

Minorities in Transportation Technology



Baseline Industry &
Demographic Trends

2020



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Introduction

New transportation technologies are revolutionizing the way people and goods move through the world, and changing multiple industries and employment sectors. Technologies such as automated vehicles and unmanned aerial systems are rapidly reaching new stages of maturity and are increasingly used everyday applications within the transportation field, creating new opportunities for practitioners and researchers. The skills required to research, implement and operate these new technologies includes STEM fields, such as computer based programming and engineering. While STEM-related skills are well represented in the current transportation workforce, emerging technologies will create new opportunities for workers with technical skills, thus reducing the need for those without such capabilities.

Historically, the benefits and burdens of many transportation decisions have not been distributed evenly across racial lines, with benefits more often given to white communities, and burdens falling on people of color. The current field of transportation technology does not include minorities - the set of racial and ethnic groups that represent a smaller portion of the overall population - at a representative rate. The following sections will explore how white persons continue to be overrepresented in all sectors of the transportation technology field. The emergence of new transportation technologies represents an important opportunity to expand access to minority workers, entrepreneurs and researchers. Advances in these technologies require significant research and development support, ample capital investments, leadership focus on technology development and entrepreneurs working to build businesses based on the new technologies. This report examines the current representation of minorities in these areas and identify both barriers to inclusion and strategies for expanding access to the field.

Methodology

This report is a product of the N.C. Department of Transportation's (NCDOT) Minorities in Transportation Technology Initiative, led by a committee of stakeholders from NCDOT, academia, private research and technology companies, and entrepreneurs. This group, whose goal is to improve opportunities for minorities in the transportation technology sector, provided the initial framework for the report. The report methodology included a literature review across multiple fields related to transportation technology, as well as documentation of institutions working to diversify the transportation industry. Research included gathering and analyzing statistics related to each of the four major report sections, and included data on local, state and national employment. The research team conducted interviews with key stakeholders and used these insights to define the scope of this report. In multiple cases, data specifically demonstrating the racial breakdown of transportation technology sectors in North Carolina was unavailable; however, the team used a variety of related sources to obtain insights on this topic.

North Carolina Demographic & Employment Statistics

North Carolina has only a slightly larger minority population than the United States as a whole, yet has a very different demographic profile. Black or African American North Carolinians make up nearly a quarter of the state’s population, with a 65% greater presence than average for the country (Figure 1). Native American people make up a small proportion of the North Carolina’s overall population, but are represented at twice the national rate. In contrast, North Carolina has about half of the percentage of Hispanic or Latinx and Asian residents as the national average.

Unemployment rates also differ significantly at the state and national level. North Carolina has a slightly higher overall unemployment rate than the national average, but demonstrates some variation in the unemployment rates among demographic groups.¹

As shown in Figure 2, the unemployment rate for each demographic group is higher in North Carolina than in the U.S.,

Figure 1: North Carolina and National Population by Race/Ethnicity, 2019

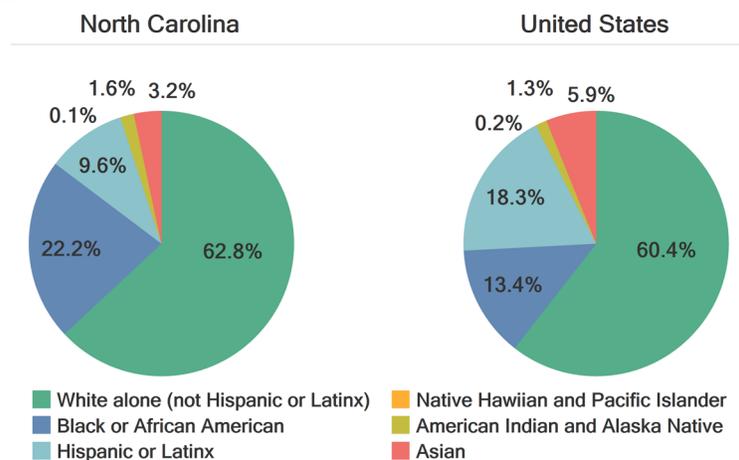


Figure 1: North Carolina and National Population by Race/Ethnicity, 2018. Source: Bureau of Labor Statistics.

Figure 2: North Carolina and National Unemployment by Race/Ethnicity, 2018

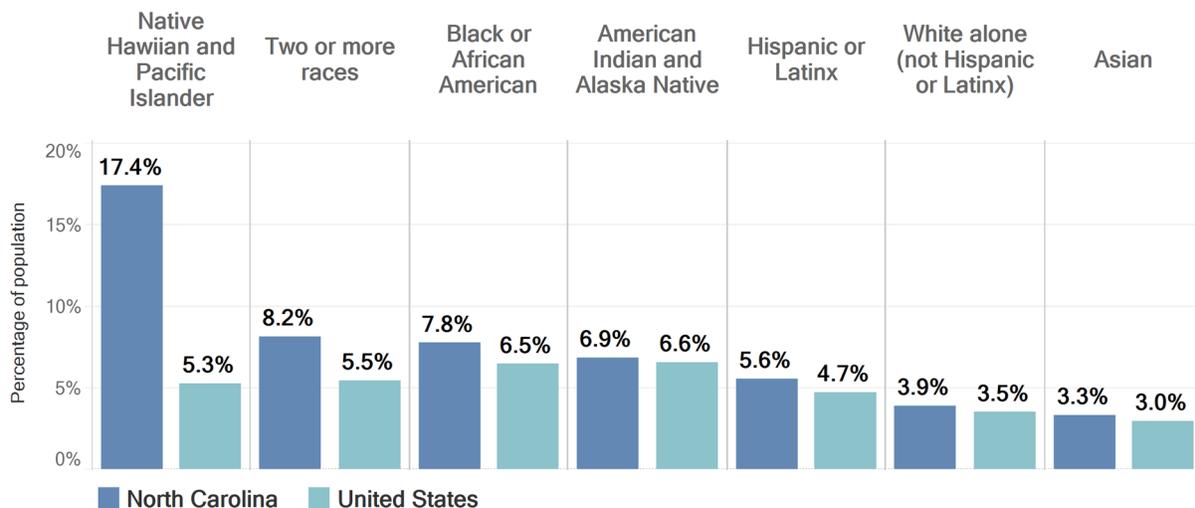


Figure 2: North Carolina and National Unemployment by Race/Ethnicity, 2018. Source: Bureau of Labor Statistics, Census Bureau.

¹ Bureau of Labor Statistics, “Current Employment Statistics”. 2018. <https://www.bls.gov/sae/>

with Native Hawaiian and Pacific Islanders experiencing the largest disparity in employment. Workers of two or more races and Black or African American workers also experienced unemployment at significantly greater rates than the national average.

North Carolina Technology & Transportation Industry Context

North Carolina is home to a burgeoning technology sector, which added more than 100,000 new jobs in the past decade (a 40.5% increase).² Technology-related jobs now make up 7.6% of overall employment in North Carolina while representing 9.4% of the total economy. Growth of the technology sector in North Carolina has outpaced most other states nationally and is the fastest growing sector in the state³. North Carolina is also ranked 11th in the nation for innovation (as a measure of tech startups/new technology business formation and venture capital investment).⁴

The transportation industry of North Carolina makes up a smaller portion of the overall workforce (3.2% in 2018; see Figure 3) than technology-related employment. Employment in transportation in North Carolina is also slightly lower than the national average for transportation employment (3.7%).⁵

Statistics on the transportation technology sector in North Carolina are not available; however, the rapid growth in this sector as a whole, combined with changing national patterns in the transportation sector indicate that transportation technology field will continue to grow and employ more workers.

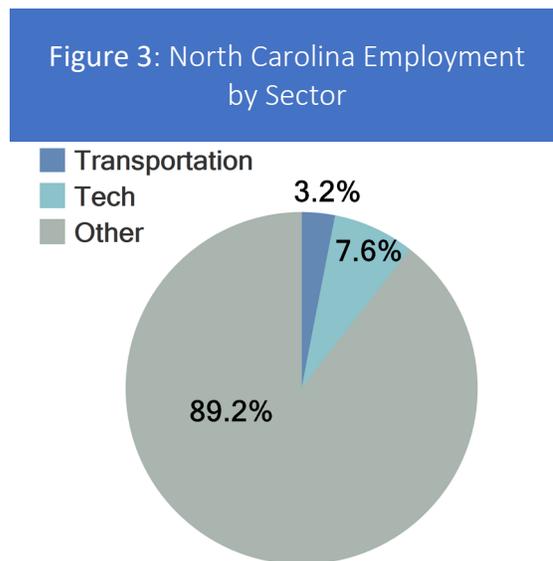


Figure 3: North Carolina Employment by Sector. Source: Bureau of Transportation Statistics, CompTIA.

² CompTIA, “Cyberstates 2020: The definitive guide to the U.S. tech industry and tech workforce”. 2020. https://www.cyberstates.org/#interactiveMap?geoid=37_north-carolina

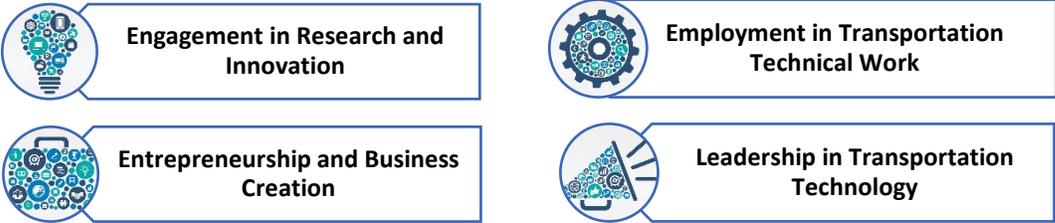
³ Ibid.

⁴ Ibid.

⁵ Bureau of Transportation Statistics, “Transportation Economic Trends 2018, Chapter 4: Transportation Employment”. 2018. <https://www.bts.gov/transportation-economic-trends/tet-2018-chapter-4-employment>

Minorities in Transportation Technology Sectors

Minority engagement in the transportation technology field can be viewed through multiple perspectives. Analysis of engagement in a distinct sub-sector within the field – such as transportation technology research – should be complemented with a broader view of the ways minority employees are represented in employment demographics. The following sections examines aspects of minority engagement in transportation technology:



Minority Participation in Research & Innovation

Innovation is a force multiplier that raises the standard of living for North Carolinians, helps create new industries, keeps existing industries competitive, and drives economic growth and well-being.⁶ Research and development (R&D) is a critical component of innovation, and NCDOT and universities conduct much of the state’s transportation research. This section presents the role these entities play in advancing research and innovation in the state while increasing minority representation within these sectors. This section also focuses on minority participation and representation in the research and innovation sector in general.

Figure 4: Location of R&D Expenditures in North Carolina, 2018

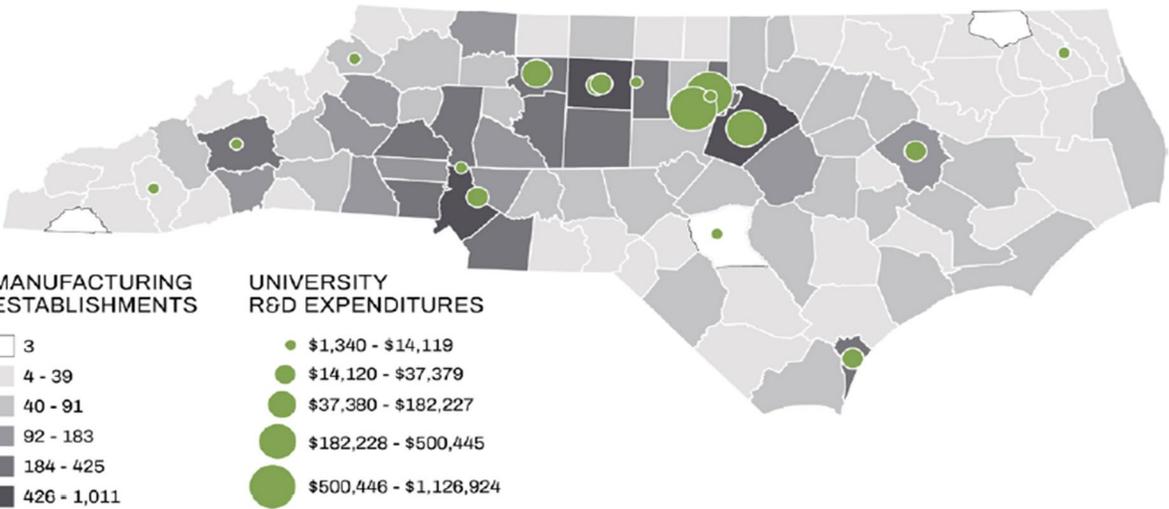


Figure 4: Location of R&D Expenditures in North Carolina. Source: Tracking Innovation - North Carolina Department of Commerce

⁶ North Carolina Department of Commerce Office of Science, Technology & Innovation. “Tracking Innovation.” December 2019. <https://files.nc.gov/nccommerce/documents/files/Tracking-Innovation-2019.pdf>

Research & Development in North Carolina

The N.C. Department of Commerce regularly monitors the state of innovation in North Carolina through its bi-annual “Tracking Innovation” publication. The [2019 Tracking Innovation report](#) found that industry expenditures account for approximately 75% of the total state R&D spending, but North Carolina’s R&D expenditures per capita is below the national average. The Department of Commerce distinguishes between industry R&D and university-sponsored research. Academic R&D level per state GDP is 146% of the U.S. level, which brings North Carolina’s total R&D ranking to 15th in the nation.

North Carolina organizations, particularly its academic institutions, generate significant intellectual property but the extent to which the state patents and commercializes these innovations is below the national average. North Carolina’s total R&D rate has grown eight times faster than the U.S. rate, underscoring its focus on R&D activity.⁷

Data indicating the location and level of all business-performed R&D within North Carolina are not available. Therefore, the N.C. Department of Commerce uses manufacturing businesses and university R&D to understand the geographic distribution of R&D in the state, as manufacturing businesses conduct approximately 64% of all business-performed R&D.⁸ The Department of Commerce does not track the innovation indicators by demographics, so minority-specific data is not available. There remains a gap in data and information about private sector research in general, and regarding transportation technology.

North Carolina is home to 11 research parks, environments that can generate, attract and retain science and technology companies and talent that work alongside sponsoring research institutions.⁹ Research parks are drivers of scientific and information technology research, and product commercialization and careers in the local area.¹⁰ Research parks are a major nexus of university and industry R&D.

Figure 5: North Carolina Research Parks

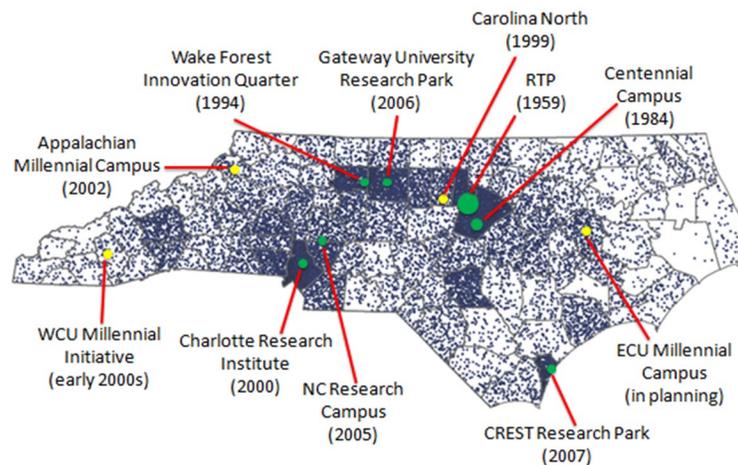


Figure 5: Map of North Carolina research parks. Date of establishment is in parenthesis. Source: NC Department of Commerce.

⁷ Ibid.

⁸ Ibid.

⁹ Association of University Research Parks, “What is a Research Park/Innovation District?” Accessed July 17, 2020 <https://www.aurp.net/what-is-a-research-park>

¹⁰ North Carolina Department of Commerce. “Science, Technology & Innovation – Science Parks,” Accessed July 17, 2020 <https://www.nccommerce.com/about-us/divisions-programs/science-technology-innovation#science-parks>

Dale Carroll, a former N.C. Department of Commerce deputy secretary, noted that the state has a “three-legged stool” approach to fostering R&D in the state. The University of North Carolina system’s 16 institutions serve as one leg, private colleges such as Duke and Wake Forest serve as the second leg, and the state’s community colleges serve as the third leg.¹¹ Academic research is an important driver of innovation in transportation technology. Colleges and universities conducting research, either independently or through state or federally funded research programs, impact innovation efforts not only within their institutions, but also within the surrounding area and for public and private partners (see Box 1).¹² These institutions contribute to development of clusters of research and innovation based businesses, such as the Research Triangle in North Carolina. Colleges and universities also contribute to innovation by providing contract services and initiating research partnerships with industry. This produces graduates who are trained in research and the use of innovative technology, and through the direct generation of new intellectual content.¹³

1. Partnerships with HBCUs and MSIs: The Carolina Small Business Development Fund and Shaw University

Universities contribute significantly to innovation within North Carolina's economy. However, resources for innovation and research development can be challenging to acquire for minority-serving institutions. In 2016, the Carolina Small Business Development Fund, a nonprofit Community Development Financial Institution, partnered with Shaw University to fund innovation and entrepreneurship. This important partnership between North Carolina's most prominent small-business lender and the first historically Black institution of higher education in the southern United States will provide an entrepreneurship center where small business owners can develop and expand their businesses. The Carolina Small Business Development Fund focuses specifically on assisting small businesses in underserved communities¹⁴ making a good partner to Shaw University, which is committed to "expanding industry and social equity."¹⁵ Shaw University and the Carolina Small Business Development Fund hope that their collaboration will have "lasting economic impact and represent a model that can be duplicated."

Current Minority Representation in Academic Research

Greater minority participation in academic research helps to incorporate more diverse viewpoints, often leading to higher quality research¹⁶ and creating advancement opportunities for minority students, researchers, and institutions within the transportation technology field.¹⁷ One of the key drivers increasing minority representation in transportation research and

¹¹ Wilkins, Joy. “States Reinvent the Future Through Industrial R&D,” *Site Selection* magazine. January 2012. <https://siteselection.com/issues/2012/jan/sas-advanced-manufacturing.cfm#gsc.tab=0>

¹² National Academies Press, *Best Practices in State and Regional Innovation Initiatives*, 2013.

¹³ Norwegian University of Science and Technology, *How Universities Contribute to Innovation: A Literature Review-based Analysis*, 2019.

¹⁴ Carolina Small Business Development Fund, 2020. <https://carolinasmallbusiness.org/>

¹⁵ “Shaw, Carolina Small Business Development Fund to Anchor Raleigh Small Business Community”. Carolina Small Business Development Fund, September 2016. <https://carolinasmallbusiness.org/2016/09/shaw-carolina-small-business-development-fund-to-anchor-raleigh-small-business-community/>

¹⁶ Hofstra et. Al., *The Diversity-Innovation Paradox in Science*, 2020.

¹⁷ National Academies Press, *Minority Serving Institutions: America’s Underutilized Resource for Strengthening the STEM Workforce*, 2019.

innovation is the work done by Historically Black Colleges and Universities (HBCUs) and other Minority Serving Institutions (MSIs). These institutions engage in a broad range of research and generate economic benefits for the state,¹⁸ including innovative research.

North Carolina has 10 HBCUs and one MSI (UNC Pembroke, established by the Lumbee Tribe of North Carolina). HBCUs and MSIs in North Carolina are already involved in transportation technology in many ways, including some research partnerships with NCDOT:

- *NCDOT and North Carolina (NC) A&T State University Research & Innovation Summit*
This research summit, hosted yearly since 2019 by NCDOT and NC A&T State University, brings together stakeholders in transportation research and innovation.
- *NC A&T State University's Center of Excellence on Connected and Autonomous Vehicle Technology*
Through a \$1 million grant provided by NCDOT, NC A&T State University is leading a new consortium focused on connected and autonomous vehicle technology, in partnership with local universities, including UNC Charlotte and NC State; local partners, such as the City of Greensboro and the Greensboro Department of Public Transportation, and other national research and industry collaborators.¹⁹
- *Fayetteville State University's SAP Next-Gen Lab; transportation geospatial research*
The SAP NextGen Lab connects students, researchers, and startups with SAP customers and partners to develop new technology innovations that are linked to the 17 UN Global Goals.²⁰ Fayetteville State University also conducts transportation geospatial research on behalf of the cities of Greensboro and Fayetteville related to crash analysis, impacts of road network development patterns, GIS, safety and accessibility.²¹

Private Sector Research and Innovation Organizations

2. Conference of Minority Transportation Officials (COMTO) Ambassador Program

The goal of the COMTO Ambassador program is to assist with disseminating research to a segment of the transportation community that has limited access to these resources. Ambassadors achieve this by informing peers of the benefits of research products, encouraging implementation of research, and gathering anecdotal information from peers about the usefulness of research products applied in their agencies or companies.²²

As noted above, there is no specific data available regarding diversity within private sector R&D in North Carolina. There are several nonprofit organizations and incubators in North Carolina that provide opportunities for small businesses and startups focusing on innovation. One

¹⁸ United Negro College Fund, *HBCUs Make American Strong: North Carolina*, 2018.

¹⁹ North Carolina A&T State University, "NCDOT Funds New Center of Excellence at N.C. A&T." December 17, 2019. <https://www.ncat.edu/news/2019/12/nc-cav-funded-by-ncdot-2019.php>

²⁰ Fayetteville State University, "SAP NextGen Lab," accessed July 27, 2020. <https://www.uncfsu.edu/academics/colleges-schools-and-departments/broadwell-college-of-business-and-economics/sap-university-alliance-program-at-fsu/sap-nextgen-lab>

²¹ U.S. Department of Transportation/Volpe National Transportation Systems Center, "Transportation Research Assessment of North Carolina HBCUs & MSIs," 2019. https://connect.ncdot.gov/projects/research/RNAProjDocs/HBCU%20Summaries_FINAL.pdf

²² COMTO, "Transit Cooperative Research Program (TCRP) Ambassadors Program," accessed July 17, 2020, <https://comtonational.org/tcrp-ambassador-program/>

example is [American Underground](#), a tech hub and co-working space that provides community networking opportunities and resources for startups. Members of minority groups lead 26% of companies at American Underground, and 32% of companies are female-led.²³ The organization, in partnership with Google for Startups, hosts the Black Founders Exchange, a program designed to move companies from initial product to raising seed capital successfully within their businesses.²⁴ Black Wall Street, based in Durham, also provides leadership in the private sector encouraging the participation of Black owned businesses in technology.²⁵

There are also organizations that promote diversity within the private sector in the state. A few examples are listed below.

- The [Triangle Diversity Equity & Inclusivity \(DEI\) Alliance](#), founded by the Raleigh Chamber of Commerce, is a group of businesses in the Triangle region that seek to promote diversity, equity and inclusivity among its businesses. The Triangle DEI creates events and programs that support its mission, including an annual DEI conference.²⁶
- [The Institute](#) is an organization that focuses on business and economic growth through effective business diversity. The Institute houses the South Atlantic Region Small Business Transportation Resource Center (SBTRC), which serves as a regional office for the U.S. Department of Transportation (U.S. DOT) Office of Small and Disadvantaged Business Utilization.²⁷ SBTRC works closely with prime and subcontractors, as well as state and local transportation agencies within the South Atlantic Region. The main focus of the SBTRC is assisting firms that are interested in doing business with the USDOT directly, or with state and local agencies receiving federal funding.

NCDOT already has strong connections to MSIs via research partnerships. The department can leverage existing frameworks to continue promoting minority participation in transportation research. There is a gap, however, in available information about minorities in private-sector transportation research and ways to promote them. Private companies and members of minority communities in the private-sector research space can also advocate for increased outreach to ensure robust participation.

²³ American Underground, “Where Founders Thrive,” accessed July 17, 2020, <https://americanunderground.com/>

²⁴ American Underground, “Black Founders Exchange,” accessed July 17, 2020, <https://americanunderground.com/black-founders-exchange/>

²⁵ Black Wall Street, “Black Wall Street Homecoming,” accessed October 13, 2020. <https://komplekscreative.com/case-studies/black-wall-street-homecoming/>

²⁶ Triangle Diversity Equity & Inclusivity Alliance, “About,” accessed July 17, 2020, <http://www.triangledoi.org/about-us>

²⁷ The Institute, “South Atlantic Region SBTRC,” accessed July 17, 2020, <https://theinstitutenc.org/south-atlantic-region-sbtrc/>

²⁸ BLKTECHCLT: Serving Charlotte’s Black Techies and Entrepreneurs, accessed April 2020. <https://www.blktechclt.com/about>

²⁹ Burns, Hilary. “How this entrepreneur is celebrating diversity in Charlotte’s tech scene”. Bizjournals, March 2017. <https://www.bizjournals.com/charlotte/news/2017/03/15/how-this-entrepreneur-is-celebrating-diversity-in.html>

3. Research Spotlight: Unmanned Aerial Systems

Unmanned Aerial Systems (UAS), or drones, are an emerging transportation technology. Several North Carolina institutions are leading in UAS implementation.

NCDOT- NCDOT is actively educating the public on proper use of UAS. NCDOT offers a course that staff and residents can take to become qualified UAS pilots for commercial and government purposes. NCDOT has made available on its website a [North Carolina Unmanned Aircraft Systems \(UAS\) Operator Permit 10 Knowledge Test Study Guide](#), a 47-page pdf with the information necessary to pass the permit test.

In addition to issuing permits and providing educational resources, the NCDOT Division of Aviation provides flight services to the DOT and other State and local agencies. NCDOT is using UAS to assist with motor vehicle collision reconstruction to open travel lanes more quickly and support construction inspections.³⁰ NCDOT recently had success in using UAS for disaster preparedness and response to Hurricane Florence in 2018. NCDOT used UAS to view conditions before, during, and after the event and share real-time information on infrastructure and conditions to government agencies, utility companies, military units and the public. This work allowed NCDOT to ensure the safety of the public and provide an agile response. NCDOT also used UAS to assess post-storm damage so first responders could plan for repairs.³¹

HBCUs - Elizabeth City State University (ECSU) is home to the State's only four-year bachelor's degree program in UAS. The Bachelors of Science in UAS program, launched in fall 2019, is part of ECSU's growing aviation science program. ECSU UAS students receive drone pilot training, mission planning, data processing, system design and

integration, and more. The UAS program also includes applied research in areas such as precision agriculture, infrastructure inspection, 3D mapping, Homeland Security, thermal imagery, as well as workforce development and outreach.³² Unmanned Aircraft Systems is a fast growing public and private industry. Job growth projections expect that more than 170,000 jobs will be created by 2025.³³ ECSU houses a drone operation laboratory, which focuses on providing UAS operators and entrepreneurs the necessary skills needed to obtain FAA certification.

In the summer of 2019, ECSU held its first Drone Exploration Academy, a weeklong residential program giving high school students experience with UAS technology. Thirty-nine students from across the country participated.³⁴ Due to COVID-19 restrictions, ECSU had to cancel its second annual Academy.

ECSU also has a signed Memorandum of Agreement with the U.S. Coast Guard to work together for the future of students, and for ECSU to participate in the College Student Pre-Commissioning Initiative, which brings university juniors and seniors, together with the Coast Guard for a career as officers. Students attending ECSU who meet the program requirements, become members of the Coast Guard and upon graduation enter Officer Candidate School.³⁵ In fall 2019, ECSU hosted the second annual U.S. Coast Guard and Historically Black College and University Training and Leadership Summit, which focused on the Coast Guard's efforts to increase diversity among its workforce.³⁶

³⁰ N.C. Department of Transportation Division of Aviation UAS Program Office, "Collision Scene Reconstruction & Investigation Using Unmanned Aircraft Systems," August 2017,

https://connect.ncdot.gov/resources/Aviation%20Resources%20Documents/NCDOT_NCSHP_Collision_Study.pdf

³¹ NCDOT Division of Aviation UAS Program, "Real-time Data and Imagery for Hurricane Response," October 2018,

<https://connect.ncdot.gov/resources/Aviation%20Resources%20Documents/NCDOT%20UAS%20Hurricane%20Response%20Overview.pdf>

³² Kelly-Goss, Robert. "ECSU's Drone Program Receives US Dept of Education and SACSCOC Approval," ECSU Newsroom, May 3, 2019,

<https://newsroom.ecsu.edu/ecsu-drone-program-receives-us-dept-of-education-and-sacscoc-approval/>.

³³ Williams, Keshia. "New Aviation Science Laboratory Opens," <https://www.ecsu.edu/news/new-aviation-science-laboratory-opens.html>

³⁴ The University of North Carolina System, "First-Ever ECSU Drone Academy Preps Students for Aviation's Unmanned Future," July 30, 2019,

<https://www.northcarolina.edu/news/first-ever-ecsu-drone-academy-preps-students-for-aviations-unmanned-future/>

³⁵ Kelly-Goss, Robert. "Coast Guard, ECSU Strengthen Relationship with Memorandum of Agreement," ECSU Newsroom, February 14, 2019,

<https://newsroom.ecsu.edu/coast-guard-ecsu-strengthen-relationship-with-memorandum-of-agreement/>

³⁶ Day, Chris. "Increasing diversity: USCG, HBCUs meet for summit," The Daily Advance, September 26, 2019,

https://www.dailyadvance.com/news/local/increasing-diversity-uscg-hbcus-meet-for-summit/article_948933dc-6d98-5a89-8d13-e8e977ecc000.html



Minority Business Ownership & Entrepreneurship

From Charlotte to Elizabeth City, the people of North Carolina have a strong reputation as innovators and entrepreneurs. Minorities are increasingly playing a role in creating the businesses that drive this innovative culture. As a share of total firms in the state, minority-led businesses grew from 17% in 2007 to 39% in 2017. In the transportation sector, business creation and ownership among minorities grew 21% between 2007 and 2017.³⁷ For the purpose of this report, “new businesses” or “startups” are those in operation for five or less years; “small businesses” are those employing fewer than 500 employees.

Despite North Carolina’s dramatic growth in business ownership by people of color, minorities own a much lower share of total firms in the state relative to the overall racial makeup of the state (Figure 6). Minority-owned businesses report significantly lower profits than their white-owned counterparts do. Persistent structural problems in access to capital, community investment and other systems place undue burdens on some of North Carolina’s most creative businesses.

Barriers

While starting a successful business is difficult for anyone, members of minority communities face even more barriers on their path to success. The factors that lead to a startup’s success are often related to the entrepreneur’s personal financial, educational and social capital. Structural inequities in each of these areas have disproportionately affected minority communities both historically and in the present, putting them at a significant disadvantage when starting a business.

Figure 6: Rate of Minority-Ownership of Small Businesses Relative to Overall State Population, North Carolina, 2012

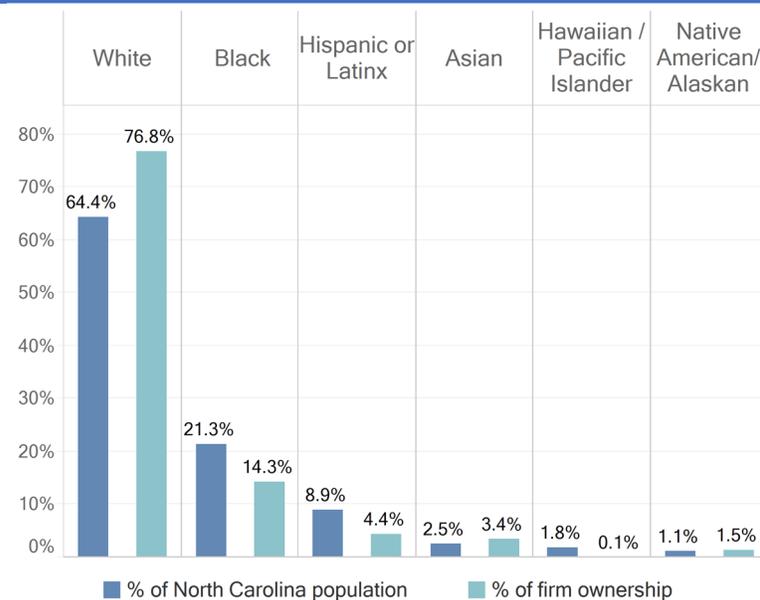


Figure 6: Black and Hispanic people are underrepresented in NC business ownership relative to the overall population of the state. Source: USDOT Volpe Center analysis of 2012 American Community Survey and 2012 Minority Business Development Agency data.

³⁷ U.S. DOT Volpe Center analysis of the U.S. Census Bureau Annual Survey of Entrepreneurs data, 2017. <https://www.census.gov/programs-surveys/ase.html>

Access to Capital

The vast majority of entrepreneurs take out loans to procure the capital needed to start their businesses.³⁸

Transportation-focused startups are particularly expensive, as they often require a significant upfront investment in capital in the form of vehicles, computers or other specialized equipment. However, minority-owned firms are much less likely to be approved for small business loans than white-owned firms (Figure 7).³⁹ When they successfully borrow funding, minority-owned firms receive lower amounts and higher interest rates.

Net Worth

One major factor lenders examine when processing loan applications is an applicant's total assets and net worth. To mitigate the risk of lending money to a startup, banks usually seek collateral from an applicant such as homes, cars or other high-value assets. A lack of significant collateral is often a barrier for minorities; the net worth of Hispanic or Latinx and Black people is 11 to 16 times lower than that of white people (Figure 8).⁴⁰ A 2019 Duke University report found that white business owners start their businesses with an average of \$106,720 compared to Black business owners who start with an average of \$35,205, or less than one-third of the white business owners capital.⁴¹

In 2018, houses in predominantly Black neighborhoods assessed \$48,000 lower than similar houses in majority white neighborhoods. Taken cumulatively, predominantly Black

Figure 7: Entrepreneur Reliance on Personal Wealth and Social Networks for New Business Financing

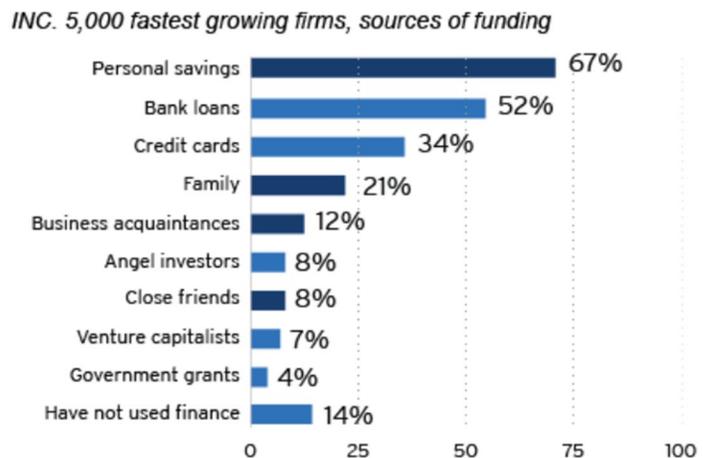


Figure 7: Source- Brookings Institution, 2017.

³⁸ Weitz, "Why Minorities Have so Much Trouble Accessing Small Business Loans". Forbes, January 2018. <https://www.forbes.com/sites/forbesfinancecouncil/2018/01/22/why-minorities-have-so-much-trouble-accessing-small-business-loans/#58f1f2455c41>

³⁹ Brookings Institution, "Opportunity for growth: How reducing barriers to economic inclusion can benefit workers, firms and local economies", September 2017. <https://www.brookings.edu/research/opportunity-for-growth-how-reducing-barriers-to-economic-inclusion-can-benefit-workers-firms-and-local-economies/>

⁴⁰ Institute on Taxation and Economic Policy, "Race, Wealth and Taxes: How the Tax Cuts and Jobs Act Supercharges the Racial Wealth Divide. October 2018. https://prosperitynow.org/sites/default/files/resources/ITEP-Prosperity_Now-Race_Wealth_and_Taxes-FULL%20REPORT-FINAL_6.pdf

⁴¹ Camara, Zaw, Hamilton and Darity, "Entering Entrepreneurship: Racial Disparities in the Pathways into Business Ownership". Samuel DuBois Cook Center on Social Equity at Duke University, October 2019. https://drive.google.com/file/d/1PKPONU9Wwglun800tS1bAaf8BtSan_C5/view

Figure 8: The Racial Wealth Divide in America

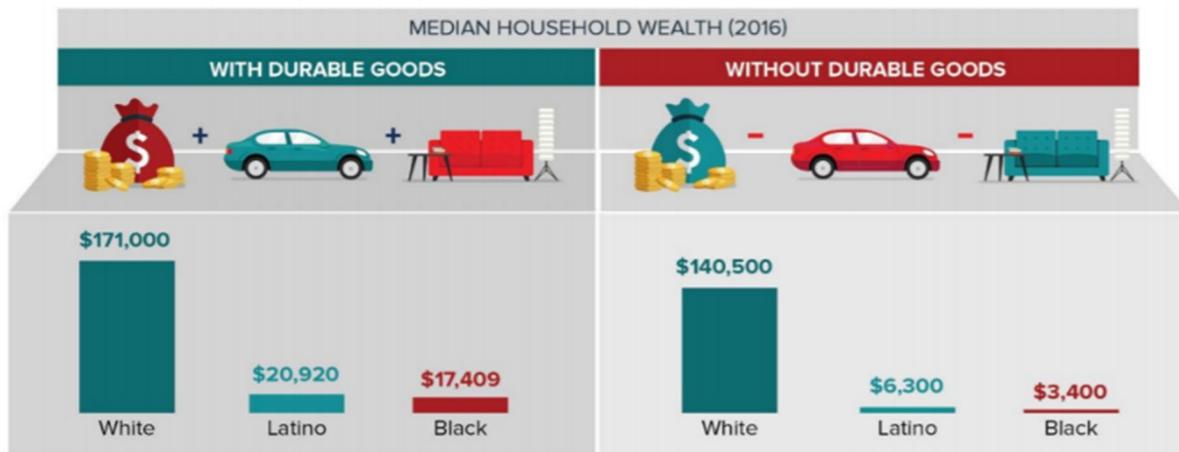


Figure 8: Source: Institute on Taxation and Economic Policy, 2018.

neighborhoods throughout the U.S. are missing equity amounting to \$156 billion.⁴² The same report finds metropolitan areas in North Carolina have some of the widest racial home equity gaps in the nation. These gaps make a direct impact on the ability of Black entrepreneurs to access capital, presenting a barrier to launching new enterprises.

Credit History

Minority small business owners in the U.S. have an average credit score of about 707, 15 points lower than the average credit score among all small business owners (Table 1).⁴³ Lenders typically offer smaller loans and higher interest rates to individuals with lower scores, increasing the costs of running a business for many minority business owners.

Table 1: Average Credit Score by Race/Ethnicity, 2017

Asian	745
White	734
Other	732
Hispanic	701
Black	677

Table 1: Source: Elite Personal Finance, 2020.

Business Devaluation

Research consistently indicates that a business's location greatly influences its chance of becoming successful. A 2019 study by JPMorgan Chase found that businesses in predominantly Black and Hispanic neighborhoods saw substantially lower profit margins than those in predominantly white neighborhoods.⁴⁴ In majority Black neighborhoods, only 30% of businesses had profit margins at or above 15%, compared to 70% of businesses in majority white neighborhoods.

⁴² Perry, Rothwell and Harshbarger, "The devaluation of assets in Black neighborhoods". Brookings Institutions, November, 2018. <https://www.brookings.edu/research/devaluation-of-assets-in-black-neighborhoods/>

⁴³ Elite Personal Finance, Average Credit Score in America 2020. June, 2020. <https://www.elitepersonalfinance.com/average-credit-score/>

⁴⁴ Gallup, Brookings Institute, "Five-star reviews, one-star profits: The devaluation of business in Black communities." February, 2020. <https://www.brookings.edu/research/five-star-reviews-one-star-profits-the-devaluation-of-businesses-in-black-communities/>

A 2020 Brookings-Gallup national study found that establishments rated poorly on the consumer ratings app Yelp grow at roughly the same low rate as highly rated establishments—and both perform worse than poorly rated businesses in neighborhoods that are less than 1% black.⁴⁵ However, the report’s findings also show a positive trend for North Carolina: minority-owned businesses in both the Durham-Chapel Hill and Raleigh Metropolitan Statistical Areas are two of the highest-rated regions in the nation for minority owned businesses. Yelp ratings for minority-owned businesses in primarily Black neighborhoods have a higher average rating than businesses in majority-white ZIP codes.

Figure 9 below describes where transportation jobs are in relation to non-white population centers in North Carolina. Notably, counties which are majority-minority have very few transportation jobs. Most minority-held transportation jobs are located in large cities.

Conclusion

While the growth in minority-owned businesses is encouraging, more work must be done to ensure a more equitable culture of transportation entrepreneurship and innovation in North Carolina. The public and private sectors, along with academia, non-profits and others can each play a role in helping to bridge this gap.

Figure 9: Transportation Sector Jobs Held by People of Color in North Carolina and Non-White Population by County, 2017

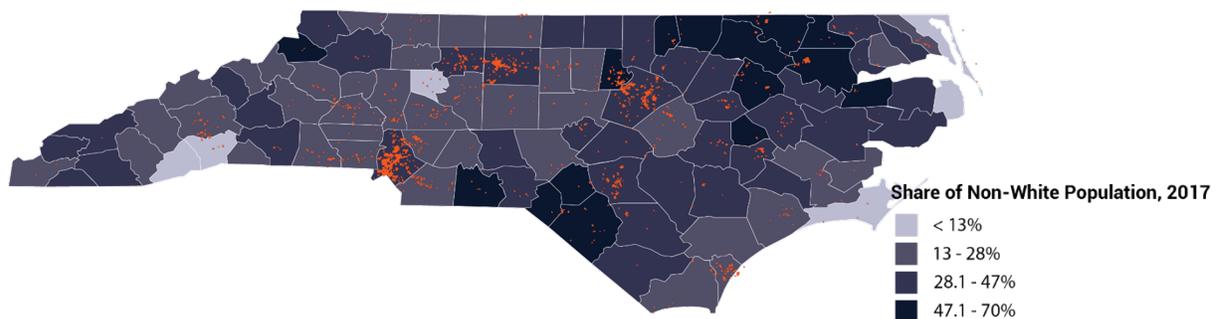


Figure 9: 1 dot = 10 transportation/warehousing jobs held by a non-white person. Sources: U.S. Census Bureau Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics (LODES), version 7. Ethnicity data: U.S. Census Bureau, 2017 American Community Survey.



Minority Participation in Transportation Technology Technical Work

The share of degrees granted to minority groups in science, technology, engineering and math (STEM) fields has increased over the last 10 years, but there is still much work to do to achieve more equitable representation in the technical workforce.⁴⁶ Despite earning more STEM degrees, minority workers nationwide are still underrepresented in transportation technical work, a term including a broad range of jobs related to the production or implementation of transportation technology that require advanced degrees or specialized skills-based training.

⁴⁵ Ibid.

⁴⁶ Muro, Berube and Whiton, “Black and Hispanic Underrepresentation in Tech: It’s time to change the equation”. Brookings Institutions, March 2018. <https://www.brookings.edu/research/black-and-hispanic-underrepresentation-in-tech-its-time-to-change-the-equation/>

Technical jobs are increasing in number as emerging technologies revolutionize the transportation sector, and North Carolina has the opportunity to harness this growth in transportation technology jobs to address current racial disparities in the workforce. Analysis of the participation of minorities in the field and barriers to entering transportation tech will inform strategies NCDOT, private employers and academic institutions can use to diversify the field.

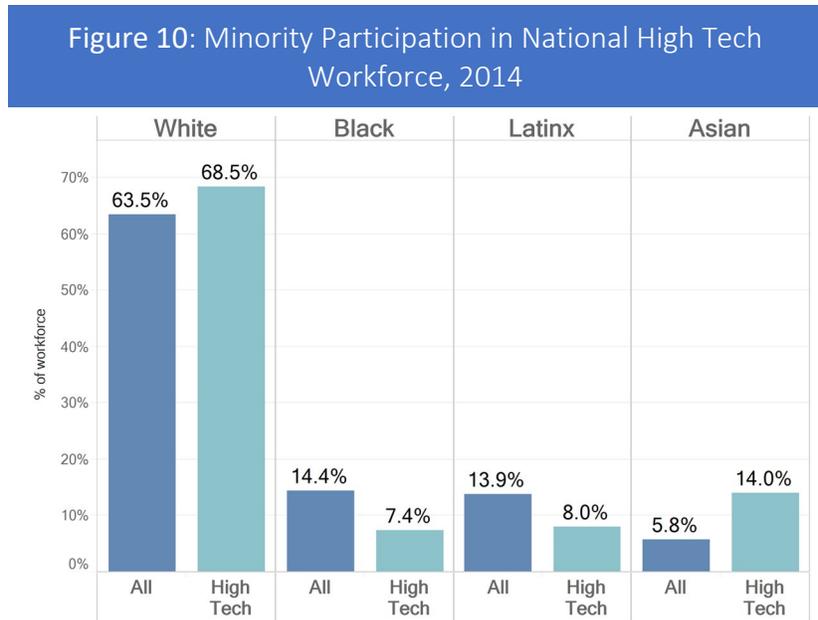


Figure 10: Minority workers in high tech sector. Source: Diversity in High Tech, US Equal Employment Opportunity Commission. 2014.

Statistics on minority

participation in technical work within transportation are limited due in part to the broad nature of the term “technical work”. While data on the entire field of “technical jobs” is not available, data on several other job classifications can be used to understand the overall picture of minorities’ technical work participation both nationwide in North Carolina. The categories explored in this report include STEM jobs, High Tech jobs, Computer and Math jobs (each of which may not represent transportation specific jobs), and transportation Professionals and Technicians (which may not represent technology jobs).

Current Minority Representation in the Technical Workforce

Data gathered at the national, state and local level on transportation technical jobs helps to contextualize the current rate of participation for minorities in North Carolina. These datasets each reflect slightly different job categories, and in some cases, different demographic groups.

National Participation Rates for Minorities in the STEM Workforce and the High Tech Sector

Nationally, the participation rate of minority workers in technical jobs can be inferred through two sets of data – statistics on the percentage of workers in STEM jobs by race and on the percentage of workers in “high tech” fields by race.⁴⁷ Nationwide, Black workers hold 9% of STEM jobs, while representing approximately 11% of the population, and Hispanic workers hold 7% of STEM jobs while representing approximately 16% of the population.⁴⁸ These disparities match those in the high tech sector, where all minority groups (except Asian-Americans) are

⁴⁷ The “High Tech” sector is defined as “industries that employ a high concentration of employees in science, technology, engineering and mathematics (STEM) occupations and the production of goods and services advancing the use of electronic and computer-based production methods” (EEOC, *Diversity in High Tech*, 2014).

⁴⁸ Funk and Parker, “Women and Men in STEM Often at Odds Over Workplace Equity.” January 2018. https://www.pewsocialtrends.org/wp-content/uploads/sites/3/2018/01/PS_2018.01.09_STEM_FINAL.pdf

underrepresented (Figure 10).⁴⁹ While neither dataset is transportation sector specific, they demonstrate that racial inequity in technology job share is a national issue.

Participation Rates for Minorities in the North Carolina Transportation Jobs

The 2018 employment data from the U.S. Equal Employment Opportunity Commission on the transportation sector in North Carolina includes two categories that fit into the technical workforce: professionals and technicians.⁵⁰ Both of these job categories are heavily represented in the transportation technology sector, where workers with advanced degrees and field specific training are essential to developing and implementing new technologies. North Carolina’s minority workers make up a smaller percentage of professionals and technicians in transportation than white workers. As compared to the population of each minority in the state, Black workers are underrepresented in these fields by 56%, Hispanic workers by 62%, and Asian workers by 22% (Figure 11).⁵¹ White workers in these fields are overrepresented, mirroring national data in similar fields and overall employment statistics.

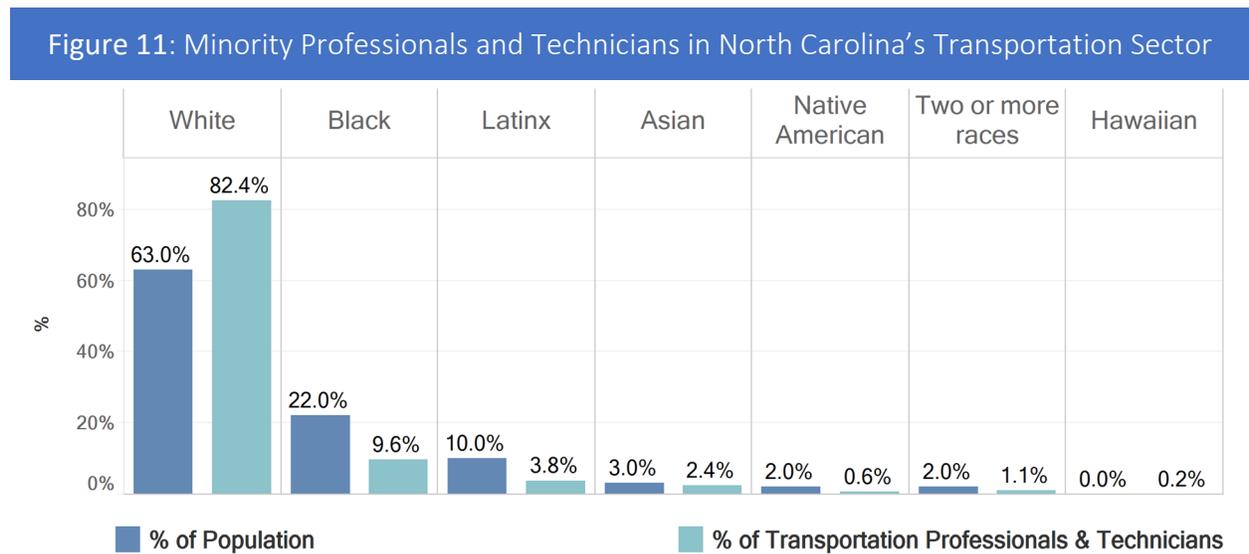


Figure 11: All minority groups are underrepresented in transportation technical and professional fields within North Carolina relative to the overall population of the state. White people are disproportionately represented. Source: USDOT Volpe Center analysis of 2018 Bureau of Labor Statistics Current Employment Statistics national and state estimates.

National vs. North Carolina Minority Participation Rates in Transportation Tech Jobs

Nationally, white workers represent more than 82% of those in transportation professional and technician job categories despite making up just 60% of the total population. North Carolina exhibits a similar pattern with white workers representing 76% of those in transportation and professional technician jobs while representing about 63% of the population.⁵² Hispanic or

⁴⁹ Note that the STEM and High Tech Sector data presented here may include overlapping data.

⁵⁰ The ‘Professional’ job category in EEOC data includes many jobs requiring advanced or terminal degrees. The ‘Technician’ job category in EEOC data includes jobs for which field-specific skills and training are required. (2018 Job Patterns for Minorities and Women in Private Industry (EEO-1), 2018).

⁵¹ Bureau of Labor Statistics, Current Employment Statistics (<https://www.bls.gov/sae/>), 2018.

⁵² Ibid.

Figure 12: Minority Professional and Technician Representation in the Transportation Sector in North Carolina and the U.S.

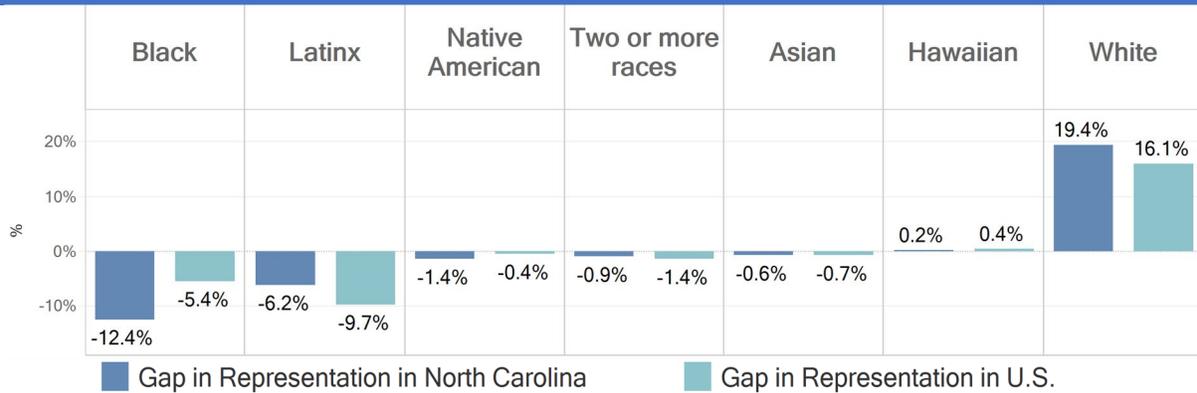


Figure 12: Disparities between representation of minority groups in North Carolina and in the U.S. Source: USDOT Volpe Center analysis of national and North Carolina data from 2018 EEOC Data & U.S. Census Quick Facts

Latinx, Black and Native American North Carolinians are even more underrepresented in North Carolina than they are nationally. Figure 12 demonstrates the comparative rate of underrepresentation of these groups in the U.S. and in North Carolina.

Local Minority Participation Rates in Math and Computer Jobs in North Carolina Cities

Local data on minority worker participation in North Carolina’s transportation technology field is scarce, but a report on diversity in computer and math jobs represents at least some transportation technology jobs.⁵³ The report included data for six North Carolina metropolitan areas on the representation of Black and Hispanic workers in computer and math jobs, for 2010 and 2016. Representation in these fields rose slightly in many metros. However, in Raleigh, though representation of Hispanic workers increased by two percentage points (2.3% to 4.2%), representation of Black workers fell by two percentage points (10.5% to 8.5%) (Figure 13). Charlotte also saw representation fall for both Hispanic and Black workers in computer and math jobs, while Greensboro saw the percentage of Black workers

Figure 13: Raleigh Black and Hispanic Workers in All Jobs and Computer & Math Jobs

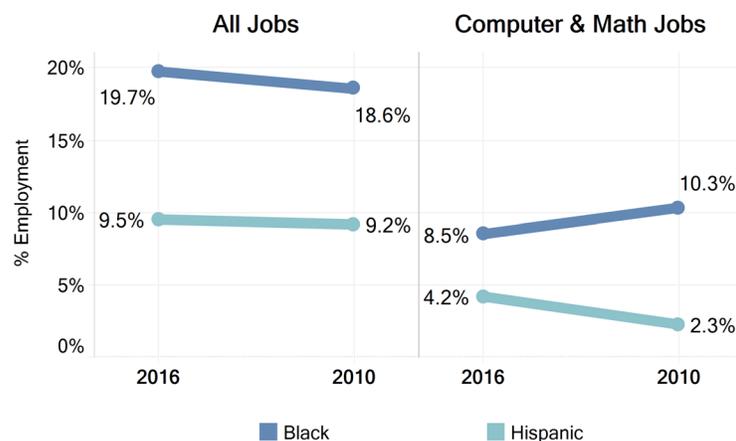


Figure 13: Minority representation in Raleigh, 2010-2016. Source: Black and Hispanic underrepresentation in tech: It’s time to change the equation, The Brookings Foundation. 2018.

⁵³ Muro, Berube and Whiton, “Black and Hispanic Underrepresentation in Tech: It’s time to change the equation”. Brookings Institutions, March 2018. <https://www.brookings.edu/research/black-and-hispanic-underrepresentation-in-tech-its-time-to-change-the-equation/>

increase from 11% to 19% of the computer and math workforce in six years. Overall, this data indicates that local participation rates for minority workers vary significantly, and may improve for one racial group while declining for another. Understanding local and regional trends may make targeted interventions more effective.

Barriers to Minority Participation in the Transportation Sector

Educational Access and Preparation

Employment in all STEM jobs nationwide is projected to increase over 8% by 2028.⁵⁴ Artificial intelligence (AI) related advancements will increase the number of highly trained workers needed to design and operate AI, as well as integrate it into everyday life. Similarly, advances in automation will create a large increase in demand for software developers, information security analysts and computer systems engineers.⁵⁵ Most workers will need to acquire new core skills applicable to all of these jobs, particularly in math, reading, computer science and critical thinking.⁵⁶ Minority populations face well-documented disparities in educational access and outcomes due to systemic racism and disinvestment in minority communities.⁵⁷ Initiatives like the Future of Work Grand Challenge (see box 4) that focus on educational and skill development opportunities for people of color can help address this barrier.⁵⁸

4. The Future of Work Grand Challenge: Planning for Displaced Minority Workers

The Future of Work Grand Challenge, a joint effort by New Profit, XPrize, and MIT Solve, is calling for ideas and solutions to the challenges technology advancement and automation pose to workers searching for employment. Their goal is to award 40% of their funding to entrepreneurs of color, and ultimately want to help 12 million Americans from underserved communities prepare for the job market by 2025.

The challenge involves a two-fold approach to these issues. The XPrize portion focuses on “rapid reskilling,” which aims to teach job seekers new skills that are relevant to the current job market by searching for solutions that can train people in 60 days or less, with no entry cost. While the challenge specifically calls for an idea that can train 500 people in that time frame, it must also prove that it can be scaled up by being deployed to 5,000 people in three different industries.

The MIT Solve portion of the challenge takes a different but complementary approach to these obstacles by focusing on solutions that “accelerate pathways to current and future employment across the US.” This initiative aims to drive resources and support to BIPOC entrepreneurs and innovators; increase access to higher learning, skill building, training opportunities, etc.; and enable learners to make the best work path decisions for them, including non-degree paths.

⁵⁴ Bureau of Labor Statistics, “Employment by Detailed Occupation”. 2018. <https://www.bls.gov/emp/tables/emp-by-detailed-occupation.htm>

⁵⁵ MSU, Texas A&M, American Center for Mobility, “Preparing the Workforce for AVs and Truck Platooning”. 2018. <https://comartsci.msu.edu/sites/default/files/documents/MSU-TTI-Preparing-Workforce-for-AVs-and-Truck-Platooning-Reports%20.pdf>

⁵⁶ Executive Office of the President, “Artificial Intelligence, Automation, and the Economy”. December, 2016.

<https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Artificial-Intelligence-Automation-Economy.PDF>

⁵⁷ Kapor Center for Social Impact, “The Leaky Tech Pipeline: A Comprehensive Framework for Understanding and Addressing the Lack of Diversity across the Tech Ecosystem”. 2018. https://www.kaporcenter.org/wp-content/uploads/2018/02/KC18001_report_v6-1.pdf

⁵⁸ MIT, “Reimagining Pathways to Employment in the US Challenge”. 2020.

<https://solve.mit.edu/challenges/ReimaginingPathways#challenge-subnav-offset>

Bias in Hiring and Promotion

Education alone will not increase minority representation. Nationally, 21% of computer science degrees are awarded to Black and Latinx students while these groups make up only 10% of the computer science workforce.⁵⁹ Disparities between the qualifications of the minority workforce and their rate of employment in chosen fields in North Carolina and the United States suggests systemic racial bias in hiring, promotion and retention-related decisions.

Impacts of Changing Transportation Sector

As technologies involving automation and artificial intelligence change the transportation field, minority workers are more likely to lose jobs due to the rapid evolution of skills and experience needed to fill technical roles.⁶⁰ These changes particularly impact those with fewer technical skills and degrees.⁶¹ A recent study found that 14% of total possible job losses for the Black workforce from automation might fall in the transportation field (including any jobs not in the tech field currently, such as truck driving).^{62,63} Projections indicate that advancement of automation could increase income inequality significantly for minority workers, while a simultaneous increase in transportation technical jobs occurs.⁶⁴ These new jobs will require a re-training strategy to identify workers and fields suited to meet the new needs in transportation technology (Figure 14).

The “Leaky Tech Pipeline”

The “Leaky Tech Pipeline” is a framework for understanding minority underrepresentation in tech fields. The framework conceptualizes the lack of diversity in the technology sector as “the

Figure 14: Job Displacement Intervention Matrix

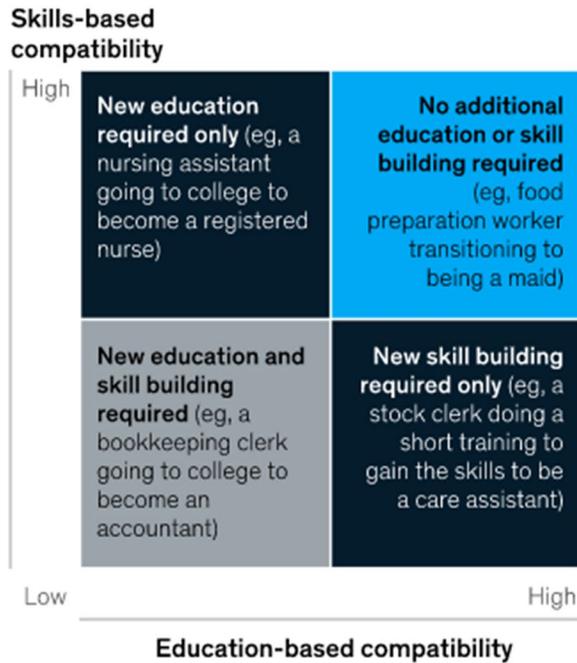


Figure 14: Matrix showing the mix of education and new skills that would equip workers to transition between fields and jobs. Source: McKinsey, *The Future of Work in Black America*, 2018.

⁵⁹ Ibid.

⁶⁰ McKinsey, “The Future of Work in Black America”. October, 2019. <https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-in-black-america#>

⁶¹ Executive Office of the President, “Artificial Intelligence, Automation, and the Economy”. December, 2016.

<https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Artificial-Intelligence-Automation-Economy.PDF>

⁶² McKinsey, “Automation and the Future of the African American Workforce”. November, 2018.

<https://www.mckinsey.com/featured-insights/future-of-work/automation-and-the-future-of-the-african-american-workforce>

⁶³ Romer, “Black and Hispanic men could face disproportionate job loss due to transportation automation”. Economic Policy Institute, October, 2019. <https://www.epi.org/blog/transportation-automation-job-loss/>

⁶⁴ Lewis, Rogers and Turner, “Beyond Speculation: Automated Vehicles and Public Policy”. Eno Center for Transportation, May, 2017. https://www.enotrans.org/wp-content/uploads/2017/04/AV_FINAL-1.pdf

result of a complex set of interrelated (and often cumulative) structural and social/psychological barriers.”⁶⁵ This framework identifies issues related to qualifications of workers, access to work experiences, and the ability to develop new businesses through entrepreneurship (see previous section on entrepreneurship). Addressing diversity in technology fields thus depends on using a wide variety of approaches, focused on retaining potential workers prior to entry to the workforce, and ensuring the continued success and advancement of workers in the field. This framework will inform the strategies section of this report.

Minority Representation in Industry Leadership Roles

As discussed in earlier sections of this report, while minority groups have achieved gains in STEM fields over the past decade, equal representation, including transportation technology, has not yet been achieved.⁶⁶ Minority representation is also limited thus far in STEM industry leadership roles. For the purposes of this report, industry leadership roles include managerial positions, senior roles, and board members within a transportation technology firm.

Across industries, increasing minority representation in leadership roles is a well-documented challenge and is not unique to the transportation or transportation technology sectors.⁶⁷ In the broader technology sector, a lack of minority representation in industry leadership has received significant attention from scholars⁶⁸ and the public.⁶⁹ Higher levels of gender diversity and ethnic/cultural diversity among their leadership teams have also been shown to outperform companies with less diversity among their leadership teams in terms of profitability and revenue generation.⁷⁰ In North Carolina specifically, the nonprofit sector has also identified minority representation in leadership as a challenge to address.⁷¹ This section discusses available information and data on minority representation in the transportation technology sector and challenges related to increasing minority representation in the transportation technology sector.

Current Minority Representation in Industry Leadership Roles

Data on the transportation technology industry as a whole is limited. As a result, specific statistics about the industry and the diversity of its leadership, both nationally and within North Carolina, is not readily available. However, information and data are available about the

⁶⁵ Ibid. Kapur Center.

⁶⁶ Ibid.

⁶⁷ Alliance for Board Diversity, “Missing Pieces Report: The 2018 Board Diversity Census of Women and Minorities on Fortune 500 Boards,” accessed June 22, 2020, <https://www2.deloitte.com/us/en/pages/center-for-board-effectiveness/articles/missing-pieces-fortune-500-board-diversity-study-2018.html?id=us:2el:3pr:diversity:eng:boardef:011619>.

⁶⁸ Williams, Joan C., “Hacking Tech’s Diversity Problem,” *Harvard Business Review*, October 2014, <https://hbr.org/2014/10/hacking-techs-diversity-problem>.

⁶⁹ Dickey, Megan Rose, “The Future of Diversity and Inclusion in Tech,” *TechCrunch*, June 17, 2019, <https://techcrunch.com/2019/06/17/the-future-of-diversity-and-inclusion-in-tech/>.

⁷⁰ Ibid.

⁷¹ North Carolina Center for Nonprofits, “Walking the Talk: Equity, Diversity, and Inclusion in North Carolina Nonprofits,” accessed June 9, 2020, <https://www.ncnonprofits.org/special-projects/walking-talk-equity-diversity-and-inclusion-north-carolina-nonprofits>.

technology industry more broadly and the status of diversity among technology sector leadership. This section provides a brief overview and summary of these existing conditions.

Broadly speaking, the technology industry as a whole faces significant challenges related to diversity. A 2018 report analyzing diversity in the industry found that large technology firms have relatively few women, Black, or Latinx employees overall.⁷² The report also found that diversity decreased as seniority in roles increased; that is, women and minorities were even less likely to hold leadership roles at these technology firms. Technology companies have been slow to diversify their boards as well; only recently have major tech companies added minority candidates, with a focus on adding women, to their corporate boards.⁷³ Evidence suggests that, by fostering an inclusive culture, diverse boards can lead to positive benefits for companies, their workforces, and their bottom lines.⁷⁴

Barriers to Increasing Minority Representation in Industry Leadership Roles

Studies have shown that increasing minority representation in leadership roles is a challenge across all sectors of the economy.⁷⁵ The barriers to increased minority representation are similar across sectors and apply as much to the transportation technology sector as to other industries. This section provides an overview to key barriers related to increasing minority representation in leadership roles.

Limited Industry “Pipeline” to Leadership Roles

Industry stakeholders interviewed for this report identified a “pipeline problem” for the industry. In terms of hiring, recruitment, retention and promotion, the talent pipeline refers to a pool of capable, qualified and prepared to take on a role within an organization.⁷⁶ Commonly, the term “pipeline problem” is used to refer to a situation in which there are insufficient people entering the field with the appropriate qualifications for available roles. Pipeline problems can also exist when an organization lacks the sufficient connections to expand their access to potential existing sources to meet their hiring and recruitment needs. However, organizational

⁷² Tomaskovic-Devey, Donald, & JooHee Han. *Is Silicon Valley Tech Diversity Possible Now?* Center for Employment Equity, University of Massachusetts Amherst. January 2018. <https://www.umass.edu/employmentequity/silicon-valley-tech-diversity-possible-now-0>.

⁷³ Sonnemaker, Tyler, “Facebook Just Named Two Women to Its Board as It Seeks Gender Parity – Here are 13 Tech Companies That Have Recently Diversified Their Boardrooms,” *Business Insider*, March 16, 2020, <https://www.businessinsider.com/13-tech-companies-added-women-corporate-board-diversity-2019-2020-3>.

⁷⁴ Creary, Stephanie J., Mary-Hunter McDonnell, Sakshi Ghai, & Hared Scruggs. “When and Why Diversity Improves Your Board’s Performance,” *Harvard Business Review*, March 27, 2019, <https://hbr.org/2019/03/when-and-why-diversity-improves-your-boards-performance>.

⁷⁵ Reed, Susan E., “Corporate Boards are Diversifying. The C-suite Isn’t,” *Washington Post*, January 4, 2019, https://www.washingtonpost.com/outlook/corporate-boards-are-diversifying-the-c-suite-isnt/2019/01/04/c45c3328-0f02-11e9-8938-5898adc28fa2_story.html.

⁷⁶ Gardner, Park, Smith, and Willcher, “The Right Talent Always at the Ready”, McKinsey & Company, 2013, https://www.mckinsey.com/~media/mckinsey/dotcom/client_service/public%20sector/regulatory%20excellence/the_right_talent_always_at_the_ready.ashx.

relationships with higher education programs and institutions can be particularly important sources for pipeline expansion.⁷⁷

Concerning the limited industry pipeline for minority candidates in transportation technology, one stakeholder said, “You cannot hire the candidate who has not applied for the role.” This stakeholder also noted that the industry often fills leadership roles by internal promotion; therefore, if minority candidates are not being hired into other roles within the industry, there is not a sufficient pipeline of candidates into leadership roles.

Implicit Bias in Recruitment, Hiring, and Promotion

Another barrier identified by the industry stakeholder interviewees is the presence of implicit or unconscious bias in the industry. Implicit bias “refers to the attitudes or stereotypes that affect our understanding, actions, and decisions in an unconscious manner.”⁷⁹ Implicit bias can affect hiring, retention and career advancement across industries by leading to decisions in hiring and promotion that favor specific persons or groups over others.⁸⁰

Insufficient Organizational Support for Minorities

Research has also shown that many industries provide insufficient organizational support for minorities in the workplace.⁸¹ Additionally, work cultures in many workplaces have been shown to exclude minorities, negatively affecting possible advancement opportunities.⁸² Examples of insufficient organizational support and work culture that limit minority advancement include:

5. Leadership Development in Educational Curricula

Industry stakeholders highlighted that candidates with strong “soft skills” are well positioned to move into leadership positions. Soft skills are interpersonal skills that include skills such as the ability to maintain relationships, build morale, and negotiate successfully.⁷⁸ University programs that incorporate leadership development components into program curricula can better prepare minority candidates for leadership positions in the transportation technology sector.

For example, North Carolina Central University (NCCU)’s Master of Public Administration (MPA) program includes a required leadership and ethics course as a part of its core curriculum. This course is designed to teach students key leadership concepts. It also incorporates a personal development component that allows students to assess and understand their own leadership styles. Additionally, many students in the NCCU MPA program also take a minority public administration course. While not required, this course focuses on the role of minority leaders in government and how these leaders achieve success in their roles.

⁷⁷ Ibid.

⁷⁸ Akhtar, Allana, & Carolina Hroncich, “20 Soft Skills Every Leader Needs to be Successful,” *Business Insider*, January 8, 2020, <https://www.businessinsider.com/soft-skills-leaders-need-for-success-2016-4>.

⁷⁹ Staats, Cheryl. “State of the Science: Implicit Bias Review 2014”. Kirwan Institute for the Study of Race and Ethnicity, the Ohio State University. 2014. <http://kirwaninstitute.osu.edu/wp-content/uploads/2014/03/2014-implicit-bias.pdf>.

⁸⁰ Knight, Rebecca, “7 Practical Ways to Reduce Bias in Your Hiring Process,” Society for Human Resource Management, April 19, 2018, <https://www.shrm.org/resourcesandtools/hr-topics/talent-acquisition/pages/7-practical-ways-to-reduce-bias-in-your-hiring-process.aspx>.

⁸¹ Kilian, Clare McCarty, Dawn Hukai, & C. Elizabeth McCarty, “Building Diversity in the Pipeline to Corporate Leadership,” *Journal of Management Development* 24(2), pp. 155-168.

⁸² Taplett, Frances, Matt Krentz, Justin Dean, & Gabrielle Novacek, “Diversity is Just the First Step. Inclusion Comes Next,” *BCG*, April 24, 2019, <https://www.bcg.com/en-us/publications/2019/diversity-first-step-inclusion-comes-next.aspx>.

- A lack of mentors, role models and mentoring support for minority employees;
- Informal work networks that exclude minorities and limit the flow of information to minorities;
- Stereotyping and preconceptions about the roles and abilities of minorities; and/or
- Lack of significant work opportunities, including a lack of visible and/or challenging work assignments for minorities.⁸³

6. Racial Inequity in 2020: Impacts of Social Movements for Racial Equity

The ongoing work of social organizations dedicated to racial equity throughout the U.S. have continued bringing focus to the ways institutions, individuals and American society contribute to racism and discrimination. In the spring of 2020, multiple incidents of police force against people of color spurred a renewed round of protesting, introspection and conversation on how structural racism influence the lives of people of color in the United States. The arrest and death of George Floyd, a black man who died in police custody, generated international mourning and demands for police and other reforms. This moment within ongoing organizing was amplified by the ongoing pandemic and economic downturn, generating a movement that has already changed the country.⁸⁵

Cities across the United States have moved since the death of Georg Floyd to implement new policies on the use of force, discipline of officers who violate protocols, and redistribution of funds from police activity to community and economic development programs.⁸⁶ These changes, while not universal, demonstrate a capacity for change and the power of protest to generate meaningful dialogue within government agencies. The impacts of these protests and changes on many institutions have included calls by employees to diversify organizations, investigate disparities in how people of color advance within institutions, and a renewed focus on committing to work on the structural elements of racism our institutions perpetuate.⁸⁷ Many national corporations have taken a strong stance supporting racial justice, and local campaigns have focused on supporting entrepreneurs of color.

Amid this national conversation, transportation industry leaders have an opportunity to seize this momentum and generate meaningful changes within the industry. Examining the historical impacts of transportation on communities of color, and in particular on predominantly black neighborhoods, as well as current disparities in representation of people of color in the field highlights ways that new policies focused on equity could improve the field. From prioritizing the voices of people of color in the transportation planning process to diversifying corporate boards of transportation start-ups, making changes within the industry workforce can have ripple effects in the broader economy as well as in the provision of transportation services. Creating spaces for entrepreneurs of color to build new businesses focused on future technologies can harness future growth and amplify economic empowerment.

⁸³ Kilian, Claire McCarty, "Corporate Leadership: Building Diversity into the Pipeline," *American Psychological Association*, August 2009, <https://www.apa.org/pi/oema/resources/communique/2009/08/diversity>.

⁸⁴ Sophia Ankel, "30 days that shook America: Since the death of George Floyd, the Black Lives Matter movement has already changed the country". June 24, 2020. <https://www.businessinsider.com/13-concrete-changes-sparked-by-george-floyd-protests-so-far-2020-6>

⁸⁵ Ibid.

⁸⁶ Alex Altman, "Why the Killing of George Floyd Sparked an American Uprising". Time Magazine. June 4, 2020. <https://time.com/5847967/george-floyd-protests-trump/>

Strategies & Recommendations to Increase Minority Representation in Transportation Technology

Expanding access for minority groups in the transportation technology field requires a multi-sector approach. Working across NCDOT, academic institutions and private organizations, the Minorities in Transportation Technology Initiative is well positioned to implement recommended changes on a broad scale throughout the industry, as well as forge specialized partnerships designed to leverage resources and opportunities across sectors. While the following strategies include recommendations directed toward public, private and academic institutions in the transportation technology field, many are applicable in any industry with underrepresentation of minority groups. Some strategies are transportation technology specific, and some are targeted toward a single type of institution. Strategies are marked with the sector they target (private, public, academic) and are organized by the subject areas of this report (research & innovation, entrepreneurship, technical work, and leadership).

Strategies Applicable Across Sectors

Some strategies apply to multiple sectors of the transportation technology industry. These strategies can be applicable for private, public and academic agencies, with adjustments to implementation strategies and tailoring for subject matter.

Mentoring

Research has shown that formal mentoring programs benefit minority and female employees.⁸⁷ These programs can create opportunities for employees to build relationships with more senior staff in a structured setting, allowing for interactions that may not otherwise occur organically. These relationships improve retention and have been shown to reduce implicit bias among senior leaders.⁸⁸ The following are a few mentoring programs that private, academic or public agencies could reference in designing one of their own:



Establish Venture Mentoring programs such as MIT's Venture Mentoring Service to connect successful school alumni with current students who have entrepreneurial aspirations



Consider an internal mentoring program in which NCDOT facilitates mentoring and partnerships between minority students and researchers participating in the NCDOT Research and Development Office



Participate in mentorship programs such as the Entrepreneur Futures Network, Techstars Mobility or National Science Foundation I-Corps program to foster new entrepreneurial talent

⁸⁷ Dobbin, Frank, & Alexandra Kalev, "Why Diversity Programs Fail," *Harvard Business Review*, July-August 2016, <https://hbr.org/2016/07/why-diversity-programs-fail>.

⁸⁸ Ibid.

Hiring and Retention Practices

Traditional hiring practices often do not effectively account for or limit implicit bias. Across industries, changing hiring practices can bring in a more diverse workforce, while addressing systemic bias within policies at the organization can help retain minority employees and ensure they are able to advance and grow in their careers. As a first step, institutions may wish to revisit their existing practices to identify gaps and issues. Companies can then implement a thoughtful approach to their hiring procedures to address possible biases more directly. The following strategies are ways that institutions can address bias in employment:

Job Application Process Strategies

-  Reword job descriptions to avoid gendered references
-  Reconsider the hiring criteria used for jobs and align them to the actual skill level needed for completing a job
-  Expand outreach to minority populations when posting jobs and hiring for positions like interns and co-ops
-  Examine whether a degree is needed for the position, or if experience and other education would equip the worker with the same knowledge

Candidate Selection Process Strategies

-  Use a blind resume review process in which names and identifying characteristics are removed prior to review by hiring committees or officials
-  Use standardized review questions for all candidates applying for a given position

Post-Hiring Strategies

-  Adopt a hiring review panel to assess the quality of hiring decisions and investigate bias in the hiring process from application through interviews and candidate selection.
-  Establish employee resource groups for diverse groups to provide support, peer contacts, education and mentoring
-  Use data on minority employee hiring, retention and advancement to identify key patterns and strategies (i.e., a minority group may be represented in entry level positions, but not in management).
-  Increase the proportion of minorities on corporate boards, on leadership teams and in other positions of power throughout the organization

Hiring and Retention Policy Strategies

-  Adopt explicit diversity, equity and inclusion goals for the workplace; increase awareness of the benefits of inclusion in the workforce
-  Institute an open, transparent pay scale with clear criteria for pay increases, promotions and other opportunities
-  Evaluate recruitment, interviewing, compensation, performance management and promotion policies to ensure they are equitable as written and enacted
-  Create performance plans and incentives for hiring managers to increase diversity of the workforce
-  Conduct regular bias trainings for all employees, focusing on ways to reduce the impact of racial bias on all personnel actions

Transportation Research & Innovation Strategies to Increase Participation

The following section, drawn from discussions with interviewees and other research, provides proposed strategies for NCDOT and the private sector to increase representation within transportation research. Research parks, as “sites of opportunity where businesses and

knowledge resources meet to promote the innovation economy,”⁸⁹ are an untapped source of potential for NCDOT and researchers to broaden inclusion efforts. With 11 sites geographically dispersed across the state and connected with various universities, including HBCUs, NCDOT could conduct outreach in numerous ways, included below:

*Research & Innovation Outreach and Programs*⁹⁰

- 

Conduct outreach specifically to research parks for internships and other hiring
- 

Create a research ambassador program modeled on the Conference of Minority Transportation Officials (COMTO) Ambassador Program
- 

Create a North Carolina-specific organization to encourage DEI in private-sector research through networking and outreach. Minority professionals in private industry could spearhead this initiative.
- 

Replicate the partnership between Opportunity Hub and Morehouse College, which have successfully worked to increase minority student placement at major tech firms

Research & Innovation Partnerships

- 

Host peer exchanges or other technology transfer initiatives using partnerships between NCDOT and research parks
- 

Expand NCDOT’s partnership with the Transportation Research Board (TRB) Minority Student Fellows Program to include more than the current two participating HBCUs sending students to TRB
- 

Investigate the possibility of partnership between NCDOT and research parks for research implementation projects
- 

Consider expanding NCDOT’s current educational partnerships to include a focus on community colleges, using the Bridges to Baccalaureate Research Training Program as a potential model⁹⁰

⁸⁹ North Carolina Department of Commerce. “Science, Technology & Innovation – Science Parks,” Accessed July 17, 2020 <https://www.nccommerce.com/about-us/divisions-programs/science-technology-innovation#science-parks>

⁹⁰ Morehouse College, “Morehouse to Partner with Top Tech Talent Firms in Coding Bootcamp”. March 16, 2020. <https://morehouse.edu/newscenter/morehouse-to-partner-with-top-tech-talent-firms-in-coding-bootcamp.html>

⁹¹ The program, run by the National Institute of General Medical Sciences, provides structured activities such as seminars, workshops, and training to prepare a diverse cohort of community college students to transfer to and complete a bachelor’s

Entrepreneurship Strategies and Opportunities to Increase Participation

Increasing the number of minority-led transportation startups in North Carolina will require action by both the public and private sectors to address structural barriers faced by minority entrepreneurs. Businesses require many types of resources to grow and thrive, including adequate public infrastructure and commercial spaces. Providing incubator spaces that are accessible financially and are located in neighborhoods with a high percentage of minority residents can help expand opportunity for entrepreneurs, and might represent a chance for private businesses to help create opportunity through partnership with non-profits and public institutions focused on economic development. Ensuring that business districts and clusters of parcels zoned for small businesses in minority neighborhoods have access to parking, streetlights, and transit access is also crucial.

In addition to physical spaces, business incubators can provide specialty programming (such as offering MDE training certifications or soft-pitch programs), and funding opportunities specific to the transportation technology sector. Developing and expanding programs that increase access to capital for minority-owned businesses such as loan participation programs, loan guarantee programs, and collateral support programs can offer an entry point to entrepreneurship for those unable to access funding other ways. The following strategies also target minority entrepreneurs:

Entrepreneurship Funding and Access Strategies



Offer or expand public contract set-asides for minority-owned enterprises, such as North Carolina's Historically Underutilized Businesses (HUB) and Disadvantaged Business Enterprise Programs (including for locally administered projects)



Consider opportunities to support minority-owned transportation start-ups as a means of diversifying partnerships and offering opportunities to a new generation of transportation entrepreneurs



Identify and address structural inequalities preventing people of color from accessing the available funding and resources



Consider developing and expanding available creative financing solutions to provide attractive commercial space for businesses in predominantly minority neighborhoods, such as the development of business improvement districts (BIDs), leveraging Opportunity Zone Tax Credits or public land development and leasing



Support efforts of minority-based Chambers of Commerce (such as the Black, Asian and Hispanic Chambers of Commerce) to support people of color in making connections within the industry, identify and gain access to funding opportunities, find businesses partners with relevant skillsets, etc.

degree in biomedical research field. National Institute of General Medical Sciences, "Frequently Asked Questions Bridges to the Baccalaureate (B2B)," last updated August 19, 2019, [https://www.nigms.nih.gov/training/bridges/Pages/Frequently-Asked-Questions-Bridges-to-the-Baccalaureate-\(B2B\).aspx](https://www.nigms.nih.gov/training/bridges/Pages/Frequently-Asked-Questions-Bridges-to-the-Baccalaureate-(B2B).aspx)

Entrepreneurship Outreach & Partnership Strategies



Develop targeted outreach and communications strategies to minority communities to help them understand where the opportunities exist to create contracting firms that meet government needs within transportation technology.



Continue offering NCDOT programs such as ConnectDOT Small Business Programs, which help to expand opportunity in the transportation industry



Partner with North Carolina HBCUs and Minority Serving Institutions to develop curriculum and programs focused on building transportation, business, and entrepreneurship skillsets



Continue analyzing the award of research and business contracts by race and develop new pathways for researchers and entrepreneurs to interface with NCDOT

Technical Work Strategies to Increase Minority Worker Participation

A multi-pronged approach addressing education, retraining, and the impacts of systemic racism throughout the employment and personnel policies of public and private agencies is necessary to create significant changes in minority representation. Literature in this area focuses on three main strategies: building a pipeline of qualified candidates, addressing bias in hiring practices, and ensuring retention of minority workers. The strategies below were generated through review of literature and consultation with minority leaders in the private and public sector who have worked on diversity and inclusion issues in the tech sector.

Technical Work Outreach Strategies



Conduct specialized outreach to underrepresented groups throughout K-12 education (as noted by the Brookings Institution: Year Up, Hack Reactor Telegraph Track, Black Girls Code, Dream Corps Tech/formerly #YesWeCode)



Establish recruiting efforts from private firms at HBCUs and MSIs, with both central career services offices and individual departments with majors of interest; ensure that internships, fellowships and permanent positions are all posted



Host recruiting events for students of color with participation from NCDOT, academic institutions, and private industry employers



Increase retention and graduation rate of minority college students through mentoring, special introductory coursework, academic advising, and additional grants and loans

Technical Work Partnership Strategies



Consider expanding NCDOT engagement with minority industry groups such as the Conference of Minority Transportation Officials (COMTO) for employee development and networking opportunities



Help find private industry partners for schools in developing tech curriculum and funding tech infrastructure



Increase funding available to schools for including tech in their curriculums, particularly for HBCUs/MSIs



Use partnerships between public agencies and schools to develop retraining programs geared toward transportation technology and market to minority workers

Technical Work Retraining Strategies^{93,94,95}



Re-train displaced workers from other fields to take on new jobs in transportation tech



Develop programs targeting retraining resources to those displaced from transportation jobs



Work closely with transportation labor unions to transition workers to new technical roles, particularly workers who are a risk of displacement due to technology changes



Develop a framework for training and transitioning workers between jobs, including an understanding of which fields could equip minority workers with transportation technology skills, and what type of intervention (if any) is necessary for re-training



Consider using workforce development funds for re-training workers being displaced into high tech fields

⁹²Lewis, Rogers and Turner. "Beyond Speculation: Automated Vehicles and Public Policy." Eno Center for Transportation, May 2017. https://www.enotrans.org/wp-content/uploads/2017/04/AV_FINAL-1.pdf

⁹³U.S. Economic Development Agency, "Power Initiative." 2016. <https://www.eda.gov/archives/2016/power/>

⁹⁴Perry, "COTA drivers worried about autonomous buses". July, 2017. <https://www.dispatch.com/news/20170730/cota-drivers-worried-about-autonomous-buses>

⁹⁵Boston Consulting Group, "Towards a Reskilling Revolution: A Future of Jobs for All". World Economic Forum, January 2018. http://www3.weforum.org/docs/WEF_FOW_Reskilling_Revolution.pdf

Leadership Strategies to Increase Minority Participation

NCDOT's ability to increase minority representation in transportation technology leadership roles is not limited to its own workforce. As the state's leading employer in the transportation sector, NCDOT is well positioned to leverage its relationships to influence efforts to diversify the sector's leadership. Universities and other educational institutions also play a key role in preparing future leaders across sectors. By leveraging new partnerships among industry, NCDOT and educational institutions—especially with historically black colleges/universities (HBCUs) and minority-serving institutions (MSIs)—can help to diversify the pipeline of potential leaders in the transportation technology sector. This section provides information on potential strategies to increase minority representation in industry leadership roles:



Use NCDOT's HBCU/MSI Internship and Fellows Program as a template, and partner with private industry to place HBCU/MSI students in internships (paid or for credit) at transportation tech companies



Market the NCDOT HBCU/MSI Internship and Fellows Program more widely, and display its success so that industry leaders are aware of the program model and become partners



Leverage the relationships between NCDOT and both transportation technology companies/HBCUs & MSIs to forge connections. Consider relevant academic programs and/or career offices at HBCUs/MSIs.

7. Transportation Changes and Pandemic Impacts

While long term impacts of the Coronavirus pandemic will not be understood for years to come, the immediate and medium-term impacts are now shaping transportation, employment and health for millions of people across the country. Choices about how to adjust transportation services in the wake of increased risks of virus transmission and rapidly fluctuating travel patterns have brought questions of equity in transportation to the forefront. For public transportation agencies in particular, adjustment to service frequencies and routes for have involved questions of equity in preserving services for neighborhoods with fewer transportation options, and deciding whose services might be reduced. Planning for future disruptions to transportation systems due to pandemics or other emergencies must include considerations of equity and preserving transportation access for residents with few options, as well as in the prioritization of protecting transportation workers.

Beyond immediate impacts to travel patterns, the Coronavirus pandemic is already having major impacts on the funding and futures of many transportation agencies and on the industry as a whole. Reduced travel has strained revenue for transit agencies, reduced air travel significantly, and in some cases impacted toll revenues used to finance highways. These changes will increase pressures on transportation businesses and agencies in the near future, and have long term implications on multiple fronts. Minority workers in transportation likely face disproportionate impacts from job losses, loss of hours, and closure of transportation related businesses. As the industry rebuilds, opportunities may arise to provide more opportunities for employment to minority workers who have been impacted.

⁹⁶ NCDOT, "HBCU/MSI Fellows Program," last updated April 2, 2020, <https://www.ncdot.gov/initiatives-policies/students-youth/hbcu-msi-fellows/Pages/default.aspx>.

⁹⁷ See, e.g., <https://curricula.unc.edu/students/internships/> and <https://career.uncc.edu/experience/academic-credit>.

Looking Forward

The future of minorities in transportation technology will be shaped by the actions of those in the industry today – including those taken by private, public and educational institutions. Leadership in the field can demonstrate how inclusive policies, a focus on providing access to opportunity, and leveraging existing successful programs will impact the economic opportunities of minority workers. Particularly in a time of change within the transportation industry, the rise of new professional opportunities and technological advancements can be harnessed to help advance representation within the industry so that people of color are involved in the decision making that will shape the future of our transportation systems.

Strategies to increase participation of minorities in the transportation industry range from outreach and partnership based solutions to specific policy recommendations directed at leveling the playing field in hiring decisions. The list of strategies in this report require active commitment across sectors, and the continued partnership of private companies, academic institutions and government. Implementing a pathway to employment that builds in the needs of private and public employers requires cooperation and communication between schools and employers, and providing equal opportunity to this education requires financial commitment.

The role of the North Carolina Department of Transportation as a convener of people interested in moving forward minorities in transportation technology can help build the communication channels and partnerships necessary to implement innovative solutions. Opening employment, entrepreneurship, academic and leadership opportunities to those who are currently underrepresented in the industry can build financial health and empower a new generation to influence transportation. Including these voices in the development of new technologies will help ensure that future use of technology is equitable, and creates equitable outcomes for those using the transportation system.



North Carolina Department of Transportation
Transportation Building
1 S. Wilmington St.
Raleigh, NC 27601

