U.S. Department of Transportation Automation and the Workforce Stakeholder Roundtable

Event Proceedings

June 2019

U.S. Department of Transportation

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Event Overview

The U.S. Department of Transportation (U.S. DOT) brought together a broad cross section of transportation stakeholders for its *Automation and the Workforce Stakeholder Event* on March 20, 2019, in Washington, D.C. Subject matter experts from industry, labor, the public sector, and academia provided insights on the workforce impacts and operational health and safety issues for commercial motor vehicle drivers in relation to automation technology.

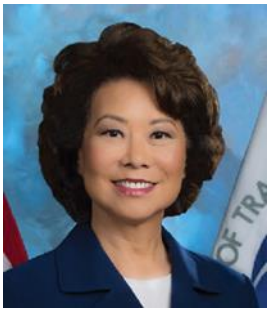
U.S. DOT designed the event based on feedback from a request for comments (RFC) issued in October 2018. The RFC solicited input on the proposed scope of the workforce study and surveyed potential information sources. RFC respondents provided detail on issues that are specific to commercial driving, or suggested ways in which the study's scope could be expanded.

These event proceedings summarize the morning panel session and the views provided by participants during the roundtable breakout sessions. Watch the event video[1] for panelists' perspectives on the impact of automated vehicles on the workforce, and for full recorded remarks from Secretary of Transportation Elaine L. Chao, former Under Secretary of Transportation for Policy Derek Kan, and Deputy Secretary of Labor Patrick Pizzella.

The views and opinions in this report do not necessarily reflect U.S. DOT's views. However, U.S. DOT will consider these perspectives in upcoming automated vehicle policy documents, guidance, and strategy, including an upcoming Report to Congress.

[1] https://youtu.be/s6KC2Twzoi8

Keynote Addresses



The Honorable Elaine L. Chao

U.S. Secretary of Transportation

Transportation Secretary Elaine L. Chao welcomed roundtable participants with an overview of the promise and challenges of automated vehicle technology to advance U.S. DOT goals. Adoption of automated vehicles promises to create many benefits. It can speed delivery and reduce energy consumption by allowing roads to carry more vehicles, more safely. Automated vehicle technology has the potential to increase mobility for older Americans and people with disabilities. And, it can enhance highway safety and may bring substantial safety benefits by addressing a factor common in many highway crashes: human error.

Secretary Chao acknowledged that while automated vehicle technology has made gains in public support, many Americans have concerns about how automated vehicles may affect their safety, security, and privacy. A 2019 AAA study found that 71 percent of Americans were afraid of riding in an automated vehicle,[2] and the Advocates for Highway and Auto Safety conducted a poll that found 69 percent of respondents were worried about sharing the road with automated vehicles.[3] Secretary Chao encouraged the private sector to engage in educating the public to address their concerns and raise awareness about the potential benefits of automated vehicles.

The U.S. DOT believes that automated vehicle technology will create new jobs in the long run. However, the transition period may be difficult for some workers. There is uncertainty about the kind of changes that are expected in the workforce—specifically, worker displacement, training, safety, and health issues—but Secretary Chao highlighted key points:

- Bureau of Labor Statistics data show there are currently over 4 million people employed as drivers.[4]

[2] https://newsroom.aaa.com/2019/03/americans-fear-self-driving-cars-survey/
[3] https://saferoads.org/2018/01/12/new-poll-finds-overwhelming-support-for-driverless-car-safety-standards/
[4] https://www.bls.gov/ooh/transportation-and-material-moving/heavy-and-tractor-trailer-truck-drivers.htm
https://www.bls.gov/ooh/transportation-and-material-moving/bus-drivers.htm
https://www.bls.gov/ooh/transportation-and-material-moving/delivery-truck-drivers-and-driver-sales-workers.htm
https://www.bls.gov/ooh/transportation-and-material-moving/taxi-drivers-and-chauffeurs.htm

- Pitney Bowes predicts a dramatic increase in parcel deliveries through 2020 due to the rapid growth of commerce.[5]

For these reasons, as technology adoption increases, demand for short-haul jobs will likely increase, even as long-haul jobs decrease. Automated vehicle technology has the potential to reduce the health and stress impacts of long-haul jobs by allowing drivers to stay closer to home and work more consistent hours than they do today.

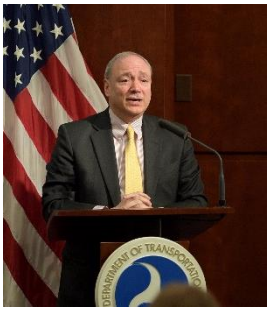
U.S. DOT, in collaboration with the U.S. Department of Labor (U.S. DOL), Department of Commerce, and Department of Health and Human Services, and with funding for research allocated by Congress, is conducting a study of workforce impacts and operational health and safety issues for commercial drivers, in relation to automation technology. This report is expected to be issued in the near future.

Secretary Chao thanked everyone who joined U.S. DOT for the *Automation and the Workforce Stakeholder Roundtable* and encouraged their continued feedback as the Department looks forward to the promise and challenge that automation will bring to the transportation sector.

[5] Parcel volumes are expected to increase from 74 billion parcels in 2017 to 100 billion parcels in 2020 across 13 countries, representing 3.7 billion people. http://www.investorrelations.pitneybowes.com/news-releases/news-release-details/pitney-bowes-parcel-shipping-index-reports-global-parcel

The Honorable Patrick Pizzella

Deputy Secretary of Labor, U.S. DOL



Deputy Secretary of Labor Patrick Pizzella reflected on past instances of public uneasiness in the face of impending technological changes. He recalled fears during the Industrial Revolution of the loss of individuality and craftsmanship that might come with the increasing standardization of production processes.

Deputy Secretary Pizzella emphasized that the key to surmounting these fears is to ensure that Americans have the skills they need to succeed in this new era. In order to mitigate any possible labor disruption due to new technology, we must build a workforce that is resilient, knowledgeable, and skillful.

In closing, Deputy Secretary Pizzella acknowledged that the acceleration of change in our society is faster than ever, and such a swift pace guarantees that the jobs of today and tomorrow will change. He reinforced Secretary Chao's charge to stakeholders that with their continued participation in these discussions our Nation can prepare, embrace, and benefit from those coming changes.

Panel Session

U.S. DOT invited representatives of labor, industry, and advocacy groups to participate in a panel session on the potential benefits and challenges of integrating automated technologies into the Nation's trucking and transit workforce. Deputy Assistant Secretary for Transportation Policy, Finch Fulton, facilitated the 30-minute discussion using a question-and-answer format. Members of the audience were also given the opportunity to ask questions.

The following panel participants shared their unique perspectives and expertise, summarized below:

- Amitai Bin-Nun, *Vice President, Autonomous Vehicles and Mobility Innovation, Securing America's Future Energy (SAFE)*
- Art Guzzetti, *Vice President-Policy, American Public Transportation Association (APTA)*
- Sam Loesche, *Legislative Representative, International Brotherhood of Teamsters*
- Todd Spencer, *President, Owner-Operator Independent Drivers Association (OOIDA)*

There are challenges in assessing the current state of automated vehicles in transit and trucking. Panelists acknowledged opportunities for safety and efficiency benefits from automated vehicle technologies in the long-haul trucking and bus transit industries, but they were divided as to technological maturity and compatibility with current business models. There is no clear pathway, for example, for addressing the many non-driving tasks truck drivers perform today. Some panelists stressed that policymakers should be realistic about the limitations of current applications of the technology.

Impacts on the future labor market are uncertain. Some panelists were optimistic that automation would improve job quality and create new job opportunities. Conversely, other panelists were wary of worker displacement caused by new technologies reducing the required skill sets for drivers (deskilling). The unpredictability of evolving market demands in response to new technology makes it difficult to forecast resulting effects on demand for labor in the long-haul trucking and bus transit industries. Panelists encouraged policymakers to focus on improving job quality and technology developers to incorporate driver perspectives while developing automated vehicle technologies to ensure that working conditions are not worsened.

There is a need for transparency. Panelists emphasized the importance of educating stakeholders in the long-haul trucking and bus transit industries on the features and limitations of automated vehicles. They also voiced a desire for the Federal government to be transparent regarding the development of regulations and standards. One panelist emphasized the need for clear information on the capabilities and limitations of current systems, noting that firms will not invest in automation unless they understand what they are buying.

Roundtable Breakouts

U.S. DOT invited experts in government, industry, labor, and advocacy to discuss high-priority, crosscutting topics during roundtable breakout sessions. Participants engaged in small-group discussions focused on refining a proposed set of automation-adoption scenarios, as well as the anticipated impacts to the workforce.

Facilitators encouraged discussion by using the Chatham House Rule.[6] Participants provided their own views—these views do not necessarily reflect the views of the Federal agencies involved—and U.S. DOT did not seek or encourage consensus. While participants brought a variety of perspectives to the roundtables, two overall themes did emerge.

There is reason to expect a slow phase-in of automation and related workforce impacts. Many participants believed that workforce impacts from automation on labor force displacement, training, safety, and quality of life will be minor in the near term. While the development of automated vehicle technology has accelerated rapidly in recent years, reliable and safe fully-automated vehicles capable of both local and highway driving are still in the future. Once technologies enter the marketplace, participants believed that it is likely that worker displacement will occur first in the long-haul trucking sector. It is possible that increased demand for local pickup and delivery jobs will somewhat offset worker displacement.

In transit, many participants expressed the view that job displacement may be even slower to emerge. Some pointed out that this may be due to the state of technological maturity in the transit industry, risk aversion of transit agencies, strong unionization, the importance of operators' non-driving tasks, security concerns, and the need to maintain public confidence.

There is a high degree of uncertainty and varied expectations about the manner in which development and adoption of automated vehicle technologies will take place. The lack of precise information on the current number of long-haul truck drivers remains a major impediment to understanding potential workforce impacts from automation, according to many participants. Whatever the approach, predicting workforce impacts will be difficult. More data is needed on the wage impacts of advanced driver-assistance systems (ADAS), post-trucking career paths, job creation and displacement, and the kind of training truck drivers receive.

Many participants believed the scenarios presented may not be realistic because they add automation to existing service models, though prevailing service models may change along with the development and deployment of automation technology.

[6] https://www.chathamhouse.org/chatham-house-rule

Key Themes by Topic

This section summarizes feedback from stakeholders who participated in the roundtable breakout sessions.

Labor Force Transformation/Displacement

Feedback from the Roundtables

Jobs are not being automated; only certain tasks are being automated. In trucking, participants pointed out that drivers are responsible for many non-driving tasks such as handling paperwork, inspections, customer service, and load security. Similarly, in transit, drivers collect fares, provide accessibility assistance, provide customer service, and assist with emergency response. Higher levels of automation may improve worker productivity to complete these non-driving tasks, or driver roles may evolve based on increased demand for specific services.

Jobs will transform and new types of jobs will be created. Participants identified many new potential roles and jobs which could emerge in the trucking and transit industries as a result of automation. Some of these jobs may become more attractive for higher quality of life, increased wages, or safety benefits. Other jobs may be less demanding roles with lower wages. Participants believed that there likely will be a need for different roles depending on future market demand and what business models emerge. For example, automation in long-haul trucking could lead to an increase in local pickup and delivery trucking jobs, allowing drivers to remain closer to home, while automation of transit buses may lead to roles for onboard attendants. Long-haul trucking may become a remote supervision role, eliminating the need to put a driver at risk for crashes while enhancing safety overall. There may also be new or different jobs and opportunities that cannot be currently envisioned, but would be enabled by reduced freight costs or new transit operational models.

Displacement effects are likely to be delayed and may be offset at least partially by retirements and other attrition. Many participants stated that it is likely that automation in the trucking industry and public transit will be adopted in phases. For example, regional differences exist in automated vehicle testing today. Sunbelt States with wide streets and fair weather currently have an advantage over the complex environments of the urban northeast. Widespread adoption was viewed to likely be delayed until technologies are capable of operating in diverse environments—this is particularly true for transit buses, which generally operate in complex and congested urban environments. Another contributing factor to delayed displacement effects identified by participants is that truck and bus drivers tend to be older and may retire or leave the profession before they would be displaced.

New jobs may require more technical skills. The increasing complexity of automated driving systems (ADS) may, according to some participants, create opportunities for higher-skilled, higher-paying jobs than current long-haul truck driving or bus transit operation. Related areas such as vehicle and system maintenance may also require new skills. Some participants, however, expressed skepticism that these new jobs would be a good fit for the existing trucking workforce.

New technologies may change the dynamics of driver turnover. Participants expressed that idea that drivers may choose to stay with or leave a carrier based on the technology they have on their trucks. For example, some participants believed that younger drivers may stay with more technologically advanced carriers while older drivers may choose to stay longer with carriers that align with their trucking experience and technology skills.

There are already large differences between different sub-markets. Large urban transit systems differ from small rural ones in terms of driver pay and other benefits. Trucking has many specialized markets, such as short-haul, long-haul, intermodal, hazardous materials, and others. Participants believed that automation will play out differently in each, and it is necessary to understand the details of each.

Labor Force Training Needs

Feedback from the Roundtables

Training needs will be diverse and complex. Due to the multitude of manufacturers, systems, and worker circumstances, participants believed that a wide variety of training and retraining programs may be needed. Drivers who choose to leave trucking and transit would benefit from job transition programs. Additionally, non-driving staff such as truck and bus maintenance workers may need initial and ongoing training due to the increasing number of electronic components involved with automated vehicle technology. Remote supervisors and tele-operators are expected to need training on these new positions.

Training needs will be ongoing. Many participants believed that as technology progresses and industry best practices are identified and adopted, training needs will evolve. Software updates and changes in hardware configuration to ADAS and ADS may also require that workers are continually educated.

Include drivers in training development. Some participants expressed that, since drivers have specialized knowledge of their jobs, they can play an important role in designing robust training programs, particularly during the pilot and evaluation phases. Some participants believed that, without the endorsement of drivers, training programs may face an uphill battle to adoption.

Training providers may diversify over time. While technologies are being developed and many varieties exist, some participants believed that trucking firms may need to provide the training to use ADAS. As ADAS become more standardized/uniform, vocational schools might be able to provide this training.

Technology Operational Safety Issues

Feedback from the Roundtables

Human factors issues require attention. Some participants pointed out that aviation industry experience shows there are human factors issues in the interaction between the human operator and automated systems, and that these factors often arise from a misunderstanding of the system or a lack of training. Participants explained that the system should be designed so that the driver knows what to expect of the automation and under what circumstances they would be expected to take over.

There is a need for clear information. Participants believed that continued outreach and education may be needed to sustain public support for automated vehicle technologies. Some participants explained that it is important the public receives information on the limitations of automation from reliable sources, including the roles of industry, government, associations, and other stakeholders, since better information will support good decision-making about adoption, and ultimately support desired safety outcomes.

Safety-related processes may need reexamination. Some participants identified the need for an agency role in certifying safety features so operators do not have to test technology vendor claims themselves. According to some participants, this extends to vehicle inspections as well. Currently, drivers are expected to certify that their own vehicle is safe before operating it. With more advanced automation equipment on board, some participants believed that a new category of safety checks may be required to certify vehicles remain safe to operate.

Standardization of systems and interfaces is a research need. Some participants believed that outfitting vehicles with systems from a variety of manufacturers, each with unique operating characteristics, could substantially increase cognitive load for the drivers in charge of monitoring them. These participants recommended that systems be designed to be intuitive for human control and noted that development and refinement of systems will benefit from driver perspectives and feedback.

Protecting individuals should be part of the design process. Some participants stressed the need to keep workers safe as automation technologies are designed and implemented, with careful consideration of human factors issues such as take-over time and fatigue.

Quality of Life and Health Effects for Professional Drivers

Feedback from the Roundtables

Technology can be used to improve job quality. Many participants believed that ADAS technologies—such as adaptive cruise control, lane-centering, blind spot detection, and automatic emergency braking—have the potential to improve quality of life for drivers in long-haul trucking and transit by increasing driver safety and alleviating job stressors. However, some participants were concerned that these benefits may be offset by new

quality of life issues if systems are not designed to be intuitive, ergonomic, and to minimize cognitive load and driver fatigue.

Higher levels of automation would be expected to have more significant impacts. Some participants believed that automation that allows the driver to step away from the wheel may further improve quality of life by increasing productivity and decreasing the sedentary nature of the driving task. For long-haul truckers, this may create opportunities for better rest while the vehicle is in motion, or free time to complete other job tasks. In transit, automation may enable drivers to better attend to passenger needs and customer service. For scenarios that might move long-haul truckers into local jobs, participants identified other potential quality of life impacts including more local employment opportunities, traditional working hours, and increased time at home with family.

Appendix A: Event Agenda

Automation and the Workforce Stakeholder Roundtable

Wednesday, March 20, 2019
9:00 a.m.–3:15 p.m.
Conference Center
U.S. DOT Headquarters
1200 New Jersey Avenue, SE
Washington, DC 20590

9:00 a.m.	Registration Begins	West Building Lobby *New Jersey Avenue Entrance*
10:00 a.m.	Welcome	The Honorable Derek Kan *Former Under Secretary of Transportation for Policy, U.S. DOT*
	Keynote Address	The Honorable Elaine L. Chao *Secretary of Transportation*
	Remarks	The Honorable Patrick Pizzella *Deputy Secretary of Labor, U.S. DOL*
10:30 a.m.	Panel Discussion *Perspectives from labor, industry, advocacy, and the Federal Government on automated vehicle impact on the workforce.* (continued)	Finch Fulton (Moderator) *Deputy Assistant Secretary for Transportation Policy, U.S. DOT* Amitai Bin-Nun *Vice President, Autonomous Vehicles and Mobility Innovation, SAFE* Art Guzzetti *Vice President Policy, APTA* Sam Loesche *Legislative Representative, International Brotherhood of Teamsters*

	Panel Discussion (continued)	Todd Spencer *President, Owner-Operator Independent Drivers Association*
11:00 a.m.	Closing Remarks	Finch Fulton *Deputy Assistant Secretary for Transportation Policy, U.S. DOT*
11:15 a.m.	Lunch	U.S. DOT Cafeteria
12:15 p.m.	Breakout Session 1: Scenarios	1. *Business as Usual* 2. *Driver and Automation as Copilots* 3. *Local Drayage*
1:15 p.m.	Break	
1:35 p.m.	Breakout Session 2: Impacts	1. *Labor Force Transformation/Displacement* 2. *Labor Force Training Needs* 3. *Technology Operational Safety Issues* 4. *Quality of Life and Health Effects for Professional Drivers*
2:45 p.m.	Report Out	Media Center
3:15 p.m.	Adjourn	

Appendix B: Terms and Concepts

Adaptive Cruise Control: A driver-assistance system that automatically adjusts a vehicle's speed to maintain a set following distance from the vehicle in front.

ADAS: Advanced Driver-Assistance Systems. Systems designed to help drivers with certain driving tasks (e.g., staying in the lane, parking, avoiding collisions, reducing blind spots, and maintaining a safe headway). ADAS are generally designed to improve safety or reduce the workload on the driver. With respect to automation, some ADAS features could be considered SAE Level 1 or Level 2, but many are Level 0 and may provide alerts to the driver with little or no automation.

ADS: Automated Driving System. The hardware and software that are collectively capable of performing the entire dynamic driving task (DDT) on a sustained basis, regardless of whether it is limited to a specific operational design domain (ODD); this term is used specifically to describe a level 3, 4, or 5 driving automation system.

Automation: Use of electronic or mechanical devices to operate one or more functions of a vehicle without direct human input. Generally applies to all modes.

Automated Vehicle: Any vehicle equipped with driving automation technologies (as defined through SAE J3016). This term can refer to a vehicle fitted with any form of driving automation. (SAE Level 1–5)

Chatham House Rule: Roundtable breakout sessions used the Chatham House Rule[7]: "Participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed."

CMV: Commercial Motor Vehicle: Any self-propelled or towed motor vehicle used on a highway in interstate commerce to transport passengers or property when the vehicle:

- Has a gross vehicle weight rating or gross combination weight rating, or gross vehicle weight or gross combination weight, of 4,536 kg (10,001 pounds) or more, whichever is greater; or
- Is designed or used to transport more than 8 passengers (including the driver) for compensation; or
- Is designed or used to transport more than 15 passengers, including the driver, and is not used to transport passengers for compensation; or
- Is used in transporting material found by the Secretary of Transportation to be hazardous under 49 U.S.C. 5103 and transported in a quantity requiring placarding under regulations prescribed by the Secretary under 49 CFR, subtitle B, chapter I, subchapter C. (FMCSA, defined in 49 CFR 390.5).

[7] https://www.chathamhouse.org/about/chatham-house-rule

DDT: Dynamic Driving Task. All of the real-time operational and tactical functions required to operate a vehicle in on-road traffic, excluding the strategic functions such as trip scheduling and selection of destinations and waypoints, without limitation:

- Lateral vehicle motion control via steering (operational);
- *Longitudinal vehicle motion control* via acceleration and deceleration (operational);
- *Monitoring* the driving environment via object and event detection, recognition, classification, and response preparation (operational and tactical);
- Object and event response execution (operational and tactical);
- Maneuver planning (tactical); and
- Enhancing conspicuity via lighting, signaling and gesturing, etc. (tactical).

Full automation: Level 5 automation, at which a human has no role in operating a vehicle.

Levels of automation: There are six levels of vehicle automation,[8] developed by SAE International, which NHTSA adopted in 2016. At levels 0 to 2, the human monitors the driving environment. At levels 3 to 5, an automated driving system monitors the driving environment.

- **Level 0:** No automation.
- **Level 1:** Driver assistance.
- **Level 2:** Partial automation.
- **Level 3:** Conditional automation.
- **Level 4:** High automation.
- **Level 5:** Full automation.

ODD: Operational Design Domain. Operating conditions under which a given driving automation system or feature thereof is specifically designed to function, including but not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or roadway characteristics.

[8] http://articles.sae.org/15021/

Appendix C: Scenarios

T-1: Level 1-2 Automation and Platooning: Trucks with automated driver-assistance features (e.g., adaptive cruise control, lane keeping, or a combination thereof) that operate on limited-access highways.

- Potential for platooning of following trucks using vehicle-to-vehicle communications and onboard sensors.
- In all variations, human drivers remain at the wheel at all times in all vehicles.

T-2: Level 4 Highway Copilot: Level 4 ADS that operates only on limited-access highways.

- Human driver is not expected to remain in the driver's seat at all times, and can ride in the sleeper cab when ADS is engaged and the vehicle is within its ODD. Human driver is expected to operate the vehicle outside of the ADS's ODD (e.g., surface streets).
- ADS has fallback capability, such that the driver would not be expected to take control on short notice. Driver would typically be given ample notice of planned disengagements (e.g., when approaching an ODD boundary).

T-3: Exit-to-Exit Automation: Level 4 ADS that operates only on limited-access highways, with remote supervision but no human driver on board.

- Remote Supervisor oversees the operation of the truck while in transit, tracking its location and responding in the event of any unanticipated issues.
- Upon exiting the highway, human driver picks up the truck or trailer and drives it the remainder of the trip.

T-4: Exit-to-Exit Automation Plus Tele-Operation: Level 4 ADS that operates only on limited-access highways, with remote supervision but no human driver on board.

- Remote Supervisor oversees the operation of the truck while in transit, tracking its location and responding in the event of any unanticipated issues.
- Upon exiting the highway, a remotely located human driver ("tele-operator") assumes direct control of the truck for the remainder of the trip using remote controls and video feeds. They are responsible for the dynamic driving task, but may be assisted by onboard sensors.

T-5: Warehouse-To-Warehouse Automation: Level 4 ADS that operates on both limited-access highways and surface streets, with remote supervision but no human driver on board.

- Remote Supervisor oversees the operation of the truck while in transit, tracking its location and responding in the event of any unanticipated issues.

- Trucks are able to navigate the entire route between origin and destination, assumed to be warehouses or distribution centers (not urban delivery/pickup points).

B-1: Driver Assistance for Transit Buses: Automated driver-assistance systems for transit buses.

- May include powertrain optimization, collision avoidance, precision docking, or lane centering.
- All systems assume a human driver is always present and remains responsible for the DDT.

B-2: Automated Fixed Route Bus Service: Fully automated bus with no human driver.

- Bus operates on a fixed route.
- Remote Supervisor oversees the operation of the bus along its route, tracking its location and responding in the event of any unanticipated issues.

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