter and the Eno Center for Transportation, A Bid for Better Transit: Improving Service with Contracted Operations, describes a range of options encompassing the delivery of government-managed and -funded services by private-sector contractors (Lotshaw et al. 2017). The authors report that competitive contracting of transportation services can improve service quality for riders and help public agencies to keep up with dynamic industry shifts, and that these partnerships can also provide agencies with opportunities to restructure in an effort to keep pace with external shifts. However, they caution that competitive contracting bids must navigate the complexities of contracts that set wage and benefit levels and of negotiating with organized labor unions. The report goes on to explain that competitive contracting can benefit the workforce by allowing agencies to add services, staff positions, and benefits.

Labor unions can contribute to workforce initiatives by serving as leaders of collaborative efforts, despite organized labor’s relatively small role in public workforce planning and development. According to a National Fund for Workforce Solutions report, Unions as Partners: Expanding the Role of Organized Labor in Workforce Development, this requires a redefinition of old paradigms; unions and employers often share goals (e.g., the desire to see their workplace succeed), and these goals can be aligned by sharing effective practices, determining mutual desired outcomes and ways to achieve them, and advancing the agendas of visionary leaders (Wagner 2010).

Collaboration between labor and management can promote workplace efficiency, improve performance, and resolve workplace issues. According to the Bureau of Labor Statistics, 17.3% of private-sector workers in the transportation and warehousing sector were members of unions in 2017, which is among the higher unionization rates across all sectors (Bureau of Labor Statistics 2017b). Unions can influence an agency’s decisions to reorganize, including having individual employees make decisions (Committee on Future Surface Transportation Agency Human Resources Needs 2003). In addition, a 2002 Transit Cooperative Research Program report, Managing Transit’s Workforce in the New Millennium, describes how unions can play a role in transit agencies’ efforts on growth, continued learning, rewards for skills development, and encouragement of advancements based on skill attainment rather than seniority (McGlothin Davis Inc. 2002).

### 2.2 Macro Concerns and Issues

The number of jobs in the transportation sector is growing and so are wages (Bureau of Labor Statistics 2018a). A robust, diverse, and qualified transportation workforce can promote overall U.S. economic growth through the efficient movement of goods and services. Transportation agencies and their workers can design and deliver services that adapt to future social and economic trends. However, with increasing automation and job separations facing the transportation workforce, it is not clear how many jobs, what kinds of jobs, or what level of pay for doing those jobs will become available over the next few decades.

Organizational staffing strategic plans can help agencies grapple with the uncertainties of planning for the future workforce. While the roles and responsibilities of human resource managers is outside of the scope of this report, the concerns described in this section are among those that may be addressed in an agency’s strategic plan, and thus are important considerations for human resource officials. TRB’s Special Report, The Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies, highlights the importance of incorporating human resource personnel into strategic plans: “A benchmarking study
for the Georgia Department of Transportation revealed that without a strategic focus for human resources in state DOTs, sustained attention to workforce development is often lacking” (Committee on Future Surface Transportation Agency Human Resource Needs 2003, p. 32).

As transportation agencies develop strategic human resource strategies to plan for future workforce needs, an awareness of the inherent challenges related to replenishing the workforce, recruiting a talented new workforce, and retaining the current workforce will help them to understand their shifting needs better. Following are some of the most critical issues facing the transportation workforce.

### 2.2.1 Impacts of Technology

Technological innovation will have a profound influence on the functions of the transportation workforce. Emerging technologies like smartphone-enabled services (e.g., ride-hailing), electric vehicles, and automated vehicles will shift the demands placed on the services and infrastructure under the purview of state DOTs.

There is much focus on machines replacing workers, but what is less emphasized is automation’s ability to complement jobs. In some cases, new technologies may require retraining workers for new tasks. For example, the International Transport Workers’ Federation points to the potential for vehicle operators to step into supervisory or management roles as their traditional positions become automated (International Transport Workers’ Federation n.d.). More broadly, state DOTs will need to adapt by incorporating agility and innovation into their organizational plans (Fuchs and Shehadeh 2017). Departments of transportation can adapt by maintaining an awareness of impending technological advances and sharing knowledge within the industry (Council of University Transportation Centers 2014).

Although it is impossible to predict the extent to which machines will substitute or complement transportation workers, general skills training for tasks that will not be taken over by machines anytime soon—critical thinking, problem solving, adaptability, and communication—may give students and workers an edge, according to economist Harry Holzer (Holzer 2017). Furthermore, Holzer lists several positive outcomes of automation, including job creation because of automation as well as a shift toward sub-Bachelor of Arts or associate degree options that prepare workers for middle-wage jobs. Still, he states that “if and when displacements do occur, we should have more robust models of ‘lifelong learning’ available to such workers to provide them with better retraining options than now exist.”

An NCHRP synthesis, Leveraging Technology for Transportation Agency Workforce Development and Training, describes how technology can also improve the training process through efficiencies created by the reduced need for physical training facilities, allowing employees to complete training at their desk, reducing the costs (both in time and money) associated with training courses and materials, and promoting consistency in content delivery (Laffey 2017).

### 2.2.2 Jobs and Wages

Though the Great Recession led to significant job loss in the transportation sector, employment has since far surpassed pre-recession levels and is projected to continue growing in the coming years (Kane and Puentes 2014, U.S. Bureau of Labor Statistics 2017a). According to a 2015 report by the U.S. Departments of Education, Transportation, and Labor, every $1 billion in transportation investments over the next 10 years is expected to create 13,000 infrastructure jobs. The same report estimated 11 percent growth in transportation employment between 2012 and 2022, mirroring the expected 10.8% growth in employment for the entire economy. However, the percentage of American workers in transportation and transportation-related
industries has declined continuously from 11.3% in 1990 to 9.0% in 2016 (Bureau of Transportation Statistics 2017).

Average hourly earnings for all transportation and warehousing employees have steadily increased since 2008 to just above $24 per hour this year (Bureau of Labor Statistics 2018b). The 2017 median annual wage for transportation occupations was $31,600, which is less than the U.S. median annual wage across all occupations of $37,690 (Bureau of Labor Statistics 2017c). Distribution of pay in the transportation sector is not flat. The five lowest paid transportation-related occupations (e.g., parking lot attendants) account for 1 million workers, while the top five occupations (e.g., airline pilots) comprise 294,660 jobs (Bureau of Transportation Statistics 2017). Though the median pay falls below the national level, wages in the transportation industry vary widely depending on the specific occupation and season. However, at the lower ends of the income scale (10th and 25th percentiles), transportation jobs tend to pay higher wages compared with all occupations nationwide (Kane and Puentes 2014). All Bureau of Labor Statistics pay data reflected in this section are standardized as straight-time, gross hourly/annual wages.

Pay differences can also vary depending on geographic region and even within a state. Often state DOTs pay less than their local or private-sector counterparts, which was demonstrated in the Washington State Department of Transportation Recruitment and Retention Study focused on preliminary engineering roles. The report authors showed a variance of up to -33% between the state DOT and select regions or cities within the state, and recommended that the state agency consider determining pay based on regional cost of living, rather than on job classification (The PFM Group 2016).

Although headlines tend to focus on job growth as the primary metric for the overall health of the U.S. workforce, occupational separations—the projected number of workers permanently leaving occupations due to either retirement or career changes—are another important consideration (Kane 2017). The NCHRP report, Strategies to Attract and Retain a Capable Transportation Workforce, points to a competitive labor market and higher wages in the private sector as a noteworthy factor leading state DOT employees to leave their positions (Cronin et al. 2011). In Texas, the state transportation agency noted water systems, oil and gas, and renewable energy industries as the main external competitors for specialized workers, particularly those involved with civil engineering (Texas Transportation Commission 2018). The Illinois DOT names other public agencies and the private sector as its direct competition for top talent in a wider array of fields, including logistics, information technology, and urban planning (Illinois Department of Transportation 2014).

### 2.2.3 Replenishing the Current Workforce

Among the key challenges facing the transportation industry is the need to predict and match future U.S. employment, demographic, and education trends. As the Baby Boomer generation retires, it will be important for the industry to replace these workers with a new workforce that reflects the nation’s broader trends related to birth and immigration rates, educational attainment, and competition within the labor market.

As of 2014, 53% of workers in six subsectors within the transportation industry were 45 years or older, which was 9% higher than the U.S. average of overall employees in this age range. Transit and rail had the highest percentages of workers over age 55: 35% and 29%, respectively, leading to a particular challenge among these subspecialties (U.S. Departments of Education, Transportation, and Labor 2015). These older, experienced workers are eligible to retire within the next 10 to 15 years, and they will need to be replaced.

Senior employees often possess specialized institutional knowledge related to their positions, which new employees must build over time. The 2011 NCHRP report, Strategies to Attract and
Retain a Capable Transportation Workforce, describes knowledge management systems as practices that can help organizations to better manage the sharing and documentation of critical knowledge that is often lost during transitions (Cronin et al. 2011). The report suggests two strategies for developing knowledge management systems: creating data and information portals through which employees can share industry and job information and development of “communities of practice,” where employees who perform specific roles share information with their counterparts in other regions.

As openings become available for the next cohort of transportation workers, workplace practices will need to reflect larger societal demographic trends. The future labor market will be more ethnically and racially diverse than the current makeup of the transportation industry. The U.S. population is trending toward the aging and decline of the white population, counterbalanced by an increase among young non-whites (Frey 2018). Yet, the current breakdown in the transportation industry indicates that African Americans and Hispanics are underrepresented in jobs that require more advanced skills, pay better wages, and offer more career ladder opportunities (U.S. Departments of Education, Transportation, and Labor 2015). The transportation industry must consider how it can better appeal to a new, more diverse candidate pool.

Additionally, women composed only 20% of the transportation sector in 2014, although they are roughly half of the overall U.S. population (U.S. Departments of Education, Transportation, and Labor 2015). Women are especially underrepresented in the trucking, highway, rail, and maritime subsectors. People with disabilities are also underrepresented in jobs across many sectors and are disproportionately out of work. Nearly a third of people in the United States looking for work are people with disabilities (Yin and Shaewitz 2015). Harnessing the talents of disadvantaged and underrepresented groups can help build a strong future workforce. According to the 2015 McKinsey & Company report, Diversity Matters, diversity helps an organization to attract a wider talent pool, strengthen customer orientation, increase employee satisfaction, improve decision making, and enhance the company’s image (Hunt et al. 2015).

Strategies to Attract and Retain a Capable Transportation Workforce describes work–life balance as an important consideration in attracting and retaining such a workforce. The report authors state that today’s workers are increasingly interested in a balance between their work and personal life and flexible work arrangements (Cronin et al. 2011, p. 122). Unless there are complementary shifts in management styles to attract and retain younger workers, these new workplace preferences may produce gaps in the transportation workforce as younger generations instead pursue other jobs offering more desirable workplace environments.

Replenishing the workforce involves planning to incorporate future cohorts that are new to the industry and facilitating the career advancement of those already in the industry. However, for some transportation agencies, hiring freezes and downsizing due to agency restructuring have created a deficiency in the quantity of mid-level managers available to replace retiring senior-level managers (Committee on Future Surface Transportation Agency Human Resource Needs 2003).

2.2.4 Recruiting, Training, and Promoting a Talented Workforce

Strategic recruitment and preparation for the next cohort of workers as well as training and promoting current staff can help employers to replenish a retiring workforce. Recruiting and training efforts entail building an awareness of transportation jobs early in children’s educational timelines, raising interest in the field for these children as potential employees, and promoting inclusive and robust education efforts to attract a skilled and diverse workforce.

To improve workforce retention, agencies can continually train their workforce to meet the evolving needs of the industry. Structural shifts in how transportation agencies are organized
and operated, technological advances, and demographic changes are among the challenges facing transportation agencies as they look to retain current skilled employees. Yet, compared with other sectors, there is an indication that the transportation sector has taken fewer steps to anticipate staffing needs, competency of the current workforce, anticipated future skills needed, and the demographic makeup of the sector (Sweet and Pitt-Catsouphes 2010).

Agencies have witnessed structural shifts in their organization and operations over time. State agencies were initially established to construct highways, but many have since expanded their missions to include multimodal efforts and to consider an array of issues beyond engineering, such as infrastructure planning, resiliency (e.g., security, environmental sustainability), and innovation (Committee on Future Surface Transportation Agency Human Resources Needs 2003, p. 3). To keep pace with shifting trends and expanding scope, these organizational developments prompt agencies to broaden their employees’ range of technical and non-technical skills consistently.

Creating a modern work environment where employees feel engaged and valued is important for retaining the current workforce. Although a survey from the Sloan Center on Aging and Work indicated that 9 out of 10 workers in the transportation and warehousing sector were at least somewhat satisfied with their jobs, which is comparable to other sectors, the same survey also pointed to a significantly higher likelihood that workers in the transportation sector indicate experiencing work–family conflict and job interference with family life, compared with other sectors (Sweet and Pitt-Catsouphes 2010). To retain employees, transportation employers can develop an awareness of employees’ work style preferences and shift organizational cultures to meet these preferences where appropriate. For instance, employers sometimes consider offering employees flextime or telecommute options.

2.3 State of the Practice

Throughout the literature, examples demonstrate how (even though there is more work to be done) practices are changing to address challenges facing the transportation industry, such as recruiting a more diverse and capable workforce and retaining and retraining the current skilled workforce. Several examples of the industry’s efforts to address these challenges and meet future needs are described in the next subsection.

2.3.1 Recruiting the Future Workforce: Examples of Preparing a Diverse Cohort of Future Workers for Transportation Careers

Strategies focused on broadening the appeal of transportation jobs to younger and more diverse generations can help to grow a robust workforce. Women and minorities may have different motivations for pursuing degrees that prepare them for careers in transportation; a 2015 study, Motivating Students to Pursue Transportation Careers: Implementation of Service-Learning Project on Transit, found that female students indicated community impact as a strong motivating factor for choosing to pursue a degree in engineering (Hernandez and Ritchie 2015). Such considerations are important for workplaces to consider as they create more open organizations that meet the needs of new worker cohorts.

Transportation industry careers represent a broad range of education levels, competencies, and skills. Community and technical colleges and traditional 4-year universities alike play a role in forming career pathways for future employees, and educational institutions can work with transportation agencies to determine future workforce needs.

Internships, mentorships, and apprenticeships can help students translate their classroom education into job-specific skills, especially among disadvantaged groups (Glitman 2010;
U.S. Departments of Education, Transportation, and Labor 2015). Often, transportation internship programs are incorporated into curricula enabling students to receive course credit for real-world work experience.

These efforts can be focused on developing career awareness and expanding education and training opportunities beginning as early as primary school and extending all the way through the existing workforce.

**Existing Initiatives**

- Some cities are beginning to experiment with transportation-specific career technical education (CTE) schools and academies. For example, Transit Tech High School is a Brooklyn, NY-based vocational high school focused on training students for jobs in rapid transit. Students have access to an on-site lab where they can practice performing maintenance tasks on trains, and they have the opportunity to intern with the Metropolitan Transit Authority. Other cities, such as Washington DC and Los Angeles, are beginning to explore CTE and vocational school programs aimed at educating the next cohort of transportation workers (Kim 2018).

- The FHWA’s Center for Transportation Workforce Development uses federal assistance funds to deliver program support, technical assistance, and workforce development activities for state transportation agencies. Programs range from early education through workplace professional development. Available programs include the National Summer Transportation Institute Program, which is designed to increase awareness of transportation careers among junior and senior high school students, especially minorities, females, and disadvantaged youth; the Summer Transportation Internship Program for Diverse Groups, which provides underrepresented undergraduate, graduate, and law students (i.e., women, students with disabilities, and racial and ethnic minorities) with on-the-job training experience; and the National Network for Transportation Workforce Development, which is composed of five regional transportation workforce centers and facilitates workforce activity and program partnerships with public and private organizations (Federal Highway Administration n.d.).

- Advance CTE: State Leaders Connecting Learning to Work is a nonprofit that represents state and community leaders responsible for career technical education across the United States (Advance CTE 2018). The organization helps to deliver high-quality CTE programs through its National Career Clusters Institute professional development program. This program provides state leaders and educators with a framework for delivering programs of study related to 16 Career Clusters representing a variety of career pathways. Of the 16 Clusters, the Transportation, Distribution, and Logistics Cluster focuses on improving education related to the transportation industry. Its career pathways include various specific roles within the industry, including operations; logistics planning and management services; warehousing and distribution center operations; facility and mobile equipment maintenance; transportation systems and infrastructure planning; management; regulation, health, safety, and environmental management; and sales and service.

- The U.S. DOT’s University Transportation Centers (UTCs) program awards grants to colleges and universities with the goal of advancing transportation research, education, and technology (Federal Highway Administration n.d.). UTCs also serve workforce development needs by providing students with training, skill enhancement, workshops, seminars, conferences, summer employment and internships, and transportation career awareness. UTCs bring educational institutions together on specific research topics, including Improving Mobility of People and Goods; Reducing Congestion; Promoting Safety; Improving the Durability and Extending the Life of Transportation Infrastructure; Preserving the Environment; and Preserving the Existing Transportation System.

- The American Public Transportation Association’s (APTA’s) Transit Virtual Career Network (VCN) is a resource that provides those seeking jobs in public transportation with information
about where to find training opportunities, financial aid opportunities, and job openings (U.S. Department of Transportation 2018). The VCN is a partnership among the Federal Transit Administration, the Rutgers Heldrich Center for Workforce Development, APTA, the National Association of State Workforce Agencies, and XPAND Corporation, with support from the U.S. Department of Labor and the American Association of Community Colleges. The VCN refers to itself as an “open source, open content” workforce services and online learning delivery platform aimed at assisting job seekers and unemployed and underemployed individuals with their transition to high-paying, high-growth careers. Services provided to users include videos and “day-in-the-life” stories to answer common questions, online assessments to determine the necessary academic preparation needed for careers, financial aid information, and Career Management Accounts to store and manage all of this information.

2.3.2 Retaining the Current Workforce: Examples of How Continuing Education Can Increase Employee Retention

In addition to attracting a new cohort of workers to transportation careers, transportation employers are also grappling with retaining current employees. Among the reasons employees may leave their current positions are that they were not properly trained to meet the expectations of their positions, and that better opportunities exist elsewhere, typically in the private sector.

TRB’s Special Report 275, The Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies, points to replacement and turnover as costly and common challenges that employers face. The “onboarding” or introductory training period is when employees are most vulnerable to voluntary turnover because they have not yet been acclimated to company cultures. The report indicates that training, mentoring, and coaching programs can help to retain workers early in their employment (Committee on Future Surface Transportation Agency Human Resource Needs 2003).

Beyond the early stages of employment, training employees to perform new and evolving skills can be an effective method of retention. TRB Synthesis 323, Recruiting and Retaining Individuals in State Transportation Agencies, reported on results from a survey of state transportation officials. According to the survey, 83% of state DOTs listed training as a strategy for retention (Tom Warne and Associates 2005).

Existing Initiatives

- The American Association of State Highway and Transportation Officials (AASHTO) oversees a technical service program, Transportation Curriculum Coordination Council (TC3), which develops training products for construction, maintenance, and materials workers (AASHTO n.d.). Among the training resources available to managers through this program are core curriculum matrices that map skill-level competencies to training resources, 120+ online courses, and a State Sharing Program that allows states to access other states’ online courses.

- The National Network for the Transportation Workforce, which is funded by the FHWA, is made up of five regional transportation workforce centers that focus on developing the transportation workforce and specific disciplines unique to the region. For example, the West Region Transportation Workforce Center has a particular focus on issues such as rural transportation and safety, tribal transportation, and federal lands (National Network for the Transportation Workforce 2018).

- The National Highway Institute (NHI) is a training and education program that was established in 1970 by the FHWA. The program offers trainings in 18 transportation industry-related program areas, including Structures, Construction and Maintenance, Intelligent Transportation Systems, Environment, and Communications. Many of the trainings can be
used toward obtaining continuing education units, certification maintenance credits, and professional development hours. The courses are offered in a variety of types (e.g., instructor-led training and online learning) and lengths and provide students with access to national experts (Federal Highway Administration 2018b).

- The National Transit Institute (NTI) at Rutgers University was established under the Intermodal Surface Transportation Efficiency Act of 1991 with the goal of developing, promoting, and administering training and education programs for the public transportation industry. Currently, the program is funded by Title 49 U.S.C. Section 5315(d) MAP-21 and Section 5314(c) of the Fixing America’s Surface Transportation (FAST) Act. The program offers courses in locations throughout the country and educational resources in five areas: Advanced Technologies, Management Development, Multimodal Transportation Planning, Transit Program Management and Compliance, and Workplace Safety (NTI n.d.).

### 2.4 Conclusions from the Literature

This chapter summarizes existing literature on workforce planning and development practices in the transportation industry. The literature highlights effective existing workforce programs across state transportation agencies, but also demonstrates the numerous challenges and opportunities and the diverse approaches to addressing them.

A host of connected activities are involved in building and maintaining the workforce. Workforce development, workforce planning, succession planning, and forecasting are all closely related. However, these terms are often conflated in the literature. Future research can focus on further distinguishing among workforce development, workforce planning, and succession planning.

The transportation workforce is facing many of the same challenges as the larger U.S. workforce in general. As industry needs shift and technologies evolve, transportation employers will increasingly need to focus on recruiting, developing, and retaining skilled workers.

Programs have been developed to address these challenges. Whereas the literature describes these various programs, it fails to address their longitudinal effects, cross-geographical implications, or funding constraints. Future evaluations should assess the effectiveness of workforce planning and development programs, for example, whether students who take part in early childhood programs are in fact more likely to enter into transportation careers, whether certain programs work in some states but not others, and how states can fund workforce efforts.

In the review of the literature, the research team uncovered two previous surveys on the subject of transportation workforce planning and development, including the 2002 NCHRP Synthesis 323, which surveyed 27 U.S. state DOT and Canadian province officials, and the 2009 Wisconsin DOT survey of state and university authorities. These surveys provided guidance on the challenges facing the transportation workforce, but their findings may be less relevant in today’s economic landscape.

The themes uncovered in this literature review informed the development of a survey to capture a more current picture of the challenges and opportunities facing state DOTs as they plan for future workforce needs.

Conducting interviews of the future and current workforce, such as the employee interview conducted in the NCHRP’s Recruiting and Retaining Individuals in State Transportation Agencies 2003 report, can help state DOTs identify which elements of transportation jobs and work settings are stated as important to the workforce that they are trying to recruit and retain. This can help DOTs better match their recruitment and workplace practices and policies to meet workforce planning and development goals.
The research team developed the survey portion of this project in parallel to and following the literature review. Previous surveys, as well as areas of research need and industry interest, informed the questions and content of the survey instrument. Pre-testing and NCHRP panel review further informed development.

The concise online survey encouraged respondents from state DOTs and LTAPs to answer questions about agency background and context, the broader workforce planning and development environment, specific types of programs, funding, and social factors. The survey instrument and instructions for finding the full, anonymized cleaned dataset can be found in Appendix A.

### 3.1 Survey Method

The survey was developed using the online platform Jotform, which allows for various question types and survey logic as well as secure data storage. The instrument is as concise as possible while collecting the relevant information needed for the study, taking about 10 to 15 minutes to complete. Beyond the basic agency information, questions were optional, allowing respondents to complete only parts of the survey as desired. Answer options of “prefer not to respond” and “I don’t know” allow researchers to observe when respondents chose to answer a question even if they did not wish or were not able to answer it.

The survey was pre-tested by colleagues of the research team and reviewed by the NCHRP Project 20-05 panel members, including state DOT workforce professionals.

#### 3.1.1 Question Types and Content

The survey includes multiple-choice, checkbox, and open-ended questions. The questions address the following:

- Basic information about the agency
- Definition and viewpoints of workforce planning and development
- Types of workforce planning and development tasks and programs and what type of agency offers each one
- Workforce program evaluation methods
- Successes and challenges in offered programming
- Program funding sources and amounts
- Resource availability and collaboration (monetary and otherwise)
- Contracting practices in workforce programming
- Future workforce needs
• Agency qualities/practices that affect the workforce
• Future plans and anticipated needs
• Additional comments

3.1.2 Target Population and Survey Deployment

The data collected support the goals of the project to synthesize the current state of practice associated with the implementation of surface transportation workforce planning and development strategies. In order to collect standard, comparable, significant data, the survey was deployed to state DOTs and to LTAPs. The email lists from the National Local Technical Assistance Program Association and the National Transportation Training Directors were used to contact potential survey respondents. One contact from each of the 50 states (excluding Washington, DC, and Puerto Rico) was chosen from each list. A list of 100 recipients was compiled, resulting in one state DOT and one LTAP contact for each state.

The federal LTAP program is available to any state that provides a 50% match in funds. All 50 states and Puerto Rico have an LTAP program, and the organizational structure takes one of two forms. Some LTAPs are housed at the state DOT, forming a combined LTAP/state DOT structure. In states where the LTAP is not at the state DOT, it is housed at a local university. As some states have combined state DOTs and LTAPs, the overall population for the survey fell to 94 recipients.

With a population of 50 to 100 agencies to respond to the survey, the research team aimed to receive responses from more than 30% of the population and about 80% of states. A total of 58 responses were received, including 27 from LTAPs, 25 from state DOTs, and 6 from combined LTAPs/state DOTs. The five states that did not respond have LTAPs that are separate from the state DOTs. Therefore, the entire population for the survey of all LTAPs and state DOTs consists of 6 combined agencies and 44 state DOTs and 44 LTAPs, for a total population of 94 agencies, giving a 62% response rate. Responses were received from 45 states, providing responses from 90% of the states.

The survey was deployed by email on the afternoon of Tuesday, April 3, 2018, with a cover letter as the email body. Respondents were given 3 weeks to complete the survey. Three follow-up emails (April 9, 17, and 27), extending the deadline to April 27, reminded respondents to complete the survey. Thirty-nine agencies responded by April 27, and the research team conducted phone calls in the following weeks to each agency that had not yet responded. The phone follow-ups significantly raised response rates.

3.1.3 Survey Biases

The survey was developed to minimize survey bias. Potential biases are examined and addressed below and in context with survey result analysis. All questions were worded as clearly and objectively as possible to minimize response bias.

The questions provided respondents with the option of indicating “prefer not to respond” and/or “I don’t know” to address item non-response bias in analysis. Agencies that have extensive or complicated organization or workforce development programs may have been more likely to experience survey fatigue and not complete the survey through to the end. Many responses, however, do include large amounts of information about involved programming and organizational structures, suggesting that the level of this bias is unknown and insights from various types of agencies are still included.

Unit non-response may be likely to occur from agencies that do not see workforce development as important or as a priority, and therefore will not see the benefits to taking the time to complete the survey for research purposes. Pushing for and reaching a state response rate of 90% also helps quell concerns around non-response biases.
Survey Results: General Trends

A total of 58 responses from 45 states spanning a diverse geographic area (as shown in Figure 3) constitute the full response set.

Out of the 45 states responding, 13 states responded twice (states shown in cross-hatch), with one response from the LTAP and one from the state DOT in those states. A few respondents indicated different structures to the organization of the LTAP and DOT than indicated by experts in the field and the research team’s investigations (Beale 2018). Because data in Figure 3 are self-reported, some states may be shown as having LTAPs housed outside of the DOT when they are in fact combined. Comparing responses from staff at the state DOT and staff at the LTAP in individual states showed that, in some states, responses varied to the point of contradiction and disagreement, while in other states responses showed similar views shared by LTAP and state DOT respondents about organizational roles, funding sources, and future needs. Table 1 shows the breakdown of response by agency type.

The responses include a mix of organizational types, including 6 (10%) from combined state DOTs and LTAPs, 27 (47%) from LTAPs, and 25 (43%) from state DOTs.

Table 1. Survey respondents by self-reported agency type.

<table>
<thead>
<tr>
<th>Agency Type</th>
<th>Number of Respondents</th>
<th>Total Number of This Type of Agency as Reported in the U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined LTAP and state DOT</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>State DOT not housing an LTAP</td>
<td>25</td>
<td>44</td>
</tr>
<tr>
<td>University-housed LTAP</td>
<td>27</td>
<td>44</td>
</tr>
</tbody>
</table>
Workforce planning and development is not approached equally by every agency. Some programs are cohesive while others are less connected, but together comprise what could be defined as the overall workforce development program. Figures 4 and 5 show agencies’ responses to the questions about the cohesiveness of workforce development and planning.

No agency noted workforce development as a completely disconnected set of activities, while a few LTAPs do have disconnected programming for workforce planning. Even given the low number of agencies citing a lack of distinction between planning and development and a less cohesive planning program, respondents reported a wide range of workforce planning activities conducted. Many LTAP respondents noted that they did not know or preferred not to answer, suggesting that the workforce planning questions may pertain differently to state DOTs and LTAPs. Figure 6 shows the types of workforce planning activities conducted by the state DOT respondents (31 respondents), including state DOTs that house LTAPs.

Three state DOTS (and 17 LTAPs, not shown in Figure 6) noted that they do not track workforce planning, while many respondents noted working with labor/management to establish training tracks for employee advancement, identifying critical needs for position recruitment, and forecasting retirement of key positions. The high number of respondents identifying critical needs suggests that they are well equipped to develop other workforce development programs as they know what the future workforce needs may be. Programs that state DOTs provide to their employees vary, as shown in Figure 7.

Twenty-four out of the 31 (77%) state DOT respondents said they offer courses for academic credit, including tuition reimbursement. Many agencies also have apprenticeship/student learning initiatives, mentorship programs, and/or job shadowing/cross-training/job-rotation
Figure 5. Cohesiveness of workforce planning ("does your department/center see workforce planning more as a cohesive body of work or more as a disconnected set of activities?").

Figure 6. Answers to “does your organization conduct any of the following workforce planning activities?” (n = 31).
programs. Several agencies noted additional types of programs offered, such as various types of tuition or paid leave arrangements for further education. The large number of agencies offering multiple types of programming indicates a focus on providing different options and the possibility of creating a more cohesive program through varied programmatic offerings.

Programs may also be offered by institutions outside of the LTAP and state DOT. Although it is not uncommon for LTAPs to be housed at universities, state transportation workforce planning and development programs expand even beyond the state DOT and LTAPs housed in various locations. Figure 8 shows which non-DOT or non-LTAP education providers are used in addition to the state agencies to provide workforce planning and development initiatives.

![Figure 7](image1.jpg)

**Figure 7.** Answers to “do your organization’s employees have any of the following programs available to them?” (n = 31).

![Figure 8](image2.jpg)

**Figure 8.** Answers to “what outside (not DOT/LTAP provided) education providers do your organization’s employees use?” [select all that apply].
The majority of agencies rely heavily on LTAPs for programming in leadership, career advancement, skills training, and mandatory training. Overall, agencies use a similar number of in-house and state-run programs for all types of training, with most of the training initiating from the state DOTs and LTAPs.

Workforce planning initiatives often focus on future needs in the transportation workforce. When asked what skills and knowledge state transportation employees would need in 10 years, respondents answered with various soft (or “power”) skills as well as technical and data-related skills. Many respondents noted the need for both power and hard skills and training.

Power Skills
- Leadership
- Negotiation
- Critical thinking
- Problem solving
- Team work
- Creativity
- Flexibility
- Conflict resolution
- Communication
- Emotional intelligence

Hard Skills
- Technology
- Programming
- Quantitative analysis
- Data science

Of the 51 respondents that listed “skill sets and knowledge [their] agency need[s] more of over the next 10 years,” 19 of them listed power skills such as leadership, communication, problem solving, emotional intelligence, and critical thinking. Leadership appeared more often (11 times) than any other power skill as a future need. This suggests a need to incorporate leadership training into programs for the current and future workforces. Twenty-one of the 51 respondents (41%) listed technology-related skills as a future need. Nine respondents (18%) included both technology and power skills as future needs showing the broad range of types of skills that the transportation workforce needs to plan for and the importance of multi- and interdisciplinary workforce development.

Even communication and collaboration between LTAPs and state DOTs is not a given in many states. Figure 9 shows the self-identified level of communication among agencies in response to the question, “Do your state DOT and LTAP Centers collaborate on training and technical assistance programs?”

Only 15 of the 55 responding agencies said they always collaborate, while 25 said sometimes, and 8 said seldom. Some programs or training areas may not benefit from collaboration due to differences in needs and increased costs and time for coordination with collaborative efforts, but it is improbable that there are absolutely no cases where LTAP and state DOT collaboration could be beneficial. This is evident in the response of “never” from only one agency. Perhaps the most interesting finding from this question is that leaders in workforce development programs may not even be aware of the coordination. Six survey respondents stated that they do not know whether or not the state DOT and LTAP collaborate. Respondents were asked as a follow-up whether or not the agencies share costs in cases of collaboration. Figure 10 shows the 50 responses to the question, “When your state DOT and LTAP Centers collaborate on training and technical assistance programs, do you share financial costs?”
As shown in Figure 9, 23 of the 48 (48%) respondents that said they do collaborate to some extent indicated that they “collaborate and share costs,” and 13 of those have a cost share from the state DOT of over 50%, and 9 are over 50% from the LTAP. Seventeen agencies (35%) “collaborate but do not share costs.”

Regardless of collaborations and funding resourcefulness, state DOTs across the country are facing a need to consider the aging and retiring workforce. Not only is a large percentage of the current workforce approaching retirement age, which is leading to a potential drop in the available workforce in the next 10 years, but the attrition of current employees leaving for other jobs is also a potential drain on the trained transportation workforce.
In order to identify reasons that state DOTs may lose qualified workers, the survey asked respondents to list “What institutional or market factors do you think are most likely to cause employees to leave your agency?” The question specified to “exclude personal factors such as lifestyle, family, marriage, retirement, health, etc.” The most commonly identified non-personal reason for employees to leave was compensation, including both pay and benefits. Figure 11 shows that 13 state DOTs, 11 LTAPs, and one combined LTAP/state DOT identified compensation as a reason for losing employees.

Agencies approach planning for the future workforce in many ways, focusing on training and retaining employees, as well as bringing in the next generation of the workforce. The next section dives into definitions of workforce planning and development provided in survey responses and key elements identified in those definitions.

### 3.3 Practitioners’ Definitions of Workforce Development

There is wide variation in the ways that state DOTs and LTAP officers frame their definitions of workforce development, though the recurring theme across all respondents was a focus on training and skill development.

While definitions of both “workforce development” and “workforce planning” vary, workforce planning may be defined as related more to future job needs such as filling positions or new skills. Figure 12 shows how many respondents differentiate between workforce planning and development by agency type.

The combined state DOT and LTAP Centers, while a small sample size of only six agencies, do indicate that they clearly know whether or not their agency differentiates, and there is an even split of three respondents indicating that they do and three indicating that they do not. When
Figure 11. Number of agencies, by type, listing compensation as a reason for employees to leave the agency (“what institutional or market factors do you think are most likely to cause employees to leave your agency?”).

Figure 12. Agency differentiation between workforce development and workforce planning (“do you differentiate between workforce planning and workforce development?”).
broken up between LTAPs and state DOTs, more state DOTs differentiate planning and development, while fewer LTAPs differentiate.

When asked, “How does your department/center define workforce development?” most chose to focus on the training of existing employees:

*To provide education and training opportunities for its employees to improve their employment-related skills, keep them current in their chosen fields of endeavor, and assist them in achieving their career development goals. Developing the skills necessary for our employees to work efficiently and safely to meet the mission vision and values of our agency.*

Others delineated a difference between workforce development prior to beginning a transportation job and once the employee is already on the job:

*Workforce development is defined as activities focused on job-specific training of new and existing workforce as well as awareness training focused [on] K-12 students who are the potential future workforce. Workforce development is viewed as geared toward promoting education and outreach in [my state], with the goal of developing a broad educational program to expand knowledge and interest in transportation-related careers.*

Most referenced the agency’s focus on technical skills building:

*We provide training in technical topics and areas to the existing workforce that focus on leadership, management, and planning. Our workforce development courses give local agency staff the technical skills they need to perform and excel in their current and future jobs.*

Others focused on the human resources component of workforce development:

*Improving skills of human resources and meeting the needs of industry demand with a skilled workforce. Workforce development is a section within the Office of Human Resources with a focus on training and development of employees.*

Finally, many respondents mentioned some combination of building skillsets to serve both the employee and the employer, generally:

*Workforce development includes a combination of technical and behavioral training programs to enhance individual employees as well as a systematic approach to increasing the overall competency and agility of the department’s workforce. Developing the skills necessary for our employees to work efficiently and safely to meet the mission vision and values of our agency.*

In general, working toward agency goals and building skills were common themes throughout many variations of workforce development definitions. Each agency and each state may have different skill set needs and agency visions and goals, which lead to variation in training and development programs. Examining specific elements of different approaches can help states and agencies find best practices and examples that closest match their own internal vision and model.

### 3.4 Survey Results: Insights from Comments and Responses

Respondents were given the opportunity to provide open-ended responses throughout the survey. Some themes resonated from response/comment boxes, sometimes echoed in multiple questions. Notable themes include interagency partnerships, specifically targeted programs, varying program evaluation methods, succession planning, leveraging of non-federal funds, and contracting out various program elements. Technology enhanced programs through webinars and distance learning online resources appeared as themes throughout many survey questions and case examples at a large majority of the responding agencies (as shown in Table 2).
## Table 2. Identified workforce planning programming themes.

<table>
<thead>
<tr>
<th>Recurring Themes</th>
<th>State Agency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interagency, interstate, or inter-organizational</td>
<td>New England DOT</td>
<td>Aspiring Leaders development program allows state employees to interact with and learn from peers from other agencies.</td>
</tr>
<tr>
<td>partnerships</td>
<td>New England LTAP</td>
<td>Engaging with the public works community through program development and implementation to ensure learner and agency input.</td>
</tr>
<tr>
<td></td>
<td>Plains DOT</td>
<td>Programs are conducted along with partnering state agencies and local universities.</td>
</tr>
<tr>
<td></td>
<td>Southeast DOT</td>
<td>Sometimes shares resources with the National Transportation Training Directors and the AASHTO Transportation Curriculum Coordination Council.</td>
</tr>
<tr>
<td></td>
<td>Rocky Mountain</td>
<td>Indicated that it provides training to tribal entities, who help the LTAP to meet its mission and are partners that “require a high degree of competence and fidelity from the LTAP.” The LTAP has recently put together a Succession Planning Task Force made up of DOT agency leaders to develop tools and resources.</td>
</tr>
<tr>
<td>LTAP</td>
<td>Rocky Mountain DOT</td>
<td>County partners often provide facilities at no cost.</td>
</tr>
<tr>
<td></td>
<td>Mideast LTAP</td>
<td>Shares resources by receiving instructional time from subject matter experts from the U.S. Department of Labor, the DOT, and the state police.</td>
</tr>
<tr>
<td></td>
<td>Southwest LTAP</td>
<td>Shares resources and coordinates trainings through the DOT for local, tribal, and state transportation agency employees.</td>
</tr>
<tr>
<td></td>
<td>Southwest DOT</td>
<td>Uses resources from AASHTO’s Transportation Curriculum Coordination Council, to which it is a paying member.</td>
</tr>
<tr>
<td></td>
<td>Rocky Mountain DOT</td>
<td>Shares resources through a four-state consortium, the Transportation Learning Network. Each member state contributes money to the Network, which delivers technical video conference training and webinars.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specifically targeted programs</td>
<td>Mideast LTAP</td>
<td>Would like to expand to outreach to high schools, vocational-technical schools, and potential construction industry employees, but has yet to find the appropriate means.</td>
</tr>
<tr>
<td></td>
<td>Mideast DOT</td>
<td>Management, diversity, and intercommunication courses have been successful.</td>
</tr>
<tr>
<td></td>
<td>Rocky Mountain DOT</td>
<td>Considers instruction on workplace behaviors, including temperament types and accountability, to be most effective because they help employees understand others’ behavioral habits and offer tools and practice for real situations that employees face, respectively.</td>
</tr>
</tbody>
</table>
### Table 2. (Continued).

<table>
<thead>
<tr>
<th>Recurring Themes</th>
<th>State Agency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New England DOT</td>
<td>Considered its Transportation Worker Program, a prescribed advancement program with labor and management commitment, as its most successful.</td>
</tr>
<tr>
<td></td>
<td>Plains LTAP</td>
<td>Noted the importance of considering right-of-way training and Americans with Disabilities Act requirements for workforce development programs.</td>
</tr>
<tr>
<td></td>
<td>Plains DOT</td>
<td>Leadership and management training, which the agency claims is especially important given the increase in retirements in key positions; the customizable development program for business professionals to focus on both technical and non-technical skills, which includes individualized career coaching and a “social component”; and job shadowing.</td>
</tr>
<tr>
<td></td>
<td>Far West LTAP</td>
<td>Most efforts are targeted at developing maintenance and operations skills. The respondent noted that when the agency moves away from those skill sets, program attendance drops.</td>
</tr>
<tr>
<td></td>
<td>New England DOT</td>
<td>Civil engineer training program provides entry-level engineers with the opportunity to work in all aspects of the DOT and helps them develop relationships and obtain a complete view of the organization.</td>
</tr>
<tr>
<td></td>
<td>Far West LTAP</td>
<td>Contracting courses (such as a contract specification writing course) are most successful.</td>
</tr>
<tr>
<td></td>
<td>Far West DOT</td>
<td>Exploring the use of augmented reality to deliver workforce development programs.</td>
</tr>
<tr>
<td></td>
<td>Plains DOT</td>
<td>To evaluate its workforce development programs, the DOT conducts needs assessments of senior managers.</td>
</tr>
<tr>
<td>Range of evaluation rigor and methods</td>
<td>Rocky Mountain DOT</td>
<td>Programs are evaluated through annual needs assessments with counties and cities, post-training evaluations, regular discussions about training needs, and evaluation of annual city and county insurance claims.</td>
</tr>
<tr>
<td></td>
<td>Great Lakes LTAP</td>
<td>Employs the Kirkpatrick Model, a four-level training evaluation model, for post-course evaluation, and conducts a return-on-investment analysis for select courses.</td>
</tr>
<tr>
<td></td>
<td>Southwest DOT</td>
<td>Evaluates its workforce development initiatives by assessing the number of training hours per employee (average of 43 hours), training expenditures per employee, percentage of General Educational Development program participants per those who are eligible, participation in the Tuition Assistance Program, training event post-program assessments, and annual surveys of employee engagement.</td>
</tr>
</tbody>
</table>

(continued on next page)
Table 2. (Continued).

<table>
<thead>
<tr>
<th>Recurring Themes</th>
<th>State Agency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting aspiring leaders (succession planning)</td>
<td>Rocky Mountain DOT</td>
<td>Performs pre- and post-training assessments of employee performance.</td>
</tr>
<tr>
<td></td>
<td>Rocky Mountain DOT</td>
<td>Assesses leadership and development programs with Kirkpatrick’s model. The agency assesses program success by interviewing both employees and managers, and has found that reports of performance improvement are generally slightly higher among the employees themselves than among managers, though both employees and managers do perceive improvements as a result of the leadership courses.</td>
</tr>
<tr>
<td></td>
<td>Southwest Combined LTAP/DOT</td>
<td>Power skills including “complex problem solving, critical thinking, creativity, people management, and coordinating with others” were listed as agency needs in the next 10 years.</td>
</tr>
<tr>
<td></td>
<td>Far West DOT</td>
<td>Shift toward a more informal mentorship program that is working better than a previous iteration that was too labor-intensive for mentors.</td>
</tr>
<tr>
<td></td>
<td>Rocky Mountain LTAP</td>
<td>Supervisory Skills and Development Program helps participants with communication and leadership skills.</td>
</tr>
<tr>
<td></td>
<td>Southeast DOT</td>
<td>Project Managers Bootcamp, which teaches managers to be more knowledgeable about project processes, and the New Supervisors Training, which provides participants with a better understanding of human resource policies and the merit system and reinforces leadership principles.</td>
</tr>
<tr>
<td></td>
<td>Great Lakes DOT</td>
<td>A combination of planning for the future, hiring before people leave so they can be shadowed by incoming employees, and having more than 1 month of notice before employees leave or change positions.</td>
</tr>
<tr>
<td></td>
<td>Rocky Mountain DOT</td>
<td>Among the most successful programs has been a program on “leading when you are not in charge.”</td>
</tr>
<tr>
<td></td>
<td>Mideast DOT</td>
<td>Talent Development initiatives provide resources for succession planning.</td>
</tr>
<tr>
<td></td>
<td>Rocky Mountain LTAP</td>
<td>American Public Works Association and its state Association of Road Supervisors and Engineers scholarships can be used to help cover the costs of the LTAP’s courses.</td>
</tr>
<tr>
<td></td>
<td>New England LTAP</td>
<td>Participant fees and scholarships from partner agencies fund these programs.</td>
</tr>
<tr>
<td></td>
<td>Great Lakes Combined LTAP/DOT</td>
<td>Sometimes relies on instructors from federal agencies, as they are provided at no cost and their travel expenses are covered.</td>
</tr>
<tr>
<td></td>
<td>Mideast LTAP</td>
<td>Receives some state and university funding assistance from an elite private institution with some land grant state-funded undergraduate colleges.</td>
</tr>
<tr>
<td>Recurring Themes</td>
<td>State Agency</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Great Lakes LTAP</td>
<td>Receives an annual grant from the Governor’s Highway Safety Office to pay for NHI courses.</td>
</tr>
<tr>
<td></td>
<td>Southeast LTAP</td>
<td>All workforce development opportunities available to LTAP employees are offered through the university in which the center is housed and are free to participants.</td>
</tr>
<tr>
<td></td>
<td>Plains LTAP</td>
<td>When outside funding is provided, it is usually in the form of conference support or courses paid for by external partners such as equipment dealers or product specialists.</td>
</tr>
<tr>
<td></td>
<td>Southeast DOT</td>
<td>Community college grants funded by state workforce development initiatives.</td>
</tr>
<tr>
<td></td>
<td>Southeast DOT</td>
<td>The only listed funding source is local, which is also a much higher local budget than any other respondent.</td>
</tr>
<tr>
<td></td>
<td>Great Lakes DOT</td>
<td>Sometimes receives federal funding for participation in peer exchanges and other types of training.</td>
</tr>
<tr>
<td></td>
<td>Southeast LTAP</td>
<td>Outside vendors are used for their technical expertise. They are primarily chosen by word of mouth, though they must present an outline and description of content.</td>
</tr>
<tr>
<td></td>
<td>Far West LTAP</td>
<td>The real cost in conducting programs is the student overhead rather than instructors, thus they choose to bring in outside quality instructors.</td>
</tr>
<tr>
<td>Procurement</td>
<td>Far West DOT</td>
<td>Contracting out for an industrial/organizational psychologist for a Leadership Development Program is significantly less expensive than to have one on staff.</td>
</tr>
<tr>
<td>practices and</td>
<td>Rocky Mountain LTAP</td>
<td>With only two full-time staff, they are unable to host all of their trainings in-house so they must hire contract workers.</td>
</tr>
<tr>
<td>rationales</td>
<td>Plains DOT</td>
<td>Some outside vendors are contracted services, while some are classes already available through other organizations. However, the agency recently acquired an in-house trainer to develop and present training courses.</td>
</tr>
<tr>
<td></td>
<td>Southeast LTAP</td>
<td>Because the LTAP is small, it regularly uses outside instructors. Potential instructors must first be observed administering a class.</td>
</tr>
<tr>
<td></td>
<td>Rocky Mountain DOT</td>
<td>Outside vendors must go through the state procurement process by creating a scope of work and, depending on the amount of the purchase, using a Request for Proposals process.</td>
</tr>
<tr>
<td></td>
<td>Far West LTAP</td>
<td>When external vendors are used to provide training, the method of selecting vendors depends on the contract size; Requests for Proposals are used for larger contracts, while familiarity with providers is sufficient for smaller contracts.</td>
</tr>
</tbody>
</table>
The survey included the question, “Are there models and lessons that DOTs/LTAPs should import from other sectors and disciplines?” Many respondents did not answer, or responded “NA,” which likely means there are lessons to be learned, but the respondents do not know what those lessons are. A few respondents mentioned workforce pipeline considerations outside of the field as well as telecommuting flexibility, project management, and apprenticeships and mentoring.

### 3.5 Summary of Survey Findings

Survey results reveal a consistent lack of employees to implement a full training program. The typical state DOT has only a handful of employees to create and administer training programs. Similarly, the typical LTAP is operating with a small staff, although they are sometimes augmented by grant-supported staff. There is little correlation between the size of the state and the number of people tasked with training and workforce development.

The survey indicates that training and human resource/workforce planning functions are often located in different organizational units of the state DOT. This divide is even more dramatic when the LTAP is not located within the state DOT. In some cases, two sets of training are offered—one by the LTAP and one by a training arm of the state DOT.

State DOTs and LTAPs are focused on roadway engineering, safety, and equipment technical instruction. This portfolio of course offerings is limited when compared with the portfolio of a modern state DOT and its constituent regional/local governments. Planning, environmental/cultural protection, and multimodalism are all key components of the transportation infrastructure program. Although these topics are found in some state DOT/LTAP training catalogs, they are not as universal. Furthermore, many respondents suggest that managerial and leadership trainings are areas of need that are not being adequately addressed.
Case Examples

4.1 Overview

The organizational structure and program offerings of state DOTs and LTAPs vary considerably. To help understand the details of workforce development and planning practice, the research team collected detailed information on five case examples. Case examples were selected to profile a cross-section of organizational types encountered in the survey. The research team sought the following candidate types of agency to profile:

- Two state DOTs where LTAP is a component of the state DOT
- Two university-based LTAPs
- One state DOT in a state where the LTAP is housed at a university

Agencies that submitted a survey response were eligible to be a case example. Survey respondents were also asked if they were willing to be a case example—an affirmative answer helped narrow the field. The research team considered geographic distribution and LTAP organizational structure when narrowing the candidate case example list to five targets. Comprehensiveness of survey answers and an active program (compared with others who participated in the survey) were also considerations for selection. The proposed case examples were submitted to and endorsed by the project panel. The selected agencies are shown below. The first two case examples are state DOTs that directly operate an LTAP. The second two are standalone LTAPs—both at universities. The final case example covers a state DOT (without LTAP) with an active workforce development program.

- Ohio DOT/LTAP
- Alaska DOT/LTAP
- Montana LTAP (Montana State University)
- New York LTAP (Cornell University)
- Michigan DOT

The survey respondent was contacted and invited to participate as a case example. Additional staff members were invited to participate in the process, if desired by the respondent. The research team reviewed documents retrieved on the case example’s web page, work plans/reports, and the survey response, including documents submitted as part of the survey phase of the project.

The next step was to conduct phone interview(s) to fill in gaps in knowledge. A customized, semi-structured interview instrument was drafted for each case example. The interview instrument was shared with the respondent in advance of the initial phone call. Most case examples were completed using a single 45- to 75-minute-long phone call, although follow-up calls were conducted as needed. A draft case example was prepared and transmitted to the respondent for review. The respondent was asked to correct factual inaccuracies and direct the research team to additional resources that would help expand the information available to the authors.
The intent of each case example was to present a snapshot of the organization or functional unit, highlighting its activities related to the workforce in its state. Each case example contains a brief overview of the LTAP or state DOT functional unit(s) that conducts workforce development and/or workforce planning. Additionally, the research team identified and expanded on up to three practices or programs that were notable for their innovation, effectiveness, or transferability to peer organizations.

### 4.2 Ohio Office of Local Programs/LTAP Center

<table>
<thead>
<tr>
<th>LTAP status</th>
<th>Component of DOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-house skills training</td>
<td>Yes</td>
</tr>
<tr>
<td>Training offered to non-DOT employees</td>
<td>Yes</td>
</tr>
<tr>
<td>Workforce forecasting</td>
<td>No</td>
</tr>
</tbody>
</table>

Ohio’s LTAP Center is in the Office of Local Programs within ODOT’s Planning Division. The LTAP Center’s five staff members take the lead on skills training, technical training, and non-training technical assistance primarily for non-ODOT employees. Other parts of ODOT—namely the Office of Employee Development and Lean—lead efforts related to ODOT employee-only required training, human resources, union training, and workforce forecasting. The Office of Employee Development and Lean does not train individuals unless they are DOT employees.

Ohio LTAP manages a portfolio of courses developed by ODOT, the FHWA Resource Center, NHI, NTI, an e-learning suite of classes, technical assistance resources and one-on-one consultations, and professional development webinars. In 2017, Ohio LTAP had contact with 14,895 students (some students more than once). Of those, 7,865 (or 52%) attended live, in-person, instructor-led courses.

Ohio LTAP’s position within ODOT provides several advantages. First, Ohio LTAP participates in the regular ODOT budget process and does not have to compete for grant renewal. Second, Ohio LTAP is in a position to coordinate closely with other parts of ODOT, such as the Office of Employee Development within the Human Resources Division and technical offices, such as Roadway Engineering and Environmental. Third, being located in the Office of Local Programs gives direct access to the planners and engineers at Ohio’s county and municipal public works agencies.

The $1.067 million core program budget for FY 2018 was derived from four sources. Federal funds and ODOT each contribute $150,000. The Governors Highway Safety Office (GHSO) contributed $163,000 (specifically to cover NHI safety course fees). The largest piece of the LTAP Center’s budget—56 percent—is drawn from course fees, about $604,000. Public agencies pay $10 per contact hour for an Ohio LTAP-developed class ($50 for a full class day). Private-sector employees pay $25 per contact hour. NHI courses carry higher fees, but all safety courses have no tuition based on the GHSO funding to cover the NHI safety courses or an internal policy decision to provide other roadway safety-related training at no charge. Technical skill courses tend to be in highest demand, and classes on roundabouts and performance-based intersection design frequently sell out within hours of being posted.

Ohio LTAP has applied for and received grants for special projects. Grants are not generally included in the budget information above because these funding sources are time limited and
secured for special, time-limited projects. Ohio LTAP has successfully secured grants from the Ohio State Transportation Innovation Council and the U.S. DOT/FHWA.

Ohio LTAP has developed an online suite of e-learning courses for the counties, municipalities, and townships and to become qualified for Local Project Administration (LPA). LPAs are required to train their staff using the suite as a condition of maintaining their ability to self-administer federally funded projects. The online course suite was developed by LTAP staff using a U.S. DOT Technology Transfer grant.

A wide variety of students participate in Ohio LTAP training. About 10% of the enrolled students are drawn from ODOT Headquarters or one of ODOT’s 12 district offices. Most LTAP enrolled students are drawn from Ohio’s LPAs. Other public agencies (e.g., utilities, metropolitan planning organizations, and public transit operators) also regularly enroll in courses.

Although Ohio LTAP has a robust lineup of programs, staff have identified several needs:

- An important unmet subject matter training need is on unmanned aerial vehicles (UAVs), to include the utility of UAVs to highway engineers, including how to deploy them and use collected data. Now, no readily available outside program addressing this topic has been found for ODOT to use and no funding has been provided or obtained to create a course from scratch.
- An analysis of demographics and evolving learning styles would lead to an enhanced mix of course delivery methods. For instance, agencies must adapt to increases in teleworking.
- More LTAP staff would help to improve the number of contacts with local governments, add new courses, and enlarge strategic studies.
- According to the ODOT Office of Employee Development and Lean, each ODOT staff member’s job description used to include an annual training plan for their position. This requirement went away in 2008 because of the recession. Restoring this requirement would improve the profile of training, improve skills, and help the Office of Employee Development and Lean forecast the need for class offerings.

There is no funding on the immediate horizon to address these needs. However, Ohio LTAP believes grant applications may be able to pay for special initiatives, and it has been successful in applying for and winning grants in the past.

4.2.1 Notable Practice #1: Use of ODOT Subject Matter Specialist Instructors at Zero Cost

Ohio LTAP draws on its in-house specialists to be the instructors for nearly all courses. When a course need is identified, a current ODOT staff member is recruited to teach the course. LTAP staff work with the newly minted instructor to design the course. LTAP staff bring expertise in course design, adult learning, and learning modality, while the instructor is responsible for the technical rigor of the course. Instructors use ODOT manuals, best practices, AASHTO publications, and national best practices as a part of their course development. LTAP staff work with the instructor through the development process.

After the first course offerings, LTAP continues to support the instructor through course material updates prior to scheduling course sessions in later years. Reviews are timed to take place at least 6 months before the next scheduled course offering, which is sufficient lead time to implement changes. LTAP staff also handle all course publicity, registration, and logistical support.

Courses are reviewed by LTAP staff after each offering using the Kirkpatrick evaluation model (Kirkpatrick Partners 2009). Each course receives a Level 1 review during this regular process,
which assesses what the participants thought of the training they received. More intense levels of scrutiny are applied to four different select courses in a year’s time. Amendments to the course are considered and/or made from the results of these reviews.

Using ODOT staff members has several advantages. The most important advantage is controlling expenses. Ohio LTAP spends only 1.5% of its annual budget on contract instructors. Currently this is for courses on gravel roads and the Americans with Disabilities Act, but outside instructors have been used for other courses in the past when the expertise was not readily available from among ODOT staff. In-house instructors do not receive additional compensation for teaching a class, but their workload is balanced to allow time to prepare and teach. Non-LTAP staff instructors charge their time to a cost code related to training, but this does not affect the bottom line of the LTAP Center. Senior executives at ODOT who place an emphasis on training and make clear that being an instructor is encouraged and prioritized to promote knowledge sharing make this system possible.

4.2.2 Notable Practice #2: Non-Training Technical Assistance

Some LTAPs are focused on classroom and online courses. The Ohio LTAP operates technical assistance programs that are not courses. These programs provide help to practitioners, facilitate peer-to-peer information exchange, and take on tasks that are not in the portfolio elsewhere in ODOT. Examples of non-training technical assistance programs are:

- A circuit rider program that visits the state’s LPAs to assist with topics such as work-zone traffic control, roadway safety, generational differences, and snow/ice removal.
- A series of professional development bicycle rides to help ODOT, LPA, and partner staff see firsthand the physical status of bicycle facilities.
- LTAP staff who led road safety audits by request from LPAs.
- Maintenance of video libraries for use on demand by professionals. Videos in the public domain are posted on YouTube. Videos subject to copyright or use limitations are kept in a lending library facilitated by Ohio LTAP.
- Delivery and Tech Transfer Toolboxes that help LPAs better understand technologies and processes important to their operations. For example, one of the offerings is “How to Perform a Curve Speed Study.”
- Creation of various smartphone applications providing in-the-field training on subjects such as traffic sign installation and roadside safety.
- Maintenance of an online database of pre-screened outside publications to assist with knowledge building on roadway topics.
- An equipment loan program through which LPAs can borrow materials such as radar speed feedback counters and pedestrian counters.
- LTAP coordinates an annual innovation awards program recognizing local government partners who bring innovative ideas into practice.
- Within ODOT, the Office of Employee Development and Lean has a job shadowing/mentoring program to help build capacity. For example, the Highway Technician Academy pairs newer employees with experienced technicians to build competencies. ODOT also offers a new manager training program that has a significant mentoring component.

4.2.3 Notable Practice #3: Regular Local Consultation

Ohio LTAP engages in regular consultation with local governments, or more broadly, its customers. The consultation process leads to an improved course catalog and other technical assistance programs. In addition, consultation activities serve as a marketing tool to increase awareness of courses and assistance opportunities, as customers frequently change due to
elections and retirements. The consultation activities are shown in Ohio LTAP’s work plan, and are in turn reflected in the statewide work plan.

Ohio LTAP performs a customer needs assessment with all existing customers (LPAs, consultants, contractors, ODOT employees, etc.) every 2 years. This takes the form of a survey. The results are used to determine training topics and scheduling priority over the preceding 2 years. The biennial customer needs assessment is supplemented with periodic, in-person focus groups. The intent of focus groups is to take a deeper look at LTAP services and determine what additional service types need to be provided to assist customers in their planning, building, and maintenance of Ohio’s local roadway system.

LTAP staff also have regular outreach meetings at the county and township levels. Staff travel to each of Ohio’s 88 counties at least once every 3 years. Although many people are involved in the outreach meetings, the primary audience is the township trustees, fiscal officers, and their respective county engineer. County engineers also carry the training message to municipal and township trustees within their jurisdiction.

### 4.3 Alaska DOT Office of Research, Development, and Technology Transfer

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State transportation workforce development and planning activities are housed in the Department of Transportation and Public Facilities (DOT&PF), with the Department’s Office of Research, Development (RD) & Technology Transfer (T2) housing the LTAP program. The DOT&PF’s workforce management plan consists of six integrated elements: (1) employee recognition; (2) employee wellness and engagement; (3) knowledge management; (4) modern work environment; (5) succession planning; and (6) workforce development. The goal behind workforce management is to have the right people in the right jobs at the right time with the right knowledge. The workforce development efforts are focused on personal and professional development. There are separate training personnel throughout the agency, focusing on separate modes and/or knowledge areas (e.g., police and fire officers, marine vessel employees, and engineers). The agency plans to consolidate coordination of training into a unified strategic workforce management group. DOT&PF contracts with an industrial organization psychologist to help with learning outcomes, course delivery, content development, and organizational development. Including the LTAP—or Alaska T2—program, the DOT&PF has 20 full-time equivalent employees assigned to workforce management, with only one position assigned full time.

The agency uses a combination of funding sources for workforce management and currently spends roughly $150,000 annually, not including salaries and benefits. While there is generally sufficient funding for targeted workforce development efforts, there is not enough for a comprehensive workforce management program. Full funding of such a program would require new monies for items such as reimbursements for all continuing education credits, payment for any
job-related certifications, additional full-time positions dedicated to workforce management, and a new knowledge management IT system.

The state is experiencing budgetary challenges due to declining revenue from oil and gas extraction that, in turn, affects the DOT&PF and T2 Center’s funding.

The agency also uses internal and contracted instructors for its workforce management program. Either the Department of Administration’s training manager or the external contracted trainers certify internal instructors. The agency is repurposing a vacant position to become an internal training manager, who will be responsible for training internal instructors and coordinating the workforce management program’s training and course development. Highlighted programs include the Leadership Development Program, Alaska Maintenance Leadership Academy, Department Employee Recognition Program, and the online onboarding site.

Through the new strategic workforce management plan, the agency will be dedicating additional staff resources to integrate knowledge management with more traditional workforce planning and development activities in order to foster even greater employee skills, engagement, and job satisfaction. Core competencies across all employees include civility, safety, cyber security, teaming, and communication.

Like state DOTs across the country, the Alaska DOT&PF struggles with employee retention. Because salaries will never be competitive with the private sector, the Department is looking for innovative ways to attract new employees, but recognizes that retention is just as important as recruitment. As part of its strategic plan, DOT&PF is focused on garnering national and international recognition in its workforce development efforts, and is encouraging its best and brightest employees to foster national relationships.

4.3.1 Notable Practice #1: Nationally Recognized Leadership Development Program

The DOT&PF’s Leadership Development Program has been nationally recognized by AASHTO and TRB as a best practice. The first cohort graduated in 2015 and to date, more than 150 employees have graduated from the program. In addition, 20% of the graduates have been promoted since their graduation; some have received more than one promotion. Among those who have completed the program, post-program surveys have indicated that supervisors need several skills in order to succeed, including a better understanding of their roles, responsibilities, and legal liabilities; easy technical guides and knowledge management systems; and training on how to be more effective communicators and how to facilitate meetings.

As part of the Leadership Development Program, cross-discipline, peer-to-peer knowledge exchanges have been implemented. These programs bring personnel together from various disciplines within the agency for trainings on skills that are universal. Trainers have recognized that by breaking down silos within the agency, staff are able to learn from each other and easily transfer skills across disciplines.

4.3.2 Notable Practice #2: Use of Informal Mentoring Program

The DOT&PF used to offer a formal mentorship program, but the program ended after some mentors indicated that it was too labor-intensive and there were consistently more mentees than there were mentors. To help address these issues, the agency now uses a grassroots informal program, “coaching moments,” in place of the original mentor program. Through coaching moments, tenured staff are encouraged to advise junior staff informally when teachable opportunities arise.
The coaching moments model has been used, for example, in the context of meeting debriefs, or “after-action reviews,” in which small teams discuss what went well and what can be improved on in the future for projects and presentations. This has been more widely accepted across the agency and is proving successful in encouraging knowledge transfer, professional development, and continuous learning/improvement.

### 4.4 Montana LTAP

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The Montana LTAP was launched in 1983 at Montana State University as the Rural Technical Assistance Program. It became the LTAP in 1991 and its mission is to serve local agencies, cities, and counties that likely only interact with the Montana Department of Transportation (MDT) to administer projects, but not for training. In this way, the MDT and the LTAP are interactive, as the LTAP provides critical training and the MDT focuses on general workforce development. As the MDT workforce turns over and loses skills and knowledge base, the LTAP works to fill the voids.

In 2017, the Montana LTAP conducted more than 50 MT LTAP Training Sessions, with about 2,751 non-unique participants accounting for 242 training hours and 10,106 participant hours. The program also answers more than 1,000 requests for technical assistance on an annual basis. The LTAP focuses much of its time on individual employees and on developing their skills base through the Road Scholar and Road Master certification programs. The agency is currently co-developing a safety certification program with the state of Colorado, the Education and Workforce Program Manager at the Western Transportation Institute, and the Colorado LTAP. Such collaborations allow it to work within the constraints of a limited budget while still making a relevant impact in the LTAP Region and, possibly, on a national level.

The agency’s budget is composed of $150,000 in federal support from the FHWA, which is matched with $150,000 from MDT derived from the state gas tax. MDT provides an additional $80,000 in state planning and research discretionary funds. State funds are heavily lobbied for and supported by MDT and local agencies, including the Montana Association of Counties, which pushed for the state gas tax increase in 2017. Before then, the state gas tax had not been increased since the mid-1980s.

Some of the agency’s trainings are provided at no cost, but most do charge fees, which average $50 to $100 per person. These fees go into a revolving fund that is used, in part, to maintain the agency’s two work vehicles, which function as the staff’s field offices. Agency personnel are consistently out in the field interacting with customers, whether delivering content and/or simply being in contact.

Working within the existing budget constraints, the agency is focusing on delivering its standard training offerings, but at higher quality and credibility than previously available. This means, for example, that they recertified the field training staff through the American Traffic
Safety Services Association for the work-zone traffic control, flagger, and traffic control Supervisor courses to maintain delivery of relevant, credible, high-quality training.

To determine needs for courses and other workforce development efforts, the agency administers a questionnaire at the annual Montana County and Road Supervisors (MACRS) conference. Beyond this, MACRS has five districts throughout the state, and each district representative calls peers in their district to determine training needs, relaying this information back to LTAP. LTAP staff also interview local transportation agency staff to assess training needs. These efforts are continual and ongoing.

Often, city and county road supervisors are used to deliver training content. LTAP staff have noticed that in many cases, these supervisors benefit from delivering the instruction; most of them know more than they realized, so teaching represents a growing opportunity for staff.

4.4.1 Notable Practice #1: Regional and State Collaborations

The LTAP participates in collaborative partnerships. Its staff attend and provide content for multiagency events such as the North and South Dakota Regional Local Roads Conference, participate in regional and national LTAP coordinating organizations, serve on the Montana Highway Patrol Transportation Incident Management System committee, and collaborate on research projects with the MDT, MSU-Bozeman, and the Western Transportation Institute.

They are also collaborating with the Colorado LTAP, Colorado Department of Transportation, and Front Range Community College (FRCC) to assist in the development of the first-in-the-nation 2-year AAS degree program in Highway Maintenance Management. This program is designed to help employees meet the demands of the future while earning post-secondary credentials. The AAS degree, which was scheduled to begin in January 2019, is geared for highway maintenance supervisors and those wishing to advance in the organization or to be better prepared for supervisory positions.

The AAS degree is relevant to state, county, and municipal public works agencies as well as public-sector companies involved in the maintenance of roads and bridges. FRCC will be evaluating industry-provided training and certifications, including those from the American Public Works Association, LTAP, and the NHI.

4.4.2 Notable Practice #2: Impending Challenges Associated with TTAP Restructure

The recent restructure of the FHWA Tribal Technical Assistance Program into a national center headquartered in Virginia may challenge Montana’s ability to provide necessary transportation training services for the existing tribal constituents that it serves. Previously, tribal technical assistance was offered by regional centers, including several in western states. Tribal representatives in Montana consider themselves customers of the Montana LTAP, and have expressed desire to continue attending Montana LTAP trainings despite the administrative consolidation. There is a general distrust of federally run programs from the eastern United States coming to tribal governments to provide programs and training support. As a local agency, with local representation, Montana LTAP continues to have a working relationship with the tribes in Montana.

Montana LTAP sees the Montana Tribes as a key partner and customer in Montana, and the LTAP is working to accommodate them as much as possible within its existing training model. This has required a larger focus on eastern and northern Montana and on selecting new venues to address the increased training demand.
New York’s LTAP is one of the oldest continually operating transportation training institutions in the country, and predates the Federal Local Technical Assistance Program. Cornell had been involved in extension for highways since the mid-1910s, but has had an official program, the Cornell Local Roads Program, in operation since 1951. The Cornell Local Roads Program became the official FHWA-supported LTAP Center for New York State in 1984. The contemporary administrative unit uses dual names: the Cornell Local Roads Program and the New York LTAP (LTAP is used for the remainder of this case example).

Today LTAP is housed in the Cornell University College of Agricultural and Life Sciences’ Department of Biological and Environmental Engineering. This location has advantages and disadvantages. Cornell University is part private and part public. The LTAP chooses to locate in the College of Agriculture and Life Sciences because that college is public; the College of Engineering is private. Being located on the public side of the university facilitates state financial contributions and offers a more advantageous overhead rate on grants. However, the administrative position of the LTAP can be problematic for branding and awareness by those who are seeking training or technical assistance. It can also hinder the involvement of graduate and undergraduate students enrolled in the College of Engineering. The LTAP has built strong links to other university functional units, such as the Department of Natural Resources, the Department of Public Policy, and the Community and Rural Development Institute, which can, in part, aid the center in workforce development activities aimed toward university students.

The LTAP has six full-time staff who organize and conduct training, technical assistance, leadership programs, and research. Three part-time staff are facilitators for LTAP events. In addition, LTAP hires circuit riders who offer instruction and technical assistance to New York’s 1,599 local highway governments. Technical assistance includes researching and answering inquiries from practitioners—as many as 600 are received per year. Many of the answers are posted to a website, which functions as a frequently asked questions (FAQ) page (Cornell Local Roads Program n.d.).

The New York LTAP Center is funded by FHWA’s standard $150,000 grant, which is overmatched by the New York State Department of Transportation (NYSDOT) for a total funding of $640,000. Significant overhead subsidy accrues due to the LTAP Center being on the public side of Cornell University—overhead rates charged to the LTAP are 18%. Finally, participant fees and continuing education credit fees bring in $40,000 to 50,000 each year, or about 6% of the total LTAP budget. LTAP has been successful in applying for special project grants, including those offered by the Morrill Land Grant/Smith-Lever Act, FHWA ASAP program, and the New York Governor’s Highway Safety Office.

The local revenues are generally used as flexible funds to support extra activities. LTAP believes a nominal course fee results in better student engagement and fewer cancellations. However, courses must be affordable and accessible to all. Engineering courses cost $75 per class day, and all other courses are $55 per class day.

The LTAP course catalog includes more than a dozen course titles. Courses are offered over a 2-year cycle, but can always be requested if the particular workshop is not currently scheduled.

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Historical demand helps predict desire for a workshop and can result in a course being deleted from the catalog. Approximately 75% of courses are taught by LTAP’s circuit riders. New courses take about a year to implement. New courses have an advisory panel to review the curriculum and oversee the development of a student workbook. Other programs run by the LTAP include online tutorials, quick response online Q&A, technical tip sheets, a library of resources for professionals, research projects, and an asset management intern program.

The LTAP has recently adopted a new mission statement, a process that brought together a revived external advisory panel and that includes elements collaboration within and external to the Local Roads Program. Drafting the plan was a 4-month effort stemming from efforts to engage stakeholders. Engagement came from a variety of sources, including an external advisory panel, surveys, higher education partnerships, and professional association partnerships.

To begin the strategic planning process, the LTAP established an external advisory panel. This group was charged with leading the development of the new strategic plan and mission statement. The LTAP previously had an external advisory group, but it had been dormant for more than 20 years. The external advisory panel meets twice yearly to offer ongoing advice. The external group was composed of stakeholders, including local, state, and university leaders.

Developing a mission statement as part of the ongoing operations of the LTAP Center under guidance from outside perspectives helps the LTAP to think about long-term funding, programming, and collaboration with broad perspectives and new ideas.

Vocational instruction historically has not been offered as much as technical training for several reasons, including organizational habits and the need to maintain professional credentials. The LTAP believes that additional leadership programs are needed, and would develop them if resources were available. Frontline staff and first-level supervisors need a “leadership academy” to help these professionals make the transition from an employee to a manager/leader.

### 4.5.1 Notable Practice #1: Partnerships with Professional Associations

The LTAP has formal and informal agreements in place with allied higher education institutions and professional trade groups, which help to foster collaboration and disseminate training opportunities. Higher education partners include the State University of New York (SUNY) at Buffalo, SUNY–Binghamton, Clarkson University, and Mohawk Community College. Beyond the higher education partners, the LTAP has written agreements with six statewide associations:

- Association of Towns of the State of New York
- New York Conference of Mayors
- New York State County Highway Superintendents Association
- New York State Association of Town Superintendents of Highways
- American Public Works Association Upstate Chapter
- American Public Works Association New York Metro Chapter

### 4.5.2 Notable Practice #2: Regular Stakeholder Surveys

The LTAP undertakes many surveys of their stakeholders. One survey is an annual effort. Other types are evaluations of workshops and of conferences hosted by the LTAP. These surveys feed into strategic and short-range planning efforts.

Each year the LTAP conducts a survey of its customers. This survey is in addition to course evaluations and distance learning metrics collected as part of classes. The annual survey asks several straightforward questions about the LTAP’s course offerings and effectiveness of its programs. The annual survey also asks speculative questions to gauge the market for new courses
and programs. For example, the 2017 survey asked whether courses and modules on the geographic information system (GIS) would be of use. Based on information collected, the LTAP now knows that a majority of its customers have in-house GIS capability and have an interest in GIS course offerings.

Every 4 or 5 years, the annual survey is longer to allow for more detail and to gain a broader knowledge of the LTAP program activities. The annual survey is a required activity under the LTAP’s grant with NYSDOT.

**Notable Practice #3: Self-Funded Proprietary Program**

The LTAP’s oldest ongoing program—dating to 1938—is the Highway School. This 3-day program is intended for town road superintendents, but it is open to the public. A registration fee is charged, and the program is self-supporting, without any federal, state, or university funding. The Highway School features technical sessions that help keep engineers’ skills up to date. This includes sessions on topics including legal issues, storm water management, state of good repair, raw materials, and equipment life cycle.

The Highway School offers sessions on both technical and leadership topics. Examples of leadership sessions include emergency management, managing conflict, and a Q&A panel on legal issues. Leadership sessions consume approximately half of the agenda, and are often breakout sessions that attendees can choose to attend.

### 4.6 Michigan DOT Performance Excellence Section

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The Michigan Department of Transportation (MDOT) designs its workforce development programs around its mission of providing all employees with a baseline of knowledge and training custom to their specific role. The agency measures this goal by assessing employee possession of certain competencies. Core competencies applied agencywide and were developed before current staff in charge of the program joined MDOT. Currently, new employees receive foundational training and supervisors receive supervisory training as part of the workforce development efforts.

MDOT is divided into seven regions, with a DOT office in each region and three to five transportation service centers in each region (a total of 22), DOT maintenance garages in the state, and two central office locations. This decentralization poses challenges in agencywide strategic planning. To create a unified vision and oversight for the workforce strategic planning and implementations, MDOT created a steering committee with members from multiple regions, with multimodal backgrounds, and the Director of Human Resources. The steering committee provides direction to the Performance Excellence Section.

In general, MDOT employees receive power, or “soft” skills, from DOT workforce programming, and technical skills from LTAP programming. Succession planning efforts are led by the MDOT Human Resources Department. The entire process of onboarding (by department) is being revamped, as are other stages of their employee development life cycle.
Funding for courses and training come from varied sources. At the DOT, software and other trainings come directly out of each department’s budget, while some programs are supported directly by federal or state gas tax funds, or employees use LTAP trainings. Due to the large variety of programs and funding sources, even the Office of Performance Excellence at the state DOT is unable to identify and quantify the funding streamed into MDOT for workforce development purposes.

Given the age of the currently identified core competencies for MDOT employees, the Performance Excellence Section at the agency is refining the competencies and programming. A 2017 employee survey yielded an impressive 38.5% response rate, results from which will help workforce training staff to reassess training and programming. Preliminarily identified themes include employee desire for more on-demand and online training, possibilities to opt out of trainings when the related competency can be demonstrated prior to the training, and a desire for project management training and leadership programs.

One of the struggles that all decentralized DOTs are likely to encounter is that certain trainings/courses/workshops/programs are offered only in-person in certain locations. In Michigan, Civil Service offers programming for all state employees that interest many employees, but while some trainings are offered online, some are only available in-person in Lansing. Expanding remote training options for these courses could help them reach many more MDOT employees and decrease the challenges that employees face in acquiring training to enhance their position and value in the workplace.

MDOT offered project management training in the past—comprehensive enough to be a part of an entire certificate program, and at some point phased it out due to budget constraints. It is restarting the program this year and hopes that it will grow. In general, setting competencies or performance measures related to common skills needed at the agency can help ensure that critical programming is developed and maintained over time.

The 2017 employee survey was the first recent collection of feedback on workforce programming at MDOT. There is no formal evaluation process, although observing the employee survey responses and discussion among staff and the steering committee help assess the current state of the workforce and future needs. Communications among departments and regions can also help foster discussion about existing and potential programming. Monthly meetings that bring regional offices together help MDOT overcome geographical barriers of a large, decentralized DOT.

### 4.6.1 Notable Practice #1: Overmatch of LTAP Funding

The Michigan LTAP provides a different suite of services and training to transportation staff of Michigan municipalities and private-sector engineers. The LTAP is not a component of the DOT, and is located at Michigan Technological University in the Upper Peninsula. Like every LTAP, the state DOT functions as the grant administrator and provider of matching funds. The LTAP receives the $150,000 allocated to each state’s LTAP from the federal government and exceeds the required 50–50 match, providing $250,000 to $400,000 of Surface Transportation Program funds. Michigan Tech also provides approximately $215,000 in matching funds. Thus, the LTAP has 76% of its funding from non-federal sources.

MDOT, the Michigan LTAP, and Michigan’s local agencies work together to develop the work plan for the LTAP. While the agencies do not share costs, they do share resources and communication outlets. For example, MDOT employees are made aware of LTAP offerings and the LTAP disseminates information on MDOT webinars to its entire network of local transportation employees.
4.6.2 Notable Practice #2: Intern to Hire Program

To address workforce pipeline challenges and plan for future needs, MDOT implements internship and co-op programs, including ones that encourage veterans as well as students at historically black college and universities (HBCUs) to learn as an intern at MDOT. Funding for MDOT employee workforce development and planning originates from scattered sources. The variety of internships for veterans, young people, and people from specific underrepresented demographic groups all come from unique funding sources dedicated to the targeted recipients. Most of this money is federal and has very specific requirements for both the interns and the type of program.

While these programs are not in direct collaboration with the HBCUs or other organizations, they have helped to diversify the incoming workforce. MDOT looks to match its internship pool with available entry-level openings, giving preference to people who have completed internships. MDOT also partners with local universities such as Ferris State and Michigan State for surveying, GIS, and facilitation training. These programs (and others) may be better used if there was a comprehensive list and centralized location where MDOT employees could explore available training opportunities.
This synthesis shows clear activity, interest, and need for continued transportation workforce strategies. The state DOTs, LTAPs, universities, and private partners providing leadership and training are keenly aware of the broader U.S. workforce in general and have developed a robust and diverse set of professional training and practice.

The literature review, survey, and case examples revealed the following key findings:

- **There is no standard definition or understanding about workforce development.** There is wide variation in the ways that state DOTs and LTAPs frame their characterizations of workforce development, though the recurring theme across all respondents was a focus on training and skills. As a result, there is no clear consensus about how to handle many workforce challenges and most do not differentiate between working development and workforce planning. The state DOTs appear to rely on LTAPs for training and education for technological skills, with state DOTs focusing on so-called “soft skills” such as crisis management and managing conflict. There appears to be a need to incorporate leadership training into programs for the current and future workforce.

- **The institutional structures are different from state to state.** Relatedly, states’ approaches to workforce planning and development at DOTs and LTAPs also vary. In less than one-third of the states, the DOTs and LTAPs are closely coordinated and always work collaboratively and share resources and communication outlets. Others are not as cohesive and operate independently from one another without sharing costs. Several of the survey responses note development opportunities through universities and private contractors.

- **There is a range of options for funding.** The FHWA provides $150,000 each year to LTAPs that must be matched by state and local resources, though this “flat” amount does not vary based on state size or complexity. While several states provide funding beyond the required match, the budgetary challenges in certain states mean the funding is precarious and in danger of cuts. There may also be opportunities for partnerships with the myriad other transportation workforce organizations, associations, and/or community colleges.

- **Practices are clearly changing to address new challenges facing the industry.** The transportation sector is facing many of the same opportunities and challenges as the larger U.S. workforce in general, though some are also unique to transportation. For example, the most commonly identified non-personal reason for employees to leave transportation agencies is compensation: including both salary and benefits. This complicates efforts to replenish a retiring workforce, and the need to recruit, retrain, and retain existing workers as industry needs shift and technologies evolve. These macro themes are slowly finding their way into state DOT and LTAP programming.

- **The primary focus remains on traditional highway/roadway planning and programming.** The state DOT and LTAP coursework, programs, and monitoring are beginning to evolve to reflect a more multimodal nature of transportation, but the emphasis remains on highway
engineering, safety, and equipment operations. This is understandable given the original mission and state DOTs and LTAPs, but with the changing nature of the workforce, replenishment may depend on casting a wider net. The skills required in transportation departments today and in the future go beyond the traditional construction, maintenance, and operations missions of agencies.

Overall, this synthesis finds that transportation workforce strategies are highly decentralized with no national standards for operations, planning, or programming. This is not necessarily a criticism because there is tremendous variation in the transportation workforce needs from state to state. However, it means there is little documentation of best practices, making it difficult to know what innovation can be transferred from state to state.

Therefore, future research should focus on developing a national perspective for transportation workforce development and the need for a national recognition for evidence-based methodology and further research into peer-to-peer learning. This approach would address standardization and benchmarking in order for states to learn from each other. Key areas that could be addressed include:

- **Advancing a clear definition for transportation workforce development.** A common definition and characterization would help clarify both the traditional needs inherent in workforce development as well as future trends. Greater attention is needed to determine the distinctions among workforce development, workforce planning, and succession planning.
- **Understanding how to improve workplace and job quality.** The most commonly identified non-personal reason for employees to leave was compensation, including both salary and benefits. With ongoing funding and budgetary challenges in many states, their competitive proposition to attract and retain workers may lie in a better balance between work and personal life or flexible work arrangements.
- **Developing options for new multimodal coursework.** There is certainly a need for traditional roadway engineering, safety, and equipment/tool technical instruction. However, states should also consider expanding their portfolios of course offerings and focus on multimodalism, planning, as well as managerial and leadership “soft skills.”

One thing is clear: The work and need for state DOT and LTAP workforce strategies will remain of paramount importance and must continue to evolve to meet the needs of a changing workforce and industry.
References

2019–2023 Agency Strategic Plan. Texas Transportation Commission, Texas Department of Transportation, Austin, TX, 2018.


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Wittwer, E., T. Adams, and E. Toledo-Duran. 21st Century Workforce Development Summit, Report CFIRE 01-10/ WisDOT 0092-09-14, Wisconsin Department of Transportation and National Center for Freight and Infrastructure Research and Education, Madison, WI, 2009.

Survey Instrument and Raw Data

A.1 Survey Instrument

This survey is a critical part of a Transportation Research Board (TRB) National Cooperative Highway Research Program (NCHRP) study on workforce planning and development practice at state Departments of Transportation (DOTs) and the Local Technical Assistance Program (LTAP) Centers. It is being conducted by researchers at the Eno Center for Transportation, an independent, nonprofit research and workforce development organization.

The goal of the survey is to provide a comprehensive understanding of a range of major implication and impact considerations and to document the state DOTs and LTAPs workforce development experiences. A literature review and case studies will accompany the final report which will synthesize the background information, survey data, and case study analysis to demonstrate current workforce planning and development practices at the state level.

This survey is designed to be completed by Training Department officials at the DOTs and the LTAP Center Directors in each state. These individuals generally correspond to the members of the National Transportation Training Directors (NTTD) and the National Local Technical Assistance Program Association (NLTAPA). If this does not accurately describe your position, please share the email you received with the link to this survey with the proper person at your agency. This survey will take about 15 minutes to complete. No personally identifying information will be shared with anyone outside of the research team, and all reported data will be anonymous.

Please click “next” to begin to the survey. Thank you for helping us better understand workforce development at state DOTs.
General Information

State DOT/LTAP Center Name: __________________________________________________
City: ______________________________ State: [Drop down]

PART I – Macro Considerations

In order to understand the broader environment under which you provide workforce
development programs, we wish to understand some general terms and concepts:

1) How does your department/center define workforce development?
   [Open response/No definition/Prefer not to respond]

2) Do you differentiate between workforce planning and workforce development?
   [Yes/No/I don’t know]

   2a) If yes, how so? [Open response/Prefer not to respond]

3) Does your department/center see workforce development more as a cohesive body of work
   or more as a disconnected set of activities?
   [Completely cohesive body/Mostly cohesive body/neither cohesive body nor disconnected
   set of activities/Mostly disconnected/Completely disconnected/I don’t know /Prefer not to respond]

PART II – Implementation and Impact

These questions are intended to help us understand how programs are executed and any
challenges, problems, and successes.

1) Please indicate if your department/center coordinates the following workforce development
   tasks: [Select all that apply]

   If any of the boxes are checked, ask “Who offers the program?” then select all that apply
   [State DOT/State Government not DOT/LTAP Center/Higher Education (Other than LTAP
   Center)/Private Sector/Other (describe)]

   • Mandatory training [onboarding, workflow, timekeeping, workplace policies,
     compliance, etc.]
   • Required skills training [specific knowledge required to discharge the duties of a position
     for a new hire, i.e., skills development after employment]
• Technical updates training [training on new technologies relevant to a current position that traditionally increase worker productivity]
• Career advancement training [skills not required to discharge a current position, but useful to fill other positions]
• Leadership/management training [intended to prepare people for supervisory positions]
• Leadership/management training [intended to continue developing skills.]

2) What other educational providers does your training audience utilize on a regular basis other than your offered training? [Select all that apply]

• Non-LTAP University programs
• Community college or technical school
• Organized labor
• Trade associations
• National Highway Institute
• Public sector workforce development programs
• Other __________

3) Does your training audience have any of the following available to participate in other than what is offered by your program? [Select all that apply]:

• Courses for academic credit, including tuition reimbursement
• Apprenticeship or other student learning programs
• Mentorship programs [pairing of junior employees with more senior employees]
• Job shadowing or rotation programs
• Other
• No, the department/center does not sponsor or provide paid time to participate in any of the above

If any checkbox in question above is checked besides “no,” ask:

3a) In your opinion, are these programs targeting and benefitting the appropriate individuals in your workforce? [Always/Sometimes/Seldom/Never/Prefer not to respond]

4) Please indicate if your DOT/LTAP conducts any of the following workforce planning activities [Select all that apply]

• Has a standard curriculum for specific job classifications
• Works with labor/management to provide a training track for employee development which ties to position advancement
• Surveys employees to determine the impact of learning on promotional opportunities
- Maintains dashboards to report employment trends
- Surveys employees for job satisfaction
- Attempts to forecast retirement of key positions
- Identifies critical needs for position recruitment
- Conducts and summarizes exit interviews
- Issues regular reports to senior executives
- We do not track or forecast employment trends
- Other __________________
- Prefer not to answer

5) How do you evaluate workforce development programs?
[Open response/None/Prefer not to respond]

6) Over the last five (5) years, what workforce development programs have been the most successful? Why?

7) Over the last five (5) years, what workforce development programs did not work, and why not?
[Open response/None/Prefer not to respond]

PART III – Funding and Partnerships

This part of the study intends to better understand the costs of various programs and to what extent partnerships are entered into.

1) Please indicate how your department's/center's workforce development offerings are funded. If available, please indicate the amount of funds received:
[Select all that apply and indicate the annual funding for each]

- Appropriation from state legislature $______
- Inter-office transfer of funds for student participation $______
- Federal aid $______
- Local government contribution not supported by federal-aid $______
- Attendance fee payments $______
- Other [explain] $______
- Other examples where resources are shared, even if there is no financial commitment from one partner to the other _________

2) Does your state DOT and LTAP centers collaborate on training and technical assistance programs?
[Always/Sometimes/Seldom/Never/Prefer not to respond]
3) If/when your state DOT and LTAP centers collaborate on training and technical assistance programs, do you share financial costs?
   [Collaborate and share costs/Collaborate but do not share costs/Do not collaborate/Don't know/Prefer not to respond]
   if “collaborate and share costs”, ask

3a) Approximately what percentage of the training and technical assistance program shared cost comes from the DOT? [Open answer number only/Don't know/Prefer not to respond]

3b) Approximately what percentage of the training and technical assistance program shared cost comes from the LTAP? [Open answer number only/Don't know/Prefer not to respond]

3c) Describe any sources of funding that are not the DOT or LTAP [open response]

4) Approximately what percentage of your total budget for workforce development programs goes to vendors for work that is contracted out?
   [Open answer number only/Don't know/Prefer not to respond]

5) In your opinion, what are reasons that an outside vendor is brought in?
   [Open response/Don't know/Prefer not to respond]

6) If utilized, how are vendors selected? What standards must be met in order for a vendor to be selected.
   [Open response/Don't know/Prefer not to respond]

**PART IV – Social and Demographic**

_It is important for the study to understand how workforce development programs are targeting different groups of people, both for ongoing training and for future recruitment._

1) Which skill sets and knowledge will your DOT need more of over the next ten years?
   [Open response/Don't know/Prefer not to respond]

2) What institutional or market factors do you think are most likely to cause professionals to leave state DOTs? Please _exclude_ personal factors such as lifestyle change, family, marriage, retirement, health, etc. from your answer.
   [Open response/Don't know/Prefer not to respond]

3) What institutional or market factors do you think might increase the probability of professionals staying with state DOTs? Please _exclude_ personal factors such as lifestyle, family, marriage, retirement, health, etc. from your answer.
   [Open response/Don't know/Prefer not to respond]
PART V – Other

Outside the current context of workforce development programs, this study wishes to understand what broad lessons can be learned.

1) If your department/center had unlimited resources, what are the first workforce development programs you would offer?

2) Are there models and lessons that DOTs/LTAPs should import from other sectors and disciplines?  
   [Open response/Don't know/Prefer not to respond]

3) Is there anything else that you think would be of interest for this study of transportation workforce planning and development at state DOTs/LTAPs?  
   [Open response/Don't know/Prefer not to respond]

4) If you are aware of studies, course catalogs, or other documents that would be of interest for this study of transportation workforce development at state DOTs/LTAPs, please submit them. [Upload option]

Part VI – Follow-up Information

Name of person completing the survey: _______________________________________

Phone number of person completing the survey: ________________________________

Email of person completing the survey: _______________________________________  

Are you willing to be considered for a case-study?  
   [Yes/No/I don't know]
A.2 Raw Data

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