DEVELOPMENT OF A TRANSPORTATION WORKFORCE DEVELOPMENT PROGRAM FOR OKLAHOMA

FINAL REPORT
ODOT TASK ORDER NUMBER 2160-20-09

Submitted to:
Office of Research and Implementation
Oklahoma Department of Transportation

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OKLAHOMA
Transportation

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 Celsius or (F-32)/1.8		°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000	T
TEMPERATURE (exact degrees)				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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EXECUTIVE SUMMARY

With accelerated retirement from Departments of Transportation (DOTs) and rapidly changing technologies, tools, and practices, workforce development and outreach are getting increased attention from many DOTs, including Oklahoma DOT (ODOT). Workforce development is an integral part of all University Transportation Centers (UTCs). The primary goal of this Task Order was to develop a framework for ODOT that can be used for undertaking workforce development and outreach activities to address the needs of existing employees and to increase the awareness of transportation as a potential career among students and others. To achieve this goal, the following tasks were pursued in this Task Order: (1) a short course on risk management; (2) a workshop on AASHTOWare Pavement ME; (3) a national survey of state DOTs on their workforce development and outreach programs; (4) a survey of ODOT employees to identify their needs; (5) a review of workforce development programs being pursued by the UTCs nationally; and (6) development of a high-level workforce development and outreach framework. An overview of each of these tasks is given in this report. Essential elements of the potential framework include the following: (i) Metrics will need to be developed to gauge employee satisfaction. As Missouri DOT points out, a correlation between outreach programs and retention will need to be established; (ii) Total lifecycle of an employee will need to be considered, from outreach in middle school all the way to employee exit interviews. Agencies can develop recruiting programs for students in high schools, community colleges, and universities. Job fairs, internships, social media engagement, and one-day events and outreach programs have been the most successful; (iii) Non-student potential employees can be reached using social media, job fairs, websites and recruiting programs; (iv) Partnerships with community organizations and civil rights groups will help create a more qualified and diverse pipeline for employment; (v) Current employees will need to feel that they are being listened to, their contributions are valued, and their professional growth is nurtured throughout their entire time at the DOT. This will necessitate more leadership training for management, professional development opportunities for all, and regular demonstrations to show that employee input is valued and implemented. Recognition of work performance and contributions can be considered. Increased mentoring, continuing education opportunities, and cross-training can be implemented; (vi) Many private sector positions include flexible work schedules and telecommuting. The public sector will need to institute these policies to remain competitive. Similarly, reducing barriers in requirements will keep the agency more competitive with the private sector; (vii) For new hires, comprehensive onboarding and orientation training, in

addition to department-specific training, is recommended. Emphasizing workplace culture issues and information technology will also be important.

It was realized that the framework would be a living document that is revised and updated regularly, reflecting the changes in agency needs, policies, and resources, among others. Attention should be given to hybrid platforms encompassing both in-person and virtual platforms.

1. INTRODUCTION

With accelerated retirement from Departments of Transportation (DOTs) and rapidly changing technologies, tools, and practices, workforce development and outreach are getting increased attention of many DOTs, including Oklahoma DOT (ODOT). Workforce development is an integral part of all University Transportation Centers (UTCs). Since its inception as a Regional UTC, the Southern Plains Transportation Center (SPTC) has pursued impactful workforce development and outreach activities including Transportation Regional Internship Program (TRIP), short courses, seminars, workshops, Transportation Leadership Council, Transportation Leadership Forum, and research assistantships. More than 300 undergraduate and graduate students have benefited from the TRIP so far. Also, thousands of professionals from the academic community, transportation organizations, and industry working in the transportation sector have benefitted from the seminars, webinars, workshops, and short courses and have received professional development hours (PDHs).

Goal: The primary goal of this Task Order was to develop a framework for ODOT that can be used for undertaking workforce development and outreach activities to address the needs of the existing employees and to increase the awareness of transportation as a potential career among students and others. The following tasks were pursued in this Task Order to achieve this goal: (1) a short course on risk management; (2) a workshop on AASHTOWare Pavement ME; (3) a national survey of state DOTs on their workforce development and outreach programs; (4) a survey of ODOT employees to identify their needs; (5) a review of workforce development programs being pursued by the UTCs nationally; and (6) development of the workforce development and outreach framework. An overview of each of these tasks is given in this report. It was realized that the framework would be a living document that is revised and updated regularly, reflecting the changes in agency needs, policies, and resources, among others. Attention was given to hybrid platforms encompassing both in-person and virtual platforms. In developing the framework, in addition to addressing the agency needs, consideration was given to SPTC's need for developing a competitive proposal for possible funding from the U.S. DOT (OST-R) under the next UTC competition and for seeking other funding.

2. OVERVIEW OF TASKS AND ACCOMPLISHMENTS

2.1 Short Course on Risk Management and Analysis for Infrastructure Projects

This short course was a one-day event. It was held on July 28th at the Champion Convention Center in Oklahoma City. It was organized jointly by Southern Plains Transportation Center (SPTC) and Oklahoma Department of Transportation (ODOT). The course was instructed by Dr. Douglas D. Gransberg, president of Gransberg and Associates and emeritus professor of construction engineering at the University of Oklahoma. Dr. Gransberg has 20 years of industry and 24 years of academic experience to work on risk management. He has been involved in projects worth more than $12 billion and helped 20+ public agencies to implement risk management in their projects. The participants of this short course spanned from government institutions to private agencies and academicians. A list of participants is attached is attached in Appendix C. The following objectives were considered in developing the content of this short course: (i) learn how to identify, quantify, and contractually allocate risks; (ii) understand the meaning of risk and uncertainties and their potential impacts to a project; and (iii) model and quantify project options in a high-risk environment. To accomplish these learning objectives, the short course was divided into eight modules. Module 1 involved introduction to risk management which covered design and construction risk context, risk management theory, and decision theory. Modules 2 through 4 covered design, scope, cost, schedule, construction, how to use risk rankings like pairwise comparisons and importance index, and how to develop bid tab data for risk analysis input for use in risk identification, evaluation, and quantification. Also, Module 4 focused on qualitative risk analysis using risk registers, exposure milestones, response plans, and monitoring and control plans. Module 5 focused on quantitative risk analysis using a hybrid 3-point input process, risk response decisions, and risk-based line-

item contingencies. Module 6 was focused on stochastic risk analysis which covered the FHWA major project cost estimate risk analysis, rational contingency development, Monte Carlo simulations, and how to interpret simulation output. Module 7 covered qualitative risk evaluation and developing a qualitative risk register for a typical ODOT project including both design and construction risks. The final module presented a summary of risk management and risk mitigation planning. An overview of each module is given below.

Module 1: Dr. Gransberg started Module 1 by emphasizing the concept of "Risk-Awareness" for a project rather than being "Risk-Free." It was noted that a project itself can be very complex and have many uncertainties that drive risks. The level of uncertainty in a project may vary from other projects. Also, these uncertainties, many times, are beyond the control of the project manager. Dr. Gransberg mentioned that the golden rule of risk management is to Identify the risk and manage using five basic response options, namely accept, transfer, share, mitigate and avoid risk. Dr. Gransberg mentioned that shedding the risk may cost the owner twice, as higher project cost due to contractor's contingency and cost to settle claim for risk when it is realized. The differences in the perception of risk by the owner and the contractor were discussed as well. The owner's perception of risk is generally driven by project scope, budget and schedule, whereas contractor's perception is driven by bid price, actual costs and final quality of the project. These differences in perspectives drive different parts of the project. For example, the perception of the owner can have a big impact in the project scope, whereas the perception of the contractor has a big impact on the bid price. Dr. Gransberg presented results from the NCHRP Report 884 to illustrate the difference in the owner's and contractor's perceptions. In that study, 27 risk factors were identified and both parties were asked to rate the frequency and impact of each factor. The results indicted differences in risk perception by the owner and industry. It was emphasized that successful risk management requires that the owner be brutally honest with himself/herself. Dr. Gransberg stressed that to successfully manage risk it is important to know what you do not know, be terminally pragmatic and refuse to engage in the thinking that "everything is going according to the plan." The causes of complexity/uncertainty in a project such as inexperience, technical/nontechnical challenges, funding sources, environmental concerns, political issues and public relations challenges were discussed. It was mentioned that risk assessment and management offers a systematic approach to understand uncertainties surrounding projects. The objectives of risk management are to substantiate contingencies required to implement projects on budget and have sufficient

funds to cover risk-related situations. The differences in the criteria between risk-based and non-risk-based decisions were explained. The risk-based decision does not look for the cheapest option as a main criterion. It seeks to minimize risk by maximizing cost and schedule certainty and optimizing quality. A number of causes for the cost and schedule overruns were discussed during this module as well. In order to realize the uncertainty of cost for a project, it is important to realize that the cost estimate of the project is not a single number, but a range. Dr. Gransberg made the participants aware that the fundamental of risk-based decision is to replace contingency with explicit risk and opportunity events. The assessment of risk for a project requires quantifying risk and uncertainty in base to determine uncertainties in total. It was suggested that the risk analysis process be reviewed in six steps, namely validation of base conditions, risk identification and quantification, assessment (modelling), discussion/review, risk mitigation planning, and implementation/monitoring. The first four steps are related to risk assessment and the last two are the process of risk management. Both risk assessment and management are dynamic processes and depend on ongoing monitoring, feedback, and reassessment. Toward the end of Module 1, Dr. Gransberg discussed the validation of base conditions which included verifying the reasonableness and accuracy of the base project scope, schedule and budget. Each of these criteria was explained in detail. Also, the importance of defining project scope (e.g., environmental, design, construction etc.) and establishing key milestones and project cost breakdowns were explained with examples.

Module 2: The risk identification and quantification process were discussed in this module. The objectives of this module were to learn the process to identify significant project risks and estimate the impact of individual risk. The process included preparing a list of potential risks, estimating impact in terms of cost and delay, screening risks and documenting in risk register. Dr. Gransberg presented a list of sources of risk related to technical, quality and performance, such as inadequate scoping, use of unproven technology, and unrealistic performance goals. Also, risks related to external factors, organizational and project management were discussed. In Module 2, Dr. Gransberg introduced the participants with the risk analysis tools, namely risk register and design decision register. The process to fill out different sections of the risk registers, such as risk assessment, risk response and residual risk assessment were discussed with examples. The need for risk exposure milestones and risk retirement plans was discussed as well.

Module 3: The focus of this module was to familiarize the participants with differences in risk evaluation perspectives from different entities. Dr. Gransberg mentioned that the owner, designer and contractors generally see the contract as the foundation for resolving risks. Also, they may consider the traditional division of responsibilities as a way to resolve risk, however, these assumptions may not be applicable for a given project. Also, their attempt to resolve risk may be driven by ethical perspectives which often ignores the project realities. Dr. Gransberg mentioned that, among all these perspectives, only contractual perspective would be used by the courts, if the risk is not resolved outside of the courts. Therefore, an optimal combination of different perspectives related to possible risk responses was recommended for the owner while conducting risk evaluation. Also, Dr. Gransberg mentioned that the risk evaluation approach taken by insurance companies is completely different than others as they are not concerned about the project success, long-term professional liabilities, or target profits. Sureties/insurers use highly focused contractual perspective on risk and only evaluate risk that applies to their ability to avoid loss if risk is realized. In addition, Dr. Gransberg discussed the key risk allocation clauses used by the surety/insurer. Furthermore, the perspectives used by the contractors during developing a project risk profile were discussed in Module 3. Generally, a project risk profile is articulated in the solicitation for bids. The importance of adopting the contractor's perspective when evaluating a risk profile was explained. Also, it provides the owner an opportunity to review the efficacy of longstanding business practices. Different risk profile elements such as contractual, technical, quality management, schedule, cost, organizational and third-party impacts were discussed in Module 3. Also, an example risk profile was presented for the convenience of participants.

Module 4: Dr. Gransberg presented risk quantification procedures in Module 4. He emphasized that the level and depth of risk analysis should be proportional to the scale and complexity of a project. It was mentioned that the risk quantification is a multi-step process which involves estimating likelihood of risk, defining range of values (cost and time), establishing correlations among risk events, estimating expected value of risk and documenting in risk register. Two different quantification approaches were explained, namely deterministic (uses single values and calculate an expected value for each risk) and stochastic (usually data-driven, risk is expressed as an overall probability distribution). Also, three methods of risk quantification, namely qualitative, hybrid and data-driven quantitative were introduced in this module. The qualitative process included classifying each risk based on its type, assessing

likelihood of occurrence for each risk and assigning score (1-5), assessing the impact to the project if risk occur and assigning score (1-5), evaluating and ranking the importance of each risk, evaluating trigger event for each risk, assessing the outcomes, developing the risk response strategy and plan, and documenting the decision process. Dr. Gransberg cautioned the participants about the qualitative risk assessment as it relies on professional judgement and consensus decisions.

Module 5: The hybrid risk analysis method was presented in Module 5. Dr. Gransberg described this method as the easiest way to move into objective evaluation of risk and contingency. Generally, historical data (bid prices) are used to develop the cost model. However, this method recognizes that the bid prices may vary. It was mentioned that the use of the bid tab pricing for estimating construction costs has five issues, namely location, inflation, scale, uncertainty, and level of competition. An example procedure of cost estimating using a Pareto distribution from bid tab pricing was presented. Dr. Gransberg recommended using weighted average unit costs to specific risks before using a hybrid risk analysis. The risk impact would then be determined by using the price to compute the cost of additional work for the realized risk. The hybrid quantitative risk analysis process involved transferring qualitative information to the qualitative risk analysis model, replacing the likelihood rating with an estimate of the probability of occurrence, computing total minimum, most likely and maximum values for each risk, computing probable impact and expected value of the risk impact, associating qualitative risk ranking with expected values of the risk and determining appropriate risk response and actions. Then the residual risk impact needed to be computed using the estimated cost for each action. The decision on whether or not to implement the risk response would then be taken and the response cost would be added to the project cost subsequently. Dr. Gransberg mentioned that the hybrid approach adds additional amounts of rigor to the analysis process. It was indicated that care should be taken during this analysis as the data used for the hybrid model may or may not be relevant to the future costs.

Module 6: In Module 6, Dr. Gransberg discussed the assessment of risk through statistical modelling. The specific tasks involved in this process were identifying appropriate model for assessment, evaluating impacts by non-simulation and simulation methods, verifying results and validating adequacy of project contingency. Dr. Gransberg discussed the definition, types and properties of models. Also, different classifications of models were discussed during this session. He mentioned that the stochastic cost models are symbolic models which may be

represented using mathematical formulation. The process of baseline modelling from bid tab pricing was explained. It was recommended to use historic data to assign a probability curve to each stochastic pay item. Also, Dr. Gransberg presented a workflow to develop a spreadsheet-based simulation model. In addition, an example of risk modeling was presented for a tunnel project where three major risk factors were considered, namely excessive groundwater flow, total rock hardness and tunnel boring machine breakdowns. Probabilistic analyses with Monte Carlo simulation were used to determine the total risk costs for the associated risks with 90% confidence level.

Module 7: This module was designed to provide the participants hands-on training on qualitative risk analysis. For this purpose, the participants were divided into small groups. Information related to the I-35 flyover project near Riverwind Casino was provided to these groups. The groups were asked to review the plan sheet and identify four risks associated with schedule, cost, technical and public relations. Then for each risk, the likelihood and impact were determined by these groups, and placed into the risk register provided with the notes. The groups then determined the events that represented risk exposure period. The appropriate response strategy for each risk was then determined accordingly. The practice example provided an opportunity to the participants to share their views on risk assessment and management.

Module 8: In Module 8, which was the final module, Dr. Gransberg summarized the basics of risk assessment and management processes discussed during the short course. He emphasized the importance of maintaining open lines of communication and consensus building. Also, he discussed the importance of developing cost-effective mitigation strategies to reduce impacts on project budget and schedule. Finally, he thanked the participants and shared his contact for further inquiries.

2.1.1 Survey Outcome

A short survey was conducted among the participants to obtain their feedback on the short course. The survey consisted of a total of 11 questions. At the time of preparing this overview, 28 participants responded to the survey. The survey outcomes for the multiple-choice based questions are presented below in a graphical format. Among the 28 participants, 26 were satisfied and 1 was somewhat satisfied with the content of this short course, in an overall sense. One participant did not answer this question. Also, 26 out of 28 participants mentioned that they were satisfied with the delivery of this short course, whereas the other two participants were

somewhat satisfied. Out of 28 participants, 27 were satisfied with the facilities and 22 were satisfied with the food. Five of the participants mentioned that they were somewhat satisfied, whereas one participant was not satisfied with the food. Most of the participants mentioned that they found out about the course from ODOT and SPTC e-mails. Also, 24 participants mentioned that they are interested, whereas, other 4 answered 'maybe' in attending future short courses. Most of the participants thought that no changes are needed for the future events. However, one participant suggested to include some hands-on examples for future short courses. Also, one participant recommended to invite senior management and consultants to the training courses. In addition, the participants suggested the following topics for future short courses:

- Roadway & Bridges
- Anything related to project management and transportation
- Deep dive on various topics related to project management
- Any construction management topic available
- Schedule Management, Scrum, innovative project delivery, industry best practices nationwide
- Project Management, Project Delivery
- Construction Management, Quality/Quantity Control, Arbitration/Mediation/Litigation
- CADD types
- Pavement management, measurement while drilling, data analytics
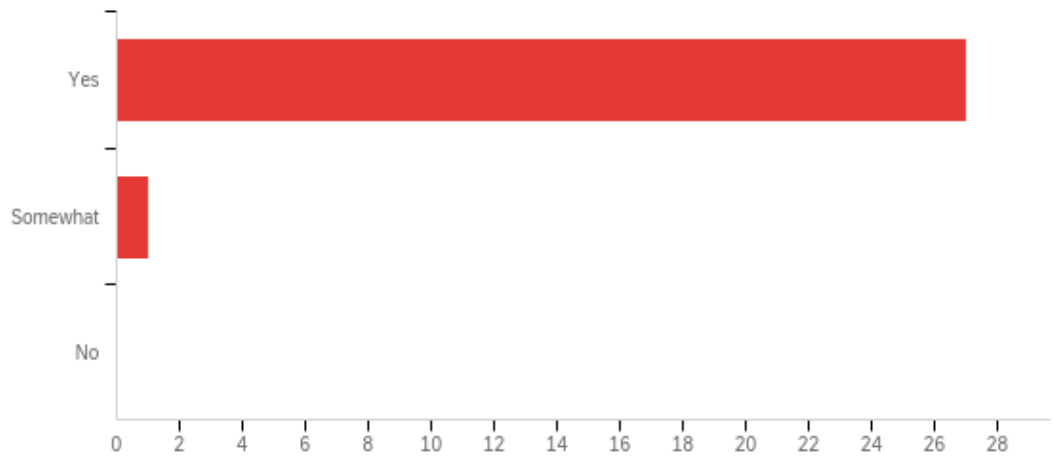
Q2 - CONTENT: Were you satisfied with the content of this short course, in an overall sense?
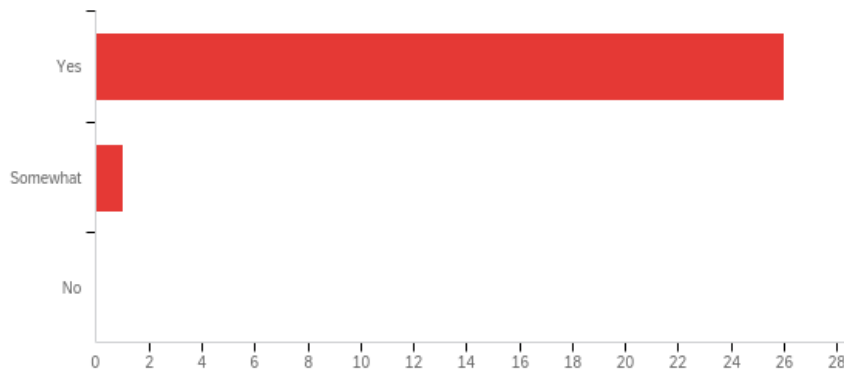
Q4 - DELIVERY: Were you satisfied with the delivery of this short course?
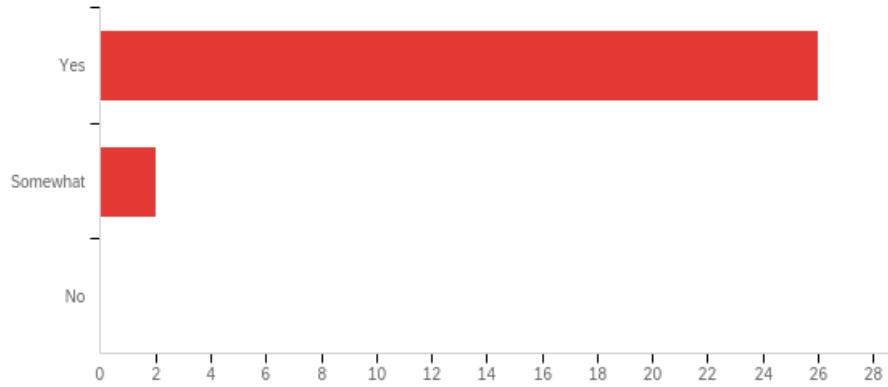
Q5 - FACILITY: Were you satisfied with the facilities at this venue?

Q6 - FOOD: Were you satisfied with the food provided?
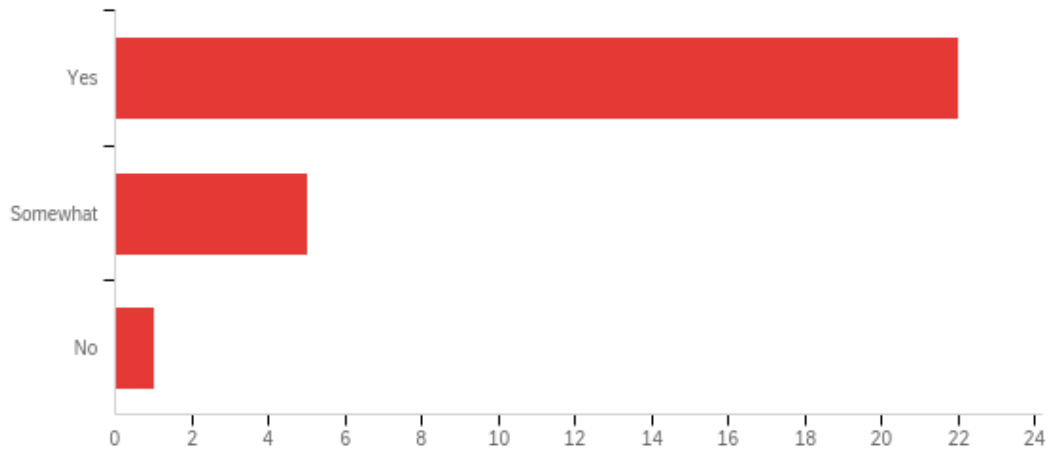
Q7 - How did you find out about this short course?
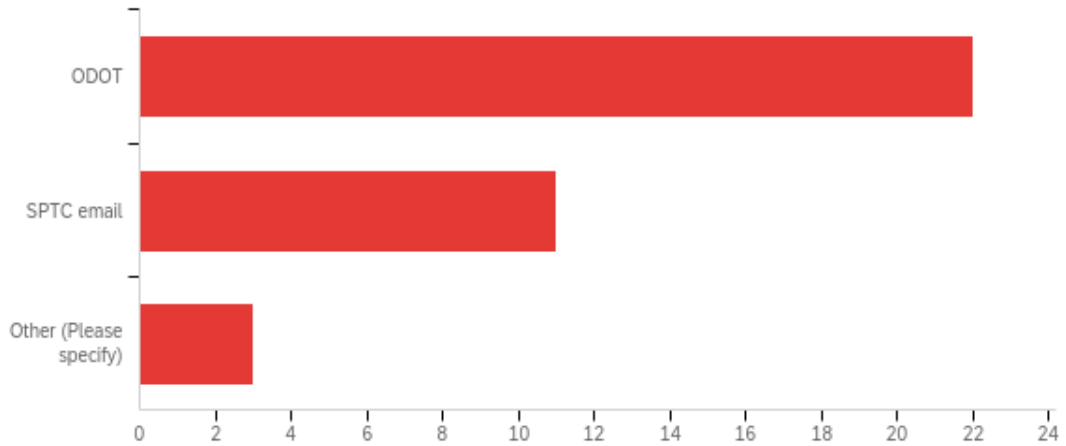
Q8 - Would you like to attend future short courses in areas of your interest?
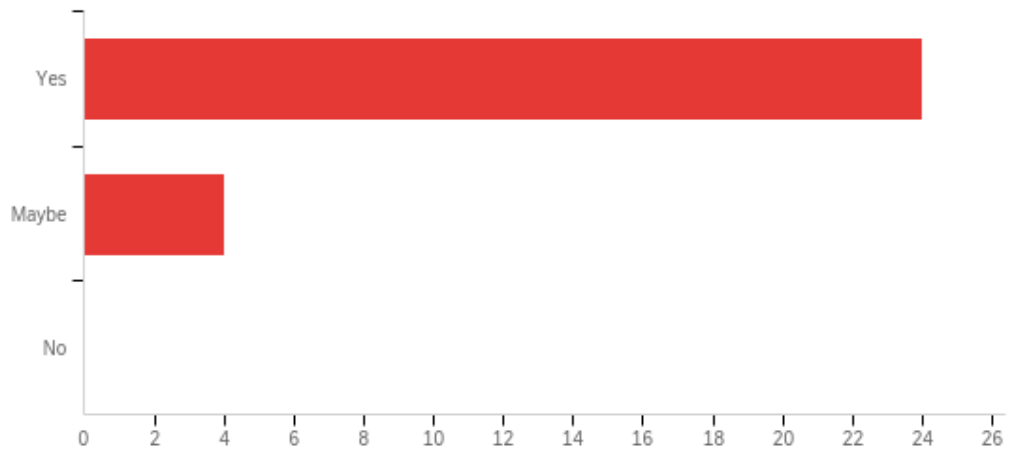
2.2 AASHTOWare Pavement ME Workshop

The AASHTOWare Pavement ME Design Workshop was a three-day event, held on August 4th through 6th at the ODOT's Materials Division Conference Room. It was organized jointly by the Southern Plains Transportation Center (SPTC) and ODOT. The workshop was co-taught by Geocal staff, a Colorado-based Geotech firm and SPTC. The participants spanned several divisions (Roadway Design, Materials, Bridge, and Office of Research and Implementation) at ODOT and Federal Highway Administration (Oklahoma Division).

The goals for this workshop were to:

- Understand AASHTOWare Pavement ME Design procedures;

- Understand how this methodology differs from previous pavement design methodologies;
- Recognize the importance of accurate design inputs;
- Bring awareness of the versatility of the ME design in both new construction and rehabilitation pavement design projects; and
- Give participants hands-on experience in using the software.

Day 1:

Introduction: The AASHTOWare Pavement ME Design Workshop began in the morning of August 4th with an introduction of the participants (see the participants list below). It was followed by a short presentation on the resources (human, equipment, laboratory), capabilities, and track record of Geocal. Dr. Nur Hossain, President of Geocal and a former graduate of the University of Oklahoma, who is an expert in pavement design using the AASHTOWare Pavement ME Design software made this presentation. Matt Coen, a staff engineer at Geocal assisted Dr. Hossain, particularly with the design examples. Dr. Syed Ashik Ali, a Research Associate and Post-Doctoral Fellow at the University of Oklahoma also assisted Dr. Hossain with the presentation of design examples involving Oklahoma pavements. Additionally, Mr. Sagar Ghos, a doctoral student at OU, assisted the participants with their hands-on exercises. It was evident that Geocal has been involved in many pavement design projects. Most of their projects were Colorado DOT projects. The design examples covered by Dr. Ali came from the forensic investigation projects in Oklahoma.

Design Philosophies: In introducing the design software, Dr. Hossain discussed the major differences in design philosophies used in this software and in the previous design methods – the AASHTO 1986 and 1993 designs. It was noted that the term "Mechanistic" refers to mathematical models used to calculate pavement responses (stresses, strains and deflections) under traffic loads and climatic conditions. Accumulation of damage or distress over the design life of the pavement is an important consideration in the ME design. The empirical part of pavement design refers to the use of statistical or empirical correlations between the

calculated damage and the observed damage as well as among and between pavement distresses, properties (geometric and material), and performance. Examples of empirical correlations were given throughout the workshop.

It was noted that the AASHTO 1986 and subsequently AASHTO 1993 pavement designs were based on the AASHO Road Test in Ottawa, Illinois in the 1960s. The objective of this project was to determine any significant relationships between the number of repetition of specified axle loads of different magnitudes and arrangements with the performance (accumulated damage) of flexible and rigid pavements having different thicknesses. The data from this famous project were used to develop design nomographs and charts for asphalt and concrete pavements. Given the design equivalent single axle loads (ESAL), reliability, drainage, and layer moduli/coefficients, pavement thicknesses can be determined from these nomographs. Representation of actual traffic as a design ESAL is a major limitation of this design. Also, lack of consideration of climatic conditions (except drainage, seasonal variations in modulus, frost depth, etc.) is a weakness of the AASHTO 1986 and 1993 designs.

AASHTOWare Pavement ME Design Inputs: Conversely, the AASHTOWare Pavement ME design or M-E design takes an entirely different approach in which the designer selects pavement thicknesses and materials and evaluate their performance under expected traffic and climatic conditions. Specifically, the Pavement ME Design uses three categories of input: Traffic, Climate, and Materials. Each category is divided into three different levels, Level 1 using the most accurate and site-specific data, Level 2 using inputs of intermediate accuracy, and Level 3 using the default (national average) values. These levels provide the designer flexibility in data selection, depending upon their availability. It was noted that the consideration of traffic in the form of axle load spectra for different classes of vehicles and adjustment factors provides a much more realistic way of representing actual traffic than the design ESAL considered in the earlier design methods. Generating the traffic input data, however, presents a challenge for the DOTs as collection of such data need time and resource. Dr. Hossain cited the traffic data collected from the instrumented pavement section on I-35 near Purcell, Oklahoma as an example. Likewise, the AASHTOWare Pavement ME Design considers climatic data such as temperature, precipitation, wind speed, percent sunshine, and relative humidity in evaluating pavement distresses. In the absence of actual climatic data for a particular location, the designer can select weather stations from the national climate database and form a virtual

weather station to use in evaluating pavement distresses such as thermal cracking, longitudinal cracking, alligator cracking, rutting, and roughness.

Comparison Between Two Designs: Following the review of both design approaches, Dr. Hossain presented a design example from Colorado. In this widening project (approximately 3 miles from East 56th Avenue – Pena Boulevard to Peoria Street), Geocal used both AASHTO 1993 and AASHTOWare Pavement ME designs for comparison purposes. It was reported that for comparable performance, the new method provides a thinner pavement (0.5-in. to 3.5-in.), which can lead to significant savings in construction costs.

Distress Models and Calibration: For a selected pavement structure (layer thicknesses and materials), reliability, and traffic and climatic conditions, the AASHTOWare Pavement ME Design predicts distresses as a function of service life. These predictions are generally based on the mechanistic-empirical models. These models have evolved over the years and will continue to evolve in future with the new understanding of mechanisms responsible for these distresses. Because of the evolving nature of the distress models, the input parameters in different versions of the software can be different. Also, the model coefficients may have to be calibrated based on the local/regional data for improved prediction. Both model calibrations and input parameters (Level 1 or Level 2) require resources. Dr. Hossain's doctoral dissertation involved calibration of the rut model based on the Level 1 traffic and material data obtained from the instrumented pavement section on I-35 near Purcell, Oklahoma. This topic was discussed in more details subsequently.

Outputs: The outputs of the AASHTOWare Pavement ME Design software consists of tables and graphs of accumulated distresses over the selected design life of the pavement. The accumulated distresses (e.g., IRI, rutting, thermal cracking, bottom-up cracking, top-down cracking) with time are compared with the agency requirements. Changes in thicknesses, materials and other parameters make the process repetitive until a suitable design is obtained. The software allows the designer to optimize the design for a selected reliability.

Hands-on Design Examples: The afternoon session was focused on providing hands-on experience to the attendees. Dr. Hossain reiterated that in addition to adjusting layer thicknesses, the designer can adjust materials, add geogrid or other load distribution elements, and adjust maintenance/rehabilitation schedules to ensure acceptable performance. It was emphasized that the M-E design follows an iterative process. The first design example involved the realignment of Weld County Road (WCR) 44 over US-85 that required new pavements

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for the realigned section of US-85 as well as the new on/off ramps. The existing pavement was an asphalt pavement. The key input parameters included the following: Reliability: 90%; Nearest Weather Station: Greeley, Colorado; Ground Water Table (GWT): 5 feet; and Average Annual Dailey Truck Traffic (AADTT): 2,200 trucks per day. The following trial pavement section was used: 7½ inches of top asphalt; 6 inches of asphalt base layer; 24 inches of A-2-4; and A-4 subgrade. Some errors in the input files were found while running the program. So, it was decided to continue this design example the next day.

Day 2:

The second day of the workshop began by working on the design example form the previous day. Dr. Hossain and his team were able to fix the input errors overnight. This time, the software ran as expected, producing tabular and graphical outputs. In addition to reviewing the results obtained by the participants, some what if scenarios were analyzed to examine the influence of input parameters on the levels and occurrences of distresses. To gain experience in designing concrete pavements, the previous design example was repeated for concrete pavement. The following pavement section was used for this purpose: 8½ inches of concrete; 6 inches of asphalt base (Type A-1-a); 24 inches of compacted A-2-4 soil; and A-4 subgrade. In a third example, the participants worked on an overlay design project in Oklahoma. The pavement section considered here was part of a forensic investigation study in which a 2,500-ft pavement section on US 412 (west of I-35) was investigated for extensive fatigue cracking and rutting. The original pavement constructed in 1969 consisted of an asphalt layer (varying between 10 and 12-in.) supported by a treated aggregate base (varying between 8 and 9.5-in.) and an A-7-6 subgrade layer. A 2.5-in. asphalt overlay (S4 mix with PG 70-28 OK binder) was constructed in 2009. The design ESAL for this pavement was 6.7 million. Ground penetrating radar images as well as pavement cores have shown significant delamination at three different depths. The following key parameters were used in the design: Reliability: 90%; Nearest Weather Station: US, OK (36.5, -97.5); GWT: 10-ft.; and AADTT: 1,280 trucks per day. The following scenarios were considered: 12-in. of existing asphalt; 9.5-in. milling; 9.5-in. asphalt overlay; 8.5-in. treated aggregate (A-3); and A-7-6 subgrade; design life: 10 yrs. In addition, Dr. Hossain went over an asphalt overlay design project from Colorado on US-34. The project involved rehabilitation of the existing US-34 pavement, extending from Fort Morgan to Brush, Colorado. The existing pavement was a rural principal arterial consisting of two to four asphalt-paved lanes. Dr. Hossain discussed the challenges encountered due to the presence of a

concrete pavement beneath the existing asphalt pavement along part of the roadway, as it was difficult to model in the M-E design. Also, Colorado DOT input requirements for existing layers for overlay design were discussed during this session. The following key parameters were used in the design: Project divided into five sections; Reliability: 90%, Nearest Weather Station: Akron, CO; GWT: 10 feet., AADTT: 304 to 1,118 trucks per day (depending on road section); Design Life: 10 yrs.; Depth of Milling: 2 inches to 3 inches; Overlay Thickness: 2 inches to 4 inches. The afternoon session included two design exercises in which the participants generated/organized their own input files, conducted the analysis and compared their results. The first exercise (asphalt pavement) considered the following: Roadway: 88th Avenue (West of Rosemary Street); Location: Commerce City, Colorado; Classification (CDOT): Minor Arterial; Number of Lanes: 4 (2 in each direction); Base/Pavement Construction: April 2022; Traffic Opening: May 2022. The second example (concrete pavement) included the following: Roadway: S. Santa Fe Dr.; Location: Englewood, Colorado; Classification (CDOT): Principal Arterial; Number of Lanes: 6 (3 in each direction); Base/ Pavement Construction: September 2022; Traffic Opening: October 2022.

Day 3:

The final day of this short course was spent on covering the calibration and back calculation functions of the M-E design software. As part of his doctoral dissertation, Dr. Hossain used Level 1 material and traffic data and a virtual weather station for the prediction of rut. The predicted rut values were compared with the measured values over a period of five

years. Also, layer-wise rut was measured at the end by digging trenches at three different locations. These data were used to calibrate the rut models. Both layer-wise and total rut models were calibrated, and the sensitivity of rut coefficients was studied. It was noted that the need for local/regional calibration of distress models varies depending upon the difference between the observed and predicted distresses, available resources, and agency priorities. On the topic of back calculation, Dr. Hossain mentioned inconsistencies in

back-calculated values over a pavement section. The designer, however, can benefit from the use of meaningful back-calculated values in pavement designs.

The last part of the workshop involved open discussions and identification of areas where agency investments may be needed to assist designers and increased agency-wise use of the M-E design. Development of a pavement design manual for ODOT was seen as a clear priority. The other topics are listed below:

List of Topics:

1. Arrange Pavement ME Design workshop for field engineers;
2. Develop region-wise Level 1 material (e.g., asphalt and aggregate) database (XML files) for M-E design;
3. Develop Level 1 traffic database for M-E design with the help of ODOT Traffic Division;
4. Compile existing distress model calibration information and use in pavement design;
5. Centralize pavement design information and identify process for regular update;
6. Explore the differences in the FWD back-calculation methods used by different software.

Matt Romero, Materials Division Engineer, provided a tour of the facilities including laboratory, equipment, and personnel. Overall, this three-day workshop was a great educational experience for the participants and the instructors.

List of Participants:

Matt Romero	Division Engineer	Material division, ODOT
Amanda Warren	Pavement Design Engineer Manager	Roadway Design Division, ODOT
Gregory Garland	Geotechnical Branch Manager	Material division, ODOT
Christopher Clarke	Geotechnical Engineer	Material division, ODOT
Thomas Leis	Geotechnical Engineer	Material division, ODOT
John Richards	Geotechnical Engineer	Material division, ODOT
Kevin Suitor	Asphalt Branch Manager, ODOT	Material division, ODOT
Janet Reed	Pavement Design Engineer Manager	Roadway Design Division, ODOT
Shon Jessee	Geotechnical Engineer	Bridge Division, ODOT
Waseem Fazal	Pavement & Materials Engineer	Federal Highway Administration, Oklahoma Division
Teresa Stephens	Research Engineer	Office of Research and Implementation, ODOT

Musharraf Zaman	Professor	University of Oklahoma
Nur Hossain	Principal Engineer	Geocal
Matt Coen	Staff Engineer	Geocal
Syed Ashik Ali	Postdoctoral Research Associate	University of Oklahoma
Sagar Ghos	Graduate Research Assistant	University of Oklahoma
Rose Ladd	University of Oklahoma	SPTC/OTL

2.3 National Survey on Workforce Development and Outreach Programs

This task was outsourced to CTC & Associates LLC. In consultation with the Task Order team, CTC & Associates LLC designed and conducted a survey of state departments of transportation (DOTs) to gather information about the current transportation agency practices, programs and future plans for employee recruitment and retention. An overview of the survey results is given below. Additional details from the CTC & Associates LLC report are included in Appendix A.

2.3.1 Survey of Employee Outreach Strategies

An online survey was distributed to members of the American Association of State Highway and Transportation Officials (AASHTO) Committee on Human Resources. Topics addressed in the survey included current transportation agency practices and programs for internal and external employee outreach in addition to agencies' future plans. Eleven state DOTs responded to the survey: Alaska, California, Iowa, Michigan, Minnesota, Missouri, Montana, New Jersey, North Dakota, Texas and Wyoming. All responding agencies engage in outreach practices, methods and programs to elicit interest among students and others in future employment.

Highlights of survey responses are given below in the following categories:

- Employee recruitment
- Employee retention
- Program and practice assessment

2.3.1.1 Employee Recruitment

Student Education Level: All agencies responding to the survey provide recruiting programs and practices for students in community colleges, colleges and universities; all agencies except Iowa DOT also offer programs for high school students. In addition, five agencies-Michigan, Minnesota, New Jersey, North Dakota and Texas DOTs- provide programs

that focus on students in middle schools, and three agencies- Michigan, Minnesota and North Dakota DOTs- design programs for students in elementary schools.

Outreach Strategies for Recruiting Students: Outreach strategies most frequently reported by agencies to recruit students were job fairs, internships and social media, followed by one-day events (such as Career Day) and outreach programs. Agencies are less likely to sponsor workshops and speakers bureaus, host webinars or advertise in newspapers, magazines, professional journals and publications when recruiting.

Outreach Strategies for Recruiting Other Potential New Employees: Social media and job fairs are used by all agencies responding to recruit other potential new employees, followed by websites and recruiting programs. These agencies are less likely to reach this group through newspapers and journals, other print publications and webinars.

New Employee Incentives: Ten of the 11 agencies use salary, benefits, and work schedule and leave flexibility as incentives to recruit new employees. Training (nine agencies) and education opportunities (seven agencies) are other common incentives.

Recruiting Strategies for Members of Disadvantaged Groups: Eight agencies - Alaska, California, Iowa, Minnesota, Missouri, Montana, New Jersey and North Dakota DOTs - have developed strategies or policies to recruit members of disadvantaged groups. Attending off-site events such as career fairs and networking events, developing relationships with professional organizations, and working with vocational schools and vocational rehabilitation programs are among common strategies.

Required Training Programs for New Hires: All agencies responding to the survey provide or require training programs for new hires. Practices include onboarding or new employee orientation training (eight states), department-specific training (five states), human resources and information technology training (two states each), workforce development (two agencies) and required training for supervisors (one agency).

State-Specific Programs and Practices: A series of case studies highlight the most effective practices or programs that agencies use to recruit new employees (see Page 48). Information provided in these summaries includes a brief description of the program or practice, the audience and, in some cases, costs related to the effort. When available, information about program partners, additional financial support or in-kind services, and the overall impact on hiring efforts is also provided.

2.3.1.2 Employee Retention

Current Employee Incentives: Common incentives to retain current employees include training and recognition of work (10 agencies each) followed by promotions and work schedule/leave flexibility (nine agencies each). Other incentives include education opportunities, salary and benefits (eight agencies each).

Training/Staff Development Programs and Practices: Mentoring, coaching and leadership programs are used by all agencies responding to the survey to train and develop staff. Other professional development opportunities and cross-training are also commonly offered (nine agencies each) along with continuing education (eight agencies). Agencies are less likely to offer job rotation (four agencies) and communities of practice (two agencies).

State-Specific Programs and Practices: Leadership training (eight agencies), professional development (four agencies) and supervisory skills training (three agencies) are the most effective practices or programs that agencies use to enhance job satisfaction and contribute to employee retention.

Impact of Strategies and Incentives on Employee Retention: Nine agencies described the impact of these strategies and incentives on employee retention and/or metrics used to assess the impact. The Michigan DOT respondent noted that results indicate that employees who feel valued and are allowed to grow personally and professionally are satisfied and tend to stay. In Minnesota, incentives give employees an opportunity to learn about other areas of the agency and the work that is performed. In North Dakota, resignations and retirements decreased after the agency developed the Leadership Development Journey and began using the Gallup platform to recruit and retain employees.

Among the metrics used are findings from employee satisfaction and other surveys (five agencies), talent review sessions (one agency), work area workshops (one agency) and exit interviews (one agency). The Missouri DOT respondent reported that although the agency does not collect or track data, "a correlation between [outreach] programs and retention is likely." New Jersey and Wyoming DOTs are currently developing metrics; California DOT has not established metrics.

Exit Interviews: All agencies responding to the survey except California DOT conduct an exit interview when an employee leaves the agency. Information typically gathered during

these interviews addresses workplace culture, managerial practices, salary and benefits, and recommendations for improvement.

Several agencies reported on the administration of exit interviews. For example, Minnesota and North Dakota DOTs currently send a survey to employees when they leave, although the Minnesota DOT respondent noted that employees don't often return completed surveys. The North Dakota DOT respondent added that the agency is transitioning to the online Gallup platform to conduct exit interviews. New Jersey DOT is also planning to expand its exit surveys to collect more usable data that would improve employee retention.

2.3.1.3 Program and Practice Assessment

Successful Recruitment and Retention Practices: Career development and training programs (four agencies) and advertising on social media and other online outlets (three agencies) are the most successful practices that agencies have implemented for recruiting and retaining employees. Additional highlights from respondents follow:

- In the two years prior to the COVID-19 pandemic, New Jersey DOT closed its vacancy gap from 12% to 7% and saw an increase in representation of historically underrepresented groups and minorities. In addition, the number of people leaving the agency for reasons other than retirement slightly decreased.

- In the past year, North Dakota DOT has begun using the KXNET job board and Gallup platform to recruit and retain employees. The respondent noted that during the peak of the pandemic, the agency had the lowest number of vacant positions at one time than it had in over a decade.

Recruitment and Retention Challenges: Workforce shortages and competition from the private sector (eight agencies) and candidates with inadequate credentials (four agencies) are common barriers to employee recruitment and retention efforts. Other challenges were diversity issues (two agencies) and agency location (two agencies).

2.3.2 State Department of Transportation Practices

External and internal resources presented in Appendix A were developed by a select group of state DOTs. A 2016 conference presentation showcases seven case studies from multiple states that illustrate partnerships among universities, public agencies, industries and K-12 schools to expand the knowledge of science, technology, engineering and math (STEM) in

students. A 2016 Georgia DOT report highlights STEM programs with DOT involvement, including the Summer Transportation Institute, AASHTO TRAC and RIDES program, internship and shadow programs, one-day STEM awareness workshops and speakers bureaus.

Other workforce preparation programs highlighted include the Youth Development and Mentoring Program (Michigan DOT); Phoenix Internship Program (Minnesota); existing and potential workforce development programs within North Carolina DOT; and the West Virginia Bridge Design and Build Contest (West Virginia Division of Highways). Career development and mentoring opportunities offered by Missouri and Utah DOTs are also presented in Appendix A.

2.3.3 Highlights of Recruitment, Retention and Outreach

Highlights from employee recruitment include engagement with students at the middle school level, with multiple agencies designing programs for that age group. Other efforts included job fairs, internships, career fairs, and social media engagement. Less popular efforts were workshops and speakers, webinars, and advertising in print media. Eight of the eleven states surveyed had developed policies to address recruitment from disadvantaged groups, including engagement with professional organizations, vocational schools, and rehabilitation programs.

Employee retention revolved around training and recognition of work, flexible leave, staff development programs, and mentorship. The most effective programs for enhancing job satisfaction were leadership training, professional development opportunities and supervisory skills training.

For program practice assessment, CTC and Associates LLC pointed out that career development and training programs as well as advertising on social media and other online outlets were the most successful practices for recruitment and retaining employees. Major threats to recruitment and retention involved the private sector, candidates with inadequate credentials, agency location, and lack of diversity.

Overall conclusions from state DOTs included the following:

- Leverage social media to increase outreach.
- Form strong partnerships with schools and community organizations as well as civil rights/affirmative action groups and the agency's communications office to develop a pipeline to employment.

- Increase agency visibility to applicants.
- Reduce barriers in position requirements to be more consistent with private sector competitors.
- Offer flexible work schedules or telecommuting.
- Advocate for salary increases based on data showing the limited talent pool and average wage data.
- Make a concerted effort to listen to existing employees about their wants and needs.

2.4 Survey of ODOT Employees

The Task Order Team met with representatives from the ODOT Human Resources Department to discuss creation of a survey tool to gauge interest in potential topics for short courses, workshops, seminars, and other workforce development/training activities. ODOT agreed to review the survey and disseminate it among its employees. After two rounds of reviewing, ODOT sent the 12-question survey via email agency-wide with a deadline of one month. The questions covered areas such as employee area of expertise, preference for short course, seminar, workshop, and topics of interest for development/training activities, among other questions. At the end of that period, 205 employees participated in this survey. The results of this survey will greatly assist SPTC in developing the aforementioned activities to assist in workforce development and training for ODOT.

In general, respondents came from a diverse field at ODOT. While a plurality were in construction, maintenance, customer service, and various other areas were also represented. Of the 205 respondents to the survey, a majority stated they had worked for ODOT more than 20 years, while tied for second was less than 5 years and between 5 and 10 years.

When asked for their preference of workforce development/training activity, short courses received the majority of votes. Regarding length of the short course, one day was the favorite option. For potential topics of short courses, leadership/management received the most votes, followed by computer skills and roadway design and construction. Seminar received the second most votes. Respondents voted for transportation planning as the most popular topic, followed by construction, with a diverse spread across knowledge, management, traffic safety, finance, innovation/modernization, and other options.

Workshops received the third most number of votes. The top three topics were leadership, Microsoft Office, and construction. A majority of respondents selected four hours as

the ideal duration for a workshop. Certificates came in fourth, with six hours (two one-semester courses or equivalent) being the most popular option by a large margin. For specific trainings, popular topics included Microsoft Office, business/finance, computer programs, leadership, and construction. Regarding the option of virtual or in-person workshops, seminars, short course, training, and certificates, in-person barely edged out virtual, receiving 105 votes to 97 respectively.

When asked to specify if there were any workforce development/training activities employees would like to see, the majority preferred mentorship programs, followed by internships. This question could be answered by typing out a response and produced a robust set of comments.

Notable comments on this section included frustration with training and the EIT experience. Some respondents compared themselves to being "thrown out to the sharks" learning as they went and mostly by errors. Another comment said that a "real mentor program for EITs would be nice." Other comments included the need for training of supervisors and stronger leadership development. Others made mention of hiring summer interns from universities, more practical experience, and better knowledge transfer from older employees to newer employees. Details of survey responses can be found in Appendix B.

2.5 Overview of Programs Pursued by the University Transportation Centers

There are three main challenge areas the University Transportation Center programs are focusing on: recruitment, retention, and training. An overview of these programs is given below. Additional details can be found in Appendix A.

The Center for Integrated Asset Management for Multimodal Transportation Infrastructure Systems is working to enhance the fundamentals of engineering programs under the COVID-19 situation so that they can foster workforce development.

The Southeastern Transportation Research, Innovation, Development, and Education Center is in the process of developing a framework for training and education to support the diverse workforce needs of the transportation sector in their region. They are working to identify current and future needs and develop and define the roles that academic institutions and UTCs can fill to help with training and education activities.

The Transportation Consortium of Southcentral States are working to advance transportation workforce development by attracting and supporting diversity in the transportation

field with internships and research assistantships. They also work to provide experiences to help prepare individuals as they enter the workforce. Tran-SET is working to incorporate sponsored research into educational and training products and activities.

In 2018, the Pacific Southwest Region University Transportation Center created the Southwest Transportation Workforce Center (SWTWC). The Southwest Transportation Workforce Center has several ongoing programs and initiatives. Their research into apprenticeship programs found that participates in such programs tend to earn more throughout their career, so SWTWC is planning to host webinars to help transportation agencies create and implement apprenticeship programs. SWTWC is also working on the formation of a Geospatial Information System (GIS) Training Program for tribal populations. This training program would engage tribal populations that are interested in a career with GIS skills and can help build a group of skilled professionals in tribal populations.

The SWTWC has identified a large gap in transportation workforce development in the form of tractor-trailer drivers. They will conduct targeted outreach efforts to non-traditional candidates such as tribal populations, women, and veterans and develop a career pipeline through community colleges and regional trucking companies.

SWTWC's final workforce development initiative is to diversify the transportation supply chain. Supply chain professionals note that the industry has difficulty with recruitment and retention of employees. The Southwest Transportation Workforce Development Center will develop a support system by engaging with underserved populations to identify needs and barriers so that access to supply chain occupations will be increased.

In 2019, the Pacific Northwest Transportation Consortium (PacTrans) worked to create a Workforce Development Institute so that they could develop a program platform with programs and courses to help with workforce development needs in its region. The institute will make training programs accessible online so that trainees can finish at their own pace and schedule. It will deliver a collection of training courses and workshops.

Currently, PacTrans is developing training programs by conducting interviews with a variety of industry professionals to discover development needs in the industry. Also, in 2019, the West Region Transportation Workforce Center (WRTWC) led an initiative to create safety career pathways. The WRTWC formed a discipline working group of national leaders in the transportation industry to identify critical safety occupations, the core competencies

transportation safety professionals need, where gaps currently exist in safety education, and new methods that can be used to deliver the needed knowledge, skills, and abilities to those in the industry. Their initiative focused on combining academic and industry so that workforce safety needs can be addressed using models that can adapt to new technologies and workplace.

The Southeast Transportation Workforce Center worked with numerous partners to create two transportation workforce focused playbooks. The Women in Transportation Playbook highlights best practices and strategies for increasing the number of women pursuing transportation professions. The T-STEM Academy Playbook showcases the T-STEM Academy at East High School and describes the process and key elements that have led to the programs launch and success over a very short period of time.

The Women in Transportation Initiative has led to SETWC and its collaborators to develop diversity focused conference sessions and workshops, transportation based outreach programs to women and girls and to develop literature on women in transportation. The playbook outlines a roadmap of how to begin addressing workforce challenges.

The T-STEM Academy Playbook focuses on how to develop a transportation-focused high school program to bring awareness to transportation careers, and also to help train the next generation of workforce professionals.

All these programs are working to meet the challenges of workforce development in the transportation industry. While the three main challenges of recruitment, retention and training are all addressed by the preceding programs and initiatives, the most attention is placed on workforce training, followed by recruitment. Not much emphasis is currently placed on retention of employees.

2.6 Potential Framework for Workforce Development and Outreach

The conclusions from the CTC & Associate LLC report as well as the ODOT employee survey can be used to create a potential framework for workforce development for ODOT. The framework may include the following:

- Metrics will need to be developed to gauge employee satisfaction. As Missouri DOT points out, a correlation between outreach programs and retention will need to be established.

- Total lifecycle of an employee will need to be considered, from outreach in middle school all the way to employee exit interviews. Agencies can develop recruiting programs for students in high schools, community colleges, and universities. Job fairs, internships, social media engagement, and one-day events and outreach programs have been the most successful.

- Non-student potential employees can be reached using social media, job fairs, websites and recruiting programs.

- Partnerships with community organizations and civil rights groups will help create a more qualified and diverse pipeline for employment.

- Current employees will need to feel that they are being listened to, their contributions are valued, and their professional growth is nurtured throughout their entire time at the DOT. This will necessitate more leadership training for management, professional development opportunities for all, and regular demonstrations to show that employee input is valued and implemented. Recognition of work performance and contributions can be considered. Increased mentoring, continuing education opportunities, and cross-training can be implemented.

- Many private sector positions include flexible work schedules and telecommuting. The public sector will need to institute these policies to remain competitive. Similarly reducing barriers in requirements will keep the agency more competitive with the private sector.

- For new hires, comprehensive onboarding and orientation training in addition to department-specific training is recommended. Emphasizing workplace culture issues and information technology will also be important.

Employee Outreach Strategies Synthesis

Prepared for

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Michael Molina, Oklahoma Transportation Library

Prepared by

CTC & Associates LLC

September 15, 2021

EXECUTIVE SUMMARY

Oklahoma Department of Transportation (ODOT) is reviewing impactful methods of outreach that will elicit interest in—and prepare potential candidates for—future employment with ODOT. The agency is also interested in employee retention practices used by other transportation agencies to engage current employees in developing leadership and other skills and to enhance job satisfaction.

To gather information for this review, state departments of transportation (DOTs) were surveyed about current transportation agency practices, programs and future plans for employee recruitment and retention. A literature search produced outreach practices, programs, methods and frameworks used by state DOTs, University Transportation Centers (UTCs) and academic institutions to elicit interest among students and others in future employment in a public transportation agency and to enhance job satisfaction and contribute to employee retention among current transportation agency employees.

Survey of Employee Outreach Strategies

An online survey was distributed to members of the American Association of State Highway and Transportation Officials (AASHTO) Committee on Human Resources. Topics addressed in the survey included current transportation agency practices and programs for internal and external employee outreach in addition to agencies' future plans. Eleven state DOTs responded to the survey: Alaska, California, Iowa, Michigan, Minnesota, Missouri, Montana, New Jersey, North Dakota, Texas and Wyoming. All responding agencies engage in outreach practices, methods and programs to elicit interest among students and others in future employment.

Highlights of survey responses are summarized below in the following categories:

- Employee recruitment.
- Employee retention.
- Program and practice assessment.

A more detailed look at individual state practices and future plans in employee recruitment and retention are presented in the remainder of this report.

Employee Recruitment

Student Education Level

All agencies responding to the survey provide recruiting programs and practices for students in community colleges, colleges and universities; all agencies except Iowa DOT also offer programs for high school students. In addition, five agencies—Michigan, Minnesota, New Jersey, North Dakota and Texas DOTs—provide programs that focus on students in middle schools, and three agencies—Michigan, Minnesota and North Dakota DOTs—design programs for students in elementary schools.

Outreach Strategies for Recruiting Students

Outreach strategies most frequently reported by agencies to recruit students were job fairs, internships and social media, followed by one-day events (such as Career Day) and outreach programs. Agencies are less likely to sponsor workshops and speakers bureaus, host webinars or advertise in newspapers, magazines, professional journals and publications when recruiting.

Outreach Strategies for Recruiting Other Potential New Employees

Social media and job fairs are used by all agencies responding to recruit other potential new employees, followed by websites and recruiting programs. These agencies are less likely to reach this group through newspapers and journals, other print publications and webinars.

New Employee Incentives

Ten of the 11 agencies use salary, benefits, and work schedule and leave flexibility as incentives to recruit new employees. Training (nine agencies) and education opportunities (seven agencies) are other common incentives.

Recruiting Strategies for Members of Disadvantaged Groups

Eight agencies—Alaska, California, Iowa, Minnesota, Missouri, Montana, New Jersey and North Dakota DOTs—have developed strategies or policies to recruit members of disadvantaged groups. Attending off-site events such as career fairs and networking events, developing relationships with professional organizations, and working with vocational schools and vocational rehabilitation programs are among common strategies.

Required Training Programs for New Hires

All agencies responding to the survey provide or require training programs for new hires. Practices include onboarding or new employee orientation training (eight states), department-specific training (five states), human resources and information technology training (two states each), workforce development (two agencies) and required training for supervisors (one agency).

State-Specific Programs and Practices

A series of case studies highlight the most effective practices or programs that agencies use to recruit new employees (beginning on page 48). Information provided in these summaries includes a brief description of the program or practice, the audience and, in some cases, costs related to the effort. When available, information about program partners, additional financial support or in-kind services, and the overall impacts on hiring efforts is also provided.

Employee Retention

Current Employee Incentives

Common incentives to retain current employees include training and recognition of work (10 agencies each) followed by promotions and work schedule/leave flexibility (nine agencies each). Other incentives include education opportunities, salary and benefits (eight agencies each).

Training/Staff Development Programs and Practices

Mentoring, coaching and leadership programs are used by all agencies responding to the survey to train and develop staff. Other professional development opportunities and cross-training are also commonly offered (nine agencies each) along with continuing education (eight agencies). Agencies are less likely to offer job rotation (four agencies) and communities of practice (two agencies).

State-Specific Programs and Practices

Leadership training (eight agencies), professional development (four agencies) and supervisory skills training (three agencies) are the most effective practices or programs that agencies use to enhance job satisfaction and contribute to employee retention.

Impact of Strategies and Incentives on Employee Retention

Nine agencies described the impact of these strategies and incentives on employee retention and/or metrics used to assess the impact. The Michigan DOT respondent noted that results indicate that employees who feel valued and are allowed to grow personally and professionally are satisfied and tend to stay. In Minnesota, incentives give employees an opportunity to learn about other areas of the agency and the work that is performed. In North Dakota, resignations and retirements decreased after the agency developed the Leadership Development Journey and began using the Gallup platform to recruit and retain employees.

Among the metrics used are findings from employee satisfaction and other surveys (five agencies), talent review sessions (one agency), work area workshops (one agency) and exit interviews (one agency). The Missouri DOT respondent reported that although the agency does not collect or track data, "a correlation between [outreach] programs and retention is likely." New Jersey and Wyoming DOTs are currently developing metrics; California DOT has not established metrics.

Exit Interviews

All agencies responding to the survey except California DOT conduct an exit interview when an employee leaves the agency. Information typically gathered during these interviews addresses workplace culture, managerial practices, salary and benefits, and recommendations for improvement.

Several agencies reported on the administration of exit interviews. For example, Minnesota and North Dakota DOTs currently send a survey to employees when they leave, although the Minnesota DOT respondent noted that employees don't often return completed surveys. The North Dakota DOT respondent added that the agency is transitioning to the online Gallup platform to conduct exit interviews. Wyoming DOT's survey, which is currently available on the SurveyMonkey online site, is currently under review by a human resources focus group to better evaluate metrics and gather data. New Jersey DOT is also planning to expand its exit surveys to collect more usable data that would improve employee retention.

Program and Practice Assessment

<u>**Successful Recruitment and Retention Practices**</u>

Career development and training programs (four agencies) and advertising on social media and other online outlets (three agencies) are the most successful practices that agencies have implemented for recruiting and retaining employees. Additional highlights from respondents follow:

- In the two years prior to the COVID-19 pandemic, New Jersey DOT closed its vacancy gap from 12% to 7% and saw an increase in representation of historically underrepresented groups and minorities. In addition, the number of people leaving the agency for reasons other than retirement slightly decreased.

- In the past year, North Dakota DOT has begun using the KXNET job board and Gallup platform to recruit and retain employees. The respondent noted that during the peak of the pandemic, the agency had the lowest number of vacant positions at one time than it had had in over a decade.

<u>**Recruitment and Retention Challenges**</u>

Workforce shortages and competition from the private sector (eight agencies) and candidates with inadequate credentials (four agencies) are common barriers to employee recruitment and retention efforts. Other challenges were diversity issues (two agencies) and agency location (two agencies).

Related Research

A literature search reviewed relevant domestic publications and resources related to workforce development practices, with a particular focus on the practices and processes used by public agencies. Findings are organized into the following topic areas:

- National programs.
- UTC programs and resources.
- State DOT practices.
- Professional transportation associations.
- Related resources.

National Programs

Resources from three national programs are highlighted:

- *Center for Transportation Workforce Development.* Some of the center's programs and products are described, including primary/secondary/postsecondary and professional development materials, the National Summer Transportation Institutes and the Careers in Transportation Curriculum for grades 6-12.

- *National Operations Center of Excellence.* The center offers "a suite of resources to serve the transportation systems management and operations (TSMO) community."

- *National Network for the Transportation Workforce.* The network comprises four regional transportation workforce centers funded by the Federal Highway Administration (FHWA). Numerous workforce development resources produced by these centers are presented.

University Transportation Center Programs and Resources

Resources and programs are provided from the following organizations:

- Council of University Transportation Centers.
- National Institute for Transportation and Communities.
- NEXTRANS Center.
- Southeastern Transportation Research, Innovation, Development and Education Center.
- Transportation Consortium of South-Central States.

State Department of Transportation Practices

External and internal resources are presented that were developed by a select group of state DOTs. A 2016 conference presentation showcases seven case studies from multiple states that illustrate partnerships among universities, public agencies, industries and K-12 schools to expand the knowledge of science, technology, engineering and math (STEM) in students. A 2016 Georgia DOT report highlights STEM programs with DOT involvement, including the Summer Transportation Institute, AASHTO TRAC and RIDES program, internship and shadow programs, one-day STEM awareness workshops and speakers bureaus.

Other workforce preparation programs highlighted include the Youth Development and Mentoring Program (Michigan DOT); Phoenix Internship Program (Minnesota); existing and

potential workforce development programs within North Carolina DOT; and the West Virginia Bridge Design and Build Contest (West Virginia Division of Highways). Career development and mentoring opportunities offered by Missouri and Utah DOTs are also presented.

Professional Transportation Associations

Transportation-related resources for grades K-12 are provided. Developed and curated by the Institute of Transportation Engineers STEM Committee, these materials include STEM activities, videos and presentations.

Related Resources

Additional strategies for both internal and external outreach are presented, including an issue of *TR News* that addresses a range of workforce development issues. Three National Cooperative Highway Research Program (NCHRP) reports focus on transportation workforce planning and development strategies, including a 2019 report that highlights case studies conducted in several states, a 2016 project that investigates the use of transportation workforce cross-training and a 2011 report that analyzes 25 promising recruitment and retention programs.

Conclusions and Recommendations

State Department of Transportation Recommendations

Eight state DOT respondents provided recommendations to transportation agencies seeking to initiate or enhance employee outreach practices. Highlights from those recommendations are presented below:

- Leverage social media to increase outreach (California).
- Form strong partnerships with schools and community organizations (California), as well as civil rights/affirmative action groups and the agency's communications office (New Jersey) to develop a pipeline to employment.
- Increase agency visibility to applicants (Michigan, Minnesota and North Dakota).
- Reduce barriers in position requirements to be more consistent with private sector competitors (Michigan).
- Offer flexible work schedules or telecommuting (Alaska).
- Advocate for salary increases based on data showing the limited talent pool and average wage data (Michigan).

- Make a concerted effort to listen to existing employees about their wants and needs (Missouri).

Trends in Recruitment and Retention

Below is a summary of trends in employee recruitment and retention practices and activities based on the data gathered for this project. When developing impactful outreach methods for implementation, ODOT could consider:

- ***Student education level***. Develop recruiting programs and practices for students in high schools, community colleges, colleges and universities.

- ***Recruiting strategies:***
  - *For students*, consider job fairs, internships, social media, one-day events and outreach programs.
  - *For other potential new employees*, consider social media, job fairs, websites and recruiting programs.
  - *For members of disadvantaged groups*, attend career fairs, networking events and other off-site events. Also, develop relationships with professional organizations, vocational schools and vocational rehabilitation programs.

- ***Incentives:***
  - *For new employees*, consider salary and benefits packages, as well as work schedule/leave flexibility and training.
  - *For current employees*, offer opportunities for career training and development. Also, provide avenues to recognize work performance and contributions, and consider promotions, salary and benefits packages, as well as work schedule and leave flexibility.

- ***Training and development programs:***
  - *For new hires*, provide onboarding or new employee orientation training in addition to department-specific training. Additional training about human resources and workplace culture issues and information technology could be considered.

- *For current employees*, implement mentoring, coaching and leadership programs. Also, consider other professional development and continuing education opportunities, and cross-training.

INTRODUCTION

Oklahoma Department of Transportation (ODOT) is examining impactful methods of outreach to elicit interest in and prepare potential candidates for future employment with the agency. ODOT is also interested in practices to engage current employees in developing leadership and other skills that will enhance job satisfaction and contribute to employee retention.

To gather information for this examination, state departments of transportation (DOTs) were surveyed about their employee recruitment and retention programs and practices. In addition, a search of relevant domestic literature was conducted about the outreach practices, programs, methods and frameworks used by state DOTs, University Transportation Centers (UTCs) and academic institutions to elicit interest among students and others across a range of ages in future employment in a public transportation agency. Outreach practices that engage current transportation agency employees were also examined.

Below is a summary of the findings from these efforts. Effective agency practices are highlighted for ODOT to consider for possible implementation to enhance its outreach efforts.

SURVEY OF EMPLOYEE OUTREACH STRATEGIES

Overview

A survey of state DOTs gathered information about current transportation agency practices, programs and future plans for internal and external employee outreach. The survey was distributed to members of the American Association of State Highway and Transportation Officials (AASHTO) Committee on Human Resources; this committee includes DOT representatives from all 50 states and the District of Columbia.

Survey questions are provided in Appendix A. Contact information for respondents is provided in Appendix B. The full text of survey responses is available as a supplement to this report.

Eleven state DOTs responded to the survey:

• Alaska.	• Minnesota.	• North Dakota.
• California.	• Missouri.	• Texas.
• Iowa.	• Montana.	• Wyoming
• Michigan.	• New Jersey.	

All responding agencies reported having experience engaging in outreach practices, methods and programs to elicit interest among students and others in future employment with their agencies. Survey responses are summarized below in the following categories:

- Employee recruitment.
- Employee retention.
- Program and practice assessment.

Employee Recruitment

Student Education Level

Recruiting programs and practices for all agencies responding to the survey focus on students in community colleges, colleges and universities; all agencies except Iowa DOT also focus on high school students. Five agencies—Michigan, Minnesota, New Jersey, North Dakota and Texas DOTs—develop programs for students in middle schools, and three agencies—Michigan, Minnesota and North Dakota DOTs—develop programs for students in elementary schools. Table 1 summarizes survey responses.

Table 1. Student Education Level: Focus of Recruiting Programs and Practices

State	Elementary School	Middle School	High School	Community College	College/ University
Alaska			X	X	X
California			X	X	X
Iowa				X	X
Michigan	X	X	X	X	X
Minnesota	X	X	X	X	X
Missouri			X	X	X
Montana			X	X	X
New Jersey		X	X	X	X
North Dakota	X	X	X	X	X
Texas		X	X	X	X
Wyoming			X	X	X
Total	3	5	10	11	11

Outreach Strategies for Recruiting Students

Job fairs, internships and social media are the most frequently used outreach strategies by these agencies when recruiting students, followed by one-day events (such as Career Day) and outreach programs. Workshops; speakers bureaus; webinars; and newspapers, magazines, professional journals and publications are least likely to be used. Table 2 summarizes survey responses.

Table 2. Outreach Strategies Used to Recruit Students

State	Outreach Program	Intern-ships	Mentor-ships/ Shadow Programs	Websites	Webinars	Social Media	Job Fairs	One-Day Events[2]	Workshops
Alaska		X					X	X	
California	X	X				X	X	X	
Iowa		X	X	X		X	X		
Michigan	X	X	X	X	X	X	X	X	
Minnesota	X	X		X		X[1]	X	X	
Missouri	X	X	X	X	X	X	X	X	
Montana	X	X	X			X	X		
New Jersey	X			X		X	X		X
North Dakota	X	X	X	X		X	X	X	
Texas		X	X	X	X	X	X	X	
Wyoming		X		X			X	X	
Total	**7**	**10**	**6**	**8**	**3**	**9**	**11**	**8**	**1**

1 Not very actively. Indeed, Handshake, etc., focuses on colleges and universities.
2 One-day events, such as Career Day.

Table 2. Outreach Strategies Used to Recruit Students, Continued

State	Speakers Bureau	Newspapers/ Journals[1]	Other Print Publications	Other	Description
Alaska					
California					
Iowa	X		X		
Michigan					
Minnesota			X		
Missouri	X	X	X		
Montana					
New Jersey		X	X	X	• Paid summer student program: Similar to an internship but students get paid and don't receive college credit.

State	Speakers Bureau	Newspapers/ Journals[1]	Other Print Publications	Other	Description
					• Outreach to student organizations in specialized areas of study, women's groups and minority groups. • Partnerships with high school guidance counselors to recruit students not pursuing a degree.
North Dakota					
Texas		X	X	X	• Conferences. • LinkedIn sourcing/conditional grant programs.
Wyoming				X	• High school STEM (science, technology, engineering and mathematics) fairs. • Internship in which students are employed in positions with full benefits and pay.
Total	2	3	5	3	

1 Newspapers, magazines, professional journals and publications.

Outreach Strategies for Recruiting Other Potential New Employees

To recruit other potential new employees, all agencies responding to the survey use social media and job fairs. Websites and recruiting programs are also commonly used. The least likely outreach strategies used to reach this group are newspapers and journals, other print publications and webinars. Table 3 summarizes survey responses.

Table 3. Outreach Strategies Used to Recruit Other Potential New Employees

State	Recruiting Program	Recruiting Frameworks	Websites	Webinars	Social Media	Job Fairs
Alaska		X			X	X
California	X	X			X	X
Iowa			X		X	X
Michigan	X	X	X	X	X	X
Minnesota	X		X		X	X
Missouri	X	X	X	X	X	X
Montana	X		X	X	X	X
New Jersey	X		X		X	X
North Dakota	X	X	X		X	X
Texas	X		X		X	X
Wyoming			X		X	X
Total	8	5	9	3	11	11

Table 3. Outreach Strategies Used to Recruit Other Potential New Employees, Continued

State	Newspapers/ Journals[1]	Other Print Publications	Others	Description
Alaska				
California				
Iowa				
Michigan				
Minnesota	X	X	X	• Niche sites. • Conferences. • One-to-one outreach to candidates. • Employee referral program. • Direct mailings.
Missouri	X	X		
Montana				
New Jersey	X		X	Partnerships with: • Community organizations. • New Jersey Department of Labor. • Career One-Stop Centers. • Soup kitchens.
North Dakota				
Texas	X	X	X	• LinkedIn sourcing. • Conferences.
Wyoming				
Total	**4**	**3**	3	

1 Newspapers, magazines, professional journals and publications.

New Employee Incentives

Salary and benefits are among the incentives used by all responding agencies except Texas DOT to recruit new employees. In addition, all responding agencies except Montana DOT offer work schedule/leave flexibility as an incentive. Training (nine agencies) and education opportunities (seven agencies) are other common incentives. Table 4 summarizes survey responses.

Table 4. Incentives Used to Recruit New Employees

State	Training	Education Opportunities	Salary/ Benefits	Work/Leave Flexibility[1]	Other	Description
Alaska	X		X	X		
California			X	X	X	• Telework. • Work that impacts the lives of most Californians.
Iowa	X	X	X	X		
Michigan	X	X	X	X		
Minnesota	X	X	X	X	X	Relocation reimbursements.
Missouri	X	X	X	X		
Montana	X			X		
New Jersey	X	X	X	X	X	Purposeful work.
North Dakota	X	X	X	X	X	• Infant at work program. • Payment add-on for regional pay differential. • Moving allowance. • Engaging work culture with purposeful work.
Texas	X	X		X		
Wyoming			X	X		
Total	**9**	**7**	**10**	**10**	**4**	

1 Work schedule and leave flexibility.

Recruiting Strategies for Members of Disadvantaged Groups

Eight agencies—Alaska, California, Iowa, Minnesota, Missouri, Montana, New Jersey, North Dakota DOTs—have developed strategies or policies to recruit members of disadvantaged groups. Attending off-site events such as career fairs and networking events, developing relationships with professional organizations and working with vocational schools and vocational rehabilitation programs are among common strategies. Table 5 summarizes survey responses.

Table 5. Strategies Used to Recruit Members of Disadvantaged Groups

Strategy/Policy	State	Description
Advertisements	Iowa	Provides diverse language radio advertisements.
Affirmative Action	Alaska, Montana	*Alaska*: Developed an affirmative action policy. *Montana*: Works closely with DOT's Office of Civil Rights to recruit minorities and underrepresented groups.
In-Person Hiring Events	California	Conducts events with underrepresented populations.
Job Postings	Iowa, New Jersey	*Iowa*: Posts jobs in specific geographical areas. *New Jersey*: Posts all open public positions on DiversityJobs.com, which posts on the following job boards: • Africanamericanhires.com. • Allbilingualjobs.com. • Allhispanicjobs.com. • AllLGBTjobs.com. • Asianhires.com. • Disabilityjobs.net. • Latinojobs.org. • Veteranjobs.net. • Wehirewomen.com.
Off-Site Events	Missouri, New Jersey, North Dakota	*Missouri*: Attends career fairs for disadvantaged groups. *New Jersey*: Develops talent acquisition teams by partnering with Human Resources (HR) subject matter experts when attending recruitment fairs, college career fairs and networking events, including those focused on women, minorities, veteran groups and other underrepresented groups. *North Dakota*: Visits: • Schools on reservations. • Prisons.
Partnerships	California	Partners with community-based organizations and nonprofits.
Professional Organizations	Missouri, New Jersey	*Missouri*: Recruits with Society of Women Engineers (SWE), National Society of Black Engineers (NSBE) and Society of Hispanic Professional Engineers (SHPE). *New Jersey*: Developed relationships with Hispanic/Latino Professionals Association (HLPA), NSBE, SHPE, Society of Asian Scientists and Engineers (SASE), SWE and others.
Programs for People With Disabilities	Minnesota	Offers Connect 700 program for individuals with disabilities (see *Related Resources* below).
Social Media/Technology	New Jersey	• Uses LinkedIn and Facebook platforms to develop and distribute employee testimonial video that showcases agency culture, leadership and what it's like to be part of the New Jersey DOT team. • Created diversity-specific engineering recruitment campaigns for LinkedIn:

Strategy/Policy	State	Description
		o HBCUs [historically black colleges and universities] + Engineering: For people who attended HBCUs and currently work in engineering functions across the U.S. o Diversity Groups + Engineering: For groups focused on race, ethnicity, gender, veterans, sexual orientation, members with disabilities and other groups.
Student Worker Programs	Minnesota	Offers Seeds Student Worker Program for college-level students (see *Related Resources* below).
Training Programs	Minnesota	Offers Transportation Associate Pathway (TAP) program, entry-level training in road maintenance (see *Related Resources* below).
Veterans Programs	New Jersey	Participates in Hiring Our Heroes for members of the military community (see *Related Resources* below).
Vocational Schools and Rehabilitation Programs	Iowa, New Jersey	*Iowa*: Works with vocational rehabilitation programs. *New Jersey*: Works with vocational schools.
Workshops	California	Facilitates informational workshops and directs applicants to active recruitments.
Other	Missouri, New Jersey	*Missouri*: Has developed employee resource groups. *New Jersey*: Works with: - One-Stop Career centers. - High school guidance counselors association. - Trenton Area Soup Kitchen.

Related Resources

Minnesota

Connect 700, Minnesota Department of Transportation, undated.

https://mn.gov/mmb/careers/diverse-workforce/people-with-disabilities/connect700/

From the website: Connect 700 allows eligible individuals with disabilities the opportunity to demonstrate their ability to perform a specific position for up to 700 hours on the job. It is:

- A pre-probationary trial work program.

- A noncompetitive selection process for individuals with certain disabilities seeking employment in the classified service of state government.

Seeds Student Worker Program, Minnesota Department of Transportation, undated.

http://www.dot.state.mn.us/careers/seeds.html

From the website: MnDOT's Seeds Program provides paid college-level student worker positions to highly motivated minority or economically disadvantaged college students, students

who are recently separated veterans, students with disabilities or female students in STEM or [nontraditional] fields of study.

Transportation Associates, Minnesota Department of Transportation, undated.

http://www.dot.state.mn.us/careers/tss.html

From the website: Transportation Associates work as trainees who perform skilled roadway surface and roadside maintenance activities. Following the one-year training period will be an automatic promotion to Transportation Generalist, with good performance.

Join the MnDOT Team, Minnesota Department of Transportation, undated.

www.dot.state.mn.us\careers

Additional information and resources are available for:

- Students and new graduates.
- Entry-level and experienced professionals.
- Highway maintenance workers and technicians.

New Jersey

Hiring Our Heroes: Creating a Nationwide Hiring Effort, Hiring Our Heroes, undated.

https://www.hiringourheroes.org/

From the website: Hiring Our Heroes (HOH) connects the military community—service members, military spouses and veterans—with American businesses to create economic opportunity and a strong and diversified workforce.

Required Training Programs for New Hires

All agencies responding to the survey provide or require training programs for new hires. Agencies in eight states—Alaska, Iowa, Michigan, Minnesota, Missouri, Montana, North Dakota and Wyoming—provide onboarding or new employee orientation training. Agencies in seven states—Alaska, California, Iowa, Minnesota, New Jersey, Texas and Wyoming—provide department-specific training. Additional training by respondents includes HR and IT training, required training for supervisors and workforce development. Table 6 summarizes survey responses.

Table 6. Required Training for New Hires

Training	State	Description
Department-Specific Training	Alaska, California, Iowa, Minnesota, New Jersey, Texas, Wyoming	*Alaska*: Provided by new hire's supervisor after onboarding. *California*: Department provides any required training. *Iowa*: • Provides required training dependent on job responsibilities. • Includes safety and compliance training. • Encourages individual areas to provide training that enhances the new hire's knowledge of the environment and job responsibilities. *Minnesota:* Offers: • Engineer rotation training program. • Snowplow training. *New Jersey:* Offers: • Specialized training for highway operation technicians and Commercial Driver's License (CDL) holders. • Safety training for safety-sensitive positions. *Texas*: Provides instructor-led training specific to new hire's role (funded through unit's overhead). *Wyoming*: Identifies occupation-specific training (including completion deadline date).
Human Resources Training	Michigan, New Jersey	*Michigan*: Provides mandatory HR training for new employees, including: • Diversity, equity and inclusion information. • Discriminatory harassment. • Workplace rules. *New Jersey:* Provides training for: • Active shooter. • Americans With Disabilities Act (ADA). • Ethics. • Family and Medical Leave Act (FMLA). • Policy prohibiting discrimination.
IT Training	New Jersey, Texas	*New Jersey*: SANS (IT security training). *Texas*: Computer-based training (funded centrally through HR division).
New Employee Orientation/ Onboarding	Alaska, Iowa, Michigan, Minnesota, Missouri, Montana, North Dakota, Wyoming	*Iowa*: Includes safety training. *Michigan*: New 12-month process for new employees and their supervisors: • Provides suggested trainings and professional development opportunities. • Helps to familiarize new employee with information available on department's website and other areas of the department. *Missouri*: Includes safety training. *Montana*: Required to complete within the first 90 days. *North Dakota*: Onboarding training includes timesheets, benefits, policies, DOT's mission and how employee's role directly ties to mission. *Wyoming*: Offers orientation day and course.
Supervisory Skills Training	Montana	Required of all supervisors.

Training	State	Description
Workforce Development Program	Michigan, Missouri	*Michigan*: • Offered for new hires and new managers/supervisors. • Provides training in topics ranging from conflict resolution to having meaningful conversations (online and in-person). *Missouri:* • Offers a robust learning management system with wide variety of training opportunities to aid in employee's development and career success. • Participates in LinkedIn Learning platform (extensive training opportunities).
Other	New Jersey	• Driver awareness training and system/information based training (e.g., timekeeping, IT) (bundled; must complete within the first 90 days). • Fire safety

State-Specific Programs and Practices

Below are summaries of the most effective practices or programs that agencies use in recruiting new employees. Summaries include the audience and a brief description of the program or practice. When available, information about partners, financial support, in-kind services and the impacts on hiring efforts is also provided.

Alaska

Practice/Program Name:	Learning and Development Through Department of Administration
Audience:	Employees in the workforce.
Description:	This program provides an academy for supervisors as well as other courses and curriculums. The length varies depending on the course. Courses are free to state employees; cost distributed among state of Alaska departments.
Practice/Program Name:	Workplace Alaska Hotline and Customer Service (recruitment via NEOGOV)
Audience:	New and perspective employees.
Description:	Most state of Alaska jobs, including student and college intern positions, are posted here.

California

Practice/Program Name:	Recruitment advertisements via social media (including LinkedIn, Indeed, Facebook, Twitter and Handshake) and professional organizations (AASHTO, Women in Transportation and NSBE)
Audience:	Graduating college students and candidates external to the organization
Description:	Social media outreach coincides with the California civil service required recruitment process. Outreach through professional organizations typically has an associated cost ranging from $250 to $5,000 and is generally used for upper management/executive-level positions or classifications that are hard to recruit.
Practice/Program Name:	In-person recruitment fairs at colleges and universities
Audience:	Graduating college students and student interns.
Description:	This practice is most effective when recruitment event is not part of a larger career fair encompassing other employers. The agency coordinates events throughout the year, working with school and specific program representatives to plan and market an event. The HR Recruitment Unit partners with relevant occupational/divisional subject matter experts (SMEs) to develop content for informational sessions. On the day of event, information about the agency and the state hiring process are available at the agency's booth. SMEs give short presentations in classrooms, and the agency holds an information session on campus in the evening. Cost varies depending on the college. Many are free because they help support student careers within the relevant educational program.
Practice/Program Name:	Partnering with community-based organizations and nonprofits to market agency vacancies to their constituent groups

Partners/Financial Support/In-Kind Services:	Partners include Work for Warriors (veterans), Prison to Employment, Pathways to State Service, Back to Work (formally incarcerated), tribal groups and California Conservation Corps.
Audience:	Underrepresented or disadvantaged populations.
Description:	The agency works with organizations to plan an in-person or virtual information session about the agency, the state hiring process and available vacancies. It also conducts workshops on application and interviewing best practices.

Impacts on Hiring Efforts

Success is typically measured by the quantity and quality of applicants who apply for associated vacancies. Due to the format of the state hiring process, it's difficult to capture accurate performance metrics on recruitment efforts. Metrics that the agency can capture require a tremendous amount of manual data compilation but it can determine how many students who participated in the information sessions applied and were appointed to positions.

Iowa

Practice/Program Name:	Student internship/cooperative opportunities (100 students per year)
Partners/Financial Support/In-Kind Services:	Federal Highway Administration (FHWA) and Fixing America's Surface Transportation (FAST) Act funds allocated to workforce development.
Audience:	Students whose academic studies align with work duties.
Description:	Students gain real-world work experience that complements their course studies. Industry professionals serve as mentors. Cost: $1.6 million per year.
Practice/Program Name:	Social media boosted posts for vacant positions
Audience:	Working professionals looking for full-time employment.

Description:	This practice allows the agency to focus on a specific region or professional demographic. Cost: Approximately $100 per post. Length: One week.
Practice/Program Name:	Winter Operations (temporary snowplow operators, 500 to 600/season)
Audience:	People 18 years of age with a CDL (or desire to get one) seeking part-time employment through the winter season.
Description:	Temporary employment often leads candidates to want permanent jobs at the DOT with benefits. "Great way for candidates to try us out." Cost: advertising, $80,000 per year for radio ads, social media and digital marketing.

Impacts on Hiring Efforts

- *Program 1*: This program exposes interns to the agency environment through hands-on activities. Interns are crucial to the support of efforts. No formalized measure has been established.

- *Program 2*: The agency recently began measuring this program, now that it is centralized. Data gathered is by job profile, money spent and recruitment efforts.

- *Program 3*: Impact was measured by the percentage of vacancies filled to keep the traveling public safe and reduce demands on full-time employees (FTEs). In addition, the agency tracks the temporary workers who transition to full-time employment.

Michigan

Practice/Program Name:	Active recruitment
Partners/Financial Support/In-Kind Services:	Department work areas, HR and 504(e) recruitment funding (federal funding through the Ladders of Opportunity initiative, which supports on-the-job training).
Audience:	Employees in the workforce.
Description:	The agency established this practice in June 2020 to support active recruitment for hard-to-fill positions based on intake

meetings involving HR staff, the recruitment team and hiring managers. After assessing the position and the candidate landscape, the agency co-develops a recruitment plan for a specific position that includes sites to post the job, best sourcing avenues and outreach venue to make qualified candidates aware of the position. Costs include staff time and posting sites.

Practice/Program Name:	Internship Program
Partners/Financial Support/In-Kind Services:	Universities.
Audience:	In-state college students.
Description:	This program allows for a paid summer internship program focused on transportation engineering and planning. Students receive hands-on practical experience and can network with existing Michigan DOT employees for future employment opportunities. Cost varies by region and is charged against federal highway projects.
Practice/Program Name:	Transportation Diversity Recruitment Program (TDRP)
Partners/Financial Support/In-Kind Services:	Partners: HBCUs. Financial support: 504(e) federal funds.
Audience:	Out-of-state HBCU students.
Description:	This paid summer internship opportunity is a chance for students attending HBCU programs to come to Michigan to explore what Michigan DOT and the state of Michigan have to offer. The agency is continuing to grow the program and has included consultant partners as sponsor employers. With the limited number of minority students attending Michigan engineering schools, this program

was developed to grow diversity within the DOT and the transportation industry.

Impacts on Hiring Efforts

The internships, both traditional and TDRP, are the backbone of the agency's engineering and planning pipeline. The agency is currently developing processes to better assess the effectiveness of all workforce programs. It has seen immediate increases in applicants applying and utilizing the active recruitment process focused on the hardest-to-fill positions. But even with the extra effort, the agency cannot recruit sufficient staff and much like the engineering pipeline, it needs to develop ways to produce its own talent for technician, skilled trades and maintenance positions.

Minnesota

Practice/Program Name:	Employee Referral Program
Partners/Financial Support/In-Kind Services:	HR funds.
Audience:	All current employees.
Description:	Minnesota DOT employees are one of its best recruiting sources. Minimal cost/nominal gifts are given to employees when a person they referred is hired.
Practice/Program Name:	Seeds Program
Partners/Financial Support/In-Kind Services:	Base funding: HR.
Audience:	College-level student workers in these categories: minority, disabilities, economically disadvantaged, women in STEM or nontraditional fields, and veterans.

Description:	Students can participate in this program for up to 48 months. Costs are shared by HR (50%) and the office supporting the student (50%).
Practice/Program Name:	Graduate Engineer and Land Surveyors Trainee Program
Partners/Financial Support/In-Kind Services:	HR funded the whole program.
Audience:	Entry-level job seekers with a bachelor's degree in civil engineering.
Description:	This two-year rotation program is funded by HR.

Impacts on Hiring Efforts

These efforts bring in students at the start of their career (with no experience) and give them on-the-job training and experience to then apply for positions.

Missouri

Practice/Program Name:	Career Fair
Partners/Financial Support/In-Kind Services:	Local universities and career centers.
Audience:	College students (sophomore level or above) and nontraditional and nondegreed workers.
Description:	Missouri DOT typically participates in three to five career fairs annually, ranging from $150 to $300 each. During the career fairs, agency representatives meet with and speak to students about the range of opportunities at the agency, including internships, seasonal work and full-time employment.

Practice/Program Name:	Social Media Recruitment
Audience:	Anyone following Missouri DOT's social media accounts.
Description:	The agency uses Facebook, Twitter, YouTube, Instagram, LinkedIn and other social media accounts to not only provide the most timely news updates regarding bridge, road and traffic conditions but to highlight employment opportunities throughout the state. Costs are mostly attributed to staff time posting and managing content.
Practice/Program Name:	Internship Program
Partners/Financial Support/In-Kind Services:	Universities and internal professionals.
Audience:	Students currently enrolled in a related bachelor's or post-bachelor's degree program.
Description:	The internship program gives students an opportunity to gain professional-level experience related to their education while providing Missouri DOT with a pool of qualified candidates to fill professional-level positions once students obtain their degrees. Costs range from $10.30 to $17.06 per hour for each intern as well as staff time required to lead, train, develop and mentor interns.

Impacts on Hiring Efforts

These practices have helped Missouri DOT continue to recruit new employees of varying backgrounds. Through social media, the agency can reach a larger, more diverse audience and utilizing internships and career fairs, it can also find students to fill professional-level jobs.

Montana

Practice/Program Name:	The Management Development Program

Audience: Current employees.

Description: The Management Development program is a six- to nine-month
                             introductory survey course for employees interested in pursuing a
                             career in management. It reviews a variety of leadership
                             competencies, including personality type preference, emotional
                             intelligence, managing change, dealing with stress, critical
                             conversations and communication. It also includes an optional
                             opportunity to pursue some topics in greater depth through
                             independent study. The goal of this program is to share with
                             employees the skills, joys and challenges of supervising others so
                             that each can make an informed decision regarding career
                             choices.

Practice/Program   The Visionary Leader Program
Name:

Audience: Higher-level managers, but not senior managers.

Description: The Visionary Leader program is the newest version of the popular
                             Leadership Enhancement and Development (LEAD) program that
                             has been offered in the past at Montana DOT. The training team
                             solicited feedback from managers and leaders across the agency,
                             including past class participants, to revise the program to best suit
                             the leadership training needs of the agency. The program runs 12
                             to 18 months and has a required capstone project.

Practice/Program   Supervisor's Compass
Name:

Audience: Current and new managers.

Description: This two- to three-day program presents a roadmap on how to be
                             an effective leader, complete supervisory tasks efficiently and
                             effectively, and develop and support the career growth of each
                             staff member. It also starts the conversation about leadership—
                             what real leadership looks like, how to lead former peers and how

to effectively handle the myriad leadership challenges the workplace presents.

Impacts on Hiring Efforts

Areas impacted by these efforts are data collection and performance measures.

New Jersey

Practice/Program Name:	LinkedIn
Partners/Financial Support/In-Kind Services:	IT, Budget office
Audience:	Recent graduates and employees in the workforce for higher-level, difficult-to-recruit positions.
Description:	The agency piloted LinkedIn's advertisement and recruitment tools for six months before committing to a yearly program. Currently it is on a year-to-year program with an annual cost of $70,000, which includes a specific number of recruiter seats; job slots; upgraded homepage; and $25,000 delegated to specific recruitment advertisements.
Practice/Program Name:	Summer Student Employment Program
Partners/Financial Support/In-Kind Services:	Colleges and universities. Budget similar to an internship.
Audience:	Rising juniors and seniors in college.
Description:	The agency typically recruits for this program in the fall program through college fairs and Handshake. It holds an annual recruitment effort that mirrors the usual recruitment process. Students work from May through August and are paid $18 or $20 an hour, depending on their level of college education. The

program initially started with 30 students. Due to its success in sourcing full-time employees, it had approximately 50 students before the COVID-19 pandemic. Cost: Typically $500,000.

Practice/Program Name:	Handshake/Diversity Recruitment Initiatives (DRI)
Partners/Financial Support/In-Kind Services:	DiversityJobs.com, budget, colleges and universities, minority and underrepresented organizations.
Audience:	High school graduates, college graduates and employees in the workforce.
Description:	Handshake is free and allows students and employers to share information easily, learn about career fairs, student events on campus, etc. The agency uses this program yearly. Additionally, the DRI organizations that the agency belongs to and events it attends as well as the DiversityJobs.com partnership cost approximately $20,000 annually, depending on the organizations it joins and events it attends.

Impacts on Hiring Efforts

The agency has seen a 2% to 6% increase in the representation of underrepresented groups in its candidate pool from 2018 to 2019, with a direct correlation to an increase in those who were hired. While the data was difficult to obtain in 2020 since the agency paused its recruitment and hiring efforts for several months due to the pandemic, it does have information related to highway operations entry-level positions. In 2020, specifically related to the highway operations technician trainee applicant pool demographics, New Jersey DOT increased its African American representation in the candidate pool by 93.3% and its Hispanic or Latino representation by almost 10%. The agency also collected data, including surveys from summer students and their supervisors to assess the program and identify how many participants were offered, accepted and are still New Jersey DOT employees. The agency has used LinkedIn's analytics to assist with measuring its success using the platform.

North Dakota

Practice/Program Name:	Future Leaders
Partners/Financial Support/In-Kind Services:	Partners: Vision Zero, North Dakota Highway Patrol.
	Financial support: Wellness Committee and Employee Appreciation Committee purchase snacks and bottled water ($50 each).
Audience:	Students grades K-12.
Description:	The program is an all-day, in-office setting for children to learn about North Dakota DOT. Initially children and grandchildren of North Dakota DOT employees were invited to inform them about their parents' job responsibilities and the role of the entire agency for the citizens of North Dakota.
	The recruitment manager accompanies the children around the Central Office location for tours and demonstrations. The itinerary includes filming a public service announcement with the Communications division; touring the Maintenance division, Survey and Photogrammetry area of the Design division, Programming division and Pavement Management of the Planning and Asset Management division; receiving a motor vehicle license plate demonstration; touring the Driver's License area, including creation of REAL IDs for those who brought proper documentation; a one-hour divisions expo that includes all the Central Office divisions set up in a career fair style to explain their roles at North Dakota DOT; visiting with the Highway Patrol; watching a snowplow demonstration with an equipment operator where the students can sit in the snowplow and honk the horn; and watching a drone demonstration where drone pilots fly a drone. The Executive Office welcomes the children with Human Resources and meets with the children at the end of the day. The children spend lunch with their parents.

	Cost: Salary for the time employees spend preparing and participating in the event. The Wellness Committee and Employee Appreciation Committee purchase snacks and bottled water ($50 each).
Practice/Program Name:	Touch a Truck
Partners/Financial Support/In-Kind Services:	City progress organizations or other establishments.
Audience:	Children of all ages (0 to 18 years), college students and adults.
Description:	People are invited to sit in the snowplow while they talk with the recruitment manager and equipment operator about the role of North Dakota DOT. The agency has also done its own community fairs with Touch a Truck in smaller town section office locations to include more communities. Events typically run three to four hours. Cost: Minimal (approximately $100 to $1,000 for the sponsorship space).
Practice/Program Name:	North Dakota State Fair Booth
Partners/Financial Support/In-Kind Services:	Partner: Vision Zero. Financial support: None. North Dakota DOT pays for an indoor booth at the fair ($400 for nine days).
Audience:	Children of all ages (0 to 18 years), college students and adults.
Description:	Agency representatives discuss careers, Vision Zero, REAL ID, motor vehicle licensing registration, roadway maintenance and all other North Dakota DOT related questions or concerns. The booth is open from 9 a.m. to 9 p.m. daily. Employees are asked to work the booth. Approximately 25 employees work a three- to four-hour shift over the nine days. Employees are paid for hours working the booth, travel and admission into the fair.

Impacts on Hiring Efforts

These practices have been successful in hiring at the time and in the future. The agency keeps a list of attendee names for the Future Leaders events to contact them in the future when they would be eligible for employment. Several come through the program more than once and have a desire to work at North Dakota DOT. This helps them determine what they want to do so that they can plan their studies accordingly.

To determine the effectiveness of these practices, the agency monitors its website hits and applications when attending Touch a Truck, community fairs and the North Dakota State Fair.

Texas

Practice/Program Name:	Summer Internship Program: Recruiting High School and College Students
Audience:	High school and college students.
Description:	Summer internships provide on-the-job training for students. Internships run from May 15 through August 15 (40 hours per week). Students' pay depends on college credits and ranges from $12.50 to $14 per hour.
Practice/Program Name:	Conditional Grant Program
Audience:	Disadvantaged individuals, high school seniors to college sophomores.
Description:	The Conditional Grant Program provides $3,000 per semester for up to five years.

Wyoming

Practice/Program Name:	Laramie Design Squad
Audience:	College level (freshman through senior year) are eligible to apply.

Description: This is a unit within the project development team that is made up of supervisors and students. The students are enrolled in the state university and work part time in a student internship capacity. The program typically runs for two years and/or ends when students graduate from their engineering program.

Employee Retention

Current Employee Incentives

Training and recognition of work followed by promotions and work schedule/leave flexibility are among the most common incentives used by responding agencies to retain current employees. Education opportunities, salary and benefits were nearly as common. Other practices include teleworking options and leadership development. The Wyoming DOT respondent noted that the agency recently initiated a work group to focus on recruitment and retention efforts statewide. Table 7 summarizes survey responses.

Table 7. Incentives Used to Retain Current Employees

State	Training	Education[1]	Salary/ Benefits	Promotions	Work/Leave Flexibility[2]	Recognition[3]	Other	Description
Alaska	X		X	X	X	X	X	Some teleworking options.
California			X		X	X		
Iowa	X	X	X		X			
Michigan	X	X		X	X	X		
Minnesota	X	X	X	X	X	X		
Missouri	X	X	X	X	X	X		
Montana	X				X		X	
New Jersey	X	X			X		X	
North Dakota	X	X	X	X	X	X	X	•Wellness incentives. •Leadership Development Journey. •Infant at Work program. •Telecommuting.
Texas	X	X	X	X	X	X		
Wyoming	X	X	X	X	X	X	X	Pension program.
Total	10	8	8	9	9	10	3	

1 Education opportunities.
2 Work schedule and leave flexibility.
3 Recognition of work.

Training/Staff Development Programs and Practices

All agencies responding to the survey offer mentoring, coaching and leadership programs to train and develop staff. Other professional development opportunities and cross-training (nine agencies each) and continuing education programs (eight agencies) are also commonly offered. Agencies are least likely to offer job rotation (four agencies) and communities of practice (two agencies). Table 8 summarizes survey responses.

Table 8. Training/Staff Development Programs and Practices

State	Cross-Training	Job Rotation	Communities of Practice	Mentoring/ Coaching	Continuing Education[1]	Professional Development[2]	Leadership Programs	Support for Degree[3]
Alaska	X			X			X	X
California	X	X		X	X		X	
Iowa	X	X		X	X	X	X	
Michigan	X		X	X	X	X	X	X
Minnesota		X		X	X	X	X	X
Missouri	X			X	X	X	X	X
Montana	X		X	X		X	X	
New Jersey	X			X		X	X	X
North Dakota	X			X	X	X	X	X
Texas	X	X		X	X	X	X	
Wyoming				X	X	X	X	
Total	**9**	**4**	**2**	**11**	**8**	**9**	**11**	**6**

1 Continuing education programs.
2 Professional development programs.
3 Support to complete a degree.

State-Specific Programs and Practices

Leadership training, professional development and supervisory skills training are the most effective practices or programs that agencies use to enhance job satisfaction and contribute to employee retention. Table 9 summarizes survey responses.

Table 9. Programs and Practices Supported to Enhance Employee Retention

Practice/Program	State	Description
Education Support	Michigan, Minnesota, Missouri	*Michigan*: Administrative leave for employees to attend college classes toward an associate's, bachelor's or master's degree in a field utilized by Michigan DOT. *Minnesota*: Tuition reimbursement program. *Missouri*: Educational Assistance Program: Employees are eligible to pursue an undergraduate degree after successfully completing probationary period (six months).

Practice/Program	State	Description
Employee Engagement	Iowa, North Dakota	*Iowa*: N/R. *North Dakota*: Gallup employee engagement training (conducted with the state Gallup contract). North Dakota DOT recruitment manager is a trained Gallup Champion. Trainings and materials for all North Dakota employees and managers.
Flexible Work Schedule/Teleworking	Alaska, Minnesota	*Alaska*: Flexible work schedules and teleworking agreements. *Minnesota*: Employee Mobility Program allows employees to stretch assignments/opportunities to work out of class.
Job Rotation	California	Internal rotations between another division or district, and external agency assignments to promote understanding and communication between the department and partners.
Leadership Training	California, Iowa, Minnesota, Missouri, Montana, New Jersey, North Dakota, Wyoming	*California*: • Programs for supervisors and managers. • Hierarchy of programs, beginning with Managerial Training Program (must complete base level program before moving to the next level). *Iowa*: Leadership Master Class Series (for supervisors and emerging leaders). *Minnesota:* Leadership Development and other enterprise leadership programs. *Missouri:* HYPE (Helping Young Professionals Engage) leadership program to empower young professionals. Meeting topics vary from public speaking and leadership to finding career motivation and success. *Montana*: • Management Development Program. • Visionary Leader Program. *New Jersey*: Currently working on developing a leadership program; exploring more intensive trainings and other programs that may assist in this area. *North Dakota*: • Leadership Development Journey (for all employees). Webinars, presentations, tours, demonstrations, watch parties and knowledge cafes offered through HR. Members are encouraged to present to the group. • State leadership sessions: 10 trainings for employees and managers. *Wyoming*: • Pilot leadership program to be launched in March 2022. • AASHTO sequential leadership resources.

Practice/Program	State	Description
Mentoring	California, New Jersey	*California*: • Annual mentorship program provides structured framework for monthly meetings between mentee and mentor. • Program provides leadership topics and resources to support monthly meetings. • Six-month cohorts. *New Jersey*: Formal volunteer mentorship program where individuals seek mentors throughout other divisions in the department.
Professional Development	Alaska, Michigan, Missouri, Texas	*Alaska*: • Open to all employees (may be voluntary or required). • Courses: A Respectful Workplace Curriculum, Change Concepts Curriculum, Emotional Intelligence Concepts Curriculum, Ethics Curriculum, Leadership Beginnings Curriculum, Leadership and Change Curriculum, Performance Expectations Curriculum, Preventing Sexual Harassment Curriculum, Supervisor Performance Management Curriculum, Supervisor Skills Curriculum, Valuing Diversity Curriculum, Assertive Communication, Collusion Communication Behaviors, Emotional Intelligence, Meet Model (feedback model), Personal Qualities for Effective Communication, Working for State Government, Whole Communication. *Michigan*: Continually refreshing leadership training and development opportunities for all staff. *Missouri*: Performance Development Institute. Focuses on organizational awareness, professional business skills and interpersonal skills. *Texas*: • Succession planning model based on a performance management model of frequent conversations about career development. Open to all employees interested in leadership roles. • Contract administration and project management training career paths: Open to all employees as a secondary path to project leadership roles. • Employee training and development for both current and future roles (open to all employees).
Student Internship Programs	Iowa	N/R

Practice/Program	State	Description
Supervisory Skills Training	Alaska, Montana, New Jersey	*Alaska:* Academy for Supervisors: • Required of all supervisors. • 30-40 hours of class time and exercises. • Courses: Working for State Government, Emotional Intelligence Concepts Curriculum, Leadership and Change Curriculum, Supervisor Skills Curriculum, Supervisor Performance Management Curriculum. *Montana*: Supervisor's Compass. *New Jersey*: Step Program (supervisor training to assist in transitioning from employee and coworker to supervisor, and the responsibilities of a supervisor).
Other	Michigan	Federal training funds (used instead of work unit operating budgets).

N/R No response.

Related Resources

North Dakota

Gallup Workplace Solutions, Gallup, Inc., undated.

https://www.gallup.com/workplace/

Gallup helps organizations "develop and engage employees to create an exceptional workplace and boost your business outcomes." Services include culture transformation, employee experience and engagement, leadership, organizational effectiveness and hiring analytics.

Impact of Strategies and Incentives on Employee Retention

Nine agencies described how these strategies and incentives have impacted employee retention. Some of the survey respondents described metrics used to measure the impact (for example, performance measures used or data collected). Respondents from New Jersey and Wyoming DOTs noted that their agencies are currently developing metrics; California DOT has not established metrics; and Missouri DOT does not collect or track data. Table 10 summarizes survey responses.

Table 10. Impact of Strategies and Incentives on Employee Retention

State	Description of Impact and/or Metrics
Alaska	Employee satisfaction surveys
California	Metrics have not been established.
Iowa	Employee engagement. The agency surveys permanent employees annually using Gallup Q12 to gather feedback and address areas of opportunity with individual teams and work units.
Michigan	• Twice-yearly talent review sessions, random surveys and work area workshops. Results indicate that employees who feel valued/are allowed to grow personally and professionally are satisfied and tend to stay. • Employees' ability to be autonomous and have open, candid conversations with supervisors about work, work–life balance and career growth.
Minnesota	• Incentives give employees an opportunity to learn about other areas of the agency and the work that is done. • Agency always encourages employees to develop skills for advancement.
Missouri	• A correlation between these programs and retention is likely, but data is not currently being collected or tracked. • Programs may aid employee retention through employee engagement, commitment, dedication and loyalty to the organization.
New Jersey	Agency is working to develop performance measures for its initiatives.
North Dakota	• Resignations and retirements decreased after the agency developed the Leadership Development Journey and began using the Gallup platform. • The Recruitment Manager monitors all budgeted FTEs weekly for position movement and changes. Information is shared with the Executive Office and managers. • Exit interviews and Gallup surveys indicate agency training programs are valuable and appreciated.
Wyoming	Metrics currently under development.

Exit Interviews

All agencies responding to the survey except California DOT conduct an exit interview when an employee leaves the agency. Information typically gathered during these interviews addresses workplace culture, managerial practices, salary and benefits, and recommendations

for improvement. Michigan, Iowa, Missouri, Montana and New Jersey DOTs ask employees to provide a reason for leaving while other agencies ask employees to comment on specific aspects of employment. Below are additional highlights from respondents:

- Respondents from Minnesota and Wyoming DOTs reported distributing an exit interview but did not provide details about the content.

- Minnesota DOT sends a survey to employees when they leave, but employees don't often return completed surveys.

- North Dakota DOT currently mails a survey to employees after they leave employment; the agency is transitioning to the online Gallup platform to conduct exit interviews.

- Wyoming DOT's current exit survey, which gathers feedback through the SurveyMonkey online tool, is currently under review by an HR focus group to better evaluate metrics and gather data.

- New Jersey DOT is also hoping to expand its exit surveys to collect more usable data that would improve employee retention.

Table 11 summarizes survey responses.

Table 11. Topics Evaluated in Exit Interviews

Topic	State	Description
Employee Demographics/ Work History	Iowa, Missouri	*Iowa*: • Age. • Ethnicity. • Years of service. *Missouri*: • Employee's role. • Employee's team. • Direct supervisor.
Employee Development/ Opportunity for Advancement	Alaska, Montana	*Montana*: Training opportunities available.
Managerial Practices/Ratings	Alaska, Michigan, New Jersey	*Alaska*: • Workload distribution. • Fair treatment by management. • Consistent application of policies/practices. • Management's receptivity to employee ideas. *Michigan*: Supervisor rating. *New Jersey*: Supervision.

Topic	State	Description
Recommendations for Improvement	Alaska, Michigan, North Dakota	*Alaska, North Dakota*: Action/change that would have kept employee from leaving. *Alaska*: • Ideas to make the state of Alaska a better place to work. • Recommend the state of Alaska as an employer? *Michigan*: Recommend the agency as an employer? *North Dakota*: Suggestions for work culture improvement.
Salary/Benefits	Alaska, Iowa, Montana	*Alaska*: • Employee pay/wages. • Benefits offered to employees. *Iowa*: Opinion about job duties/pay. *Montana*: Salary/benefits satisfaction.
Workplace Culture	Alaska, Iowa, Michigan, Missouri, Montana, New Jersey, North Dakota	*Alaska:* • Access to information needed for job. • Communication within work unit. • Cooperation and teamwork. • Workload distribution. • Job recognition. • Resolving equal employment opportunity complaints. • Resolving employment disputes/grievances. *Iowa*: Opinion on culture/environment. *Michigan:* Job satisfaction. *Missouri*: • Opinion of organization as a whole. • Experience from a diversity and inclusivity perspective. *Montana*: What they liked best and least about the work. *New Jersey*: • Department goals and mission. • Morale. *North Dakota*: Employee experience.
Other	Michigan, Iowa, Missouri, Montana, New Jersey, Texas	*Michigan, Iowa, Missouri, Montana, New Jersey, Texas*: Employee specifies reason for leaving.

Program and Practice Assessment

Successful Recruitment and Retention Practices

Six agencies—Alaska, Iowa, Michigan, Minnesota, Missouri and North Dakota DOTs— described successful practices that their agency has implemented for recruiting and retaining employees, including advertising on social media and other online outlets, career pathway programs and training. Below are additional highlights from respondents:

- In the two years prior to the COVID-19 pandemic, New Jersey DOT closed its vacancy gap from 12% to 7% and saw an increase in representation of historically underrepresented groups and minorities. In addition, the number of people leaving the agency for reasons other than retirement slightly decreased.
- In the past year, North Dakota DOT has begun using the KXNET job board and Gallup platform to recruit and retain employees. The respondent noted that during the peak of the pandemic, the agency had the lowest number of vacant positions at one time than it had had in over a decade.
- North Dakota DOT is currently developing documents related to employee recruitment and retention practices. The agency would like to prepare a hiring document that would ensure consistency by all hiring managers across the state, provide information about opportunities to attend community events as a North Dakota DOT ambassador, and offer training and mentorship information. The agency would also like to begin an employee spotlight feature that highlights an employee's career advancements with the agency.

Table 12 summarizes survey responses.

Table 12. Successful Recruitment and Retention Practices

Practice/Program	State	Description

Advertising on Social Media and Other Online Forums	Alaska, Iowa, North Dakota	*Alaska*: Facebook, Instagram and Twitter.
		Iowa: Gallup platform for employee engagement (retention).
		North Dakota:
		  • **KXNET job board**. In May 2020, began posting all jobs on the KXNET job board, which covers North Dakota, South Dakota, Montana, Wyoming and parts of Minnesota. The agency has received interest from 2,000+ applicants.
		  • **Gallup platform**:
		    ○ In fall 2020, began using Gallup; resources have helped employees/managers transition from remote to in-office work.
		    ○ Training and resources have helped with hiring and retention.

Career Development/ Training Programs	Iowa, Michigan, Minnesota, Missouri	*Iowa*: Supporting a culture of training and development. *Michigan*: Engineering pipeline (developed over several decades) has filled entry-level positions effectively. There is room for growth in diversifying the engineering field however. *Minnesota*: Recruit entry-level positions and interest candidates in public service through: • Engineering programs.

Practice/Program	State	Description
		• Seeds program. • MnROW: Retaining Our Workforce program (see *Related Resources* below). • Phoenix Internship Program (see *Related Resources* below). *Missouri*: Maintenance worker series offers a competitive salary and benefits package, including ample training and development options/career growth opportunities.
External Postings (Recruitment)	Iowa	Maximum opportunity to bring new knowledge to the agency.
Salary/Benefits	Missouri	Maintenance worker series offers a competitive salary and benefits package, including a generous balance of vacation/sick leave.

Related Resources

Minnesota

MnROW: Retaining Our Workforce, Minnesota Department of Transportation, undated.

http://www.dot.state.mn.us/careers/mnrow.html

From the website: Piloted in 2017, MnDOT's Retaining Our Workforce (MnROW) program was established as an internal strategic retention program designed to retain top talent within the department. The mission of MnROW is to retain current career pathway program students throughout the department by providing full-time on the job development positions, making employees highly qualified to compete for permanent positions within MnDOT.

Phoenix Internship Program, Minnesota Department of Transportation, undated.

http://www.dot.state.mn.us/careers/phoenix.html

From the website: The Phoenix Program is a partnership between MnDOT and Project Lead The Way, which provides student jobs and paid internships for high school students enrolled in science, technology, engineering or mathematics courses at area Project Lead the Way high schools.

Recruitment and Retention Challenges

Ten agencies described challenges their agencies have experienced with recruiting and retaining employees. Workforce shortage, competition from the private sector and candidates with inadequate credentials are common barriers. The Iowa DOT respondent noted that the

agency is currently conducting a strength, weakness, opportunity and threat (SWOT) analysis to support both recruitment and retention. Table 13 summarizes survey responses.

Table 13. Recruitment and Retention Challenges

Challenge	State	Description
Diversity Issues	Iowa, Minnesota	*Iowa:* Connecting to diverse communities. *Minnesota*: Diverse applicant pools.
Job Qualifications/ Competencies	Alaska, Iowa, Michigan, Wyoming	*Alaska*: Minimum qualifications for certain jobs. *Iowa*: Quality of candidates (due in part to a change in Iowa DOT's standards of hiring toward competencies that reflect agency desires versus hiring for hard job skills). *Michigan*: Attaining the correct credentials to qualify for positions. *Wyoming*: Work readiness and experience issues.
Location	Alaska, Minnesota	*Alaska:* Positions statewide. *Minnesota*: Positions in rural areas.
Workforce Shortage/ Competition From Private Sector	California, Michigan, Minnesota, Missouri, Montana, New Jersey, North Dakota, Wyoming	*California*: Local government salaries, especially for professional classifications like civil engineer or attorney (recruitment and retention). *Michigan*: • Limited number of people entering the transportation sector. • Private sector flexibility in wages. *Minnesota*: Staying competitive with private sector salaries. *Missouri*: Many jobs have fallen behind market value and are no longer competitive, even with generous benefit offerings. *Montana*: • Workforce shortage in general. • Inability to compete with the private sector. *New Jersey*: Recruiting and retaining automotive and electrical mechanics, who often leave for higher paying positions outside of state government. *North Dakota*: Recruiting engineering technicians and positions in prominent oil field areas. The agency has developed a regional pay differential in those areas to help with hiring and retaining employees. *Wyoming*: • Low application count. • Salary issues.
Other	Montana	Current administration does not allow a flexible work environment.

Recommendations for Employee Outreach Practices

Survey respondents from eight state DOTs provided the following recommendations to transportation agencies seeking to initiate or enhance employee outreach practices:

Alaska

- Offer flexible work schedules or telecommuting.

- Communicate through employee satisfaction surveys.

California

- Leverage social media to increase the breadth of outreach.

- Form strong partnerships with schools and community organizations to develop a pipeline to employment for constituent groups.

Iowa

- Be willing to break down every current process and find the gaps.

- Seek unconventional resources to gather knowledge to support efforts.

Michigan

- Make jobs more accessible by creating greater awareness of DOT jobs at all levels of the pipeline.

- Reduce barriers in position requirements to be more consistent with private sector competitors.

- Advocate for salary increases based on data showing the limited talent pool and average wage data.

Minnesota

- Personalize outreach. Have one-on-one interactions with applicants when possible.

- Educate applicants about the agency and be visible to applicants.

Missouri

- Continue to evolve and adapt to the times in terms of what prospective employees are looking for in an employer.

- Make a concerted effort to listen to existing employees about their wants and needs.

New Jersey

- Develop teams of employees and subject matter experts in the areas recruiting new employees.

- Encourage alumni participation in career fairs.

- Partner with civil rights/affirmative action groups and your communications office to continue to broaden the candidate sourcing list and pool.

- Think of different ways to engage employees. Don't simply rely on your HR recruitment staff to research and be part of your recruitment team.

North Dakota

- Develop larger-scale events, such as Future Leaders, and invite the children and grandchildren of current staff to experience a day in the life of the employees. This practice is a great way to develop interest in the transportation sector at a young age. With continued interest they will be more apt to have a desire to work for that organization.

RELATED RESEARCH

This literature search reviewed relevant domestic publications and resources related to workforce development practices, with a particular focus on the practices and processes used by public agencies. Findings are organized into the following topic areas:

- National programs.

- UTC programs and resources.

- State DOT practices.

- Professional transportation associations.

- Related resources.

National Programs

The following national programs are highlighted below:

- Center for Transportation Workforce Development.

- National Operations Center of Excellence.

- National Network for the Transportation Workforce.

Center for Transportation Workforce Development

Center for Transportation Workforce Development, Federal Highway Administration, undated.

https://www.fhwa.dot.gov/innovativeprograms/centers/workforce_dev/

This center "provides national leadership, coordination and assistance that support initiatives to develop and expand the nation's transportation workforce. From early education through ongoing professional development, the center provides program support, technical assistance and workforce development activities in partnership with federal, state and local agencies, industry organizations, schools, colleges and universities, and other education providers."

Described below are a few of the center's programs and products:

- *Primary/secondary/post-secondary and professional development*. These programs and products are geared to building awareness and interest in future careers in transportation among K-12 students.

- *Garrett A. Morgan Transportation Technology Education Program*. This program improves the preparation of students, particularly women and minorities, in STEM through curriculum development and other activities related to transportation.

- *National Summer Transportation Institutes (NSTI)*. This program serves to increase awareness and stimulate interest in transportation to middle and high school students. NSTI is a two- to four-week STEM-focused program that exposes students to transportation and encourages them to pursue transportation-related courses of study at the college and university level.

- *Fast Forward* is an electronic magazine with career profiles, featured interviews with real-world students and transportation professionals, and information on extracurricular programs and college scholarships.

- *Careers in Transportation Curriculum*. This project provides transportation-focused lesson plans in math, science and social studies that educators can incorporate into existing grade 6-12 courses and curriculums. All lesson plans housed on the site

were developed by teachers for teachers with input from their industry partners and are free for everyone to use.

Other workforce initiatives include the Dwight David Eisenhower Transportation Fellowship Program, which "awards fellowships to students pursuing degrees in transportation-related disciplines."

National Operations Center of Excellence

A partnership of AASHTO, the Institute of Transportation Engineers (ITE) and the Intelligent Transportation Society of America (ITSA) with support from FHWA, the National Operations Center of Excellence (NOCoE) is "designed to offer a suite of resources to serve the transportation systems management and operations (TSMO) community."

The center has two primary components:

- Operations Technical Services Program, funded through contributions from state transportation agencies and FHWA. Current services under development include peer exchange workshops and webinars, ongoing assessments of best practices in the field and on-call assistance.

- Web portal that contains case studies, resources, links, discussion forums and a calendar of TSMO-related events.

The citations below highlight some of the resources available on the NOCoE site.

K-12 Student Education, National Operations Center of Excellence, 2021.

https://transportationops.org/workforce/k-12

From the website:

Educating K-12 students on career opportunities in the field of transportation is essential to improving the workforce.

Several activities are underway throughout the country, ranging from DOT engagement with K-12 students to actual high schools focused developing transportation professionals. A collection of resources below focused on science, technology, engineering, and math (STEM) programs related to transportat[ion]. We are looking to identify more programs and resources for K-12 students that will enable the TSMO workforce.

Among the programs cited here:

- *ITE's STEM Resources* include activities, lessons and projects focused on transportation related STEM projects for K-12.

- *ASCEVille.* With ASCEville.org, ASCE [American Society of Civil Engineers]is helping kids open the floodgate to a deeper exploration of civil engineering through the addition of content specifically focused on many of the project areas in which civil engineers work. Through exploration of easily identifiable structures in their daily lives like dams, bridges, roads and transportation, water systems, sustainability and disaster response, kids will come away with a broader understanding of how civil engineers help find technological solutions to overcome many of the world's most interesting challenges.

Community Colleges, National Operations Center of Excellence, 2021.

https://transportationops.org/workforce/communitycolleges

From the website:

Community colleges provide a crucial role in [the] education [of] TSMO professionals but also have the ability to directly support local, regional, and state DOTs by providing curriculum focused on training current and future TSMO professionals.

The site links to a case study describing the experience of Washtenaw Community College and its collaboration with Michigan DOT, local Michigan road commissions, and the automotive and transportation technology sector to "tackle the short-and long-term workforce needs for diverse technical skills that employers in the region are seeking."

University Education, National Operations Center of Excellence, 2021.

https://transportationops.org/workforce/university

This website notes that "[b]asic training should be developed and offered in-house as part of ongoing professional development. More specialized training can be provided in-house or obtained through outside sources such as professional organizations, universities, or Federal Highway Administration (FHWA) workshops. A strategic approach to TSMO training will require the development of a formal training plan, which will require an investment in time by TSMO management and HR staff to determine the specific and general training needs, sources and associated policies for training. Existing training and certification programs should be used to augment TSMO workforce professional development."

Workforce Training Database, National Operations Center of Excellence, 2021.

https://transportationops.org/training

This searchable database of TSMO industry training and courses allows the user to conduct a simple keyword search or use the advance search to filter results by organization, category, delivery method, mode and fees.

National Network for the Transportation Workforce

The National Network for the Transportation Workforce (NNTW) comprises four regional transportation workforce centers funded by FHWA:

- West Region Transportation Workforce Center, based at Montana State University.

- Northeast Transportation Workforce Center, based at the University of Vermont.

- Southeast Transportation Workforce Center, based at University of Memphis.

- Southwest Transportation Workforce Center, based at California State University, Long Beach .

(A fifth regional center, Midwest Transportation Workforce Center, based at the University of Wisconsin, was established in 2014 but does not appear to be currently functioning.)

As its website indicates, NNTW "is a collaborative of university-based research centers that seek to connect, empower and advance the 21st century transportation workforce through specific research, education and industry engagement. Originally launched through funding by the Federal Highway Administration (FHWA), each NNTW Regional Center team is dedicated to providing a more strategic and efficient approach to transportation workforce development."

Northeast Transportation Workforce Center

The center's website describes the role of University of Vermont's Transportation Research Center (TRC) in the work of this regional workforce center. The TRC began as a UTC and is currently a team member on another UTC, the National Center for Sustainable Transportation. It hosts the Northeastern Transportation Workforce Center, one of five FHWA-funded centers around the country.

Tracking Outcomes in the National Summer Transportation Institute, Glenn McRae and Hannah Ullman, University of Vermont Transportation Research Center, December 2019.

The authors attempted to uncover "definitive evidence" that the National Summer Transportation Institute (NSTI) program, founded in 1993, was meeting its mission ("to promote the Science, Technology, Engineering and Math (STEM) disciplines in transportation—education and career opportunities among middle and high school students, including at-risk youth").

Through this program, "students typically spend between one and four weeks in a program (residential or day) at a host college or university. All U.S. states and territories are eligible to host a program through their U.S. DOT civil rights divisions. The program is currently operated out of FHWA's Center for Transportation Workforce Development."

Researchers identified a number of barriers to determining program success, including the lack of contact lists to track students from middle school and high school into postsecondary education and training, and then on their chosen career path. Possible solutions:

- Conduct a survey or interviews of past students.

- Use social media platforms to stay in contact with past participants. This requires some level of incentives to be effective.

- Sign up NSTI students in the university's "future student" registry.

- Use alumni support programs to develop a welcome program for former NSTI students.

- Align NSTI funding with regional UTCs.

- Maintain a national registry of NSTI participants.

- Develop a regional and national network of NSTI institutions to share resources, experience, curriculum and practices.

Related Resource:

"Effectiveness of a Precollege STEM Outreach Program," Bin (Brenda) Zhou, *Journal of Higher Education Outreach and Engagement*, Vol. 24, No. 3, pages 61-72, December 2020.

https://openjournals.libs.uga.edu/jheoe/article/download/2452/2591/5520

The author examined the NSTI program that uses "an integrated approach to raising participants' awareness of STEM educational and career opportunities" and employs

government agencies, the host university and local professional associations in making "significant contributions to the program development and implementation." The author applied a quantitative approach to examine multiple factors affecting a NSTI program's effectiveness at promoting STEM college education. Selected findings from the study:

- The effectiveness of this outreach program differed based on demographics and satisfaction with the program. Family characteristics played a critical role in participants' perceived benefits from the intervention.

- The participants' overall satisfaction with the program was cited as an "external" influencing factor. Unlike demographic factors, which can take decades to change, the author notes that "[t]his finding provides educators and outreach program directors an opportunity to intervene. Participants' satisfaction is estimated to have a relatively high impact on program effectiveness, which means a small change in this factor can generate a relatively big impact."

The author recommends designing outreach programs "with engaging curriculum activities that match high school students' preferences and learning styles. A challenging yet attractive STEM curriculum is critical to the effectiveness of a precollege outreach program." Written comments from high school participants indicate a particular interest in:

- Hands-on activities.

- Competitive exercises.

- Interactions with professionals that can "inspire high school students and help them develop ideas for future education and career choices."

"I See Myself in That Career": Exploring Methods to Attract the Next Generation Transportation Workforce, Glenn McRae, Marissa McFadden and Hannah Ullman, University of Vermont Transportation Research Center, December 2019.

https://scholarworks.uvm.edu/cgi/viewcontent.cgi?article=1013&context=trc

From the introduction:

This project follows on the long-standing premise behind FHWA and other program investments that increasing awareness of career opportunities is essential to attracting new entrants at an early age, and that awareness building needs to be dynamic. This includes

providing views of who works in the transportation field, what their experiences are, and what they value about their work.

Researchers, noting that "first-person glimpses into transportation careers are just as essential for job seekers as knowing job specs, qualifications, pay scales and opportunities for advancement," developed in-depth career profiles to showcase people from diverse backgrounds and interests engaged in transportation-related work. These profiles are seen as an inducement for students to consider future education and training needed to enter the field. This project sought to "establish a basic pool of profiles that can be marketed to target audiences to determine whether this method achieves the goal of attracting new entrants to the field."

Appendix A, which begins on page 26 of the PDF, includes 14 profiles of people working across 11 different environmental fields in transportation-related work. Each profile includes a question-and-answer section, key information about the job, and a guide to key skills and abilities.

Transportation Job Needs and Priorities Report, Phase 2: Action Plans Northeast Region Plans Northeast Region, Glenn McRae, University of Vermont Transportation Research Center, August 2016.

https://scholarworks.uvm.edu/cgi/viewcontent.cgi?article=1044&context=trc

This report assessed potential workforce programs and partnerships to address workforce gaps and presents five strategic action plans to move workforce development initiatives forward:

- Action Plan 1: Attracting Tomorrow's Workforce Across the Northeast (Toolkit).

- Action Plan 2: Advancing Transportation Career Paths to the Future.

- Action Plan 3: Greener is Better: Promoting and Branding Transportation as a Green Career.

- Action Plan 4: Implementing Succession Planning/KM [knowledge management] to Increase Organizational Resilience: Crafting Strategies and a Handbook.

- Action Plan 5: Upskilling Transportation's Current Workforce to Meet Emerging Challenges and Opportunities.

Action Plan 1: Attracting Tomorrow's Workforce Across the Northeast (Toolkit) begins on page 28 of the report, page 29 of the PDF. The action plan's summary notes that this strategy "will attract new candidates, specifically through the strengthening and promotion of career entry education and awareness programs (e.g., summer institutes, targeted engagement events and realistic job previews (RJPs)). NETWC will advance efforts designed to effectively engage various audiences such as state and local education program directors, teachers, counselors, colleges and graduate schools, professional associations and nontraditional applicants (e.g., women, minorities and veterans)."

The toolkit includes a description of the issues, audiences and an implementation plan with these steps:

- Assemble agency project team.

- Identify and network with partners and vendors in the region.

- Hold planning meetings with partners and vendors.

- Develop marketing materials and realistic job review tool.

- Engage students.

- Collect data.

- Follow up with partners and review quarterly reports with vendors.

Also included are a communication plan, internal and external resources, and examples of effective programs and expected impacts (expected positive outcomes and challenges to consider).

STEM Learning: Transportation: A Natural Vehicle for Integrated STEM Learning, Northeast Transportation Workforce Center, July 2016.

http://netwc.net/stem-learning/

This web page offers access to a webinar sponsored by TRB ABG20 Committee on Education and Training with the National Network for the Transportation Workforce and hosted by the Northeast Transportation Workforce Center that explored STEM learning in programs using a transportation lens through informal educational settings.

Transportation Education Demonstration Pilot Program, Glenn McRae, University of Vermont Transportation Research Center, June 2012.

From the report:

The Transportation Education Development Pilot Program (TEDPP) develops innovative workforce development programs to attract and retain skilled workers in the transportation sector of Vermont, New Hampshire and Maine and encourages statewide economic development by cultivating a well-trained workforce.

The author describes four programs "designed to test new approaches in transportation workforce development and leverage new resources and activities [in] addressing the need to build capacity to meet new and emerging needs in the workforce":

- *Transportation Systems Academy (TSA).* Geared to nontraditional labor pools to provide career awareness and skills training for the transportation industry, this program includes training modules, career pathways and career development information as well as job seeking and workplace skills. The program can be integrated into existing curriculum or programs or combined as a stand-alone program to assist students in gaining "a foundation that will prepare them to be competitive in the job marketplace for positions in transportation operations and maintenance as the first step on a career path."

- *Transportation Systems Institute (TSI).* This program was created to address the needs of incumbent state transportation workers within Vermont, New Hampshire and Maine. Training modules were led by Vermont Technical College professionals and outside experts.

- *Second Careers in Transportation.* As the report notes, this program was "refocused to emphasize positions in the public sector (strategic partner focus) and to employ the training/education rubric of the TSA (same program, different audiences) to help bridge both unskilled older workers into the field and to place a specific emphasis on reaching out [to] [v]eterans as a community of second career seekers even though many of them are in a younger age bracket."

- *Community College.* The report discusses efforts under this program to develop and launch a new associated degree program in Applied Business Operations, with a track in Transportation Systems, as part of increasing the career pathway infrastructure needed in Vermont and testing a model for other systems.

Among the lessons learned:

- Capacity for new distinct programs is very limited.

- To be sustainable programs need to have a foundation that extends across multiple industries/fields and not just focus on transportation.

- Programs will be successful if they are developed as part of strategic partnerships.

Note: As the TRC's current website indicates, the end of the TEDPP led to the consolidation of FHWA's workforce efforts into the [Center for Transportation Workforce Development](#) and the creation of five regional surface transportation workforce centers under the auspices of the [National Network for the Transportation Workforce](#). TRC was chosen to host the [Northeast Transportation Workforce Center](#).

Southeast Transportation Workforce Center

Education, Southeast Transportation Workforce Center (SETWC), The University of Memphis, December 2019.

https://www.memphis.edu/setwc/education/index.php

From the website:

As part of the mission of SETWC, we will be engaging regional education partners[,] including K-12, technical programs, community colleges and universities[,] to:

- Compile a list of transportation-related education programs in the region,

- Identify effective practices for recruiting students to transportation fields,

- Identify gaps and areas of need for workforce demands,

- Facilitate partnerships to address gaps, and

- Align the transportation workforce pipeline efforts and programming to regional job needs and priorities.

T-STEM Academy at East High School

The Southeast Transportation Workforce Center (SETWC) was instrumental in launching and continues supporting a Transportation-STEM (T-STEM) focused blueprint through an exemplar high school in the Memphis area as one of the priority action items identified in the SETWC strategic plan. The vision is that this school and its collaborative

partnerships will become a local, regional and national example for preparing students for STEM careers, with particular focus on the transportation industry. The T-STEM model will serve as a platform for truly transformational educational experiences for students that prepare them to be successful in postsecondary career and educational endeavors.

An [undated brochure](#) provides more information about the T-STEM Academy.

Empowering the New Mobility Workforce: Educating, Training and Inspiring Future Transportation Professionals, Tyler Reeb, Editor, Elsevier, Inc., 2019.

https://socialinnovation.usc.edu/wp-content/uploads/2019/09/Reeb-1631682.pdf

Edited by the associate director of the Southwest Transportation Workforce Center, this book compiles contributions by a range of authors examining critical issues in workforce development. In the fourth and last part, Stephanie Ivey, director of the Southeast Transportation Workforce Center, writes about inspiring the next generation mobility workforce through innovative industry–academia partnerships (see page 317 of the book, page 356 of the PDF).

Programs highlighted in Ivey's discussion include:

MacGillivray Freeman's Dream Big: Engineering Our World, MacGillivray Freeman Films, 2016.

https://dreambigfilm.com/

From the website:

The project is so big, it is more than a movie—it's part of a movement aimed at bringing engineering into the forefront of our culture. *Dream Big* is the first giant-screen film to answer the call of the STEM (Science, Technology, Engineering, Math) initiative, which aims to inspire kids of diverse backgrounds to become the innovators who will improve the lives of people across our entire planet as we head into the 21st Century and beyond. That's why the film will be accompanied by ongoing educational, museum and community efforts to expose young people from all backgrounds to what engineering is…and what it can conjure in the world.

An [educator guide and lesson plans](#) include multidisciplinary activities for students in grades K–12 and have been written to meet Next Generation Science Standards and common state science objectives. Each lesson presents students with an engineering challenge inspired

by the work of real engineers and can be used to help introduce the engineering mindset to the classroom or home.

Transportation Spotlights, Southeast Transportation Workforce Center, undated.

https://www.memphis.edu/setwc/transpospotlight.pdf

From the document:

Transportation Spotlights are an initiative of the Southeast Transportation Workforce Center to showcase professionals from a variety of transportation occupations. The Spotlights are intended to demonstrate diversity—in career path, gender, ethnicity, level of experience—such that students understand that the transportation industry provides an opportunity for people from every background and area of interest to make an impact in our society.

A few Spotlight examples:

- Keith Williams, District Traffic Engineer, Pennsylvania DOT

- Kayla Holcomb, Transportation Operations Specialist, Gannett Fleming

- Calvin Abram, Office of Community Transportation, Tennessee DOT

Girls Experiencing Engineering (GEE), The University of Memphis, last updated August 2019.

https://www.memphis.edu/gee/whatisgee/index.php

From the website: The primary goal of the GEE Program is to increase the number of girls pursuing careers in STEM fields by offering female middle school and high school students an opportunity to increase their awareness and interest levels regarding existing and potential opportunities in the fields of mathematics, science, and engineering. Students have the opportunity to participate in general engineering sessions as well as focus sessions (discipline specific), with program material rotating each summer to accommodate repeat participants. Secondarily, the program seeks to create a broader impact by providing high school and middle school science and math teachers with new pedagogical methods and tools for use in their classrooms through online resources and training workshops and by providing high school girls with leadership training and practice opportunities through peer mentoring. Finally, the program includes a goal of broadening knowledge of participants' parents about career opportunities in engineering through parent orientation sessions.

Women and Girls in Transportation Initiative (WITI), U.S. Department of Transportation, last updated September 2019.

https://www.transportation.gov/osdbu/women-and-girls

This internship program for women from colleges and universities across the country are offered with the mission to "increase the participation of women in the transportation industry and prepare young women to become our nation's future leaders by creating ladders of opportunity and small business' economic competitiveness through careers, partnerships, strategic partnerships and education."

National Transportation Career Pathways Initiative

This national career pathway program was the result of an FHWA grant that tasked the five regional National Network for the Transportation Workforce centers with launching demonstration programs focused on five strategic disciplines: planning, environment, operations, engineering and safety. As a press release noted at the time the program kicked off in October 2016, the goal behind the career pathway demonstrations is to engage postsecondary students to choose transportation career paths and to gain critical skills identified by industry and employers.

National Transportation Career Pathways Initiative, Final Project Report, National Network for the Transportation Workforce, February 2019.

https://www.nntw.org/wp-content/uploads/2020/04/NTCPI-Year-Two-Report-final.pdf

This report includes two implementation plans of particular interest for this project:

Discipline: Transportation Operations

Program: Attracting Next Gen Transportation Operations Professionals

Description: Deploy web-based interactive career portal that promotes operations and operations professionals. Design and deploy experiential learning projects for integration into K-16 curriculum.

Discipline: Transportation Engineering

Program: Advancing Apprenticeship in Highway Maintenance and Engineering

Description: Facilitate, document and nationally promote a highway maintenance apprenticeship program. Connect apprenticeship to associate degree program for credit articulation.

University Transportation Center Programs and Resources

Resources and programs associated with the following organizations appear below:

- Council of University Transportation Centers.

- National Institute for Transportation and Communities.

- NEXTRANS Center.

- Southeastern Transportation Research, Innovation, Development and Education Center.

- Transportation Consortium of South-Central States.

Council of University Transportation Centers

National Transportation Workforce Summit: Summary of Results; Framework for Action, Council of University Transportation Centers, 2012.

http://netwc.net/wp-content/uploads/2018/02/NTWS_Summary_of_Results1.pdf

Results of this summit include a collaboratively developed Framework for Action that includes the following goals:

- Matching curriculum with transportation industry needs.

- Increasing transportation degree, credit and skill portability.

- Improving student readiness for the transportation workforce.

Each goal includes a description of the challenge, a strategy for addressing it, action items and the parties involved in implementation.

National Institute for Transportation and Communities

In addition to providing curricula and programs for K-12 students, this UTC also provides resources, including fellowships, and supports transportation-related student groups at university partner campuses. These groups offer student development by hosting guest speakers, taking field trips, attending conferences and participating in social and professional events.

Transportation STEM Resources for K-12 Education, National Institute for Transportation and Communities, 2021.

https://nitc.trec.pdx.edu/events/k-12

From the website:

Through funding new curriculum and engaging with community partners on STEM education, we seek to introduce students to transportation concepts and careers at an early age. Additional focus is placed on increasing the number of women and Black, Indigeneous and people of color in the transportation profession by attracting and retaining those students to transportation-related degree programs.

The site notes that in addition to education and outreach programs for grade school, middle school and high school students, the center also "invest[s] funding and expertise into the development of new K-12 transportation curriculum that can be used by educators." Links to curricula suitable for grades 3-5, 6-12, 8-12 and 9-12 are provided with a notation about terms of use.

NEXTRANS Center

NEXTRANS Center operated as the Region 5 UTC serving Illinois, Indiana, Ohio, Michigan, Minnesota and Wisconsin.

Region V Transportation Workforce Assessment and Summit, Teresa Adams and Maria Hart, NEXTRANS, May 2017.

https://www.purdue.edu/discoverypark/nextrans/assets/pdfs/142UWY2-2__Summary%20and%20Final%20Technical%20Report.pdf

From the report's technical summary:

Findings

1. The outcome of K-12 investments to promote transportation career awareness [is] unknown. A collective impact strategy is needed to bring stakeholders together around a common mission and common performance measures. The collective impact strategy has been successful in other sectors.

2. The transportation sector invests in training programs without fulfilling personal or organizational workforce development goals because most programs are not

credentialed or stackable. One strategy for developing and retaining the transportation workforce is to create career pathways. Pathways are usually geared for a specific population in a certain geographic area. Transportation agencies that work with educational partners to identify career pathways into and within the organization will retain their workforce longer.

3. Many participants of the Regional Summit expressed concerns over how difficult it is to market transportation jobs to younger generations who might think of the occupations as low tech or with limited advancement opportunity. The industry must reach out to schools, minorities, women and returning citizens with targeted messages that promote the industry and remove the stigma and misconceptions about transportation jobs.

Recommendations

1. USDOT [could] partner with USDOL [U.S. Department of Labor] to ensure that emerging occupations within the departments are reflected in the SOC [Standard Occupational Classification] system.

2. Education, internship and apprenticeship programs will be necessary to bring future transportation workers up to speed with new technological advances in their positions. Transportation agencies should take advantage of apprenticeship models to attract and retain skilled workers.

Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE)

The July 2019 publication cited below provides this description of the STRIDE mission:

The mission of the U.S. DOT University Transportation Centers (UTC) Program is to advance the state of the art in transportation research and technology, and to develop the next generation of transportation professionals. STRIDE, in its efforts to achieve this mission, seeks to fund projects that engage K-12 students—especially females and underserved/rural populations—to expand their knowledge of and encourage interest in transportation careers.

K-12 Workforce Development and Technical Transfer Activities, K-12 Final Report, Eugene Murray, James B. Martin and Brittany Gaustad, Southeastern Transportation Research, Innovation, Development and Education Center, July 2019.

This report describes the development of four K-12 proposals for STRIDE funding that "focus on conducting a variety of activities to improve connections for middle and high school age students between their science, technology, engineering and math (STEM) topics in the classroom and the application of these topics in the transportation industry." Below is a brief description of each proposal:

WTS Transportation YOU Activities for Middle and High School Girls (see page 13)

North Carolina State University's Institute for Transportation Research and Education (NCSU ITRE) and the NC Triangle chapter of the Women's Transportation Seminar (WTS), with support from the NC Department of Transportation, propose working together on an educational project for middle and high school age girls. This project would build on an existing WTS program to expand its reach beyond the local chapter area and impact students in communities across the state.

NCSSM Learning Modules (see page 26)

NC State University's Institute for Transportation Research and Education (NCSU ITRE) and the North Carolina School of Science and Mathematics (NCSSM), with support from the NC Department of Transportation (NCDOT), propose working together to develop transportation-focused learning modules for high school-level engineering, computer science and mathematics courses. Through the modules students will learn and practice critical thinking and problem-solving using real-world transportation data and scenarios, while also gaining awareness of transportation issues and impacts. As the students pursue STEM-related degrees in colleges and universities, their experience with the learning modules may inspire some to consider careers in transportation.

Support for NCDOT Summer Transportation Institute Programs (see page 47)

The NC Department of Transportation (NCDOT) has several educational programs for middle and high school students across the state—and especially for students from rural and underserved populations—to help bring greater awareness to careers in transportation. One such program is the *National Summer Transportation Institute* (NSTI). NC State University's Institute for Transportation Research and Education (NCSU ITRE) and NCDOT propose

working together to bring additional resources to the state's NSTI host sites and enhance the students' learning experience.

NCDOT Construction Career Days (see page 59)

The NC Department of Transportation (NCDOT) has several educational programs for middle and high school students across the state—and especially for students from rural and underserved populations—to help bring greater awareness to careers in transportation. One such program is the NCDOT Construction Career Days events. NCDOT and NC State University's Institute for Transportation Research and Education (NCSU ITRE) propose to develop new skill-based, problem-solving activities for these events.

UF Workforce Development Efforts, Leslie D. Washburn, Southeastern Transportation Research, Innovation, Development and Education Center, June 2014.

https://stride.ce.ufl.edu/wp-content/uploads/2017/03/Washburn-UF-Workforce-final-report.pdf

This report describes three K-12 outreach activities planned for STRIDE that engaged participants from the University of Florida Transportation Institute (UFTI):

- *LEGO Robot Vehicle Lesson Plans for Secondary Education*: UFTI used the Introduction to Transportation curriculum developed at the University of Florida for students in grades 5-8 in local schools, afterschool programs and summer camps. Students learned various fundamentals of transportation engineering and how the use of advanced technology is integral to solving current and future transportation problems.

- *Transportation Career Day*: Designed to introduce high school-age students to transportation careers, the daylong event featured a presentation, lab tour and hands-on traffic simulation exercise.

- *Family Engineering Events*: UFTI hosted an informal engineering education program at local elementary schools to team up children ages 7-12 and their parents or caregivers to experience fun, hands-on engineering activities.

Other outreach efforts addressed in this publication include:

- GatorTRAX, a university student run organization that hosts engineering and math workshops for K-12 students.

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- Cade Museum for Creativity and Innovation in Gainesville, which provides hands-on classes and labs that focus thematic-based learning using inventors and inventions to teach and inspire creativity in the next generation. UFTI partnered with the Cade Museum to provide workshops not only with the LEGO robotic curriculum, but also with newly developed straw bridge challenge, roller coaster design challenge and engineering day curricula.

Transportation Consortium of South-Central States (Tran-SET)

Tran-SET is AASHTO Region 6's UTC, a "collaborative partnership between nine major institutions and two community colleges across five states (Arkansas, Louisiana, New Mexico, Oklahoma and Texas)."

Recruiting, Retaining and Promoting for Careers at Transportation Agencies, Christofer Harper, Susan Bogus Halter, Raghava Kommalapati and Doeun Choe, U.S. Department of Transportation Research and Innovative Technology Administration, December 2018. https://digitalcommons.lsu.edu/cgi/viewcontent.cgi?article=1019&context=transet_pubs

Researchers examined the practices to recruit, train and retain qualified employees at state DOTs primarily from AASHTO Region 6. Using the results of a literature review and survey, researchers developed a recommended list of best practices for recruiting and retaining DOT employees that included increased social media presence, quantification of overall benefit packages, implementation of flexible work schedules and telecommuting, clarification and restructuring of the promotions and incentives process, and increased communication and feedback between staff and management.

Educational Outreach

The research effort included a series of educational outreach activities, including:

- Prairie View A&M University (PVAMU) offered K-5 students a half-day transportation workshop at a local community college that included a "brief and engaging presentation" followed by hands-on activities.

- PVAMU focused on incoming freshman interested in engineering programs with its five-week Summer Bridge Programs intended to prepare students for the rigor of pursuing a STEM major. The research team developed three modules that focus on transportation-related hands-on activities for the 2018 summer program.

- University of New Mexico engaged high school students with their participation in the university's [Summer Transportation Institute](). The institute's programs are "designed to encourage and help prepare students to pursue college-level studies and careers in engineering and STEM related fields."

AASHTO Outreach Programs

The research team also considered using AASHTO's [TRAC]() (Transportation and Civil Engineering) and [RIDES]() (Roadways in Developing Elementary Students) educational outreach programs. These programs are described on the AASHTO website as offering hands-on activities that "introduce students in grades K-12 to the work world of transportation and civil engineering and inspire them to consider careers in those fields. Both programs are aligned with national standards and are currently being aligned with the Core Curriculum Standards of Learning."

TRAC's eight modules engage students in designing bridges, building magnetic-levitation trains, planning a city, programming automated vehicles and learning about environmental issues that impact transportation. State DOTs work with schools in their state to provide the curricula, resources and speakers to teach a hands-on activity and/or talk to students about the importance of math and science in preparing for their future.

State Department of Transportation Practices

Programs and practices of the following state DOTs are highlighted below:

- Multiple states.

- Georgia.

- Michigan.

- Minnesota.

- Missouri.

- North Carolina.

- Utah.

- West Virginia.

Citations for publications addressing external outreach practices are presented below, followed by resources that examine agency practices to reach out to current employees.

External Outreach

Multiple States

"The Partnership of University, Industry and K-12 Schools to Improve Awareness of STEM Fields," Rajarajan Subramanian and Shirley Clark, *2016 ASEE Mid-Atlantic Section Conference*, October 2016.

https://www.hofstra.edu/pdf/academics/colleges/seas/asee-fall-2016/asee-midatlantic-f2016-subramanian.pdf

The authors present seven case studies that illustrate partnerships among universities, public agencies, industries and K-12 schools to expand the knowledge of STEM in students, with a focus on programs officially affiliated with the state DOT. Included is a case study of state DOT involvement in STEM programs.

Student participation. Researchers examined 87 programs with participation from 33 state transportation agencies or divisions of the agencies:

- 14 of the 87 programs (18%): Elementary school students (grades K-5).

- 33 (42%): Middle school students (grades 6-8).

- 59 (75%): High school students (grades 9-12).

Some programs invite a mix of these students to participate.

Program duration varies from a few hours to more than six months, with a significant proportion of the programs (37%) running from two to four weeks. These programs usually occur over the summer months.

Partners. Most programs involved more than one partner organization with the highest representation from research institutions (UTCs), universities and colleges.

Financial support. More than half of the programs receive some financial support from the DOT

involved, with 9% receiving in-kind support; another 9% receive financial support directly from the federal government through U.S. DOT.

Most common program. Among state DOTs, the [National Summer Transportation Institute (NSTI)](#) is the most commonly supported STEM program. The authors describe the state agency's role as "support[ing] host sites to implement Summer Transportation Institutes (STIs) as a free, two- to four-week, residential or nonresidential program and FHWA Division offices oversee the program." Host sites are typically universities or research centers. Funding grants are provided from the FHWA through the state DOT, though NSTI programs can also be supported by other sponsors. A state DOT may support more than one NSTI host site.

Georgia

STEM and Our Future Transportation Leaders, Adjo Amekudzi-Kennedy, Margaret-Avis Akofio-Sowah, Stefanie Brodie, Yanzhi (Ann) Xu, Audrey Leous and Valerie Curtis, Georgia Department of Transportation, February 2016.

https://rosap.ntl.bts.gov/view/dot/31067/dot_31067_DS1.pdf?

The authors examined DOT involvement in STEM programs through a literature search and an online survey of agencies that have hosted STEM outreach programs. Included is a discussion of the following programs:

- Summer Transportation Institute ([Caltrans](#)) (see page 10 of the report, page 26 of the PDF).

- AASHTO TRAC and RIDES program (Louisiana) (see page 12 of the report, page 28 of the PDF).

- Internship and shadow programs ([MnDOT Phoenix Internship Program](#)) (see page 13 of the report, page 29 of the PDF).

- One-day STEM awareness workshops (various examples) (see page 14 of the report, page 30 of the PDF).

- Speakers bureau ([Kentucky Engineering Exposure Network (KEEN)](#)) (see page 15 of the report, page 31 of the PDF).

Key findings include:

- Over 40% of state DOTs are involved in K-12 STEM outreach programs. These programs are most commonly residential or nonresidential summer programs, teacher training and curriculum development programs, internship and shadow

opportunities, one-day STEM awareness events and periodic employee visits to schools to present on transportation and STEM.

- Agencies will benefit from including both longer- and shorter-term alternatives in their STEM programming to cultivate STEM efficacy and build long-term relationships with a smaller percentage of students while increasing STEM awareness broadly among K-12 students.

- Strategic programming will contribute to developing a pool of students for future recruitment to replenish the transportation workforce, while enhancing STEM culture within the agency.

Implementation recommendations include developing a how-to manual that supports the implementation of an agencywide STEM Outreach Program composed of at least one long-duration program (two to four weeks) and one short-duration program (one day). Elements of the manual are expected to include:

- Specific details on who would champion and coordinate various aspects of the program.

- Where various program elements can be most effectively housed within the agency, including the districts.

- What mechanisms can be used in soliciting employee volunteers, for example, what incentives aligned with the agency's personnel-related strategic goal can be used to promote employee participation.

- Appropriate metrics for demonstrating progress toward achieving the strategic goal.

- Where supporting educational resources can be found for different program elements.

- Funding sources with application deadlines.

- Specific strategies that have been applied to sustain STEM programs effectively in best practice state DOTs.

Michigan

Youth Development and Mentoring Program (YDMP), Michigan Department of Transportation, 2021.

From the website: The mission of the Michigan Department of Transportation Youth Development and Mentoring Program (YDMP), in partnership with the Federal Highway Administration (FHWA), is to prepare a diverse workforce for the future by providing participants with opportunities to pursue higher education, personal growth and exposure to transportation careers. The program values responsibility, empowerment, respect, integrity, relationship building and safety. MDOT offers mentoring activities and sessions to teach job and life skills, introduce college/university options, and present high school students and recent high school graduates with information about careers in civil engineering, road construction and maintenance, planning and other areas of transportation.

Minnesota

Phoenix Internship Program: Student Internships for High School Students, Minnesota Department of Transportation, undated.

http://www.dot.state.mn.us/careers/phoenix.html

From the website: The Phoenix Program is a partnership between MnDOT and Project Lead The Way which provides student jobs and paid internships for high school students enrolled in science, technology, engineering or mathematics courses at area Project Lead the Way high schools.

The program also partners with local youth employment organizations including Step Up: Achieve, Right Track, and EMERGE. Students who do not attend a Project Lead the Way school but are participating in one of our other partner programs are also eligible for the program.

Please note: If there are no project lead the way schools in or near a MnDOT district, students interested in STEM related careers and students who attend schools that include advanced STEM curriculum are also eligible for the program.

By working at various MnDOT offices and districts statewide, Phoenix interns students gain on-the-job work experience in a variety of areas.

STEM Education and Outreach, Minnesota Department of Transportation, undated.

http://www.dot.state.mn.us/stem/

From the website:

The Minnesota Department of Transportation recognizes the need to develop a diverse and talented workforce to fulfill our vision of creating a safe, efficient and sustainable transportation system for the future. Our goal is to provide high quality activities and initiatives to help promote science, technology, engineering and mathematics from kindergarten through postsecondary education.

Our main focus areas include:

- Promoting the Bridge UP! curriculum to all interested teachers, students, parents and beyond.

- Providing support to school districts to implement the Bridge UP! curriculum.

- Building relationships with K-12 and postsecondary schools across the state.

- Encouraging and mentoring the next generation of civil engineers and technicians.

- STEM program.

Other links on the site include the following:

- Free at-home/classroom activities and resources. Provides an assortment of educational activities and resources available for students or children.

- Careers at MnDOT. Explores MnDOT professional career paths, student programming and job openings and provides resources to create resumes and applications, and prepare for interviews.

Learn more about the Bridge UP! curriculum and MnDOT's involvement in STEM outreach with this short video.

North Carolina

Developing a School to Transportation Workforce Pipeline in North Carolina, Terry Regan, North Carolina Department of Transportation, December 2019.

https://www.ncdot.gov/about-us/board-offices/offices/hbcu/Documents/hbcu-school-to-work.pdf

This report focuses on actions that can be taken by North Carolina DOT (NCDOT) to "catalyz[e] a minority student-focused school-to-career pipeline program." Below are recommended actions (from page 2 of the report, page 4 of the PDF):

Recommendations for Existing NCDOT Programming:

1. Expand existing NCDOT K-12 programs such as DOT Volunteers and Construction Career Days to include a broader range of transportation-related skills such as transportation planning, operations, computer science, finance, etc.

2. Develop communications materials that help students and educators explicitly connect each relevant degree program with transportation programs. NCDOT should keep lists of historically Black colleges and universities (HBCUs)/minority serving institution (MSI) career fairs and related opportunities and schedule class visits to help students put a face to transportation careers, answer their questions, etc.

3. Consider integrating innovation concepts and challenges into existing National Summer Transportation Institutes.

4. Consider incorporating "in-service training" during internship program to help students contextualize transportation careers as making a difference in their communities, using national best practices described in this report as a model.

5. Consider partnering with HBCUs/MSIs to carry out statutorily-required public engagement efforts, planning exercises, etc., on behalf of NCDOT. These institutions are members of the communities where NCDOT is completing state transportation projects and would be good ambassadors on behalf of the DOT, while at the same time providing students and professors real world experience in non-engineering transportation projects.

6. Develop opportunities for HBCU students who are already engaged with NCDOT through internships or other programming to become "transportation ambassadors" to K-12 classrooms.

New Programs to Consider:

1. Programming for middle and high school students to expose them to emerging transportation technology, innovation, and entrepreneurship such as drone delivery technologies or transportation and logistics-focused small businesses.

2. Explore a partnership with the Carolina Small Business Development fund campus incubators, which are already located at several North Carolina HBCU campuses.

3. Establish an Alumni Network for graduates of NCDOT's student programming. Keep in contact with these students through a listserv and social media channels to continue engagement with them as they develop their career trajectories.

4. Articulate skill sets NCDOT finds most desirable in new hires (data analysis, entrepreneurship, environmental stewardship, computer science, etc.) and partner with HBCUs/MSI which have corresponding degree programs at HBCUs/MSI in the state and work with professors and staff in that department to incorporate transportation content in the curriculum.

West Virginia

West Virginia Bridge Design and Build Contest, West Virginia Division of Highways, BridgeWalk, and West Virginia Department of Education, 2020.

https://wvbridgedesignandbuildcontest.com/

From the website: The West Virginia Bridge Design and Build Contest is a statewide contest intended to conduct outreach to middle school and high school students in the area of civil engineering. The contest primarily covers bridge design, but teams invited to the Finals will also have the opportunity to compete in a bridge building contest.

Internal Outreach

Missouri

Personal Growth Opportunities, Human Resources, Missouri Department of Transportation, 2020.

https://www.modot.org/personal-growth-opportunities

Four Missouri DOT career development offerings are described. *From the webpage*:

- *MoDOT U*: MoDOT U is a Learning Management System. This system allows employees to keep track of training they have completed. MoDOT U also contains over 1,600 online courses that any employee can access directly in the system. The course topics range from soft skills (like communication, leadership and time

management) to more technical skills (like Microsoft Word/Excel, and a wide variety of safety topics).

- *MO Learning*: MO Learning is a world-class online training platform powered by LinkedIn Learning. There are over 7,400 high-quality courses that vary in topics. Some of the course topics include soft skills, software and personal wellness.

- *Professional Development Institute*: The Professional Development Institute (PDI) is a self-paced development program designed to help professional-level employees (typically SG11-16) to be well-rounded and have greater organizational awareness. The ultimate goal of PDI is to enhance participants' business, interpersonal and professional skills through high-quality curriculum, live webinars, networking and group discussion.

- *Mentoring Program*: MoDOT's mentoring program is designed to positively impact the lives of its employees by providing support and learning opportunities that will promote professional development for a diversified and talented workforce. This self-guided program provides employees with career guidance and support through the establishment of formal mentorships. Feel free to take it at your own pace, but remember you will only get out what you put in.

Accelerated Professional Engineering Cross Training, Human Resources, Missouri Department of Transportation, 2020.

https://www.modot.org/cross-training-opportunities

From the website: The Accelerated Professional Engineering Cross Training (APEX) Program was created to accelerate the development and maximize the potential of professional engineering employees through a rotational cross-training program. Employees selected for participation in this program will be rotated through various divisions to enhance their professional and leadership development.

Mentoring Program, Equal Opportunity and Diversity, Missouri Department of Transportation, 2020.

https://www.modot.org/mentoring-program

From the website:

What is a Mentorship?

A mentorship is a nurturing relationship between two MoDOT [Missouri DOT] employees, where one person invests time, energy and personal knowledge in assisting the growth and development of another person.

The mentorship requires the mentor and mentee to work together to reach specific goals and to provide sufficient feedback to ensure that the goals are reached.

It can include formal and informal elements, such as written goals and scheduled meeting times or an occasional chat or email exchange.

Purpose:

- Acclimates new employees to MoDOT culture and values.

- Provides networking opportunities.

- Focuses on short- and long-term professional development goals.

- Focuses on professional development that may cross job boundaries outside a mentee's area of work.

- Creates a continuous learning environment to ensure leadership succession.

- Improves recruitment and retention of highly skilled professionals.

- Creates higher job satisfaction.

Utah

Mentoring, Utah Department of Transportation, undated.

https://site.utah.gov/connect/employee-resources/employee-training/mentoring/

From the website: The goal of UDOT's [Utah DOT's] mentoring program is to connect people with continuous learning opportunities.

The major function of the Mentoring Program is to promote the mentee's career and personal development, facilitating continuous improvement. It also serves as a culture-building tool aimed at sharing best practices, transferring institutional knowledge and creating a network of interpersonal relationships across the organization.

Any UDOT employee may participate in the mentoring program as a mentor or mentee. The program is open to all employees including regions, admin[istration], TOC [traffic operations center], Motor Carrier and other divisions.

Professional Transportation Associations

Technical Resources: Science Technology Engineering and Math (STEM) Resources, Institute of Transportation Engineers, undated.

https://www.ite.org/technical-resources/councils/transportation-education-council/science-technology-engineering-and-math-stem-resources/

From the website: The ITE [Institute of Transportation Engineers] STEM Committee has developed and curated K-12 outreach resources that are relevant to the transportation industry and the broader STEM community.

Click on a link below to go to a specific STEM Resource section:

- ITE Member Videos for National Engineers Week and Introduce a Girl to Engineering Day.

- K-12 Transportation-Related STEM Activities.

- K-12 Outreach Presentations/Templates.

- Information About Transportation Careers.

- Resources on Introducing Kids to Engineering.

- Additional K-12 STEM Outreach Resources.

- Featured ITE STEM Committee Activities.

Related Resources

External Outreach

Transportation Workforce of the Future, *TR News*, Number 323, September/October 2019.

http://onlinepubs.trb.org/onlinepubs/trnews/trnews323.pdf

This thematic issue of *TR News* includes a range of articles addressing workforce development. Among them:

- Help Wanted: People, Organizations, Jobs and Businesses for Tomorrow's Transportation (page 3).

- View from the Top: The Future Multimodal Workforce (page 6).

- How to Win the War for Talent (page 16).

- Building a Business Case for Increasing Diversity in the Transportation Workforce (page 22).

- The Future Is Now: Transportation Agencies and Their Capabilities (page 28).

- Job Openings for Transportation System Management and Operations: Delivering TSMO Services (page 32).

- Maintaining the System: Defining Routes for Advancement for the Highway Maintenance Workforce (page 38).

Internal Outreach

"Factors Affecting Workforce Resilience in Public Transportation Agencies," Kristal Metro, Christofer Harper and Susan M. Bogus, *Journal of Management in Engineering*, Vol. 37, Issue 4, July 2021.

Citation at https://ascelibrary.org/doi/10.1061/(ASCE)ME.1943-5479.0000920

From the abstract: Ensuring the resiliency of a nation's transportation infrastructure network requires a skilled and dependable workforce; this relies heavily on a transportation agency's ability to recruit and retain their employees. Public transportation agencies face unprecedented challenges in preserving the workforce necessary to function effectively and need robust strategies to maintain workforce resiliency by recruiting and retaining quality staff to construct and maintain transportation infrastructure now and into the future. This study identified existing workforce issues and recruitment and retention practices by state [d]epartments of [t]ransportation (DOTs) and compared rural and urban transportation employee outlooks. Results indicated that the primary incentives for current DOT employees to consider private-sector employment are better salary and promotional opportunities. Additionally, rural DOT regions have a more difficult time recruiting and retaining employees, and rural DOT employees feel that DOTs are not fully aware of their needs. This study contributes to the body of knowledge by providing a means to assess and ultimately improve workforce resiliency in public

transportation agencies, thereby allowing management to maintain transportation infrastructure successfully.

NCHRP Synthesis 543: Transportation Workforce Planning and Development Strategies, Robert Puentes, Alice Grossman, Brianne Eby and Alex Bond, 2019.

Publication available at https://www.nap.edu/download/25624

The report summary notes that there "is no standard definition or understanding about workforce development" but researchers did identify a recurring theme: a focus on training and skills. Case examples "present a snapshot of the organization or functional unit, highlighting its activities related to the workforce in that state." Below are summaries of the case examples included in the report:

- The **Ohio Office of Local Programs/LTAP Center** uses a sophisticated training evaluation model for postcourse 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 [two]-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 [three]-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.

The authors recommended future efforts 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 nonpersonal 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."

Advances In Developing A Cross-Trained Workforce, NCHRP Project 20 68A, Scan 13-01, August 2016.

http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-68A_13-01.pdf

This project investigated the use of transportation workforce cross-training (CT) to enhance agency "efficiency and agility in adapting to changing missions, priorities and budgets, and conditions under which CT strategies are applicable and appropriate." *From the conclusions and recommendations*:

- TDOT [Tennessee DOT] cross-trained employees of regional construction and maintenance divisions to consolidate forces.

- ConnDOT [Connecticut DOT] pairs bridge designers with inspectors. This experience informs designers about when and where maintenance and repairs occur in the project life cycle and teaches designers how to design mitigations based on an understanding of inspector reports.

- Iowa DOT developed a Shared Worker Program after experiencing a significant downsizing in 2001/2002.

- MoDOT [Missouri DOT] has an accelerated Professional Engineers (PE) CT Program, which has a duration of one year and is open to engineers in training who have been with the department for three to five years.

- Ohio DOT used CT to augment construction knowledge, skills and abilities and incorporated a blend of maintenance and construction duties into one classification series.

- Oregon DOT has effectively rotated right-of-way employees into different areas of its program to provide experience that prepares them to take over critical positions as they become open.

- UDOT [Utah DOT] implemented CT in 2004 for all maintenance and construction working levels and maintenance and construction engineers at the regional level.

- At VDOT [Virginia DOT], supervisors focus on addressing needs for continuity of operations.

NCHRP Report 685: Strategies to Attract and Retain a Capable Transportation Workforce, Brian Cronin, Lance Anderson, Beth Heinen, Candace Blair Cronin, Daniel Fien-Helfman and Marie Venner, 2011.

Publication available at https://www.nap.edu/download/14475

From the foreword: Under NCHRP Project 20-81 "Guide to Implementing Strategies to Attract and Retain a Capable Transportation Workforce," a team led by ICF International conducted a thorough review of relevant literature and current practices, convened focus groups to benchmark best practices and practical tools, and conducted in-depth case study analysis of 25 promising recruitment and retention programs. An introductory chapter explains how the

guidebook was designed, how the separate chapters relate to each other, and how users can maximize the complex and multidimensional nature of the information and resources provided.

Supplemental materials are available on the TRB website at http://www.trb.org/Main/Blurbs/164747.aspx with full case summary details of the practices identified in the guidelines, as well as one-page implementation checklists that quickly show the purpose and intended audience for each practice.

The survey below was distributed to members of the AASHTO Committee on Human Resources.

(Required) Does your agency engage in outreach practices, methods and programs to elicit interest among students and others in future employment with your agency?

Response Options:

- No, and we have no plans to do so. (Directed the respondent to the **Agencies Not Engaging in Employee Recruitment Outreach** section of the survey.)

- No, but we have plans to do so. (Directed the respondent to the **Agencies Considering Engaging in Employee Recruitment Outreach** section of the survey.)

- Yes, we have engaged in outreach practices to interest students and other job candidates. (Directed the respondent to the **Current Outreach Practices** section of the survey and the sections that follow it.)

Agencies Not Engaging in Employee Recruitment Outreach

Employee Recruitment

1. Please briefly describe why your agency has not implemented practices to recruit new employees.

2. If your agency were to actively reach out to potential new employees, what recruitment strategies would be useful? Select all that apply.

- Practices
- Programs
- Incentives
- Recruitment frameworks
- Websites
- Webinars
- Printed publications
- Other (Please describe.)

(Required) 3. Does your agency engage in strategies or incentives to develop leadership and other skills in **current employees**?

- Yes (Directs the respondent to the **Employee Retention** section of the survey.)
- No (Please briefly describe why your agency has not engaged in these employee retention practices.) (After responding, respondent is directed to the **Wrap-Up** section.)

Agencies Considering Engaging in Employee Recruitment Outreach

1. Please briefly describe your agency's plans to reach out to potential new employees.
2. Please briefly describe the steps your agency has taken to engage in employee recruitment outreach practices.
3. What strategies does your agency anticipate using to actively reach out to **potential new employees**? Select all that apply.

- Practices
- Programs
- Incentives
- Recruitment frameworks

- Websites
- Webinars
- Printed publications
- Other (Please describe.)

(Required) 4. Does your agency engage in strategies or incentives to develop leadership and other skills in **current employees**?

- Yes (Directs the respondent to the **Employee Retention** section of the survey.)
- No (Please briefly describe why your agency has not engaged in these employee retention practices.) (After responding, the respondent is directed to the **Wrap-Up** section.)

Current Outreach Practices

Employee Recruitment

The questions below inquire about your agency's practices to recruit students and others for future employment within your agency.

Background

1. Has your agency developed strategies targeted toward **students**?

- Yes (Please respond to **Questions 1A** and **1B** below.)

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- No (Please skip to **Question 2**.)

1A. What educational level do your practices/programs target? Select all that apply.

- Elementary
- Middle school
- High school
- Community college
- College/university

1B. What **outreach strategies** does your agency use when targeting **students**? Select all that apply.

- Outreach programs
- Internships
- Mentorships/shadow programs
- Websites
- Webinars
- Social media
- Job fairs

- One-day events (such as Career Day)
- Workshops
- Speakers bureau
- Newspapers/magazines/professional journals and publications
- Other printed publications
- Other (Please describe.)

2. What **outreach strategies** does your agency use to reach out to **other potential new employees**? Select all that apply.

- Recruiting programs
- Recruiting frameworks
- Websites
- Webinars
- Social media

- Job fairs
- Newspapers/magazines/professional journals and publications
- Other printed publications
- Other (Please describe.)

3. What **incentives** has your agency used to recruit **new employees**? Select all that apply.

- Training
- Education opportunities
- Salary and benefits
- Work schedule and leave flexibility

- Other (Please describe.)

4. Has your agency developed strategies or policies to recruit **members of disadvantaged groups**?

- No

- Yes (Please describe.)

5. Does your agency provide or require training programs for new hires?

- No

- Yes (Please describe.)

<u>Program/Practice Description</u>

1. Please describe the three most effective practices or programs that your agency uses in recruiting new employees.

   Practice/Program 1

- Practice/program name:

- Partners/financial support/in-kind services:

- Target audience (e.g., student, including grade level; employees already in the workforce):

- Briefly describe the practice/program (including the cost and length of the program):

   Practice/Program 2

- Practice/program name:

- Partners/financial support/in-kind services:

- Target audience (e.g., student, including grade level; employees already in the workforce):

- Briefly describe the practice/program (including the cost and length of the program):

Practice/Program 3

- Practice/program name:

- Partners/financial support/in-kind services:

- Target audience (e.g., student, including grade level; employees already in the workforce):

- Briefly describe the practice/program (including the cost and length of the program):

2. Please briefly describe how these strategies and incentives have impacted hiring efforts, including how the impact was measured (e.g., performance measures used, data collected).

Employee Retention

The questions below inquire about your agency's practices to enhance job satisfaction and contribute to employee retention.

1. What **incentives** does your agency use to retain current employees? Select all that apply.

- Training
- Education opportunities
- Salary and benefits
- Promotions

- Work schedule and leave flexibility
- Recognition of work
- Other (Please describe.)

2. What programs or practices does your agency use to train and develop staff? Select all that apply.

- Cross-training
- Job rotation
- Communities of practice
- Mentoring/coaching
- Continuing education programs

- Professional development programs
- Leadership programs
- Support to complete a degree
- Other (Please describe.)

3. Please describe the three most effective **practices or programs** that your agency uses to develop leadership and other skills that enhance job satisfaction and contribute to employee retention.

- Practice/Program 1
- Practice/Program 2

- Practice/Program 3

4. Please briefly describe how these strategies and incentives have impacted employee retention, including how the impact was measured (e.g., performance measures used, data collected).

5. Does your agency conduct an exit interview when an employee leaves your agency?

- No

- Yes (Please briefly describe the information your agency collects during the exit interview.)

Assessment

1. What successes has your organization experienced with recruiting and retaining employees?

2. What challenges has your organization experienced with recruiting and retaining employees?

3. What recommendations do you have for agencies seeking to initiate or enhance employee outreach practices?

4. Has your agency developed documentation related to its employee recruitment and retention practices? If yes, please provide an electronic copy of those procedures or send any files not available online to carol.rolland@ctcandassociates.com.

Wrap-Up

Please use this space to provide any comments or additional information about your previous responses.

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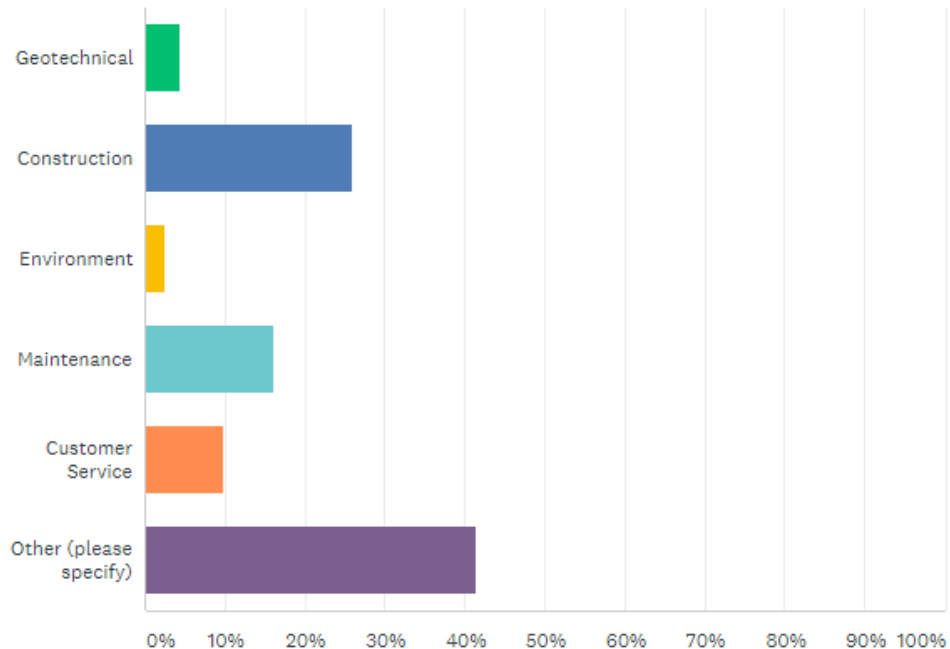
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APPENDIX B: ODOT SURVEY

ODOT Survey Questions and Answers

Question 1

## What is your current area of expertise?

Answered: 205   Skipped: 0

For question 1, of the 205 who responded, the second most popular choice was construction (53), followed by Maintenance (33), Customer Service (20), Geotechnical (9), and Environment (5). The most popular answer was Other (85). Responses in the Other category included:

civil rights, office administration, bridge division, traffic, transportation planning, human resources, accounting/finance, information technology, mechanical repair, traffic equipment operator, contracts, quality assurance, beautification, project management, communications, real estate, materials, grant administration, aviation, risk management, survey, design/drafting, structures, local government liaison, purchasing, data analysis, research, and comptroller.

Question 2

Which of the following workforce development/training activities (Oklahoma Transportation-funded) would be of interest to you (please check all that apply)

Answered: 204   Skipped: 1
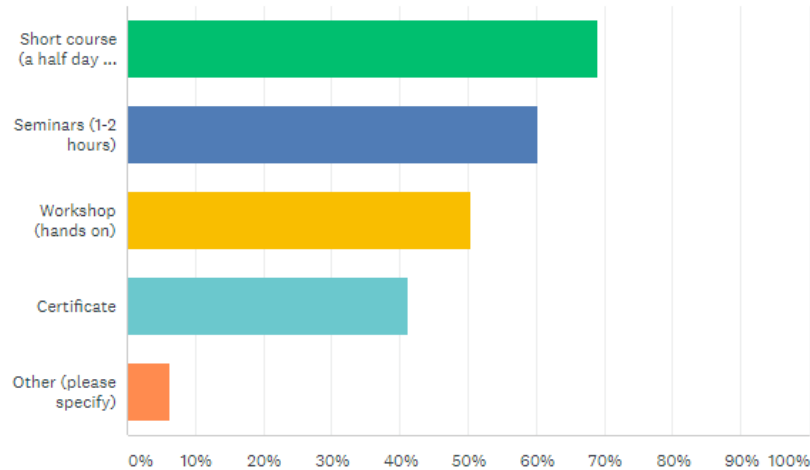
For question 2, of the 204 who responded, the most popular choice was short course (a half day up to a full day) (141). The second most popular choice was seminars (123), followed by workshop (103), Certificate (84), and Other (13). Responses in the Other category included:

Comprehensive open roads/inroads computer training (immersion), leadership, FHWA roadside hazard 2 day class, computer training, hands-on training, purchasing, supervision, vocational training and additional college, webinars, a combination of hands-on short course for excel, and virtual training offering PDHs.

Question 3

If short courses are of interest to you, please specify preferred duration

Answered: 178   Skipped: 27
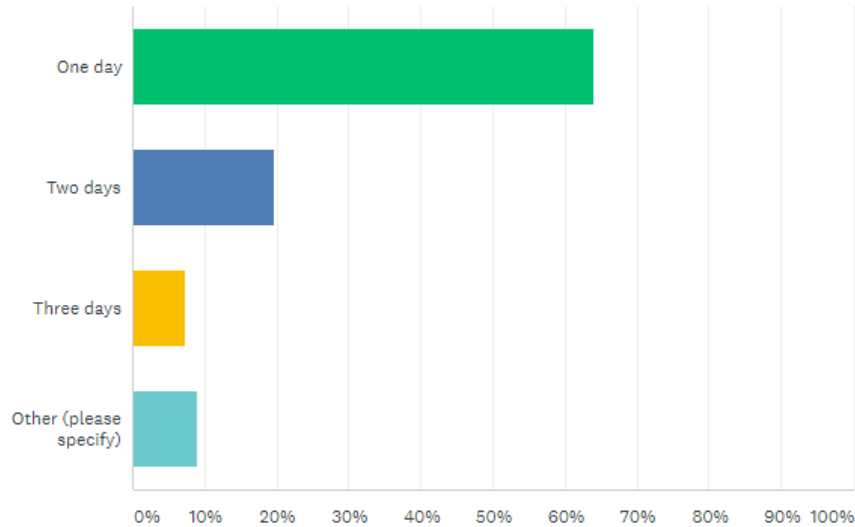
For question 3, of the 178 who responded, the most popular answer was one day (114), followed by two days (35), three days (13), and Other (16). Responses in the Other category included:

A few hours, half a day for one or two days, 1-hour to 4-hour courses, 1-3 days, half a day, all of the above, 1-2 day courses, depends on the subject, and as long as it takes.

Question 4

If short courses are of interest to you please specify topics of interest

Answered: 115   Skipped: 90

This question required typed responses. Of the 115 who responded, these were the following answers:

Leadership/Management (16)

Computer skills for Microsoft Office/Adobe/Teams/Office 365 (14)

Bridge/pavement/roadway design and construction/geotechnical (13)

Accounting/financial/contracts/audits/procurement (8)

Surveying (7)

Traffic/employee safety (6)

Construction/latest practices (6)

Anything (5)

Advanced software: OpenRoads/inroads, microstation/Agile, etc (4)

Project management (3)

Plan development (3)

Inspection/safety (3)

Human resources (3)

Funding programs (2)

Geology (2)

Reading plans/blueprints (2)

Maintenance quality assurance programs (2)

Modernization (2)

Updated design practices (2)

GIS (2)

R/W (2)

Documentation/how to document work performed by contractors (2)

AASHTO Code (1)

Administration assistant (1)

Advanced coding (1)

BIM (1)

Concrete (1)

Contract review/negotiation (1)

Disaster related training (1)

Diversity (1)

Environmental justice (1)

Fleet management (1)

Grant administration (1)

Ground improvement techniques and methods (1)

Highway safety analysis of proposed improvements (1)

How to work with difficult supervisors (1)

Integration of softwares for rapid plan development (1)

Intelligent/connected vehicles (1)

Intelligent traffic systems (1)

Knowledge management (1)

Land mobile radio (1)

Latest innovations/emerging technologies (1)

Local government issues (1)

Low impact development (1)

Materials (1)

Microsoft Cloud applications (1)

OHP accident reports (1)

ODOT TOPS software (1)

Public relations (1)

Residential (1)

Risk management (1)

Roadside hazards (1)

SiteManager training (1)

Social/worklife balance (1)

Traffic/Weather monitoring (1)

Transportation planning (1)

UHPC (1)

Utility process (1)

(Comment: ODOT doesn't use much from various research projects from around the US. What are other DOTs doing? Network with other DOTs software training [MDX, STRUDL, MIDAS, LEAP, NSBA splice).

Question 5

If workshops are of interest to you please specify topics of interest

Answered: 86   Skipped: 119

This question required typed responses. Of the 86 who responded, these were the following answers:

Leadership (8)

Microsoft office (6)

Construction (5)

Financial (5)

Bridges (4)

Design practices/drafting software (4)

Maintenance (4)

Materials (3)

Improve workplace culture/teamwork (3)

Roadway/pavement design and construction (3)

Geotechnical (2)

Human Resources (2)

Survey/survey technologies (2)

Project management (2)

Innovation/modernization (2)

Business communication/etiquette (2)

2D hydraulic modeling (1)

AASHTO code (1)

Administration assistant (1)

Asphalt/aggregates (1)

Asset management (1)

AutoCadd (1)

Contract review/negotiation (1)

Customer service (1)

Development of highway plans (1)

Disaster (1)

Diversity (1)

Drainage (1)

Earthquake engineering (1)

Emerging software (1)

Fleet management (1)

Fuel master training (1)

Funding programs (1)

gINT (1)

GIS (1)

Grant administration (1)

Intelligent traffic systems (1)

Learning a new language (1)

Maintenance quality assurance programs (1)

Openroads/inroads, microstation (1)

Oracle training (1)

Retirement (1)

Safety (1)

Strategies for developing interagency partnerships (1)

Traffic/roadway safety (1)

Utility process (1)

Work zones (1)

Question 6

If training is of interest to you please specify area of interest

Answered: 92   Skipped: 113

This question required typed responses. Of the 92 who responded, these were the following answers:

Microsoft Office (8)

Business/finance (8)

Computer programs (8)

Leadership (7)

Construction (6)

Project management (5)

Bridges (4)

Survey (4)

Traffic (4)

Maintenance/quality assurance (4)

Human Resources (3)

Design/drafting (3)

Communication (3)

Environmental (3)

Drainage/erosion (2)

Telework (2)

Roadway design (2)

Safety (2)

Geotechnical (2)

2D hydraulic modeling (1)

Accident reports (1)

Asset/fleet management (1)

BIM (1)

Civil rights procedures (1)

Contract negotiation (1)

Customer service (1)

Diversity (1)

Earthquake design (1)

GIS (1)

Grant writing (1)

Innovation/modernization/knowledge management (1)

Latest mechanic innovations (1)

Materials (1)

Native American studies (1)

OSHA 30 (1)

PMP (1)

Relationship between job duties and requirements (1)

R/W (1)

Utility (1)

Comment: I have a lot of experience teaching short disaster related classes, road nomenclature and basic bridge fundamentals. I would be interested in helping teach some of these classes. Bruce Martin ODOT District 8 County Bridge Programs 918-838-9933 or 918-695-8008.

Comment: Something that helps emotional intelligence. Dealing with your own emotions and the emotions of others in the office. How to continue to do your best when it doesn't seem like enough or when the environment doesn't really encourage it.

Comment: Give us the tools executive staff wants us to have.

Question 7

If a certificate program is of interest to you please specify the level (select all that apply)

Answered: 125   Skipped: 80
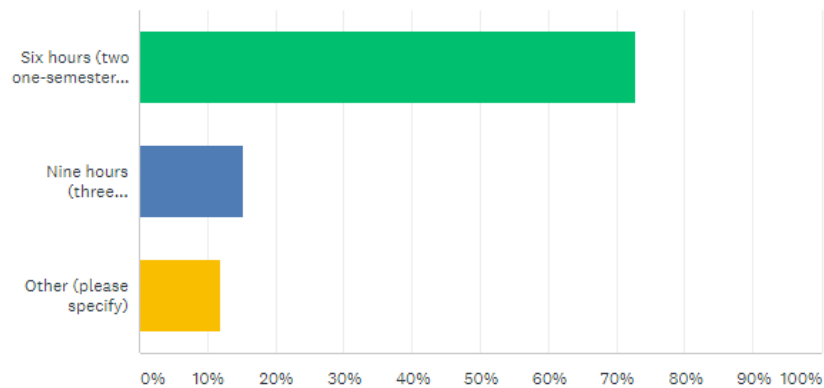
| ANSWER CHOICES		RESPONSES	
Six hours (two one-semester courses or equivalent)		72.80%	91
Nine hours (three one-semester course or equivalent)		15.20%	19
Other (please specify)	Responses	12.00%	15
TOTAL			125

For question 7, of the 125 who responded, six hours (two one-semester courses or equivalent) was the most popular choice (91). The second most popular was nine hours (three one-semester course or equivalent) (19). Responses in the Other (15) category included:

126

Professional development hours for professional engineer, a few hours, job related topics, continue to competency, any required period for completion, don't need any certification in my position, none, materials certification, I am open to any of these, depends on what the topic is. I feel that some programs will require more than others, N/A, any, any and all, all that I am allowed to have, and all.

Question 8

Of the following areas of interest, please select up to three that you would want to attend a workshop/seminar on

Answered: 202   Skipped: 3
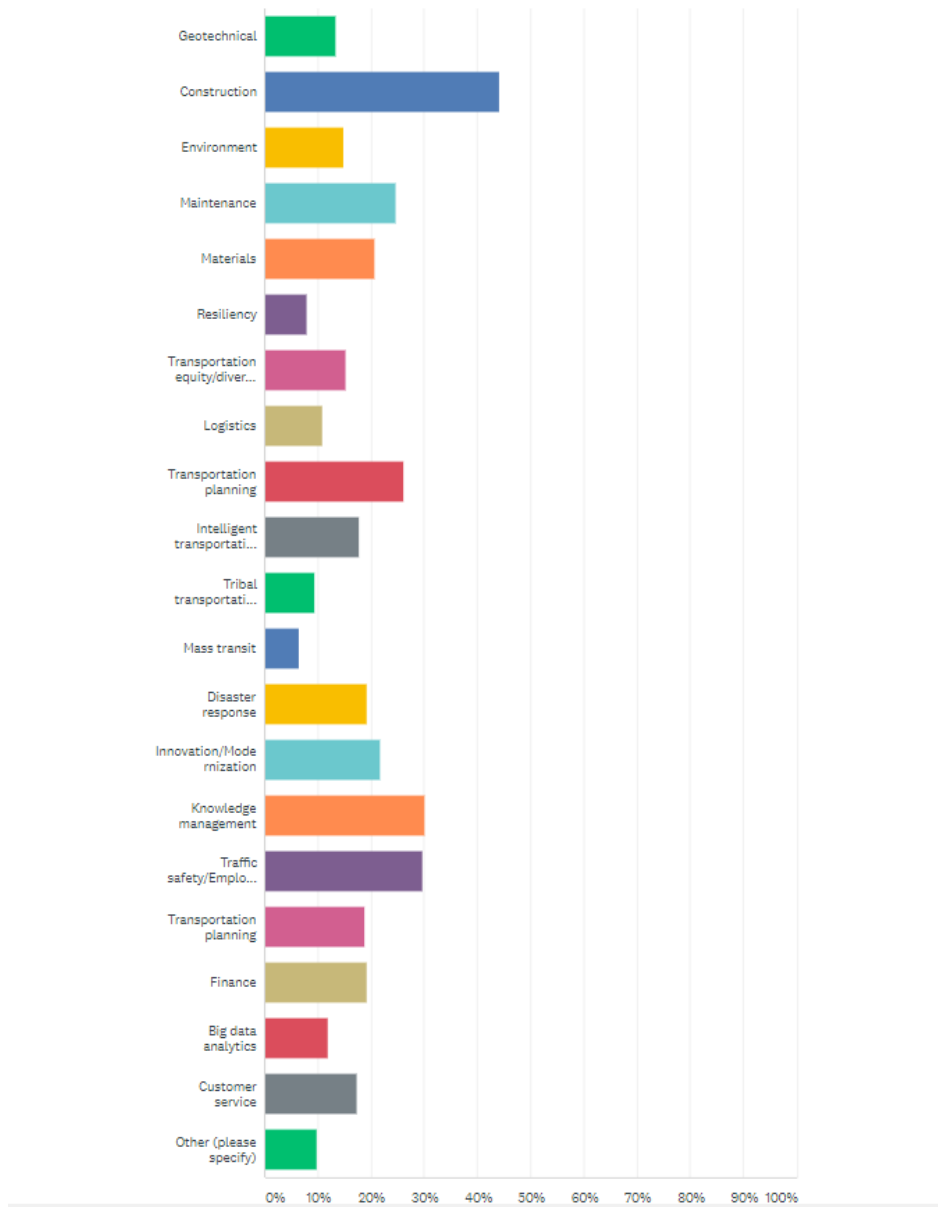
For question 8, of the 202 who responded, transportation planning (91) which was included as an option twice was the most popular choice. This was followed by construction (89), knowledge management (61), traffic safety/employee safety (60), maintenance (50), innovation/modernization (44), materials (42), disaster response (39), finance (39), transportation planning (38), intelligent transportation/connected vehicles (36), customer service (35), transportation equity/diversity/accessibility (31), environment (30), geotechnical (27), big data analytics (24), logistics (22), other (20, tribal transportation/indigenous communities (19), resiliency (16), and mass transit (13). Responses in the Other category included:

Bridge/roadway design, civil rights, HR, survey & utilities, hydraulics/hydrology, openroads/inroads, microstation, technology and software, management, technical/communicative skills, grant administration, answer as executive staff for field ops, technology, remote work and life/work balance, human resources, engineering/plan production, hydraulic modeling, structures, Native American law and regulations, and IT.

Comment: I am interested in helping teach and learn anything that will help my counties since I work daily with them and help them through many of the challenges that they meet in today's world.

Question 9

How long would an ideal workshop/seminar last?

Answered: 197   Skipped: 8
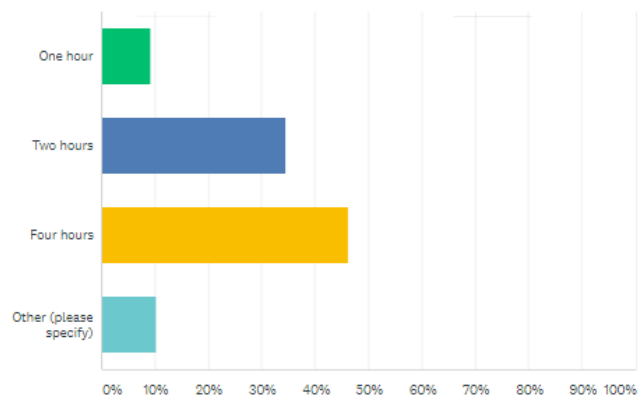
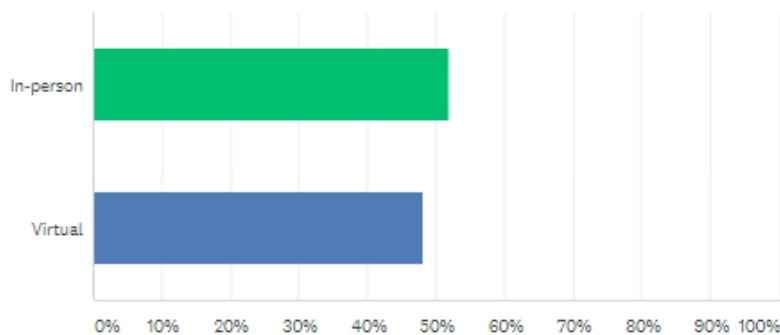| ANSWER CHOICES		RESPONSES	
One hour		9.14%	18
Two hours		34.52%	68
Four hours		46.19%	91
Other (please specify)	Responses	10.15%	20
TOTAL			197

For question 9, of the 197 who responded, four hours (91) was the most popular answer. This was followed in order by two hours (68), other (20) and one hours (18). Responses in the Other category included:

Two days, 4-8 unless need more days, 1 hour webinar or 4 hours if driving in person, completion upon basic competency, 2 days, 6 hours, all day to be worth the drive to the city, however long it takes, depends on the topic covered, eight hours, 3 hours, seminar: 2 hours workshop: half or full day, 5 hours that would include breaks, it depends on the topic, workshop: 3 days, 8 hours, as long as it needs to be, depends on the subject, 2-4 hours, six hours.

Question 10

Do you prefer in-person or virtual workshops, seminars, short courses, trainings, and certificates?

Answered: 202   Skipped: 3

ANSWER CHOICES	RESPONSES	
In-person	51.98%	105
Virtual	48.02%	97
TOTAL		202

For question 10, of the 202 who responded, in-person (105) was the most popular answer followed by virtual (97).

Question 11

Are there any other workforce development/training activities you would like to see (please specify)? Examples include: mentor programs, internships, etc.

Answered: 48   Skipped: 157

This question required typed responses. Of the 48 who responded, these were the following answers:

Mentor programs (17)

Internships (7)

No (3)

CADD training, specifical Opan Roads and Magnet Field & Magnet Office and AutoCad (2)

Cross training (2)

Career development

College credit courses from OSU, UCO, or OU.

Comptroller training

Cross-agency connections & coaching

HR training

Internships and OJT in other areas of transportation

Leadership

NHI training courses

OJT mentor programs

PMP

Procurement training

Training programs for workers to meet minimum requirements fast

Utility relocation processes

Comments:

I don't think our division does an adequate job of training new contract administrators. We kind of get thrown out to the sharks and learn as we go, mostly by errors.

Retirement planning beyond the pedestrian classes we have now.

Half-day open house (i.e. if I wanted to learn something about rail division, they would have a half-day each year I could stop by and learn more).

Survey Division needs formal training for no experience new hires instead of being thrown to the mercy of what the crew decides to teach them. Survey should have an in-depth mentoring program. Promotions should require an unbiased abilities test along with the supervisor's recommendations.

More internships from college students

Maintenance field unit clerks training on construction/residency knowledge to better understand how they both interact.

Any that would encourage recruitment and retention of employees

Mentor programs, any kind of teamwork/team development stuff. Particularly if it has to do with bridge inspection and climbing bridges and techniques involved in it.

Training supervisors to manage their employees.

There needs to be a training program for whenever an employee retires that the new employee is not just thrown into the fire. This has always been an issue in my 31 years at ODOT. This could be done for candidates to a job opening just a day or two to show what the job entails. It is a disservice to the counties and the citizens to just throw someone into the job and it takes a long time to catch up and sometimes that never happens.

Mentor programs only work if there is a true transfer of knowledge from mentor to mentee. The mentor needs to share actual projects and experiences with a mentee. It should be hands on and not just a lecture. It should focus on the actual development of the mentee.

Cross training. I feel that more than 1 person should know how to do any task at hand when working inside the same office/facility.

I would like to see ODOT hire summer interns/help from the universities (OU and OSU)

I need relevant, practical training to increase my knowledge base, skills and actual functionality as a maintenance and construction engineer. I am also interested in mentorship or anything to make me a better leader and manager. I am not interested in anything based on social theories. Learning a better way to do anything is very useful.

Utility management program with emphasis on how and why it is important and the details to do the job right as well as permitting of utilities.

A real mentor program for EITs would be nice. Once we finish rotation, we are just placed wherever and have to kinda figure the rest out.

I have asked my higher up people and because I am not an EIT I am not allowed to enroll in any of the classes that I am emailed. If this could be changed I would love to enroll in all that you will teach me.

Most of our training for engineers is hands on. This has some issues as transportation is rarely taught in college and I feel like a more structured training regimen would be beneficial.

Question 12

How long have you been working for Oklahoma Transportation?

Answered: 205   Skipped: 0
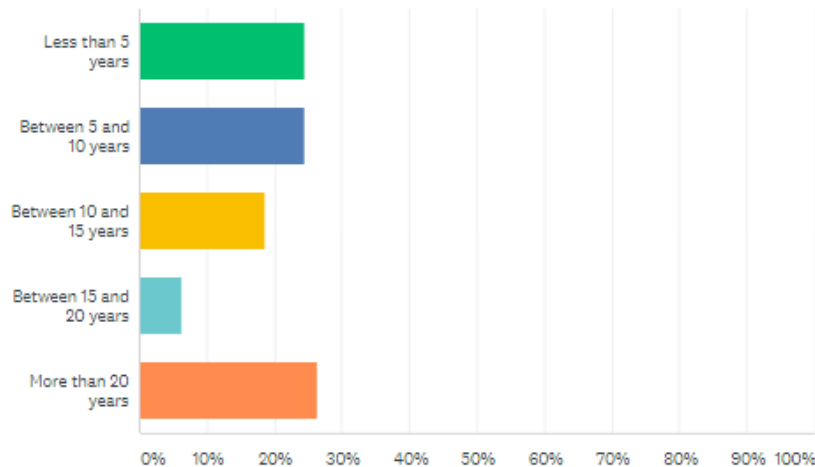
ANSWER CHOICES	RESPONSES	
Less than 5 years	24.39%	50
Between 5 and 10 years	24.39%	50
Between 10 and 15 years	18.54%	38
Between 15 and 20 years	6.34%	13
More than 20 years	26.34%	54
TOTAL		205

For question 12, out of 205 responses, more than 20 years (54) was the most popular answer. This was followed in order by less than 5 years (5), between 5 and 10 years (50), between 10 and 15 years (38), and between 15 and 20 years (13).

APPENDIX C: LIST OF PARTICIPANTS ON SHORT COURSE ON RISK MANAGEMENT AND ANALYSIS FOR INFRASTRUCTURE PROJECTS

First Name	Last Name	Company
John	Ojuola	Magdala Associates
Shelly	Williams	ODOT
MATT	VANAUKEN	ODOT
Melissa	Davis	Oklahoma Department of Transportation
Lenae	Clements	Oklahoma Department of Transportation
Siv	Sundaram	Oklahoma Department of Transportation
Joe	Brutsche	ODOT
Daniel	Nguyen	ODOT
Inger	Peters	ODOT
Anjie	King	ODOT
Andy	Wilson	Oklahoma Department of Transportation
Brian	Linam	ODOT
Lary	Willis	Oklahoma Transportation
Charles	Sims	ODOT
Brandon	Dudgeon	ODOT
Tarek	Maarouf	Oklahoma Department of Transportation
Raul	Gutierrez	Oklahoma Transportation
Jessica	Kratchmer	ODOT
Musharraf	Zaman	The University of Oklahoma
Syed Ashik	Ali	University of Oklahoma
David	Saulsberry	Oklahoma Department of Transportation
Luke	Bustos	ODOT
Alison	Enright	Oklahoma Department of Transportation
Amber	McIntyre	ODOT
Roger	Schultz	ODOT
John	McKay	ODOT - Local Government
Tammy	Newby	ODOT

First Name	Last Name	Company
Russ	Ketner	FSB
Niranjan	Desai	AEP
Chandrakant	Shah	Self Employed
Adedamola Ibikunle	Oyesanya	INTERTEK/PSI
Wenyao	Liu	Oklahoma State University
Nasim	Uddin	University of Alabama at Birmingham
XUE	YANG	Oklahoma State University
Jack	Stewart	Canadian County
Harold	Smart	KAL Construction
Roy	Khalife	Standard Testing
Farid	ahmad	Standard Testing
Gbemi	Agbetunsin	SE3CED
Georges	Nader	The City of Oklahoma City
Dominique	Pittenger	University of Oklahoma
Alex	Peta	Oklahoma Department of Transportation
Scott	Sundermeyer	Oklahoma Department of Transportation
Erin	Faulkner	Oklahoma Department of Transportation
Greg	Worrell	Oklahoma Department of Transportation
Kathy	Koon	Oklahoma Department of Transportation
Katherine	Golden	Oklahoma Department Transportation
Amanda	Alexander	Oklahoma Department of Transportation