FINAL REPORT

PROJECT C4

JULY 2022

Framework for the Development of a Diverse Transportation Workforce in the Southeast Region

Ruth Steiner, Ph.D., University of Florida
Mohammed Hadi, Ph.D., Florida International University
James Martin, PE, North Carolina State University
Virginia Sisiopiku, Ph.D., University of Alabama at Birmingham
Dimitra Michalaka, Ph.D., The Citadel
Steven Click, Ph.D., Tennessee Technological University

STRIDE | Southeastern Transportation Research, Innovation, Development and Education Center

UF | Transportation Institute UNIVERSITY of FLORIDA

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. Project C4	**2. Government Accession No.**	**3. Recipient's Catalog No.**
4. Title and Subtitle Framework for the Development of a Diverse Transportation Workforce in the Southeast Region		**5. Report Date** 7/28/2022 **6. Performing Organization Code**
7. Author(s) Ruth Steiner, Ph.D., University of Florida, rsteiner@ufl.edu Mohammed Hadi, Ph.D., Florida International University, hadim@fiu.edu James Martin, PE, North Carolina State University/ITRE, jbm@ncsu.edu Virginia P. Sisiopiku, Ph.D., University of Alabama at Birmingham, vsisiopi@uab.edu Dimitra Michalaka, Ph.D., The Citadel, dmichala@citadel.edu Steven M. Click, Ph.D., Tennessee Technological University, sclick@tntech.edu		**8. Performing Organization Report No.** STRIDE Project C4
9. Performing Organization Name and Address *University of Florida Transportation Institute*, 365 Weil Hall, PO Box 116580, Gainesville, FL 32611 *Florida International University*, 10555 West Flagler Street, Miami, FL 33174 *North Carolina State University/ITRE*, 909 Capability Drive, Suite 3600, Research Building IV, Raleigh, North Carolina 27606 *University of Alabama at Birmingham*, Hoehn Engineering Building, Rm. 140 1075 13th Street South, Birmingham, AL 35294-4440 *The Citadel,* 171 Moultrie Street Charleston, SC 29409 *Tennessee Technological University,* 1 William L. Jones Dr., Cookeville, TN 38505		**10. Work Unit No.** **11. Contract or Grant No.** Funding Agreement Number 69A3551747104
12. Sponsoring Agency Name and Address *University of Florida Transportation Institute/* Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE) 365 Weil Hall, P.O. Box 116580 Gainesville, FL 32611 *U.S Department of Transportation/Office of Research, Development & Tech* 1200 New Jersey Avenue, SE Washington, DC 20590		**13. Type of Report and Period Covered** 8/1/2020 to 7/28/2022 **14. Sponsoring Agency Code**

15. Supplementary Notes

16. Abstract - State transportation industries and other public and private sector employers have consistently identified workforce development on the top of the needed capabilities for the advancement and maturity of their programs. This realization has become even more pressing with the increasing use of emerging technologies and strategies and the establishment of associated programs. These technologies and strategies include connected, automated, shared, and electric vehicles, Mobility as a Service (MaaS), micro-mobility, electric vehicles, business intelligence, big data, and other such services. The challenges of training the workforce of the future are exacerbated by other trends in the transportation profession. The diversity of the workforce – racial and ethnic, gender, second career professionals, veterans and encore careerists and workers with diverse life skills – needs to increase. The establishment and maintenance of a workforce with the required knowledge, skills, and abilities require education, training, recruitment, and retention activities that are currently lacking. The United States Department of Transportation (USDOT) University Transportation Centers (UTCs) and academic institutions including both universities and community colleges can play an important role in the success of these activities. This project develops a framework for training and education to support the diverse workforce development needs of the transportation sector in the Southeast region with an emphasis on the role of secondary academic institutions. The project identifies current and future needs and define the roles of the UTCs, universities, and community colleges in the region in the training and education activities. The effort documented in this report will build on the national and the Southeast region efforts that have already been done in this regard.

17. Key Words workforce development, diversity, equity, inclusion, and justice (EDIJ), innovative technology	**18. Distribution Statement** No restrictions

19. Security Classif. (of this report) N/A	**20. Security Classif. (of this page)** N/A	**21. No. of Pages** 134 pages	**22. Price** N/A

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by a grant from the U.S. Department of Transportation's University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.

ACKNOWLEDGEMENT OF SPONSORSHIP AND STAKEHOLDERS

This work was sponsored by a contract from the Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE), a Regional University Transportation Center sponsored by a grant from the U.S. Department of Transportation's University Transportation Centers Program. The research team would like to thank all the participants in stakeholder meeting and interviews and for the respondents to our survey.

Funding Agreement Number - 69A3551747104

LIST OF AUTHORS

Principal Investigators:

Ruth Steiner, Ph.D.
University of Florida
rsteiner@dcp.ufl.edu
ORCID 0000-0001-7276-3742

Mohammed Hadi, Ph.D.
Florida International University
hadim@fiu.edu
ORCID 0000-0003-2233-8283

James B. Martin, PE
North Carolina State University
jbm@ncsu.edu

Virginia P. Sisiopiku, Ph.D.
University of Alabama at Birmingham
vsisiopi@uab.edu
ORCID 0000-0003-4262-8990

Dimitra Michalaka, Ph.D.
The Citadel
dmichala@citadel.edu
ORCID 0000-0001-7001-0579

Steven M. Click, Ph.D.
Tennessee Tech University
sclick@tntech.edu
ORCID *0000-0001-6032-4144*

Additional Researchers

Kweku Brown, Ph.D.
The Citadel
Kbrown16@citadel.edu
ORCID 0000-0001-6497-8479

Jeremy Griffith
Graduate Research Assistant
University of Florida

Mehri Mohebbi, Ph.D.
University of Florida
Mmohebbi@ufl.edu
ORCID 0000-0001-6033-3526

Muhammed Sherif, Ph.D.
University of Alabama at Birmingham
msherif@uab.edu
ORCID 0000-0001-9691-7953

Tao Wang, Ph.D.
Post-Doc Research Assistant
Florida Atlantic University

Table of Contents

LIST OF TABLES

LIST OF ABBREVIATIONS

Abbreviation	Meaning
AASHTO	American Association of State Highway and Transportation Officials
APA	American Planning Association
APBP	Association of Pedestrian and Bicycle Professionals
ASCE	American Society of Civil Engineers
CASE or ACES	Connected, automated, shared, and electric vehicles
CE	Civil engineer
CEBOK	Civil Engineering Body of Knowledge
CTE	Career technical education
DEIJ	Diversity, equity, inclusion, and justice
FHWA	Federal Highway Administration
GIS	Geographic information systems
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
ITSA	ITS America
KYTC	Kentucky Transportation Cabinet
LTAP	Local Technical Assistance Program
MaaS	Mobility as a Service
NCHRP	National Cooperative Highway Research Program
NHI	National Highway Institute
NNTW	National Network for the Transportation Workforce
PE	Professional Engineer
SDITE	Southern Division of ITE
SETWC	Southeastern Transportation Workforce Center
STEM	Science, Technology, Engineering, and Math
T-STEM	Transportation STEM
TSMO	Transportation Systems Management and Operations
USDOT	United States Department of Transportation
UTC	University Transportation Service
WTS	Women's Transportation Seminar

ABSTRACT

State transportation industries and other public and private sector employers have consistently identified workforce development on the top of the needed capabilities for the advancement and maturity of their programs. This realization has become even more pressing with the increasing use of emerging technologies and strategies and the establishment of associated programs. These technologies and strategies include connected, automated, shared, and electric vehicles, Mobility as a Service (MaaS), micro-mobility, electric vehicles, business intelligence, big data, and other such services. The challenges of training the workforce of the future are exacerbated by other trends in the transportation profession. The diversity of the workforce – racial and ethnic, gender, second career professionals, veterans and encore careerists and workers with diverse life skills – needs to increase. The establishment and maintenance of a workforce with the required knowledge, skills, and abilities require education, training, recruitment, and retention activities that are currently lacking. The United States Department of Transportation (USDOT) University Transportation Centers (UTCs) and academic institutions including both universities and community colleges can play an important role in the success of these activities. This project develops a framework for training and education to support the diverse workforce development needs of the transportation sector in the Southeast region with an emphasis on the role of secondary academic institutions. The project identifies current and future needs and define the roles of the UTCs, universities, and community colleges in the region in the training and education activities. The effort documented in this report will build on the national and the Southeast region efforts that have already been done in this regard.

Keywords: workforce development, diversity, equity, inclusion, and justice (EDIJ), innovative technology

EXECUTIVE SUMMARY

With the generational change from Baby Boomers to Generation X and Millennials in the workforce, transportation agencies are facing challenges in finding workers who are qualified to take over a variety of tasks from the skilled operator of large equipment for the operations and maintenance of transportation facilities to the highly skilled and technically competent technical workers. For example, according to the Transportation Learning Center, 54.5% of people in the current workforce within the six largest transportation sectors are 45 years or older, 8.7% higher than the national average (U.S. Departments of Education, Transportation, and Labor 2015). Transportation agencies at the state and local level understand the critical need for managing and operating the transportation systems using advanced strategies and technologies. In the past decade, this realization has led to the development of strong transportation systems management and operations (TSMO) programs around the nation including the Southeast region. These TSMO programs and activities have seen rapid advancements in technologies, strategies, and methods that provide the potential to improve the system performance. However, the industry's current capacity to respond and adapt to these advancements has led to a failure to effectively capitalize on additional benefits.

This need became even clearer with the emergence of the connected, automated, shared, and electric vehicles (known as CASE or ACES) and the increasing use of big data, decision support tools, performance measurements/management, and advanced modeling, among others. It also became clear that the skills, knowledge, and education of the TSMO workforce development can be a major limitation to the maturity of TSMO programs and the maximum use of their capabilities. The turnover of the staff within state DOTs has amplified this problem as they have recognized that the pay scale in our industry makes it difficult to compete with other disciplines that need similar capabilities as those needed for the next generation of TSMO workers. The TSMO needs extend to various process and associated positions. There is a need for education/training, recruitment, and retention to ensure that the agencies have adequate and effective staff in these positions. Through the years, various national organizations have studied the needs and the required resources to support the TSMO workforce development. The most important of these efforts are those of the United States Department of Transportation (USDOT) Intelligent Transportation Systems (ITS) Professional Capability Building (PCB) program, American Association of State Highway and Transportation Officials (AASHTO), and the National Operations Center of Excellence.

The workforce development needs are not limited to the TSMO programs. Much is written about the shortage of drivers in the trucking and logistics sectors, but similar challenges exist in public transit and construction (Braden 2017). For their part, federal and state transportation workforce shortages are widely considered a problem, presenting "a present and growing need" for workers (Martin and Dudley 2017). Although jobs in transportation are available for people with various levels of education, traditional training pipelines frequently are not designed to steer graduates toward the transportation sector. Furthermore, the types

of jobs and skills needed are evolving. With increased automation and changes in the role of technology, jobs in the transportation sector are likely to change in the future. Workforce strategies are needed to meet critical staffing needs and develop the current and future transportation workforce. (NASEM, 2019)

Training the transportation workforce for the mobility as a service (MaaS) part of the transportation sector will require the engagement of a greater diversity of stakeholders than the traditional transportation sector, such as TSMO employment. The Southeastern U.S. is recognized nationally for the low rate of transit service. As new transportation options emerge, they may present challenges to existing transit and paratransit operators. Most transit service is provided at the metropolitan scale and involves less-traditional stakeholders, such as public transit agencies, paratransit operators and shared mobility service providers. Understanding the needs of these diverse stakeholders may require special outreach efforts to engage organizations that provide shared mobility services and representatives of state and local transit and paratransit agencies to understand the issues related to shared mobility and new transportation options.

The challenges of training the workforce of the future are exacerbated by trends in the transportation profession. These include: 1) the need for increase in the diversity of the workforce – racial and ethnic, gender, second career professionals, veterans and encore careerists and workers with diverse life skills; 2) the changing nature of the transportation profession leading to the need to incorporate more advanced technology in traffic management and to provide a greater variety of transportation options (e.g., Uber, Lyft, autonomous and connected vehicle); and 3) the differences in wage scales between the public and private sector. For a long time, transportation agencies have been organized and optimized to deliver capacity expansion projects in an efficient and effective manner. With the changes in the workforce and changes in transportation, the needs for workforce development will change. State departments of transportation and other transportation organizations at the local, regional, state and federal level will need to integrate transportation into education beyond the primary and secondary education levels by developing community college and university programs aimed at training skilled individuals for the transportation workforce through credit and non-credit programs, degrees, certificates and continuing education programs (Committee on Future Surface Transportation Agency Human Resource Needs, 2003).

1.0 INTRODUCTION

The transportation workforce faces challenges presented by demographic changes, labor market forces, and the growing need for interdisciplinary skillsets. This review finds that although there is no comprehensive or unified approach to workforce development, the existing state of practice demonstrates a range of strategies reflecting an understanding of and response to existing workforce challenges. The current state of practice generally is strong in addressing the educational needs of students in the pre-professional pipeline and the technical skill training needs of the existing workforce, though gaps exist in addressing the present needs to promote workplace diversity, anticipate and train for emerging technologies, and develop interdisciplinary skillsets.

1.1 OBJECTIVE

The intention of this project is to establish a baseline understanding of how workforce development is defined, the challenges that it aims to address, and the current state of workforce development practice. This understanding will act in synthesis to identify current and anticipate future gaps in the state of workforce development practice in the Southeastern transportation industry and suggest strategies to successfully meet identified challenges. In summary, this project encompasses five primary tasks: 1) to establish a working definition of workforce development; 2) to identify the prevailing challenges in the transportation workforce; 3) to summarize the state of workforce development practice; 4) to identify the role UTCs might play as a partner in responding to workforce development challenges; and 5) to propose actionable suggestions for the improvement of transportation workforce development in the Southeastern region.

1.2 SCOPE

The scope of the study is specific to the Southeast United States to the extent previous literature allows, though the existing body of knowledge at the regional scale is limited. The Southeast Region generally encompasses 12 states and Puerto Rico, in alphabetical order: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, and West Virginia. The US Department of Transportation (USDOT) Region 4 University Transportation Center (UTC) includes only eight of these states; Arkansas, Louisiana, Virginia, and West Virginia and Puerto Rico are a part of other UTCs. The Table 1 includes an overview of the major characteristics of each state within the Southeastern Region, including population, total employment, and total employment in transportation-related occupations.

Summary of Regional Stakeholders and Responsibilities				
State/Commonwealth	**Total Population**	**Total Employment**	**Total Employment in Transportation-Related Occupations**	**Share of Total Employment**
Alabama*	5,024,803	1,910,169	75,944	4.0%
Arkansas	3,012,232	1,174,759	60,692	5.2%
Florida*	21,569,932	8,444,982	359,955	4.3%
Georgia*	10,725,800	4,309,934	240,087	5.6%
Kentucky*	4,503,958	1,793,494	122,013	6.8%
Louisiana	4,651,203	1,779,669	78,698	4.4%
Mississippi*	2,956,870	1,090,083	57,226	5.2%
North Carolina*	10,457,177	4,322,076	181,479	4.2%
Puerto Rico	3,281,538	832,067	19,422	2.3%
South Carolina*	5,130,729	2,027,881	78,913	3.9%
Tennessee*	6,920,119	2,915,020	192,980	6.6%
Virginia	8,632,044	3,744,370	144,709	3.9%
West Virginia	1,789,798	642,016	26,984	4.2%
* - Southeastern states that are a part of the USDOT UTC Region 4.				

TABLE 1: TRANSPORTATION CHARACTERISTICS OF SOUTHEASTERN STATES (RETRIEVED FROM US BUREAU OF TRANSPORTATION STATISTICS, 2020; HTTPS://WWW.BTS.GOV/PRODUCT/STATE-TRANSPORTATION-STATISTICS)

Due to this gap in regional considerations, the literature review relies on sources at all scales and sectors to document the state of workforce development practice, primarily at the national and statewide levels. To best account for this gap in literature, case examples from the Southeast are used, where applicable, in synthesis with the findings from more general literature to document the state of practice within the region. This project is organized to discuss the state of transportation workforce development at-large, encompassing the many sectors, modes, and occupations that fall under the wide purview of the industry. This project does not look at the many facets of the transportation industry in detail, rather it aims to provide a general overview of the common workforce development challenges, needs, and practices across the full range of the transportation industry.

2.0 LITERATURE REVIEW

The transportation industry is rapidly changing in response to emerging technological, demographic, and labor pressures (NASEM, 2019). It is predicted that the transportation industry will add an additional 417,000 net jobs from 2012 to 2022. At the same time, the industry is "aging-out" - as of 2015, 54.5% of the workforce within the six largest transportation sectors are 45 years or older, 8.7% higher than the national average (U.S. Departments of Education, Transportation, and Labor 2015). Accounting for retirees and turnover, overall estimates indicated the need to hire approximately 4.6 million transportation workers between 2012 and 2022, an equivalent of 1.2 times greater than the employment rate at the time. (U.S. Departments of Education, Transportation, and Labor 2015).

The demographics of the nation are becoming increasingly diverse. The transportation industry continually struggles to reflect the diversity of the overall population; both women and minorities make up a lower proportion of the transportation workforce than the national average, particularly in advanced, higher paying positions (U.S. Departments of Education, Transportation, and Labor 2015).

The pace of technological advancement in the transportation sector, with the emergence of ITS, MaaS, and CASE, among others, have expanded the skillsets necessary for success in the industry, requiring additional educational flexibility and responsiveness from workforce development strategies to meet an ever-expanding body of technological knowledge (Leonard, Mindell & Stayton, 2016; NOCoE, 2016).

The continued success of the industry is dependent on the ability of workforce development efforts to meet a growing set of challenges. As defined in the recent NCHRP 543 Synthesis report, workforce development constitutes a set of "strategies aimed at developing competencies and skills for specific positions and individuals." (NASEM, 2019) Building upon this definition, the understanding of workforce development for the purposes of this study is to encompass the skill-building strategies for recruitment, retention, training, and education of the current and future transportation labor force in response to specific challenges and needs.

2.1 Prevailing Challenges in the Transportation Industry

2.1.1 Trends in Labor Market

Existing literature on the state of the transportation workforce has been keen to address a critical shortfall in high-skilled personnel the industry has experienced over the past 20 years. Addressing this shortfall is critical in the continued performance and success of the industry, particularly as the demand for transportation professionals grows with the national population, as technological innovation expands the industry scope, and as a growing proportion of the aging workforce retire. Job demand is expected to grow in all sectors of the transportation industry, however, much of this growth falls disproportionately upon the trucking and logistics industry (Braden, 2017; U.S. Departments of Education, Transportation, and Labor 2015). Recent research finds an emerging demand specifically for science,

technology, engineering, and math (STEM) occupations, CTE (career technical education) or vocational occupations, skilled laborer occupations, and supply chain and logistics occupations (Cronin & Alexander, 2019).

Contributing to this shortfall is a difficulty for the transportation industry to compete with other industries in the recruitment and retention of a skilled workforce. The recent NCHRP 685 report identified wage competition, rigidity in existing workplace culture, a lack of promotional opportunities, and educational curriculum challenges as barriers for the transportation industry to compete with other industries to recruit the future workforce. (Cronin & Alexander, 2011)

2.1.2 Demographic Change

The transportation industry is rapidly aging-out; over half (54.5% as of 2015) of transportation workers, particularly in managerial and administrative positions, are 45 years of age or older. With an estimated 50% or more of the industry expected to retire in the next 10-15 years, the recruitment of millennial and Gen Z entry workers along with the retention and development of existing staff is crucial for the sustainability of the industry, both in terms of maintaining a fully staffed labor force and for the ability to transfer valuable knowledge and experience (U.S. Departments of Education, Transportation, and Labor 2015; Gallagher & Villwock-Witte, 2016; Martin & Dudley, 2017; Cronin & Alexander, 2011).

This generational shift brings unique considerations for transportation workforce development. For the older generations, retaining their ability to perform in the face of shifting technologies and job expectations is a challenge. The focus of workforce development efforts often ignores more experienced, older workers in favor of mid or entry-career professionals. Despite demonstrable need, access to continuing education and skill-based training opportunities is typically lacking for older transportation workers (Popkin, Morrow, Di Domenico & Howarth, 2008). Training methods are also a concern for older workers, as trainings are often offered in online or self-paced formats unfavorable to the learning styles and preferences of older workers. The importance of using appropriate training methods is essential when considering the aging workforce, as older workers often favor ‘hands-on’ training over an online counterpart (Popkin, et al., 2008). As senior workers retire, it is important that the specialized knowledge and experience gained over the course of their professional career is not lost in the transition to retirement. Promoting the transfer of institutional knowledge through information management systems and mentoring strategies can contribute to the successful transition towards a younger workforce and the continued success of the industry (Cronin & Alexander, 2011).

Attracting the next generation of workers to the transportation workforce and ensuring the development of necessary skills is critical to meeting the existing shortfall and anticipating future departures incurred by the aging workforce. As such, many workforce development efforts have prioritized K-12 education as a means to attract the next generation (Ivey, 2019;

U.S. Departments of Education, Transportation, and Labor, 2015; CUTC, 2012). The intention of pre-professional workforce development efforts is to increase career awareness of transportation fields along the STEM education pipeline, aiming to attract a larger and more diverse talent pool for the interdisciplinary needs of the transportation workforce (Ivey, 2019; Cronin & Alexander, 2019). The literature also points to the need for the reform of educational curricula in traditional post-secondary transportation education pipelines (university programs, community college, and vocational schools) to better reflect career requirements. Millennials also have specific set of expectations and backgrounds that differ from previous generations, requiring the transportation industry to reform workplace structures to create a more competitive and attractive workplace. The transportation industry has historically been attractive to Millennials in offering job security, opportunities for personal and professional development, flexible schedules, and a work–life balance. However, lasting image issues, a lack of opportunities for mentorship, and unattractive workplace cultures present challenges to millennial recruitment. (Gallagher & Villwock-Witte, 2016)

2.1.3 Lack of Gender and Racial Diversity

As the demographics of the nation become more diverse over time, the recruitment of new workers entails attracting an increasing number of women and minorities to the traditionally white and male-dominated transportation industry. Women and minorities are currently under-represented and under-utilized across all sectors of the transportation industry in State DOTs and transit agencies, particularly in high-paying skilled, managerial, and administrative positions (National Academies of Sciences, Engineering, and Medicine, 2007; U.S. Departments of Education, Transportation, and Labor, 2015). Strategies of workplace reform, similar to those used to attract Millennials to the industry (promoting work-life balance, flexible scheduling, promoting opportunities for upward mobility and education, etc.), are used to attract under-represented women and minorities to the industry.

Promoting and valuing diversity in the workforce has been proven to have tangible value-added. A recent series of reports on workforce diversity from McKinsey have demonstrated the ways that a diverse workforce can contribute to better overall industry performance. The 2015 study, *Diversity Matters,* concluded that an increase in workforce diversity increases profitability and markers of performance through benefits to talent recruitment, improved customer orientation, employee satisfaction, and decision making and innovation (Hunt, Layton & Prince, 2015). These findings are furthered in a 2020 study, *Diversity Wins: How Inclusion Matters,* which found that inclusion strategies play a critical role in increasing employee engagement, rates of retention, worker productivity, and individual financial performance (Hunt, Dixon-Fyle, Prince & Dolan, 2020).

2.1.4 Interdisciplinary Skill Requirements

The modernization of labor and the rapid emergence of new technologies has expanded the set of skill competencies necessary for a successful career in the transportation industry. A recent report, *Inspiring the Next Generation Mobility Workforce Through Innovative Industry*

Academia Partnerships, states "in industry, unlike education where curriculum and programs of study remain largely entrenched in silos, disciplinary lines are no longer so distinct. In fact, employers are moving toward recruiting candidates based on skills, rather than on particular degrees." (Ivey, 2019) Technical and non-technical fields not typically covered by traditional transportation educational pathways such as sustainability, "soft" skills (management, communication, etc.), economics, urban design, and public policy, among others are becoming a part of a larger desired skillset for transportation professionals (Joh & Li, 2015; NASEM, 2019). Additions to the latest Civil Engineering Body of Knowledge (CEBOK) reflects the ongoing efforts aimed to address educational shortcomings in the traditional educational pipeline (ASCE, 2019). The most recent CEBOK, drawing on a survey of CE industry professionals, added engineering economics as a distinct area of focus and updated the sustainability, communication, teamwork and leadership, lifelong learning, professional attitudes, professional responsibilities, and ethical responsibilities outcomes to better reflect the requirements of the workforce (ASCE, 2019).

Rapid technological advancements within the transportation industry, exemplified in the emergence of technological fields like TSMO, ITS, MaaS, and CASE have expanded the scope of desired skillsets of the current and future labor force. Educational gaps in traditional educational pathway curricula and competition for skilled labor with the private sector have resulted in difficulties attracting applicants with the desired technical STEM skillsets to the transportation field (NOCoE, 2016; NCHRP, 2019).

2.2 The State of Practice

The state of workforce development practice has historically been characterized by fragmented and uncoordinated efforts among a large variety of different stakeholders. There is no industry consensus on the approach to nor methods used in workforce development practice. Despite this fragmentation, the literature points to a set of commonly shared themes regarding the needs and priorities of workforce development practice. Broadly, these themes consist of efforts to recruit, train, and retain the future and existing transportation workforce. Recruitment strategies aim to attract the next generation of the transportation workforce, primarily through addressing the pre-professional educational pipeline and issues of workforce diversity. Continuing education efforts intend to train the existing workforce for the requirements of work in the industry, typically through technical skills training, through practices are beginning to expand to encompass a wider range of desired educational needs. Retention strategies focus on reducing voluntary turnover, typically consisting of efforts to improve the workplace environment and create opportunities for career advancement.

2.2.1 Existing Network of Stakeholders

The current challenges facing the transportation industry are multifaceted, existing along the whole spectrum of the workforce development pipeline and among the many modes housed within the industry. As such, the ecosystem of southeastern stakeholders involved in workforce development practice includes a multitude of sectors and fields. This section is

organized in a table to provide a summary of stakeholders involved in workforce development within the Southeastern region, documenting their place in the hierarchy of sectors and scopes. Additionally, this summary provides a brief description of each stakeholder's role. While not comprehensive, this summary provides the general picture of who is involved and the parts they play in contributing to ongoing workforce development efforts in the region.

Summary of Regional Stakeholders and Responsibilities		
	Stakeholder	**Role**
	Governmental Sector	
01	United States Department of Transportation (USDOT)	• To provide funding and direct support for programs and research • Develop broad policy goals and frameworks • To set and promote a comprehensive national agenda
02	Other Federal Administrations (e.g., FHWA, FTA, NHTSA, etc.)	• Facilitate and lead industry specific assessments and programs • Align national programming with industry specific needs
03	State-Funded Research Organizations (NNTW, , etc.)	• To provide research and development of transportation workforce development strategies • To coordinate and inform other stakeholders on the implementation of workforce development strategies
04	State Department of Transportation	• Conduct workforce development efforts for State transportation workforces • Support other organizations in workforce development efforts at the statewide scale
05	Local Technical Assistance Programs (LTAPs; Occasionally Integrated Into State DOTs)	• To provide low-cost training assistance and other workforce support to local municipalities, counties, rural areas, and other related actors • To serve as a hub for workforce development information and services within each of the States
	Non-Profit, Research, and Academic Sectors	
06	University Transportation Centers (UTC)	• To develop and support research initiatives that support and document workforce development objectives • To coordinate with other organizations to develop innovative programs and advance workforce development practice
07	Regional Research Non-Profits (e.g., SDITE, etc.)	• To coordinate workforce development efforts through collaboration with organizations within the region • To assess and research the workforce development concerns of the region
08	Secondary Education (e.g., Universities, Community Colleges, Technical and Vocational Schools)	• Prepare students for careers in the transportation industry with proper curriculum and other educational opportunities
09	K-12 Education (High Schools, Magnet Programs, etc.)	• Build awareness of and interest in transportation careers from an early age • Prepare students for secondary education programs leading to transportation careers through STEM based curriculum
10	Public Sector Professional Organizations (e.g., AASHTO, APBP, ASCE, APA, ITE, ITSA, WTS, etc.)	• To serve as a connection between the workforce and research communities • Develop assessments and provide strategic frameworks for workforce development practice • Develop and offer workforce development resources in partnership with other actors
	Private Sector	
11	Private Industry Employers	• Provide and conduct training, recruitment, and training for the workforce

TABLE 2: SUMMARY OF REGIONAL STAKEHOLDERS AND RESPONSIBILITIES

While commonalities and levels of coordination exist among actors, the priorities and methods differ among stakeholders - there is little in ways of a universal approach to workforce development, both in conception and in practice (NASEM, 2019). This is exemplified best by the differing levels of participation and approaches of southeastern LTAPs and State DOTs, though the private, educational, and non-profit sectors are not immune. Despite an understanding of the workforce challenges facing the industry at large, stakeholders have differing approach based on specific needs and available resources.

2.2.2 Existing Workforce Development Needs and Practices: Recruitment

In response to the identified challenges of generational change, a lack of workforce diversity, and a growing demand for transportation professionals, workforce development efforts often focus on recruitment strategies. Typical recruitment strategies break out into two common categories: educational-based interventions (usually at the K-12 level) and recruitment targeting workplace diversity. These categories occasionally overlap and act in tandem, aiming to promote future workplace diversity through educational interventions and reforms.

Education

Recruitment efforts along the educational pipeline, starting in K-12 and extending into universities, community colleges, and trade schools, aim to promote awareness of the transportation field and STEM education prior to professional entry. Existing educational development strategies have included the use of scholarships, curriculum reform and integration, mentorship/internship/apprenticeship programs, and public communication efforts (press reports, conferences, etc.). Education constitutes a major priority for workforce development practice in the region; a recent assessment of Southeastern workforce development programs found that out of 1756 workforce development programs across all 12 states and sectors, 212 focused on K-12 education, 335 at the community college/trade school level, and 416 at the university level (SETWC, 2016).

Increasing Workforce Diversity

Efforts to recruit underrepresented demographics, namely women and minorities, address the lack of diversity present in the transportation industry, the changing demographics of the nation, and the documented benefits of a diverse workforce. Strategies to increase workplace diversity follow a similar approach as educational strategies, often focusing on increasing career awareness and opportunities for women and minorities. These recruitment strategies often include the use of targeted advertisement and communication efforts. Specifically, best practices for advertisement and communication include making women and minorities visible in promotional materials, having women and minorities serve as recruiters, communicating a clear policy of inclusion, and locating promotional materials in places highly visible to women and minorities (NASEM, 2020; Avery & McKay, 2006.). Other recruitment strategies focus on improving the image of transportation fields, aiming to change the existing

perception of the white, male majority industry as unwelcoming to women and minorities (Agarwal & Dill, 2008).

Case Examples of Recruitment Practices

- *Southeastern Transportation Workforce Center (SETWC)*

The Southeastern Transportation Workforce Center, housed within the University of Memphis Transportation Center, is the regional affiliate of the National Network for the Transportation Workforce (NNTW). Established in 2014 with Federal Highway Administration (FHWA) funding, the NNTW is a network of five regional university transportation research centers coordinated to address workforce development concerns and share best practices. Within the region, the SETWC has been a leading force in coordinating recruitment efforts in the areas of K-12 and women in transportation. In 2017, the SETWC, in collaboration with the local school district, established the *Transportation-STEM (T-STEM) Academy* at a local high school. As the name suggests, the T-STEM Academy is a magnet school with an educational curriculum focused on developing the core STEM and transportation-specific competencies necessary for a career in the industry. Students of the program are provided the opportunity to earn industry certifications and college credits through dual enrollment at the University of Memphis. The program also connects high school students to industry professionals through field trips and classroom visits, giving early awareness to careers in the transportation industry. Beginning in 2015, the SETWC has hosted the *Choosing Transportation Summit*, a two-day professional conference with a focus on addressing the challenge of recruiting women to the transportation industry. The SETWC also has an ongoing interview and infographic series called the *Transportation Spotlight,* profiling the experiences of women transportation professionals to promote career awareness.

- *Kentucky Transportation Cabinet (KYTC)*

Kentucky's state department of transportation, the Kentucky Transportation Cabinet (KYTC), has developed educational strategies to recruit current and prospective students, particularly historically underrepresented minorities, to careers in the transportation industry. KYTC's Minority Internship Program (MIP) provides internship opportunities for various positions within the KYTC to women and minority students enrolled in Kentucky colleges and universities. These internship opportunities provide job exposure, mentoring, and networking opportunities to women and minorities interested in future careers in the transportation industry.

2.2.3 Existing Workforce Development Needs and Practices: Continuing Education/Training

The most common function of workforce development efforts is in the continuing education and training of the existing workforce. Continuing education interventions aim to develop or strengthen key competencies necessary for success in the transportation industry.

Additionally, the continuing education of the workforce aids in the retention of the workforce, particularly for entry workers. Typically, these strategies focus on the development of traditional technical skill competencies, though the emergence of new technologies and increasing intersectionality with other fields, training strategies are beginning to encompass a wider range of desired skills. Continuing education strategies exist in a variety of formats, ranging from on-the-job trainings, self-paced online courses, in-person or online seminars and workshops, professional certifications, and university courses, among others.

Technical Skills

Traditionally, transportation workforce development efforts have focused on technical skills training, particularly in roadway maintenance and construction (Chang, Lutz & Brown, 2020; NASEM, 2019). The existing state of Southeastern efforts generally reflect this trend; previous assessments of the region found 1756 workforce development programs across all 12 states and Puerto Rico, 735 of which focused on career or technical training (SETWC, 2016). Further, a review of Southeastern LTAP and State DOT offerings indicate that the focus remains on technical skills training, particularly for roadway maintenance and safety. However, in response to the growing body of knowledge and acknowledgement of the range of challenges facing the industry, the portfolios of practitioners are expanding to include a wider range of recruitment, retention, and training topics. The focus on technical skills training is to be expected, as the primary task for workforce development is to ensure employees have and continue to build upon the necessary skills and knowledge to succeed at their jobs. Technical skill training focuses primarily on operations and engineering field competencies related to construction, maintenance, operations, and safety. Existing training portfolios of state DOTs and LTAPs nationwide, including the Southeast, consist primarily of these traditional technical skill trainings, namely in roadway design and construction.

Interdisciplinary Skills Trainings

In response to an increasingly diverse set of job requirements of the modern transportation industry, trainings are beginning to incorporate a wider variety of skillsets (Tom Warne and Associates 2005). The silos of traditional engineering and operations job requirements are expanding; interdisciplinary skillsets that include knowledge of public administration, finance, environmental science/sustainability, and urban planning/design, among other intersecting fields, are in high demand. Most recently, NCHRP Synthesis 543 surveyed state DOTs and LTAPs across the US to identify areas of need, finding that planning, environmental/cultural protection, multimodalism, managerial, and leadership trainings were generally lacking within the portfolios of DOTs and LTAPs across the US (NASEM, 2019). The portfolios of southeastern LTAPs and State DOTs reflect the findings of this study; most are lacking in critical competencies outside of roadway safety and maintenance.

Emerging Technologies

Technological skill development has become an increasing priority for workforce development efforts with recent innovations in the transportation field, though it remains lacking in many workforce development portfolios. The fields of ITS, TSMO; CASE, and MaaS have all emerged in recent years and continue to evolve. Specific technical trainings for these fields are beginning to permeate existing workforce development strategies to meet demand for these skillsets, though are not commonly included in existing transportation agency training portfolios nationally.

Case Examples of Continuing Education/Training Practice

- *North Carolina Local Technical Assistance Program (NC LTAP)*

North Carolina's Local Technical Assistance Program offers a comprehensive portfolio of resources available to assist local transportation agencies and the state department of transportation in workforce education. The NC LTAP currently offers its Roads Scholar program, consisting of three tiers of training curricula based on industry skill needs. The training courses are traditionally offered through in-person workshops, though they have begun to migrate to an online webinar format since the emergence of the COVID-19 pandemic. The first tier of courses provides mostly technical roadway maintenance and operations training, with a few courses on professional and supervisor skill development. The second tier, the Advanced Roads Scholar program, offers advanced technical skill training and a wider suite of interdisciplinary skills training, including management techniques, professional writing workshops, and basic planning and sustainability concepts. The third tier, the Master Roads Scholar program offers a variety of interdisciplinary skills training, including an introduction to geographic information systems (GIS), professional ethics, and leadership skills, among others.

2.2.4 Existing Workforce Development Needs and Practices: Retention

To maximize the effectiveness of training efforts and leverage recruitment efforts, workforce development efforts often use strategies specifically aimed at retaining existing workers. These strategies address the common, non-performance related, causes of voluntary turnover, namely the perceptions of an unattractive workplace environment or a lack of clear career advancement opportunities (Cronin & Alexander, 2011).

Managerial Training and Promotion

Offering clear opportunities for upward mobility is a key component of reducing voluntary turnover among competition for high skilled labor. The perception of a lack of career advancement is a common reason for departure of high-skilled employees. Further, the younger generations entering the workforce typically have an expectation of quick career advancement (Gallagher & Villwock-Witte, 2016).

Improving the Workplace Environment

Creating a workplace where employees feel safe, valued, and respected works to increase employee commitment and reduce voluntary turnover. Strategies to improve the workplace environment include promoting a work-life balance, valuing diversity, and improving the physical workplace, among others. The promotion of a work-life balance entails allowing for flexible work schedules, making opportunities for telework available when desired, offering more paid time off/alternative leave schedules, and offering healthcare, fitness, and rehabilitation support and care. Employees tend to stay in positions where others like them are represented and valued. This is especially important when considering the experience of women and minorities in the historically white, male dominated transportation industry. Along with an increased focus on the recruitment of women and minorities, the workplace structure, culture, and environment must be supportive of their particular considerations. Promoting and communicating the benefits of a diverse workplace, including setting a clear priority on Equity, Diversity, and Inclusion training can help in creating a welcoming and supportive workplace environment for all, but particularly for women and minorities. Additionally, improving the physical conditions of facilities, including the provision of appropriate, updated technological resources, can help in promoting a positive workplace environment and a reduction in voluntary turnover.

Case Examples of Retention Practice

- *Florida Department of Transportation Statewide Workforce Development*

In May of 2019, Florida Senate Bill 7068 launched the Florida Department of Transportation's Statewide Workforce Development program to consolidate a comprehensive workforce development strategy for the state. One initiative of this program was the *Industry Pay and Benefits Workforce Comparison Survey*. This survey collected pay information for 30 entry level positions across 1,800 different private and public transportation employers to assess whether wages and benefits in Florida's roadway construction industry were comparable with other markets competing for entry-level workers with similar skills. The results from this survey were used to inform future workplace management practices to better retain skilled workers in a competitive labor market.

2.3 Role of Self-Assessment

Previous literature has identified the importance of self-assessment of training needs by workforce development practitioners, particularly of State DOTs and LTAPs. While most agencies have a strategy of self-assessment that guides strategic planning, it is not a universal occurrence (National Academies of Sciences, Engineering, and Medicine, 2006). To keep pace with the changing demands of the industry, it is crucial to reinforce the need to incorporate audience feedback into the development of workforce development strategies.

2.4 Conclusions from the Literature

The scope of transportation workforce development is broad and multifaceted. The lack of unified or comprehensive workforce development framework among a wide variety of

stakeholders is reflected in the existing body of knowledge. There is no comprehensive understanding of the state of workforce development practice at-large; previous literature often focuses on a specific sector or facet of workforce development. Most of the previous research related to workforce development addresses national or statewide practice; this study aims to address the need for a regional assessment of transportation workforce development needs and conditions.

The challenges facing the transportation industry are widely documented and generally well understood by workforce development stakeholders. The current state of workforce development practice in the region demonstrates that practice is responding to need, though not comprehensively. The focus of workforce development efforts remains on traditional technical skills training, particularly within the public sector. The beginnings of a wider approach to workforce development can be seen within the region, particularly through the work of the academic and non-profit sectors.

3.0 METHODOLOGY

This study employs a mixed methods approach to data collection, relying on the synthesis of information from an introductory stakeholder meeting, a survey sent to transportation professionals, and a series of interviews with identified industry experts. The data collection instruments, and anonymized results can be found in Appendices A-E.

3.1 Data Collection

Stakeholder Meeting

To validate findings from the literature review and to identify and refine topics for further exploration in future data collection efforts, an hour-long stakeholder meeting was hosted by the research team on 1/13/2021. The meeting consisted of 17 industry practitioners recruited from identification of expertise by our research team and their networks. The 17 participants were selected to obtain a sample that was representative of the Southeastern Transportation Industry, including at least one participant from each state within the region (with the exception of Alabama) and a diversity of sectors, roles, and experience. The participants were divided into 4 distinct groups based on topics of focus following the findings of the literature review, then led in moderated discussions by members of the research team. The groups were organized to discuss: 1) Equity, Diversity, and Inclusion; 2) Continuing Education/Workforce Training Needs; 3) Workforce Development Priorities and Mediums; and 4) Strategies to Respond to Demographic Change. The participants were notified of these categories and were required to self-select a group based on their subject matter expertise. The discussions were moderated by members of the research team, following a rough script addressing: 1) Current Conditions; 2) Expected Changes; and 3) Future Conditions. Data was collected via detailed note taking from research assistants assigned to each group and an online collaborative document open to the meeting participants. Participants were encouraged to

freely make notes and address each topic on the online document, allowing for additional information to be gathered independent of the notes taken from the meeting. This meeting provided the preliminary information used to develop and refine the questions included in the practitioner survey and interview series.

Practitioner Survey

Informed by findings from the literature review and stakeholder meeting, a survey questionnaire was sent to transportation professionals across the United States (see Appendix B). The survey was hosted online through a UF affiliated Qualtrics account. The survey was distributed through the digital communication channels of major transportation professional organizations (ITE Newsletter, APA Newsletter, Personal and Professional Email Lists, etc.). Respondents were given the option to receive a survey distribution link that they could share freely among their professional network to increase response rate. Through this distribution method, the survey intended to broadly capture the lived experience of workforce development practices and previously identified challenges facing the transportation workforce. Due to the broad audience, the intention of the survey, and limits on the timeline of the research, a specific sample size and distribution was not targeted. The survey questions were categorized following previous organization strategies, addressing the following: existing conditions, priorities, and mediums; future conditions, priorities, and mediums; educational pipelines; retainment/recruitment challenges; emerging technologies; demographic change; and equity, diversity, and inclusion strategies. Demographic and other identifying questions were also asked to enable comparison, validation, and the creation of sub-selection if the overall sample size allowed.

Interviews

A series of informal interviews were conducted with nine transportation professionals and workforce development practitioners in parallel with the survey to discuss the experience of transportation workforce development and gather a range of strategies/responses to prevailing challenges in the industry. The interviews were hosted online via Zoom. The interview participants were selected following recommendations from participants in the stakeholder meeting. The participants represented a diverse group of transportation professionals operating in the private, public, or academic sectors within the United States. Seven of the nine participants have previous experience or are located within the Southeastern Region, the remaining two participants were had previous experience in workforce development in states outside of the Southeast but were included to allow for additional comparison and contrast. The interviews were led by members of the research team, following an informal script addressing the same topics as the survey in additional depth. Through this parallel structure, the two methods intend to work in synthesis to develop additional validity and fidelity to overall data collection efforts.

3.2 Data Analysis

Survey

The practitioner survey was processed using tools available through Qualtrics. The Survey is 30 questions long, not including identifying questions. The survey took 10-20 minutes on average to complete. The survey was open from July 1st to September 1st, 2021. The total sample size gathered during this period was 43 complete responses. The open-ended responses were exported and processed using NVIVO to identify common responses.

The small sample size of 43 respondents is a limitation to this method of data collection. The effectiveness of this survey is limited by its sample size and cannot be considered statistically significant nor representative of the Southeastern Transportation Workforce at-large. While this limits the ability for the survey to provide a means for analysis on its own, this method was never intended to stand alone, and as such, is still relevant within the larger context of results found in this study. Regardless of the sample size, the results from the survey are used in synthesis with findings from the interviews and literature review to broadly characterize the existing experience and perceptions of transportation professionals in the Southeast.

Interviews

The series of informal interviews were recorded with participants consent and transcribed manually. The interviews included a set of 28 questions to guide open discussion, paralleling the questions developed in the survey as closely as possible. The interviews lasted 40-60 minutes, based on participant availability and the depth of response. The transcripts were processed in NVIVO using thematic analysis methods to categorize the response to each question.

4.0 RESULTS

The complete record of the anonymized results for the practitioner survey and informal interview series are available for reference in Appendix A and B, respectively. The following section provides a narrative of major findings for each survey and interview question.

4.1 Major Findings from the Survey

Workforce Development Resources are Abundant and Well-Known, but Lack Coordination

The survey data suggests that transportation professionals learn of workforce development opportunities from a wide variety of sources, both internal and external to their organization. Most respondents (60.3%) indicated they use workforce development resources more than once per quarter, with roughly one fourth (23.3%) using resources more than once per month.

Additionally, responses indicate transportation professionals are often seeking workforce development on their own accord, rarely guided, or made aware of a strategic workforce development plan internal to their organization. Respondents indicated that they have received workforce development resources from a variety of sources, including professional organizations, online courses (LinkedIn Learning, Coursera, etc.), the academic sector, and governmental organizations, reflecting the fragmented network of stakeholders involved in the provision of resources. The results indicate that workforce development resources are made available through not only a variety of sources, but a variety of mediums as well, including in-person workshops/seminars, online trainings (both synchronous and self-guided), and on-the-job training. The responses also suggest that workforce development offerings are generally informed by employee evaluation or feedback, typically as part of their annual performance review or as an annual survey. The presence of a system of internal evaluation may help in future coordination or formulation of resources based on employee need. Overall, the survey indicates that workforce development resources are abundant and well-known to industry professionals. However, the lack of coordination among stakeholders and strategic direction from employers often leave the onus on employees to address workforce development on their own accord.

Workforce Training Reflects Professional Demand, Addressing a Variety of Technical and Non-Technical Skills

The survey responses suggest that the objectives of workforce development training are diverse, aiming to address both technical skills (including technological skills) and "soft" skills (including both personal and professional skill development). According to the responses, cross-training or interdisciplinary skills development is less readily available than technical and soft skill development. Moreover, respondents indicated that technical and "soft" skills training were most commonly valuable for success in their current position. Therefore, the prioritization of technical and "soft" skills development – and the discounting of cross-training and other ancillary skills - reflects professional demand. Overall, the survey indicates that current workforce training prioritizes technical and "soft" skills training, following professional demand for the development of these particular competencies.

Emerging Technologies and Knowledge Transfer are Major Areas of Future Concern

Respondents commonly indicated that emerging technologies will drastically change the responsibilities of their work, and subsequently, the competencies necessary for success in their current position. Respondents commonly indicated a need for additional training in the areas of software, data management, data visualization, and computer science for future success in their current position. Additionally, respondents commonly indicated that due to the pace of technological change, the role of knowledge management/transfer will become increasingly crucial to continued success in their position.

Strategies to Address Recruitment Challenges Are Unclear to Industry Professionals

Survey responses indicate a lack of communication from management to staff on existing strategies to address current recruitment challenges facing the industry. Average scores for questions related to the respondent organization's ability to fill vacant positions and respondent's understanding of their organization's recruitment strategy were 2.81 and 3.05 (on a five-point Likert scale) respectively, pointing towards a lack of consensus or understanding of organizational recruitment strategy. Additionally, respondents indicated that their employers recruit through a variety of mediums, most commonly online job listings (LinkedIn, etc.) (24% of total responses), internships or mentorships (16% of total responses), professional organization communications (15% of total responses), academic communications (15% of total responses), and digital advertising (13%).

Transportation Work Provides an Attractive Work Environment, but May Lack Opportunity for Advancement and Desired Compensation for Some

Overall, responses to questions related to workplace satisfaction scored positively on a five-point Likert scale (no response had an average score less than 3.5), indicating a generally positive perception of work in the industry. However, among these questions, responses were lower for those related to adequate compensation and opportunities for advancement (3.58 and 3.73, respectively) relative to questions related to workplace flexibility, culture, and safety (4.24, 4.32, and 3.89, respectively). The difference in scores indicate that while respondents are generally satisfied with the quality and attractiveness of their workplaces, there may be room to improve in the areas of compensation and opportunities for advancement.

Pre-Professional Educational Pipeline Provides Technical Skill Development, but Lacks in Personal Skill Development

For questions related to educational preparedness for success in the industry, respondents indicated that their educational backgrounds were successful in providing them the technical and professional (i.e., report writing, working in teams, etc.) skills necessary for success in their current position (scoring an average score of 3.94 and 3.75 on a five-point scale, respectively). Additionally, respondents indicated that their educational backgrounds did not prepare them with certain skillsets, namely administrative (2.53), personal (2.50) skills, as well as knowledge of law (2.5) and equity, diversity, and inclusion strategies (2.44).

4.2 Major Findings from the Interviews

The Existing State of Transportation Workforce Development Generally Addresses Technical and "Soft" Professional Skill Development Through a Diverse Network of Sources and Mediums

When asked about the current state of workforce development practice, interviewees commonly identified traditional technical and "soft" professional skills as the primary areas of focus, mirroring the findings from the practitioner survey. According to common themes

emerging from the interview responses, the current workforce development priorities of technical and professional skill development are primarily aimed at supporting existing staff in achieving success in the demands of their current position. This echoes the traditional understanding of the role of workforce development found in the literature review: as "*strategies aimed at developing competencies and skills for specific positions and individuals.*" (NASEM, 2019).

Additionally, major themes from the interviews further the understanding of transportation workforce development as an effort of a multitude of diverse stakeholders. When asked about the source of workforce development resources used in their work, nearly all respondents indicated that their training resources are sourced from a mixture of internal and external providers, including those from national (e.g., USDOT, National Highway Institute (NHI), etc.), regional (e.g., LTAPs, State DOTs, etc.), professional (e.g. AASHTO TC3, etc.), and private (e.g. Coursera, LinkedIn Learning, private consultancy, etc.) sources.

Based on the interview responses, the mediums of workforce development resources are similarly diverse, with responses commonly indicating that training is generally offered through in-person events like seminars, on-the-job training, or workshops, or more recently, due to the COVID-19 pandemic, through online offerings like synchronous webinars and self-paced online courses.

Emerging Technologies and Shifts in the Labor Market are Major Areas of Concern for the Future State of Transportation Workforce Development

When asked to identify major challenges facing the transportation industry, interviewees commonly identified emerging technologies and trends in the labor market as their areas of primary concern. Concerns around emerging technologies were twofold. The first theme that emerged is a concern for the current lack of personnel with the expertise to properly use or plan for emerging technologies (like drones and autonomous vehicles). The second is the lack of technological skillsets available in the labor pool, both now and into the future, due to ineffective or absent recruitment efforts and competition with other, better paying industries. Additionally, common concerns were raised on the ability for the transportation industry to both retain existing employees and recruit new ones due to a comparative lack of compensation and absent or ineffectual efforts to generate interest in the industry from non-traditional educational and pre-professional pipelines. Generally, the interviewees voiced concerns that the industry will not be able to hire personnel with the skills necessary (namely in information technology and data management) to meet the requirements of a field with rapidly changing responsibilities. Less common responses included concern for general trends in the labor market, like the declining labor participation rate and competition for maintenance workers due to minimum wage hikes.

Educational Pipeline Does Well to Prepare Technical Skills for Entry Workers, but Can Improve in Professional Skill Development and Recruitment Efforts

When asked about educational preparedness of entry level employees, interviewees agreed that the educational pipeline is producing personnel with adequate technical capabilities but lacking in professional skills like communication (both verbal and written), project management, and organization. The interview responses commonly pointed towards the strength of University and Technical Schools in technical coursework and weakness in providing opportunities for professional engagement and industry exposure as causes of the skills gap for entry employees. An important theme to note however, is that despite their concerns, interviewees commonly conceded that the strength of professional skills is not a major expectation or point of attraction when hiring entry level workers, as this can be learned through on-the-job training and experience, rather that entry level employees are selected based on their technical ability to do the work assigned. Additionally, other common concerns for the educational pipeline included a need for additional, earlier recruitment efforts and better communication of expectations and skillsets necessary for work in the transportation industry. Generally, interview responses indicated a general satisfaction with educational preparedness of entry level employees but concerns about the lack of recruitment efforts and opportunities for pre-professional industry exposure within the educational pipeline.

Awareness of Barriers/Challenges for Women and Minorities in the Transportation Industry is Gaining, but Implementation of Strategies Has Yet to be Seen

When asked about the experience of women and minorities in the industry, interviewees commonly agreed that there is recognition and acceptance about the importance of workplace diversity, but that tangible strategies to better the experience of women and minorities are severely lacking. The interview responses indicated that there is a general understanding of the transportation industry as white male dominated. The interview responses made it clear that despite a common understanding of why strategies to increase diversity are important, progress to implement successful strategies has yet to be seen. Interviewees commonly responded that while equity, diversity, and inclusion trainings and overall awareness of the issue are common, there has been little to no change in demographic representation within their organization and no specific strategies have been implemented to improve the workplace for underrepresented groups.

Generational-Specific Strategies not Related to Knowledge Transfer are Generally Seen as Reductive

When discussing strategies to address the generational shift in the transportation labor force, interview respondents commonly voiced concern, expressing that generation-specific strategies are generally viewed as reductive. Interviewees voiced a common understanding that the current discourse on the differences in generational work and learning styles is not connected nor important to the challenge currently facing the transportation industry. Based on the responses, generational-specific strategies (i.e. recruiting Millennials, adapting the workplace to meet the needs of generational learning styles, etc.) are not currently used and seen as counterproductive to the needs of the industry. According to the interview responses,

the age/generation of a particular employee has no tangible bearing on their ability to succeed in the position they were hired, and conversely, the factors that are important (i.e. technical expertise, professional skills, etc.) are universal across all generations. Interviewees expressed that they would prefer more universal workforce development strategies based on employee need, rather than a particular employee's generational standing. However, when discussing the "aging out" of the industry, interview responses commonly identified the need for more robust knowledge management/transfer systems and leadership training to ensure institutional knowledge is not lost to turnover.

Though Common Points of Understanding Exist, There is No Universally Accepted Definition of Workforce Development

When asked for their definitions of workforce development, each participant had a unique understanding of its definition and role. While responses showed an understanding of major themes – commonly addressing the educational pipeline, training needs, and employee satisfaction/success – no universal definition of workforce development emerged from this series of interviews. Based on the responses, there seems to be a general understanding of the purpose of workforce development, but that understanding is fragmented based on the specific needs and strategies employed within their particular organization, furthering the findings of the survey and literature review.

5.0 CONCLUSION

This study has reiterated that the transportation industry continues to face clear and present threats to the strength of its workforce. Demographic changes, labor market forces, emerging technologies, and the growing need for interdisciplinary skillsets are all well documented challenges facing the industry now and will continue into the future. This study has found, in reinforcement of previous findings, that there is an uncoordinated understanding of the purpose and application of transportation workforce development within the Southeast. While this study has shown that the region is generally strong in technical and professional skill development for existing employees, there is little progress on recruitment and retainment strategies, including K-12 education, labor practices, and workplace diversity. The largest barrier to the resolution of workforce challenges facing the Southeastern transportation industry is the general lack of coordination among stakeholders within the region. The prevailing issues and potential solutions have been documented in previous literature, though the application of this research as part of a coordinated effort to address these challenges has yet to be fully realized. Thus, this study aims to provide a general summary of both existing and future challenges facing the Southeastern transportation industry and provides a source of reference for future research and action on workforce development practices within the region.

6.0 RECOMMENDATIONS

6.1 Recruitment

Conduct Recruitment Earlier in the Pre-Professional Educational Pipeline

A concerted effort to recruit in the earliest stages of the educational pipeline (K-12) across the region could help in addressing a few of the identified recruitment and labor challenges facing the industry. Renewed efforts to conduct meaningful recruitment earlier in the educational pipeline can combat the lack of interest and awareness in careers in the transportation industry, competition with other industries in the recruitment of younger workers, and a general lack of unified K-12 recruitment strategy identified as major areas of concern by this study. By leveraging the existing expertise within the region, namely the strategies practiced by the SETWC, STRIDE can potentially coordinate a regional effort to add additional recruitment programs in K-12 school programs. By having a permanent presence in the early educational pipeline, STRIDE can ensure continued exposure to careers in the transportation industry throughout the pre-professional pipeline of the Southeast. Creating a continuum of transportation career awareness and exposure to the youngest generation can potentially help bridge the existing shortage of transportation workers in the near future. Additionally, partnerships with both private and public employers in K-12 recruitment is encouraged to increase industry exposure, connect students to realistic job expectations, and provide future networking opportunities.

Conduct Recruitment Outside of Traditional Educational Pathways

In addition to rebuffed K-12 recruitment, the industry could benefit from recruitment from non-traditional secondary educational programs that produce in-demand skills, such as programs related to computer science, business, among others. This project identified a few relevant trends that can be addressed by the recruitment of workers from non-traditional educational backgrounds: 1) A breakdown in traditional work silos within the transportation industry; 2) An increased demand for interdisciplinary and technological skillsets; and 3) A severe and increasing shortfall in labor. Due to the changing nature of transportation work and the existing shortfall in incoming labor, recruitment effort ought to extend beyond the traditional engineering/planning programs. STRIDE, in partnerships with UTC's, other universities, and industry employers, have the capacity to potentially develop a framework for recruitment outside of the traditional engineering/planning pathways. This could be as simple as having a presence at a wider variety of college career fairs, networking with existing student organizations outside of traditional programs, and/or creating interdisciplinary student projects/programs. Overall, there ought to be a concerted and coordinated effort to recruit personnel with in-demand skills wherever they may be, which is increasingly likely to come from non-traditional educational pathways due to the changing requirements of transportation work.

Re-emphasize Efforts to Recruit Women and Minorities to the Transportation Industry

The findings of this study re-emphasize the lack of representation of women and minorities in the transportation industry. While this study shows a general awareness of the importance of workplace diversity and EDI trainings, it is unclear whether or not there is any unified and specific recruitment strategies aimed at improving the representation of women and minorities within the industry. This study has shown a general passivity towards the recruitment of women and minorities within the transportation industry. STRIDE, along with employers and professional organizations (like WTS), have the capacity to develop a more active strategy to the recruitment of women and minorities to the primarily white-male dominated transportation industry. Specific strategies can include additional mentorship programs, improved communication, and promotion (following the example of the SETWC's *Transportation Spotlight* program), working with existing student organizations (WTS student chapters, NSBE student chapters), and developing a set of recommended EDI strategies for employers, among others.

Promote Efforts to Rebrand the Transportation Industry to the Next Generation of Potential Workers

Misconceptions and perceptions about transportation work remain a major barrier to the transportation industry's recruitment efforts. As a general recommendation, there ought to be a concerted effort by industry and state DOTs to better communicate realistic expectations of transportation work to the general public. As addressed in this study, the transportation industry provides a diversity of positions and a number of specific benefits (like steady hours, pensions, etc.), though the public is often unaware of or have misconceptions about these facets of transportation work. To effectively recruit, a universal baseline, one that currently does not exist, must be better established by effectively communicating the benefits and realistic expectation of what it means to have a career in the transportation industry. STRIDE may have a role to play in this, through the development of promotional materials and research support, though State DOTs and other major industry employers are the primary stakeholders in this effort.

Follow the Recruitment Efforts of Competing Industries, Particularly Tech

In this study, the tech industry was named as a major source of competition for talent. As a general suggestion, it may be effective to follow and attempt to emulate the practices of these industries to better combat this competition for talent. While the tech industry provides a different set of benefits and expectations, it would be beneficial to better understand what major selling points/attractors are being leveraged to recruit talent and adapt the transportation industry's recruitment strategy accordingly. Essentially, the tech industry has been identified as a specific source of recruitment competition, thus, the transportation industry ought to develop a specific response in the recruitment strategies. STRIDE may have a

role in research assistance, but the main stakeholders are the industry employers who are most heavily involved in recruitment.

6.2 Academic Preparation

Update Traditional Educational Pipeline Curriculum to Reflect In-Demand Skills

The findings of this study have re-emphasized the rapidly shifting nature of the transportation industry. While this study found that job-preparedness of entry level workers is generally satisfactory, there are shortcomings in a few key competencies, namely in professional and technological skillsets. Efforts to increase the responsiveness of secondary educational curriculum can help in responding to the quickly changing expectations and skill-needs of the transportation industry both now and into the future. STRIDE or a similar research organization, in partnership with employers and UTC's across the region, ought to develop a regular review of traditional university program curriculum and adapt following identified industry needs. Close, permanent industry partnerships will be key in identifying what skills are in-demand both now and in the future. Additionally, Universities can better prepare the next generation of transportation workers immediately by providing more opportunities for industry exposure and additional coursework related to in-demand skills like data management, computer science, and professional skill development. The existing network of stakeholders have the capacity and connections to begin the development of such a program: the existing methodology employed by the ASCE in the development of updates to the CEBOK can be used as a rough example of how industry-educational partnerships can be used to update curriculum to better reflect in-demand skills.

Create Opportunities for Interdisciplinary Education and Collaboration

This study found that work in the transportation industry is becoming increasingly inter-disciplinary. As such, educational programs ought to create more opportunities for students in traditional pathways to collaborate with students from other, non-transportation related fields. The cross-pollination of skillsets through work on interdisciplinary teams can aid in overall preparedness for work in the increasingly diverse transportation industry. Since the traditional silos of transportation work are breaking down, the educational silos must similarly break down to allow the development of and exposure to interdisciplinary skillsets. STRIDE or a similar research organization, in partnership with regional UTC's and universities, ought to begin to develop a series of best practices in promoting interdisciplinary educational opportunities within university engineering and planning programs. Industry partners can be leveraged to introduce meaningful and actionable projects for interdisciplinary university student teams to work on, either through coursework or other extra-curricular programs.

Promote Opportunities for Pre-Professional Industry Exposure Through Renewed Collaboration and Recruitment Efforts

This study identified a shortfall in professional skill development within the pre-professional educational pipeline. To combat this shortfall, opportunities for industry exposure, though mentorship, internships, or an improved industry presence within the academic environment, ought to be promoted insofar as possible. A major trend identified in this study is that generally, professional skill development is best learned through on-the-job, learned experience. While there may be no substitute for learned experience, structural efforts to provide pre-professional industry exposure may be beneficial in providing professional skill development and increasing overall job-preparedness for those interested in careers in the transportation industry. STRIDE or a similar research organization, along with other regional UTC's, universities, and industry partners, ought to renew efforts to increase the opportunities for professional skill development via industry exposure. Strategies can include providing guest lectures or workshops from industry professionals, providing specific coursework related to professional skill development, working with industry partners to develop internship or mentorship cohorts/programs, and providing academic projects that better emulate a workplace environment.

Support the Development of Partnerships and Pathways with Community Colleges and Technical Schools

To combat the labor shortfall facing the transportation industry, community college and vocational/technical schools ought to be better leveraged to produce personnel with desired skillsets, namely in the maintenance and operations sector of the transportation industry. Technicians, surveyors, data scientists, and other in-demand, high-paying transportation careers often do not require university degrees. Therefore, community colleges and technical schools should be leveraged to produce personnel with skillsets appropriate for these in-demand positions. STRIDE or a similar research organization, in partnership with other universities, community colleges, and technical schools, ought to begin to collaborate on the sharing of resources and development of curriculum/program related to transportation career preparedness, either through certificate programs or degree offerings.

6.3 Continuing Education/Training

Promote the Provision of Additional, Improved Opportunities for Technological Skills Training

As identified in this study, technological skills training is a major area of concern for industry professionals. Emerging technologies like MaaS, TSMO, automated vehicles, simulation, and drones are beginning to outpace the skillsets present in the current transportation workforce. More worrying, however, is the lack of resources available for the continuing technological education of the current workforce. To better provide for the changing technological training needs of current industry professionals, STRIDE, or a similar research organization, in partnership with LTAPs, UTCs, DOTs, and professional organizations (the major

sources of training resources and technological expertise), ought to develop a suite of technological skills training for the transportation industry within the region.

Promote the Utilization of Multiple Training Delivery Methods Where Appropriate

This study identified a recent shift in training delivery methods in the advent of the COVID-19 pandemic. Traditional in-person workshops and training events had to shift to an online setting, either through asynchronous, on-demand offerings or synchronous webinars/workshops. This shift has shown to be beneficial, allowing for additional flexibility and a greater reach. Thus, STRIDE and its partners should work with LTAPs, DOTs, and UTCs to provide resources to improve online training offerings to make this beneficial shift more effective and permanent. While those providing workforce training have done an adequate job responding to the pandemic, STRIDE and other university partners can use their specific expertise on online education delivery learned during the COVID-19 pandemic to improve the online catalogues of these providers.

Promote the Use of Knowledge Management Systems to Combat the Aging Out of the Transportation Workforce

This study has identified that the transportation workforce faces the threat of losing institutional knowledge as the industry ages-out. This is particularly pressing due to the shortfall in incoming labor and lack of personnel capable of mentorship or on-the-job knowledge transfer that would typically suffice. The use of knowledge management systems, software or other methods to allow the storage and access of institutional knowledge related to job performance, can better facilitate the transfer of institutional knowledge from the older-to-younger generations, particularly as a large proportion of the current workforce ages-out. As a general recommendation, all stakeholders ought to invest in knowledge management systems, primarily to organize and preserve the institutional knowledge present in their existing workforce.

6.4 Retention

Promote Flexible Work Arrangements

This study found that the effects of COVID-19 on work preferences/behaviors are viewed as generally favorable and ought to be encouraged to remain as an option. The work from home or hybrid work schedules have seen more prevalence in the era of COVID-19 and, as seen in the information collected from this study, are favored and likely to stay in effect. The additional workplace flexibility and responsiveness to individual preference that these models provide are part of larger labor strategies that can be effective at retaining employees within the industry, particularly from other industries that may or may not provide these arrangements permanently. As a general recommendation, STRIDE, along with other regional stakeholders, should support in the transition to permanently flexible work arrangements,

particularly through the communication of best practices, resources, and general lessons learned in during the COVID-19 pandemic.

Advocate for Competitive Compensation for Public-Sector Transportation Workers in the Southeast

One of the major themes emerging from this study's interviews was frustration from the inability to provide competitive compensation for workers within the region's public sector. Compensation varies from state-to-state, however, based on the interview responses, the region faces a major threat to retention and recruitment due to the inability to compete with private transportation firms and other industries for workers, both skilled and un-skilled. With a short labor supply and raising minimum wages, those who would be typically attracted to unskilled maintenance and operations positions are seeking other options. For high-skilled workers, the public sector is often unable to offer wages comparable to the private sector, contributing to voluntary turnover. While the severity of the issue differs from agency to agency and state to state, some public sector agencies, such as the case of TxDOT, have been able to become an employer of choice by offering competitive wages. As a general recommendation, public sector agencies throughout the region ought to explore the possibility of raising compensation to aid in reducing the barriers to retainment and recruitment, particularly with an understanding of the existing labor shortfall and expected increase in demand.

Promote Regional Key Performance Indicators to Identify and Continually Improve Progress on Equity, Diversity, and Inclusion Strategies

The responses gathered by this study showed that while transportation practitioners understood the value of workplace equity, diversity, and inclusion strategies, the application of such strategies is inconsistent. To move beyond understanding and into practice will require a systematic commitment to increasing diversity within the majority white, male industry. As a general suggestion, efforts to promote a clear equity, diversity, and inclusion framework with measurable key performance indicators among the many sectors of the regional industry ought to be pursued. A framework with clear indicators may provide a better understanding of the state of representation of women and minorities across the region and aid the further coordination of action on these issues. Creating a welcoming workplace environment for underrepresented groups through the implementation of equity, diversity, and inclusion strategies is crucial in attracting a diverse workplace better reflective of the nation's demographics.

6.5 Business Processes

Begin Organizational Efforts to Create Regional Dialogue on Workforce Development and Labor Best Practices

This study, reinforcing the findings of previous literature on the topic, found that the state of transportation workforce development is characterized by a lack of common understanding and coordination. Despite the rich body of literature on the topic and previous efforts to communicate a clear workforce development framework, there is a lack of coordination among sectors within the region to address the prevailing issues pertaining to transportation workforce development. STRIDE or a similar research organization, in partnership with other stakeholders within the region, ought to begin the process of communicating a clear, unified workforce development framework as identified in this and previous studies to be shared among the existing network of regional stakeholders. Efforts to communicate existing research and adopt a unified workforce development framework may help create a begin to create a universal understanding of challenges, solutions, and available resources. This common understanding may benefit future efforts to coordinate the actions of regional stakeholders.

6.6 Collaboration and Coordination

Provide a Centralized Clearinghouse for Transportation Workforce Development Resources Available to the Southeastern Region

This study found that despite an abundance of available and well-known transportation workforce development resources, there is a lack of coordination among actors. Currently, there is no centralized source of information regarding transportation workforce development resources within the region. The SETWC has previously conducted efforts to provide one such catalogue of resources, though it is no longer available. STRIDE or a similar research organization, in partnership with the SETWC, other universities and UTCs, ought to begin to catalogue existing workforce development resources available to the region's stakeholders and provide a centralized, regularly updated repository for this information. By creating a single point of available resources, STRIDE, or another hosting party, may improve coordination among the different workforce development providers and users within the region. Creating such a platform will also facilitate additional networking and communication efforts between regional stakeholders and increase collaboration across private, public, and educational sectors.

Create a Regional Platform for Sharing Resources and Best Practices for Transportation Workforce Development

In addition to providing a catalogue of existing workforce development resources, the development of an open platform or forum for stakeholders and providers to share practices may provide additional benefit to coordination within the region. This can be as simple as a LinkedIn group or email list but could take various other forms. This differs from the previous recommendation in terms of user and function. A centralized catalogue provided and managed by STRIDE or other partners can serve to give stakeholders and providers a quick glance at existing efforts. A regional, open platform or forum can allow stakeholders to openly communicate with one another, share resources and/or best practices, and coordinate

independent of, or with, STRIDE and its partners. It could also provide a centralized place to promote new workforce development events, establish working groups, or discuss particular issues within the region.

7.0 REFERENCE LIST

Agrawal, A. W., & Dill, J. (2008). To be a Transportation Engineer or Not? How Civil Engineering Students Choose a Specialization. *Transportation Research Record*, *2046*(1), 76–84. https://doi.org/10.3141/2046-10

American Society of Civil Engineers (ASCE). (2019). *Civil Engineering Body of Knowledge: Preparing the Future Civil Engineer* (Third Edition). American Society of Civil Engineers. https://doi.org/10.1061/9780784415221

Avery, D. R., & McKay, P. F. (2006). Target practice: An organizational impression management approach to attracting minority and female job applicants. *Personnel Psychology*, *59*(1), 157–187. https://doi.org/10.1111/j.1744-6570.2006.00807.x

Braden, D. (2017, October 23). "US Driver Shortage Becomes Top Trucking Concern," Journal of Commerce. [Online].

Chang, K. N., Lutz, B., & Brown, S. (2020). Workforce Development Needs and Objectives of Today's Transportation Engineering Professionals. *Transportation Research Record*, *2674*(9), 148–156. https://doi.org/10.1177/0361198120926995

Committee on Future Surface Transportation Agency Human Resource Needs. (2003). The Transportation Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies – Special Report 275 Retrieved from: https://www.nap.edu/download/10764.

Council of University Transportation Centers (CUTC). 2012. *A National Transportation Workforce Development Strategy: A Roadmap to the Future.* http://cutc.tamu.edu/workforce.html.

Cronin, B., & Alexander, A. (2019). Responding to the demographic and skill shifts in the mobility workforce. In T. Reeb (Ed.), *Empowering the New Mobility Workforce* (pp. 125–148). Elsevier. https://doi.org/10.1016/B978-0-12-816088-6.00006-7

Gallagher, S., & Villwock-Witte, N. (2016). Millennials in the Transportation Workforce. *Transportation Research Record*, *2552*(1), 43–47. https://doi.org/10.3141/2552-06

Hunt, V., Dixon-Fyle, S., Prince, S., & Dolan, K. (2020). *Diversity Wins: How Inclusion Matters*. McKinsey and Company. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/diversity%20and%20inclusion/diversity%20wins%20how%20inclusion%20matters/diversity-wins-how-inclusion-matters-vf.pdf

Hunt, V., Layton, D., & Prince, S. (2015). *Why Diversity Matters*. McKinsey and Company. https://www.mckinsey.com/~/media/mckinsey/business%20functions/organization/our%20insights/why%20diversity%20matters/why%20diversity%20matters.pdf

Ivey, S. (2019). Inspiring the next generation mobility workforce through innovative industry–academia partnerships. In T. Reeb (Ed.), *Empowering the New Mobility Workforce* (pp. 317–348). Elsevier. https://doi.org/10.1016/B978-0-12-816088-6.00015-8

Joh, K., & Li, W. (2015). *Developing an Interdisciplinary Transportation Certificate Program for Todays Transportation Workforce*.

Leonard, J. J., Mindell, D. A., & Stayton, E. L. (2020). *Autonomous Vehicles, Mobility, and Employment Policy: The Roads Ahead*. MIT Task Force on Work of the Future Research Brief.

Martin, C., & Dudley, A. (2017, August). Help Wanted. *Public Roads*, *81*(1). https://www.fhwa.dot.gov/publications/publicroads/17julaug/05.cfm

National Academies of Sciences, Engineering, and Medicine (NASEM). (2011). Strategies to Attract and Retain a Capable Transportation Workforce. NCHRP Report 685. Washington, DC: The National Academies Press. https://doi.org/10.17226/14475.

National Academies of Sciences, Engineering, and Medicine (NASEM). (2019). Transportation Workforce Planning and Development Strategies. NCHRP Synthesis 543. Washington, DC: The National Academies Press. https://doi.org/10.17226/25624.

National Academies of Sciences, Engineering, and Medicine (NASEM) (2020). Attracting, Retaining, and Advancing Women in Transit. TCRP Synthesis 147. Washington, DC: The National Academies Press. https://doi.org/10.17226/25741.

National Operations Center of Excellence (NOCoE). (2016). *NOCoE 2016 Workforce Summit Proceedings and Implementation Plan*. https://transportationops.org/publications/nocoe-2016-workforce-summit-proceedings-and-implementation-plan-final

Popkin, S. M., Morrow, S. L., Di Domenico, T. E., & Howarth, H. D. (2008). Age is more than just a number: Implications for an aging workforce in the US transportation sector. *Special Issue: Contemporary Research Findings in Shiftwork*, *39*(5), 542–549. https://doi.org/10.1016/j.apergo.2008.02.003

Southeast Transportation Workforce Center (SETWC). (2016). *Job Needs and Priorities Report*. Southeast Transportation Workforce Center, http://www.memphis.edu/setwc/job_needs_and_priorities_report/index.php

Tom Warne and Associates, LLC. (2005). *In-Service Training Needs for State DOT's*. National Cooperative Highway Research Program. http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/20-24(50)_FR.pdf

U.S. Department of Education, Office of Career, Technical, and Adult Education. (2015, August). *Strengthening Skills Training and Career Pathways across the Transportation Industry.* Washington, D.C.

8.0 APPENDICES

8.1 Appendix A: Stakeholder Meeting Notes

Equity, Diversity, and Inclusion

Moderator – Moderator 1

Participants – Participant 1, Participant 2, Participant 3

This breakout group will discuss the significance of seeing workforce development through an EDI (Equity, Diversity, and Inclusion) lens. The primary intent of this facilitated discussion is to understand 1) why uplifting equity and promoting diversity and inclusion is essential for workforce development, 2) which tools and methods can be used to creating an equitable workforce environment in the transportation industry, and 3) what types of challenges transportation agencies face to address equity issues and promote diversity in different levels within workforce.

Current Conditions: How are diversity initiatives/councils/committees currently conducted? Which rules, regulations, and policies are in the way of achieving an equitable workforce? How are current workforce development methods addressing this?

- Budding outreach efforts in some MPOs to work with people in places such as schools, churches, or community centers.
- Early exposure to the transportation industry and careers are lacking. Most students (in civil engineering) take only one undergraduate course on transportation. Some efforts for more outreach to women and minority students by way of discussions in transportation courses and with student organizations.
- Generally, few women and minorities in the transportation faculty of academic institutions.
- Some institutions (i.e., ITRE) working on incorporating discussions of diversity into strategic planning processes. Many people can be lost from the industry mid-career without continuing support for diversity and inclusion. Need for more intentionality in attracting people and giving them access to decision-making spaces.
- Some firms (i.e., Stantec) have initiatives to recruit from HBCUs. Industry exposure is lacking in transportation curriculum. Boards/committees are dominated by white men, with some efforts to become more diverse. Looking to mentorship, coursework, and professional organizations as avenues for exposure to the industry.

Expected Changes: How are methods/tools expected to change? How are the areas of focus/intent expected to change? Which strategies can be taken to promote diversity within the workforce and uplift equity in the transportation industry?

- Improving policies on maternity/paternity leave.

- Organizations like Caucus Of Minority Transportation Officials approaching issues of justice such as criminal records barring potential blue-collar workers from jobs. Shift towards a more top-down approach in organizations to issues of diversity, equity, and inclusion.
- More serious efforts regarding the delivery and enforcement of organizational trainings on diversity, equity, and inclusion.
- Workplaces making greater efforts to mitigate effects of things like family leave on careers.

Future Conditions: To what extent addressing equity, diversity, and inclusion is essential for the transportation workforce's future in southeast states?

- More flexible policy on work hours to better accommodate needs and responsibilities employees may have outside of work (i.e., eldercare, childcare, etc.)
- More accountability with regards to how organizations approach issues of diversity, equity, and inclusion. Clear methods of tracking, measuring, monitoring the actual alignment of those values with stated missions and visions within an organization.
- Greater transparency within organizations.
- Transparency and accountability across all levels of organizations (entry-level to the most senior positions)
- Continuing education and discussion on diversity, equity, inclusion, and justice even as progress is made.

Major Takeaways:

- Outreach and recruitment are crucial in meeting diversity challenge
- Mentorship in K-12 should be bolstered
- Workforce and labor conditions must be sensitive to specific needs of particular demographics
- Address EDI in everyday work
- Continue discussion of importance of diversity in the workplace and how it supports success

Continuing Education

Moderator – Moderator 2
Participants – Participant 4, Participant 5, Participant 6, Participant 7

Generally, this breakout group will discuss the role of continuing education workforce development practices available for current transportation professionals. The primary intent is to understand how continuing education trainings are provided, what continuing education aims to address (in terms of gaps in specific skills, emerging topics, etc.), how the current methods of continuing education training meets/does not meet the needs of transportation professionals, and what continuing education methods/needs may look like in the future.

Current Conditions: How is continuing education training currently conducted? What skills/knowledge are current professionals most lacking in? How are current workforce development methods addressing this?

- How is continuing education training currently conducted?
    - Assist in paying for PDH credits
    - Provide training sessions (in-person, online)
    - AASHTO T3 initiative
    - Community colleges
    - Internal trainings
    - LTAP
- What skills/knowledge are current professionals most lacking in?
    - Advanced technologies (e.g., signal timing, work zone traffic control)
    - Maintenance
    - Intro into leadership
- How are current workforce development methods addressing this?
    - Request for feedbacks (asking questions, taking surveys) to improve courses
    - Advance leadership Academy
    - Creating knowledge management portal
    - Workshops on Tacit knowledge
    - employee retirement tracking to identify potential lost knowledge

Expected Changes: How is the role of continuing education changing, if at all? How are methods expected to change? How are the areas of focus/intent expected to change?

- How is the role of continuing education changing, if at all?
    - Doing everything virtually
        - changes access to training (no location or travel time constraint)
    - Higher demand for training in general
        - More need for training due to higher turnover rates
    - Sharing of course/training materials between agencies
- How are methods expected to change?
    - See similar question below
- How are the areas of focus/intent expected to change?
    - More about technologies
    - Change in what kind of background knowledge attendees have and therefore what training is necessary
    - Keeping up with the audience
    - More training on self-awareness, self-care, protecting mental health, and perhaps remote working

        - Needed because of Less contact with co-workers - fewer lunches together, fewer group activities...

Future Conditions: How might continuing education trainings be conducted in the future? What skills/knowledge are expected to be a priority for continuing education in the future? How might continuing education practices improve to meet future needs?

- How might continuing education training be conducted in the future?
    - More virtual
    - More micro-training
    - Personalized training (on-demand, by request, "self-improvement")
- What skills/knowledge are expected to be a priority for continuing education in the future?
    - Technology already expected to know (remote work prerequisites)
    - Soft skills (communication, leadership, problem solving)
    - Technical writing skills
    - Occupational safety
- How might continuing education practices improve to meet future needs?
    - Virtual training lacks a physical, lab-like environment - need to address this
    - Be aware of audience changes as workforce changes
    - Cross training - don't just train for the job you're in
        - More job changes, being versatile

Major Takeaways:

- Higher demand for transportation professionals, expanding body of knowledge (interdisciplinary skills), and technological innovation driving the need for more robust educational programming
- Audience is very different than it was previously, technological literacy becoming an increasing priority to ensure training methods are appropriate
- Technology, soft skills (self-care, mental health, management, etc.) training all priority needs for continuing education.

Prioritizing Workforce Development Needs

Moderator – Moderator 3
Participants – Participant 8, Participant 9, Participant 10, Participant 11, Participant 12

Generally, this group will discuss what the highest areas of need are for workforce development considerations in the transportation sector. This discussion is intended to be general, encompassing any topic/sector that is addressed by workforce development, both now and in the future. The intent is to understand what the major areas of need/focus are for

workforce development practitioners, how workforce development practices are being conducted to meet these areas of need, and how these needs and practices might change in the future. This includes a discussion of the methods in which workforce development is practiced and the effectiveness at meeting current and future workforce needs. This discussion should focus on understanding the highest priority needs to be addressed by workforce development both now and in the future.

Current Conditions: How is workforce development currently practiced? What topics/areas of focus (EDI, leadership, skills trainings, etc.) are currently a priority for workforce development practice? Are there needs not being met by the current practices? Should any areas of focus take higher priority given current conditions?

- Participant 8
    - Road Building/Traffic Training highest priority (currently)
    - Short in terms of computer science/electrical engineering
    - Succession relies on on-the-job training/knowledge transfer
    - Little TSMO knowledge coming out of university CE programs
    - ITS Knowledge lacking, IT skills lacking in current and entry workforces
    - IT division relied upon higher level technical assistance for ITS needs.
    - Most DOT workers come from civil engineering. Job duties are more multidisciplinary than traditional CE educational curricula.
    - Role of certification
        - ISMA has courses on TSMO
        - ITS America online certification great resource for technical development
- Participant 9
    - Gap in WD folks and ability to participate on systems engineering
    - Data management/IT education lacking in private sector workforce
    - Connectivity of emerging technologies necessitates data literacy education across all sectors
- Participant 10
    - Knowledge loss and retainment issues
    - Gap between retirees and new cohorts
    - Millennials and existing workforce have different educational/workforce expectations
    - Skills gap/turnover
        - T2 – rents operators and technology at the same time to support understaffed, under skilled transportation agencies
- Participant 11
    - On-the-job training should be bolstered, diversified to close gap between knowledge coming out of school and expectations on the job; particularly for ITS, TSMO, and systems.

- Limited experience with high technology systems, i.e., advanced computing, and emerging technology systems.
- Traditional Civil Engineering Workforce, i.e., Design, Construction, Maintenance; very little transportation education/development
- Hires primarily come from traditional CE degree graduates with small percentage of hires outside CE education/training

Expected Changes: What areas of focus/methods are expected to be a higher priority in the future? How might workforce development practices change to better meet future needs? What needs will become a higher priority for workforce development in the future?

- Increased need for awareness of IT, data management, cyber and physical security, configuration management
- Ever evolving technology
- Ability to work within multidisciplinary teams-planning and design especially
- More focus on transportation (signals, traffic, ITS) during education and early development
- Early development and continuous education programs developed using community colleges or other sources as needed to provide more comprehensive and structured development than on-the-job/ad hoc training

Future Conditions: How might workforce development practices change to better meet future priorities?

- Participant 8
  - Reform CE and PE curriculum to include most current technological/interdisciplinary skill needs
- Participant 9
  - Management and "soft" communication skills lacking currently, higher focus on less technical skills
  - Mentoring crucial in developing next managerial class

- Increased need for agility--ability to adapt to changing circumstances, job requirements
- Increased connectivity--need to be aware of parallel efforts in other modes, agencies, private sector
- Continuous education for practitioners
- More cross-pollination with private transportation/mobility ventures (EV, AV, rideshare)

Major Takeaways:

- Technological change and more interdisciplinary job requirements necessitate that educational pathway curricula include a wider range of topics.
- Current training methods rely primarily on on-the-job training, typically for roadway construction and maintenance
- Workforce development practices need to emphasize IT and emerging technology trainings, both along the educational pathway and within the workforce.

Responding to Demographic Change

Moderator – Moderator 4
Participants: Participant 13, Participant 14, Participant 15, Participant 16, Participant 17, Participant 18

Generally, this group will discuss the impact of demographic changes on the transportation workforce and any considerations these changes may have for the methods/focus of workforce development practices. The transportation industry is aging, mostly male, and mostly white. An increase in diversity is expected throughout the transportation industry (young people, POC, and women in particular), bringing with it many challenges that may be addressed through workforce development practice. The intent of this group is to discuss how workforce development practices can respond to demographic challenges in the workforce, both now and in the future. The discussion should focus on identifying these challenges based on stakeholder feedback and determine the role of workforce development in addressing these stated challenges.

Current Conditions: Generally, what is the current demographic makeup of the transportation industry? How is demographic change, if at all, being addressed through workforce development practices? Are there needs not being met by current workforce development practices, with respect to demographic change in the industry?

- Participant 13
  - The issue of an aging workforce
  - The baby boomers are aging out and are no longer able to participate in the workforce.
- Participant 14
  - We are seeing shortages in all sectors, some is because of the demographic shifts, some is because of legacy policies in place that don't really work for new generations that want to come into work.
- Participant 15
  - Retain and train
  - Even on the training side, there has been an attempt to understand how to make people more productive
  - As the workforce shrinks, there are certain things that can't be shrunk
  - No one has found a middle ground- the three-bear problem
  - We hire technical folks or we're hiring people who don't have the main expertise
  - Problematic as we look to train the next group, what is us and what is not our responsibility?

    - Dealing with diminishing budgets, what kind of role do we want to take?
    - Who is stepping up and trying to fill the gaps?
    - Certain pieces of equipment and new technology makes it unclear as to who should take on the burden when looking at training
- Participant 16
    - The industry is trying to keep up with the demand and ramping up the entire industry
    - The South Carolina DOT's construction budget has tripled in the last year but there is still not the support needed as the expertise is not available
    - The retirement is increasing, you can buy out early and there has been a lot of competition for employees
    - Salaries have increased dramatically so many are taking retirement as soon as possible or buying out early
    - A lot of change in South Carolina, not necessarily the same elsewhere
- Participant 13
    - When planning succession, you can't base it on age or other factors
- Participant 14
    - Same issue in Florida
- Participant 16
    - Inability to match that production
- Participant 15
    - Creation of internship program to rally interest, skewing from typical maintenance and construction
    - The emphasis has moved to different resources
    - Cross-training different groups
    - Bringing on less experienced staff to try to cover the demographic gap and the lack of new blood
    - Increasing specialized, increasing general criteria, incredibly at odds with each other
    - Level of electives are offered at the graduate level rather than the undergraduate level
- Moderator 4
    - The workforce is becoming increasingly specialized through graduate school
- Participant 15
    - Large separation between people who have gone to college and people who can make it to the secondary degree program. Cannot get enough workers who are in the blue-collar section, how do we train people comparably?
    - What background should people have before they enter such a program
    - The blue-collar section seems to be a more important layer of training, more than taking people through additional college education
- Participant 14
    - Multi-disciplinary agency, targeting training to specific types of personnel. The training program is not capturing what it should and there is a reluctance to offer more cross-disciplinary training. Missing out on a good percentage of employees

    - More disciplines are needed than engineering and those different skillsets do not receive the focus
- Participant 15
    - The financial modeling side is increasingly becoming an issue
    - Multimodal
        - Example of rail operations
            - The services are not provided within the organization, so they are outsourced
- Participant 13
    - The outsourced people are competing for a shrinking pool of labor
- Participant 16
    - How are shifting demographics changing this?
- Participant 15
    - Two sorts of people: new and old. Can create friction, not based on age but on historical work experience
    - Different ways of addressing the issues
    - White collar- people have been staying in the workforce for much longer due to the flexibility of salaries
    - Managers can be less experienced than the person that they are directing to do work, inversion of the direction of services

Expected Changes: Generally, what is the direction of demographic change in the transportation industry? How might demographic change impact the transportation industry?

- Participant 13
    - We are into Generation Z; we have moved past Millennials. Generation X is a third of the size of the Baby Boomers, we will see a skipping of generations.
    - More junior people in senior roles
    - Generation Z in prime education years without a traditional education- COVID will be a watershed thing as we move towards remote work. Could see major changes in public sector work
- Participant 14
    - Flexibility in public sector needs to change
    - The system was built prior to technology and needs to adapt to this
    - The younger generations will not work that way, there are definite times where they tune out
        - Work-life balance
    - People who are disadvantaged socioeconomically need the same opportunities in the workforce

Future Conditions: What will the transportation industry look like in the future, in terms of demographics? How might workforce development practices change to meet future needs

necessitated by demographic change? What are some specific considerations for workforce development practices to better address future challenges associated with demographic change?

- Participant 17
    - Is there a preference for more people with more skills? Should there be more courses taken? Differences between white collar and blue collar?
- Participant 15
    - The workforce is more mobile, more highly trained and more experience
    - Once they have a skillset, the expectation is high mobility
    - Time zone or location is no longer a problem, accessibility is much higher
    - Someone still has to be on the equipment, you cannot change when services are needed in a specific location
        - Will have to deal with less hands and more training
- Participant 13
    - A lot of blue-collar workers learn different, on-hand training rather than virtual training
- Participant 17
    - Do you think state DOT should have common groups to tackle specialized problems instead of hiring outsourcing?
- Participant 15
    - Companies based on acquisition models can fill that role
    - Skill sets in different fields

Major Takeaways

- Millennials entering workforce; need to emphasize work life balance, technological literacy
- Educational preferences different among demographic groups, particularly between older existing workers and younger entry workers
- Retainment and recruitment issues remain prevalent
- Cross-train workforce to meet interdisciplinary skill needs
- The aging workforce creates challenges for succession planning that has not seen a cohesive workforce development strategy implemented yet – efforts should be made to address this.

8.2 Appendix B: Practitioner Survey Instrument

Default Question Block

Q1.

RESEARCH PARTICIPANT INFORMED CONSENT FORM

Please read this document carefully before you decide to participate in this research study. **Your participation is voluntary, and you can decline to participate, or withdraw consent at any time, with no consequences.**

Persons conducting the research:

Primary Investigators:

- Dr. Ruth Steiner: Department of Urban and Regional Planning/STRIDE, rsteiner@ufl.edu
- Dr. Mehri Mohebbi: Department of Urban and Regional Planning, mehri.mohebbi@essie.ufl.edu

Purpose of the research study:

To identify the current gaps in transportation workforce development and predict future gaps with the advancement in technologies and strategies. Our goal in this research is to understand and document best practices in workforce development for the transportation sector and develop a workforce training framework and plan for southeast states.

What you will be asked to do in the study:

As a transportation professional in the Southeast states, we would appreciate your participation in a brief survey on the current practices and future needs of transportation workforce development in the Southeast. The survey will address your experience and knowledge on 1) the general understanding of workforce development in your agency/organization; 2) the current conditions of workforce development practice; 3) the future conditions of workforce development practice; and 4) the efforts of workforce development to address prevailing challenges in the transportation workforce. You will be asked for general personal information including your company, position, and other demographic characteristics. This information will not be published; all personal information will remain secure, confidential, and anonymized.

Time required:

The survey will take no longer than 10-20 minutes, based on the depth of response.

Risks and benefits:

There are no risks or discomforts anticipated and all answers will remain confidential. There are no direct benefits of participation for you. However, the transportation profession and members of the research team may benefit from better workforce

development through your participation in this research.

Confidentiality:

No sensitive information will be elicited. The Qualtrics survey will similarly remain confidential. No personal information will be used or referenced within the purposes of this research and will remain confidential within the primary research team. The summaries of your responses may be shared with others, but will be anonymized. There is a minimal risk that security could be compromised but our survey host – Qualtrics - uses strong encryption and other data security methods to protect your information.

Withdrawal from the study:

You are free to withdraw your consent and to stop participating in this study at any time without consequence. You may decline to participate or leave the survey at any time. If at any point, you do wish that your response not be recorded, we will erase your entry. Any materials or information collected from you may be requested for deletion or omission at any time.

If you wish to discuss the information above or any discomforts you may experience, please ask questions now or contact Jeremy Griffith, at aceme123@ufl.edu.

If you have any questions regarding your rights as a research subject, please contact the Institutional Review Board (IRB02) office (University of Florida; PO Box 100173; Gainesville, FL 32610; (352) 392-0433 or irb2@ufl.edu.)

Agreement:
I have read the procedure described above. I voluntarily agree to participate in the procedure and I have received a copy of this description. Now that you've read about the study, if you wish to participate, click the "I agree to participate" button

- ○ I Agree to Participate
- ○ I Do Not Agree to Participate

Block 1

Q2. How many employees work at your current agency/organization?

- ○ 1-10 Employees
- ○ 10-25 Employees
- ○ 26-50 Employees
- ○ 51-100 Employees
- ○ 100+ Employees

Q3. Which of the following best describes your agency/organization?

- ○ Regional or Local Government (e.g. County, MPO, etc.)

- ○ State Government/State DOT
- ○ Federal Government
- ○ Private Sector Agency/Consultancy
- ○ Higher Education/Academic Sector
- ○ Non-Profit Sector
- ○ Other, please specify

Q4. How many years of career experience do you possess? (Please include *all* professional work experience)

- ○ I am an Entry Level Employee (0-5 Years Experience)
- ○ I am a Mid-Level Employee (5-10 Years Experience)
- ○ I am a Senior-Level Employee (10-20 Years Experience)
- ○ I am a Executive-Level Employee (20+ Years Experience)

Q5. Which of the following certifications/licenses do you possess? (Select all that apply)

- ☐ None
- ☐ Engineer In Training (EIT)
- ☐ Professional Engineer (PE)
- ☐ Professional Traffic Operations Engineer (PTOE)
- ☐ American Institute of Certified Planners (AICP)
- ☐ American Institute of Certified Planners Certified Transportation Planner (AICP-CTP)
- ☐ Project Manager Professional (PMP)
- ☐ Professional Transportation Planner (PTP)
- ☐ Road Safety Professional (RSP)
- ☐ Other, please specify

Q6. Which of the following organizations are you a member of? Please indicate the division and/or chapter, where applicable. (Select all that apply)

- ☐ American Planning Association (APA)

- [ ] American Society of Civil Engineers (ASCE)
- [ ] American Public Works Association (APWA)
- [ ] National Society of Black Engineers (NSBE)
- [ ] Society of Hispanic Professional Engineers (SHPE)
- [ ] American Association of State Highway and Transportation Officials (AASHTO)
- [ ] Institute of Transportation Engineers (ITE)
- [ ] Transportation Research Board (TRB)
- [ ] Women's Transportation Seminar (WTS)
- [ ] Other, please specify

Q7. Do you have any previous involvement with workforce development as an organizer, instructor, or any other leading roles?

- ○ Organizer
- ○ Instructor
- ○ Other Leading Role, please specify
- ○ No

Q8.
How do you typically learn about training opportunities? (Select all that apply)

- [ ] Internal Sources/Communication
- [ ] Email Lists
- [ ] Word of Mouth
- [ ] Online/Email Advertisement
- [ ] Communication from Professional Organizations/Societies
- [ ] Other, please specify

Q9. During the course of time you have been in your *current position,* about how often have you used workforce training resources (e.g. any workshops, seminars, training courses, etc. related to workforce skill development)?

- ○ Never
- ○ Very Rarely (One or Twice a Year)
- ○ Infrequently (Less than Once per Quarter [3 Months])
- ○ Frequently (More than Once per Quarter [3 Months])
- ○ Very Often (More than Once per Month)

Q10. Does your *current organization/agency* have a strategic workforce development plan/agenda?

- ○ Yes, it is clearly communicated and shared with staff
- ○ Yes, but it is not clearly communicated to staff
- ○ No, my organization does not have a strategic workforce development plan
- ○ I don't know

Q11. My organization/agency's plan includes the following: (Select all that apply)

- ☐ Technical Skills Training for Current Employees
- ☐ Non-Technical Skills Trainings for Current Employees
- ☐ Strategies for Recruitment of New Employees
- ☐ Strategies to Retain Existing Staff
- ☐ Other, please specify
- ☐ None of the Above
- ☐ I Don't Know/Prefer Not to Respond

Q12. Which of the following sources do you most commonly receive training from? (Select all that apply)

- ☐ Training Directly Provided by my Employer
- ☐ Training Provided by Governmental Sectors
- ☐ Training Provided by Professional Organizations (e.g. ITE, TRB, APA, etc.)

- [ ] Training Provided by Other Private Sector Organizations
- [ ] Training Provided by Academic Institutions
- [ ] Self-Guided Training, please specify source/author
- [ ] Other, please specify

Q13. How are you typically informed of training opportunities? (Select all that apply)

- [ ] Communication from my Employer
- [ ] Communication from Professional Organizations (ITE, TRB, APA, etc.)
- [ ] Professional Social Media Networks or Email Lists (LinkedIn, Indeed, etc.)
- [ ] Word of Mouth
- [ ] Online Advertisments
- [ ] Personal Research
- [ ] Other, please specify

Q14. Please select the topics of training currently available to you through training *directly provided* by your current employer. (Select all that apply)

- [ ] Technical Skills
- [ ] Professional "Soft" Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)
- [ ] Managerial/Administrative Skills
- [ ] Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)
- [ ] Cross-Training/Interdisciplinary Skills
- [ ] Technological Skills (e.g. Software Training, etc.)
- [ ] Equity, Diversity, and Inclusion
- [ ] Law
- [ ] Professional Ethics
- [ ] Other, please specify
- [ ] My Employer Does Not Directly Provide Training
- [ ] I Don't Know/Prefer Not to Respond

Q15. Where are the materials typically sourced from for the training *directly provided by your employer*?

- ☐ Internally Developed (Materials Produced by Employer)
- ☐ Other Private Sector Providers or Consultants
- ☐ Academic Providers
- ☐ Governmental Providers
- ☐ Non-Profit or Professional Organization Providers (e.g. AASHTO, ITS America, etc.)
- ☐ Other, please specify
- ☐ I Don't Know/Prefer Not to Respond

Q16. Please select the topics of training currently available to you through training provided by *sources other than* your current employer. (Select all that apply)

- ☐ Technical Skills
- ☐ Professional "Soft" Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)
- ☐ Managerial/Administrative Skills
- ☐ Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)
- ☐ Cross-Training/Interdisciplinary Skills
- ☐ Technological Skills
- ☐ Equity, Diverity, and Inclusion
- ☐ Law
- ☐ Professional Ethics
- ☐ Other, please specify

Q17. For the following training topics, please indicate the degree to which they are personally valuable to success in your current position

Technical Skills	
Professional "Soft" Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)	
Managerial/Administrative Skills	
Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)	

Cross-Training/Interdisciplinary Skills	
Technological Skills	
Equity, Diversity, and Inclusion	
Knowledge of Law	
Knowledge of Professional Ethics	
Other, please specify	

Q18. Please select the mediums/methods by which training is currently offered. (Select all that apply)

- ☐ On-the-Job Training
- ☐ Mentorship/Apprenticeship
- ☐ In-Person Seminars/Workshops
- ☐ Professional Certification Courses
- ☐ Online Self-Paced Courses
- ☐ Online Webinars/Workshops
- ☐ Other, please specify

Q19. Please indicate your preference for the following training methods.

On-the-Job Training	
Mentorship/Apprenticeship	
In-Person Seminars/Workshops	
Professional Certification Courses	
Online Self-Paced Courses	
Online Webinars/Workshops	
Other, please specify	

Q20. Based on your previous experience, are the current workforce development practices of your employer informed by employee feedback?

- ○ Yes, please specify how this information is collected
- ○ No
- ○ I Don't Know

- ○ Prefer Not to Respond

Q21. Please specify how this information is collected by your employer.

Block 2

Q22. Based on your experience, briefly describe how the competencies or skills necessary for success in your current position might change in the next 10 years.

Q23. Which of the following resources, if any, does your employer offer to assist you in participating in training programs?

- ○ Full Expense Reimbursement (Travel, Food, Lodging, Attendance Costs, Etc.)
- ○ Partial Expense Reimbursement
- ○ Paid Time Off
- ○ Professional Development Credits
- ○ Other, please specify
- ○ None of the Above
- ○ I Don't Know/Prefer Not to Respond

Q24. Which of the following factors are major limitations to the ability to access training resources? (Select all that apply)

- ☐ Affordability
- ☐ Usefulness (In Relation to My Expertise)
- ☐ Time-Constraints
- ☐ Medium of Training
- ☐ Other, please specify

Block 3

Q25. Please indicate the degree to which you agree/disagree with the following statements.

My agency/organization has a clear plan for the recruitment of new employees.	
My agency/organization is able to quickly fill vacant positions.	

Q26. Please indicate which of the following recruitment strategies are used by your current employer. (Select all that apply)

- ☐ Online Job Listings (LinkedIn, Indeed, etc.)
- ☐ Professional Organization Job Boards
- ☐ Academic Partnerships (University Recruitment Events, etc.)
- ☐ Professional Career Fairs/Recruitment Events
- ☐ Digital Advertising
- ☐ Physical Advertising
- ☐ Internships, Apprenticeships, Mentorships, etc.
- ☐ Others, please specify
- ☐ None of the Above
- ☐ I Don't Know/Prefer Not to Respond

Q27. To what degree did the following factors contribute to your choice to work at your current organization/agency?

Competitive Salary/Benefits	
Attractive Workplace/Company	
Opportunity for Achievement/Upward Mobility	
Flexible Work Arrangements	
Attractive Location	
Other, please specify	

Block 4

Q28. Please indicate the degree to which you agree/disagree with the following statements.

There are opportunities for promotion/career advancement available to me.	
I am adequately compensated in my current position.	
My workplace environment is safe and comfortable for all.	
My workplace has a culture of respect and inclusion.	
My workplace is responsive and flexible to my individual needs.	

Q29. Please indicate the degree to which you agree/disagree with the following statements.

There is a diversity of race/ethnicities represented in my workplace.	
There is a diversity of ages represented in my workplace.	
There is a diversity of gender represented in my workplace.	
Equity, Diversity, and Inclusion strategies are a clear priority in my workplace.	
The culture/environment of my workplace is supportive of my personal identity.	

Q30. Please indicate the degree to which you agree/disagree with the following statements.

My educational background prepared me with the skills necessary to perform the requirements of my current position.	
My workplace provides me the educational opportunities/resources to be successful in my current position.	

Q31. Out of the following competencies, please indicate the degree to which your *educational background* prepared you to meet the requirements of your current position.

Technical Skills	
Professional "Soft" Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)	
Managerial/Administrative Skills	
Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)	
Technological Skils	
Interdisciplinary Skills	

Knowledge of Law

Knowledge of Professional Ethics

Knowledge of Equity, Diversity, and Inclusion

Other, please specify

Q32. What is the name of your current employer?

Q33. What is your title?

Q34. What is your professional field? (Select all that apply)

- ☐ Roadway
- ☐ Freight
- ☐ Aviation
- ☐ Transportation Planning
- ☐ Rail
- ☐ Mass Transit
- ☐ Maritime
- ☐ Other, please specify

Q35. How many years have you been in your current position?

- ○ 0-5 Years
- ○ 6-10 Years
- ○ 11-15 Years
- ○ 16-20 Years
- ○ 20+ Years

Q36. How many years total have you been employed in the transportation industry?

- ○ 0-5 Years
- ○ 6-10 Years
- ○ 11-15 Years
- ○ 16-20 Years
- ○ 20+ Years

Q37. What is your highest level of education? If you hold multiple degrees, please indicate so in the "Other" option.

- ☐ High-School Diploma
- ☐ Associate's Degree (AA)
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ PhD
- ☐ Other, please specify

Q38. What is your educational background? (Select all that apply)

- ☐ Engineering, Manufacturing and Construction
- ☐ Education
- ☐ Arts and Humanities
- ☐ Social Sciences, Journalism and Information
- ☐ Business, Administration and Law
- ☐ Natural Sciences, Mathematics and Statistics
- ☐ Information and Communication Technologies (Includes Computer Science)
- ☐ Agriculture, Forestry, Fisheries and Veterinary
- ☐ Health and Welfare
- ☐ Services
- ☐ Urban and Regional Planning
- ☐ Other, please specify

Q39. Which of the following best describes your racial/ethnic background?

- ○ Alaskan or American Native
- ○ Asian or Pacific Islander
- ○ Black or African American
- ○ Hispanic or Latinx
- ○ White or Caucasian
- ○ Mixed Race/Two or More Races
- ○ Other, please specify
- ○ Prefer Not to Respond

Q40. What is your age?

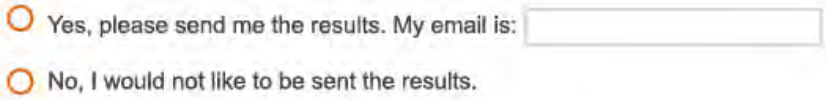
- ○ 18-25 Years Old
- ○ 26-35 Years Old
- ○ 36-45 Years Old
- ○ 46-55 Years Old
- ○ 55+ Years Old
- ○ Prefer Not to Respond

Q41. What is your gender?

- ○ Male
- ○ Female
- ○ Non-binary / Third Gender
- ○ Prefer Not to Respond

Q42. What state are you located in?

Q43. If you would like to receive a summary of results from this survey, please include your email address below. Your email address will be recorded separately from your survey response and will only be used to send the results.



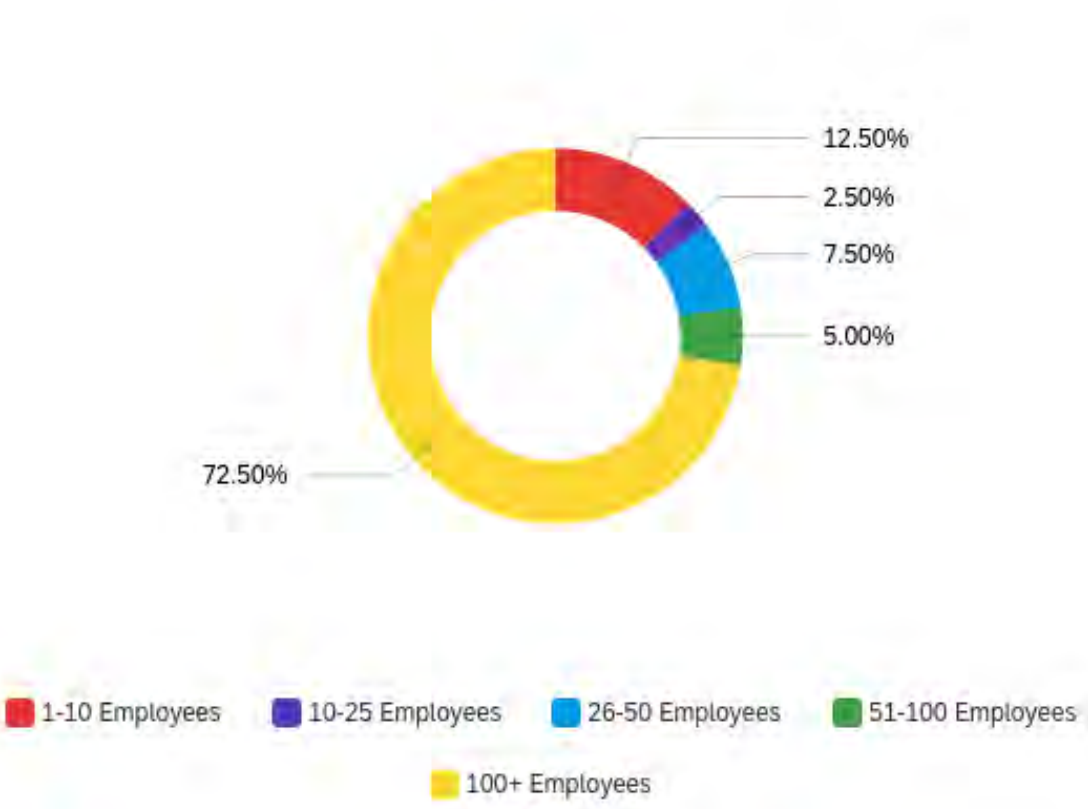
8.3 Appendix C: Practitioner Survey Results

Default Report

STRIDE Workforce Development Practitioner Survey

October 11th, 2021, 10:10 am MDT

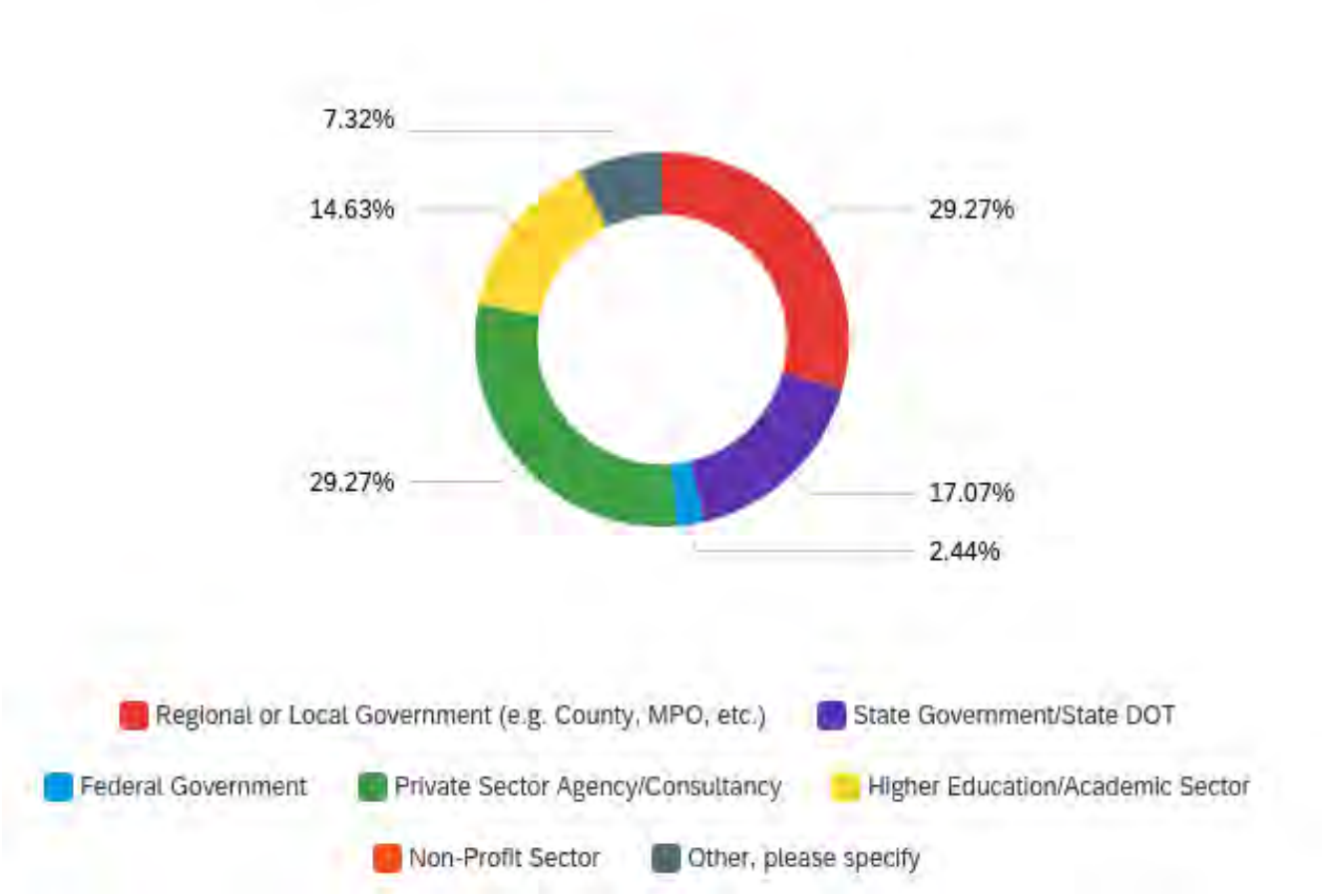
Q2 - How many employees work at your current agency/organization?



#	Answer	%	Count
1	1-10 Employees	12.50%	5
2	10-25 Employees	2.50%	1
3	26-50 Employees	7.50%	3
4	51-100 Employees	5.00%	2

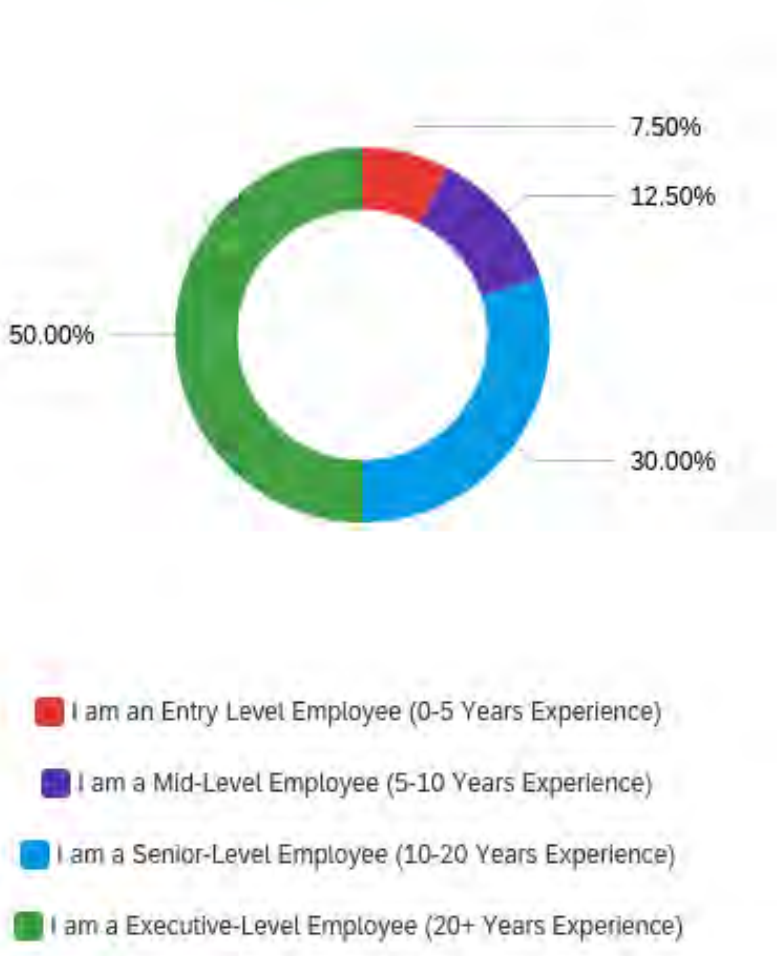
5	100+ Employees	72.50%	29
	Total	100%	40

Q3 - Which of the following best describes your agency/organization?



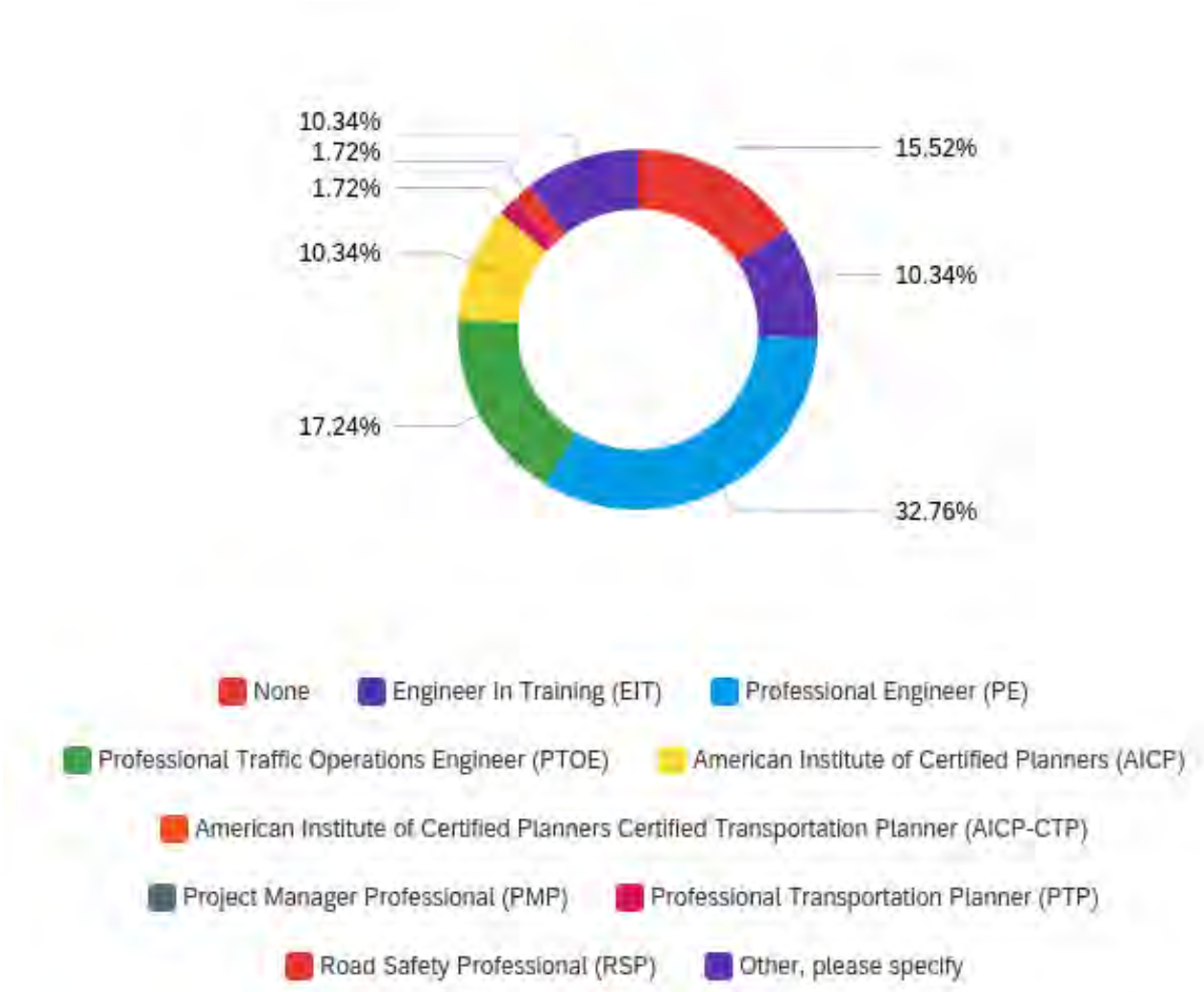
#	Answer	%	Count
1	Regional or Local Government (e.g. County, MPO, etc.)	29.27%	12
4	Private Sector Agency/Consultancy	29.27%	12
2	State Government/State DOT	17.07%	7
5	Higher Education/Academic Sector	14.63%	6
7	Other, please specify	7.32%	3
3	Federal Government	2.44%	1
6	Non-Profit Sector	0.00%	0
	Total	100%	41

Q4 - How many years of career experience do you possess? (Please include all professional work experience)



#	Answer	%	Count
4	I am an Executive-Level Employee (20+ Years' Experience)	50.00%	20
3	I am a Senior-Level Employee (10-20 Years' Experience)	30.00%	12
2	I am a Mid-Level Employee (5-10 Years' Experience)	12.50%	5
1	I am an Entry Level Employee (0-5 Years' Experience)	7.50%	3
	Total	100%	40

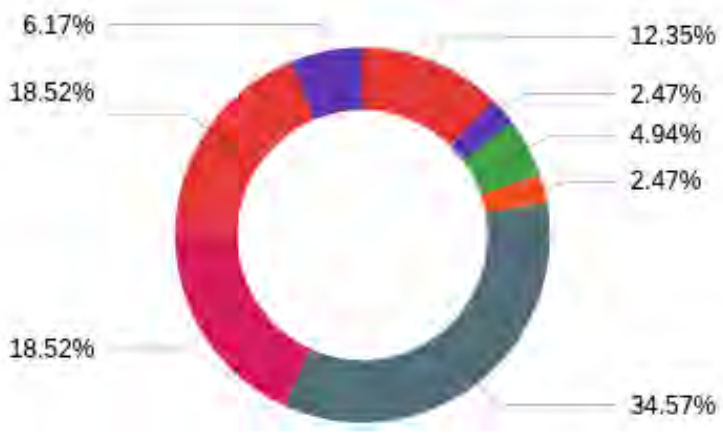
Q5 - Which of the following certifications/licenses do you possess? (Select all that apply)



#	Answer	%	Count
3	Professional Engineer (PE)	47.50%	19
4	Professional Traffic Operations Engineer (PTOE)	25.00%	10
1	None	22.50%	9
2	Engineer In Training (EIT)	15.00%	6
5	American Institute of Certified Planners (AICP)	15.00%	6
10	Other, please specify	15.00%	6

8	Professional Transportation Planner (PTP)	2.50%	1
9	Road Safety Professional (RSP)	2.50%	1
6	American Institute of Certified Planners Certified Transportation Planner (AICP-CTP)	0.00%	0
7	Project Manager Professional (PMP)	0.00%	0
	Total	100%	40

Q6 - Which of the following organizations are you a member of? Please indicate the division and/or chapter, where applicable. (Select all that apply)



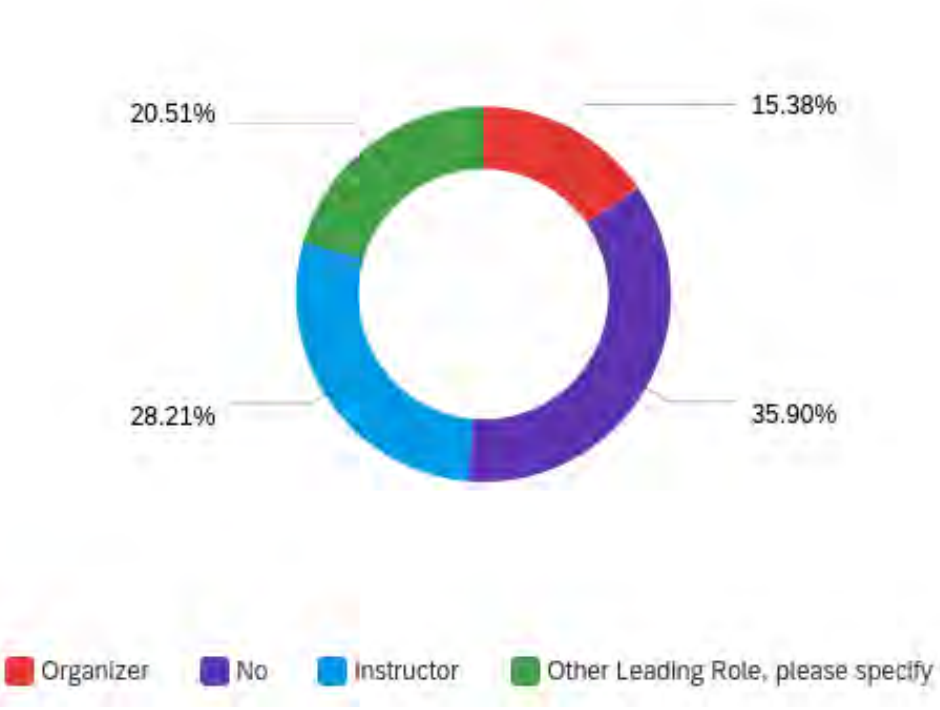
#	Answer	%	Count
7	Institute of Transportation Engineers (ITE)	70.00%	28
8	Transportation Research Board (TRB)	37.50%	15
9	Other, please specify	37.50%	15
1	American Planning Association (APA)	25.00%	10
10	Women's Transportation Seminar (WTS)	12.50%	5

4	American Society of Civil Engineers (ASCE)	10.00%	4
2	American Public Works Association (APWA)	5.00%	2
6	American Association of State Highway and Transportation Officials (AASHTO)	5.00%	2
3	National Society of Black Engineers (NSBE)	0.00%	0
5	Society of Hispanic Professional Engineers (SHPE)	0.00%	0
	Total	100%	40

Q6_9_TEXT - Other, please specify

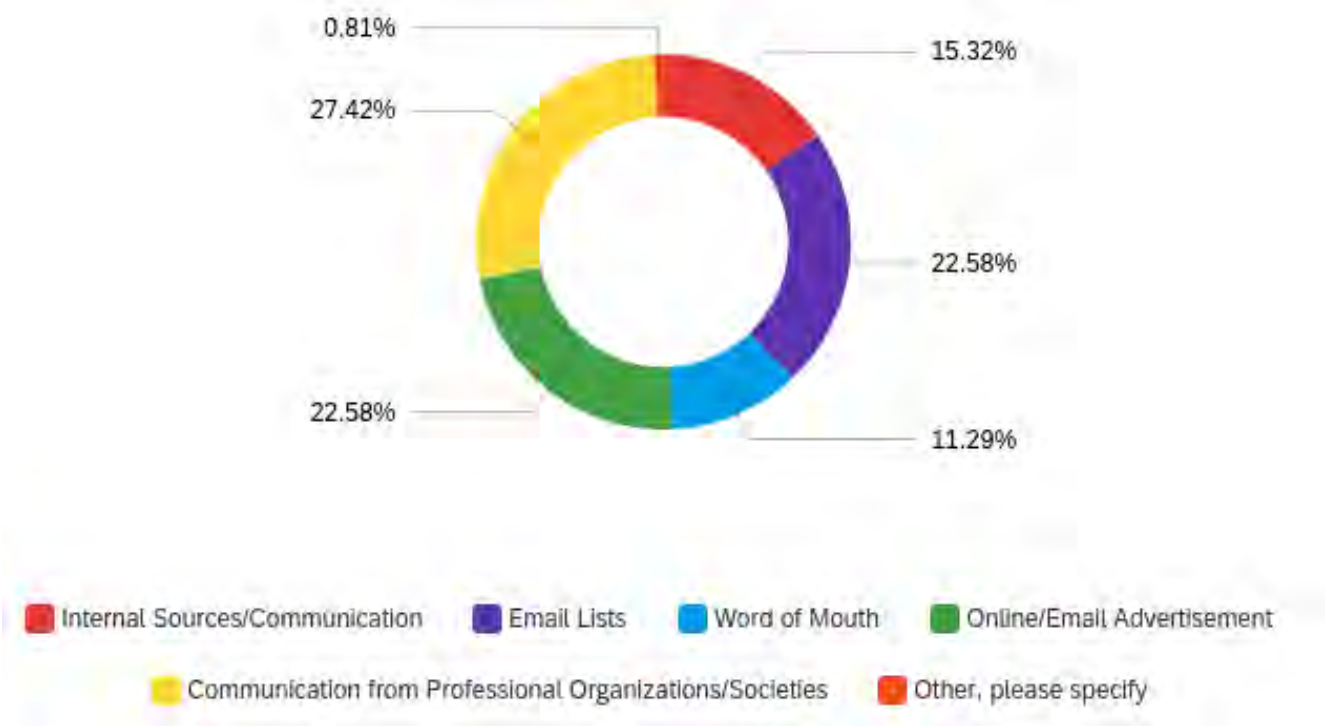
Other, please specify - Text
ASEM and CMAA
American Public Transportation Association
AMPO,
Association of Pedestrian and Bicycle Professionals
IMSA
Association of Pedestrian and Bicycle Professionals
Prince Hall Past Secretary
Association of Pedestrian and Bicycle Professionals (APBP) - Tampa Bay Chapter
American Public Transportation Association (APTA)
ITS GA
TPCB
ITS Georgia
ITS America
Association of Metropolitan Planning Organizations (AMPO)

Q7 - Do you have any previous involvement with workforce development as an organizer, instructor, or any other leading roles?



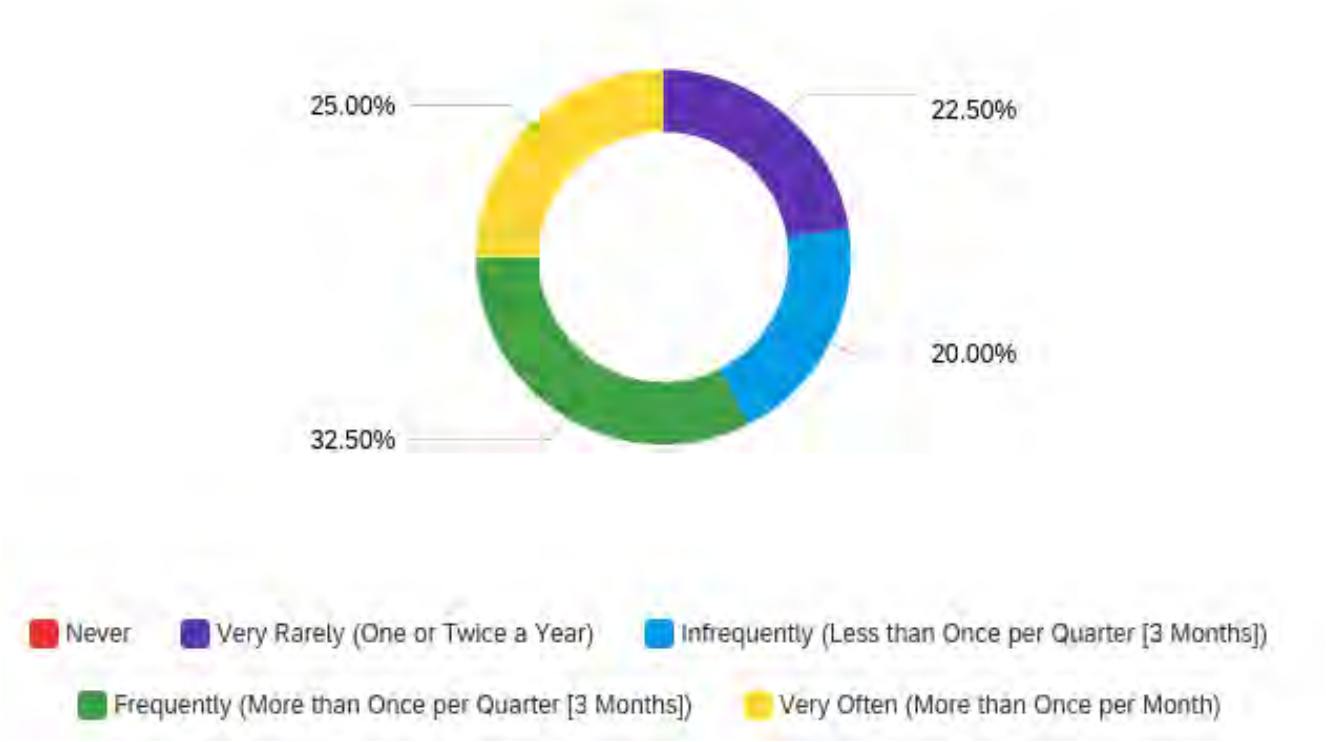
#	Answer	%	Count
2	No	35.90%	14
3	Instructor	28.21%	11
4	Other Leading Role, please specify	20.51%	8
1	Organizer	15.38%	6
	Total	100%	39

Q8 - How do you typically learn about training opportunities? (Select all that apply)



#	Answer	%	Count
5	Communication from Professional Organizations/Societies	89.47%	34
2	Email Lists	73.68%	28
4	Online/Email Advertisement	73.68%	28
1	Internal Sources/Communication	50.00%	19
3	Word of Mouth	36.84%	14
6	Other, please specify	2.63%	1
	Total	100%	38

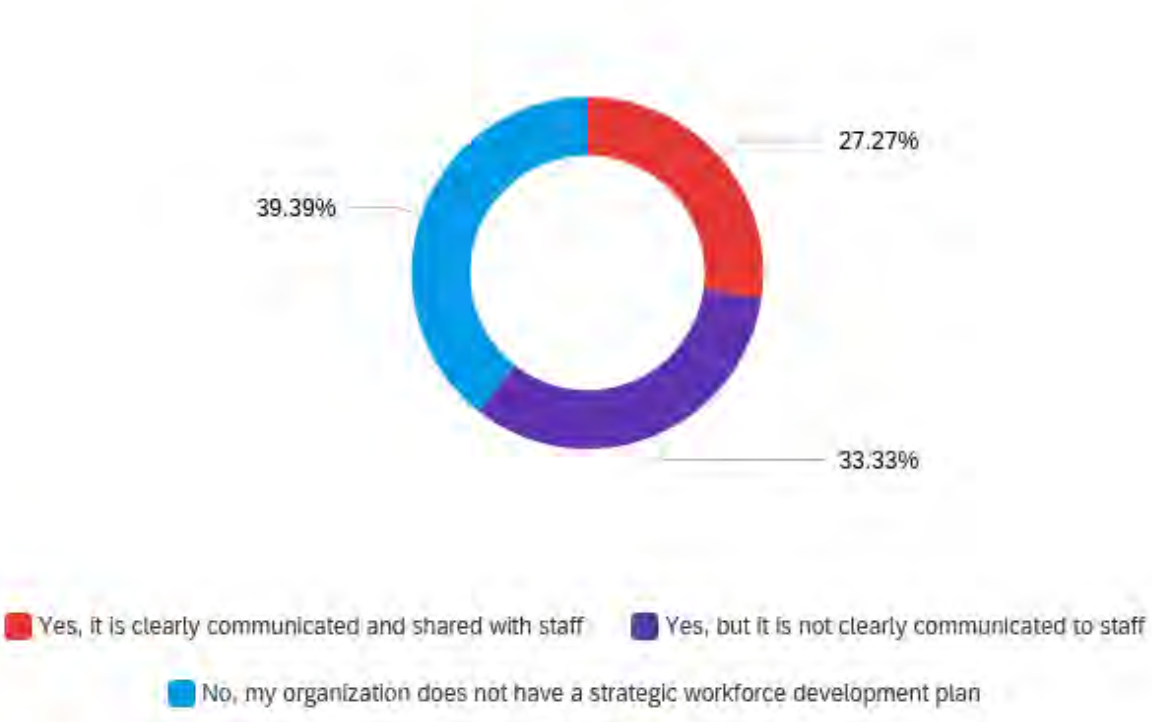
Q9 - During the course of time you have been in your current position, about how often have you used workforce training resources (e.g., any workshops, seminars, training courses, etc. related to workforce skill development)?



#	Answer	%	Count
2	Very Rarely (One or Twice a Year)	22.50%	9
5	Very Often (More than Once per Month)	25.00%	10
1	Never	0.00%	0
3	Infrequently (Less than Once per Quarter [3 Months])	20.00%	8
4	Frequently (More than Once per Quarter [3 Months])	32.50%	13
	Total	100%	40

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	During the course of time you have been in your current position, about how often have you used workforce training resources (e.g. any workshops, seminars, training courses, etc. related to workforce skill development)?	2.00	5.00	3.60	1.09	1.19	40

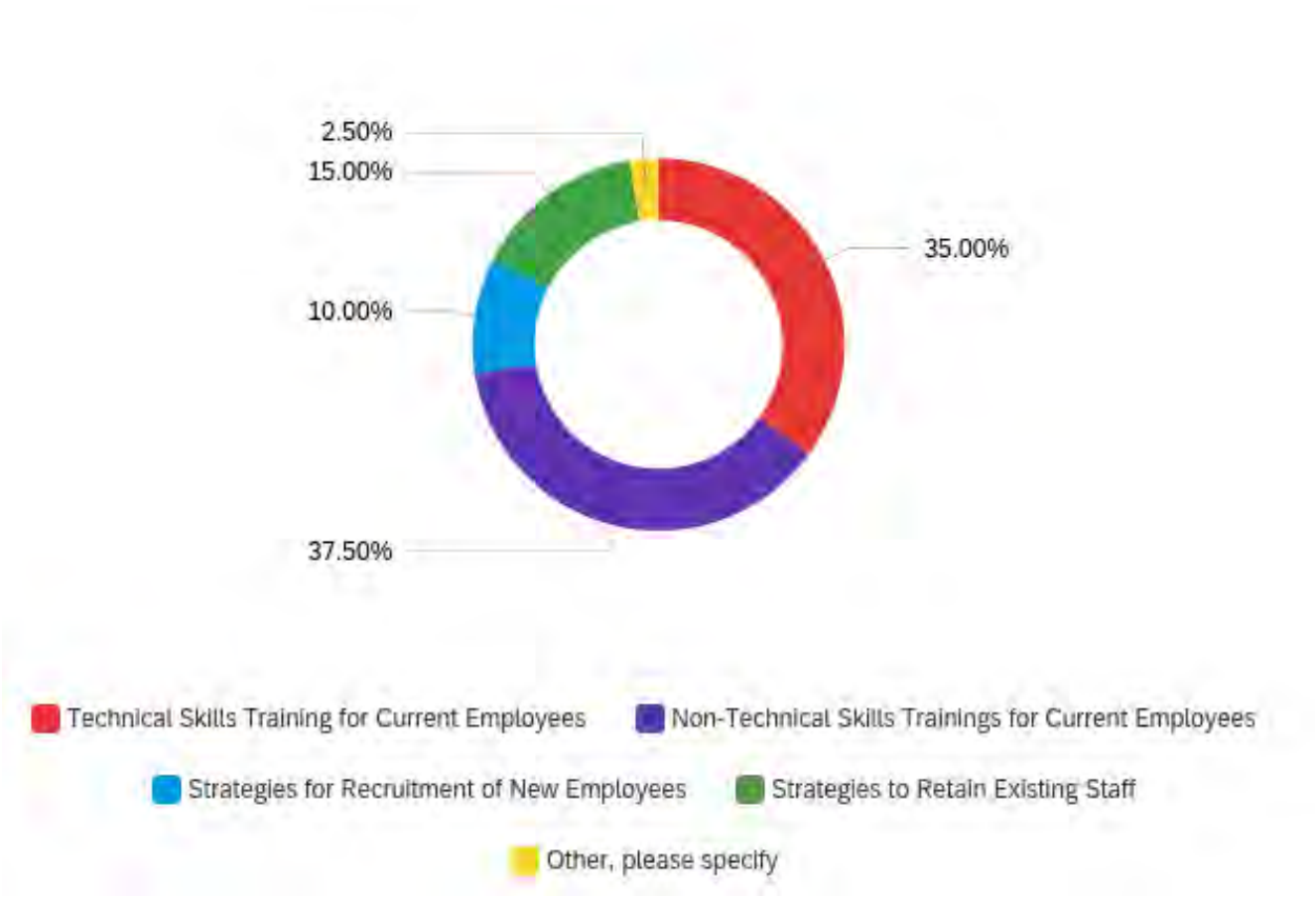
Q10 - Does your current organization/agency have a strategic workforce development plan/agenda?



#	Answer	%	Count
3	No, my organization does not have a strategic workforce development plan	39.39%	13
2	Yes, but it is not clearly communicated to staff	33.33%	11
1	Yes, it is clearly communicated and shared with staff	27.27%	9
	Total	100%	33

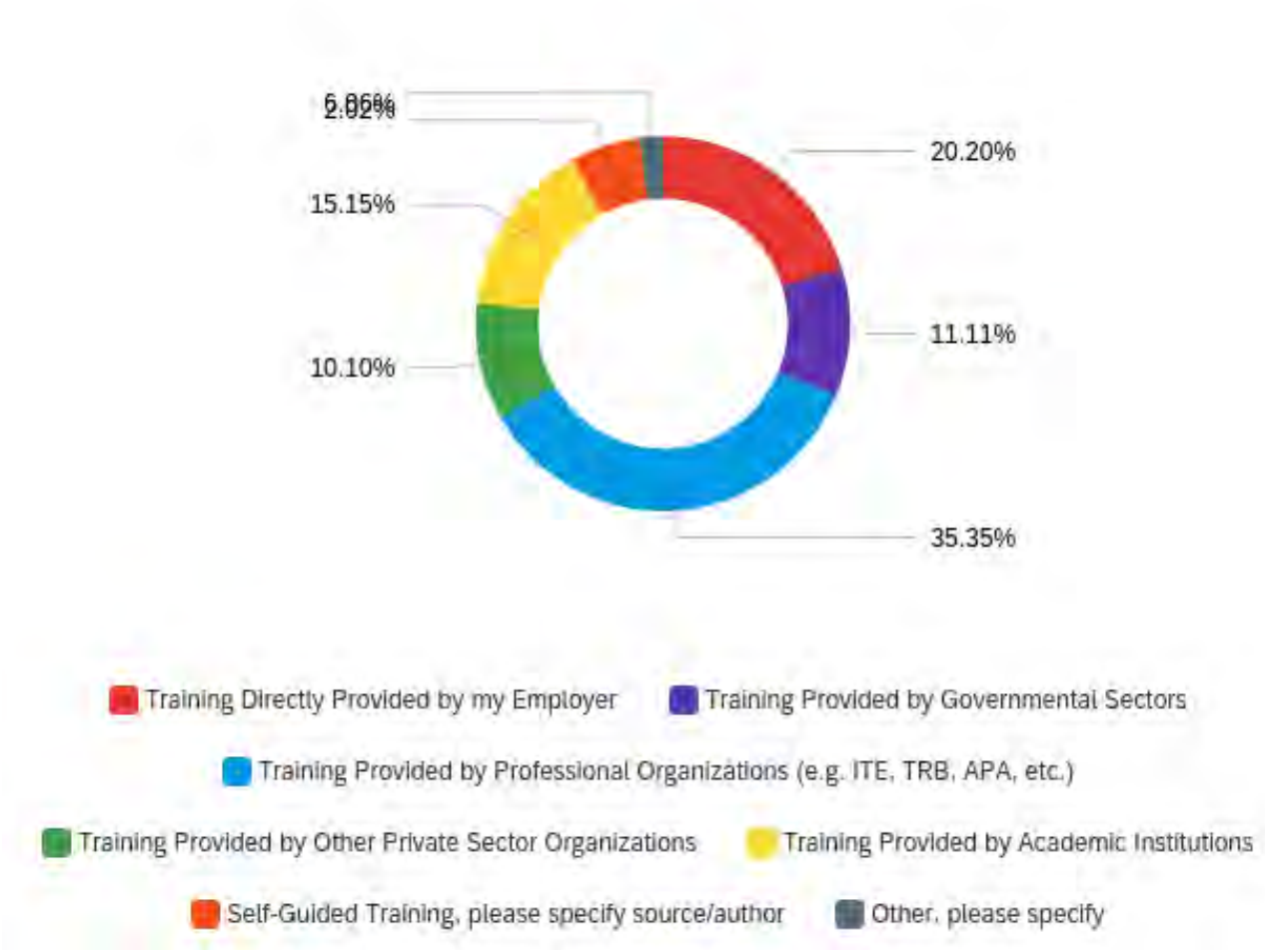
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Does your current organization/agency have a strategic workforce development plan/agenda?	1.00	3.00	2.12	0.81	0.65	33

Q11 - My organization/agency's plan includes the following: (Select all that apply)



#	Answer	%	Count
2	Non-Technical Skills Trainings for Current Employees	37.50%	15
1	Technical Skills Training for Current Employees	35.00%	14
4	Strategies to Retain Existing Staff	15.00%	6
3	Strategies for Recruitment of New Employees	10.00%	4
5	Other, please specify	2.50%	1
	Total	100%	40

Q12 - Which of the following sources do you most commonly receive training from? (Select all that apply)



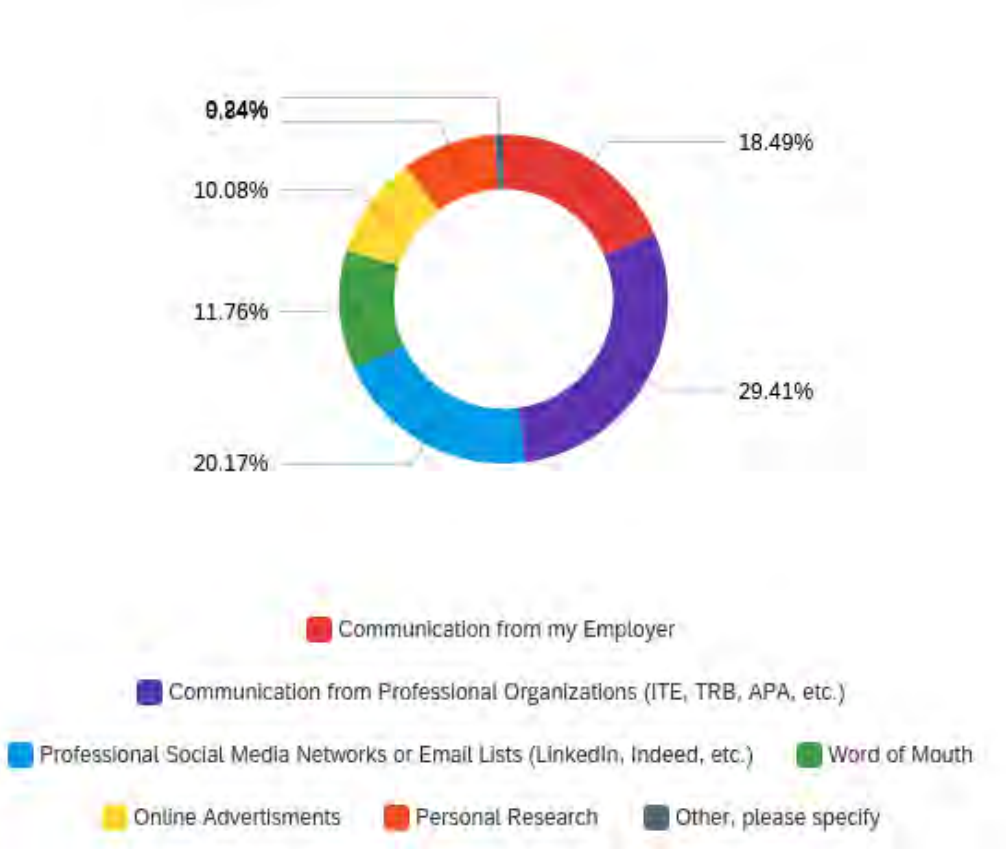
#	Answer	%	Count
3	Training Provided by Professional Organizations (e.g. ITE, TRB, APA, etc.)	89.74%	35
4	Training Provided by Other Private Sector Organizations	25.64%	10
2	Training Provided by Governmental Sectors	28.21%	11
5	Training Provided by Academic Institutions	38.46%	15
1	Training Directly Provided by my Employer	51.28%	20
6	Self-Guided Training, please specify source/author	15.38%	6
7	Other, please specify	5.13%	2

	Total	100%	39

Q12_6_TEXT - Self-Guided Training, please specify source/author

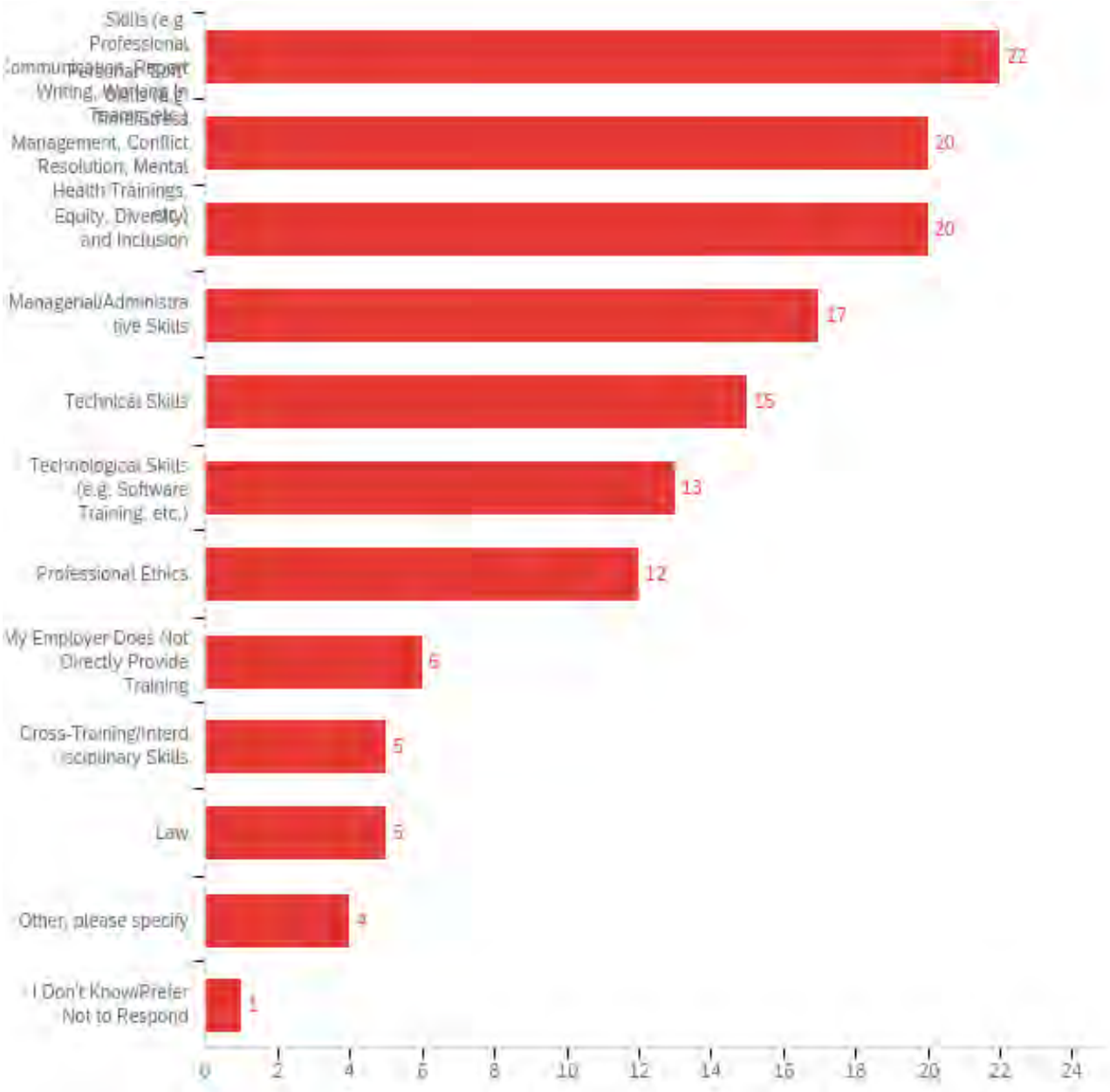
Self-Guided Training, please specify source/author - Text
CTQP FDOT
Primary sources
LinkedIn Learning
Udemy/YouTube

Q13 - How are you typically informed of training opportunities? (Select all that apply)



#	Answer	%	Count
2	Communication from Professional Organizations (ITE, TRB, APA, etc.)	89.74%	35
3	Professional Social Media Networks or Email Lists (LinkedIn, Indeed, etc.)	61.54%	24
1	Communication from my Employer	56.41%	22
4	Word of Mouth	35.90%	14
5	Online Advertisements	30.77%	12
6	Personal Research	28.21%	11
7	Other, please specify	2.56%	1
	Total	100%	39

Q14 - Please select the topics of training currently available to you through training directly provided by your current employer. (Select all that apply)



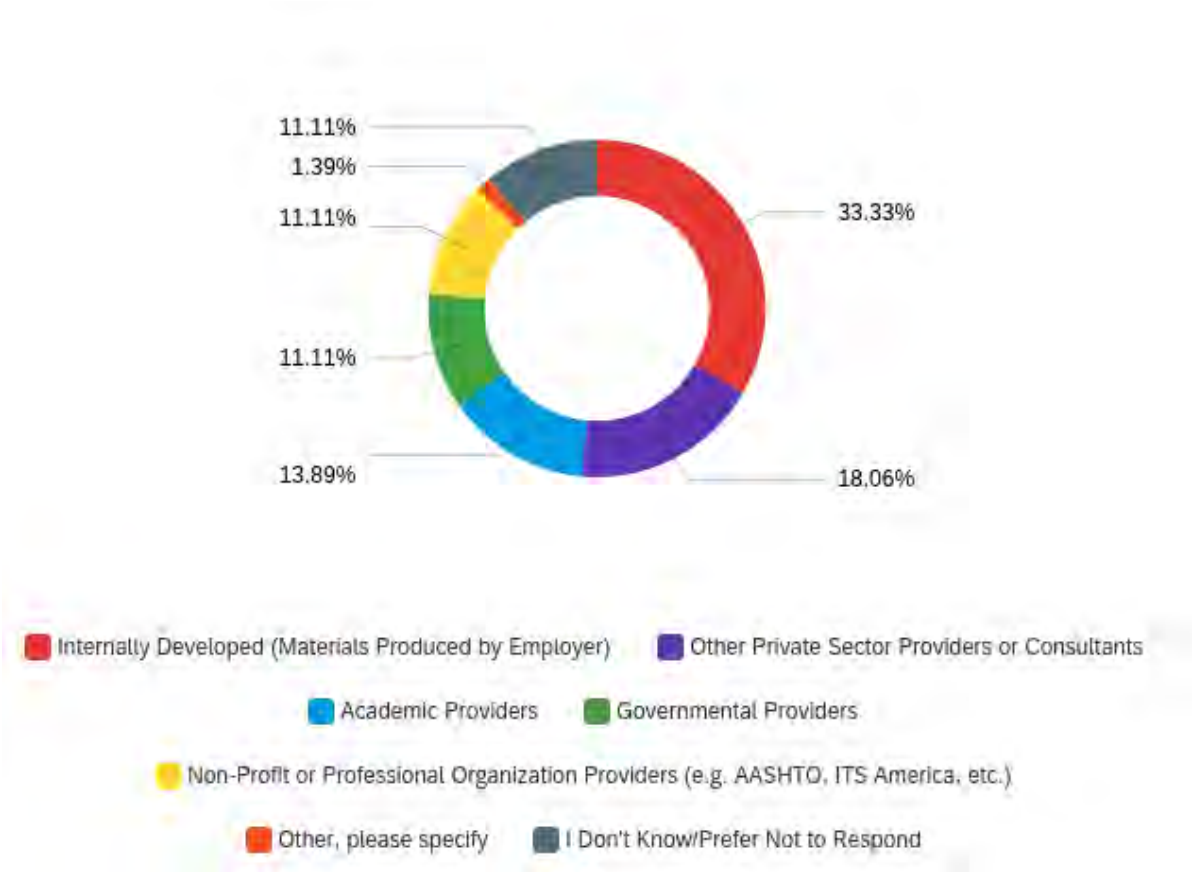
#	Answer	%	Count
2	Professional "Soft" Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)	56.41%	22
7	Equity, Diversity, and Inclusion	51.28%	20

4	Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)	51.28%	20
3	Managerial/Administrative Skills	43.59%	17
1	Technical Skills	38.46%	15
6	Technological Skills (e.g. Software Training, etc.)	33.33%	13
9	Professional Ethics	30.77%	12
11	My Employer Does Not Directly Provide Training	15.38%	6
5	Cross-Training/Interdisciplinary Skills	12.82%	5
8	Law	12.82%	5
10	Other, please specify	10.26%	4
12	I Don't Know/Prefer Not to Respond	2.56%	1
	Total	100%	39

Q14_10_TEXT - Other, please specify

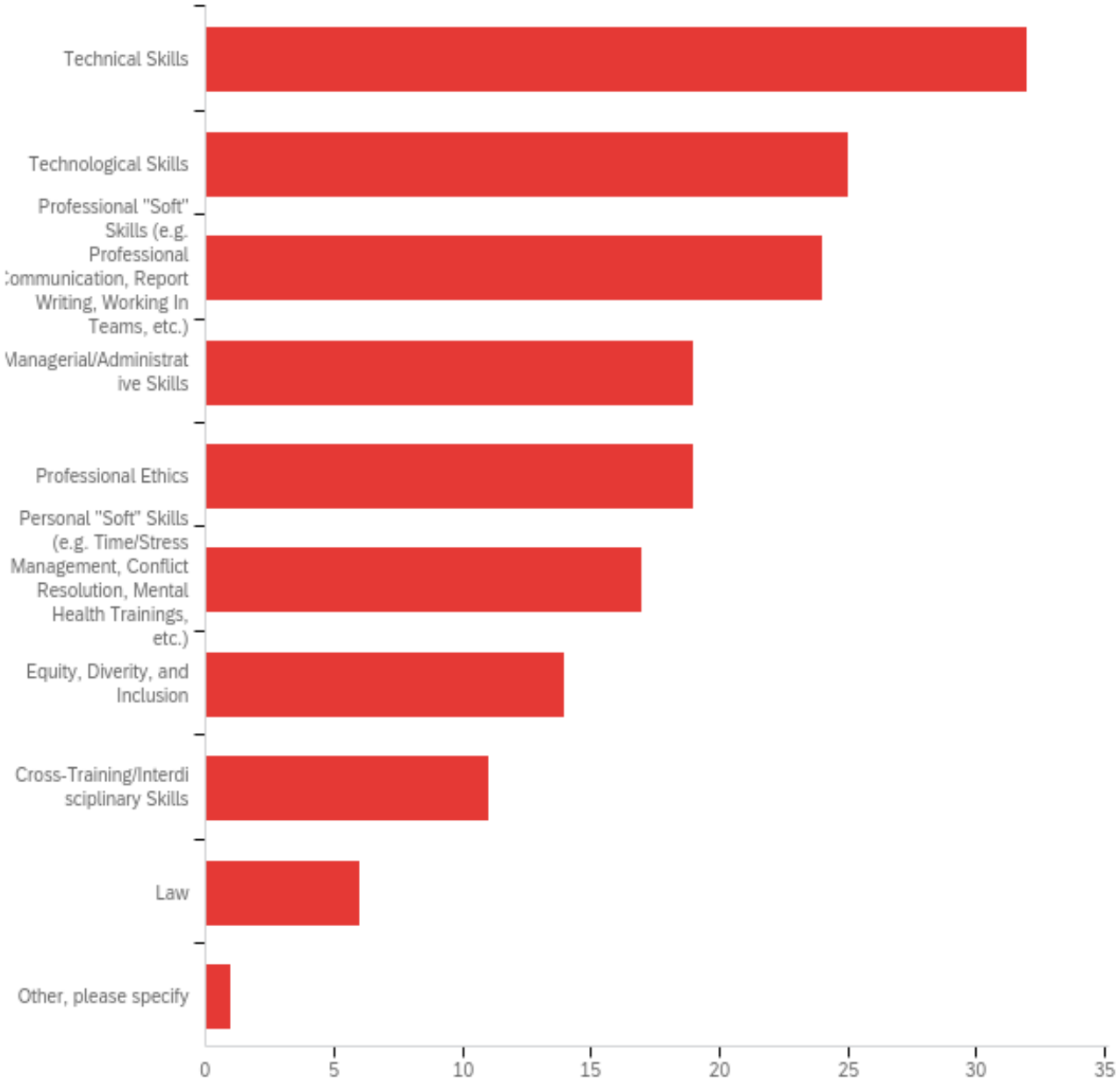
Other, please specify - Text
TSMO
Security topics
Emergency response training
We have a lot of these, but they aren't necessarily "currently" available

Q15 - Where are the materials typically sourced from for the training directly provided by your employer?



#	Answer	%	Count
1	Internally Developed (Materials Produced by Employer)	63.16%	24
2	Other Private Sector Providers or Consultants	34.21%	13
3	Academic Providers	26.32%	10
4	Governmental Providers	21.05%	8
5	Non-Profit or Professional Organization Providers (e.g. AASHTO, ITS America, etc.)	21.05%	8
7	I Don't Know/Prefer Not to Respond	21.05%	8
6	Other, please specify	2.63%	1
	Total	100%	38

Q16 - Please select the topics of training currently available to you through training provided by sources other than your current employer. (Select all that apply)



#	Answer	%	Count
1	Technical Skills	84.21%	32
6	Technological Skills	65.79%	25

2	Professional "Soft" Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)	63.16%	24
3	Managerial/Administrative Skills	50.00%	19
9	Professional Ethics	50.00%	19
4	Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)	44.74%	17
7	Equity, Diversity, and Inclusion	36.84%	14
5	Cross-Training/Interdisciplinary Skills	28.95%	11
8	Law	15.79%	6
10	Other, please specify	2.63%	1
	Total	100%	38

Q17 - For the following training topics, please indicate the degree to which they are personally valuable to success in your current position

Technical Skills

Professional "Soft" Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)

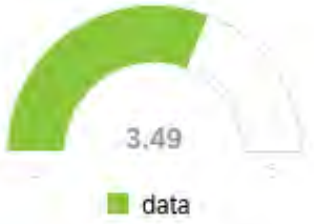
Managerial/Administrative Skills

Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)

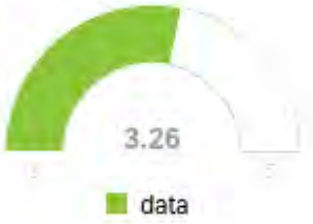
Cross-Training/Interdisciplinary Skills

Technological Skills

Equity, Diversity, and Inclusion



Knowledge of Law

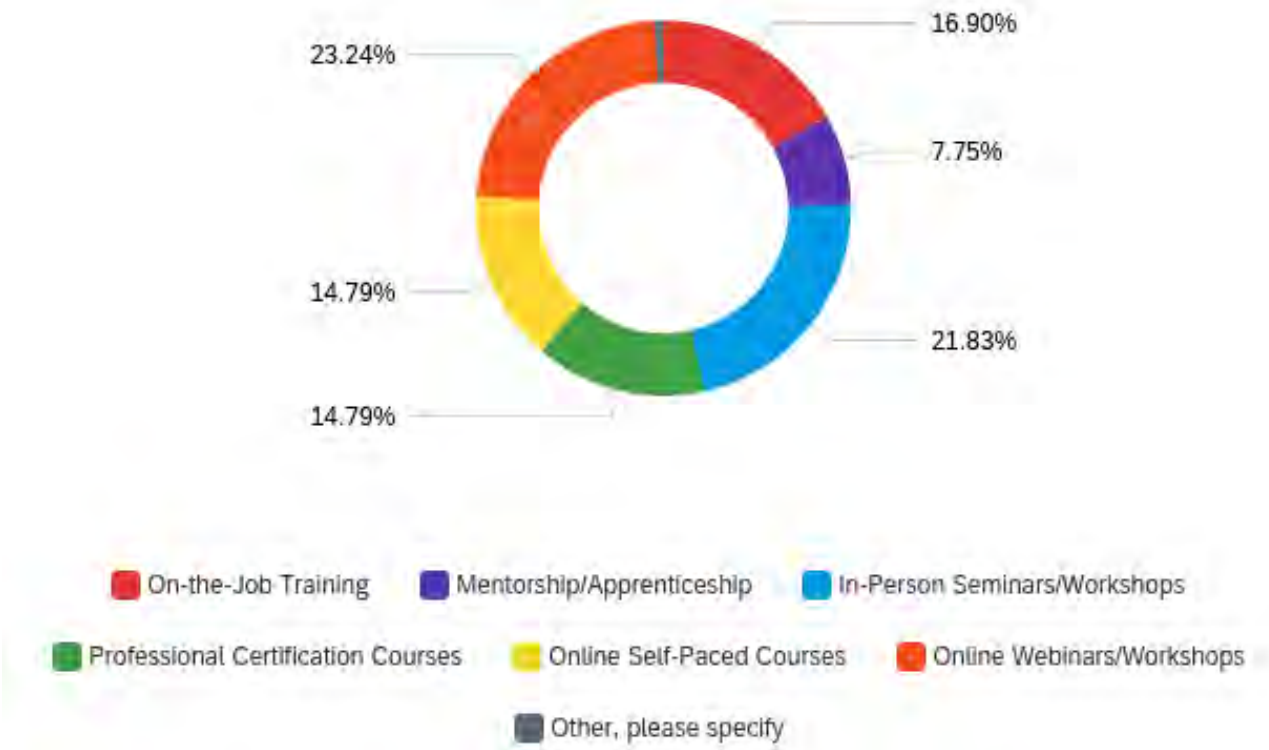


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
2	Professional Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)	2.00	5.00	4.24	0.87	0.76	38
1	Technical Skills	2.00	5.00	4.18	0.79	0.62	38
10	Other, please specify	3.00	5.00	4.00	1.00	1.00	2
4	Persona Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)	2.00	5.00	3.86	0.91	0.82	37
3	Managerial/Administrative Skills	1.00	5.00	3.78	1.11	1.23	36
6	Technological Skills	2.00	5.00	3.76	0.85	0.72	37
9	Knowledge of Professional Ethics	1.00	5.00	3.69	1.19	1.42	35
7	Equity, Diversity, and Inclusion	1.00	5.00	3.49	1.11	1.22	35
8	Knowledge of Law	1.00	5.00	3.26	1.05	1.11	35
5	Cross-Training/Interdisciplinary Skills	1.00	5.00	3.17	0.91	0.83	35

#	Question	Not At All Valuable		Slightly Valuable		Somewhat Valuable		Very Valuable		Essential/Extremely Valuable		Total
1	Technical Skills	0.00%	0	2.63%	1	15.79%	6	42.11%	16	39.47%	15	38

2	Professional "Soft" Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)	0.00%	0	5.26%	2	13.16%	5	34.21%	13	47.37%	18	38
3	Managerial/Administrative Skills	2.78%	1	11.11%	4	25.00%	9	27.78%	10	33.33%	12	36
4	Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)	0.00%	0	8.11%	3	24.32%	9	40.54%	15	27.03%	10	37
5	Cross-Training/Interdisciplinary Skills	2.86%	1	17.14%	6	48.57%	17	22.86%	8	8.57%	3	35
6	Technological Skills	0.00%	0	8.11%	3	27.03%	10	45.95%	17	18.92%	7	37
7	Equity, Diversity, and Inclusion	5.71%	2	14.29%	5	22.86%	8	40.00%	14	17.14%	6	35
8	Knowledge of Law	5.71%	2	17.14%	6	34.29%	12	31.43%	11	11.43%	4	35
9	Knowledge of Professional Ethics	8.57%	3	5.71%	2	22.86%	8	34.29%	12	28.57%	10	35
10	Other, please specify	0.00%	0	0.00%	0	50.00%	1	0.00%	0	50.00%	1	2

Q18 - Please select the mediums/methods by which training is currently offered. (Select all that apply)



#	Answer	%	Count
6	Online Webinars/Workshops	84.62%	33
3	In-Person Seminars/Workshops	79.49%	31
1	On-the-Job Training	61.54%	24
4	Professional Certification Courses	53.85%	21
5	Online Self-Paced Courses	53.85%	21
2	Mentorship/Apprenticeship	28.21%	11
7	Other, please specify	2.56%	1
	Total	100%	39

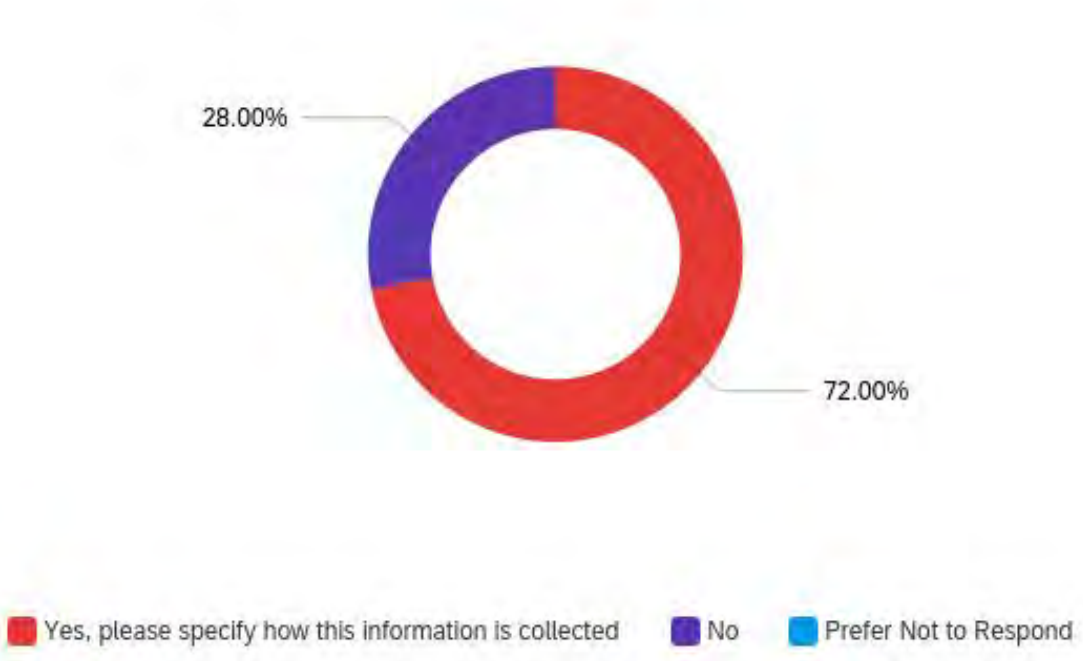
Q19 - Please indicate your preference for the following training methods.

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	On-the-Job Training	2.00	5.00	4.32	0.87	0.75	34

3	In-Person Seminars/Workshops	2.00	5.00	4.30	0.87	0.75	37
6	Online Webinars/Workshops	2.00	5.00	4.00	0.81	0.65	37
4	Professional Certification Courses	2.00	5.00	3.83	0.93	0.86	36
2	Mentorship/Apprenticeship	1.00	5.00	3.49	1.11	1.22	35
5	Online Self-Paced Courses	1.00	5.00	3.47	1.07	1.14	36
7	Other, please specify	0.00	0.00	0.00	0.00	0.00	0

#	Question	Strongly Not Preferred		Slightly Not Preferred		No Preference		Slightly Preferred		Strongly Preferred		Total
1	On-the-Job Training	0.00%	0	2.94%	1	17.65%	6	23.53%	8	55.88%	19	34
3	In-Person Seminars/Workshops	0.00%	0	5.41%	2	10.81%	4	32.43%	12	51.35%	19	37
6	Online Webinars/Workshops	0.00%	0	5.41%	2	16.22%	6	51.35%	19	27.03%	10	37
4	Professional Certification Courses	0.00%	0	11.11%	4	19.44%	7	44.44%	16	25.00%	9	36
2	Mentorship/Apprenticeship	5.71%	2	8.57%	3	40.00%	14	22.86%	8	22.86%	8	35
5	Online Self-Paced Courses	8.33%	3	5.56%	2	30.56%	11	41.67%	15	13.89%	5	36
7	Other, please specify	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	undefined

Q20 - Based on your previous experience, are the current workforce development practices of your employer informed by employee feedback?



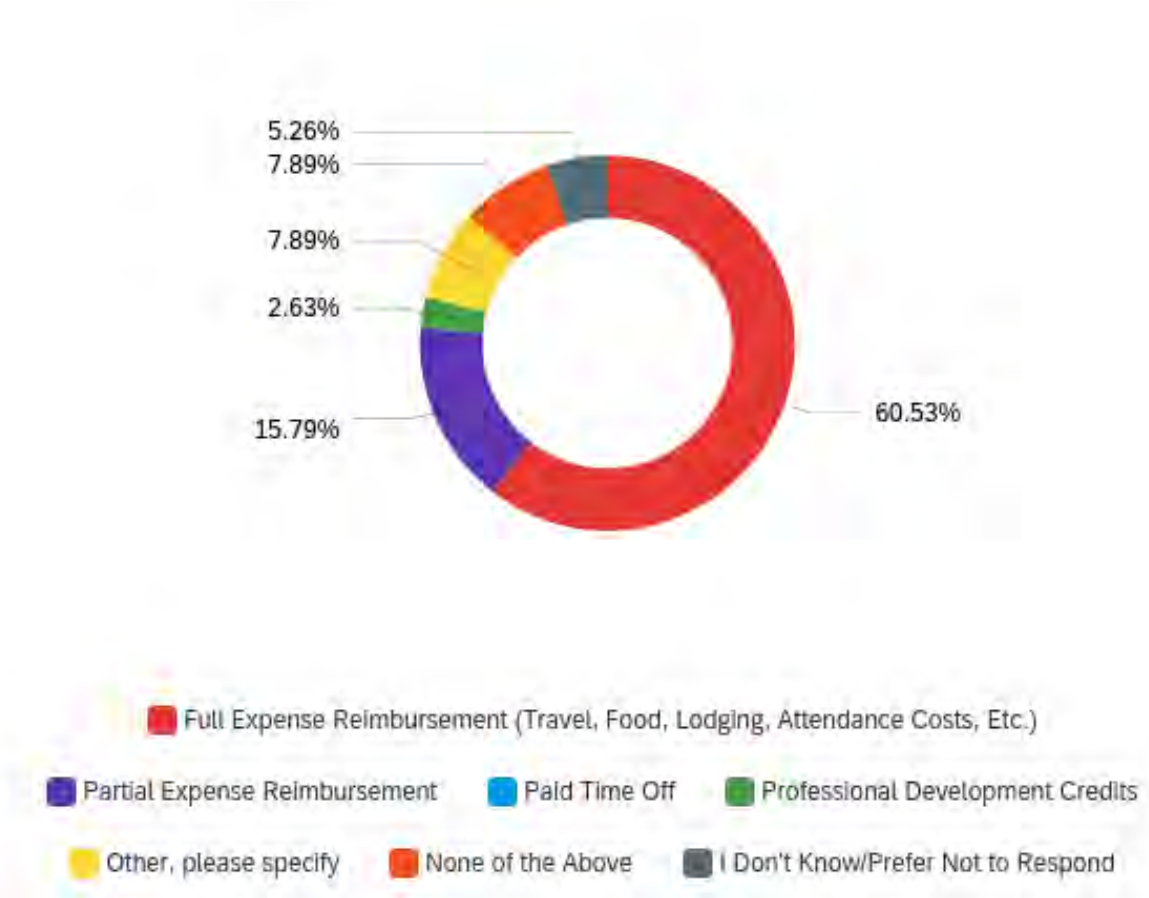
#	Answer	%	Count
1	Yes, please specify how this information is collected	72.00%	18
2	No	28.00%	7
4	Prefer Not to Respond	0.00%	0
	Total	100%	25

Q22 - Based on your experience, briefly describe how the competencies or skills necessary for success in your current position might change in the next 10 years.

Based on your experience, briefly describe how the competencies or skills necessary for success in your current position might change in the next 10 years.
The major competencies are artificial intelligence and software technologies.
Rate of change in technology and mobility models is creating an increased need for critical thinking and staff who can work across disciplines
Will drastically change.
I believe there will be more reliance on technical skills that I'm not using daily now (GIS, data management, Tableau, etc.). Racial and health equity will become more standardized - hopefully ingrained across all training and throughout the culture of the workplace - rather than as standalone.
Developing successful transportation networks will rely on cross-organizational collaboration between transit operators, local government, land developers, and business owners. Success will rely on the ability to build and lead networks of these organizations consistently towards common, long-term goals.
having to work with diverse staff on projects that are not the traditional Civil engineering, more use of data and data analysis via AI/Machine Learning, working in hybrid environments
New technologies, new teaching mediums
technology advances, remote work
I think my position will require more technological skill than required of me
-
More management skills, less technical
Technical competencies are currently discipline specific (e.g. systems engineering for traffic signal systems), in the next decade significant integration of systems across facilities will introduce data management competencies and capabilities to assess and make decisions across facilities/modes.
Over the next decade, the narrow focus of my organization hopes to expand in the realm of infrastructure development in foreign jurisdictions.
Continue to evolve in current directions: new software versions, new designs and ideas, tighter budgets.
More education and training on the technical requirements of meeting design regulations for implementing the transition plan.
Managerial and communication skills are necessary for me to manage bigger projects. I will also need to develop my technical skills by working on more diverse projects with some time allocated for training.
Being an Assistant Project Manager, I think in the next 10 years I will get more involved with the business development/marketing/management side of my career.
Evolving technologies and new practices will push the need for the focus to change from what has always been done to what can be done differently. The old saying "if it ain't broke, don't fix it" has kept us where we are now, stuck in the technology of 30-40 years ago when the department began.

Technology focused instead of 'soft skills'. More online learning.
Technology is changing so quickly, the tech we are working with today likely won't be deployed in 10 years, staying on top of that information is challenging. Also, understanding how to motivate and work with younger generations.
Will need more training on how to apply technological advances to the profession.
Increased need to stay current with change in advanced technologies related to CAV.
It will continue to grow in technology needs. For the transportation field, the techs used to only need to know mechanical and electrical skills. Engineers only needed their typical skill sets. Now, both are in need to more technical/computer-network skills. Fiber optic and radio communications, firewalls, data transfer, advanced data collections. As technology evolves, the more these positions will have to become more of a hybrid position of tech/ITS or engineer/ITS positions.
More technology dependent.
communication technics, visualizations, and social media.
The software tools we use and going to become more complicated and hopefully accurate. They will require more engineering judgement to use (e. g., the calibration of a VISSIM models). Data analysis will be a big part of the job. Partly because we will have access to tons of data generated by RSI and AV/CVs. Need to be careful on how the data informs our decisions.
With working from home becoming more prevalent, I'll still need to spend time with clients. I don't see much change in the necessary skills needed in the next 10 years.
Technology is becoming the main component of communication and analysis. Those who can adapt quickly will do well, those who don't will struggle.
Likely to remain the same.
Increased availability of data from smart technologies will necessitate staff learning new software applications to stay abreast of population and transportation dynamics

Q23 - Which of the following resources, if any, does your employer offer to assist you in participating in training programs?

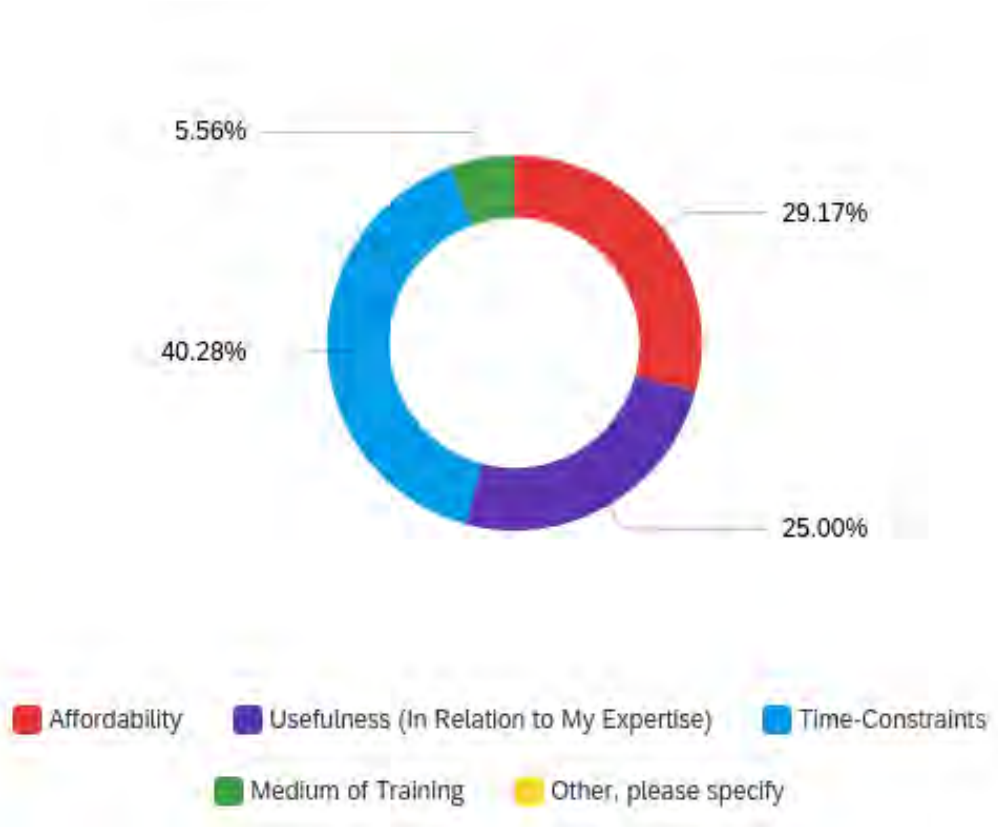


#	Answer	%	Count
1	Full Expense Reimbursement (Travel, Food, Lodging, Attendance Costs, Etc.)	60.53%	23
2	Partial Expense Reimbursement	15.79%	6
5	Other, please specify	7.89%	3
6	None of the Above	7.89%	3
7	I Don't Know/Prefer Not to Respond	5.26%	2
4	Professional Development Credits	2.63%	1
3	Paid Time Off	0.00%	0
	Total	100%	38

Q23_5_TEXT - Other, please specify

Other, please specify - Text
Typically, we can only attend training programs/conferences/etc. if it is directly related to and therefore chargeable to a project, unless they are mandatory trainings required by the University.
Limited full expense reimbursement (must be approved ahead of time, usually only 1-2 a year)
For minor training, full reimbursement. For degree training/education it is only a partial.

Q24 - Which of the following factors are major limitations to the ability to access training resources? (Select all that apply)



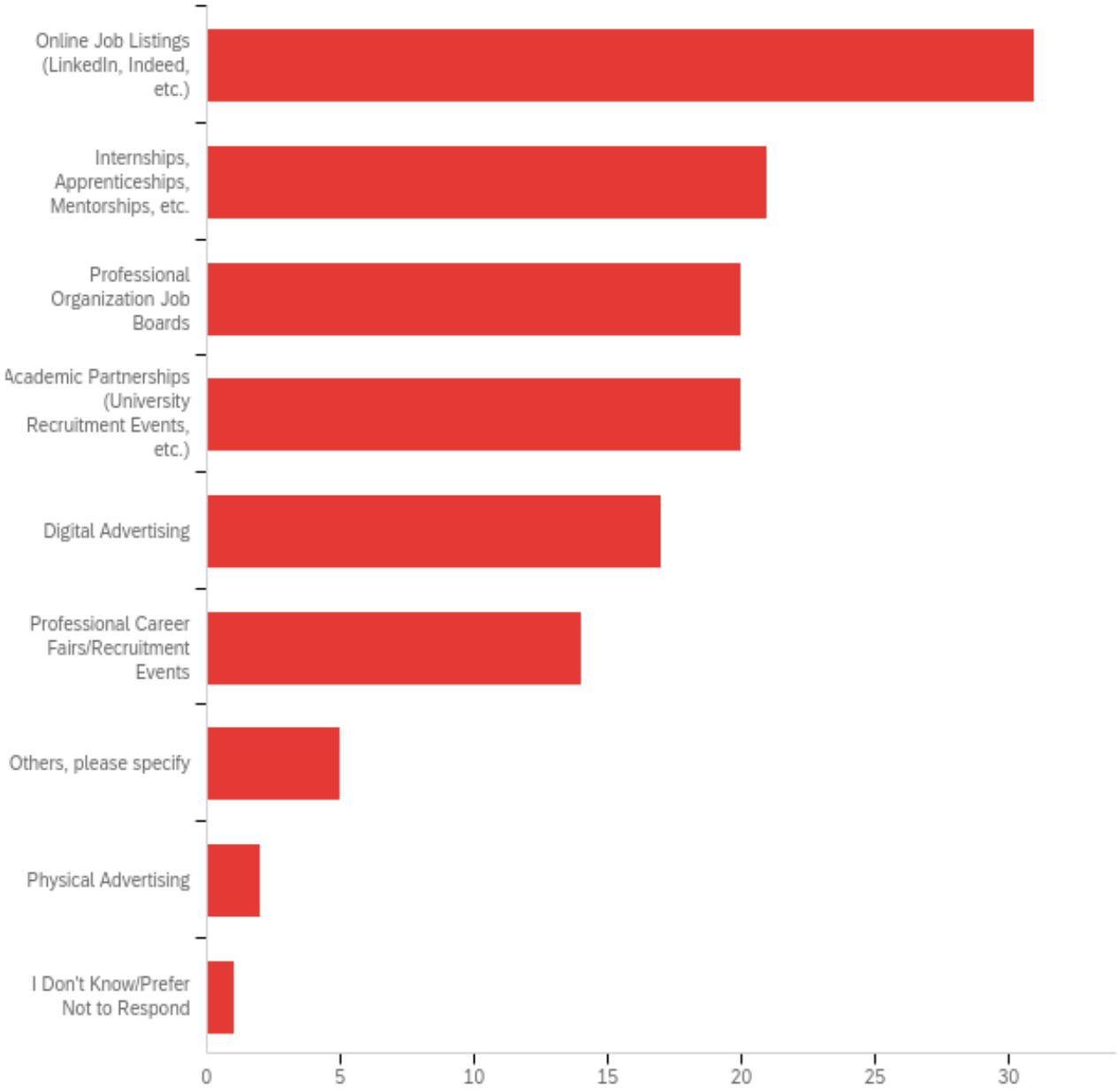
#	Answer	%	Count
3	Time-Constraints	76.32%	29
1	Affordability	55.26%	21
2	Usefulness (In Relation to My Expertise)	47.37%	18
4	Medium of Training	10.53%	4
5	Other, please specify	0.00%	0
	Total	100%	38

Q25 - Please indicate the degree to which you agree/disagree with the following statements.

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	My agency/organization has a clear plan for the recruitment of new employees.	1.00	5.00	3.05	1.18	1.40	37
2	My agency/organization is able to quickly fill vacant positions.	1.00	5.00	2.81	1.35	1.82	36

#	Question	Strongly Disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	My agency/organization has a clear plan for the recruitment of new employees.	13.51%	5	18.92%	7	24.32%	9	35.14%	13	8.11%	3	37
2	My agency/organization is able to quickly fill vacant positions.	25.00%	9	13.89%	5	30.56%	11	16.67%	6	13.89%	5	36

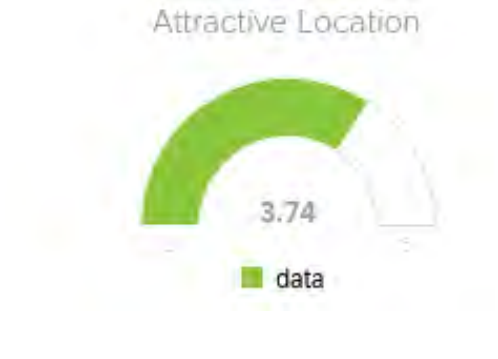
Q26 - Please indicate which of the following recruitment strategies are used by your current employer. (Select all that apply)



#	Answer	%	Count
1	Online Job Listings (LinkedIn, Indeed, etc.)	86.11%	31
7	Internships, Apprenticeships, Mentorships, etc.	58.33%	21
2	Professional Organization Job Boards	55.56%	20

3	Academic Partnerships (University Recruitment Events, etc.)	55.56%	20
5	Digital Advertising	47.22%	17
4	Professional Career Fairs/Recruitment Events	38.89%	14
8	Others, please specify	13.89%	5
6	Physical Advertising	5.56%	2
10	I Don't Know/Prefer Not to Respond	2.78%	1
	Total	100%	36

Q27 - To what degree did the following factors contribute to your choice to work at your current organization/agency?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
6	Other, please specify	1.00	5.00	4.17	1.46	2.14	6
4	Flexible Work Arrangements	1.00	5.00	3.85	1.26	1.60	34
2	Attractive Workplace/Company	1.00	5.00	3.83	1.26	1.58	36
5	Attractive Location	1.00	5.00	3.74	1.29	1.68	35
1	Competitive Salary/Benefits	1.00	5.00	3.67	1.27	1.61	36

3	Opportunity for Achievement/Upward Mobility	1.00	5.00	3.65	1.13	1.29	34

#	Question	Not at All		Slightly		Moderately		Strongly		Very Strongly		Total
3	Opportunity for Achievement/Upward Mobility	5.88%	2	5.88%	2	35.29%	12	23.53%	8	29.41%	10	34
1	Competitive Salary/Benefits	8.33%	3	11.11%	4	19.44%	7	27.78%	10	33.33%	12	36
5	Attractive Location	11.43%	4	5.71%	2	14.29%	5	34.29%	12	34.29%	12	35
2	Attractive Workplace/Company	8.33%	3	8.33%	3	13.89%	5	30.56%	11	38.89%	14	36
4	Flexible Work Arrangements	8.82%	3	5.88%	2	17.65%	6	26.47%	9	41.18%	14	34
6	Other, please specify	16.67%	1	0.00%	0	0.00%	0	16.67%	1	66.67%	4	6

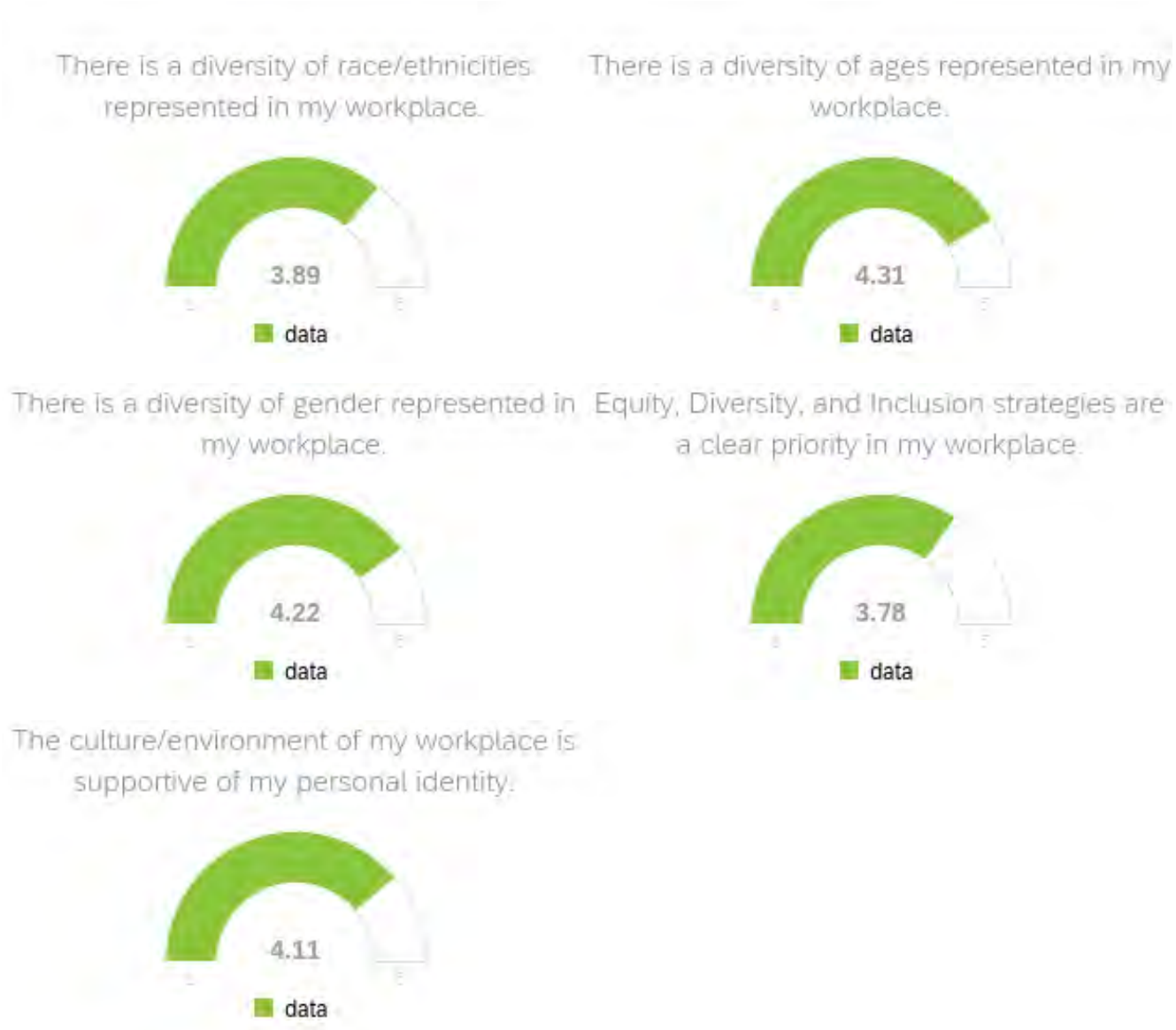
Q28 - Please indicate the degree to which you agree/disagree with the following statements.

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
5	My workplace is responsive and flexible to my	8.11%	3	2.70%	1	5.41%	2	24.32%	9	59.46%	22	37

	individual needs.											
3	My workplace environment is safe and comfortable for all.	2.70%	1	5.41%	2	2.70%	1	35.14%	13	54.05%	20	37
4	My workplace has a culture of respect and inclusion.	8.11%	3	10.81%	4	10.81%	4	24.32%	9	45.95%	17	37
2	I am adequately compensated in my current position.	8.11%	3	16.22%	6	13.51%	5	18.92%	7	43.24%	16	37
1	There are opportunities for promotion/career advancement available to me.	13.16%	5	7.89%	3	13.16%	5	39.47%	15	26.32%	10	38

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	There are opportunities for promotion/career advancement available to me.	1.00	5.00	3.58	1.31	1.72	38
2	I am adequately compensated in my current position.	1.00	5.00	3.73	1.37	1.87	37
3	My workplace environment is safe and comfortable for all.	1.00	5.00	4.32	0.96	0.92	37
4	My workplace has a culture of respect and inclusion.	1.00	5.00	3.89	1.31	1.72	37
5	My workplace is responsive and flexible to my individual needs.	1.00	5.00	4.24	1.19	1.43	37
6	6	5.00	5.00	5.00	0.00	0.00	1

Q29 - Please indicate the degree to which you agree/disagree with the following statements.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
2	There is a diversity of ages represented in my workplace.	1.00	5.00	4.31	0.99	0.99	36
3	There is a diversity of gender represented in my workplace.	1.00	5.00	4.22	1.06	1.12	36

5	The culture/environment of my workplace is supportive of my personal identity.	1.00	5.00	4.11	1.17	1.38	36
1	There is a diversity of race/ethnicities represented in my workplace.	1.00	5.00	3.89	1.17	1.38	36
4	Equity, Diversity, and Inclusion strategies are a clear priority in my workplace.	1.00	5.00	3.78	1.16	1.34	36

#	Question	Strongly Disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
2	There is a diversity of ages represented in my workplace.	2.78%	1	5.56%	2	5.56%	2	30.56%	11	55.56%	20	36
3	There is a diversity of gender represented in my workplace.	2.78%	1	8.33%	3	5.56%	2	30.56%	11	52.78%	19	36
5	The culture/environment of my workplace is supportive of my personal identity.	5.56%	2	5.56%	2	13.89%	5	22.22%	8	52.78%	19	36
1	There is a diversity of race/ethnicities represented in my workplace.	5.56%	2	11.11%	4	8.33%	3	38.89%	14	36.11%	13	36
4	Equity, Diversity, and Inclusion strategies are a clear priority in my workplace.	5.56%	2	8.33%	3	22.22%	8	30.56%	11	33.33%	12	36

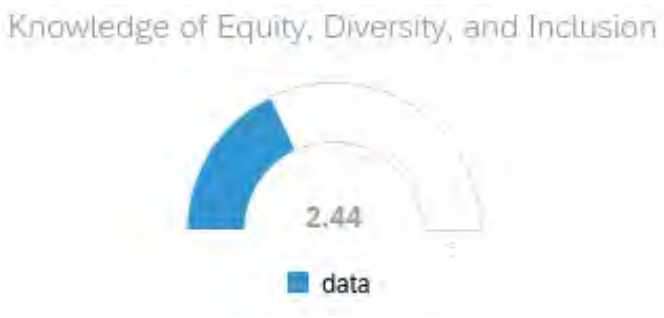
Q30 - Please indicate the degree to which you agree/disagree with the following statements.

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	My educational background prepared me with the skills necessary to perform the requirements of my current position.	1.00	5.00	4.22	1.11	1.23	36
2	My workplace provides me the educational opportunities/resources to be successful in my current position.	1.00	5.00	4.08	0.92	0.85	36

#	Question	Strongly Disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	My educational background prepared me with the skills necessary to perform the requirements of my current position.	5.56%	2	5.56%	2	2.78%	1	33.33%	12	52.78%	19	36

2	My workplace provides me the educational opportunities/resources to be successful in my current position.	2.78%	1	5.56%	2	5.56%	2	52.78%	19	33.33%	12	36

Q31 - Out of the following competencies, please indicate the degree to which your educational background prepared you to meet the requirements of your current position.

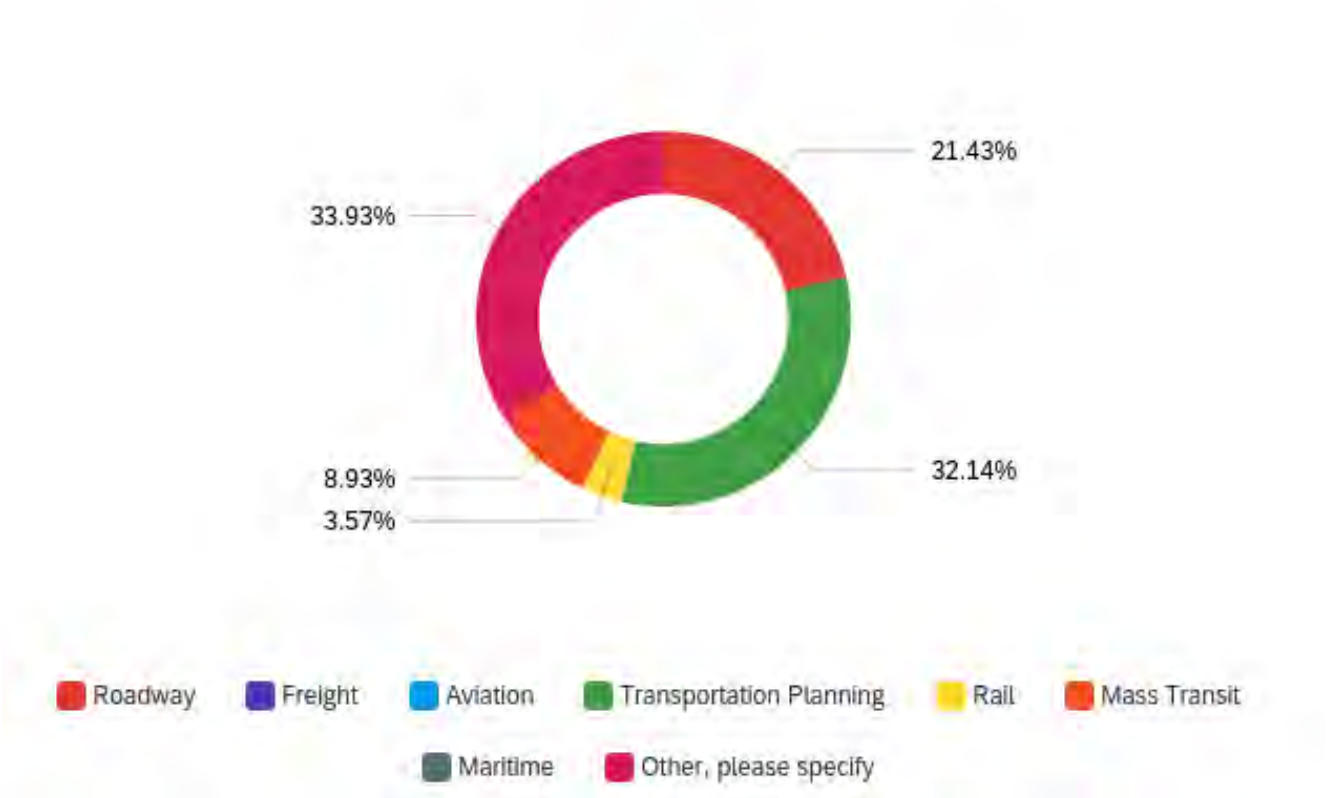


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Technical Skills	1.00	5.00	3.94	1.03	1.05	36
2	Professional Skills (e.g. Professional Communication, Report Writing, Working In Teams, etc.)	1.00	5.00	3.75	1.11	1.24	36
5	Technological Skills	1.00	5.00	3.50	1.07	1.14	36
8	Knowledge of Professional Ethics	1.00	5.00	3.19	1.13	1.27	36
6	Interdisciplinary Skills	1.00	5.00	3.11	1.15	1.32	36
3	Managerial/Administrative Skills	1.00	5.00	2.53	1.26	1.58	36
7	Knowledge of Law	1.00	5.00	2.50	1.12	1.25	36
4	Personal Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)	1.00	5.00	2.50	1.28	1.64	36
9	Knowledge of Equity, Diversity, and Inclusion	1.00	5.00	2.44	1.36	1.86	36
10	Other, please specify	0.00	0.00	0.00	0.00	0.00	0

#	Question	Not at all		Slightly		Moderately		Strongly		Very Strongly		Total
1	Technical Skills	2.78%	1	2.78%	1	30.56%	11	25.00%	9	38.89%	14	36
2	Professional "Soft" Skills (e.g.	5.56%	2	2.78%	1	36.11%	13	22.22%	8	33.33%	12	36

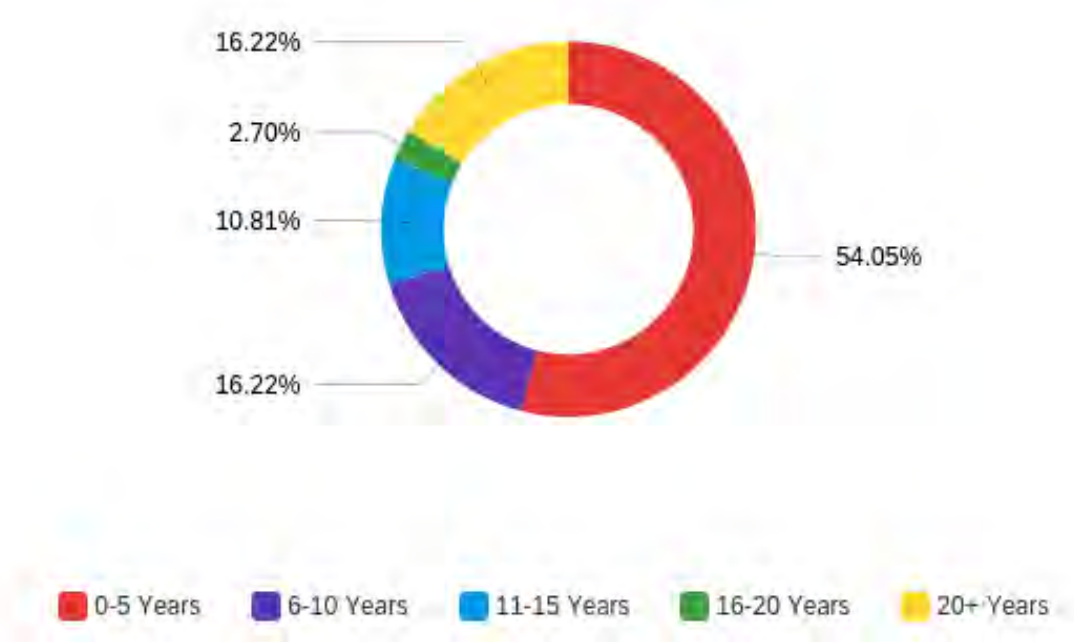
	Professional Communication, Report Writing, Working In Teams, etc.)											
5	Technological Skills	5.56 %	2	8.33 %	3	36.11%	13	30.56 %	11	19.44 %	7	36
8	Knowledge of Professional Ethics	8.33 %	3	13.89 %	5	44.44%	16	16.67 %	6	16.67 %	6	36
6	Interdisciplinary Skills	11.11 %	4	13.89 %	5	41.67%	15	19.44 %	7	13.89 %	5	36
3	Managerial/Administrative Skills	25.00 %	9	27.78 %	10	27.78%	10	8.33%	3	11.11 %	4	36
4	Personal "Soft" Skills (e.g. Time/Stress Management, Conflict Resolution, Mental Health Trainings, etc.)	27.78 %	10	25.00 %	9	27.78%	10	8.33%	3	11.11 %	4	36
9	Knowledge of Equity, Diversity, and Inclusion	36.11 %	13	16.67 %	6	25.00%	9	11.11 %	4	11.11 %	4	36
7	Knowledge of Law	25.00 %	9	19.44 %	7	41.67%	15	8.33%	3	5.56%	2	36
10	Other, please specify	0.00 %	0	0.00 %	0	0.00%	0	0.00%	0	0.00%	0	undefined

Q34 - What is your professional field? (Select all that apply)



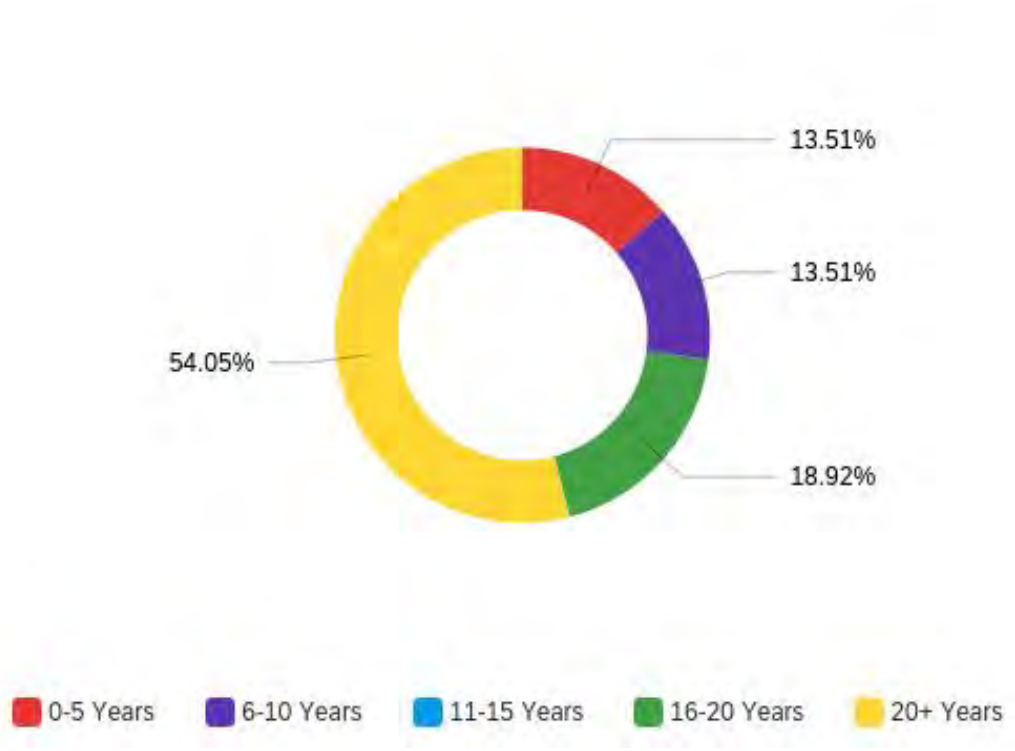
#	Answer	%	Count
8	Other, please specify	52.78%	19
4	Transportation Planning	50.00%	18
1	Roadway	33.33%	12
6	Mass Transit	13.89%	5
5	Rail	5.56%	2
2	Freight	0.00%	0
3	Aviation	0.00%	0
7	Maritime	0.00%	0
	Total	100%	36

Q35 - How many years have you been in your current position?



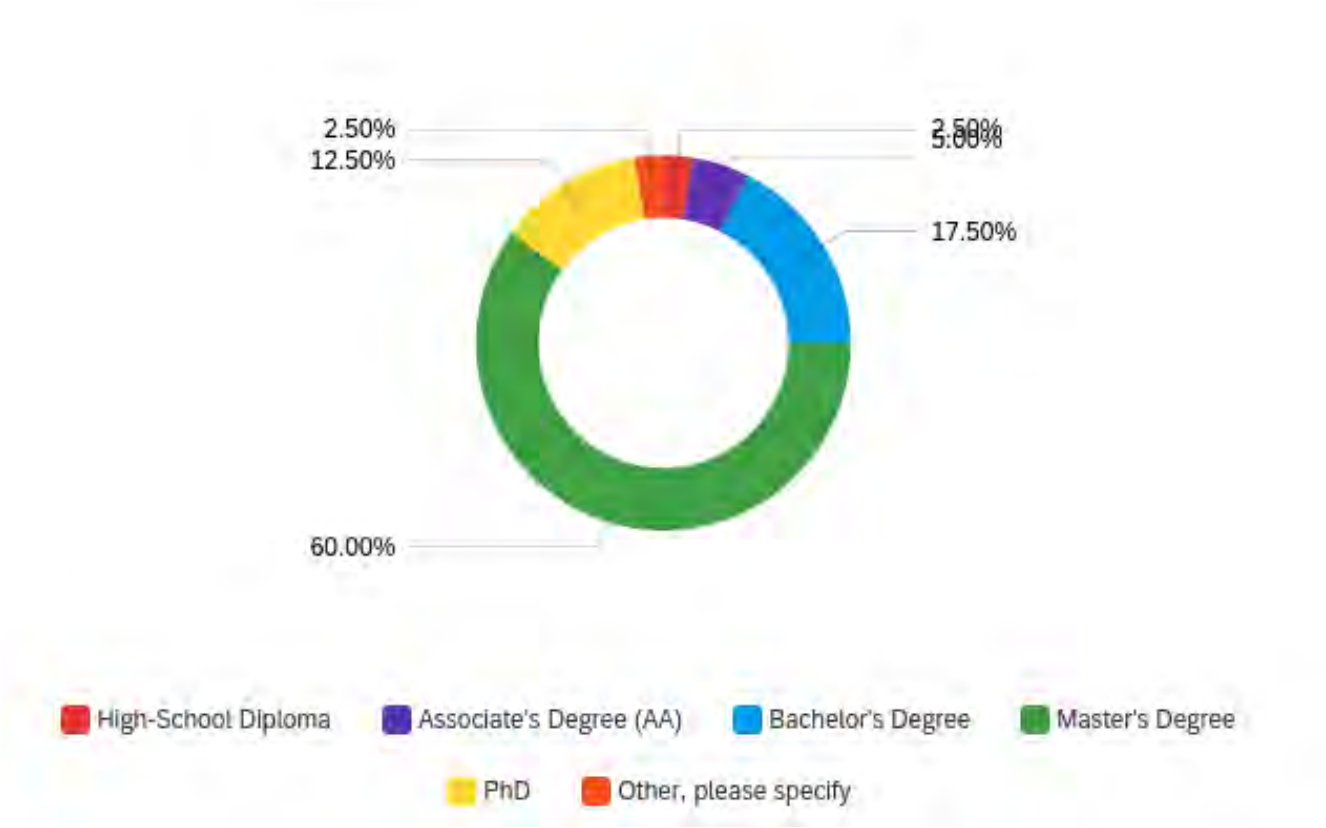
#	Answer	%	Count
1	0-5 Years	54.05%	20
2	6-10 Years	16.22%	6
5	20+ Years	16.22%	6
3	11-15 Years	10.81%	4
4	16-20 Years	2.70%	1
	Total	100%	37

Q36 - How many years total have you been employed in the transportation industry?



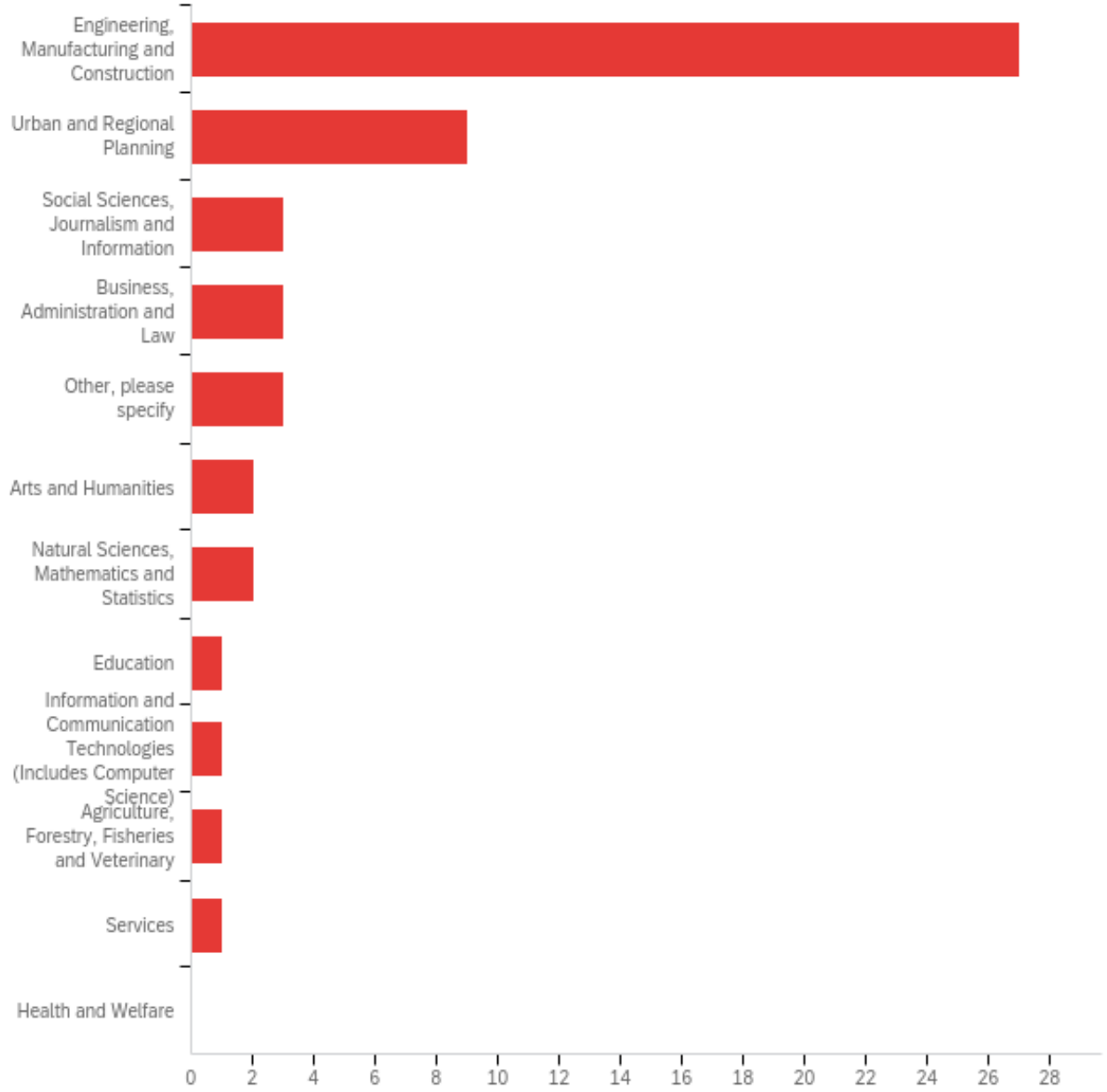
#	Answer	%	Count
5	20+ Years	54.05%	20
4	16-20 Years	18.92%	7
1	0-5 Years	13.51%	5
2	6-10 Years	13.51%	5
3	11-15 Years	0.00%	0
	Total	100%	37

Q37 - What is your highest level of education? If you hold multiple degrees, please indicate so in the "Other" option.



#	Answer	%	Count
4	Master's Degree	66.67%	24
3	Bachelor's Degree	19.44%	7
5	PhD	13.89%	5
2	Associate degree (AA)	5.56%	2
1	High-School Diploma	2.78%	1
6	Other, please specify	2.78%	1
	Total	100%	36

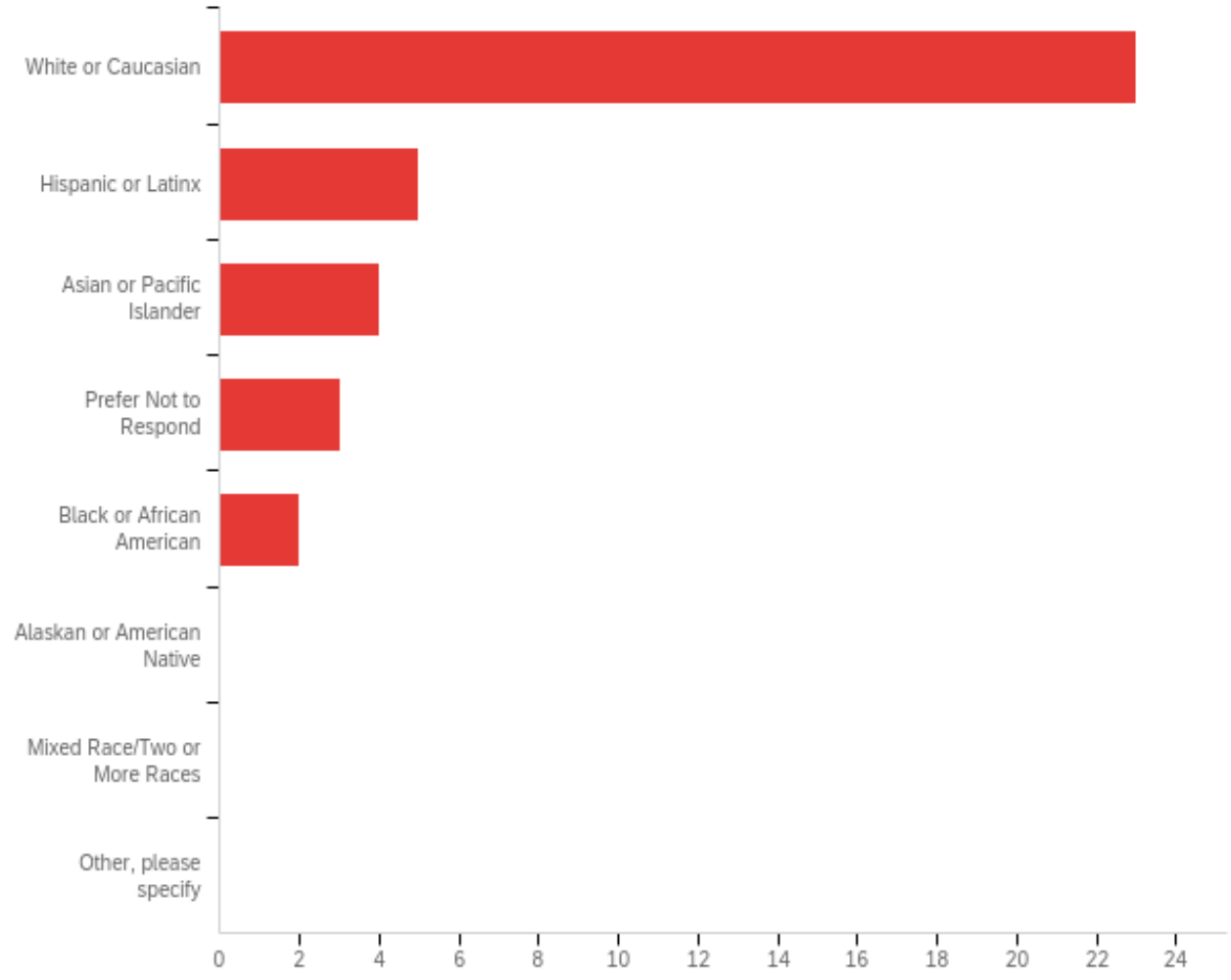
Q38 - What is your educational background? (Select all that apply)



#	Answer	%	Count
1	Engineering, Manufacturing and Construction	72.97%	27
11	Urban and Regional Planning	24.32%	9
4	Social Sciences, Journalism, and Information	8.11%	3

5	Business, Administration and Law	8.11%	3
13	Other, please specify	8.11%	3
6	Natural Sciences, Mathematics and Statistics	5.41%	2
3	Arts and Humanities	5.41%	2
2	Education	2.70%	1
8	Agriculture, Forestry, Fisheries and Veterinary	2.70%	1
10	Services	2.70%	1
7	Information and Communication Technologies (Includes Computer Science)	2.70%	1
9	Health and Welfare	0.00%	0
	Total	100%	37

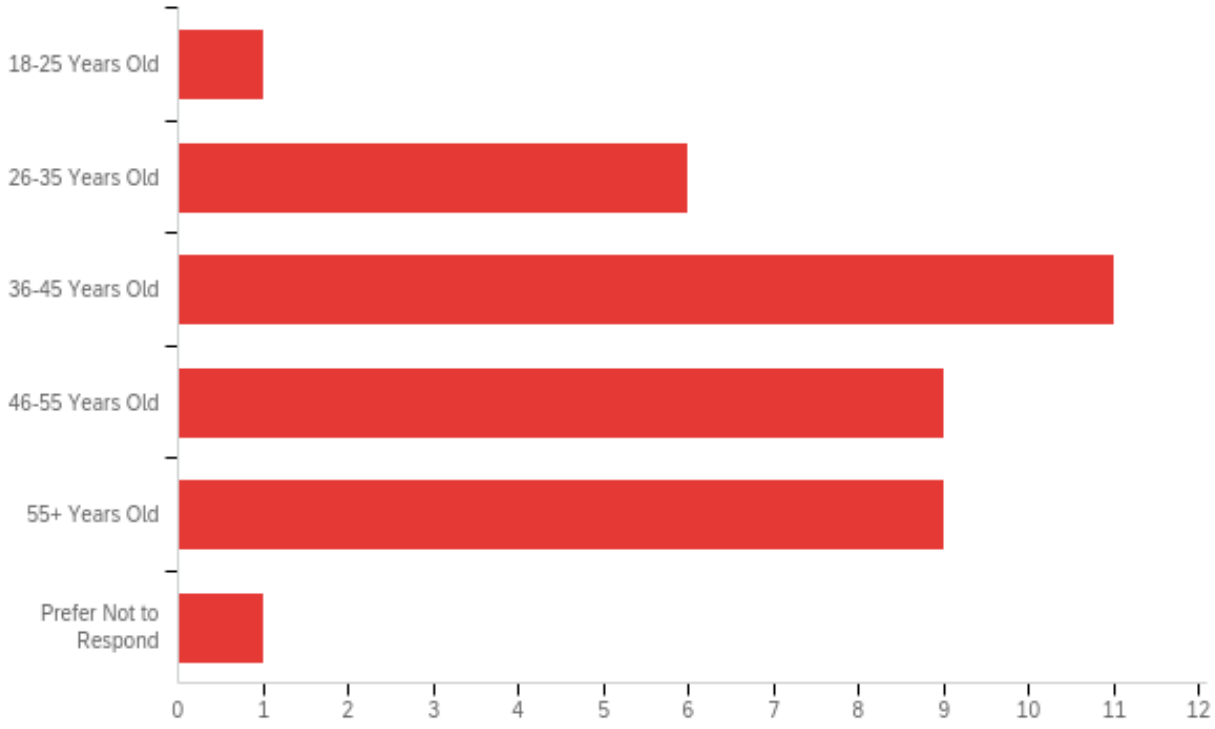
Q39 - Which of the following best describes your racial/ethnic background?



#	Answer	%	Count
5	White or Caucasian	62.16%	23
4	Hispanic or Latinx	13.51%	5
2	Asian or Pacific Islander	10.81%	4
8	Prefer Not to Respond	8.11%	3
3	Black or African American	5.41%	2
1	Alaskan or American Native	0.00%	0
6	Mixed Race/Two or More Races	0.00%	0

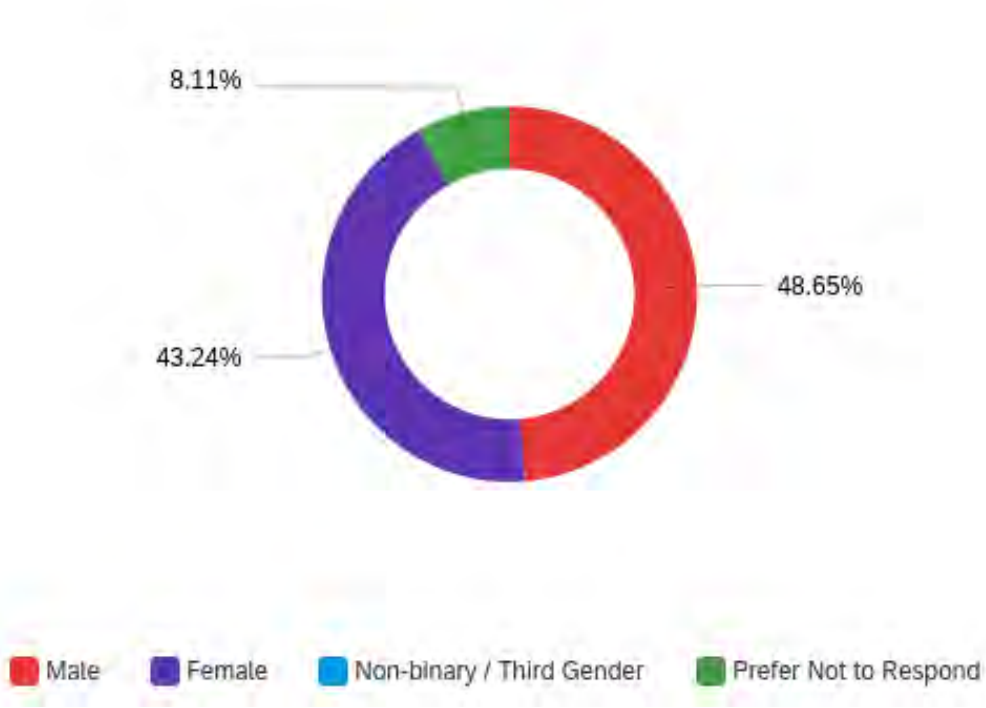
7	Other, please specify	0.00%	0
	Total	100%	37

Q40 - What is your age?



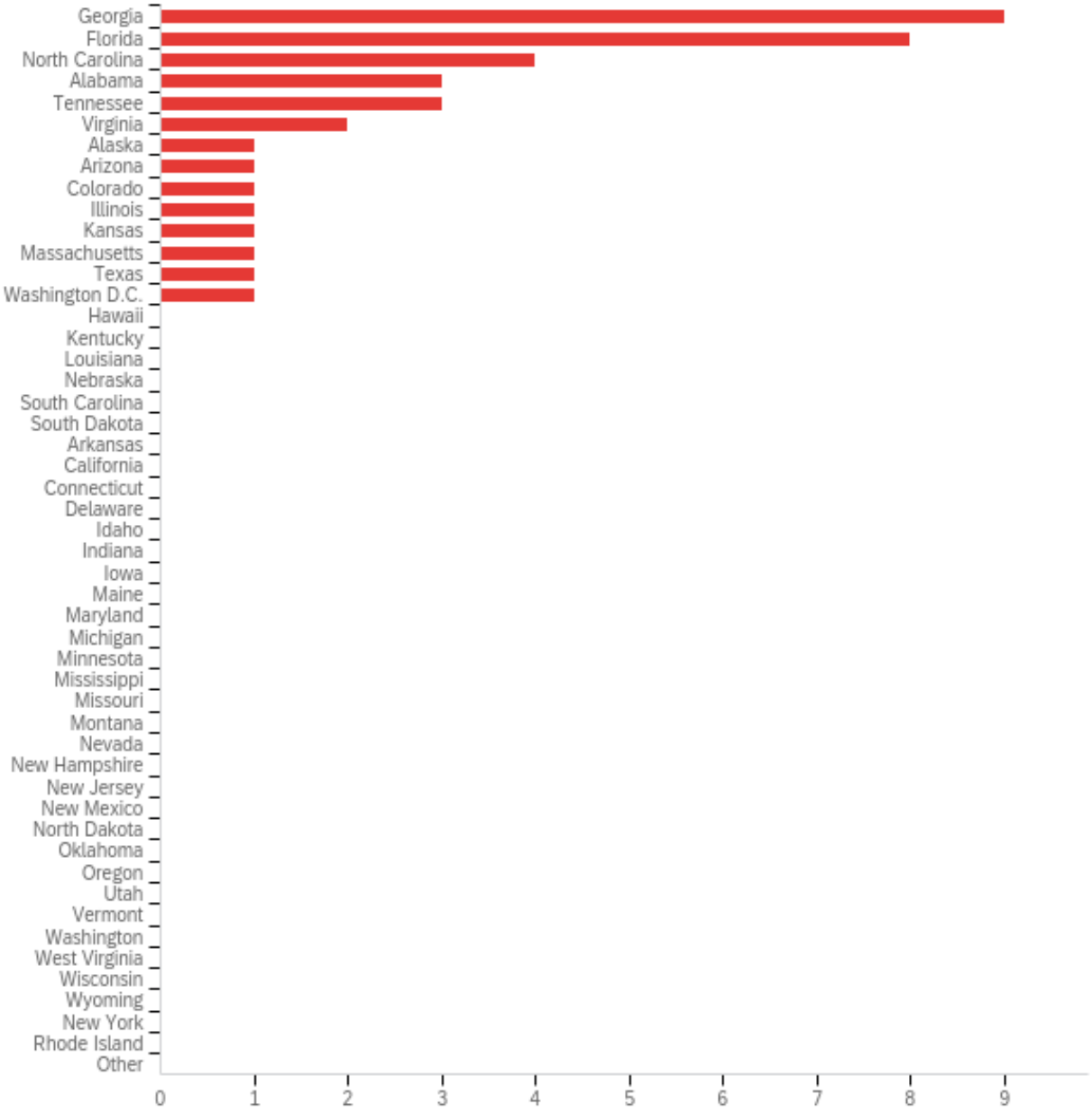
#	Answer	%	Count
3	36-45 Years Old	29.73%	11
4	46-55 Years Old	24.32%	9
5	55+ Years Old	24.32%	9
2	26-35 Years Old	16.22%	6
1	18-25 Years Old	2.70%	1
6	Prefer Not to Respond	2.70%	1
	Total	100%	37

Q41 - What is your gender?



#	Answer	%	Count
1	Male	48.65%	18
2	Female	43.24%	16
4	Prefer Not to Respond	8.11%	3
3	Non-binary / Third Gender	0.00%	0
	Total	100%	37

Q42 - What state are you located in?



#	Answer	%	Count
2	Georgia	24.32%	9
17	Florida	21.62%	8
38	North Carolina	10.81%	4

43	Tennessee	8.11%	3
10	Alaska	2.70%	1
11	Arizona	2.70%	1
14	Colorado	2.70%	1
20	Illinois	2.70%	1
23	Kansas	2.70%	1
28	Massachusetts	2.70%	1
7	South Carolina	0.00%	0
4	Kentucky	0.00%	0
	Total	100%	37

8.4 Appendix D: Informal Interview Question Guide

STRIDE Workforce Development

Outline of Questions

- Start with "high-level" questions
  - Defining workforce development
  - Current workforce development efforts/priorities
  - Current workforce development needs (what's not being addressed currently?)
  - Future workforce development needs
- Then go into specifics as identified in literature review
  - Addressing commonly identified workforce development challenges
    - Changing Demographics
    - Educational Pipeline
    - Emerging Technologies
- Wrap up with summary questions, open ended discussion

Questions

Introductory Questions –

- What is your position, company, location, and field? Can you give us a little background into your role and responsibilities?
- How long have you been in your current position?
- How long have you been in the transportation industry generally?
- Do you hold any specific professional certifications?
- Have you had previous experience in developing workforce development programs? Can you briefly describe what that entailed?

Existing Conditions

Current Workforce Development Methods -

- How is workforce development conducted (ex. workshops, webinars, online training courses, on the job training, etc.)?
- In your experience, what methods have been most/least successful, why?
- Are the workforce development resources developed in-house, offered from outside sources, or a mixture of both?
- Any specific examples of successful workforce development efforts you have participated in or developed?
- How are the current needs identified and incorporated into workforce development resources?
- Is there any system of internal evaluation or needs assessment to develop future workforce development activities?

Current Workforce Development Priorities

- What needs do current workforce development efforts aim to address? (ex. technical skills training, professional development, etc.)

Future Conditions

Future Workforce Development Priorities -

- Overall, what do you see as the major challenges facing the transportation workforce?
- Given your previous response, what needs might workforce development efforts address in the future?

Future Workforce Development Methods -

- Do you foresee a change in the way workforce development is currently conducted?
- How and why might they change?

Gap Analysis

Current Needs Not Met -

- Are there any needs not being met by current workforce development efforts?
- In your opinion, why are they not being addressed?

Actions Needed to Address Future Priorities and Methods -

- What changes might be made to better address future workforce development needs?
- What resources are not currently available that ought to be?

Responding to Commonly Identified Workforce Challenges

Educational Pipeline –

- What are the typical educational backgrounds of entry level workers?
- Do you feel the educational backgrounds of entry level workers adequately prepare them for the responsibilities of the job?
- What skills are they most commonly strongest in?
- What skills are they most commonly lacking in?

Changing Demographics

- How, if at all, are workforce development efforts currently addressing the generational shift in the transportation workforce?

STRIDE Workforce Development

Outline of Questions

- Start with "high-level" questions
  - Defining workforce development
  - Current workforce development efforts/priorities
  - Current workforce development needs (what's not being addressed currently?)
  - Future workforce development needs
- Then go into specifics as identified in literature review
  - Addressing commonly identified workforce development challenges
    - Changing Demographics
    - Educational Pipeline
    - Emerging Technologies
- Wrap up with summary questions, open ended discussion

Questions

Introductory Questions –

- What is your position, company, location, and field? Can you give us a little background into your role and responsibilities?
- How long have you been in your current position?
- How long have you been in the transportation industry generally?
- Do you hold any specific professional certifications?
- Have you had previous experience in developing workforce development programs? Can you briefly describe what that entailed?

Existing Conditions

Current Workforce Development Methods -

- How is workforce development conducted (ex. workshops, webinars, online training courses, on the job training, etc.)?
- In your experience, what methods have been most/least successful, why?
- Are the workforce development resources developed in-house, offered from outside sources, or a mixture of both?
- Any specific examples of successful workforce development efforts you have participated in or developed?
- How are the current needs identified and incorporated into workforce development resources?
- Is there any system of internal evaluation or needs assessment to develop future workforce development activities?

- Are there any strategies specific to the expectations and needs of Millennials and Gen Z workers? Any specific to older workers?
- How, if at all, are workforce development efforts currently addressing the needs and expectations of women in the transportation workforce?
- How, if at all, are workforce development efforts currently addressing the needs and expectations of minorities in the transportation workforce?

Recruitment and Retainment Challenges

- Are you currently experiencing any challenges finding qualified applicants for open positions? What might be causing these challenges?
- Are you currently experiencing any challenges in retaining workers or turnover generally? What might be causing these challenges?

Emerging Technologies

- In what ways, if at all, has technology changed the responsibilities of the transportation industry?
- How is this reflected in your practice?

Conception of Workforce Development

Generally, how do you define workforce development?

Wrap Up Questions

- Follow up to any points of clarification, additional depth needed in responses
- Generally, how might the practice of workforce development change to better meet the current and future needs of the workforce?
- What resources would you like to see more of in the future?

8.5 Appendix E: Informal Interview Results

Name	Description	Files	References
Changing Demographics		1	1
Minorities in Transportation		6	6
Recognition, but No Specific Strategy		5	5
Specific Strategy Implemented		1	1
Strategies to Managed Generational Shift		6	7
Generational Thinking is Reductive		3	4
Knowledge Transfer		3	3
Older Workers		2	2
Technological Training		1	1
Younger Workers		2	2
Women in Transportation		7	9
Issues in Recruitment, Industry Image		3	4
No Specific Strategies		3	3
Recognition, but Progress Lacking		4	4
Definition of Workforce Development		8	8
Educational Pipeline		1	2
Educational Backgrounds		7	8
Educational Preparedness		5	8
Lack of Connection to Job Responsibilities		1	1

Lack of Professional Skill Development		3	5
Maintenance Staff Lacking Basic Skills		1	1
Strong in Technical Skills		3	3
Strongest Skills Upon Entry		2	2
Weakest Skills Upon Entry		4	5
Soft Professional Skills		4	4
Technological Skills		1	1
Emerging Technologies		1	2
Changes in Responsibilities, Increase in Productivity		7	7
Adding Interdisciplinary Responsibilities		5	6
Data Science Increasingly Important		2	2
Changes in WD Mediums		0	0
Existing Conditions		0	0
Current Needs Addressed by Workforce Development		4	8
Equity, Diversity, and Inclusion		1	1
Soft Professional Skills		4	6
Technical Skills		4	6
Technological Skills		1	1
Existing Methods		3	4
Existing Sources		7	10

Diverse Mix of External and Internal		5	8
Internally Developed and Managed		0	0
Mostly External		1	1
Mostly Internal		2	2
Mediums		7	8
In-Person Training		4	5
Mentorship		1	1
Online Training Courses		5	5
Needs Assessment Procedure		6	9
Centralized Assessment		3	3
Informal Assessment		6	7
Need-Driven, Customer Driven		1	1
Successful Methods		4	4
Centralized, Virtual Programming		4	5
Cross Training		1	1
Unsuccessful Methods		1	1
Online Training for Technical, Maintenance Staff		1	1
Future Conditions		1	1
Current Workforce Challenges		8	8

Adapting to Emerging Technologies		4	4
Competition with Other Industry		2	2
Labor Shortages		1	1
Lack of Interdisciplinary Skillsets		2	2
Retention and Recruitment		5	5
Future Workforce Development Methods		5	5
Hybrid Structure		3	4
No Change		1	1
Future Workforce Needs		4	5
Technological Progress Expanding Need for Interdisciplinary Skills		4	5
Needs Not Currently Met		4	5
Interdisciplinary Skills Training		2	2
Knowledge Management		1	1
Recruitment in Pre-Professional Educational Pipeline		3	4
Soft Skill Development		1	1
Resources Needed		3	5
Acceptance and Implementation of Established Solutions		1	2
Reduce Barriers to Employment or Certification		1	1

Updated Technology or Software and Applicable Trainings		1	1
Retainment and Recruitment Challenges		0	0
Challenges to Recruitment		6	10
Compensation		3	3
Competition with Other Industries		2	2
Lack of Recruitment Efforts in Educational Pipelines		3	3
Macroeconomic Factors or Labor Shortage		2	2
No Challenge		3	3
Poor Industry Image		3	4
Challenges to Retainment		5	6
Compensation		1	2
Competition with Other Industries		2	3
Lack of Flexible Work Arrangements		1	1
Turnover in Entry Workers		2	2
Unattractive Work Environment (Job Fit)		2	2