# UNDERSTANDING THE MIDDLE-SKILL WORKFORCE IN THE CONNECTED & AUTOMATED VEHICLE SECTOR

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# EXECUTIVE SUMMARY

## OVERVIEW

The movement of people and goods – the mobility industry – is rapidly expanding and evolving to include new forms of package delivery,[1] mobility as a service (MaaS), the deployment of autonomous vehicles,[2] and more. Within this industry, the connected and automated vehicle (CAV) sector is reimagining how an automobile moves and interacts with its environment. Innovations include new technologies in Advanced Driver Assistance Systems (ADAS), such as predictive control on multi-lane roads,[3] as well as the research and development of driverless vehicles.[4] The testing and design of CAVs are concentrated within Southeast Michigan. The region strongly supports this activity through its combination of public and private automotive research & development centers, test facilities, numerous well-known research universities and community colleges, as well as hundreds of employers in the automotive industry.

This research report explores the workforce supporting CAVs in Southeast Michigan, specifically looking at the development and evolution of middle-skill jobs. Middle-skill jobs are classified as jobs that require more skills and experience than a high school education provides, but less than a four-year degree. Within the CAV sector technicians comprise the majority of middle-skill jobs, and the bulk of these technicians are in the private sector.[5] While most reports on the CAV sector workforce focus primarily on highly-skilled engineer and design jobs,[6] there is a growing need to understand middle-skill jobs, such as technicians.

As a whole, the automotive industry is experiencing a critical shortage of qualified technicians as identified by industry trade groups.[7] Fast-paced change in the CAV sector and its consequent demands exacerbate this problem further. This research addresses how these middle-skill jobs in the CAV sector are transitioning as it relates to testing and infrastructure.

The skillsets required to work on a vehicle have drastically changed over the last 30 years. Before the 21st century, cars were mostly mechanical and simple maintenance and troubleshooting could often be completed by hobby mechanics. As vehicle technology developed, however, the number of electronic, electrical and software components increased, as well as the associated skillsets required for those working on them (see Figure 1). For example, the electronic modules within a vehicle have exponentially increased from just one or two to now around 70 modules in most cars. Additionally, the software and connectivity of vehicles are

**Technician Workforce General Skills**

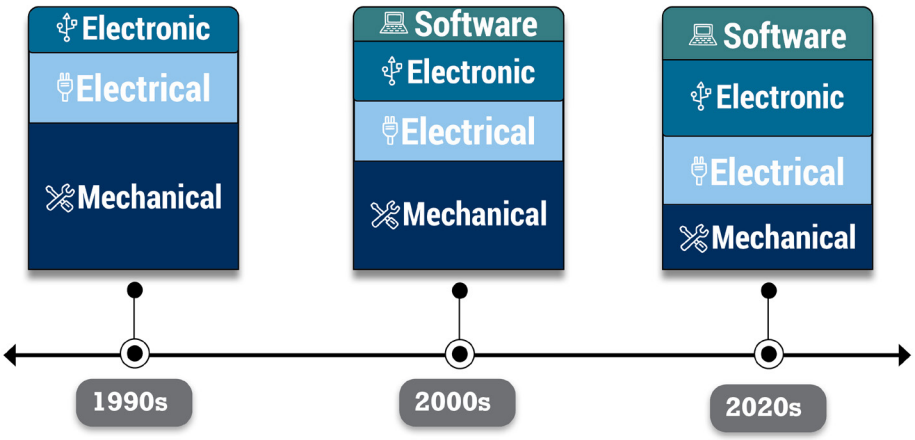


**Figure 1.** *The skillsets required to work on today's vehicles are more diverse and more complex than 30 years ago*

1 See the following article as one example of many: Keith Naughton, "Ford tests package-carrying robots for driverless delivery" Bloomberg, May 22, 2019. https://www.autonews.com/mobility-report/ford-tests-package-carrying-robots-driverless-delivery

2 For example: Michael Dobuski, "GM moves forward with building recently announced driverless shuttle," ABC News, January 27, 2020. https://abcnews.go.com/Business/gm-moves-forward-building-recently-announced-driverless-shuttle/story?id=68572540

3 Nathan Goulet and Beshah Ayalew, "Coordinated Model Predictive Control on Multi-Lane Roads," Volume 3: 21st International Conference on Advanced Vehicle Technologies; 16th International Conference on Design Education, August 18, 2019. https://doi.org/10.1115/detc2019-98117.

4 See the following articles for examples of recent research on autonomous and automated vehicles.
Felix Becker and Kay W. Axhausen, "Literature Review on Surveys Investigating the Acceptance of Automated Vehicles," Transportation 44, no. 6 (November 2017): p1293–1306. https://doi.org/10.1007/s11116-017-9808-9. ; Dimitris Milakis, Bart Van Arem, and Bert Van Wee, "Policy and Society Related Implications of Automated Driving: A Review of Literature and Directions for Future Research." Journal of Intelligent Transportation Systems 21, no. 4 (2017): p324–48. https://doi.org/10.1080/15472450.2017.1291351. ; Keshav Bimbraw, "Autonomous Cars: Past, Present and Future - A Review of the Developments in the Last Century, the Present Scenario and the Expected Future of Autonomous Vehicle Technology." Proceedings of the 12th International Conference on Informatics in Control, Automation and Robotics, December 2015. https://doi.org/10.5220/0005540501910198.

5 Technicians involved in installing and maintaining CAV infrastructure are often employed in the private sector. While the public sector employs traditional technicians that perform maintenance and repairs on public infrastructure, the demands of a quickly advancing field make it challenging for public sector technicians to become heavily involved in the installation, maintenance, troubleshooting, and repair of CAV infrastructure. That said, current municipal technicians have responded to some degree to CAV technology changes, and are involved in the initial installation and basic maintenance of certain types of CAV infrastructure. This shift has created an increased demand for infrastructure technicians with electrical and network experience, and has necessitated greater levels of coordination between municipal technicians and IT departments. It is unclear what the public-private breakdown of CAV infrastructure responsibility will be in the future, but it appears likely that the private sector will absorb much of the installation, maintenance, and repair of these systems and equipment.

6 For example, "Connected Mobility: Oakland County Skills Needs Assessment Project," Oakland County, March 21, 2017, https://www.mistempartnership.com/cm/dpl/downloads/articles/34/Connected_Mobility_Skills_Needs_Assessment_-_Oakland_Cty.pdf

7 "Mobility and Automotive Industry to Create 100,000 Jobs, Exacerbating the Talent Shortage," PR Newswire, The Boston Consulting Group, January 11, 2019. https://www.prnewswire.com/news-releases/mobility-and-automotive-industry-to-create-100-000-jobs-exacerbating-the-talent-shortage-300776686.html.; Alan L. Adler, "The Hurdles of Fixing Automated Vehicles," Automotive News, Feb 19, 2018. https://www.autonews.com/article/20180219/RETAIL05/180219994/the-hurdles-of-fixing-automated-vehicles ; Richard Truett, "Self-driving Vehicles will Revolutionize Service Business," Automotive News, Aug 21, 2017. https://www.autonews.com/article/20170821/RETAIL05/170829989/self-driving-vehicles-will-revolutionize-service-business

quickly evolving and changing, especially with the continued push towards automation, driven by demands for both convenience and increased safety.

The demanded skillsets of technicians are evolving as quickly as the vehicle itself. Within this report, two interdependent categories are utilized to anlayze middle skill positions: job duties and skillsets. Job duties are defined as the tasks employees are expected to successfully complete within their role. Skillsets are the technical and soft skills that equip employees to accomplished their duties (Figure 2).

Through this qualitative study, the team completed 63 interviews with managers in engineering and/or human resources (HR) departments.

The participants represented 30 organizations including Original Equipment Manufacturers (OEMs), suppliers, other businesses related to the CAV industry, ecosystem organizations and public organizations (such as city and state government).

While CAV technician job duties are broad, four thematic areas emerged from participant interviews with CAV-direct employers: **prototyping, troubleshooting, testing, and maintenance.** These areas all overlap and reinforce themselves, but the distinction here facilitates further analysis. Participants most often discussed job duties for CAV technicians related to prototyping and troubleshooting, followed by testing and maintenance.

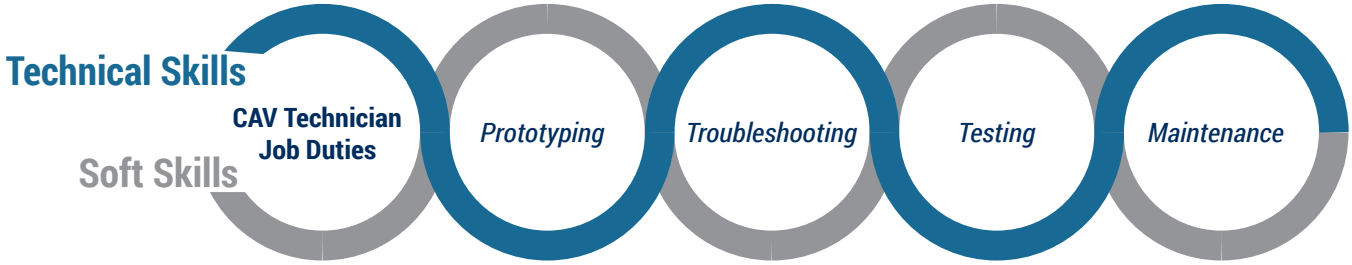


**Figure 2.** *The job duties of CAV technicians are accomplished through a combination of technical skills and soft skills. These areas are interwoven and dependent upon each other. More details on skillsets are provided in subsequent sections.*

## SKILLSETS

The base skillsets of mechanical, electrical and electronic knowledge– or combined mechatronics – form the critical foundation for the CAV technician workforce (Figure 3). Emerging skills in software and data-related systems are continuing to expand as more components on the vehicle are connected and linked together and to infrastructure. Advanced skills in systems and cybersecurity will also need to grow alongside the expanding complexity and connectivity of the vehicle. Woven through all these technical skills is also the binding nature of soft skills like problem solving and communication.

Successfully training and equipping middle-skill workers in the CAV sector is a critical part of its continued growth and development. Technicians offer unique perspectives and experiences in testing and can help streamline advancements when appropriately equipped and trained. The success of this sector in Southeast Michigan will depend not only on the engineering designers and innovators, but also the technicians who assist in bringing an idea from design into reality through prototyping, testing, troubleshooting and maintaining new products.

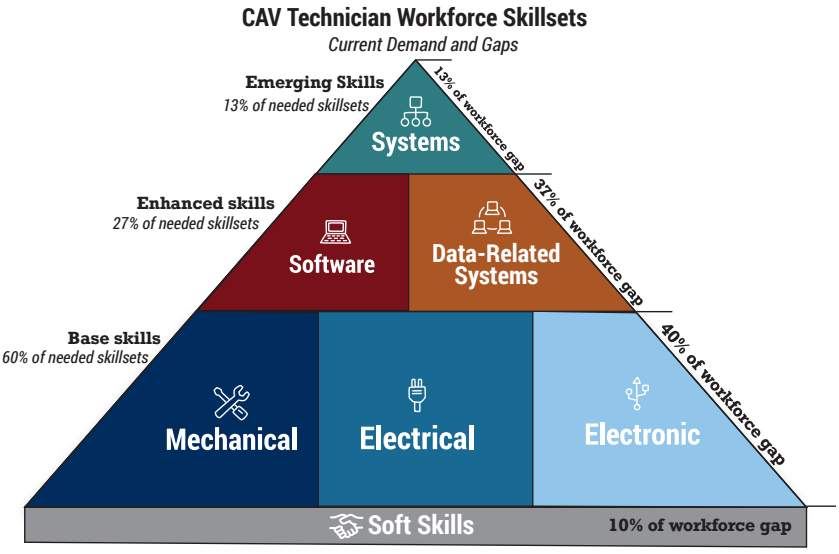


**Figure 3.** *CAV technician skill demands and gaps*